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CASEMENT'S PRESSURE REGULATOR FOR FLUIDS.

CASEMENT'S PRESSURE REGULATOR FOR FLUIDS.

In describing the invention of which our illustrations depict the construction and principal applications, we deem it hardly necessary to prefix any extended prefatory remarks regarding the obvious utility of the type of apparatus to which it belongs. The advantages of a device by which a maximum and normal pressure may be reduced for ordinary continuous employment to any required low degree, while the full force is susceptible of instant utilization at any moment; or by which, from a single powerful source of supply, several deliveries may be effected, all varying in intensity; will, we think, be clearly apparent.

The points briefly enumerated above constitute the objects of the present device, and a reference to our illustrations will render plain the simple means by which the inventor secures them. Fig. 2, on page 134, shows in section the interior mechanism, and modifications of the same are represented in the other engravings, of which due explanation will be made as we progress. A is the pipe which conducts the fluid from the source of supply, and represents the apparatus used by the inventor in conducting gas, from a natural gas well to his dwelling at Painesville, Ohio, for heating and illuminating purposes. Just above the orifice of

pipe, A, is coupled a short section of tube, forming a chamber; and secured between the couplings by a flange and packing rings, is a truncated conical diaphragm, B. The latter it is proposed to make of hardened steel, and also as thin as possible, while securing the requisite strength, so that its upper aperture, which forms a seat for the valve, C, will be reduced as much as practicable to lessen the area subject to friction, and thus prevent any liability of the valve to stick. Valve, C, has a long stem which passes up through a guide, D. The upper portion of the chamber is closed by a screw plug, E, which can be readily removed to admit of access to the interior, and also for the purpose of placing in position the rings, F, of heavy metal, which serve to weight the valve.

We will suppose that the gas escapes from its source under the high pressure of 20 lbs., to the square inch, and that it is desired to distribute the same at a constant pressure of but one third of a pound. In such case, the weights on valve, C, would be adjusted to aggregate 19 $\frac{2}{3}$ lbs. It is evident that, with this force acting in one way opposed to the greater one coming from the other direction, the amount of gas corresponding to the difference between the relative pressures would be that allowed to pass the valve; for should

the pressure above the valve equal that below it, clearly gravity would bring the valve to its seat, closing the orifice and preventing further escape, until the pressure above once more became less than the force acting from below. Hence, by adjusting the weights, any degree of pressure in the distributing pipe may be maintained. The valve is, of course, automatic, and, as it is held suspended by the upward current, adjusts itself to the quantity of gas demanded, so that, as a moment's consideration will show, the sudden extinction of, say, twenty out of twenty-one burners cannot have the effect of causing the single one left to flare and sing; or, conversely, if an additional number of lights be started, the result is simply to decrease the pressure above the valve more rapidly, and allow of a quicker flow from below, which soon restores the proper equilibrium.

The gas, we have stated, passes under the conical valve, C. It then rises through the chamber and escapes by the delivering main, G, depositing in its course any impurities which it may hold in suspension, which, naturally falling to the bottom of the chamber, between the walls of the latter and the diaphragm, B, are subsequently drawn off by the cock, H. The shape of the diaphragm and consequent loca-

[For remainder, see page 134.]

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PATENT MONOPOLIES IN CONGRESS.

Another of the overgrown monopolies, which not only oppress the people but retard the progress of industry in this country, is now before Congress attempting to induce that body to give it another lease of life. Some forty years ago, an American residing in England, invented a machine for forming felt hat bodies, which he subsequently brought to the United States for the purpose of patenting. Owing to an informality, his application was rejected; but some years afterwards, the right was granted to Mr. H. A. Wells, who presented the same machine, modified by one or two minor changes. Since 1846, the association owning this patent have held a complete monopoly of the business, and, by refusing to license others to use the machine (except a few whom they bought off to prevent opposition to their last extension), they force all the manufacturers of the country to send their fur to the ring factories to be manufactured at ring prices. The actual cost of forming a hat body is but two cents, and the charge is from six to twenty cents, showing the enormous profit of from two hundred to one thousand per cent on every hat of the ten million and over yearly produced in the United States. The actual loss to the hat makers over what the cost would be, if allowed to manufacture their own hat bodies, is estimated at over 42 per cent, and against this the trade can do nothing. If any dealer complains, the ring refuse to make his hats, and his business is ruined. Several years ago, Wells died, and since then, for the benefit of his "poor" widow, who has only made \$111,000 out of the job thus far, two extensions were granted. Now, the ring comes before Congress again and asks for seven years longer, making thirty-five years in all in which to carry on their monopoly, and this in the face of the fact that the original form of machine patented by Wells, is not used and has not been for the past twenty-five years, but simply serves as a ground for litigation and the securing of damages for infringements. The hat makers are resisting the attempt with all their influence, and they assert, that, with this oppressive tax abolished, they could not only produce more goods, and regain their lost foreign trade, but sell cheaper, and give their hands employment for the whole, instead, as is now the case, of only two thirds of the year.

These Wells patents, in common with those held by the sewing machine combination and the Woodbury planer ring, are infamous taxes on the people, and as such the country suffers for want of their abolition. We do not think the fault lies in our patent system, for the principles on which our laws are based are primarily the encouragement of the useful arts and the dissemination of knowledge concerning the same throughout the community. To foster their production upon the ground of expediency, and not of justice, limited monopolies are granted to the original and first discoverer, which, in accordance with the value of his invention, may yield him an ample remuneration for his thought and labor. Now if the inventor of a valuable article or process fails within a certain period to gain a just reward, then he may with justice be granted longer time; but if, on the other hand, he, or those representing him, succeed in obtaining a fair and adequate return during the lifetime of the patent, then there is clearly no reason for continuing the monopoly.

Mr. Saylor, of Indiana, has recently introduced a bill in the House of Representatives, the object of which is the suppression of the abuses we have pointed out, but the means taken are not such as will secure the desired result. It is provided that any article made under a single patent may be used, etc., by any one on payment of a royalty of 10 per cent on the market value, and that the user shall secure the patentee by a \$10,000 bond, filed in the Patent Office. The royalty on patents for improvements, or on inventions covered by two

or more patents, is to be fixed by the courts, and the same provision applies to copyrights. The trouble with this measure is that it strikes both ways; while benefiting the buyer, it injures the seller. It reduces the profits, perhaps, of the big corporations, but in like manner those of the smaller inventors whom it should protect. It puts into the hands of one man, the right to absorb the labor of another, carried on through years and at great expense, into a slightly improved device, giving the former individual all the profits, while the real worker must be content with a ten per cent royalty. Finally, apart from the crudity and ambiguity of its provisions (for on what basis is "market value," a fluctuating equivalent varying with locality, season, etc., to be estimated?), the law is open to the same objections as those relating to usury, as it arbitrarily restricts an individual's right to his personal property, and this we believe to be contrary to public policy, unless the need be imminent, clear and apparent, as in event of war.

We might urge other objections to the act—which we trust will not pass—but we dismiss it for the present to consider that which we believe to be the only true remedy to the existing difficulties. Mr. Saylor, in his argument, brings forward a mass of suggestive statistics; the India rubber industry pays 59 per cent on the capital employed, the cabinet organ business, 69 per cent, agricultural implements, 52 per cent. In seventeen months the capital invested in sewing machines doubles itself, besides paying all expenses; and finally comes the Wells hat manufacture, with the immense profits already pointed out. Now, with the full comprehension of these and other like cases: and there is no reason why a perfect understanding of the nature of these grinding incubi on the industries of this country should not be afforded us, for we, in common with other journals, have reverted to the matter again and again: why, we ask, do Mr. Saylor and his associates in Congress not strike directly at the roots of the evils and end them at once by refusing to extend their existences when the prescribed limits are reached? This hat body outrage has been fastened on the country for the last seven years by an innocent looking amendment tacked on the end of a bill on the last night of a session. Members failed to investigate, the measure passed, and the work was done. In other instances which we might mention, wealth is unsparingly used, opposition is bought off, professional talent employed, "poor" widows brought out as figure heads, Congressmen coaxed and cajoled, if not bribed, and, in fact, every art and trick of the lobby practised to ensure the passage of a desired bill—the object of which is simply to impose additional burden on the backs of the people.

The remedy needed is an enactment which will do away with these Congressional extensions, which will fix certain limits to the lifetime of a patent, subject to the discretion of the proper officials in the Patent Office. These limits should include one extension, to be accorded after careful investigation and for cause; but beyond the period so granted, not a day should be allowed. During twenty-one years, if the invention be of value, abundant remuneration can be gained; and monopolies of half a century's standing should be effectually abolished and rendered impossible.

SLIPPERY PAVEMENTS.

It takes but a short stroll along Broadway, during winter time, to convince one that, excellent as the Belgian pavement is in many respects, it nevertheless becomes, when well worn down by use and when covered with snow or ice or even with thin mud, a prolific cause of falls and injury to the heavily burdened horses constantly traveling over it. We know of no statistics which will show the average yearly amount lost through animals thus becoming maimed; but judging from our own observation and from the isolated fact that, quite recently, in passing once up and down Broadway on a single frosty day, we counted fifteen falls and four horses left by the roadside to die, it may be imagined that the aggregate must reach a considerable figure. The street, at times, becomes dangerous even to pedestrians in crossing, and hence doubly perilous for the horses from the insecure footing of their metal shoes. It would seem that the wooden pavements now on many of the side streets in this city, offer great advantages in point of security over roads of stone; but experience has so proved the unsuitability of the former, to meet the requirements of a street constantly alive with a heavy traffic, that their use on such thoroughfares as Broadway is practically out of the question. The subject is one to which we think the attention of inventors might be profitably turned, and a substantial pavement, combining the durability of stone with the supporting capability of wood, produced. In this connection, we notice that an investigation has been conducted in England, by Mr. William Haywood, engineer and surveyor to the Commissioners of Sewers of the city of London, which mainly consisted in observations as to the number of accidents befalling horses on asphalt, wood, and granite pavements. The investigations extended over fifty working days, and were principally made during the rainy weather of spring. The granite was found to be most slippery, the asphalt next so, and the wood the least. Considered in respect to moisture, asphalt was most slippery when merely damp, and safest when dry; granite most slippery when dry, and safest when wet; wood most slippery when damp and safest when dry. Wood, on the whole, is less slippery than either asphalt or granite in a marked degree, it being only inferior to granite when the pavements were wet, and the difference then between the wood and the granite being considerable. Of the accidents most obstructive to traffic, as well as most injurious to horses, asphalt had the greatest proportion, granite next, and wood least.

HERSCHEL, TYNDALL, AND DRAPER ON THE SUN RAY

Studying the solar spectrum, about the beginning of the present century, the elder Herschel passed a sensitive thermometer through the successive colors and observed that the greatest heating effect was not at all coincident with the brightest illumination. At the violet end of the spectrum, the heat was scarcely apparent. As the thermometer passed toward the red, the temperature slowly increased, the maximum appearing sometimes in the red, sometimes at a distance beyond the red, where no rays were visible.

The inference which he drew from these observations was that the heating rays were separate and distinct from the luminous rays and of a lower refrangibility. By the use of photographic papers, it was subsequently ascertained that the chemical action of the sun ray appeared to be greater toward the violet end of the spectrum, the maximum power apparently residing in the violet or ultra-violet radiations. Thus, as the rays of high refrangibility diminished in brilliancy, they seemed to increase in chemical power, much as the rays of low refrangibility increased in heating power with their lessened brightness. Hence arose the belief, which the scientific world has generally entertained of late years, that the solar radiation was triple in constitution, and so likewise the emanations from other self-luminous bodies. A favorite illustration of this view has been a cable woven of three strands, which were regarded as being separated by the prism into three independent yet slightly overlapping spectra: a visible spectrum culminating in the yellow; a heat spectrum at the red end and beyond the red; and a chemical spectrum chiefly in and beyond the violet.

In the spectrum produced by a prism of flint glass and prisms of highly refracting gems, the greatest heat was found below the red; with a crown glass prism it was associated with the pale red; with a prism filled with alcohol it appeared in the orange; while a prism of water gathered the heat chiefly in the yellow. Yet in spite of the evident connection which these facts would seem to point out between the position of the heat spectrum, so called, and the nature of the prism employed, no attention was paid to the suggestion, made by Dr. Draper as early as 1844, that the phenomena observed must be due not to any inherent property of the sun ray but to the prism, which crowded together the rays of the red end of the spectrum and greatly dispersed those of the blue and violet portion. In other words, the red end of the spectrum is warmest as the earth is warmest at the equator, not because the heat rays tend chiefly to that region, but because a greater number of solar emanations fall upon a given area there.

Perhaps the person who has been most influential in giving currency to Herschel's error is Professor Tyndall. In the eighth of his classic lectures on "Heat, considered as a Mode of Motion," he illustrates the subject with characteristic force and felicity. Using the thermo-electric apparatus devised by Melloni, he brings to bear upon the face of the pile the spectrum of electric light passed through a prism of bisulphide of carbon, and says: "I turn the handle and the slit gradually approaches the violet end of the spectrum; the violet light now falls upon the slit, but the needle does not move sensibly. I pass on to the indigo, the needle is still quiescent; the blue also shows no action. I pass on to the green, the needle barely stirs; now the yellow falls upon the slit; the motion of the needle is now, perhaps, for the first time visible to you; but the deflection is small, though I now expose the pile to the most luminous part of the spectrum. I will now pass on to the orange, which is less luminous than the yellow, but you observe, though the light diminishes, the heat increases; the needle moves still farther. I pass on to the red, which is still less luminous than the orange, and you see that I here obtain the greatest thermal power exhibited by any of the visible portions of the spectrum. The appearance, however, of this burning red might lead you to suppose it natural for such a color to be hotter than any of the others. But now pay attention. I will cause my slit to pass entirely out of the spectrum, quite beyond the extreme red. Look to the galvanometer; the needle goes promptly up to the stops. So that we have here a heat spectrum which we cannot see, and whose thermal power is far greater than that of any visible part of the spectrum. In fact, the electric light with which we deal emits an infinity of rays which are converged by our lens, refracted by our prism, which form the prolongation of our spectrum, but which are utterly incompetent to excite the optic nerve to vision. It is the same with the sun."

Subsequently Professor Tyndall, by means of a prism of rock salt, determined a heat curve in the region of the dark rays below the red, which, as he expresses it, "suddenly shoots upwards in a steep and massive peak, a kind of Matterhorn of heat, which quite dwarfs by its magnitude the portion of the diagram which represented the visible radiation." The same teaching was represented in the American lectures, the "Matterhorn" diagram occupying page 148 of Appleton's edition of the lectures. These lectures, it will be remembered, were delivered many times among us during the winter of 1872-3.

In the month of August, 1872, Dr. Draper published, in the leading scientific periodical of Great Britain, a memoir (a digest of which was shortly after given in the SCIENTIFIC AMERICAN) on the distribution of heat in the spectrum, in which he not only repeated his belief that the method employed by Herschel and subsequent investigators must necessarily lead to incorrect results, but furnished an overwhelming array of observations disproving them. As for Professor Tyndall's estimate of the proportions of heat on the two sides of the "extreme red," he held that "they were valueless for lack of care in determining the point of division." The red light shades off gradually, so that it is almost

impossible to tell where it really comes to an end. "A linear thermopile, such as is commonly used, is liable under these circumstances to give deceptive results; and any error in its indications counts in a double manner; it not only diminishes the value of one spectrum, but adds that diminution to the value of the other." Thus an error of only two millimeters in estimating the position of the extreme red would have taken so much from the invisible and added it to the visible that the two would be brought to an equality; then the slightest turn of the screw, that carried the pile toward the dark space, would have given a preponderance to the visible. "It is obvious, therefore, that there cannot be certainty in such measures unless fixed lines are resorted to as standard points."

This done, the destruction of Tyndall's position is complete. The optical center of the spectrum is the ray which, according to Angstrom's determinations, has the wave length of 5,768. Now if the rays on two sides of this line be brought to separate foci and their thermal effects carefully measured, it is obvious that any excess of heat at either end of the spectrum will be speedily detected. By an ingenious apparatus described at length in the memoir, Dr. Draper did so compare the heating power of all the less refrangible rays with that of all the more refrangible, using prisms of various material, and making some hundreds of observations on an unclouded sun. Taking 100 as the standard for the heating power of the entire spectrum, the mean of four sets of measures, with a prism of rock salt, gave 53 for the heat of the more refrangible region, and 47 for the less refrangible. Another series of three sets gave for the two regions 51 against 49. With a prism of flint glass, two series, one of ten sets of measures and the other of eight, gave respectively 49 to 51 and 52 to 48. Two series of the same number of experiments with a prism of bisulphide of carbon gave 52 to 48, and 49 to 51, respectively for the more refrangible and the less refrangible rays. With a quartz prism, twenty-seven experiments gave 49 to 51; while another set of twelve gave 53 as the mean for the more refrangible and 47 for the less. These are given as fair examples of results obtained by a multitude of experiments during several months, including winter and summer. The heating powers of the two halves of the spectrum show such close correspondence that we may safely follow Dr. Draper's lead and impute the differences to errors of experimentation.

The second memoir on chemical action of the spectrum, published in December, 1872, proves even conclusively that every part of the spectrum, no matter what its refrangibility may be, can produce chemical changes; and that the "actinic curve," so-called, does not represent any peculiarities of the spectrum, but simply the habitudes of certain compounds of silver. As a logical consequence, the supposed triple constitution of the sun ray must be dropped among the myriad other dead delusions that mark the onward course of Science, as the skulls of perished camels mark the course of a caravan. There is in the sun ray neither light nor heat nor chemical power, as such, but simply vibrations, which, when stopped, may manifest themselves in one or other of all these phases of phenomena according to the nature of the extinguishing substance. "The evolution of heat, the sensation of light, the production of chemical changes, are merely effects, manifestations of the motions imparted to ponderable atoms."

It was a matter of surprise to many that, during his lectures here, Professor Tyndall did not so much as mention these important researches, not even to question the justness of Dr. Draper's conclusions. It is perhaps still more surprising that he has since as carefully refrained from publicly discussing them, yet still continues to teach the old doctrine.

It would be asking too much, perhaps, to expect Professor Tyndall to reconsider his subject in the face of the numerous and imperative engagements, that had been made for him here, but surely time enough has since elapsed to allow him to do so. The omission of any reference to Dr. Draper's later work, even in a foot note in the edition of the lectures published by the Appletons, might be excused for the same reason. But what can we think, when the English reprint retains the old teachings without the suggestion of a doubt in regard to their correctness? To put it in the mildest form, it places Professor Tyndall in a slightly equivocal position for one who boasts himself an unprejudiced seeker after truth, for the truth's sake.

It is reported that, when his attention was called to Dr. Draper's researches, Professor Tyndall—repeating his favorite Alpine figure—said that his investigations had raised such a Matterhorn of heat at the red end of the spectrum that it was impossible to get over it, short of a year at least. The year has passed; is there still a Matterhorn of pride to be surmounted?

WHITWORTH STEEL.

Sir Joseph Whitworth has recently published a valuable work, in which he gives an exhaustive account of his method of casting and rifling steel guns. It will be remembered that, some time ago, we published an account of the remarkable performances of the nine pounder cannon of the above inventor, and also referred to the crucial test caused by the explosion of 1½ lbs. of powder in a cylinder of fluid compressed steel, in which no other opening was left save that of the vent. The cylinder was a copy of the breech of the nine pounder gun, and it was estimated that the strain would be six times greater than if the shot were allowed to leave the piece. The projectile was screwed in, and the charge fired. Although all the gas escaped through the vent, which was thereby enlarged from one to two tenths of an inch, no

alteration could be detected in the external or internal dimensions of the cylinder.

In explaining the nature of his steel, the author states that it is impossible to cast a large gun of highly carbonized steel that can be relied upon as perfectly sound. With a small amount of carbon in its composition, however, the metal becomes so ductile that it will elongate under pressure from 30 to 50 per cent before breaking, and then will not fly in pieces, but only bulge and tear. To obviate the defect of honeycombing in steel of this description, recourse was had to extreme pressure upon the metal while in a fluid state, equal in some cases to twenty tons per square inch. As a measure of the quantity of air expelled by this process and the consequent improvement in density and soundness, it is stated that, within five minutes after the application of pressure, the fluid column will be shortened by an inch and a half per foot of length; and drawing out and forging develops, in a still higher degree, the strength of the material. It is cast in hollow cylinders, for reasons connected with rapid cooling and the more complete exclusion of air, and is manufactured in thirteen qualities, ranging from a tensile strength of 40 tons per square inch to one of 72 tons, the ductility at the two extremes being respectively 32 and 14 per cent.

The invention is of the highest importance, not only in its application to weapons of war, but to the more useful implements of peace. For steam boilers and railroad axles, it would seem that steel of such extreme strength must be invaluable.

A PAPER AND GLASS DEBATE.

A correspondent sends us a couple of interesting questions, which, he informs us, are to be the subject of a debate, relating to the merits of paper and glass. The first is: "Providing we had no paper, what other substances may be mentioned that would take its place?" and the second, "Providing we had no glass, what are its possible substitutes?" Of course the idea is to bring out, in the present connection, not names of substances which may be advantageously used instead of the above named almost indispensable materials, but of such as we probably would employ (and of many of which in fact our ancestors did avail themselves) did glass or paper cease to exist or become unobtainable. The case is imaginary but leads to much instructive thought.

In lieu of glass, we can find materials suitable for window panes, for drinking vessels, and in some cases even superior to it for small lenses, but nothing that combines all its properties, or is capable of its ready manipulation into desired forms. For windows, perhaps the best substance other than glass is simple mica, which may be readily split from the rock in thin translucent sheets. It is now used for doors of stoves, to protect paper shades around gas lights, and in other common employments. The Romans filled their windows with *lapis specularis*, a fossil of the class of mica, which is readily cloven into thin smooth laminae. The same substance is found in the Island of Cyprus, in masses a foot in breadth and three inches in thickness. It is used for the construction of hot houses, and for the protection of delicate plants. Up to the present day it is also much employed in Russia, in place of glass for windows.

Horn cut into sheets is still used for lanterns, and for drinking vessels, and, if made sufficiently thin, would answer for illuminating purposes. Oiled linen or other fabric, similar to that now used by draftsmen for tracing, would also be available, and so would very delicate sheets of India rubber. Skins, prepared like parchment or vellum, would be translucent though not transparent. Gelatin, however, might be treated with bichromate of potash so as to be insoluble, and if it would stand the weather would give quite clear window lights. Collodion films, we should imagine, if made thick enough, could also be used for the purpose, as also animal membrane.

In addition of mica, the mineral kingdom offers a variety of substances. There is the Brazilian pebble, a species of quartz, now used in an immense extent for spectacles and other lenses. We have seen perfect spheres of this material three inches in diameter, without a single speck or flaw to blemish its complete transparency. Rock crystal and other varieties of quartz might also be employed, if means could be devised to cut them properly; so could plates of selenite, of thin alabaster, or even of rock salt, though the latter would not be very durable. Some shells are sufficiently thin to be translucent, and ivory could be made into plates having the same property. Amber would be transparent enough but difficult to obtain while, like ivory it would be rather costly. Large leaves of trees, if chemically treated, might have their texture preserved and serve to cover windows if other means failed; or if the dwelling were located in polar latitudes, one might follow the example of the Esquimaux and use blocks of clear ice.

In recalling substitutes for paper, many of the materials, suggested in place of glass owing to their translucency, would, from their flexible nature, answer even more suitably for writing purposes. Such is evidently the case with parchment, membrane, cloth, horn, rubber, collodion, or gelatin sheets. We might go back to graven tablets, like the Moabite stone, or write with the stylus upon wax, as did the ancients; in fact, there are numberless modes of inscribing our thoughts on solid substances. But paper has a multitude of other uses, especially in these days of paper clothing, paper furniture, paper churches, and paper money. Hence materials are needed with more of its attributes than simply its use as a vehicle for the dissemination of our ideas. The same source of supply, open thousands of years ago, is still at hand, for the papyrus tree flourishes yet in Egypt and Sicily. The bark of the common white birch may also be employed; or

by ingenious machines we can cut shavings of fine grained wood to serve in place of hangings for our walls. Sheets of metal, rolled to almost infinite attenuation, would, however, probably form the most favored substitute. About two years ago the Upper Forest Tin Works, in Wales, rolled the most delicate sheet of iron ever made. The metal was worked in a finery with charcoal and the usual blast, then forged into a bar, and finally passed through the tin rolling mills. When finished, the sheet was 10 inches by 5½ inches in dimensions or 55 inches in surface, and weighed but 20 grains. It would require 4,800 such layers to make up a mass one inch in thickness. Letters have been sent across the Atlantic on iron thinner than ordinary paper, and nearly as light. Steel, iron, and copper could thus be pressed into service; and where flexibility was necessary, probably alloys could be made to answer the purpose.

SCIENTIFIC AND PRACTICAL INFORMATION.

A TEST OF THE AUTOMATIC TELEGRAPH.

A public test of the automatic system of telegraphy recently took place on a single wire between this city and Washington. The matter transmitted was the President's late message, with the Spanish protocol attached, numbering 11,130 words, it having been selected in consequence of the declaration that its transmission over eight wires by the Western Union Company, on December 2, 1873, was a fact unparalleled in telegraphy.

The President of the Automatic Telegraph Company submits a report, which is corroborated by the testimonials of various well known gentlemen who witnessed the trial, to the effect that the entire document was copied complete in New York in 58 minutes from the time of the beginning of the sending in Washington. Ten perforators, thirteen copyists, and two Morse operators were employed, as against sixteen expert Morse operators by the Western Union people. The average pay of perforators and copyists is \$40 per month; of operators, \$100.

A NEW ACOUSTIC PYROMETER.

It will be remembered that, some time ago, we gave an account of an acoustic pyrometer, devised by Professor Mayer, of the Stevens Institute. The principle on which the instrument is based is the variation of the length of a sonorous wave in air, when the temperature of the latter is changed.

Mr. Chautard states, in *Les Mondes*, that in his opinion the method proposed by Dr. Mayer is difficult in application, and he suggests the following arrangement as more suitable for practical requirements:

The sound is produced by the aid of an organ tube, Ut 4, for example, disposed with reference to a resonator which is put in relation with the two branches of a König improved interference apparatus. To the movable branch is attached a long tube of copper, which enters the furnace or other locality, the temperature of which it is desired to determine. This tube returns on itself and communicates with a small manometric capsule. The fixed branch of the apparatus is terminated by another capsule, which, like the first, is in relation with the same source of heat. The arrangement is completed by a revolving mirror, in which the state of the flame is seen.

Thus disposed, if the pipes which separate the resonator from the capsules each contain an equal number of half wave lengths, the flame will be edentulated; in the contrary case, the indentations will diminish, and this as much more as the difference of length of the tubes is more nearly equal to an unequal number of half wave lengths. In the latter event, the flame takes, in the mirror, the aspect of a ribbon; and by noting the changes in its appearance the calorific state of the air in the tube in the furnace is determined. If the temperature is elevated, the length of wave augments, and a clearly defined interference is shown by the flame in the mirror. If, during the continuance of the experiment, the movable tube be gradually elongated, it will be easy to bring the flame back to its primitive state, that is, to cause the indentations to re-appear. Then, by the aid of a scale previously determined and empirically translated into thermometric degrees, the degree of temperature in the tube can be easily noted.

TO NEW SUBSCRIBERS.

All subscriptions to the SCIENTIFIC AMERICAN will be commenced with the year, unless persons, at the time of remitting, request to the contrary. Nearly all subscribers preserve their numbers for binding; and in most cases where subscriptions are received during the first quarter of the year, if the back numbers are not sent, they are subsequently ordered. To save both the subscribers and ourselves trouble, the back numbers from January 1 will be forwarded, unless we are advised to the contrary. This course will be pursued till April 1, after which date the paper will be sent from the time of receipt of remittance; but subscription may commence at any time, at the request of the subscriber. The above regulation applies only to those who give no instructions, at the time of remitting, as to when they desire to commence.

G. D. says: "I think there is a great deal of humbug about the Troy chainmakers, in the paragraph from the *Troy Times*. Any good smith can make chain, and England is full of them; they would be glad to get one half of the wages mentioned."

A CORRESPONDENT, O. A. O., reports that in Sebastopol, Cal., from November 1, 1873, to January 14, 1874, the enormous quantity of 83 inches of water fell, in the form of rain and snow.

IMPROVED MOVABLE TEETH FOR SAWS.

The novelty of this invention consists, first, in punching out only the central part of the lower half of the circular shanks, then cutting off the remaining segment at *d*; it is thus rendered elastic, and may be sprung laterally, so that the V on the inner edge of the socket may enter into the corresponding groove cut in the edge of the shank, as shown in the tooth at the left hand of the engraving. It will be seen that, if the said tooth were turned in the direction to elevate the point, the circular shank would be rolled out of the socket, the butt of the tooth, *c*, passing to the opposite side of the plate; also, were the point turned down so that the butt, *c*, would pass the shoulder, *a*, then the butt, *c*, would spring into line with the plate; then the tooth must be struck on the back, at *b*, light successive blows with a hammer, until the shoulders meet. To remove a tooth from or to insert it into a socket, the corresponding movements must, of course, be made; and to effect the object, a common hammer only is required. The shanks are milled to the size of the sockets and given a spring temper; the tooth is next laid on an anvil and struck with a hammer on the side and near the inner circle, so as to open the space where it has been cut, at *d*, and make the shank larger than the socket. The segment or spring of the shank is left just strong enough to cause the necessary friction to hold the tooth firmly in position, and it readily conforms to the size of the socket, always making a perfect fit when turned into place.

Some of the advantages claimed for this new mode of construction are: A more perfect interchange of teeth; being so strong and stiff, the saw will be the same in every respect as a saw with solid teeth; and the saws afford twice as much stock for wear, as those heretofore made, and are said to be fifty per cent cheaper to the consumer.

Patented in the United States and Canada through the Scientific American Patent Agency, by W. P. Miller.

For further particulars address R. Hoe & Co., 29 and 31 Gold street, New York city.

HILF'S IRON PERMANENT WAY.

We extract from *Engineering* the annexed illustrations of a system of iron permanent way, recently designed and introduced on the Nassau State Railway, in Germany, by Mr. Hilf. About 65 miles of line have been laid, and we understand that the cost of maintenance has been scarcely one third of that for ordinary permanent way. The invention consists in iron longitudinal sleepers to which the rails are secured, the gage being maintained by the bolts passing through the web of rails. The latter, shown in section in our engravings, are of Bessemer steel, and for the Nassau railways were made in lengths of 19 feet 8½ inches each, weighing 48 lbs. to the yard.

The mode of fastening rails and sleepers is clearly represented in Fig. 1. The former are notched only at the ends and are secured by a bolt, *a*, placed on one side to avoid longitudinal displacement. *b* is the tie rod, two of which per length of rail are used. The entire structure weighs 232 64 lbs. per yard, and its entire cost, in Europe, is estimated at about \$7.50 per similar distance. In Fig. 2 is represented the drainage adopted in connection with the system. A peculiar arrangement of switch is employed, the characteristic of which is that the center is not between the two lines of rails, but within the line, so that two frogs are saved.

The combination is such that a train may pass from one line to the other in either direction, or, by another setting of the points, may remain on the same rails.

Oil Notes.

Apologies of oil, especially petroleum, the following facts gleaned from the pages of the National Oil Journal, are quite novel and of considerable interest:

There have been several articles going the rounds of the press, strongly recommending, to farmers and others, the use of crude petroleum as a cure for the grub or borer. It is suggested to apply the oil with a brush to the trunk or bark of a tree. To this our contemporary registers a very strong objection; and while admitting that petroleum is useful for burns, scalds, corns, sore throat, consumption, fleas, bed bugs, and as a cockroach exterminator, he remarks that there is a point where the utility of the product ends, and that is just before it is rubbed on fruit trees. The editor has tried it, and finds that every leaf is killed in a single day, while there is little doubt but that the same result would follow the application to the bark.

Some time since, we referred to a number of compounds

sold throughout the country as non-explosive oils, but which really were very dangerous, and of course a fraud on the public. A curious record of nostrums is also to be found among recent English patents; and among a list of seven of these mixtures, the following are specimens of ingredients to be added, to prevent explosion: Cascarilla bark, Iceland moss, alkanet root, camphor, potatoes, sulphur, iron rust, gum olibanum, sal soda, and onions. These articles are added in very small amounts to very large quantities of gasoline or naphtha.

It is hardly needful to remark that they merely act as impurities, and disguise the odor of the burning fluid, while of

the average daily product of the Pennsylvania oil regions, from the discovery of petroleum to November 1, 1873, was 10,753 barrels, and the total aggregate for that period 13,385,589 barrels.

Dental Amalgams.

It is the general practice to combine the alloy with an excess of mercury, afterwards squeezing out the surplus mercury with the fingers or a pair of pliers.

As it is impossible to get rid of the mercury by this operation, since about twice the necessary quantity remains, leaving the amalgam hard and unworkable, the only proper course is to use the exact proportion necessary to the combination. Should a surplus of mercury at any time be found on the surface of an amalgam filling, when the packing is finished, it can be tolerably well absorbed by slices of crystal gold, cut thin with a razor and laid upon the dry surface of the filling, until they are white with the mercury, when they are removed.

Now, if chemically pure silver and tin be combined in atomic proportions, silver 108, tin 118, twenty-four grains of the clean filings, mixed with seven grains of mercury, will result in a powder, adhesive under pressure, which will not dissolve in alcohol, and therefore needs no washing, and which will weld up as solid as a coin. This is a true amalgam, containing no free mercury, in fact there is great difficulty in separating a trace of mercury below a red heat. But, of course, it is impossible to use a powder in the majority of cases.

But there is a filling which it is practicable to use in almost all circumstances, namely, the ordinary silver and tin amalgam mentioned above, with the addition of ten per cent of fine gold and sufficient platinum to insure rapid setting. If to twelve grains of alloy four or five grains of mercury be added, and the resulting compound be carefully packed, without washing, into the cavity, little by little, with small points, warmed, if necessary, and finished up by repeated burnishing, the result will be a more perfect filling than can be procured by ordinary means, and that, too, with a compound containing little or no free mercury.—*Dental Miscellany.*

Idleness.

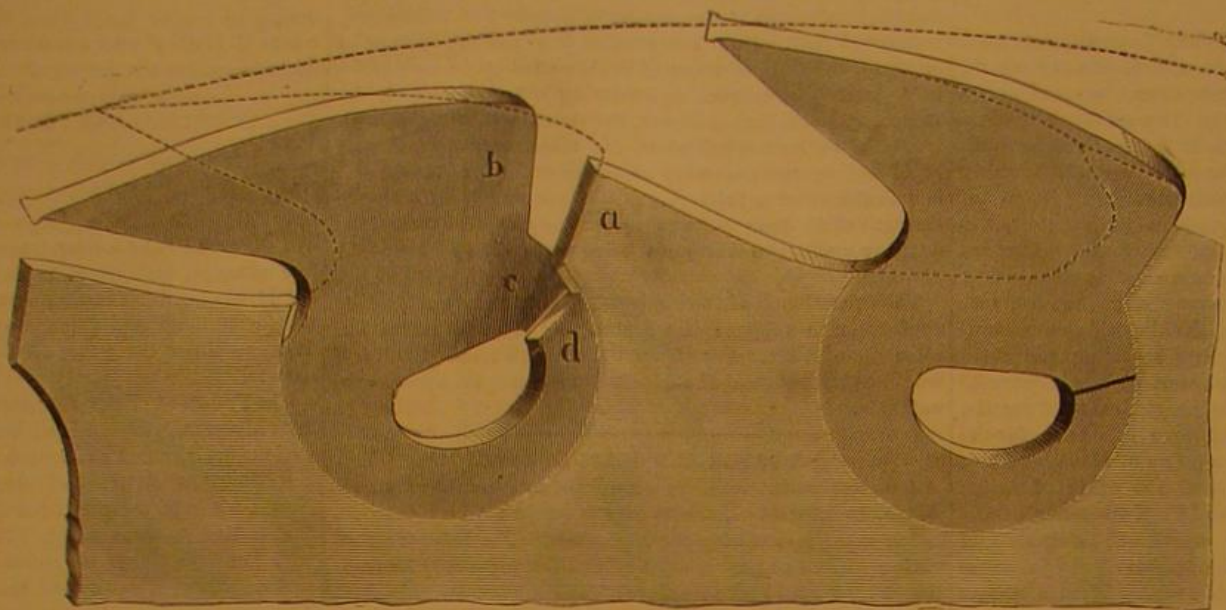
Many young people think that an idle life must be a pleasant one; but there are none who enjoy so little, and are such burdens to themselves, as those who have nothing to do. Those who are obliged to work hard all day enjoy their short periods of rest and recreation so much, that they are apt to think if their whole lives were spent in rest and recreation, it would be the most pleasant of all. But this is a sad mistake, as they would soon find out if they made a trial of the life they think so agreeable. One who is never busy can never enjoy rest; for rest implies a relief from previous labor; and if our whole time were spent in amusing ourselves, we should find it more wearisome than the hardest day's work. Recreation is only valuable as it unbends us; the idle can know nothing of it. Many people leave off business and settle down to a life of enjoyment; but they generally find that they are not nearly so happy as they were before, and they are often glad to return to their old occupations to escape the miseries of idleness.—*Herald of Health.*

Where to Buy Sporting Tackle.

Mr. Walter C. Hodgkiss, late of Cooper, Harris, and Hodgkiss, of this city, a firm noted for its sale of guns, revolvers, and articles for sportsmen's use, has recently withdrawn from that concern, and assumed business on his own account, at No. 7 Warren street, New York. Mr. Hodgkiss offers an exceptionally excellent assortment of the goods above named, and we would suggest the inspection of his stock, to all desirous of supplying themselves with the newest and best improvements in hunting implements and supplies.

J. E. E., of Pa., writes to say that recently, in a church at Alleghany City, Pa., a crowded congregation were warned by the pastor that the services could not be continued, and they retired quietly and in good order. The church was on fire in the roof; and had it not been for the presence of mind of the minister, and of the sexton who discovered the fire, the consequences might have been terribly fatal. Such self-command deserves the highest commendation.

Mr. H. Crosby writes to point out that the easiest way to describe a heptagon in a circle is to take half the chord of the arc of 120°, which is equal to a side of the required figure. This is correct, and will be of practical use.



IMPROVED MOVABLE TEETH FOR SAWS.

course the chances of explosion are not in the least diminished. No oil, which at low temperature will give off the vapor which, mixing with a proper proportion of air, causes explosion, is safe, no matter how much sulphur, potatoes, or other useless matter be added.

As an exemplification of the sudden rise and equally abrupt fall of some of the towns, or rather cities, which sprung up in the oil regions when the petroleum fever agitated the country, our contemporary says (on the authority of another journal that we never heard of) that the famous and at one time popular hotel, the Danforth House, Pithole City, which cost twenty-eight thousand dollars, was sold recently for a ten dollar note, and the furniture, which cost three thousand dollars, brought less than ninety. Within one month from the completion of the first house, Pithole city had an eighty thousand dollar hotel. In two months she had a daily paper, and a fast one it was too. In three months she had a theater. That theatre went to Pleasantville, thence to Lawrenceburg, thence to Parker's Landing, thence to where the woodbine twineth, in the second great fire at the landing last winter. In four months she had another theater and an academy of music. In five months she had her celebrated mud fire extinguisher, a curious invention for throwing mud. In six months she had seventy-four hotels and boarding houses, where the substitute for water was dispensed. In

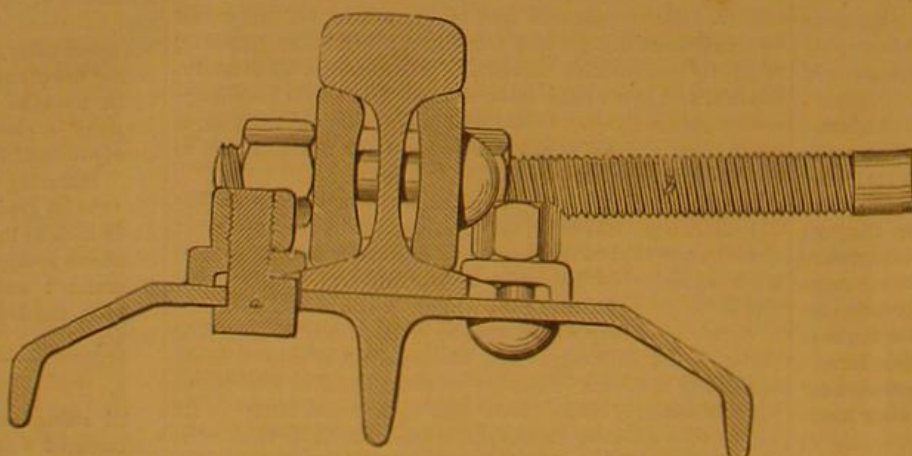
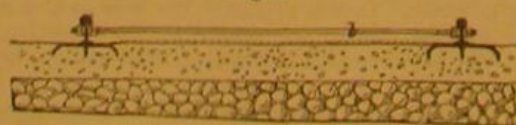


Fig. 1.—HILF'S IRON PERMANENT WAY.

seven months the Miller farm pipe line was completed, which event threw four thousand men and two thousand horses out of employment, and Pithole city had reached the zenith of her glory. She had at that time fifteen thousand inhabitants, elaborate water works, and all the paraphernalia of a city government. She has now no theater, no hotel, no telegraph office (the telegraph office was closed for time and

Fig. 2.



eternity last week), and but nine families out of all that multitude. The Pithole and Oleopolis Railroad runs but one train of one car a day, and that only to hold the charter.

In the way of statistics, we note that the total quantity of petroleum, exported from the United States in 1873, reached 236,899,223 gallons, showing an increase from 80,000,000 to 95,000,000 gallons over the three preceding years; also that

PIPE CUTTING AND THREADING MACHINE.

The slow and tedious process of cutting and threading wrought iron pipe with the tools now used, together with the great waste of material and the imperfect work produced (except with expensive and cumbersome machines), have long been causes of complaint among steam and gas fitters.

Our illustration represents a machine claimed to have the same capacity as more costly stationary machines, with the great advantage of compactness and portability, weighing but one hundred pounds, occupying a space of 15x17 inches only, and so constructed that a boy can thread, cut, or make nipples from pipe, as large as 2 inches diameter, with perfect ease.

Fig. 1 shows the machine as fitted for hand power, motion being transmitted to the several parts by means of gearing, as shown; while on the extreme left is seen the pipe, A, held stationary by the adjustable jaws of the pipe vise, B.

Fig. 2 shows the reverse of the side shown in Fig. 1. The pipe is held stationary in the vise, and passes through the center of gear, A, the rotary motion of which is imparted to the die held in the die box, B, by means of the studs or guides, C C, upon which the die box freely slides forward as the die passes upon the pipe.

When cutting pipe, the tool post, with the cutter, D, has automatic feed, cutting ends of pipe square and smooth.

Wherever steam, gas, or water pipes are used, this machine, it is claimed, will be found of great value, especially upon steamships and in places where economy in space and portability are desirable.

Perhaps we can lay before our readers no better testimonial as to the merits of the device than the opinion expressed regarding it in an official report by Chief Engineer Edward Fithian, U.S.N. That officer says that, in making repairs, etc., on shipboard, the invention would prove a useful and economical tool, as it can readily be set up anywhere, and thus perform a large amount of work which otherwise would have to be taken ashore, to a shop. The report says that it operates with the greatest ease, its capacity is fully equal to that of three men under the old method, and any threading possible with an ordinary die stock is done by it, besides other work. Chief Engineer Fithian recommends the tool "without hesitation."

Patented April 27, 1869, and September 30, 1873. For further particulars, address the Chase Manufacturing Company, 120 Front street, New York city.

IMPROVED TRENCH BRACES.

Mr. Samuel G. McKiernan, of Paterson, N. J., has patented, December 2, 1873, through the Scientific American Pa-

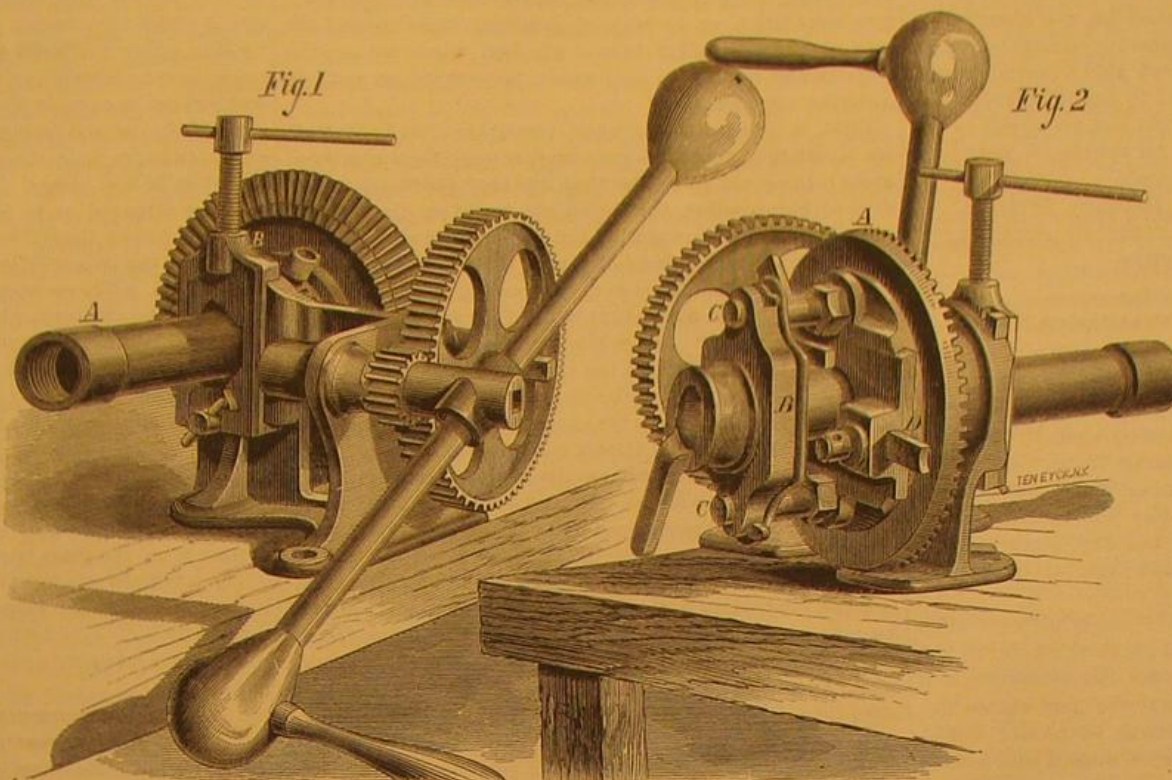


tent Agency, a novel arrangement of adjustable braces for supporting the sheathing of sewer trenches and similar excavations. The construction of the device will be readily understood from the sectional view in the foreground of the accompanying engraving.

There is a rod, A, having a right hand screw thread formed upon one end, and a left hand screw thread upon the other. To the center of this rod is rigidly attached a block, B, in which holes are made to receive a lever by which the device is turned. Two blocks of wood, C, are perforated longitudinally to receive the rod, A; and in these, near their inner

ends, are secured metallic nuts, D, into which the threads of rod, A, fit.

In using this invention, when the sheathing planks are placed upright, cross boards are set at suitable distances apart for the blocks, C, to rest against. The inventor adds that his adjustable braces permit of excavations being made by first sinking a hole for the width of one sheathing board. Against each side of the trench a plank is placed horizontally and supported by a suitable number of braces. Then the excavation continues down for the width of another board



PIPE CUTTING AND THREADING MACHINE.

and the same operation above noted is repeated, and so on until the desired depth is reached. In filling up, the lower board upon each side is first removed, and the earth thrown in, and thus for each plank in turn from the bottom upwards.

Natro-Metallurgy.

The various processes of refining lead, employed at the present day, cause, in cases where the metal is impure, considerable waste, and necessitate the reduction of an enormous quantity of oxide, to which they are besides inadequate for the removal of certain foreign metals. A new plan which has recently been devised by MM. Payen and Roux, of Marseilles, France, allows the complete refining of any argentiferous lead without the formation of oxides of lead, and has, according to the *Chronique de l'Industrie*, the particular advantage of permitting the collection of all foreign metals, of which the value may be worth considering. The process is founded on the property which a bath of caustic hydrated melted alkali possesses in dissolving or at least oxidizing successively all the metals except three, by drawing them into a soluble scoria, in a state of igneous fusion. The three exceptions are lead, silver, and gold. The metals united with the lead are, one after the other, removed by melted soda, the action of the bath being maintained first by a jet of steam, designed to restore constantly the water of the hydrate from which the metals gain oxygen, and urged, according as the metals are in a less degree oxidizable, either by a blast of air, or, finally, by carefully measured additions of nitrate of soda.

The theory of the reaction is as follows: By simple solution in water, soda abandons all the oxides which it holds in solution or suspension, and is evaporated and dried for use in the operation, almost without loss. The metals oxidize in the melted alkaline bath in the order of their affinity for oxygen, an order modified, however: 1, by their particular affinity for soda; 2, by the action of affinity exercised by the largest mass present. Thus tin and the metals of platinum, although much less oxidizable than lead or copper, are attacked very rapidly, and before the latter in the soda bath, by reason of their propensity to act as electro-negative elements. Hence also, in an alloy very rich in lead, the copper oxidizes first.

Another phenomenon of not less importance is that the solutions of the oxides in the soda bath act chemically in presence of the reagents exactly as do the metallic salts dissolved in water. It is thus in this igneous solution: All the metals are precipitated, one after the other, in the inverse order of their solubility; and in the direct order, they preserve each other from oxidation. In this respect, even insoluble reducing agents, such as charcoal, may be employed in the bath.

The principal applications in the process are its adaptation, not only to the refining of lead and the extraction of silver by the zinc process from lead and argentiferous scoria, but the purification of argentiferous copper and old complex alloys; the treatment of ores of platinum, gold, silver, etc., of ores of chromium, etc.

Since March last, the inventors have constructed a plant and have carried on the process at Marseilles; and we learn that the hard leads of Greece (containing 2½ per cent antimony 1 per cent arsenic, ½ per cent copper, and 1 to 2 per cent iron

and sulphur), hard Spanish lead, and other forms of the metal containing large quantities of foreign substances, have been successfully treated. A company has been formed for the fusion of ores, separation of metals, and then refining by the processes of natro-metallurgy.

Hot Beds.

Prepare materials at once, consisting of cleanly collected leaves, and rank, but well moistened, stable litter, for the construction of these. In making a hot bed, have a good wide foundation marked by inserting some strong stakes in the corners, for by these stakes the plumb, and height of the beds, too, can be determined. The foundation should consist of a layer of brush wood, over which asparagus, bean, and pea haulm should be placed, and fermenting material placed over that, being careful to make it firm by beating with the fork in preference to much trampling, and leaving space on either side of the frames for the convenience of linings. One made immediately of equal parts of stable litter and leaves, will be found useful for starting a few early gloxinias, caladiums, achimenes, and roots of *Lilium auratum*; also for cuttings of different kinds; and it will afterwards be useful for the raising of various kinds of seeds. Throw into a heap a mixture of two or three parts of leaves and one of litter, and turn it once or twice, applying some manure water if dry; the material may also be used for another bed in February. Besides the hot beds necessary for bringing plants into flower, several are required for vegetable

forcing, especially where there are few hot-water-heated structures. In April and the two following months, these beds will be useful for soft-wooded greenhouse plants, such as balsams, cockscombs, some annuals, and various odds and ends. In others, cucumbers, chilies, etc., may be grown; and those not required can be removed and used as manure, or turned for forming a compost for the potting bench. Their size must be in proportion to the amount and continuity of heat they are required to produce. If for starting stove plants on, they may be built as high as 5 feet; but if for growing potatoes, carrots, radishes, and other vegetables, 3 feet will be found sufficient. They sink considerably after being built; and when the heat begins to fail, the best way of recruiting it is by adding fresh linings around the frames.

ON THE PURIFICATION OF MERCURY.

BY PROFESSOR ALBERT E. LEEDS.

In investigations carried on in physical laboratories, and in the volumetric analysis of gases, a large quantity of mercury is employed; and as it is very readily contaminated, a method for its rapid and convenient purification is important.



Such a method must provide for the removal of the three kinds of impurities which are usually present: First, for foreign metals, especially lead, zinc, and tin; secondly, common dirt and dust; and thirdly, water or other liquids.

The most convenient device hitherto employed was a long glass tube, into which the mercury was poured through a paper funnel, the funnel having a pin hole at the bottom, and serving to retain the dirt and dust. The tube was partly filled with dilute nitric acid, and was provided with a stop cock below, or with a bent tube, so that a short column of mercury might balance a long column of acid.

The device herein recommended consists of a glass funnel, A, capable of holding five or ten pounds of mercury, the tube of which is cut off at a point just below the stopper of the bottle, B. Cotton wool is jammed into the tube until it fills up the neck, and bulges out at the bottom of the funnel. A short glass tube bent at right angles passes likewise through the India rubber stopper of the bottle and is connected with a water air pump. The bottle is two thirds filled with dilute nitric acid (one part of acid and four or five parts of water). The impure mercury poured into the funnel, A, is drawn through the cotton plug in a multitude of streams, and passes as a fine rain through the acid below. The foreign metals, if not in too large quantities, are removed by solution in the acid, and the pure mercury collects below. It is then run off through the stop cock into a second funnel, C; and, after being thoroughly dried by suction through another plug of cotton wool, it is caught and preserved in the bottle, D. A short time suffices for the almost automatic purification of a large quantity of mercury.

Stevens Institute of Technology, February, 1874.

Correspondence.

The Principles of Ventilation.

To the Editor of the Scientific American:

Unless I greatly mistake the intelligence and disposition of the average American, his "scientific" representative will be deluged with articles protesting against the crude notions contained in the article coming from "the land o' cakes," entitled "The Ventilation of the United States Senate Chamber." I purposely ignore the special subject of his article, the senate chamber, and beg leave to refer very briefly to some of the most untenable of his general assertions.

He boldly asserts that "the whole secret of ventilation consists" in providing "an entrance for fresh air below and an exit for foul air above," and bases this erroneous idea upon the false assumption that "foul air," making no distinctions, "ascends and accumulates at the ceiling" only. He also says: "If our halls, like the ancient Greek houses, were without roofs, ventilation would cause no thought," for "the foul air from our lungs and bodies would ascend right into the air, and a fresh supply would come down to us through the same opening."

As a simple and plain refutation of his statement regarding the tendency of foul air to "accumulate at the ceiling," I would refer him to the familiar experiment of placing a bit of lighted candle at the bottom of a tall glass jar with open top. He will find, upon exhausting the lungs into the bottom of the jar, by means of a tube, that the light will be extinguished almost immediately; and if he breathe downward into the jar—not directly over the flame, but near the side of the vessel—the light will just as certainly be put out as in the previous experiment, only the inevitable and fatal result will be retarded. If, instead of the lighted candle in the tall jar, he places "the ancient Greeks" or a few live Scotsmen in a "high" room, closed at the bottom and open to the free air of heaven at the top, he will find results quite parallel to those in his previous experiments. Any causes favoring the sudden generation of an excessive amount of carbonic acid gas would result in speedy death to them all, or in asphyxia, as in the first experiment. Confinement in the same place, under more favorable circumstances, would somewhat retard the fatal result; but ultimately, as the air became contaminated by poisonous exhalations, languor, decay, and death by some "chronic" malady, would occur as surely as the light was slowly extinguished in the second experiment.

In both these instances, "the destroying angel" is carbonic acid; it is the principal deleterious element which contaminates the air we breathe, and to which we are most universally exposed; it is generated by decomposition, by combustion, and by respiration. At any ordinary comfortable living temperature, the specific gravity of this poisonous gas, even when exhaled from the lungs, is greater than that of the surrounding air; therefore it of necessity gravitates to the bottom of the jar or to the bottom of a room, instead of rising to the ceiling. No matter what may be its source, if in excess it is "the destroying angel," always injurious, often fatal. We find, in what is called pure air, about 4.5 parts of carbonic acid to 10,000 of air; the open air of cities is often contaminated by from 6 to 15 parts to 10,000, while the confined air of some public halls and school rooms has been found to contain as many as 75 parts to 10,000, in such cases rendering the air absolutely poisonous.

If warming were not inseparably connected with proper ventilation, as, unfortunately for the position of your correspondent, it is in our climate, it might do to provide only for the escape of foul air above and the introduction of fresh air below; but, as he admits, "one undeviating law of air currents is that they always take the shortest cut, and depend upon it" the necessary and inevitable effect of providing an opening for inlet below and an opening for outlet above would be to "freeze out" the inmates of a room, whether the incoming fresh air is warm or cold. If cold, the incoming fresh air would spread itself out and fill the lower part of the room first; if warm, it would immediately take "the shortest cut" and escape at the top, without materially affecting the temperature or the quality of the air throughout the room, except in the direct course of the moving current, which would be from inlet to outlet.

For these plain reasons, the crude method advocated by your correspondent is not commendable even in a warm climate or in the summer weather, for then, if the doors and windows be left open, the air will freely circulate in any

natural direction. In short, his positions are contrary to the advanced experience and philosophy of such able specialists as Box (see his work on heat) Reid, Ruttar, Leeds and others on ventilation. His ideas are diametrically opposed to modern practice and experience, especially in the West, where the downward exhaust principle has been introduced very generally in nearly all new public and private buildings.

A. R. MORGAN.

To the Editor of the Scientific American:

Your correspondent, Mr. Wm. Mackean, in his article on ventilating the senate chamber, must either allude to summer ventilation or be without practical experience of the subject; for ventilation in cold weather, when we require warmth and comfort as well as air, necessitates an entirely different arrangement.

First, if he use an opening of two square feet in the roof for ventilation, and numerous smaller ones (their combined areas being equal to or less than the roof aperture) in the floor or wainscoting, the heated air would go direct to the opening in the roof, warming the surrounding air but little, and leaving the large body of air in the room very cold. I have seen the temperature of a room fall 3° in 5 minutes on opening the hot air register in the floor and the ventilator in the ceiling; and although the fire was kept up about four hours, the temperature did not rise half a degree.

Secondly, he says that the air, on being discharged from the lungs, is warmer than the surrounding air, and therefore rises; which is true, but it only rises a short distance, when it becomes of the same temperature as the air through which it passes; and being loaded with matter thrown off from the lungs, it becomes heavier and falls to the floor to be again inhaled.

There is a vast difference between ventilation in the summer and ventilation in the winter, also between a building heated by hot air and one heated by direct radiation from a heated surface.

CHARLES A. WEST.

Richmond, Va.

The Centralization of Matter.

To the Editor of the Scientific American:

A few modern scientists have recently proclaimed the theory that the resistance of space to the planets, in their revolutions around the sun, will ultimately cause them to approach to and become part of the sun. Another writer says that the centralization of matter is one of the great laws of Nature, which will eventually produce the same result: that each satellite, as it loses its internal heat, will be absorbed by its planet, and the planets by the sun. I do not know whether this is orthodox science, or whether it is a "new departure," but if this process of Nature is in existence, it certainly has been going on for all time, and our own planet should exhibit some of the results or footprints of this great law. Therefore I ask: Has the earth, since it has taken its place as a planet, received any accession of considerable bodies of matter, going to make up the great mass it now presents? Most assuredly it has; several of the continents still bear unmistakable evidence of being a deposit of this character, having probably been former satellites of the earth, and to have been precipitated upon it without great violence, but sufficient to crumble and scatter their contents in the direction of their motion. South America bears the most striking illustration of a phenomenon of this character. When the satellite had gradually wound its diminishing orbit, until it came within the confines of the earth's atmosphere, by a storm or commotion below it is suddenly enveloped in our heated atmosphere; and losing its hold upon the cold medium of space, with a plunge it is precipitated to the earth. The first contact is at Cape Horn; then with a rolling, settling, and crumbling motion, it spreads out nearly to its present limits, and, while yet in motion, commences the grandest feature of all. Before this great mass of debris can acquire the motion of the earth in rotation, the great waters and sediment of the Pacific are surged up to the very clouds, rolling up the western border like a scroll, of which the Andes bear witness, and of which your correspondent, Professor Orton, (page 40 of your current volume) says: "Here the landscape was purgatorial, presenting the confusion of the grab box of a geologist."

The fact that guano is now admitted to have been a sediment of the ocean, and is found on the mountain sides, as well as on the islands, and that the beds of the ocean (especially the Atlantic) are crushed down near the borders of the continents, all tend to confirm this theory. The crowding up of the Andes proves that the earth was rotating in about the same position as now, although what is now Cape Horn may have been near the equator before this occurrence. As the surface of the satellite would be a frozen mass, her glacial period would soon have an end; and the sudden acquisition of so large a body of matter on one side of the earth (within what is now the southern hemisphere) would necessitate the withdrawal of a large body of water from the northern hemisphere to establish an equilibrium, and complete the spheroid. Hence the greater exposure of land surface now in the northern hemisphere, much of which is known to have been submerged.

Where then is the base line of geology, when we find that our igneous rocks were produced in other worlds, before being deposited with us?

A. D.

A Substitute for Mica in Stoves.

To the Editor of the Scientific American:

The want of durability in mica and the difficulty in bending it renders the application of another material desirable. My observations have convinced me that we have the most desirable qualities in thin glass tubes, so arranged as to pre-

sent an even and a nearly airtight surface. As glass tubes are drawn at the glass houses, they are slightly though perceptibly conical, a matter of no moment, as, by alternating the larger and smaller openings, when they are laid parallel, close joints result.

Three kinds of glass are met with in the market: Brown bottle, greenish lime, and cullet and flint glass, more or less perfect. Either of these kinds may be used, as radiant heat from the fire will anneal them; flint glass, being the most pliant, is best adapted to the nicer purposes. Tubes drawn quite thin, from one eighth to one third of an inch bore, may be used, always with reference to the thickness of the envelope of which they form a part. They may be arranged side by side, either vertically or horizontally, to fill any size or space, resting loosely in a recessed space or in a clip of malleable metal to support them and exclude dust. Combinations of shorter and longer tubes may be used for paneling or otherwise varying the surface. But ornamentation will doubtless be best gained through colored and particolored tubes, so arranged as to produce the most pleasing variety. It is well known that silvering within the colorless or colored tubes can be easily so adjusted that much light will be transmitted, while on another part the luster of burnished metal may be obtained, while little light is lost.

Sliding, folding, and curved screens of any size, flexible or fixed, can be formed with these tubes, so that stoves with open or closed fronts may be made. There is not the slightest risk of fracture of the tubes, excepting from a blow or similar accident; and any partial destruction can be repaired by substitution in a few minutes' time; indeed, the pliancy of the structural forms of large size is a safeguard. Washing or other cleansing of the surfaces can be done without danger when the glass is cool.

The increased consumption of glass in this way will diminish its cost in the form of small tubes, and lead to the introduction of ornamental and beautiful designs in all appliances for warming apartments by visible fires.

A. A. HAYES.

Electroplating Pewter Surfaces.

To the Editor of the Scientific American:

I noticed in a recent number of the SCIENTIFIC AMERICAN that a correspondent experienced great difficulty in plating pewter surfaces. To him, and all others who have met with similar difficulties, I will give the following recipe, which will be found simple and very effective:

Take 1 ounce nitric acid and drop pieces of copper in it until effervescence ceases; then add ½ ounce water, and the solution is ready for use. Place a few drops of the solution on the desired surface, and touch it with a piece of steel, and there will be a beautiful film of copper deposited. The application may be repeated if necessary, though once is generally sufficient. The article must now be washed and immediately be placed in the plating bath, when deposition will take place with perfect ease. This is an excellent recipe, and should be known to all electroplaters.

Friendsville, Ill.

JAMES POOL.

About Ourselves.

To the Editor of the Scientific American:

We have come to the conclusion that a thing of real practical value has but to be advertised in the SCIENTIFIC AMERICAN to insure its success. From one week's advertisement of our small Welch Water Engine, in your columns, we have answered as many as eighty letters in a single day. That single advertisement will pay us largely as an investment, unless the overwhelming amount of correspondence therefrom really ruins us.

THE NEW ENGLAND MOTOR AND MOWER COMPANY.
Danbury, Conn.

The Acrophore.

This is an apparatus for enabling persons to breathe and work, with a light, in unbreathable and explosive gases in mines, wells, sewers, and caverns. It is the invention of Messrs. Denayrouze, of Paris. The acrophore consists of a number of large or small cylinders as desired, which are lowered into the mine with the workman. Connected with the cylinders is a long flexible tube about an inch in diameter, of such strength that it cannot be damaged even by being trod upon. The person who is to use the acrophore first puts on a strongly made jacket of webbing, to the back of which is attached a couple of moderating valves which serve to supply the compressed air to the mouth at ordinary atmospheric pressure—not higher—the pipe being attached to these valves. Another pipe passes over the shoulders and to a mouth piece. The nostrils are closed by a nipper. The mouth piece is constructed so as to be available either for a light or heavy breathing man. Exhalation is accomplished by means of a small aperture in the tube about two feet from the mouth. This aperture is fitted with a proper valve, which stops the ingress of all air or gases. By another valve and tube, air is supplied to the lamp which the miner carries in his hand, and enables it to burn brightly, and a pair of "goggles" are provided in case the eyes are likely to be affected. These can readily be fastened on by means of an elastic strap.

D. D. S. writes to suggest that lightning rods be made in the form of an elongated oval, about 6 feet wide, so that the conductor would present the appearance of two rods, side by side, joined at the top; and they would also be joined under ground. He thinks that this arrangement will give better protection to a building, from the better ground communication it would afford.

Richard Trevethick's Thousand Feet Tower.

Mr. F. S. Hoffman, of Philadelphia, Pa., writes to remind us that the eminent engineer Trevethick proposed to erect an iron tower 1,000 feet high, in commemoration of the passage of the Reform Bill in England in the year 1832. In that year he sent a note to the *London Morning Herald*, which contains the following:

"Design and specification for erecting a gilded conical cast iron monument (scale 40 feet to the inch), of 1,000 feet in height, 100 feet in diameter at the base, and 12 feet diameter at the top; 2 inches thick, in 1,500 pieces of 10 feet square, with an opening in the center of each piece 6 feet diameter, also in each corner of 18 inches diameter, for the purpose of lessening the resistance of the wind, and lightening the structure; with flanges on every edge on their inside, to screw them together; seated on a circular stone foundation of 6 feet wide, with an ornamental base column of 60 feet high; and a capital with 50 feet diameter platform, and a figure on the top 40 feet high; with a cylinder of 10 feet diameter in the center of the cone, the whole height, for the accommodation of persons ascending to the top. Each cast iron square would weigh about three tons, to be all screwed together, with sheet lead between every joint. The whole weight would be about 6,000 tons. The proportions of this cone to its height would be about the same as the general shape of spires in England. A steam engine of 20 horse power is sufficient for lifting one square of iron to the top in ten minutes; and as any number of men might work at the same time, screwing them together, one square could easily be fixed every hour; 1,500 squares requiring less than six months for the completion of the same. A proposal has been made by iron founders to deliver these castings on the spot at £7 (\$35) per ton; at this rate, the whole expense of completing this national monument would not exceed £80,000 (\$400,000). By a cylinder of 10 feet diameter, through which the public would ascend to the top, bored and screwed together, in which a hollow floating sheet iron piston, with a seat round it, accommodating 25 persons; a steam engine forces air into the cylinder column from a blast cylinder of the same diameter; and working three feet a second, would raise the floating piston to the top at the same speed, or five or six minutes ascending the whole height; the descent would require the same time. A door at the bottom of the ascending cylinder opens inwards, which, when shut, could not be opened again, having a pressure of 1,500 lbs. of air tending to keep it shut until the piston, descends to the bottom. By closing the valve in the piston, it would ascend to the top with the passengers floating in the air, the same as a regulating blast piston, or the upper plank of a smith's bellows. The air apparatus from the engine should be of a proper size to admit the floating piston, with the passengers, to rise and fall gradually, by the partial opening or shutting of the valves in the top of the piston. Supposing the springs or soft substance, for the piston to strike on at the bottom of the column cylinder, descending three feet a second, would give no greater shock than falling from 9 inches high, that being the rate of falling bodies, or the same as a person being suddenly stopped when walking at the rate of two miles an hour. The pressure of the air under the piston would be about half a pound on the square inch; the aperture cannot let the piston move above 3 feet a second, but this speed may be reduced to any rate required by opening or shutting the valves on the floating piston."

"Within two months," says Trevethick's biographer, "from the date of the design for a gilded column, Trevethick had passed away. His family in Cornwall received a note, dated April 23, 1833, from Mr. Rowley Potter, of Dartford, stating that Trevethick had died on the morning of that day, after a week's confinement to his bed. He was penniless and without a relative by him in his last illness, and for the last offices of kindness was indebted to some who were losers by his schemes."

Trevethick's grave was among those of the poor buried by the charitable; no stone or mark distinguished it from its neighbors. He is known by his works. His high pressure steam engine was the pioneer of locomotion and its wide-spreading civilization. England's mineral and mechanical wealth on land and sea are indebted to its expansive power, its applicability, and durable economy."

The Semi-Centennial Anniversary of the Franklin Institute.

The Franklin Institute recently celebrated the semi-centennial anniversary of its foundation, at the Musical Fund Hall, in Philadelphia. Mr. Coleman Sellers, the President, presided, and delivered an address, in which he sketched the past work of the Institute, and its influence upon the mechanical and scientific progress of the country. An earnest plea was made in behalf of technical education, and the value of proper instruction for working men warmly advocated.

Mr. Frederick Fraley, one of the founders of the Institute, gave some interesting recollections of its establishment, and said the first meeting was held in the County Court House, in Philadelphia, on February 5, 1824. Professor R. E. Rogers spoke upon the immense progress of knowledge which has occurred during the past half century, and, in quite a lengthy address, reviewed the history of inventions, beginning with Fulton's steamboat and ending with the most recent developments in astronomy, physics, and other mechanical and scientific professions.

President Morton, of the Stevens Institute, pointed out that, in the view of Science, the universe of matter is as truly the universe of motion, and hence the branch of study to which we should most devote our attention is that which treats of matter in its relation to motion, in other words, to

"mechanics." It is to the development of this knowledge that the Franklin Institute has contributed during the last fifty years. The speaker compared the advancement of the world to the gradual growth of a child; and in conclusion, he said that the necessities of the age are new means of applying great truths already discovered.

Electroplating.

At a session of the Physical Association held in Frankfort on August 30 last, Dr. Otto Volger delivered an address on the history and progress of the art of depositing metals by galvanic action, of which the following is an abstract:

At an early date it was known that a current of galvanic electricity was able to decompose liquids, and that metals deposited from solutions of their salts by this means assumed fantastic shapes, which appeared so similar, at the first glance, to vegetable growth that they were called galvanic trees, or metallic vegetation, although really consisting of crystals, and formed according to the laws of crystallization. Professor Böttger took especial delight in producing this sort of vegetation with different metals.

The use of such metallic deposits for electroplating was discovered accidentally. In 1830, Mr. J. P. Wagner, of Frankfort, and Professor Jacobi, of St. Petersburg, were endeavoring to employ electromagnetism as a motive power, instead of steam. Jacobi employed a Daniell's battery, which is distinguished for its constant and regular action. It consists of an outer cup of copper, and an inner cell of unglazed porcelain which contains the zinc rod. The intermediate space is filled with a saturated solution of sulphate of copper. When the battery is working, this solution of blue vitriol is slowly decomposed, depositing metallic copper, which finally becomes injurious, and must be removed. Once when Jacobi was busied with removing such a deposit from his copper cup, he noticed that there were several layers of copper, each having the form of the sides of the copper vessel, and hence, concluding that the sheet copper of which the vessel was made had split up into layers, he accused the man who made it of employing a poor quality of sheet copper. A closer investigation, however, showed him that these layers, or leaves, did not belong to the walls of the vessel, but to a new deposit of metal, which imitated, in a remarkably perfect manner, the shape of the surface of the walls. It occurred to Jacobi that this troublesome disadvantage could be turned to profit by using it for reproducing objects. In 1838, he communicated to the St. Petersburg Academy a description of his discovery of the use of galvanic electricity for reproducing objects in the arts.

Czar Nicholas requested a German chemist named Klein, who was then employed in the imperial printing office, to test the practicability of the discovery and to ascertain to what extent it was capable of development. The answer being a favorable one, he gave the discoverer the means of making his new art the common property of the whole world.

Electrotyping or plating with copper consists in merely making the object to be copied the negative element of a simple Daniell's battery. If the object is a conductor, metal for instance, and is to be only partially covered, the parts that are to remain uncovered are rendered non-conductors by coating with some non-conductor, as wax, stearin, or varnish. If it is a non-conductor, its surface is rendered conducting by brushing it over with a thin film of the finest graphite or silver powder. Murray discovered that graphite works the best. The reaction consists in the separation of the sulphate of copper into sulphuric acid and oxide of copper, while the water is simultaneously separated into oxygen and hydrogen. The sulphuric acid liberated at the anode or positive pole unites with the oxide of zinc, formed there by the oxygen given off from the decomposed water, to form sulphate of zinc, which goes into solution.

The hydrogen evolved at the opposite pole abstracts the oxygen from the oxide of copper, and forms water, while the copper is left in a metallic state. Hence it is really the hydrogen which causes the reduction of the oxide of copper to metallic copper, at the negative pole or cathode.

Up to the year 1840, this new art was only employed for making small copies, like coins and medals, and these often came out of the mold imperfect, or were broken in detaching the mold. At that time, however, Professor Böttger prepared handsome relief plates of copper, and also employed galvanism for depositing a metallic coating on other metals, as for instance gilding silver, copper, and brass. In the same year, a copper plate engraver, named Kress, came to St. Petersburg, learned from Klein the galvanoplastic art, as Jacobi had named it, and became acquainted with the latter. Jacobi called his attention to the fact that he could in this way make perfect copies of his etched or engraved plates, thus multiplying the original plate so as to obtain a great number of the most excellent impressions; for it is well known that a plate soon loses its sharpness, and every impression is poorer than the preceding one. At this suggestion Kress took up the art, and by 1844 had brought it to great perfection in his business. In 1841 Professor Böttger had made a copy from one of Professor Felsing's copper plates, in Darmstadt (the *Ecco Homo*, after Guido Reni, 12½ inches by 9½ inches), which was so perfect that Felsing declared that proofs printed with it were identical with those from the original plate, and of equal value. These plates are still in existence, the one in Berlin Museum, the other at Frankfort on the Maine.

The galvanoplastic art has extended itself in three directions: 1. For covering other metals, as in electroplating with gold, silver, copper, steel, and nickel. 2. In producing objects formerly cast in metal. This has been brought to great perfection in several German cities, especially Mayence,

where the smallest natural objects are copied and the largest works of art produced. Among the latter are three colossal figures on a monument in Frankfort. 3. The reproduction of engraved and stereotyped plates, and the like. In the latter, farther progress is still possible.

Early in 1840, Pélitot reduced protochloride of iron by passing hydrogen gas over it, and in this way obtained metallic iron in octohedral crystals and in malleable plates. In 1846, Professor Böttger made the first attempt to decompose the chloride of iron by the electric current, and with success, but soon found that a mixture of the double sulphate of iron and ammonium and the double chloride of iron and ammonium was better for electroplating. This he prepared by dissolving simultaneously 2 parts by weight of protosulphate of iron and 1 part sal ammoniac in water. As anodes he employed a piece of sheet iron; the cathode at once acquired a polished appearance from the metallic iron deposited on it. In this way he copied a florin in iron (several such specimens were exhibited by the lecturer.) The iron is very hard, like steel, but unfortunately very brittle, so that it frequently breaks in taking it from the mold. No technical use could at first be found for it. In 1859 Jacquin found an application of it in covering copper plates with steel. This consisted in precipitating on the copper an extremely thin film of iron, which did not destroy the sharpness of the impression, but by its hardness offered such a protection to the copper that the latter was almost as durable as a steel plate. In this process, also, Professor Böttger's recipe proved the best and was generally followed.

Recently, a chemist in St. Petersburg, also named Klein, has brought electroplating with iron to a remarkable degree of perfection. In 1868 he exhibited, before the St. Petersburg Academy, excellent results which he had obtained by using a solution of bisulphate of the protoxide of iron, and a Meidinger battery, with a piece of sheet iron as anode. Klein deposited the iron in large plates both thick and thin, as copies from engraved copper plates, and thus combined a soft, easily wrought plate for the engraver, and an iron plate as hard as steel for the printer. The iron thus deposited was, to be sure, very brittle, which Klein found to be due to the hydrogen occluded in it, its specific gravity being 7.675, or a little higher than rolled iron. By heating the iron, he succeeded in expelling the hydrogen, when it became more dense, and had a specific gravity of 7.811, which is higher than wrought iron. It was perfectly malleable, highly elastic, and could be welded like sheet steel, in short, was an excellent malleable iron. Klein has prepared plates of this iron weighing 16 lbs.

Electroplating in iron will find an important and extensive use in manufacture of stereotype plates, especially for printing government paper and postage stamps, where colored inks are employed, for the iron would not be attacked by the colors containing mercury, which acts on copper and other metals.

In conclusion, the lecturer referred to the occurrence of native metals in the earth, and the theory, advanced almost 30 years ago, comparing the earth to a voltaic battery. Hardinger believed that he could prove that the surface of the earth was the anode and the interior of the earth the cathode of a galvanic battery. According to this, native metals should only be sought deep down in the earth, which is not always the case. It is much more probable that native metals have been reduced by the decomposition of organic matter. This applies especially to copper, and also to the very rare telluric iron. The graphite found in the latter, is to be considered as the residuum of decomposed organic compounds. In the Rotanger sea in Sweden, native iron is found replacing particles of wood, as if petrified, and the microscope is able to detect the cells and determine that it was a species of pine wood. The interior of the cells is also filled with a deposit of iron. This is not to be attributed to the action of a galvanic current, but to the reducing power of the hydrogen liberated from the decomposition of organic matter.

Borax for Colds.

A writer in *The Medical Record* cites a number of cases in which borax has proved a most effective remedy in certain forms of colds. He states that, in sudden hoarseness or loss of voice in public speakers or singers, from colds, relief for an hour or so, as by magic, may be often obtained by slowly dissolving, and partially swallowing, a lump of borax, the size of a garden pea, or about three or four grains, held in the mouth for ten minutes before speaking or singing. This produces a profuse secretion of saliva, or "watering" of the mouth and throat, probably restoring the voice or tone to the dried vocal cords, just as wetting brings back the missing notes to a flute when it is too dry.

A correspondent, Mr. A. O. Kruger, reports the discovery of a copper mine at Isle Royal, Minn., which yields ore of a quality similar to those of the Calumet and Hecla mines on the south shore of Lake Superior. It is in a conglomerate rock, the belt of ore being 26 feet between foot and hanging wall, and has been found at points 14 miles apart. Our correspondent states that preparations for mining on an extensive scale are in contemplation, and that the discoverers believe that it will be the largest copper mine in the world.

"A Railroader" writes to suggest placing a partition in the sand box of a locomotive, so that screenings of sand or gravel may be used if required. A second rod would be required to let the gravel on to the rail; but the coarser stuff would be very useful when the metals are covered with ice or snow.

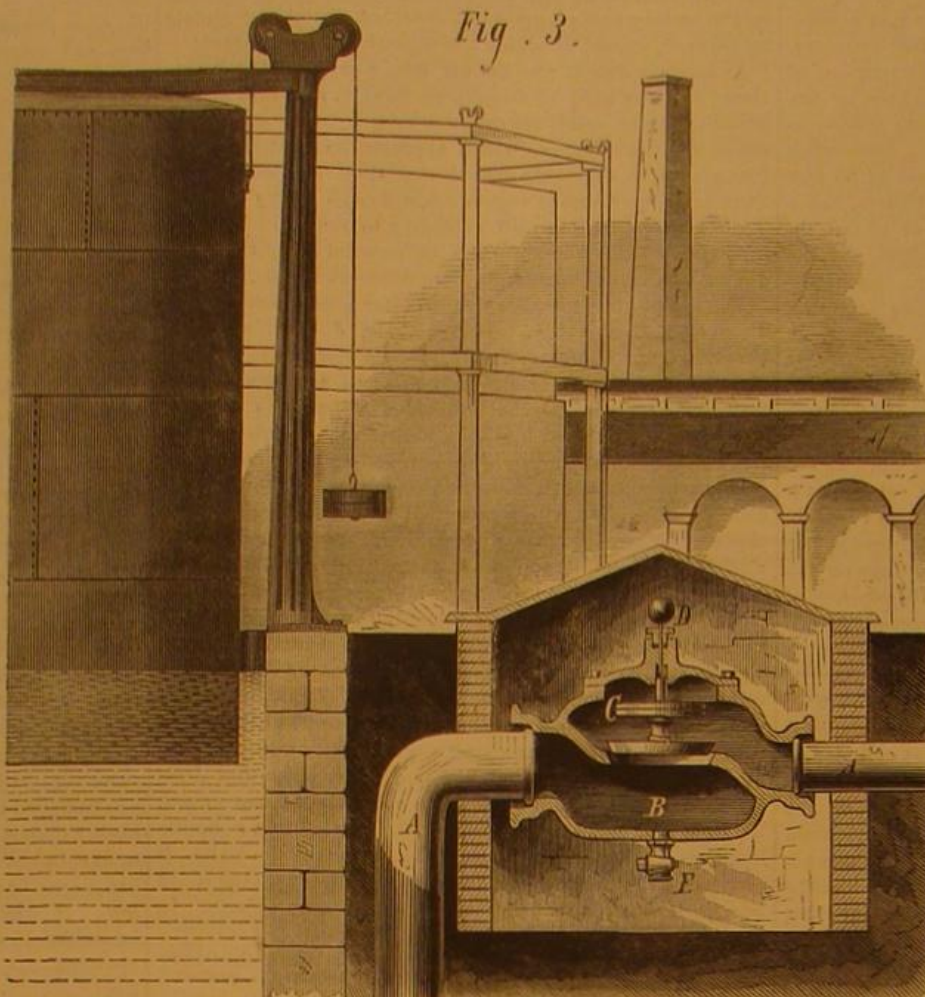
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tion of this cock may be altered to suit conditions of accessibility, etc. It doubtless has been surmised that the escape of a strong current by the valve, would, when the gas is first admitted, produce a vibratory motion or chattering of the valve. To avoid this, the inventor supplies a push pin, I, which is pressed down by the flange and held by the weight, J, above it, until its lower extremity strikes the valve stem, thus steadying the latter until the gas has entered the distributing mains, and the proper conditions of pressure above and below the valve result. The pin is then released, when it returns to its normal position.

Another application of the device, essentially the same, though differing somewhat in construction, is shown in Fig. 3. The apparatus is here placed in the main leading from the gasometer. The latter is weighted or otherwise arranged to give the fullest pressure ever necessary, and the regulator governs the quantity of that force required for existing needs. The mains, A A, enter a box which is divided into two compartments, as shown. In the diaphragm the valve, B, is seated, and the area of its face is made sufficiently large to compensate for the low pressure coming from the holder; or about equal to, or perhaps a little greater in diameter than, that of the main. C C are the weights, and D the push pin, acting exactly as above described. E is the cock for drawing off deposits, etc. Of course the advantages of this adaptation are about the same as already described, only more extended. For instance, if we lived next door to a theater or hall in which a thousand burners were nightly lit, this wholesale illumination, the inventor tells us, would be without effect on the dozen or so lights in our dwelling. It has also been suggested that the regulator might be advantageously located in various quarters of a city, so as to regulate the supply of gas—or water, just as well—in accordance with the extent of the demand.

In Fig. 4, we show an application of the device toward the regulating of the descent of water in pipes down mountain sides. Commencing at the summit, it is proposed to place a regulator, A, at a point in the pipe where the water attains a pressure say, of 120 pounds, so as to reduce the latter to 20 pounds. Then further down, after the water again assumes the first mentioned pressure, a second regulator, B,

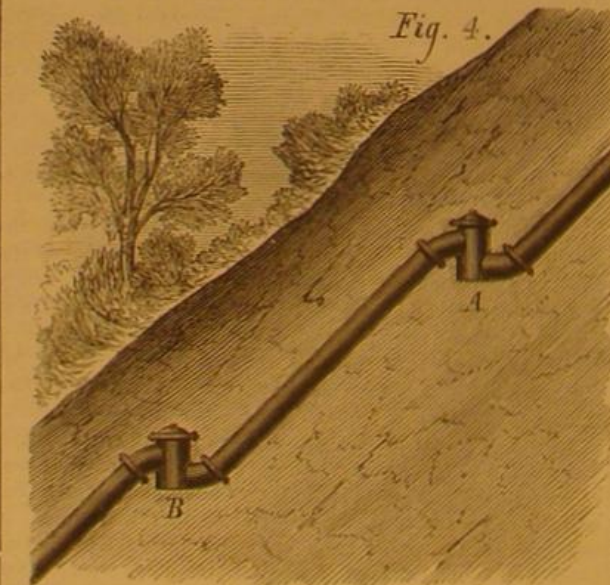
of an entire city, so as to change the pressure, in the mains, to the high force useful in throwing streams for extinguishing fires, from the working pressure ordinarily employed. This may be adapted to the Holly system of water works, in which the water is pumped directly from the river by powerful engines usually constructed in substantial buildings on the banks, and of the type represented in our engraving, and subsequently driven through the distributing mains. The idea in this case is to divide the main into two



CASEMENT'S PRESSURE REGULATOR FOR FLUIDS.

branches which are afterwards reunited. In each branch a regulator is placed, and through each the water may be directed by opening or closing the valves shown. The regulator in the fire pressure branch is adjusted to pass a powerful stream, while that in the other admits of the escape of a current of a force just necessary to insure the complete distribution of the water to all parts of the town.

Another advantage which the inventor claims is that the pressure is equalized throughout the entire system of pipes, so that the latter may be of a uniform strength over their extent, and not subjected to undue strains at any point beyond the valves.



We have now cited sufficient modes of application of the invention to give our readers a fair idea of its value and uses. The inventor informs us that he has made it the subject of practical tests with invariably successful results, and that it has been in operation in his own dwelling, as we before stated, regulating the flow of his gas well for some time past. He is enabled to gage just the pressure he requires, either for fires or lights, by suitable arrangements of pipes and differently adjusted regulators. The device is susceptible of ready adaptation to the purposes of a safety valve for steam boilers, for regulating the water pressure in cooking ranges, water backs, etc., or the pressure of compressed air or vapors.

Patented, through the Scientific American Patent Agency, in the United States, Canada, England, Australia, and most of the countries of Continental Europe. The inventor is Mr. Daniel T. Casement, of Palmsville, Lake county, Ohio. Letters for further information should be addressed for the next three months to the patentee, at the Fifth Avenue Hotel, New York city.

The Page Patent Litigation.

There seems to be a probability that the validity of the Page patent will be thoroughly and legally tested. We have before mentioned in *The Telegrapher* the fact that suits had been commenced in the United States Courts against the Manhattan Quotation Company and Mr. Charles T. Chester, of this city, for infringement of this patent, and they are to be contested to the end, and its validity, as affecting telegraph instruments and apparatus, either established or denied judicially.

Our readers are fully aware of our opinion in this matter, and we have shown, as we think, conclusively, that Professor Page was not the original inventor of the devices for which a patent has been granted to him, and that, in fact, the patent is an outrage on the public, who have paid largely for these same devices to other patentees, whose patents have expired and become public property. So well convinced was the Western Union Company of the invalidity of the patent that, when first offered to them for purchase, after an investigation by experts and eminent patent lawyers, it was rejected. It was subsequently purchased by that company for good and sufficient reasons, no doubt, not connected with its validity, and has, for the last three years, been held in *terrorem* over the telegraph interests of the country not connected with the Western Union—no serious attempt having heretofore been made to enforce it.

It should, by all means, be disposed of at as early a day as possible. If properly contested, that it can ever be maintained legally we regard as an impossibility.

The resources of the Western Union Company will enable them to press the matter, and the contest will be protracted and expensive. All who are interested in defeating it should at once join hands with the defendants and make common cause with them, sharing the expenses as they will the benefit of success. The railroad companies are especially and vitally interested in this matter; for if the Page patent be once established, they are at the mercy of the Western Union Telegraph Company, so far as their telegraph facilities are concerned, and will be made to pay roundly for the exemption from

such control during the last few years, since the Morse patents expired. They should be wise in time, and cooperate with those who are engaged in supporting the independence of the telegraphs of the country.—*The Telegrapher*.

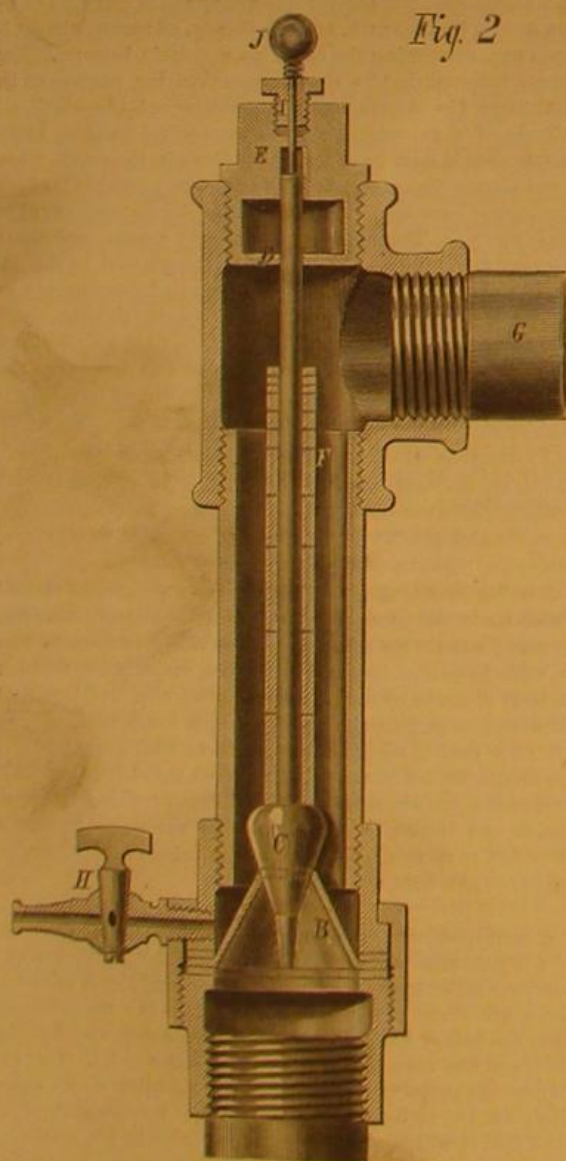
Beach Mining in California.

On the coast line of Klamath county, Cal., there is a remarkable deposit of auriferous gravel. For nine miles along the beach an unbroken line of cliffs, towering from one to five hundred feet, serves as a sea escarpment to the mountains behind, and these are immense masses of gravel of varying size and of distinctly marked layers or stratifications. In these "gold bluffs," as they are termed, the precious metal is found in considerable quantities, principally in the tenth strata, which is "black sand" or gravel with iron cement.

