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IMPROVED PORTABLE ELEVATOR AND CONVEYER.

The excavation of a sewer in a city street is generally the means of blocking up all, or nearly all, the roadway with the earth thrown up on each side of the trench. That this is productive of no small amount of inconvenience, as an impediment to travel and business, often for a considerable time, it is hardly necessary to point out; and hence the invention which we herewith illustrate, having among its principal advantages that of avoiding the above nuisance, will at once commend itself to the careful attention of contractors, engineers, and the public.

In the large engraving is represented the apparatus as it appears in operation, and in Fig. 2 is shown a side view of the essential working portions. A is a frame made of wood or other suitable material, and supported at the sides on trucks, so as to straddle the ground to be excavated. From the top of the frame are suspended by rods two parallel tracks, B, which are placed sufficiently far apart to allow the buckets, when hanging from both tracks, to pass each other. On these rails travel small trucks, C, of which there are any desired number on each bucket (each bucket excavating 8 feet in length), all of which are connected together by ropes or chains. The latter pass from the trucks on one track, around a friction roller, D, at the end of the frame, and are then attached to the trucks on the other track, so that, when one set of trucks are moved, the others will travel in a contrary direction.

Several friction rollers are disposed along the top of the frame, A, over which pass the bucket ropes, which are brought to a windlass, as represented in the large illustration. After the buckets are filled with earth, they are hoisted by this means until their balls are sufficiently high to allow of being engaged by the hooks hanging below the trucks, C, on one track. When each truck has received its bucket, the whole line of vehicles is moved to the rear of the excavation, thereby, at the same time, running forward the other set of trucks. The buckets are then emptied, while other buckets are being filled and attached to the trucks over the point of work, when the operation as above described is repeated. The same ropes which hoist the buckets are attached to the empty ones on their arrival, lifting the same sufficiently to allow of the hooks on the trucks being removed from the balls, when they are easily lowered into the trench, where the hoisting hooks are transferred to full buckets, leaving the empty ones to be filled.

It will be noted that the necessity of throwing earth upon the sides of the excavation is here avoided, and that the ground adjacent to the latter is left clean and open to travel. The soil removed is only shoveled once, and that into the buckets, which remove it to the rear and empty it upon the completed masonry. The construction of the framework is such as to afford an excellent scaffold for lowering material to the masons, and also for starting and driving street piling wherever required. We are informed that the apparatus can be moved in from twenty to thirty minutes, and, when transported, leaves the ground behind it smooth and clear.

The inventor adds that, in practice, the framework should be made three times the length to be excavated, and eight feet longer. For instance, if four elevating ropes are to be operated, excavating 32 feet, there will be, besides this distance, 32 feet in which the brick masons are at work, 32 feet for back filling, and 8 feet for natural slope of the back fall. There are three sets of buckets required, one set at each end of the tracks, and one in the bottom of the cut, being filled; so that when the empty set is lowered, all that is necessary is to transfer the hooks from them to the full buckets, leaving the empty ones, which are re-filled by the time the next

July 16, 1872. For further particulars address the inventor, Mr. William F. Shanks, sewer contractor, 174 Gray street, Louisville, Ky.

Amateur Railroad.

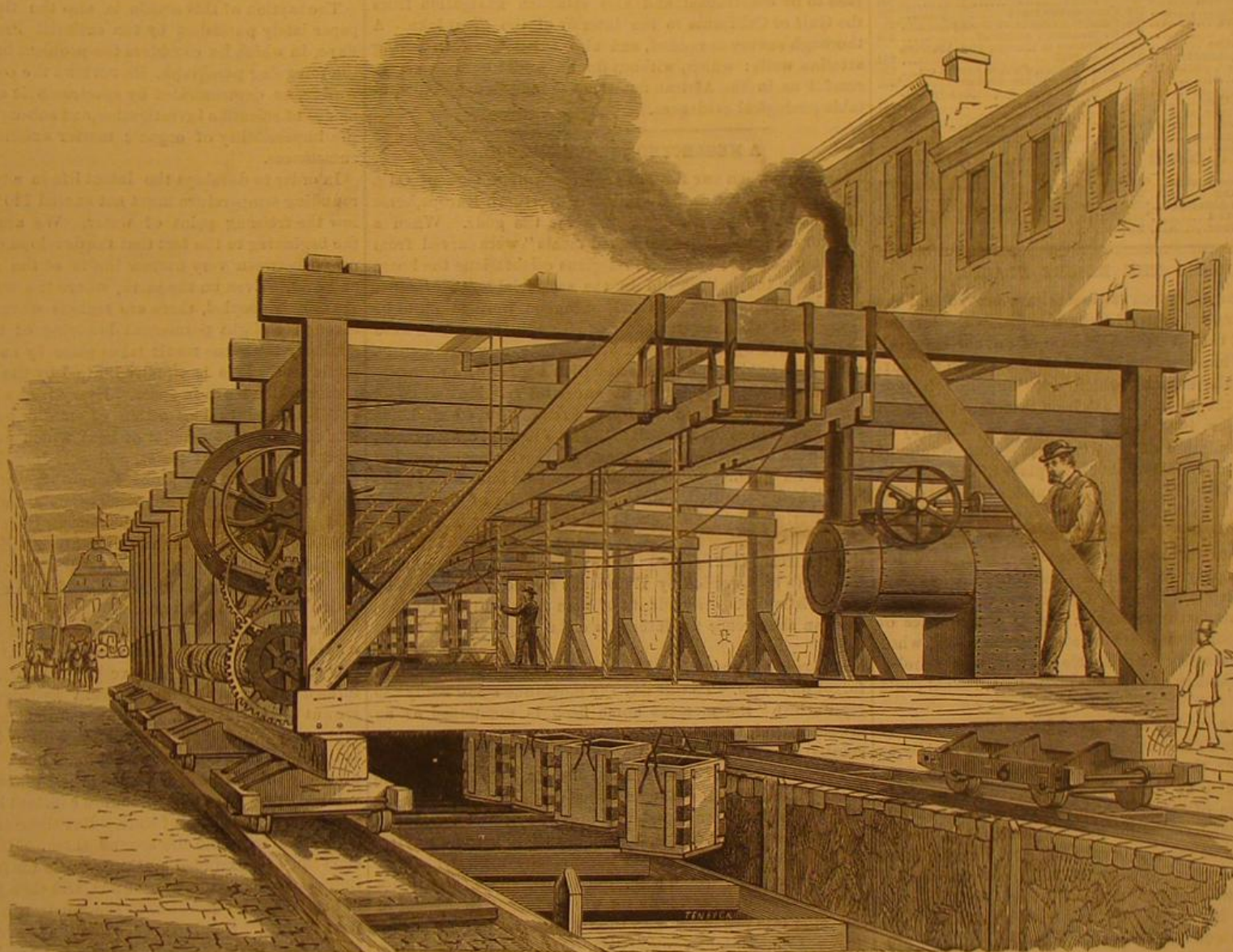
The Fredericksburg and Gordonsville Railroad Company has some seventeen miles of road completed from Fredericksburg, Va., to Parker's Store, which is not now operated. Some of the means devised by the people on the line to make use of the track, are thus described by the Fredericksburg Ledger. "A gentleman who is residing here, who is the owner of a small stationary engine, has attached to it a flat car on the Fredericksburg and Gordonsville Railroad, and with a molasses hogshead for his water tank, runs up and down the road between this city and Parker's Store for freight and passengers. One of those indefatigable geniuses peculiar to the Wilderness of Spotsylvania, becoming disgusted with the tardy movements of the railroad company, and fearful that his hoop poles, if kept much longer on hand, would not be merchantable, conceived the novel idea of hauling his poles to town on a flat car drawn by a young bull. The car was loaded with 100 bundles of poles. There was some difficulty in teaching the bull exactly what was expected of him. The mo-

du operandi was as follows: The bull drew the car up the grades, and was then unhitched and mounted on a platform at the rear of the car, which then ran down grade without help. As soon as his bullship got the hang of the thing, he took it very kindly, dragging the car up the grades with great alacrity, and evincing the same pleasure in riding down that is shown by boys who drag their sleighs up hill for the pleasure of riding down again.

Chicory in Ground Coffee.

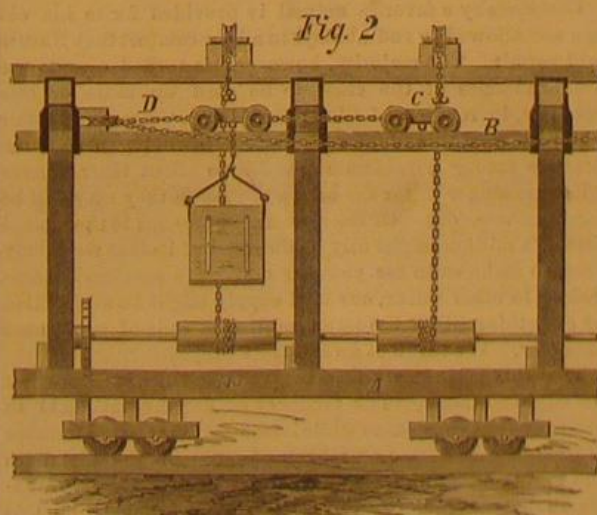
A preliminary examination of coffee for admixture is best made by gently strewing the powder upon the surface of cold water. The oil contained in coffee prevents the particles from being readily wetted by the water, thus causing them to float. Chicory, burnt sugar, etc., contain no oil, and their caramel is very quickly extracted by the water, with production of a brown color, while the particles themselves rapidly sink to the bottom of the water. On stirring the liquid, coffee becomes tolerably uniformly diffused without sensibly coloring the water, while chicory and other sweet roots quickly give a dark brown turbid infusion. Roasted cereals do not give so distinct a color.

A RUSSIAN CHINESE RAILROAD.—A special commission of the Coöperative Society of Russian Manufacture and Trade has reported in favor of the construction of a railroad line between Russia and China, through Siberia. The road, with its connections, would traverse for the most part a thickly populated country, and open up immense cattle and wool growing districts which are now isolated from the business world. It would have to be built in sections, commencing with a fortified town in Western Russia and ultimately reaching Peking.



SHANKS' PORTABLE ELEVATOR AND CONVEYER.

set are brought from the rear and lowered. By means of a friction cone and brake, when the buckets are raised to the desired height, they are stopped and held until the truck



hooks are attached to extra balls, when they are lowered by the brake swinging naturally under the trucks.

The apparatus, it is stated, will excavate 33 or 40 feet of earth quicker with 28 men than 50 men can perform the same work, throwing the soil up at the sides while it makes the fill in addition. It does not interfere with bracing, can be put together with bolts, and, when taken apart, can be applied to any sized cut, varying in width from 3 to 25 feet.

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RECLAIMING THE DESERT PLACES.

The explorations of French engineers have proved that the surface of the great Desert of Sahara is below the level of the ocean, in fact that it is the bottom of an ancient fresh water lake which has dried up by gradual changes in the surrounding levels, the streams which once supplied it now going directly to the ocean. It has been therefore suggested to change this desert back into a lake, and in this way to alter the whole climate of that country. This would, of course, create a moist atmosphere in place of the burning hot, dusty whirlwinds which are the curse of that region. There are, however, no rivers to be turned into the basin; and the artesian wells, successfully bored by the French, which create oases in the desert around them, give too insignificant a supply for such a great purpose. It has, therefore, been proposed to make a channel to the ocean, and lead the ocean water into the desert; but in consequence of the vigorous evaporation in that latitude, the water, when once spread out over any considerable surface, would probably disappear as quickly as even the largest sized canal could pour it in.

The Caspian sea, which is situated below the surface of the ocean, evaporates the waters of the Volga as rapidly as that colossal river, the largest in Europe, is able to pour them in. The water of the Volga is fresh, containing only a small percentage of salts; but this small amount of salt remains in the Caspian sea, while pure water only is abstracted by evaporation; thus the sea is very salt, and becomes more so every year. If now the collection of fresh water, in a closed lake, from which there is no exit but evaporation, ends in making a salt lake in a cold climate, the introduction of sea water to form such a lake under a tropical sun, as proposed for Sahara, would result in making a huge salt pan, which would gradually fill up with solid salt, till it reached the level of the supplying ocean; and we should only have transformed the dry sandy plains of the desert into dry salt plains, and which of the two would be the worse is a matter for discussion.

We think that a continuation of the French system of boring artesian wells in all available spots is the best method of reclaiming the desert. Many of these wells have already been completed, and it is indeed touching to read the description of the joy and religious enthusiasm of the natives when they see, for the first time, a bountiful supply of fresh cool water poured forth from the bowels of the earth in spots where never before was water seen for miles around. The creation of an oasis in the desert is the immediate consequence of each well; and in the course of years the dreadful Sahara may be so profusely clothed with artificial oases that most of its terrors will have passed away.

As to our American deserts, recent explorations and surveys of the great desert of the Colorado river have shown that it also was the bottom of a lake which has dried up, because the river has cut its channels in the rocks, through which it flows to the ocean, so low down (from 4,000 to 6,000 feet) that the lakes, formerly connected with and supplied by the river, lie now far above its present level. These lakes have for centuries collected at their bottoms the deposits of the Colorado river; and the now exposed surface consists, therefore, of an alluvial soil of extreme fertility (containing potash, soda, lime, and phosphates), which, however, cannot produce any crops on account of the total absence of moisture. The whole region is indeed a desert like that of Sahara; and like the latter, a portion of it lies below the surface of the ocean, as proved by barometric observations. It is believed that the waters of the Gulf of

California formerly extended some 175 miles further inland than they do now, that subsequently the delta deposits of the Colorado (which were enormous, considering the deep channel which it has hollowed out for itself) formed a dam in the sea 175 miles from the shore, finally enclosing a sheet of water, which then dried up and now forms that part of the desert which is lower than the ocean.

It is proposed to lead the waters of the ocean into this low portion, so as to inundate it, and increase the atmospheric moisture in that region; and it appears that the plan is feasible, at a comparatively small cost; but one objection is that then a large portion, some 30,000 or 40,000 square miles, which otherwise might be made productive, would be sacrificed; and this plan is also open to the same objection as that of inundating the Sahara with sea water: it would end in the creation of an enormous salt pan. We prefer the other plan which has been suggested, irrigation from the upper part of the Colorado river, which, to be sure, would cost much more, but would reclaim all the highlands of this desert. The geologist of Williamson's expedition, Mr. W. P. Blake, points out that, by cutting a canal or deepening a certain small river low enough, so that the water from the Colorado could enter it at all seasons of the year, a constant and plentiful supply of water can be furnished to the interior of the desert and used for irrigation, while the surplus will fill the low portions with fresh water, find its exit to the Gulf by a pass to be constructed, and also establish navigation from the Gulf of California to the interior of the great lake. A thorough survey is needed, and also experiments in boring artesian wells: which, without doubt, would here be as successful as in the African desert, as is indicated by indisputable geological evidences.

A NEGLECTED SOURCE OF FOOD.

Ages ago when our forefathers were worshippers of Odin and the rest of the dead divinities of Northern Europe, horse flesh was accounted a delicacy fit for the gods. When a warrior died, the "funeral baked meats" were carved from his slain charger; and in all religious celebrations the horse figured, as the bullock did in the sacrificial feasts of other nations. Thus horse flesh and paganism were found to be inseparable when the Germanic and Scandinavian tribes were christianized by royal proclamation. The new made christian could not begin a dinner at which his favorite meat appeared without relapsing to his ancestral religion and going through the entire round of pagan rites with which horse flesh had been so long associated. As a natural consequence, horse flesh became not only synonymous with paganism but one of its defenses—we should have said bulwarks if the sound had permitted. Against it the bulls of the church were hurled, and its use was prohibited under pain of eternal damnation. Gradually, as christianity gained ascendancy, the obnoxious meat passed out of use, and in process of time it came to be regarded by Europeans as "long pig" was by the christianized descendants of man-eating Fiji islanders, with an abhorrence as intense as the original liking had been.

Subsequent generations have inherited the prejudice and forget its origin. To this day the multitude stand ready "to cry unclean" the moment horse flesh is mentioned as an article of food, though it would puzzle them to give one substantial reason for so regarding it.

The truth is that no meat can be cleaner. The horse is one of the nicest of feeders, and as choice in his drinking as in his diet; and, as has been abundantly proved by the experience of modern Europe, where horse flesh has lately become an important element in the food supply, the meat which we reject is at once wholesome, nutritious, and nearly if not quite as savory as beef. As we are no longer in danger of relapsing into paganism with the taste of it, the only sanitary reason, moral or otherwise, for avoiding it is done away with.

There remains the economical reason for its disuse arising from the fact that good horses are worth more for other purposes. But the time comes when the best of horses ceases to be profitable for service. What then?

Occasionally a favorite animal is provided for in his old age and allowed to end his days in all the comfort that Nature will permit. The majority, however, are turned over to the tender mercies of the cruel to be used up, more or less speedily, in rough and ill requited labor. To guard their favorites from this unhappy end, it is becoming a common practice among considerate people to shoot their horses when no longer fit for the carriage, though they may still be far from worn out. Of the nine million horses in the United States, a million might fitly be disposed of in that way every year, to make room for younger and more serviceable animals. In other words, our food supply might be augmented by something like a thousand million pounds of good meat annually. We throw it away—for a prejudice!

That this prejudice will be overcome in time, we have not the slightest doubt. The tendency of our civilization is to multiply food consumers while lessening the relative number of producers. As a natural consequence we must be more and more careful to avoid unnecessary waste. Every available source of wholesome food must be husbanded, and this among them. Unfortunately those who would be most directly benefited by the addition of horseflesh to our lists of meats are just those whose prejudice against it is most intense. Here, as in Europe, it must first gain a place on the tables of the well-to-do.

Perhaps as simple a plan as any for effecting this would be the following: We have noticed the growing custom of shooting horses when their term of profitable service has come to an end by age or accident. Instead of burying the carcasses or giving them to the renderer to be converted into

soap grease and fertilizers, the flesh might be properly dressed and distributed among those who, from curiosity or conviction of its wholesomeness, might desire to give it a trial. If pains were taken to announce this intention before hand, and to prove to intending eaters that the horses were in good condition and free from disease, there would be little difficulty, we imagine, in disposing of the choicer cuts. All that is required is a beginning, and this course would ensure it with the least amount of trouble and cost.

Who will make the experiment and report the result?

THE ASTRONOMICAL CONDITIONS OF LIFE.

Spectrum analysis, confirmed in so many particulars by the chemical analysis of meteorites, has familiarized us with the idea that all the bodies of Nature, the planets of our system as well as the suns most distant from us, are composed of the same elements, animated by the same physical forces, submitted to the same chemical laws, and present all the essential characteristics of the elements of which we are formed, even to the most delicate and minute details. Since therefore these same forces act under our eyes as essential agents of life, we are naturally led to consider the conditions of organic existence on our globe as applicable to the circumstances of other spheres. If in brief our earth is inhabited, why not the other orbs which fill up space, seeing that the same matter is everywhere present?

The caption of this article is also the title of a valuable paper lately published by the eminent French astronomer Faye, in which he considers the problem briefly outlined in the foregoing paragraph. He reviews the conditions of other worlds, as demonstrated by spectroscopic and various other modes of scientific investigation, and subsequently points out the impossibility of organic matter existing under the circumstances.

In order to develop the latent life in any germ, the surrounding temperature must not exceed 140° Fah., or fall below the freezing point of water. We are therefore led in the beginning to the fact that the development of life is comprised between very narrow limits of the scale of warmth and cold. Even on the earth, where the water, soil, and air are thickly peopled, there are regions where life disappears through a slight permanent lowering of temperature; and similarly the same result takes place by an increase of climatic heat. Life is equally limited by the isolation of the bodies which move in space. Every formation of an aggregate by the mutual attraction of smaller portions is accompanied by a development of heat which even the simplest organisms could not resist, and certainly life could not be transmitted from one globe to another by materials which even on entering our atmosphere pass suddenly from the cold state to intense incandescence. Consequently we are led to consider whether the life of organized beings is so simple that it may result from the spontaneous play of natural forces, and hence to the conditions under which such action may or may not occur.

The condition of temperature excludes immediately all bodies which shine by their own light, that is to say, every star that we see in the sky, except the planets. The nebulae, formed as they are of incandescent hydrogen and nitrogen, are out of the question. Life therefore cannot be found except upon a cold globe associated with a hot body, which radiates to it the necessary additional heat. The suns serve precisely this purpose as regards their planets, and are marvelously organized to distribute a constant light and warmth during vast durations of time. But these sources must be of a nature to maintain life around them. Hence the variable stars must be excluded, of the Whale for instance, which at times is of the second magnitude, and then gradually lessens in brilliancy and descends to the fourteenth magnitude, during 230 days. Similarly the stars that have already become cool, or are too small in mass ever to have had a very high temperature, must be left out of consideration, also the red, blue, and greenish blue stars, the light of which is deprived of the rays necessary for the development of organized beings, and lastly must be excluded the stars which exist in thousands in regions more or less contracted, where the temperature is necessarily above or below the circumscribed limits.

If now we pass to the examination of systems analogous to ours, other restrictions present themselves. In the first place, the condition of temperature excludes the planets of which the axes of rotation are too slightly inclined to the planes of their orbits, Uranus, for example, of which each hemisphere is exposed to the sun for a half revolution of forty-two years, and plunged in darkness during the balance of its course. Venus also, the axis of which is inclined 37°, is subject to great variation of temperature. We are also driven to exclude such bodies as have too slow a rotation, and hence are subject to too great influence of nocturnal radiation (the moon), and to eliminate others which, like Saturn, are surrounded with opaque rings, the shadows of which produce continual eclipses.

Proceeding still further, worlds devoid of a proper atmosphere must be omitted. An envelope formed exclusively of other permanent gases, even, will not suffice; it would be too permeable by heat, and its moderating action too limited. It is only by the presence of water in a liquid state, and by the enormous quantities of heat which, by its changes of state, it is capable of absorbing, that our atmosphere is enabled to fulfil its functions. Again the water must not cover the entire globe, but must be disposed in seas, so equilibrated that their movements reduce themselves to simple oscillations in fixed basins. This result could not be realized upon Saturn, since its mean density is lower than that of water.

As we stated at the outset, the chemical elements necessary to life are largely extended throughout the universe. While

nitrogen and oxygen have never been recognized by spectral analysis of the sun or the stars, the existence of the former gas has been determined to be probable in the nebulae, and the latter is found in meteoric stones which are almost entirely composed of terrous oxides. Hydrogen is present everywhere; carbon has not been found by spectrum analysis, but is readily recognized in the carbonaceous meteorites. Calcium, and hence lime, is largely disseminated; iron is everywhere, while Janssen's curious absorption spectrum indicates the vapor of water in the atmospheres of many celestial bodies. Closer investigation, however, shows that these chemical conditions are confined within narrow bounds, that the formation of planets at the expense of the central mass is governed by mechanical causes quite independent of such conditions, so that it cannot be concluded *a priori* that the planets necessarily possess the required atmospheres. While, on one hand, the analysis of meteorites appears to show that these bodies are formed in a medium slightly rich in oxygen: on the other, it is evident that free oxygen cannot result but from an excess of the gas over the hydrogen absorbed in the formation of water. Atmospheres of other worlds then are formed poor in oxygen or else totally free from it, and, like those of Jupiter, Saturn, and Uranus, as proved by the spectroscopy, are composed of vapors or gases which exercise an absorption unknown to our world.

The further progress we make into the domain of natural science, as applied to the heavenly bodies, the further away from us the apparent probabilities of life existing thereon seem to recede. The recent discoveries of the spectroscopy only prove the necessary conditions encompassed by still closer limits; and so far from being able to admit that they are naturally everywhere realized, we are barely able to cite two planets of our system, other than our earth, where such conditions have any shadow of probability of existing; while on the only globe of which we can speak with certainty, the moon, we know them to be utterly absent.

IMPROVEMENTS IN SUGAR MAKING.

The methods of purification employed in the sugar industry depend almost entirely upon the action of lime and the elimination of that alkali by carbonic acid. These processes leave, remaining in the saccharine products, a certain proportion of organic matters and mineral salts which oppose to a certain degree the crystallization of the sugar, while also causing the formation of molasses and the mingling of the sugar with the residue. M. P. Lagrange has recently devised a method which is based on the elimination by the joint action of baryta and phosphate of ammonia of the organic salts of lime, of certain vegetable acids combined with potash and soda, and of the alkaline sulphates existing in the sugar products. By this process, without the aid of lime or salts of lime, and while causing the eliminations as above noted, M. Lagrange believes that he is enabled to produce the products, and to secure the best conditions of alkalinity, without forming glucose at the expense of crystallizable sugar. In factories, therefore, devoted to the manufacture of cane sugar, it would seem that this improvement is of considerable importance as doing away with the serious difficulties and large losses due to the glucose formation and the lime salts.

The purifying process generally in sugar manufactories is applied to sirups of 20° Baumé, which have already been submitted to the calco-carbonic treatment. The products being led into a serpentine or double bottomed boiler, phosphate of ammonia is introduced in proportion to the lime, of which the quantity has been determined by hydrometric analysis, so as to leave in the sirup but a thousandth part of lime absorbable by the black; then the baryta is added, in such proportion to the sulphates and organic matters that the sirups will eventually contain but one one-hundredth part of matters still precipitable by that substance. The whole is then boiled, filtered, and carried to the coarse black, leaving in the receptacles a residue which constitutes a most valuable fertilizer.

In refineries where the purification is made in the boiler where the crude sugar is melted, dissolved phosphate of ammonia is substituted for fine black and blood in such proportion to the lime as to leave a hundredth part of the alkali, which the black totally absorbs: the baryta solution is next added, in such proportion to the alkaline sulphates and organic matters contained as that but the quantity of alkali necessary for the easy maintenance of the alkalinity up to the molasses will remain. To obtain the best results, experience has proved that, for a sample of sugar indicating 88°, the proportion of phosphate of ammonia crystallized per 2,200 lbs. of sugar is 1.6 lbs., and that of the baryta, per same weight of sugar, is 6.6 lbs., using the hydrate of 10 equivalents of water.

The mixture after melting is boiled, when the precipitate swells, and a clarification ensues, comparable to that obtained with blood albumen. The sirup is then treated as in the instance already cited, and the residue from the filters is also applicable for fertilizing purposes. The products of establishments using the process are said to be largely increased.

In connection with the subject of sugar manufacture may be noted an important invention recently patented by M. Marguerite (represented in this country by Mr. Edmund Ratisbonne, 48 Broad street, New York city), through this office, for obtaining sugar from molasses by the addition to the latter of certain salts which provoke crystallization. The process is said to be especially valuable in treating third quality sirups as well as molasses. The operation consists in adding to the spent molasses (containing, say, fifty per cent of sugar, fifteen per cent of salts, and twenty per cent of water) crystallized sulphate of magnesia in the proportion of twenty

per cent by weight, together with a little water to make a solution of the sulphate marking 100° Baumé. The whole is then subjected to centrifugal action in a machine having either perforated sides or very fine wire cloth. The sulphates of lime and potash precipitated are retained and the liquor is then filtered through charcoal and boiled *in vacuo*. After cooling, a certain quantity of pounded sugar is added to form nuclei and the sirup is lastly subjected to the ordinary temperature of fillings, the heat being alternately raised and lowered.

After a few days, crystallization becomes exceedingly abundant and continues to increase for some time, after which the hydro-extractor is employed. Other salts, such as sulphate of soda, sulphate and chloride of magnesium, chloride of manganese, sulphate of iron and zinc and their chlorides, and also the acetates, nitrates, and ammonia salts, though these are not so desirable, may all be used instead of the sulphate of magnesia, the proportions of which vary according to the nature of the molasses and the results of expense.

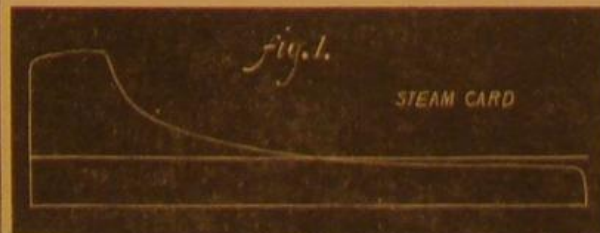
The crystallization of the sugar results from elimination of the potash, the salts of which are prejudicial, its place being taken by the magnesia, whose salts are favorable thereto. This invention we believe to be one of considerable importance in an economical point of view, and hence perhaps worthy of the closer examination of sugar manufacturers generally.

PUMPING ENGINE ECONOMY.

A *soi-disant* "practical friend" writes us a note, referring to an editorial of March 2 (page 176 of our current volume) commenting upon that "Remarkable Report about Remarkable Pumping Engines," in which he informs us that the Providence pumping engines "were overhauled and boilers cleaned just previous to the two million gallon test," that indicator cards were taken, that the coal was screened, and that a maximum duty test could not be made "owing to causes still unexplained." He thinks that a different method of testing might have given a more satisfactory result; "but that there are many points, not embodied in the report," which influenced the decision of the board of experts. He encloses several of the indicator cards taken, a set of which we here reproduce as illustrating the peculiarities of the two styles of engine, the one being the representative of the standard drop cut-off single cylinder engine and the other being a good representative of rather conservative practice in the construction of "compound" engines.

We based our remarks and strictures upon the report of the board, which we found published in the Providence *Journal* of March 2, in which the statements occur that: "The coal was not selected for any supposed superior quality, and was consumed just as it came from the yard without screening, picking or other special preparation," and "the engines and boilers, in both cases, were taken just as they were found, without any cleaning or other preparation." No mention, as we have already remarked, was made of indicators being applied to determine the cause of the low duty obtained. We have no reason to change our views as already expressed, views which we find expressed quite as strongly in the editorial columns of the *Engineering and Mining Journal* of subsequent issue and contemporary date. We have nothing to add: except that we are pleased to know that the examination was more complete than we had been led to suppose, and regret that the board should have rendered a report apparently inconsistent with the results, and that they should have allowed themselves to report at all before "circumstances permitted" a duty trial at full power and without the acquirement of essential data: and except that we are more than ever convinced that it is to the interest of all parties to make another attempt to obtain a knowledge of the real merits of the case.

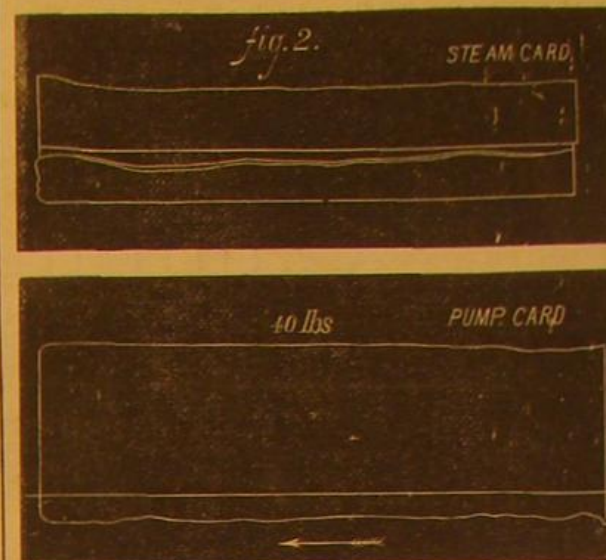
We reproduce the indicator diagrams here to exhibit the fact that it requires something more than an effective valve gear to secure good economical results, and that the "beautiful card" is no evidence of the adaptation of an engine to its work. The steam engine has been two thousand years and more in growing from the form described by Heron to its present shape, and the prominent details of designs now familiar to were known to James Watt a century ago. The



problem of designing a good engine for any special purpose is still the most important and most difficult presented to the engineer; and we doubt if one in a hundred of those who attempt it are capable of doing creditable work. Indeed we believe that the number of engineers who are really familiar with the essential conditions of success might almost be

counted on the fingers, and we are always distrustful of those who are most confident of their own powers as designers of steam engines.

In Fig. 1, we have copied the steam cylinder and pump cards of the Corliss, and in Fig. 2, those of the Worthington engine.



In the Corliss engine, steam is expanded from about one eighth stroke. In the Worthington there is no expansion by cut-off, but the ratio of expansion is the ratio of piston areas, —about three to one,—while the latter exceeded the former, on the two duty tests, by ratios of nearly two to one and four to one, respectively. The Corliss card is an exceedingly fine one, as exhibiting the action of the valve gear, but it gives no clue to the real value of the engine. The Corliss machine consists of five similar pairs of steam engines and pumps, coupled to one crank shaft; the Worthington was a single pair of cylinders, yet the pump card of the latter is beautifully smooth and far superior to that of the former. The vacuum on the steam card of the compound engine is better than on that of the single cylinder engine, as given by gage; but the difference seems less on the card. It is, however, sufficient to account for a part of the difference of duty.

The great causes of loss with the Corliss, we presume to be a short cut-off with low steam, large exposed surfaces in and outside the steam cylinders, and a boiler surface immensely disproportionate to the work done. This is shown to be the fact, also, by the evident tendency to equalization of efficiency at the higher duty test, and we are probably fully sustained in our demand for a careful test at full duty. We cannot understand yet why this was not made, and hope that we may be given good reasons for the neglect, if any exist.

The lesson taught by the affair, as it now stands, may be repeated in a few lines. It is as important for a designing engineer to know when expansion causes loss as to know when it may be expected to produce economy. It is important that the designer should understand the serious effect of external losses by conduction and radiation, and still more important that he should comprehend the nature and extent of losses by internal condensation and re-evaporation. It is important that an engineer should comprehend the necessity of making his boiler power just right, and that great losses will be incurred by error in making it either too large or too small for the work for which it is designed.

It is important that a constructing engineer should know that a loss of an inch or two of vacuum, a too tightly packed pump, or a leaky piston or valve, may destroy a hardly earned reputation.

It is important for the engine driver to understand these last points, and also that careless firing, an air hole or two, dead coals in the corners, or irregularity elsewhere, may mean a loss of very serious extent.

It is important that experts should understand all this, and many other matters not much less essential, and that they should: First, see what are the conditions under which the trial is to be made; secondly, see for themselves that everything is in order before commencing their test; thirdly, conduct the trial in such a way as shall reveal every defect and bring out every excellence of the apparatus tested; and finally, make a report that shall not only express their conclusions, but that shall enable all parties interested to see plainly the reasons thereof, and to judge for themselves whether the experts are experts, and whether their judgment is well sustained by facts, and is not warped by charity or prejudice.

A NEW disease to afflict horses and trouble their owners has appeared in New York and Brooklyn. It is called "pink eye," and appears to be a variation of the old epizootic. The discharge in the epizootic was from the nose; in "pink eye" it comes from the eyes, and for a time the horse becomes quite blind. It also causes a stiffness and swelling of the legs. The disease is not necessarily fatal, but minor diseases are superinduced by it. It is thought that the malady has been induced by the severe changes in the weather during the winter.

ALTHOUGH platinum is one of the heaviest of metals, yet its ductility is so great that Wollaston succeeded in drawing it into wire having a diameter of only one thirty thousandth part of an inch, a size so small that a mile length of the wire would weigh only one grain.

Car Axles and Bearings.

The *National Car Builder* states that, at a recent meeting of the Car Builders' Association, discussions took place in regard to Mundy's friction roller journal box. In this device the roller, six inches in diameter, turns on a solid spindle, the bearing of the roller being the whole length of the spindle. It was claimed that this was better than the ordinary plan of making the spindle and roller in one piece. The improved arrangement, it was claimed, provides a larger bearing, and prevents the escape of oil therefrom.

Mr. Garey described the following experimental tests

We understand that the metaline bearings, lately illustrated in the *SCIENTIFIC AMERICAN*, are to be tested on the cars of the Greenwich street elevated railway, in this city. This bearing, it will be remembered, is composed of compressed graphite and other substances, and runs without oil. In fact, oil is its worst enemy, for its presence quickly injures the metaline.

Improvement in the Manufacture of Beer.

The liability of beer to turn sour, ropy, etc., is due to the presence of special ferments derived from the air, and from

THE SEPARATION OF TAR AND THE MANUFACTURE OF SULPHATE OF AMMONIA FROM WASTE PRODUCTS.

The distillation of coal in closed receptacles, for the manufacture of illuminating gas, produces, beside the coke remaining in the retorts, tar and ammoniacal waters, which are collected in special apparatus, known as refrigerators and condensers. Large establishments have recently been erected in France for the purpose of obtaining these products in separate condition, in order that the coal tar may be utilized in the many ways now known to the arts, and the ammoniacal liquor chemically treated so as to yield merchantable sul-

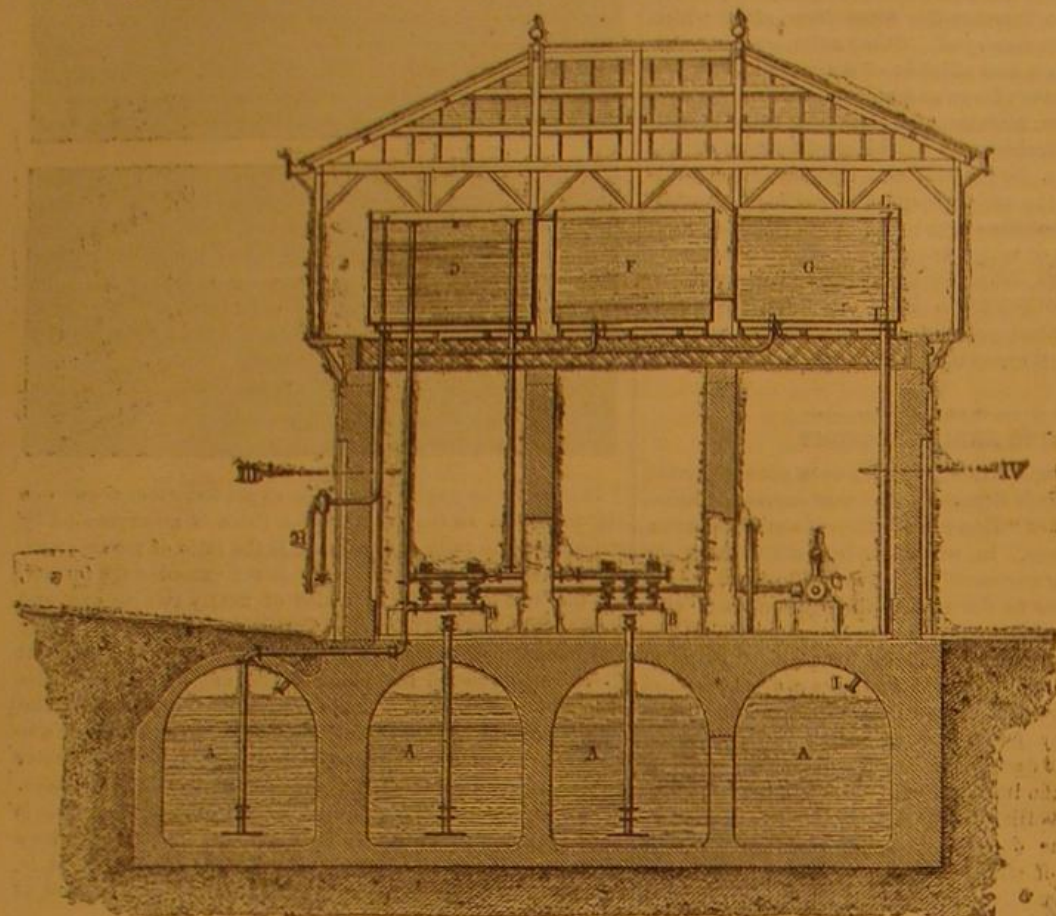


Fig. 1.—APPARATUS FOR DECANTING AMMONIACAL LIQUOR FROM COAL TAR.

which he had made of the power required to move cars with different sized journals: A passenger car with $3\frac{1}{2}$ inch journals, and weighing 44,674 pounds, required a force of 800 pounds, as shown by a dynamometer, to move it along a level track as slowly as the engine could be made to move. The car was in good running condition and the journals well fitted. Another passenger car, which was new and had run only 90 miles, weighing 46,770 pounds, and with $3\frac{1}{2}$ inch journals, required just 700 pounds, as indicated by the same instrument, to move it on the same track and in the same way as the other; thus showing that 100 pounds less force was required to move the heaviest car with the large journals. Specimens of the Ainsworth friction metal bearings were shown, one of which was stated to have run 40,363 miles under a Pullman car without heating. The metal is claimed to be 25 per cent cheaper than brass, three times more durable, and requires 50 per cent less oil.

Mr. D. A. Hopkins called attention to the advantages of lead-lined bearings. They had been tried under heavy palace cars, and had run 58,000 miles without heating or wearing out. The lead should not be more than 1-16th of an inch in thickness; it then accommodates itself to the journal, and gives a true bearing; but if thicker, will be pressed out at the sides and ends.