Mr. A. W. Chase, in a paper read before the California Academy of Sciences, gives a graphic description of how the mines are worked; and as the labor is carried on without shafts, tunnels, timbers, pumping or hoisting machinery, it may be inferred that the expense of exploration is not excessively large.

After the sand is reached, it is shoveled into little piles and thence into canvas bags, containing about 125 pounds each. These are loaded on mules, each animal carrying two, and thus transported to the "sand corral" in the works. The washing is done in "Long Toms" with copper plates, the latter being first coated with silver, before the quicksilver is applied. Mr. Chase states that, during the week he visited the mines, \$1,600 was retorted from the washings of two machines. He points out that, as the experience of the successive proprietors of this extraordinary gold mine goes to prove that, immediately after a heavy cave or slide of the banks, the beaches are richer and the gold coarser, it seems strange that, up to the present time, no artificial means have been resorted to in the way of blasting down the cliffs or undermining them by hydraulic process to increase the yield of gold. The sea, working ceaselessly night and day, is the great natural separator, and man has but to gather the results of its tireless work. Many ideas have been advanced as to the possibility of gold in quantities and coarser in character being found beyond the line of surf, predicated on the fact that it, in conjunction with black sand, has been said to have been brought up from the bottom by the leads of sailing vessels. Several expeditions have been fitted out at San Francisco to procure this sand by means of diving apparatus, etc., but none of them were successful.

THE UTILIZATION OF IRON PYRITES.—In connection with this subject, Messrs. Dobschütz and Abend state that large quantities of coal, unfit for smelting purposes on account of the pyrites it contains, are mined in Illinois. The coal does well for steam raising; but being useless in metal-lurgy, it is sold for about 2½ cents per bushel, and is even burnt to prevent its cumbering the ground near the mines.



is located, and the force is a second time reduced. This is continued until the descent is complete. By this means the water can be safely carried down any declivity, however long and steep, without undue strain or injury to the pipes.

Our large front page illustration is intended to show how the invention may be applied to regulating the water supply

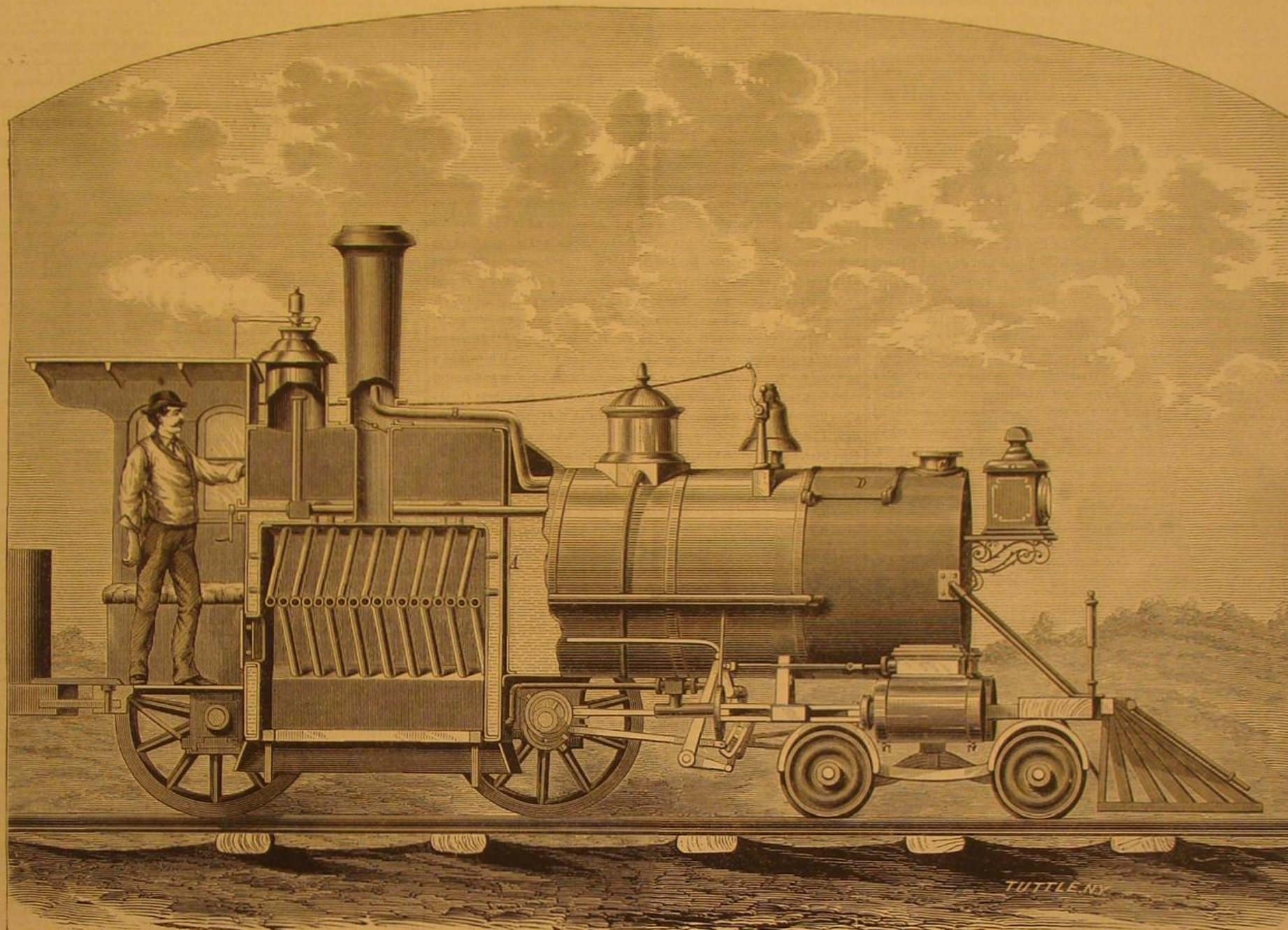
CASEMENT'S IMPROVED METHOD OF BURNING FUEL.

The improved steam boiler represented in the annexed engravings presents certain novelties in construction, by which it is the object of the inventor to utilize the largest possible portion of the fuel, and, by suitable mechanical means to render available, to the full extent, the heat of the ascending products of combustion. The imperfect utilization of the latter is a prolific source of waste, and for this reason

through their interstices. In the same proportion that they improve the combustion, they take up the greater heat produced thereby; and preventing the same from escaping by the flues, hold it, as the inventor claims, so that it is utilized by radiation, thus augmenting the power of the furnaces.

The principle upon which the invention is constructed is practically applicable to ordinary heating furnaces, stoves, or grates, and, as the inventor assures us, for any variety of

as much of the escaping heat as possible, a series of hollow dampers, shown at F, in Fig. 2, and in full detail in Figs. 3 and 4, are placed near the lower bend of the flues, D, and in chambers formed in the same. These dampers, which may be of any number, have for their shafts hollow tubes, which, passing through stuffing boxes in the shell, communicate with the water in the boiler, so that the dampers, in fine, being always full, form an additional amount of water



CASEMENT'S IMPROVED STEAM BOILER, LOCOMOTIVE, AND METHOD OF BURNING FUEL.

any device which may advance novel and useful ideas for preventing such loss may be considered as of important economical advantage.

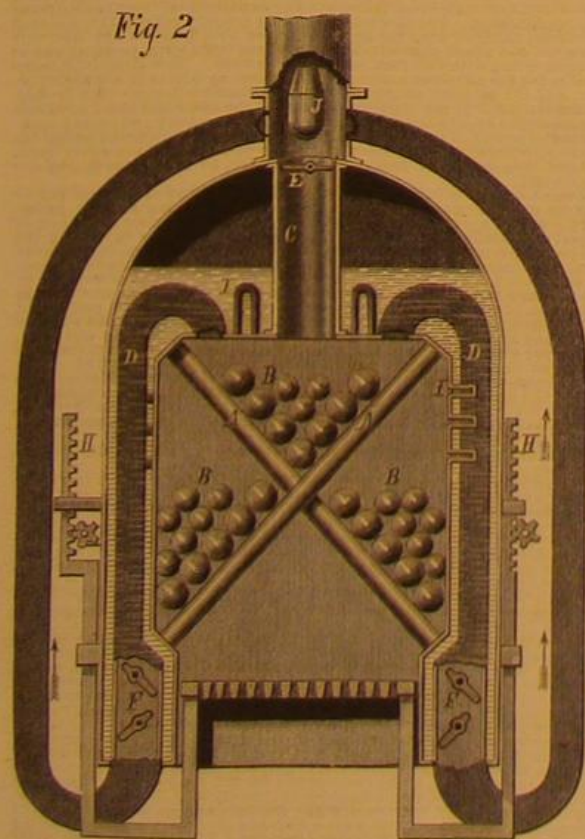
The inventor proposes to conduct the products of combustion, rising from the fire, between and around a number of

fuel. The heat, it is asserted, absorbed and radiated by the balls, tends to increase the heat given off by the apparatus, while, at the same time, the amount of material consumed will be considerably reduced.

In Figs. 1 and 2 are shown longitudinal and transverse sectional views, from which the construction may be readily understood. Placed diagonally across the fire box, and intersecting each other, are two sets of water tubes, A, Fig. 2, the ends of which are expanded into plates forming the corners of the chamber. These tubes, while largely augmenting the heating surface and improving the circulation of the generator, have for their primary object the support of the balls, B, Fig. 2, which rest upon them. It will be observed that these balls are of varying sizes, the largest being underneath in each tier; by this means, it is believed, the entire substance carried up by the draft will be more effectually divided and brought into contact with the hot metal. C is the direct escape flue, which would, in practice, be used

space. Their location and arrangement, clearly indicated in Fig. 3, show that, when they are fully open, the escaping hot current is compelled to assume a zig-zag course, striking each damper in succession, thus, it is claimed, giving off its heat to the best possible advantage. These gates are connected by gear wheels, G, Fig. 4, so arranged that, by turning one, the motion will be communicated to the others, so that all are operated simultaneously. The grate in Fig. 2 is made vertically adjustable by mechanism which will be comprehended by a glance at the engraving. The racks, H, in the upper portion of the vertical bars of the supporting frame, engage with pinions which are connected by a single crank or similar means. By making the grate so that its distance from the balls may be graduated at will, the inventor states that the intensity of the heat acting upon the latter may be regulated; and in boilers having low fire space, more room can be obtained for the operations of firing, cleaning, etc. At I are shown a number of short return flues or sim-

Fig. 2



balls or blocks of metal or other material; so that, the latter being intensely heated, the smoke, gases, etc., coming in contact with them, become entirely consumed. These balls are suitably disposed directly in the upper portion of the fire box, and in such manner as not to obstruct the draft which passes

in starting fires, or when a powerful draft was necessary. Ordinarily, however, it is proposed to employ the return flues, D. These open through the crown sheet of the boiler, pass down through the water space, thereby carrying the heat through the cold water near the bottom, thence return upwards and enter the direct flue, C. At E is a damper in the latter, by which its draft may be shut off when the return flues are in action. In order to regulate the draft, and also to take up

Fig. 3



Fig. 4

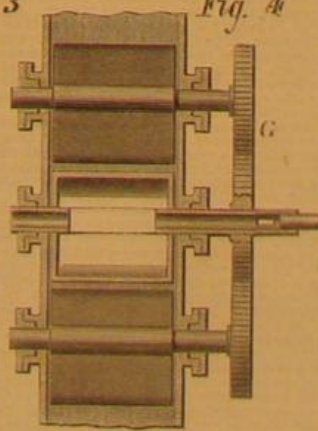


Fig. 5



ly sockets let into the walls of the fire box and the crown sheet, in order to increase the heating surface, and at J is the extremity of the exhaust pipe from the engine, the escaping steam from which increases the upward current in

the uptake. In Fig. 5 is represented the application of a similar arrangement of tubes and balls to the ordinary cylindrical boiler. The construction is quite obvious from the engraving, so that no especial explanation is deemed necessary.

Referring once more to Fig. 1, in that illustration is shown both the improved boiler applied to a locomotive and also a peculiar construction of the latter machine. The form of the generator, it is clearly evident, does not comprise the large cylinder, which forms a part of the ordinary boiler, and the larger portion of the body of the motor; and consequently it is proposed to convert the same into a simple tank completely separated from the boiler by the double partition, A. The object of this is to render the locomotive adjustable in the matter of weight, by filling this receptacle with water or heavy solid material. To illustrate, the inventor considers it unnecessary, and in fact a waste of iron, to run a thirty-five ton locomotive over a road of varying grades, where its full tractive power is needed only on heavy up slopes, while a fifteen ton engine would do all the necessary pulling on levels or down inclines. With a light and compact boiler, with a tank as represented in the locomotive in our engraving, the total weight of the machine need not exceed fifteen tons; but by filling with water or other material, the same may be quickly increased to any desired extent up to the limit, say of thirty-five tons. At C, a small funnel is erected which is designed to receive the spout from water stations; and at D a door is placed, which may be used for gaining access to the interior of the tank, or for more conveniently throwing in weights. One or both of these apertures may be employed at will; and by the materials added, the weight of the locomotive may be quickly augmented or lessened in proportion to the load it is to draw and other circumstances. In case of a line having many ascending grades, rendering it necessary to change the weight of the engine quickly, while in motion, it is proposed to place troughs between the rails at the bottom of the slope and let the water be taken up into the tank in the ordinary manner now in use on many roads for filling the tender. On arriving at the summit of the grade, this water is discharged, and the locomotive once more rendered light.

The various parts of the machine, as shown in Fig. 1, are of the usual description and require no explanation. B is the exhaust pipe, to which we have already referred as entering the uptake at J, Fig. 2.

The construction of the boiler and the peculiar arrangement of the locomotive are made the subjects of separate patents, and the credit of the inventions is due to Mr. Daniel T. Casement, of Painesville, Lake county, Ohio, who has patented them, through the Scientific American Patent Agency, in the United States, Canada, England, Australia, and most of the countries of Continental Europe. Letters for further information should be directed, for the next three months, to the patentee, at the Fifth Avenue Hotel, New York city.

Prizes offered by the Paris Society for the Encouragement of National Industry.

In addition to the grand annual medal of commerce, Chapital prize, a prize of 2,000 francs in the class of cotton industries, the Society offers the following prizes for the year 1874:

For a small motor for home industries.....	2,000
Combining cotton and short fibers.....	1,000
Dressing of millstones (Ferté-sous-Jouarre prize).....	5,000
Practical and economic production of oxygen.....	2,000
Utilization of waste matters in factories.....	1,000
Transformation yielding a natural useful product, such as guanine, egg, etc.....	4,000
Artificial production of fatty acids and wax.....	4,000
Distillation of the residue of the purification of gas.....	1,000
Conservation of food in the fresh state.....	2,000
Apparatus for small workshops producing high temperatures.....	1,000
Cultivation of grass and trees in mountains.....	2,000
Irrigation.....	5,000
(second prize).....	2,000
Production of healthy seed from French silkworms.....	500
Reclamation of land and embankments.....	2,000
A drill for sowing manure in powder.....	1,000
Study of the progression of the phylloxera from one vine to another.....	2,000
Fabrication of good photographic paper.....	2,000

Details of these and other prizes to be obtained on application to the secretary, No. 17 Rue de l'Abbaye, Paris.

Bronze Casting under Artificial Pressure.

A French officer, Colonel Lavroff, has given his attention to the casting of bronze guns under a more efficient pressure than has hitherto been employed—a parallel operation with that of Sir Joseph Whitworth in the case of iron and steel.

A cast iron platform is laid on foundation walls; and upon the former rests, first, the ground plate of the mold, and secondly the mold itself, which is of great strength. This mold is surrounded by a heavy cast iron jacket, which is bolted to the platform; springs are arranged to protect the bolts and the other part of the apparatus against the effects of the dilatation of the mold after the running. The cover is furnished with a cylinder formed of clay or other bad conductor of heat, and on this is placed a metallic piston with a pocket or receptacle. The piston and pocket form one solid piece, which is supported in its position at the required level by iron bands. The opening for the metal as well as the pocket is lined with fire clay.

The upper part of the metallic mold and the inferior surface of the cover are also lined with fire clay, in order to retard as much as possible the cooling of the upper part of the casting. The air and gases escape from the mold by means of several conical vents. The apparatus producing the pressure consists of a frame formed of two cast iron cross pieces connected together by means of bolts. This frame, while embracing the mold, is at the same time freely suspended to the chain of a crane by means of an iron ring. The frame is furnished on its under side with a piece of metal,

which serves to close the opening through which the metal is run, and to transfer the pressure to the piston. This pressure is produced by means of an hydraulic press fixed to the lower part of the platform, its piston in its descent drawing down the frame.

The conditions laid down by Colonel Lavroff are as follows: (1) Each transversal section of the interior of the mold should be at least equal to any section above it. (2) The upper part of the casting ought to be preserved as much as possible from loss of heat, by means of a non-conducting lining within the mold. (3) Finally, the piston acting on the molten metal should present to it a non-conductor, and, moreover, should act upon the central portion of the liquid column and not over its whole surface.

HOW SHALL I INTRODUCE MY INVENTION?

This inquiry comes to us from all over the land. Our answer is: Adopt such means as every good business man uses in selling his merchandise or in establishing any business. Make your invention known, and if it possesses any merit, somebody will want it. Advertise what you have for sale in such papers as circulate among the largest class of persons likely to be interested in the article. Send illustrated circulars describing the merits of the machine or implement to manufacturers and dealers in the special article, all over the country. The names and addresses of persons in different trades may be obtained from State directories or commercial registers. If the invention is meritorious, and if with its utility it possesses novelty and is attractive to the eye, so much the more likely it is to find a purchaser. Inventors, patentees, and constructors of new and useful machines, implements, and contrivances of novelty can have their inventions illustrated and described in the columns of the SCIENTIFIC AMERICAN. Civil and mechanical engineering enterprises, such as bridges, docks, foundries, rolling mills, architecture, and new industrial enterprises of all kinds possessing interest can find a place in these columns. The publishers are prepared to execute illustrations, in the best style of the engraving art, for this paper only. They may be copied from good photographs or well executed drawings, and artists will be sent to any part of the country to make the necessary sketches. The furnishing of photographs, drawings, or models is the least expensive, and we recommend that course as preferable. The examination of either enables us to determine if it is a subject we would like to publish, and to state the cost of engraving in advance of its execution, so that parties may decline the conditions without incurring much expense. The advantage to manufacturers, patentees, and contractors of having their machines, inventions, or engineering works illustrated in a paper of such large circulation as the SCIENTIFIC AMERICAN is obvious. Every issue now exceeds 42,000 and will soon reach 50,000, and the extent of its circulation is limited by no boundary. There is not a country or a large city on the face of the globe where the paper does not circulate. We have the best authority for stating that some of the largest orders for machinery and patented articles from abroad have come to our manufacturers through the medium of the SCIENTIFIC AMERICAN, the parties ordering having seen the article illustrated or advertised in these columns. Address

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Inventions Patented in England by Americans.

(Compiled from the Commissioners of Patents' Journal.)
From January 16 to January 19, 1874, inclusive.

CONDENSED MILK.—G. Conklin, New York city.

FILTER.—P. Huerne, San Francisco, Cal.

FOG SIGNAL.—G. C. Patterson, Baltimore, Md.

MAKING LAMPGLASS.—J. Rogers, New York city.

PIPE WRENCH.—J. Austin, New York city.

SHOE TIP.—A. Pollok, Washington, D. C.

VENTILATING AND WARMING.—A. G. Myers, New York city.

DECISIONS OF THE COURTS.

Supreme Court of the United States.

BASE BURNING STOVE PATENT.—HAILES & TREADWELL vs. VAN WORKER *et al.* [Appeal from the Circuit Court of the United States for the Northern District of New York.—October Term, 1873.]

A new combination is patentable if it produces a new result, although all the elements were previously known and in use.

But the new results must be something additional to the results which were separately produced complete before by the different parts of the combination; a mere aggregation of those results is not such new result, and does not render a combination legitimate.

A grouping together of devices in which each one produces its customary effect unmodified by the rest, and no more, and in which no result follows the union which was not previously produced by some of the elements, is a mere aggregation, and not a legitimate and patentable combination.

No one can prevent others from using certain specified devices, either singly or together, because he was the first to use them together, unless he thereby produced a new and useful result which was due to the joint action of the constituent parts, and was not merely an aggregate of the effects which were produced by those parts when operating by themselves.

A claim to a combination which is defined to be "substantially as described" is thereby limited to the elements which are described in the specification as composing it.

Mr. Justice Strong delivered the opinion of the court: The bill of the complainant is founded upon two patents, for alleged improvements in base burning stoves. Of these patents one is a release, dated February 3, 1863, and the other is an original, dated August 11, of the same year. The earliest asserts twelve claims, of which the first five only are charged to have been infringed by the defendants, and the second contains six claims, upon the first and second of which alone it is averred there has been any infringement. The answer of the defendants denies both the novelty and the patentability of the inventions claimed, and it denies also the infringement charged in the bill.

The stove containing the improvements described in the patents held by the complainants, and that manufactured and sold by the defendants, belong alike to a class of stoves long known as "base burners" or "self feeders," called such because they have a magazine or reservoir suspended above the fire pot, which may be filled with coal at its upper extremity, and which, when filled, is closed by a cover. The lower end of the reservoir or feeder is left open; and as the coal in the fire pot is consumed, the combustion being only in the fire pot, and not in the reservoir. Many such stoves had been made, and they were well known years before either of the complainants' patents was granted, and it is not claimed that merely as base burning stoves, they are within the monopoly of the patents. The inventions claimed are alleged improvements in the structure and arrangement of such stoves. They consist in what is described as a new combination of old and known devices, producing a new manufacture—namely, a stove uniting in itself all the advantages of a reservoir stove, and those of a reversible draft stove, which prevents the products of the combustion in the fire pot from passing up around and over the reservoir, thereby heating the fuel therein, so as to expel its gases, and cause their explosion as well as their escape into the apartments where the stove may be placed. All the devices of which the alleged combination is made are confessedly old. No claim is made for any one of them singly, as an independent invention.

It must be conceded that a new combination, if it produces new and useful results, is patentable, though all the constituents of the combination were well known and in common use before the combination was made. But the results must be a product of the combination, and not a mere aggregate of several results each the complete product of one of the combined elements. Combined results are not necessarily a novel result, nor are they an old result obtained in a new and improved manner. Merely bringing old devices into juxtaposition, and there allowing each to work out its own effect without the production of something novel, is not invention. No one by bringing together several old devices without producing a new and useful result, the joint product of the elements of the combination, and something more than an aggregate of old results, can acquire a right to prevent others from using the same devices, either singly or in other combinations, or even if a new and useful result is obtained, can prevent others from using some of the devices, omitting others in combination.

If, now, we examine the patents held by the complainants, looking first

at the objects sought to be obtained by the combinations for which the patents were granted, they are, as described in the specification, first, to prevent the passage of the products of combustion up, around, and over the top of the coal supply reservoir, so as to heat a surrounding jacket thereof; and, secondly, to heat a circulating or ascending body of air by means of radiated heat from the fire pot, and at the same time to heat the base of the stove by means of direct heat circulating through descending flues which lead into the ash pit, or around it, and to the smoke and draft flue. A third avowed object is to secure economy by retarding the fall of the coal into the fire pot from the supply reservoir, and by causing the flame to circulate outside of the contracted discharge of the reservoir, and around the upper edge of the fire pot, and thence to descend around or under the base of the stove in its passage to the smoke and draft flue. Such are the avowed objects of the combinations claimed to have been devised by the patentees, and their effects they assert to be husbanding the radiated heat, and using it for the purpose of warming the upper part of the stove and the room in which it is situated, as well as for heating air for warming rooms above, if desirable, and at the same time so confining the direct fire heat, and keeping it in contact with the base portion of the stove, as to insure warming it to a comfortable degree. A second effect claimed is relief of the incandescent coal from the weight of the body of superincumbent coal, thus preventing the compression of the burning coal in the fire pot, and securing for the flame free expansion, thus enabling it to act with greater heating effect upon the lower portion of the stove in its passage to the smoke and draft flue.

The combination employed to produce these effects consists of the following devices, among others:

1. A flaring fire pot supported by a base, the diameter of the pot being larger at the top than at the bottom.

2. A magazine or reservoir for supplying coal, located over the fire pot, and having its lower end contracted.

3. Reversible passages or flues outside of the pot for the conduct of the products of combustion downward to the base of the stove, and thence to a main draft flue leading thereout.

4. A direct draft for such stoves as are constructed with reversible flues, the direct draft being obtained by a flue passing out above the fire pot, and provided with a damper to be closed after the fuel has been ignited.

5. Openings in the case or exterior of the stove and the insertion of mica therein, for the purpose of illuminating the room in which the stove may be with the light of the burning fuel.

These devices, with others, are brought together, and claimed as a new combination, and several combinations of some of them are also claimed as inventions producing novel and useful results. What those other devices are we need not specify, for it is not shown that they are employed by the defendants.

The stove of the defendants does, however, contain all those mentioned, and contains them in combination. That each of them was an old device, well known, and in public use before the patents of the complainants were granted, is abundantly proved by the evidence submitted. A flaring fire pot, a supply reservoir with its lower extremity of smaller diameter than its upper, reversible flues, a place for flame expansion above the fire pot, the addition of a direct draft for use in igniting the fuel, provided with a damper, and the insertion of mica for illumination openings, were all found in stoves before Hailes and Treadwell claimed to have made their invention. It is true there is a peculiarity in the construction of the lower extremity of the complainants' supply reservoir. It is provided with a circular flange, extending outward and bending downward, so as to fit upon the upper rim of the fire pot, and thus form a closed combustion chamber. This, of course, is a new combination of old devices, around the upper part of the reservoir, and confines the flame and other products of combustion within a circular combustion chamber thus formed; leaving no outlet for them except through ear passages into reversible flues. For this device, the peculiar structure of the reservoir, and the formation of the closed expansion chamber, there is no equivalent in the defendants' stove. There is no such closed chamber. The reservoir does not rest on the fire pot. It has no connection with the sides or the sides of the stove. Nor is there any obstacle interposed to the passage of products of combustion up and around the reservoir when the flue for direct draft is open; and when that flue is closed, the flame is not detained over the burning coal, but the products of combustion pass directly across the edge of the fire pot, and descend along the sides thereof to the interior draft passage. Such an arrangement is not fitted to produce the effects sought and claimed for the complainants' stoves. On the contrary, it plainly excludes them.

There are other differences in the devices used both in the complainants' and the defendants' stoves, which we think are substantial, and not merely formal. The combination claimed by the complainants passes the products of combustion out of the chamber through perforations in the flange or through ears into flues leading downward, but wholly exterior to the fire pot, and not in contact with it. This arrangement makes it possible to introduce external air through perforations in the outer casing of the stove, and allow it, when heated by contact with the fire pot and the ascending flues, to escape from the top. Accordingly the outer casing is perforated, and there is no closed magazine around the fire pot. But in the defendants' stove there is no such device, and no such effects are produced. There are no external downward flues separated from the fire pot. The whole space around the magazine and the fire pot is completely inclosed. There is but a single chamber around the reservoir, over the surface of the burning coal, and around the fire pot. Through this chamber the products of combustion pass, either through the direct draft flue, when that is in use, or to the base of the stove, and thence outward. This arrangement also excludes the possibility of an effect claimed for the Hailes and Treadwell invention. It admits of no space around the fire pot to which the external air can have access.

It is not, then, the combination of old devices which the defendants use that Hailes and Treadwell invented. It is not those old devices that produce the new results claimed. The complainant's combination is a different thing. It has a greater number of constituent elements. It consists in the employment of the devices used by the defendants, together with others they do not use, and the result of the entire combination is the production of a stove differing very materially from that of the defendants; and the defendant's combination cannot produce the results claimed for that of the complainants. We have said that the devices claimed, whatever they may be, are not the production of the combined devices common to both stoves. The devices used by the defendants produce no new effects, because used in combination. The space around the fire pot leading to the base doubtless secures the beneficial results long known to follow the use of reversible flues. It may be conceded to be an equivalent for such flues; but the results of its construction are not changed by the fact that a flaring fire pot and a supply reservoir, with a contracted discharge end and openings for illumination, are used in the same stove. It still operates to conduct the products of combustion to the base and into the exit flue. No new operation is given to it by the combination. The same may be said of every other device employed by the defendants, which is also in the complainant's combination. Each produces its appropriate effect unchanged by the others. That effect has no relation to the combination; in no sense can it be called its product. Thus far nothing novel is produced. This, then, is the case with the aggregation of devices, and consequently the use of these devices, either singly or together, cannot be held to be any infringement of rights belonging to the complainants.

We pass now to consider more in detail the claims in the complainants' patents, which it is alleged the defendants have infringed. The first in the released patent, dated February 3, 1863, is unquestionably too broad to be sustained, unless limited to the means described in the specification. So it was doubtless intended by the patentee to be limited, for the broad scope of the combination claimed "substantially as described," that is, described in the specification. This limited, one of its essential elements is a closed combustion chamber over the fire pot, formed by a flange of the reservoir resting on the upper edge of the pot, and provided with perforations or ears connecting with two flues passing downward. This element is indispensable for the purposes asserted in the claim, as well as in the specification. And the peculiar construction of the chamber is more than formal. It is functional. It prevents the passage of the flame and other products of combustion up, around, and over the supply reservoir, which is a leading avowed object of the invention, precisely the improvements patented. But this constituent of the combination the defendants have never used, nor have they used any corresponding device, or device producing the same results.

The second claim is for contracting the discharge end of the coal supply reservoir, expanding the fire pot, and extending the flame passages outward for used operation in a base burning coal supply reservoir stove or furnace, essentially as set forth. The means set forth for extending the flame passage downward are perforations through the flange, forming the lateral boundary of the closed combustion chamber, or ears leading thereout, and close flues extending from the ears or perforations downward at some distance from the fire pot, through a space bounded on one side by the fire pot, and on the other by a space outside of the stove, and for the admission of external air. It might, perhaps, be questioned whether there is any device in the defendant's stove corresponding to this; but, waiving the consideration of that question, it is very evident that the combination of the three devices named is not the work of invention. They have no relation to each other. Neither the form of the feeder nor the shape of the fire pot bears at all upon the direction of the draft passages. There is no novel result flowing from more to do with a stove supplied by a vice. The reversible flues have no more to do with a stove supplied by a vice, than they would have with a stove supplied by hand. There is, therefore, nothing in this claim that interferes with what the defendants have done.

An essential element of the combinations mentioned in both the third and fourth claims is the closed combustion chamber, formed in part by a circular flange extending outward and closing on the upper rim of the fire pot, and having perforations in it, or ears for connection with the downward flues, or with perforations or ears leading out of such a chamber to the descending passages. These devices the defendants do not employ, and they cannot be used in the defendants' stove. There has been, therefore, no infringement of these claims.

The fifth claim is the only remaining one contained in the release which the defendants are alleged to have infringed. It is for contracting the discharge end of a base burning stove with a supply reservoir, and in the case of a trumpet mouth at its upper extremity, in combination with descending flame passages, substantially as described, and for the purposes set forth. How in combination? As described in the specification, united by means of perforated flanges or ears of the pot, involving, of course, the presence of a closed combustion chamber constructed substantially as already described. Construing the claim thus, as we think it must be construed, the defendants have been guilty of no infringement.

Passing now to the second patent, issued August 11, 1863, we observe that its first claim was for a combination of the illumination openings, flame expansion chamber, coal supply reservoir, fire pot, descending flue, and draft flue, substantially in the manner and for the purposes described. In the main, this is the same combination as that claimed in the released patent. The only change is the addition of illumination openings. These were a well known device applied to stoves long before either of the patents were granted. They perform no peculiar office in the new combination. They have no possible relation to it. They do not affect, in the slightest degree, the results of that combination, whatever they may be. It is impossible to regard the mere addition of illumination openings to a stove containing the improvements described in the released patent as the formation of a new patentable combination. It is not invention. If, however, it were, the defendants have not trespassed upon it, for of the combination the peculiarly formed close expansion chamber is an essential constituent, and that is not found in the defendants' stove.

Similar remarks might be made respecting the second claim of the patent of August, the only remaining one alleged to have been infringed. All the elements of the combination have not been used by the defendants.

The decree of the circuit court is affirmed.

Recent American and Foreign Patents.

Improved Thill Tag.

Dewitt C. Bassett, Cambria Mills, Mich.—This invention relates to means for supporting the thills of a vehicle, and furnishing, at the same time, a convenient mode of attachment for the saddle, breeching strap, and girth. The thill tag consists of a two part tube and a tube containing loops for the saddle, breeching, and girth straps arranged loosely thereon.

Improved Asphaltic Cement Tank.

Tobias New, New York city.—This invention relates to the residuum of coal tar, now used for roofing, paving, and vault covers. As soon as sufficiently cool, this residuum is placed usually in barrels, wherein it soon solidifies, and from which it can only be removed by their destruction, while the cooling and reheating impairs its quality. The present invention is a tank in which this valuable cement may be offered to the trade with all its original qualities, and without any necessity for the destruction of the package that contains it. The tank or metallic barrel is made airtight, to prevent the evaporation of the valuable adhesive properties of the cement, and, in conjunction with the inner lining, which is a non conductor of heat, to prevent the escape of calorific. The asphaltic cement is drawn from the still into these barrels or packages, which are then transferred to a chamber, kept always at a suitable temperature, and there held in readiness to be supplied to the trade. During transportation from one locality to another, a small fire is maintained in a central furnace, but only sufficient to make up for the heat that will very slowly escape from the airtight and heat-protected package.

Improved Potato Planter.

Jonathan R. Phelps, Chatham, N. Y.—This invention consists of a cutter on a hollow rotating dropping drum at the bottom of the hopper, in such relation with the passage to the dropping tube that the potatoes, settling down upon the disk, through the hole in the hopper, will be cut off in sufficient quantity for the seed of one hill and delivered into the passage to the tube. The invention also consists of a discharger combined with the cutter and the disk, so as to force out any of the cut pieces that may lodge in the throat between the cutter and the disk, and deliver them into the passage to the tube. The invention also consists of a spring pusher, combined with the cutter, to push the cut pieces into the passage.

Improved Washing Machine.

Elbridge Marshall, Toronto, Kan.—The clothes are placed in a box, between a grooved side and a vertical beater, the top closed down, and a sufficient quantity of water added thereto. A lever is then worked up and down, which produces a reciprocating motion of the beater by the action of toggle levers, and thereby the rubbing, pressing, and squeezing of the clothes till they are perfectly cleaned. This machine may also be used for pressing lard, by putting the lard in a bag between the beater and the side, and placing it in an inclined position for the clear lard to run off.

Improved Cotton Bale Tie.

Leopold Weil, 214 West 51st Street, New York city.—This invention consists of one or more transverse slots through the end portions of the band or hoop, through one or more of which slots, in each end portion, a flat metal pin or key is passed, the two end portions being overlapped. In the case of a bale, the key will merely extend along the hoop or band, between the latter and the bale, so as to be secured by the pressure of the bale. The key has a head to prevent it from passing through; and, if needed, it may be bent or indented with a punch, to secure it from working out. The inventor's object is to provide a bale tie of undiminished strength, and to do away with the necessity of making bends in the band to fasten it. The invention can also be applied to barrel hoops, etc.

Improved Running Gear for Carriages.

Daniel Hutchinson, of Hannibal, Mo.—The object of this invention is mainly to provide light vehicles with a platform gearing, by which the construction of the sustaining parts can be made lighter, and the upturning of the body of the carriage prevented, as the front wheels are made to turn freely below the same. The invention consists in substituting for the king bolt a disk turning in an outer surrounding sleeve, which carries the front spring of the carriage, and the springs connecting the step brace of the same. The dispensing with the perch and stays equalizes the additional weight of the step brace and disk pivot.

Improved Magazine Fire Arm.

Frank P. Peace, Marysville, and James W. D. Williams, Knoxville Tenn.—This invention consists of a magazine chamber on each side of the barrel, with a transversely reciprocating block behind them for taking the cartridges from said chambers alternately and presenting them to the barrel, also for removing the shells to a discharger. The block is worked by a crank shaft and connecting rod set in motion by a trigger wheel, which is turned far enough each time it is pulled for firing to effect one movement of the block, which brings the cartridge into position just before the hammer falls. The object is to provide a simple and efficient repeating arm, which can be loaded and fired by simply pulling the trigger.

Improved Bed Warmer.

Job Crockett, Portsmouth, O.—This invention consists of a flat circular metallic bed warmer, to be filled with hot water, which is provided with a screw plug fitting hermetically into a screw seat. The latter is arranged with notches for allowing every drop of water to be extracted from the inside, both plug and seat projecting to the inside of the pan, being flush with the outer surface.

Improved Machine for Sampling Ores and other Material.

John Colloom, Idaho Springs, Col. Ter.—This invention consists of a small short spout which is slowly and regularly moved at intervals under the mouth of a spout or trough, through which the substance to be sampled is caused to run, receiving a certain portion of the said substance, and diverting it from the regular course into a sample box. The proportion of the substance taken to the whole mass is determined by the proportion which the said short spout or receiver bears to the length of the circuit it travels, in the greater portion of which it is not passing the spout. The object is to obtain, from crushed ore, grain, and other substances, samples representing an average as to quality, and the proportionate weight.

Improved Railway Switch.

Carl Naucke, Jr., Magdeburg, Germany.—The object of this invention is to provide a switch mechanism, in connection with the common railroad signal switch, by which the correct position of the switch rail may be obtained by the locomotive engineer, even if the switch is wrongly set by accident or mistake, permitting thereby a full control of the switches by the same without slackening speed, and increased safety against accidents arising from misplaced switches. The invention consists in providing the pivoted switch rails with an attachment plate. This connects, by bell crank levers, with a link-shaped pivoted rod, operated and guided in such manner that the attachment plate and switch rails are moved whenever a latch connection of the link-shaped rod with a longitudinal lever rod, which looks into the sliding switch bar, is released by the action of an inclined lever of the locomotive on the roller of a weighted crank of the locking lever rod. The detaching of the lever rod from the sliding bar is thus produced, and the switch rails are thereby carried into position for the train.

Improved Bevel Sawing Machine.

George S. Grier, Milford, Del.—This invention consists in combining a vertically reciprocating saw with a canting frame, rack ring and pinion, and feed table, having bars supported in concavities of the uprights, whereby the whole machine is rendered much more convenient, and its products are caused to exhibit a more thorough, workmanlike, and uniform appearance.

Improved Loom Temple.

John C. Thickins, Washington Mills, N. Y.—This invention consists of a wheel for the weighted strap of a loom temple, provided with a ratchet and pawl arranged to allow the wheel to turn freely when the weight goes down. The weight is free to exert all its force without any loss by friction, and the wheel is prevented from turning when the strap is pulled up. By this means the influence of the friction of the strap on the wheel, to the weight for holding the fabric outstretched against the tendency of the tension of the warp to contract it, is increased.

Improved Railway Rail.

George O. Kunkle, Zieglerville, Pa.—The cap rail is so shaped that its head overlaps that of the base rail, passing then along its side, and being curved at the inner corner of the base, so as to slip easily along the base rail, and be easily removed and replaced. The base rail is first placed in position, being produced to correspond with the cap rail, with rounded head and forward projecting lower corner. The cap rail is then placed with its outer edge under the chair recess, and slid along the base rail till the head overlaps the base rail, resting fully thereon. Both the upper and lower rails may be removed and substituted very quickly, and without drawing a spike. The wear is confined almost entirely to the upper rail, which may be made of steel, the lower of iron. A chair may be used on every tie, or on alternate ties, as desired.

Improved Machine for Gunning Saws.

Thomas S. Jackson, La Grange, Tex.—A slotted stand or socket is adjustably connected with the bed plate. This slotted stand resembles the tool socket of a turning lathe, and it is made adjustable in a similar manner. An arm extends horizontally at a right angle from the shank, which latter is placed in the socket stand. To one side of this arm is attached, on a horizontal arbor, a face gear wheel. The emery wheel is made fast on another arbor, which is supported by the arm, and has upon it a pinion with which the gear wheel engages. A rapid revolving motion is given the emery wheel by revolving the gear wheel. The machine may be operated by hand or by motive power, and is made to gum or dress the teeth of a saw without the use of files, and in the most expeditious manner.

Improved Dental Plugger.

George H. Chance, Salem, Oregon.—Heretofore the metal points of the instruments used by dentists in filling teeth with gold have been exclusively of steel. The above inventor uses gold rendered of suitable hardness by alloy. The advantages claimed are prevention of electrical action from the contact of the steel tool and the gold filling. Second, obviating the danger of minute particles of steel remaining in the filling, forming a center of oxidation. Third, in preventing undue force being used, to the detriment of the operation and pain of the patient, the pliability of the gold point being such that it will bend before an excessive blow, while sufficiently hard for all practical purposes.

Improved Inside Blind.

John H. Voorhees, Williamsburgh, N. Y., assignor to Hardy and Voorhees, of same place.—To one end of the shutter roller is attached a pulley around which is passed an endless belt which also passes around a small pulley on the casing, and by means of which the shutter is wound upon and unwound from the roller. The pulley is recessed to receive the spring, which is coiled around the pivot of the roller. The inner end of the spring has an eye formed upon it, which is slipped over a pin attached to the pulley. The outer end of the spring has an eye which connects with a lever, which, by a pin and a series of holes in its arm, may be adjusted as desired. The tension of the spring is regulated by turning the lever around its pivot. The spring is so arranged as to be wound up by the descent of the shutter, and to be fully wound up when the said shutter has been fully lowered. By this arrangement, the spring increases in strength as the shutter descends, so as to be always about equal to the weight to be supported, so as to always balance the said weight, and thus enable the shutter to be raised and lowered with a very slight outlay of power.

Compensating Attachment for Flour Packing Machines.

Lewis Cravelling, Akron, O.—This invention consists in the connection of a strong spiral spring with the shaft from which the barrel platform is suspended, and with a hollow cog wheel, which is guided by a projecting rim in the base plate of the casing, and adjusted to any degree of tension of the spring by means of a pinion with check pawl and crank, as required for the different purposes for which the packer is used. The increasing weight of the barrel or sack to be packed will be compensated by the increased tension of the spiral spring on the shaft, so that the process of packing continues uniformly from beginning to end, the platform returning then easily into elevated position for filling the next barrel.

Improved Fountain Ink Pad for Hand Stamps.

Francis J. Contant, New York city.—In passing up and down through the top of the ink tank, a certain amount of friction is required to keep the ribbon tightly strained across the pad. This is accomplished by means of elastic valves, one of which is stationary. The other is gripped between metallic plates, and moved so as to press the valve against the ribbon by means of finger screws, which move in slots in the top of the tank. There is a plate at one end of the tank, through which the screws pass, which plate is forced up and the screws moved laterally by cam levers. Finger screws at the other end are attached to an angle plate, and produce the same result in a different manner. With this fountain pad the quantity of ink carried up by the ribbon is always the same, and cannot be varied except by compressing the ribbon between the valves.

Improved Mitering Machine.

John Henry Rowland, Denver, Col. Ter.—This invention consists of a saw guide and plane guide for controlling the saw and plane in cutting off and smoothing the wood sticks. There are a couple of shifting stops and a scale for a guide, by which to adjust the stops against which the wood pieces are held for sawing bevels of any angle, right or left. The support for said stops is jointed to the saw and plane guide so as to be adjusted around its major axis, and at right angles to the direction in which the shifting stops change the angles of the miterers for making the latter splayed.

Improved Bevel Sawing Machine.

George S. Grier, Milford, Del.—This invention consists in a saw beveling machine with a ratchet on each end of the table, the teeth of the two being inclined reversely from the middle; an adjustable frame placed transversely across a sawing machine table; in combination with an adjustable pointer, connected and moving with the table of a stationary scale plate, having a vertical row of notations and a series of notated arcs rows. These improvements are specially adapted to facilitate the preparation of ship timber and the cutting of irregular forms.

Improved Grading Attachment for Levels.

Dr. John Thornley, Charlottesville, Va.—This invention is an improvement upon the grading level for which letters patent No. 143,913 were granted to the same inventor, dated October 21, 1873, and it consists in so constructing and arranging the adjusting graduated bar and its sliding extension piece that a single screw secures them in the desired position, either extended or retracted, and whereby they may be locked together at their respective outer and inner ends by a spring and shoulder connection; and in the combination of said adjusting bar with a piece which is hinged to the under side of the level.

Improved Piston Packing.

Andrew J. Isler, Brownsville, Pa.—This invention relates to means whereby wedges may be applied, in a novel and useful manner, to the spring packing of a piston, and to means whereby the screws that fasten the follower to the piston head may be fastened by nuts on the outside, while the heads of the bolts are located on the inside of the piston head.

Improved Wood Stove Heater.

John C. Frazier, West Alexander, Pa.—This invention consists in making a wood stove with an upper and lower division, the former enlarged and projecting over the latter to receive a hot air chamber, which is provided with two registers, one opening into a pipe leading to the room above, while the other opens into the room in which the wood stove is located.

Improved Safety Attachment for Pocket Books.

John Trout, Omaha, Neb.—This invention consists of a long flap a little wider than the length of bank notes, with one or more elastic straps or cords extending across from edge to edge on the inside, and attached at their ends to the edges of the flap to secure the bank notes, which are to be placed under the straps, and then rolled or folded up in the flap. There is also a safety fastening for attaching the book to the clothing, so as to retain it in case of an attempt to pick it out of the pocket. This fastening is a notched stud pin projecting from a base plate, attached to the clothing and passing through a plate on the book, behind which is a spring catch engaging the said notched pin, so as to hold it until released by pushing the catch out of the notch by a thumb bit provided for the purpose. The fastening is also applicable for securing other pocket articles.

Improved Combined Plow, Scraper, and Chopper.

Hezekiah W. Rumbell, South Point, N. C.—To the beam, a little in front of the standard, is attached a second standard, which carries a scraper for barring off the plants. Suitable gearing on the forward part of the beam rotates a longitudinal shaft which revolves in bearings in arms attached to the beam. To the shaft are attached two knives, the shanks of which are made of such a length that the knives may be in proper position to chop the plants.

Improved Moccasin.

George F. Parker, St. Stephen's, Canada.—The sole piece is made of an elliptical form, and sufficiently wide and long to form a seam with upper and heel piece, which slopes from the leg seam in opposite directions toward heel and toe, and is at some distance above the tread face. The protuberance of seam is brought upon the outside, to make a smooth surface on the inside. The upper of the sole has a tongue and side projections, to and under which is sewn the front piece, the latter being made to overlap the heel piece and rear leg piece to which it is sewn. By constructing the boot of pieces that are thus shaped and fitted together, a very comfortable and durable moccasin is obtained, while the leather can be cut to more advantage and with greater economy.

Improved Band Pulley.

Edwin Sanford, Hartford, Conn.—This invention consists in making the lagging of pulleys of one rubber or leather strap, at intervals and at each end thickened to enter recesses in the rim of the pulley, secured by screws passing up through the wheel rim thereinto, whereby it will be no longer necessary to take down shaft and remove pulley whenever the lagging needs repair or replacement, but simply to unfasten the screws.

Improved Piston Rod Packing.

Charles H. Fuller, Akron, Ohio, assignor to himself and Edmund W. Deacon, of same place.—An outside casing of rubber is surrounded by covering of canvas. A coil of hempen rope is filled with pulverized soapstone, and with a second rope of rubber cloth is wound around a mandrel of wood of the size of the piston rod, alternately, and then surrounded by the casing. The whole is finally cut off square, so as to fill the stuffing box. In this manner the packing is prepared for use, and may be placed around the piston rod by cutting it open longitudinally, either parallel or obliquely with the piston rod. The packing is elastic, and is made to hug the rod by screwing down the gland. The rubber casing keeps the coils in place, and the soap stone, combined with the hemp, prevents friction.

Improved Thill Coupling.

Bernard H. Wessel, Cincinnati, Ohio, assignor to himself and George H. Groot, of same place.—The object of this invention is to facilitate the changing of the shafts of a carriage to pole, and vice versa. It consists of a coupling which is attached to the shafts or pole, and applied directly through the axle or by means of clips and clip plate, and held thereon by a screw, or equivalent, together with a rubber cushion. The device also consists in changing the shackle or coupling at the axle, instead of removing the bolt (as is usually done) that passes through the eye of shaft or pole.

Improved Furrow Scraper.

Frederick G. Thurston, New York city, assignor to M. Ma Del Gado and Joaquin Llera, same place.—The scraper plate has its forward edge made straight and beveled to cause it to enter the ground readily. The middle rear part is cut away, to cause the soil taken up by the end parts of said plate to pass into the furrow to be filled. The plate is made of such a length as to cross the furrow and rest upon the ridges at its sides. The soil taken up by the end parts of the plate, encountering upwardly projecting flanges which incline to the rear, passes inwardly and drops through a notch in the rear part of the plate into the furrow.

Improved Car Coupling.

Harbert K. Forbis, Danville, Ky.—The draw bars hook together side by side. They are fitted at the rear end in a hanger, and secured, by a key, with a strong buffer spring. This hanger is suspended from a strong plate, pivoted to the car bottom to swing laterally, and allow the draw head the necessary sidewise movements. At the front end of this plate is a stud projecting down each side of the draw bar, to insure the alignment of the one with the other, so that the draw bar will not cramp in the hanger when bumping. A cap on either draw bar slides along in front of the hooked end of the draw bar of the other car, and locks the hooks together. A cap is arranged to be forced back by the end of the draw bar when coupling, and forward after the hooks have engaged, by a spring. It has a bend, and is fitted on an inclined rest, so as to slide obliquely against the hook, and be constantly pressed thereon to insure the hooks against working apart, and to prevent rattling. For uncoupling, the caps are drawn back by a cord, which may be conducted to a lever upon the platform.

Improved Stalk Puller.

Cadwallader Heacock, Trinity, Tex.—The wooden handle of the instrument is inserted in eyes in the upper end and middle part of a metallic bar. The upper part of the latter, between the eyes for the handle, has a curve formed in it to serve as a fulcrum. The part of the bar in front of the end of the handle is nearly parallel with the same, and has a fluke formed upon its side, and projecting to the rearward at an acute angle. The adjacent edges of the fluke and body of the bar are beveled upon the lower side, to cause said edges to take a firmer hold upon the stalk to be pulled. The end of the bar forms a hook for throwing the pulled stalks together into windrows. In using the instrument, the fluke is passed around the stalk near the ground, and the instrument is drawn back to bring the said stalk as far as possible into the angle. The bow sliding upon the ground enables this to be done easily. The handle is then pressed downward, and the bow serving as a fulcrum, the stalk is drawn from the ground.

Improved Station Indicator.

Michael Farnan and Samuel W. McPherson, New York city.—A pawl lever is pivoted between pawls, so that a movement of it in one direction turns one of two rollers, and a movement of it in the other direction turns the other. To this pawl are connected cords which pass through the ears. A belt passes over the rollers, and has marked upon it the names of the stations. By pulling the cord, which connects with a separate indicator in each car, the brakeman may quickly change the name exhibited. A bell is arranged to sound whenever the belt is shifted.

Improved Combined Cultivator, Stalk Cutter, Harrow, and Corn Planter.

Matthew Green, Walker Station, Mo.—This apparatus is used as a cultivator and stalk cutter combined across the rows. The cutters run on each side of the young plants, and throw up the earth to the adjoining rows by the front plows, while the rear plows open the earth between them. The stalk cutters serve for the purpose of cutting the stalks, and also as fenders for protecting the young corn from being loosened by the tearing up of the stalks, and preventing injury by the falling of heavy clods upon them. After the first plowing, the auxiliary front plows are taken off, and placed on the side beams after the rear plows have been taken off, changing both front and rear plows, so as to throw the earth toward the corn, and produce the covering up of the weeds. For harrowing, the plows are taken off, and the ground smoothed for seed planting, each at the proper time.

Improved Spike Auger.

Roland O. Arbour and Joseph Arbour, Baton Rouge, La.—In the center of the auger a longitudinal hole is bored, in the upper part of which is cut a screw thread. A guide, consisting of a straight bar of steel or iron, is made to nicely fit the hole, and is provided with a screw thread to engage with the female screw of the auger. The outer end of this guide is provided with points, which engage with indentations in the head of the spike, previously made with a punch. As the auger is revolved the guide remains stationary, and the auger will screw into it and cut an annular hole around the spike. The points of the guide being embedded in the head of the spike, the auger is pressed against the wood sufficiently to keep the guide in place. When the auger has passed through the plank it is removed, and then the guide is hidden in the auger, and is extracted by applying the end of the punch which acts as a plug wrench on spurs, and turns the guide round and unscrews it, when the operation may be repeated on another spike, and so on until the plank is released. This auger may be made of any size, so as to suit any sized spikes, and is an expeditious way to release the planks from a vessel in case of repairs or for other purposes.

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Small Tools and Gear Wheels for Models, List free. Goodnow & Wightman, 24 Cornhill, Boston, Me.



H. F. C.'s question is incomprehensible.—R. G. M. will find directions for setting a safety valve on p. 363, vol. 29.—C. W. D.'s query as to the ball falling through the earth is answered on p. 107, vol. 20.—F. M. H. should apply to a dealer in mineral specimens.—H. C. will find a recipe for coating plate iron pipe on p. 11, vol. 29.—J. L. C. will find full particulars of the boiler test commission on p. 97, vol. 20.—S. F. B. should apply to the chainmakers mentioned in our article.—S. should consult Crookes and Bohrig's work on the metallurgy of copper.—J. A. B.'s explanation of a snake's movements is the generally received and, doubtless, correct one.—N. K. can tin small pieces of iron wire by the process described on p. 578, vol. 28.—J. M. R. will find an explanation of the mystery of the long and short screw drivers on p. 393, vol. 18.—J. S. can fasten leather to iron by the process described on p. 41, vol. 26.—A. G. can temper mill picks by following the directions on p. 170, vol. 23.—G. H. W. should apply to a lumber dealer. See our advertising columns.—L. H. H. should consult a boiler maker.—W. L. C. will find a description of the manufacture of lamp black by burning mineral gas on p. 21, vol. 28.

F. E. says: I have a brick building, one story high, 14 feet from the floor to the eaves, and 35 feet from the floor to the ridge pole of the roof. It contains one large open space, used for a machine shop, 120 feet long x 70 feet wide, with an iron truss roof. The roof covering is made of 2 inch matched pine plank, nailed tightly together and covered with iron, well painted outside and inside. This roof is perfectly tight in all stormy weather; but in frosty weather I am troubled by its sweating and water dropping down all over my tools, etc. I heat by steam pipes round the room under the benches. The usual temperature is 62°. Can you tell me what to do to stop its sweating? I have tried a dead air space under the roof of 1 1/4 inches, which helped but does not entirely stop it. Would letting the cold air from outside into the dead air space do any good? A. If the 1 1/4 inch air space were enlarged to one foot in depth, and the cold air were admitted to it sparingly, and tempered by admitting also some of the warm air, it would probably remedy the difficulty. At the same time, the inside ceiling that encloses the air space might be of such material and set at such a grade as to catch and carry off any drip that might still be formed on the inside of the roof itself.

J. L. C. asks: 1. In the spring I wish to build a bank wall 150 feet in length and 5 feet high. This wall I wish to make of concrete. What thickness ought the wall to be? A. The thickness of the wall should be about 2 feet at top, increasing to 3 feet at bottom; the wall commenced 3 feet below the level of the ground and carried up 6 feet high, so as to be 3 feet underground to prevent its being disturbed by frost. Fill in behind with loose stone, and provide openings through the wall at the bottom of the bank to discharge the water which may accumulate behind it. 2. Will such a wall stand the cold and frosts of a New England winter? A. Yes, if proper precautions are taken to build it properly; bring out a projection at top of the concrete, to act like a coping. 3. As Portland cement is high in price, would it do to build the body of the wall with a cheaper article, and skin coat with Portland cement? A. No; it will be found that Portland cement is the cheapest, as there will be less required of it. 4. What are the best proportions for the various articles used in making concrete? A. Of Portland cement, one may be used to thirteen of the other ingredients. Take one barrel of the cement to four barrels of clean sharp sand, and fill in with as much gravel, stone chips, and small stones as can be worked into it, when well supplied with water, and have their surfaces coated with the same. 5. After the wall is built, I wish to paint in imitation of granite. Can it be done? A. Paint with a cement wash. 6. What kind of cement, other than Portland, is best to use? A. Rosendale cement is a good article.

T. O. H. asks: If a man has a right to sell a patent plan in a certain county, has he a right to sell to a man who lives in another county? A. Yes.

H. R. asks: 1. What distance will a well proportioned steamboat make, compared with the travel of her wheels at ten miles per hour in dead water? A. Deduct about 10 per cent. 2. Does the same rule apply to steamboats as to a train of railway cars on a dead level? A. No.

A. O. P. says: I recently found, among the entrails of a prairie chicken, a snake nearly two feet in length. I discovered also that the liver of the chicken had been destroyed by being literally cut to pieces. How could the snake in entering the chicken pass through the gizzard? Could the chicken live without a liver? A. We cannot explain the phenomenon from this statement.

D. H. T. asks: How large a piece of soft cast iron, flanged at right angles, would have the same strength as a piece of white oak 3 1/4 inches square, and of any length? A. Cast iron has nearly twice as great tensile strength as white oak; it offers about ten times as much resistance to a crushing force, and between three and four times as much to a strain applied transversely.

G. F. J. asks: What is the best work on mechanical drawing for a machinist who wishes to begin with first principles? A. "The Practical Draftsman's Text Book of Industrial Design" will be a good book for you to have. 2. What number of wood screws can be cut in one hour by the most improved machinery? A. Will some of our readers who manufacture wood screws answer this?

S. S. S. asks: 1. How can I cut a large glass bottle across the middle? A. Take a good three cornered file, file a circular notch around the middle of bottle; let the notch be at least 1/16th of an inch deep, and, if the glass is very thick, 1/4 of an inch. Into this circular notch fasten a soft small lamp wick or thread of tow, well moistened with alcohol, taking care not to wet the surrounding glass surface. Light the thread, which should be large enough to fill the notch and not wound too tight, and while burning revolve the bottle in the hands, taking hold of the ends, and holding it horizontally so as to confine the flame to one particular part. When burnt out, plunge the bottle at once into cold water. If necessary, repeat the heating and cooling steadily. 2. Will a porous cup made of plaster of Paris be as good for battery as one made of earthenware? A. No. The plaster will crumble away in time, and is not sufficiently porous.

T. C. asks: What is used for white writing fluid on colored envelopes? A. A solution of oxalic acid, or indeed almost any acid, when used as an ink on blue paper, will appear white by discharging the color of the paper. White crayons are also used for the purpose.

J. P. asks: 1. With a propeller 50 feet long, 8 feet beam, with direct acting engine 888 inches, fitted with plain slide valve cutting off at a little more than 1/2 stroke, and boiler with 200 feet heating surface, 19 feet grate surface, and 200 inches of chimney section, to burn wood: a screw with three arms, of 3 feet diameter and 6 feet pitch, one third out of the water: What speed am I likely to get? A. Probably from 5 to 6 miles an hour. 2. Will the slip of a screw so slightly submerged occasion a great loss of power? A. Yes. In reply to your other questions, we do not think the boiler will give a very satisfactory result.

N. H. asks: 1. How can I cut and polish agate? A. The lapidary's cutting plates are arranged as follows: 1. Soft iron (very thin) with diamond dust in oil; 2. pewter with coarse emery and water; 3. ditto with fine emery and water; 4. wood, with sand and water; 5. pewter, with rottenstone and water; 6. leather with putty powder, slightly wet. 2. How shall I imprint gold lettering on leather book backs? A. Attach gold leaf to the leather with white of egg, and impress the letters on. The letters are made of brass, and should be hot, but not enough to sputter when wetted. Slightly oil the gold and the face of the letter with a greasy rag. 3. Is the so-called poppet valve of a locomotive arranged differently from an ordinary safety valve, other than in being held down by a spring instead of weights? A. The poppet valve is conical, and fits into the aperture, instead of being tight on the face. 4. Where is the Di Cenzola collection of antiquities to be seen? A. At the Metropolitan Museum of Art, in the Kruger Mansion, 40th street, New York city.

R. R. C. asks: What is a good book on railroad construction, from laying out and leveling to putting down the rails, for the use of beginners and students? A. Vose's "Handbook of Railroad Construction" will be useful to you, but you cannot find all in any book. See our advertising columns for booksellers' addresses.

C. C. H. asks: Can I construct a rifle telescope by using one double convex lens of 28 inches focus for object glass, and one double concave of 1 inch focus for the eyepiece? What should be the sizes, respectively, of the two glasses, to insure a clear field of view? A. You can make a Galilean telescope in the way you propose. The field of view, however, in this telescope is not very large. An adjustment is made when a telescope is used with a rifle by raising the end near the eye. For ordinary purposes, as a terrestrial telescope or spy glass, at least 4 or 5 glasses are used, one for the object glass, and the others for the eyepiece. The object glass can only be well made by a skillful optician, so that it would probably be much cheaper for you to buy a small glass than to attempt to make one. For particulars as to the construction of the telescope see any good work on optics.

J. B. P. says: A friend having a threshing machine engine, with hind wheels of 4 feet diameter, wishes to make it a self-propeller. To do this he has taken off one of the 4 feet wheels and substituted an 8 feet driver, connecting to his engine with a chain, running his engine six revolutions to the drive wheels' one. I told him he would get as much power and speed by connecting in the same way on to his 4 feet wheel and running his engine three revolutions to one of the drive wheel. Who is right? A. From the data sent, you are right.

W. M. R. asks: Is the common red clover seed used for any purpose besides sowing? I hear that it is used for coloring prints. A. We have never heard of the red clover seed being used for the purpose mentioned.

S. A. T. says: 1. I wish to speak of what I call steam fuel. In the workroom of my factory (30x40 feet) we have a cast iron stove, 20 inches in diameter, in which we keep fire from 8 A. M. until 5 P. M. in the following manner: In the morning, the entire contents of the stove are let down into the ash pan which hangs and projects below the stove body. There is about 1 bushel of fuel. Into the pan is poured enough water, generally 4 quarts, to knead the ashes into a thick dough; afterwards fire is started and the coals are all red hot, which is at 9 A. M. The contents of the ash pan are spread evenly all over the top of the fire. It remains red hot through the entire day; not only the stove gets red hot, but, on taking off the lid of the stove (which opens on top) and looking in, the contents present the appearance of molten iron. This becomes solidified into one clinder, which is lifted out next morning and the ashes under it let down for another dough mixture; there is but one coal-ling, and that is at 8.15 A. M., the stove throwing out an intense heat for 8 or 10 hours without raking. A stove can be arranged to keep fire for 10 or 12 hours, but then you get no heat. There are evidently 4 quarts of water burnt up in our stove every day. A. This is an interesting account of a system of economical firing which has frequently been recommended. 2. How can I get the tin off tin plate, so that it will hold black asphaltum varnish? I can burn it off, but our "ash dough fire" burns the iron to pieces. A. Cover the tin with a coat of ordinary paint. 3. How can I wash chamois skin which has become dirty, so that it will not be as dry and hard as a board? A. If it is washed perfectly clean, and well rinsed, it will not be hard, when dry. 4. Is there any method by which cheap photography can be accomplished for home use at a moderate price from a manufacturer of photographic materials. 5. I have a sign in my store composed of red letters on blue ground. Every person who looks at it complains of its hurting their eyes, in fact it really does so; and if you look at it steadily for a few seconds, the letters appear to move or dance. A. A combination of red and blue, which are not complementary colors, is an improper arrangement with regard to producing the best effect upon the observer. 6. Some of my workmen have chapped hands, caused by having them wet a great deal and frequently immersed in strong caustic soda water. They crack open and the dirt will get under the skin or in the pores; and, if greased over night, will not wash clean next morning. A. It would be well to protect their hands with waterproof gloves. One of our correspondents recommends dipping the hands in vinegar or vinegar and water to neutralize the alkali. 7. I send a mineral specimen. What is it? A. The mineral sent is a quartz crystal, of no pecuniary value.

B. H. asks: 1. Please give me a good rule for finding the pressure of steam in pounds to the square inch in an engine boiler? A. You can best determine it by a gage. 2. How can I find the horse power of an engine? A. See article on "Indicating Steam Engines," in SCIENTIFIC AMERICAN for January 31, 1874. 3. To what railroad official had I best apply for a situation? A. It depends on the situation you desire. Probably the president would be the proper person to see. If you want a position on the engineer corps, the master mechanic, if you want a position on a locomotive, the superintendent, for appointment as brakeman or conductor and so on.

W. F. W. asks: Does the lever principle apply to a water wheel? For instance, in two overshot wheels, one 10, the other 20 feet in diameter, with buckets of equal size, if one bucket in each wheel be filled, will one give any more power than the other? Does the same principle hold good in turbine wheels? A. The principle of the lever applies in all such cases.

A. S. asks: Can a person obtain instruction in New York on proper use of instruments as used by the United States Signal Service Bureau? If so, where? A. You can obtain rules and instructions from the Bureau. You can obtain the prices of instruments from a reliable maker.

A. H. O. asks: 1. What material is best for an emery belt? A. Leather. 2. Is there anything better than glue to stick the emery on with? A. We think not.

P. H. R. asks: Can a clock be made to run without power from springs or electricity, and without requiring to be wound up, in fact, to receive a steady movement from itself? Is such a thing possible? Is there any company or society in the United States that would support a poor man in experimenting in such work? A. We must answer no to all your questions.

O. P. asks: What is the effect of excessive dampness on masonry constructed with ordinary mortar? My mill is built of brick with stone foundation. At its base in the rear, the stream flows, washing it somewhat, while the dripping from the race above creates some spray and much dampness. Is there any danger of the foundation or wall giving way? If so, what kind of mortar should have been used in the first instance? A. It is quite likely that your foundation is unsafe, but could not answer positively without knowing more particulars. Some kind of hydraulic cement is ordinarily used in such cases.

C. H. asks: Given the size of ports, exhaust and stroke of the valve, how large should the valve be? A. If the valve has no lap, it must be large enough to cover both ports, when in mid position, and the stroke is twice the width of the steam port.

F. C. C. says: 1. If I undertake to carry water in wooden pipes a mile under the ground, how much waste must I allow for absorption, evaporation, etc.? A. It will depend upon the material. You can readily determine the matter by experiment. 2. There is fall enough to throw the water into a tank over a boiler and save the labor of a well pump. How much shall I save by this? A. About twice the theoretical power required to lift the water. 3. What would be the difference in cost between a wood pipe and a cast iron pipe, and which, upon the whole, had I better have? A. The wooden pipe would be much the cheapest in many localities. If you have facilities for making it, we think the wooden one may be the best for you. 4. What is the smallest sized pipe, wood or iron, that I could use, and what is the least fall the water need have? A. You do not send enough data for us to answer this question. Your best course would be to have an effective condenser of your steam.

F. G. H. asks: Will a round chimney give a better draft than a square one, if the area and surface presented for friction are the same in both cases? A. In practice there is no essential difference in the draft of the two forms.

L. W. asks: Which is the most economical to heat a tank of water, using live steam or heating pipes in the water? Does it necessitate running the pipe to the bottom if done with live steam? Will not the pipes heat it quicker, and take less steam if there be an outlet into the water or elsewhere? A. The relative economy of the two systems will depend considerably upon the general arrangement.

H. G. B. asks: How can I alloy gold? A. Gold is alloyed with silver or copper, or with both. Melt the gold in a separate crucible; and if copper is to be added, this is also to be melted in another crucible and poured into the gold. To ensure a thorough combination, two red hot crucibles should be used, and the liquefied metals poured alternately from one into the other. To prevent oxidation from the air, put into each crucible a small quantity of a mixture of common salt and charcoal. The metallic alloy should also be occasionally stirred with a rod of pottery ware.

W. H. F. asks: Is the objection to steam propulsion on canals the washing away of the banks? Would a system which would propel the boat without disturbing the water be of any use? A. The difficulty about canal navigation by steam is not the washing of the banks. The trouble is to find a method of slow propulsion by steam that shall be as cheap and easy of management as towage by animals.

R. T. asks: 1. Will a patent be granted to another person on an already patented mixture, if one or more ingredients be added or omitted? A. Not unless there is some essential difference in the compound produced, or in adapting it to another purpose. Merely adding to or taking away from a patented material compounded for a certain purpose, and use without substantially altering it for said purpose and use, is not patentable, unless as an improvement on the prior patent. 2. How is gas lime made? A. Gas lime is simply the refuse lime from the gas purifiers in gas works.

J. H. asks: What is the best method for mixing paints for painting on glass, to stand heat and cold, and to be exposed to all kinds of weather? A. Glass in which the colors are fixed by fusing certain metallic substances on its surface, and known as "stained glass," is what we would recommend to fulfill the conditions required. This you can buy more cheaply than you can make.

P. C. C. asks: 1. Is it practicable to condense the exhaust of a small compound engine, the steam working 150 feet per minute? A. Yes. 2. Is it practicable to do so in a condenser constructed so that the steam exhausts into gas pipes with cold water running around them? A. This would be the best way of doing it. 3. How will I determine the area of condensing surface, the temperature of cold water, of course, being known? A. In practice, from 2 1/2 to 6 square feet of surface are allowed for each indicated horse power of the engine.

A. C. R. says: How do engravers transfer pictures from paper to wood for re-engraving? A. By first soaking the print in a saturated solution of alcohol and white caustic potash to soften the ink, when the latter will readily transfer to the block under roller pressure. This also answers A. J. P.

A. L. C. asks: Why are objects pictured on the retina of the eye in an inverted position, always seen right side up? A. There are numerous theories. One is that the image formed on the retina of the eye conveys to the mind correct ideas of the relative positions of external objects. Another is that persons judge of the position of an object by the direction in which the rays come to the eyes.

G. H. M. asks: 1. Do you use a machine to fold your papers as they come from the press? A. Folding attachments for presses have been made, but have not proved successful. The folding is now done on separate machines. 2. What is the capacity of one of your presses? A. The capacity of the presses on which the SCIENTIFIC AMERICAN is printed is about 2,000 copies per hour. 3. Would not a machine to fold papers as they come from the press be desirable? A. Yes, if it could be made to operate without being troublesome.

E. B. asks: Is there a sure test to distinguish genuine butter from the artificial, made in this city? A. It is claimed by the manufacturers that the artificial butter will keep longer without becoming rancid, the readily decomposable compounds not being found in the manufactured article. You might submit the two kinds to a test of this nature.

E. P. asks: How large must be a copper plate for a ground wire? How deep should it be buried? A. About 2 feet square, placed several feet deep. 2. What is the iron pipe running down to the ground on a fire alarm box for? A. To make connection with the earth.

J. R. M. Jr. asks: In a screw press, with a steel screw, if the screw works in a stationary nut, how much weight would the screw sustain before it would strip the thread or break? A. Multiply the cross section of the cylindrical portion of the screw in inches by the tensile strength of the steel in pounds per square inch. This gives the resistance to breaking. The area of surface resisting stripping in the thread, multiplied by three quarters of the tensile strength in pounds per square inch, gives approximately the resistance to stripping.

W. A. B. asks: Will a common lead pipe, say 1 inch in diameter, having a stream of cold water running through it, melt if exposed to the heat of a blast furnace? I am well aware that a lead pipe without water will melt immediately, but am in doubt about its standing the intense heat if a cold stream is run through it. A. Yes, if the heat is sufficiently intense.

F. M. B. asks: What is the size of the largest steam cylinder ever cast? A. There are engine cylinders 130 inches diameter. 2. If I purchase a patented machine for any particular use, for instance, a blind lat tenoning machine, cutting off and making the tenons on both ends at one operation, do I purchase the machine and right to use it without any reference to the length of time the patent has to run on the machine? Have I the privilege to run it as long as the machine lasts? A. You can use the machine as long as it lasts, unless otherwise agreed.

G. M. asks: What is the greatest number of revolutions that the propeller of a first class ocean steamship makes per minute? Also of a fast going steamship of war? A. Between 50 and 65, in each case.

E. W. B. asks: 1. What do you think of the possibility of making a freight locomotive to run up grades of 75 feet to the mile, with a ratchet wheel working on a third rail, the wheel to be applied to the rail at the pleasure of the engineer? A. This plan is in use in some localities. 2. Can eggs be preserved by placing them in an airtight vessel and exhausting the air, slowly, so as not to break the shells by the pressure outward, or by separating the whites from the yolks and then exhausting the air? A. We think there are practical difficulties in the way. 3. Can eggs be condensed in the same way that milk is done? A. This is done at present with a fair success.

C. H. M. asks: 1. What are the contents of a ball 7 1/2 inches in diameter? A. 220-89 square inches. 2. Cut this ball through into 15 parts of equal thickness, at or through center of ball; what are the contents of each part? A. For the segments: Let r be the radius of the base and h the height of the segment; the solidity = $(\pi^2 \times 3 + h^2) \times 0.5236 h$. For each zone: let r = radius of one base, R = radius of the other, h = height of the zone; solidity = $(\pi^2 + R^2 + h^2) \times 0.5236 h$. 3. Cut this ball into 15 equal parts (slices); what is the thickness of each part? A. This you can find by trial, substituting values in the preceding formulae.

T. H. Y. asks: 1. What is a good recipe for killing fleas on a dog? A. Use carbolic soap. 2. How can I destroy garden moles? A. Set traps for them, such as those described in our paper a few months ago.

H. L. says: People say that, if a man be bitten by a dog, he is likely to go mad if the dog is not killed; but if the dog is killed at once, there is no danger. I fail to see why it is of any good to kill the dog, except to prevent his biting any other person. A. We quite agree with you.

J. C. H. asks: 1. How can I back up a mill burr, and what kind of plaster is best? What quantity would I need for a 4 1/2 foot run? A. Make the backing of plaster of Paris. Fill the interstices between the stones with a cement made of powdered alum and powder from burr stone. Some millers add a little molasses. 2. What is the best work on milling? A. Consult the catalogue of a scientific publisher. See our advertising columns.

C. D. asks: Which are considered, in Europe and America, to be the most masterly and thorough works on statics and dynamics? A. Probably Professor Bartlett's work on "Theoretical Mechanics," and Professor Rankine's "Treatise on Applied Mechanics."

F. P. B. asks: Can I revarnish the body of a guitar without injuring its tone? What kind of varnish would be the best? The color of the body is dark. A. We advise you to take it to an instrument maker.

G. E. H. asks: 1. If a boiler has water in and steam up, where is the pressure the greatest, at the top of the boiler over the steam space, or on the bottom under the water? A. Pressure is greatest on the bottom. 2. In reckoning the horse power of an engine, as in your answer to J. W. F., January 31, why do you not make an allowance for friction of the wearing parts, or is there no need of it? A. The calculation was for the indicated horse power, in which no allowance for friction is usual. 3. How long before the SCIENTIFIC AMERICAN is dated is it printed? A. About ten days.

W. I. asks: Is the capacity of a boiler increased by enlarging the steam drum? Is not a steam drum 24 inches in diameter x 8 feet long better than a drum 18 inches in diameter x 4 feet long, for a boiler 40 inches in diameter x 24 feet long? A. The steam room is increased by the change, and frequently this is very desirable.

S. E. D. asks: If we take a quantity of water heated to 100° Fah. and an equal quantity at 40° Fah. and pour them together, is there any actual loss of heat, or is it merely disseminated or distributed throughout the whole quantity? And further, what would be the temperature of the water after being so amalgamated? A. The only loss would be from radiation; and taking no account of this, the temperature of the mixture would be 70°.

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

O. R.—Your mineral appears to be a fine Prussian blue, J. H. S.—Your specimens are iron pyrites, encrusted with a soft bituminous material.

L. L. F.—Your ore is the oxide of iron. In abundance, it might prove valuable.

H. C.—Your mineral is red jasper, consisting essentially of silica, but containing also alumina and oxide of iron. Some varieties, like the striped and Egyptian jasper, on account of the richness and variety of the colors, are of considerable value for ornamental vases, seals, etc. Jasper is susceptible of a high polish.

B. D. C.—A fine yellowish colored clay. We would advise you to submit it to some potter, who will test it by burning in the kiln. A manufacturer of paints would also inform you of its value as a pigment.

W. L. V.—No. 1 is galena, sulphide of lead, the ordinary ore from which the lead of commerce is extracted. It is frequently argentiferous; but to determine this, a chemical analysis is necessary. No. 2 is blende, sulphide of zinc with quartz, and traces of iron pyrites.

C. T. C.—No. 1 is iron pyrites, sometimes fused as a source of sulphur, a valuable mineral when in sufficient quantity near means of transportation. No. 2 is quartz, colored with oxide of iron, of no value.

J. McW.—Your specimen is chlorite with quartz and mica. Chlorite is so named from a Greek word meaning green, on account of its color. It is a silicate of alumina and magnesia with oxide of iron and sometimes lime.

C. J. B.—This specimen consists of galena (sulphide of lead) and blende (sulphide of zinc in quartz), Lyell's "Geology" and Dana's "Mineralogy" are standard works.

J. W.—This mineral is a kind of hornblende, like hypersthene. It yields, by analysis, silica, alumina, magnesia, and lime, and its colors are produced by iron, etc.

G. J.—Red hematite, or red oxide of iron. It contains 70 per cent of metallic iron. It is valuable as a burnisher; the red powder which it gives on pulverizing is valuable as a polishing power, and it is an excellent ore of iron.

E. N. B. asks: 1. What is the tonnage of the United States steamer Swatara? By old measurement she is about 970 tons. 2. What are the dimensions of the engines of the torpedo boat Alarm and of the United States steamer Gettysburg? What is the length of the latter? 3. What are the lengths and breadths of the frigates Sabine, Saratoga, St. Mary, St. Louis, Dale, and Cyane? 4. What was the speed of the Dictator and Monadnock in their race, in 1865 or thereabouts?—H. W. asks: How can type metal be made black or of any dark color, before jappanning?—A. McK. asks: Who was the first inventor of the letter copying press?—E. T. T. asks: Where can I find a description of a man hoisting engine for use in mine and other shafts?—D. L. M. asks: If the center core of the centennial tower is perpendicular, and we drop a 1 lb. weight from the south side of its top, where will it strike at the base?—W. G. asks: How can I silver glass globes, etc.? How are different colors produced? Can the silvering be done upon a flat surface with the same effect as on globes?

COMMUNICATIONS RECEIVED.

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

On Car Coupling Dangers. By S. H. D.
On the Moon Question. By M. R.
On the Minerals of South East Missouri! By H. C. T.
On Heating Buildings. By W. H. G.
On a Cure for Rheumatism. By T. C. E.
On the Erie Canal. By J. M. H.
On Preventing Damage from Boiler Explosions. By G. M.

Also enquiries from the following:

C. C. L.—J. S.—B.—W. B.—C. W. Y.—E.—E. B.—H. E. N.—J. W. H.—J. H. M.—J. W.—R. T.—R. L. M.—A. G. H.—J. S. P.—J. H. A. Jr.—N. R.

Correspondents in different parts of the country ask: Who makes sewage pipe machines? Who makes potato peeling machines? Where can a large aquarium be obtained? Who makes a substitute for India rubber? Who makes four wheeled velocipedes? Who makes the "flying ponies" on which children ride at fairs, etc.? Who sells mulay saw mills? Who makes cooking stoves, heated by kerosene flame? Makers of the above articles will probably promote their interests by advertising, in reply, in the SCIENTIFIC AMERICAN.

Correspondents who write to ask the address of certain manufacturers, or where specified articles are to be had, also those having goods for sale, or who want to find partners, should send with their communications an amount sufficient to cover the cost of publication under the head of "Business and Personal," which is specially devoted to such enquiries.

[OFFICIAL]

Index of Inventions

FOR WHICH

Letters Patent of the United States WERE GRANTED IN THE WEEK ENDING

January 27, 1874,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

Air, compressing, W. Johnston.....	146,909
Annunciator, electric, L. Finger.....	146,758
Ash box and sifter, J. D. Helms.....	146,826
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(Specially reported for the Scientific American.)

CANADIAN PATENTS.

LIST OF PATENTS GRANTED IN CANADA.
FROM FEBRUARY 4 TO FEBRUARY 10, 1874.

- 3,081.—L. D. Sawyer, H. P. Coburn and I. Ames, Hamilton, Wentworth county, Ontario, assignees of L. B. Holt, Worcester, Mass., U. S. Improvements in machines for shelling corn, called "Holt and Sawyer Corn Sheller," Feb. 4, 1874.
- 3,082.—James Foley, Montreal, P. Q. Improvements on machines and process for manufacturing extract of bark for tanning and other purposes, called "Foley's Improved Machine and Process for Making Bark Extract," Feb. 10, 1874.
- 3,083.—L. W. Pond, Eau Claire, Eau Claire county, Wis., U. S. Improvements on booms, called "Pond's Improved Boom," Feb. 10, 1874.
- 3,084.—W. Richards, Toronto, Ontario. Machine for cutting open the ends of metallic cans containing oysters or preserved meats and fruit, called "Richards' Can Opener," Feb. 10, 1874.
- 3,085.—J. P. Manton, Providence, Providence county, R. I., U. S. Improvement on ship's windlass, called "Manton's Ship's Windlass," Feb. 10, 1874.
- 3,086.—H. H. Robinson, Stanbridge, P. Q. Improvements on those appliances used for preventing horses and cattle from running about, called "Robinson's Safety Yoke," Feb. 10, 1874.
- 3,087.—G. S. Harwood, Boston, Mass., U. S. Improvements on first breaker feeder for carding machinery, called "Improved First Breaker Feeder," Feb. 10, 1874.
- 3,088.—P. Hodge, Waterloo, Ontario. Improvements on coffee roasters, called "Hodge's Improved Coffee Roaster," Feb. 10, 1874.
- 3,089.—G. B. Thompson, Boston, Mass., U. S. Improvement on shirt bosoms, called "Thompson's Magic Shirt Bosom," Feb. 10, 1874.
- 3,090.—A. T. Miller, Ottawa, Ontario, assignee of A. R. Giles, Ottawa, Ontario. Improvements on carriage jack, called "Miller's Improved Wagon Jack," Feb. 10, 1874.
- 3,091.—H. F. Read, Brooklyn, Kings county, N. Y., U. S. Improvements on water meters, called "The Gem Water Meter," Feb. 10, 1874.

HOW TO OBTAIN
Patents and Caveats
IN CANADA.

PATENTS are now granted to inventors in Canada, without distinction as to the nationality of the applicant. The proceedings to obtain patents in Canada are nearly the same as in the United States. The applicant is required to furnish a model, with specification and drawings in duplicate. It is also necessary for him to sign and make affidavit to the originality of the invention.

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If the inventor assigns the patent, the assignee enjoys all the rights of the inventor.

A small working model must be furnished, made to any convenient scale. The dimensions of the model should not exceed twelve inches.

If the invention consists of a composition of matter, samples of the composition, and also of the several ingredients, must be furnished.

Persons who desire to apply for patents in Canada are requested to send to us (Munn & Co.), by express, a model with a description in their own language, showing the merits and operation of the invention, remitting also the fees as above for such term for the patent as they may elect. We will then immediately prepare the drawings and specification, and send the latter to the applicant for his examination, signature, and affidavit. It requires from four to twelve weeks' time, after completion of the papers, to obtain the decision of the Canadian Patent Office. Remit the fees by check, draft, or Postal order. Do not send the money in the box with model. Give us your name in full, middle name included. Inventions that have already been patented in the United States for not more than one year may also be patented in Canada.

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VALUE OF PATENTS,
And How to Obtain Them.

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PROBABLY no investment of a small sum of money brings a greater return than the expense incurred in obtaining a patent, even when the invention is but a small one. Large inventions are found to pay correspondingly well. The names of Blanchard, Morse, Bigelow, Colt, Ericson, Howe, McCormick, Howe, and others, who have amassed immense fortunes from their inventions, are well known. And there are thousands of others who have realized large sums from their patents.

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HOW TO
OBTAIN

PATENTS

This is the closing inquiry in nearly every

letter, describing some invention which comes to this office. A positive answer can only be had by presenting a complete application for a patent to the Commissioner of Patents. An application consists of a Model, Drawings, Petition, Oath, and full Specification. Various official rules and formalities must also be observed. The efforts of the inventor to do all this business himself are generally without success. After great perplexity and delay, he is usually glad to seek the aid of persons experienced in patent business, and have all the work done over again. The best plan is to solicit proper advice at the beginning. If the parties consulted are honorable men, the inventor may safely confide his ideas to them; they will advise whether the improvement is probably patentable, and will give him all the directions needful to protect his rights.

To Make an Application for a Patent.

The applicant for a patent should furnish a model of his invention if susceptible of one, although sometimes it may be dispensed with; or, if the invention be a chemical production, he must furnish samples of the ingredients of which his composition consists. These should be securely packed, the inventor's name marked on them and sent by express, prepaid. Small models, from a distance, can often be sent cheaper by mail. The safest way to remit money is by a draft or postal order, on New York, payable to the order of MUNN & Co. Persons who live in remote parts of the country can usually purchase drafts from their merchants on their New York correspondents.

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This is an inquiry which one inventor naturally asks another, who has had some experience in obtaining patents. His answer generally is as follows, and correct:

Construct a neat model, not over a foot in any dimension—smaller if possible—and send by express, prepaid, addressed to MUNN & Co., 37 Park Row, together with a description of its operation and merits. On receipt thereof, they will examine the invention carefully, and advise you as to its patentability, free of charge. Or, if you have not time, or the means at hand, to construct a model, make as good a pen and ink sketch of the improvement as possible and send by mail. An answer as to the prospect of a patent will be received, usually, by return of mail. It is sometimes best to have a search made at the Patent Office; such a measure often saves the cost of an application for a patent.

Preliminary Examination.

In order to have such search, make out a written description of the invention, in your own words, and a pencil, or pen and ink, sketch. Send these, with the fee of \$5, by mail, addressed to MUNN & Co., 37 Park Row, and in due time you will receive an acknowledgment thereof, followed by a written report in regard to the patentability of your improvement. This special search is made with great care, among the models and patents at Washington, to ascertain whether the improvement presented is patentable.

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Did patentees realize the fact that their inventions are likely to be more productive of profit during the seven years of extension than the first full term for which their patents were granted, we think more would avail themselves of the extension privilege. Patents granted prior to 1861 may be extended for seven years, for the benefit of the inventor, or of his heirs in case of the decease of former, by due application to the Patent Office, ninety days before the termination of the patent. The extended time inures to the benefit of the inventor, the assignees under the first term having no rights under the extension except by special agreement. The Government fee for an extension is \$100, and it is necessary that good professional service be obtained to conduct the business before the Patent Office. Full information as to extensions may be had by addressing MUNN & Co., 37 Park Row, New York.

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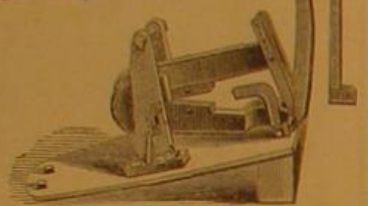
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American manufacturers are invited to consider the following facts and suggestions:

In the first place: It is well known that the leading jobbing and commission merchants are invariably reluctant to handle new and unknown goods, even when convinced of their merits, and, if at all induced to act as agents for their sale, claim so many advantages over the smaller merchants that the manufacturer is compelled to give some form of monopoly to the principal commission merchants; thus one merchant demands that the trade-mark of the manufacturer shall be omitted, and that the name of the seller shall be substituted in its place; another, that the goods shall be stamped as though they were imported, inasmuch as he deals largely in imported goods; and a third insists on such a large discount that he shall be enabled to undersell the smaller merchants; and thus at every turn the manufacturer is met with obstacles created by the relation of the commission merchant and the retail dealer.

The prominent retail dealers are also unwilling to purchase goods that are not known, and reasonably urge that no one will ask for them; and thus, at last, the manufacturer is forced to address the consumer, giving such a description of his wares as will enable the purchaser to demand them, and thus the reluctant merchant of yesterday becomes the most enterprising merchant of to-day. Advertising has brought him customers; his rivals hear of it, and straightway announce that they, too, have a full stock and are prepared to sell at close prices.

The advantages resulting from addressing the public are that:

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The manufacturer of goods favorably known can always exact his own terms, and jobbers and commission merchants will be compelled in self interest to become active and willing agents in his interest instead of obstacles to his success.

The most noted and successful manufacturers are those who have addressed the public. Their wares are the last to feel the effects of panics, and the first to show signs of activity after depressed periods.

The cost of addressing the public is more than paid for—by the increased sales, and partly from the right of exacting your own terms; and, for the reason that you greatly aid the jobbing merchant, you can reasonably demand the best terms.

There are many disadvantages attending making goods with a fictitious trade-mark to suit customers. It makes the manufacturer a mere workman for the seller, and gives the seller the opportunity of standing between the maker and consumer; and as a natural consequence, the manufacturer is always at the mercy of any one who will undertake to supply the retail dealer with the same line of goods at less price; whereas, if the maker insists on having his own trade-mark on his goods, they are sold on their merits, and his rights are respected and appreciated by all concerned.

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Vol. XXX.—No. 10.
(NEW SERIES.)

NEW YORK, MARCH 7, 1874.

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IN ADVANCE.

IMPROVED GRINDER FOR CASTINGS.

The invention herewith illustrated consists in a large cylindrical vessel rotated by improved mechanism, and adapted to hold quite large castings, stove plates, sinks, and hollow ware, for example, in order to give the same the requisite cleaning and polishing. The cylinder is made with two heavy wooden or metallic heads, and with a lagging of heavy plank or metal forming its sides, in the shape of a number of plane sections. Two or more of these sections are removable in order to admit of the introduction into the interior of the receptacle, of castings regardless of size or form.

In our engraving one of the sections is shown detached and placed upon the floor. Through the opening thus left will be seen a flange, A, which runs around the circumference of both cylinder heads. The sections to be removed are provided with suitable handles; and in order to detach them from the grinder, the bolts, B, are slackened up by unscrewing the nuts, C. The ends of the planes are then readily slipped from under the flanges, A, which, it will thus be seen, braces the sections against the outward pressure of the heavy contents of the machine. When the latter is filled, the covers are replaced, the nuts, C, tightened, and the various portions are at once firmly bound together. These sections are provided with suitably beveled edges in order to secure close joints, and those not intended to be removable are permanently secured in place.

The reader has doubtless already remarked that the mechanism for rotating the cylinders differs from that employed in the ordinary rumble. In the present case, the edges of the heads rest and revolve upon four flanged rollers, D. Upon the shafts of the latter, which have their bearings in heavy framework, are two gear wheels, E, which mesh with the pinion, F, which is on the same shaft as the driving pulley. It is obvious that the motion of the latter is imparted to the rollers and by these to the cylinder, the weight in the latter, of course, contributing to increase the traction between the surfaces.