Mr. Garey remarked that in the course of his experience he had heard much of the antifriction metals, but had rarely or never seen any. He did remember making a trial of one specimen, which, it was claimed, would run without any oil at all, and not get hot. And it did so for a considerable time, and then he had to throw it away. It was like the horse that undertook to live without eating; as soon as he got well under way, he died.

the materials used. By boiling the infusion of malt and hops, cooling out of contact with air and fermenting with pure yeast in vessels to which only carbonic acid or pure air is admitted, a beer is produced of superior quality, which may be preserved without trouble for any time. Even a partial adoption of these precautions is attended with valuable results. In preparing pure yeast to start with, the author makes use of the fact that oxygen favors the growth of true yeast but hinders the propagation of the other ferments. Pure yeast being obtained, the beer is afterwards fermented in an atmosphere nearly destitute of oxygen, as its quality

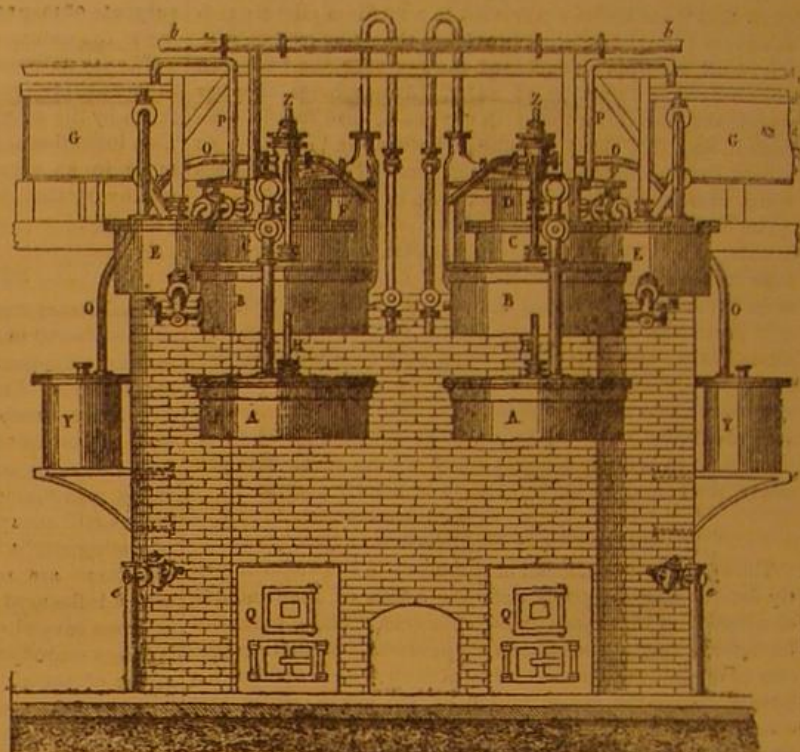


Fig. 2.—DISTILLER—END VIEW.

phate of ammonia. Our engravings represent the principal portion of the extensive plant of the works, showing the apparatus for separating the substances and for subsequently extracting the salt above mentioned from the waters. The latter, when received from the gas house, are conducted into huge cisterns of masonry, A, in Fig. 1, situated as shown underground. Thence, by means of the pumps, B, actuated by the engine, C, the liquor is elevated to a series of large reservoirs, D F G, located in the upper story of the building. Reservoir D is subdivided by a partition into two compartments, into each of which the water successively passes. As

indicated by the proportion of shaded lines in Fig. 1, the major part of the tar is deposited in this first reservoir; the water conducted by a surface pipe then enters the reservoir, F, leaving more of its tar, and is finally decanted into G in almost a pure state, whence it is drawn off by the pipe, L, into suitable vessels of a certain measured capacity. The tar that is deposited is removed from the bottoms of the reservoirs by the pipes, H I and K, the last two communicating with the pipe, H, which extends outside the building so as to deliver the tar into the vehicles designed to transport it to the factory where it is to be utilized. The

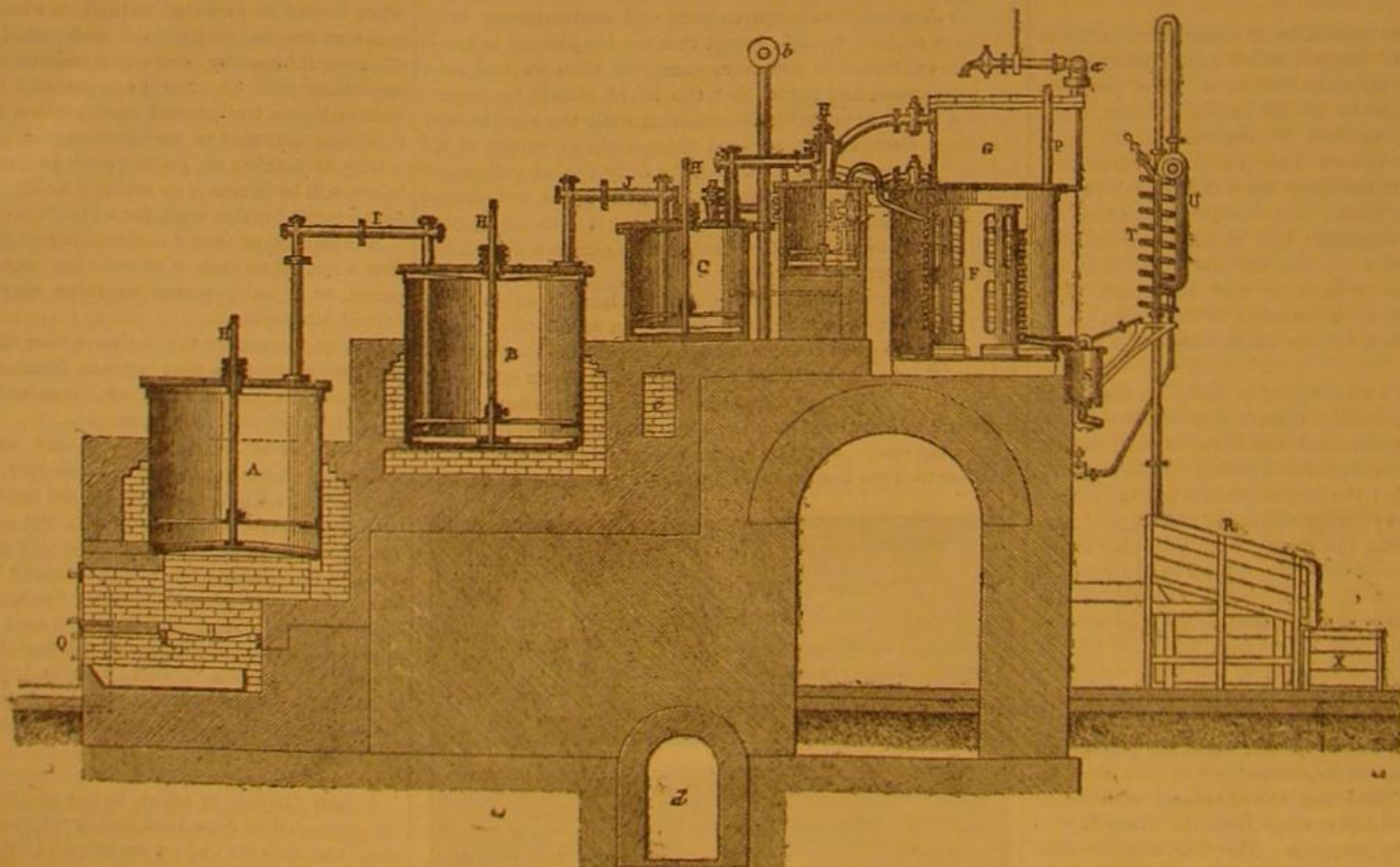


Fig. 3.—APPARATUS FOR MAKING SULPHATE OF AMMONIA

is thereby improved. Pure yeast when kept in pure air undergoes no change, even at summer temperatures. The *mycoderma vini* does not, as the author once thought, become changed in beer yeast on submersion in a nutritive fluid; under these circumstances it acts as an alcoholic ferment, but does not propagate itself.—L. Pasteur.

THE more machinery a nation has in operation, the more fully and profitably is its labor employed, the more rapid its material progress, and the more developed its civilization.

total area of all the reservoirs, D F and G, is about 107 square feet.

In Figs. 2, 3, and 4, are represented end and sectional views of the distilling apparatus, which is composed of a double set of boilers and mechanism. G is the vessel which receives the decanted liquor from the reservoirs through the cock, a. A part of the water is thence directly conducted to the vessels, E, in which a quantity of lime is previously introduced, and in which is machinery for agitating the contents. Receptacle E is connected by tubes, M (Fig. 3), near the bottom,

with the boiler, B, this with the boiler, A, and also with the boiler, C, which also communicates with a tank, D. All four of these vats are provided with agitators, H, and the vapors from each one pass into the others by tubes, I and J. Boiler A is heated directly by the fire beneath, B by the escaping products of combustion, and C by the vapors from B. The vapors entering D pass through a serpentine tube in F, which is surrounded by water, also drawn from G. This worm passes into a receiver, S, Fig. 4, whence any products of condensation that may occur are led to a secondary receiver, T, from which, by the tube, O, they are (Fig. 2) carried back to D. The ammoniacal gas then passes to the worm, T, Figs. 3 and 4, and, finally, to the crystallizers, V. At U are devices

vals with vertical pieces of corrugated hoop iron, F, which are retained in position while the concrete casing is in progress, by horizontal rows of wire binding them to the circumference of the column. The concrete casing is $3\frac{1}{2}$ inches in thickness, and the object of the corrugated hoop iron is evidently to cause it to bend, and to avoid the possibility of a straight joint all around the circumference of the column. In Figs. 3 and 4 the arrangement is somewhat different. In the place of the corrugated hoop iron, fillets of wood, B B, are employed and held in place by a wrapping of iron wire mesh. It will be observed that in this case the thickness of the concrete is reduced to $1\frac{1}{2}$ inches.

The relative value of these two arrangements will be per-

incasement of column B showed a crack about 3 feet in length. This was caused probably by the expansion of heated air or steam within the hollow space, the experimenters having inadvertently omitted to form escape holes in the concrete casing, as had been intended. No signs of injury to the incasement of columns, A and C, were visible, although the flames reached above the caps of the columns.

After two hours had elapsed it was determined to have one of the columns laid horizontally in the middle of the fire, so as to insure a uniformly intense degree of heat along its whole length, as the other columns, when in an upright position, were obviously more severely affected for a few feet above their bases than near their caps. The column, C, was therefore pushed over so as to lie horizontally in the fire, and remained in that position until the close of the experiment.

The fire was eventually extinguished by a quantity of water thrown on suddenly, and a careful examination showed that no cracking, blowing, or disintegration of the concrete had resulted from this severe test. Portions of the concrete were then removed as speedily as possible from each column. In no case had the strips of lead melted, nor did they show the least sign of injury. The hand could, immediately after the removal of the concrete, be borne on its inner surface, or upon the iron columns, without discomfort; and the registering cards attached to the ends of the gage rods showed no indication whatever of expansion.

The wood fillet, immediately opposite the crack in the

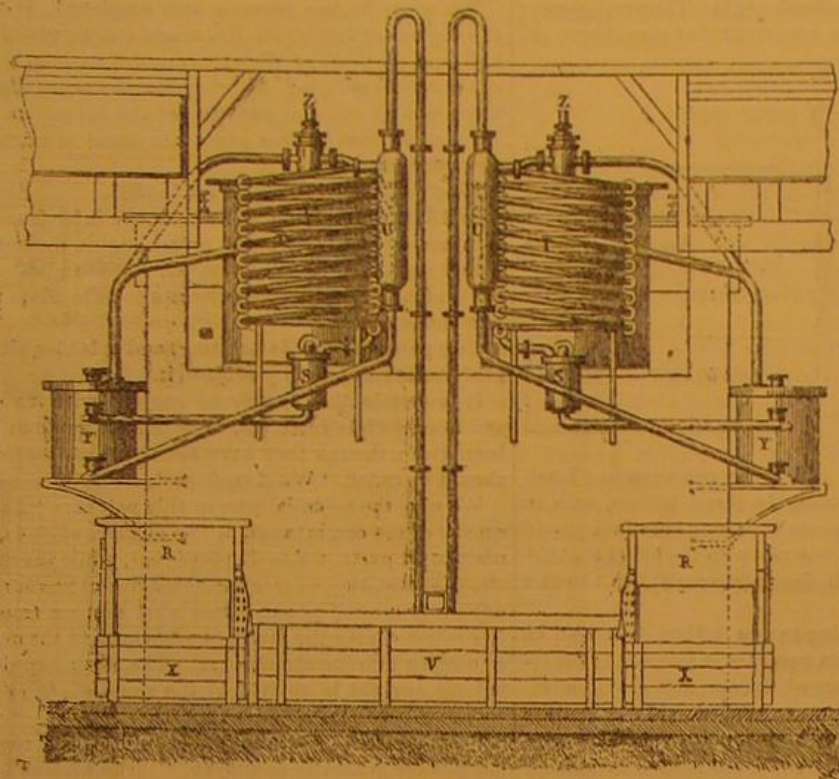


Fig. 4.—DISTILLER—SECTIONAL VIEW

arranged to prevent the absorption of the water in the receivers into the crystallizers, and P are also safety tubes leading the vapors formed by the water in the cistern, F, back into G. R are the dropping boards for the sulphate of ammonia, and X, leaden vats receiving the mother liquor. Fig. 5 represents a vertical section of one of the sulphuric acid vats, in which the ammoniacal vapors resulting from the distillation are treated. It is hermetically closed by the cover, M, and the products are led into it by the conduit, N, until the acid is saturated. The noxious vapors engendered are carried off by the subterranean flue, O, which connects with the chimney of the works, in which they are burnt up, the contents of the shaft being always kept at a very high temperature.

The *Bulletin de la Société d'Encouragement pour l'Industrie Nationale*, in commenting on this improved apparatus, says that the ammoniacal water is delivered perfectly pure and limpid, and that the deleterious and disagreeable vapors arising from the distilling processes, which generally converts the operation into a nuisance to residents of the neighborhood, are completely suppressed. Owing to the feeble strength of the waters, and the consequent expense which would be incurred if it were attempted to transport them by rail to a separate establishment, the distilling apparatus is set up directly in the gas works.

Italian Ornamental Brick.

Our engraving shows a form of brick, used at Mentone, in constructing ornamental screenwork on the upper portion of walls, and worth the notice of our readers. It is capable of producing various effects according as the bricks are combined. In the engraving (Fig. 1), the bottom layer is made by



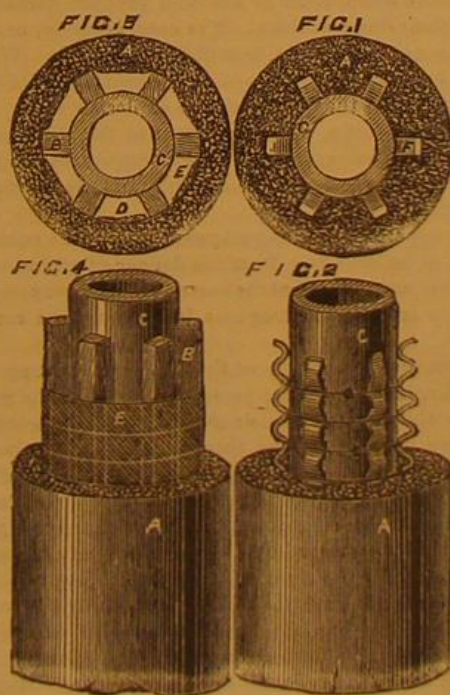
the bricks being laid horizontally, and the next tier perpendicularly; but another effect can be produced by placing all the bricks perpendicularly, while still another may be obtained by placing them all horizontally. In each case the effect produced is very good, and the frequency with which it is met with about Mentone testifies to the partiality the people have for it. The brick (see Fig. 2) is 8 inches long, $5\frac{1}{2}$ inches broad at the widest part, and $2\frac{1}{2}$ inches in the middle. It might be advantageously introduced into this country, and made in ordinary brick earth or in terra cotta.

Iron and Fireproof Construction.

Iron should be used in a building as the bones are used in a human being—to give strength; but it should be protected, as the bones are by the flesh and muscles. A well-known means of protecting iron is that of Messrs. Dennett & Co., of Nottingham, shown in the accompanying illustrations.

In Figs. 1 and 2 the column, C, is first provided at inter-

received from the results of the following experiment, which was carried out in Nottingham, and was lately reported in the *Engineer*. Three hollow cast iron columns were selected, which, for the sake of distinction, may be termed A, B, and C. The two former were similar in dimensions, being about 10 feet in length, and having an external diameter of $7\frac{1}{2}$ inches. The column, A, was incased with a solid mass of concrete $3\frac{1}{2}$ inches in thickness, as shown in Figs. 1 and 2. The column, B, was incased as shown in Figs. 3 and 4. In both instances the material was floated on and the face troweled.



The columns, A and B, were fixed erect on the ground about 4 feet apart, and their caps and bases were entirely inclosed by the concrete.

The column, C, was incased in a manner exactly similar to A, but the concrete was laid thereon only a week before the experiment, whereas A and B had been incased a month previously.

Strips of lead were fixed vertically along the whole length of each column under the concrete and in contact with the iron, it being fairly assumed that, if the lead were prevented by the protection of the incasement from melting, a temperature would be preserved below that which could injuriously affect cast iron.

A gage rod, with a self-registering card and pencil, were placed inside each of the columns, A and B, for the purpose of testing the expansion of the iron lengthwise.

All three columns stood within a distance of a few feet from each other, and a fire of wood and shavings, saturated with gas tar, was lighted around their bases, and maintained at as fierce a degree of heat as possible for a space of four and a half hours.

After the fire had been burning about an hour, the hollow

casing of column B, was charred somewhat on its outer edge; the sides and the edge of this fillet next the iron, as well as the two adjacent fillets, were discolored by smoke for 2 feet or 3 feet of their length, and the other fillets remained as white as when they came from the saw. A strip of lead near to the crack in the incasement of column B, and another strip in that side of column C, which had been laid downwards to the fire, were considered to have suffered the most severe test, but neither of these strips showed indications of melting, and were removed by the hand without inconvenience.

The following report of some experiments made by the professor of chemistry at the Massachusetts Institute of Technology, at Boston, Mass., upon Dennett's concrete, with regard to its fire-resisting qualities, has been forwarded to us by the patentees. Since the recent calamitous fire in that city, great interest has been manifested in the question of fire-proof construction, and these experiments were made at the request of Col. Seaver and other gentlemen, for the purpose of testing the value of this material, with a view to its use in the construction of the floors of several important buildings which are about to be re-erected.

"The point first investigated was the relative power of resistance of the brick and the cementing material. For this purpose a very intense heat was employed, probably much higher than would be produced in an ordinary conflagration. The specimens, numbered one to four, have been heated in crucibles to a temperature between the melting points of cast steel and wrought iron. The temperature measured was about 1,200° to 1,500° centigrade, or about 2,200° to 2,700° of the Fahrenheit thermometer.

"*Behaviour of the Building Material at 2,200° to 2,700°.*—Nos. 1 to 3 show partial fusion of the brick, and in No. 1 the brick in the interior has partially melted and run away from the cement, leaving it intact. In no case was the gypsum melted except on the surface, and then a portion has been changed, by the reducing action of the furnace gases, into sulphide of calcium. By pulverizing the pieces which had been subjected to the most extreme heat, and boiling them with water, unaltered gypsum (sulphate of calcium or sulphate of lime) was extracted. These facts prove that the cement is less affected by fire than the bricks, and that it may protect them to a certain extent from the action of a very fierce flame. The fragments of brick contained in the specimens shown me happen to be rather more infusible than many samples in this neighborhood, as is shown by specimen 4. A piece of ordinary red brick, also labeled No. 4, was heated in the crucible, together with a piece of the building material, and the result was that it served as a flux to melt the whole into a slag or glass in which fragments of unmelted cement may be seen. All the specimens (Nos. 1 to 4) were heated at the same time, in the same furnace, to a temperature which was measured and found to be between the melting points of cast steel and wrought iron, as stated above.

"*Behavior of the Building Material at about 1,800°.*—The process of manufacture of the building material gives reason to suspect that it might be vulnerable at a lower temperature, but the following experiments show this is not the case. The plaster of Paris is made to set and bind the bricks

by mixing it with water, which combines chemically with it; and it might be supposed that, when the moisture escapes as steam, on first heating it, the cement might crumble. In order to test this point, the furnace was maintained at about 1,000° C., or 1,800° F., and the specimens marked 5 and 6 were introduced suddenly, and were closely watched. There was no appearance of crumbling, although the lower side of each became red hot in three minutes. Each was taken out from time to time, as it became gradually hotter, and allowed to fall a distance of two feet on a brick pavement. It will be seen, on inspecting the pieces, that the molded faces still preserve their sharpness, and that the specimens have only broken on the edges and corners. No. 6 was taken from the furnace when red hot, and a strong jet of water from a faucet was directed on its smoothest face; small flakes, less than 1-16 inch in thickness, scaled from the surface in the lower part, and a small piece fell away from one corner. The injury was very slight. When taken away from the jet of water, No. 6 was put immediately into the hot furnace, but did not appear to suffer from the rapid change of temperature. No. 5 has been heated half an hour, and No. 6 one hour, at a temperature which was measured and found to be about 1,800° F. (between the melting points of gold and silver). Under these tests, probably more severe than a portion of a building would be subjected to during a fire, this building material has undoubtedly suffered and lost in strength from the calcination of the plaster of Paris, but apparently not to an extent which would endanger the safety of an ordinary construction. The freedom from crumbling of the plaster of Paris cement, which is extraordinary, may be due to the high temperature at which (as I am informed) it has been burnt before mixing with water."

—Building News.

A New Fertilizer.

In many of the large tallow-rendering factories of Texas and elsewhere, the fatty matter is separated from the bodies of the cattle, after the animal has been skinned, by boiling the entire carcass in a strong, tight vessel of large capacity, under steam pressure, until the meat, muscle, and offal are thoroughly disintegrated and the bones softened and crumbled. The tallow thus liberated rises to the top of the mass, and is then drawn off from the vessel. In Texas, where animals are slaughtered in immense numbers for the hides and tallow, the residue in the tank being mixed with a large amount of water, and the bones so crumbled that they cannot be separated, is thrown away, thus wasting a vast quantity of the most valuable material for fertilizing purposes.

The process below described, which has for its object the utilization of this waste, is susceptible of very extended application, and is based on a peculiar action of plaster (which the inventor claims to have discovered) upon animal matter, in that, when aided by a gentle heat of about 250° F., the plaster entirely absorbs the moisture of the meat and destroys its tendency to recombine therewith. All decomposition, we are informed, is prevented, while the valuable constituents, most of which, in many processes, are lost through the effect of the high degree of heat necessarily employed, are preserved indefinitely for use.

After the fat has been removed from the tank, the residue is carried to a suitable vessel, and the solid matter allowed to settle. The supernatant liquid is drawn off into another vat and rapidly evaporates by the action of heat to a sirupy consistency. With this is then mixed the solid residue and a quantity of plaster of Paris equal to about twenty per cent of original weight of the meat. The mass becomes converted into a friable substance which can be ground to a fine powder, and which possesses, it is claimed, fertilizing properties equal to good guano. The plaster, beside absorbing the water, the inventor states, fixes the ammonia and nitrogenous elements, and destroys the hygrometric properties of the meat, so that it will keep in any climate for any length of time. The plaster itself is also valuable as a fertilizer.

An analysis, of the product made from the waste of rendering tanks, by the chemist of the Agricultural Department at Washington, gives its composition as follows:

Phosphoric acid.....	6.87 per cent
equal to bone phosphate.....	15.00 per cent
Nitrogen.....	5.11 per cent
equal to actual ammonia (NH ₃).....	6.21 per cent,

which is equal to a fair average guano.

Dead animals and the waste of abattoirs, by simply hashing them, by means of a powerful machine, with a small proportion of plaster of Paris, may thus be advantageously utilized, and would produce a fertilizer richer in manurial constituents than that shown in the above analysis. The cost of manufacture is said to be very small. Patented November 25, 1873. The inventor desires to dispose of rights or to obtain a partner with means to develop the invention. For further particulars, address Mr. H. Stevens, Brazoria, Brazoria county, Texas.

GRASSING A SLOPE.—A steep slope may be grassed over without sodding by first smoothing the surface and then mixing a tough paste or mortar of clay, loam, and horse manure, with sufficient water. The grass seed, which should be a mixture of Kentucky blue grass and white clover, should be thickly but evenly scattered upon the moist surface of this plaster, as it is spread upon the bank. The plaster should be at least one or two inches thick, and a thin layer should be laid over the seed. The surface should be kept moist, and a light dressing of some active fertilizer would help the growth. In a few weeks the growing grass should be cut and should be kept short at all times until a thick sod is formed.—*Keystone, in the New York Tribune.*

RECENT BOILER EXPLOSIONS.