The manufacturers inform us that they have had in use one of these machines, 5 feet in diameter by 5 feet in length, and find that it requires but few repairs, while doing its work with much efficiency. The apparatus has been in operation in their foundry since 1869, and three more have recently been added. From 500 to 1,000 pounds of bugs (small scraps of iron from the bottom of the cupola) are put in with the castings, the quantity varying with the size of the machines. The manufacturers also state, in order to show the small amount of power required to drive the apparatus, that they run three grinders, two full of castings and bugs (in dimensions about 2½ by 3 feet) and the other with facing, a 14 inch emery wheel, and a drill, with 100 feet of 2 inch shafting with a 1½ inch double belt traveling 600 feet per minute. This device is covered by two patents granted to George Miller, of Providence, R. I., and a third patent to the same inventor relates to the application of the plan to water wheels. The cylinder in this instance is the wheel, overshot or otherwise, from which power is transmitted to the friction rollers, and thence to the pulleys, in reverse direction, in short, to the hammer above described. The wheel thus arranged, it is claimed, admits of cheaper construction than when the cen-

tral shaft and the necessary arms for supporting thereon are used. The power also being communicated to the machinery from four different points, and these being those at which the wheel is supported, it is considered that the strain upon the latter will be more equally divided, and that twisting and cross strains will be avoided. The inventor also believes that the present arrangement will have advantage in point of

take the strainer out to be cleaned. If the joint be not perfectly tight, the water gradually escapes down through the bolt holes and causes an annoying leak.

To obviate this trouble, the invention represented in the annexed engraving is proposed. A is the strainer (Fig. 1), secured to the funnel in an annular space, as shown. The outlet or nozzle, B, to the funnel is cast to the sink's bottom,

and on the thick portion of the latter are formed lugs, C. D is a gland, also provided with lugs, which enable it to be secured to lugs, C, outside the funnel, by a nut and bolt, as shown in Fig. 2. The space between the gland, D, and the nozzle, B, receives the soft metal waste pipe, E, the end of which is turned over as a flange into the enlarged upper portion, F. It will be observed that, instead of allowing the screws, G, which hold the strainer, A, to the funnel bottom, to pass clear through the latter, they merely enter into the thick portion, so that of course no water can escape by the means before referred to. These screws are made of brass to prevent them becoming rusted in their seats, and consequently are easily removable. A rib or truss, H, is constructed across the center of the under side of the strainer, to back up the thin metal of the latter against injuries, and to stiffen the casting in the operation of molding.

As a point of advantage claimed, it may be noted that the fastening of pipe to the nozzle is entirely independent of the attachments of the strainer. The latter, while being so bolted as to be quickly taken out

when necessary, is, from the fact of its being thus secured, not liable to be lifted from its place by servants, in order to throw filth, crumbs, or matters likely to clog the pipes, down the sink.

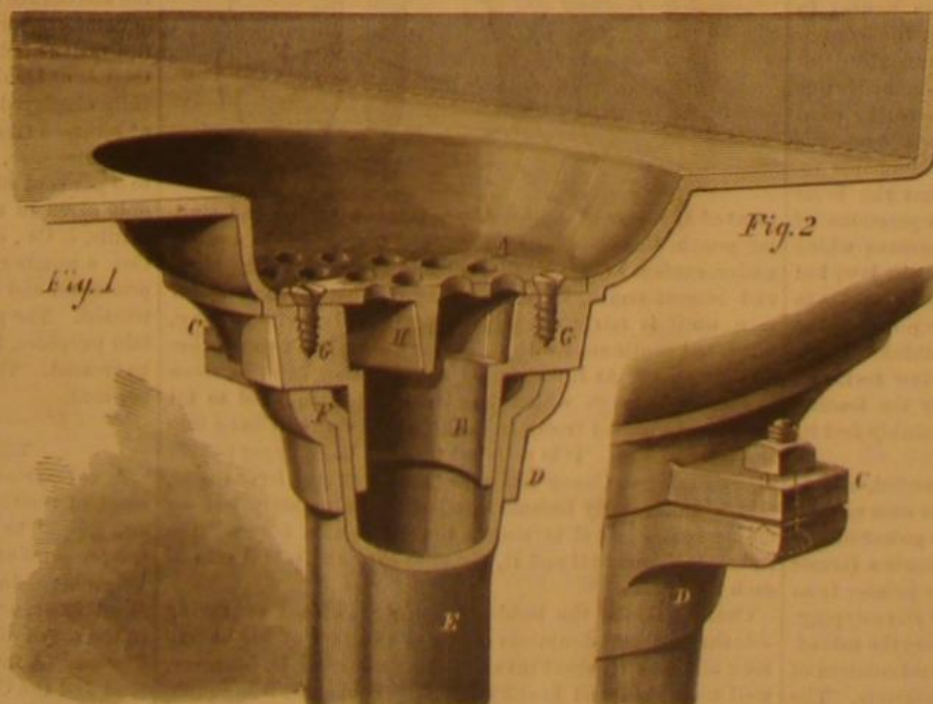
Patented December 2, 1873, by Henry Miller. The manufacturers, who may be addressed for further information relative to sale of rights, etc., are the Miller Iron Company, Providence, R. I.

MILLER'S IMPROVED GRINDER FOR CASTINGS.

lessening friction. Further particulars regarding the grinder may be obtained by addressing the Miller Iron Company, Providence, R. I.

MILLER'S IMPROVED SINK.

A prominent objection to many forms of sink in common



MILLER'S IMPROVED SINK.

employment is that the strainer inside and the flange of the waste pipe outside are secured to the sink by screws which, passing directly through all portions, are set up by nuts. The disadvantage is, that two extra holes are thus made in the bottom of the sink, which require constant packing to render them watertight, which packing must be removed and re-adjusted whenever it becomes necessary to

—thrown about like bricks, if necessary—and are yet firm; and when required for use, they can readily be crushed, or melted by the application of a little hot water. A ton weight of the manure measures 26 cubic feet, and contains 253 of the cakes. The manufacture of bone dust for fertilizing is a large and rapidly increasing industry in this country, and this Australian method might be profitably adopted here.

Novel Way of Exporting Bone Dust.

The immense trade in Australian canned meats, now carried on, has had the effect of causing a great accumulation of bones in Melbourne, Australia, where the putting up is done. The sale of the bones is now growing into a remunerative branch of export trade as bone dust manure; and an Australian paper, speaking of the subject, gives an account of the manner of its exportation. It says that a recent vessel, bound for London, has on board a shipment of one hundred tons of bone dust, prepared for exportation in an altogether novel manner, and one which promises to come into extensive use. To facilitate this trade, an apparatus has been contrived for compressing bone dust into half its original compass, reducing it at the same time into a form very convenient for shipment. By means of strong pressure the crushed bones are molded into cakes of six inches square and three inches thick, something like flooring tiles, each cake weighing a little over four pounds. These bone dust tiles are just adhesive enough to admit their being handled freely

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PROPOSED LAW FOR CASTINGS.

Mr. Sumner has introduced the following bill (No. 119) into the Senate:

Be it enacted, etc. That no person shall counterfeit or make a facsimile of any metal casting, by using such casting as a pattern in molding, unless by the written consent of the owner or producer of the original pattern from which the casting was made; and any person who shall counterfeit or make a facsimile of any metal casting, either in whole or in part, by the means aforesaid, without the consent of the owner, shall be liable to such producer or owner of the original pattern in the amount of the ordinary wholesale profits upon the articles so produced, recoverable, with costs, by bill in equity, in any circuit court of the United States, and the court may restrain by injunction, and may order that all counterfeit metal patterns, and the metal products therefrom, shall be delivered to the complainant or be destroyed by the marshal, and may pass such further orders and decrees as may be meet in the premises.

"This has been read twice, ordered to be printed, and referred to the committee on patents. We hope it will rest there. The patent laws already provide in the most comprehensive manner for the protection of original work; and if Congress goes further still and attempts to establish an espionage over the details of every man's shop, the result can only be injurious to manufacturers of all kinds of castings. No doubt injustice is now done enterprising men by imitators who make use of designs which have cost a great deal of money to get up. But if there is no invention in these designs, we do not see how the Government can interfere to prevent it; and we decidedly think that it ought not to interfere. The effect of espionage, such as this bill would call forth, is to be seen in the scandals which the operations of revenue informers have lately produced in some of the best known business houses in this country. There is a loud outcry against the continuation of laws which permit cases of such undoubted injustice to be increased in number, and we doubt if this bill would receive the support of the manufacturing community. We have pointed to the notorious 'revenue cases' as an example of what would be the probable result of passing this law, and we will add that the firms which have suffered most seriously by the operations of informers are not those small and weak concerns which might be supposed to be the surest victims of the law, but they are among the most prominent and powerful houses in the country. The bill under consideration is probably the work of some 'leading' manufacturers, who think to protect themselves against piracy. Unless this law forms an exception to others of its kind, it is precisely the leading men among manufacturers who would probably feel its rigors."—*Engineering and Mining Journal*.

The foregoing remarks seem to us well founded, and to the protest of our cotemporary we can add our own against such unnecessary tinkering with the protective power of the Government. The above measure virtually prevents a farmer from re-casting his plow point; it prevents the printer from duplicating his type pages by electrotyping or stereotyping. We might continue and cite other instances where the sole effect of the law will be simply oppression and a retardation of industry, in lieu of a furtherance of its best interests. The act is a legitimate outgrowth of the misconception regarding the nature of our patent laws, which is now so prevalent, and which seems even to have extended to the eminent senator from Massachusetts. As we have repeatedly urged, our patent system is not devised for the purpose of compelling the community to pour their cash into the pockets of one class of individuals or manufacturers. Nothing is further from the spirit of our patent laws. To encourage industry and to promote the progress of the useful arts,

to open new fields of employment in which all the people may freely enter, and thus to lead to greater material prosperity for the whole nation, is the sole aim of the existing statutes, and the substantiality of this foundation is proved by the results of their operation during the past.

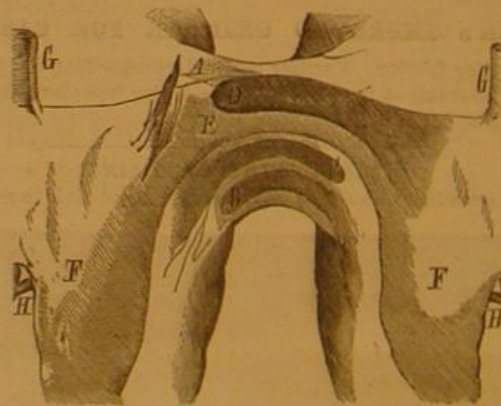
A man's best efforts are owing to his country, in entire abnegation of self and without fee or reward; so indeed are his goods and even his life. But while the people may, in times of need, take the latter and benefit by them, they have no means, however pressing the necessity, of forcing a person to invent; while, on the other hand, there are not many individuals who will give their time, labor, and ideas voluntarily, to the country, out of deference either to principle or patriotism, considered apart from other motives. Hence a stronger incentive is necessary; and this, out of expediency pure and simple, the law supplies in granting a limited monopoly. It cannot force people to invent, but it can bribe them; it can induce the individual to benefit the entire nation, by giving him a little extra emolument for himself; in brief, it uses the offer of a protected right, for a certain period, merely as a bait to produce inventions which are to be the free property of the public. The amounts realized by individuals for new ideas, though in some cases large, are insignificantly small in comparison with the value of the benefits conferred upon mankind by the origination.

Just so long as the notion is held that certain special manufacturers are the object of the solicitude of our system, and not the people, so long will such enactments as that of Mr. Sumner periodically make their appearance. If a manufacturer makes a casting of some new device, or casts something that has never been cast before, or even casts in an original and peculiar manner, he can submit his ideas to the proper authorities, have them passed upon, and, if they are suitable, obtain a patent which protects him in their enjoyment. Here there is evidently, for the reasons above given, an advantage gained for the community. But, under Mr. Sumner's law, any man is to be secured in perpetuity in the right of any mere casting, not because it is specially beneficial or useful to the people, but simply because he wants the Government to help fill his pockets by bolstering him up in a monopoly against everybody else. There is neither justice, expediency, nor reason in the measure.

THE AUTOPSY ON THE SIAMESE TWINS.

The report of the autopsy on the bodies of the Siamese twins has been made public through the *New York Times*; and so far as the dissection has progressed, it reveals some remarkable and unlooked-for conditions in the physical constitution of the strange phenomenon.

The feature of greatest interest is connected with the ligament, which is about four inches long and eight inches in circumference, and a section of which is shown in the annexed diagram. There is a union at the two ensiform cartilages, which are joined at a point very near the median line of the band (dotted lines, A). Eng's process was much the more robust of the two, though neither cartilage was ossified. Besides this were three very curious pouches, the lower one of which, B, is only separated from the skin by a very delicate layer of tissue, and passes from the abdomen of Chang, and is lost in the duplicature of the suspensory liga-



ment of the liver of Eng. Above this is a second and similar pouch, C, belonging to Eng, and between this and the under surface of the ensiform conjunction, A, is the third and largest pouch, D, also prolonged from Chang's abdomen until it fairly reaches the peritoneal cavity of Eng, but is not continuous with it. Thus Chang had two pouches and Eng one. At E was found a connecting band between the livers, through which the plaster injection, used to fill the vessels, passed freely from the portal vein of Chang into the body of Eng. It is believed that the large upper pouch, D, belonging to Chang was once filled with true liver tissue, which at maturity became smaller, and ultimately left an empty space. At E is shown the connection between the livers, F F, and at G and H, the vena cava and portal vein of each body.

Chang's side of the band—on the right of our engraving—is the weakest, doubtless owing to the fact of his having been almost a constant invalid. Eng's portion is, however, well nourished and healthy. The peritoneum, it is found, is unquestionably prolonged into the ligament. Without entering further into the technical details of the dissection, the general result seems to point to the fact that a division of the twins would have been a very dangerous, if not fatal, operation. The two portal circulations were connected, and the peritoneal processes extended across the ligament, thus presenting great difficulties to the use of the knife.

Chang, it is believed, died of an attack of cerebral paralysis, and Eng of fright. The position of the hearts has not

yet been determined; and a further report, regarding these organs as well as the lungs, will probably complete the investigation.

THE INDUSTRIAL USES OF BISULPHIDE OF CARBON.

Up to the year 1850, the sole industrial application of bisulphide of carbon was in the vulcanization and dissolution of caoutchouc; but since later invention has found means of producing the material at low price, it has been applied to a multiplicity of uses in a large number of the arts. The extraction of oils from grains, the wholesale removal of fatty matter from wool, the treatment of spices to obtain the same in insoluble form, the fabrication of prussiate of potash by the Gélès process, and of sulphocyanide of ammonium for the preparation of the toys called Pharaoh's serpents, the purification of crude paraffin, the manufacture of liquid fire for incendiary projectiles, and as a means of destruction of vermin, are a few of the principal employments of bisulphide of carbon, many of which have already been fully explained in these columns.

As respects magnitude, however, and future influence upon manufactures, its adaptation to the utilization of waste residues is of major importance, and is fast forming the groundwork of a new and distinct industry. The credit of first extracting the fatty matters from these refuse products, is due to M. Deiss, of Belgium, and by the aid of the bisulphide, the former are obtained in quantities sufficient to serve for lubrication of machinery or the fabrication of soaps and candles.

In order to show the rapidly increasing value of this useful substance, we have gathered from foreign contemporaries quite a number of its most recent as well as most important applications, and are thus enabled to present a fair view of the various refuse matters, in connection with which it is now employed. In the manufacture of fatty acids, brown compact deposits are precipitated. These, mixed with sawdust in order to facilitate the action of the bisulphide, and treated with the latter yield, up to twenty per cent of acids, which otherwise would go to waste. The pasty mass of metal filings, dirt, grease, etc., taken from car and wagon axles, is first treated with hot sulphuric acid, then with bisulphide, and, lastly, washed and dried. This isolates the grease in a saponified state. Cotton waste, employed in or about machinery, is freed from its grease by bisulphide and is again available for use. Residues of the manufacture of beeswax, which formerly found no sale except as manure, selling at about two dollars a hundredweight in France, are now subjected to the action of bisulphide and an excellent yellow wax is extracted; the final residue is still useful as a fertilizer.

Sawdust which has served to filter oils purified by sulphuric acid yields after pressure 15 per cent of oil; again, 50 per cent of oil is obtained from the muddy deposits due to the mingling of oils with sulphuric acid. These are washed in boiling water, dried, mixed with sawdust, and lastly treated with bisulphide. Balls of oleaginous grain, when they cannot be used as food for cattle, yield fatty matters; and their residue is an excellent fertilizer, as it contains large proportions of nitrogenized substances and phosphates. Bisulphide is also used to extract the grease from olives after they have been pressed, and from residues of tallow and suet after melting and pressure, also from the residues of the manufacture of cocoa. Bone fragments, when treated with bisulphide at 104° Fah., yield 12 per cent of grease, they are subsequently unfit for the manufacture of gelatin, but answer excellently for the fabrication of bone black. The cleanings of wool cards, when acted upon by bisulphide give about 30 per cent of fatty substances, utilizable for the manufacture of soaps.

It is evident from the great number of waste products, and the abundance of some of them, that a very considerable amount of greasy and oleaginous matter can be returned to the various industries through the new processes involving the use of bisulphide. The material has also been successfully employed in the scouring of wool and in the extraction of bitumen from schists and bituminiferous sandstones. In the latter case, the quantity of bitumen obtained is from 4 to 5 per cent superior to that furnished by distillation, which only gives in all from 7 to 8 per cent. MM. VanHaecht, Emile, & Co., of Belgium, exhibited in the Vienna Exposition a number of improved machines for carrying on these processes, and in which all species of fatty residues could be treated. The price of manufacture does not exceed, for certain purposes, \$2.40 per ton; about half a ton per hour can be treated. The loss of bisulphide is reduced to barely 1 per cent.

TELEGRAPHIC PROGRESS IN 1873.

A submarine cable has been extended along the eastern coast of South America, uniting Para, Pernambuco, Bahia, and Rio. The inauguration of this line was celebrated in the presence of the Emperor of Brazil, on the 23d of last December. In a short time, the wire will be prolonged to Montevideo, and then both American continents, from Canada to the south of Brazil, will be in telegraphic connection with Europe. A fourth cable was successfully laid between England and the United States during the month of July. In Africa, owing to the Ashantee war undertaken by Great Britain, the telegraph has been introduced to a limited extent. In Australia, considerable progress has been made in erecting lines between Queensland and the western portion of the continent. It is proposed to connect New Zealand and Australia with a double cable, also extending from Queensland to India.

The use of the duplex system has become wide both in England and in our own country. We note a curious inven-

tion by Mr. Viquier, of Shanghai, China, by which dispatches are sent not only in the Chinese language but printed in its intricate characters. The automatic plan in the United States is proving quite successful, and in public tests has accomplished some remarkable feats in rapid telegraphing.

With regard to batteries, in spite of the improvements in those of Grove, Bunsen, Leclanché, May, Davy, and others, it seems that we as yet have none that is absolutely constant, though it may be that future modifications of the secondary batteries of Planté will lead to such a result.

Sir Richard Glass, Sir Francis Ronalds, and Auguste De la Rive, all prominent in the history of telegraphy, have died during the past year.

ROBERT L. THURSTON.

We notice with sincere regret the death of Mr. Robert L. Thurston, one of the oldest manufacturers of Providence, R. I., and father of Professor R. H. Thurston, of the Stevens Institute. Mr. Thurston began as a machinist, at a very early age, and had but attained his majority when he became interested with John Babcock, Sr., in the building of an experimental engine and a tubular boiler, which were placed in a small ferry boat used near Fall River. The performance of this craft induced her builders to construct two more vessels, the Babcock and the Rushlight, which, plying between Providence and New York, created a sensation equalled only by that occasioned by Fulton's Clermont. In 1830 Mr. Thurston embarked in business in Providence, R. I., and, after several changes of firm, ultimately formed the well known concern of Thurston, Greene, & Co., the first manufacturers who ever built a standard form of expansive steam engine. Mr. Thurston was not fortunate in monetary matters, and at the beginning of the war incurred heavy losses, which, coupled with his advancing age, led to his retirement from active business life, during the summer of 1863.

The subject of this brief sketch will be widely lamented, not only by the large number of work people with whom, during his long and useful life, he has been brought in contact, and who have experienced his uniform kindness and benevolence, but by all generally, as one of those representative men whose name will always be linked with the material growth and prosperity of the country.

STEARIN CANDLES.

The hard white stearin candle of today is quite a different article from the tallow dip that our grandmothers used to make, and which was then a vast improvement over the pine knot of the preceding generation. Tallow dips were made directly from the tallow, which was obtained by melting beef suet and straining it to remove animal fiber and impurities. Stearin candles are also made from tallow; but in this case it is first separated into its constituents, some of which are solids and others liquids, and only those melting at a temperature above the ordinary summer heat are employed.

Tallow is a mixture of stearin, palmitin, and olein, compounds of glycerin with stearic, palmitic and oleic acids respectively. Oleic acid and glycerin are both liquids at ordinary temperatures, and hence it is desirable to remove them from the tallow before employing it in the manufacture of candles. To accomplish this, several methods are in use. The simplest and one of the best is that invented by Wright and Fouché, and consists in decomposing the fat with superheated steam.

The apparatus employed is called a digester, and consists of two copper boilers, placed one above the other and connected by two pipes, one of which reaches nearly to the bottom of the lower vessel and ends at the bottom of the upper one. The other is fixed to the cover of the lower one and enters the upper one near the top. The melted fat mixed with an equal quantity of water is run into the digester, which is not completely filled and is heated for 15 hours under a pressure of eleven atmospheres. By the end of that time the glycerin becomes separated from the fatty acids, and is dissolved in the water. The contents of the digester are then blown into large vats where they are allowed to settle, and the fatty acids, being specifically lighter, rise to the top, the glycerin water settling to the bottom. As soon as this has taken place, the glycerin water is drawn off into a tank below and heated by a steam coil to evaporate the water, the evaporation being kept up until the glycerin acquires a specific gravity of 25°. At the proper moment, when all the glycerin water has been drawn off, the mixed fatty acids are run into large lead-lined vats. Here they are mixed with a small quantity of oil of vitriol to purify them, and heated by a steam coil. Then the liquid flows into a much larger vat beneath, from which it is run into pans, about 10 inches wide by 18 long and resembling huge cakes of chocolate. These pans are arranged on racks and the acids allowed to crystallize. The fat now solidifies, but it still has distributed through it the oleic acid. To remove this, the cakes are wrapped in strong cloth, usually hair cloth, and submitted to the action of a powerful hydraulic press, whereby a large proportion of the oil is squeezed out.

When no more oil can be pressed out, the pressed cakes are taken directly from this press and, without being unwrapped, are placed in a horizontal press between plates of iron and heated by steam pipes, where still more of the oleic acid is removed. The pressed cakes, although nearly pure, are again melted, treated with dilute sulphuric acid, and subjected a second time to hot pressure. This furnishes a very solid, perfectly white substance, consisting principally of stearic acid, improperly called stearin, with some palmitic acid. From this, the candles are molded in the usual manner.

The oil which is pressed out consists of oleic acid holding in solution more or less of the solid acids, which it is desirable to save. For this reason, it is taken back to the tanks where the acids are melted, and mixed with them to be worked over again. It is finally sold for washing wool, softening leather, or making soap.

Another method of separating stearic acid from the glycerin and oleic acid, formerly much used, consists in saponification by means of lime. When lime is added to melted tallow and heated, the fatty acids combine with it to form an insoluble lime soap, the glycerin remaining in solution. The lime soap thus formed is decomposed with sulphuric acid, sulphate of lime being precipitated, and the melted fatty acids rise to the surface. The latter are transferred to lead-lined tanks, treated with oil of vitriol, drawn off, cooled, and pressed cold and hot, as in the other processes. If superheated steam is employed, a much smaller quantity of lime is required. At a pressure of ten atmospheres, with 2 or 3 per cent of lime, saponification and decomposition are complete in seven hours. This process, invented by De Milly, is a combination of both the above, and effects a saving in time over the first, and a saving in lime and acid over the second.

A fourth method, quite different from any of the above, was introduced by Dubrunfaut in 1841. Unlike the other processes, it can be employed to decompose very impure fats from slaughter houses, bone and marrow fats, kitchen stuff, residues from refining fish oils, and the like. Oil of vitriol is added to the molten fat, a moderate heat applied, and the mass stirred for 15 or 20 hours. The neutral fat is thus converted into a mixture of sulpho-fatty acids and sulpho-glyceric acid. These are decomposed by running them into large wooden tanks lined with lead and one third filled with water, and heating to 212° Fah. After the fatty acids separate, they are purified with water; the water evaporated, and the acids carefully distilled by means of superheated steam, at a temperature of 500° Fah. to 650° Fah. According to De Milly's new process, the tallow is heated to 248° along with 6 per cent of oil of vitriol, and the action limited to 2 or 3 hours. It is thereby possible to obtain 80 per cent of the solid fatty acids in a condition at once fit for making candles without redistillation, only 20 per cent having to be distilled.

SCIENTIFIC AND PRACTICAL INFORMATION.

BLACK PHOSPHORUS.

M. Ritter considers that the color of the variety of phosphorus known as black is due solely to the presence of metals or foreign metalloids. Arsenic in commercial phosphorus causes the appearance of the phenomenon, on account of a separation of phosphuretted arsenic. No allotropic modification exists.

OIL SPOTS ON FINISHED GOODS.

It is an exceedingly aggravating occurrence to find a piece of cloth, perfect in every other respect, ruined by oil spots. They are most frequently due to sheer carelessness and neglect of cleanliness in oiling the machinery. Workmen should be instructed to watch for them, and, as soon as one is discovered, to hunt up the cause and remedy it forthwith. Cloth thus injured should not be left in folds, or, if such disposition is absolutely necessary, pieces of thick paper should be placed between to prevent multiplication of the defects by the oil spots coming in contact with the clean portions.

The *American Textile Manufacturer* says that the simplest and surest process for extracting oil spots is to saturate the spot with benzine, then place two pieces of very soft blotting paper under and two upon it, and press well; in some cases a hot iron is necessary; in others a high pressure, say 100 lbs. per inch, without heat is sufficient. By this means the fat is dissolved and entirely absorbed by the paper. To rub the oil spot with a sponge saturated with turpentine or benzine only spreads the grease.

A HUGE AEROLITE.

A correspondent of the *Chicago Times* says that an enormous aerolite recently fell in the vicinity of Farmersville, Livingston county, Mo. The shock of its impact with the ground is stated to have been like an earthquake, and the molten mass is described as fully twenty feet high above the soil, and some twenty-five feet in diameter. It presents the usual appearance of such bodies, being a black, shining mass of meteoric iron. Its size is unprecedented.

RUMFORD'S DETERMINATION OF THE MECHANICAL EQUIVALENT OF HEAT.

Professor R. H. Thurston recently submitted a note to the American Society of Civil Engineers, in which he presented a résumé of the history of thermodynamics as given by Professor Tait in his work on the subject. In this, Professor Tait places the services of Count Rumford as second in importance to those of Davy, as well as in the actual influence upon the growth of the science, and does not apparently consider them comparable to those of Joule.

Professor Thurston considers that, as it is well known among engineers that the ordinary unit of measurement of horse power is much too high for application in estimates of animal power, it would be more correct to consider the horse power of Rumford as 25,000 instead of 30,000 foot pounds per minute. In such case the mechanical equivalent, as deduced by the latter, would be 782.8, differing by only 1.5 per cent from the value now accepted, as determined by Joule half a century later, which is nearer the probably correct value than the result of any other investigation, and is even far more accurate than many results obtained by Joule himself. Professor Thurston thinks that we may claim for Benjamin Thompson, of Concord, N. H. commonly

known as Count Rumford: 1. That he was the first to prove the immateriality of heat and to indicate that it is a form of energy, publishing his conclusions a year before Davy. 2. That he first, and nearly a half century before Joule, determined, with almost perfect accuracy, the mechanical equivalent of heat; and 3, that he is entitled to the sole credit of the experimental discovery of the true nature of heat.

HYDRATE OF CHLORAL AS A PRESERVING AGENT.

M. Personne reports that, beside the strong alkalies, all the weak ones, magnesia, the alkaline salts, including borax and phosphate of soda, all the animal alkaline liquids, such as blood and white of egg, transform chloral into chloroform when the mixture is heated to 104° Fah. Fresh blood to which chloral has been added, and which is retained at normal temperature, coagulates completely, keeping its red color, and remains without alteration. A piece of muscle plunged in a chloral solution of 10 per cent, became slightly pale in tinge and deposited a sediment; but after a few hours immersion, it dried rapidly and became sufficiently friable to be pulverized.

It is believed that chloral solution of the above strength may be used for preserving the most alterable animal matters. The author states that he has thus kept a cerebellum for more than a month in perfect condition. He recommends the addition of glycerin to the solution, to prevent the articles preserved from becoming rigid and dry.

THE CHILI INTERNATIONAL EXPOSITION.

The Republic of Chili has, through its representative, formally notified our government that an international exposition will be held at Santiago, to open in September 16, 1875. Some valuable general concessions are to be made to exhibitors at the exposition. There will be a reduction of fifty per cent in the price of freight from Valparaiso to Santiago and on lines belonging to the government. Articles, excepting such as relate to dress fabrics, furniture, house decoration, jewelry, glass, earthenware, and similar products of manufacture, together with those of mining industry, will be admitted free of duty. Those excepted will not be charged in case they are reshipped. Forty dollars will be allowed for the payment of the passage of any special workman or mechanic in charge of, conducting, or directing exhibited machines or industries, such workmen to be duly accredited with passports certified by the Chilean Consul at the port of their embarkation. A reduction is also to be made on the freight of goods on the way to the exhibition from the different lines of steamers running to Valparaiso, the amount of which will be made known shortly.

A BOILER EXPLOSION.

A correspondent, G. F. A., writes from Peoria, Ill., enclosing a newspaper slip which describes a disastrous boiler explosion at that place, on January 31. The boiler was new, having just been completed, and was undergoing a test by steam pressure. It had no safety valve, nor any means of relieving the pressure other than by a rupture. A steam gage was attached; and when this indicated a pressure of 139 pounds per square inch, the boiler exploded, killing one of the bystanders and severely scalding another, the person who was killed being completely dismembered. The boiler was broken into fragments, which were thrown to great distances. It appears that the correctness of the gage was doubtful, so that it was impossible to tell what was the actual pressure when the boiler exploded. Judging from the above facts, this was a case of reckless engineering, calling for the sternest censure.

We are greatly obliged to our correspondent for sending us an account of the explosion, as we believe that giving publicity to proceedings of this kind is one of the surest means of inaugurating more careful management. Will not our readers in all sections send us information on matters of this kind, enclosing extracts from the local papers? In this way they will render us valuable assistance in our endeavors to bring about a more enlightened system among those who are entrusted with the care of steam machinery.

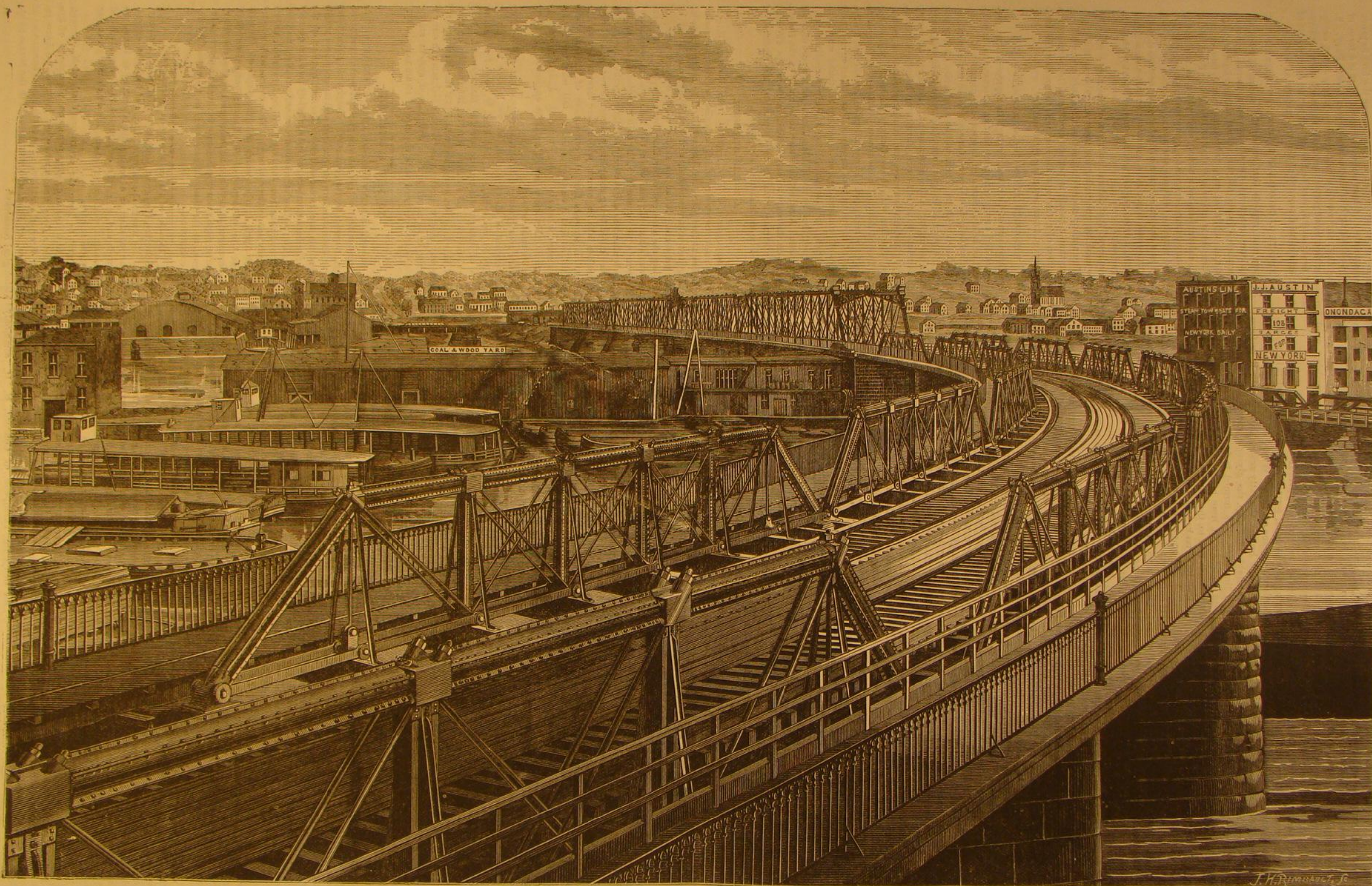
TO NEW SUBSCRIBERS.

All subscriptions to the *SCIENTIFIC AMERICAN* will be commenced with the year, unless persons, at the time of remitting, request to the contrary. Nearly all subscribers preserve their numbers for binding; and in most cases where subscriptions are received during the first quarter of the year, if the back numbers are not sent, they are subsequently ordered. To save both the subscribers and ourselves trouble, the back numbers from January 1 will be forwarded, unless we are advised to the contrary. This course will be pursued till April 1, after which date the paper will be sent from the time of receipt of remittance; but subscription may commence at any time, at the request of the subscriber. The above regulation applies only to those who give no instructions, at the time of remitting, as to when they desire to commence.

Death of Three Eminent Scientists.

Max Schultze, the great German professor of anatomy, is dead. He was in the prime of life, and had just experienced the satisfaction of seeing his laboratory at Bonn, the most ample and elegantly constructed in Europe, finished under his immediate supervision. His death is a great loss to biological science.

We regret to learn the premature death of M. Fernand Papillon, to whose interesting papers on phenomena of life (in *Revue des Deux Mondes* and other journals) we have repeatedly directed attention. The death is also announced of Dr. Legros, of Paris, who was poisoned in the course of his histological researches.



THE HUDSON RIVER RAILROAD BRIDGE ALBANY, N. Y.

THE ALBANY RAILROAD BRIDGE.

The large and handsome engraving which we publish on another page is an excellent view of one of the finest pieces of civil engineering work existing in this country. It is the largest double track iron railway bridge in the United States, and extends across the Hudson river at Albany, N. Y. Messrs. Clarke, Reeves & Co., the designers of the proposed iron centennial tower, were the constructors.

The total length of the structure is 1,740 feet, or nearly one third of a mile, and it consists altogether of fifteen spans, of which one is a draw span 274 feet in length. The superstructure is entirely of wrought iron, and the main girders are proportioned to carry a rolling load of 6,000 lbs. per lineal foot of bridge, in addition to the weight of the fabric itself. The turntable is operated by a steam engine, and is so constructed, that if any part wears out, it may be replaced without interrupting the use of the swing bridge; and suitable lever turning gear is also provided, so that, should it become necessary, the swing bridge may be operated by hand.

The engine and boiler, and all the machinery required to actuate the draw span, are situated within the turntable and are out of sight. The draw span can be opened and closed very quickly. When being swung, the weight is carried by the center and amounts to about 350 tons, but the equilibrium is so accurate that it can be readily moved by two men.

The floor system of the bridge is rather stronger than is usually made in this country, and the system of construction generally was based on the plan followed at the Phoenixville works, which provides that the bridge does not fail to return to its original camber without readjustment after testing. To allow for expansion, one end of each girder is fixed to the pier, while the other end is carried upon rollers formed of lengths of 1½ inches cold rolled shafting, mounted in wrought iron frames.

The weight of iron in the fabric is 1,750 tons, and the total cost, including machinery, sidewalks, etc., was about \$320,000. Our view is taken from the Albany side, at which point a new and finely arranged depot has recently been constructed.

A New Idea about Comets.

A paper was read before the Hackney Scientific Association on January 13, by Mr. Reeves, advancing an entirely new theory with regard to comets; and by the use of diagrams, he showed that the part of the comet termed the tail, being always in a direction from the sun and therefore as often in advance as behind the nucleus, is not really a tail. That as comets are transparent, and all matter is known to be either solid, liquid, or gaseous, comets must be the latter, for solids and liquids are opaque. That the only known power by which this gaseous matter can be held together is gravity, which must necessarily have a center, and, every part of the body being free to move, resolves itself into a sphere, the center of which is in many cases exceedingly dense, gradually attenuating towards the circumference. That the rays of the sun are refracted in their passage through the spherical comet, thus luminating the portion beyond the center or nucleus, which illumination forms the tail. He then explained how all the various and peculiar phenomena of comets, such as their shapes, colors, horns, nuclei, as well as their being with and without tails, etc., arise; and that they are entirely in accordance with the universal laws of Nature.

Preserving Cut Bunches of Grapes.

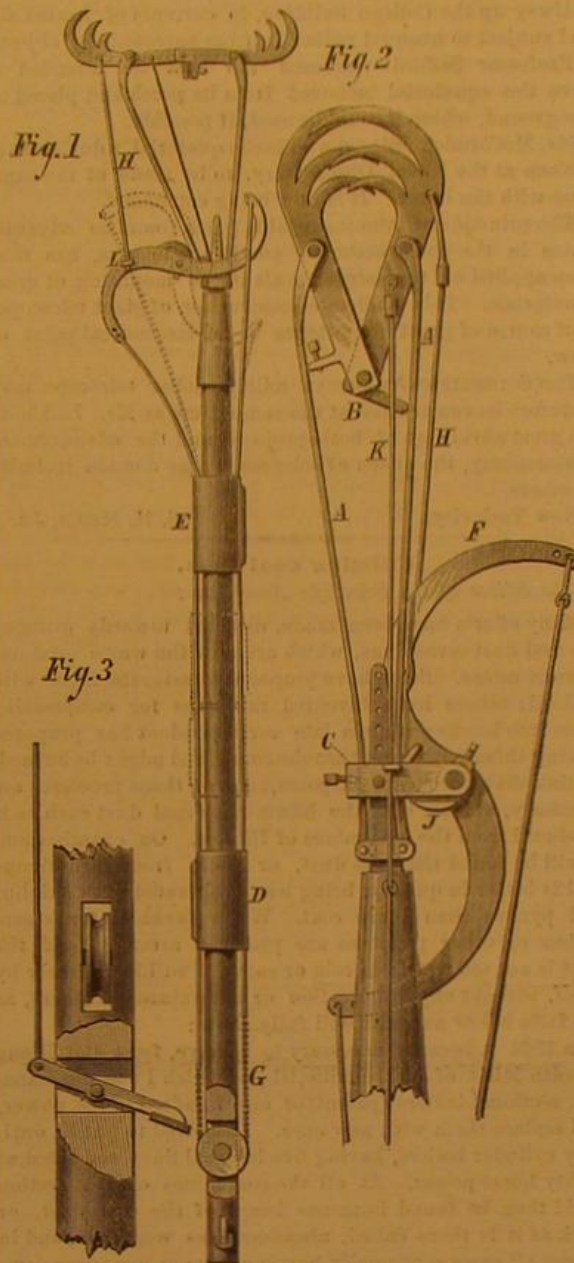
A correspondent of *The Garden* recommends the use of the ingenious little device depicted in our engraving, for preserving bunches of grapes in water, after they are cut from the vines. Any plumber can make the tin tubes for a few cents each, and they should be hung up, with the bunches, in the vinery; but a separate small house or hot frame, to which the heat could be turned on when necessary, would be an improvement. The house or frame should be well ventilated and free from damp and dust; and it would be useful for young vines in pots, cucumbers and melons.

IMPROVED FISH GRAPPLING SPEAR.

This invention, the object of which is indicated by its title, is an improvement of considerable merit over the old-fashioned fish spear. It is also excellently adapted as a substitute for the gaff, as its action is much more certain, while it requires less skill to manage. The grappling arms are easily and quickly set by ingenious mechanism leading to the handle, while there seems little about the apparatus to get out of order and so impede its working. Our engraving represents the device with its claws open (Fig. 1) and closed (Fig. 2), and also (Fig. 3) show the tripping arrangements in the handle.

The spear hooks are jointed together, as shown, and provided with springs, A, which are bent when the hooks are opened and so held by the toggle joint at B. The springs are arranged in a clip, C, and not permanently attached, so that the hooks may be released to facilitate their opening and setting. D and E are sliding sleeves upon the handle with which the rock lever, F, is connected by a chain, wire, or cord, G, which passes up over a pulley near the end of the stock. The rock lever communicates with the spear hooks by a wire, H, so that, by sliding the sleeves along the

handle toward the hooks, the lever will be turned to the position shown in Fig. 1, to open and reset the hooks; and by moving the sleeves in the opposite direction, it will be turned back again (as shown in Fig. 2 and the dotted lines in Fig. 1), by sliding the swivel stud, I, back upon it to free the connecting rod, H, so that the latter will allow the jaws to close when tripped. The same operation subjects the springs to the required tension for actuating the hooks, by means of the cam, J, pivoted to the clip. A set screw is provided in connection with the cam for producing and varying the tension of the springs; and the clip is made adjustable on the stock and along the springs for the same purpose.



Generally the hooks are tripped by striking them against the back of the fish at the joint; but as, in case of striking a stone or other hard substance, the points might be injured, a wire, K, is connected to one of the prongs near the joint, and extends up to a small trip lever shown in Fig. 3. This lever, worked by the finger, pulls the joint back, and so trips the hooks.

Patented through the Scientific American Patent Agency, October 28, 1873. For further particulars address the inventor, Mr. Jonah W. Knapp, Cross Rivers, Westchester county, N. Y.

ASTRONOMICAL NOTES.

OBSERVATORY OF VASSAR COLLEGE.

For the computations of the following notes (which are approximate only) and for most of the observations, I am indebted to students. M.M.

Positions of Planets for March, 1874.

Mercury.

On the 1st of March, Mercury rises at 7h. 12m. A. M., and sets at 7h. 20m. P. M. On the 31st, Mercury rises at 4h. 59m. A. M., and sets at 4h. 37m. P. M.

Mercury should be looked for soon after sunset; early in March, some degrees north of the sun's place. Mercury and Venus pass the meridian or south at nearly the same time on the 14th, Mercury being, however, 6° north of Venus in declination.

Venus.

On the 1st of March, Venus rises at 6h. 50m. A. M., and sets at 5h. 50m. P. M. On the 31st, Venus rises at 6h. 14m. A. M., and sets at 7h. 4m. P. M.

The moon and Venus will be in conjunction on the 18th.

Mars.

On the 1st, Mars rises at 7h. 58m. A. M., and sets at 8h. 41m. P. M. On the 31st, Mars rises at 6h. 52m. A. M., and sets at 8h. 35m. P. M. It will be seen that Mars is very unfavorably situated for observations.

Jupiter.

Jupiter rises on the 1st at 7h. 12m. P. M., and sets at 7h. 30m. A. M. On the 31st, it rises at 4h. 54m. P. M., and sets at 5h. 18m. the next morning.

All through March Jupiter is in excellent position for observation, coming to meridian at midnight on the 19th, and

nearly at midnight for the whole month. Its altitude, too in our latitude, is above 50°, and it can be studied to great advantage. Every person who has a telescope, even a small one, should watch the varied phenomena of its moons, especially on the evenings of the 7th and 18th. On the 7th, the largest of its moons will disappear by eclipse, passing into Jupiter's shadow, and the smallest will disappear by transit, coming between us and Jupiter, and being lost to view while projected on Jupiter's disk.

Jupiter and the moon are in conjunction on the 31st, when the moon is nearly full.

Saturn.

On the 1st of March, Saturn rises at 5h. 19m. A. M., and sets at 3h. 1m. P. M. On the 31st, Saturn rises at 3h. 30m. A. M., and sets at 1h. 18m. P. M. As this planet comes to the meridian in the forenoon and is far south in declination, it is not well situated for observation.

Uranus.

Uranus is in good position for observations, but needs a good telescope. On the 1st it rises at 2h. 48m. P. M., comes to meridian at 10 P. M., and sets at 5h. 12m. the next morning. On the 31st Uranus rises at 0h. 46m. P. M., and sets at 3h. 12m. A. M. the next morning. It is still among the small stars of Cancer, a few degrees south of γ Cancri.

Neptune.

On the 1st, Neptune rises at 8h. 32m. A. M., and sets at 9h. 34m. P. M. On the 31st, it rises at 6h. 37m. A. M., and sets at 7h. 42m. P. M. Even with good telescopes, no good observations can be made on Neptune at present.

Sun Spots.

The record is from January 20 to February 14 inclusive, and, though much broken by cloudy days, is yet regular enough to indicate that in the spots individually there has been no marked change, no sudden appearance or disappearance. On the 24th, spots appeared on the eastern limb which proved to be the advance of a large group, the whole of which was on the disk by the 26th. Photographs of the 29th and 30th showed the group still entire, and on these days the largest portion of it was seen with the naked eye. Observations were then interrupted until February 6, when what was probably the last of it was just within the western limb. On the 6th there was a small circular spot "coming on," that is, near the eastern limb, which was still seen on the 14th, having been carried during the interval to the opposite side of the disk, still maintaining its original shape. Five other small spots, on the 14th, extended east of the circular one, nearly in the line of the horizontal diameter. There were faculae on the 10th and 14th.

Zodiacal Light.

This was seen, early in the evening, on the 4th, 5th, 11th, and 14th, stretching from the western horizon towards the Pleiades.

Barometer and Thermometer.

The meteorological journal from January 17 to February 13 gives the highest barometer, February 2, 30.63; the lowest barometer, January 28, 29.62; the highest thermometer January 23, at 2 P. M., 56°; the lowest thermometer, February 9, at 7 A. M., -11°.

Amount of Rain.

The rain which fell during the morning of January 28 amounted to 0.12 inches.

The rain which fell between the afternoon of February 13 and the morning of February 14, amounted to 0.13 inches.

Patent Calf Feeder.

In these days, when the successful rearing of cattle is an important item of farm management, a wide difference may be seen in the appearance of two calves—the one fed by a painstaking hand, and the other allowed to gulp down its food without time for admixture with the saliva. This is a very important matter, seeing that success or failure frequently depends upon it. Of course, the nearer the process of feeding is approximated to the slow natural action of sucking, the better for the young animal. The implement shown in our illustration, for which we are indebted to the *Ironmonger*, if properly cleansed from time to time, feeds in the most natural manner and renders it impossible for the calf to gorge itself. It is a vessel of galvanized iron, shaped like a milk can, having upright sides and concave bottom, with an iron bale handle and a splayed hoop foot, which causes it to stand firmly on the ground. Midway in the vessel is a fixed ledge, into which a self-locking cover closely fits. This cover has a vulcanized india rubber teat, fixed in its center and communicating with an india rubber tube extending to the bottom of the vessel, the concave nature of which allows of the calf making a clean meal. The vessel holds about five quarts, and can be readily cleaned by removing the cover. The new feeder entirely dispenses with the unpleasant and dangerous practice of feeding with the finger, and the food is not so liable to be wasted.



TO TAN SKINS.—The following method is recommended by a correspondent: Take equal parts salt, alum, and Glauber's salt, and half a part saltpeter; pulverize and mix. Handle the skins and rub the mixture in well three or four times a day, the oftener the better. If there is not moisture enough in the skin to dissolve the salts, put a little water into the latter. We are assured that no moth will attack furs, the felts of which have been thus prepared.

Correspondence.

Mr. Richard A. Proctor and the Million Dollar Telescope.

To the Editor of the Scientific American:

Mr. R. A. Proctor, whose most interesting and instructive course of lectures has just closed in this city, was inclined to doubt the possibility of making a telescope much superior to Lord Rosse's. He also stated, in the lecture of January 19, in regard to Mr. Lick's Rocky Mountain Observatory, that "the proposed magnifying power of 8,000, to bring the moon within 30 miles, was impossible." ($240,000 \div 8,000 = 30$.) Now Lord Rosse, an accurate and conscientious observer, permitted himself to record an observation made with a power of 6,000 diameters, that is, he made out the object nearly as well as if he had used a lower power. In this same way, the power of one hundred diameters for each inch of aperture, instead of fifty diameters, may be applied to a good objective during the 100 hours, or thereabout, of suitable weather which occur during the year. Mr. Proctor, having been informed more fully with regard to the million dollar telescope scheme, and having been requested by us to give his views on certain matters of interest connected with the subject, on the 20th inst., made the following graceful compliment to the world's most skilled optician, and to the magnificent project which bids fair to be realized at no distant date:

"And here let me mention the superiority of the refractor at Cambridge to the Rosse telescope; and let me allude also to the possibilities of great future discoveries by means of a telescope, to be five feet in aperture, which, it is said, your optician Alvan Clark proposes to make, at a cost, I believe, of \$1,000,000. That amount will be wanted. It seems a considerable sum. But if any one can do it, it is Clark, for he is unrivaled as an optician. Mr. Cooke, of England, was the only optician comparable with him, but he is dead. I have never had an opportunity of making any comparison between the great telescope of Cooke, 25 inches in diameter, which is used in an inferior atmosphere, and was completed in the hands of his successor, and those of Clark. The telescope at Washington is 26 inches in aperture. But now that Cooke is away, Clark is the greatest of living opticians; and if a telescope is to be made, it is to be hoped he may be spared to make it." Mr. Clark informed me last summer that he did not expect to live long enough to finish such a work, but both he and his son Alvan expressed a willingness to undertake the construction of a million dollar equatorial, if the money were raised for the purpose, the object glass to be 5 feet 6½ inches clear aperture, and focus 75 feet. The flint and crown disks would be made by Messrs. Chance, of Birmingham, England, or specially in the United States. It will not be found difficult to make large glass disks of homogeneous "metal," if the proper materials are used with the requisite care.

The common glass crucible is built up gradually in rings of about two inches in height, the clay being constantly mixed and trodden by the naked feet of the workman. The fabrication of the melting pot thus requires an entire year. The same care should be devoted to the materials to be placed inside. Optical glass of the very best quality, free from streaks, should be selected and crushed. Fragments of uniform specific gravity should then be sorted out by the hydraulic bucket or an equivalent mining appliance for the separation of ores. These glass fragments, of uniform quality and size, should be charged into the crucible, and melted in the most intense heat attainable in a Siemens' gas furnace, then cooled as slowly as possible, and the central part of the mass sawn out. This mass of perfect glass may be reheated if necessary in the usual disk mold, to soften and flow by its own weight into the requisite shape. Mr. Clark says that the flexure due to the weight of a large object glass does not appear sufficient to disturb its corrections. A reflector, however, such as the 4 foot at Melbourne, can hardly be prevented, by the most elaborate system of counterpoise levers, from bending so much as to distort the image.

Dr. Draper's fine lunar photographs, although taken with a 15½ inches Newtonian silvered glass mirror, supported on an india rubber air cushion, the eyepiece driven by a clepsidra, are hardly as sharp in definition as those of Mr. Rutherford. The latter were taken with an 11 inch refractor with a second flint lens in front of the object glass, corrected by continual trial photographs of stars until the combination converged actinic rays to the same focus. The equatorial is driven by a Bond spring governor clock. At present Dr. Draper's 28 inch silvered glass reflector and Mr. Rutherford's 13 inch triple photographic objective may be regarded as typical specimens of their respective kinds. I infer, therefore, that while the silvered glass reflector is cheap and possesses no chromatic aberration, yet the achromatic is by far the best for accurate work.

European opticians (so Messrs. Merz & Steinheil assured me, in Munich) generally try to get an absolutely homogeneous glass, to work in spherical curves, according to the formula of Gauss. Mr. Clark, choosing simple curves, and the best glass he can get from Messrs. Chance, excels all others in the exquisite delicacy of his local corrections for slight want of homogeneity in the glass, incorrect figuring, etc. You described his method of recorection, as applied to the Pittsburgh 13 inch telescope, in the SCIENTIFIC AMERICAN of September 20, 1873. Mr. Clark was formerly a portrait painter, and gained, in the practice of his profession, the sensitive touch and correct eye necessary for the work endorsed by such critics as the late Rev. Mr. Dawes and Dr. Huggins. Dawes' double star work was accomplished mainly with a seven inch glass by Clark, and Huggins,

splendid researches, on the spectral character and composition of stars and nebulae, were prosecuted with an eight inch by the same maker.

All observers are not aware that, when a perfectly corrected object glass is uncovered to the sky, it must be allowed to radiate heat for about half an hour before the spherical aberration becomes zero.

I read that Mr. Lick has entrusted Colonel Von Schmidt, an eminent engineer, with the location of the Rocky Mountain Observatory. This task I regard as almost equally onerous and important with that of the optician. The splendid 18 inches, belonging to the Dearborn Observatory at Chicago, is almost utterly useless (or was when I saw it), being perched in a high, ill ventilated tower halfway up the College building, in currents of heated air, and subject to unequal radiation from surrounding objects.

Professor Safford informed me that he intended to have the equatorial removed from its perch and placed on the ground, where it could be used, if possible.

Mr. McCormick ordered a 26 inch equatorial, a duplicate of the one at the Naval Observatory, to be made at the same time with the latter. It is now being completed.

The principle of interchangeable parts, found so advantageous in the construction of smaller machines, has thus been applied on the largest scale to the mounting of great equatorials. This wholesale construction of giant telescopes is of course of great importance in an economical point of view.

The SCIENTIFIC AMERICAN million dollar telescope may therefore be constructed at the same time as Mr. Lick's, to the great advantage of both projects, and the advancement of astronomy, the queen of sciences, whose domain includes all others.

New York city.

S. H. MEAD, JR.

Utilizing Coal Dust.

To the Editor of the Scientific American:

Many efforts have been made, directed towards utilizing the coal dust screenings, which are now the waste products of most mines. Some have proposed to saturate them with coal oil; others have invented machines for compressing them into blocks; while a late correspondent has proposed mixing them with corn, that the compound might be burned. I think that, for steam purposes, none of those processes are necessary, at least with the bituminous coal dust such as is produced from the coal mines of Illinois. On examination, it will be found that the dust, or slack, from bituminous coal is better in quality, being less adulterated with sulphur and pyrites than lump coal. When furnaces for steam boilers or other purposes are properly arranged, and the dust is not too wet from rain or snow, it will burn freely by itself, without any preparation or admixture whatever, as the facts below narrated will fully show:

In 1868 it became necessary to remove, from the Home Woolen Mills, of Jacksonville, Ill., of which I was the manager, sectional boilers (patent) of one hundred horse power, and replace them with new ones. I resolved to put in ordinary cylinder boilers, having five internal flues and rated at eighty horse power. At all the coal mines of that section could then be found immense heaps of the coal dust, or slack as it is there called, abandoned as worthless, and in almost all cases continually burning from spontaneous combustion. I resolved to set the new boilers and construct the furnace with the view of using this waste product exclusively for fuel. Before starting the fires, I made a contract for all the slack (in case I succeeded in using it) the mill would need, the same to be delivered on board the cars at twenty-five cents per ton. The experiment proved successful; and from that date, until the burning of the mills in 1873, that fuel was used exclusively, with the exception of a few months one summer (when so little coal was being mined that slack could not be had), and an occasional car load of coal when the other failed to arrive. With this as fuel, an engine of 75 horse power was run, driving the machinery of a four set woolen mill; and direct steam was also supplied to dye house, dresser, wool and cloth drying machines, and in cold weather to the heating pipes necessary to heat the entire building, containing 38,000 square feet of flooring. In use, the slack was found nearly as effective as coal; and from that long experience in its consumption, it was fully established to be only about twenty per cent inferior to the best lump coal, ton for ton, for equal amounts of steam. After this mill commenced burning it, the superintendent of the mines found that the cars could not be loaded at the price originally named, and fifty cents per ton (delivered on board cars) was agreed upon as the price; and that price, and no more, was paid to the mines for the four years of its use. During the same time, lump coal on board cars at the mines ranged from two dollars and a half to three dollars per ton. Under the new boilers, much less of this dust was used for fuel than had been previously used of the best lump coal under the sectional boilers, although the amount of machinery was considerably increased.

After the economical use of this fuel had been established in the Home Mills, the proprietors of other mills examined into the manner of using it, and also adopted it. For the past two years, another woolen mill at Jacksonville, and one at Springfield, Ill., each using seventy horse power engines, and direct steam for other purposes, have been utilizing coal dust in their furnaces. Others in the same section of the State have adopted it, and it is now established beyond all question that it can be successfully burned in the manner above stated. Even in starting fires, no other fuel is necessary, except a few handfuls of kindling wood, such as used with lump coal.

To arrange for burning the coal dust, no considerable

change in furnaces from ordinary construction is necessary. What is true for the proper burning of lump coal is absolutely indispensable for the dust. The rules are simple and easily understood: A large supply of air in the furnace, regular feeding, open fires, and a good draft. When black smoke is seen coming from the chimney, these requisites are not all present. In fact, no more black smoke should ever be seen coming from a furnace burning either dust or lump coal than from one burning wood, and no coal-burning furnace is properly constructed for its work which emits, for more than a half minute at a time, sufficient smoke to be observed without very close inspection. In the case of the Home Mills, although the chimney was but fifty-four feet high, it was rarely that any smoke whatever could be seen. The engineer in charge understood his business thoroughly, was reliable, and always saw that the furnace was in proper order. That, indeed, was one of the principal causes of continued success, and will always be found to be all important.

The use of slack under steam boilers alone has been advertised to, but it can be used for almost any other like purpose. Those persons using considerable amounts of coal, who can obtain dust at low rates, need have no fear that they will fail if they will follow the above suggestions. No compression into blocks, admixture with coal oil, or adulteration with corn is necessary. A faithful fireman to shovel in spall and regular supplies, an open fire, and a good draft, will never fail to make as fierce and effective fire as lump coal, with a very large saving in cost.

Columbus, Ga.

JOHN HILL.

Asphalt Pavements.

To the Editor of the Scientific American:

It is suggested that some mixture or mode of laying down asphalt pavements must be found, for obviating the tendency to greasiness. This greasiness is the cause of the slippery character of such pavements when wet or damp. Another great objection to them is the disposition to wash away with rain, to soften in the sun, and to crack on drying. These latter faults are caused by the want of an absorbent element to hold the volatile portions from evaporation and softening in the sun. This absorbent must be of a character that will not crack of itself, if mixed with water to a thin consistency and dried at slow heat. Sand, clay, ground slate, talc, Grafton mineral, lime, etc., are used at present for admixture in such compositions, but they do not possess the absorbent and non-cracking qualities. The mineral known as fuller's earth is, I believe, the best thing for this purpose. The peculiarities of fuller's earth, among similar minerals, are its powerful affinity for greasy matters, its finely comminuted character (it is an unpalpable powder when crushed, which is evinced by the readiness which a piece takes polish from the friction of the finger nail), and its peculiarity of drying, rapidly or slowly, without cracking. These render it invaluable for really good and lasting pavement made from asphalt, coal tar, or other bituminous matters.

Two parts of fuller's earth, with one part of a mixture of asphalt and coal tar, or the asphalt alone, make a good compound for the purpose.

INVESTIGATOR.

The Preservation of Timber.

To the Editor of the Scientific American:

I came here 30 years since, and began clearing land and building houses with hewn logs and boards split from the tree. After several years' residence I noticed very often that pieces of the same kind of timber decayed more quickly than others; and after much thought and observation, I came to the conclusion that timber felled after the leaf was fully grown lasted the longest. I noticed that timber felled when the leaf first commenced to grow rotted the sap off very quickly, but the heart remained sound; that timber felled after the fall of the leaf rotted in the heart, even when apparently sound on the outside. When fire wood cut in the winter, was put on the fire, the sap came out of the heart; but when cut in the summer, the sap came out of the sap wood and next the bark. I noticed also that all our lasting wood had but little sap at any time in the heart: such as cedar, mulberry, sassafras, and cypress.

A cypress post cut in the summer of 1838 is still sound, although exposed to all weathers, while one of the same kind of timber, cut in the winter of 1856 and painted, has rotted in the heart. I saw yesterday a piece of gum plank, which I sawed in the summer of 1859, that has lain exposed ever since, and is perfectly sound; while oak timber that was felled in the winter before is now entirely rotten.

My conclusion then is: Cut timber after full leaf, say in July and August, to get the most last from it. The sap goes into the heart of the tree after leaf fall, and causes decay.

Arkansas.

JAMES A. MOORE.

Fish in the Hot Springs of Nevada.

To the Editor of the Scientific American:

About 80 miles north of this place, on the north slope of Bull Run Mountain, which never loses its massive banks of snow, rises a small stream, formed by springs that furnish the purest and coldest water I ever drank. The stream, after running a distance of half a mile, is about 2 feet deep and about 6 feet wide on an average; at this point a succession of hot springs rise on the banks, and flow into the stream, increasing the volume of water about one third. The water of these springs is so intensely hot that less than three seconds are consumed in boiling eggs in it. The creek above and below this point swarms with fine brook trout; and strange as it may appear, to persons standing on the banks where the hot water is discharged into the brook and looking

through the rising vapor, you can see hundreds of the fish swimming to and fro in the boiling element with as much indifference as though there were no hot water near.

This letter, if unaccompanied by an explanation, would undoubtedly pass for a Nevada fish story; but to satisfy the incredulous, I will give the result of my investigation, it being July when I visited the place. I took a common thermometer with me, which only registered to 130° Fahrenheit. A test of the water above the hot springs showed a mean temperature of 42°; fastening my thermometer to a pole, I immersed it above the influx of hot water; and keeping it as near the bottom as possible, I moved it gradually down stream. The result was a very low temperature at the bottom, gradually rising to 65° until I reached a point (a fourth of a mile down the stream) where the temperature became uniform throughout. This, it will be seen, shows that the hot water, having a specific gravity much less than the cold, retains its place on the surface, forming an upper intensely hot stratum, and leaving the lower water with its finny tribe undisturbed, and to all appearances swimming to and fro in one of Nature's caldrons.

This stream is one of the many that form the head waters of the Columbia River; and to this point, over eighteen hundred miles from its mouth, in the spring and fall, the salt water salmon come in hundreds to spawn.

Elko, Nev.

G. A. F.

The Spider's Web.

To the Editor of the Scientific American:

It is commonly believed that spiders are able to project their webs to distant objects, thus bridging over the intervening space; but how this is done, I have never seen explained. Once I saw a small spider upon some projecting object above a table, before an open window, briskly engaged in trying to do something, without seeming to accomplish his object. I therefore watched him, and saw that, after attaching his thread to the projecting object, he spun down four or five inches, and then commenced climbing his thread, carrying the same with him, or, rather, winding it up into a ball. Having reached his point of support, he descended again, and wound up the thread as before. This he did three or four times, till his ball was nearly as large as the head of a pin. Then taking his position upon the top of his projection, he remained apparently motionless for half a minute, at the end of which time his ball had disappeared, and there was seen a delicate line, a foot or more in length, flying in the wind. He was evidently trying to attach his thread to a lamp standing in the center of the table; but he had miscalculated the direction of the wind. I then carefully broke off the flying thread, when, finding that he had failed to reach the lamp, he repeated the attempt, going through precisely the same movements as before. This he did four or five times, when, doubtless concluding that the fates were against him or that some one was interfering with his operations, he left for parts unknown.

Whether he projected his ball of silk, as the sailor does his coil of rope, or whether he merely unwound it, letting the free end fly in the breeze, I could not make out; but it is very certain that when the flying thread appeared, the ball beneath his feet had disappeared.

Franklin, N. Y.

The Curious Ways of Plants.

Who can account for the ways of plants, or explain why a certain species will grow in one place, and will not in another exactly similar, so far as human intelligence can determine?

The American aloe is a hundred years in getting ready to flower, whereas the gourd grows like Jack's bean stalk. Some wild flowers disappear on the advance of civilization; while, on the other hand, the plantain, if the truth is told, goes wherever Europeans go; and in this country was unknown until after the English came, following so closely on their tracks that the Indians gave it the name of "white man's foot."

Some varieties, as above intimated, may be found in a particular locality, and nowhere else within half a dozen miles. There is, for example, in this neighborhood, in central New England, one spot where are a few shrubs of the mountain laurel ("spoon wood") in a little patch by the roadside; and although this would seem the natural country for it, it can be discovered in no other place anywhere about.

Then there is the fringed gentian, which has been seen beside a secluded road some six miles away; but, with that exception, appears wholly unknown in the vicinity: yet the closed gentian is abundant. Another of the perversely disappointing flowers is the dog tooth violet; not, however, more capricious than the yellow violet and the noble liverwort (*hepatica triloba*), which, in certain dry maple woods, in the one case, and in open knoll-covered pastures, in the other, grow in great abundance; still, one might search acres of similar woods and pastures for them, all to no purpose.

Another case, somewhat in point, is the holly-indigenous, or at least one variety, to moist woods along the eastern border of New England; but so partaking of the aforementioned eccentricity, that he may count himself a happy man who can find it, and prove his success by great armfuls of it, wherewith to deck his house at Christmas. One gets glimpses of it while riding through some swampy tract on Cape Ann; the bright berries and evergreen leaves, so suggestive of English good cheer, betraying it. There, too, in summer, by searching diligently, one may find a species of magnolia, that being about its northern limit.

No common New England flower is so little to be depended upon as the trailing arbutus. It is difficult to determine what it wants. It abounds in gravelly knolls by the way-

side, and thrives on the very edge of pasture bogs, and in the shade of woods; and yet, with all this versatility, there are many towns where it is never found, and where, though transplanted and tended with care, it cannot be made to live.

Quite opposite, in these respects, is the "cardinal flower," whose home is by the water side, the only place where it grows naturally, although the kind of water is not of imminent consequence, for it will do just as well in a dark nook under the up-heaved root of a willow, on the edge of a mill pond, in the muddiest ooze, as in the cleanest sand along a river's bank, its chief requirement seeming to be that it shall not be crowded; one stalk always standing by itself, independent of its kind, and not in close neighborhood to other plants. It is so adaptive that it will bear removal to a garden, taking kindly to its new conditions; and there it will come up, year after year, flaming out in live scarlet, in "one glorious blood red," as if nothing had happened to it.

There are other facts, more singular, as to the ways of growth and "how's" of blooming. One can understand that a grape vine may hold to its support by means of a tendril, while an ivy or a Virginia creeper secures itself by thrusting its rootlets into a crevice of a wall or in the bark of a tree; but why should a honeysuckle and a bean vine wind in opposite directions, the one going to the left and the other to the right? and either will swing on the wind, or sprawl over the ground, rather than turn the other way.

The ketmia opens at nine o'clock in the morning, and shuts at ten, as if it had a visual weakness; while a bed of portulacas never expands unless the sun is out; and the hotter he shines, the wider they spread themselves; and the evening primrose waits until he has gone down, and then comes open with a snap, like a subdued kind of fire cracker.

But most unaccountable of all, perhaps, is the night-blooming jasmín. You see a simple tree-like plant, with a plain style of leaf, at the base of which grows a spray of yellowish green tubes, like lilac buds, suggesting, more than anything else, a string of small candles. You look at them in the middle of the day, and they are "only that and nothing more;" and you might, if you did not know their ways, forget all about them; but when evening comes, forgetting is impossible. The room is full of fragrance, rich as orange flowers, and almost as subtle as violets; and lo, your little candles are all lighted; and from somewhere about them comes that perfume which is so delicious and so mysterious as to its source. The next morning, they begin to contract; by noon, the five points are all close packed, and there is no scent to them or about them at all till night comes on again; and so they continue, scentless through daylight, but of exquisite sweetness when darkness appears.—A. B. Harris, in the *Christian Weekly*.

Machinery as applied to the Manufacture of Watches.

That our American cousins have gone far ahead of us in the application of labor-saving machinery is a truism which has become almost stale by repetition, and is capable of proof by reference to their very complete "Patent Office Reports," or to the pages of their scientific and technical journals. Scarcely can we find a department of trade in which some automatic machine does not supply the place of dear skilled labor. But in no branch of manufacture has automatic machinery proved such a thorough success as in the production of watches. In the manufacture of small arms the application of machinery to the making of interchangeable locks and stocks revolutionized the trade, and to this manufacture are the Americans indebted for a system which has supplied them with a home-made watch, for a system which is ultimately to become the leading one alike in England, France, and Switzerland. It is useless for English watch manufacturers to say "the thing cannot be done; the machine-made watch cannot beat the hand-made English lever in the home market." To their own cost the record of the past proves the fallacy of such argument. Twenty years ago America was supplied with her better class of lever watches almost wholly by Coventry and Liverpool, the demand for a common article being met by a large importation of movements of Swiss and French make. To-day these latter countries supply still the enormous demand of the States for cheap work, but more than 90 per cent of the good lever watches are now of American make. The machine made watch has supplanted not only the product of the skilled French operative, but that of his more highly skilled English brother.

The reasons which have led to this result are diverse. National pride may have had something to do with this, but the protective tariff, so often put forward by the watch trade as the leading reason, has had positively nothing to do with the defeat of the hand workers, who gave up the contest ingloriously. The truth is that the American watch companies have never yet known anything of trade competition, have never yet been able to keep pace with the demand for their products, and the main portion of their success must be attributed to their machinery—to the fact which is becoming more and more evident daily, that machines planned by brains at once scientific and practical must beat the simply practical rule-of-thumb workman, and the arms and muscles of iron will outwork and outlast mere flesh and bone. At the present moment the watchmakers of England are unable to supply the home demand for their products, and it may therefore be *apropos* to draw attention for a few minutes to the machine system as applied in the United States. As is generally known, the English system divides the manufacture into a vast number of branches, in each of which the work is performed by hand, or by the use of very simple lathes, driven by manual or foot power. In only three instances in England are we aware of the employment of steam power in the production of watches, and in one instance only is duplicating

machinery used, and then only in the production of the plated or the rough movements. The American system subdivided the manufacture into a much larger number of details, and apportions a machine to the perfection of almost each operation leaving not more than 10 per cent of work to the skilled workmen.

Not only do we find an advantage in respect of the watch-making tools proper; we find also very great superiority in the appliances for making these tools. The use of labor-saving contrivances in America in all the avenues of trade has given rise to especial machinery for their production, and this is very noticeable in the watch factory machine shop. The screwing and sliding lathes are made to meet more varied requirements than are the English articles. Planers, too, are capable of adjustments which are not attainable, except in very expensive machines, in England; and in small form, with a 4 inch or 6 inch stroke, we have as yet failed to find the machine. Another most useful tool, which is an absolute necessity to the watch machine shop, is the universal milling tool; and indeed no machinist can afford to be without it, if he has once used it. Yet we can find in England no tool which can take its place, or which combines such a multiplicity of operations. It is adaptable not only for ordinary milling, but it can be used to cut straight or spiral reamers, drills, and mills. It can be arranged to cut spur or beveled gears, and it can also be used to cut straight or spiral cones. The movement and feed of the tool carriage is automatic, and it is provided with adjustments for any desired angle. Such a machine cannot but be a favorite with close workmen on fine work. A machine wholly unknown outside the watch factory is the parallel and cone grinder, a modification of course of the grinding tools now replacing the file in so many shops. This machine reduces to absolute truth and fit the hardened steel spindles and bearings which are the specialty of watch-making machines. By it any taper given to the spindle may be reproduced in the bearing, sleeve, or collar, and the fit is at once removed from the region of doubt. Any desired degree of finish, too, may be attained, that usually preferred being by the use of diamond laps. So it will be seen that, while the tools for the manufacture of watch machinery are very fine, here is no lack or means for the production of highly finished and perfect work.

The picture of this American machinery teems with lessons to the Englishman. To the machine manufacturer it speaks very loudly. We must all bear witness to the marvelous beauty and finish of some of our English lathes, with their ingenious compound rests, for the turning, etc., of shaped surfaces. But nowhere in England can we see such lathes as we find mounted on the benches of the watch factory; nowhere on this side of the Atlantic can we see tools so well made and closely fitted or provided with such multiplicity of adjustments for the close correction of errors resulting from wear or otherwise. This state of things is due alike to the lathes and men of the machine shop, for the system has most certainly produced a set of workmen who are second to none as practical machinists, and, in all probability, cannot be equaled.—*The Engineer*.

Railroading at a High Elevation.

The Buenos Ayres *Standard* lately contained the following account of a trip made in a construction train from Arequipa, over the Andes. Among other places reached was Vilcomayo, 14,533 feet above the level of the sea. The newspaper man has reached these high altitudes. "As I write," says the tourist, "there lie before me copies of *El Ciudadano*, a newspaper published at Puno, and of *El Herald*, a newspaper published at Cusco, both of them being well printed and well written sheets, and both of them being published more than 12,000 feet above the level of the sea. Nor is either of these the champion climber of the newspaper world. At Cerro de Pasco they issue a very clever gazette devoted to mining and the mines; and Cerro de Pasco is fourteen thousand feet above tide water. Of Vilcomayo, the writer says: 'Here, amid the supreme desolation of the Andes, at a height at which man in Europe does not dream of living, was a genuine railway village. There was an 'American hotel' two stories high, with a piazza, and some forty or fifty rooms for the accommodation of the railway people. There were all the buildings, station houses, machine shop, engine houses, coal yards, required for a large road. There were the cabins of the laborers employed on the work, many hundreds of men, Chilians (the Yankees of South America), Bolivians, Peruvians, whites, ladinos, Indians,—a motley multitude, but superior, both in respect to capacity and conduct, to the average navvies of Europe and the United States. With the early morning a further run of an hour at good speed brought us to the actual summit of the road, at 14,586 feet above the sea level, and we then began to descend the Atlantic slope.'

Improvement in Tanning.

M. B. Picard reports a new system of tanning skins which is carried through without acid and in a much shorter time than is required by ordinary processes. He first boils the tan down in water, making a complete extract, and then frees the decoction by decantation from all residue and foreign substances. The strength of the essence thus obtained is regulated according to the quality, thickness, etc., of the hides to be treated, weakening it when necessary with pure water. It is placed in the pits in a cold state, and the skins are immediately thrown in. The latter are lifted and their positions changed three times during both the first and second days, twice during the third, and once a day afterwards. Ordinarily, eight days suffices to complete the operation, and the inventor states that the proportion of about 77 pounds of extract to 220 pounds of skins gives excellent results.

IMPROVED SAW GUMMER.

This is a convenient and simple little implement, which may be readily attached to circular or other saws, and operated without necessitating the removal of the same from the arbors or attachments. It is readily adjusted, self-feeding, easily operated, and, according to the inventor, causes a large saving of labor and files, while materially economizing the power required to run the saw.

Fig. 1 is a perspective, and Fig. 2, a plan view. A is a curved slotted piece of metal, in which the saw to be gummed is rigidly confined by the set screws, B. The position of the blade is controlled by the adjustable gages, C. D is a mandrel, supported by the curved frame, E, which is pivoted to the piece, A, at F. Through one side of this frame the mandrel works with a screw thread, and consequently it has a longitudinal motion while it is being revolved by means of the cranks, G, on its ends. Near its middle is formed the cutting cylinder, into dovetail shaped grooves in which are fitted the cutters, I, which, from the movement of the mandrel, are compelled to give a drawing stroke. By this means the cutters are prevented from heating, and hence losing their temper. Confined between the cranks, G, is a bail, J, which moves back and forth with the longitudinal movement of the mandrel, and upon which is a wedge, K, which operates between the two rollers, L, one being on the bed piece, A, and the other on the frame, E. The effect is to force the cutting cylinder under the tooth of the saw as the mandrel moves along. The screw nut, through which the latter works, is made in two parts, one being a clamp, M, hinged to the frame, E, fastened by the set screw, and constructed as clearly shown in Fig. 1. Through the dovetailed and tapering form of the grooves in the cutting cylinder, the cutters, while operating, are forced into their sockets, and hence are not liable to become loosened. They can, however, be easily removed when worn out, or can be ground when dull without taking them from the cylinder, by simply unshipping the mandrel for the purpose. In operation, the device renders the usually tedious process of gumming the saw easy, expeditious, and perfect.

Patented through the Scientific American Patent Agency, by Mr. David Boyd, whom address for further particulars, at Ghent, Ky.

Australian Stupidity.

Nothing, however preposterous, if propounded as a specific for disease, is too absurd for people to believe in. A member of the Victoria Legislative Assembly recently seriously asked the Colonial Government to appropriate \$25,000 to buy a diphtheria remedy from a man named Greathead. The latter remarkable person asserted that diphtheria is caused by "insects which breed in millions in a few days under a film which they make, which swells up in the throat and completely stops respiration," and he prescribes some drops of sulphuric acid in water. And this is the remedy for which the appropriation of \$25,000 is asked.

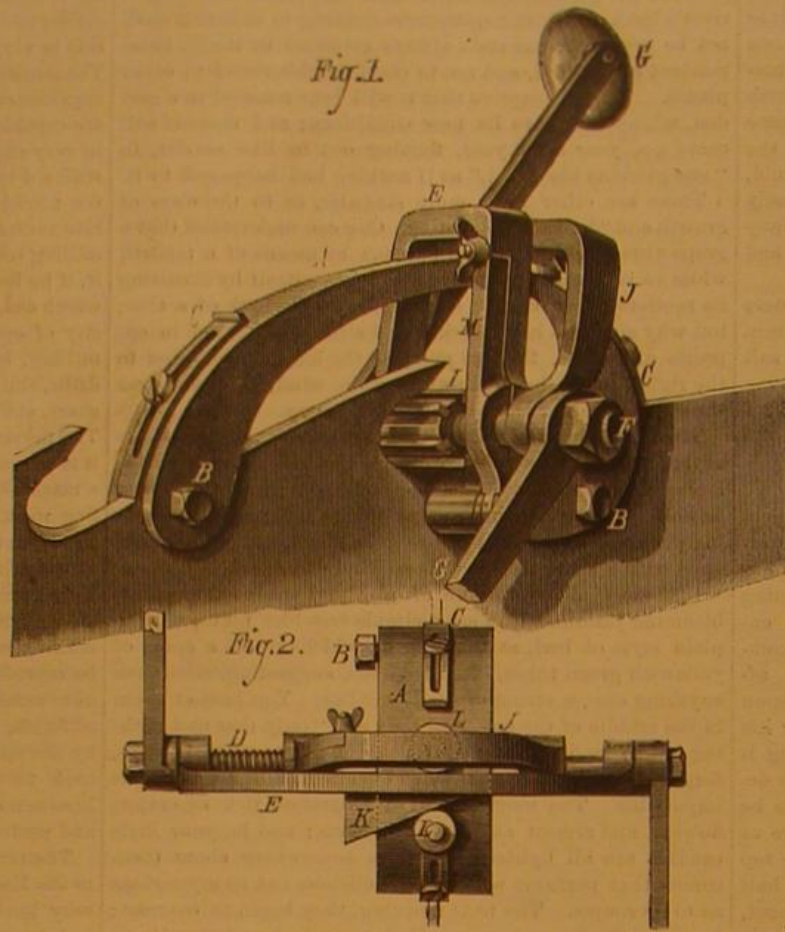
IMPROVED ELECTRIC AND VAPOR CHAIR.

The invention herewith illustrated consists in a chair lined with metal and padded with sponge, so as to contain medi-



cated liquids for curative purposes. In connection with the metal portions, a portable electric battery is arranged; and by suitable apparatus, as shown by our engraving, vapor is conducted to the body for opening the pores of the skin, etc. The patient, it is claimed, can receive through the saturated sponges the full charge through the system in the lightest or heaviest force, the device being alike capable of adjustment for either strong or weak subjects.

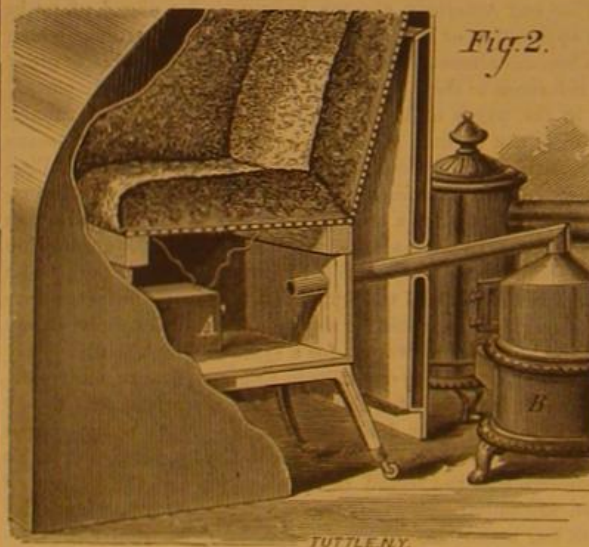
Fig. 1 shows the invention as adapted for the use of electricity alone. The base is made hollow, and its top of metal is perforated. The inside of the arms and back are lined with plates in order that one conductor of the battery, A, which is placed inside the base chamber, may be applied thereto, while the other is held by the patient, or else applied to some part of the chair, in order to be directed through the desired portion of the body. The feet are placed in a trough



THE LITTLE GIANT SAW GUMMER.

or rest, which is also lined with metal, and, with the remainder of the chair, as above noted, is covered with sponge. By a ratchet mechanism, the height of the rest is readily adjusted.

In Fig. 2 the adaptation of the chair to the administering



of vapors in connection with electricity is shown. The battery is located as before described, and the vapor is conducted into the base by a tube from the generator, B. It then rises through the perforations in the seat, becomes charged with the chemicals with which the sponges are saturated, and thus acts upon the body. To confine the vapor, a case, shown broken away, may be employed, which incloses the chair and patient. There is an opening in its upper part to allow the head to protrude, and a flexible cape may be applied around the neck of the person to more fully close the opening. The chair is employed in cases of rheumatism, paralysis, impurities of the blood, colds, skin diseases, or for other medical operations whenever available.

Patented by Mary A. Hayward, September 26, 1871. For further particulars, address C. B. Townsend, sole agent, 242 Cumberland street, Brooklyn, N. Y.

Preventing Damage from Boiler Explosions.

A correspondent, Mr. George Mann, proposes to prevent the broken fragments of a boiler, from being hurled through space, and doing more injury even than the ruptured or exploded boiler will do by the emission of steam at the time. He suggests surrounding the boiler with a short link iron chain, winding it around the boiler continuously from one end to the other. The chain is to be drawn just so as not to hang loose, and to touch the boiler all round. There will be sufficient slack, so that the chain will not be strained over tight when the boiler is fully expanded to its utmost limit by heat. It is not intended to add strength to the boiler; but when the explosion comes, the chain is to hold the boiler in statu quo, allowing free escape to the steam only, while the broken fragments are prevented from flying round

like so many cannon balls. The only damage which can occur would be the scalding of persons near by the steam. Mr. Mann claims this invention as his own, and hopes no one will try to steal his thunder.

New Improvement in Photo-Lithography.

M. Paul announces in *Les Mondes* a new process for transferring the photographic image to the stone. The ordinary process, we may remark, consists in producing a positive image on gelatinized paper, treated with bichromate of potash. After exposure, the whole is covered with lithographic ink, and washing with hot water follows in order to remove the non-modified gelatin. The image remains with its covering of ink, and by simple means is transferred to the stone.

The outlines thus obtained, however, M. Paul considers, fall in clearness because the hot water produces a swelling of the undissolved gelatin and softens the lithographic ink; and he states that, in the transfer, which requires pressure, the parts thus affected produce blurs. To avoid this, M. Paul substitutes albumen for gelatin, so that the washing can be done in cold water. The unaltered albumen after insolation is removed with a fine sponge. Very clean and sharp images, it is said, are thus produced.

The statement above made, to the effect that the bichromatized gelatin process is incapable of yielding fine lines, is incorrect. The Osborn process, used for several years in this city by the American Photo-Lithographic Company, yields prints of such perfection that only a practiced eye can detect any differences from the original in the finest lines.

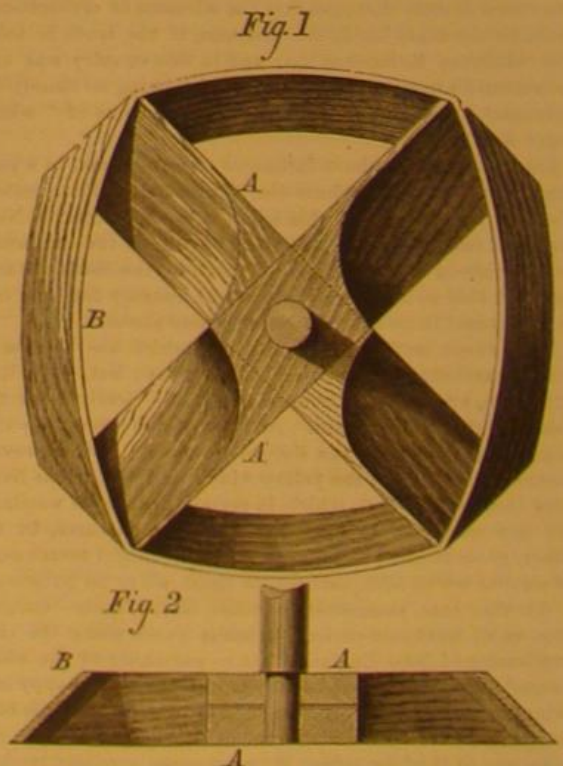
New Galvanometer.

Dr. Friedrich Müller describes, in *Poggendorff's Annalen*, a new form of galvanometer with improved reading and deadening arrangements. The needle is immersed in glycerin diluted with one eighth of water, and above it there is a horizontal tube of glass in rigid connection with it, to which the suspending thread is attached. Platinum wires bent vertically upwards from the ends of the tube are in a plane with the suspending thread. And the zero point of a scale, seen beyond, is in a line with these three parts when the needle is in its normal state of rest.

THE VICTOR CHURN DASHER.

The object of the improved dasher herewith illustrated is to increase the efficiency of the old fashioned up-and-down churn. It is a simple and inexpensive device, but the inventor claims that it saves nearly one half the labor through the thorough agitation which it gives to the cream.

To the lower end of the dasher handle are attached the centers of two crossbars, A, which are arranged at right angles with and halved to each other, as shown in the sectional view, Fig. 2. The two arms of each bar are beveled in opposite directions, so that, as will be seen from Fig. 1, adjacent edges may both incline upward and toward each other, or both downward and from each other. B is a band attached to the outer ends of the blades, and so formed that the part which is opposite the faces of the arms which incline upward may slope inward and upward, and the part opposite the downwardly tending faces may incline downward and inward. By this construction, it is claimed, as the dasher is worked, four strong currents will be formed, two following outward towards the wall of the churn, and two following



inward toward its center. The effect of this is to cause a very strong commotion in the milk, bringing the butter in a short time. One or more of these dashers may be attached to the handle, as may be desired, or as may be rendered necessary by the size of the churn.

Patented through the Scientific American Patent Agency, by Mr. David Boyd, of Vevay, Ind., December 30, 1873. For further particulars address David Boyd, Ghent, Ky.

THE VICTORIA REGIA HOUSE AT CHATSWORTH, ENG.

The celebrated residence of the Duke of Devonshire, at Chatsworth, owes its renown to the grand scale on which the science of horticulture is there carried on. The credit of the formation of the gardens, as they at present exist, is due to Mr., afterwards Sir Joseph, Paxton, whose ingenious system of ridge and furrow glasshouse building, first designed by him for the Duke's hot houses, was carried out on a very large scale in the structure for the Great Exhibition of 1851, which is now the Sydenham Crystal Palace. The vineries, pineries, strawberry beds, and vegetable gardens at Chatsworth are such as only the highest taste and skill, supplemented by great wealth, could organize and maintain.

We present herewith a view of the hot house in which the Victoria Regia, the superb water lily of the Amazons, is to be seen in its greatest luxuriance. The large tank, seen in the center, says *The Garden*, to which we are indebted for the illustration, contains another tank, 16 feet in diameter, and considerable deeper than the outer portion; this contains the soil in which the Victoria lily is planted. The walls of the tanks are built of brick, and the bottom is paved with stone; the tanks are lined with lead throughout, and the two inch hot water pipes which supply them are also made of lead.

While the plant is growing, a little wheel, in the form of an overshot mill wheel, is fixed near the edge of the tank, and continually kept in motion by a small jet of water from a tap immediately over it; thus the surface of the water is always rippled. The Victoria Regia, being an annual, dies in November, when the water in the tank is drained off, and the soil contained in the inner part removed. The lilies in the angular tanks, being also out of season, are, about the same time, mostly cleared away and stored in troughs filled with water in the cucumber house. The aquarium, thus stripped of its summer occupants, is filled in winter with large chrysanthemums for furnishing cut blooms. As the Victoria lily annually produces and ripens a good stock of seeds, these are preserved in vessels of water until sowing time comes round, which is generally about the middle of December, or between that and January. The plants are potted singly, and re-potted as they advance in growth, until they have attained sufficient strength, when the best plant is planted out in a heap of fresh soil. At Chatsworth this lily luxuriates better and flowers more freely than it does in any other place in England, the largest leaves in summer measuring as much as $7\frac{1}{2}$ feet in diameter.

Nickeling.

BY S. P. SHARPLES, MASSACHUSETTS STATE ASSAYER.

In answer to numerous inquiries, I again give a brief description of the process of nickeling. The patent is still before the courts, and no decision has been reached in regard to it.

The double sulphate of nickel and ammonium, which is the salt that is generally used, may now be had in commerce almost pure. It is manufactured on a large scale by Joseph Wharton, of Camden, N. J., who controls the nickel market in this country. Cast nickel plates for anodes may be obtained from the same source. The anodes should considerably exceed in size the articles to be covered with nickel. Any common form of battery may be used. Three Daniell's or Smee's cells, or two Bunsen's, connected for intensity, will be found to be sufficient. The battery power must not be too strong, or the deposited nickel will be black. A strong solution of the sulphate is made and placed in any suitable vessel: a glazed stoneware pot answers very well if the articles to be covered are small. Across the top of this are placed two heavy copper wires, to one of which the articles to be covered are suspended, to the other the anode. The wire leading from the zinc of the battery must then be connected with the wire from which the articles are suspended, the other battery wire being connected with the anode.

In order to prepare the articles for coating, they must be well cleaned by first scrubbing them with caustic soda or potash, to remove any grease, and then dipping them for an instant in *aqua regia* and afterwards washing thoroughly with water, taking care that the hand does not come in contact with any part of them. This is accomplished by fastening a flexible copper wire around them, and handling them by means of it. The wire serves afterwards to suspend them in the bath.

If the articles are made of iron or steel, they must be first covered with a thin coat of copper. This is best done by the cyanide bath, which is prepared by dissolving precipitated

oxide of copper in cyanide of potassium. A copper plate is used as an anode. After they are removed from the copper bath, they must be washed quickly with water and placed in the nickel bath; if allowed to dry or become tarnished, the nickel will not adhere.

Great care must be used through the whole process to keep all grease, dust, or other dirt from the articles to be covered, or else the result will be unsatisfactory. The whole process is one of the most difficult that is used in the arts, it being far easier to gild, plate, or copper an article than to



THE VICTORIA REGIA HOUSE AT CHATSWORTH, ENGLAND.

nickel it; but if due care be taken, the results will amply pay for the trouble.—*Boston Journal of Chemistry*.

SIR FRANCIS PETTIT SMITH.

Sir Francis Pettit Smith, an inventor whose celebrity in connection with the development of screw propulsion and its introduction into steam navigation is worldwide, recently died in England. We publish herewith a portrait of this eminent man.

Like many others to whom mankind is indebted for great inventions, he began life as a farmer, a calling which gave little promise of leading him to the conceptions which have

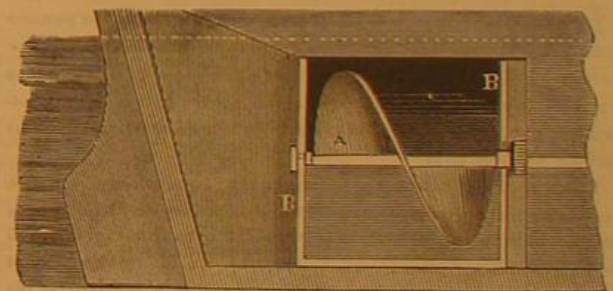


terminated in such priceless results. Possessed of a strong taste for mechanics, however, he soon abandoned agricultural pursuits to prosecute his favored study, and to carry on investigations and experiments in the subject which, from an early date, engrossed almost his entire thoughts. In 1834, at twenty-six years of age, we find him trying models of

boats propelled by a screw and driven by powerful springs, and a year later exhibiting his plans in London, and seeking to convince others of their feasibility. From this period dates his public—if so we may term it—life, and contemporary journals now come to our aid in preparing this brief account of his labors. An old volume of the English *Mechanics' Magazine* is before us, and in its pages, now yellow with time, we find the reports of the earliest trials of the then novel mode of propulsion. Let us here remark that to the subject of our sketch is not due the credit of inventing

the screw propeller; for as early as 1727, one Duquet, a Frenchman, proposed to force a "vessel up a river against the current by means of screws," and there are no less than fifteen mentions of applications of the principle—including two American patents for "screw propelling wheels to boats," and for "a screw or spiral lever for propelling vessels"—of prior date to the patent of Sir Francis; but to him, however, is to be ascribed the honor of first successfully demonstrating the practicability of the plan by devising a means and proving its value by direct experiment. The patent of Sir Francis is dated May 31, 1836, and it claims "a propeller, whether arranged singly in an open space in the dead wood, one on each side of the same, or more forward or more aft, higher up or lower down, completely or partially immersed." This was afterwards modified to make the screw of a single thread, a double thread, or of a thread of two turns, located singly in the center of the dead wood. On obtaining his letters, Sir Francis constructed a small steamboat of 10 tons burden

and six horse engine power, which he tried on the Paddington canal and on the Thames river with satisfactory results. During the following year she was put to sea, visiting points along the coast, and proving so completely successful that the Lords of the Admiralty directed further investigation into the invention, with a view of its introduction into the Royal Navy. Mr. Smith, aided by the Messrs. Rennie, engineers, then constructed a larger vessel, the *Archimedes*, a ship 155 feet long, of 237 tons burden, and ninety horse power engines. The old periodicals before us contain numerous reports of this boat's performances, but there is a vein of dubiousness running through all the comments, that shows that the editor had little faith in the new fangled idea.



In 1839, however, he published a cut of the new vessel, a portion of which, showing the screw, we reproduce in facsimile. A, the blade of the propeller, forms an angle of about 40° with the shaft, and is made of iron plates. B is the frame in the dead wood of the vessel. The diameters of the screws used were 5 and 7 feet, and their lengths $7\frac{1}{2}$ and 8 feet. It is curious, at this day, to read the remarks made upon the invention, in the article accompanying the engraving: "It has, altogether, great defects, which will prevent it from competing with the common paddle wheel, both in point of economy and of power." "Useless, on account of the impracticability of keeping the whole screw under water." "Engines and boilers will require the whole space up to the deck." are examples in point. In a number of the same journal, of later date, is a most elaborate treatise on the subject, in which the author completely demonstrates the screw to be absolutely worthless; but despite this wholesale condemnation, the inventor calmly continued his experiments, built more vessels, and ended by proving his device so unequivocal a success that the Government began to apply it to naval ships. In 1842 H. M. S. *Rattler* was constructed, and a series of investigations made by Mr. Smith and Mr. Brunel to determine the best proportions of the screw; while, at the same time, another craft, the *Alecto*, was built on precisely the same lines as the *Rattler*, but with paddle wheels, in order to institute a comparative test. The superiority of the *Rattler* was so evident that the Admiralty at once ordered the Queen's yacht *Fairy* and twenty other vessels to be built for screw propulsion under Mr. Smith's direction.

The subsequent rise and progress of the system is within the memory of most of our readers. Before 1850, when Sir Francis retired from the business, more than a hundred

vessels of all classes were built or in process of construction. At the present day, by far the majority of steamships in the world are propellers, and but a single side-wheel vessel is to be found among the great lines which ply across the Atlantic.

Some three years ago Mr. Smith was knighted, in recognition of his eminent services; and for a considerable period he held the post of Curator of the Patent Office Museum at South Kensington, England. The Admiralty purchased his patent right for \$100,000.

New Imitation of Silver.

In the SCIENTIFIC AMERICAN of January 24, is described a patented process for obtaining a metallic alloy which resembles silver better than any substance yet known, with respect to color, specific gravity, malleability, ductility, sound and other characteristics. The new alloy is a compound of copper, nickel, tin, zinc, cobalt and iron. If this new metal is as perfect as represented, there may be a good chance for coin counterfeiters, etc., to start a flourishing business in making trade dollars, halves, quarters, etc. We had a call this week from a distinguished personage in this city, whose authority and influence is well known to members of our community. He thinks the metal referred to should not be made, and has therefore issued the following

PROCLAMATION:

Fearing that the granting of a patent for the imitation of silver, such as mentioned in the SCIENTIFIC AMERICAN of the 24th day of January, 1874, may lead to endless frauds in the silver currency of the country, now, therefore, we, Norton I. Dei Gratia Emperor of the United States and Protector of Mexico, do hereby command the Commissioner of Patents to cancel the said patent, and declare the manufacture of such a metal a penal offence.

NORTON I.

Given in San Francisco, Cal., this 3d day of February, 1874.—Mining and Scientific Press.

Dr. Hall and the Scientific American.

It is not often that we copy what others say of us, but the following comes from one whose opinions are so generally respected that we select it from a multitude of other testimonials, and give it place:

"SCIENTIFIC AMERICAN. Weekly. \$3 a year. Now in its 30th year. It is one of the best conducted newspapers in the country, and in its line it has not an equal in ability in the world. It is not only adapted to the wants of mechanics, inventors, and scholars, but, as a family paper, giving most valuable information of a domestic character and about home life, it merits very general patronage. Moral, reliable, and self-respecting."—Hall's Journal of Health.

REPORTS OF THE FRANKLIN INSTITUTE COMMITTEE ON THE MODE OF DETERMINING THE HORSE POWER STEAM BOILERS.—As may be learned from our advertising columns, the reports of this committee, which contain the results of much research, of value to engineers, are now printed in pamphlet form and for sale at the Institute.

IMPORTANCE OF ADVERTISING.

The value of advertising is so well understood by old established business firms that a hint to them is unnecessary; but to persons establishing a new business, or having for sale a new article, or wishing to sell a patent, or find a manufacturer to work it: upon such a class, we would impress the importance of advertising. The next thing to be considered is the medium through which to do it.

In this matter, discretion is to be used at first; but experience will soon determine that papers or magazines having the largest circulation, among the class of persons most likely to be interested in the article for sale, will be the cheapest, and bring the quickest returns. To the manufacturer of all kinds of machinery, and to the vendors of any new article in the mechanical line, we believe there is no other source from which the advertiser can get as speedy returns as through the advertising columns of the SCIENTIFIC AMERICAN.

We do not make these suggestions merely to increase our advertising patronage, but to direct persons how to increase their own business.

The SCIENTIFIC AMERICAN has a circulation of more than 42,000 copies per week, which is probably greater than the combined circulation of all the other papers of its kind published in the world.

PATENT OFFICE DECISIONS.

United States Circuit Court—District of Massachusetts.

PATENT MARINE PAINT.—JAMES G. TAYLOR & CO. vs. CHARLES E. FOLSON. [In Equity.—Before Shepley, Judge.—Decided January 1, 1874.]

In an original patent for a paint for ships' bottoms, "copper ore" in the form of an oxide was specified as one of the ingredients, and a preference was expressed for "the oxide of copper made from pyrites or friable ores;" a release of the patent was sustained, although it mentioned that such ores contained other substances which retarded the solution of the oxide of copper, and described that ingredient as made by roasting the pyrites friable ores exposed to air, the article thus produced being well known in the arts.

Proof that the samples deposited in the Patent Office with the original application do not correspond with the ingredients specified in the release will not impair its validity; whether an applicant has complied with the requirements for obtaining a patent is for the Commissioner to determine, and the court will not review his action.

If a paint has been before known including as essential ingredients oxide of copper and antimony mixed with copper to harden the whole, it is a patentable novelty to dispense with the antimony and use the oxide of copper without it, and to add earthy ingredients which retard the solution of the copper.

A suggestion contained in a prior patent for purifying oil of turpentine and naphtha, and dissolving in them India rubber and the like, that such solutions may be combined with the oxides or salts of copper, and applied to ships' bottoms, which is impracticable, will not affect the validity of a patent for a paint composed of tar, naphtha, and oxide of copper.

A paint containing oxide of copper and oxide of iron, to retard the solution of the copper, is an infringement of a patent for a paint prepared from a natural ore containing oxide of copper and earthy matters, which retard its solution.

This is a bill in equity for an alleged infringement of letters patent granted to defendants on the third day of November, 1862, and released on the seventeenth day of October, 1871, in two divisions, for an improved paint for ships' bottoms, or marine paint.

Decree for injunction as against division B of complainants' patent, and for an account, as prayed for in the bill.
Brown & Holmes, for complainants.
T. W. Clarke, for defendant.

Supreme Court of the United States.

PATENT WAGON REACH.—PHILIP HICKS, APPELLANT, vs. GEORGE KELSOY. [Appeal from the Circuit Court of the United States for the Northern District of Illinois.—October Term, 1873.]

A wagon reach of wood strengthened by straps of iron on each side, and curved to allow the fore wheels to pass under, being well known, it required no invention to dispense with the wood and bolt the straps together, or to forge them in one piece; and a patent for a reach thus made was declared void for want of novelty in the invention.

Mr. Justice Bradley delivered the opinion of the court:
Hicks, the appellant in this case, obtained a patent for an improved wagon reach, and filed a bill against the defendant charging infringement and praying the usual relief. The defendant answered, denying the novelty of the alleged invention, and also denying infringement.

The reach claimed as new had an upward bend or curve to allow the fore wheels to turn under it in turning the wagon. It was admitted that reaches of this sort had long been used, made of wood strengthened by straps of iron attached to each side of the reach. The supposed improvement of the plaintiff consisted in leaving out the wood in the curve and bolting the iron straps together, whereby the curve became all iron and less bulky, but in all other respects having the same shape and performing the same office as before. Instead of being bolted together, the straps might be welded so as to make the curve consist of solid iron.

The question is whether this mere change of material, making the curve of iron instead of wood and iron, was a sufficient change to constitute invention, the purpose being the same—namely, to turn the wheel under the body of the wagon—the means of accomplishing it being the same—namely, by a curved reach—and the form of the reach and mode of operation being the same? It is certainly difficult to bring the case within any recognized rule of law, but it is clear that the patent can be sustained. The use of one material instead of another in constructing a machine is, in most cases, so obviously a matter of mere mechanical judgment, and not of invention, that it cannot be called an invention, unless some new and useful result, an increase of efficiency, or a decided saving in the operation, is clearly attained. Some evidence was given to show that the wagon reach of the plaintiff is a better reach, requiring less repair, and having greater solidity than the wooden reach. But this is not sufficient to bring the case out of the category of mere or less excellence of construction. The machine is the same. As helms made of hickory may be more durable and more cheap in the end than those made of beech or pine; but the first application of hickory to the purpose would not be, therefore, patentable.

Cases have frequently arisen in which substantially the question now presented has been discussed. Perhaps, however, none can be cited more directly in point than that of Hotchkiss v. Greenwood, (11 Howard, 293,) in which it was held that the substitution of porcelain for metal in making door knobs was not patentable, though the new material was better adapted to the purpose and made a better and cheaper knob. So, in a case at the circuit, referred to by Justice Nelson in the last named case, the substitution of wood for bone as the basis of a button covered with tin was held not patentable. (11 How., 356.)

In Crane vs. Price Webster, (9 Cal., 409,) it is true, the use of anthracite instead of bituminous coal with the hot blast in smelting iron ore was held to be a good invention, inasmuch as it produced a better article of iron at a less expense. But that was a process of manufacture, and in such processes a different article replacing another article in the combination often produces different results. The latter case is more analogous to the cases of compositions of matter than it is to those of machinery; and in compositions of matter a different ingredient changes the identity of the compound, whereas an iron bar in place of a wooden one, and subserving the same purpose, does not change the identity of a machine. (See Curtis on Patents, 3d ed., secs. 70-73.)

But the plaintiff's counsel alleges that his invention does not consist of the mere substitution of a particular material which had been previously used for the same purpose in the same way, but consists in the production of a certain described article by a certain described mechanical process, which process, viewed as a whole, is new and useful; and then he describes what he supposes to be such new mechanical process. This is his argument; but the facts do not bear out such a view of the case. They are precisely and only as we have before stated them.

In our judgment the patent in this case is void for want of novelty in the alleged invention. The decree, therefore, must be affirmed; and it is affirmed accordingly.

Supreme Court of the United States.

PATENT SAWING MACHINE.—EUGENE S. HUNSON AND JACOB LAGOWITZ, PLAINTIFFS IN ERROR, vs. NORMAN W. DODGE, T. BENJAMIN MEIGS, AND WILLIAM E. DODGE.

[In error to the Circuit Court of the United States for the Southern District of New York.—October Term, 1873.]

If one who purchases a patented article from those who have no authority to sell it obtains an assignment for his territory of the patent for the original term, he is not liable for using the article after the patent is extended.

Mr. Justice Hunt delivered the opinion of the court:
This is an appeal from the Circuit Court of the United States for the Southern District of New York.

The bill alleges that Myers & Eunsen were the original and first inventors of a sawing machine; that letters patent were granted to them therefor on the 23d day of May, 1834; that the patent was extended for seven years from May 23, 1839; that the complainants are the owners of the letters patent for the State of New Jersey; that the defendants have infringed the patent by the use of a sawing machine at Jersey City, Hudson county, New Jersey, during the extended term of the patent, without right or license; that the complainants have thereby suffered great damage, and the defendants have made large profits.

The answer of the defendants admits the grant and extension of the patent; admits that the defendants use a sawing machine containing the patented devices and combinations; alleges that the defendants are the successors in business of the firm of Dodge & Co.; that Dodge & Co. bought the machine in question in 1855 from the Huntington Machine Works; that Dodge & Co. purchased the machine at the right of the patentees in the original term of the patent for Hudson county, New Jersey, and used said machine in said county till January, 1859, when the business passed into the hands of the defendants, who have continued to use said machine ever since; and insists that, having owned the right for Hudson county, New Jersey, under the original term, they are protected by virtue of the acts of Congress, in the use of the same machine during the extended term.

The agreed statement of facts admits that in 1855 the predecessors of the defendants bought of the Huntington Machine Works a machine which infringed the complainants' patent, and that the company selling to them had no right or license to build or sell the same; that, upon being notified of the infringement, the purchasers bought of one Schureman, who was an assignee of the patentees, the right under the patent for Hudson county for the original term of the patent; that the defendants used the machine in that county during the original term, and have continued there to use it during the extended term. The judge at the circuit held that they had the right to use the machine during the extended term, and dismissed the complaint. It is from this decree that the complainants take their appeal.

The 15th section of the patent act of 1836 ends with these words, namely: "And the benefit of such renewal shall extend to assignees and grantees of the right to use the thing patented, to the extent of their respective interests therein." (5 Stat., 125.)

This court has decided many times that this section gives to an assignee of the patent during the original term the right to continue, during the extended term, the use of a machine used by him during the original term. (Hudson vs. Rousseau, 4 How., 646; Bloomer vs. McQueen, 14 How., 539; Child vs. C. P., 23 How., 47; Bloomer vs. Miller, 1 Wall., 540.)

The complainants seek to distinguish the present from the cases cited in this manner: In those instances, they say, the machines were lawfully constructed by the patentees, or purchased from the patentees or their assignees; whereas the machine purchased by the defendants in this case was not a lawfully made machine, and was never purchased from the owner of the patent. We are of the opinion that this distinction is not well taken. That the machine was purchased from an infringer, and a wrong done, is true. When informed of the offence, the purchaser at once corrected the evil by purchasing the entire right of the patentees for the county where his machine was then used, and where it has since been used. This was equivalent to an original lawful purchase or manufacture of the machine. By the purchase of the right for Hudson county, and from the moment of that purchase, the defendants held and used the machine by a lawful title, as perfectly as the patentees or their assignees if the original purchase had been from them. They then became, in the language of the statute, "grantees of the right to use the thing patented," so continued to the time of the expiration of the original patent, and the right so to use was, in the further language of the statute, "the extent of their interest therein."

We are of the opinion that the decree of the Circuit Court was correct, and that it should be affirmed.

NEW BOOKS AND PUBLICATIONS.

PHYSICAL GEOGRAPHY. By John Young, M.D., F.G.S., F.R.C.S.E., etc. \$1.50. New York: G. P. Putnam's Sons, corner of Fourth avenue & 23d street.

This book will prove a welcome addition to educational literature, from the fact that it collates, in compact form, the most recent knowledge regarding the physical condition of our planet. In discussing formation, the writer draws largely upon the teachings of geology, and in some degree upon those of astronomy, in every instance in which these sciences border upon his subject. Ethnological and archaeological information of value is also incorporated, so that the work, as a whole, is a comprehensive and excellent treatise upon a study which may almost be considered a distinct science. A few illustrations are interspersed, and a copious index is added. As its title indicates, the book is a reprint, and is designed by the publishers as a portion of their Advanced Science Series.

THE AMERICAN HISTORICAL RECORD, AND REPERTORY OF Notes and Queries concerning the History and Antiquities of America, etc. Edited by Benson J. Lossing, LL.D. \$4 per annum. Philadelphia: John E. Potter & Co., 617 Sansom street.

This valuable publication is still chiefly occupied in searching out and preserving information concerning the early history of our country, a work which is vitally necessary to our future historians, and which could scarcely be in abler hands than those of the eminent scholar and archaeologist who edits it. Among the many publications which reach us, there is none that is more worthy of close and attentive reading.

THE PORTABLE ATLAS, consisting of Sixteen Maps. Constructed and Engraved by John Bartholomew, F.R.G.S. Price \$1. New York: G. P. Putnam's Sons, corner of Fourth avenue & 23d street.

This is a reprint of an English work, and hence the majority of the maps relate to countries under British rule. The plates, however, are finely executed and printed, and are valuable in that they show the results of recent explorations. This is especially the case in the map of Africa, in which the localities now inseparable from the name of Livingstone are accurately laid down. The book, as its title indicates, is in portable quarto form.

SURCHARGED AND RETAINING WALLS. By James S. Tate, C. E. Also, TREATISE ON THE COMPOUND STEAM ENGINE. By John Turnbull, Jr. Nos. 7 and 8 of Science Series. Each 50 cents. New York: D. Van Nostrand, 23 Murray and 27 Warren streets.

These useful little publications deserve the attention of practical men. The book on the compound steam engine contains much valuable information on a subject which now attracts universal attention.

THE BRITISH JOURNAL PHOTOGRAPHIC ALMANAC, AND PHOTOGRAPHER'S DAILY COMPANION FOR 1874. Edited by J. T. Taylor. London: H. Greenwood. New York: E. & H. T. Anthony & Co., 591 Broadway.

A handy book of reference, excellently gotten up, and issued by the conductors of the British Journal of Photography, a publication deservedly well known to our readers.

THE BIRTH OF CHEMISTRY. By G. F. Rodwell, F.R.S., F.C.S. Price \$1.25. New York: Macmillan & Co., 38 Bleeker Street.

This little work is a valuable resume of all that is known of the origin and history of the chief of the sciences. Mr. Rodwell's contributions to contemporary knowledge all bear the mark of much thought and originality, and deserve to be produced in a form more permanent than the pages of a weekly periodical. The publishers, therefore, have added this interesting book to the list of their Nature Series.

EVERY SATURDAY contains the cream of the English literary periodicals, and should be in the hands of every lover of light and entertaining literature. Two excellent serials, taken from advance sheets, are now in progress—one by Thomas Hardy, a rising English novelist to whom critics have accorded a position little inferior to that of George Eliot. A new editorial department, occupying the last two pages of each number, has been added; a change which cannot fail to render the journal even more acceptable, from the fact of its thus assuming an individuality which could not attain while remaining merely a collection of reprints. The publishers, Messrs. Hurd & Houghton, 13 Astor Place, New York, offer Every Saturday and the Atlantic Monthly together for \$8 per annum, or Every Saturday, singly, for \$5.

Inventions Patented in England by Americans.

[Compiled from the Commissioners of Patents' Journal.]

From January 2 to January 29, 1874, inclusive.

BOTTLE STOPPER.—N. Thompson (of Brooklyn, N. Y.), London, England.
COMPOUND STEAM ENGINE.—T. L. Jones, Natchez, Miss.
CUTTING PIPE, ETC.—F. W. Allen, New York city.
ELECTRIC ANNUNCIATOR.—L. Finger, Boston, Mass.
ELECTRIC MACHINE.—H. J. Smith, Boston, Mass.
ELECTRIC TELEGRAPH.—W. E. Sawyer, Washington, D. C.
ELECTRIC TELEGRAPH.—J. B. Stearns (Boston, Mass.), London, Eng., & del. Hoist.—W. Hart, Philadelphia, Pa.
INDICATOR.—S. D. Tillmann, Jersey city, N. J.
KALEIDOSCOPE.—J. Collicott, Boston, Mass.
LAMP.—C. H. Leighton, Lowell, Mass.
LAMP.—T. S. Williams & Co., Boston, Mass.
METAL PAIL, ETC.—H. W. Shepard, Brooklyn, N. Y., & del.
MODE OF COMBUSTION.—D. T. Casement, Painesville, Ohio.
PROPELLER.—J. S. Morton, Philadelphia, Pa.
REDUCING FURNACE.—J. Wilson, Dover, N. J.
REGENERATIVE FURNACE.—T. S. Blair, Pittsburgh, Pa.
RIBBON LOOM, ETC.—E. P. Chapin, Providence, R. I.
ROTARY ENGINE AND PUMP.—W. R. Manley, New York city.
SEWING MACHINE CABINET.—H. E. Tracy & Co., New York city.
TOY.—W. A. P. La Grove, New York city.

Recent American and Foreign Patents.

Improved Pneumatic Station Indicator.

James P. Kealey and Joseph Rigney, Bridgeport, Conn.—A case contains a roller and a chain of name plates. The roller is turned the width of one face at each station to present the plates having names of the stations in front of the sight opening, and the name plate chain cannot be carried beyond the point of showing the name of the last station on the route, in case the car should be run beyond its route on another section or division, and it is held ready for running back on its own route. Springs are employed to allow the roller to turn in case the mechanism for turning it is kept in operation after passing beyond the terminal station, and to pull the roller back each time. This will be found desirable in case the car should get coupled in a train for a road or station to which it does not belong, with cars having annunciators for that road, so that its annunciators would of necessity be coupled with the others, and so have to be worked that the others may be.

Improved Finger Bar for Harvesters.

Victor N. Collins, Dixon, Cal.—The bar is formed with a top sloping backward; also, with a flange on the front upper edge, and with flanges on the rear side. The fingers are formed with a wide base to bear against the side of the bar, and are firmly secured so that they cannot turn out of place. The top plate for the bar is made of a wide thin strip of iron folded back on the under side from the lower edge to the side of the bar, forming the top guide for the carrier; and said plate is bolted to the finger bar. There is an upward inclination of the top plate at one end to cover the end of the endless carrier as it rises up over the pulley at that end on which the carrier works. A spring is attached to said plate at the other end to guide said grain carrier down under the upper guide.

Improved Car Coupling.

William B. Morgan, Shelby City, Ky., and Henry D. Wallen, Jr., Grand Rapids, Mich.—The forward ends or faces of the bumper heads are rounded off; they are made oblong or elliptical in their general form. In the face of the bumper heads is formed a high and narrow opening, with straight ends and curved or concave sides. The coupling hook has in one end an eye to receive a bolt, which passes through vertical slots in the sides of the bumper heads to pivot the said hook to said bumper heads. The parts of the bolts that pass through the slots of the said bumper heads are flattened, so that the said bolts cannot turn to work the nuts screwed upon them loose. The bolts may be raised and lowered, to adjust the position of the hook to the height of the adjacent car. In the forward lower part of the mouth of the bumper heads are formed or secured inclined plates for the beveled forward end of the hook to strike against and slide up as the cars are run together.

Improved Carriage Seat.

John A. Althouse, New Harmony, Ind.—This invention consists in making a seat adjustable so as to fit wagons of different widths, and also in the manner of fastening the seat to the sides of the box, and in the arrangement of the seat springs. The seat consists of a piece of board provided with bed pieces, which are rabbeted, so that, when they rest upon the top edges of the wagon box, the joints are covered by flanges. The springs are made of sheet steel, and are secured to adjusting plates attached to the seat by screws, which pass through the slots. These slots allow the plates, springs, etc., to be moved outward or inward, as may be required, for adapting the seat to wagon boxes of any ordinary width. The ends of the springs are attached to the bed pieces. Clamping screw hooks pass through the bed pieces and hook to the inner sides of the side boards, and are tightened thereto by means of the lever nuts on the outside.

Improved Egg Carrier.

Wendell Wels, St. Paul, Minn.—The object of this invention is to construct egg carriers in such a manner that not only the eggs are securely packed in the cells, but also the cover connected to the case, in such a manner that it may be easily placed on or taken off without breaking or splitting the same. In the case of the egg carrier are arranged, in tiers placed one above the other, the cells for the eggs, which are formed of parallel strips of one series, and interlacing strips of the other series vertically to them. The first strips are provided with slits cut from each edge toward the center under right angles to it, leaving the central part undivided. The second strips are provided with a central slit, of the same width as the uncut part of the first strips, together with a narrow V shaped aperture, stamped out, through which the first strips are, by bending them, introduced and adjusted, so as to interlock and form a tier of cells, which may be easily lifted from the case without detaching from each other. The top of the case is provided with two side strips, which slip along the side of the case and rest on the side strips of the same. The top is connected to the case by merely slipping springs down, till they interlock with metallic bands, forming a firm and safe attachment of top and case, and obtaining a permanent egg carrier without injury to the top by nails, screws, etc.

Improved One Wheeled Three Horse Riding Plow.

Robert C. Airey, Highland, Ill.—The short axle may be adjusted to set the wheel, and at an angle to the beam; and by suitable means the line of draft, and consequently the pitch of the plow, may be conveniently regulated. The plow beam is hinged to the cross beam, so that the plow may be swung out and in, as desired. The forward end of the beam may be raised and lowered to cause the plow to run out of and into the ground, as desired, and the seat can be conveniently adjusted, as the weight of the driver may require.

Improved Buckle.

George H. Lefevre, Winneconne, Wis., assignor of one half his right to Joshua S. Judson, Austin, Minn.—This buckle is constructed with a metallic loop, made to admit two thicknesses of leather strap. The end of the strap is provided with one or more holes to receive pins. The other end of the strap is passed through the buckle and then through the loop, thus crowding the end of the strap upon the pins, and holding it there. The buckle is readily detached by reversing this operation. With this loop a broken strap can be attached to a buckle with ease.

Improved Fruit Jar.

Thomas Hale and Henry Hale, Wales, N. Y.—The upper part of the can is made in the form of a wrench section, so that such an instrument can be fitted over it. On the cap, which screws to the neck of the can in the usual manner, is formed a ball through which two holes are made on opposite sides. A rod is placed through these apertures, and by it, as a lever, the cap is easily unscrewed or secured, a wrench fitting over the section holding the vessel from turning.

Improved Needle Sharpener for Sewing Machines.

John L. Woodruff, Easton, Pa.—This invention consists of a curved arm which is attached by a set screw to the sewing machine table, and which carries at its upper end a rubber wheel, connected to the fly wheel of the machine, through which the needle is passed to be sharpened by a small whetstone.

Improved Register Valve for Water Heaters.

George H. Tucker, Milwaukee, Wis., assignor to himself and James C. Ricketson, of same place.—This invention relates to valve mechanism for regulating the admission of water to a boiler feeder. The water is supplied to the heater through a pipe connecting with a shell. Said shell is essentially globular in form, and has a diaphragm joining its diagonally opposite sides, and forming, intermediately, a flat seat for a disk valve. The valve seat has openings, corresponding in shape, size, and number, with those in the valve. A spiral spring encircles the stem, bears on the valve, and is arranged or fitted in a circular recess in the plug, at its opposite end. A screw passes through the side of the shell, and bears against the short guide stem of the valve, to prevent the pressure of water in the pipe above from holding the valve. The means of operating the valve is a float working in a tank which communicates with the heater. To relieve the float of undue friction, rollers are employed. The connection between float and valve is by extension rod and arm, the latter being fixed to the valve stem. When the water rises or falls in the heater, it rises or falls correspondingly in the tank. The float will have a like and simultaneous movement, and hence the valve will be turned one way or the other, as required, to admit or shut off the water.

Improved Lever Motor.

John Stone, Millgrove, Mo.—This invention relates to imparting mechanical power to a drive shaft through the pendulum movement, and consists in the mode of combining the pendulum with the crank pitman and an actuating lever.

Improved Fountain Pen.

William E. Thomas, Queenstown, Md.—This invention relates to that class of pens which are provided with a tubular handle or barrel designed to serve as an ink reservoir; and it has for its object to improve the construction of said pens, so as to render the same more convenient in use and effective in operation than others heretofore constructed.

Improved Water Meter.

John Waterhouse, Chicago, Ill.—This invention relates to apparatus designed for measuring water from service pipes as it is delivered to the consumer. The water from the induction pipe runs into and fills one compartment, forcing the air contained therein through an air pipe into the other compartment, and this compressed air forces the water up through the induction as it is being used. When the water in one compartment descends to a certain depth, a float will follow and pull the long arm of a lever outward, which releases a short arm, and allow a weight to fall. At the same time, a weight in the other compartment, which is submerged in water ascends and catches on the short end of the lever, which operation changes the flow of the water. A small rod is fastened in the center of the pivot tube, whence it passes through the front of the meter in a watertight packing, and terminates in a suitable device for connecting with any approved registering apparatus.

Improved Suspender.

Franklin O. Painter, Middletown, Ct.—The button straps and the shoulder straps are pivoted to a pivot piece of sheet metal, their ends being provided with a metallic plate, so that they readily turn on the pivot, and enable the shoulder straps to adjust themselves to the back of the wearer. The back button straps are also tipped with metallic plates attached by rivets, and these plates are pivoted to a back plate, so that they freely turn and adjust themselves to the position of the button on the pants. The front button straps are also provided with metallic plates, attached as heretofore described, and connected with the shoulder straps by a pivot. These straps render freely on the pivot, and are allowed to adjust themselves to the position of the front buttons of the pants. By connecting the pants with pivots, self-adjusting and easy suspenders are formed, less likely to twist in putting on.

Improved Gas Burner.

Cornelius Bogert and Henry Medlin, New York City.—This invention consists in arranging a plug centrally in the discharge aperture of a burner to cause the gas to pass out in thin vertical sheets, thereby exposing more surface to the air, becoming thus more completely oxydized, and therefore giving its maximum of illumination.

Improved Oil Tank.

Hazen Titus, St. Petersburg, Pa., assignor to himself and Thomas Cushing, same place.—This invention has for its object to furnish oil tanks or reservoirs, so constructed that, should the oil take fire and an explosion take place, the exploded gases may escape freely, and the tank may be again tightly closed automatically, so as to smother the fire and thus save the oil. The invention consists in oil tanks provided with a number of openings, closed with hinged covers, to allow the exploded gases to escape freely without injury to the tanks. The covers are so arranged that they will fall back by their own weight as soon as the pressure is removed, and lightly close the tank, smothering the fire and preventing the oil from being burned up.

Improved Dental Impression Cup.

George Rhindler Fouke, Westminster, Md.—This invention is an improved cup for taking impressions for dental plates, so constructed as to allow direct manipulative pressure to be applied to the soft parts of the roof of the mouth after the ordinary pressure has been applied. By this means the dental plates, when cast or otherwise made, press upon the soft parts of the arch of the mouth, rather than upon the hard parts, thus distributing the pressure, and securing a better fit and a more effective atmospheric plate. The invention consists in an impression cup that is provided with a flexible lining on the inside, and with "cut-outs" or apertures that expose the ascending sides of the alveolar arch.

Improved Heating Range.

Isaac J. Baxter, Peckskill, N. Y.—This invention relates to cooking ranges, and consists in several improvements whereby it is contemplated to economize the fuel used in the warm seasons of the year and utilize the surplus heat necessarily generated at other seasons. This heat is employed in raising the temperature and comfortably warming other apartments of the house.

Improved Wash Boiler.

Hugh Ross, Plattsburg, N. Y.—This invention is an improved detachable steam washer, which may be placed and adjusted into any wash boiler, and combines the advantages of a steam cleaning and bleaching apparatus. It consists in a novel arrangement of hot water passages and side air chambers, together with valve connections for the circulation of the boiling water. By means of hinge connections of the sides and the bottom, the washer may easily be inserted into any form of boiler of sufficient size, the bottom being also provided with a central partition for producing the separate action of each half of the washer. The invention further consists in applying to the bottom of the washer a chamber or receptacle to hold the acids or other chemicals for removing stains or bleaching the clothes.

Improved Elevator.

Charles F. Stewart and Milton Stewart, Muncie, Ind.—This invention relates to apparatus for hoisting bricks to different parts of a building in process of erection, which may be adjusted to various heights and easily applied to the sides of the building. The supporting frame of the apparatus is made of timber, and the lower ends of its side pieces are pivoted to shoes of a strong lateral piece, which again turns by a central bolt in a stable base part of strong timber. The base part rests on the ground, and remains firmly in position thereon, while the main frame may be swung into any direction and inclination required. For the purpose of transporting the elevator from one place to another the base part and piece are brought under the frame, so that the whole takes up less space. The main frame is extended to different heights by the sliding frames, which are suitably guided and are of different widths, one being narrower than the other, the wider one forming the support and guide for the narrower. By a suitable arrangement of rollers and ropes connected with a crank, the extension frames are hoisted to the height required by the state of the building. The buckets are of a size large enough to take up one brick at a time, and are attached to an endless belt which passes over drums which are rotated. The bricks are deposited by the buckets in a chute which is inclined, down which they slide to the point where they are needed.

Improved Automatic Gate.

Jacob Grobb, Clinton, Can.—This gate is opened and closed by means of a cord, the ends of which are attached to a frame, the legs of which frame are confined to the ground, so that it may freely vibrate back and forth from an upright position. The top of the frame is connected with a sliding bar, which communicates with the fastening spring of the gate. When the gate is closed, the frame is inclined and stands at an angle with the surface of the ground of about thirty degrees. One end of the cord is attached to one leg of the frame, and then extends to an upright standard, where it passes through tackle blocks, and is extended to the standard, where it passes through three more tackle blocks, the same as before, from which blocks it is returned, and its other end is fastened to the other leg of the frame. When the cord is drawn, the frame will commence to rise, and in doing so will draw on the sliding bar, and thereby draw back the fastening spring and unfasten the gate. The frame will be drawn to an upright position when the gate is about half open, or at an angle with the road of about forty-five degrees. A continued pull opens the gate entirely, and inclines the frame in the opposite direction, and to about the same angle at which it stood when the gate was closed. The gate is closed by pulling the cord in an opposite direction, and the same effect is produced on the frame.

Improved Stock Feeder.

Ulysses Borel, Sue City, Mo.—A rectangular inclosure is designed to contain the hay or feed for the stock. Racks are applied to its outer side, below openings therein, which latter are closed by doors secured to the sides of the inclosure by staples and long links. The arrangement is such that when the doors are opened or lowered, they are supported on the racks by means of the links. The inner sides of the doors are thus turned outward, and form upward continuations of the racks, enlarging their capacity, and aiding in preventing the hay from falling over them on the ground.

Improved Burglar Alarm.

James J. Kane, Brooklyn, N. Y.—The bell is sounded by two hammers, one operated by an escapement and scape wheel, and the other by a connecting rod and crank, the crank and the scape wheel being turned by a wheel on a drum, containing a clock spring, which revolves said drum, when it is tripped and let free to turn by disengaging the lug on it from a stop lever. In order to cause this stop lever to trip the drum, a cam lever is connected with the window or door by a wire, to be moved one way by the pulling of the wire by the raising of the window or opening of the door. The cam lever is also connected with a spring pulling in the opposite way to trip the drum, by pulling the cam lever in that direction in case the wire is cut or detached from the door or window, and thus is provided an alarm which, it is claimed, cannot be evaded by cutting or detaching the wires, which has been done to other alarms of this character before opening the window or door, by means of instruments inserted in the cracks or by cutting away the casing. Suitable mechanism is arranged for tripping a hammer which, striking a cap, lights a fuse and a candle.

Improved Eaves Trough Support.

Thornton F. Morrison, Findley, O.—The roof bracket is a simple strap of metal, slotted at one end to receive the hanger, and perforated at the other to receive nails for fastening to the roof. The cross tie is made triangular in cross section. The hangers are made in two pieces, which are passed directly through the ties and then hooked under the bottom. The tie is made of two pieces, soldered together, and soldered to the eaves trough at each end. The upper end of the hanger passes through a slot, and is clasped around the edges of the bracket. When the hangers are attached to the ties and to the bracket in this manner they do not get loose, but form a sure and permanent support for the eaves trough.

Improved Car Coupling.

Franklin Thorpe, Sioux City, Iowa.—The cavity of the bumper is made in the form of a rectangular chamber, to the rear end of which are attached vertical plates, the upper sides of which are inclined or curved. In the forward part of this chamber is placed a block having two inclined plates projecting from its rear side. Upon the upper part of the forward, side of the block is formed a lip which, when pushed forward, supports the coupling pin. The lip projects over the inner end of the link, and holds said link in a horizontal position, so that it will enter the bumper of the adjacent car. A triangular bar, which crosses the chamber of the bumper, rests upon the inclined edges of the plates. To the bar is attached a rod, which passes down through a hole in the lower side of the bumper, so that a weight may be attached to it to draw the bar down with sufficient force to push the block forward when the coupling pin is withdrawn. By this construction, when the coupling pin is withdrawn, the bar pushes the block forward, so that the coupling pin may rest upon the lip. As the cars are run together, the entering link pushes the block back, allowing the coupling pin to drop through the link, coupling the cars.

Improved Stone Tool.

Thomas Joyce, Scranton, Pa.—The object of this invention is to construct miners' picks, drills and stonecutters' tools in general, with changeable points, so that a number of different bits may be alternately inserted, as required by the work, and thereby the number of tools lessened.

Improved Seed Planter.

William C. Pierce, Pashmatahs, Ala., assignor to Knighton & Willis, same place.—This invention consists in a frame hinged to the beam of the planter, supported by a wheel at its lower end, and having a hopper pivoted to lugs attached to the frame, so that its forward end may move up and down. This motion is given to the hopper by a bar, which is struck by pins attached to a small wheel which engages with the supporting wheel first mentioned. The hopper slides upon an adjustable plate at its forward end, which has a hole formed through it, through which, when the hopper rises, the seed escapes and drops to the ground. The side of the hole through the plate is regulated by a slide, placed upon its rear side, which passes up through the slit in the cross bar. To the rear side of the slide, a little above the discharge hole, is attached a bar, which projects forward and downward, to prevent the seeds from scattering, and to guide them downward into the furrow. A gate slides up and down in grooves in the sides of the hopper, and in its lower edge is formed a notch, so that, by raising or lowering the gate, more or less seed may pass back and escape through the plate and slide. The forward end of the bottom of the hopper is cut away, and in the opening thus formed are placed two or more rods. Upon the bottom of the hopper is placed a false bottom, which is secured in place by a screw, which passes through a slot in the false bottom, and screws into the hopper bottom. With this construction for planting corn and other seeds in hills, the gate and plate are adjusted so that, by each revolution of the large wheel, the desired number of kernels may be dropped to the ground. For planting small seeds in drills, the space through which the seeds pass is partially closed by adjusting the plate, and a sufficient number of pins are placed in the larger wheel to keep the hopper in constant motion.

Improved Stock Feeder.

James M. Collins and William A. Miles, Atlanta, Mo.—To posts are attached slats to form the crib. The inner sides of the middle posts are grooved longitudinally to receive the edges of the board, to divide the crib into compartments, so that it may contain corn in the ear in one part and shelled corn or oats in another part. The floor of the crib, which rests upon strips, has an upwardly projecting flange attached to its outer edge to form a trough for the stock to eat from, into which the corn or other grain is admitted, through sliding doors which work up and down in guides attached to the posts. To the latter also are attached strips which support a floor made inclined, so that it may be self-cleaning, in the projecting parts of which, that form the bottom of the feed troughs, are formed trap doors, which may be opened and the refuse from said troughs pushed through conveniently to fall into the hog house beneath. Wheels and axles, are placed beneath the floor. Racks rest upon ledges attached to the crib, just above the sliding doors, and flare outward. To the middle parts of their upper edges are hooked braces, the inner ends of which are secured to the upper part of the crib.

Improved Mortising Tool.

Harbert E. Forbis, Danville, Ky., assignor to himself and John W. Proctor, same place.—The object of this invention is to provide an efficient tool for making mortises by boring into the wood, and at the same time cutting it out laterally. It consists of a cylindrical piece of steel having cutting edges along the sides formed by, say, two grooves extending from the cutting end along each side to the shank, and vanishing in the surface thereof. There are also cutting bits formed on the end by a deep notch made between said bits, which project on each side of the notch. The bits bore into the wood, while the cutting edges form the mortise laterally.

Improved Safety Attachment for Pockets.

Wiley Henry Cairns, Petrolia City, Pa.—This invention has for its object to furnish an improved guard for attachment to pocket books to prevent the possibility of their being drawn from the pocket without the owner's knowledge. Two short arms are pivoted to each other at one end, and also to the side of the pocket book. The other ends of the arms are pivoted to two bars at a little distance from their outer ends, which said outer ends project at the side edges of the pocket book, and have rubber blocks attached to them to prevent them from cutting or tearing the pocket. The other or inner ends of the bars are pivoted to each other and to the end of a short sliding bar which passes through a keeper attached to the side of the pocket book, and has a thumb piece formed upon or attached to its other or free end. By this construction, by drawing the sliding bar upward, the projecting ends of the bars will be drawn inward, allowing the pocket book to be readily removed from or inserted in the pocket. By suitable construction, when the sliding bar is released, a spring causes the rubber-tipped ends of the bars to project and rest against the pocket, and thus prevent the pocket book from being withdrawn from said pocket without the owner's knowledge.

Improved Truss Bridge.

John A. Patterson and Andrew J. Sprague, Toledo, O.—This invention consists of modifications and improvements in the construction of the Howe truss bridge. It is proposed to omit the end posts and pier panels commonly employed at the ends, mainly for making a finish thereof, and for a finish to apply metal facades of any ornamental construction, attaching them to the upper ends of the first diagonal braces, and the beam connecting the top chords. The angle blocks for the foot rests of the braces are made in the form of strong angle plates, united together at the proper angle for being at right angles to the braces which rest on them, with end plates and middle plates for strengthening them, projecting downward from the lower sides to rest on the floor timbers. These plates are slotted to straddle the coupling pin, which is suspended on vertical suspending rods, which pass through slots in the plates of the angle block. These plates terminate at the lower edges sufficiently higher than the plane of the connecting pin to allow the links of the lower chord to pass under them to the pin, whereon they are suspended. The floor timbers are suspended from these coupling pins by short rods and the foot plates, the rods having an eye in the upper end, through which the pins pass, and pass through the foot plates at the lower end, and receive a nut, by which to hold the plate. To connect the horizontal brace rods of the lower chord to the floor beams, the flat wrought iron plates with oblique holes are employed, and holes are made through the corners of the beams for the rods. In making the angle blocks, it is proposed to cast the under sides and the plates on metal chills, to make them sufficiently smooth and complete to be put in place without having to be finished.

Improved Permutation Lock.

Wilhelm Koch, Cincinnati, O.—For opening the lock, a dial knob is turned in one direction till the pin of a driving wheel engages the tongue of a first tumbler, the pin of the first tumbler the tongue of the second, and so on until all the tumblers are in motion. The dial plate is then set with the first letter selected to the index mark, carried thence in opposite direction to the second letter, and so on alternately in opposite directions till the tumblers are in position for admitting the fence of the fence lever. The driving wheel is then set so that a pendulum rests upon cross pins; then lifting, by a return motion of the knob, the pendulum lever and releasing the fence lever, which engages the driving wheel and rotates the bolt lever and bolt, bringing the recess of the face disk into position to receive the bolt of the safe door. The lock may be set to any combination of letters on the dial plate by placing the tumblers into their position, as described, by using, instead of the index mark, which is vertically above the dial plate, the side mark, which brings the recesses of the tumblers under the spring rings in position for the action of the wedge lever, and allows the entering of the wedge teeth and the changing of the tumblers to any desired combination of letters. The wedge lever is then withdrawn and the lock opened on the index mark.

Improved Self-Oiling Bolster.

John D. Wells, Jr., Putnam, Conn.—This invention consists of an oil chamber in the hub of the gear, which runs on the bolster and revolves the bobbin; there is a small passage from the bottom of the chamber to the hole through the wheel for the bolster; and a slot is made in the latter to the spindle, by which the oil supply is carried from said chamber and delivered to the bolster only while running. From the bolster the oil finds its way through the slot to the spindle, in a manner calculated to lubricate the parts efficiently, and at the same time economize the oil. The oil passage from the oil chamber to the bolster hole of the gear prevents the waste of oil while the machine is not running, in consequence of being so small that the oil only flows when the parts are in motion.

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Parties needing estimates for Machinery of any kind, call on, or address, W. L. Chase & Co., 95, 96, 97 Liberty Street, New York.

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W. W. S. can improve his bottled beer by following the directions on p. 107, vol. 29.—W. G. P. will find directions for bronzing malleable iron castings on p. 208, vol. 30.—W. P. can remove writing ink from postage stamps by the process described on p. 396, vol. 26.—H. S. can make an eolian harp by following the directions on p. 330, vol. 26.—J. B. R. & Co. will find a recipe for Babbitt metal on p. 122, vol. 28.—H. W. C. will find directions for making transfer or impression paper on this page.—P. M. will find that marine glue, as described on p. 202, vol. 28, will answer his requirements. The paper mache decorations are described on p. 16, vol. 27.—A. J. C. will find descriptions of solder for all purposes on p. 251, vol. 28.—A. N. can make a silver wash by the process detailed on p. 299, vol. 28.—H. C. S.'s query doubtless relates to the method of Dr. De la Perouse, fully described on p. 119, vol. 30.—L. C. will find a good recipe for paste on p. 280, vol. 28.—M. E. will find the required information in "Perpetuum Mobile," in two series, by Henry Dircks, C. E.

R. G. asks: "To one gallon of gasoline, add one tablespoonful of salt, one tablespoonful of soda, pounded fine, and a piece of alkaneet root one inch long." Is this a recipe for a safe oil? A. These bodies do not diminish the danger of burning very light and cheap oils in kerosene lamps, and fatal accidents happen every day from persons being deceived by such statements.

L. D. C. asks: Which is the best treatise on geology? A. Lyell's "Manual of Geology." Read also, if you have a chance, Hugh Miller's works.

H. W. C. asks: Will you give me a recipe for black printers' ink? A. Take pure balsam copaiba 9 ozs., lamp black 3 ozs., indigo and Prussian blue, each 1/2 oz., Indian red 1/2 oz., dry yellow soap 3 ozs.; grind to smoothness with a muller on a stone.

J. W. R. asks: How can I make a paste that will stick paper firmly to new bright tin? A. Mix a tablespoonful or two of brown sugar with each quart of four paste.

T. asks: Where can I procure a work on steam heating? A. Box on "Heat" is a standard authority. See our advertising columns for booksellers' addresses.

J. J. asks: 1. What will make glue remain soft and elastic after it is dried on cloth? A. The solution of caoutchouc described on p. 251, vol. 29, will perhaps serve your purpose. 2. How is emery stuck to emery cloth? A. The best glue is used.

W. G. P. asks: How can I dye small pieces of wood green? A. Try crystals of verdigris dissolved in water.

S. asks: Can you give me a recipe for making an imitation of rosewood without the use of nitric acid? A. Dissolve 4 ozs. potash in 1 gallon hot water, and 4 ozs. red sanders wood; when the color of the wood is extracted, 2 1/2 lbs. gum shellac are added and dissolved over a quick fire. Use this on a groundwork stained with logwood.

R. H. asks: 1. How are red and green fires made? A. Red light is a mixture of nitrate of strontia, sulphur, and chlorate of potash. Green light is a mixture of carbonate of baryta with sulphur and chlorate of potash. 2. Of what does the smoke, resulting from burning these fires, consist? A. The smoke is a mixture of the sulphides of barium, strontium, and potassium, with sulphuretted hydrogen, sulphurous acid, hyponitric acid, carbonic acid, hypochloric and chlorous acids, and the chlorides of sulphur and potassium. All these bodies would be unpleasant and some very injurious to breathe. 3. A young man burnt his hand by lighting these; what is his best remedy? A. The burned hands should have been wrapped in strips of soft linen or muslin, which were covered over with a mixture of equal parts of linseed and sweet oil.

G. S. T. asks: 1. What is the most simple form of anemometer? A. A good one is described on p. 246, vol. 26, and another on p. 233, vol. 29. 2. Where can I find a description of Professor Coffin's card anemometer, referred to in his memoir on p. 62, vol. 30? A. Address Lafayette College, Easton, Pa.

C. S. asks: How can I obtain the frosted appearance upon silver ware commonly called oriental finish? It is done with some kind of acid. A. Your best mode will be to experiment with muriatic, nitric, and other acids until you get the desired results. 2. What ingredients are used as a paint for fancy gilding? A. The metal may be gilt by using a solution made by dissolving as much gold in aqua regia as it will take up. Fine linen rags are soaked in this solution, carefully dried, and afterwards burnt to tinder. The substance to be gilt must be well polished; a piece of cork is first dipped into a solution of common salt in water, and afterwards into the tinder, which is well rubbed on the metal to be gilt, and the gold appears with its proper luster.

C. R. asks: How can I make fumigating pastils? A. Take 1/4 lb benzoin, 1/4 lb. cascarilla, 1 1/2 ozs. myrrh, 1 1/2 lbs. charcoal, 1/2 oz. otto of nutmegs, 1/2 oz. otto of cloves. Powder the first four and mix by sifting. Add the ottos, and also 2 ozs. of niter which has been previously dissolved in tragacanth mucilage. After well beating in a mortar, the pastils are formed into shape in a mold, and gradually dried.

A. M. T. says: 1. I have constructed the telescope described on p. 7, vol. 30, and I have had perfect satisfaction so far in seeing the mountains and craters of the moon, which were visible very plainly. I have been trying to look at the sun, but by its brilliancy it is impossible to do so without different arrangements. How can I look at the sun with the above named telescope? A. Put as many pieces of red glass between the eyepiece and the eye as will enable you to look at the sun without being dazzled. 2. How and in what part of the heavens can I find the planets? A. The Nautical Almanac gives the position for every day and hour during the year. See our Astronomical Notes, published monthly. 3. Where can I find the nebulae? A. Their position is marked in any map of the heavens.

M. W. M.—A preliminary examination would be necessary to ascertain the novelty of your piston packing. See our advertisement in this issue.

C. T. S.—Such a trap could be constructed, but it would be complicated and expensive.

J. W. B. asks: Does pure hydrant or other non-stagnant water contain animalcules? If so, what power of microscope is required for detecting them? A. Pure hydrant water should not contain animalcules. 2. I have tried the recipe on page 351, vol. 24, for kalsomine, which covers and adheres well, but has no glaze. It is over a rough whitewashed wall, and the stains from the soot of the chimney show through. What can I do to cover them, and to give the kalsomine a glazed appearance? A. Kalsomine has no glaze. It should have been so mixed that it would have been thin enough to work well, without being too thin to cover. In answer to your other question: No.

C. E. W. says: We have recently introduced a new system for making gas from petroleum; and for safety's sake, we use only oils that have all volatile gases, such as naphtha, rhigoline, benzine, etc., driven off by heat or otherwise. The only objectionable feature in this new gas is that it smokes; and although, by reducing the burners to a minimum, we have improved it, we have not entirely overcome the difficulty. We use now 1/4 foot, 1/2 foot, and 1 foot burners only. We are using hardly any pressure. What is the cause of the gas smoking, and how could it be obviated? Why do fish tail burners make it smoke worse? A. These oils are highly carbonized, and require a large supply of air for their perfect combustion. In a fish tail burner, the gas at the moment of combustion is in contact with the air only on the outside of the flame. You must use some form of argand burner, which will admit air to the interior of the flame.

E. B. S., F. C. R., F. E. P., A. F. S. C. H. J., C. J. K., N. L. F., C. E. M., J. B. T., J. G. M., J. W. P., and F. G. H. have sent correct answers to the slip and cannon question. F. G. P. does not clearly understand the query.

W. J. S. asks: Is the Walter printing press used in this country? A. The Walter press is in use in the New York Daily Times establishment here.

M. asks: 1. I have a plunger pump attached to the crosshead of my engine, which runs at 120 revolutions per minute. This pump has the full stroke of engine. The delivery pipe and suction pipe are of the same size; and when the engine runs fast, the check valve thumps dreadfully. I cannot use the pump when she is running fast; but when running slow, it works very well. There is an air chamber on the delivery valve. Now I wish you would tell me what is the cause of this. I think that, when running fast, the plunger leaves the water. A. Probably the plunger runs faster than the water can flow into the pump. 2. What do you call wire-drawing steam? A. Reducing the pressure, by allowing the steam to expand without performing work. 3. Does it make any difference in leading the steam to a gate, whether the pipe is the same size all along? A. No. 4. What does "Fahrenheit" mean? Is it the name of the man who first invented the thermometer? A. It refers to the thermometric scale graduated by Fahrenheit. The thermometer was not invented by Fahrenheit, but he first made mercurial thermometers. 5. What is the greatest perpendicular height to which a double acting pump will lift water? A. From 30 to 32 feet.

L. D. S. asks: 1. Are there any rules for finding the distance and vanishing points when drawing from Nature? An English work says there are none. A. No. None are needed. To sketch from Nature, one must learn to see correctly, and this must be acquired by practice. In drawing ideal pictures, the distance and vanishing points are located according to the judgment of the artist, so as to produce the best effect. 2. Who publishes the best book of instruction on pencil and India ink drawings? A. We know of none that we can recommend. Many are published, however. We do not believe that free hand drawing can be learned from books. 3. What kinds of paint are used for painting pictures on the glass slides used in magic lanterns? A. See p. 123, vol. 30.

C. asks: What sized boilers shall I require to give me steam enough to do the following work: To keep 6 drying chambers, 30 feet in depth, with end and one side wall of stone, divided off by frame partitions every 4 feet, and with total front of 36 feet, heated by one inch boiler steam pipe at a temperature of 150° Fah. night and day. To supply steam at 60 lbs. pressure to run a 12x30 engine for 6 hours per day. To supply steam sufficient to keep 16,000 gallons water at 80° day and night in winter, in the latitude of St. Louis, Mo. A. Professional question. Should be submitted to an engineer.

T. C. H. asks: How can I make transfer paper, to copy a drawing by tracing with a steel point? A. Make a stiff paste of lard and plumbago, and smear over the paper with a piece of rag.

E. H. B. asks: Why does pork, when it is killed in the wane of the moon, shrink from the bone when boiled? A. It does nothing of the kind.

W. T. McL. asks: Who was the scientist Nuttall? He seems to have been one of our most thorough naturalists in botany and ornithology. A. An English naturalist who resided for some years in this country. He explored nearly all the States of the Union; and was, from 1822 to 1834, Professor of Natural History at Harvard. He died in England in 1859.

A. R. G. asks: Would a turbine gain any power by having two spiral flanges or buckets run up the shaft to the top of the penstock? A. No. There is a certain proportion of the height of the penstock to which the spiral flanges can be extended with economy. But putting such flanges all the way up only distributes the power due to the head of water.

W. G. B. asks: When patent claims are separable, or can be used in some other combination even if it be for the same purpose, is not inserting them the same thing as trying to get several patents by merely paying for one? In reality, is not the combination the only thing patented? A. The patent relates to one invention only, and all claims that relate to another must be put in a separate application.

W. A. M. H. asks: How can I make corn starch? A. In making starch, the corn, wheat, or other grain is steeped in water for some days till the saccharine portion ferments and the starch granules become free from glutinous matter. The sour liquor is then drawn off, and the feculous residue washed on a sieve; what passes through is allowed to settle, the liquid again drawn off, and the starch washed from the slimy water. It is then drained in perforated boxes, and dried by exposure to the heat or to the air. In treating corn, about 200 grains of alkali, in the form of caustic soda, are added to each gallon of liquid to facilitate the separation of the gluten and other nitrogenous matter.

F. C. asks: Is there a chemical compound which, applied to paper, will be decomposed by an electric current passing on a wire in contact with it, so as to leave a permanent mark? A. Yes. Prussiate of potash.

G. P. H. asks: How many feet of gas does one burner burn in one hour? A. It depends on the size of the orifice of the burner. The larger the orifice, the more gas escapes. Street gas burners are generally bored to burn three feet of gas per hour. Five feet burners are often used in dwellings and churches.

W. W. H. asks: Is there any danger of injuring the enamel on one's teeth by cleaning with an ordinary brush and water twice a day? A. No. The danger is that, if the cleaning be neglected, not only the enamel but the entire substance of the teeth will sooner or later become injured and decay.

M. C. M. asks: 1. How can I find the contents of a cylindrical vessel or drum that shall be equal to the contents of a rectangular cistern, and also the contents of a cistern that shall be equal to the contents of a cylinder? A. Find the area of the base of the cylindrical vessel, and divide the contents of the box by that area. The quotient will be the height. Or if the height is given, divide the contents of the box by that, and the quotient will be the area of the base. 2. Does a caveat for a patent have to undergo the same examination as an application for a patent? A. No examination is required in filing a caveat. In applying for a patent afterwards, the same regulations must be complied with as if you had not taken out a caveat.

G. C. H. asks: How can I construct a simple, cheap, and efficient electrical battery for the cure of disease? A. The magneto-electric machine is the one generally used for the administration of electricity in disease. By this instrument a rapid succession of shocks, the intensity of which can be graduated, are given, either to the whole body or to the particular part affected. In this machine either a permanent magnet, or an electromagnet, for which a battery must be used, is employed to generate a secondary current in a long coil of fine wire. Consult some good physician as to the best form of apparatus.

G. T. P. asks: How can I make a leather cement? A. Dissolve 1 part caoutchouc in 3 parts chloroform.

H. E. R. asks: 1. What solution is used in plating with nickel, and how can I make it? A. The nickel salt used in plating is the double sulphate of nickel and ammonia. It will probably save you time, trouble, and expense to purchase this salt already made from the manufacturers who supply the nickel platers in New York. 2. Is there any substance which, if added to the solution, will cause the plating to appear bright, or will it have to appear burnished? A. You can polish the ware after plating.

P. D. asks: 1. What is the quantity of cyanide of potassium required to precipitate 5 pennyweights gold from the nitro-muriatic solution? If too much cyanide be used, how can I recover the gold that has been dissolved by cyanide in the acid solution? A. About 1 pennyweight 16 grains. You cannot dissolve the cyanide of gold by cyanide of potassium in the acid solution. 2. What are the proportions used to make a gold solution (about 1 quart) so as to get a good yellow, bright color on chains? A. Agitate ether with a solution of perchloride of gold for some time, allow it to repose, and decant the supernatant portion. 3. What is the chemical name for what is generally called the B. Bray tallow? A. The name you mention is probably a trade mark or brand of some kind of tallow. 4. How can I braze thin sheets of copper and brass for cooking utensils, and what is the best spelter to use, and how is it made? A. The edges after being filed or scraped quite clean are covered with a mixture of hard solder and powdered borax made into a paste with water. The whole is then allowed to dry, and afterwards exposed in a clear fire to heat sufficiently to melt the solder. Spelter is the commercial name for zinc. For hard solder, apply to the plumber.

A. B. asks: 1. What ingredients are used in the manufacture of Pharaoh's serpents' eggs? A. Pharaoh's serpents are said to consist principally of the sulphocyanide of mercury, which we would not advise you to attempt to make, but to apply to a chemist, and then to be careful in using. 2. What will remove superfluous hair from the head and not injure the skin and remaining hair? A. There are numerous depilatories or hair removers. We do not advise you to use them, as they are more or less injurious to health. 3. How can I separate alcohol from home made grape wine without injuring it for drinking purposes? A. If you distill your home made wine, you will drive off most of the alcohol, obtaining a kind of brandy, and only water will be left behind. 4. How can I make gold and silver ink, to be of use? A. Gold or silver in very fine powder is ground up with a little gum water. A cheap gold ink is made with what is called mosaic gold, the bisulphuret of tin.

E. R. McC. asks: Can a patent be attached to a debt of the inventor? A. No. An injunction might be granted in a proper case, preventing its transfer except to a receiver appointed by the court.

C. R. M. says: Kainit, as usually sold, consists of 25 to 30 per cent of sulphate of potassa, 14 to 16 per cent sulphate of magnesia, 4 to 5 per cent chloride of magnesia, 35 to 40 per cent chloride of sodium, and 10 to 12 per cent sulphate of lime. I want to use it as a substitute for ashes (which I cannot get), as a manure for onions. What is its probable efficacy? The potash and salt are good, but is the sulphate of magnesia likely to be injurious? A. The large proportion of potash in kainit should render it superior to ashes as a fertilizing agent, and we do not believe that the other salts will materially affect it in this respect.

H. A. S. says: 1. On page 27, current volume, in your answer to M. W. H., you say that 9,000 feet per minute is recommended as the proper speed for the rims of circular saws of all sizes. I think that, other things being equal, the speed of the rim should be in proportion to the power. I should figure the speed of the little foot power saw by compound proportion, thus: If a saw with teeth one inch apart, running with six horse power, cutting nine inch lumber, requires a speed of 9,000 feet per minute, what should be the speed of a saw with teeth half an inch apart, cutting one inch lumber and running with one eighth horse power?

6: 3/4 :: 9,000: 843 1/2. I do not say 843 feet per minute is 1: 3/4 :: 9,000: 843 1/2. just the right speed for a foot power saw, but I think it would be correct if 9,000 is just right for the supposed six horse power saw. The smaller saw might, however, be made to saw smoothly by running at a higher speed, but I think only by a loss in the amount of work done. I think the reason that your correspondent's saw did less work at the higher speed was that more power was required to cut the sawdust finer, and more was lost in economizing friction. A. Your theory does not agree with the results obtained by experiment. 2. Not long since I heard a man say that kerosene oil would destroy the temper of steel. Is it true? As the temper depends on the internal structure of the steel, and the oil can reach only the surface, I do not see why the temper should be injured throughout. A. You are right. 3. At what speed should a power drill run? A. In wrought iron, the speed of the drill should be about 12 feet a minute.

R. C. says, in reply to S. G. F., who asked about filtering water: If he can dig a trench, parallel with the stream, arrange a filtering gallery and filter the water through the bottom of his gallery, perhaps it would help him out and give no further trouble.

W. S. D. says, in reply to J. M., who asked if a check wall under the back end of a steam boiler will save fuel: Build a bridge wall just 1 foot forward

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

G. L. E.—Your specimen consists of dark colored tourmaline in quartz. Tourmaline is a silicate of alumina, containing also oxide of iron and potash.

N. M.—These specimens are iron pyrites, and are of little value at the present time.

A.—The mineral sent is graphite or plumbago; which, you know, is composed of carbon. The specimen shows traces of iron.

COMMUNICATIONS RECEIVED.

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

On Death Statistics. By S. B.
On Ventilation. By S. W. and by W. S. Jr.
On the Art of Tanning. By D. S.
On the Duration of Brain Impressions and the Memory. By D. S. T.
On the Use of Petroleum in Steam Boilers. By J. B. W.
On Canal Navigation in Winter. By C. P.
On the Cow Milk Tree. By C. L.

Also enquiries from the following:

H. W.—N. T. W.—C. A. M.—F. L. R.—J. H.
Correspondents in different parts of the country ask: Who makes ditching plows, to be drawn by horse power? Who furnishes small castings of a low grade of steel? Where can infusorial silica be obtained in large quantities? Who makes feed water heaters? Who makes electric gas lighters? Who constructs boilers which will not explode when the water gets low? Where is a boring machine, suitable for hubs for setting boxes, sold? Where can asbestos be obtained? Makers of the above articles will probably promote their interests by advertising, in reply, in the SCIENTIFIC AMERICAN.

Correspondents who write to ask the address of certain manufacturers, or where specified articles are to be had, also those having goods for sale, or who want to find partners, should send with their communications an amount sufficient to cover the cost of publication under the head of "Business and Personal," which is specially devoted to such enquiries.

[OFFICIAL]

Index of Inventions

FOR WHICH

Letters Patent of the United States

WERE GRANTED IN THE WEEK ENDING

February 3, 1874,

AND EACH BEARING THAT DATE.

(Those marked (r) are reissued patents.)

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APPLICATIONS FOR EXTENSIONS.

Applications have been duly filed, and are now pending for the extension of the following Letters Patent. Hearings upon the respective applications are appointed for the days hereinafter mentioned:

28,108.—LEATHER FINISHING MACHINE.—W. P. Martin, April 15.
28,129.—SEWING MACHINE.—G. B. Arnold, April 22.
28,174.—PICTURE HANGING MOLDING.—H. Hochstrasser, April 22.
28,181.—BURNISHING BOOT SOLES.—E. T. Ingalls, April 22.
28,184.—CEMENT TYPE MOLD.—H. Knight, April 22.
28,189.—SUGAR DYEING MACHINE.—A. W. J. Mason, April 22.
28,198.—CULTIVATOR TEETH.—D. B. Rogers, April 22.
28,214.—RUFFLE.—G. B. Arnold, April 22.
28,214.—WATER WHEEL.—A. M. Swaid, April 29.
28,470.—SLIVER MACHINE.—F. T. Grant, May 13.

EXTENSIONS GRANTED.

27,034.—HARVESTER.—J. Butter.
27,043.—UMBRELLA STAND LOCK.—A. M. Foote.
27,065.—COFFEE MILL.—J. & E. Parker.

DESIGNS PATENTED.

7,148.—SHIELD.—G. W. Dauth, Reading, Pa.
7,149.—SHIRT CUP PLATE.—J. Jepson, West Meriden, Ct.
7,150.—SLEIGH.—F. D. Kennedy, Albany, N. Y.
7,151.—SLEIGH.—J. Lodewick, Troy, N. Y.
7,152.—COMB.—W. Pauly, College Point, N. Y.
7,153.—BRACKET.—J. B. Sargent, New Haven, Conn.
7,154.—TYPE.—R. Smith, Philadelphia, Pa.
7,155 & 7,156.—CARPETS.—T. J. Stearns, Boston, Mass.
7,157.—LABELS.—S. Ward, Boston, Mass.

TRADE MARKS REGISTERED.

1,811.—CIGARS.—J. H. Battis, Salem, Mass.
1,812.—OILS.—J. A. Bostwick & Co., New York city.
1,813.—SMOKED MEATS.—J. Grubb & Co., Cincinnati, O.
1,814.—PRINTED PUBLICATION.—J. Gruber, Hagers-town, Md.
1,815 & 1,816.—IRISH LINENS.—Paton & Co., N. Y. city.
1,817.—PLASTER.—J. McI. Smith, New York city.
1,818.—FLOUR.—J. Stabler, Baltimore, Md.
1,819.—BISCUIT.—Thurston & Co., Cambridgeport, Mass.
1,820.—SAWS.—The Wheeler & Co. Manufacturing Company, Middletown, N. Y.

SCHEDULE OF PATENT FEES.

On each Caveat	\$10
On each Trade Mark	\$25
On filing each application for a Patent (17 years)	\$15
On issuing each original Patent	\$20
On appeal to Examiners-in-Chief	\$10
On appeal to Commissioner of Patents	\$20
On application for Reissue	\$30
On application for Extension of Patent	\$50
On granting the Extension	\$50
On filing a Disclaimer	\$10
On an application for Design (3 1/2 years)	\$10
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[Specially reported for the Scientific American.]

CANADIAN PATENTS.

LIST OF PATENTS GRANTED IN CANADA, FEBRUARY 11, 1874.

3,065.—J. P. Manton, G. H. Remington and B. D. Thayer, Providence, R. I., U. S. Improvements on ship's windlasses, called "Improved Pump Brake Windlasses for Vessels." Feb. 11, 1874.
3,066.—H. Hills, G. W. Mills and Wm. Mc. Lockwood, Highland, Oakland county, Mich., U. S. Improvements on pruning shears, called "Hill's Pruning Shears." Feb. 11, 1874.
3,067.—F. W. Rhinelander, N. Y., U. S. Improvements on boot and shoe tips, called "Rhinelander's Enamelled Shoe Tip." Feb. 11, 1874.
3,068.—W. H. Lunt, Cambridge, Mass., U. S. Improvement in filters, called "The Lunt Filter." Feb. 11, 1874.

of the back end of the boiler, up to 4 inches from the bottom of the boiler, and then another wall just at the end of the boiler upon an iron bar hung on the side walls, to hang down 8 or 10 inches below the top of the bridge wall. Let the second wall come close up to the boiler. You will save fuel each day enough to pay you for your trouble and expense, and not a spark will escape into the smoke stack.

G. S. D. says, in reply to A. M., who asked how to find the weight of a person's head without cutting it off: Attach to the person, as high up as convenient, an ordinary rubber bag or life preserver with tube and stop cock. Immerse the apparatus in water, and force air into the bag until the head is entirely above the surface. Secure the bag of air in any suitable vessel, fill with water, and weigh. Let out the air, again fill the vessel with water, and weigh. The difference between these two weights will equal the weight of the head.

T. V. says, in reply to T. J. McM.'s question: How can I divide a line into two parts so that the square of one of the parts may be double the square of the other? Let A B be the given line. Draw A C, making 1/2 of a right angle with A B, and draw B C, making 1/2 right angle with same line; at the angle C, draw C D at right angles to C B. Then the square on D B is double that on A D.

E. B. W. says, in reply to the question: What would become of a body dropped into a hole passing through the earth's center? This question has been much discussed, and the following opinions given: 1. By the prodigious momentum acquired in falling, the body would pass out at the opposite side into space. 2. That it would move to the opposite surface, return to the starting point, and vibrate for ever from side to side. 3. That these vibrations would lessen and the body finally rest at the center. I hold that none of these opinions are correct, but that the body would fall to the center and not pass it. What of its momentum? asks some one. In general, the momentum or inertia of a moving body is represented by the product of its velocity and weight, and may be formulated thus: $m = v \times w$. When the body reaches the center of gravity, being attracted equally in all directions, it has no weight; and the formula becomes $m = v \times 0 = 0$. That is, the momentum of a falling body ceases at the center of gravity. Nothing then remains to cause it to pass that point. Will some mathematician calculate the culminating points of the velocity and momentum in the descent of a falling body? I opine the former is much nearer the center than the latter.

M. J. M. says, in reply to R. T. and others who asked for a recipe for wood filling: Take 3 lbs. corn starch or silver white, 1 lb. pulverized pumice stone, 1/2 pint boiled oil; add Japan varnish enough to dry the oil; and turpentine to make it the consistency of thin paint; apply with a brush, then let it stand until it begins to turn white, then commence rubbing with a cotton cloth, always in a circle and against the grain of the wood. For cleaning the filling out of carving, make a brush of hair cloth by removing the thread from the hair, leaving the hair about an inch long; roll it tight and fasten with tacks. Set the wood aside for one day to dry. After it has become dry take seven parts of boiled oil, one part of asphalt, and oil the work with it clean with cotton cloth. You will find that the wood will be very white before applying the oil, but the oil will restore it to its original color.

- 3,009.—E. Smart, Brockville, Leeds county, Ontario. Improvements on oil gates, called "Smart's Improved Molasses and Oil Gate." Feb. 11, 1874.
- 3,100.—E. P. Hannaford, Montreal, P. Q. Improvements on a signal lamp, called "Hannaford's Stationary Signal Lamp." Feb. 11, 1874.
- 3,101.—H. A. Holmes, Epsom, Merrimack county, N. H., U. S. Improvement on machines for sawing clap boards, called "Holmes' Clapboard Machine." Feb. 11, 1874.
- 3,102.—Wm. Fuller, Montreal, P. Q. Composition of plastic material, called "Fuller's Plastic Compound." Feb. 11, 1874.
- 3,103.—Wm. X. Stevens, Brookfield, Worcester county, Mass., U. S. Improvements on shears for cutting bars and rods of iron or other metal or material, called "Stevens' Improved Bar Shears." Feb. 11, 1874.
- 3,104.—C. E. Blake, San Francisco, San Francisco county, Cal., U. S. Improvements on dentistry, the same consisting in a means of disguising the bright color of gold filling for teeth, whereby said filling is also rendered more durable, and also of an improved metallic foil for dental purposes, called "Blake's Improved Filling for Teeth." Feb. 11, 1874.
- 3,105.—G. J. Wilson, Ottawa, Ontario. Improvement on a machine for drying clothes, called "Wilson's Eureka Clothes Rack." Feb. 11, 1874.
- 3,106.—G. Young, Oshawa, Ontario county, Ontario. Improvements on shuttles for sewing machines, called "Young's Improved Shuttle." Feb. 11, 1874.
- 3,107.—F. Culham, Widdier Station, Bosanquet, Lambton county, Ontario. Improvements on nut fasteners of railroad rails, called "Culham's Patent Nut Fastener of Railroad Rails." Feb. 11, 1874.
- 3,108.—P. Munstinger, Mitchell, Perth county, Ontario. Improvements on pumps, called "Munstinger's Improved Pump." Feb. 11, 1874.
- 3,109.—W. H. Cutler, Buffalo, Erie county, N. Y., U. S. Improvements in portable inhaling tubes, called "Cutler's Inhaling Tube." Feb. 11, 1874.
- 3,110.—R. B. Tait, Oakville, Halton county, Ontario. Improvements in car couplings, called "Tait's Improved Car Coupler." Feb. 11, 1874.
- 3,111.—H. McKenzie, Marquette, Marquette county, Mich., U. S. Improvements on apparatus for leaching, called "McKenzie's Perpetual Leach." Feb. 11, 1874.
- 3,112.—A. Halon, Quebec. Une cheminee portative, called "Cheminee Portative." A portable chimney. Feb. 11, 1874.
- 3,113.—A. Anderson, London, Middlesex county, Ontario. Improvements on coupling for railroad cars, called "Anderson's Safety Railroad Coupling and Buffer Combined." Feb. 11, 1874.

HOW TO OBTAIN Patents and Caveats IN CANADA.

PATENTS are now granted to inventors in Canada, without distinction as to the nationality of the applicant. The proceedings to obtain patents in Canada are nearly the same as in the United States. The applicant is required to furnish a model, with specification and drawings in duplicate. It is also necessary for him to sign and make affidavit to the originality of the invention.

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A small working model must be furnished, made to any convenient scale. The dimensions of the model should not exceed twelve inches.

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On filing an application for a Canadian patent, the Commissioner causes an examination as to the novelty and utility of the invention. If found lacking in either of these particulars, the application will be rejected, in which case no portion of the fees paid will be returned to the applicant.

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HOW TO OBTAIN PATENTS

This is the closing inquiry in nearly every letter, describing some invention which comes to this office. A positive answer can only be had by presenting a complete application for a patent to the Commissioner of Patents. An application consists of a Model, Drawings, Petition, Oath, and full Specification. Various official rules and formalities must also be observed. The efforts of the inventor to do all this business himself are generally without success. After great perplexity and delay, he is usually glad to seek the aid of persons experienced in patent business, and have all the work done over again. The best plan is to solicit proper advice at the beginning. If the parties consulted are honorable men, the inventor may safely confide his ideas to them; they will advise whether the improvement is probably patentable, and will give him all the directions needful to protect his rights.

To Make an Application for a Patent.

The applicant for a patent should furnish a model of his invention if susceptible of one, although sometimes it may be dispensed with; or, if the invention be a chemical production, he must furnish samples of the ingredients of which his composition consists. These should be securely packed, the inventor's name marked on them and sent by express, prepaid. Small models, from a distance, can often be sent cheaper by mail. The safest way to remit money, is by a draft or postal order, on New York, payable to the order of MUNN & Co. Persons who live in remote parts of the country can usually purchase drafts from their merchants on their New York correspondents.

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In order to have such search, make out a written description of the invention, in your own words, and a pencil, or pen and ink, sketch. Send these, with the fee of \$5, by mail, addressed to MUNN & Co., 37 Park Row, and in due time you will receive an acknowledgment thereof, followed by a written report in regard to the patentability of your improvement. This special search is made with great care, among the models and patents at Washington, to ascertain whether the improvement presented is patentable.

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Did patentees realize the fact that their inventions are likely to be more productive of profit during the seven years of extension than the first full term for which their patents were granted, we think more would avail themselves of the extension privilege. Patents granted prior to 1861 may be extended for seven years, for the benefit of the inventor, or of his heirs in case of the decease of former, by due application to the Patent Office, ninety days before the termination of the patent. The extended time inures to the benefit of the inventor, the assignees under the first term having no rights under the extension except by special agreement. The Government fee for an extension is \$100, and it is necessary that good professional service be obtained to conduct the business before the Patent Office. Full information as to extensions may be had by addressing MUNN & Co., 37 Park Row, New York.

Caveats.

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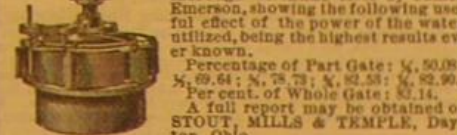
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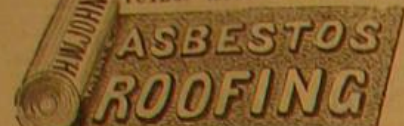
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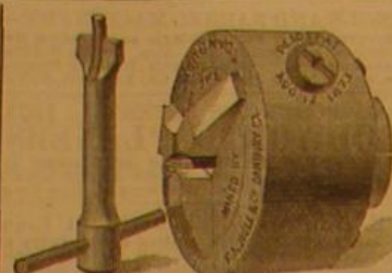
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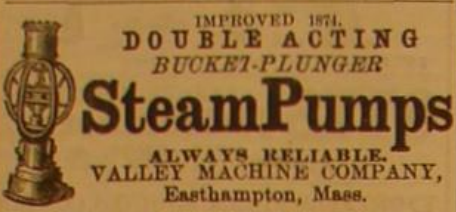
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[NEW SERIES.]

NEW YORK, MARCH 14, 1874.

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NEW AND GIGANTIC TELESCOPE.

Among the many ideas which have been elicited by the discussion in these columns regarding a gigantic or "million dollar" telescope, we have recently had submitted to our examination one which seems to us quite novel, ingenious, and, although untried, not unpractical. It is a scheme for a huge instrument, to be built on either the Gregorian or Cassegrainian system, in which the image is first received on a large parabolic mirror located in a position diametrically opposite to the objective in a refracting telescope, thence reflected back to a secondary mirror, which, in accordance with the respective systems, is either concave or convex, and by the last re-reflected to the eyepiece, the tube of which passes through an orifice in the center of the large glass. It is hardly requisite to explain the immense labor and, in fact, almost insuperable difficulties which would be encountered in constructing a reflector of the proposed size—ten or fifteen feet in diameter—of metal, and mounting the same. The great mirror in the telescope in Melbourne, Australia, though but 3.8 feet in diameter and weighing 3,498 pounds, required 1,270 hours of continuous labor to bring it into the last polishing stage, while its adjustment and mounting exacted the

nicest engineering skill. In brief, it may be safely asserted that a metallic mirror, of the large size above noted, supposing it could be successfully constructed, would, from its great weight but far more on account of its consequent flexure, be practically useless.

Mr. Daniel C. Chapman, of this city, who is the originator of the plan we are about to describe, suggests both a mode of making a mirror of light weight, and also a method of supporting the same. The reflector, he says, may be constructed of glass. A mold of clay, metal, or cement, of the required shape, is carefully formed and placed in a suitable furnace, cavity upward. Over the latter a huge plate of glass is disposed, and the heat applied. At a certain temperature, the glass begins to soften, and in such state may be bent, fitted into the mold, and subsequently annealed. The whole is then removed and placed on a plane. The glass is taken from its bed, disposed convex side up, and a backing of cement or plaster, the composition of which is previously determined by experiment so that it shall have the same coefficient of expansion as the glass, is applied, to several inches in thickness. The mirror is next inverted, placed on a turning table, and carefully ground or finished within, into

the exact form necessary. But little labor, comparatively speaking, will here be required, as an approximate or very nearly true curve will, it is believed, be taken by the glass in fitting itself to the mold. The reflecting face is, lastly, silvered by Dr. Draper's process, a solution of Rochelle salts and nitrate of silver being applied, which very quickly deposits a fine uniform metallic surface. It will be noted that the inventor thus obtains a reflector of light plaster and glass, the weight of which is necessarily quite small.

Next, for its suspension, and this will be rendered clear by the large engraving on our front page: On the rear of the plaster backing are made a number of projections, arranged with sockets to receive the ends of any number of braces. The latter are of wood, strong and well seasoned, and covered with some preserving material. These, extending from various points on the back, meet at the center of a huge copper sphere, which incloses the entire apparatus except the mirror, and then, intersecting, spread again to abut against the interior periphery of the globe. The mode of arranging these stages is, of course, a matter of engineering detail, and will depend greatly upon local



NEW AND GIGANTIC TELESCOPE. DESIGNED BY DANIEL C. CHAPMAN.

circumstances. The shell of the sphere comes, as shown in the engraving, just to the edge of the mirror, but has nothing to do with its support, the braces being solely for this purpose. The secondary mirror is held by two stays, which extend from the circumference of the reflector and meet at a calculated distance from the same. It is not necessary that the reflector be placed at the surface of the globe, but it may be placed at or near the center, leaving an opening of the same size in the globe, with perpendicular sides, thus requiring little or no counterpoise. The standards and stays holding the small mirror may be attached to the extreme external surface of the globe, thus giving a larger base and greater steadiness. The stays toward the poles are so arranged that the lower one is detached when nearing the horizon, in case it should be desirable. By this method there is nothing, as far as we can now see, to prevent the successful constructing and using of a telescope of very large size.

Through the center of the large glass is made an opening, and in this is a telescope tube, suitably jointed and terminating in an eyepiece within the globe at the observer's seat. The situation of the latter is clearly shown in the illustration, and it is suitably supported so as to be always vertical. By this arrangement the observer is constantly located in the right position; and by placing a partition of some non-conducting material between him and the backing of the reflector, so as to leave an intermediate space of four or five inches, a warm room to work in may be gained, and a means of keeping the braces dry provided.

The great sphere pivots in a ring, the axis of which is inclined to point to the pole, and is pivoted at one side in the cap of a single heavy pier. Below the globe is a vault filled with water or other liquid, in which it floats and from which it receives its principal support. It is evident that the motion of the apparatus will thus be susceptible of easy regulation, and may be effected by simple mechanical appliances arranged with counterpoises and governed by the observer. As our object is not to enter into the minor details of this plan, but rather to exhibit the idea upon which it is based, further explanation is deemed unnecessary.

The inventor thinks that a mirror of fifteen feet diameter may be constructed and mounted as we have described. As compared with a refracting telescope with an objective of corresponding size, and a focal length of 200 feet, the refractor would give a sun picture 20 inches in diameter; the reflector, having 100 feet focal length, would show an image 10 inches in similar dimension. In point of quantity of light, compared with Herschel's reflector, which was nearly five feet in diameter, the focal distance being still 100 feet, a 15 foot mirror would gather nearly 14 times as much. For photography, a great reflecting telescope could not be advantageously employed, as it would fail to give sufficiently fine definition of the object; but for spectroscopic work, it would be very useful and especially valuable for heat investigations with the thermopile. As a searcher for faint comets and double stars, from the large amount of light received, it would lead to results of great importance, and enable us to examine and resolve nebulae before which the highest magnifying power now existing fails.

Scientific American.

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LAKE TITICACA.

This is the most singular and interesting lake in the world. Situated on the crest of the Andes, it is the highest large body of fresh water; and as concurrent traditions point to it as the spot where Manco Capac, the first Inca, appeared and woke the aboriginal tribes from their long sleep of barbarism and ignorance, it is the historic center of South America. Humboldt called it the theater of the earliest American civilization. On an island within it are the imposing ruins of the Temple of the Sun, and all around it are

monuments which attest the skill and magnificence of the Incas. There are also, as at Tiahuanaco and Silustani, the remains of burial towers and palaces, which antedate the crusades, and are therefore pre-Incarial.

Lake Titicaca is about the size of our Ontario, shallow on the west and north, deep towards the east and south. The eastern or Bolivian shore, being backed by the lofty range of Sorata, is very high and precipitous. The lake never freezes over, although the temperature of Puno is often 18° at sunrise. Two little steamers of 100 tons each do a trifling business. Steam is generated by llama dung, the only fuel of the country; for there are no trees within 150 miles. The steamers actually cost their weight in silver; for their transportation (in pieces) from the coast cost as much as the original price. A steamboat company has just asked from Bolivia the exclusive privilege of navigating Titicaca and the Rio Desaguadero to Lago Pampa, with a guaranty of six per cent cost on the capital and a share in all new mines discovered.

Professor Orton, the latest traveler in that region, calls attention to the fact that Lake Titicaca is not so high as usually given in geographical works by about 300 feet. Its true attribute is 12,493 feet, and in the dry season it is four feet less. This fact has been revealed by the consecutive levelings made in building the Arequipa railway just finished, which reaches from the Pacific to Lake Titicaca. The road rises from the sea to Arequipa, 7,550 feet; thence to the summit, 14,660 feet; and then descends over 2,000 feet, to Puno on the west shore of the lake, a distance by the track of 325 miles from the ocean. Pentland's estimates of Sorata, Illimani, and other peaks of the Andes, having started from the Titicaca level as a base line, must come down full 300 feet.

SWINDLING PATENT SELLERS.

We have received of late a great number of letters calling our attention to the rapid growth and extension of the frauds perpetrated upon inventors by inducing the latter to forward sums of money, as pretended fees, to certain agents who pretend to sell patent rights. Some time ago, we had occasion to show up these knaves, and warned our readers to beware of them, mentioning an instance of some scamps in the West receiving not only money but models, the latter of which they either left in the express office or behind them in a loft when they decamped from the town, while they, of course, applied the funds to their own benefit. We are led once more to revert to the subject by the reception of several queries regarding a "Mississippi Valley Manufacturing Company," doing business in Vicksburg, Miss. One correspondent, among the many, favors us with a copy of the letter received by him, which reads as follows:

(Handsome letter head of buildings, etc.)

Mississippi Valley Manufacturing Co.

January 13, 1874.

Mr. ————
Dear Sir:—Will you, upon receipt of \$1,200 cash, allow us to have your coupling for gas and water mains manufactured to supply the trade of the South and West, for the term of two years upon a royalty of \$5.00 per dozen made? If you desire to dispose of your invention in this manner, send \$5.00 to pay part of the attorney's fees for examining title, etc. Upon receipt of same, we will make the necessary inquiries at the Patent Office, and also have your invention examined before a board of competent judges, when, if everything proves perfectly satisfactory, we will remit the amount by draft on any bank you name, the same to be subject to your order upon the receipt by us of the necessary transfer. Our arrangement will not prevent you from selling any State you may receive offers for. Comply at once with our terms, if you wish us to take hold of it. Yours truly,

MISS. MANUFACTURING CO.

This swindle is so very palpable that one is almost at a loss to understand how any person can be so foolish as to be deceived by it; and yet another correspondent, who has interviewed an official at Vicksburg regarding the subject, says that large numbers of letters are constantly sent to the above address. Inquiries, made as to the business location of the recipients of these missives, revealed a little room in a "decayed part of the city," the whole contents of which would not exceed twenty dollars in value. The parties are young men who are leading a fast and dissolute life on the money thus fraudulently obtained. The inventor rarely receives an answer to his letter enclosing the funds. The Vicksburg Herald has also investigated the matter, and remarks: "We have only to say, for the protection of people everywhere, that we have never heard of any such company, and that it exists only in the imagination of the swindlers who are trying to defraud the public." So much for the Mississippi Valley Manufacturing Company. Still another correspondent asks for information concerning the Western Michigan Patent Agency, Grand Rapids, Mich. This very enterprising firm wants only ten dollars and a model, to make the inventor rich. The writers ask if these gentry are related to the scoundrels who were located in Albion, Mich., some time since, and who flourished under another name.

It is curious to note with what alacrity people will risk good money for the chances of a large profit. The same feeling which induces the ignorant to stake funds in lotteries, where the probabilities are all against them, impels others to transmit their cash to persons of whom they know nothing in the hope of thus securing some enormous gain. It may be laid down as an infallible rule that an invention that is really valuable can always be disposed of privately and readily for its full worth, and the owner of the right, fully appreciating this fact, is never beguiled by such dazzling

baits as are offered by these swindling agencies. We are perfectly well aware that it is about as hard to show an inventor that his device, when once patented, is of small utility and value, as to convince a mother that her baby is ugly, and both individuals usually resent the imputation in about the same manner. It is these very inventors, however, who, having exhausted every plan to dispose of their rights, snap at the allurement artfully held out to them, and of course are fleeced. The world gives little sympathy, for it laughs at their veridancy in being so readily deceived; but when the trials, the labor, and expense, which these men incur to carry out their cherished ideas, be reflected upon, the subject becomes more one for pity than for derision.