A correspondent sends an account of a boiler explosion at the Binghamton water works, on March 10, together with the report of the inquest and the finding of the jury. The explosion seems to have been very violent, pieces of the boiler being carried several hundred feet and firmly imbedded in the earth. One of the engineers was killed by the explosion. The boiler was one of two which stood side by side. We do not get a very clear idea of the arrangement of the steam pipes, but it was stated on the inquest that great difficulty was experienced in keeping the same pressure in the two boilers, though both were furnishing steam to a single engine. The engineer testified that there was frequently as much as five pounds difference of pressure in the two boilers, as shown by their respective steam gages. The arrangement of feed pipes is shown in the accompanying plan, there being only one check valve, so that, when the pressure was the same in both boilers, the water would stand at the same level in each; and when the pressure in one was increased, water would be forced out of it into the other. Even with two check valves, there could be no certainty of maintaining the same water level in the two boilers, with a single pump, since the water would go into that boiler in which the pressure was least. The whole system of connections in these boilers, both in steam and water spaces, appears to have been very faulty; and in addition, much testimony was taken to the effect that the boiler was not well built, so it does not seem difficult to find reasons for this explosion.

It is not an uncommon thing to see boilers connected in this manner, so that the steam pressure is frequently different in them. But it is a source of danger, and should be remedied at once. We hope that our remarks may arouse the attention of some who are thus inviting disaster.

Another correspondent sends us a newspaper containing an account of a boiler explosion in Burlington, Iowa, the boiler having neither fire nor water in it, being under repairs at the time. According to the account, a tube in the boiler had been stopped with plugs, and on striking one of these plugs with the hammer a violent explosion occurred in the tube. The writer of the account did not see the explosion, apparently, and may possibly have colored it to suit his theory—that explosive compounds, as violent in their action as dynamite or nitro-glycerin, are formed from the earthy matter contained in the water, and are liable to be exploded by a blow. From his own account, however, it does not appear that the explosion, violent as it was said to be, injured the boiler or the workmen.

Explosive compounds of nitrogen produce great destruction by their decomposition. The case, however, as presented in this newspaper slip, is sufficiently curious. We would be glad to hear from some of our correspondents who are acquainted with the details of this explosion also.

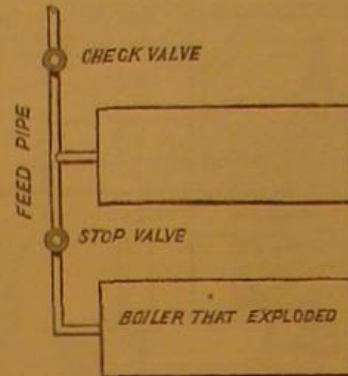
Mr. E. B. Martin, Chief Engineer of the Midland Steam Boiler Inspection and Assurance Company of England, in his last annual report to the company, makes the following statement:

"The experience of the past year confirms the opinion that no form of boiler is free from the danger of explosion, if not well looked after; and that the best means of preventing explosions is to insist upon frequent inspections and careful attendants."

The successful working of these boiler-inspecting companies in England for several years, together with the publicity given to the results of their inspections, have gone far to overthrow the mysterious theories that were always advanced when a boiler exploded. On the occasion of an explosion in England, careful reports are usually made by the engineers of these companies, and the yearly report gives accounts of all disasters of this kind, with brief statements of the causes. But the most effectual deathblow to the mysterious theory is that the boilers under the care of these companies do not explode, showing that boiler explosions can be prevented. We have frequently called attention to this fact, and desire to impress it upon our readers. Experience shows that government inspection, as at present conducted, is of no service in preventing boiler explosions, and that thorough inspection, under the auspices of reliable private companies, is efficacious. Those of our readers who use steam power will do well to consider these statements, and act accordingly. Our readers know that we improve every opportunity to call attention to this matter.

Mr. Martin reports that, during the year 1873, the Midland company had 3,555 boilers under their care, and made 14,377 inspections. The number of explosions reported in England in 1873 was 88, 66 persons being killed and 94 injured. (In this country, as our readers may recollect, there were also 88 explosions, by which 139 persons were killed, and 164 injured.) The particulars of all but four of these explosions were obtained, and Mr. Martin classes them under the following heads:

1. Thirty-six explosions from causes that might have been prevented by inspection, such as weak tubes, bad repair, faulty connections, bad material or construction.
2. Nineteen explosions from causes that could only have been detected by inspection, such as corrosion.
3. Thirty-three explosions from causes that could have



been prevented by attendants, such as overpressure, scale, low water, and careless blowing off.

Compound Engines.

Jonathan Hornblower, who built the Newcomen engines, patented the use of two cylinders, to effect the expansion, in England on the 13th July, 1871, No. 1298. He said that he employed the steam, after its action in the first cylinder, to do work in the second expansively.

Hornblower's engine met with small success. As it used steam at low pressure, it had but a limited expansive power, and the advantages became of no account; rather they became negative on account of the resistance due to the use of two pistons.

But when higher pressure was employed, Woolf did, for the engines of Trevithick, Evans, and others, what Hornblower had done for those of Watt; he applied to them the principle of the double cylinder. As he could make use of high pressure, there was promise of success for the invention, and it did succeed, so that he has given his name to engines having two cylinders.

Woolf's patent was taken out in 1804.

In 1834, Ernst Wolff (a German, we infer from his name) took out a patent (No. 6,600) for an engine described as compound, as now-a-days constructed, which indicates the possibility of modifying existing engines so as to adapt them to the new mode of action.

This patent is very interesting, and it is singular that English authorities hardly refer to it.

It is certain that compound engines with two cylinders and intermediate reservoir, to which the name of Woolf has been given, though they have not the same mode of action, should be called "Woolf engines."

We give the essential part of this patent: "The invention consist of the combination of two or more engines, each complete in all parts, and so disposed that, while the first receives steam at one, two, or more atmospheres of pressure, the next engine is moved by the steam that escapes from the first. In the last engine the steam is condensed in the ordinary way or escapes into the atmosphere. The work supplied by the several engines is applied to the same shaft, or to several combined, or to independent shafts."

"As in steam vessels and other applications, two conjoined engines are generally employed." The present invention is especially adapted for this purpose, as it presents economic advantages; as it reduces the expense of the apparatus without increasing its application.

"It is sometimes useful to have between the cylinders an intermediate reservoir to regulate the pressure; this may be placed with advantage at the base of the chimney, so as to maintain or raise the temperature and the pressure of the steam in its passage from one cylinder to the other. Indeed, if necessary, the heat may be supplied by a special fire-box."

"It is often necessary to employ a special pipe with a stop-cock to admit the steam from the boiler to an intermediate reservoir in order to give the machine the power of starting any crank. This direct introduction may be employed to increase for a time the power of the engine."

The writer then explains a method of modifying old engines by adding to a high pressure engine a low pressure cylinder; or, in the case of a marine engine, by substituting for one of the low pressure cylinders a high pressure cylinder.

The drawing annexed to the patent shows a pair of marine beam engines.

The compound marine Woolf engine is at present built in many English ships; though some maintain the Woolf type, with superposed cylinders. In France, all engines are of the first kind.

The Transfer of Varnish Negative Films.

For the purpose of peeling off the film from a varnished negative, I prepare in the first place a mixture composed of the undermentioned materials, namely:

Gelatin.....	60 parts
Acetic acid.....	90 "
Water.....	180 "
Ordinary soap.....	1 part

The above ingredients are mixed together, and then poured rapidly over the varnished film in such a way that every part of the surface is uniformly covered, and no portion treated a second time. The superfluous liquid is poured off and thrown away, for it cannot be employed again for the same purpose.

The film is then allowed to dry, and, when perfectly desiccated, some thick normal collodion is poured over it, to which a little castor oil has been added. This leather collodion, having dried uniformly over the negative film, will be found capable of being peeled off, bringing the collodion image with it.

Should the film, when separated from the glass, lack thickness, and it is desired to secure the *cliché* film of a stouter and more compact nature, the same may be treated with a solution of gelatin (without soap) after the leather collodion has been applied, and even with a second application of collodion if such is deemed necessary.

By employing this plan of proceeding, I may mention that I have stripped upwards of a hundred negative films from glass, all of which had been previously varnished, without having had a single mishap. They were from plates prepared by the ordinary wet collodion process; but whether dry plates (and especially those which have been prepared with a substratum of albumen) could be so readily treated, is a matter of which I have no experience at present.—*Koch Reigh, in Photographisches Archiv.*

SCIENTIFIC AND PRACTICAL INFORMATION.

TEMPERANCE PROBLEMS.

The French Temperance Society offers prizes for the solution of the following questions: First. To determine by the aid of chemical analysis, repeated on a large number of specimens taken at random, the analogies and differences which exist between spirit of wine and the alcohols of all other derivations supplied to commerce. Prize, two hundred dollars. Second. Is it possible to distinguish positively, by the examination of chemical or physical properties, the wines and natural brandies (that is, those coming from fermentation of grape juice or the distillation of fermented product) from the wines and brandies fabricated or mixed with alcohols of other derivation? Prize, one hundred dollars. Third. To determine, by the aid of clinical observation or experiment, the differences which, in respect to their effects upon the system, in similar alcoholic proportion, exist between the natural wines and brandies and the liquors made from alcohol of industrial production. Prize, two hundred dollars.

Papers may be in either French or Latin, and must be submitted before December 1, 1874, to the Secretary of the Society, at Paris.

THE MAXIMUM DENSITY OF WATER.

Recent experiments of Professor Mack at the University of Prague have fixed $+3.945^{\circ}\text{C}$ ($=+38.901^{\circ}\text{Fah.}$) as the temperature at which water arrives at its maximum density. In conducting these researches, Rumford's method of substituting a thermo-electric series for the mercury thermometer was followed, by which means much fuller and more accurate results were obtained.

FATHER SECCHI ON RUTHERFORD'S RULED PLATES.

Father Secchi communicates to *Les Mondes* the result of his observations of the solar protuberances during the latter part of the past year. He says that the coexistence of spots with eruptions on the edges of the sun has been verified 89 times. The reversed lines which have been observed during the eruptions are B, C, D, D', b of magnesium, and a large number of the iron bands, besides the ordinary lines of hydrogen and the line D. A spiral movement (quite rare) in the spots has been noted several times in the protuberances, and a rotation around a horizontal axis has also been frequently remarked.

Father Secchi has recently experimented upon the plates of glass ruled by Mr. Rutherford of this city. He states that, ruled with 60,000 lines to the inch, the effect of the plate in the spectroscopy was astonishing. The protuberances were obtained even with spectra of the first order, and were observed much more clearly with spectra of the second order. It was found necessary to add a red glass in order to absorb the violet rays. The details of the protuberances were very clear, and the filaments delicately defined. In spectra of the third and fourth orders, the line, C, of one fell very near F of the other, and thus protuberances of two different colors, red and white, in the field of the telescope were obtained.

With these plates, it is added, the first spectrum has a dispersion equal to that of two prisms of ordinary flint glass; the second to that of four prisms, and so on; but the advantage soon disappears, owing to the mixing together of the spectral colors and the enfeeblement of the light.

HYDROGENATED PALLADIUM.

MM. Troost and Hautefeuille have determined that palladium forms with hydrogen a definite combination, of which the formula is Pa_2H . This, once formed, acts upon hydrogen gas in the same manner as platinum, and in quantity variable with its physical condition. Potassium and sodium also form with hydrogen combinations, K_2H , Na_2H ($\text{N}=23$, $\text{K}=39$); and the latter with hydrogenated platinum produces a series parallel to that of which Wurtz finds the first term in what he calls hydride of copper, or Cu_2H .

NEW MODE OF DETERMINING TANNIN IN ASTRINGENT MATERIALS.

This process, communicated to *Les Mondes* by M. Terrell, is founded on the absorption of oxygen by tannin in the presence of alkaline liquors in a special apparatus. The latter consists of a glass tube, 0.6 inches in diameter and 7.8 cubic inches in capacity, suitably graduated. The upper portion is closed, and below is a glass cock; between which and the zero of graduation is a space of 1.2 cubic inches, in which the alkaline liquor is introduced. The solution contains one third, by weight, of caustic potash, and it is known that 1.5 grains of tannin absorb 1.2 cubic inches of oxygen.

The astringent material is ground as finely as possible, and from 1.5 to 3 grains are enveloped in unsized paper. The alkaline solution is introduced at the tube by plunging the latter into the liquid and opening the cock below. The material is then dropped in and the apparatus carefully shaken, care being taken to note the temperature and pressure of the atmosphere, and also not to warm the air within the tube by the hands. The liquid becomes immediately of a yellowish brown, and the agitation is frequently renewed. The extremity of the tube is plunged in water, and the cock opened. An absorption follows, but the cock is immediately closed, as soon as the colored liquid appears to descend through the lower opening. After twenty-four hours, during which the above operation is frequently repeated, the entire apparatus is plunged in water to bring it to the surrounding temperature, and the cock is opened under the surface to detect the final absorption. When this is complete, the cock is closed, and from the graduation of the tube may be read the quantity of oxygen absorbed; and knowing that 1.5 grains of tannin absorb 1.2 cubic inches of oxygen, it is then

easy to determine the richness, in tannin, of the material analyzed.

PHOSPHORUS STEEL.

M. Euverte, director of the Terre Noire foundry in France, communicates to the *Société des Ingénieurs Civils* some important results of his researches, carried on over the past two years, with a view to determine to what point it is possible to introduce phosphorus in steels. Phosphorous materials having been placed in sufficiently large proportion in a Siemens-Martin furnace, and the operation having been terminated with ferro-manganese with 42 per cent of manganese, or with spiegeleisen, it was found that the metal obtained was of good quality and malleable. It was established that the cast steels can contain a certain proportion of phosphorus without losing their malleability or their valuable qualities of resistance. A steel containing 0.003 of phosphorus and 0.0015 of carbon may be utilized for making an excellent rail.

The Sewers of Paris.

In Paris, says *Chambers' Journal*, it is quite a common thing to make a trip underground, at any rate from the Place du Chatelet to the Place de la Madeleine. The old guide books are full of the wonders of the catacombs; now-a-days, instead of going into these great gypsum quarries, visitors are allowed to traverse the *égout Rivoli*, and there are always plenty of claimants for the tickets of admission. You sit in a sort of open railway truck, with a lamp at each corner, pushed rapidly on by four men in white blouses; there is no more smell than there is in the streets above—not so much, except just when we are passing (our guide tells us) under the barracks of the Louvre. Under the Place de la Concorde the land journey comes to an end; at this point the Rivoli sewer falls into the main; and so, instead of our cars, we have to take to boats; but the voyage is a short one, and we soon get to the winding iron staircase, by which we emerge among the astonished idlers of the Place de la Madeleine.

This, of course, is the show sewer—widest, loftiest, cleanest of all—just like a canal, with broad, neat footpaths. Between this and the house drain, there are ten kinds of sewers, getting gradually smaller and smaller, but all, except two, having footpath enough for the scavengers to walk along. Beside noting the telegraph lines, wrapped in their gutta percha covering, we see a long pipe, too narrow for water, too wide for gas, inside which every now and then we hear a whiz like the rush of an arrow. This is the pneumatic tube, along which cases full of little parcels are driven by atmospheric pressure. The only other things to be seen (for the journey is rather a dull one) are the shafts, called *regards*, by which the workmen can escape if the sewer gets flooded by heavy rains. As a means of escape, every *regard* has its iron ladder leading to the man hole in the street.

What struck me most was the vaulting of the main sewer. It shone as if covered with chunam, and was so smooth that it carried the voice to a vast distance. There is a whole system of telegraphing which depends on the echo along this vaulting.

How is the main sewer cleaned? There are big barges nearly as wide as the water, each furnished in front with an iron plate fitting almost exactly into the subterranean canal. These barges have each three holes, as big as an octavo volume, cut in their lower edge. The barges are dragged up stream, and the solid matter is all forced through the three holes, leaving the channel completely free. Each of these barges is calculated to do the work of a hundred men. Where the sewer is too narrow for barges, rails are laid along the footpaths, and trucks furnished with some sort of plates do the work just as well. So swift is the stream that one never sees a bit of anything floating along; whatever there is, is swept under the surface. But lower a sluice gate, and stop the current, and within a short time the water will be covered with straw, with dead cats and dogs, with feathers enough to stuff a score of beds, etc. Corks, too, of which there are great numbers, are caught by a grating before they can escape into the Seine, and, after being pared down, are sold to the perfumers. "Wine merchants and scent merchants are both good trades in Paris," said our guide, as he explained to us the future use of the corks. If you can get leave to climb up the ladder of one of the *regards*, you will be able to look into one of the narrower sewers without footpath, which pours its unsavory cataract into the main drain.

Sewers of this type have to be kept clean "by hand." Somehow, nearly all the 630 men employed in the Paris sewers are Gascons "from the sunny South." It is a hard life, and men can rarely stand it more than fifteen years. They get pains in their joints, general weakness—what they call *plomb* (as if their limbs were of lead). "Sewer rats" the poor fellows are called; and their only comfort is that they have waterproof boots, a new pair every six months. The old boots are not thrown away; they are stowed on one of the quays; and when a good many hundred pair are collected, there is a grand auction, and they are sold in lots of a hundred for from 120 to 125 francs. It is almost always the same man who buys them, and he cuts off the feet and sends them to the bogs up the Oise, where they are used by the peat cutters; the legs are subjected to a process which turns them into fine, soft leather. Many a fashionable lady's boots are made of the leather which has been first used by a Gascon scavenger. Of real sewer rats there are comparatively few. They can't work through the hard cement (chunam) with which the new sewers are cased. They keep to the old stone-roofed drains; and of course they still abound in the markets and at the abattoirs and knackers' yards. There are many stories of their fierceness, but of these I need not at present say anything.

During the winter of 1870 the Parisians were dreadfully frightened lest the Prussians should get into the drains, and suddenly show themselves in the middle of the city, as Camillus did in Veli. So they actually walled up the main sewer in two or three places, leaving just space enough for one man to squeeze through. These walls were pulled down as soon as the armistice was signed, and were not rebuilt during the commune, though the Versailles troops, holding Asnières, might have marched in a dozen abreast if they had cared to do so. After the fall of the commune the cry was "search the sewers;" and stories got into the papers of bands of desperadoes holding out below, and selling their lives even more dearly than their friends had done above ground. What was there not in Paris papers at that time? Who is to know the truth? The officials say that not a single human being was found down there. Rifles were found in plenty, not only those dropped down street traps by runaway communists, but those hidden by quiet citizens, lest the possession of them should bring about a domiciliary visit from the commune. But more numerous still were the *képis*, red sashes, and scarfs, cartridge boxes, etc., of which there was quite a heap under each man hole in the quarter of the barricades. As the fellows ran off they got rid of all their badges, hoping thus to escape the savage fury of the Versailles troops.

Blue Sky and White Clouds.

The ethereal blue color of the sky is due to minute particles of matter which float in the air. Were these particles removed, the appearance of the sky would be dead black. It is a fact in optics that exceedingly fine portions of matter disperse or scatter the blue rays of light, coarser portions scatter red rays, still coarser portions scatter all the rays, making white light. An atmosphere is full of aqueous vapor, the particles of which diffuse white light in all directions. When these particles are enlarged, they become visible in the form of clouds. The vapor particles of the white clouds are supposed to be finer and lighter than those of the dark clouds.

That the diffusion of light in our atmosphere, the blue coloring of the sky and the colors of the clouds, are due to the presence of matter floating in the air, has been conclusively proven by Tyndall. On passing a beam of sunlight through a glass tube, the beam is rendered brilliantly visible by the reflection of light from the dust particles floating in the air contained in the tube. But on removing the dust particles, which is done by filtering the air by cotton wool, or causing the air to pass over a flame, the beam of light is no longer visible in the tube.

Liquid Carbonic Acid.

Cailletet has, by use of an apparatus very similar in principle and construction to that devised by Professor Andrews, of Belfast, succeeded in liquefying carbonic acid, under conditions which enable him to test many of its properties, while still in the liquid state. His apparatus consists of a hydrostatic press, by which mercury can be forced, under a pressure of 900 atmospheres, if necessary, into a cylindrical glass reservoir, terminating in a narrower thick tube. Liquid carbonic acid he finds to be colorless, mobile, and a non-conductor of electricity. It is not decomposed by a powerful induction spark, but the spark has, in the liquid, a very white dazzling appearance. Salt, sulphate of soda, chloride of calcium, sulphur, phosphorus, stearin, and paraffin are quite insoluble in liquid carbonic acid. Iodine is slightly soluble. Liquid carbonic acid is but slightly soluble in water; petroleum, however, dissolves five or six times its bulk. Bisulphide of carbon dissolves sparingly. Ether mixes with it, in all proportions, with great readiness. Liquid fats dissolve in it, but not solid fats. Sodium does not reduce it.

The Fireless Locomotive.

This consists of a locomotive intended for drawing street cars, for tunnel service, etc. The boiler is charged with highly heated water before leaving the station; and from this water steam rises, sufficient to work the engine without using fuel during the trip.

A new fireless locomotive, built at the Grant Locomotive Works, was recently tried at Paterson, N. J. It has four wheels, 36 inches in diameter, and 7x10 inch cylinders. The boiler is 37 inches in diameter and 9 feet 6 inches long, and the whole engine empty weighs 6 tons. On the trial, with the water heated to a temperature equivalent to a pressure of 150 pounds per square inch, the engine ran, with an ordinary loaded horse car, a distance of 7 miles. The track on which the trial was made is an ordinary horse car track, laid on a common road, with very heavy grades for short distances in some portions. The steam pressure after running the distance named was reduced to 40 pounds.

BACTERIA IN DISEASE.—Dr. Hiller, of Winden, has come to the conclusion, after many experiments, that bacteria are incapable of exciting inflammatory action of fever, that they cannot multiply unless in the presence of putrid material, or after death, through the stoppage of the circulation; but when present after death, this is no proof of their existence before that time, but for reasons as given.