We would once more warn the people against not only the attempts to defraud, above exposed, but against every other they may receive that even appears of similar nature, particularly against specious parties who, for a certain sum, agree to sell a patent and advertise it in some patent journal or other obscure circular or sheet. It is very rarely that these men ever effect a sale; and if they be swindlers, they dare not announce the fact, if they have done so. Indeed, if any of our readers desire to prove for themselves the genuineness of the offers of their correspondents, they have only to write to the latter for the names of reputable persons whose patents have been sold through their agency; and if any be returned personal investigation will soon determine the question of authenticity.

FAILURE OF THE NEW TELEGRAPH LINE BETWEEN EUROPE AND AMERICA.

We are sorry to know that the new enterprise which was intended to secure the opening of telegraphic communication between the old and new worlds at reduced prices, has, according to the latest advices from London, become a failure. The money paid in has been returned to the stockholders. The title of the organization is the Light Cable Telegraph Company, and they have for some time been engaged in winding the wire preparatory to sinking an ocean cable from Great Britain to our coast of New Hampshire, *via* the Azores, Newfoundland, and Nova Scotia. The charge for messages was to have been 50 cents a word, the present rates being one dollar per word.

The capital of the company was \$2,000,000. The cable was to have been much lighter and cheaper than any ocean cable of equal length. The conducting wires were protected by a simple covering of tarred Manila hemp, which has been found by experience to be almost indestructible in salt water. The weight of the new cable was only a little over 700 lbs. to the mile, or 150 lbs. per mile in water. Messrs. Mitchell & Co., Newcastle, Eng., have lately completed a new steamer of 5,000 tons burden, specially intended to receive and submerge the new cable, the laying of which was expected to commence about the middle of June next.

The engineer and electrician was Mr. Robert Sabine. Sir Samuel Canning was the consulting engineer. We still hope that a reorganization may be effected on a basis that will insure the laying of the cable.

RELATIVE RIGHTS OF EMPLOYERS AND WORKMEN IN RESPECT TO INVENTIONS.

If there were likely to be any permanency or reliability in the official decisions of the Patent Office, the case of interference which we publish herewith, on another page, would be of interest and value. It exhibits in a tolerably clear light the relative rights of employers and employees in respect to the ownership of inventions. The doctrine now held by the Patent Office is that the inventor has the right to avail himself of the mechanical skill of those whom he employs to put his invention into practical form. If the inventor gives general directions to his workman to produce a certain machine, the combination of parts or arrangement so produced belongs exclusively to the inventor, and the workman has no patentable right therein. This should be distinctly understood and remembered by workmen. But when a workman himself suggests and invents an improvement, without previous direction from his employer, the invention belongs to the workman, and the employer has no claim thereon, although the device may have been made in the shop of the employer, with his tools, and during time belonging to him. This should be distinctly understood and remembered by employers.

THE OIL DEPOSITS OF THE GREAT WEST.

About eight hundred miles west of Omaha the line of the Union Pacific Railroad crosses Green River, and the approach to the river is for a considerable distance through a cutting, of from 20 to 40 feet in depth, made in rock. During the construction of the road, some workmen piled together a few pieces of the excavated rock as a protection for a dinner fire, and soon observed that the stone itself ignited. The place thereafter became known as Burning Stone Cut.

The general superintendent of the road, Mr. T. E. Sickels, has caused analyses and experiments to be made with this substance, which proves to be a shale rock, rich in mineral oils, which may be produced by distillation in abundant quantities, say thirty-five gallons to the ton of rock, at the cost of a few cents only per gallon. The oil thus obtained is of excellent quality and comes over in two or more grades one suitable for burning and one for lubrication. Its abundance and cheapness of production is such as to render it certain that the markets of the Pacific coast, and all places west of the Mississippi, will ere long be wholly supplied from these deposits. The oil can be distilled, delivered, and sold at the points indicated, at cheaper rates than the Pennsylvania and West Virginia oils can be transported to the Mississippi.

The deposits in question are supposed to cover an area of territory one hundred and fifty miles long and fifty miles

broad. They overlie the immense coal beds found in that region, and consist of sandstone impregnated with oil. They are supposed to have originated by the absorption of oil by sand, the oil having been expelled from the ancient vegetable growths by heat and pressure, during the original process of coal formation.

These rich oil shales may be loaded directly into the cars from their native ledges on each side of the track of the existing railway, and their possession must ultimately yield an immense revenue to the company.

ENFORCEMENT OF UNAUTHORIZED CAVEAT RULES.

It has heretofore been the practice of the Patent Office to permit the widest liberty to inventors in the matter of their caveat papers. A photograph, a pen and ink sketch, a drawing of almost any kind, has sufficed, and this freedom has always been a matter of much satisfaction to persons engaged in studying and working out inventions.

In the other departments of the Patent Office, the inventor has been subjected to trouble and expense by the introduction of new rules, or the addition of new forms and ceremonies in the obtaining of patents. The one oasis in the Patent Office desert has been the caveat bureau. Here the inventor has always felt that restrictions were to a great extent removed. He was at liberty to block out his papers in the crudest style if he pleased, and, by payment of ten dollars, have them stuffed away into the official pigeon holes, taking an official receipt therefor. He has always known that his chances of receiving official notice of competing applications for patents were improved by having his caveat papers prepared in a clear and careful manner. Nevertheless, in very many cases, he prefers to describe his invention in his own style in the caveat, even if the officials make his lack of time an excuse for their neglect to send him the notice. Even without the notice, he has found the free caveat facilities, heretofore afforded by the Patent Office, to be a real convenience and comfort.

But the Commissioner of Patents has concluded to deprive the inventor of these satisfactions by requiring that, hereafter, all drawings for caveats shall be done according to the red tape rule. Photographs and ambrotypes (which, by the way, are the cheapest, most convenient and best modes of clearly reproducing a new thing) are now excluded from caveats; so are the ordinary pen and ink and pencil drawings, done on common foolscap paper, uniform with the specification. Inventors who wish to file caveats must now furnish drawings or tracings done on the official sizes and separate from the specifications. Few inventors can do this. They must in future employ agents to make special drawings for them, and pay special charges therefor, thus considerably increasing the expenses of the caveat.

We think this enforcement of rules is entirely unnecessary. It is doubtless a convenience to the clerk who files the caveats, and probably the papers look a little better to the official eye, when filed, if all are uniformly executed. But it is doubtful whether the rule will serve any other purpose. It will certainly subject the caveator to increased expense and inconvenience.

In respect to the filing of applications for patents, the law is very specific. It recites that the applicant shall file a full, clear and concise description of the invention, framed in such exact terms as to enable any person skilled in the art to make, construct and use the same. When the nature of the case admits, drawings must be furnished, and also a model.

In respect to caveats, the law contains no such requirements. It reads as follows:

"Any citizen of the United States, who shall have made any new invention or discovery, and shall desire further time to mature the same, may, on payment of the duty required by law, file in the Patent Office a caveat setting forth the design thereof, and of its distinguishing characteristics, and praying protection of his right until he shall have matured his invention; and such caveat shall be filed in the confidential archives of the Office and preserved in secrecy, and shall be operative for the term of one year from the filing thereof; and if application shall be made within the year by any other person for a patent with which such caveat would in any manner interfere, the Commissioner shall deposit the description, specifications, drawings, and model of such application in like manner in the confidential archives of the Office, and give notice thereof, by mail, to the person filing the caveat, who, if he would avail himself of his caveat, shall file his description, specifications, drawings, and model within three months from the time of placing said notice in the post office in Washington, with the usual time required for transmitting it to the caveator added thereto, which time shall be indorsed on the notice. And an alien shall have the privilege herein granted, if he shall have resided in the United States one year next preceding the filing of his caveat, and made oath of his intention to become a citizen."

It will be noticed that the law does not prescribe the supply of drawings or models, but leaves the creator free to make up the contents of his caveat to suit himself. We believe that the Commissioner's stringent rule in regard to caveats is not warranted by law. Rule 97 reads as follows:

"When practicable, the caveat must be accompanied by full and accurate drawings, separate from the specifications, well executed on tracing muslin or paper that may be folded, and of the same size as demanded in drawings for patents."

Under the general powers of the Commissioner, he may doubtless give minor directions as to the size of sheets, etc.; but in ordering that the caveat must be accompanied by full and accurate drawings, separate from the specifications, he probably exceeds his authority. We hope the order will be modified so as to bring it within the terms of the law, while

granting the utmost possible latitude to the caveator in preparing his papers.

MOUNT SINAI.

The exact location of this memorable spot, sacred in the minds of all Christian people as the place where Jehovah appeared to man in fire; where the Ten Commandments were written by the finger of the Lord upon two tables of stone and delivered to Moses—has always been unsettled. But a Calle telegram announces that all doubt is now removed. Dr. Beke, the celebrated scholar and traveller, gives as the result of his recent expedition the discovery of Sinai and the finding of verifying inscriptions, of which he has made copies. The cable despatch says that the expedition places the holy mountain at "a day's journey northeast of the village of Akaba, Arabia, at an altitude of five thousand feet above the level of the sea."

Dr. Beke has long maintained that Sinai was an extinct volcano, and the correctness of that opinion is now said to be fully confirmed by his personal explorations. Indeed, the Biblical account of the manifestations, which took place at Sinai in the presence of the tribes of Israel, corresponds in several respects to the descriptions given in these modern times of the volcanic eruptions of Vesuvius. In the nineteenth chapter of Exodus the following graphic narrative is presented:

"And it came to pass on the third day in the morning that there were thunders and lightnings, and a thick cloud upon the mount, and the voice of the trumpet exceeding loud; so that all the people that was in the camp trembled."

And Moses brought forth the people out of the camp to meet with God; and they stood on the nether part of the mount.

And Mount Sinai was altogether on a smoke, because the Lord descended upon it in fire; and the smoke thereof ascended as the smoke of a furnace, and the whole mount quaked greatly."

Moses then went up the mount, and the Ten Commandments were proclaimed; the inspired narrator adds:

"And all the people saw the thunderings, and the noise of the trumpet, and the mountain smoking; and when the people saw it, they removed and stood afar off."

Subsequently, it will be remembered, the Israelites forgot their vows and went back to heathenish practices of idol making, and set up a metallic calf. Moses, on coming down from the mount, had the tables of stone in his two hands; and when he saw the molten calf, he threw down the tables and broke them in pieces. Then he broke up the idol, pounded it into fine dust, which he scattered in a brook that came down from the mount. The inspired narrative then tells us how, by prayer, the Lord was appeased, and He commanded Moses to hew out another pair of tables, and take them up the mount, which he did. Whereupon the Lord again wrote out the same ten commandments as at first, and gave the two new tables to Moses, who brought them down from Sinai and put them in an ark which he had made of shittim wood, "and there they be." Deut. X, 5.

It would be interesting to know what kind of stones are conveniently found at Sinai, out of which Moses might have hewn the tables. From their light weight, indicated by his carrying one in each hand, going up and down the mountain, it would seem as though they might have been composed of slate or other laminated formation. We presume that Dr. Beke's report will give full particulars of the geology of the neighborhood, and perhaps tell us something new about the Mosaic stones.

PLEASANT WORDS.

We are receiving so many kind letters of encouragement and approval of our efforts that, while we should delight in returning our sincere thanks individually to each writer for his good wishes, we would but trespass on the good nature of our readers in monopolizing too large a space in columns which might be filled with more generally interesting matter. We trust, however, that we may not lay ourselves open to the imputation of undue egotism by quoting a few of the pleasant words we receive, since we do so more to mark our appreciation of the spirit which prompts them than for the benefit they may secure to us in the commendation which they express:

"I have completed my quarter of a century as a reader of your paper, and a good portion of that time have been a direct subscriber. I thought to do without the SCIENTIFIC AMERICAN this coming year, but it won't work, so I try it another year. I have been trying to find fault with it all my life, and for all I know will continue trying, and so far unsuccessfully," says one correspondent, and a score or so more writers echo about the same opinion. The *Science Record* for 1874 is also coming in for its share of approval. A letter before us says: "It is a perfect storehouse of valuable and instructive information," and another reader tells us that the lady members of his family join with him in thinking it "one of the most useful and interesting books in the library." For all of which very flattering comments we metaphorically disapparel our heads, make our very best bow, and, with conscious unworthiness, return acknowledgments as grateful as they are sincere.

SCIENTIFIC AND PRACTICAL INFORMATION.

TRIAL OF THE WATER WORKS AT ROCHESTER, N. Y.

The water works of the city of Rochester, N. Y., constructed on the Holly system, have recently been completed, and on the occasion of a public test developed a power and capability which may be fairly considered as unprecedented. The machinery consists in two sets of pumping engines, each of four double acting cylinders 9×24 , each set being arranged to take suction and discharge at eight suc-

cessive and equal points during the revolution, to give a uniform and steady flow. These supply the mains and pipes for ordinary use and are run by two turbine wheels driven under a 90 foot head. There are also two pairs of double cylinder steam engines, actuating four double acting pumping engines $10\frac{1}{2} \times 27$, a 150 horse rotary Holly engine, and two rotary Holly pumps. The capacity of all is not less than 4,000,000 gallons per hour in the street mains per 24 hours, and 3,000,000 gallons in the same time can be delivered extra, by the steam machinery. The water is taken to the city by an aqueduct from Hemlock Lake. On the occasion of the trial, says the *Rochester Union*, the works succeeded in throwing thirty large streams at one time, to a sufficient height to be efficacious in cases of fire, reaching an average altitude of 135 feet; one two inch stream was thrown up 220 feet; one four inch horizontal stream was thrown 465 feet; one three inch stream reached an altitude of 285 feet; a four inch vertical stream was thrown 287 feet; and a vertical stream five inches in diameter was thrown 250 feet! These are, indeed, astounding facts. It was, however, in the thirty stream test that the practical usefulness of the system was most clearly demonstrated. The four and five inch streams could rarely if ever be rendered useful for fire purposes, and it is doubtful whether under any circumstances it would be safe to have recourse to them. So great is the force of the torrent thrown from the standing pipes that few buildings in any city would be able to stand up long under it.

A NEEDED IMPROVEMENT IN SUGAR MAKING.

Mr. José Guardiola, of Hacienda, Chocó, Guatemala, the inventor of several improved machines for sugar making, coffee drying, etc., descriptions of which were some time since published in these columns, forwards us a letter inquiring whether there is any means by which sugar drained in centrifugal machines can, after the operation, be compressed into loaves or square cakes, so as to remain as hard and compact as ordinary sugar loaves drained in the mold. To drain sugar in a centrifugal machine is an operation which takes but a few minutes, and has the advantage of economy of time and cleanliness; while on the other hand purging sugar in molds requires from six to ten days, increased expenses, more buildings, and greater waste. Our correspondent thinks that pressure will not effect the desired result, but we hardly agree in this view. As long ago as thirty years, sugar was pressed in copper molds. In regard to his inquiry above, however, we learn upon investigation that, if the crystals are compressed when damp and the sugar put into a drying room heated to a temperature of 130° , adhesion will be likely to take place.

THE CHILI EXPOSITION.

In relation to the projected international exposition, to be held in the fall of 1875, in Santiago, Chili, our manufacturers would do well to bear in mind that at the present time fully ninety-five per cent of the trade with Chili is monopolized by England, as against five per cent with the United States. The South American Republics undoubtedly offer a great market for our productions, and it would seem, from our geographical position, that the advantages of the same should be to us instead of to Great Britain. The reason is, however, the lack of as extended means of communication between the United States and Chili as exist between Chili and England; but it would appear that, were the limits of trade between the two first mentioned countries enlarged, the facilities for its greater pursuit would necessarily follow. We have received a prospectus of the enterprise, which gives full particulars. Information may be obtained from Mr. Stephen Rogers, Consul for Chili, 249 West 42d street, New York city.

STEAM ON THE CANALS.

The commissioners appointed to examine the inventions submitted as appliances for steam navigation of the canals, and in competition for the reward of \$100,000 offered by the State of New York, have made their final report to the Legislature. The committee were not unanimous, owing, as they state, to the ambiguity and extreme stringency of the law creating the commission, and were unable to make the award under the circumstances, and they leave to the Legislature the question of compensation. Mr. Baxter's boat, they admit, distanced all competitors, but it is believed that Mr. Dobbin's device also possesses great merits, so the matter is compromised by suggesting that \$35,000 be paid to the first named inventor on his placing upon the canals seven vessels, built and equipped in like manner as the boat tested, and \$15,000 to Mr. Dobbin on his supplying three, constructed according to his plan. It seems to be the general opinion that the act providing for the above mentioned sums will be passed and the matter thus ended.

THE RAPID PROPULSION OF FLOATING BODIES.

It has been remarked in England that, on the canals, the boats, when drawn by horses at a considerable degree of speed, float higher in consequence of the oblique action exercised by the water. Impelled at an enormous velocity, floating bodies would merely scrape along the water, like a *ricochet* bullet.

The English Admiralty recently charged Mr. Froude to examine into the phenomenon; and he finds that the laws of the resistance of a plane surface, A , placed in the water under an angle, θ , are the following: $P = 3.43 A v^2 \sin. \theta$ for a plane deeply immersed, and $P' = 2.14 A v^2 \sin. \theta$ for a plane placed at the surface. The vertical component is $P \cos. \theta$.

An example will render this clearer: A floating body displacing 2,500 tons, of which the bottom has an inclination of 4 inches to a foot, is given a velocity of 16 knots, that is 26.4 feet per second, and thus causes an emersion of 171 tons. Substituting the latter number in the formula, the velocity gained will be 7.6 feet per second.

(Christmas Lectures at the Royal Institution, by Professor Tyndall.)

ON THE MOTION AND SENSATION OF SOUND.

It is needless for me to say to the ladies and gentlemen who honor these lectures with their presence, that they are intended more especially for the instruction of boys and girls. As in all other cases where it has fallen to my lot to teach others, I shall endeavor, while avoiding superficiality, to strip the subject of all unnecessary difficulty, and of all parade of learning, and to present it in simplicity and strength to the youthful mind.

The title of the lectures is "The Motion and Sensation of Sound." Now every boy knows what I mean when I speak of the sensation of sound. The impression, for example, of my voice at the present time upon the organ of hearing, is the sensation of sound. But what right have I to speak of the motion of sound? This point must be made perfectly clear at the beginning.

For this purpose I will choose from among you a representative boy, or allow you to choose him, if you prefer doing so. This boy, whom you may call Isaac Newton or Michael Faraday, will go with me to Dover Castle, make the acquaintance of the general commanding there, Sir Alfred Horsford, and explain to him that we wish to solve an important scientific problem. He is sure to help us; he will lend us a gun, and an intelligent artilleryman; and we will make arrangements with this man to fire the gun at certain times during the day. We set our watches together; and now, before quitting him, we ask the artilleryman to fire one shot. We are close at hand, and we observe the flash and listen to the sound. There is no sensible interval between them. When we stand close to the gun, flash and sound occur together.

Well, we quit the artilleryman, warning him to fire at the exact times agreed upon. Let us say that the first shot is to be fired at 12 o'clock, the second at 12:30, and so on every half hour. We quit our artilleryman at half past eleven, descend from the castle to the sea shore, where a small steamer is awaiting us. We steam out a little better than a mile from the place where we have left the artilleryman; and now we pull out our watches and wait for 12 o'clock. Newton at length says: "In exactly half a minute the gun ought to fire;" and, sure enough, at the exact time agreed upon, we see the flash of the gun. But where is the sound which occurred with the flash when we were on shore? We wait a little, and precisely five seconds after we have seen the flash we hear the explosion; the sound having required this time to travel over a little better than a mile.

We now steam out to twice this distance and wait for the 12:30 gun. We see the flash, but it requires ten seconds now for the sound to reach us; we treble the distance, it requires fifteen seconds; we quadruple the distance, and find the sound requires twenty seconds to reach us. And thus, if the day were clear, we might go quite across to the coast of France and hear the gun there. In all cases we should find that the flash appeared at the precise time agreed upon with the artilleryman, which proves that light reaches us in so short a time that our watches fail to give us any evidence that the light requires any time at all to pass through space, while the sound reaches us later and later the farther we go away. I think these experiments give us every right to speak of the "Motion of Sound."

But they also inform us how the velocity of sound has been actually determined. The most celebrated experiments on this subject have been made in France and Holland. Two stations were chosen, ten or twelve miles apart; guns were fired at each station, and the interval between the flash and the report was accurately measured by the observers at the other station. In this way it was found that, when the air is at the temperature of freezing water, the velocity of sound through it is 1,090 feet a second. On different days we should find it traveling at different speeds—as the weather grows warmer, the sound is found to travel faster.

But I must not let you go with the idea that light requires no time at all to pass through space. This great problem has also been solved; and we now know that, while sound moves at the rate of 1,090 feet a second, light passes over the almost incredible distance of 186,000 miles in the same time. Hence, in the distances employed in our observations, our watches were entirely unable to inform us that light required any time at all to pass through space.

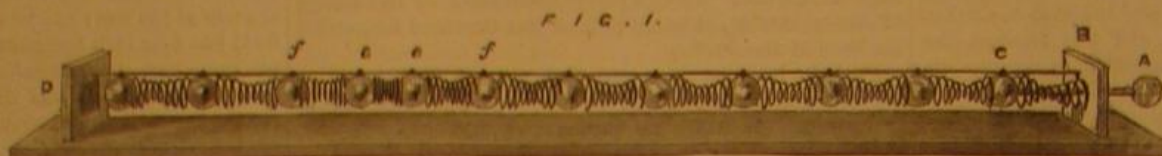
But if I stopped here, your next question would be: What is this thing which passes through the air with a velocity of 1,090 feet a second, and which, when it reaches us, makes us hear an explosion? We must give a thorough and complete answer to this question, but to do this we need a little preparation. Like sailors going into battle, we must clear our decks for action; and here I must ask you to give me your patient and resolute attention.

In order to know how sound is propagated through the air, we must first know something regarding the air itself. Let us examine the air.

First, the air has weight. It presses upon a single square foot of this table with the weight of nearly a ton ($144 \times 15 = 2,160$ lbs.) I have here a glass cylinder covered at the top

with a sheet of india rubber. The air presses on that surface with the weight of nearly 900 lbs. But then you will ask how the india rubber bears it. Why is it not pressed in? Because air is on both sides of it, and the pressure on the inside is exactly equal to that on the outside. But if I take away the air from the inside of the cylinder, you will soon see the india rubber pressed down by the weight of air above it.

[A tube from an air pump was then attached to a pipe communicating with the interior of the cylinder, which stood on a brass plate, so which its edges were ground parallel; the pump was set in action, and the india rubber diaphragm at once sank down, in the end clinging to the sides of the glass, forming a deep vessel, lining the inside of the cylinder.]

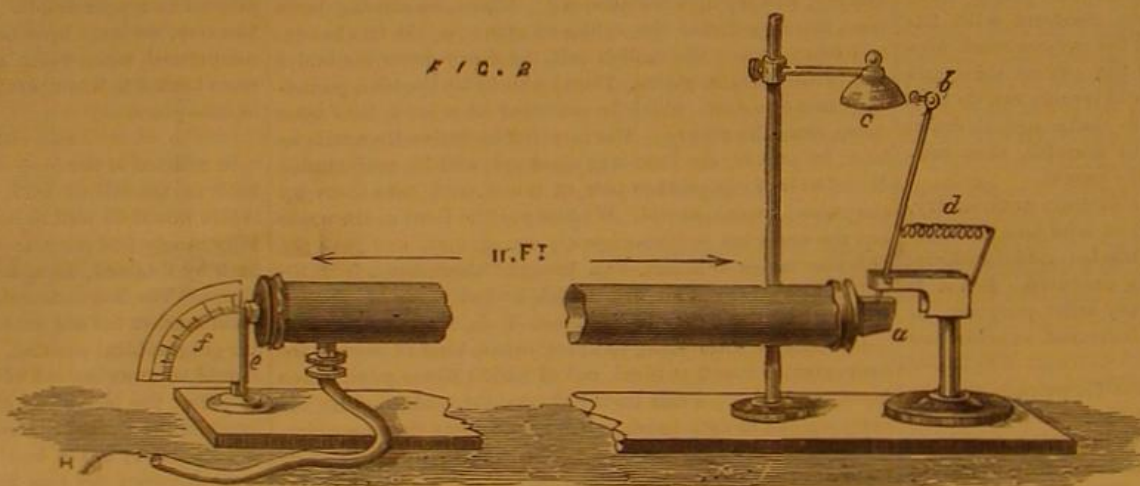


When the air is let in again, you observe the rubber returns slowly to nearly its primitive position; it would entirely, but that the india rubber is a little over stretched.

We have thus seen the effect of removing the pressure from the inside. What would occur if we took the outside pressure away? The india rubber would expand. Instead of trying to remove the whole of the air from this room, which is impossible, I will cover these two slack and collapsed bladders with this glass vessel, fitting accurately on to the plate, over which they are suspended; and then draw off by the air pump the air surrounding them. See how they gradually blow out; the folds are now nearly abolished; now they have become quite smooth.

Why is this? Because the air particles have the power of pushing one another apart, and thus take up sufficient space to fill the bladders when the external pressure is removed. The air in this room is pressed upon by the weight of the whole atmosphere. The repelling force which the air particles exert upon each other is called the elastic force of the air.

Now we have to consider how the sound of the gun is propagated through air. Does the gun fire anything through



air? No. We may, in a rough way, represent the particles of air by the solitaire balls arranged in a row close together in this groove. I take the first one and roll it against the second. You observe the row does not move, only the end one goes away. The first delivers up its motion to the second, and then stops, the second delivers its motion to the third, the third to the fourth, and so on until the last, which, meeting no resistance, flies off. In this way we may figure the motion as transmitted from particle to particle of the air.

A still better idea may be derived from this model (Fig. 1), which has been devised by the ingenuity of my assistant, Mr. Cottrell.

In my hand I hold a stem, A, passing through the upright, B, by which a shock can be sent from a ball, C, through a spring, to another ball, thence through another spring to another ball, and so on, until at last the shock reaches the last ball, which is projected against the india rubber pad at the end, D, placed there to represent, in a rude mechanical way, the drum of the ear. I press the stem, A, with a sudden motion of my hand, and you see that, though the ball, C, only moves to and fro, yet it sends forward a kind of pulse, *feeef*, which travels along the line, and ultimately causes the last ball to give a smart stroke against the pad, D.

If you could creep into the tube of the ear, you would find, a little way in, a beautiful fine membrane called the tympanum, or tympanic membrane. The shock of the pulses of air falling on this membrane causes it to shiver; its tremors are transmitted to the auditory nerves, and by them are conveyed to the brain; and cause you to have the sensation which we call sound.

You ought to be able now to figure the way in which the explosion of this popgun is transmitted through the air. I place a ramrod in the tube; there is a cork in the other end; and pushing the rod towards the cork, I cause a crowding together of the particles of air; this they resist, as I can feel by the force I am compelled to exert, and at last their combined resistance takes effect by blowing out the cork at the other end with a sort of explosion.

The suddenly expanding air communicates its motion to the air adjacent to it; this again to the air further off; finally the condensed pulse strikes the tympanum of your ears,

and you hear the noise. I can show you the passage of a pulse through air in another way. We have here a tube 11 feet long, and about 4 inches wide, its two ends are closed by thin sheet india rubber. Against the india rubber surface at one end a cork gently presses (as in Fig. 2, a); to the cork a slender stem is attached, having a little hammer at its upper end, b, kept from striking the bell, c, against which it abuts, by a slender wire spring, d. If now a pulse be sent from the other end of the tube, the india rubber will drive away the cork, and will drive the hammer against the bell. A dull push will not ring the bell at the further end. The particles of air are very mobile and readily slip round one another, so that it requires a sharp shock to generate a sound wave in the tube and make the bell ring outside the tube. I tap sharply with my fingers on the india rubber, and the sound of my tap and the blow of the hammer, upon the bell at the other end of the tube, are audible at one and the same time. This tube is 11 feet long; sound travels through air of the temperature of

this room at about the rate of 1,100 feet per second; the time therefore taken by the sound wave, in traversing this tube, is $\frac{1}{10}$ of a second, an interval of time far too minute to be measured by our ears.

Air is therefore a carrier or transmitter of sound. Suppose we remove the air from about a sounding body, will it then be heard? This experiment was made by Mr. Hawksbee, a great many years ago (1705). A bell with a hammer worked by clockwork is placed under a glass globe. From the globe we will pump as much of the air as we can. At present you hear the sound with perfect distinctness; the pumping has at first apparently little effect upon the sound, but very soon it dies away, and now you see the hammer thumping away upon the bell, without producing any noise. It is doing its work in perfect silence. I allow the air to re-enter the glass globe, the tinkling sound of the bell is soon heard, and quickly grows up into the usual musical ring.

We have therefore proved that when the air is removed we have no sound, and when the air returns the sound returns also.

We will now follow the matter up a little further. Professor Leslie found that, when a little air was in the chamber surrounding the bell, and you could hear a little sound, if the space from which the air had been taken was filled up with hydrogen, the hydrogen quenched the sound. Now Professor Stokes has shown us that to create a sound wave in hydrogen a sharper tap is necessary than in air, so that the shock that produces a sound wave in air does not suffice to produce a sound wave in hydrogen (which is a much lighter and less dense gas).

My assistant, Mr. Cottrell, has devised the experiment I am about to show you to demonstrate this effect.

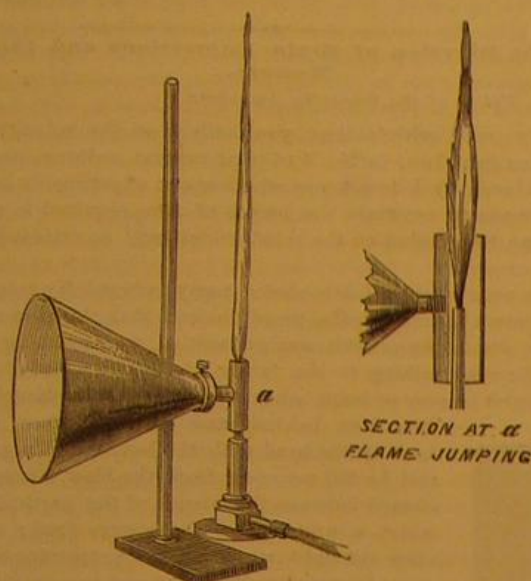
I have a long tin tube (Fig. 2) narrower than the one I used just now, but having, like it, a piece of india rubber stretched over each open end, with a hammer and bell arranged against one of them, as before; at the other is a cork hammer fixed to a thin strip of steel, which can be drawn back to any given distance (measured on *f* graduated card). I have thus the means of sending a pulse along the tube as before and making the bell at the other end sound, but I now do it by a stroke of measured force. I now let hydrogen into the tube at the end adjacent to the striking cork (by the tube, H), which is a little lower than the other end; and while the hydrogen is entering I continue to send pulses of measured strength along the tube, the bell continues to sound for a little while, but in one minute a sufficient amount of air has been displaced to cause the bell to cease ringing. When we remove the hydrogen, you again hear the bell, showing that the pulse can again be carried from end to end of the tube.

Up to this point our illustrations have been audible; I now wish to render visible to you the action of a tube in preventing the dissipation of the sound. The test that I propose to use is a flame. I have behind the table a good sized gas holder, by which gas can be forced through a steatite burner. I light it, and we have that long pointed flame (a, Fig. 3), and we shall find that that flame is very sensitive. Chirrup to it, and see how rapidly it answers; a great part of the length of the flame is abolished instantly when the sound wave reaches it (b, Fig. 3). I rattle money, tap two keys, and this flame jumps in response to each jingle that I

FIG. 3.

make. The current of air in the room, owing to our care for your comfort in the matter of fresh air, prevents these phenomena showing themselves as well as they do when the theater is empty; but they are perfectly manifest. No one in this room can hear my watch ticking; but if I hold it near the flame you can distinctly hear the flame give a little roar, and see it suddenly shorten for each tick of the watch. The regularity with which it jumps indicates the regularity with which my watch is ticking.

Fig. 4.



And now observe the action of a tube in preventing the dissipation of sound. Using a less sensitive flame as the sound test, I take off the india rubber ends from our 11 foot tube, and place the flame at the end furthest from myself. The tapping of these two keys together does not affect the flame; but now, my distance from the flame being as great as before, I tap them opposite the open end of the tube, and each tap is rendered, by means of the flame, as visible to your eyes as it is audible to your ears.

Through the unconfined air this small bell does not affect the flame when set ringing; but when I place it at the extremity of the tube, the flame dances to each stroke. Speaking pipes possess their value solely from their preventing the dissipation of the sound pulses; they act precisely as this tube does.

As you know, light cannot well get round a corner; neither can sound, though it does so more easily than light. This little bell acts automatically. I wind it up and start it. At a few feet distance the flame answers to each stroke. Placed behind a board, the flame becomes tranquil. I again bring it out from behind the board, and the flame jumps to each movement of the hammer. (For this experiment the sensitive flame was arranged as in Fig. 4, with a large glass funnel having its tubular end opposite the root of the flame; the board was held about 10 feet distant from the mouth of the funnel.) Sound therefore can be shaded off in the same way that light can be.

In this box, which is well padded, is a bell which I can set ringing at pleasure. The only way by which the sound can get out is this small square opening at one side of it. The bell is now ringing without affecting the sensitive flame (arranged as in Fig. 4); but when this box is turned round, so that its opening faces the quiet flame, we have it dancing and jumping as before.

In other respects also there is a similarity between the mode of action of sound and light.

When a beam from the electric lamp is allowed to fall upon the glass mirror in my hand, it is reflected from the mirror, and, the track of the beam being marked by the dust floating in the room, you can see the direction which it takes. This is in accordance with a well known law, namely, that the angle of incidence is equal to the angle of reflection. It is perfectly plain to you that a line drawn so as to fall at right angles upon this mirror would divide that large angle formed by the two beams of light into two equal angles.

I hope now to make visible to your eyes the reflection of sound in obedience to the same law.

At one corner of the lecture table I place our sensitive flame, *b*, at the opposite corner the padded box containing the electric bell, *a*, with its opening directed in the path taken a moment ago by the beam of light, and I will hold this board, *c*, when everything is ready, where I before held the glass mirror. My assistant will now set the bell ringing. You observe that the flame is uninfluenced by it; but when I bring the board forward, the shortening of the flame at each stroke of the bell proves that the law of the reflection of sound is the same as the law of the reflection of light; the angle of incidence is equal to the angle of reflection. In this case the flame is knocked down by an echo.

We have thus considered the reflection of sound from a plane surface; let us now see if it behaves like light when reflected from plane surfaces.

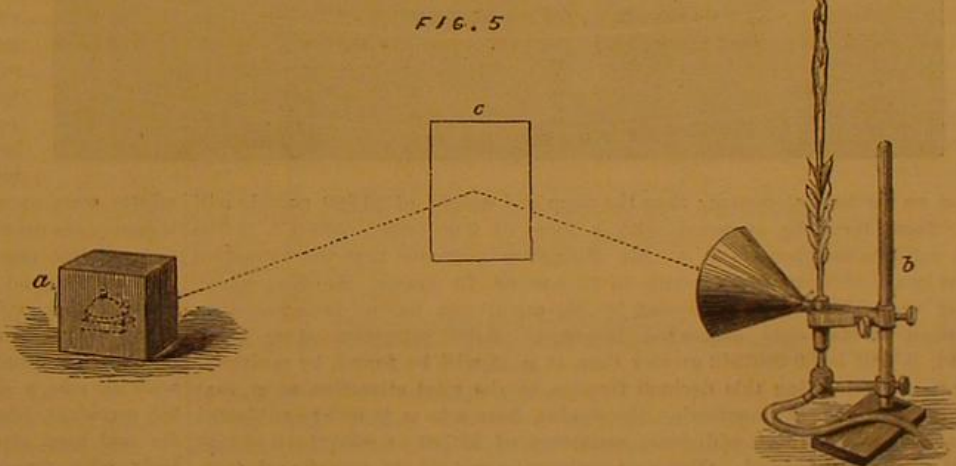
The beam of the electric lamp is now directed upon the

concave mirror. You can see the band of light marked in the fine dust floating in the air; as soon as it strikes the polished surface it is thrown back, but the rays no longer pursue parallel paths, they are converged, thrown together into one spot. By holding a piece of tracing paper at the point where they meet, termed the focus, the brilliant little star of light caused by their convergence is made visible.

Substitute for the lamp a small bell, and for the tracing paper at the focus of the mirror our sensitive flame, and the conditions are the same as in the previous experiment, sound waves taking the place of the waves of light. You cannot see the track of these aerial pulses as you could the luminous ones, but their obedience to the same law of reflection is very manifest by the shortening of the sensitive flame as each sound wave reaches it. The flame, when out of the focus of the mirror, is unaffected; replace it in the spot when the sound waves are crowded together, and it responds to each stroke. Move the bell so that the sound pulses, though only having the same distance to travel to the flame, no longer fall on the mirror; the flame remains perfectly quiet.

We may go further still. Here are a pair of mirrors, the curvature and size of which is the same. They are arranged so as to face one another. A light is placed in the focus of one, that its rays which fall divergent upon the curved surface are reflected from it parallel; they travel to the opposite mirror, and are again converged; a piece of tracing paper held at the focus of the further mirror shows the spot of light as before (Fig. 6).

Sound is reflected in precisely the same way, and the sensitive flame, when carefully manipulated, can be used as a means of proving this fact. For these experiments it is essentially necessary that the flame be reduced to the proper pitch of sensitiveness. By reducing the pressure of the gas we can regulate the flame so that it will not respond unless strongly agitated. The flame is placed in the focus of the mirror, *a*, and when the bell is rung, not being in the focus of the conjugate mirror, there is no action. I now bring it into the focus, *b*, and the flame shows a very strong action. By other modes of experimenting it has long been ascer-

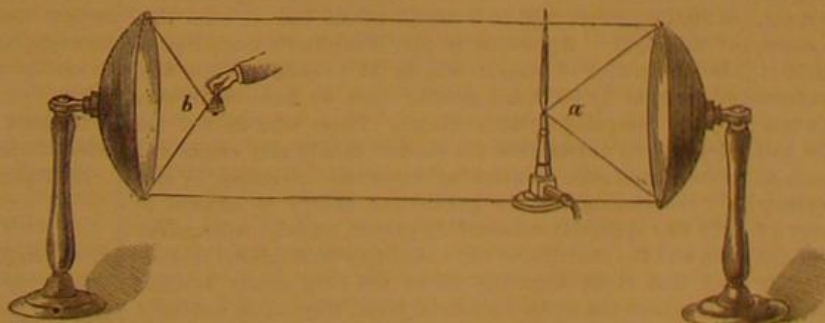


tained that sound was thus reflected from plane and curved surfaces; but never before have these phenomena been made visible. Hitherto these effects have been investigated by the sense of hearing; I have now been able to prove them by appealing to your eyes.

New Fossil Man.

In the *Revue Scientifique* for December, it is stated that a third skeleton of a troglodyte has been discovered by M. Rivière in the caves of Mentone. This new skeleton, judging from the various and numerous implements by which it was surrounded, lived at an epoch far more remote than that assigned to the skeleton now in the Museum of Paris. The warlike instruments and objects found with them, though

Fig. 6.

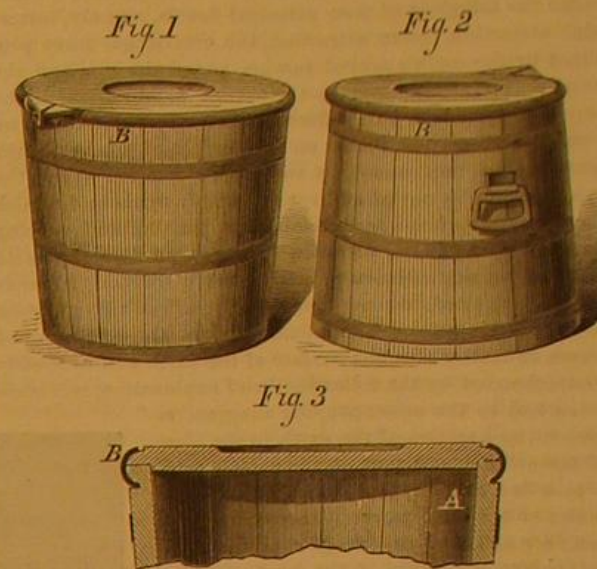


composed of flint and bone, are not polished. They are only sharpened, and by their coarse execution appear to belong to the paleolithic age. On the upper part of the remains was a large number of small shells, each pierced for stringing as a collar or bracelet. No pottery nor any bronze object was found. Our readers may recollect that the first skeleton found in the same neighborhood, on the bank of a railway cutting on the sea margin, appeared to have been crushed by a fall of rock. It was figured in several English journals last year.

In a French industrial establishment, employing 630 men, chiefly vegetarians, the sick fund was constantly in debt. By the introduction of meat into the food of the men, the average loss of time per man, on account of illness or fatigue, was reduced from 15 to 8 days per annum.

GILBERTS & HARRIS' RETURN BUTTER AND OYSTER PAIL.

Fresh, sweet butter is appreciated by every one; but however good its quality in the beginning, it will not retain its original flavor unless properly packed in suitable receptacles. Where the butter is exposed to the bad air of damp cellars and dust, it is very liable to become deteriorated, and hence lessened in value while in transit; while butter, packed in good pails, brings from 1 to 5 cents more per pound than when in the common tub or firkin. Similarly good return oyster pails, that hold from 5 to 25 gallons, are found much the



cheapest and most convenient way of sending oysters over the country; but these have ordinarily to be locked to preserve their contents from being taken while in transit, and even then the purchaser frequently receives his gallons short because the pails in common use are not tight enough to keep

the liquid from slopping over. The pails shown in our engravings are, it is claimed, stronger, tighter, and better adapted to preserve their contents, and stand the rough handling of transportation, than any now in the market. They are made from white oak staves, and are held together by heavy galvanized iron hoops. The covers are of sufficient thickness to allow a flange, *A*, to extend over the top of the package, while the under side of the cover projects into the pail, as shown in sectional view, Fig. 3. The cover is rounded on its upper corner in form of a quarter circle, and a corresponding quarter circle is cut on the outer edge of the package, the two forming a rib, *B*, of semicircular or semi-elliptical cross section, with the cover joint along its medial line. A hoop is then swedged in form to fit this rib, except that its edges are a little shorter, while it has strong malleable flanges, shown on the left, in Fig. 1, at each end.

A screw passing through one flange into the other is turned by a common screwdriver or key. It will be readily seen that the hoop, when tightened by its clamping device, operates in both vertical and lateral directions, and not only draws the cover down on the package, but strengthens it around the top.

On the oyster pail (Fig. 2) the screw, instead of being slotted, is made and turned by a key; this saves all expense and trouble of locks.

This method of holding the cover is equally adapted for fruit jars or any article having a movable cover. These pails were awarded three first premiums at the New York State Fair, in September last, and also at the Provincial Fair, Canada, and are, we are informed, readily endorsed by all butter and oyster dealers. They are now manufactured by the Jamestown Butter and Oyster Pail Company, at Jamestown, N. Y., to whom all orders should be addressed.

Trout in an Artesian Well.

The *American Journal of Science and Arts* presents the following curious statement: Mr. Bard, the agent of the California Petroleum Company, at San Buenaventura, was lately engaged in constructing a wharf at a point southeast of that place. Wanting water to supply this wharf, he commenced sinking an artesian well on the sea beach, not 5 feet from high water mark. At the depth of 143 feet a strong flow of water was obtained, which spouted forth to a height of 30 feet. It was controlled with a "goose neck," and utilized. One day, while the agent was absent, the men round the well noticed fish in the waste water. On his return they called his attention to the fact, and on examination the well was found to be filled with young trout, thousands of them being thrown out at every jet. These trout were all the same size (about two inches long) and perfectly developed. The eyes were found perfect. Now there is no stream nearer than the Santa Clara river, several miles distant. Could these fish then, it is asked, have come from its head waters by some subterranean outlet? There are no trout in the lower portions of the stream. The temperature of the well water is 64° Fah.

Correspondence.

The Relative Attraction of the Earth and the Sun.
To the Editor of the Scientific American:

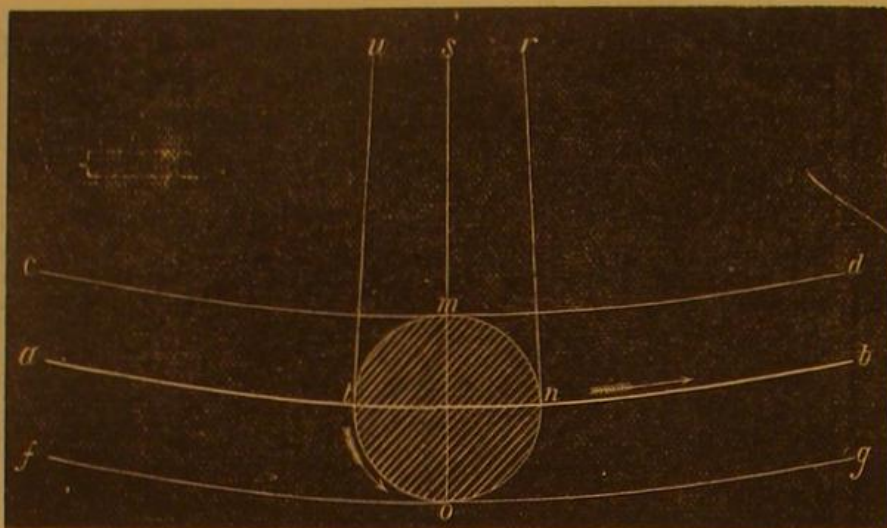
The subject of terrestrial and solar attraction having recently been discussed in the SCIENTIFIC AMERICAN without leading to any definite conclusion, I propose to show, by the following demonstration, the exact amount of the solar energy which tends to produce irregularity in the earth's attraction at certain points during the diurnal revolution. Matter resting on the surface of the earth is at all times under the influence of four principal forces, namely, terrestrial attraction, solar attraction, the centrifugal force produced by the earth's orbital motion round the sun, and the centrifugal force caused by the earth's rotation round the axis. In considering the effect produced by these forces on a particle of matter placed on the surface of the earth, the centrifugal action caused by the earth's rotation round the axis may be left out of sight, as it simply tends to diminish the attraction of the terrestrial mass, the diminution being constant at any given point, in whatever position the earth may be placed. Planetary and lunar attraction, it needs hardly be stated, do not appreciably affect the question under consideration. The influence of the three first named forces on matter near the surface of the earth will be readily comprehended by the following brief explanation, reference being had to the accompanying diagram representing a section of the earth in the plane of the ecliptic, and part of the earth's orbit. om is a straight line drawn through the center of the earth towards the center of the sun, nr and tu being tangential lines also pointing to the center of the luminary. ab represents part of the earth's orbit, cd and fg being curves parallel to the same, intersecting the central radial line at m and o .

Mr. Slaughter, in his communication to the SCIENTIFIC AMERICAN, correctly assumes that the weight of bodies on the surface of the earth is not permanent, and that the greatest difference takes place under the meridian, at m , and at the opposite point o , at midnight; but he has greatly overestimated the energy of the disturbing cause, apparently overlooking the important fact that solar attraction is counteracted by the centrifugal force resulting from the earth's motion round the sun. It needs no demonstration to prove that, unless the sun's attraction on the terrestrial mass was exactly balanced by the centrifugal force caused by the orbital motion, our planet would fall into the sun or retreat from the luminary into boundless space.

Before entering on a demonstration showing the exact difference of the weight of 20,000 pounds (assumed by Mr. Slaughter) under the meridian and at midnight, it will be proper to state the magnitude of the elements on which the demonstration will be based, namely: the mass of the sun, 314,760 times that of the earth; mean distance between the centers of the sun and the earth, 91,430,000 miles; half equatorial diameter of the earth, 3962.91 miles, and mean semi-diameter, 3956.30 miles. Agreeably to the dimensions thus specified, the radii of the curves, cd , ab , and fg , will be respectively 91,426,044, 91,430,000, and 91,433,956 miles. It should also be stated that the writer has recently constructed an instrument by means of which it has been ascertained practically that, at the rising and setting of the sun, solar attraction, exerted on a body resting on the surface of the earth at n or t (see diagram), is exactly balanced by the centrifugal force acting in an opposite direction called forth by the earth's orbital motion round the sun. The following explanation will give a general idea of the instrument referred to: A solid cast iron ball, eleven inches in diameter, highly polished, is immersed in a bath of mercury, and connected by a fine steel wire to a delicate chemical balance, in such a manner that any attractive force acting on the ball will disturb the balance. The force of gravitation being inversely as the square of the distance, and directly as the mass, the attraction of the sun on the floating ball can be ascertained by the following calculation: $91,430,000 \div 3,956.30 = 23,109.9$, mean radii of the earth contained in its distance from the sun. Dividing the square of this amount in the sun's relative mass, 314,760, we learn that the sun attracts the ball with a force $= 0.0005893$ of terrestrial attraction. Hence, as the weight of the ball is nearly 181.47 pounds, or exactly 1,270,300 grains, the sun attracts it with an energy of $0.0005893 \times 1,270,300 = 748.6$ grains. Careful tests of the new instrument have shown that any pull exerted laterally on the floating ball may be measured by means of the chemical balance applied, provided the force exerted exceeds eight grains. Hence, a difference amounting to less than one hundredth of the energy exerted by solar attraction, or the centrifugal energy resulting from the motion of the ball round the sun, can be readily detected by the adopted device. It only remains to be stated that not the slightest disturbance of the balance has been observed during repeated trials made while the sun has been rising and setting; thus proving that the pull of 748.6 grains, exerted by solar attraction on the floating ball, is counteracted by some other force. For astronomical purposes, the result of the trial can only be regarded as an approximation; but for our present purpose it is abundantly precise, since it takes cognizance of an energy of only 8 grains in 1,270,300 grains, or $\frac{1}{158,812.5}$ of the weight of the body attracted. Referring to the diagram, it will be seen at a glance that the sun's attraction on a particle at n acts in the direction indicated by the line, nr ,

while the attraction of the earth on the same particle is exerted at right angles to nr ; and that consequently solar attraction will not affect terrestrial attraction at the points n and t . It will be evident, therefore, that, leaving out of sight the constant influence of the earth's axial rotation, the weight of bodies during sunrise and sunset shows the exact amount of terrestrial attraction.

We may now enter on the task of determining the precise amount of difference in weight which results from transferring the supposed 20,000 pounds from n to m , and from t to o . Agreeably to the laws of motion, the centrifugal force of equal bodies, moving round a common center at unequal distances in equal times, is directly as their radii. Consequently the centrifugal force of a body at m , caused by the orbital motion round the sun, must be less than the centrifugal force at n . The difference will be ascertained by dividing the radius of the curve ab in the radius of the curve cd . Accordingly the diminution of the centrifugal force will be $91,426,044 \div 91,430,000 = 1 - 0.9999562 = 0.0000437$. Now the sun's attraction at m is greater than at n , in the inverse ratio of the squares of the radii of the curves cd and ab , namely: $91,430,000^2 \div 91,426,044^2 = 1.0000875 - 1 = 0.0000875$. Consequently solar attraction exerted at m is $0.0000875 + 0.0000437 = 0.0001312$ greater than at n , where it is exactly balanced by the centrifugal force caused by the earth's orbital motion. We have already demonstrated that solar attraction at the point n is 0.0005893 of terrestrial



attraction; thus the supposed weight of 20,000 pounds will be attracted with a force of $0.0005893 \times 20000 = 11.786$ pounds at n . Mr. Slaughter estimates that the attractive energy amounts to 12 pounds 10 drams, the discrepancy being occasioned by his calculation having been based on data somewhat incorrect. Solar attraction at m being 0.0001312 greater than at n , it will be found, by multiplying this decimal fraction by the total attraction at n , that in transferring the weight, from n to m , it will be subjected to an additional attraction of $11.786 \times 0.0001312 = 0.001546$ pound. Obviously, when the weight is transferred from t to o , a diminution of solar attraction will take place in the inverse ratio of the square of the radii of the curves fg and ab ; while the centrifugal force will be increased in the direct ratio of the radii of these curves. Calculation shows that the former is 0.0000865 , and the latter 0.0000432 . Allowing for the stated increase of centrifugal force, it will therefore be found that the solar attraction at o will be 0.0000432 less than at t or n . Consequently, by transferring the 20,000 pounds to o , the solar attraction of 11.786 pounds, exerted on this mass when placed at t and n , will be reduced $0.0000432 \times 11.786 = 0.000509$ pound. The previous demonstrations having established the fact that an increase of the sun's attraction of 0.001546 pound takes place during the transfer from n to m , it will be readily perceived that a difference of solar energy of $0.001546 + 0.000509 = 0.002055$ pound will result from the difference of attraction at m and o . In other words, the weight of the supposed mass of 20,000 pounds will be 0.002055 pound less at noon than at midnight. Agreeable to Mr. Slaughter's computation, the diminution of weight will be 24 pounds 1 ounce, thus upwards of 11,000 times greater than we have established by the foregoing demonstration. Those who do not feel disposed to investigate the subject closely may arrive at a correct conclusion, concerning terrestrial attraction, by simply considering that the gravitating energy is affected by only two appreciable disturbing causes, namely, solar attraction and the centrifugal force resulting from orbital motion; and that these opposing forces are very nearly balanced throughout the entire terrestrial mass, completely neutralizing each other at its center. Likewise that, at all points on the sphere tangential to the sun's rays, solar attraction is exactly balanced by the centrifugal force caused by the orbital motion, a fact practically established by the floating ball of the instrument before referred to. Let it also be remembered that the increase and diminution of the distance from the sun at noon and at midnight amounts to less than $\frac{1}{158,812.5}$ of the earth's distance from the solar center. A moment's consideration, therefore, will show that the disturbing force which modifies terrestrial attraction must be exceedingly small. Again, if such a great disturbance of the earth's attraction existed as Mr. Slaughter supposes, the beat of the pendulum would be so irregular, from hour to hour, during the diurnal revolution, that the most perfect clock would prove a very imperfect device for measuring time. With reference to the proposed employment of heavy weights for ascertaining the variation of terrestrial attrac-

tion resulting from solar influence, it should be borne in mind that, by means of the pendulum in combination with the balance wheel of the chronometer, the amount of any appreciable irregularity of terrestrial attraction may be accurately measured. It will be remembered that the present Astronomer Royal of England, many years ago, computed the earth's density by ascertaining the variation of the beat of the pendulum at the mouth and at the bottom of the Harton coal pit, 1,200 feet deep. This depth being only $\frac{1}{158,812.5}$ of the earth's radius, we can judge of the efficacy of the pendulum as a means of measuring terrestrial attraction.

J. ERICSSON.

The Duration of Brain Impressions and the Memory.

To the Editor of the Scientific American:

I have read, with interest, your article on the velocity of nervous impulses, in No. 7 of your current volume; and I am induced by it to ask you whether any experiments have been made to ascertain the length of time required to produce an impression on the mind which will be retained in the memory.

In a case wherein I defended a party indicted for assault with intent to murder, the proof showed that the prosecutor, on whom the assault was committed, was standing in a public road, talking to the father of the defendant about an alleged larceny of hogs, when the defendant approached him from behind, and struck him on the back of the head with the butt end of a gun, and he fell senseless from the blow. A fight ensued between the friends of the parties, in which a number of shots were fired; and after the fight was over, the prosecutor was carried into a yard near by and resuscitated, regaining consciousness in about thirty minutes after receiving the blow. He testified most positively that he had not the slightest recollection of receiving the blow. He recollected and detailed the conversation between himself and defendant's father up to the moment the blow was struck, and also what occurred and what was said when he regained consciousness, as stated by a number of other persons who witnessed the occurrence; but of the blow itself, how, when, and from whom it was received, not the slightest impression had been made on his mind. Except the surface bruising on the back of the head, which lasted a few days only, no bad effects were experienced from the blow, and his mind and memory are unimpaired.

A similar result was observed, during the late war, in persons stunned by the explosion of shells. A gentleman now in this city, who was an officer in the Confederate Army, was fighting in the ranks, at the battle of Murfreesboro', in Tennessee. Just as he was in the act of taking aim with his rifle, a shell struck his weapon and exploded. He fell senseless, blackened with powder, and apparently dead. He had been struck on the head and other parts of the body with fragments of the shell, and was dangerously wounded; but after an unconsciousness of several hours, he was discovered to be alive, and was cared for and recovered. His mind and memory are as clear as ever, and he is now a successful lawyer in full practice. He assures me that no impression of the explosion of the shell was made on his mind. He saw no flash, heard no sound; he recollects distinctly aiming his rifle to fire; but after that, there is a perfect blank in his memory until his resuscitation.

These instances appear to indicate that the nerves of sensation may be paralyzed in less time than is required to make an impression on the mind which memory will retain. What time is required to make such an impression? The flash and noise of the explosion of a shell immediately in front of a man in battle would excite the nerves of sight and hearing as violently as it is possible to excite them; and in the last instance stated, the light of the flash certainly reached the eye before the fragment struck the head. What caused the delay in stamping an impression of it on the memory, and how long must the vital organs remain intact to enable the mind to receive an impression through the senses?

It seems to me that these questions suggest a field for scientific inquiry, in which important results may be reached. Montgomery, Ala. D. S. TROY.

Crude Petroleum in Steam Boilers.

To the Editor of the Scientific American:

Mr. I. M. Allen, President of the Hartford Steam Boiler Inspection and Insurance Company, says in his report: "In some parts of the country, crude petroleum has been found to keep boilers free from scale without injury to the iron; while in the same districts and in the immediate vicinity, boilers not using purifiers would have a scale from $\frac{1}{4}$ to $\frac{1}{2}$ inches thick." He continues: "We have a specimen of scale in this office nearly $1\frac{1}{2}$ inches thick, that was removed from a boiler in the West by crude petroleum. I am aware that there is a great prejudice against using anything of the kind in steam boilers, but earth oils are very different from animal oils. They are very volatile; and in an experience of several years, where hundreds of boilers have been treated with them, we have found no injury to plates or tubes, and the boilers have been kept free from scale." Further on in the report, he again says: "Feed water heaters are of great service in removing sediment, if they are of proper construction. But an open heater, using exhaust steam, with no appliance for preventing grease and sediment from entering

the boiler, is not to be relied upon; and as I have already said, steam users should be careful, in selecting a heater, to get the best; we have experienced a vast amount of trouble with improperly constructed heaters. The subject of incrustation and scale is one that cannot be elaborately treated in a report like this," etc.

Now, what struck me as peculiarly significant in the above is the fact that the president of the above named company says that, during several years, they have known hundreds of boilers to be kept free from scale, etc., by the use of crude petroleum in the boilers, and that he should afterwards discourage the use of open heaters as being peculiarly fitted to let grease into the boilers. It would have been more consistent with his experience of the use of crude or rock oil, as a boiler cleaner, to recommend the use of open heaters, provided rock or crude oil is used as a lubricator; for it is only by the use of an open heater that crude or any other oil can be gotten into a boiler while it is in use; and a constant and unvarying supply must certainly be better than an occasional and perhaps not a sufficient one. My own experience, as a mechanic and user of engines and boilers, is that, where crude or rock oil is used as a lubricator for cylinders, there is no objection to the open heater; but on the contrary, it is beneficial to the boiler and a pretty sure preventive of scale or incrustation. I do not think, however, their use with animal oil is to be recommended; but with crude oil, properly prepared, there does not seem to be any objection at all, but, on the contrary, benefits.

In my own case I have used an oil prepared from petroleum, which is especially adapted for lubricating hot surfaces; and by its use, I have overcome the objection brought by Mr. Allen to the use of the open heater.

I hope that you will, as early as possible, clear away the confusion on this subject, and thus confer a great benefit on those whose business compels them to use steam boilers.

Detroit, Mich.

ONE OF THEM.

A Sewing Machine Engine.

To the Editor of the Scientific American:

There is probably no field that presents more instances of simple and apparently perfect mechanical construction than that of steam engines. I recently saw an extremely simple oscillating engine in one of the show windows of a sewing machine store. It consisted of scarcely more than a cylinder of about $2 \times 1\frac{1}{2}$ inches, clamped to one of the rear corners of an ordinary sewing machine table; the clamp serving also as a rest for the trunnions of the cylinder, the engine being connected by a belt to the upper pulley of the sewing machine. The oscillation of the cylinder caused the alternate admission and discharge of steam, the steam being supplied through a one quarter inch flexible tube. The boiler was about the size of an ordinary one gallon milk can, and could be placed in any convenient out-of-the-way place, in the room or out of it; the vertical tubes of the boiler were made of extremely thin brass, and braced within with a spiral wire.

I know nothing as to the success of this device; but it would be difficult, I think, to get up anything more simple for the purpose, in the line of steam engine manufacture.

Some cheap power, either steam, air, or something else for working the sewing machine for family use, is one of the great needs of the time; and inventors who have the subject in hand should bear in mind that, in order to succeed, their devices must be cheap, durable, and inexpensive to run. To ensure the first of these qualities, the device must be very simple; to ensure the second, it must receive the very best material and workmanship.

F. G. W.

The Eucalyptus or Australian Blue Gum Tree.

To the Editor of the Scientific American:

I have just read an interesting article in the SCIENTIFIC AMERICAN of February 14, upon the Australian fever tree, or, as it is called here, the eucalyptus or Australian blue gum. In closing your article, you state that this tree, which is now attracting considerable attention to its medicinal and sanitary qualities, has been acclimated to the south of France, Algiers, Corsica, Cuba and Mexico, and suggest that it might be cultivated to advantage in the swamps of the Southern States. I thought it might not be uninteresting to you to know that this tree is already being extensively cultivated in California, where it was introduced over twelve years ago. Some of the trees that were set out in this city about that time are now 70 feet in height and 20 inches in diameter. Probably 100,000 of these trees have been sold in this city and San Francisco this season; and not less than that number are already growing in and about this city, the tree being very popular on account of its quick growth and clean, lasting foliage, to say nothing of its sanitary qualities. I have raised from the seed and planted about 10,000 on a farm within two miles of Oakland during the past four years. The first were planted four years ago this spring; and when set out, were from 12 to 15 inches in height. Some of these trees have already made a growth of 40 feet. The land is rolling foot hills, 300 feet above tide water; and the trees have passed through three unusually dry seasons and have had no attention except being plowed once each year and kept clear of weeds. Thus they seem to flourish equally as well as those planted in the low lands or marshes, better in fact than the latter. No tree here, excepting the Monterey cypress, indigenous to California, seems to stand the drought so well as the blue gum, which has made it a very popular ornamental tree. Upon my place I have some five or six varieties of the same tree, namely, the blue, red, white, iron bark and pepperetta. Of these, the blue gum is the quickest in growth and is the most extensively cultivated,

The seeds are first started in hot beds. After the plants are up an inch or two high, they are placed under slats to harden and prepare them for the hot sun when set out, which has to be carefully done, without removing the soil from the roots. The tree then makes a vigorous growth, frequently shooting up five or seven feet in the first year, the green stalk having the appearance of a rank weed. This appearance will continue for two years, when the tree not only begins to change the appearance of its body but also the shape of its leaves; the latter, which when young were very broad and blue, now begin to appear at the top of the tree, long, slim and of a very dark green, the tree thus carrying in appearance two distinctly marked leaves. I have sent you by express four different varieties of these leaves, which I hope will reach you in a state to explain more fully than I have done here.

The eucalyptus appears to stand a great deal of frost after a growth of two years. In fact our unusually cold weather here, this season, the ice being frequently frozen as thick as a dollar, does not seem to have affected the young trees in the least. The tree will undoubtedly flourish well in the Southern States; and after what is known of its sanitary qualities, it should be extensively cultivated. The seeds are very small, probably 5,000 to the ounce, and can be had of seedsmen in San Francisco.

The eucalyptus is already being extensively planted in this State for lumber and fuel; for the latter purpose, it is superior to any timber we have here. As a shade tree, it is entirely free from insects. The leaves placed among clothing are a thorough protection from moths.

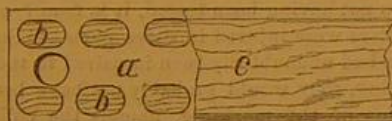
J. G.

Oakland, Cal.

To Make a T Square.

To the Editor of the Scientific American:

Two years ago, a T square blade which possesses the advantages of both wood and steel was made; and though somewhat expensive, it is an excellent instrument.



In a piece of sheet steel, *a*, 36 inches long by $2\frac{1}{2}$ wide, and $\frac{3}{4}$ of an inch thick, holes *b*, $\frac{1}{2}$ by $\frac{1}{4}$, were punched as shown. These holes were filled by pieces of mahogany pressed in firmly with a vise, and then worked down even with the metal. Pieces of mahogany, *c*, the same size as the steel and $\frac{1}{4}$ thick, were then laid one on each side, and the whole glued together and clamped upon a planer table, where, after it was thoroughly dried, the edges were planed parallel without moving the blade. The wood covering was next reduced to $\frac{1}{32}$ of an inch in thickness, and the corners beveled.

New Britain, Conn.

F. H. R.

Value of the Scientific American as an Advertising Medium.

To the Editor of the Scientific American:

I can fully endorse what a correspondent says on this head, in your issue of February 28. Ten years since, I made and sold a small article, which had its day and then passed, as I supposed, into oblivion. Last week, however, I received new orders for it. I am afraid now to advertise in your paper, lest, some quarter of a century hence, parties will demand service long after I am dead and forgotten.

EGBERT P. WATSON.

About Ourselves.

MESSRS. MUNN & Co:

Gentlemen: I take the earliest opportunity of returning you my most sincere thanks for the efficient and honorable manner in which you have conducted the business of obtaining for me a patent for my self car coupling. After employing, during the past five years, as many different agents and failing in each case, it was my good fortune to fall in with a gentleman who strongly advised me to go to you, assuring me that, if I did so and it were possible, a patent could be obtained through your agency. That he was not disappointed in his estimation of your ability, the receipt of my letters patent is sufficient proof; and I, therefore, cannot allow the opportunity to pass of making due acknowledgment of your straightforward and honorable course as patent agents, and I shall not fail to advise all my friends, seeking a like accommodation, to place their business unreservedly in your hands. As we receive the SCIENTIFIC AMERICAN here through the hands of news agents, I presume I shall see a notice of my invention among the notices of patents secured through your agency, which I find in the weekly issue of your valuable journal.

THOS. R. LAND.

Grass Valley, Nevada county, Cal.

The Hartford Steam Boiler Inspection and Insurance Company.

The Hartford Steam Boiler Inspection and Insurance Company makes the following report of its inspections in the months of December, 1873:

The number of inspection visits made during this month was 1,156, and the number of boilers inspected, 2,318; of these, 771 received thorough internal inspection. The hydraulic test was applied in 132 cases. These were upright tubulars, or new boilers in the yards of the boiler makers. The whole number of defects discovered was 948—of which 262 were regarded as dangerous. These defects in detail were as follows:

Furnaces out of shape, 43—13 dangerous; fractures, 64—40 dangerous; burned plates, 54—24 dangerous; blistered plates, 174—34 dangerous; deposit of sediment, 138—15 dan-

gerous; incrustation and scale, 120—19 dangerous; external corrosion, 76—17 dangerous; internal corrosion, 31—8 dangerous; internal grooving, 10—4 dangerous; water gages defective, 29—6 dangerous; blow-out defective, 28—11 dangerous; safety valves overloaded and defective, 19—8 dangerous; pressure gages defective, 137—25 dangerous, varying from —20 to +12. Boilers without gages, 66—5 dangerous; deficiency of water, 5—2 dangerous; braces and stays broken and dangerously loose, 67—26 dangerous; boilers condemned, 13. The comments which are made on these reports from month to month may appear to some readers a little stale. We know there is a striking similarity in them all; but when such facts as those above are enumerated, month after month, it shows that there is great need of frequent and careful examination of steam boilers. It must be born in mind that there are all kinds and types of boilers in use in the country, and that the average ability of attendants is very low. Defects which point directly to disaster are met with almost daily, and we believe many explosions of boilers have been prevented by the thorough examination which has discovered such defects as those in the above report. A cursory examination or a simple test will do little towards bringing such defects to light. The work must be thorough, and time enough must be taken. No specific rule can be laid down for making these examinations. Each case requires treatment in accordance with the circumstances connected with it: these are the type of boiler, pressure carried, character of bracing, quality of water, efficiency of attendant, etc., all of which have much to do with the question of preventing boiler explosions. Experiments on obsolete or special types of boilers will do little towards preventing the explosion of boilers in use, because the conditions under which boilers are used in manufacturing are very different from those under which experimental boilers are used. Valuable information can be obtained on certain points by well directed experiments. Tests of safety valves are an important matter, and one that should receive special attention. It may, however, be a question whether the best way of making such tests would not be to subject them to actual use on boilers that were doing regular duty, day after day, for six months or a year. We believe in tests that are practical, and our experience goes to show that, especially in a question of such vital importance as that which seeks for its solution the prevention of boiler explosions, too great care and too much time cannot be taken. A great many worthless boiler appliances have been palmed off upon steam users, the only proof of their efficiency being that they had worked well under some experimental test. But when subjected to the conditions of constant use, they have proved utterly worthless.

During the months of November, December, and January, there were 37 boiler explosions in this country; 14 of these were in saw mills and planing mills—7 were railroad locomotives. In one instance, a boiler exploded while being tested by steam. We have never known of but one other instance of testing boilers by steam. This was done by the boiler maker himself, and he was killed, with two others who were assisting him. We think in both cases there was lamentable ignorance. The parties had doubtless read or heard of testing boilers by the expansion of water by heat. It will be readily seen that testing boilers by steam pressure is about as suicidal as to be suspended by a rope around one's neck to test his ability to withstand hanging.

Improved Compound Marine Engines.

The principle of the "compound" steam engine, from which so much good and economical work has of late years been obtained, is that it has both a high and a low pressure cylinder or cylinders, and that the steam which has done duty in the former is made to do duty also in the latter, before it is suffered to escape. The compound engine was first patented by Arthur Woolf, in the year 1804; and he placed the two cylinders in a vertical line, one above the other, and worked them by a single crank. Since that time a great many experiments have been made in relation to the subject, and almost every conceivable combination of cranks and cylinders has been tried; but the accepted type at present is the two cylinder engine, with the cylinders either vertical or side-by-side. Messrs. Lamport and Holt employ the former construction, with a single crank, and thus return almost precisely to the principles laid down by Woolf, seventy years ago. It now appears that, if his invention had been earlier appreciated at its true value, many millions of tons of fuel and many hundreds of thousands of pounds sterling would have been saved. The present price of fuel is so high, and its unnecessary consumption is so much to be condemned, on account of the influence which the coal supply exerts over the cost of iron and of many other commodities, that shipowners will often find it necessary to make quickness of passage subordinate to other considerations, and will be forced to inquire how they may safely convey the largest cargoes from port to port at the best paying speed, and with the least expenditure of coal and stores, rather than how they may attain the highest speed without reference to its cost.—Iron.

Mr. A. Augustus Adeo, United States *Chargé d'Affaires* in Spain, is a native of New York. He speaks and writes the French, Spanish, and German languages, and has superior qualifications for the position he holds. He has been in the diplomatic service for five years, and was for three years Secretary of Legation at Madrid. We have had occasion to require Mr. Adeo's services a number of times since his residence in Spain, and we can personally testify to his superior ability in the administration of the office he holds under our government. But few of our representatives abroad fulfill their mission as acceptably to their countrymen as Mr. Adeo.

OAKLEY'S CURRANT WASHER.

Dried currants, as purchased from grocers, are frequently not over clean, so that it is usually necessary to wash them before preparing them with articles of food. In order to provide a simple and efficient means to enable the housekeeper to perform this operation, the device represented in perspective and section in the annexed engravings has recently been invented.

The principal vessel is an ordinary bake pan of any desired size, in proportion to the desired capacity of the machine. To its edges are affixed suitable bearings for projections from the central portions of the ends of a cylinder, A, the sides of which are formed of perforated sheet metal. The latter is rigidly secured in the end which carries the crank, but the solid portion of the other extremity forms a cap, B, as shown in the section Fig. 2, which is readily removable to give access to the interior of the cylinder. Two rods are secured to the inner side of the crank end and extend into the cylinder, in order to secure the agitation of its contents.

The large lumps of currants which have caked together being first broken up, the receptacle is filled and the cap, B, tightly fitted in place. The projections are then dropped in the bearings and the trough filled with water to within about half an inch of its upper edge. If the cylinder is then rotated slowly by means of the crank, the inventor states, within two minutes the currants will be entirely freed from grit and a large proportion of the stalks. If they be very dirty, the water may be advantageously changed, and the process repeated. The fruit thus prepared can be dried or used as required, without the usual rubbing in a cloth.

Patented January 13, 1874. For the purchase of rights or of the entire patent, apply to F. Oakley, 96 Bond Street, Toronto, Canada.

A NEW TOOL HOLDER.

All machinists are aware of the trouble in getting a lathe tool so held in the tool post that it can be quickly and conveniently elevated or depressed as the work may require, and still be held perfectly solid upon the rest. Many devices to effect this result have been suggested; but in those in which cheapness is the principal recommendation, the difficulty appears to arise from a want of solidity under the tool. Mr. Lewis Reder has patented, through the Scientific American Patent Agency, a simple and effective tool holder that seems to meet this want.

From the annexed engravings it will be clear to any mechanic that one incline of the washer, A, Fig. 4, is higher than the other, the pitch being just the same; and, second, that the shoe is thicker (see Fig. 3, and B in Figs. 1 and 2) at one end than the other, both extremities of it being beveled to suit the inclines of the washer. This simple little article, with momentary changes, produces four positions for the lathe tool, holding it perfectly firm in each, namely: First, by placing the thin end of the shoe and high part of the washer together, the tool is held in a level position; second, by turning the washer so that the thick end of the shoe and high part of the washer are together, the point of the tool is thrown below the level; third, by now turning the tool post and washer half round, the point of the tool is thrown above the level; and, fourth, by turning the washer around the tool post, the tool is adjusted to any height under any of the three conditions named above.

The advantages claimed for this simple improvement are its comprehensiveness, solidity, durability, and extreme cheapness.

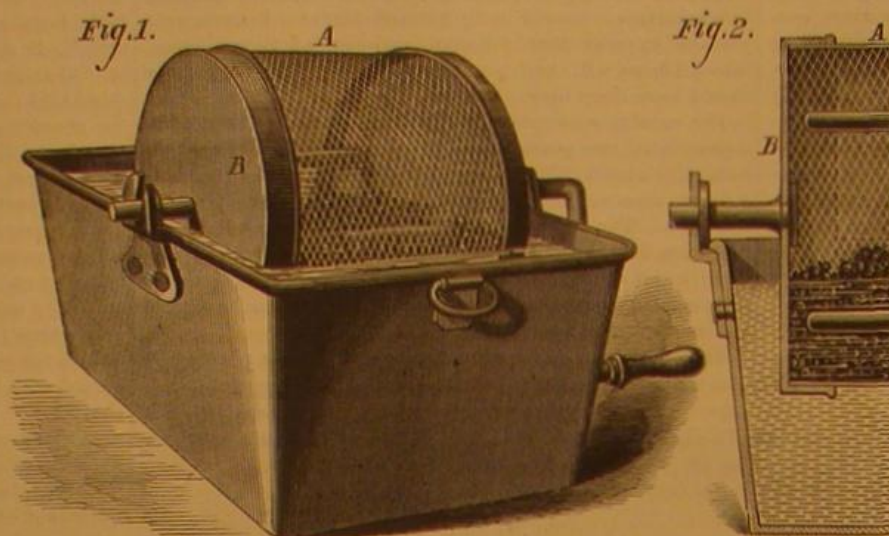
Mr. Reder has arranged for its introduction to the trade of the United States with E. and A. Betts, machinists' tool builders, of Wilmington, Del., who have prepared themselves with suitable apparatus to manufacture the invention of cast steel, at low prices.

Use of Steel for Boilers.

Mr. R. L. Haswell, of Vienna, spoke recently on this subject before the Society of Austrian Engineers. He remarked that the accidents which had occurred on railways using locomotive boilers of steel has thus far been only ascribed to the material; yet this was due, on the one hand, to the preparatory working of the plates, and on the other to the small thickness, as well as to the insufficient mode of assorting them before they were used. The State Railway thus far had used about 50,000 cwt. steel plates, among which only 200 cwt. were thrown aside during the manufacture of the boilers.

Mr. Haswell only knows of five instances where the boilers got cracks, four of which occurred in the fire box plate and one in the cylindrical part. Mr. Haswell ascribes their faulty

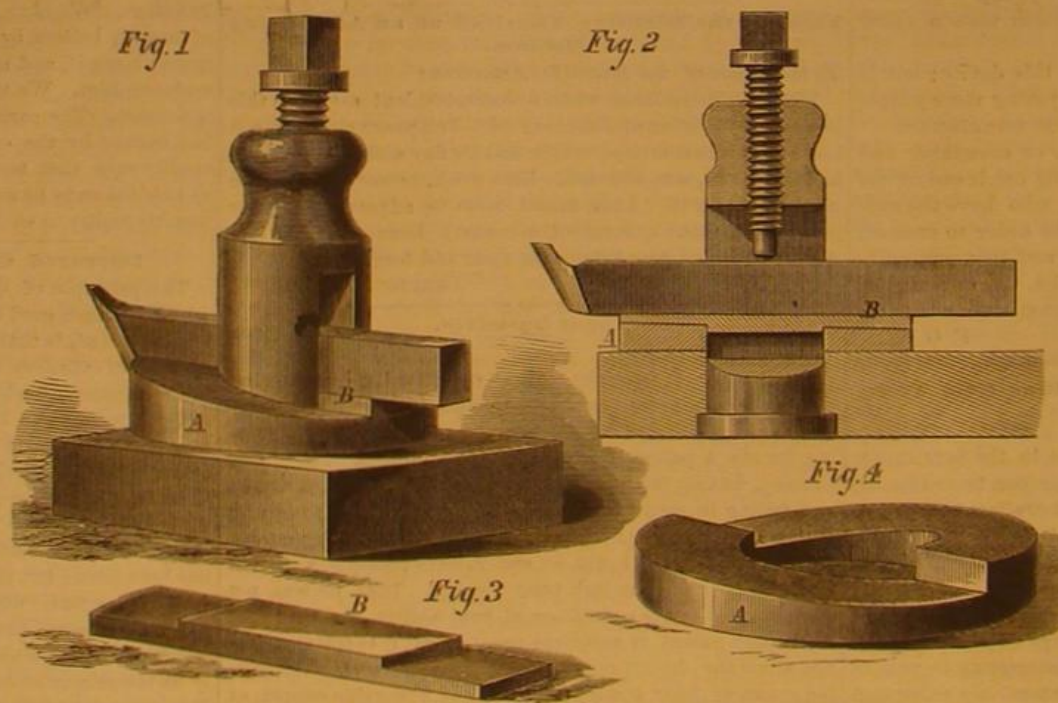
condition to the fact that they were rolled when too warm. This shows that, even by purchasing steel plates from most renowned establishments, and of the best quality, one cannot depend on their superiority for the purpose in question without assorting them with the utmost care, because it can readily occur that in heating the plates one or more get spoiled. Hence, in the establishment of the State Railway, all plates are subjected to tests for their tensile strength before they are used. That these tests are perfectly reliable is shown by the fact that, of 350 boilers consisting of steel plate, only a sin-



OAKLEY'S CURRANT WASHER.

gle one was found torn thus far, and this in the cylindrical part. The box plates not having been tested, it is readily explained that four boilers were injured in those parts. But, although these plates had undoubtedly been impaired in their strength by overheating, they would probably not have been torn if the construction of the machines, namely the boiler supports, did not involve an immense strength.

In order to obtain steel boilers answering all requirements, only correspondingly thick plates and plates of the best material, without any addition (for otherwise the steel is not homogeneous), ought to be used; they ought to be scrupulously assorted according to the texture and tensile strength. After boring or punching they should be carefully annealed; the riveting must be formed with pedantic care, and the bending done with wooden hammers. That steel plates manufactured in Austria are of excellent quality is proven by the manner in which boilers are there constructed; the box front



REDER'S IMPROVED TOOL HOLDER.

plate, dome cover, and the sides of the tubes are only furnished with an edge or border, while in England they are compelled to use angle iron for these connections.

Steel plates are preferable to iron plates, owing to the fact that they possess the same degree of elasticity in all directions—from 12 to 15 per cent: in iron plates it is in the direction of the fibers, and, according to Mr. Kirkaldy, about 15 per cent, but in a cross direction only 5 per cent. If one proceeds in the manner indicated, says Mr. Haswell, steel plates may be used with perfect safety. The boiler manufacturer has the advantage that he finds fewer plates to throw aside, and the railways, on the other hand, will have more carefully constructed, stronger, and, in the end, cheaper boilers.—*Industrie Zeitung*.

THE Dudley Mining Institute, England, offer a prize of \$100 for the best model of a hand coal-cutting machine submitted to the Council next June. Mr. T. Parton recently stated that the ordinary loss of coal is 40 per cent, owing to the imperfect methods of working it. Where the best arrangements are in force, the loss does not exceed 10 per cent.

A Railroad Signal Office—An Hour in the Grand Central Depot at New York.

A correspondent of the *Troy Times* gives the following account of the mode of dispatching and receiving trains at the Grand Central Depot in this city:

The signal office is a little room at the northern entrance of the depot, about thirty feet above the pavement. It is reached by a narrow passage way from the west side, and when you get into it you see a sight which made Jones go into an unmistakable surprise. Looking down the depot there was a space of more than 600 feet length by 200 feet breadth, covered with an iron roof and lighted from the top. Trains of cars were coming and going incessantly, but no confusion was perceptible, and everything, as my friend said, "went on like clock work." There are two operators in service here, relieving each other during a tour of duty, which extends from 5 A. M. to 11 at night, their motions being regulated by a large and costly clock. The gentleman in charge received us very politely; but before we had hardly thanked him, we heard the sharp and rapid ring of a bell overhead. It was marked "Ninety-sixth to Seventy-fifth street." "You see," said the operator, "there is a train coming in, and it wants to know if we are ready for it." "But how does it ring that bell?" said Jones. "By electricity," was the reply. "This is Hall's patent, which works like a charm." In a few minutes another bell rang. It was marked "Sixty-first to Fifty-sixth street." "The train now reports itself again," said the operator, "and this renews notice either to prepare for it or to signal it to stop." He touched a telegraphic machine, and then

said, "this throws up the signal to come in," and, sure enough, in a few minutes the train arrived. One hundred and forty trains arrive and depart in a day, including the Central and Hudson, the Harlem, and the New Haven Roads, and hence the signal service is one of incessant activity. The operator then informed us that each road has four starting bells of different keys, all of which were rung by him by means of electricity. Three started passenger trains, and one ordered out the cars as soon as emptied. "You see," said he, "this train which has just come in. The passengers are gone, and I want to know if the baggage is taken out." He touched a stop and rang a bell (as he said) 600 feet distant. In a moment a bell overhead struck twice. "Baggage is out," he said, "otherwise he would have struck once, and I would have waited. I must order the train out. Do you see that locomotive just ahead? Well, now, see it move." He touched a stop and I saw the letter Z displayed at a window in a side building. "He hears a bell ring, also," said the operator. The engine backed down and hitched to the empty train and the Z disappeared. "I shall now send him out," said the operator, as he touched another stop, and the empty train at once moved forward and left the station. The letters X Y Z (I may add parenthetically) designate the locomotives of the Harlem, Hudson River, and New Haven Roads, and are the signals to back down and connect with trains.

"I am now about to send out a passenger train," continued the operator; "a half hour ago I struck twice to open the doors and let the passengers pass from the sitting room to the cars. Now I shall soon close that very door, but first I must stop checking baggage." A small knob was touched by his finger. "Now," said he, "the next trunk that comes must wait for another train. There (another touch with the finger), the baggage car is hauled out and switched on the right track. Five minutes more and she is off. Here goes the 'close the door bell' at a touch; no one passes in after this. Now I say 'all aboard,' a touch, and we hear the distant voice

of the conductor echoing through the vaulted roof. "Now it moves," another touch, and the rumbling movement was immediately perceptible, and in a few moments the train left the station. As the cars go up the road, they signal their progress by ringing bells in the same office until they have got through the city streets, and thus give assurance of a clear track for all that may follow. The station will contain twelve trains of thirteen cars each; and by means of this wonderful system, they are all managed with dispatch and safety.

FROG CULTURE.—Seth Green, the great fish culturist and State Commissioner for stocking streams, now proposes frog culture for food. He says: "We have many stagnant pools about the country, that are useless in their present state; and believing that there is nothing made in vain, I do not know of any other use for them than to make them into frog ponds. I also believe it would make the man wealthy who could raise a million frogs and get them to market."

ONE hundred cubic inches of air weigh thirty-one grains

A NEW WATER METER.

Mr. Charles Deacon, C. E., engineer to the borough of Liverpool, has recently brought into use a water meter which he applies to mains for the purpose of detecting waste. The invention, says *The Engineer*, to which we are indebted for the engraving, consists of a vertical tube lined with brass and equal in diameter at the upper end—where it is connected with the inlet from the main—to the diameter of that main, but larger at its lower end. In the tube is a horizontal disk of the same diameter as the main, with a vertical spindle on the center of its upper face, from the end of which the disk is hung by a fine wire passing out at the top of the tube through a brass gland. The wire is connected above with a counterbalance weight, which, when the water is at rest, retains the disk at the top of the tube, which it completely fills. If water is caused to flow through the instrument, the disk will find somewhere in the tube a position which it will retain until the velocity of the water changes. The lower end of the conical tube being about double the area of the main, no obstruction to the flow can take place, while the motion for any given increment of velocity near the top, or place of minimum flow, can be made equal to, or even greater than, that due to an increment at the bottom or point of maximum flow, so that its sensitiveness is not diminished at low velocities—a feature which is unattainable in any meters constructed on the turbine or analogous principles.

In order to insure the absence of any friction it was found desirable to abandon the use of a stuffing box, and to substitute a single brass gland, the hole in which fits the wire accurately, but not tightly. This wire, being an alloy of iridium and platinum, maintains its condition for any length of time, and the small quantity of water which oozes past it is allowed to drain away. The absolute accuracy and freedom with which the meter acts has been proved by the strictest tests. The vertical motions of the wire are registered by a pencil, connected with it, on a drum revolving once in twenty-four hours, the paper on which can easily be removed at any time and replaced by a sheet with horizontal lines, each of which corresponds with the height at which the pencil stands when the number of gallons per hour marked upon the line is equal to the quantity passing through the meter. The essential peculiarity then of the waste water meter is that it registers on paper the exact quantity of water moving at every instant, and the exact time and rate

at which that quantity changes. At twelve on the first fine night, a waste water inspector sounds each stopcock on the house supply pipes. If the inmates have retired, and a flow of water is heard, the stopcock is closed, its number and the time being accurately noted. At the same instant the meter registers the reduction in the flow of water, and the time at which it takes place. It is sometimes found desirable to arouse the inmates and enter the house, in order to obtain the necessary evidence of waste, especially when the running of water from taps is heard. In other cases the house is visited by the inspector early on the following morning; and if, while he is within, another inspector outside turns on the stopcock, there is generally no difficulty in detecting the source of waste at once. If, however, the waste is not superficial, sounding with the teeth at the taps and other fittings will generally discover a leak in the buried pipes. Each source of internal waste having been discovered by these means, the greatest care must be exercised by the inspectors to insure its remedy in the best possible manner.

A New Method of Determining the Sun's Distance.

The method consists in determining the parallax of one of the exterior planets when in opposition, not by micrometrical measurements of its distance from neighboring stars, but by noting the exact moment at which it may occult a given star and the duration of the occultation (provided such a phenomenon takes place). Theoretically, this is perhaps the most accurate of all methods, but there seems to exist, at first sight, an insuperable objection to its practicability; namely, the apparent impossibility of noting the exact instant of the disappearance and reappearance of the star. If we can get over this difficulty, nothing will stand in the way of a successful application of this method to determine the sun's distance. And here the spectroscope comes to our aid, and affords us the means of conquering this difficulty most completely.

Suppose, just previous to the expected disappearance of the star behind the body of the planet, the spectrum of the two be brought into the field (the star being at that time of course very close to the edge of the planet's disk). We shall evidently have the spectrum of the star superposed on that of the planet, the characteristic stellar lines appearing as well as the planetary ones. This double spectrum will continue visible in the field of view so long as the star's light reaches

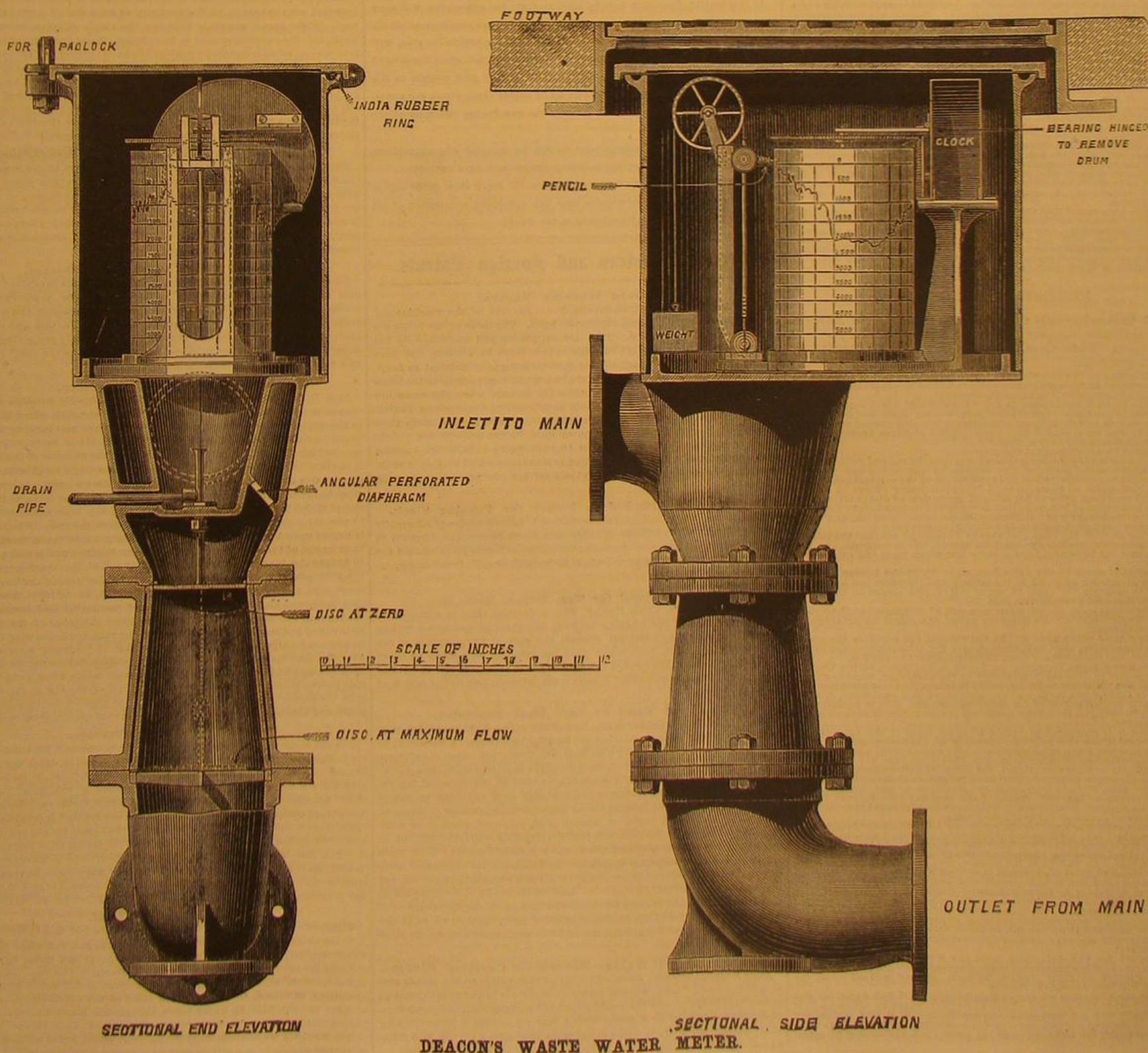
the observer, but the instant its light is cut off by the advancing disk of the planet, at that instant will the stellar spectrum vanish. However slow the apparent motion of the planet, and however dubious the time of the star's disappearance, as determined by telescopic observation, it will be seen that the result obtainable by this method of observation must be most rigorously exact.

The only doubt as to the value appears to be the infrequency of the phenomenon. This, of course, depends entirely on the minimum brightness of the star compared to the planet, necessary to bring out its spectrum at the same time as that of the planet with the required distinctness. On the whole, Saturn would seem to be the planet most favorably situated for the occurrence of this phenomenon, as he has a considerable apparent diameter, while his being much less bright than Jupiter or Mars in opposition would allow of the use of much smaller stars than these two planets—his very slow motion also being a considerable advantage. By knowing previously, approximately, the portion of the planetary disk which will first occult the star, it would be easy to shut out a great portion of the light of the planet, and observe the spectrum only of that portion of the disk behind which the star would disappear. By an arrangement of this nature, I believe that stars down to the fifth, or even the sixth, magnitudes might be very well used for this purpose with either of the three above mentioned planets; and occultations of stars of these magnitudes cannot be very infrequent.—George F. Hardy, in the *English Mechanic*.

New Steam Auxiliary.

A new invention by Mr. J. Berger Spence, of London, consists in passing steam at ordinary atmospheric pressure into a solution of caustic soda, which is thereby raised to its own boiling point. It is proposed to use the heat thus developed to generate steam, the waste steam from an engine boiler being employed in the first instance to heat the caustic soda. Mr. Spence showed that the effect was absolutely produced by raising a solution of caustic soda to a heat considerably over 212° by means of a jet of steam, but he stated that he had not yet worked out practical details as to the employment of the idea, though he exhibited a sketch of an arrangement of boilers which he considered might render it available.

THE combustion of one pound of coal in one minute is productive of a force equal to the work of three hundred horses during the same time.



DEACON'S WASTE WATER METER.

NEW BOOKS AND PUBLICATIONS.

ANIMAL PHYSIOLOGY: the Structure and Functions of the Human Body. By John Cleland, M.D., F.R.S. With 158 Engravings. Price \$1.50. New York: G. P. Putnam's Sons, corner Fourth Avenue & 23d Street.

An elementary work on the science, designed as an introduction to more extended treatises. It is also well adapted to interest the general reader in that most fascinating of studies—one's self—and is sufficiently free from technical verbiage to render the perusal of its pages pleasant while, of course, instructive. We note no especial difference in the plan of the book from the similar work prepared for collegiate uses by Professor Huxley, and it is necessarily a compilation from various sources. The illustrations are both excellent and numerous, and a valuable glossary occupies the concluding pages. The volume is a reprint from the English edition, and forms a part of Putnam's Advanced Science Series.

HYDRAULICS OF GREAT RIVERS: The Paraná, the Uruguay, and the La Plata Estuary. By J. J. Révy, C. E. New York: E. & F. N. Spon, 446 Broome Street.

The government of the Argentine Confederation, three years since, authorized an investigation into the question of the watersheds of their territory, extending from the Rio Vermejo to the Rio Negro, and from the South Atlantic to the Andes. This work was most thoroughly done by M. Révy, of London, England, and the result is before us in an exceedingly handsome volume, illustrated with maps, plans, and sections. The book will be valuable to engineers generally, and especially to those engaged in similar work, as the author's analysis of his results treats the subject of fluvial drainage in the broadest manner; and he gives due commendation to the Argentine Republic for contributing this volume to our libraries of physical geography.

PATENT OFFICE DECISIONS.

SPLIT MACHINE.—RUSSELL AND SCOW.—INTERFERENCE.

[Appeal from the Board of Examiners in Chief in the matter of the interference between the application of Samuel I. Russell, and the patent of Anton F. Scow, granted May 23, 1871, for improvement in machines for cutting splints.—Decided February 17, 1874.]

The case of Fawcett vs. Graham, C. D., 1869, p. 113, referred to and approved.

It is a well established principle that an inventor has the right to employ the mechanical skill of others to carry out his ideas without forfeiting his right to the invention.

In an interference, one who is shown not to have been an original inventor can derive no advantage from having obtained a patent.

Abandonment of an invention is not favored; it can only be established by positive proof, and not by mere presumption or inference.

TRACHER, Acting Commissioner.

This case, as developed by the evidence, presents for determination the question of originality rather than priority of invention.

The Examiner of Interferences and the majority of the Examiners-in-Chief have found in favor of the applicant Russell. The rule of practice in such cases has been stated by the Commissioner in Fawcett vs. Graham, (C. D., 1869, p. 113.)

In this appeal it is not shown that the tribunal below erred in the finding of facts in the case; but the most that can be claimed is that the Board erred in deciding the weight of testimony to be with Russell. This judgment of two tribunals ought not to be set aside except upon the clearest showing that it is contrary to the evidence. In my opinion, has not been done; on the contrary, after carefully reading the testimony of both parties, I have no hesitation in concurring in the decision of the Board and Examiner that, although the testimony is conflicting, the weight of evidence is with the applicant.

What Mr. Scow understands by invention may be gathered from a portion of his "answer 4," where, after stating that Russell suggested putting on an eccentric, he says he invented it as described in his patent. It appears that he believes the person who carries out the ideas and suggestions of another to be a true and original inventor. This may furnish an explanation of his claim to the invention patented. Russell was the employer; Scow was the foreman of one of his shops. Now, it is shown that Russell was in the habit of giving general instructions to his foreman, who proceeded to embody them in suitable form, and in doing so gave the necessary instructions to the workmen under him. This, in my opinion, has not been done; on the contrary, after carefully reading the testimony of both parties, I have no hesitation in concurring in the decision of the Board and Examiner that, although the testimony is conflicting, the weight of evidence is with the applicant.

Considerable stress is laid upon the circumstance that Russell delayed to file his application until some time after the grant of a patent to Scow; and the assertion is made that this delay occurred with full knowledge of Scow's application and patent. I am unable, however, to find a particle of evidence that Russell had knowledge, either of the application by Scow or of the issue of a patent to him. There is, therefore, no presumption of acquiescence in Scow's claim to the invention, for he had never made it in the presence of Russell, who, so far as shown, had no information of the claim set up in the Patent Office; and if Scow is not an original inventor he is not to receive any advantage from having hurried to the Office and obtained a patent.

It has also been urged that the evidence shows more than two years' public use of the machine by Russell prior to his application for a patent; but this is by inference only. Now, abandonment by public use or otherwise is not looked upon with favor. It can only be established by positive proof. Mere presumption or inference will not answer; and this suggestion, therefore, may be summarily dismissed.

The decision of the Examiners-in-Chief is affirmed.

DECISIONS OF THE COURTS.

United States Circuit Court—District of New Jersey.

CHARLES QUINCY vs. SAMUEL BARBER.—PATENT STONE PAVEMENT.

[In equity.—Before Nixon, Judge.—Decided December 30, 1873.]

NIXON, District Judge:

This bill is filed by the complainant for an injunction and an account for the infringement of released letters patent granted to complainant August 22, 1870, for "Improvement in Stone Pavement."

The single claim in the release is for "a pavement composed of stone blocks made in the form of parallelopipeds, having their narrow ends or edges cut smooth and their broad sides purposely cut rugged or uneven, when the blocks are arranged with their rugged surfaces transversely to the street, substantially as described."

The answer to the defendant alleges—
1. That the release to the complainant was fraudulent and void, because the surrender was not made for the purpose of correcting any errors or imperfections in the description or specification of the original patent, but a cover and claim as complainant's invention many things in the art known and used long prior to his alleged invention or discovery, and because the said released letters patent covered and included many things of which the complainant was not the original and first inventor, and which were not described or claimed in the original letters patent.

As it is the duty of the Commissioner of Patents to see that the release does not cover more than the original patent, the presumption of law always is that the release is for the same invention until the contrary is shown.

No attempt is made by the defendant, upon whom the burden rests to prove the allegation of fraud in the release, and the court can hardly be expected to presume it. (Sec. 33, act of July 8, 1870, Judas vs. Dobson, 2 Abb. E. R. 404, 405, 406, 407, 408, 409, 410, 411, 412, 413, 414, 415, 416, 417, 418, 419, 420, 421, 422, 423, 424, 425, 426, 427, 428, 429, 430, 431, 432, 433, 434, 435, 436, 437, 438, 439, 440, 441, 442, 443, 444, 445, 446, 447, 448, 449, 450, 451, 452, 453, 454, 455, 456, 457, 458, 459, 460, 461, 462, 463, 464, 465, 466, 467, 468, 469, 470, 471, 472, 473, 474, 475, 476, 477, 478, 479, 480, 481, 482, 483, 484, 485, 486, 487, 488, 489, 490, 491, 492, 493, 494, 495, 496, 497, 498, 499, 500, 501, 502, 503, 504, 505, 506, 507, 508, 509, 510, 511, 512, 513, 514, 515, 516, 517, 518, 519, 520, 521, 522, 523, 524, 525, 526, 527, 528, 529, 530, 531, 532, 533, 534, 535, 536, 537, 538, 539, 540, 541, 542, 543, 544, 545, 546, 547, 548, 549, 550, 551, 552, 553, 554, 555, 556, 557, 558, 559, 560, 561, 562, 563, 564, 565, 566, 567, 568, 569, 570, 571, 572, 573, 574, 575, 576, 577, 578, 579, 580, 581, 582, 583, 584, 585, 586, 587, 588, 589, 590, 591, 592, 593, 594, 595, 596, 597, 598, 599, 600, 601, 602, 603, 604, 605, 606, 607, 608, 609, 610, 611, 612, 613, 614, 615, 616, 617, 618, 619, 620, 621, 622, 623, 624, 625, 626, 627, 628, 629, 630, 631, 632, 633, 634, 635, 636, 637, 638, 639, 640, 641, 642, 643, 644, 645, 646, 647, 648, 649, 650, 651, 652, 653, 654, 655, 656, 657, 658, 659, 660, 661, 662, 663, 664, 665, 666, 667, 668, 669, 670, 671, 672, 673, 674, 675, 676, 677, 678, 679, 680, 681, 682, 683, 684, 685, 686, 687, 688, 689, 690, 691, 692, 693, 694, 695, 696, 697, 698, 699, 700, 701, 702, 703, 704, 705, 706, 707, 708, 709, 710, 711, 712, 713, 714, 715, 716, 717, 718, 719, 720, 721, 722, 723, 724, 725, 726, 727, 728, 729, 730, 731, 732, 733, 734, 735, 736, 737, 738, 739, 740, 741, 742, 743, 744, 745, 746, 747, 748, 749, 750, 751, 752, 753, 754, 755, 756, 757, 758, 759, 760, 761, 762, 763, 764, 765, 766, 767, 768, 769, 770, 771, 772, 773, 774, 775, 776, 777, 778, 779, 780, 781, 782, 783, 784, 785, 786, 787, 788, 789, 790, 791, 792, 793, 794, 795, 796, 797, 798, 799, 800, 801, 802, 803, 804, 805, 806, 807, 808, 809, 810, 811, 812, 813, 814, 815, 816, 817, 818, 819, 820, 821, 822, 823, 824, 825, 826, 827, 828, 829, 830, 831, 832, 833, 834, 835, 836, 837, 838, 839, 840, 841, 842, 843, 844, 845, 846, 847, 848, 849, 850, 851, 852, 853, 854, 855, 856, 857, 858, 859, 860, 861, 862, 863, 864, 865, 866, 867, 868, 869, 870, 871, 872, 873, 874, 875, 876, 877, 878, 879, 880, 881, 882, 883, 884, 885, 886, 887, 888, 889, 890, 891, 892, 893, 894, 895, 896, 897, 898, 899, 900, 901, 902, 903, 904, 905, 906, 907, 908, 909, 910, 911, 912, 913, 914, 915, 916, 917, 918, 919, 920, 921, 922, 923, 924, 925, 926, 927, 928, 929, 930, 931, 932, 933, 934, 935, 936, 937, 938, 939, 940, 941, 942, 943, 944, 945, 946, 947, 948, 949, 950, 951, 952, 953, 954, 955, 956, 957, 958, 959, 960, 961, 962, 963, 964, 965, 966, 967, 968, 969, 970, 971, 972, 973, 974, 975, 976, 977, 978, 979, 980, 981, 982, 983, 984, 985, 986, 987, 988, 989, 990, 991, 992, 993, 994, 995, 996, 997, 998, 999, 1000.)

2. The defendant also alleges prior use, and abandonment to the public by the complainant; but he gives no notice and offers no evidence to sustain the charges.

The only matter put in issue by the answer and the proof is the question of infringement. The defendant denies the allegations of the bill in this respect, and the burden is upon the complainant to show it.

The laying of a stone pavement on South Broad Street, facing Lincoln Park, in the city of Newark, is admitted by the defendant, and the expert witness, J. Boyd Elliot, is called to testify in reference to its construction.

He states that he has made an examination of said pavement, that he understands the principle of its construction, and that it corresponds substantially with the invention described in the complainant's released letters patent.

1. Because it is composed of blocks of stone made in the form shown and described in the said patent, consisting of parallelopipeds or solid figures, whose sides are parallelograms; said blocks being provided with ends or edges formed sufficiently smooth, that when they are abutted together in position to form a pavement, the joints or seams between the said blocks are closed, or substantially so, in a longitudinal direction, or parallel with the sides of the street, or in the direction of the line of travel along the street, so that the wheels of the vehicles passing over it will meet with a comparatively smooth surface, or be prevented from sinking into crevices or openings between said blocks.

2. Because said blocks are so selected and laid with their broad sides abutting against each other as to produce open joints in a direction transverse to the street, in such a manner that a firm foothold is provided for the draft animal traveling along the street, substantially as described in the said patent. He expresses the opinion that the combination of these blocks of stone to form a pavement is of such a character as to perform the functions set forth in the complainant's released patent, and the advantages to be gained in the formation of such a pavement, recited in said patent, exists to a substantial degree in the pavement constructed and laid by the defendant.

This testimony stands without material contradiction, and there must be a decree against the defendant, unless it should appear, upon further examination, that the invention of the complainant is not in fact a patentable subject.

The counsel for the defendant upon the argument took the ground that there was nothing patentable in the complainant's alleged invention. It was objected in reply that, as no such defense was set up in the answer, it was then too late to urge it.

Whether the objection of the complainant is valid and sufficient depends upon what the counsel of the defendant meant by affirming that the invention was not patentable. If he meant that it was not on the ground of a want of novelty the objection was well taken, for such a defense falls under the first section of the patent act, and should be specified.

But if he meant that the invention was not a patentable subject—that is, did not come within the description of "any new and useful art, machine, manufacture, or composition of matter, or any new and useful improvement thereof, not known or used before the application" for the patent, as required by the 34th section—such a defense is authorized by the general pleadings, because the bill of complaint necessarily imports that the patentee has invented a patentable subject.

Assuming, therefore, that he meant the latter, the remaining question is whether the improvement claimed by the complainant is an improvement in "any new and useful art."

The patentee, in the specification of his letters patent, describes his invention as relating to a pavement composed of stone blocks, which are made in the form of parallelopipeds, and the surfaces of which are so prepared that the blocks, when placed together, will form close joints in the direction parallel with the sides of the streets or in a longitudinal direction, while the joints running transversely to the street remain open at the top, and thereby a pavement is obtained which offers a good foothold for the draft animals, and at the same time a smooth surface for the wheels passing over the same.

The edges of the blocks adjacent to the transverse open joints are to be chamfered off so as to insure a good foothold for the draft animals.

To exhibit its superiority over other forms of stone pavement, he further states that if a street is paved with truncated pyramids, as used in the Russ or Belgian pavement, close joints are formed at the surface of the pavement, both in a longitudinal and transverse direction, and said surface offers no foothold to the draft animals passing over the same; but by placing a series of blocks together, as exhibited in Fig. 2 of this release, close joints are formed in a longitudinal direction, and open joints in a transverse direction, and a stone pavement is obtained which offers a firm foothold to the draft animals, while it presents a comparatively smooth surface to the wheels of vehicles passing over it, and at the same time each block is firmly retained in position by the adjoining blocks without requiring any intermediate layers of stone or other material.

Such an improvement in the mode of constructing a stone pavement is a patentable invention, and must be held to be new in the absence of proof to the contrary from the defendant, and it is doubtless useful in the sense in which that term is used in the act, to what degree or extent is wholly unimportant, as it is not a question in the case.

Let there be a decree for the complainant for an injunction and an account.

Edmonds & Field and George Harding, for complainants.

George Foske, for defendants.

Inventions Patented in England by Americans.

[Compiled from the Commissioners of Patents' Journal.]

From February 2 to February 7, 1874, inclusive.

GUM EXTRACTION.—D. D. Cattinach, Providence, R. I.

HOKING, ETC.—R. McKinley, Hyde Park, N. Y.

IRON SHEARS.—W. X. Stevens, East Brookfield, Mass.

LIQUID METER.—F. W. Brooks, New York City.

METAL TUBE.—E. P. Wilbur, Bethlehem, Pa.

MOLDINGS.—J. Gochwind, Union, N. J., et al.

PIPE TONGS AND CUTTER.—F. T. Ferguson, Boston, Mass.

ROCK DRILLING.—W. W. Dunn (San Francisco, Cal.), London, England.

SEWING MACHINE.—W. G. Beckwith, Newark, N. J.

SPINDLE BOLSTER, ETC.—C. F. Wilson et al., Brooklyn, N. Y.

STEAM BOILER, ETC.—B. T. Babbitt, New York City.

STEEL FROG.—J. Patterson, Hornellsville, N. Y.

STOVE, ETC.—J. E. Sherman, Bucksport, Me.

WELDING COPPER.—W. G. Rehbein et al., Baltimore, Md.

IMPORTANCE OF ADVERTISING.

The value of advertising is so well understood by old established business firms that a hint to them is unnecessary; but to persons establishing a new business, or having for sale a new article, or wishing to sell a patent, or find a manufacturer to work it: upon such a class, we would impress the importance of advertising. The next thing to be considered is the medium through which to do it.

In this matter, discretion is to be used at first; but experience will soon determine that papers or magazines having the largest circulation, among the class of persons most likely to be interested in the article for sale, will be the cheapest, and bring the quickest returns. To the manufacturer of all kinds of machinery, and to the vendors of any new article in the mechanical line, we believe there is no other source from which the advertiser can get as speedy returns as through the advertising columns of the SCIENTIFIC AMERICAN.

We do not make these suggestions merely to increase our advertising patronage, but to direct persons how to increase their own business.

THE SCIENTIFIC AMERICAN has a circulation of more than 42,000 copies per week, which is probably greater than the combined circulation of all the other papers of its kind published in the world.

Recent American and Foreign Patents.

Improved Washing Machine.

Theophilus C. Eberhardt, Hochheim, Tex.—The box of the machine and rubbing boards are made semicircular in form. The faces of the latter are corrugated and perforated. They are supported and oscillated by the square shafts, which pass out through square holes of sockets, and have handles. The outer surface of the sockets is made cylindrical in form. The rubbing boards are forced forward by bent springs secured to the inner ends of the sockets, which slide upon the boards, when the same are drawn outward or apart. By suitable construction, the rubbing boards, shafts, sockets, and springs all move together, so as to always retain their proper relative positions. To the outer ends of the sockets are rigidly attached levers. These are pivoted to connecting rods, which connect with cranks formed upon a shaft. The shaft carries on its ends fly wheels, which may be arranged to rest upon the floor for convenience in moving the machine.

Device to be Attached to Fences for Turning Stock.

Jacob Halk, De Kalb, Ill.—This invention relates to modes of effectually turning stock with hoop band or other light railed fences, and consists in peculiarly formed bars for deterring the animals from rubbing against the fence, or otherwise bringing to bear their weight, so as to break down, injure, or impair the same.

Improved Chest for Tea, Coffee, Rice, etc.

George Littlebridge, Little Cooley, Pa.—A vertical slide is arranged to regulate the size of the opening between the chest proper and a trough applied exteriorly, and thereby control the exit of the contents of the chest into the trough, from which they are removed by a scoop or other convenient device. The trough has a lid or cover as well as the chest, and thus the tea or other substance is kept from deterioration by the action of the atmosphere.

Improved Vault or Safe Door Fastening.

John B. Cornell, 120 Center Street, New York City.—This invention consists of auxiliary bolts connecting the locking bolt frame to the door, so that, when the primary bolts which hold the frame and door in intimate contact have been broken by an explosion, the auxiliary bolts, first allowing the door to be opened far enough to give vent to the force of the explosion, then arrest the further movement, and hold the door so nearly closed that access to the safe cannot be gained without cutting or breaking the door or bolts with tools. A second plan proposed consists of slots from the locking bolt holes in the frame extending obliquely upward or downward toward the inside of the frame a certain distance; these slots are so made that, while they will secure the locking bolts with ample security against the efforts of the burglars to pry and wrench the door off, yet the tremendous force of an explosive inside of the safe will force the frame along the bolts to the ends of the slots, and thus afford the necessary vent to dissipate the force of the explosion and still hold the door so as to demand too much labor for gaining access to be performed with safety after the noise.

Attachment to Self Raking Reapers for Carrying Binders.

Allen Eljah, Clarence, Iowa.—This invention relates to the stands employed upon that class of reapers wherein the grain is bound up into bundles before it is dropped, and the novel means for accommodating the binders. These means consist in a frame with a rear projection, a non-revolving shaft having end stirrups, and a stand connected with a stirrup by a chain at one front corner, and at the other with the projection of the frame.

Improved Stud and Button Fastening.

Philip H. Long, Newark, N. J.—This invention relates to the construction of stud and button fastenings for shirt bosoms, collars, wristbands, etc., and consists in a stud or button and base, so constructed that the two are securely fastened together by turning the stud or button as part of a revolution, and unfastened by a reverse movement.

Improved Fire and Water Proof Roof.

Tobias New, New York City.—The object of this invention is to provide means for protecting buildings (having interior wooden timbers) from fire as well as from water; and consists of a roof made of a stratum of fireproof material laid on felt or planking to about two inches in thickness. A piece of timber is bedded in the fireproof substance, and has its upper side flush with the surface thereof. On this is placed a water-repellent covering and over this an ordinary gravel, slate, tin, or other roof.

Improved Toy Gun.

John Alexander, New York City, and Hiram W. Gordon, Lynn, Mass.—This invention consists of a toy gun, in which a rod or pusher is thrown forward in the barrel by a spring, for expelling marbles and the like. The barrel has a funnel-shaped muzzle, in which marbles, peas, or other round bodies of different sizes can be held, by friction, in front of the pusher to be expelled, the said marbles and other objects being gently pressed in to secure them.

Improved Wind Mill.

William C. Nelson, Kentland, Ind.—The wheel is made in two sections, each having a separate portion of the hub, which is hinged to a middle portion which comprises a T head to the shaft. Each section of the wheel has a spring attached to the middle portion of the hub, and arranged to hold the section up to the wind when the latter is not too strong, and to yield when the latter is the case, and, by allowing the section to swing around toward the plane of the shaft, relieve the wheel, and thus protect it from damage. The wheel is arranged to receive the wind from behind the standard, on which its shaft is supported, and to dispense with a tail vane, which is required for keeping it in the winds, when arranged to take it in advance of the post.

Improved Animal Trap.

John M. Marberry, Johnsonville, Tenn., assignor to himself and John M. Palmer, of same place.—The wire cage has the usual entrances, and is attached to a bottom board. A small bait box, having wire sides and a hinged top, is secured to the bottom board by hooks and staples. The opening in the cage for the insertion of the bait box is closed by a prison box, which is attached to the cage by wire hooks. The box has a vertically sliding door which is held either closed or elevated by a sliding bolt. When the trap is to be put in readiness for catching animals, the prison box is detached from the cage, and the bait box removed through the opening thus uncovered. When bait has been put in the box, it is replaced and secured. The prison box is then attached to cover the opening in the side of the cage. The animal enters the cage, and thence passes naturally into the prison box with a view to concealment. The gate being lowered and secured by the bolt, the box may be removed to a place convenient for dispatching the animal.

Improved Brick Kiln.

Nelson Sicksels, Newell, Iowa.—The walls inclosing the kiln are permanent. The lower portion of the bricks to be burned, in which arches are formed. These bricks are arranged close together in the direction at right angles to the arch, but with spaces between them the other way; and long bricks are placed across the arches a short distance above the bottom suitable for burning coal. The bricks above the arch bricks to be burned are arranged with spaces in both directions to be filled or partly filled with coal. Wider spaces are made between the stack of green brick and the walls, also for containing coal to be burned. They are divided vertically into several compartments by rows of bricks extending against the walls to separate the coal and keep it from falling to the bottom of the spaces as it burns. The arches extend through the kiln from side to side, and have the coal placed in them throughout their whole length to be burned throughout alike. The fires are started at the mouths of the arches, and kept burning moderately until the bricks get dry; then they are allowed to advance throughout the kiln in all the spaces as fast as necessary.

Improved Trumpet for Railway Heads, etc.

Richard E. Frye, Manchester, N. H.—The upper part to the lower side of the mouth is beveled, and a slide gate or valve is arranged under clips or guides forward and back over the beveled portion, to expand or contract the mouth, as may be required, the upper wall of the mouth being formed in the end of the slide. To adjust and secure the slide is a screw-threaded rod, passing through an eye stud on the top of the trumpet, and having adjusting and binding nuts arranged on each side.

Improved Grate Cleaner Attachment.

Adolph Tieusch, Memphis, Tenn.—The object of this invention is to provide fire place and other grates to which it may be applicable with a permanent attachment for cleaning them, or removing the ashes and cinders that accumulate in the bottom thereof. To this end a shaft is pivoted beneath the grate, and provided with laterally projecting arms or fingers that will work up between the grate bars as the shaft is rocked by a foot lever or other suitable device.

Improved Fire Extinguisher.

John Dillon, 421 Fourth Avenue, New York City.—By suitable construction access may be obtained to the interior of the case, which is fastened to the wall of the room, by turning back the cover and turning down the upper part of the front, or both the upper and lower parts of said front may be turned down. A reel shaft revolves in the interior of the case, and is made with shoulders, to prevent it from having a longitudinal movement. One end of the shaft is tubular, and with its cavity is connected, close to the reel disk, the end of the wire-lined rubber hose, to the other end of which is secured a nozzle. The wire of the hose enables the water to pass through it freely, even when wound upon the reel. When the hose is wound upon the reel, the nozzle is inserted in a hole in the bracket. The tubular end of the shaft projects beyond the bracket, and is made conical to fit into the tapering hole in the globular end of the short ingress pipe, the other end of which is connected with the water pipe of the house. The short pipe is provided with a stop cock, which, by suitable mechanism, may be opened and closed by lowering and raising the said lower part of the front of the case. By other arrangements the front of the case may be lowered and raised without disturbing the stop cock, allowing the same to be closed while the front is lowered to shut off the water when about to wind the hose upon the reel. The latter operation causes the water to run from the said hose, so that it may be free from water when wound up. A ring groove is formed around the tapering part of the end of the shaft, so that the water may pass constantly from the pipe to the interior of the shaft, and thence to the hose, even when the said shaft is revolving.

Improved Curtain Fixture.

Improved Machine for Soldering Cans.

William D. Brooks, Baltimore, Md.—This invention consists in several improvements which have been tested by many practical experiments, and which greatly lessen the average expense of soldering the tops, caps, and sides of cans and have made it possible for unskilled hands to do the work rapidly and well.

Machine for Marking Letters and Canceled Stamps.

Chas. J. Goff and Elmer B. Hursy, Clarksburg, W. Va.—This invention relates to mechanical means whereby stamped letter envelopes in the Post Office Department may be conveniently and rapidly canceled. The invention consists in a series of improvements by which a single person can, in a comparatively short space of time, do all the canceling required at any post office, thereby not only securing uniformity and thoroughness in the work, but great economy of time and cost.

Base Burning Stove for Anthracite Screenings.

Henry R. Robbins, Baltimore, Md.—This invention relates to an improved magazine stove, especially adapted for burning anthracite coal screenings, and thereby utilizing what has been generally regarded as a waste product of the coal yard. The magazine, or cylinder for holding the coal, has a conical terminus formed of a narrow ring and vertical bars, the latter arranged at such distance apart as to prevent escape of the bulk of screenings between them, while allowing free access of flame and heat from the body of incandescent coal in the fire pot immediately below. Thus a degree or extent of combustion which would be difficult or impossible to produce and maintain, by means of the ordinary form of cylinder in magazine stoves is assured, while the area or surface of burning coal is largely increased and thereby a correspondingly greater degree of heat produced. The gas formed in the cylinder is fed down into the flame or burning coal by tubes, which are arranged directly over the fire pot so that the gas becomes highly heated before reaching the coal, and thus has its inflammable and combustible property increased. The invention also includes an arrangement of two annular registering slides with a fire pot open on the sides, whereby the combustion may be increased at the base or top, or both, of the body of screenings contained in the pot, as occasion or necessity requires.

Improved Transplanter.

Ara Race, Cheraw, S. C.—This invention relates generally to transplanters, but particularly to those which are used for the removal and transportation of cotton plants. The invention consists in combining a concave plate with a reciprocating spade; in the construction of the spade with a convexity on the inner side and opposite the convexity of plate; and in combining a crooked slotted rod with the spade handle.

Improved Watch.

Louis Evans, Pittsburgh, Pa.—This invention consists in combining the winder post with the wheels and barrel, and also in the application of levers in connection with the wheel post and the dial wheel.

Water Heater, Warming Closet, etc., for Cook Stoves.

John O. Shriner and John Taylor, New Castle, Ind.—The object of this invention is to provide for household use an attachment for the ordinary cook stove which is adapted for heating a large or small quantity of water by means of a reservoir and a hollow cylinder placed in the stove pipe or drum, the two being connected by branched circulating pipes arranged in a peculiar manner. The invention also includes a warming closet which is arranged to slide on the cover and slide of reservoir.

Improved Fire and Water Proof Roof.

Tobias New, New York city.—This invention relates to a peculiar construction of the roofs of buildings so that they may be always preserved in a waterproof condition, and yet allow the same to serve as a walk over which families or servants may travel in order to utilize the same for drying clothes and other useful purposes.

Improved Binding Attachment for Harvesters.

William M. and George H. Howe, Lansing, Minn.—This invention consists in combining a straw rope twister, a binding arm, a tucker and a cutter so that the rope is made and delivered automatically; also in certain subsidiary features of improvement which greatly add to the efficiency and utility of the binding attachment.

Improved Water and Gas Cut Off.

Eugene M. Morris, Baltimore, Md.—This invention relates to means for locking and operating the valve of a gas or water cock. It consists in combining with a valve rod connection a ratchet-angled drum, a thumb-pieced detent slide, and a spring.

Improved Perspectograph.

Anderson R. East, Selma, Ind.—The object of this invention is to provide a simple and efficient mechanical apparatus by which to take the points or boundary lines of all visible stationary objects accurately and transfer them to paper on a sketch board. Two perpendicular bars extend from a bed piece. On one bar are two sleeves, the lower of which carries a horizontal arm, the further extremity of which is slotted to receive the second perpendicular bar. On the horizontal arm slides a vertical rod through which, at its upper end, passes another horizontal arm, which is attached to the upper sliding piece on the bar first mentioned. Pivoted to either sliding piece at will is a converging arm which carries one eye plate on a vertical staff. On all these portions except the swinging arm are marked scales. A single example of the mode of using the instrument will suffice to show its application. To operate by the use of the perpendicular scale and the horizontal scale on the upper sliding piece, or, in other words, to take field notes by latitude and departure, using the sliding scales, slide the horizontal scale to the top of the meridian, and move the scale of latitude (the vertical rod on the lower horizontal arm) to the extreme right. An object in the foreground to the extreme left and nearest to the observer is selected and regarded through the eye plate. The scale of latitude on the base is next moved till it comes in direct line with the eye and the said point. Then the horizontal scale at the top of the meridian is loosened and moved down till it also comes in direct line from the eye to the object, and the angle of incidence or the latitude and departure of the said point of the object is found at the intersection of the two scales. A horizontal scale on the plate board is moved until it cuts the degree of latitude of said point in the object, and a dotter is fixed to the angle of longitude or departure. By a gentle pressure on the dotter the point is carried on the paper. In this way the operation is carried on from object to object, and from point to point, until the entire field is gone over.

Improved Breast Pad.

Frederick Cox, Brooklyn, N. Y.—This invention consists of inflatable India rubber breast pads so constructed as to fit over the breast and not bear directly upon it. There is an annular cushion to bear around the base of the natural breast, and also a ventilating opening from the cavity. The device improves the form of the natural breasts by keeping them in the natural shape, instead of flattening and depressing them, as the common pads do; and they are more healthful, and retain their own proper shape better.

Improved Lard Cooler.

William J. Wilcox, Paterson, N. J.—To make a strictly prime article of lard, it is necessary to stir or agitate it to a certain extent while it is cooling after having been rendered or melted by heat. To this end it is proposed to employ two revolving agitators, turning on their own axes, while at the same time rotating around the axis of the tank. The agitators being on opposite sides of the axis of the tank, their action is rendered very nearly equal throughout all parts of the latter. Four of said agitators may be used as well, two being in a line at right angles to the line of the other two; but generally two only will be sufficient.

Improved Medicinal Capsule.

Peter Cauhape, New York city.—This method of making the capsules consists of dipping a ball in the gelatin in a liquid state, of such low temperature that a thin film will adhere to and solidify on the ball when lifted out, sufficiently to form an elastic envelope. This is pulled off the ball by the fingers, and placed in a mold, with the mouth upward, to be filled with the medicine, after which it is sealed up. By flattening the ball to a certain extent at the bottom, the accumulation of the material thereat will make the sack round, forming an article which is much better in respect of appearance, and is more acceptable to the public than the old elongated form.

Improved Medical Compound.

Edmund C. Lippincott, Eatontown, N. J., and Thomas R. C. West and James West, Brooklyn, N. Y.—This improved compound is for the cure of cancers, and is made of the juice of sheep sorrel, turpentine, and muriatic acid. The whole mass is reduced by evaporation to a thick, pasty state, when it is complete, and ready for use. It is applied to the parts affected in the ordinary way of using such remedies.

Improved Iron Pavement.

John Vandercar, Brooklyn, assignor to Martin Van Buren, New York city.—On the bottom of each section which is placed on the roadway is a flange, which is embedded in the foundation and prevents the section from getting displaced by the wear upon it. The sections, each with a tight bottom, have a broad surface, and may be made to lock together so as to support each other. The intermediate chambers are filled with concrete, which will harden by exposure to the air, or may be filled with sand or gravel so as to give a good foothold for horses. The chambers are eight or ten inches in depth. A pavement thus formed of sections, it is claimed, may be readily taken up for putting down water or gas pipes without injury.

Improved Kitchen Safe.

John B. Harrison and Josiah M. Harrison, St. Joseph, Mo.—This invention is an improvement in kitchen safes of the class in which spice drawers, dough kneading boards, and flour sifters are arranged conveniently for use. There are spice drawers, and a space provided with shelves, closed by a hinged door. A bracket supports a kneading roller and other articles. The hinged dough-kneading board may be adjusted at various angles to the front of the safe, thereby adapting it for convenient use. The top of the safe has a hinged lid which forms the cover of the conical hopper. The latter is designed to be a permanent receptacle for flour or meal, and has a sieve applied to its apex in such a manner as to be readily detached for cleaning, etc. Within the sifter is a rotary stirrer, the shaft of which is provided with a crank handle outside the safe. To control the descent of flour or meal into the sifter, a slide which forms the true bottom of the hopper is employed.

Improved Locomotive Drawbridge.

George Sickelsteel, Lapeer, Mich.—This invention consists of a strong frame, about as long as two spaces and two abutments of an ordinary bridge, mounted on wheels. The latter are so arranged and connected together that, the locomotive being run on the bridge and rested with each of its driving wheels on two wheels of the bridge and set in motion, its wheels will actuate the wheels of the bridge, and cause it to cross on the abutments. The bridge is always supported by two of the abutments, or more if made longer, so as to prevent it from tilting down between them. A movable bridge is thus provided which itself crosses with the cars, and leaves the spaces between the abutments free for the passage of vessels. The invention is intended to take the place of the drawbridges now used for navigable streams, and is calculated to save much time, both to the cars and vessels.

Improved Gang Plow.

Allison G. Cummins and John R. Cummins, McKinney, Tex.—The king bolt is extended upward and curved forward, and to its upper end is pivoted a lever, to which, at a little distance from its pivoted end, is pivoted the end of a connecting rod, the other end of which is pivoted to the tongue. By this construction, by moving the free end of the lever to the rearward, so as to lie along the curved upper part of the king bolt, the plows will be raised and locked away from the ground. When breaking up, or when bedding or ridging cotton or other land, or when doing other plowing that requires a rigid plow beam, a brace is used, the forward end of which is connected with the forward bolster, and its rear end is hooked into the hinged plow.

Improved Car Coupling.

George D. Spielman, Lancaster, Ohio.—This invention consists of a horizontal bar, arranged transversely to the car in a horizontal slot in the end of the drawhead, and pivoted to its middle to the latter. A hook on one end engages the end of a similar car on the drawhead of the other car to be coupled. The second bar similarly engages the end of the first mentioned bar. The slots in the drawhead are shaped so that the coupling bars can be raised at the ends having the hooks, and depressed at the other ends to allow the hook ends to rise up over the other ends for coupling. The hook ends of the bars are provided with chains to lift them up. The drawheads are also chambered out above and below the slots, for the coupling bars to receive the ordinary coupling links, and pin holes are provided for the ordinary coupling pins, so that cars with this improved coupling can be attached to others having the ordinary couplings. The hook of one bar encounters the end of the other bar not provided with a hook, and rises up on it because of its curved end, while, at the same time, the said end swings down in consequence of the hook at the other end rising on the end of the other bar. The bars extend into the slots far enough to receive the pivots behind the ordinary coupling pins, and they are slotted sufficiently for both of said pivots to allow them to swing upward and down, as needed for engaging and disengaging with each other. The coupling is very strong and durable, and will couple self-actingly, as well on curves as on straight lines, and will uncouple in case the cars run off or shift.

Improved Bag Fastener.

Scott Wellington, East Saginaw, Mich.—A strap of leather is made of such a length as to allow the gathered mouth of the bag to be readily passed through it, and its ends are riveted to a small metallic plate. Upon the side, edge, and center of the middle part of the plate, are formed lugs connected by two rods. To the outer rod are pivoted two pointed plates, of such a length that they cannot pass the inner rod, and which are designed to press the fastening strap down against the said inner rod. A narrow strap has its middle part sewed to the middle part of the strap first mentioned. The end parts of this strap are passed through staples attached to the main strap, and their ends are passed through the spaces between the lugs and rods. In using the tie, it is extended, and is passed over the gathered mouth of the bag to be fastened. The narrow strap is then drawn tight, and is held securely by the tongues.

Improved Window Screen.

John H. Thompson, Flemington, N. J.—This invention relates to the construction of screens for windows, and consists in an adjustable frame by means of which the screen is adapted to windows of different sizes. The frame is made in two parts, the sides being constructed so that the parts lap past and slide on each other, so as to keep the edges of the screen cloth tightly inclosed when the frame is extended. Strips are inclosed by the sides, forming a part thereof, to which the screen cloth is attached. Each piece consists of two parts, which are fastened together with the screen cloth between them, the end pieces only being grooved. The depth of the grooves in the ends of the frame determines the extent to which the frame may be extended without leaving an opening. The screen cloth is preferably made of wire, but ordinary mosquito netting may be used.

Improved Bridge.

Richard Long, Stetapolls, Iowa.—This invention relates to improvement in railroad and other bridges of shorter spans, with wooden arches, and consists in the use of stirrups suspended from the arches which carry the cross beams, together with longitudinal stay rods, which connect the ends of the arches.

Improved Reversing Valve for Steam Engines.

Philip T. Brownell, Elmira, N. Y.—Steam is admitted through an aperture, in a cup which fits on the receiving chamber. Pipes connected with this chamber convey the steam to the several cylinders. The valve receives a rotating motion from the crank shaft, and the latter is supported by a spider, which is fitted to the upper edge of the chamber. Upon the lower end of the shaft is a cross bar, with a toe at the end, which takes hold of lugs on the top of the valve for revolving the same. The valve is a hollow shell, having partitions and a hollow tubular center. The cylinder slides in the center, and has a horizontal partition which separates the live from the exhaust steam. The center has two long slot ports, and the sliding cylinder has two corresponding therewith in size and position. The cylinder is given a slight sliding motion, which allows either pair of these ports to register for admitting steam and exhausting it. The sliding cylinder revolves with the valve. When one pair of ports is admitting steam, the opposite pair are exhausting it; and this action is instantly reversed by a slight movement of the sliding cylinder.

Improved Folding Satchel or Box.

Lorenzo M. Gillet, New York city.—This invention is a small satchel or box for travelers that can be folded up in a small, compact package when empty. The bottom, sides, ends and top, may be cut in one piece from pasteboard, leather, or other suitable material, or said parts may be made separately with joints to bend at the angles of the box for adjusting it or setting it up for use. The sides and top fold against the edges of the ends and project a little beyond them, so that staples on said ends will project through slots to fasten the ends and sides together by pins through them, or any other equivalent arrangement. The top will overlap one of the sides and form a lid for opening and closing the box or satchel. Any ordinary trunk or satchel handle may be attached, or a shawl strap may be buckled around the box for carrying it.

Improved Combined Ash Box and Sifter.

John D. Heins, New York city.—This invention consists in the arrangement of a sieve and close ash box in a large inclosing box, whereby wood may be conveniently removed, and also ashes may be sifted without allowing any portion to escape. The wood and coal are supplied to chambers by raising the hinged cover, and the former may be removed without disturbing said cover by turning down a door which is hinged at the front and is of a width less than the depth of the box. The sieve is worked by a detachable handle, to be introduced through the holes in the case. After the ashes have been sifted out, the sieve can be taken out when the handle has been detached, and emptied into the coal chamber, and the ash box can be withdrawn from time to time to carry the ashes away.

Improved Ditching Machine.

John M. Dunn and Murdoch M. Dunn, Erin, Miss.—This invention has for its object to improve the construction of the machine for which letters patent No. 119,334 were granted to John M. Dunn. The frame may be slid to adjust the machine laterally to work in any desired part of the excavation. The wheels and axle may be swung forward to lower the machine into working position, or swung back to raise the machine for passing from place to place. The device may be readily secured in place when adjusted, and is raised or lowered by suitable mechanism connected with the wheels. The plow may also be raised and lowered and adjusted. A wheel made with a wide tread projects upon one side of its body. In the angle between the body and rim of the wheel are secured small plates, arranged radially, and which serve as buckets to carry up the soil thrown into the cavity of the wheel by the plow. A guard plate keeps the earth from falling from the ascending buckets. As the buckets reach the upper part of the wheel, the soil falls from them into an inclined spout attached to the frame, where it is received upon the wings of a wheel, by which it is projected upward and outward to fall upon the ground at the side of the ditch. The earth from the wheel is caused to fall at the desired distance from the wide wheel by a shield against which it strikes. The winged wheel is so arranged that it may be driven by the advance of the machine.

Improved Pantaloons.

William O. Linthcum, New York city.—The object of this invention is to render pantaloons more elastic, and the fastening more durable than they have hitherto been; and it consists in an adjustable elastic strap attached to the waistband or top of the pantaloons behind, and in a plate fastening in front. By means of this elastic strap, the pants are made self-adjusting to the waist or abdomen, and are rendered easy and comfortable to the wearer.

Improved Heating Stove.

Edwin A. Osborne, Charlotte, N. C.—The ash pit is deeper at the back than at the front part, to prevent the ashes rolling forward, and there is an opening in the bottom at the front, with a collar cast around it for receiving the pipe through which the air is admitted to support combustion in the stove. The supply of air is regulated by a damper, which has an elevation, to prevent the falling of ashes into its vent, and a thin narrow handle, which extends from the inside of the ash pit through a narrow opening in the front. This is all cast in one piece. The pipe extends through an opening in the floor corresponding with the position of the front of the stove, and at the lower end below the floor is a wicker work of wire, with a tin or sheet iron bottom, as a spark arrester. The covering for the ash pit is a common movable cover. The object of the invention is to obtain the supply of air outside the room to be heated, thus preventing currents, preserving the uniformity of the temperature, and requiring less fuel.

Improved Middlings Purifier.

Morris Sower, Princeton, Ill., assignor to Sower Brothers, same place.—An inclined frame is placed within the main frame, and is made a little shorter than the latter, so that it may have a longitudinal movement. It is actuated by an eccentric in one or both directions, supporting springs always bringing it back promptly when released. The frame to which the bolt cloth is attached is suspended within the vibrating frame by flexible straps. By this arrangement each movement gives a sudden jar to the cloth frame, which keeps the cloth clean without the use of brushes. The middlings are fed to the cloth frame by a roller or other suitable feed from a hopper, which is placed above the upper end of the frame. Below the discharge opening of the hopper a spout leads into an expansion chamber, from the lower part of which a short spout leads out through the rear end of the box, which is provided with a trap door. From the expansion chamber an opening is formed into the fan chamber. The air is so directed that it passes up through as well as along above the bolt cloth, while a third current goes through the middlings as they fall from the hopper. By this construction the air drawn through the machine by the fan carries the light impurities with it. Any of the middlings that may pass through the spout with the air settles in the expansion chamber, and may be drawn off when desired.

Improved Plow.

Isaac M. Fork, Belton, Tex.—This invention has for its object to furnish an improved plow, so constructed that it will scour and keep bright in the stiffest and most sticky prairie soil, and will thus work without clogging where ordinary plows cannot work. The invention consists in an improved plow plate, formed of a single piece of iron or steel, with its point in the form of an isosceles triangle with a rearwardly inclined land side flange. The angular line between the land side flange and the mold board is concaved upon the arc of a circle about six feet in diameter. The mold board is convexed, so that a line drawn from its rear corner to the point of intersection of the said angular line and the point may be upon the arc of a circle of about twelve feet in diameter.

Improved Sash Holder.

John X. Miller, Chester, Pa.—This invention consists in proving the window sash at both sides with triangular recesses, into which strong band springs are placed, with forward projecting rollers attached thereto. These rollers bear against one guide strip of the window frame, so as to hold the sash by its friction on the other guide strip in any position in which it is placed. For locking the sash in closed position, so as to prevent its opening from the outside, small catches are attached to the lower parts of the outer guide strips, which catches engage a corresponding recess of the sash, while the necessary play of the sash for engaging and disengaging it from the catches is obtained by recesses at both sides.

Improved Gear Button for Flour Packers.

Lewis Creveling, Akron, O.—The object of this invention is to supply, in the place of the button at present in use, one which controls more exactly the throwing out of gear of the machine, and packing the barrels and sacks more evenly as to weight. This invention consists in the application of a T rail to the upright frame piece of the platform on which the barrels and sacks are placed, with a button slotted to correspond, which may be set firmly thereon by means of a thumb screw in the position required to pack the barrels or sacks, and then throw the machine out of gear.

Improved Corn Husking Implement.

Jacob F. Schmeitzer, Manteno, Ill.—The object of this invention is to furnish to farmers an improved corn husker, which is made easily adjustable, to be used in cold weather with or without mittens or gloves, and be adapted for different sizes of hands. The invention consists in making the handle plates sliding in each other, and fastening them rigidly, by a set screw, in the position desired to fit the hand.

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C. S. A. can improve his rancid butter by the process described on p. 353, vol. 36.—J. P. W.'s correction to the problem on p. 11, vol. 30, has been anticipated.—W. W. will find directions for making earthenware and porcelain on p. 3, vol. 30.—C. H. C. will find recipes for yellow and blue lights on p. 54, vol. 30.—For answers to your other queries, consult the booksellers who advertise in our columns.—J. W. C. should address the makers of emery wheels.—S. D. L.'s answer to the ship and cannon problem is correct.—C. P. B. Jr.'s query is incomprehensible.—L. G. G. will find directions for transferring engravings on p. 138, vol. 30.—G. M. H. will find a description of the preparation of platinum sponge on p. 330, vol. 25.

J. W. H. asks: 1. Can a paper pulp be used instead of several layers of paper in making images for the stage? A. Probably it could. 2. How can I make the pulp? A. Old paper may be made into a pulp with a solution of lime and gum or starch, pressed into the form required, coated with linseed oil, and baked at a high temperature.

J. M. says: I have a boiler 42 inch by 20 feet; it is two years old and there are two holes eaten in it by rust, right over the fire; they are eaten from the inside. What can I do to prevent rust doing any more damage? A. If the corrosion be caused by scale, change the feed water, or use some substance that will prevent the formation of scale.

W. L. N. says: I find that all matter that makes scale in a boiler is at one time a floating scum on the water, till, by attracting more particles, it becomes heavy and precipitates to the bottom. I propose to take that scum from the boiler while in the fluid state. Is the idea a good one? A. It is not a fact that the principal incrustations in a boiler are caused by substances that float on the water as a scum.

D. C. asks: 1. What will be the approximate velocity of steam at 200 lbs., flowing into another body of steam at a pressure of 100 lbs., through a pipe 2 square inches in area and 5 inches in length? What would it be under the same conditions if discharged into steam of 50 lbs.? Would not the work performed by the steam on entering the respective pressures be about equal? Will Professor Rankine's formulas, given on p. 115 of your volume 29, apply to these cases? A. The rules given in the article referred to are as accurate as any that have been deduced. 2. Would a polished plate with no uneven surfaces encounter much loss of power if revolving rapidly in steam at a high pressure? A. No. 3. How is it that steam will expand to twice its volume and half its pressure when the heat of one volume with a pressure of 2 is not equal to that of 2 volumes with a pressure of 1? A. The law that the volume is inversely as the pressure is only true of a perfect gas whose temperature is maintained constant during the expansion.

A. B. says: 1. It is stated that daguerreotypes may be made by the electrolytic process. Can a printed page of a book be made in a similar way? A. Electrotype copies of daguerreotypes can be made. 2. It is said that a sheet of paper folded into two leaves is called a folio, into four leaves a quarto, etc. What is the size of the sheet so folded? A. It differs greatly, being elephant folio, demy folio, etc. 3. Is magneto-electricity the same in kind as the electricity produced by any of the numerous forms of the galvanic battery, such as Grove's or Hunsen's? A. The electricities obtained from magneto-electric machines and batteries have still resembling, lighting, and electrolytic powers, but differ greatly in quantity and intensity.

H. J. B. asks for a recipe for plating small articles of silver without a battery. A. The metallic surface intended to be silvered, having been well cleaned, is rubbed, by means of a smooth cork, with a mixture of 1 oz. chloride of silver, 1 oz. common salt, 1 oz. chalk, and 5 oz. carbonate of potash, made with water into a creamy paste.

R. J. asks: 1. What are the proper proportions of salt and ice to freeze ice cream? A. Twice as much pounded ice as rock salt, but the proportions may be changed somewhat without destroying the efficiency of the mixture. 2. For keeping ice, which is best, dry or wet sawdust? A. Dry sawdust. 3. I have a large amount of charcoal and ashes, being the debris from a furnace. Will it be of more value as a fertilizer, or as an underlying bed for an ice house? A. It depends upon circumstances; but ordinary coal ashes and charcoal not being remarkable fertilizers, you might better use in the way indicated.

A. B. C. asks: 1. What is shown by chemical analysis to be the composition of coal? A. The Pennsylvania anthracites consist of 1-31 per cent water, 8-84 per cent hydrocarbons, 87-45 per cent carbon, 7-37 ash. The percentages of these constituents vary greatly, the bituminous coals having more hydrocarbons and volatile combustible matter with less fixed carbon. 2. Is fire or flame a material thing? A. The flame of a candle or gas burner is composed of gaseous matter in a state of ignition. This gaseous matter, generally speaking, consists of various compounds of carbon and hydrogen. By carefully looking at a flame, it will be found to consist of three parts: the lowest of a bluish color, where the hydrogen is uniting with the oxygen of the air. The heat given out by their chemical union is very great, and raises the particles of carbon to white heat. These white hot particles give out the light. Around these is a thin shell of carbonic acid, and the spent gases arising from the combustion.

C. M. F. asks: 1. Has the use of the microscope any injurious effect on the eye? If so, how can I avoid it? A. It has when frequent intervals of rest are not permitted to the eyes, or when the observations are prolonged for several hours at a time. A little practice will enable the observer to keep both eyes open, while looking through the eye piece with one eye, and at the same time see as distinctly as if the other eye were closed with the hand. This, and using the left and right eye alternately, afford great relief. 2. Is there any way of throwing the light upon an opaque object under the microscope, other than the lens? A. By means of a Lieberkuhn, which is a highly polished speculum of silver, and reflects the light down upon the surface of the opaque object. 3. Will the use of the lens injure the eye, and why? Will the use of the mirror by lamp light injure the eye? A. Used properly, with a lamp which does not flicker, in such a way as to get a good illumination without either blinding the eye with its intensity, or taxing it by too long an observation: both the lens and mirror can be used without any injury. 4. If I should replace the three smallest lenses of a microscope by three others of higher powers, would it answer the same as a higher priced instrument, without altering the other parts? A. It would answer the same purpose, provided the other parts would give a corresponding delicacy of adjustment of the focus and of the stage.

C. R. M. asks: 1. Where is carbon black diamond found? A. In Brazil. 2. Could arsenic be substituted for Paris green in the poisoning of potato bugs? A. Arsenic is equally or more poisonous, but experiment would tell whether the bug would as readily eat a white powder as one which is of the same color as the leaf.

C. F. D. asks: Is there anything which will cement broken coral? A. Apply powdered sandarac or mastic with a small brush, heat until it melts, and press the broken pieces together. Or mix boiled linseed oil and red lead; and after applying, let it harden quietly for some weeks.

J. D. W. asks: 1. Is there an easy method of extracting pure hydrogen from house gas? A. Large quantities of pure hydrogen can be easily and simply made from other materials, but from house gas its extraction is difficult. 2. How can I get more pressure on house gas as it comes from the burner? A. The plan usually followed is to receive the gas from the mains in a small gas holder, and connect this with the burners. 3. What causes it to explode? Is it dangerous to handle 15 or 20 gallons at a time? A. Mixture with air. When the air is prevented from mixing with the gas there is no more danger than in handling gun powder or other explosive.

H. J. B. says: I have made an explosive powder composed of 2 ozs. chlorate of potash, 1 oz. prussiate of potash, and 1 oz. white sugar, which has 3 times the force of common gunpowder. Is it dangerous? A. This powder has been known since 1849. It has the following advantages. It can always be obtained of uniform strength and quality, by weighing out the proper quantities of each ingredient. It does not attract moisture and is not acted upon by exposure to the air. The manufacture requires but a short time, the projectile force is far greater, and the powder need not be granulated. Its disadvantages are that it is more readily fired than ordinary gunpowder, therefore more dangerous, that its manufacture is very expensive, and that during its ignition it acts so very strongly upon iron and steel that it can only be used in bronze ordnance, and in the filling of shells, etc.

B. F. C. says: In your pamphlet containing the United States patent law and other information, you give a recipe for making liquid glue which is as follows: "Dissolve gum shellac 3 parts, and caoutchouc 1 part, in separate vessels, in ether free from alcohol, and pour a gentle heat. When thoroughly dissolved, mix the two solutions." I have tried to make some of this glue, and could not make the rubber dissolve. I had no trouble with the gum. Do you think the fault was in the ether? What kind of rubber is required? Will an old car spring do? A. Use rectified sulphuric ether that has been washed to remove alcohol and acidity, and India rubber that has not been vulcanized. When the caoutchouc has become well softened by the ether, break it up into small pieces and stir well until homogeneous soft mass is obtained. It will be as well to cut the rubber into small pieces before pouring the ether on them, but the mass must be frequently and well stirred. Pour the solution of shellac into that of the rubber, and incorporate them thoroughly by stirring.

D. E. asks: In your issue of January 10, 1874, a correspondent gives a problem with a diagram. From his statement I infer that the annular space, &c., is airtight. This being the case, how is it possible for either piston to fall, even though the balance of the cylinder contains only air and not a denser fluid? A. Under this supposition, it is impossible for motion to take place.

S. asks: Is there a simple and easy method of extracting perfume from flowers, etc.? A. Yes. The fresh flowers are placed between layers of cotton wool, saturated with sweet olive oil; in some cases, pure lard is employed. The essential oil thus obtained is separated from the sweet oil by agitation with strong and highly rectified alcohol. The essential oils of jessamine, sweet violets, hyacinths, etc., are obtained in this manner. The perfumed extract is then prepared from the essential oil by dissolving it in very pure alcohol; and in order to blend the mixture and render it mellow, it is kept several months in a bottle before being sold. This also answers A.

M. B. C. says: I have a building of frame, 70 feet long, 33 feet wide, 2 stories high; the second story is used for drying stock. It is lined and ceiled with hemlock floor boards, and heated by steam, with 8 rows of 1 inch pipe extending across one end and 48 feet along each side, making about 1,000 feet of pipe. I desire to have my stock dry faster; can I accomplish this by making an opening in the floor of about 144 square inches, connecting with a wooden chimney at end of building 12 inches square and extending 3 feet above the roof? Would it be practicable to box in about 48 feet in length of the pipe along one side for heating the air as it comes in? And would there be any draft inwards by admitting air from outside, by an opening at one end? Or must I run a tube down to the bottom of next room to secure a draft? Will such an arrangement supply the room with sufficient warm dry air, and also relieve it of the damp air by the first named arrangement in the floor connecting with the wooden chimney? A. There is a popular fallacy in connection with this subject of drying by heated air, that needs correction. It is supposed generally that to dry anything we have only to confine air in a close room and then heat it to a certain temperature, and keep it so for an indefinite length of time. The true theory is as follows, and the best success is assured when our practice accords with it: Air has the greatest capacity for absorbing water when expanded by heat of the sun or otherwise; but when saturated, it is incapable of further absorption. When it has the appearance of being the most dry, it is then much charged with water, and is still absorbing water from everything it touches; when it has, on the contrary, the appearance of being very wet and humid, it is not much charged with water and is giving off that which it has. In regard to this case, it is evident that by charging the air in the room with caloric, we prepare it for the absorption of water, and so cause it to have a drying power upon the stock; but when it is fully saturated with the water it has taken up, its drying power is overcome and its action is passive. It, however, we drive this air out of the room and take in fresh air, we can again expand it with heat, and again give it a drying power equal to its capacity for the absorption of water; and thus proceed more rapidly with the operation of drying the stock. Instead, however, of having a continuous current passing through the drying room, it will answer as well to periodically open all the windows for a short time, and let the air be totally changed in the room; then close them, heat up again, and keep them closed for a period sufficient to fully saturate the air with water. This might be determined by the feeling of dryness or humidity which the air presents, not opening the windows until the air appears very damp; and a few trials would soon determine the length of time best to work with one volume of air.

D. C. B. asks: 1. Can you give me recipes for making transparent colors? A. It will be cheaper and more satisfactory for you to buy them. 2. How can I make a good transparent varnish for brasswork? A. With copal and alcohol.

W. D. asks: Where is the deepest artesian well in the world? What is its depth? A. The deepest artesian well of which we have seen an account is at Louisville, Kentucky. Its depth is 1,986 feet.

G. asks: 1. How shall I construct a fire escape, suitable for a lady traveling? A. Try your inventive skill. 2. How shall I draw an oval? A. See p. 299 vol. 23.

T. & H. ask: How can we make a joint in a brass pipe, so that it can be bent in any direction? We have been told of a knuckle joint, but no one knows what it is. A. The joint consists of a ball and socket, the latter being something more than a hemisphere.

G. L. H. asks: How can I construct a rain gage? How can I tell the amount of evaporation? A. The rain gage ordinarily used consists of a cylindrical vessel having a funnel-shaped cover, in which there is a very small hole. A glass tube connected to the bottom of the vessel shows the height of water. In accurate operations, it is customary to ascertain the evaporation daily, usually in a separate vessel.

J. McJ. asks: Is a house properly rodded for conducting off-lightning, where the rod is fastened to the finials of the roof by means of copper wire not insulated? A. It is correct to attach the rod directly to the roof or building without insulators. But no building can be said to be properly rodded or protected against lightning, unless the lower part of the rod or terminal under the ground is made quite extensive. The extremity of the rod should connect with masses of old iron, or iron ore, or coke, or charcoal, laid in trenches, or the rod itself should be elongated and carried off one hundred or more feet from the building, and put in connection with water, if possible. The particular method of attaching the rod to the building, whether with or without insulators, is of far less importance than the terminal arrangements of the rod. The golden rule for safety is: "Provide the largest possible area of conducting surface for the terminal of the rod."

C. W. C. asks: 1. How can I make the best black writing ink? A. What is the best black ink is probably a matter of opinion; but you will find a good recipe on p. 330, vol. 23. 2. How can I make red ink? A. Dissolve pure vermilion in caustic ammonia. 3. How can I estimate the horse power of a boiler? A. The term "horse power of a boiler" is so indefinite that we cannot give you any good rule.

G. H. B. asks: Is rolled sheet zinc pure metal? If composition, what are the proportions and ingredients? A. It ordinarily contains small quantities of lead and iron, a little tin and cadmium, and sometimes traces of arsenic, copper, carbon, and sulphur.

J. L. H. asks: 1. How can I readily tin iron rods 1/4 inch square and from 12 to 18 inches long? A. Cover the rods with muriate of zinc, and put them into a tin bath. 2. What is the process of electroplating, access being had to a telegraph battery? A. You should consult some standard work on the subject, as we have not space for the details in these columns.

M. W. B. asks: What causes the light and dark stripes on a ceiling, the light stripes corresponding with the laths and joists, and the dark stripes with the space between? A. The moisture in the wood.

F. M. S. asks: In the manufacture of gun cotton, is the use of chemically pure acids imperative? A. No. The commercial acids are frequently used. 2. What proportion and strength of acids should be used? A. 105 parts by weight of sulphuric acid at 66° B., to 50 parts of nitric acid at 48° B. 3. Is gun cotton an article of manufacture or commerce to any extent, and has it been put to any practical use? A. It is used for projectiles, in the art of photography, and in surgery. 4. Is there any mechanical arrangement by which the electric current of high tension can be reduced to a more voluminous one of lower tension? A. Yes.

G. A. P. says: I am running a grist mill with two sets of bevel gears, using about 30 horse power. I wish to throw the gears out and use a belt. Will a 20 inch belt be sufficient, if it be driven from a four foot to an eight foot pulley? The belt will run 720 feet per minute, on upright shafts. A. We think the belt will be large enough. We have already given rules by which the proper width of belt can be determined approximately.

D. N. C. R. asks: About what size would a boiler require to be to run an engine 30 revolutions per minute, the size of the cylinder being 5 inches stroke and 3 inches diameter? A. It would probably require from 35 to 40 square feet of efficient heating surface.

J. F. D. asks: How can I make small articles of India rubber? Is there a book on the subject? A. Hancock's "Manufacture of India Rubber" will give you considerable information on the subject; but probably you would best acquire the art by practical experience at a manufactory.

A. S. S. asks: Is this the correct way of finding the actual horse power of a high pressure steam engine? Diameter of cylinder 7 inches, length of stroke 1 1/2 feet, revolutions per minute 80, with steam power on piston at 60 lbs. per square inch, and allowing 1 1/2 lbs. per square inch for friction: $7 \times 7 = 49 \times 58 = 2842$. The length of double stroke is 3 1/2 feet $\times 80 = 280 \times 2842 = 795760 \div 42017 = 18 \frac{8094}{42017}$ horse power. A. The solution is correct for the assumed data.

S. asks: 1. How thick would iron have to be to withstand a pressure of 30 lbs. to the square inch? A. It would depend upon the form of the vessel. 2. I have a small steam engine. Bed plate is 15 1/2 inches long by 8 inches wide, with a 10 inch wheel. Cylinder is 1 1/2 inches diameter by 3 inches stroke. What would be the horse power, with 30 lbs. of steam to the square inch and running as fast as possible without injury to the engine? A. Multiply the pressure on piston in pounds, by speed of piston in feet per minute, and divide by 33,000. 3. How can I calculate where to drill the hole where the shaft goes through in the eccentric, so as to give the right travel to the slide valve? A. Make the distance, from center of eccentric to center of hole, half the travel of the valve. 4. What is the best way to seat or grind the slide valve so as to make it fit steam tight to the cylinder? A. Use a scraper to face off the valve and seat. 5. What is the best polish for iron castings which are tolerably smooth? A. Fine emery will answer well for the iron.

W. L. P. asks: 1. Who was the engineer of the Suez canal? A. Ferdinand de Lesseps. 2. What is its length, breadth, and depth? A. About 100 miles long, 300 feet wide at the top, 100 to 150 feet wide at the bottom; average depth 24 feet. 3. In what years was it commenced and completed? A. Commenced in 1854, and completed in 1869. 4. What was its cost? A. About ninety million dollars. 5. Does it pay? A. It pays its expenses, but has not yet yielded anything to its original shareholders. See p. 119, vol. 30.

C. W. A. asks: 1. How many grains of chloride of gold will a given number of grains of metallic gold make? A. This is found by first adding together the combining weights of chlorine and gold, and dividing the result by the combining weight of gold alone. Thus $Cl = 35.5$, $Au = 196$, $Au Cl = 231.5$. $\frac{231.5}{196} = 1.184$. Therefore one grain of metallic gold will make 1.184 grains of chloride of gold. 2. Are iodine and bromide of potassium soluble in a mixture of equal portions of absolute alcohol and ether. *sulph. com.* to the extent of 5 or 10 grains to the oz. of the mixture? What is the process? A. This is a question which you can determine by experiment. Agitate the powdered bromide or iodine in the mixture of alcohol and ether, carefully applying heat if necessary.

E. R. W. asks: What two substances, elements or compounds (ice and snow excepted) possess the least amount of friction when brought into contact with hard substances? A. It is not possible to answer this question in its present very general form, because it is necessary in the first place to know how the substances are to be brought in contact, and secondly, what the hard substances are, for much depends upon the adaptation of lubricating materials to the circumstances under which they are to be used. The softer greases, as oil, hog's lard, etc., diminish the resistance under small pressures more than under high pressures. The harder greases, as tallow, soft soap, and mixtures of grease and plumbago, produce less effect with small pressures than with large ones.

J. H. S. asks: What do the words sin., cos., and tang., and the sign Σ , in algebra mean? A. Sin. = sine of an arc or angle. Cos. = cosine. Tan. = tangent. Σ = the sign of the summative, and means that terms of a series are to be added together. Thus $\Sigma(x) = \text{sum of all the terms of the series of this general form: } x + x' + x'' + x''' + \text{etc.}$ 2. Would it be profitable to construct a winged steam valve, so as to give the engine power from the valve instead of requiring power from the engine to run it? A. As we understand this question, it would be very profitable, if it could be done.

L. P. C. — For replies concerning the assignments you mention send your address to Munn & Co., and send ten dollars.

S. M. M. asks: Is there an instrument by which any mineral of value in or under the ground may be found? If there is anything of the kind that you know of, please inform me. A. The presence of iron ores below the surface of the ground can in many cases be determined by a magnetic needle; but there is no instrument for indicating other metals.

G. S. D. asks: Is a process by which milk can be preserved for several weeks, the cream separated and churned at convenience into an extra quality of butter free from incipient rancidity, therefore little prone to deterioration, patentable? A. Probably it is.

E. L. asks: How or where are the wires concealed or put out of sight in connecting an electric burglar alarm with the doors and windows of a dwelling house? A. In new houses, the wires are frequently placed behind the plastering. But ordinarily they run along the base boards of the apartments.

F. H. B. asks: What will remove ink and fruit stains from paper, linen, etc., without injuring the fabric? A. For ink, rub the spot with a weak solution of oxalic acid. For fruit stains, make a mixture of 1/4 lb. chloride of lime and 3 pints water, add 7 ozs. crystallized carbonate of soda dissolved in 1 pint of water. Mix thoroughly, allow to settle, and pour off the clear liquid. This will remove fruit stains from linen.

J. F. asks: What is the correct theory about the formation of ice? Does it form from the bottom of the water or from vapor escaping and congealing on the top? A. It forms at the top, by the production, at the freezing temperature, of innumerable crystals, which interlace one with another until at last there results a solid mass.

W. H. W. M. asks: 1. Can sugar and sirup be made from rags and sawdust by the aid of sulphuric acid? A. Yes. 2. By pouring sirup into the tea, the tea turns a black color; does it denote that the sirup is made from rags, etc.? Would the action of the acid in the sirup operate on the tannin in the tea, and produce the black color? Will not good sirup without acid affect the tea in the same manner? A. It is more likely that there was a trace of iron present, which formed a tannate of iron and caused the ink appearance. Sirup manufactured in a proper manner will not blacken tea. 3. The following is another test: Mix the sirup with a solution of muriate of baryta. If there be any acid in the sirup, its presence would be denoted by a white precipitate. This is reputed to be a sure test. I have tried the test myself, and it became of such a black color that I could not see the bottom of the saucer. A. It is true that a solution of muriate of baryta will detect the slightest trace of sulphuric acid, and form with it an insoluble white compound.

C. O. E. asks: 1. How can I silver plate iron? How can I make the best silver solution for iron? A. Wash in weak lye to remove grease. Dip into weak aqua fortis to remove rust. Scour with a hard brush and fine sand. Then, having fastened to a wire, dip in strong nitric acid and, as quickly as possible, afterwards in the silver bath. This may be made by dissolving silver in pure aqua fortis. Afterwards a solution of cyanide of potassium is added until nothing more is thrown down. The liquid is poured off, fresh water added and poured off several times until the cyanide of silver is well washed from the acid, and then solution of cyanide of potassium is added until it is all dissolved again. A silver plate is used for the other pole of the battery. 2. How can I get different colors of gold by galvanic plating? A. The process is too complicated to be published in these columns. Consult a good book on electroplating. 3. How can I plate iron with nickel? A. Make a bath of 1/4 lb. of the double sulphate of nickel and ammonia to a gallon of hot water. Use a Smee battery. The articles to be plated require, according to the power of the battery, from six to ten hours, but the average will be eight hours. After being plated, they are washed with hot water and polished on a cloth buff with crocus, rouge, Vienna lime, or other polishing powder, and oil. Two points must be attended to: 1. To have the solution always kept neutral; 2. to clean the iron perfectly, which may be done with muriatic acid.

A. B. C. asks: How can I make a cheap and efficient induction battery for medical use? A. By wrapping a coil of stout insulated wire around a core of soft iron, and connecting the ends of this wire with a galvanic battery. Around this coil another coil consisting of fine insulated wire is wrapped, and of much greater length. The ends of this wire are the poles to be used. An arrangement like a toothed wheel must be introduced somewhere in the circuit for making and breaking the connection.

D. B. W. says: In the SCIENTIFIC AMERICAN, December 3, 1873, I find a recipe for making a rubber cement by dissolving rubber in benzine, which fails to work; the rubber does not dissolve. Can you tell what the difficulty is? A. Try pure unvulcanized rubber and stir the ingredients well together frequently, with a stick or knife. The benzine must be highly rectified and pure. Sulphide of carbon is also a solvent of rubber.

E. B. asks: Is there a sure and simple test for distinguishing between genuine and artificial butter? A. There are sure tests, but they are too complicated for any one but a practical chemist to apply. For answers to your other questions, consult a stationer.

H. W. J. says: 1. I wish to make a telescope with a four inch lens, 72 inches focus. What must be the size of my eyepiece? What can I see with such a telescope? A. You can apply an eyepiece of one inch focus; but unless the object glass be achromatic you cannot employ the full aperture, nor in any case have a very satisfactory field of view. 2. How can I polish articles that I have silver plated, and how many Calland cells will be necessary? A. You can polish silver with fine chalk, applied with chamols leather or a soft wool enrag. For plating a few small objects, one or two cells are sufficient.

P. H. M. asks: Is the cause of the existence of the Gulf stream known? If so, what is it? A. Its cause by the heating of the waters of the Atlantic ocean under the equator, which makes them lighter, and causes them to flow over the top of the water lying to the northward, this water flowing in below towards the equator.

F. C. B. asks: Is there any process to restore blackberry wine or any other liquid that has become musty by putting it in a musty barrel? A. Mustiness in wine, it is said, may frequently be removed by violently agitating the wine for some time with a little coarsely powdered charcoal, freshly burnt, or even some slices of bread toasted black. A little bruised mustard seed is occasionally used for the same purpose.

E. S. M. says: I am about to construct a reflecting telescope, the mirror being formed by silver chemically deposited upon glass. Can you give me some recipe for a solution to deposit the silver in a proper form? A. There are various methods of depositing silver upon glass. Here is one which you may make available by practice: A solution of gun cotton in caustic potash is added to a solution of nitrate of silver, followed by sufficient strong liquor of ammonia to redissolve the precipitate. The resulting argentiferous liquid is applied to the glass which is then slowly heated over a water bath until effervescence ensues and the deposit of silver is complete. Let a chemist prepare the solution of gun cotton, which requires care in handling.

G. E. R. asks: What substances are used with extract of logwood to make a cheap red color? A. In a decoction of three pounds sumac, the goods are steeped over night, and then spirited at 2° Twaddle; wash and work through a decoction of three pounds Lima wood and one pound logwood for thirty minutes, then raise with a gill of red spirits; work for fifteen minutes more; wash out and finish.

S. asks: What colored light is best for persons to read by, and how can I impart that color to lamp chimneys? A. Blue. It can be painted over with a thin coat of Prussian blue.

H. R. R. asks: 1. How can a handsome purple color be made for druggists' show bottles? A. Make a solution of permanganate of potash in distilled water. 2. Can I make two different colors in the same bottle, that is, two colors that will not mix, as, for instance, red and green? A. Aqueous solutions alone will not answer. Dissolve some sulphate of nickel for the green, and upon this pour some oil colored with cochineal.

F. P. C. asks: Is there any satisfactory way of testing adulteration of linseed oil with cotton seed oil? If so, what? A. We are not aware of any reliable experiments on this point. Consult some good practical chemist.

W. says: I have bought 100 square inches of water, to be taken from the raceway under a 2 feet head. When the water is used, the surface in the pond and raceway lowers about 4 inches. If I draw my water through a 10 inch square hole, how deep must I put my flume, so that I can get my 100 inches of water and no more? A. See article on "Friction of Water in Pipes," p. 48, vol. 29.

V. T. asks: How can I make a fuse that will burn at the rate of about 200 feet per minute, and that will take fire at a temperature of about 150° or 200° Fah.? A. Consult the specifications of the recently patented fire alarms.

J. B. asks: How is a person affected by laughing gas? Is it injurious? How is it administered? A. Taken in moderate quantities, it exercises a strong influence upon the muscles which are brought into play when there is laughter; but in larger doses, of five gallons and upwards, it produces unconsciousness and insensibility to pain. When manufactured from pure nitrate of ammonia, and washed by passage through water, solution of green vitriol, and solution of potash, it may be taken without danger by persons in good health, if administered in a proper manner. It is breathed through a stopcock which admits the gas from the bag to the lungs, but sends the gas issuing from the lungs out into the atmosphere.

N. S. asks: 1. How can I seal the ends of small glass tubes? A. Use a blowpipe. 2. What is the process of silver plating? A. See pp. 229, 315, vol. 29.

E. C. M. asks: 1. Are the Cornwalls (England) tin mines the only ones in the world? A. No. 2. Is it true that one has been discovered in California? A. Yes. For answers to your other questions see books on metallurgy, frequently advertised in our columns.

W. R. asks: 1. How many figures denote a billion, and how many a trillion? A. A billion is 1,000,000,000. A trillion is 1,000,000,000,000. 2. Has the earth two revolutions, one on its axis, and the other round the sun? A. The earth rotates on its axis, and revolves round the sun. 3. Is the sun the center of the solar system? A. Yes. 4. Are the stars inhabited? A. Nobody knows. The approximate constitution and condition of many of the stars has been determined by the spectroscopy, and the results show that none that have yet been examined present the conditions necessary to support human life. For example, our moon is found to be without water or air and intensely cold. Saturn and Jupiter are red hot. It is thought some of the moons of this planet may possibly be inhabited.

F. H. S. says: 1. I want to cast a small steam engine of brass: what is the composition that the foundries use to put in their tanks? Can I melt brass in a common stove? A. A good composition is 7 lbs. copper, 3 lbs. zinc, 3 lbs. tin. Probably you will find a forge better for the purpose. 2. How much power would an engine cylinder 1 1/2 x 4 inches, with 10 lbs. of steam have, and also with 30 lbs.? A. See article on "Indicating Steam Engines," page 64, vol. 30. 3. Would a crank do instead of an eccentric for the slide valve? A. Yes. 4. Can you recommend me a good book on molding brass, and one on the steam engine? A. Byrne's "Practical Metal Worker's Assistant," and Bourne's "Catechism of Steam the Engine." 5. How thick should a small boiler (about 2 feet x 1 foot) be to withstand a pressure of 10 lbs., and also one of 30 lbs.? How thick would brass have to be? A. Sufficient data not sent. 6. How does a steam gage tell the pressure in a boiler? Must the pipe leading to the gage be one inch? A. The gage is so graduated that a pressure of 1 lb. per square inch gives a corresponding indication. The size of the connecting pipe makes no difference.

G. N. K. says: We wish to heat a factory (30x30 feet and four stories high) with exhaust steam and are advised to put in 4 inch tin pipes, one tier in each room, painting those where the most heat is wanted some light color, and where less heat is wanted, a dark color. Will this answer as well as iron pipes? Why will the tin pipe radiate heat when painted? A. A tin or iron surface covered with lampblack radiates more heat than the plain metal. When coated with white lead, it radiates about the same amount of heat. Tin is a fair conductor of heat, having about one third of the conducting power of gold.

C. V. asks: If an engine crank pin suddenly breaks, thereby destroying the connection between piston and crankshaft, what will follow? A. The piston would strike against the cylinder head; and if the latter be not strong enough to resist the blow, it would be broken.

A. O. B. says: In answer to a correspondent, you say that "eyestones are not alive." I think so too, but would like to know why they move about when placed in strong vinegar. A. We suppose it is on account of the generation of carbonic acid. For answers to your other questions, see "Friction of Water in Pipes," p. 48, vol. 29.

E. says: I have a double acting engine of one nominal horse power, speed 300 revolutions per minute. What would be the proper width of belt to connect engine to line shaft? A. Probably about an inch.

W. H. G. asks: Why is it that oxygen and hydrogen, when mixed in certain proportions and ignited, explode? The product is water, but does not an expansion take place? A. When these gases unite, the volume of the combination is much less than the original volume of the gases; so that a vacuum is produced, into which air rushes with great rapidity.

P. C. T. asks: Will a leaden ball, if thrown into the sea, sink to the bottom? If not, why not? A. Yes. 2. What is the depth of the deepest sea soundings? A. About 30,000 feet.

H. T. L. asks: Is there any chemical compound that will unite with or dissolve the albumen on albumenized paper? A. If the albumen is that of the white of eggs, it may be dissolved in alcohol containing a little alkali in solution.

"Erfinder," St. Louis, Mo.—Please send your name and address.

P. W. L. says, in reply to the query: "Can the four roots of the following equations be obtained: $x^2 + y = 7$, and $y^2 + x = 11$?" Certainly they can, and are as follows: $x = 2$ and $y = 3$, or $x = 3$ and $y = 2$, and $y = -2$ and $x = -3$.

H. D. M. says, in answer to N. F. T., p. 123, vol. 30: It is the soot on the bottom of the kettle that prevents it from burning the hand. It will prevent it only for a short time, probably until N. F. T. thinks it quits boiling. A bright bottomed kettle will burn the instant it touches the hand.

E. says, in reply to M. who asked for a good metal for models: Melt 6 lbs. tea lead, 1/2 lb. tin, and 1/2 lb. antimony. This will be a good stiff metal.

E. S. says, in further explanation of the board question, propounded by D. M. A. (see p. 91, vol. 30): Let W and w equal the two widths. Then will $\left(\frac{W^2 + w^2}{2}\right)^{1/2}$ = the width of the board at the dividing point. Application to your question: $\left(\frac{12^2 + 4^2}{2}\right)^{1/2} = (80)^{1/2} = 8.9442$.

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

J. A. S.—Rounded fragments of quartz, the one of a yellow color being ferruginous quartz.

J. C.—This product appears to be a fair specimen of lard. To determine whether it is adulterated or not will require a chemical analysis. Lard oil is a commercial product and burns well in lamps if the wick tube be kept cool. It is chiefly obtained as a secondary product in the manufacture of stearin.

S. B.—The shining particles are mica and are mixed with rounded fragments of quartz.

M. McK.—It is white sand of superior quality, and is useful for making glass.

COMMUNICATIONS RECEIVED.

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

- On Healing Wounds by Charcoal, etc. By P.
- On American Inventions in Europe. By H. S.
- On Pavements. By S. S.
- On Detecting Gold and Silver in the Earth. By G.
- On the Curvature of the Earth. By G. E. W.
- On the Thousand Feet Tower. By E. C. M.
- On American Silk Manufacture. By H. C. F.

Correspondents in different parts of the country ask: Where are cotton seed liners sold? Where can the seed and cuttings of sumac be obtained? Who sells machines for making broom handles? Who makes the best clothes wringer? Who makes waterproof gloves, for use in handling strong lyces, etc.? Who makes a cider press that will get four gallons of cider from a bushel of apples? Makers of the above articles will probably promote their interests by advertising, in reply, in the SCIENTIFIC AMERICAN.

Correspondents who write to ask the address of certain manufacturers, or where specified articles are to be had, also those having goods for sale, or who want to find partners, should send with their communications an amount sufficient to cover the cost of publication under the head of "Business and Personal," which is specially devoted to such enquiries.

[OFFICIAL.]

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To Make an Application for a Patent.

The applicant for a patent should furnish a model of his invention if susceptible of one, although sometimes it may be dispensed with; or, if the invention be a chemical production, he must furnish samples of the ingredients of which his composition consists. These should be securely packed, the inventor's name marked on them and sent by express, prepaid. Small models, from a distance, can often be sent cheaper by mail. The safest way to remit money is by a draft or postal order, on New York, payable to the order of MUNN & Co. Persons who live in remote parts of the country can usually purchase drafts from their merchants on their New York correspondents.

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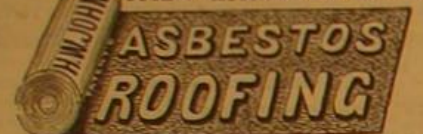
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SCIENTIFIC AMERICAN

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Vol. XXX.—No. 12.
[NEW SERIES.]

NEW YORK, MARCH 21, 1874.

\$3 per Annum,
IN ADVANCE.

IMPROVED SLOTTING MACHINE AND SLOTTING AND PLANING TOOL.

Our engraving represents a new form of slotting machine, which combines a number of the best improvements contained in those of previous construction, making it a most compact and efficient machine with excellent proportions, which our engraving illustrates. As the general arrangement of the device is familiar to mechanics, no detailed explanation is required. A few dimensions, however, may be of interest in enabling the reader to form a better idea of the advantages and merits claimed for the invention. The extreme stroke, we learn, is $8\frac{1}{2}$ inches, and will slot to the center of 36 inches. The bar, which has a vertical adjustment of 10 inches, has a continuous guide, and is so connected with the crank shaft as to have a quick return, while it is perfectly balanced by the lever and weight shown. The pinion shaft has a cone of three changes driven by a 3 inch belt, the largest end of the cone being 14 inches. The crank motion is driven by a gearing of seven and a quarter to one. The table is circular, has feed in three directions, longitudinal, transverse, and circular, and also possesses traverse of 16 inches longitudinally and $16\frac{1}{2}$ inches transversely.

All the feeds are driven from one feed shaft in a simple and effectual manner. There are several minor conveniences about the machine which increase its value, and which the eye of the practical workman will readily understand.

To the ingenious slotting and planing tool, which is represented in position upon the table, we direct special attention. It consists of a steel yoke bar attached to the main slotting bar, to which, by screws and tool holders, the cutting tools are secured, so that the faces of the latter may be adjusted as far apart, within the capacity of the yoke, as desired. The piece to be planed—say, for instance, a bar which it is desired to form into a square, hexagonal, or octagonal rod, is placed on a center which connects with the index wheel shown on the left. This last is simply a disk having 24 notches cut in its circumference, and arranged with a stop, which, engaging with any notch, holds the wheel, and consequently the rod to be cut, in any desired position. From this it will be evident that, by turning the wheel regularly one notch ahead, the tools will plane a twenty-four sided bar, two notches a twelve sided, three an eight sided, and so on; so that a nut, for example, of any geometrical figure or section that has parallel sides, may be accurately and readily made. In attaching this appliance to a planer, the yoke is fastened to the clapper or tool box.

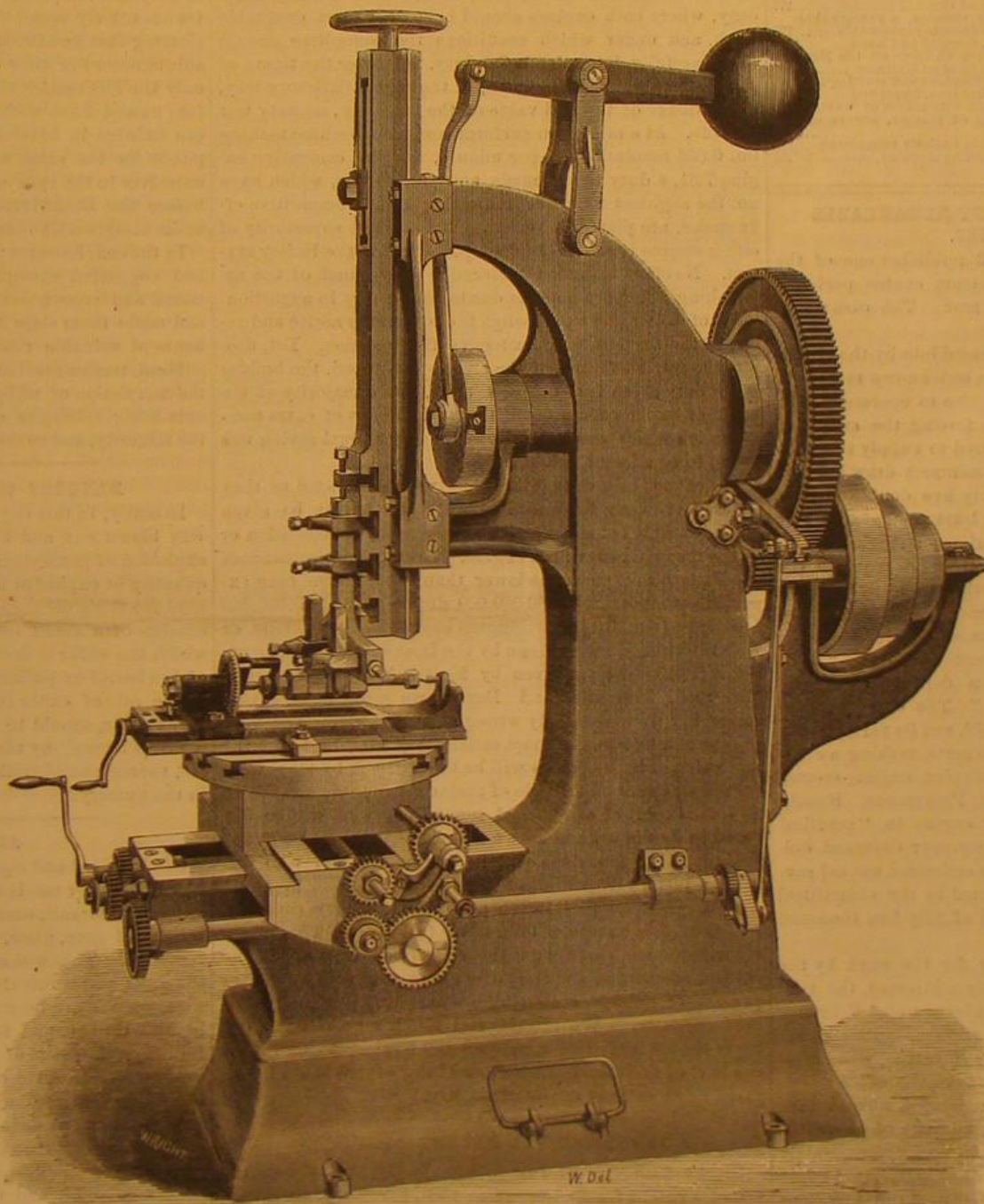
The New York Steam Engine Company, of No. 98 Chambers street in this city, to which enterprising concern mechanics and manufacturers generally are indebted for the production of a variety of the best forms of standard metal working machines now in the market, are introducing the improved machine tool above described.

Further information may be had by addressing as above. Parties visiting the city are invited to call and see the machine at their warehouses.

New Results with Magnets.

The common idea is that, at each temperature, t , steel takes a certain magnetization, which is less as t is higher, and which it retains on cooling. This is not correct. M. Jamin placed a bar, heated in a sand bath so as to receive the blue color of springs, in a bobbin traversed by a current, and retarded its cooling (by a suitable arrangement). The steel took somewhat less magnetism than if it had been cold. Then he broke the circuit, and, on examining the remanent magnetism with a proof

contact, found it much greater than the bar would retain if first cooled (109 grammes instead of 54). Thus the coercitive force does not diminish with heating, but increases. But if the force of detachment be again measured, minute by minute, it is found to increase, at first very rapidly, then less so, till in a quarter of an hour it has quite disappeared; and this whether the bar be kept hot, or allowed to cool naturally. The transition is almost continuous from total magnetization to remanent, which in time descends to zero. Now reheat the bar, but to a less temperature. Its total magnetization (while the current passes) is greater than in the former case; but immediately on breaking, the remanent magnetism is less than in that case; on the other hand, it disappears less quickly, and never entirely. Again, begin with-



SLOTTING MACHINE AND SLOTTING AND PLANING TOOL.

out heating the bar. The total magnetism is still greater; the remanent (on breaking) still smaller, and invariable with the time.