How a railroad opens up a new country is demonstrated very remarkably by a comparison of the United States census of 1870 with the territorial census of 1873. This shows that between those years all the counties on the line of the Denver and Rio Grande have either trebled or quadrupled in assessed wealth and population.

IMPROVED GRATE CLEARING ATTACHMENT.

We illustrate herewith a quite simple device, designed to be attached to the ordinary form of fireplace grate, and to supply a ready means for raking or poking the fire. It may also be adapted for stoves to serve as a drop table, and can be constructed with rods and handles, so as to be operated by hand if so desired.

In Fig. 1 the invention is shown in perspective, and Fig. 2 is a sectional diagram. A are a number of fingers which enter between the interstices of the lower bars of the grate. These fingers are all cast upon or attached to a curved bar, B, the journals of which pivot in projections on the grate at C. Pivoted to lugs on the bar, B, are links, D, one on each side, which connect with short levers or treadles, E. The latter are readily moved by the foot, thus raising the fingers (which ordinarily fall in the position shown in the engraving) and causing them to enter among and agitate the coals.

The apparatus obviates the necessity of the poker, and serves to rake the entire fire at once, thus accomplishing its object expeditiously and in a thorough and efficient manner.

For further particulars address Mr. A. Tiensch, Memphis, Tenn.

Intermittent Lameness.

The Doctor remarks: "A very curious thing has been described by Dr. Sabourin, namely, that lameness may ensue from obliteration of arteries. Horse lameness is often so obscure that any light proves desirable. It is not, however, confined to the horse, but extends also to man. The cause, as observed, is owing to obliteration of the aorta and iliac arteries. Commonly, in previous good health, the subject begins to limp, in one or two limbs to tremble, and finally to fall. Rest is commonly productive of relief. MM. Bouley and Goubaux long ago pointed out the nature of the affection in horses, while M. Charcot first pointed out its occurrence, comparatively rare, in man. Arteritis has been supposed to be the occasion in horses, owing to the violent efforts they have to make, and embolism in men. In any case the occurrence affords a favorable illustration of the advantages of the study of comparative pathology."

THE SHAKER SASH BALANCE.

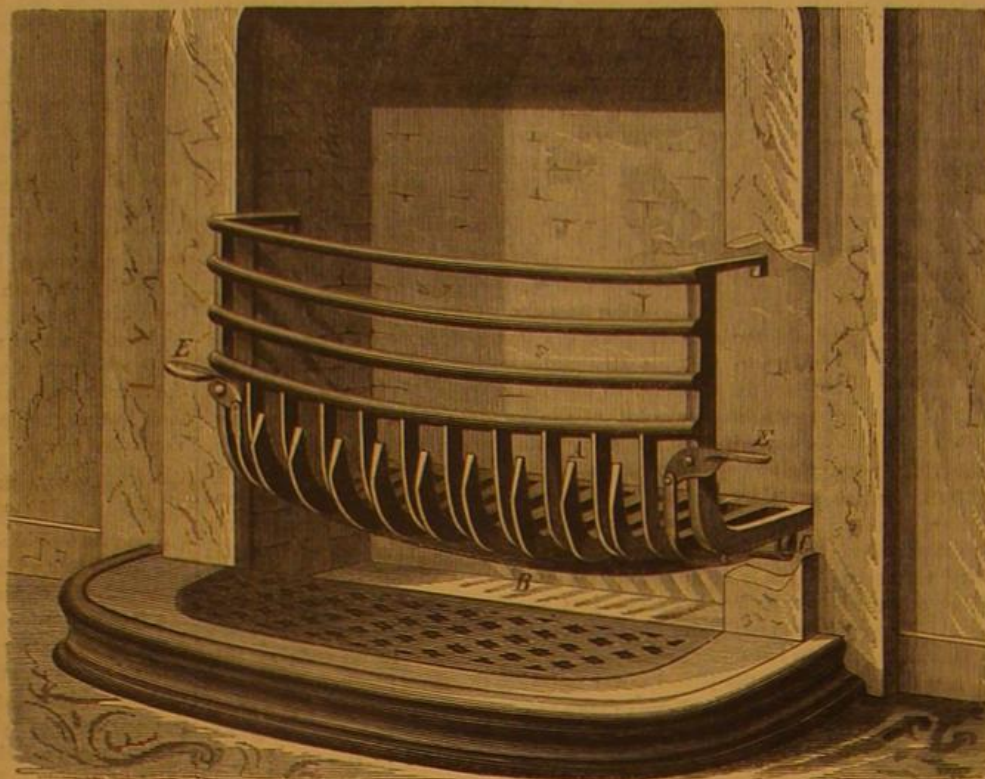
Our illustration represents a very simple and ingenious de-



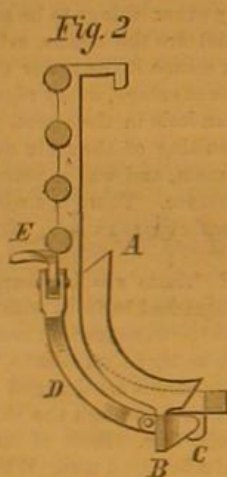
vice, which does away with the use of the usual cords and pulleys on windows, by making one sash balance the other. It is cheap, readily applied, and will afford all the means for ventilation that side weights do.

A cord, Fig. 1, is attached to the center of the upper sash, by passing it, from beneath, upwards, through a hole bored to fit, and making it fast by a wedge driven in from on top, and then over a pulley adjusted as represented in the upper part of the window frame. The end extends down through

the apparatus, A, which, shown in detail in Fig. 2, forms the essential portion of the device. It consists simply in two eccentrics, B, secured in a suitably ornamented metal case, and fastened to the upper part of the lower sash. It needs no explanation to show that one sash counterpoises the other, so that by a mere touch of the finger each may be raised or lowered to any given distance. If, however, it be desired to

**TIENSCH'S IMPROVED GRATE CLEARING ATTACHMENT.**

move but one, and that the top sash, the operation is readily accomplished by drawing the cord to the right or left, which relieves the grip of the eccentrics. On straightening the line, the latter immediately resume their clasp and hold the sash in any position. To raise the lower sash, it is only necessary to hold the cord firmly and lift the sash with the hand, when it will remain as placed.



The inventor claims it to be specially adapted to churches, halls, theaters, etc., in order to secure ventilation.

Patented by I. J. Russell, of South Union, Ky. For further particulars regarding sale of rights, etc., address the general agent, Mr. W. J. McGown, as above.

The St. Gothard Tunnel.

The length of this immense work will be 14,900 meters, or 9 miles 715 yards. The altitude of the northern entrance, at Goeschenen, will be 3,703 feet above the level of the sea, and that of the southern entrance, 3,850 feet. The highest point in the interior of the tunnel will be 3,873 feet above the sea level, which will be reached by a rise from the Goeschenen end of 7 per 1,000; from this point there will be a descent towards Airolo of 1 per 1,000. The rock to be traversed is for the most part mica gneiss and mica schist. Great improvements are stated to have been introduced into the perforating machinery employed, but thus far the progress of the works can scarcely be said to have been very rapid. The length of tunnel actually pierced is, however, a little more than 2,330 feet on each side, and an advance of 10 feet is daily made in each gallery at Goeschenen; the rock is perfectly solid, requiring neither planking nor arching; but at Airolo it is necessary to line the gallery and arch the roof with masonry.

Scientific Men Scientifically Studied.

Mr. Francis Galton, well known for his researches in regard to hereditary mental powers, has been pursuing these studies. He made personal inquiries of one hundred and eighty leading scientific men of the day, and on their replies based his conclusions. Most important was the almost persistent combination of remarkable energy of body with remarkable energy of mind. Size of head was considered and, as a general rule, was larger than of ordinary gentlemen. Still, remarkably many scientific men had small heads, and the small heads were remarkable for activity. Health was a marked feature. Independence of spirit and tenacity of purpose were also most marked characteristics of men of science, and notably a large proportion were men of business, as principals of large commercial or mercantile concerns. The great incentive to science seemed, to the author, to be innate taste, and in character he regarded the scientific mind as anti-feminine. As to hereditary qualities, that of health seemed most essentially due to parentage; and on the parental side the influence of qualities was apparently on the father's side, in the proportion of 128 to 45 on the mother's side. A combination of all essential qualities seemed necessary to the production of a man of mark, and that the laws of chances and alternatives came in to give actuality to results. In re-

gard to education, the general condition seemed to be that they were not tied down in their studies to particular subjects, but were given to the investigation of many.—*Medical and Surgical Reporter.*

MUNSON'S IMPROVED LIGHTNING ROD.

Electricity, as is well known, can be best dissipated by conductors which present a large number of sharp edges; and if such angles extend throughout the length of the conductor, the current is received at any point, as readily as at the pointed apex. It is with this principle in view that the improved form of lightning rod herewith illustrated has been invented; and in addition to the advantages thus secured, it presents a variety of others, rendering it, it is claimed, a thorough and efficient protection to any edifice upon which it may be placed.

Our engravings represent two of the modes of construction out of the several which the inventor has adopted and successfully used. As shown in Fig. 1, the rod is composed of eight copper wires, A, and two large galvanized iron wires, B, laid up into a single rope. Fig. 3 is a section of the same. In Figs. 2 and 4, the cable is formed of eighteen copper wires, A, and one large core of galvanized iron, B, twisted together as before. The copper wires, it will be noticed, are square in section, and are drawn perfectly straight, so that when they are twisted up in the rod an innumerable number of sharp edges is presented. The iron wire is galvanized, not only to prevent corrosion but to increase its conducting power. The presence of two dissimilar metals in the rod also results in constant magnetic action, whereby its effectiveness and durability is enhanced, while its electric condition is preserved.

There are no joints in the invention to become disconnected and thus offer points of escape for the current. The rod is perfectly flexible, and can be bent to any angle or curve, while it cannot be broken from its fastening by the effect of wind or jars. Its continuity, therefore, is a point of considerable importance, which, taken in connection with the conducting capacity of the metals used, the spiral form, and the other advantages already alluded to, combines to render the device theoretically one of much value. As regards its practical workings, the inventor submits a number of testimonials from insurance companies, architects, and several eminent scientific gentlemen, all of whom speak very favorably of the merits of the rod.

The rod is covered by four patents. For further particu-



lars address Mr. David Munson, sole manufacturer and patentee, 220 East Washington street, Indianapolis, Ind.

HOLLAND, with only 3,500,000 inhabitants, holds \$160,000,000 of American securities. This speaks well for Dutch prudence and economy.

In our description of the water clock on the Pincian Hill at Rome, instead of "every second minute," read "every second."

MODERN AMERICAN LIGHTHOUSES.

We publish herewith views of two lighthouses recently erected on the Great Lakes. The first, that at Cleveland, Ohio, is situated on the shore of Lake Erie, and is chiefly noticeable for the substantial elegance of its architecture; the second is on Spectacle reef, in Lake Huron, and is in many respects a remarkable engineering work. We are indebted to *Engineering* for the engravings, and we extract the following description of the Lake Huron structure from a report of the Lighthouse Board:

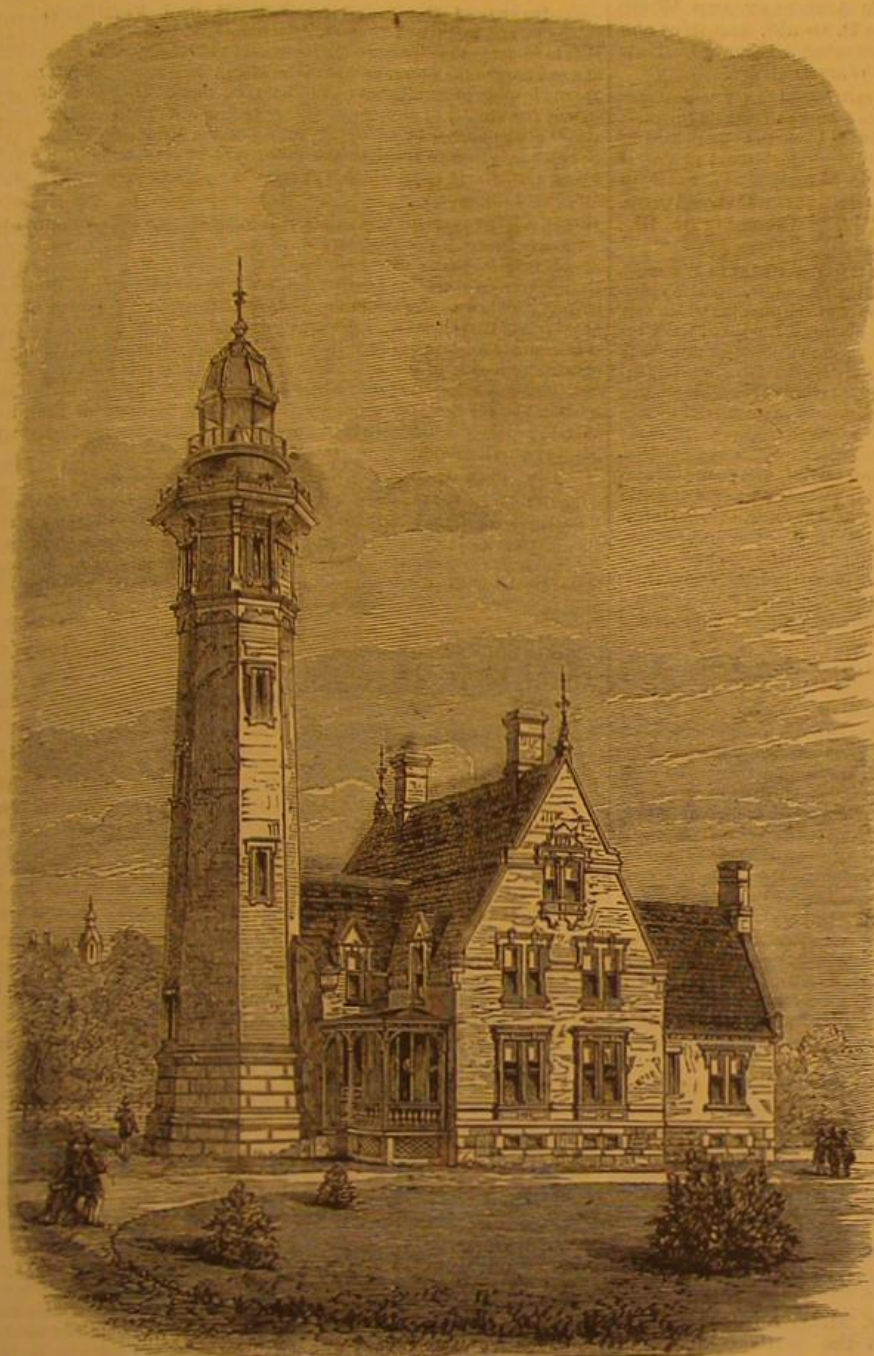
A crib, of 92 feet square, with a central opening of 48 feet square to receive the cofferdam which was to form the pier of protection, as well as a landing place for materials during the building of the lighthouse, was in 1873 constructed at Scammon's Harbor. The original intention was to put the crib in position in four sections, but upon further

light, and by the 20th, quarters for the workmen had been completed upon it, which were at once occupied. By means of a submarine diver, the bed rock within the opening of the pier was then cleared off, and the work of constructing the cofferdam was taken in hand. The cofferdam itself consisted of a hollow cylinder 41 feet in diameter, composed of wooden staves, each 4 inches by 6 inches and 15 feet long. The cylinder was braced and trussed internally, and hooped with iron externally, so as to give it the requisite strength. It was put together at the surface of the water, and when complete was lowered into position on the bed rock by means of iron screws. As soon as it rested on the rock (which was quite irregular in contour), each stave was driven down so as to fit as closely as it would admit, and a diver filled all openings between its lower end and the rock with Portland cement. A loosely twisted rope of oakum was then

Paraffin.

At a recent meeting of the Society of Arts, London, Mr. Frederick Field gave the following interesting information:

In pursuing his celebrated researches upon the tar obtained from the red beech, Reichenbach discovered in the ultimate portion of his distillates a white translucent substance, to which he gave the name paraffin (from *parum* and *affinis*), owing to the comparatively slight action exerted upon it by most chemical re-agents. The tar was submitted to repeated fractional distillation, and the portions passing over last were mixed with strong sulphuric acid and violently agitated. After standing in a warm place for some hours, the paraffin floated upon the carbonized residue in the form of a pale colored oil, which, after cooling, solidified, and was pressed between folds of bibulous paper. By frequent crystallizations from boiling ether, it was obtained as a brilliantly white body.



LIGHTHOUSE AT CLEVELAND, OHIO.



LIGHTHOUSE ON SPECTACLE REEF, LAKE HURON.

consideration it was decided to attempt placing it as a whole upon the reef, which was successfully accomplished.

The depth of water on the reef at the points to be occupied by the four corners of the pier of protection was found to be as follows: At northeast corner, 10 feet 6 inches; at northwest corner, 13 feet; at southwest corner, 14 feet 6 inches; and at southeast corner, 9 feet 6 inches: the position to be occupied by the pier of protection having been so chosen that the sides would correspond to the cardinal points of the compass.

On the evening of the 18th of July, 1871, everything being in readiness, at 8 P. M., the tugs *Champion* (screw propeller) and *Magnet* (tow wheel) took hold of the immense crib and started to tow it to the reef, 16 miles distant, followed by the *Warrington* (screw propeller), having in tow the schooner *Belle* (the two having on board a working force of 140 men), the tug *Stranger* (screw propeller) with barges *Ritchie* and *Emerald*, and the tug *Hand* with two scows of the lighthouse establishment. The barge *Table Rock*, with fifty cords of stone on board, was left in reserve at the harbor. The construction scow, with tools, etc., on board, was towed with the crib. At 2 A. M., next morning, six hours after starting, the fleet hove to off the reef, awaiting daylight and the abatement of the wind, which had again freshened up. At 6½ A. M., it having moderated, the pier, with considerable difficulty, was placed in position; and after being secured to the temporary pier and the moorings previously set for the purpose, all hands went to work throwing the ballast stone into the compartments, and by 4 P. M., succeeded in getting into it about 200 cords (1,200 tons). By this time the wind was blowing freshly and the sea running so high as to make it necessary to stop work for the time; but early next morning all the reserve stone was put into the compartments.

By September 12, the pier had been built up to its full

pressed close down into the exterior angle between the cofferdam and rock, and outside of this a larger rope made of hay. The pumping machinery having meanwhile been placed in readiness, the cofferdam was pumped dry, and on the same day (14th October) a force of stone-cutters descended to the bottom and commenced the work of leveling off the bed rock, and preparing it to receive the first course of masonry. The bed rock was found to consist of dolomitic limestone (confirming the previous examinations), highest on the western side toward the deepest water, and sloping gradually toward the eastern. In order to make a level bed for the first course of masonry, it was necessary to cut down about 2 feet on the highest side, involving a large amount of hard labor, rendered more difficult by the water forcing its way up through seams in the rock. But the work was finally accomplished, the bed being as carefully cut and levelled as any of the courses of masonry. The first course of masonry was then set, completing it on the 27th of October.

The degree of success of this novel cofferdam may be inferred from the fact that, although prepared with pumps of an aggregate capacity of 5,000 gallons per minute, not more than a capacity of 700 gallons was used, except when emptying the cofferdam, and then only to expedite the work. Once emptied, a small portion of this capacity was ample to keep the cofferdam free from water; and this at a depth of 12 feet of water, on rock, at a distance of nearly 11 miles from the nearest land. Every person connected with the work may well feel a just pride in its success.

A BUILDING in San Francisco that has 500 rooms is to have a clock with 500 dials, a dial for each room. The dials will be operated with compressed air, conducted in pipes all over the building. The clock has been built by the Seth Thomas Clock company, of Thomaston, Conn.

highly plastic and somewhat unctuous. For many years it was regarded as simply a chemical curiosity. It is now annually made, as will presently be shown, by thousands of tons.

Paraffin is a pure hydrocarbon, having no oxygen whatever, and its analysis has given the following percentage composition: Carbon, 85.16; hydrogen, 14.76.

Paraffin, when pure, is perfectly colorless and translucent; after slightly warming, it becomes highly plastic, and can be easily molded with the greatest ease. Hence, it differs in some respects essentially from spermaceti, with which it has often been erroneously compared, as well as from stearic acid and other bodies used for the manufacture of candles.

From this plasticity, in warm rooms, paraffin candles (if not of a very high melting point) are liable to bend; while on the other hand, those made of sperm or stearic acid, although of a lower melting point, remain erect. Of course, as has been observed, this very much depends upon the fusibility of the substance, and the harder descriptions of paraffin are always selected for candles which have to be subjected to much heat.

Liquid paraffin is very mobile, and can be filtered through paper almost as readily as water itself.

It is scarcely acted upon, even by fuming sulphuric acid, unless at very high temperatures, so that it can be purified by this means from many other organic substances with which it may have been associated, they being immediately charred by contact with sulphuric acid.

When submitted for a length of time to the action of chlorine or bromine, chlorinated or brominated compounds are formed with disengagement of torrents of hydrochloric or hydrobromic acids.

Mr. MacIvor, who has devoted many years to the study of paraffin, says that, after this body is acted upon by chlorine, it first becomes a gummy looking solid, and afterwards a liquid c

orless and transparent; and as the passage of the chlorine is continued, a hard brittle resin is the result. The substance consists of—

Carbon.....	29.55
Chlorine.....	66.82
Hydrogen.....	3.39
	99.76

This gentleman has also remarked that the paraffins having the highest melting point are those which are most easily acted upon by the gas.

Iodine dissolves in paraffin, imparting to it a beautiful violet color, which becomes brown as the paraffin solidifies; but the action of this element upon the hydrocarbon is very feeble, no apparent decomposition taking place after prolonged heating for many hours.

By the action of strong nitric or sulphuric acids, M. Campion discovered a new body, which he calls paraffinic acid, and describes it as a bright, transparent liquid, of a very inflammable nature.