M. Gauguin observes that, when one has magnetized an iron bar as strongly as it is possible to do so with a current of given intensity, the magnetization may be considerably increased by using currents of the same direction, but of less intensity. This, however, depends on the mode of detaching the armature after interruption of the current; in these cases it was detached by a sudden movement at right angles to the polar faces; if it is detached by sliding along the faces, the feeble currents do not add to the magnetism developed by the stronger initial current. M. Gauguin considers the detaching of the armature weakens the magnetism; and this, through a shaking (*enbranlement*) of the molecules of iron, which diminishes the coercitive force. He works out a hypothesis of these and other phenomena.

TRANSPARENT GUM.—A little glycerin added to gum or glue is a great improvement, as it prevents the gum or glue becoming brittle. It also prevents gummed labels from having a tendency to curl up when being written on.

Fuller's Computing Telegraph.

It is singular to how small an extent general use is made of the various instruments which have, from time to time, been introduced for reducing the labor of numerical calculation. Some of these instruments are, no doubt, costly, but this is far from being the case with all. The "slide rule" is within the reach of every one; but how rarely do we come upon any person who uses it to a great extent? And yet the amount of fatiguing calculation a simple slide rule may save is something wonderful. Such rules can be made, and can be procured of special manufacture, which increases the range of their utility by enabling calculations to be made, embracing several figures. Another useful contrivance is the "computing telegraph" just reintroduced amongst us by Mr. John E. Fuller, of Boston, Eng., who first produced it some thirty years ago, and who since that time has been continually improving it, so that at the present moment it is a most complete instrument.

It consists of a squared board made of old tarred rope, a material which is not given to expansion or warping; upon this is pasted an engraved card, which has a graduated circle of the diameter of $8\frac{1}{2}$ inches. Within this circle there is an inner circle, which revolves, and is graduated in the same manner as the outer circle. The divisions are from 0 to 10, completing the circle, and are the same for both; the divisions are similar to those of the ordinary slide rule, and decrease in a perfectly regular logarithmic order. In fact, the instrument is a circular slide rule. It possesses a great advantage over the ordinary straight slide rule, in consequence of its length (the actual length of the rule being 26.7 inches); this advantage is further increased from the circular arrangement being endless. Only one of 0 to 10 is required; while in the ordinary rule, one wants 0 to 10 and 10 to 100.

The instrument, in fact, forms a slide rule of a very perfect character, and enables one to work out the simplest and most complicated arithmetical question. In calculations where the same factor has to be used many times, the saving of time is simply enormous. Where in a multiplication sum the product is over four figures, and accuracy may be required, it is only necessary to make a mental calculation as to the tens and units, the computer furnishing the leading figures: for instance, $565 \times 179 = 101,135$; the slide rule at once shows the 101,1 and a small mental calculation gives 35 as the final figure. For engineers of whatever kind, such a calculating machine is invaluable, and no engineer's office, electrician's testing room, or manufacturer's counting house should be without it.—*Engineering.*

Sixty Miles an Hour on the New York Central Railway.

Recently, says the *Syracuse Journal*, a special train conveying Vice President Vanderbilt and other Central Railroad officials, consisting of an engine, (Mr. James Wood, engineer) and two passenger coaches, made the run from Rochester to Syracuse in eighty-five minutes, including one stoppage for water at Clyde of five minutes. This would leave the running time, the distance being eighty-one miles, eighty minutes, or at the rate of 60 $\frac{1}{2}$ miles in one hour. This is the fastest time on record between the two cities.

AMERICAN car wheels have now become a permanent and reliable item in our domestic export trade. In the year 1871 the number exported was 2,318; in 1872 it was 4,760, and in 1873 it rose to 7,515, despite the stagnation of the last four months. This is of much more importance to American industrial interests than the question whether our raw iron can be profitably exported to England.

Scientific American.

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NEW YORK, SATURDAY, MARCH 21, 1874.

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A REMARKABLE REPORT ABOUT REMARKABLE PUMPING ENGINES.

The Providence Journal of March 2 publishes one of the most remarkable reports relating to steam engine performance that we remember ever to have read. The case seems to be as follows:

In February, 1872, a contract was entered into by the city of Providence with George H. Corlies, the well known mechanic, for the construction of a pumping engine to operate a high service level, on the Holley system, forcing the supply of water into the mains as fast as required to supply the continually varying demand. When consumers draw heavily, the pumps and the engine make twenty five double strokes per minute. At night, and when the least amount of water is required, the engine makes sometimes a single revolution, or even less, per minute. The contract required the engine to be "capable of raising, with ease, five million gallons of water in twenty-four hours" to a height of one hundred and twenty feet above low water, "under a possible varying head of forty feet on the suction," and to "work smoothly, steadily, and easily, when delivering but one million gallons in twenty four hours." The engine was to have been completed on October 1, 1872, and its performance was to be determined by a board of experts, making a competition trial with the Worthington duplex engine, erected at the Pettaquamscutt station, south of Providence. Should the Corlies prove equal to the latter engine in "practical value," the builder was to receive thirty-four thousand dollars, and "a further sum equal to the estimated annual saving (if any such saving shall be reported by the committee) for ten years," not to exceed a total of fifty five thousand dollars.

The engine was designed especially for the work by the contractor; and having been but lately completed, the trial has been only recently made, the report being dated February 4 last, and signed by the well known experts Erastus W. Smith, Frederick Graff, and George H. Reynolds, who, after long delay, were finally selected to make the official test. The contract provided that the competition should take place at an average delivery of two millions of gallons in twenty-four hours. The head at trial was approximately eighty-eight feet. The tests were made of forty eight hours duration, and were apparently conducted, with the exceptions to be noted, with the care and intelligence to be expected of experts of high professional standing. The engines were, however, not overhauled, nor were the boilers cleaned, as they should have been to secure the most creditable results. The coal was not screened. The water supplied to the boilers was not measured, and no indicator cards seem to have been taken. Hence we are without any means of judging whether the extraordinary difference of efficiency was due to differences in boilers or in engines. It is not stated whether the engines and pumps were examined to ascertain whether leakage occurred or not. The quantity of water delivered was, however, determined by weir measurement, which probably gave the means of ascertaining pump leakage with sufficient precision.

The results obtained are the following, when raising two million gallons:

	Corlies engine.	Worthington duplex.
Time.....	48 hrs. 30 min.	48 hrs. 0 min.
Head pumped against.....	88 feet.	87-978 feet.
Gallons per twenty four hours.....	2,051,564	1,991,519
Leakage of pumps, per cent.....	8.75	2.51
Coal used, pounds.....	11,500	5,008
Ashes falling through grates, pounds.....	1,098	486
Gallons raised, per pound of coal.....	242.19	389.27
Cost coal per year, at this rate.....	\$7,222.00	\$3,610.00
Duty, due pressure noted, foot pounds.....	21,565,740	23,528,210
" actual, by delivery.....	25,175,284	30,571,995

Both engines were tested for adaptability to varying rates

of speed, and both were found satisfactory. Both engines are stated by the committee to be proportioned for a delivery of five millions of gallons in twenty four hours, and they were both next tested under this higher load, and also at their slowest speeds, with results thus given:

	SLOW SPEED TRIAL.	TRIAL WITH 5,000,000 GALS. DELIVERY.
	Corlies Worthington	Corlies Worthington
Time occupied, hours.....	34	54
Head pumped against, feet.....	88.16	88.223
Gallons raised per day.....	171,747	803,917
Coal consumed per 24 hrs., lbs.....	1,417	1,425.75
Duty, 100 lbs. coal, foot lbs.....	8,467,870	16,878,316
Cost, per annum.....	\$5,308.58	\$1,377.50
Revolutions, per minute.....	0.866	7.81

On the basis of these trials, an award is made by the committee of the full amount of contract price, thirty-four thousand dollars, to Mr. Corlies. Two of the committee go still further than this, and recommend an additional gratuity of twenty-one thousand dollars, in view of the "great range of capacity" and "special adaptation" of the engine to the peculiar duty demanded of it. The third member demurs, stating that he believes that "the contractor has not accomplished anything valuable that he did not bind himself to do" by the terms of the contract, and that no "annual saving"—which was the condition of this extra compensation—has been shown.

We think this one of the most remarkable instances of inconsistent report that has ever come under our observation. A competitive trial shows an engine, at average duty, to have less than half the efficiency of another. At maximum duty, where both engines should have done most creditable work, and under which conditions the committee should have carefully determined the duty, whatever the terms of the contract, in order to obtain, in the only satisfactory way, a knowledge of the real value of the machines, no duty test is made. At a minimum performance, one machine making but 0.866 revolutions (!) per minute, and the competing engine 7.81, a duty test is made, and the results, which have not the slightest value as indicating their comparative efficiencies, are placed on record. No marked superiority of either engine is shown in "adaptability" to the Holley system. No effort is made to determine how much of the astonishing difference noted is due to discrepancy in apportionment of boiler power, although the committee notice and refer, in their report, to an excessive disproportion. Yet, despite the terrible failure of the engine examined, the builder is not only given full contract price, but a majority of the board of experts recommend the full amount of extra compensation which was to be allowed if any annual saving was found to be effected, etc.

We cannot believe that the trials were conducted as they should have been, for such low duty can hardly be given where there is not something very wrong in the condition or in the management of the engine. Even the performance of the Pettaquamscutt engine is lower than should have been expected. Comparing its 53,000,000 duty with the 70,000,000 reported of the little Worthington engine at Phoenixville, or with the splendid work done by the Leavitt engine at Lynn, Mass. (103,000,000), as given by Messrs. Worthen, Hoadley, Kirkwood, Hermans, and Davis, we must believe that something went decidedly wrong at Providence. We hope to hear of a new and a more satisfactory trial, in which the real value of both engines will be brought out by more careful management on the side of their constructors, and shown by some expert of established reputation, who will be disposed to do the work in such a manner that the real merit of the competing machines will be ascertained, and who will make a just award without fear or favor.

We cannot feel that, in the present case, either constructors or experts have done themselves full justice. The former are well known throughout the country as experienced and skillful mechanics, and the latter are equally well known as experts of unimpeachable high character, personally and professionally. We should feel much regret if the one party should suffer in consequence of mismanagement on the part of their subordinates, or if the other should be injured by an evident excess of charity.

A CONGRESSIONAL PATENT DISCUSSION

On the 28th day of June, 1859, McClintock Young obtained a patent for an improvement in harvesting machines, which, under the law then in force, expired fourteen years from that date. The patentee then had the right to apply for an extension of seven years, which privilege he exercised six months previous to the expiration of his time. The case lay in the Patent Office until the 27th of June, 1873, when the Acting Commissioner was asked to grant the extension, the matter having been fully adjudicated to that effect. The official postponed his decision until the arrival of the Commissioner, who, returning on the 28th, signed and issued the necessary documents. Young then sold his extension to McCormick, to whom the original patent had been assigned for \$10,000, for an additional sum of \$5,000; but before the latter consideration was paid, some lawyers raised the question as to the validity of the extension, on the ground that the patent expired on June 27, and that the extension should have been as of that date instead as of the following day. Under the law no extension could be granted after the expiration of the original patent, and hence the point at issue arose, whether or not the same occurred on June 27 or June 28. The Commissioner held that June 28 was the proper date; but in order to avoid litigation, a bill was recently introduced in the House of Representatives to remove all doubts on the subject and to confirm the validity of the extension by giving to it the same binding effect as though it had been signed by the Commissioner on June 27, 1873.

We hardly think that the most penetrating scrutiny would

ordinarily perceive any deep, dire, and hidden signification underlying this very simple statement of fact. To the average intellect, it appears that a poor inventor comes before Congress and asks that body to rectify a mere clerical error on the part of one of its officials, in order that he may receive the small sum offered him as a reward for his labor and not be deprived of the same through the expenses of tedious litigation. He cannot afford to take the matter to the courts and wait for a decision, even if such were the proper course; but, armed with a written opinion of the Commissioner directly in his favor, simply requests our representatives to quiet a legal quibble raised as to his undoubted right to his own justly earned property.

But several acute and far reaching minds in the House are not to be deluded by any such specious argument as this, it must be investigated and examined, over twelve columns of fine print in the *Congressional Record* and some hours of valuable time. This is an attempt to embarrass the entire agricultural population, to reduce the rural stranger to penury and want; to impose a grinding monopoly on industry, no matter if it is through a little improvement on a well known machine, the whole patent right of which is to bring the inventor \$15,000. Besides, reason our astute legislators, this is not the hat case, or the planer extension, or the sewing machine job, and there are no poor widows or lobby agents or other skilled talent to explain things to our satisfaction. It is only a poor man who asks for his own; therefore we will call his bill "dangerous legislation," assume (whether rightly or not) that his patent wound up on the 27th, and show that we are utterly opposed to Congressional extensions by considering that he asks us for one, no matter whether the facts substantiate the view or not; we will persistently perceive only the McCormick machines, even though they are not before us and have nothing to do with the subject, so that we can indulge in heroics over the vast amount paid by the public for the same, and by this means we shall advertise ourselves in the eyes of the people and glorify our names before the SCIENTIFIC AMERICAN and other journals that make disagreeable remarks about monopoly jobs.

In the end, however: after these ingenious special pleaders had suggested enough buncombe and nonsense, had questioned and cross-questioned the supporters of the measure, and made them state the case over nine times, had wasted hours of valuable time where minutes would have amply sufficed, pushing aside business of the highest importance, the completion of which the country urgently requires: on a vote being taken the opposition were fortunately found in the minority, and so the bill was passed.

DANGERS OF NURSERY EXPLOSIVES.

Recently, in this city, the front of a toy store on Broadway was blown out, and several persons badly injured, by the explosion of percussion wafers—bits of paper having a small quantity of explosive material upon them. The wafers were used for firing off toys termed "parlor artillery." The toy consists of a small barrel provided with a hammer, under which the wafer is fired, a ball of rubber being thrown out of the barrel on pulling the trigger.

The sale of explosive toys, no matter in what form they may appear, should be discouraged. We have seen children severely burned by the apparently harmless pulling crackers, through accidental explosion. Explosives have no place in the nursery.

AMERICAN SODA.

One hundred and eighteen thousand tons of crude soda at fifty dollars per ton is reported as about the annual importation of this salt, used, as our readers know, in the manufacture of soap, glass, and other articles of general consumption. This will convey some idea of the importance of the great and wonderful natural deposits of carbonate of soda, which have been found in the West, six hundred miles beyond Omaha, and forty miles north of the Union Pacific Railway. Deposits of soda are here found in all stages and conditions. In some cases, alkaline lakes are encountered, the water saturated with the carbonate. One especial deposit, of many acres in extent, consists of a crust of carbonate of soda more than six feet deep, under which is a strong alkaline liquid. This great deposit lies there, waiting for people to come and take it away. In quantity there is enough to supply the wants of the world for an age. In quality it is superior to the crude article now manufactured, as it contains twenty per cent more of carbonate of soda; while in cost it is very cheap, as it may be delivered in New York, when the railway to the deposits is opened, for thirty dollars per ton. The soda trade is evidently destined to change. Instead of employing vessels to bring the product here, we shall soon fill them with improved cargoes of the article to go abroad.

THE GREAT LAVA FLOOD OF OREGON.

Professor Joseph Le Conte, of the University of California contributes to the *American Journal of Science and Arts* the results of observations made by him during a geological tour in Eastern and Central Oregon. He states that probably the most extraordinary lava flood that ever occurred once covered the greater portion of Northern California, and Northwestern Nevada, nearly the whole of Oregon, Washington, and Idaho, and ran far into Montana on the east, and British Columbia on the north. Derived from streams originating in fissures in the Coast, Cascade and Blue Ranges, it covered an area of 300,000 square miles to an average thickness of 2,000 feet. The whole Cascade range is composed of lava, tier upon tier from top to bottom, forming a depth in some places of 4,000 feet. The order of events which occurred in the region of the Columbia river is graphically depicted

and the writer gives with considerable detail the natural phenomena which lead him to the conclusion that the locality was a forest, probably a valley overgrown with conifers and oaks. The subsoil of this forest was a coarse boulder or drift. By excess of water, either by flood or changes of level, the trees were in time killed, their leaves shed and buried in the mud and their trunks rotted to stumps. Then a tumultuous and rapid deposit of coarse drift, containing drift wood, covered up the forest ground and the still remaining stumps to the depth of perhaps several hundred feet, the surface thus formed eventually becoming eroded into hills and dales. Over a long period following came the outbursts of lava in successive flows, with the silicification of the wood, and the cementation of the drift by the percolation of hot alkaline waters containing silica, as happens so commonly in sub-lava drifts. Finally succeeded the process of erosion by which the present stream channels, whether main or tributary, have been cut to their enormous depth.

In referring to the age of the Cascade range, Professor Le Conte concludes that it was first born of the sea, by horizontal washing and vertical swelling, probably at the end of the jurassic, though only as a low range, continuing the sierra northward; its subsequent increase took place at the end of the miocene, by the outpouring of the great lava flood above described.

SCIENTIFIC RESULTS OF THE POLARIS EXPEDITION.

The report of the voyage of the *Polaris*, now issuing from the Government printing office, contains a memorandum by Dr. Bessel on the scientific results and discoveries of the expedition. Large numbers of astronomical observations were made, but the records were all lost, with the exception of a few of little value. Soundings were taken along the coast of Grinnell Land, which proved that the hundred fathom line follows the coast at a distance of about fifteen miles from Smith's Sound. One of the casts brought up an organism of still lower type than the *bathypus* discovered by the English dredging expedition. It was called the *protobathypus roboronitii*. The aurora was frequently observed, but it never appeared with sufficient brilliancy to produce a spectrum. The most careful examinations failed to show any electricity in the atmosphere. The land was covered by drift, the main line of which, indicating its motion, runs from north to south.

Although the details of the discoveries are very meager—and, owing to the loss of specimens as well as records, nothing can be done to amplify them—Dr. Bessel believes that the voyage has not been without results of the highest importance. These he summarizes as, first, the fact that the *Polaris* reached 82° 16' N., a higher latitude than has been attained by any other ship; second, the navigability of Kennedy Channel has been proved beyond a doubt; third, upward of 700 miles of coast line have been discovered and surveyed; and fourth, the insularity of Greenland has been demonstrated.

NERVE FORCE.

Dr. Brown Séquard is delivering, in Boston, a course of lectures on a topic regarding which little is positively known to the world in general, and which, so far as popular ideas are concerned, is so enshrouded with fogs of animal magnetism, electro-biology, power of the will, psychic power, and kindred theories, that there are few who can definitely and clearly lay down the certain facts which modern investigation has proved to be true. There are not probably many physicians who have made the matter one of such deep and extensive research as has Dr. Séquard; and hence the discourses and opinions emanating from so high an authority are especially welcome, and the very curious and instructive information contained in them will, from the very circumstance of its being so little understood, have the additional charm of new revelations in science.

There are two elements in the nervous system, which, united together, are nevertheless absolutely distinct. One is the nerve cell with its filaments or prolongations, the other the fibers. Within the nervous centers, that is, the brain and spinal cord, there is but one of these fibers united with the cells. In other parts of the body there are cells which have two real fibers starting from them, besides the ramifications. Produced in these elements is the force which manifests itself in nervous actions, but it is proved that nervous force can nevertheless exist without the elements. In some low forms of creation, there are tissues which do not represent at all the known elements of the nervous system, and by disease the latter organization in man may be transformed beyond recognition, and yet the nervous force still manifests itself. There is no likelihood, however, that nervous force can show itself outside the boundaries of the system, no facts in proof of such an idea and hence at the very outset, Dr. Séquard deals a crushing blow at the fundamental theories of animal magnetism. The transformation of nervous into motor or other forces is, however, possible, and is constantly exemplified in the actions of our bodies. Certain animals evolve light as a transformation of the force, others electricity; and Dr. Séquard tells us that, in severe cases of consumption, patients in a high state of nervousness evolve visible illumination from the lungs. The chemical changes occurring in the body take place under this influence; there seems to be, although the circumstance is not definitely decided, a transformation of light, acting upon the retina, into nervous force, and motion such as shampooing or kneading of the limbs all increases its quantity, as does also heat. The application of heat to children, the lecturer considered, as exceedingly useful to help their development. If the air

they breathe is cool, and warmth is applied to their limbs, but not so much to the body, they certainly grow faster.

The blood is necessary to the production of nerve force itself, but oxygen alone can supply some power. Strychnin has also a remarkable effect. The influence of the will is very slight, and this is a wise provision of Nature to prevent foolish waste. Dr. Séquard considers that moderate exercise will lead to a production of nerve force and facilitate the employment of our brain power: but there is no question that if we draw away more of the nerve force from our system than can be reproduced in a given time, if we walk very fast, for instance, for five or six hours, we become unfitted for mental work. We are weakened in every organ depending upon nervous force, the heart and the lungs especially, and hence it appears that the same focus supplies the force both for physical and mental action. The power is distributed as is galvanism on a cylinder; and if a cause operates to divide the system into halves, each half has only the amount of nerve force it had before. The fact of our really having two brains is no objection to the unity of the force, because every part of our nervous system is in close communication. We cannot touch a part of the skin or any other portion of the organization without producing a commotion all over the nervous system.

Excitability and nerve force are two very distinct things. Strong persons will generally not be moved by the former cause, while on the contrary persons who have but little nerve force will react under it, however slight, without giving the mind time to think what it is. In health, nervous power and electricity are both present, but they are clearly not the same; for the speed of the former is only from 80 to 200 feet per second, while the latter travels a distance thousands of times greater. There are two great influences of nerve force, the production of activity either normal or morbid, and the cessation of the same. The brothers Weber discovered that when the big nerve in the neck which goes to the heart is galvanized, the organ stops passively and not actively as do the muscles of the arm when similarly influenced. It is believed that all such phenomena occur through the same mechanism. An irritation starts from a part which can convey nervous force, and the latter, reaching the cells of gray matter which were active, immediately stops them. Dr. Waller has found that, by pressing the same nerve, called the *par vagum*, that the motion of the heart is arrested to a certain extent, and relief afforded in cases of headaches, neuralgia, and similar maladies.

Dr. Séquard says that experiment has shown that there is much greater vitality in animals in America than in Europe. People can withstand more terrible injuries, and the animals of this continent seem to have a less tendency to death by hemorrhage than those across the Atlantic. In addition to those already cited, there are many other causes which will often stop the heart's action; a severe blow on the abdomen, a sudden douche of cold water, chloroform, and carbonic acid in the larynx are cited as examples. Galvanization of the cervical sympathetic, often resorted to by physicians as a cure for headache is very dangerous for a similar reason.

There is no doubt that the respiratory movements are all due to the activity of cells of gray matter, just as the movements of the heart are; the cells of gray matter, as regards respiration, being placed on the base of the brain and in a part of the spinal cord. The same nerve, the *par vagum*, which goes to the heart, has a set of fibers which, instead of going down, go upward and toward those cells of gray matter in the base of the brain and spinal cord. So that if you divide the *par vagum*, having one hand by which you can act on the heart, and another by which you can act on the brain, you can at will, at one moment, stop the heart's action, and in another stop the respiratory movements. The stopping of the respiratory movement is very peculiar, and two kinds of fibers are able to do it. One goes to the larynx, acting by the superior laryngeal nerve, and acts by the cessation of the diaphragm, which is a muscle of the chest. The other need not here be described. Respiration can also be stopped by carbonic acid in the larynx. Palpitation of the heart may be diminished by breathing in forcibly as much air as possible. In health, therefore, every act of breathing is a moderation of the heart's action. The morbid phenomenon of respiration can also be stopped by the influence of arrest.

Coughing, for instance, can be stopped by pressing on the nerves of the lip in the neighborhood of the nose. A pressure there may prevent a cough when it is beginning. Sneezing may be stopped by the same mechanism. Pressing also in the neighborhood of the ear, right in front of the ear, may stop coughing. It is so also for hiccup, but much less so than for sneezing or coughing. Pressing very hard on the top of the mouth inside is also a means of stopping coughing. And the will has immense power there. There was a French soldier who used to say, whenever he entered the wards of his hospital, "the first patient who coughs here will be deprived of food today." It was exceedingly rare that a patient coughed then.

ACOUSTIC DARKNESS AND MENTAL LIGHT.

Professor Tyndall, in the course of a recent investigation into the performance of the signals which, by loud sounds audible at considerable distances, serve to warn vessels approaching dangerous coasts during foggy weather, has been led not only to the determination of some important facts regarding the acoustic transparency and opacity of the atmosphere, but to the exemplification of how the imagination may be scientifically employed in the solution of apparently unanswerable problems. The sound producing apparatus consisted in two large brass trumpets, 11 feet long and blown by an air pressure of 18 pounds, two locomotive whistles, and an 18 pounder gun fired with a 3 pound charge of

powder. Professor Tyndall embarked aboard a small steamer, which, under his direction, was moved from point to point from the locality of the sounding instruments, South Foreland Cliff, near Dover. The observations were carried on over several days, with varying results, some of which the investigator found himself at a loss to explain. Thus, on one day the distance at which the sound could be heard was 5½ miles; on the next day, 10 miles. The former day the wind was in the direction of the sound; on the latter, the wind was opposed. Again, on another occasion it was noted that the sounds were not impaired during the continuance of rain; though this state of the atmosphere, according to expressed opinions, should have deadened them. A clear atmosphere has been extolled as the best for sound; but the noise of the horns, says Professor Tyndall, was heard 12½ miles dead to windward of the cliff, and while the latter was obscured by a thick haze. It was a curious and incomprehensible fact that, under these conditions, the sound ranged at least twice as far as it had done on days when neither haze nor wind was there to interfere with it. To add to the perplexity of the investigator, subsequently to the observation of the above phenomena, on a perfectly bright, clear day, with smooth sea and no wind, not a vestige of sound of either horn, whistle, or gun could be detected at a distance of two miles. He says he stood "amazed and confounded," for he saw no palpable clue to the solution of the problem. It was a case where one's senses are of no use, where they and all the philosophical instruments in the world cannot be of the least assistance. How, then, is it to be answered? There is the least shade of exultation in Professor Tyndall's crisp sentences when he announces that by the scientific use of the imagination—a process of reasoning of which he is the firmest advocate, although many have deemed his masterly treatise on the subject loose and illogical—he was led to a satisfactory explanation. His mind sets itself at work. Sulphur, reasons he, is exceedingly transparent to radiant heat, whereas the ordinary brimstone of commerce is highly impervious to it. Why? Because the brimstone does not possess the molecular continuity of the crystal, but is a mere aggregate of minute grains, not in perfect optical contact with each other. When this is the case, a portion of the heat is always reflected on entering and quitting the grains. Hence, when the grains are minute and numerous, this reflection is so often repeated that the heat is entirely wasted before it can plunge to any depth in the substance. A snowball is not optically continuous ice, but an aggregate of grains of ice; and the light which falls upon the snow, being reflected at the limiting surfaces of the snow granules, fails to penetrate the snow to any depth. Thus, by the mixture of air and ice—two transparent substances—we produce a substance nearly as impervious to light as a really opaque one. And this is equally true of foam, clouds, and all transparent substances in powder. But to proceed further. Humboldt, in his observation of the falls of the Orinoco, found that the noise was three times louder by night than by day. The plain between him and the water consisted of grass and rock intermingled. In the heat of the day, the temperature of the rock was 30° higher than by night. Hence, he inferred that over every heated rock rose a column of air rarefied by heat, and he ascribed the deadening of the sound to the reflections which it endured at the limiting surfaces of the denser and rarer air. Thus he proved that a non-homogeneous atmosphere is unfavorable to the transmission of sound.

Professor Tyndall says that, as he thus reasoned and stood on the deck of the steamer pondering the question of what could so destroy the atmosphere over a calm sea as to enable it to quench in so short a distance so vast a body of sounds, he became conscious of the exceeding power of the sun beating against his back and heating near objects. Here was a clue, and the rapidity with which he followed it is well shown in the short, terse sentences which sum up a complete explanation of the mystery. "Beams of equal power," says the Professor, "were falling on the sea, and must have produced copious evaporation. That the vapor generated should so rise and mingle with the air as to form an absolutely homogeneous mixture, I considered in the highest degree improbable. It would be sure, I thought, to streak and mottle the atmosphere with spaces in which the air would be, in different degrees, saturated or, it might be, displaced by the vapor. At the limiting surfaces of these spaces, though invisible, we should have the conditions necessary to the production of partial echoes and the consequent waste of sound."

Following up this mental conclusion with experimental test, it was found fully verified. A cloud coming before the sun checked the production of vapor so that sounds, before inaudible at three miles distance became clearly heard. Again, as the sun went down, the signals became louder and further recognized to such an extent, it is stated, that at 6 P.M. the sound had risen to more than fortyfold the intensity which it possessed at 2 in the afternoon. And thus, by a simple use of the imagination, by conceiving of a state of nature which the senses could not indicate, the investigator was led to a result susceptible of the clearest material proof.

TAKE CARE OF THE MATCHES.—A Great Barrington (Mass.) merchant found a box of parlor matches on the store floor the other morning, which had been knocked off the shelf by a rat or mouse over night. On opening the box the discovery was made that by the concussion every match in the box had been lighted, and the wood of which they were made was charred and turned brown. Fortunately the box was so tight as to smother the fire, and no harm resulted. It was a narrow escape; and if a fire had taken place, its cause would have been a perpetual mystery.

IMPROVED SELF-CLOSING FAUCET ATTACHMENT.

The invention represented in our engraving is a simple attachment for barrels and similar receptacles, which is so constructed that a faucet may be inserted with ease and safety for drawing off the contents, thus obviating the use of corks and the destruction of barrel heads by the repeated driving in of the corks now commonly used in lager beer and other casks. The inventor claims that the device is particularly suitable for large butts or tanks in breweries, and that it has been successfully used in such establishments.

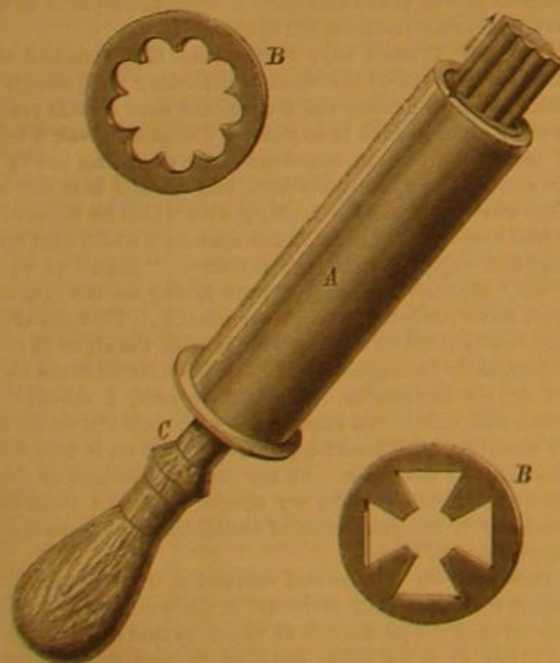
Our engraving represents the invention inserted in a cask, shown in section, to which the metal faucet tube, A, is applied by means of an outer screw thread with conical inclination. The head of the latter projects a little outside of the wood. At the inner end of this tube is a collar, B, which serves as a rest for the spiral spring, C. The latter is coiled about a tubular valve, D, in the rear portion of which are made apertures, E. The extremity of the valve is solid, of smaller diameter, and carries, by a nut, the soft rubber disk, F, and also the strainer, G. The strainer, it will be noticed, fits closely over the end of the tube, A. The effect of the spring, C, and the nut, is to press the disk, F, tightly against the tube, A, so that no liquid can escape therefrom. The object of the tube is also to hold a faucet, which is provided with suitable washers, and screws in as shown. When it is desired to draw off the liquid, the faucet is turned in far enough to strike the valve, D, forcing the same back, so that the disk, F, is carried toward the inside of the barrel, and the apertures, E, pass to the outside of the tube, A. The apparatus will then be in the position represented in the illustration. The liquid consequently enters through the openings, E, and the strainer, G, into the valve, and thence to the faucet, by which it may be drawn off at pleasure. The strainer, G, prevents any impurities from passing out, and may be cleaned by unscrewing the tube, A, from the barrel after the same has been emptied. By means of the hole and pin, H, through the end extension of the valve, D, the connection of parts is still further secured. On withdrawing the faucet the valve attachment closes upon the tube, A, and the barrel is ready for refilling. When the cask is shipped, the cavity in the tube may be closed and sealed.

The device is made of brass or malleable iron coated with tin, as desired, and of any size, from one quarter inch to three inches in the discharge passage. It can also be used with globe cock connections and hose for filling casks or for withdrawing the contents, as may be desired.

Patented through the Scientific American Patent Agency, September 30, 1873. For further particulars address Mr. R. McConnell, Box 1,037, Omaha, Neb.

WATSON'S BUTTER FORMER.

The object of this device is to produce ornamental forms in butter for table use with economy and dispatch. It consists of a tin tube, A, provided with a die, B, which slips into the same at its upper end; these, with the follower, C, which is merely a wooden plunger fitting the tube, constitute the



entire apparatus. In using it, the butter, in a moderately firm condition, is made into a roll, placed in the tube, and forced through the die by the plunger, C; it issues from the end in a long roll, having the configuration or shape of the die. It is afterwards cut into short pieces for individual use, arranged in a coil, or piled crosswise on plates, as taste may dictate. Butter so formed has an ornamental appearance that adds greatly to the attractions of the table.

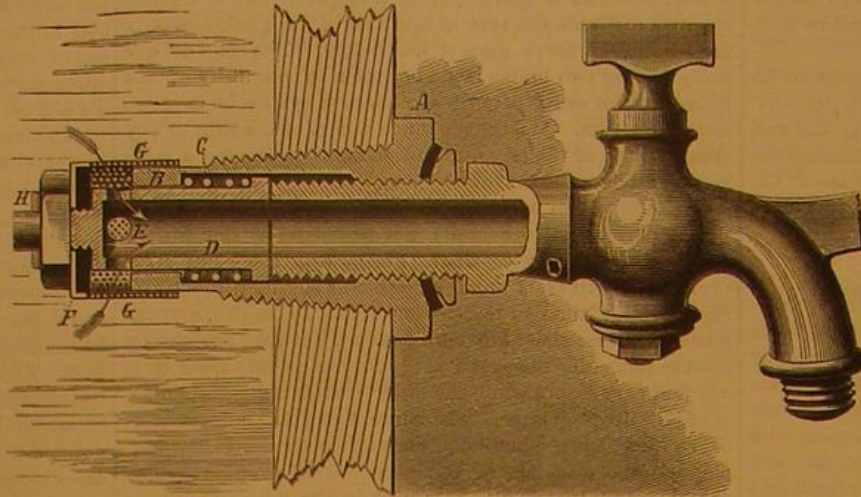
Patent pending through the Scientific American Patent Agency. For further information, address Egbert P. Watson, 43 Cliff street, New York.

The Thermal and Mechanical Properties of Air.

Professor R. H. Thurston, of the Stevens Institute, has recently forwarded to us a copy of a valuable chart which he has lately prepared, which graphically exhibits the ther-

mal and mechanical properties of air. One hundred cubic feet of the gas, at 60° Fahr. temperature, is taken as unity, and curves are constructed exhibiting the changes of temperature, pressure, and volume. The curves, three in number, indicate respectively temperature and pressure, the no transmission of heat or adiabatic line, and uniform temperature and varying pressure or isothermal line. By the aid of suitable scales, the coincident volume for any given pressure may be quickly read off; or conversely, the pressure corresponding to the change of volume already known may be noted. The temperature, similarly, due to any given degree of compression, can be easily found.

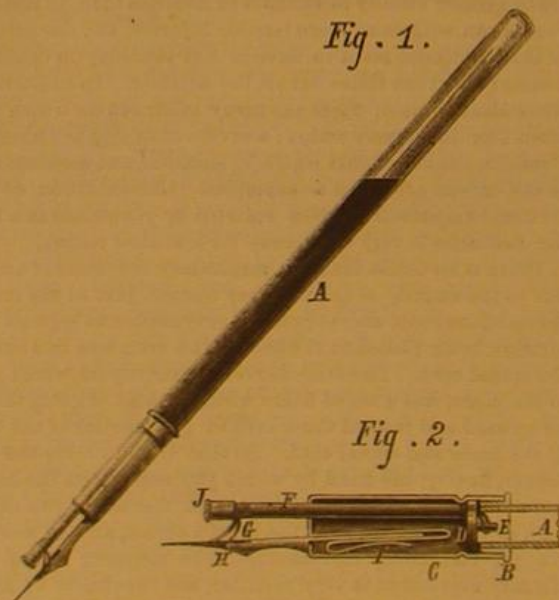
The work, we think, will prove both useful and acceptable to students of science as a means of saving many long calculations. It is handsomely photo-lithographed. The drawing, which, we understand, was performed under Pro-

**IMPROVED SELF-CLOSING FAUCET ATTACHMENT.**

fessor Thurston's direction by one of the students of the above institution, is admirably accurate, and deserves more than a passing word of praise.

FONT PEN WITH A CAPILLARY FEEDER.

This is an ingenious little device, which will, doubtless, meet with a ready welcome from all whose daily duties necessitate a large amount of writing. It is a penholder in which any form of pen may be used, and which contains a



large supply of ink in its glass handle. The fluid is fed to the pen by capillary attraction, so that the latter is kept constantly supplied as long as the contents of the reservoir last. The apparatus is made of neat and convenient form, and of metal or rubber that will not corrode with ink or be injured when washed in water.

In our illustrations, Fig. 1 shows the device complete, and Fig. 2, a section of the apparatus for feeding and holding the pen. A is the extremity of the glass handle or reservoir, which is provided with a ground neck and a screw ring, B, which engages with the tube, C, and is packed with a rubber ring. D is a disk plate, fitting (movably) in the tube, C, and against the end of the holder, and carrying a pin, E. Around the latter is shown the loop of a doubled thread which passes down through the tube, F, its ends protruding at G, to touch the pen, H. The shank of the pen is firmly held in a bent spring, I.

To use the invention, the glass handle is unscrewed and filled with ink, and then re-attached to the tube, A. This may be done easily and without spilling the fluid. The ink moistening the ends of the pen and the thread, writing can be at once proceeded with, as the ink, as drawn by capillary attraction down the latter, exudes from its ends, G, and so constantly supplies the pen. The quantity of ink allowed to escape is regulated by the cap, J, which screws over a slotted opening in the tube, F. The ends of the thread, G, emerge through a slot, and, by screwing the cap up tighter, may be compressed to retard or close the passage of the fluid as desired. After being written with, the pen is laid aside, and never leaks, although the cap may remain open.

We are informed that, when once filled with ink, the pen will be always ready for service during days or even weeks. If any variety of good writing fluid be used, no trouble need be experienced from dust or drying. Almost any sort of pen

may be employed, and inserted and charged as readily as in the common holder. The invention, as a whole, appears quite efficient and useful, and, we should imagine, would prove a saleable addition to the stock of any stationer.

Patented through the Scientific American Patent Agency, February 10, 1874. For further particulars, address the Font Pen Office, No. 7 Murray street, New York city. [See advertisement in the present number of the SCIENTIFIC AMERICAN.]

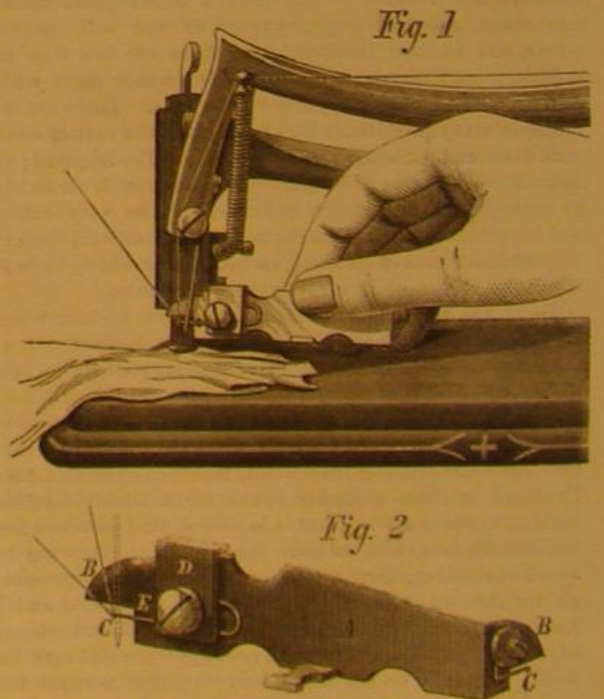
The Prevention of the Sweating of Leather.

A correspondent of the *Deutsche Gerber Zeitung* reminds leather dressers of the evils arising from the use of impure oil. He refers to the nefarious practice of dishonest dealers in oil of mixing resin (which is 50 per cent cheaper) with the pure fish oil. The consequence is that the leather, after laying some time, begins to show resinous spots, sometimes so numerous as to cover the whole surface of a hide. Though pointed out some years ago, it was again observed in the leather exhibited at Vienna. The same correspondent suggests as a remedy the application of spirit of sal ammoniac to the leather, which, though it must be repeatedly used, he asserts to be effective. According to a communication of Dr. Lahmann, in a later number of the same journal, the causes of this exudation must not alone be sought in the bad quality of the oil, but are to be partially attributed to the action of oxygen on the oil, the exudation being more frequent if the leather is freely exposed to the air. He recommends the use of fish oil which has been used and has already undergone the prolonged chemical changes to which fresh oil is not subjected, and which, if they take place in the leather itself, eventually involve the decay of the latter. He further strongly deprecates mixing fresh oil with the fish oil, advising the use of the latter alone.

SCHOFIELD'S IMPROVED NEEDLE THREADER.

This is an ingenious and useful little invention which will doubtless save many trials of the patience as well as of the eyes. The inventor states that it will prove especially useful in threading medium and very fine needles, and that persons totally unskilled in its use can, after an hour's practice, readily draw the end of the thread through the eye as rapidly as twenty-five times in a minute.

Our engravings show its mode of operation so clearly that but little description is needed. The body, A, Fig. 2, is of thin sheet metal, and has a lateral foot to hold the instrument in an upright position. The projecting guide piece, B, is passed up and down along the side of the needle until the hook, C, which is placed in the same direction as, but slightly to the side of, the guide, strikes the eye and passes through it. The hook is of steel and made of various sizes, some small enough to be used with the finest needles. Its rear portion is bent in U shape, and is held in a groove in the handle by means of plate, D, and screw. The projecting portion of the handle beside the hook carries a small set screw, the extremity of which is represented at E, Fig. 2. This bears against



the hook and regulates the distance of the same from the guide, B, to be adjusted for needles of different thicknesses. At the other end of the handle a hook and needle guide are placed in similar manner, but at right angles to the body, so that needles may be threaded from the sides, back, or front, as desired.

A child, it is stated, may learn to use this device in a few moments, while its use cannot but result in a considerable saving of time and trouble. The mode of holding it in the hand is clearly shown in Fig. 1.

Patented through the Scientific American Patent Agency, September 23, 1873. For further particulars regarding sale of rights, or for samples (a handle and a dozen hooks will be mailed for \$1.50), address the inventor, Mr. Thomas Schofield, Grass Valley, Nevada county, Cal.

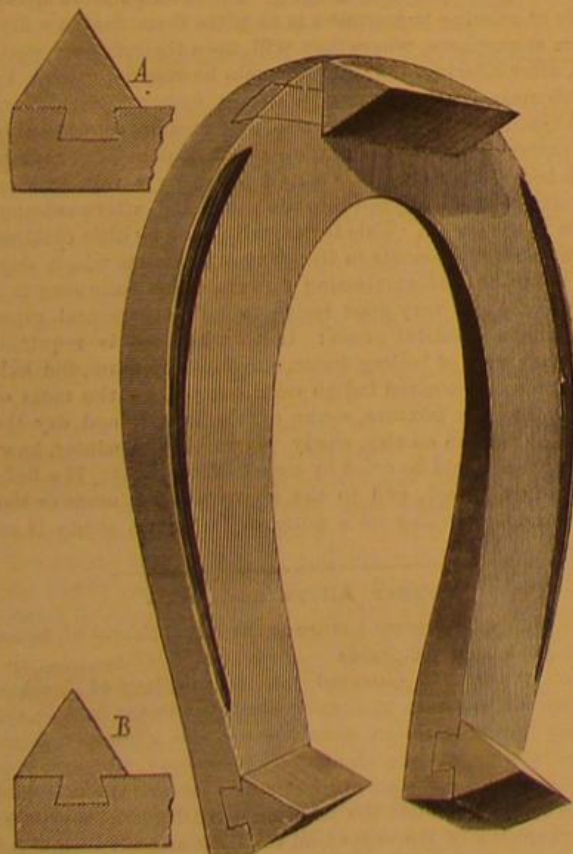
THE NEWFOUNDLAND DEVIL FISH.

Some weeks since we printed a letter from a correspondent in St. John's, Newfoundland, which was accompanied with a photograph, giving a description of a huge octopus or devil fish, found by some fishermen, entangled in their nets. We present herewith an engraving prepared from a photograph of this monster, which shows the head and arms with the beak in the center. The eyes are further back and do not appear. The nucleus is supported on a stand, and the eight short arms hang down with the suckers standing out prominently from the surface, the small ends resting in a round bath in which it had to be carried. A number of suckers are wanting in one arm, having been torn off in capturing the fish; the rest are perfect. At each side of the shorter arms the two long tentacles, 24 feet each, rest on a pole over which they have been doubled several times, their terminations, covered with large and small suckers, hanging down at the extreme right and left of the picture.

It is said that even this enormous creature is small beside some which infest the northern coasts of this continent, and of which trustworthy accounts are in existence. The terrible fate of any victim which may come within its clutches can well be imagined. Each of the short arms carries one hundred suckers; and the moment one of them touches the prey, the fish feels the contact and draws back a membranous piston. A vacuum is created and the edges of the disk are pressed against the surface of the victim with a force equal to the weight of the atmosphere added to that of the water above. The more the victim writhes, the more does it come in contact with other disks, each of which adheres; other arms soon encircle it, bringing it within reach of the powerful beak. "No fate could be more horrible," says a writer, in concluding a very graphic description of the monster, "than to be entwined in the embrace of those eight clammy, corpse-like arms, and to feel their folds creeping and gliding around you, and the eight hundred disks with their cold adhesive touch gluing themselves to you with a grasp which nothing could relax, and feeling like so many mouths devouring you at the same time. Slowly the horrible arms, supple as leather, strong as steel, cold as death, draw the prey under the fearful beak and press it against the glutinous mass which forms the body, and then, as the victim is paralyzed with terror, the powerful mandibles rend and devour." We doubt if the most depraved opium eater, in those terrible stages of delirium which succeed the delightful dreams induced by the drug, could imagine anything much more dreadful than such a death.

BARNUM'S REMOVABLE HORSESHOE CALK.

Mr. John D. Barnum, of America Union, Dutchess county, N. Y., has invented a new removable calk for horseshoes, which, judging from the reports of its actual use, would seem to be a valuable and useful article. Its object is, while affording a sure footing to the animal on icy pavements, to



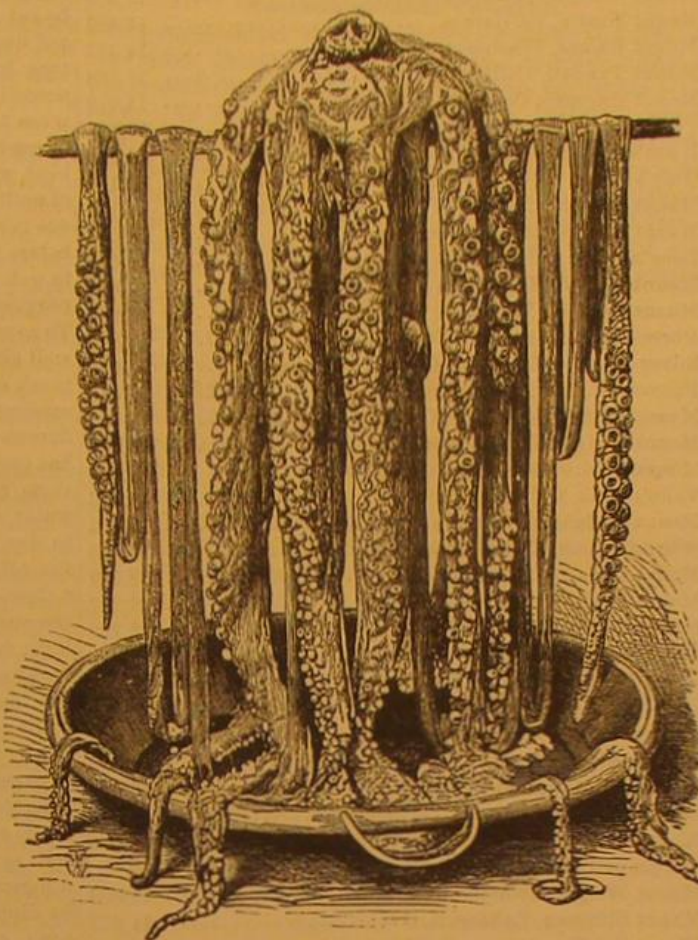
economize in horseshoes and time; for instead of shifting shoes when the calks become worn out, it is only necessary to knock out the calks themselves, and very easily insert a new set. No especial shoe is needed, as all that is required to adapt the ordinary form to the device is the cutting of three grooves, one at either end and one near the toe, as shown in the annexed engraving. These grooves are made slightly tapering, and receive the dovetail tenon on the calks, as shown in the sections, A and B. The calk is attached by entering the small end of the tenon in the groove and then driving it tightly in. The projecting extremity of the tenon

is then struck up or hammered smooth against the outer side of the shoe, forming a tight clinch.

When the calk has been worn and requires removal, it is only requisite to straighten out the clinched portion of the tenon and drive it out of the groove, when another calk may be inserted. Proposals regarding the investment of capital for manufacture, and inquiries for further information, should be addressed to the inventor as above.

Improvements in Concrete Construction.

A paper was recently read before the Institution of Civil Engineers, London, by Mr. Bindon Blood Stoney, C. E., "On



THE NEWFOUNDLAND DEVIL FISH.

the Construction of Harbor and Marine Works with Artificial Blocks of Large Size."

The author described a new method of submarine construction, with blocks of masonry or concrete far exceeding in bulk anything hitherto attempted. The blocks were built in the open air on a quay or wharf; and after from two to three months' consolidation, they were lifted by a powerful pair of shear legs, erected on an iron barge or pontoon. When afloat, the blocks were conveyed to their destination in the foundations of a quay wall, breakwater, or similar structure, where each block occupied several feet in length of the permanent work, and reached from the bottom to a little above low water level. The superstructure was afterwards built on the top of the blocks in the usual manner by tidal work. By this method the expenses of cofferdams, pumping, staging, and similar temporary works were avoided, and economy and rapidity of execution were gained, as well as massiveness of construction, so essential for works exposed to the violence of the sea. There was now being built in this manner an extension, nearly 43 feet in height, of the North Wall Quay in the port of Dublin. Each of the blocks which composed the lower part of the wall was 27 feet high 21 feet 4 inches wide at the base, 12 feet long in the direction of the wall, and weighed 350 tons. The foundation for the blocks was excavated and leveled by means of a diving bell, the chamber of which was 20 feet square and 6½ feet high. When the men were at work, the bell rested on the bottom. A tube or funnel of plate iron, 3 feet in diameter, rose from the center of the roof of the bell to several feet above high water level. An air lock in the top of this funnel afforded a passage up or down, without the bell having to be lifted out of the water. The material excavated was cast into two large trays, suspended by chains from the roof of the bell; when these were filled, the bell was lifted a few feet off the bottom, and the bell barge was drawn a short distance away from the line of the wall, where the stuff was discharged, by tilting the trays, and the bell returned to its work again. The hull of the floating shears was rectangular in cross section, 48 feet wide and 130 feet long. The aft end formed a tank, into which water was pumped to balance the weight of the block suspended from the shears at the bow of the vessel. The shear legs were rectangular tubular pillars of plate and angle iron, with a cross girder resting on the top; above this girder there were two sets of pulleys, through which were reeved the lifting (pitch) chains, formed of one and two flat links alternately. There were eight parts to each chain, or sixteen parts altogether, so that each part had to support, theoretically, one sixteenth of the suspended block. The inner ends of the chains passed down to the deck, where they were controlled by a pair of powerful crab winches driven by a 14 horse power steam engine, which also worked a centrifugal pump for filling or emptying the tank. The slack of the chains, after passing through the crab winches, was led under the deck, and was coiled up in

the engine room over fixed pulleys by two donkey engines. When paying out chain, the donkey engines were thrown out of gear, and the crab winches on deck hauled up the slack according as it was wanted. Two cast iron girders were built into the bottom of each block, and at the end of each girder there was a rectangular hole. Four vertical tubes were built in the block over these holes in the girders, and the suspending bars were lowered from above and turned at right angles, so that their ends, which were T shaped, caught beneath the girders. The upper ends of the suspender bars were also T shaped, and were attached in a similar manner to the lower sets of pulleys, through which the lifting chains were reeved. When a block was set in place, the suspender bars were turned back 90°, and withdrawn for further use. Each block had vertical grooves left in the sides; and when two blocks were in place, these grooves formed a tube 3 feet square. A mass of concrete was subsequently thrown into the grooves, to act as a key or dowel between block and block; this completely plugged up the joints, which were only about ¼ inch open on the face.

The paper also contained a description of an annular block of concrete 19 feet in diameter, weighing 80 tons, which the author constructed for the base of a beacon tower, in the year 1863, and conveyed two miles down the Liffey, where it formed its own cofferdam, in water 5½ feet deep at low spring tides. The water was pumped out by hand pumps, and the ground inside excavated, concrete being placed on the top of the ring as it sank, like the brick wells in India or the shafts of the Thames Tunnel.

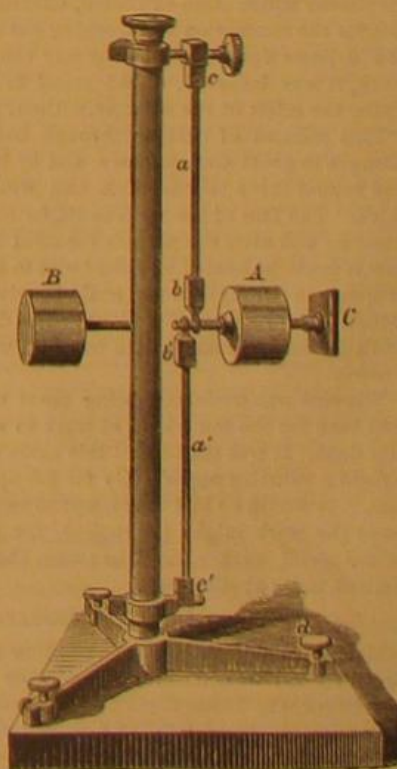
The method of making concrete and mortar, adopted by the author, differed in some respects from that in ordinary use. He preferred a rapid mixture of the ballast or sand with cement or lime to the slow triturating process of the mortar pan with edge runners. The concrete mixer, devised by him, driven by a 3 horse power engine, would turn out from 10 to 12 cubic yards per hour. The mixer was a fixed horizontal or inclined trough, open on the top, with a longitudinal axis, having stout iron blades at short intervals which, as they revolved simultaneously, pugged the materials and screwed them forward. The water was let on gradually through a rose, and the first few blades incorporated the materials in a dry state before they reached the water.

The author believed the application of the new system of gigantic blocks to the construction of breakwaters would, in many cases, be cheaper, more rapid, and more permanent than the ordinary methods of construction.

Zöllner's Horizontal Pendulum.

M. F. Zöllner communicates to the English *Philosophical Magazine* a paper on the origin of the earth's magnetism and the magnetic relations of the heavenly bodies, in which he describes a method by which he considers we are enabled to measure even those small forces which are, for instance, produced by the difference in distance between any point on the earth's surface from sun or moon and the distance of the earth's center of gravity, or by difference in the centrifugal force of two points at different distances from the earth's surface.

The apparatus is represented in the accompanying engraving; *a a'* are thin watch springs held in continual tension by the weight, *A*, with the mirror, *C*, in front. The stand is made of iron, and the feet of the tripod are as long as possible, in order to effect very small changes in position of the points of suspension with regard to the direction of gravitations by the slow movement of the screws. By means of the screw *d*, situated in a vertical plane passing through the two points of suspension, *c* and *c'*, the sensitiveness of the instrument may be governed, as by the relative position of the points, *c* and *c'*, the time of vibration of the horizontal pendulum is determined. A time of vibration of 30 seconds (half a period) is easily accomplished. *B* is a counterpoise of *A*. Before the oscillating mass, *A*, and the parts belonging to it were placed in the rings, which fit into small incisions cut into the cylindrical axis, it was set in vibration by the direct action of gravity round a knife edge occupying provisionally the place of the turning point. The time of oscillation amounted to nearly 0.25 of a second. By means of a known relation, the ratios of moments of direction are thus easily obtained, which are exerted by gravity on the vibratory mass in the



horizontal and vertical directions. The mirror attached to the end of the pendulum allows the reading off of the changes in the direction, according to the method of mirror-reading, on a scale 10 feet $\frac{1}{4}$ inches distant from the mirror. With regard to the above mentioned time of vibration of 0.25 second, it was calculated that a 0.2539 inch division on the scale corresponds to a deviation of 0.0097063 second of an arc of an ordinary pendulum. The instrument is so extremely sensitive that deviations of only 0.001 second of an arc may be obtained even with a time of vibration of 14.44 seconds. A railway train at a distance of a mile has been found to set the instrument in operation.

Observations are best made in deep and quiet mines, where the variations of temperature and shakings of the earth are absent, and all those influences can, therefore, be determined quantitatively which are caused either directly by volcanic movements of the ground, or indirectly by magnetic induction, through changes in the velocity of the streaming masses on the inner part of the earth. Besides the generation of an inner tidal and pressure wave, the sun and moon exert a direct influence on the positions of the instrument, because they attract, with different intensity, the center of gravity of the earth and the center of gravity of the pendulum. We may thus expect to determine the magnitude on which these influences depend, by a much extended and statistically headed series of observations, that is to say, the masses and distances of sun and moon in units of the mass and radius of the earth.

Supposing the instrument set up in the meridian, the pendulum, if moving only under the influence of the sun, would pass, in twenty-four hours, four times through its position of equilibrium in the meridian—at sunrise, sunset, and at the upper and under passage of the sun through the meridian. As the movement of the pendulum is not an effect of summation, as that of the sea in the tides, but is generated directly by attractive action at a distance, it must take place simultaneously with the corresponding true position of the sun. But if gravity, as light, takes a time of about eight minutes in arriving from the sun to the earth, the above position of equilibrium would take place so much later. If, therefore, we only succeed in determining these positions to within one minute of accuracy, the question whether gravity needs time for its propagation could be decided even if this velocity were ten times that of light.

The discussion of observations made simultaneously in two vertical circles with the horizontal pendulum, and their comparison with the readings of magnetic instruments, will supply valuable material, tending to elucidate the causes of the close relation between the mechanical, electrical, and magnetic phenomena on our planet; the explanation of which will, perhaps, some day give us a clear conception of the occurrences in the earth as the language of signs of the senses, chiefly by the help of light, has given us of the occurrences on its surface.—*Science Record for 1873.*

New Metallic Decorations.

At a recent meeting of the Royal Institute of British Architects, Mr. C. H. Cooke introduced to the profession a new style of decoration, recently perfected in Paris, and applicable to iron, brass, and zinc, which is expressed simply and plainly as "cut work."

The cutting of these metals was effected by a steam saw, the hardness and make of the saw being in reality the secret of the whole work; and this tool, as was shown by the various specimens which were exhibited, offered the greatest facilities for the conception and working out of the most intricate and delicate design obtained by any other means. The zinc work, it was believed, would stand in this country, as at Paris, the effect of the weather, without painting.

This method of cutting through hard metals has been brought to great completeness, and by it could be cut brass and copper three inches thick and wrought iron one inch thick. The face of the work could be chased or engraved as desired; and after the pattern required had been cut by the saw, it could be heated, and the twist to the ends or points, so frequent in wrought work, could be given, and certain portions of the ornamental work raised or depressed as desired; and this forms a combination in metal working hitherto unknown.

The cost was moderate, being more than a third less in cost than for the same kind of work in wrought iron as usually done. It was stated that this mode of working in metals offered a valuable opportunity for the operation of the architect. It would be idle to attempt to enumerate the various ways the work might be applied, for every architect and actual metal worker must be aware that it was almost unlimited in its applications.

TIN FOIL ORNAMENTATION.

Mr. Cooke also said that the printing on tinfoil, in imitation of wood or marble, was applicable to wall decoration, woodwork, and house furniture, and would be found on examination to possess many advantages. Some would, he knew, object to it as a sham, but they must have some sham; and for his part he looked upon this as very good, useful sham, especially when they could put this work upon damp walls, and decorate the surface at the same time; besides which, it offered great facilities for decoration in places where it was difficult to obtain skilled labor, and the ease and skill with which it could be used would be specially valuable either on new buildings or temporary erections, and be a great boon to our colonists. For halls and staircases, it certainly would be much more effective and serviceable than paperhanging as now used. From the extreme thinness of the material, it was capable of enveloping the most delicate of moldings, and the surface being varnished, and then

placed in a hot chamber, and subjected to a heat of 120° Fahr., it was considered permanent and durable. This work can be obtained in rolls two and three feet wide, and eighteen feet long.

The Mountains of the United States.

The following is the height of the principal mountains in the United States, as compiled from Professor Hayden's Report, in the *United States Register*:

ROCKY MOUNTAINS, SIERRA NEVADA AND CASCADE RANGE.	
	Feet.
Mount St. Elias, Alaska, (Est.).....	15,800
Mount Fairweather, Alaska, (Est.).....	14,783
Mount Whitney, California.....	15,000
Mount Shasta, California.....	14,443
Mount Rainier, Washington Territory.....	14,434
Mount Tyndall, California.....	14,386
Mount Harvard, Colorado Territory.....	14,270
Pike's Peak, Colorado Territory.....	14,216
Irwin's Peak, Colorado Territory.....	14,192
Gray's Peak, Colorado Territory.....	14,145
Mount Lincoln, Colorado Territory.....	14,124
Mount Yale, Colorado Territory.....	14,081
Long's Peak, Colorado Territory.....	14,050
Mount Brewer, California.....	13,886
Mount Hayden, Wyoming Territory.....	13,858
Horse Shoe Mountain, Colorado Territory.....	13,806
Silver Peak's Mountain, Colorado Territory.....	13,650
Fremont's Peak, Wyoming Territory.....	13,570
Mount of the Holy Cross, Colorado Territory.....	13,500
Mount Hodges, Uintah Mountains.....	13,500
Mount Tokwano, Uintah Mountains.....	13,500
Vellie's Peak, Colorado Territory.....	13,456
Mount Audubon, Colorado Territory.....	13,402
Gilbert's Peak, Uintah Mountains.....	13,350
Mount Dana, California.....	13,237
Mount Lyell, California.....	13,217
Mount Guyot, Colorado Territory.....	13,223
Parry's Peak, Colorado Territory.....	13,133
Three Teton's, Idaho Territory.....	13,000
Bald Mountain, Idaho.....	13,000
Mount Flora, Colorado Territory.....	12,878
San Francisco Mountains, Arizona Territory.....	12,052
Wahsatch Mountains, Utah.....	12,000
Spanish Peaks, Colorado Territory.....	12,000
Mount Englemann, Colorado Territory.....	12,000
Snow Line, 41° North Latitude.	
Mount Wright, Colorado Territory.....	11,800
Mount Silliman, California.....	11,623
Mount San Bernardino, California.....	11,600
Mount Hood, Oregon.....	11,225
Mount Pitt, Oregon.....	11,000
Lone Peak, Utah Territory.....	11,000
Black Hills, Wyoming Territory.....	11,000
Wind River Mountains, Wyoming Territory.....	11,000
Electric Peak, Yellowstone Park.....	10,992
Mount Baker, Oregon.....	10,719
Emigrant Peak, Montana Territory.....	10,629
Lassen's Butte, California.....	10,577
Mount Sheridan, Wyoming Territory.....	10,420
Mount Washburn, Yellowstone Park.....	10,388
Ward's Peak, Montana Territory.....	10,371
Mount Delano, Montana Territory.....	10,200
Mount Blackmore, Montana Territory.....	10,134
Mount Doane, Yellowstone Park.....	10,118
Mount San Antonio, California.....	9,931
Mount St. Helen's (Volcano), Washington Territory.....	9,760
Old Baldy, Montana Territory.....	9,711
Mount Garfield, Idaho Territory.....	9,704
Mount Adams, Washington Territory.....	9,570
Bridger's Peak, Montana Territory.....	9,000
Crater Lake, Cascade Range, Oregon.....	9,000
Mt. Olympus (Coast Range), Washington Territory.....	8,136
Yellowstone Lake, Wyoming Territory.....	7,788
Mount Mitchell, Allegheny Mountains, N. Carolina.....	6,782
Mount Washington, White Mountains, N. Hampshire.....	6,285

PASSES OVER THE ROCKY MOUNTAINS.

	Feet.
32d Parallel, near El Paso.....	5,714
35th Parallel, near Albuquerque.....	7,472
38th Parallel, (Cochecopa Pass).....	10,000
41st Parallel, (Union Pacific Railroad).....	8,241
42d Parallel, (South Pass).....	7,085
47th and 48th Parallels, (Cadott's Pass).....	6,044
47th and 48th Parallels, (Deer Lodge Pass).....	6,200
47th and 48th Parallels, (Lewis & Clark's).....	6,323
Flathead Pass, (Northern Montana).....	5,459
Kutanie Pass, (British America).....	6,000

PASSES OVER THE SIERRA NEVADAS.

	Feet.
Tejon Pass, 34° 45' North Latitude.....	5,250
Walker's Pass, 35° 30' North Latitude.....	5,300
New Pass, to Owen's River.....	3,164
Mono Pass, to Mono Lake.....	10,700
Silver Mountain Pass, to Carson City.....	
Donner Pass, (Central Pacific Railroad).....	7,042
Beckwith's Pass, to Pyramid Lake.....	4,500
Truckee Pass.....	7,200
Lassen's Pass, (40° 35' North Latitude).....	
Madelin Pass.....	5,667

P. suggests that a waterproof sizing or glazing be used in the manufacture of paper collars, so that they can be cleansed by wiping them with a moistened cloth.

Dyeing and Coloring Natural Flowers.

"Painting the lily" is generally considered about the acme of useless performances, but a correspondent of the *Garden* in the following lines tells us how to do it. The idea, of course, is not to improve on Nature's handiwork, but simply to prepare the flowers so that they will keep for an indefinite length of time, and, when arranged in bouquets, form handsome ornaments. The process, it will be seen, may also be applied to grasses and mosses with very good effect.

Dyeing is especially used for the red *xeranthemum annuum* fl. pl., red asters, and all kinds of ornamental grasses. Mix ten parts of fresh water with one part of good nitric acid, plunge the flowers in, shake off the liquid, and hang them up to dry. In this way *xeranthemums*, which should be cut when entirely open, will acquire a beautiful bright red tint; while grasses only become a little pale red on the tops, but will keep afterwards for many years, and may, if needed, be colored otherwise at any time. Asters generally, when treated in this way, are not so fine as if dried in sand, or smoked with brimstone. To color flowers and grasses blue, violet, red, scarlet, and orange, use the different kinds of aniline; for yellow use picric acid, and for bright scarlet use borax. The aniline dye should be dissolved in alcohol before it is fit for use, in which condition it should be kept in well closed bottles until it is required. It may also be purchased in a dissolved condition of any respectable chemist. To color by means of aniline, take a porcelain or any other well glazed vessel, pour in some boiling water, and add as much dissolved aniline as will nicely color the water. According to the quantity of aniline used, the color of the flowers will become more or less bright. After the water has cooled a little, plunge in the flowers or grasses, and keep them in it till they are nicely colored; then rinse in cold water, shake off the liquid, and hang them up in the open air to dry. To obtain a fine blue, take aniline *bleu de lian*, boil the color with the water for five minutes, and then add a few drops of sulphuric acid before using. For violet, use one part aniline violet and one part of aniline *bleu de lian*; for red, aniline fuchsin; for scarlet, one part of aniline fuchsin and one of aniline violet; for orange, aniline *d'orange*; for lemon color, picric acid, which should be dissolved in boiling water and then thinned with a little warm water. Dip in the flowers, but do not drain off the liquid. All kinds of ornamental grasses can be thus colored, especially *stipa pennata* and *ammodium alatum*, white *xeranthemums*, and most other everlasting flowers. *Immortelles*, however, as well as the other kinds of *helichrysums*, must be treated differently; their natural yellow color must first be extracted by dipping them in boiling soap water, made with Italian soap, and afterwards dried in an airy, shady place. The flowers generally become closed when thus treated, and should be placed near an oven and subjected to the influence of a dry heat, when they will soon re-open. This is very important if they are intended to be colored; if not, they will remain fine pure white *immortelles*. Most *immortelles*, however, are colored bright scarlet by means of borax, which gives a beautiful color; but it does not keep well, and becomes gradually paler. For this purpose, dissolve as much borax in boiling water as will color it nicely; when cool, dip the flowers, but do not allow them to remain in after they have taken the color; if kept in too long, they will not again open their flowers. The chief point in every mode of coloring *immortelles* is to place them first in a dry, warm atmosphere, where they will open their flowers well; and, after coloring, they should again be exposed to heat, by which means they will nearly always reopen them. Very nice looking *immortelles* are also produced by coloring only the center of each flower scarlet, which is done very rapidly with borax, by means of a small pencil or a thin wooden splinter, which is dipped into the color and afterwards applied to the center. This is generally done by little children in those establishments in Germany and France which supply the trade with everlasting flowers. The following is a very cheap and very good recipe to color ornamental grass and moss a beautiful green: If a dark green is required, take two parts of boiling water, one ounce of alum, and half an ounce of dissolved indigo carmine; plunge the moss or grass into the mixture, shake off the liquid, and dry the grass or moss in an airy, shady place. In the winter, however, they should be dried by means of fire heat. If a light green is required, add to the above mixture more or less picric acid, according as a more or less light shade is required.

Copper Alloys and Ores.

Dr. Percy, in a recent lecture at the Royal School of Mines on the above subject, said:

You must have observed the iron railings of London. Where the iron is in immediate contact with the lead at the bottom, there corrosion takes place to the greatest extent. When two metals are brought together—say, zinc and copper—they rust on exposure to air and moisture, but one of them serves to protect the other from rusting. To prevent the corrosion of the copper on ship bottoms, Sir Humphrey Davy recommended that pieces of zinc should be placed in contact with the copper: by that means the corrosion of the copper was prevented, but the zinc corroded and wasted very rapidly. Since that time the Admiralty have had some more precise experiments made on this subject, and it has been found that, when in contact, lead promotes the corrosion of copper, and copper promotes the corrosion of iron.

What takes place when copper and lead are melted together (say) at temperature of melting point? Will they alloy—that is, remain permanently united when the metal has become cold, as in the case of common brass, a compound of spelter and copper? Suppose I take a quantity of copper

and melt it, and add thereto an equal weight of lead and mix the whole together thoroughly; then if I take out the mixture and cool it rapidly, I get an ingot composed of copper and lead, almost wholly in mechanical mixture. Suppose, instead of cooling it rapidly I leave it to cool slowly; an almost complete separation of the two metals takes place; the lead, being the heaviest of the two, accumulates at the bottom of the mold. The separation in this latter case is not perfect, for the copper will retain about 2 per cent of lead, and the lead also about that percentage of copper. There is, therefore, no proper alloy of these metals in the strict sense of the term.

Next let us take copper and iron, and the iron we use will be that which is most like pure iron—wrought iron. Suppose we expose the mixture of copper and iron to a very high temperature; we shall not get anything but a mechanical mixture; when the proportion of the iron increases beyond a certain degree, we can distinguish under the microscope small grains of that metal, diffused through the mass. Iron is a white metal, and copper a red one. In every other case that I know, when two metals differing in color form a true alloy, the product differs in color from either of the metals, but in the case of this mixture of iron and copper, the product is a ruddy colored mixture like copper, the iron being diffused through it. That is to my mind a satisfactory proof that it is a mechanical mixture, and not a true alloy. To get this mixture in the best manner, take some oxide of iron and oxide of copper, as fine as possible, and mix them up intimately with some finely powdered charcoal, and then subject the mass to a high temperature; the charcoal, as we know, will then reduce both the oxides, and set free the metals in a condition most favorable for their combination.

Metallic copper or native copper is frequently found in connection with other copper ores; sometimes in vast masses, as near Lake Superior, where it was said there was one mass of copper in the metallized state weighing not less than 500 tons. In this condition it is, perhaps, one of the most expensive ores of copper, for the metal is excessively tough, and cannot be blasted, but must be prepared for the market by being cut up with tools. The next ore is the oxide of copper; there are really two oxides of copper, the red and the black, and they are among the richest ores of copper. Then we have the blue and green carbonate; the latter is commonly called "malachite" and is frequently applied to ornamental purposes. These latter ores are compounded of oxide of copper, carbonic acid, and water; and when heated up to a good red heat, they lose water and carbonic acid, and the residue consists of oxide of copper. In treating an ore of this kind, then, we may consider ourselves, therefore, as virtually treating an oxide of copper. There is another class of ores in which copper is combined with sulphur; one exactly similar in all respects to that compound I have before described—the gray sulphide of copper, an extremely valuable ore. Then there is another in which iron occurs as a constituent—common yellow ore or copper pyrites; it consists of copper and iron, and sulphur. Sometimes copper pyrites is mistaken by inexperienced persons for iron pyrites, a compound of iron and sulphur, which is far less valuable than the other, but here is a simple test by which you can infallibly distinguish between them. Apply the point of a penknife in the case of copper pyrites, you can scratch it easily; but in the case of iron pyrites, you can make no mark upon it.

CHEMICAL NOTES.

Action of Heat on Gases and Vapor Condensed by Charcoal.

When wood charcoal, saturated with dry chlorine, is placed in the longer branch of Faraday's siphon gas-condensing tube, and the heat of boiling water is applied to it, the shorter branch being placed in a freezing mixture, a portion of the gas is volatilized. Pressure being thus developed, liquefied chlorine soon appears in the tube. The experiment is well adapted for a lecture demonstration. The author has liquefied in this manner ammonia, sulphur dioxide, hydrosulphuric acid, hydrobromic acid, ethyl chloride and cyanogen.

Wood charcoal retains so firmly the vapors of the volatile liquids, bromine, hydrocyanic acid, carbon sulphide, ether and alcohol, that, upon repeating with them the experiment just described, no liquid is obtained.

Pouillet observed a slight evolution of heat when water, oils, ethyl acetate, and alcohol were absorbed by mineral powders, and still more marked effects with organic powders. The author finds that, with charcoal, still more heat than in the above case is given out when it absorbs liquids upon which it has, apparently, no chemical action. Thus with 5—10 grains of charcoal, and 40—80 grains of bromine, the temperature was raised 30° C. If the charcoal had been previously heated to expel gas, and then cooled *in vacuo*, the absorption of bromine being also conducted *in vacuo*, no doubt the rise of temperature would have been still greater. —*Melane, Comptes Rendus—Journal of the Chemical Society.*

Sugar from Caoutchouc.

Caoutchouc from Madagascar yields a saccharine substance, which A. Girard has named "matezite," from the native word for caoutchouc. Matezite is white, very soluble in water, less soluble in alcohol, from which it crystallizes in tufts. It melts at 181° to a vitreous mass, which does not crystallize on cooling, and may be sublimed at 200°—210° without decomposition. It deposits in drops. Its formula is $C_{10}H_{20}O_2$; and on treatment with hydriodic acid, it undergoes a decomposition analogous to the others, forming a sugar called by the author *matezodamboss*.

Glycyrrhizin, or Liquorice Juice.

P. Griesmayer says: "It has been suspected that sugar, extracted from liquorice root, has been used for the purpose

of adulterating beer, and yet the opinion of chemists has been that such sugar is not fermentable. Glycyrrhizin is a glycoside, which, on boiling with acids, decomposes into glycyrretin and sugar. Even after boiling it with water, sugar may be detected by Fehling's test. The sugar obtained in this manner was treated with yeast, and after three days the fermentation was complete, and alcohol was found in large quantity by means of the well known reaction converting it into iodoform. During the latter stage of the fermentation a peculiarly disagreeable putrid odor was perceived, and the substance emitting it passed over into the distillate; the disagreeable taste of some German beers is doubtless owing to this body. —*Dingler's Polytechnisches Journal.*

Amylammonium Chloride.

Amylammonium chloride, introduced under the skin of the rabbit, guinea pig, and dog, causes, in small doses, a marked diminution of the pulse, and some fall in temperature. In larger doses convulsions are produced, which end in death. With man a dose of from 8 to 16 grains lowers the pulse 10 to 20 beats per minute, and occasions a fall in temperature. Dr. Dajardin Beaumetz has administered this salt with advantage in some cases of typhoid fever. Amylamine has not the sedative action on the nervous system which trimethylamine possesses, but surpasses it greatly in its effect on the pulse, and in its toxic action.

Experiments on the Preservation of Eggs.

F. C. Calvert finds that eggs, either entire or pierced at the end by a fine needle, may be kept for three months without change in an atmosphere of nitrogen, hydrogen, or carbonic anhydride. In dry oxygen entire eggs undergo no change, but if the gas is moist the egg becomes covered with a white filamentous mold.

An egg pierced at the extremity soon becomes putrid either in dry or in moist oxygen, the amount of oxygen consumed, and of carbonic anhydride and nitrogen evolved, being much greater in the latter case than in the former.

New laid eggs immersed in weak chlorine water contained in a stoppered bottle underwent no change for nearly eight months, but on leaving the bottle open for a week, they became covered with *penicillium glaucum*.

Eggs kept in a weak solution of chlorinated lime soon began to show signs of change externally by the growth of penicillium. With lime water and with calcium sulphite, similar results were observed.

Eggs kept in solution of phenol exhibited no change for three months. They were then slightly coated with penicillium, but their contents were perfectly sweet.

Camphor for Seeds.

According to A. Vogel, camphor is found to have a marked effect in stimulating the germination of seeds, both by shortening the period of germination and causing more seeds to sprout. Turpentine has a similar action, but seems to exert a hurtful influence on the further development of the plant, which is not the case with camphor.

The Costly Mistakes of Civil Engineers.

President White, of Cornell University, makes the following strong assertion in a recent lecture:

"Another great department bearing on a multitude of industries, directly and indirectly, is civil engineering. Take one among the fields of its activity. We have in the United States about 70,000 miles of railway, and every year thousands of miles are added. I do not at all exaggerate when I say that millions of dollars are lost every year, by the employment of half educated engineers. Proofs of this meet you on every side. Lines in wrong positions, bad grades, and curves, tunnels cut and bridges built which might be avoided. All of us know the story. But this is not all. Hardly a community which has not some story to tell of great losses entailed by bad engineering in other directions. Here it is the traffic of a great city street interrupted for a year because no engineering can be found able to make the calculations for a 'skew arch' bridge, a thing which any graduate of a well equipped department of engineering can do; there it is a city subjected to enormous loss by the failure of its water supply system because the engineer employed made no calculation for the friction of water in the pipes; in another instance it is a whole district sickened by miasma, because a half taught engineer was entrusted with its drainage. We must prepare men for better work; and for every dollar thus laid out, we shall create or save thousands. Nay, we shall save lives as well as money. Mr. Baldwin Latham, in his recent book on 'Sanitary Engineering' and Dr. Beale, in his work on 'Diseased Germs,' show by statistics that a proper application of engineering to sewerage would save one hundred thousand lives yearly in Great Britain alone, and the same truth holds in this country."

One Hundred and Twelve Miles an Hour on the Ice.

The Poughkeepsie Eagle gives an interesting account of an example of such movement, which recently took place on the Hudson river at Poughkeepsie. "The wind blew very fresh from the south, and the owner of the new ice boat Cyclone determined to take advantage of the favorable opportunity for timing his yacht. The Hudson at this point is very wide, and at the course selected its breadth is one mile. Having made every preparation for the feat to be accomplished, the reef points were shaken out of the sails, and every stitch of canvas spread to the gale. With two men on the windward runner to keep the boat down to the ice, the helm was turned, the sails filled, and in a moment, with every inch of canvas drawing, she was under full headway. Like an arrow from a bow she darted away on the course, clouds of pulverized ice following in the track of

her runners as they hummed over the surface of the river, and in what seemed but an instant the river had been crossed and the mile accomplished in the almost incredible time of thirty-one seconds, being at the rate of two miles in a minute and two seconds, or 112½ miles per hour. Persons on shore compared the speed of the flying racer to that of a meteor flashing through the sky, and watched her movements with eager interest. The owner afterward put the boat through some movements on the ice, and astonished the lookers-on by sailing all the way across the river on one runner, the force of the wind throwing her over on her beam ends and raising the windward runner from ten to twelve feet above the ice. Although but few were found willing to partake of the amusement, all seemed disposed to coincide in the opinion that ice yachting is the most exhilarating of sports, and the evolutions of which one of these yachts is capable, the most graceful of anything they had ever witnessed."

We have in various articles in the back volumes of the SCIENTIFIC AMERICAN illustrated and described the philosophy which governed the movement of ice boats, and have pointed out the reasons why they were frequently driven at a considerably higher velocity than the speed of the wind by which they were propelled. But we think the above statement of velocity needs further verification.

Allowing that the breeze which propelled the boat was a high wind, its velocity could not have exceeded thirty-five miles per hour, while the boat moved at the rate of one hundred and twelve and a half miles per hour, which is faster than a tornado. The wind of the latter reaches a velocity of one hundred miles an hour, pressing with a force of fifty pounds to the square foot upon whatever object it touches, sweeping away buildings and trees in its fearfully rapid progress.

Correspondence.

Harmonic Law of the Planetary Distances.

To the Editor of the Scientific American:

Permit me, through your valuable paper, to publish to the world a new harmonic law existing between planetary distances and motions. It is superior to Kepler's third law, which, although only an approximation, has been the basis of all theoretical astronomy for the last two hundred and fifty years. The following will be found mathematically exact:

The square root of the quotient arising from dividing the distance of any exterior planet by the distance of any interior planet, multiplied by the velocity of the exterior planet, shall equal the velocity of the interior planet. I give the last corrected figures of planetary distances and motion, so that any one, acquainted with the first rules of arithmetic, can work the problem, proving the existence of this beautiful and exact law, another signature of the Omniscient Almighty:

	Mean distances in miles.	Mean motion per hour.
Mercury.....	35392638	105 (thousand +) 330 miles.
Venus.....	66191478	77 " 050 "
Earth.....	91430220	65 " 533 "
Mars.....	139312226	53 " 090 "
Jupiter.....	495693149	27 " 744 "
Saturn.....	872134583	21 " 221 "
Uranus.....	1753851052	14 " 968 "
Neptune.....	2746271232	11 " 958 "

Kingstown, Ind.

ALFRED LUTHER.

REMARKS BY THE EDITOR.—Our correspondent should communicate his results to Professor Daniel Kirkwood, of Bloomington, Ind., who is called by Mr. Proctor the "Kepler of Modern Astronomy." Kepler's laws are as follows:

1. Each planet describes round the sun an orbit of elliptic form, and the center of the sun always occupies one of the foci. 2. The areas described by the radius vector of a planet, round the solar focus, are proportionate to the time taken in describing them. 3. The squares of the times of revolution of the planets round the sun are proportional to the cubes of their major axes. The search for this last law (which applies to the satellites also) cost Kepler 17 years' calculation. Harmonic relation appears throughout the universe. Overtones in music, the formation of crystals, phyllotaxis or the arrangement of leaves around the stem, all show most curious numerical relations. The lines of fluted spectra of the first order are supposed to be successive harmonics of a single motion in the molecules of luminous gas. Perhaps these harmonic laws may yet teach us, beside the distances of planets, the distance of atoms and the size of the molecule.

Charcoal for Wounds, etc.

To the Editor of the Scientific American:

The best simple remedy I have found for surface wounds, such as cuts, abrasions of the skin, etc., is charcoal. Take a live coal from the stove, pulverize it, apply it to the wound and cover the whole with a rag. The charcoal absorbs the fluids secreted by the wound, and lays the foundation of the scab; it also prevents the rag from irritating the flesh, and it is antiseptic.

If, however, you prefer a white scab to a black one, use quinine instead. This possesses all the virtues of the charcoal, and is, besides, astringent and tonic. P.

HACHISCH.—M. Naquet has lately been studying the physiological action of hachisch. The extract of hemp seed (*cannabis indica*) administered to various persons produces a great exuberance of ideation; it is not new ideas, but the exaggeration, amplification, and combination of ideas which pre-existed in the person's mind. Hachisch produces one curious effect (which is also observed in acute mania); this is a singular inclination to make puns and plays upon words,

IMPROVED AUTOMATIC TOOL GRINDING MACHINE.

It is hardly necessary to point out to any mechanic who has ever sharpened a tool, either by hand or by the aid of mechanical apparatus, in connection with the grindstone, that the main difficulty to be overcome is the securing of a perfectly true straight edge. Without entering into the relative merits of the various devices which have been invented in order to attain this object, we desire, in the following description, to call attention to an improved machine, which is claimed not only to grind long cutting edges perfectly straight, or to a perfect curve, but to perform its work automatically without necessitating skilled care. It is also so constructed as to obviate the jumping of the knife on the stone, while its effect upon the latter is to keep it truly round and square on the face.

In our engraving the blade, A, which may be a tobacco, leather, paper, or planing machine knife, or in fact, any other cutter of a length within the limits of the frame, is secured to a tool holder, B. The latter has on its lower side projections through which passes the long rod, C. By means of the set screws at D, the tool holder, B, after being set at any desired angle, may be rigidly clamped to the rod, C, while the knife blade is secured and adjusted on the tool holder by means of the clamping screw shown thereon.

The rod, C, extends through one of the upright standards of the frame, and carries on its end an arm, E, in which is a nut through which passes the feed screw, F. The latter has near its end four pulleys, two of which are fast and two (the inner ones) loose. The bands of these pulleys are arranged with a simple shifting apparatus, so that only one belt on the fast wheels can be in action at a time, the other belt slipping to the adjacent loose pulley. As the belts, as will be seen from the engraving, are arranged so as to communicate motion in relatively opposite directions, it is evident that, by the means above described, the feed screw may be caused to revolve in either way at will. Communicating with the shifting device, part of which is represented at G, is a stop rod, H, on which are shown two sliding collars, I. The rod, H, slides in its bearings, and is connected to a moving weight or counterpoise, J.

From the above it will be clear that, as the proper pulley is rotated, the feed screw turns, for example, so as to carry the nut on the arm, E, forward, and consequently the tool holder and blade on the rod, C. This motion continues until a downward projection on the arm, E, strikes the forward stop, I, carrying the same along with it and thereby moving the stop rod, H. The latter pulley on the lower part of the counterpoise lever throws the weight over to the right, and, at the same time, thus shifts the belts to the other pair of pulleys, giving to the feed screw a contrary motion. The result is that the knife is drawn along the face of the stone in the opposite direction until the other stop is encountered, the rod moved, belts shifted, and the same operation repeated.

Just to the right of the tool holder is an arrangement which constitutes one of the most important features of the machine. It consists of a sliding piece on the rod, C, to which is attached, at K, a metal spring which bears against the pattern bar, L. This piece is rigidly clamped to the rod, C, by a suitable set screw, and is therefore carried along with it. The action of the spring, as a moment's consideration will show, is to bear the tool against the stone to the exact point desired, while holding it rigidly to give sufficient play to avoid the jumping or jarring of the tool against inequalities of the surface. Hence, no matter how irregular the shape of the stone, the blade is constantly held against all points of its periphery.

We have already shown how the angle of the blade is adjusted. The amount to be ground away can also be limited by set screw attached to the spring carrier, which, as represented, takes against the pattern bar, L. This device prevents any damage to the tool through inattention, as the machine will only allow the grinding to continue to the bounds fixed by the screw. By using a properly curved pattern bar to suit the shape of knife, blades of peculiar form may, through the operation of the spring arrangement, be ground with perfect curves.

The mode of attaching the machine to the grindstone by the bolts and slotted plates, so as to allow of still further adjustment, is clearly indicated in the illustration. Three sizes of the machine are made to suit various lengths of blades, and also an extra smaller form for use with the common hand grindstone. No honing, we are informed, is necessary after the tool has once been properly ground with the device. Fur-

ther particulars may be obtained by addressing Mr. E. Conner, general agent, No. 95 Liberty street, New York city.

Chloride of Gold for Toning.

At a meeting of the photographic section of the American Institute, Mr. H. J. Newton, the President, gave the following description of his method of making chloride of gold:—

I take two drams of nitric acid and three drams of hydrochloric acid; in that I dissolve a five dollar gold piece. That is pure enough; the copper is an advantage rather than a detriment. In this way you have 135 grains of gold. Reduce that so as to have eight grains of gold to the ounce, or one grain to each dram, and you will always know when you pour it out how much you have. That will give you about 16 or 17

Further, as the bend with this tool is a curve and not an angle, it is claimed that it will hold much longer, because the set is all equal and even from the point of the tooth; when the teeth are once confirmed to the set, it is only necessary to renew the set by bringing the cam to a given point, such as the stop on the cam.

Reference being had to the engraving, in Fig. 1 is shown a circular saw in position with the set applied. The operator stands behind the saw, the set being attached to the teeth by placing the bed die, A, on the point of tooth, so that the point will project beyond the die one sixteenth of an inch.

The cam lever, B, is then brought down to the stop, C, on the cam, bending the tooth toward the latter.

A four point gage is provided on the cam lever, seen at D, and E is a screw to adjust the same to the amount of set desired. The die bar, F, is governed by the thumb nuts, G, on the cam links projecting through the bed.

The advantage of this arrangement is that the bending power is brought to bear on the tooth between the two bed bearings, so that the operator has only to bear down on the cam lever; and the more power he applies, the tighter he fastens the set to the saw. A handle is provided at I for convenience in handling.

For band or jig saws, the form of the set, as represented in Fig. 2, is changed, having a longer bed, terminating in a handle having an adjustable cam link which can be moved laterally on the bed.

The die bar is the same as the circular saw set, also the cam lever, having a stop. These, together with the thumb nuts, regulate the amount of set to be given to a saw. The die bar is kept in contact with the cam by the recoil of the spring, J.

Sliding laterally upon the bed is a guide bar, K, having a narrow hanging lip and grooves, and fastened in place by the thumb screw, L.

The saw is placed on the set so as to leave the tooth to be set over the bed die, M.

The sliding guide bar is then brought up to the back of the saw, and fastened by the thumb screw. The cam is brought down to the stop, giving as much set as desired by screwing up the thumb nut, G.

A loose adjustable pawl, N, is hinged to the bed, and is used on very fine saws, to regulate the position of the teeth over the die, M, by engaging the pawl with the teeth; and as the saw is moved the pawl clicks on the teeth, every two clicks indicating the tooth to be set. The advantage of the pawl, in setting very fine saws, is that it saves the close scrutiny otherwise needed; and if the operator stops a moment, it is claimed, it shows with absolute certainty where to commence again.

The set can be used with the saw on the pulley, as it can be attached to a bench by the bolt, O. All the various sizes of these tools are now being made and sold throughout the Southern and Western States by Curtis & Co., of the Empire Saw Works, St. Louis, Mo., who have the exclusive control of that part of the United States. S. C. Forsaith & Co., Manchester, N. H., and Grandy Brothers, Stafford Springs, Conn., manufacture and sell throughout the Eastern and Middle States, from whom descriptive circulars and price lists can be obtained, and to whom all orders should be addressed.

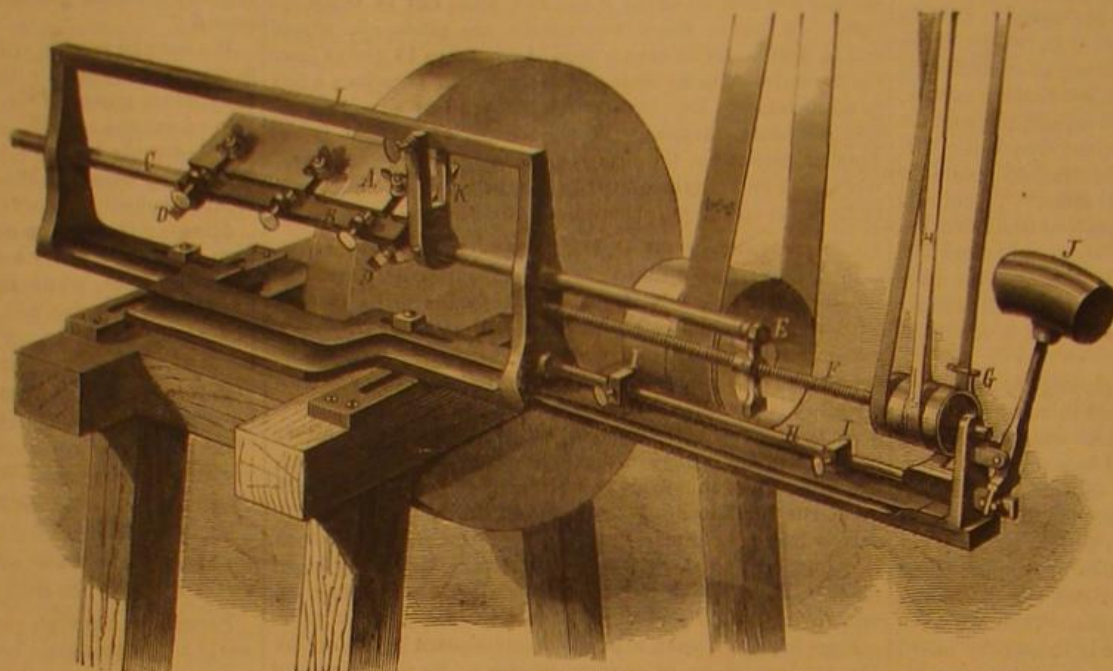
Patented, through the Scientific American Patent Agency, April 8, 1873.

Frost Striations in Mud.

The Rev. F. R. Goulding, in the *American Journal of Science and Arts*, calls attention to the phenomenon of slight but plainly marked striations of the soil after a frost, looking as if a very light harrow had been drawn over it from northwest to southeast, leaving irregular furrows varying from half an inch to an inch and a half in depth from center to center. This aspect occurs, it seems, during black frosts in Upper

Georgia, and the stripes invariably run, as above noted, both in shaded and sunny places, and whether the air be still or in motion at the time. They begin to show themselves before the frozen surface has thawed. It is noted as a coincidence that their direction is at right angles to the stratification of the country, the outcroppings of the rocks being in a line from northeast to southwest. Can any of our correspondents throw light on the question? The writer states that he has examined the phenomenon quite closely, but can find no apparent cause.

A NEW tubular wick petroleum lamp has been contrived by MM. Deffenne. It consists of ten small circular wicks in place of one large one. They are arranged in a circle, and are attached to a frame movable by a single rack.

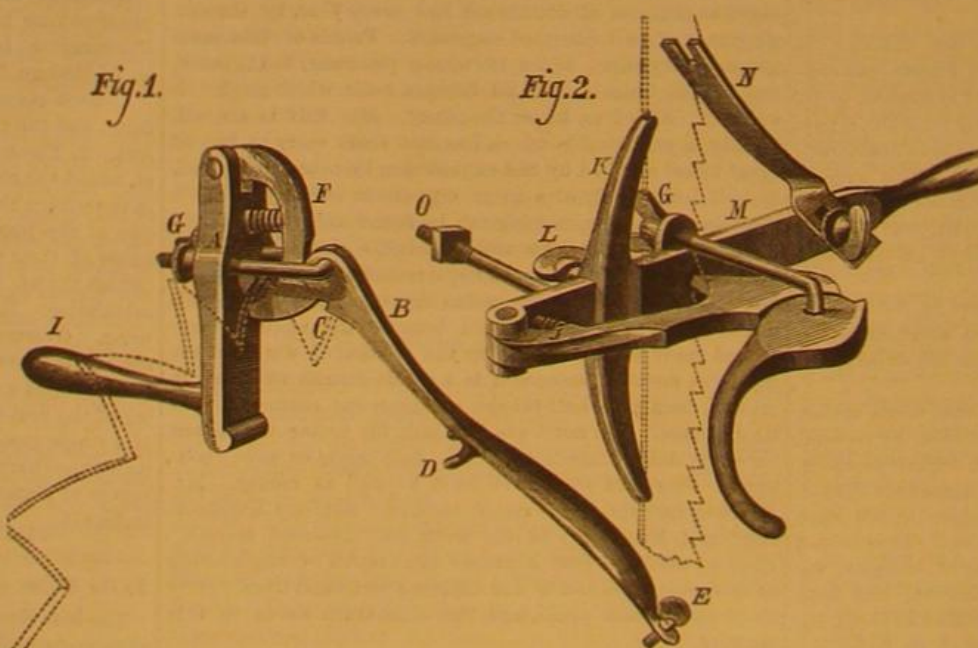


AUTOMATIC TOOL GRINDING MACHINE.

fluid ounces to a five dollar gold piece. That will keep. You may put in salt if you choose; I sometimes do that. This solution will go farther than any you buy. A few hours before you use it, neutralize it with bicarbonate of soda, borax, or any of the alkalis, according to the tone you desire. Bicarbonate of soda will give you a brown tone, and borax a black. Make it up a few hours before you want to use it, so that it will turn litmus paper blue, and I do not believe you can prepare gold to make better tones. When you make this solution it is acid, but you can neutralize it with bicarbonate of soda down to the point where a drop of it will turn green, or you can make it perfectly neutral, and add a little *aqua regia*.

IMPROVED CIRCULAR AND BAND SAW SET.

The improved saw set represented in our illustrations is claimed to work easily and surely and without injury to the saw. The manufacturers submit a large number of testimonials from sawyers in all parts of the country, and state



IMPROVED CIRCULAR AND BAND SAW SET.

that not one of the instruments has been returned to them for any reason whatever.

The illustrations show the set as applied to a large circular saw and to a band saw. It is, however, we are informed, equally applicable to crosscut or upright blades. The inventor, Mr. C. E. Grundy, is a practical sawyer of some fifteen years' experience, and claims that he has tried every kind of saw and manner of filing, setting, and swaging, and that (for a circular saw to do the most work with the least amount of wear to the plate, bearing in mind the time required to put in order) teeth bent or set give the best result.

It is evident that a piece of steel like a saw tooth point will bend by a slow, firm, and even pressure being applied where it would break by a sudden blow of a hammer, the twist of a wrench, or the spring of a bar of iron.

HOUSE TOP GARDENING.

In Mexico and in several other tropical countries, aerial gardens, constructed upon the roofs of the houses, are common, and form delightful resorts for the occupants during the cool of the evenings. Various plans for so utilizing the tops of our city houses have already been suggested, the latest and one of the most practical of which is illustrated by the annexed engravings, extracted from the *Garden*. Our neighboring city—Brooklyn—we may here remark, presents some extensive examples of gardens on the house tops, but constructed on a scale of magnitude differing widely from the ideas contemplated in the subjoined description. Several of the finest residences are built almost on the edge of the Heights, so that the roofs of the warehouses, constructed at the foot of the declivity, are almost at a level with their foundations. On these roofs earth has been heaped to considerable depth, so that the odd sight is presented of handsomely laid out terraced plots, covered with shrubbery and even small trees, surmounting massive three-story and even higher brick buildings.

Mr. Lascelles, a horticultural builder, writes that he has proved the practicability of his plan, illustrated herewith, upon edifices in the very heart of London.

The plan seems practical and not expensive to adapt to any of our city houses.

The roof conservatory forms the roof story of Mr. Lascelles' offices; the floor of the conservatory, which is on a level with the bottom of the cornice shown in our illustration (Fig. 1) forms also the roof of the story beneath; it is well formed of concrete, with iron imbedded in it, to secure all the needed strength. Brick beds have been formed round the sides of the house, and these contain earth for vines, which cover the roof. The surface of these beds forms a convenient standing place for plants in pots. The house is of wood, bent by the aid of steam, and well, but not expensively, constructed, and the effect from the street is very good. The glass is not bent, although it is so in appearance. With dense shade overhead, a house of this kind would form a fernery, and, without such shade, fruits that endure a dry atmosphere might be grown after the orchard house fashion. Abundance of water would, of course, be required in any case, but this would not lead to much inconvenience, as the ordinary supply to the house could be made available by the cistern being placed on the conservatory floor. The roofs of large public buildings, such as theaters, would afford capital sites for winter gardens on a large scale; water in abundance is required on such roofs, and that is the chief requirement of the plants. In such cases, the winter garden would form a new and most attractive feature of the establishment. As regards business houses, a modification of the same plan might be desirable where very good light was required in the upper story. Such a pleasant innovation in the city naturally suggests many ways in which a like kind of glass house might be made to add to the comfort and elegance of private houses of every class, from those who could afford a well furnished winter garden to those who could only use the upper story as a playground for children. We are assured that the architectural difficulties (even in the present state of our knowledge of the subject) are surmountable. The ordinary square type of glass house would, of course, be unendurable over any handsome house. The fact, however, that palms, and many other sub-tropical plants, suited for decoration, thrive perfectly in a less brilliant light than that of a common greenhouse, would relieve the architect from the necessity of making the roof a glass shed. If the approaches to the conservatory floor were, as they should be, roomy and convenient, the difficulties of moving the soil, plants, etc., would not be so great as they might at first sight appear. This, however, seems a case to which the principle of co-operation might be advantageously applied, and we commend the suggestion, for what it is worth, to the attention of those who are interested in the matter. Suppose, for instance, a builder is about to erect a row of a dozen or so of good large houses; each of these might be furnished with its conservatory on the roof, communicating with the conservatories of the houses on both sides, so that the whole would form one continuous greenhouse, uniform in height and architecture, and so presenting a much more pleasing appearance, when viewed from the road or street, than if the conservatory of each house was detached and built in a different style. This would form a very fine winter garden, common to all the inhabitants of the row or block of houses, much in the same way as is at present the case with many London gardens now. One consideration in favor of the house top conservatory is the facility with which it might be heated; for temperate climate plants, the always ascending heat of the house would suffice. It could be kept in excellent order by one gardener, paid by subscription from each

family, who would thus, at a trifling expense, enjoy all the advantages of an extensive first class winter garden on their own premises, as it were. Another point gained would be that, by the use of one common lift (constructed while the houses are building), soil, plants, etc., for the entire row, could be raised to the roof, and thus spare each family the trouble and inconvenience of having such things carried up through the house. Some persons, from a desire of complete privacy, might object to this arrangement; but we believe that, considering the many advantages which it possesses, others may be induced to give it a trial, and it is, at least, one deserving of some consideration.

A fernery or plant case might be arranged to run the whole length of the front windows of a story, and be heated by a

small boiler placed behind a fireplace. From this a two inch flow and return pipe is taken through the case, so as to heat it when required. The space around the pipes can be filled with bark, or water, if desirable, so as to produce a moist and genial bottom heat. The ferns, mosses, and other decorative plants are arranged in flat square pans of zinc or earthenware, as shown in our sectional sketch (Fig. 2), and the effect of the whole, especially when seen from within, is

was that steam liberated at atmospheric pressure—that is, at a temperature of 212°—and passed into any saline solution having a boiling temperature higher than that of water would raise this saline solution to its own boiling point. Thus, as Mr. Spence showed experimentally, if we take a solution of nitrate of soda, which boils at 250°, and if we blow into that solution steam at 212°, the temperature of the solution will be raised to 250°, the steam being condensed and yielding its heat. The explanation seems to be that the salt has a stronger affinity for the water in the steam as water, than the heat has for it as vapor. The water is therefore seized by the salt, and the latent heat is evolved as heat of temperature. A single cubic inch of water made into steam at 212° will raise 6 cubic inches of water from 32° to 212°, which shows the enormous amount of latent heat that steam contains. In utilizing the exhaust steam (at 212°) from a high pressure engine, Mr. Spence brings it into contact with a solution that has a boiling temperature higher than that of water. For this purpose he prefers to use a solution of caustic soda, on account of its high boiling point, and because it is not liable to act injuriously upon iron. The exhaust steam will raise a solution of caustic soda to a temperature of 375° (more or less, according to its density), and the heated solution is then circulated through pipes in an ordinary boiler, and its heat is radiated, for the purpose of generating steam in the place of heat derived from fresh fuel. If the boiler is at a pressure of 30 lbs., the solution will leave it at a temperature of 250°, so that 125° of heat would have been radiated to the water. The solution having been to some extent diluted by the condensation of the exhaust steam, its capacity for heat will be reduced in a corresponding degree; and if steam at 212° were again blown through it, it would not reach the same temperature as before. It is therefore passed into another boiler of ordinary construction, where it takes the place of water, and is concentrated by steam being generated from it. In this way its original capacity

for receiving heat is restored. Besides this method of utilizing the waste steam of high pressure engines, Mr. Spence has found the principle equally applicable, and with even greater advantages, to the condensing engine. The solution may be brought in contact with the exhaust steam in an ordinary surface condenser. A partial vacuum is produced, because, although the injected solution may be of higher temperature than the steam, its absorbing power of heat is in the same ratio as that of cold water to steam. The solution is again heated to a degree capable of generating steam, and the vacuum is produced. Mr. Spence maintained that if, by taking advantage of his father's discovery, a mode of utilizing the large amount of latent heat contained in the steam now thrown into the atmosphere could be brought into practical operation, so that this latent heat could be made to do actual work, the discovery, especially at the present price of fuel, would be one of enormous value, and he announced his intention of speedily trying the experiment on a manufacturing scale. Mr. Crampton objected to Mr. Spence's project that the amount of tubing required for the conveyance of the caustic soda solution would be so large that it would eat up any profits likely to accrue from the discovery, and the audience generally, although the facts proved by Mr. Spence were new to them, seemed little disposed to admit that they would prove to be of any practical value. On this point, however, the larger experiments which Mr. Spence is about to institute must shortly remove all doubt.

We publish the above, says *Engineering*, because the facts upon which Mr. Spence's proposed scheme is based are of some interest; but it appears to us evident that, quite apart from the complication of the proposed arrangements, their employment could only be attended by a dead loss instead of an economy, as the heat expended in re-evaporating the steam condensed in the caustic solution (so as to keep the latter at its normal density) must evidently exceed that imparted by the caustic solution to the boiler.

The Main Force of Culture.

Science occupied a low position until of late years; and great and honorable as it is now, does not deserve to be considered as the leading influence in culture. The main force of culture is industrial art. It enabled the first savages to make the flint knives, the stone axes and mortars, the bows, arrows, spears, slings, harpoons, nets, boats, huts, fire sticks, and digging sticks (the earliest implements of tillage), without which they could not have raised themselves above the level of the brute. It enabled the stone-age savages to smelt copper and tin and unite them in a hard, elastic alloy fit for swords, spear heads, arrow heads, helmets, breast plates, shields, chisels, hoes, plow points, hammers, axes, and knives. Then, and not until then, did men have durable dwellings of cut stone, productive tillage with the capacity to maintain many people in a small area, cities, national organizations

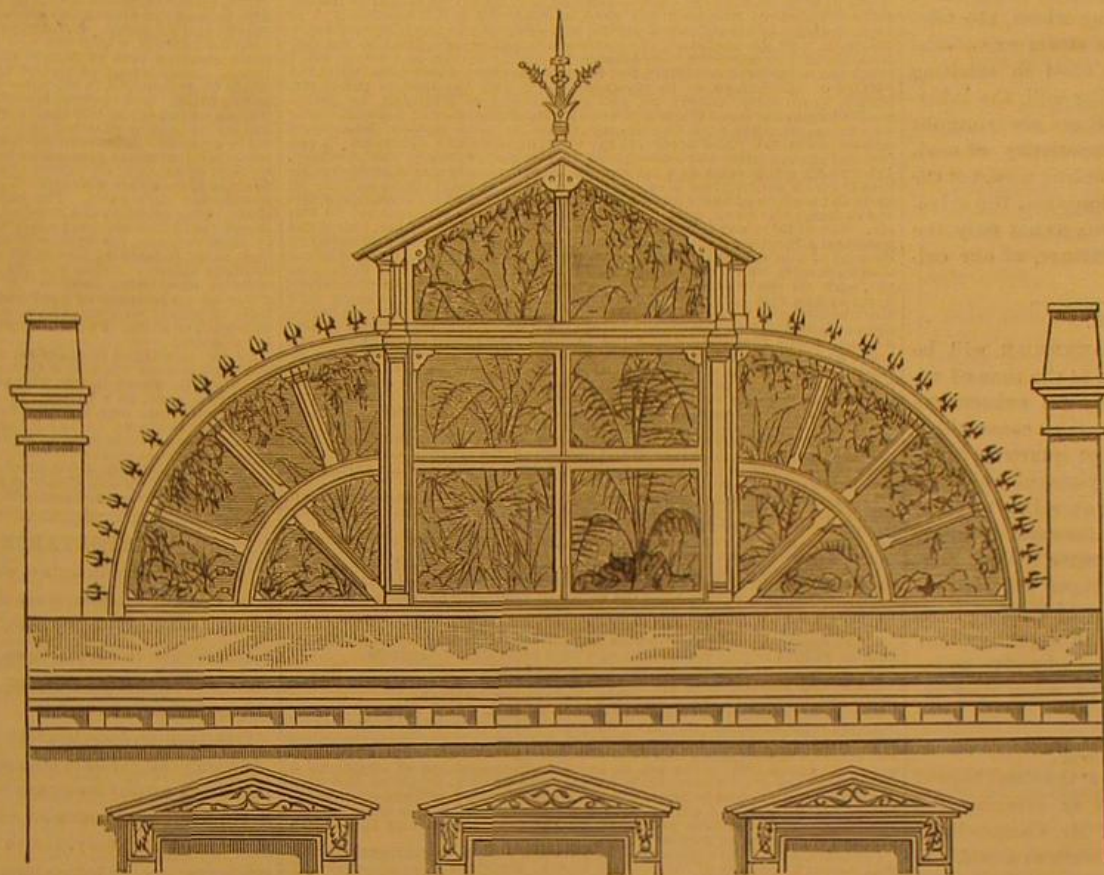


Fig. 1.—HOUSE TOP GARDEN IN THE CITY.

small boiler placed behind a fireplace. From this a two inch flow and return pipe is taken through the case, so as to heat it when required. The space around the pipes can be filled with bark, or water, if desirable, so as to produce a moist and genial bottom heat. The ferns, mosses, and other decorative plants are arranged in flat square pans of zinc or earthenware, as shown in our sectional sketch (Fig. 2), and the effect of the whole, especially when seen from within, is

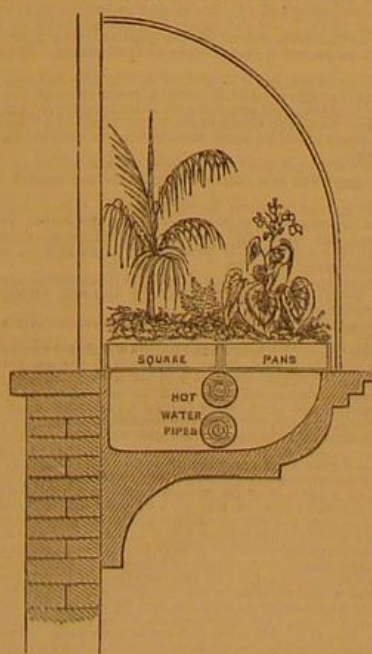


Fig. 2.—SECTION OF PLANT CASE.

very effective, and affords relief to the eye, which would otherwise look out on a dismal prospect of blackened roofs and soot-begrimed chimney pots.

We look on this elegant innovation as a great improvement, and think, with its originator, that, if generally adopted, the appearance and comfort of our dwellings and offices in the town would be considerably enhanced.

The Utilization of Waste Steam.

The *London Times* publishes the following accounts of the system to which we briefly alluded on page 167 of our current volume:

On January 28, at Stafford House, Mr. Spence exhibited to a distinguished audience a plan by which he proposes to employ the heat of waste steam as a substitute for fuel. This method is founded upon a discovery made by the father of the inventor, and announced by him to the British Association at its meeting at Exeter, in 1869. The discovery

laws, well disciplined armies, systematic civil polity, religion and ornamental art. Several thousand years elapsed before this beneficent industrial spirit, which had first taught the savage to fashion tools of stone and then elevated him to the bronze age, raised him to the age of iron by teaching him to smelt, forge, temper, and weld the most useful of all the metals. If the useful arts had done nothing for man but to teach him how to work stone, bronze, and iron, they would deserve the credit of laying the indispensable foundation of all our culture, and thus doing more for us than any other branch of human employment has done. But their service did not cease there. It has continued and still continues with increasing beneficence. If we divide culture into a dozen eras instead of three, the stone, bronze, and iron ages, we should have to designate nearly all of them from industrial events. The sailing vessel, the mold board which turns over the furrow of the plow, the water wheel, the magnetic needle, gunpowder, the paper mill, movable type, the spinning wheel, the telescope, the quadrant, the chronometer, the steam engine, the steam boat, the steam railroad, the steam blast in smelting furnaces, the puddling furnace, the rolling mill, the labor-saving machinery of a thousand kinds—these are triumphs of industry, and the main causes of the superiority of modern over ancient civilization. It is the working man, not the soldier, the priest, the statesman, the philosopher, the scientist, the artist, or the author, who has given us not only the foundation, but also most of the superstructure, of our culture.—*Overland Monthly.*

TO NEW SUBSCRIBERS.

All subscriptions to the SCIENTIFIC AMERICAN will be commenced with the year, unless persons, at the time of remitting, request to the contrary. Nearly all subscribers preserve their numbers for binding; and in most cases where subscriptions are received during the first quarter of the year, if the back numbers are not sent, they are subsequently ordered. To save both the subscribers and ourselves trouble, the back numbers from January 1 will be forwarded, unless we are advised to the contrary. This course will be pursued till April 1, after which date the paper will be sent from the time of receipt of remittance; but subscription may commence at any time, at the request of the subscriber. The above regulation applies only to those who give no instructions, at the time of remitting, as to when they desire to commence.

Death of the \$40,600 Cow.

The celebrated Eighth Duchess of Geneva, the short horned cow to which we have already referred as bringing the enormous price of \$40,600 at the sale of Mr. Campbell, at New York Mills, recently died in giving birth to a calf. It will be remembered that the animal was purchased through a mistake by the agent of a noted English cattle breeder, and subsequently resold to Col. Lewis G. Morris, of Fordham, N. Y., for \$30,600. The loss is not only a heavy one pecuniarily, but a severe disappointment to the latter gentleman, as it was his object to use the cow as a means of materially improving the breed of short horned cattle in the United States. Col. Morris has still a large fortune invested in choice stock.

NEW BOOKS AND PUBLICATIONS.

HEAT AS A SOURCE OF POWER, with Applications of General Principles to the Construction of Steam Generators. By William P. Trowbridge, Higgin Professor of Dynamic Engineering in the Sheffield Scientific School of Yale College. Price \$3.50. New York: John Wiley & Son, 15 Astor Place.

Professor Trowbridge has succeeded in producing a work which, we think, cannot be of much benefit to every student of mechanical engineering. It is intended as an introduction to "The Study of the Steam and other Heat Engines," and, as its title indicates, is devoted to the careful discussion and thorough elucidation of the steam generator. The various types of the latter are fully considered, and their theoretical and practical construction explained. The initial chapters on heat, combustion and fuel, are admirable treatises on their respective topics, clearly written, and containing the most approved formulas and rules. There are numerous illustrations and a brief appendix, with tables, &c. The volume is eminently practical in its tendency, and will form a valuable hand book for the professional engineer.

THE CONSTANTS OF NATURE. Part I. Specific Gravities, Boiling and Melting Points, and Chemical Formulas. Compiled by Frank Wigglesworth Clarke, S. B. Washington, D. C.: Smithsonian Institution.

A volume of tables, compiled with great labor and research, of the gravities of nearly all known elements and compounds. The work is thoroughly well done, and the book will be found useful in every laboratory.

BUILDING CONSTRUCTION: BRICK. BUILDING CONSTRUCTION: TIMBER. Each Two Volumes (Text and Plates). By Robert Scott Burns, C. E., Author of "The Handbook of the Mechanical Arts," etc. Each Volume, 75 cents.

INORGANIC CHEMISTRY, for Use in Science Classes and Higher and Middle Schools. By W. B. Kemshead, F.R.S., F.O.S., Lecturer at Dulwich College, London. 75 cents.

ELEMENTS OF ZOOLOGY, for Schools and Science Classes. By M. Harbison, Head Master of the Newtownards Model School. 75 cents.

These volumes form parts of the admirable "Elementary Series" issued by Messrs. G. P. Putnam's Sons, corner of Fourth Avenue and 23d Street. Like the previous volumes published under this head, they are practical, lucid, and concise, and may be relied on as accurate treatises on their respective subjects.

Messrs. B. E. Bliss & Sons, of 23 Park Place, New York City, forward us the nineteenth edition of their illustrated spring catalogue of seeds, plants, etc., with supplement for 1874. The book contains a descriptive list of some 2,000 varieties of flower and vegetable seeds, a number of beautifully colored lithographs of flowers, etc., and an immense number of excellent engravings. There is besides a large amount of valuable information upon the subject of gardening generally, which will render the volume a useful guide both to the amateur and the professional gardener. The price is but 25 cents. The same firm also issue an abridged catalogue containing an almanac for the year and useful hints for every month. This is mailed on receipt of two three-cent stamps. The catalogue of potatoes for seed, which is forwarded free, has practical remarks on potato culture and full descriptions of many new and excellent varieties. The advertisement of the above enterprising firm will be found on the last page of this issue.

PATENT OFFICE DECISIONS.

United States Circuit Court—District of Massachusetts.

ADAMS ELECTRO-NICKEL PATENTS.—UNITED STATES NICKEL COMPANY vs. N. SHEPARD KEITH.

[In equity.—Before Shepley, Judge.—October Term, 1873, to wit, February 13, 1874.]

The defendant is charged with infringement of letters patent of the United States, granted to Isaac Adams, Jr., for "Improvements in the electro-deposition of nickel," dated August 3, 1869, and May 10, 1870, both of which patents have been duly assigned to the complainant.

Respondents deny the infringement, and allege that Adams was not the original and first inventor of what is claimed as his invention in either of the patents.

The history of the state of the art of electroplating with nickel, or what should with more propriety, in view of the progress then made in the art, be denominated the electro-deposition of nickel, prior to the discoveries of Dr. Adams, is sufficiently given, in the opinion of this court, in the case of United Nickel Company vs. Anthea. *Official Gazette*, vol. 1, p. 578, not to require repetition here, otherwise than by reference to, and reiteration of, the views expressed in that case. Much additional evidence has been introduced in this case, however, upon the issue of novelty. Yet, after a careful review of the whole evidence, both in relation to what was alleged in that case as anticipating the discoveries and inventions of Dr. Adams, and as again alleged in this record, accompanied with further proof, as well as what additional and new matter is here introduced, I am confirmed in the conviction that the electro-deposition of nickel by means of the described solutions prepared and used, as described in his patents, and of such an anode as his patents describe, was not known to any practical applier of the art prior to the date of the electro-plating of metals, prior to the discoveries of the patentee. By electro-plating of metals as a useful art, I mean the uniform, continuous, and coherent deposit of one metal upon the surface of another, so as to produce a coating of the desired thickness, purity, uniformity, coherence, and permanency of adhesion, as distinguished from the mere electrolysis or electro-deposition of a metal out of a solution, whether such electro-deposition be or be not in the surface of another metal, and in my view consist in the difference in the state of the art prior and subsequent to the discoveries of the patentee. Prior to his discoveries and inventions, electroplaters and electro-metalurgists well understood how desirable a result it would be to be able to plate the surface of base metals with a coating of nickel, resembling silver in luster and color, without its liability to exposure to the air. Yet while it was thus well understood, as stated by Napier, that if the practical difficulty could be overcome, the application of nickel to the coating of other metals would be extensive, and the property of not being able to tarnish would make it eminently useful for all general purposes; yet, with all the research and investigation which have been so lavishly bestowed on this case, the respondents have signally failed to show that electroplating of metals with nickel had any practical existence as accessible or beneficial to the public before the date of the inventions of Dr. Adams. Since that time, under the processes described in his patents, the art is so extensively practiced in both this country and Europe, that, as stated by one of the witnesses in this case, it would be less difficult to name articles used in the mechanic arts which have never been nickel-plated than those to which nickel-plating has been applied. The claims in the two patents are as follows: In the patent of August 3, 1869:

1. The electro-deposition of nickel by means of a solution of the double sulphate of nickel and ammonia, or a solution of the double chloride of nickel and ammonia, prepared and used in such a manner as to be free from the presence of potash, soda, alumina, lime or nitric acid, or from any acid or alkaline reaction.

2. The use for the anode of a depositing cell of nickel, combined with iron, to prevent the copper and arsenic which may be present from being deposited with the nickel or from injuring the solution.

3. The methods herein described for preparing the solution of the double sulphate of nickel and ammonia.

4. The electroplating of metals with a coating of compact, coherent, tenacious, flexible nickel, of sufficient thickness to protect the metal upon which the deposit is made from the action of corrosive agents with which the article may be brought in contact.

Also, but which is not involved in this suit—

5. The deposition of electroplates of nickel, to be removed from the surface on which the deposit is made, and used separately therefrom.

In the patent of May 10, 1870, the claims are as follows:

1. The combination with nickel to be used for anodes of a metal or metalloid, electro-negative to the nickel in the solution displayed.

2. A nickel anode, combined with carbon and cast in the required form.

As the respondent has infringed the patent of May 10, 1870, by the use of anodes in the electro-deposition of nickel, substantially like those described and claimed in that patent, and has also infringed the first claim of the patent of August 3, 1869, by the use, in the electro-deposition of nickel, of a solution of the double sulphate of nickel and ammonia, prepared and used in such a manner as to be free from the presence of potash, soda, alumina, lime, or nitric acid, or from any acid or alkaline reaction, it is not necessary to decide the questions presented on the constructions of the fourth claim of the patent of August 3, 1869.

In deciding that the evidence in the record proves an infringement of that patent by the use of the solution therein described, I do not overlook the fact that the defendant's solution is not identical with the solution of the patent, and that the defendant's solution is not identical with the solution of the patent, and that the defendant's solution is not identical with the solution of the patent.

The evidence in the case satisfies me that in the defendant's solution the first was an inert substance, and the second would be, and was, speedily eliminated from the solution by evaporation.

Decree for injunction and account as prayed for in the bill.

DECISIONS OF THE COURTS.

United States Circuit Court—Southern District of New York.

PATENT PAPER BAG MACHINE.—THE UNION PAPER BAG MACHINE COMPANY vs. G. L. NEWELL AND G. H. MALLARY.

[In equity.—Before Blatchford, Judge.—Decided November 26, 1873.]

This is an application for a preliminary injunction, to restrain the defendants from infringing letters patent granted to Benjamin S. Eider, assignor of E. W. Goodale, the inventor, for a "machine for making paper bags." As the claim of infringement on this application is confined to the first claim of the patent, only such parts of the specification need be referred to as relate to that claim. The specification says:

"This invention consists, first, in relation to the side cutters an irregular curve at or near their inner ends, in such a manner that the form of the paper cut by their action, and the corners produced by folding said paper, are such that the paste shall come upon the paper where it is single, and that it will hold better than it does when applied to the paper in the usual manner."

It designates as "side cutters" the cutters "which serve to cut the paper so that the sides may fold and make the seam in the center of the bag." It says that:

"These cutters or knives are bent in an irregular curve near their inner ends, so that in paper cut by their action, and the corners produced by folding said paper, are such that the paste shall come upon the paper where it is single, and that it will hold better than it does when applied to the paper in the usual manner."

One of the figures in the drawings contains lines which are said, by the specification, to designate the cuts made by the side cutters. The first claim is in these words:

"Making side cutters, B, with curved ends, substantially as and for the purpose set forth."

In the defendants' machine there are cutters which serve to cut the paper so that the sides may fold and make the seam in the center of the bag. They are side cutters. They make a cut of a definite length from the outside edge of the paper inward toward the center, so as to leave flaps or side pieces, which are then to be folded over from each side toward the center, overlapping each other, and making a seam in the center. The defendants' side cutters are not straight or unbent in their whole length, nor are they bent at an angle near their inner ends; but they are bent in a curve near their inner ends. The effect of this curve is that, when the side pieces are folded over, the central end piece, of a single thickness of paper, may be pasted down without folding over, in addition to such single thickness, any part of the double thickness formed by folding the sides, and yet the curve near the inner ends of the side cutters, and the central end piece, of a single thickness, is pasted down without folding over, in addition, any part of the double thickness, there are holes or openings at the corners, and, to make tight corners, it is necessary to fold down part of the double thickness, and then the paste can only come upon the inner one of the two thicknesses, while the outer one, being single, is not pasted down, and the result is that the paste does not come upon the inner one of the two thicknesses, and the result is that the paste does not come upon the inner one of the two thicknesses, and the result is that the paste does not come upon the inner one of the two thicknesses.

It is to be noted that the body of the specification speaks of the curve near the inner ends of the side cutters as being an irregular curve, and that the claim words the word "irregular" and claims making the side cutters "with curved ends, substantially as and for the purpose set forth."

It is contended by the defendants that the drawing of the patent shows the cut made by the side cutters as being, for its whole length, of a form of curve which may properly be called irregular, as a whole, and that the defendants' side cutter is straight for most of its length, and of a regular curve near its inner end. But this is immaterial. It is not shown that a side cutter with a curved inner end, for the same purpose, existed before the date of the invention, and that the word "irregular" may mean.

Nothing but a curve will produce this effect. An angle will not. The patentee was the first to use the curve. The form of curve represented in his drawings will produce the effect. His claim speaks merely of "curved" ends. Hence any curved end which will produce the result is his curved end.

It is contended for the defendants that, as the patent sued on was issued under the authority of the act of July 4, 1836, 5 United States Stat. at Large, 112, and as that act is repealed by the 11th section of the act of July 8, 1870, (16 Stat. 214) such repeal is made void the said patent.

But that is not so, yet so suit can be maintained upon said patent for any cause of action which accrued after the 8th of July, 1870, as did the cause of action in this suit. The 11th section of the act of 1870, which repeals the act of 1836, contains the proviso that "the repeal hereby enacted shall not affect, impair, or take away any right existing under" the repealed act, "but all actions and causes of action, both in law and in equity, which

have arisen under" said act, "may be commenced and prosecuted, and, if already commenced, may be prosecuted to final judgment and execution in the same manner as though this act had not been passed, excepting that the remedial provisions of this act shall be applicable to all suits and proceedings hereafter commenced."

The rights created by, and arising under, a patent granted under the act of 1836, are rights existing under that act. The proviso declares that the repeal of that act shall not affect, impair, or take away such rights. A right granted by the patent in suit is the exclusive right to make and use and vend to others to be used, the inventions claimed in the patent. Such right was a right existing under the act of 1836 on the 8th of July, 1870. The right to sue after the latter date for infringements of the patent committed after that date, may in one sense, be said not to have been a right existing under the act of 1836, because the cause of action had not then arisen. But the grant held under the patent was a right, and a vested right. Such right was intended, should continue till it should expire by its limitation. This is apparent from the provisions of the 63d and 64th, 65th and 66th sections of the act of 1870, which enact that patents granted prior to March 2, 1861, (and which were patents for fourteen years) may be extended for seven years beyond the original terms of their limitation.

It is further urged that the wording of the proviso to the 11th section of the act of 1870 is such that the only right saved is the right to prosecute actions and causes of action which arose prior to July 8, 1870, on patents theretofore granted. No reason is assigned why, if such prosecutions are allowed, they should not also be allowed in respect of causes of action arising on or after July 8, 1870, on such patents. But the point taken is rested solely on the fact that the enactment in reference to prosecutions is introduced by the word "but"; and it is maintained that the effect of the use of that word is that the right to sue after the date of July 8, 1870, is to be not affected, are limited to the actions and causes of action thereafter specified, that is, to such as arose before July 8, 1870. No such effect, however, can properly be given to the use of the word "but." The first part of the proviso, as already stated, has the effect to keep in life the patent and its grant. But actions had been brought and were pending on the existing patents, which had not been sued on, and the provisions of all prior existing acts in regard to suits on patents were being repealed. Hence, the necessity of providing that such actions and causes of action might be prosecuted in the same manner as though the act of 1870 had not been passed. But the proviso goes on to declare that the remedial provisions of the act of 1870 shall apply to all suits thereafter commenced for causes of action existing on the 8th of July, 1870, under patents previously granted. It leaves existing suits to be conducted according to the remedies previously prescribed by the prior acts. There remain, however, patents theretofore granted. The proviso does not apply to the manner of conducting such suits. The existing patents and the grants of right in them, being saved by the proviso, a reference to prior sections of the act shows that those sections apply to then existing patents, and to suits to be brought thereon, for causes of action to arise on or after July 8, 1870, as well as to patents to be issued under the act of 1870, and to suits to be brought thereon. Thus the 53d section, in regard to resellers, embraces reissues of existing patents. If not, as all prior acts are repealed, there could be no reissues of such patents. The same is true of the 54th section, in regard to disclaimers, and of sections 55, 56, 58, 59, 60, 61, and 62, in regard to suits. Full authority is given by the latter sections for bringing this suit.

As to the alleged licenses set up by the defendants, it was fully considered and passed upon in a former suit in this court, between the parties to this suit, where it was held, on final hearing, that such licenses had no valid existence, as a license, in the hands of the defendants, as against the Union Paper Bag Machine Company, and persons holding under them.

Nothing is shown to affect the novelty of the first claim of the patent sued on in the infringement is clear, and the case, on all points, is one entirely free from doubt.

The injunction asked for must, therefore, be granted.

George Hard ng and Fisher & Duncan, for plaintiffs.

Marcus P. Norion, for defendants.

IMPORTANCE OF ADVERTISING.

The value of advertising is so well understood by old established business firms that a hint to them is unnecessary; but to persons establishing a new business, or having for sale a new article, or wishing to sell a patent, or find a manufacturer to work it: upon such a class, we would impress the importance of advertising. The next thing to be considered is the medium through which to do it.

In this matter, discretion is to be used at first; but experience will soon determine that papers or magazines having the largest circulation, among the class of persons most likely to be interested in the article for sale, will be the cheapest, and bring the quickest returns. To the manufacturer of all kinds of machinery, and to the vendors of any new article in the mechanical line, we believe there is no other source from which the advertiser can get as speedy returns as through the advertising columns of the SCIENTIFIC AMERICAN.

We do not make these suggestions merely to increase our advertising patronage, but to direct persons how to increase their own business.

The SCIENTIFIC AMERICAN has a circulation of more than 42,000 copies per week, which is probably greater than the combined circulation of all the other papers of its kind published in the world.

Recent American and Foreign Patents.

Improved Locomotive Driving Wheel.

Joseph C. Wilson, Oskosh, Wis., assignor to himself and Mahlon P. Barry, same place.—This invention consists in a driving wheel formed of an inner and an outer wheel, of which the former sustains the weight of the locomotive on its hollow shaft, and revolves along the inside of the tyre of the outer wheel, the solid shaft of which passes through the hollow outer shaft. The addition of the hollow shaft, it is claimed, adds greatly to the strength of the locomotive axle, and the working of the inner wheel in the outer increases the driving power considerably by economizing in the wear and tear of the tyre, and otherwise.

Improved Apparatus for Converting Motion.

Romulus R. Stevens, Stockton, Cal., assignor to himself and Lewis M. Cutting, same place.—This invention consists of a reciprocating toothed bar above the axis of the shaft to be driven, and another below it, in different planes, connected together by yokes. With these are combined a toothed wheel on the shaft, and apparatus for shifting the bars at each end of the stroke to change them, so that one turns the wheel going one way, and the other when going the other way, thus giving continuous motion to the wheel. The invention also consists of a cam and spring, so combined with the shaft as to expend some of the excess of the power of the piston at mid-stroke on the spring, and return it to the shaft during the latter portion of the stroke, when the effect of the steam is diminished, to equalize the application of power. By this arrangement, it is believed, power may be largely economized, because the application of it is always at the rims of the toothed wheels; also because the balance wheel is dispensed with, and the engine enabled to run slower, as compared with the speed of the driving shaft.

Improved Pump.

Thomas Wilmington, Ossian, Ind.—This is a double acting lifting pump, having two cylinders made in a block of wood, with a metallic water chamber above the cylinders, or resting on the block. A plate on top of the chamber has a valve orifice, which is closed by a valve. Above the valve is another metallic chamber, which is covered by a plate, to which the delivery pipe is attached. The lower valves are seated on the plate beneath the block, to which plate the induction pipes are attached. The bucket rods pass through stuffing boxes, and extend up to the top of the stand, where they take hold of the ends of two vibrating bars. The bars work on a pivot rod, which passes horizontally through the top of the stand, and their ends extend back from the pivots, and enter loosely the ends of the cross of the working lever. The working lever is vibrated on the pivot in the top of the stand, and motion is imparted to the pistons thereby.

Improved Boot Pac.

James A. Weaver and William B. Hawkins, East Saginaw, Mich.—The sole leather boot pacs worn by lumbermen and other woodmen, and known as "longue pacs," have heretofore been made with seams at the quarters; also with seams from the top of the upper, a little each side of the instep, along the sides of the top of the foot, to the top of the toe, thus making the upper of three pieces, which require several seams for sewing them together. It is now proposed to make the whole upper in one piece, which is joined together at the heel by one short seam only. The latter is thus located where it is so re-enforced and stiffened by the counter that it is not so liable to open and leak when the leather is water-soaked. The leg is sewn to the upper, so that its seam does not join the upper at the seam of the heel of the latter, so that the tendency to open at the junction is lessened.

Improved Truck.

Andrew V. Smith, San Francisco, Cal.—This invention relates to that class of hand trucks wherein a ratchet and pawl mechanism is employed to retain the truck in a stationary position while loading, as to the patent, No. 111,213, granted to same inventor. In using the attachment, when the trucks have been run up to the side of the packages to be moved, and are stood up in the ordinary manner, the operator puts his foot upon the middle part of a chain and presses it, throwing the engaging ends of pawls into gear with teeth, locking the wheels so that the trucks cannot move back as the packages are placed upon them. When the trucks are loaded, a slight forward movement will throw the pawls out of gear, the incline of the teeth forcing the engaging ends of the said pawls back sufficiently to carry the line of draft of the springs past the pivots of the pawls.

Improved Window Sash.

Hiram C. Burk, New Cumberland, O.—The object of this invention is to improve the window sashes in such a manner that they slide easily in the frame without rubbing off the paint, and that they may be quickly and readily detached for repairs, and conveniently fastened. The window frame is provided with grooves lined with sheet metal. The sash has projecting side rails, of which one slides loosely in a groove of the sash, while the other is firmly connected thereto. The sides of sash facing the window frame are rounded off to produce as little friction as possible, and prevent the rubbing off of the paint from the adjoining parts of the frame. The groove leaves a solid part at the lower corner, on which the loose rail is supported, so that it cannot drop out on hoisting the sash. A hook-shaped projection at the upper end of the loose rail serves to lift it out of the groove, so that the sash may easily be taken out of the window frame, as the rounded-off side offers no obstruction to its detachment. The fixed rail is provided with notches, into which snaps a projecting catch of a band spring, which is suitably applied into a recess of the frame, retaining the sash at any desired position.

Improved Blacking Box.

Charles W. Beebe, Ravenswood, N. Y.—This invention has reference to that class of blacking boxes which are constructed of wood and provided with a handle and cover. It consists in forming the recess or cavity for the reception of the blacking by means of augers or boring tools, so as to lessen the cost of manufacturing said boxes, and, at the same time, to form scalloped inner sides or projections, which are designed to form a surface for rubbing the brush, in order to spread the blacking evenly on the same.

Improved Wheel Plow.

Solomon Ness, Cuba, Ill.—The wheels revolve on short axles, through the inner ends of which are vertical slots that receive the arms of a frame, on which is supported a plow frame. To the frame is attached a horizontal extension, to which a plow frame is loosely pivoted, so as to have free lateral play. The plow frame is thus held securely in a horizontal position at any desired depth, the vertical arms of the frame being adjustable in slots of the short axles, and held by wedges at any height. The tongue is loosely pivoted on the cross bolt, so as to move freely in a lateral direction, while it also turns on a vertical pivot bolt in a horizontal clevis, adjustable in different holes, according to the furrow width which is intended to be cut. Thus the tongue not only determines by its position the width of furrow also, but also preserves its freedom of lateral motion.

Improved Apparatus for Making Gas.

Joseph D. Patton, Trevorton, Pa.—The object of this invention is to provide a means for the manufacture of illuminating gas from petroleum in any liquid form. In a single retort, without subjecting it from the first to the intense heat necessary to convert it into fixed gas, and to provide for the purification and storage of the gas in a simple and efficient way. The invention consists, first, of a retort of any form placed in a furnace to secure temperatures varying from bright red heat at one end to very dull red heat at the other end of the same retort, with connections arranged to admit the oil at the coolest part, and cause it to pass along to the hottest part and out thereat when converted into gas. Second, the invention consists of a condenser located in the gas holder, divided longitudinally into compartments communicating with each other at top and bottom, the inlet pipe from the retort communicating with one compartment near the bottom, an escape pipe connecting with the bottom of the other, an exhaust pipe for taking out the deposit, and both compartments being surrounded with water. Third, a small boiler communicating with the water tank surrounding the condenser by two pipes, one lower than the other, the boiler being below the water level, and having means for heating the water to prevent the water of the condenser from freezing in cold weather.

Improved Bench Plane.

Henry A. Gatliff, South Boston, Mass.—This invention is an attachment for Jack and other hand planes, which will enable the plane irons to be easily, accurately, and quickly attached, detached, and adjusted without hammering, and without any danger of springing the plane and making it untrue. A plate is let into the stock at the upper part of the inclined seat for the plane irons. To lugs on the lower side of the plate is swiveled a hand screw, the hand piece of which can be conveniently operated. Upon the screw is placed a nut, a toe of which enters a hole in the plane irons, so that the said plane irons may be adjusted by turning the screw. Through suitable mechanism, by turning a hand screw forward, a plate sets as a lever to lock the plane irons securely in place.

Improved Photographic Background.

Preston C. Nason, Columbus, O.—This invention is an improved background carriage for photographer's use, enabling the operator to adjust it while standing sufficiently far in its front to see when it is brought into position to give the desired effect in the relief of light and shade. The frame of the carriage consists of two side bars, inclining toward each other, and connected at their upper, lower, and middle parts by three cross bars. A metallic rod, rigidly attached to the centers of the cross bars, carries a socket which may be turned and moved up and down upon the said rod. The socket is secured in place by a set screw resting against the rod. Upon the side of the socket, and at right angles therewith, is formed a second socket, to receive the spindle of the background, which is secured in place by a set screw.

Improved Wheel for Vehicles.

Joseph H. Glover, Freedom, Ky.—This invention relates to the construction and arrangement of devices for adapting a wheel for application of a colliery and securing the same to the felly. A tube receives the axle, and has boxes to receive the wear inserted in its ends. The hub is made in two parts: one is permanently attached to the tube, and the other slides upon said tube, both being made exactly alike. The outer surface of the parts is inclined in line with the curvature of the spokes, so that the wheel will pass any obstruction that will allow the rim of the wheel to pass. The parts are connected by right and left screws, which screw through the inner plates of said parts, and enter holes in their center blocks. Upon the centers of the screws are formed heads for convenience in turning them to move the parts toward or from each other, and thus lengthen or shorten the spokes. The spokes are made forked in their inner parts, and solid in their outer parts.

Improved Ice Cream Freezer.

Charles Gooch, Cincinnati, O.—The top board, which is for the purpose of keeping the shaft of the dasher perpendicular, and also to hold a pin to prevent the can from turning when it is desired it should remain stationary, has two grooves on the under side, which fit upon the top edges of the tub. The distance between the grooves is less than the diameter of the tub at the top; hence it always requires to be sprung on by compressing the tub slightly; and by reason of the grooves being out under on one or both sides, the bars and tub are firmly connected, so that the former may be used as a handle for lifting or carrying about the other. This mode of connection dispenses with catches or other supplementary metallic fastening devices. A short shaft is detachable from the cover of the can, and made square or polygonal at its ends, to adapt it for application of a crank and application to the said cover. It is used when the cream has been partially frozen or solidified, and the stirrer removed in consequence. The rotation of the can is then continued by the short shaft, and the freezing process completed.

Improved Passenger Register and Recorder.

José Medina and Manuel Medina, Cordova, Spain.—The passenger register consists of a bell crank lever, which is set in motion by the passenger on entering the vehicle, and acts on a spring below. The latter communicates through suitable mechanism with a graduated indicator dial. The time register is constructed of a regular clock train, which carries, instead of index hands, a rotary dial marked with hours and minutes, and has above it a spring so arranged with a pencil or other marker that, when said spring is depressed by the weight of the passenger on the seat, the pencil will bear on the dial and mark, by the gradations thereon, the exact time during which the seat was occupied. The pencil also marks the time when the passenger rises.

Improved Joiners' Floor Clamp.

William W. Ingram, Batesville, Ark.—The parts are put together with a pivot, on which they open and close, the same as a pair of tongs. A double ratchet bar, passing through mortises in the shanks, keeps the jaws closed when they are attached to the timber of the floor or ceiling. The ratchet is made double, so that the clamp may be used overhead, and drops by its own gravity and engages automatically. Screw points through the ends of the jaw are turned by means of a small pin, and the points enter the sides of the timber and prevent the jaws from slipping. A metallic bar, which is loosely pivoted to one jaw, is attached to a piece of wood, which is placed against the flooring or ceiling which is to be forced up to its place. This bar is rounded on its inner side, and will roll or rock on the jaw and maintain a position parallel with the floor. A drag bar is pivoted to one of the shanks. The lower end drags on the timber, and it acts as a pawl to hold the clamp in position. The clamp, as a whole, is a lever, the purchase of which is the distance between the fulcrums and the center of the metallic bar. This machine is applicable to many purposes, but is more particularly designed to facilitate the laying of floors, ceiling overhead, or on walls and in similar places.

Improved Wagon Springs.

John Carpenter, Mariner's Harbor, N. Y.—An elliptic is formed of four pieces of wood connected by hinges at the ends. Rubber springs are confined in recesses made in the pieces and in the axle and bolster. The pieces act as levers when the spring is in use. Plates of rubber are placed between the axle and bolster and the inner ends of the lever. This, it will be seen, is a double spring, and is designed for a vehicle.

Improved Whiffletree.

Lewis H. Webb, South Quay, Va.—A croich is made in the end of the strut against which the truss rod bears, and a ring is fitted in the angle formed by the trees and the branches of the strut, for attaching to the clevis, said ring being to sustain the wear of the clevis, and being arranged so that it can be shifted around in its place at any time to turn the worn place away from the clevis, and present another unworn place. The ring has a groove in its periphery, in which the truss rod and the branches of the strut bear to hold it in place. The ends of the truss rod pass through the caps at the ends of the whiffletree to receive the couplings and to hold said caps securely against becoming detached. For connecting the traces to the couplings, a ring of two parts is employed, so contrived that, when separately hooked into the coupling and then placed together, they form a complete ring in which another ring in the trace can be engaged by separating the parts a little without removing them from the coupling, and hooking the trace ring first in one and then in the other. It is equally as well adapted for the connection of a toggle pin or any ordinary hook as a solid ring, thus allowing harness with any of the ordinary hitching attachments to be used.

Improved Furniture Spring.

William T. Doremus, New York city.—This invention is an improved spring for chairs, and other articles requiring a rocking motion. Two plates, made with a bow in their middle parts, are attached to the seat and pedestal of a chair. There are three blocks made of elastic material. One is interposed between the bows of the plates, the second and third are placed within the separate bows of each plate. By adjusting the nuts of bolts which pass through them, the tension or strength of the springs may be regulated at will; and by tightening some of said nuts more than others, the spring may be adjusted to have more or less elasticity in either direction.

Improved Bracelet Fastening.

Henry Stone, Newark, N. J., assignor to Mulford, Hale & Cottle, New York city.—This invention has for its object to improve the construction of the bracelet catch so as to make it more safe and reliable in use. The invention consists in the combination of a spring catch with the hinged cap that shuts down over the ordinary spring catch of a bracelet.

Device for Promoting Combustion and Furnace for Steam Boilers.

Daniel T. Casement, Palmerville, O.—The first invention relates to the use of balls, blocks, or other pieces of metal in a layer above the bed of fuel for the gases to pass through as they rise from the fire and impinge upon the surfaces of the blocks, whereby they are more thoroughly mixed with the oxygen, and also more effectually consumed; and the invention consists of devices, instead of a grate, for suspending said balls or blocks. The second invention consists of a tube at the center of the fire space, extending from the water space at the bottom up through the fire and above the crown sheet, with stuffing joints, and having the grate for supporting the balls or other pieces of metal attached to it. The grate is composed of tubes which receive the water for protecting them from said vertical tube, and deliver it at the outer part to a coil which secures the balls against bearing on the side walls of the furnace, and also circulates between the balls to keep them from fusing, and for generating steam. It finally discharges into the central supporting tube. The invention also consists in hollow dampers arranged in the smoke stack for utilizing the waste heat. Further particulars regarding these inventions will be found in the illustration and description published on page 133 of our current volume.

Improved Washing Machine.

John Darlington, Macoma, Wis.—Uprights connected at the upper and lower ends by longitudinal pieces carry rolls, the top one of which is fluted. To cause the clothes to move evenly and suffer a uniform compression, spring pressed guards, one on each side of the machine, are used, which press lightly against the outer rolls. By suitable construction one pair of springs keep all the rolls in their true relative position.

Improved Frame for Hot Air Registers.

Edward A. Tuttle, New York city.—This invention consists of an improved method of connecting the interior open work portion of the front or "border" of a hot air register with the outer or marginal portion in a way to simplify the means for fastening it, and facilitate the removal of it whenever it may be desirable to clean out the flues. The invention consists of the openings at the upper ends of flanges, and the arrangement of the upper edge of the open work part, so that when it is placed against the flanges it can be raised behind a lug, and the top wall raised enough for the lower edge to rise over another lug and drop behind it on a lower flange, and thus be held in place by the flanges and the lugs.

Improved Carriage Door.

George Kellner, Paris, France, assignor to Wood Brothers Company, of New York city.—The object of this invention is to provide an improved folding door for that class of carriages which are alternately thrown open and closed, so that, for instance, the changing of a landau or landaulet into a berrin or brougham, and vice versa, may be obtained. The invention consists in constructing the door of two sections, the upper half of which is hinged to the lower half, swinging to the inside of the same, both parts being provided with guides for the window. The upper part locks, when thrown open, by means of spring catch at one or both sides, into socket plates of the lower part, and produces thereby a rigid connection of both halves, forming a complete door for closed or open use of the carriage.

Improved Saw Filing Machine.

Walter W. Parsons, Stanstead, Canada.—On the inner end of the shaft of the driving wheel is a short crank which works a pawl to push the filer stock sliding frame along the saw. Under this shaft is another shaft which is geared with it by wheels, so as to turn at the same speed, and it carries a cam which lifts a rocking plate once to each revolution, to hold the file up while the frame is shifted by the pawl. These shafts are so geared that the cam lifts the rocking plate just before the pawl shifts the frame along.

Machine for Removing Snow and Ice from Roadways.

Charles G. Waterbury, New York city.—A box wider than the space between the rails, and mounted on air wheels, has a furnace at each end. Both are inclosed at the sides and top, and surrounded by a water jacket for containing water for the protection of the walls of the furnace; also for generating steam for driving the fan, propelling the machine, or for use in combination with the fire heat for melting the snow and ice. From the fire grate bars in one furnace extends a plate or wall, inclosing an air box under the grate, into which the air blast is received from a fan, to supply the oxygen for the combustion of the fuel, and to blow the heat over a bridge and down upon the ground. In the other furnace the air blast is delivered on the top of the fire, and passes down between the grates, which are hollow tubes through which the water contained in the jacket circulates for their protection. Hydrocarbon fuel will be used in the furnaces constructed on this plan, either alone or in combination with coal or coke. The machine will be drawn by horses, and be moved fast or slow as needed for the depth of snow to accomplish the work. The heat will also be regulated by the quantity of air blown in by the fans, which may be regulated at will in any of the well known ways.

Tool for Squaring the Edges of Boot and Shoe Soles.

Joshua R. Reed, Baltimore, Md.—This invention relates to modes of evening, smoothing and rendering uniform the edges surfaces of boots and shoes, and consists in a tool peculiarly constructed and adapted to perform this work with great efficiency, and economy of human labor.

Improved Harvester Rake.

John E. Buxton and Thomas L. Howe, Owatonna, Minn.—This invention relates to that class of rakes used upon grain harvesters for the purpose of automatically raking the grain off the platform, transferring it to the rear end on a binding platform and distributing it in gables of a size suitable to be tied and bound with facility. The invention consists chiefly in the employment, in connection with a rising platform, constructed in width towards its upper end, of a contractible rake which serves to convey the grain to the upper end of the platform on to a binder's table, in gables ready to be bound.

Improved Baking Pan.

James D. Mason, Baltimore, Md.—This invention relates to attaching a shield or protecting plate to the bottom of the pans for the purpose of preventing the scorching of the dough, and thereby producing a better article of diet. The shield is made detachable so that the pan can be used alone when desired or necessary.

Improved Lubricator for Machinery.

Wm. S. Gillen, Leechburg, Pa.—This invention relates to means for lubricating machinery, by injecting, upon the parts subject to friction, drops of oil or other liquid at regular and short intervals. At every reciprocation of the cross bar on the slider, a stud will strike the end of a lever, unclose a valve, and allow a drop of oil to fall into that part of machinery subject to friction and designed to be lubricated.

Improved Hollow Hand Cutter for Leather, etc.

Abednego Dewes, Hudson City, N. J., assignor to himself and Marcus Hanan, New York city.—This improvement in hollow cutters, for cutting out shapes from leather, cloth, paper, etc., by hand, consists of detachable handles for said cutters, said handles being adapted for several different sizes, the object of which is to save the cost of so many handles. Each handle has four strong arms, branched horizontally from the lower end, to extend over and project beyond the top of the cutter in its long and short axes. A couple of short spring bars for fastening the handle to the cutter are slotted at one end, and meet together at a clamping bolt which passes through the slots, and screws into the center of the bottom of the handle.

Improved Bee Hive.

Hyram F. Bobo and Philip F. Johnson, Treasvant, Tenn.—The bottom slides in and out upon cleats attached to the sides, and its forward part projects in front of the hive, to serve as a platform for the bees to alight upon, and as a handle for drawing out and pushing in said bottom. Upon the upper side of the forward part of the bottom, and in line with the doors when closed, is attached a narrow board through which is formed the opening for the bees to pass in and out. To the upper side of the rear end of the bottom is attached a board which projects upward nearly to the horizontal partition that separates the brood chamber from the honey box, and to which the comb frames are hinged, so that, when the said bottom is drawn out, the frames may be swung aside to allow the comb of any particular frame to be examined. The forward ends of the comb frames of the honey box are kept at the proper distance apart by a notched bar placed upon them.

Improved Saw Gumming Machine.

David Boyd, Vevay, Ind.—This invention consists in a mandrel, carrying a cutter and provided with a screw thread at one end, so as to adapt it to receive a rotary and progressive or longitudinal movement; also a curved ball mounted on the cutter mandrel, and provided with a wedge which operates in concert with friction rollers for imparting a lateral movement to the cutter mandrel. The machine is designed for gumming large circular saws without removing them from their arbors. It will be found fully described and illustrated on page 130 of our current volume.

Improved Plow.

Harvey Blue, Medina, Wis.—To the forward part of the beam are attached two brackets, which carry a wheel which receives motion from contact with the ground. To the projecting ends of the journals of the wheel are attached cranks projecting in opposite directions, and to which are pivoted connecting rods. The rear end of one connecting rod is pivoted to a crank arm formed upon a hook which is pivoted to the side of the beam over the clew point. The hook passes down in front of the upper part of the collar of the plow and oscillates laterally to keep the collar free from rubbish. The other connecting rod communicates with mechanism, so that the forward movement of the plow may oscillate a bar longitudinally with the plow to keep it free from rubbish.

Improved Clothes Line Attachment.

Dwight W. Smith, Fox Lake, Wis.—This invention provides a convenient means for disposing of clothes for drying after being washed, and to avoid the tedious operation of hanging out the clothes in the ordinary way in the open air; and it consists in metallic supports or eyes attached to the clothes line, by means of which the line, with clothes attached, may be suspended from hooks in the wash room, and then detached and carried to the yard, and again suspended from hooks on the clothes line posts. The supporting eye is made of non-corrosive metal, having two tubes for the line. Through the lower one the line passes twice.

Improved Roofing Tile.

Garry Marvel, Rochester, N. Y.—This invention consists in a tile and cement roof, made of tile having the overlapping rib along one edge, a groove along the other edge, and the rabbet and notch in one end, arranged and connected together, the joints being cemented.

Device for Lubricating the Journals of Car Axles.

Philip Bauer, Manchester, England.—Upon the bottom of the oil receiver, and nearly in the same vertical plane with the axis of the axle journals, are two perpendicular cylindrical sockets, which receive two spiral springs. Above the upper ends of the guides is a horizontal plate, resting on the journal box, and slotted transversely in the center. Through the slot plays a flat faced disk or feed wheel. The upper parts of the circumference of the feed wheel press against the under side of the journal, and the lower dip into the oil or lubricant placed in the receiver, such lubricating material rising, by preference, no higher in the receptacle than the axial pivot of the aforesaid feed wheel. When the axle rotates, the journal, by its slight frictional contact with the feed wheel, communicates a corresponding movement thereto; whereupon oil from the oil receiver, adhering to the flat (transversely considered) face or periphery of the feed wheel as it passes through the receiver, is carried upward and over and in contact with the surface of the journal. The feed wheel is arranged to work through a central slot in a leaf spring, the ends of which are placed upon suitable fixed supports, with sufficient tension in the spring itself to keep the feed wheel continually pressed up against the journal. The agent for this invention is Mr. Charles G. Wolf, 44 Exchange Place, New York city.

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Party wanted to join inventor to introduce new and valuable invention. Address G. H. P., Box 522, New York.

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Waterproof Enamelled Papers—all colors—for packing Lard and other oily substances, Chloride of Lime, Soda and similar Chemicals, Cartridges, Shoe Linings, Wrapping Soaps, Shelf Papers, and all applications where absorption is to be resisted. Samples on application. Sam'l Crump, 75 Fulton St., New York.

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George R. Barker's Heating and Ventilating Apparatus, illustrated in this paper Feb. 14, may be seen in operation at the Franklin Institute, Seventh Street, above Chestnut, Philadelphia, Pa.

E. F. Thomas, Brooklyn, Ontario, Canada, wants to know where he can obtain a list of all the Carpenters in the United States.

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W. H. N. will find directions for hardening steel tools on p. 75, vol. 23. Steel points are sometimes used for scratching glass.—H. E. B. and L. C. F. will find directions for producing a polish on shirt fronts, etc., on p. 114, vol. 24.—C. L. C. can make tracing paper by the process described on p. 241, vol. 28.—E. will find practical directions for constructing and fixing lightning rods on p. 248, vol. 26. Read Noad's "Student's Manual of Electricity."—S. L. S. will find directions for preserving crayon drawings on p. 53, vol. 27. As to the other question, apply to a stationer.—C. D. will find explanations of sirup turning tea black on p. 171, vol. 30.—C. H. will find a recipe for a cement for glass letters on p. 27, vol. 27.—H. P. S. will find descriptions of magnets on p. 4136, vol. 24.—D. W. S. will find directions for coating iron with copper without a battery on p. 135, vol. 26.—J. M. E. can try to temper saw blades for cutting iron by following the instructions on p. 16, vol. 24.—D. S. will find recipes for all kinds of solder on p. 251, vol. 28. Walnut wood can be stained by the process described on p. 314, vol. 25. Browning gun barrels is fully detailed on pp. 154, 266, vol. 26.—E. A. C. will find instructions for skel etonizing leaves on p. 267, vol. 25, and for stuffing birds and other animals on p. 362, vol. 27.—F. R. B. should consult our advertising columns for booksellers' addresses.—A. S. H. will find a recipe for waterproof glue on p. 302, vol. 28.—M. A. H. is informed that the difference between 12 inches square and 12 square inches is 132 square inches.—A. B. D. will find explanations of the mock sun phenomena on pp. 132, 171, vol. 28.—L. C. will find directions for cleaning inkling rollers on p. 348, vol. 24.—F. P. D. will find a recipe for black finish on optical instruments on this page.—N. B. D. and Q. H. B. will find directions for waterproofing canvas on p. 122, vol. 27.—E. A. R. will find a recipe for fine blacking on p. 73, vol. 26.—G. W. C. should apply to a maker of emery wheels.—F. K. will find a recipe for bronze dip on p. 58, vol. 26.—J. R. C. and J. K. M. will find the needed particulars of the Australian fever tree on p. 108, vol. 30.—J. N. is informed that we have no record of any finer spinning than the one he mentions.

C. P. T. says: I have a steam boiler of 100 horse power, with pipes from sixteen 10 feet, deep double valve in pump, check valve near boiler, and direct valve between check and boiler. I find that, after stopping every night, if the direct valve is not closed, the boiler will fill itself full of water. Will you please tell me the cause? A. The steam in the boiler condenses; and a vacuum being formed, the water is drawn up. Leave a gage cock open at night, if it is not convenient to close the direct valve.

G. W. L. asks: What is the difference between coal and wood in the amount of steam furnished? A. A ton of coal is supposed to be equal to 1½ cords of good wood. As regards the steaming capacity, it will depend considerably on the construction of the furnace. So far as we know, the boiler mentioned is a fair specimen of the sectional variety.

W. asks: In what manner does the mode of propelling boats, described in your issue of January 24 as the invention of Mr. J. T. Bowman, of Texas, differ from that tried in the British navy, and which was so highly thought of by the late Admiral Farragut? It was applied, if I remember rightly, to a boat named the Waterwitch, and in principle, as I think, was the same method as Mr. Bowman's. A. Judging from the description, Mr. Bowman's plan only differs, from that tried in the Waterwitch, by having three openings for the discharge of water instead of two, a difference which is probably unimportant.

G. S. G. asks: Does the steamboat law compel me to have a registering steam gage, lock valve, life preservers, axes, hose, and all the other appliances, and licenses for engineer and captain, on a small steam launch 21 feet long, used on a river? I claim that a boat too small to register, used only for the owner's pleasure, is not expected to comply with the law. Am I correct? A. We think that you are right.

A. C. asks: 1. How large and how long a stroke, and what size bore would be the best proportions for a small slide valve engine for a boiler 18 inches in length x 14 inches in diameter, with 5 two inch flues, made of iron of sufficient strength to stand a working pressure of 50 lbs. to the square inch? The sides of the furnace are sheet iron tanks, so that the feed water will be boiling hot when injected. What horse power would it have at 15 revolutions per minute? A. You can make a cylinder about 4 inches diameter and of 6 inches stroke; and under the conditions mentioned, it will develop about 3-16 of a horse power. 2. I have heard it stated that the mouth of the Mississippi river was actually 300 feet higher than its source, the centrifugal motion of the earth's rotation forcing the water towards the equator. Is this so? A. The mouth of the Mississippi is further from the geographical center of the earth than the source, so that in this aspect the river runs uphill. The mouth, however, is below the surface of equilibrium due to the rotation of the earth, so that the water flows from the source to the mouth, to fill up to the proper level.

N. C. O. asks: If a boat with enormous paddle wheels were anchored in a strong stream, would not aforesaid stream put the paddles and some machinery in motion? Is this an old idea, or worth a patent? A. The device is very old. See p. 229, vol. 29.

W. J. asks: 1. Why is it that a forked switch, held with crotch up, will in the hands of some persons turn down in crossing certain places, while with others it will not turn? A. It will not do it. 2. Is there any means or instrument by which one can tell without digging where there is a vein of water in the earth? A. No.

F. A. R. says: On p. 28, vol. 30, I saw a recipe for making a deep black ink. So I procured the articles as named, but could not get the Aleppo galls. I got instead nut galls, the same quantity, but the ink is not so black as expected. Would a larger quantity of the same be necessary, or will they not answer the purpose at all? A. The percentage of tannic acid, which is the substance contained in nut galls, that is essential to making ink, varies in nut galls, and those you obtained are probably inferior to Aleppo galls. But a larger quantity ought in this case to yield more tannic acid and a better ink.

J. H. G. asks: What are the chemical symbols for the following: Lard, white wax, camphor, borax, alkanet root, rose oil, heliotrope oil, orange flower oil? A. Lard consists of olein $C_{55}H_{104}O_{12}$, margarin $C_{55}H_{104}O_{12}$, and stearin $C_{57}H_{110}O_{12}$. White wax: $C_{26}H_{52}O_2$. Borneo camphor: $C_{15}H_{26}O$. Laurel camphor: $C_{15}H_{26}O$. Borax: $Na_2O \cdot 2B_2O_3 \cdot 10H_2O$. Alkanet root, rose oil, heliotrope oil, and orange flower oil are each composed of a number of substances, and have no chemical formulae of their own.

J. H. C. asks: Will you tell me how to prepare bones to make charcoal, suitable for sugar refiners, filters, etc.? A. The bones are treated with sulphide of carbon, which dissolves the fat to the amount of 5 or 6 per cent of the weight of the bones. This fat may be recovered from the sulphide of carbon, and the latter used over again.

E. G. A. asks: 1. How can I make a silver solution for plating with a galvanic battery? A. Dissolve 2 parts of cyanide of silver and 3 parts of cyanide of potassium in 250 parts of water. 2. What length of time should a watch case be left in the solution to receive a coating sufficient to wear for two years? A. The time depends upon the strength of the galvanic current. 3. How should the wire be connected with the battery and the article to be plated? A. The watch is to be connected with the zinc plate by a wire dipping into the solution, and opposite to it a small strip of silver connected with the carbon plate.

J. E. H. says: I have been trying to make a flexible non-elastic airtight bag to hold 15 or 20 lbs. pressure to the square inch. I made a bag of strong, closely woven cotton, putting the seams together with rubber cement, and then coated it 2 or 3 times with pure rubber dissolved in naphtha, but it was not entirely satisfactory. 1. Is rubber perfectly impervious to air? A. No. 2. How thick do you think the rubber ought to be to hold 20 lbs. pressure, provided the stuff is strong enough to keep it from bursting? It is very desirable to have it as light as possible. A. One twelfth of an inch of pure rubber. 3. Is there any composition that would serve the purpose better? A. No. 4. Would the heat or perspiration of the body have any effect on rubber in the course of time? A. Probably it would.

W. L. C. asks: Will kerosene oil dissolve or soften the ordinary rubber packing after any length of time? A. It probably will.

A. asks: 1. In the present theory, is light considered a non-elastic fluid? A. Light is supposed to be a wave-like motion of a subtle elastic substance which fills all space, termed ether. 2. What is the best way to remove superfluous hair? A. By pulling. 3. Can it be permanently removed? A. Yes, by the application of substances that will burn or remove the hairy surface of the skin.

T. L. S. asks: How can I make a wash or paste which I could dip dried beef into, to keep it from the air and flies? It must be something that will not injure the meat for eating, and that will not dissolve by moisture or slight heat, and that will not crack off. A. Try immersing the beef for a very short time in a bath of melted paraffin.

F. G. K. asks: What is the cause of the variation of the sun's rays as they strike any meridian? Why is the sun not in a plane with the meridian at 12 o'clock noon at all times in the year? A. The difference is caused by the eccentricity of the earth's orbit, the obliquity of the ecliptic, and the perturbations due to the moon and planets. For the *Nautical Almanac*, write to United States Observatory, Washington, D. C.

I. R. M. says: I have found quite a difference in the weights of hard burned and soft burned bricks, the hard burned bricks being the heavier. Why is this? A. They have probably taken up more foreign matter from the fire to which they were exposed.

S. S. F. asks: Can a hole be made through a pane of glass by means of the sand blast, without breaking the glass? A. Yes.

A. S. asks: 1. How can I make models for small castings? A. Use fine sand or plaster of Paris. 2. How can I prepare a metal that will polish and can be melted over a charcoal fire? A. Brass composition will answer.

C. Bros. ask: What is the matter with our boiler? We have a 45 lbs. boiler, 14 feet long, running a 30 horse power engine. Having been in use some eight years, we recently took out all the flues, and cleaned and replaced them, washing out the boiler with soft soap and water, and, as we supposed, thoroughly cleaning it with clear water. When we fired up again, we had little trouble in raising steam for 4 days, when we were unable to raise over 21 lbs., the engine not running; and on opening throttle, it immediately all vanished. All this time we had a heavy coal fire under boiler. Will foaming in boiler cause this difficulty? Is it impossible to raise much steam from some kinds of water? A. It may be that the soap was not removed, and formed a scale. If this be the case, by blowing out a considerable quantity of water twice a day, you may remedy the trouble. You will understand that this is only a surmise on our part, and we think it would be better for you to refer the matter to a reliable engineer who can make an examination.

G. U. asks: How are boxwood rules and steel standards marked? By what mechanical means is the accuracy obtained? A. They are graduated by means of a dividing engine, the divisions being made with a suitable tool.

W. J. says: On p. 123, vol. 30: "Is there any instrument that will detect the presence of a metal in the earth?" You answer No. I think you are mistaken, or at least a gentleman in this county professes to find lead, silver, and gold with an instrument. A. We are aware that there are individuals who profess the possession of such instruments. The presence of iron ore beneath the ground may in some cases be detected by the use of the magnetic needle. But as for gold, silver, lead, and other metals, no instrument capable of indicating their presence is known to science.

J. P. asks: What is the best pump for a well of 40 feet depth? Will a chain pump answer for that depth? A. Yes.

C. R. asks: What is hydrochlorate of aniline? A. It is made by combining aniline with muriatic acid. Your specimen did not come to hand.

W. G. asks: 1. What is the elastic hand stamp made of? A. Rubber. 2. Is there a book published on all kinds of dyeing, weaving, and dressing cloth? A. You will find such books described in the catalogue of a scientific publisher. 3. Is there a journal on woolen machinery and manufacturing of wool, etc.? A. No. 4. I have a circular saw for sawing logs 44 inches in diameter and running 450 revolutions per minute, from a 40 inch double turbine water wheel, under 12 feet head and fall. I contend that, if I double the revolutions per minute of the saw, I shall double its force. Do you think that I shall gain any power? If so, how much? A. If the wheel is powerful enough, the saw should do double the work under these circumstances. 5. A schoolmaster took thin writing paper and dipped it into a yellow liquid; he placed a card with a picture on its surface against the saturated writing paper, and then put them between a couple of panes of window glass, and placed the whole in the sunbeams. In a few minutes, the picture was beautifully copied on the yellow paper. What was the liquid? A. A solution of bichromate or potash, probably.

H. L. G. asks: 1. How can I construct a cheap electrical machine? A. By using a large glass bottle for the cylinder of the machine, and coating the prime conductor with tin foil. 2. How are the batteries used by physicians made? A. Some are made of plates of zinc and carbon immersed in dilute sulphuric acid.

J. B. asks: What will be the result of the constant meteoric accumulations on the surface of the earth? The weight and bulk of our planets are being constantly increased, and if things go on as at present the doubling of the earth's weight and bulk is only a question of time. A. The moon would fall to the earth and the earth reach the sun in a shorter time. Mr. Proctor estimates the earth's present supply of meteorites at one inch in depth in 400,000 years.

A. asks: 1. Can you give me a plan for constructing a cheap telescope, consisting of two double convex lenses with a power of 36 times, without using an achromatic lens? Could I use a double convex lens, 5 inches in diameter with a focus of 72 inches and an eyeglass 1 inch in diameter with a focus of 2 inches? A. Cheap telescope tubes may be made in four ways: 1. By rolling pasteboard, covered with paste or glue, on a wooden mandrel; remove to dry, and varnish inside and out. 2. By gluing together wooden strips an inch wide over hoops. 3. Roll tightly, with glue upon a mandrel, strips of second quality veneering. Each layer must be kept in place, as glued, by a cover of canvas strapped very tight. 4. Use sheet or tinned iron, the best method. The fittings for the object glass cell and eyepiece tube are turned brass castings. A six inch crown lens was used by Zollner for observing solar protuberances. For other objects, such a lens cannot be used to advantage.

O. says: What are the astronomical names and probable distances from our globe of three fixed stars, familiarly called the triple stars? They arrive over the meridian line at about 8 o'clock P. M., and about 45° above horizon, preserving equal distance apart and in a right line. A. The three stars you mention are *Delta*, *Epsilon*, and *Zeta*, in the belt of *Orion*. They are about the second magnitude; *Delta* and *Epsilon* are double stars, while *Zeta* is triple.

C. A. C. asks: 1. Can alcohol be frozen? A. Alcohol has never been frozen, though, when cooled to a temperature of 166° below zero, it becomes viscid. 2. Is there any premium offered by any government or exposition for a varnish that will prevent wire from rusting and will not crack off while being bent? A. We never heard of such a reward.

G. R. E. asks: Is there anything that I can throw into a privy vault that will remove the offensiveness? I would like to use the soil as manure. If the upper part is filled with dry earth, would it settle and answer the purpose? A. The dry earth would fill up the well, but would be offensive. Copperas mixed with half its weight of lime would perhaps answer your purpose of removing the odor and permitting the product to be afterwards used as a manure.

H. W. S. asks: 1. How can I plate brass or copper with silver without a battery? A. Mix chloride of silver 1 part, pearl ash 2 parts, common salt 1½ parts, and whiting 1 part. Rub the mixture well on the surface of the brass or copper (previously well cleaned) with a piece of soft leather, or cork moistened with water and dipped into the powder. When silvered, wash the metal in hot water slightly alkalinized and wipe dry. 2. With what solution can I clean the articles before plating or galvanizing? A. In silver plating, the articles to be plated are first carefully freed from grease by boiling in a solution of potash, then quickly dipped in red nitrous acid to remove any oxide, and afterwards well washed in water to remove all traces of acid. If the surface be amalgamated, the adhesion of the silver will be promoted. In galvanizing, the iron is first dipped in dilute sulphuric acid to remove the oxide on the surface.

M. E. says: 1. A friend informs me that ice brought from Boston, exposed in the sunlight, will last one third longer than southern ice. Is this so? Does the ice absorb cold after freezing? A. Trials have been made of natural ice and that frozen artificially by various ice machines, with reference to their lasting qualities, and the latter were found to take longer time to melt. This is probably due to the fact that artificial ice has been frozen at and reduced to a lower temperature than the natural material. The crystallization may also, at a long continued low temperature, be more compact and render the ice more firm, as what is known as snow ice is very perishable. After water has congealed at 32°, the ice formed may be reduced like any other solid to any low degree of temperature; and ice being a bad conductor of heat, it (compared with some other solids) takes a long time for the mass to receive an accession of heat from without. These remarks may serve to explain the difference between Boston and southern ice, the former being probably frozen at a lower temperature than the latter.

J. W. H. says: I have a common wooden pump with its valve bucket about six feet below the level of the ground, being attached to the pump handle by a rod nearly nine feet long. During cold weather, the water in this pump froze, and I have reason to believe that the pump was full of solid ice from the spout down to the valve bucket, which is about eight feet. I first tried to thaw it out with hot water, but found that made but little impression; so I poured in about one quart of hard coarse salt. I soon found the ice was melted down about two feet below the spout. Twelve hours afterwards, it had melted nearly four feet, and the next day the pump was all free of ice and works as well as ever. Nearly all the time the mercury has been below zero. Will you inform me why cold salt will melt ice in cold weather? What chemical action, if any, takes place with the salt and ice? A. Whenever a solid body passes into the liquid state it absorbs heat, and the heat which is thus absorbed is called latent or hidden heat. When it passes back again from the liquid to the solid state, this heat is again given out and called sensible heat. The particles of salt and their way into the pores of the ice; and since the point of freezing of a mixture of ice and salt is many degrees below that of ice alone, the mixture becomes liquid and in passing from the solid to the liquid state must absorb heat. Finding no source to take it from, its temperature falls until the liquid is 32° colder than the solid ice and salt.

A. R. W. asks: To how many degrees of heat must iron be raised to weld it? A. According to Siemens, the welding heat of iron is 2,300° F.

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

E. L. F.—Iron pyrites, with rounded pebbles of quartz.

J. W.—Carnelian, but are not brightly enough colored to be of value.

H. B. S.—Magnetic iron ore, and is good for making iron.

R. J. L.—Your material is clay, which might prove useful in the potter's art.

W. R. E.—Your specimen is not black lead, but sulphuret of lead, and is distributed through quartz.

N. D. M.—Iron pyrites.—It does not indicate coal, although it is sometimes found with coal.

J. P. D. asks: What will soften copper wire so as to work as readily as lead? Can I soften the wire to any degree of temper?—J. F. H. asks: How can I make bungs, cut across the grain of the wood?—W. E. C. asks: What are the ingredients used to increase the adhesive properties of sugar or molasses in making popcorn balls, and what is the process of making the same?—J. C. asks: What is the best bait for enticing rats into a trap? Is there any chemical preparation that will draw them?—J. B. G. asks: Is there any way to prevent the slacking of stone coal? We lay in fuel in the fall, in good sized lumps; before spring much of it is useless.—J. O. T. asks: How can I prevent an ivory flute head from cracking, and how can I stop the cracking after it has commenced?—S. asks: How is a steeple luster given to the surface of black glass? I have seen polished black glass, with a very thin coat (of platinum or bismuth, I think) which nitric or muriatic acid does not affect. Fluoric acid raises it from the surface in bubbles. It is not an enamel burnt in, as that would destroy the facets on the glass, which show the polishing marks through this thin coat.—M. B. W. asks: 1. How is contraction of a horse's hoof produced? 2. How can I prevent contraction of the hoof? 3. On what part of the horse's leg does contracted hoof operate, to make the horse lame?—W. H. G. asks: Can you give me directions for the treatment of green moss, to prepare it as an article of commerce? There are two different processes, one in which the moss is soaked in water until it is sufficiently rotted, and another in which this result is secured by the use of chemicals.—L. F. S. asks: How did B. N. C. (see your issue of January 24) arrange his pulley to carry power from the drum on main line to his lathe? How was the pulley thrown out of gear? Could such a friction gear carry as much as 25 horse power?

COMMUNICATIONS RECEIVED.

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

- On East Tennessee Industries. By H. E. C.
- On the Centralization of Matter. By J. P.
- On a Steam Buggy. By F. G. W.
- On Poisonous Aniline Dyes. By J. E.
- On Ventilation. By G. N.

- On the Northern Lights. By J. R.
- On Wood Engraving. By H. C. F.
- On the Non-Actinic Rays of Light. By E. J. H.
- On Glue as a Healing Remedy. By E. P.
- On a New Breech Blight. By J. S.
- On Coal Oil on Railroads. By G. H. K.
- On Mental Arithmetic. By J. P.

Also enquiries from the following:

W. F. J. T.—A. C. G.—W. E.—J. R. & Co.—H. W. T.—P. W. L.—J. B. G.—P. M.

Correspondents in different parts of the country ask: Who makes steel bars, to be used instead of bells? Who sells horse clipping machines? Who makes microscopes, sufficiently powerful to detect the animalcules in water? Who sells a rubber preparation in imitation of mahogany and rosewood? Who buys potato flour? Who sells hair cloth? Makers of the above articles will probably promote their interests by advertising, in reply, in the SCIENTIFIC AMERICAN.

Correspondents who write to ask the address of certain manufacturers, or where specified articles are to be had, also those having goods for sale, or who want to find partners, should send with their communications an amount sufficient to cover the cost of publication under the head of "Business and Personal," which is specially devoted to such enquiries.

[OFFICIAL.]

Index of Inventions

FOR WHICH

Letters Patent of the United States

WERE GRANTED IN THE WEEK ENDING

February 17, 1874,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

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Fuel, waterproofing, E. F. Loiseau	147,666
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Furnace grate bar, E. Malon	147,670
Furnace, hydrocarbon vapor, C. J. Eames	147,620
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Harp, G. D. Reed	147,689
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Windmill, M. J. Kaufmann	147,567
Window screen, A. L. Fuller	147,494
Wrench, L. F. Smith	147,699

APPLICATIONS FOR EXTENSIONS.

Applications have been duly filed and are now pending for the extension of the following Letters Patent. Hearings upon the respective applications are appointed for the days hereinafter mentioned:

- 5,121.—S. R. Wilmet, Bridgeport, Fairfield county, Conn., U. S. Improvements on the manufacture of metal tubing, called "Wilmet's Improved System of Manufacturing Metal Tubing." Feb. 20, 1874.
- 5,122.—J. A. Whippley, Dartmouth, Halifax county, Nova Scotia. Improvements on skates, called "Whippley's Self Fastening Skates." Feb. 20, 1874.
- 5,123.—J. J. Thomas & E. G. Thomas, Hamilton, Ontario. A railway switch, called "Thomas' Automatic Safety Railroad Switch." Feb. 20, 1874.
- 5,124.—J. Mills, Keeseville, Essex county, New York, U. S. Improvements on horse shoe nail machines, called "Mills' Improved Horse Shoe Nail Machines." Feb. 20, 1874.
- 5,125.—T. Rose, Georgetown, Halton county, Ontario. Useful article for cleaning lamp glasses, called "Rose's Spring and Slide Lamp Glass Cleaner." Feb. 20, 1874.
- 5,126.—L. M. Stockton, Yarmouth, Elgin county, Ontario, and D. Stockton, same place. Useful tanning composition to tan cow or any other hides, called "Manuel's and Stockton's Tanning Composition." Feb. 20, 1874.
- 5,127.—W. Foglesong, Dayton, Montgomery county, O., U. S. Improvements on machine for making sheet metal pans, called "Foglesong's Sheet Metal Pan Machine." Feb. 20, 1874.
- 5,128.—D. Douds, J. H. Hartsupp and P. Douds, all of New Castle, Lawrence county, Pa., U. S. Improvements on steam pump, called "Douds and Hartsupp's Steam Pump." Feb. 20, 1874.
- 5,129.—G. Westinghouse the Younger, Pittsburgh, Allegheny, Pa., U. S. Improvement on a machine for regulating, applying and releasing the fluid pressure in railway air brake apparatus, called "The Westinghouse Triple Valve." Feb. 20, 1874.
- 5,130.—I. Dennis, New Market, York county, Ontario. Improvements in "Dennis' Economical Framed Log Barn." called "Dennis' Improved Frame Barn." Feb. 20, 1874.
- 5,131.—I. Kay, Indianapolis, Ind., U. S. Useful roller abstractor for lever watches, called "Kay's Roller Abstractor." Feb. 20, 1874.
- 5,132.—J. L. Cathcart, Washington, D. C., U. S. Useful improvements on propellers for vessels, called "Cathcart's Steering Propeller." Feb. 20, 1874.
- 5,133.—T. S. Hunt, Boston, Mass., U. S., and Jas. Douglas, Jr., Quebec. Improvement in the utilization of refuse or waste tinned sheet iron (commonly called tin plate), the title whereof is "A New and Useful Improvement in the Utilization of Refuse or Waste Tinned Sheet Iron (commonly called Tin Plate)." Feb. 20, 1874.
- 5,134.—A. H. Pedrick, Philadelphia, Pa., U. S., assignee of E. Pedrick, Petrolia, Ontario. New and useful traction hydraulic engine, called "Pedrick's New Traction Hydraulic Engine." Feb. 20, 1874.

HOW TO OBTAIN Patents and Caveats IN CANADA.

PATENTS are now granted to inventors in Canada, without distinction as to the nationality of the applicant. The proceedings to obtain patents in Canada are nearly the same as in the United States. The applicant is required to furnish a model, with specification and drawings in duplicate. It is also necessary for him to sign and make affidavit to the originality of the invention.

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HOW TO OBTAIN

PATENTS

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To Make an Application for a Patent.

The applicant for a patent should furnish a model of his invention if susceptible of one, although sometimes it may be dispensed with; or, if the invention be a chemical production, he must furnish samples of the ingredients of which his composition consists. These should be securely packed, the inventor's name marked on them and sent by express, prepaid. Small models, from a distance, can often be sent cheaper by mail. The safest way to remit money, is by a draft or postal order, on New York, payable to the order of MUNN & Co. Persons who live in remote parts of the country can usually purchase drafts from their merchants on their New York correspondents.

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In order to have such search, make out a written description of the invention, in your own words, and a pencil, or pen and ink, sketch. Send these, with the fee of \$5, by mail, addressed to MUNN & Co., 37 Park Row, and in due time you will receive an acknowledgment thereof, followed by a written report in regard to the patentability of your improvement. This special search is made with great care, among the models and patents at Washington, to ascertain whether the improvement presented is patentable.

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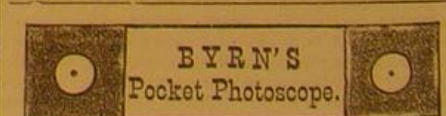
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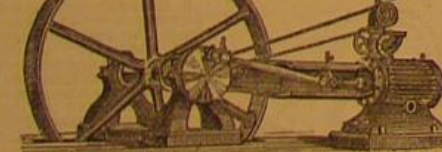
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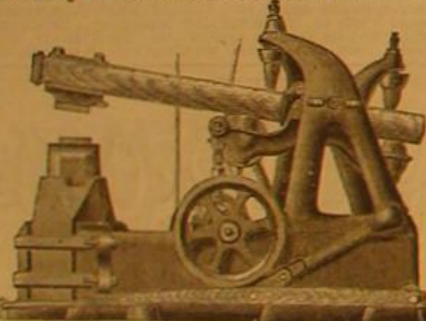
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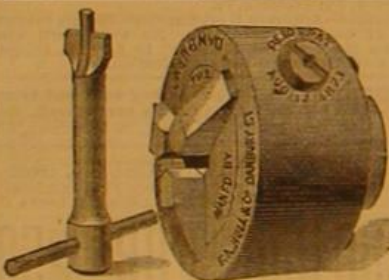
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