Strong nitric acid yields a series of interesting compounds, lately studied by Schorlemmer and others.

Mr. Fordred informed me some years ago that, when paraffin is acted upon by sulphuric acid to which a few crystals of permanganate of potash have been previously added, the action is so violent that light and heat are involved, and even at times accompanied by explosion. The best way of trying the experiment is to heat up the acid and permanganate in a tube, and drop a small piece of paraffin in the warm liquid. When they are all three placed together in the tube and heated up, the action is not nearly so violent. Success does not always attend the experiment, but it can be tried. The decomposition convinces us that the word paraffin (little affinity) is slightly a misnomer.

Paraffin is insoluble in water, very sparingly soluble in alcohol, even when boiling, more so in ether, exceedingly in naphtha, sulphide of carbon and aniline.

When heated with sulphur at a moderately high temperature, it is decomposed, carbon separates, and abundance of sulphuretted hydrogen is evolved. This fact may be of interest to chemists, as affording a ready source of this indispensable reagent in the laboratory. The two substances, the paraffin being in large excess, are heated together in a flask, when a steady and copious flow of the gas is obtained, and the characteristic action of the gas upon lead salts will be seen by the experiment.

With the regard to the beautiful translucency of paraffin, which, in spite of certain drawbacks, has made this body such an unusual favorite as a means of light, Mr. MacIvor informs me that, if, when melted, it is cooled very gradually and subjected to a slight and steady pressure, it becomes actually transparent, like ice, but that a blow, or even a scratch, will alter its molecular structure, and cause it to re-assume its normal appearance. As this change is also produced upon re-melting it, however cautiously, that triumph of manufacture in this department of industry, namely, making a transparent candle, is yet in the distance.

Mr. Gellatly has shown that the specific gravity rises with the melting point of paraffin. Thus paraffin melting at about 60° Fah. has only a specific gravity of 0.823; at 128° Fah., which may be considered a very good average (rather high, perhaps), it has a specific gravity of 0.911; and a specimen of an extraordinarily high melting point (176° Fah.) was as high as 0.940, more than 10 per cent above that at 90° Fah.

Paraffin is obtained in large quantities by distillation from oil shales.

To Render Glass Opaque or Frosted.

According to *Dingler's Journal*, a sheet of ordinary glass, whether patent plate or crown does not matter, is cleaned; and if only portions of it are to be frosted, those are left bare, while the others are protected by mechanical means in any simple manner. Some fluor spar is rubbed to a fine powder and mixed with concentrated sulphuric acid, so as to make a thin paste, and this is then rubbed by means of a piece of lead upon those parts of the glass required to be rendered opaque. A fine frosted outline or design may thus be produced upon a sheet of smooth transparent glass. To finish the operation, the glass is gently heated in an iron vessel covered with a funnel passing up the chimney, to get rid of the noxious fumes that are given off; on cooling, the plate is washed with a dilute solution of soda or potash, to remove any acid yet remaining, and is then rinsed in water. Focusing glasses for the photo camera, and development glasses for pigment printing, can be prepared in this way at very little expense.

Decline of Medical Study in France.

The *Union Medicale* says that in France the number of medical students, as well as that of practitioners, is on the decline, the medical recruitment, both in civil and military life, becoming more and more difficult. Medical studies have now become so long and laborious (the physical and chemical sciences being now far more than mere auxiliaries, and forming an important part in the preparation for examinations) that the student, after his laborious and costly career, finds, on getting into practice, that he has no effective protection from the encroachment of charlatans and parasites.

OIL and repair the harness. Unbuckle all the parts and wash clean with soft water, soap and a brush. A little turpentine or benzine will take off any gumy substance which the soap fails to remove. Then warm the leather, and, as soon as dry on the surface, apply the oil with a paint brush or a swab. Neatfoot oil is the best. Hang up the harness in a warm place to dry, but do not let it burn.

Railroads in Europe and America in 1873.

	Railroads, Miles.	Population.	Sq. Miles.
United States.....	71,565	40,232,000	2,492,316
Germany.....	12,207	40,111,265	212,091
Austria.....	5,865	35,943,592	227,234
France.....	10,333	36,469,875	201,900
Russia in Europe.....	7,044	71,207,794	1,992,574
Great Britain, 1872.....	15,814	31,817,108	120,769
Belgium.....	1,301	4,839,094	11,412
Netherlands.....	886	3,858,055	13,464
Switzerland.....	820	2,669,095	15,233
Italy.....	3,667	26,273,776	107,961
Denmark.....	420	1,784,741	14,453
Spain.....	3,401	16,301,850	182,758
Portugal.....	453	3,987,867	36,510
Sweden and Norway.....	1,049	5,860,122	188,771
Greece.....	109	1,332,508	19,941

NEW BOOKS AND PUBLICATIONS.

THE CARPENTER'S AND BUILDER'S ASSISTANT AND WOOD WORKER'S GUIDE. By Lucius D. Gould, Architect and Practical Builder. Fully Illustrated. Price \$3. New York: A. J. Bicknell & Co., 27 Warren street.

This well gotten-up volume will be practically useful to any carpenter or builder who will read it. It is not so elaborate a work as Tredgold (to whom Mr. Gould makes his acknowledgments), but is likely to be more used by mechanics and workmen than that complete and valuable, but somewhat complicated manual. Mr. Gould's work will well repay attentive perusal.

ROPP'S READY RECKONER AND COMMERCIAL CALCULATOR. By Christian Ropp, Jr. Price \$1.00. Bloomington, Ill.: Published by the Author.

Mr. Ropp is a practical farmer, and hence is well posted as to how much mathematics farmers need in the routine of their business. He also appreciates the value of time, and doubtless is aware of the puzzling which very frequently takes place over long sums in obstinate fractions, when the farm accounts are made up. Hence, he proceeds in a practical manner to make a rough road smooth, and produces the work before us, a handy little volume in pocket-book shape in which is condensed an immense amount of useful information, in the shape of short cuts through calculations which ordinarily bristle with a formidable array of perplexing figures. There are grain tables, showing the corresponding prices of bushels and hundred-weights, and time, interest, wages, and lumber tables. The book also contains clear explanations, of contractions in the various processes of arithmetic, of measures of all sorts and kinds, of bookkeeping, and, in fact, so much, and in so small a space, that we despair of enumerating all, and leave the reader to the pleasure of discovering for himself when he buys the book. There are several blank pages to serve for memoranda, a pocket for papers, and a silicate slate for rough notes. Altogether, it is a very useful manual, and one which must be a great assistance both to the farmer and the business man.

BABBITT'S HEALTH GUIDE. Price \$1. New York: Published by E. D. Babbitt, D. M., 437 Fourth Avenue.

A philosophy of cure, founded on the idea that healing elements are potent in proportion as they are subtle and refined, and weak in proportion as they are gross; that sunlight, electricity, and especially the still finer life forces, being subtle next to spirit itself, are the most potent to heal, while mineral substances, being from the coarsest department of Nature, are the weakest and least penetrating. This constitutes the law of power. The law of harmony is stated to be a nicely balanced contrast of elements. Magnetism, or the warm positive principle, and electricity, the cold negative principle, are stated to be the propelling principles of the universe, and these are combined equally to bring about harmony and health. Too much of the cold principle in the human system brings about chills, paralysis, and chronic diseases—too much of the warm principle, fevers and inflammatory diseases. While sunlight, baths, food, clothing, the social relations, etc., are explained and commended, a strong magnetic hand is considered the most potent of all instruments for charging a feeble system with a new life power, and for equalizing ill balanced conditions. Directions are given for the practice of manipulation, and the treatment for one hundred different diseases, without drugs.

THE APPRENTICE, or First Book for Mechanics, Machinists, and Engineers. By Oliver Byrne, Mathematician and Civil, Military, and Mechanical Engineer, etc. New York: A. J. Fisher, 98 Nassau street.

A new edition of a book which is well enough known to the engineering profession, but which presupposes an apprentice of a very advanced mathematical education. The reduction of all the results to units of work is an especially commendable feature in this volume, and its first few chapters are full of practical ideas, clearly expressed; but the profuse employment of the calculus hinders the value of the book in the hands of those for whom it was ostensibly written.

SKIN GRAFTING. By R. J. Levis, M.D., Surgeon to the Pennsylvania Hospital and to the Wills Ophthalmic Hospital.

Dr. Levis has done much valuable service to therapeutic science in studying and utilizing this process, which, together with the now much practised transfusion of blood, opens up the question as to whether the whole corpus may not ultimately be reconstructed.

Inventions Patented in England by Americans.

[Compiled from the Commissioners of Patents' Journal.]

From March 17 to March 23, 1874, inclusive.

BOOK SEWING MACHINE.—H. G. Thompson, Milford, Conn.
CARTIDGE CARRIER.—J. H. Black, Columbia, Pa.
CANTON.—J. H. Redfield, New York city.
CLOTHES' HOOK.—C. G. Cole, Bennington, Vt.
COMPRESSED AIR APPARATUS, ETC.—W. E. Prall, Washington, D. C.
DRESSING STONE.—A. S. Gear, Boston, Mass.
SIGNAL LANTERN.—T. A. Davies, New York city.
TELEGRAPH.—M. Gally, Rochester, N. Y.
TELEGRAPH, ETC.—G. d'Inferville et al., New York city.
THRUST BEARING.—C. Godfrey, Huntington, N. Y.
TREATING HYDROCARBON OILS.—H. A. Chesebrough, New York city.

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 Combined Blind and Sash Fastener.

William O. Pond, Mobile, Ala.—This is a combined fastening for blinds or shutters and for window sashes, consisting of an adjustable fastening bar attached to the blind, a stationary hook in the casing, and a hinged hook attached to the sash. As the sash is lowered, the hook catches into the stationary hook automatically, and securely fastens the sash down.

Improved Combined Car Starter and Brake.

William T. Beckman, Petersburg, Ill.—This invention, which is designed more especially for application to street cars, has for its object to utilize the force expended in braking the cars, for the purpose of storing power to be subsequently used as an aid to propulsion. To this end a friction clutch, a chain pulley, and ratchet mechanism are employed, and a spring, these elements or devices being so combined and attached to the axle, wheel, and draft bar, that whenever the brake mechanism is brought into action the spring will be compressed correspondingly to the force thus expended or necessary to overcome the momentum of the car and reduce its speed, or bring it to rest. The power thus stored is immediately or remotely available in starting or propelling the car.

Improved Combined Seed Drill and Fertilizer.

John F. and Samuel C. Thomas, Adamstown, Md.—This invention consists in bringing the discharge spouts of seed and manure near the ground, and one around the other, so that the seed and manure will be left on the ground in close proximity but not in contact, thus avoiding the destruction of the vitality of any of the seeds; in protecting the reciprocating stirrer of the hopper by an apron; in combining with each endless carrier an angle gate to regulate the feed; and in combining with a seed gate a spring-held spool which will allow the gate to yield to a stone or other hard substance.

Improved Heating Apparatus for Sleighs, Carriages, etc.

Thomas H. Price and Theodore F. Wade, Lafayette, Ind.—The object of this invention is to provide an improved foot-warming attachment for sleighs, carriages, etc. It consists in a metal case containing the burners, which is applied to the sleigh or carriage bottom, and provided with a concave top that forms also the bottom of a box from which heated air is discharged upward through its perforated top. Said perforated top is practically a part of the sleigh bottom. The invention also includes a heat-conducting bar arranged beneath the concave bottom of the air heating box for the purpose of equalizing the distribution of heat, and thereby securing a better effect with the consumption of a given quantity of oil or burning fluid.

Improved Bracket Insulator for Telegraph Wires.

Charles L. Le Baron, Pensacola, Fla.—The insulator is preferably rectangular in form, made of glass or other suitable non-conducting material, and has a closed slot to adapt it to be hung on a spike, and an open slot, at right angles to the closed slot, to receive the line wire. The wire is put in the slot before the insulator is hung on the spike, and the wires may, in many cases, be dispensed with.

Improved Telegraph Wire Insulator.

Charles L. Le Baron, Pensacola, Fla.—The insulator is made of glass, circular in form, and has a circumferential groove to receive the tie wire that supports the line wire, and end cavities to increase the distance electrically between the conducting wire and spike, which latter passes through the insulator longitudinally.

Improved Surface Planer.

William C. Margedant, Hamilton, O.—This invention consists of the combination in surface-planing machines with a single rotary tool, of two tables, a single piece subjacent, and an upper one formed in two sections the whole adjustable together vertically, and one of the upper independently adjustable, horizontally and vertically, so that the warp may be taken out of one piece of timber on the upper table, while another is being surface planed on the lower table.

Improved Package Envelope.

Charles C. Kelly and Julius Cobb, St. Paul, Minn.—This invention relates to the construction of package envelopes with a view to making them more secure and reliable. It consists in providing the body with end and side flaps, connecting tongues, and slits.

Improved Torch and Fire Kindler.

Robert Wiehle and Christian Feuchter, Ironton, O.—This superior kindler is formed of cornstalks soaked in petroleum, then dried, and next dipped in melted rosin, and finally wrapped in paper, which latter subserves important functions.

Improved Surface Plane.

Charles E. McBeth and William C. Margedant, Hamilton, O.—This invention consists in combining, with a part table and its adjustable slide, a socket holder arranged to slide and be held at various points of adjustment.

Improved Reverberatory Furnace for Roasting Ores.

Ernst Heiligendorfer, Belmont, Nev.—The object of this invention is to so improve the grades of reverberatory and other furnaces that a clear fire, free from smoke and of the highest oxidizing power, is obtained by currents of heated air, which are introduced between and sideways to the gases of combustion, so that the caking of the roasted ore is prevented and the grate applied effectively to roast silver ore, galena, and zinc blende. The invention consists in the introduction of partitions of cast iron plates between and at both sides of the grate, parallel to the grate bars and the fireplace, extending as high as the fuel is accumulated on them.

Improved Boot Stretcher.

John C. Compton and Henry V. Hartz, Cleveland, O.—This invention consists in combining, with a two part grooved toe piece and an inclined in-step piece, a single slide having tongues and incline; and also in combining a hollow toe and heel piece with a pivoted bar susceptible of being locked at several points of adjustment.

Improved Molding Machine.

William C. Margedant, Hamilton, O.—This invention consists in a sticker bed formed of two frames and two sections, both of the latter adjustable horizontally, so that the same machine may be employed as a sticker, molder, shaper, matcher, surface planer, or sand-papiering machine; also in feed roll arbors having hollow sockets, the former being thus allowed to slide in and out of the latter; also in combining yokes, weighted levers, connections, and end slotted levers, to compel the feed rolls always to remain in a horizontal plane at all altitudes to which they may be raised by the subjacent timber; also in combining slotted plates and frames with bolts, to enable the fence to be adjusted in various positions; also in a filling piece sliding under the table sections, and apertured to receive the shaft of a shaper or other head.

Improved Awning.

Charles L. Barnes, New York city.—This invention is an awning composed of concentric or telescopically movable sections, of wood or metal; one or more of which sections is provided with ventilators, which are closed in an automatic manner as the sections are drawn into each other.

Improved Spring Clasp for Stocking Supports.

Edward Halser, San José, Cal.—This invention relates to a new form of clasp for use in attaching stockings to elastic or other straps, whereby they are supported from a waste band or belt.

Improved Wheel Plow.

Isaac B. Green, Gillespie, Ill.—The plows are secured to the rear parts of two bar or double beams, the bars of which are connected and held at the proper distance apart by blocks of the requisite thickness interposed between them, and to which they are secured. The forward ends of the plow beams may be raised and lowered to adjust the plows to work shallower or deeper in the ground. Means are provided to keep said plow beams always in line, and prevent lateral movement of the plows. By loosening wedges the standards and beam may be moved laterally to adjust the plows further apart or closer together, as may be desired, and by moving the plow beams may be detached and exchanged, so as to throw the roll toward or from the plow, as circumstances may require.

Improved Car Brake.

Daniel T. Casement, Painesville, Ohio, at present residing at the Fifth Avenue Hotel, New York city.—The brake shoes are located between the wheels, and are fitted between stays, projecting down to the car body, to rise and fall freely directly above the rails. Spring brake bands are attached to the ends of bars and extend up over the wheels to fastening and adjusting screw and nuts, so as to be pressed on the wheels by said bars at the same time they (the bars) are pressed down. By the screw and nuts the springs can be readily adjusted to bear with the requisite force on the wheels while the shoes bear on the rails, or to cause them to lift and hold the shoes at various heights from the rails.

Improved Fire Escape.

David Demarest, New York city.—This is an improved fire escape, so constructed as to enable the occupants of one house, in case of fire, to escape into the adjoining house, and thus pass into the street. Two curved plates slide upon each other, so that they can be contracted and expanded, and are provided with stops to prevent them from becoming detached. The lower plate is provided with lugs to rest against the window frame. One of the inner lugs is provided with a clamp. The plates are of such a length, and of such a curve, that, when the inner end of one plate is secured in the window of one house, the free end of the other plate may reach and enter the window of the adjacent house. To the under side of the outer end of the first plate is hinged a brace, which swings down and rests against the side of the house. The other plate is pushed out by means of a rod. The plate is secured in the window of the adjacent house by a pin, to rest against the inner side of the window frame. A rope is provided which has a hook with a sharp point attached to each end, which hooks are designed to be passed through the windows of the adjacent houses and be hooked upon the window frames, so that the rope may serve as a hand rope for persons passing from window to window.

Improved Fire Escape.

John Gerken, New York city.—In a block which is provided with a strap hook are formed three holes, through which a rope is passed. The edges of the holes are beveled to prevent cutting the rope. In using the device, one end of the rope is secured in the room from which the person or thing is to be lowered. The device is then passed out of the window, and the person or thing to be lowered is connected with the hook. Some one upon the ground grasps the rope, and, by holding it tightly, allows the block to slide down the said rope, lowering the person or thing slowly and safely, a slight tightening of the rope being sufficient, at any time, to stop the block in its descent.

Improved Pneumatic Telegraph.

Augusto Guattari, Castellamare, Italy.—This invention relates to pneumatic telegraphs, and consists of an improved instrument adapted to serve either as transmitter or receiver, so that by means of two such instruments, placed at different stations and connected by a single air-conducting tube, messages may be transmitted in either direction. This instrument has but one dial, which serves to indicate both the signals sent and received, so that the same instrument is made to answer both purposes, thereby dispensing with one of the instruments required in all other pneumatic telegraphs, and thereby lessening the cost of the apparatus.

Improved Butter Worker.

Andrew Jackson Dibble, Franklin, N. Y.—A stand of triangular form contains the butter-working bowl, said bowl having a hook-like projection at the small end, projecting down into a notch in the top of the stand to hold the bowl from being displaced by a revolving lifter shaft. The latter is arranged under the bowl near the front end, for raising it up thereat to make the requisite descent toward the escape passage for the buttermilk, under which is a spout to conduct the milk away. The butter-working implement consists of a cigar shaped piece of hard wood, with an elongated pivot pin at one end, a handle at the other end, the oblique transverse blades on one side, formed by notches made in the body of the implement, and a longitudinal blade. The pivot pin is entered in a hole at the lower end of the bowl for a fulcrum, and is manipulated at the other end by the operator in all suitable ways for pressing, cutting, spreading, and gathering the butter by the blades.

Improved Cuspadore.

John C. Milligan, South Orange, N. J., and Joseph Musgrove, Woodhaven, N. Y., assignors to Lalance and Grosjean Manufacturing Company, New York city.—This invention is a cuspadore made in two parts, having their necks held tightly but detachably together by a screw or bayonet joint, so that the contents are not spilled in case of the receptacle upsetting.

Improved Car Coupling.

Aaron K. Kline, Readington, N. J.—The head of the coupler falls behind shoulders on the mouth of the drawhead, and is secured to draw the cars, the head being forced up over said shoulders when the cars run together, and the neck of the rod falling down in the narrow space between, as in other couplings of this character. In order to uncouple the cars without going between them, a depressing lever is used for forcing the inner end of the coupler down; for raising the opposite end of the coupler out of the drawhead; also for tilting it up so that it will slide inward and engage its end under a catch, to hold the coupling up level for coupling self-acting. This lever is operated by a double pawl, arranged above it on a cranked rock shaft, which may be turned by the operator standing at the side of the car or on the platform, or a rod may extend from the crank up to the top of the box car.

Improved Dice Box.

Randolph S. Mains, New York city.—This invention relates to the construction of glass dice boxes in which the dice are confined but always visible, so constructed that the glass cover may be readily removed for the purpose of changing the dice or converting the box to other purposes; and it consists of a case having a glass cover and a removable base, which are readily disconnected, and a glass bottom or bed.

Improved Knife and Fork Scourer.

William H. Bowerban, Brooklyn, N. Y.—This invention consists in an improved instrument for scouring and polishing knives and forks, formed by the combination of the lead or other soft metal plate with the head of the handle, made with a flat lower side, an inclined forward end, and a rounded projection upon its top. The scouring and polishing is done with scouring brick by rubbing it upon the knives and forks with the instrument. The flat part is used for scouring and polishing the knives, and the rounded top projection for the forks, its form enabling it to readily enter and follow the curves of the forks, so as to operate upon their entire surface. When thus used, the grains of brick dust embed themselves in the lead plate and are thus held so as to operate more effectively upon the article.

Improved Smelting Furnace.

John H. Latey and John D. Williams, Salt Lake City, Utah Ter.—This invention consists in combining an adjustable draft pipe with the moistening tank, into which the smoke of the smelting furnace is passed, so that the draft pipe may be adjusted to a higher or lower point therein.

Improved Feed Regulator.

Richard J. Williams, Ottumwa, Iowa.—A little below the lower end of a spout is a revolving disk, on a shaft which projects up through the spout, and has a pulley for turning it. Above this disk is a vertically sliding tube, which is connected to a rock lever which communicates with a vertically moving and revolving shaft, so that, as the shaft rises and falls, it will shift the tube down and up, and vary the discharge of the grain from the tube. This shaft extends down into the passage from the hopper to the spout leading to the hopper of the mill stones, and has a spiral disk thereat, which will rise when the stone hopper is full and the grain backs up into the hopper, and, by forcing the sleeve down, shut off the escape from the scouring and drying cylinder, and retain the grain therein until wanted.

Improved Waterproof Joint for Roofing Boards.

John Beasley, Houston, Texas, assignor of one fifth his right to Stewart and Barlett, same place.—The side edges of the boards are rabbeted somewhat dovetailing, so that the two parts lap together, and leave the sides of the boards flush with each other. The lower outer corner of the rabbet of one board is beveled, thus leaving an interior hidden groove which readily conducts off any water that may enter from the outside.

Improved Chair Back.

George F. Perrenet, Rockport, Texas.—This invention is a chair back having an extension and a clamp, having a lug. These are connected by a ball and socket joint, which allows the back free play in all directions laterally. At the upper part of the back is a strip adapted to pass round the arms at the shoulders, and button fast over each quarter, so as to hold the sitter straight up to the chair back, and prevent the stooping forward to which students are so much inclined; and about the middle of the back, upon the inside, is a vertically adjustable pad, to rest the middle of the back against.

Improved Cooking Stove.

Peter J. Ackerman, Paterson, N. J.—This stove has a fire chamber and an oven chamber placed at right angles, the latter higher than the former. A warming chamber is placed in the rear of the first, and under the flue of the second, and is inclosed by the plates.

Improved Upholsterers' Pinchers.

Joseph A. Boller, Chicago, Ill.—This invention is an improved pinchers for stretching webbing upon sofas, chairs, and other articles of furniture, and is so constructed that it may be used without danger of scratching or marring said furniture. The invention consists in the pinchers having the outer sides of their jaws flattened to adapt them to receive pads. The free end of the webbing is doubled and grasped by the pinchers, which are operated with one hand to stretch and hold the webbing while it is being tacked; with the other hand, the pads protecting the work from being marred.

Improved Revenue Guard for Cigar Boxes.

Wilhelm Wohltmann, New York city.—It is proposed to have finely engraved paper strips, to be issued by the Revenue Department with the stamps, and corresponding with them in numbers, one or more of which strips shall be extended across the box from end to end, after it is filled, but before the cover is closed down. The strips are to be pasted on the outside of the ends, so that they will be broken when the cigars are taken out by the retailer or consumer. The word "empty" may be printed on the stamp, and the seller is required to add thereto the date when the box becomes empty. This, it is believed, will effectually prevent manufacturers from committing frauds in the matter of revenue by filling boxes again without putting on a new stamp; because if the paper strips—which need not be broken to show the cigars after opening the box—are ruptured, it will be evidence to the inspectors that the box has been filled again without applying a new stamp, for with each new stamp issued there will be the accompanying paper strips.

Improved Miter Box.

Peter Snuydam, New Brunswick, N. J.—Saw guide holding tubes are mounted on a swinging block, which is under the bottom of the box. The block is pivoted in the axis of one tube, which is in the side piece, to swing horizontally either way from the transverse line along a circular bar. A flange is fastened to the latter at any point by a clamp nut. The circular bar has stops placed around its curve at such points that the swinging block there secured will cause the saw to cut square or octagonal miters. Into these stops a spring clip rises up from either side, and so holds the block as desired.

Improved Well Tube Check Valve.

Meredith B. Squires, Tidouche, Pa.—This invention consists in placing a check valve above the working valve in the tubing of oil, salt, or other wells, which is made wider than the tubing, so that the stuffing box for guiding the valve rod may be tightly and firmly applied therein during the working of the valve, and easily withdrawn for repairs, with the valve rod if required. A spiral spring, which is attached to the valve rod, acts with its lower end on the top of the stuffing box, and forces the same tightly in its seat during the working of the valves.

Improved Machine for Cutting Cube Sugar.

Henry Schnitzman, Brooklyn, N. Y., assignor to Carsten Sterck, Hoboken, N. J.—The object of this invention is to produce a machine for cutting the disks of sugar into cubes or blocks. The invention consists, mainly, of a disk feeding apparatus, in connection with sector-shaped cutters, with diagonally arranged curved blades, to which the disks are consecutively fed, and then cut by the downward motion caused by sliding guide pieces connected with the driving shaft. The blocks are dropped during the downward motion of the cutters, and, in case any should be retained, forced out by an arc-shaped spring plate, with clearing pins applied back of the cutter knives.

Improved Device for Protecting Horses' Tails.

Franklin E. Howard, Geneseo, N. Y.—This invention consists in a bag formed of leather, cloth, or other material impervious to mud, the same being slitted to form lapping edges, and adapt it to be readily applied or removed from the tail.

Improved Horse Power.

Samuel H. Moor, Springfield, Mo.—This invention consists of a contrivance of multiplying gears. The motion is equally divided between a disk and a ring, and both unite their forces on a transmitting shaft, but on opposite sides of it, each having the other for its bearing or resistance to its counterforce, so that a considerable measure of force is utilized, which, in ordinary arrangements, is lost on the bearings.

Improved Mechanism for Propelling Railway Cars.

Alfred Speer, Passaic, N. J.—One of the two cars to be coupled together is constructed at the end on a convex curve, struck from the axis of the pivot bolt by which the two cars are coupled, the radius being equal to half the short diameter of the cars. The other car is concave to correspond, so that when the cars are closed together, they will swing relatively to each other, without opening cracks at the joints, thus making a continuous unbroken sidewalk, on which people may walk as on a continuous floor. An endless flange projects downward from the middle longitudinal timber of the car, to which the power is applied by the friction rolls upon the upper ends of vertical shafts rising up from below, and nipping it on both sides between them. These rolls may be faced with India rubber, if preferred, to increase the friction. Springs may also be used to press them on the flange. The flange is matched with beveled ends where the sections meet at the joints of the cars, so that there will be a continuous action on the flange, as the driving wheels pass the end of flange, the wheels gripping the one end of the flange before they have let go the other. A full page engraving of Mr. Speer's novel system of railway propulsion, on which this device is an improvement, was published in April, 1872, in the SCIENTIFIC AMERICAN. Mr. Speer is an applicant before our State legislature, this winter, for a charter permitting him to construct an endless traveling sidewalk, on his plan, in the city of New York.

Improved Mode of Extracting Silver from Its Ores.

James Douglass, Jr., Quebec, Can.—This is a process of utilizing the waste liquors of the ordinary ore-chloridizing process, by allowing the insoluble matters contained in said liquors to precipitate, and then evaporating the clear supernatant liquid to obtain the soluble chlorides, which are reappplied in treating fresh ore. In an experiment recently made in a mill at Georgetown, Col., a filtered solution of salts, of 12° Baumé, contained 44.3 grains of saline matter in an ounce of solution, the chlorides being chiefly chloride of zinc and undecomposed chloride of sodium. This saline matter, mixed with ore in the proportion of 1 part of the salt to 3 parts of 80 ounce silver ore, chloridized it as perfectly as when 1 part of chloride of sodium was mixed with 10 parts of ore. In this mill each pan contains 75 gallons of liquor; and 35 pansful of this strong saline solution, or 2,625 gallons, are thrown away daily, and with it 2,651 pounds of salts, almost as serviceable for chloridizing fresh ore as chloride of sodium. This mill is now preparing to evaporate these waste liquors by means of the waste furnace heat, and the manager thus expects to save, at trifling cost, more than half the salt heretofore consumed. Mr. J. O. Stewart, of Georgetown, Col., is willing to give information with regard to the use of this patent.

Improved Candlestick.

David Bourland, Madisonville, Ky.—This invention is constructed to hold the candle securely until it is entirely consumed, and to prevent the difficulty arising from the lower end of the candle sticking fast in the socket of the candlestick, so that it cannot be raised by the pusher. The candle is inserted in pivoted clamps, held together by springs inside the post of the candlestick.

Improved Chair.

Isaac L. Cole, Hillsdale, N. J.—This invention is a chair made of several parts, which are obtained by pressing several layers of veneer of suitable size and thickness into forms of corresponding shape. The grain of the middle layer runs crosswise to that of the outer layers, and so alternately in similar manner if a greater number of veneers are used. The chair may be made of three parts, the seat part extending up over the back, and both extending down to form feet, and the feet spaced and braced by other portions.

Improved Spoon Holding Attachment.

Winfield S. Bennett, Saco, Me.—This invention consists of a little spring clip arranged to fasten on the upper edge of a pan or pot by springs, and hold a spoon by another spring, the said holder being made of sheet metal by stamping out a blank in dies and bending to form springs. The object is to provide a convenient means of holding a spoon, used from time to time for mixing the contents of the pan, so that it will not slide down into the pan while not in use, and thus save the cleaning of the spoon in order to lay it down after it is used.

Improved Station Indicator.

John Mulligan, 154 East 119th street, New York city, assignor to himself and William C. Fellows, Poughkeepsie, N. Y.—This invention relates to the construction and arrangement of certain parts for adjusting the tension on the apron as it is wound from the upper reel to the lower; and for connecting the clock mechanism with the reels, also disengaging it therefrom and otherwise relieving the reels of all stops or impediments to free rotation for rewinding the apron on the upper reel. When the cord is pulled a rod will be momentarily raised, thus sounding the bell to give notice to the passengers, and simultaneously freeing the reels so that the clockwork will revolve them till again arrested by the clock engaging on a pin.

Improved Water Tank for Fireproof Safes, etc.

Edward H. Parker, Poughkeepsie, N. Y.—This invention consists in providing a water tank for safes, etc., with a valve having shouldered head closed recess, and a melting mixture, with an outer protecting layer. The tank, being closed air and water-tight, is placed into the safe or vault. In case of fire, the increase of temperature to about 150° Fah. will melt the wax melting mixture, and it will run out of the recesses, the hydrostatic pressure forcing at the same time rubber disks from inner openings and allowing the water to escape. The upper valves of the tank admit the air so that an uninterrupted flow of water is established.

Improved Ice Cream Freezer.

George P. Herndon, Tupelo, Miss.—This invention has for its object furnish an automatic freezer, and consists in a vibrating tub or vessel containing the sheet metal cream holder between which a space is formed to receive the ice, and in the peculiar mechanism for imparting the vibratory movement.

Improved Telegraph Apparatus for Cable Use.

William Edward Sawyer, Washington, D. C.—The apparatus is intended as a substitute for those now in use on marine lines or cables, and is so constructed that every movement of the needle is utilized, so that a message requiring 126 movements of the needle with the present instruments requires but 34 with this.

Improved Hand Stamp.

Adolphus G. Leming, Waldron, Ark.—The upright cylindrical casing is rigidly connected to the base by a horizontal flange extension and screws. A vertical central perforation of the bottom of the casing corresponds with a larger aperture of the base, and guides the main shaft of the machine in its up and downward motion. The casing has a vertical slot which guides the projecting arm of the shaft, and has also at its upper end U-shaped stationary arms. The ends of the arms are recessed to admit rods which are pivoted to them. Band springs are firmly applied to the arms, and bent in such a manner as to act on the rods to force them outward. To the outer ends of rods is laterally pivoted the inking roller. On the downward motion of the shaft, the inking roller passes over the type bed, and then upward along the inking plate, while at the same time the type bed is stamping the object. On the upward motion of the shaft the inking roller passes again over the inking plate and forward over the type bed. The inking roller thus passes twice over the type bed and inking plate, and, therefore, the former more completely than if passing only once, so that, consequently, more uniform impressions are produced.

Improved Steam Engine.

Albert E. White, St. Paul, Minn.—This invention consists in the mode of introducing and exhausting the steam into and from the cylinder, whereby all valves are dispensed with. A sleeve or interior cylinder is fitted into the outer cylinder, which sleeve receives a slight rotating motion by means of cams at each end of the cylinder, actuated by mortises in each end of the piston. This movement of the sleeve serves to change the ports at the end of each stroke. There is a port in each end of the sleeve. By this manner of construction an engine is produced without valves. The sleeve, being perfectly balanced, is turned without undue friction, and the steam is introduced and exhausted regularly.

Improved Fly Trap.

Dixwell Lathrop, La Salle, Ill.—It is placed in the box, to which the flies and insects readily find access. The inner chamber is lighted by windows in its sides, and the flies, instead of returning the way they entered, fly upward, and, finding their escape cut off, and seeing the full light of day above them, readily pass, through an opening and tube, into a cup against a glass cover, from which they drop into the liquid in the cup, which kills them.

Improved Water Wheel.

Charles Redfield, New York city.—The cylindrical case and open bed piece are connected together, and have a cover. The water wheel shaft has two spiral blades carried in opposite directions around it, attached to a rotary cylinder, to which are rigidly attached the buckets, so that the buckets, the shaft, and this cylinder may revolve together. This greatly relieves the retarding friction of the water, that usually strikes the stationary cylinder in which the buckets move, and augments the velocity or power which is usually generated by a given current of water.

Improved Canning Apparatus for Fruit, etc.

Andrew K. Shriver, Baltimore, Md.—This invention consists in a process of heating closed cans by steam, the pressure of the heat expansion from the inside being counterbalanced by the steam pressure on the outside.

Improved Chipbreaker for Planing Machines.

William C. Margedant, Hamilton, O.—This invention relates to the pressure bar or chip breaker used in planing machines for holding down the lumber, so that, as nearly as possible, a uniform surface may be presented to the revolving blades of the cutter.

Improved Cartridge Filling Machine.

Lester A. Beardslee, Little Falls, N. Y.—This invention relates to means whereby sportsmen and others may, with convenience and despatch, load the quantity and kind of ammunition preferred into the ordinary cartridge cases which are bought at wholesale or retail for that purpose. It consists in a hollow plunger having a funnel-shaped top, and fitted to be worked up and down in guides by means of a hand lever; also in a cartridge shell holder which is adjusted upon its bed into proper position to allow the hollow plunger to enter it by means of a converging groove in the bed plate of the machine. The ammunition, being placed in the funnel end of the plunger, passes therethrough into the cartridge shell that is placed beneath it in the shell holder. The plunger not only serves to conduct the ammunition to the shell, but also serves to ram down the wad.

Improved Skate.

J. Dwight Kellogg, Jr., Northampton, Mass.—This invention relates to means for fastening skates rigidly to the foot in a convenient way, in a short space of time, and so that all tendency to work loose is removed. The invention consists in attaching the clamps to two hinged plates that support the ball of the foot, and in thereby utilizing the weight of the skater to tighten and retain the skate in its true position. It also consists in the use of sliding clamps that can be readily adapted to different sized boots and shoes. It also consists in avoiding any play of the skate on the foot, when both are lifted, by a novel mode of locking the plates that hold the clamps.

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Water Elevator—cheaper than any pump, and elevates at any angle. Address J. Harris Rogers, Inventor, Peekskill, N. Y.

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Patent Dish Washer—State Rights for sale. Made for six cents. Charles Bartlett, 26 West Exchange St., Providence, R. I.

Patent for Sale—The best Burglarproof Door Lock in the world. F. Gys, 194 Greene St., N. Y.

R. L. Galbreath, California, Montean Co., Mo. wishes to purchase apparatus for grinding and pressing linseed oil. Manufacturers, please address as above, stating cash prices, everything complete, and capacity.

Small turning in metals done to order by Hendey Brothers, Wolcottville, Conn.

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10x16 Stationary Engine, New, first class, very cheap. L. S. Mundy, Newark, N. J.

The best Horse Power for the Workshop or Farm—Machines for Threshing, Cleaning Grain, and Sawing Wood. Descriptive circular, price, &c., free. A. W. Gray & Sons, Middletown, Vt.

Engine Counters, Thermometers, "Locomotive," "Vacuum," Steam," and "Edison's Recording Gauges," which define the time as well as all pressure reached, and ring an alarm when danger approaches. Made and sold at 91 Liberty St., N. Y.

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Patent for Sale—Patent Knife, Pen and Penholder Combined. Has paid, and will pay, large profits. Address Patentee, Box 142, Hinsdale, N. H.

To Inventors—I will purchase, or work on an interest or royalty, some useful patented article easily manufactured; or will assist in securing patent of an article of merit. Address, stating particulars, L. E. A. Manney, Boston, Mass.

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All Fruit-can Tools, Ferracuto, Bridgeton, N. J.

Brown's Coal Yard Quarry & Contractor's Apparatus for hoisting and conveying materials by iron cable. W. D. Andrews & Bro., 414 Water St., New York.

For Solid Emery Wheels and Machinery, send to the Union Stone Co., Boston, Mass., for circular.

Lathes, Planers, Drills, Milling and Index Machines. Geo. S. Lincoln & Co., Hartford, Conn.

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

Temples & Oilcans. Draper, Hopedale, Mass.

Hydraulic Presses and Jacks, new and second hand. E. Lyon, 470 Grand Street, New York.

Peck's Patent Drop Press. For circulars, address Milo, Peck & Co., New Haven, Conn.

Small Tools and Gear Wheels for Models. List free. Goodnow & Wightman, 25 Cornhill, Boston, Ma.

The French Files of Limet & Co. are pronounced superior to all other brands by all who use them. Decided excellence and moderate cost have made these goods popular. Homer Foot & Co., Sole Agents for America, 30 Platt Street, New York.

Mining, Wrecking, Pumping, Drainage, or Irrigating Machinery, for sale or rent. See advertisement. Andrew's Patent, inside page.

Two 50 H. P. Tubular Boilers for Sale (Miller's patent) very low, if applied for soon. Will be sold separately or together. Complete connections and pump. Holke Machine Co., 273 Cherry Street, New York.

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Emerson's Patent Inserted Toothed Saws, and Saw Swage. See occasional advertisement on outside page. Send Postal Card for Circular and Price List. Emerson, Ford & Co., Beaver Falls, Pa.

Spools, Button Molds, and all small turned goods made by H. H. Frary, Jonesville, Vt.

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Best Philadelphia Oak Belting and Monitor Stitches. C. W. Army, Manufacturer, 301 & 303 Cherry St., Philadelphia, Pa. Send for circular.

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Parties needing estimates for Machinery of any kind, call on, or address, W. L. Chase & Co., 93, 95, 97 Liberty Street, New York.



V. T. should send further particulars as to the sewing machine motor, and also his name and address.—J. A. S. will find directions for tinning small articles of iron on p. 573, vol. 29.—W. W. will find directions for soldering all metals on p. 251, vol. 28.—B. A. H. will find directions for building houses on pp. 52, 96, vol. 28.—R. S. can mold rubber by following the directions on p. 283, vol. 29.—C. B. L. M. can cut glass bottles by the process described on p. 299, vol. 26.—L. N. L. will find that the effect of the variation of temperature on cast iron is discussed on p. 304, vol. 29.—C. L. M. S. will find a recipe for making parlor matches on p. 75, vol. 29.—C. L. M.'s musical queries are not suited to our columns.—M. G. P. will find directions for making vinegar on p. 69, vol. 30.

J. E. D. says: I have a lot of type metal which has passed through the fire. Can I use it as lead is used for fastening iron into stone? If not, how can it be freed from other material so as to be used for such purpose? A. No doubt you can use it for the purpose you mention; but it is probably of more value to a type founder than for any other purpose.

J. H. P. asks: What transparent varnish or other substance can I apply to polished tin or brass to preserve its luster? A. Pale lacquer will probably serve your purpose. Take 1 gallon methylated spirit, 5 ozs. shellac, 4 ozs. gum sandarac, 1 oz. gum elemi; mix in a tin flask, expose to gentle heat for a day or two, strain off, and add ½ gallon of spirit to the sediment.

J. B. says: The edges of the leaves of several of my books have been, as it were, eaten away by an insect, or some agent that is as yet invisible. Some leaves have been eaten as deep as one inch and a half from the edge. What do you think the insects are, and what means shall I adopt to save my books from destruction? A. The leaves have been torn. There is no insect which eats paper to such an extent or in such a manner as these leaves would indicate. Acids also could not have produced it, because more or less of a stain would remain; and, moreover, acids eat paper in such a way as to leave a square and cleanly cut edge, that is, they eat through the entire thickness of the paper, while in this case the edge is feathery. Moreover, only half the thickness of the paper (to the depth of ¼ to ½ inch from the edge) is taken away, sometimes on one side, sometimes on the other. The "invisible agent" in this case is some mischievous person.

F. H. D. asks: 1. What population have France and Germany respectively? A. By the last census, Germany 35,500,000, France 35,000,000. 2. Of what nationality was the late Professor Agassiz? A. He was born in Switzerland. 3. Is there a drink known as mum? A. Mum is beer made from wheat malt, and its use is chiefly confined to Germany, and especially to Brunswick.

S. H. B. asks: 1. What is the article used by glass blowers to prevent glass from burning or staining while being heated in the lamp? A. The staining is due to the oxide of lead present in the glass, and to prevent it a glass free from lead must be used. 2. What are the chemical elements of coal ashes? A. Principally silica, alumina, sesquioxide of iron, lime, and magnesia. Sometimes there are also found potash, soda, sulphuric and phosphoric acids.

R. E. S. asks: What can I use for dipping brass to give a dark blue color, also a black? A. We do not know of a blue dip for brass, but a blue japanned surface is produced as follows: Bright Prussian blue or smalts should be washed and ground with one sixth its weight of starch, dried, and tempered with mastic varnish. Lay on the brass, and varnish with 5 or 6 coats of: Seed lac 2 ozs., gum arabic 3 ozs., reduced to coarse powder and dissolved in 1 quart alcohol. For black, dip your articles in aquafortis till bright, then in the following till black: Hydrochloric acid 12 lbs., sulphate of iron 1 lb., pure white arsenic 1 lb. Take out, rinse in cold water, and lacquer with green lacquer.

C. H. A. asks: 1. Can you tell me of some books on the distillation of coal tar? A. "The Manufacture of Phenolic or Hydrocarbon Oils from Coal and other Bituminous Substances," by T. Antisell, "Treatise on Coal, Petroleum, and other Distilled Oils," by A. Gesner. 2. What are the ingredients of black varnish, used on roofs and outdoor iron work? A. Two lbs. tar oil, ½ lb. asphaltum, ¼ lb. powdered rosin. Mix hot, in an iron kettle, taking care to prevent ignition. Use cold. 3. Will boiling coal tar act on galvanized iron? A. No.

A. B. L. asks: What is the diminution in bulk of snow when melted? A. Freshly fallen snow weighs from 5 to 12 lbs. per cubic foot. As to your fish-hook question, apply to a dealer.

G. M. asks: 1. Are any instruments in existence by which we can determine to what extent (if any) the light and heat of the sun are of electric origin? A. It has been determined that the heat of the sun is due to combustion, and its principal source is burning, glowing hydrogen gas. 2. Is the all-pervading ether a perfect conductor of electricity? A. Electricity passes readily through space deprived of atmospheric air; and if we suppose this space to be filled with an imponderable ether, we can believe it to be a conductor of electricity. 3. Is the fact generally known that iron and steel possess magnetic polarity, when the force shaping them proceeds in a given continuous direction? For instance, most of the common cut nails, and nearly all iron and steel tools, are magnetic; the head of the nail is the negative or south pole, and the other end is the positive or north pole, and so with all tools where the machine shaping them operates in a given direction, or where the iron or steel is forced through the machine in a given continuous direction. A. It is known that hammering steel or iron induces magnetism, and this method has been recommended for inducing magnetism in steel bars. Such magnetism, however, is feeble compared with that induced by other highly magnetized bars, or by the electric current.

W. K. asks: Is there any chemical solution which will renew the color of bronze stenciling upon iron? A. Dissolve the covering of varnish by alcohol or spirits of turpentine, and then rub with a strong solution of oxalic acid; then dry and revarnish.

C. R. asks: In what form is platinum used in the nickel plating bath? A. The solution used in the nickel plating bath consists of the double sulphate of nickel and ammonia, so as to obtain a plating of nickel. When platinum is required to be deposited, the double chloride of platinum and potassium, dissolved in a solution of caustic potash, is used as the bath.

W. L. L. says: I have a house standing north and south with addition on north side and chimney on east side of addition. When the wind is in the northeast, the stove will not draw well; the smoke blows down the chimney. What is the best thing that I can put on it to prevent this? A. The most complete remedy would be to rebuild your chimney within the main house, at the center of the north end, to terminate above the ridge of the roof. If you cannot do this, you might construct a rectangular flue of galvanized iron, and attach it to the outside of main house at the center of north end, to terminate well above the main ridge, and constructed and painted to imitate a chimney; the side towards the house should be made double, with an air space of two or three inches between the sheets for safety. This pipe or tube could be extended to the ceiling of the interior, and the stove pipe conducted to it, the tube being also made double below where it enters the roof.

N. J. W. says: It has recently been stated that, in the Turkish baths in New York, patients are treated with vapor at a temperature of 240° to 260°. This statement seems incredible in view of the popular belief that water boils at 212°. Can you explain? A. In the Russian bath, where the vapor of water is employed, the ordinary heat of the bath of vapor is from 120° to 140° Fah. Steam at 240° or 260° would scald or burn the skin and would have to be superheated besides. In the Turkish bath, however, where hot air is used, a much higher temperature can be employed on account of the rapid evaporation from the surface of the body. With moderately dry air, a temperature of from 200° to 270° Fah. has been borne.

R. J. P. asks: How is compressed yeast made? A. One mode of preparation is as follows: Previously malted barley and rye are ground up and mixed, next put into water at a temperature of 65° to 75°; after a few hours the saccharine liquid is decanted from the dregs, and the clear liquid brought into a state of fermentation by the aid of some yeast. The fermentation becomes very strong; and by the force of the carbonic acid which is evolved, the yeast globules are carried to the surface of the liquid, and, forming a thick scum, are removed by a skimmer, then placed on cloth filters, drained, washed with a little distilled water, and next pressed into any desired shape by means of hydraulic pressure, and covered with a strong and well woven canvas. It keeps from eight to fourteen days, according to the season, and is excellent.

W. L. T. asks: 1. How much wire will it take to make a helix for magnetizing steel bars 6 inches long? How long should the coil be and of what diameter? A. A helix an inch in inside diameter, and made out of 20 feet of copper wire, will answer. 2. What should be the size of the cups for a Grove battery, and how many cups should I need? A. Use from two to six cups of six inches diameter and 8 inches high, according to the rapidity and amount of charge desired.

L. A. G. asks: 1. What is the melting point of platinum? A. It is above 4,000° Fah. How much has not been certainly determined. 2. What is the greatest artificial cold which can be made? A. By mixing liquid nitrous oxide with bisulphide of carbon, and placing the bath in a vacuum. The lowest temperature thus obtained is -220° Fah. 3. Is there any difference between a square foot and a foot square? A. No.

G. B. asks: Is the difference between soft brass and spring brass (sheet and wire) a difference of composition, or of manufacture? A. A difference of composition, principally.

G. E. S. asks: Will a body projected vertically upward into the air return to the earth with as great a velocity as it had on leaving the earth? A. No.

B. G. asks: How is chloride of calcium prepared? I have tried to dissolve chalk in muriatic acid, but could not succeed. A. There must have been something wrong in the acid you employed. Powdered chalk is added to muriatic acid until the effervescence entirely ceases. The liquid thus obtained, which is a solution of chloride of calcium, yields the solid body on evaporation.

A. M. Y. asks: 1. What is the acknowledged opinion as to the comparative merits of vessels with turrets, such as the Monarch, compared to the class of the Hercules? Does the fact of the Captain turning out a failure alter the high opinion previously held of such a system of construction? A. Opinions are about evenly divided on these points. 2. What vessel do you consider represents the type upon which all modern improvements have been successfully applied? A. The Ark.

J. C. asks: Of what horse power will an engine of the following dimensions be: Cylinder 11 inches in diameter, stroke 24 inches, steam 60 lbs. pressure, and cut-off at half stroke, running at 90 revolutions a minute? A. Multiply the mean effective pressure per square inch (probably between 40 and 45 pounds) by the area of the piston in square inches (7854), and by the piston speed in feet per minute (360), and divide the product by 33,000.

T. S. P. asks: 1. Will a gun scatter as much with a bore larger at the muzzle than at the breech? A. Yes. 2. What kind of oil is the best to oil gun stocks with? A. Olive oil. 3. How many cells are there in the battery of the miniature telegraph? A. One. 4. Has it a recording apparatus with it? A. No.

E. C. C. asks: 1. Will there be any advantage in the application of a continuous stroke of a steam engine to the face of a cogged wheel or wheels, 2 feet in diameter, instead of using a 12 inch crank, applying the power at the most available point? It requires three strokes of a twenty-four inch engine to perform one revolution of the wheel or wheels; it only requires two strokes with the crank. I use a self-acting or double clutch for regulating the movements. A. We do not think that any advantage will be derived from this arrangement. 2. I claim to be the projector of an invention lately sent to the Patent Office by certain parties in this vicinity, to one of whom I confidentially divulged my device, making it so plain as to enable him and his partners to contrive an exact model of it, which they did without my knowledge. He admits that I told him of it, but claims to have conceived the idea long before, the contrary of which I think I am able to sustain. How shall I proceed? A. Make application for a patent, and produce your proofs of priority of invention.

C. E. M. says: A contends that it would be simply impossible for modern brains and appliances to move a 40 foot cube of granite 10 feet in any limited time, and that it never has been done except by the ancients. B. thinks that there is nothing impossible in accomplishing the work in a comparatively short time. Has anything of the kind ever been done? A. A 40 foot cube of granite would weigh 10,500 tons, nearly. Modern appliances would, we think, be found equal to the task of moving such a weight. Perhaps one of the most recent jobs of the sort was the movement of the Great Eastern steamer, from shore into the water, at the time of her launch, a distance of 130 feet. This was done by means of hydraulic rams. The weight of the hull was between 7,000 and 8,000 tons.

S. W. W. asks: 1. If the size of the second cylinder in a compound engine could be changed at will, would it be the same as a variable cut-off in other engines, and would it be any advantage? A. We do not think there would be any advantage. 2. What advantages would a rotary engine have over other kinds, provided it could be as well packed? A. Cheapness, lightness, compactness.

J. H. D. asks: Can an office 10 feet x 20 feet be sufficiently warmed by the exhaust from a 10 horse engine, situated about 100 feet distant, the pipe to pass underground? A. Yes. 2. How large a conducting pipe would be required, and of what metal should it be made? A. Iron pipe, 1½ inches in diameter.

J. M. asks: What size is necessary for the square bar of iron to make a specified size of half round iron. A. Make the side of the square bar 0.62665 of the diameter of the half round piece.

V. C. says: I am running four stationary boilers all connected together, and I am troubled with the scale gathering over the bridge wall and causing the boilers to burn. What is the cause and how can I prevent it? The boilers are level, and I have them cleaned every two weeks. A. Probably it will be necessary for you to change the feed water, or use some scale preventive. It is difficult, however, to give a definite opinion without knowing more of the case. It is quite common for scale to form on the crown sheet of a boiler, when the circulation is bad in that part. This can sometimes be remedied by changing the position of the feed pipe, and arranging an internal pipe so as to cause a circulation of the water.

C. F. S. asks: Does the principle that wheels, chains, beams, cranes, and other iron structures (after being long subjected to blows or to distinct jarring of any kind) at length break without adequate cause, hold true in regard to the wire cables of suspension bridges? If so, ought not the cables to be renewed every few years? A. Engineers are divided in opinion on this matter, but many think that a possibility of such action is a serious objection to suspension bridges.

G. E. C. asks: Can small articles punched out of common scrap tin be silver plated? What is the best process? Will it be necessary to re-tin the pieces in order to have the edges plated? A. It would be difficult to silver them well without first giving them a layer of copper by means of the battery, and a bath of sulphate of copper. Then a bath is used, consisting of two parts of cyanide of silver and two parts of cyanide of potassium dissolved in 250 parts of water.

A. H. asks: After ice is formed, perhaps to some feet in thickness, does a vapor pass from the water through the ice, and congeal on the top of it, or is the thickness of the ice increased by the water freezing underneath? A. In still water, as in ponds, lakes, and rivers generally, ice having formed on the surface, its thickness increases according to the intensity and duration of the cold from the surface downward, by the cold layer of ice above abstracting the heat from the water below, the ice formed being reduced below the freezing point by the cold exterior atmosphere, and acting like any other solid.

A. L. K. asks: 1. What is the best treatise on prehistoric nations? A. Lyell's "Antiquity of Man" also "The Stone Age, Past and Present," by E. B. Taylor, and No. 9 of Estes & Lauriat's "Half Hour Recreations in Popular Science." 2. Is there a treatise on the mound builders separately? A. We know of none.

L. P. S. says: In a factory a $\frac{1}{2}$ inch pipe was placed against the wall, and above a tank in which acids were kept for dipping the bronze work. The pipe was covered with the finer portions of the boxwood sawdust used for drying the work after being dipped. On removing some woodwork, I found the dust on the pipe at a bright red heat. I questioned the workmen to ascertain whether there had been a lamp or fire in any form used there, and found there had been nothing of the kind; but the men had found fire there before. I then brushed the burning dust from the pipe, and soon after, on a blow being struck on the woodwork, more dust fell; and lodging on the pipe, it ignited immediately and became incandescent. I thought that perhaps the fumes of the acids affected this dust and converted it into xylolids, but the very slow combustion rather precludes such a theory. The gases at the time alluded to indicated between 60 and 65 lbs. pressure, and the steam must have passed through 20 or 30 feet of pipe after leaving the boiler. A. The supposition that there was a gradual conversion of the woody fiber into nitrocellulose, by the continued action of the acid fumes, under the circumstances narrated, is a conjecture both ingenious and probable.

C. Y.—Your boat seems to be well proportioned. Your engine should make from 250 to 300 revolutions per minute, giving a speed of from 8 to 10 miles an hour.

G. B. M. asks: 1. How can oxygen gas be generated, and can it be kept for inhalation? A. There are several methods of preparing oxygen. The safest way for an amateur is to heat good commercial binoxide of manganese to redness in an iron retort. 2. Is there any way to produce and keep up a succession of electrical sparks? A. A good electrical machine will give a succession of sparks to the knuckle or a metallic object held near the prime conductor, so long as the plate or cylinder is kept in motion. 3. How is aqua ammonia made? A. On the small scale by heating a mixture of sal ammoniac and lime and receiving the gas into cold water. 4. What is carbolic acid? Is it poisonous? A. Carbolic is made from coal tar and is poisonous. Its chemical formula is $C_{12}H_{10}O$.

A. S. asks: In testing milk, what is the relative proportion of cream and milk? If I pour 5 inches of milk into a test tube and let it remain in a moderately warm place till the cream all rises to the top, how thick ought the cream to be? From the thickness of cream in a watered sample of milk, how am I to draw correct conclusions as to the amount of water added by the milkman who sells it? A. The thickness of the cream would depend somewhat on the length of time the milk had stood in the milkman's can, and whether it was taken from the top or bottom of the can, also on the diet of the cattle and the condition when yielded. You must determine the thickness of cream from milk you know to be good, and then compare with the unknown sample. No rule expressed in fractions of an inch can be given.

J. P. H. asks: If a siphon whose vertex is 50 feet above the level of a reservoir be closed at each arm with a stopcock, and both branches be then filled with water at its vertex, after which it be made airtight and both ends be opened, will the water flow through the siphon, or will the formation of a vacuum be made of its vertex? A. The siphon will not work.

G. R. J. says: 1. When a light is applied to a perforated cork in a bottle containing oxygen and hydrogen gases, an explosion takes place, driving the cork with great force out of the bottle. When the two gases form water, is there not a vacuum in the bottle? A. If no air be allowed to enter after the explosion, a partial vacuum will be left. 2. If a vacuum is produced in the bottle, why does not the external air force the cork in? A. It would, if the cork could be prevented from blowing out. 3. What forces the cork out? A. The great expansion of the gases, due to the heat generated from chemical combination of the hydrogen and oxygen.

H. C. H. E. W. and others: You need entertain no doubt as to the possibility of making sugar and sirup from sawdust, rags, and paper. In order to effect this change, shreds of linen, paper, or sawdust are submitted to the action of strong sulphuric acid in the cold. After a certain time the acid is diluted with water and boiled for some hours, and the free acid finally neutralized with chalk. The due is then filtered, evaporated to a sirup, and set aside to crystallize. Sugar sirup is now made on the large scale in Europe from starch and dilute sulphuric acid. But this chemical sugar is glucose; it is not so sweet, nor does it crystallize so readily as the sweet natural cane sugar. Nevertheless it is imported into this country and used more extensively perhaps than many suppose. But if it be properly made and purified, there need be no alarm in using it, as it is identical in composition with the sweet principle of fruits. Chemists have not yet discovered how to manufacture cane sugar artificially. A cheap process that would convert grape sugar or glucose, which we have been considering, into cane sugar would be of great value. There is little doubt that considerable quantities of artificial glucose or grape sugar are used in the shape of sirup, either alone or mixed with natural sirup. The dark stain sometimes seen is caused by iron, which may have arisen in the manufacture. The correspondent who speaks of feeding a decoction of muriatic acid and old rags to his children is under a misapprehension. No muriatic acid is used; and if old rags are employed, they are no longer rags when converted into sugar.

E. C. H. asks: 1. Which has the greatest driving power, a balance wheel 3 feet in diameter or one 4 feet in diameter, the weight being the same in each wheel? A. Precisely alike, other things being the same. 2. Did the trilobite have feet or legs? A. No traces of limbs have been discovered. 3. How are cod fish and cocoa nuts desiccated? A. The water is exhausted from them, and they are then pressed.

C. says: Will carbonic acid gas completely extinguish fire when it exists at a dead red heat, or are its virtues confined simply to a blaze? A. We once tried some experiments with carbonic acid gas as a fire extinguisher with the following results: The gas used was compressed in an iron reservoir, to from 200 to 300 lbs. per square inch, so that a stream of gas of any desired force could be obtained. When a current of carbonic acid gas was directed upon burning shavings at the bottom of a barrel, the flame was instantly extinguished, but was rekindled after a few minutes. The shavings had been saturated with kerosene and allowed to burn some time before applying the gas. A series of experiments in this way showed that carbonic acid gas will instantly extinguish flame. When the shavings had become a mass of incandescent fuel, the gas, directed against it, destroyed combustion at the surface, but the interior heat of the mass soon rekindled the blackened surface. The interior fire and heat were not removed, though an atmosphere of carbonic acid lay above the fuel for some time. When a strong current of gas under high pressure was directed upon flame at

distance of 5 or 6 feet, the effect was lost, the fuel burning more fiercely than before, from the fact of the stream of gas spreading and carrying with it so much oxygen from the air.

H. S. asks: 1. What will force the beard to grow? A. Nature and time are the most powerful auxiliaries. Frequent shaving seems to stimulate the growth to some extent. 2. How can I make nitrate of ammonia? A. Saturate nitric acid diluted with three or four times its weight of water with sesquicarbonate of ammonia, evaporate by a gentle heat and crystallize. When not required crystallized, the salt is evaporated to dryness at 212° Fahr.; and the heat being then carefully raised to about 250° Fahr., the melted salt is poured upon a polished slab of iron or stone, and when solidified taken up and put into bottles. 3. How can I make Greek fire? A. The ancient Greek fire was a compound of sulphur, bitumen, and pitch. The name has also been given to substances that will ignite on the surface of or under water. If a glass bottle containing benzole and a small piece of potassium be broken on the surface of water, the benzole will take fire. 4. How can I combine phosphorus and chlorate of potash? A. The phosphorus is made into an emulsion with warm glue or gum and the fine chlorate afterwards incorporated by stirring. 5. What danger is there in making phosphide of calcium? A. Phosphorus requires to be handled with great caution, therefore there is danger in inexperienced hands in experimenting with it, owing to its ready inflammability. 6. How can I make a cheap galvanic battery? A. Insulate a cylinder of zinc in a copper vessel containing a solution of sulphate of copper. The zinc is one pole and the copper the other. 7. How can I make from 5 to 10 lbs. of ice at one time at a cost of from $\frac{1}{2}$ to 1 cent per lb.? A. Small machines are made in France for this purpose, invented by Carré.

W. H. S. asks: 1. At what cut-off does an engine give the most power? A. At full stroke. 2. Which gives the most power, a short or a long stroke engine, both using the same amount of steam? A. Theoretically both give the same, with similar piston speed. 3. How do engineers tell how large to make steam pipes? A. There are definite rules, depending upon piston speed, length, and form of connection, etc. 4. If I have a column of water above a boiler and the weight of water is greater than the pressure of steam, will the steam escape up through the water? A. Yes, if there is no valve between.

T. C. O. B. asks: How can a straight avenue of fifteen yards wide and two hundred yards long best be lighted up brightly? We have tried some glass reflectors, but they are entirely inadequate. Would a lens of the Fresnel kind answer the purpose? What is the best manner to adjust a lens? We have gas on the premises. A. The best lens will be of little use, if you do not have a good light. By forcing air into the flame of your gas, and directing the jet upon chalk, you can obtain quite a brilliant light.

M. E. D. says, in reply to our correspondents who asked as to washing flannels: Take soft water, as warm as you can bear your hands in. Make a strong suds, well lathered. In washing fine flannels, wet but one piece at a time; soap the dirty spots and rub with the hands, as washboards foul the flannels. When half clean, add three times as much blue as for cotton clothes. Use plenty of soap. When clean, have ready a rinsing of the same temperature as the suds, rinse well, wring tight, shake briskly for a few minutes, hang out in a gentle breeze. When nearly dry, roll smooth and tight for an hour or two. Press with a moderately hot iron. If embroiled, press on the wrong side. Flannels washed in this way will look white and clean when worn out, and the quality will look better than when new.

L. M. R. says, in answer to J. B. V., who asks how he may remove green moss from his brown stone stoop: Carbolic acid will effectually accomplish it. A solution containing one per cent of the acid in water should be applied to the plants, which will kill them, although it will not alter their appearance. After a few hours they may be washed off clean from the brick or stone.

C. W. Y. says, in reply to F. O. C. H., who asked as to patching a boiler: Take off all warped and twisted parts of the boiler plate; have your patch large enough to cover the hole nicely, then bolt it on firmly with boiler bolts, bevel the patch on the outer corner, or, in other words, thin the patch; then, with a caulking tool, upset the iron all around the patch close to the boiler. This, if properly done, will make a perfectly water and steam tight joint without cement of any kind. I have calked up leaky rivets in boilers with a caulking tool, so that they were tight under any pressure.

A. W. W. says: C. W. B. asks, on p. 203, if there is any better way to make a house warmer than the usual weatherboarding and plastering, except to fill in with brick between the boarding and plastering: Let me give him my ideas of how a frame house should be built. After the frame is up, cover the outside with rough one inch boards, then put on a covering of tar roofing felt (which will not cost over twelve or fifteen dollars for a medium sized house) and put the clapboards on top of that, then go inside and lay a course of brick on the underpinning up to a level with the top of the sills; this will make the cellar much warmer; now take some strips about one inch square and saw them off to a length of the distance between the studs, nail them on to the outside boarding between the studs, lath on to them, letting the lath run up and down, then put on a good thick rough coat of plaster; then lath and plaster the inner wall as usual. The plastering between the studs will only add a trifle to the cost of the house, probably not more than 60 or 75 dollars to a medium sized house. The rooms will be very much warmer in winter and cooler in summer, and the walls will always be dry, for the wind, frost, or dampness will never get beyond the first coat of plaster.

J. H. W. says, in answer to M. V. D.'s question as to condensation: I will say that a worm 4 feet in diameter, 8 coils deep, and $\frac{1}{2}$ inch diameter of pipe, if kept cool by a continuous stream of cold water, will condense easily 2,000 gallons of proof spirit per day. A worm of $\frac{1}{2}$ inch pipe and coiled 1 foot in diameter, 8 coils deep, will condense 1½ gallons proof spirit per hour, if the coil of pipe or worm is kept cool as above stated. This would make the latter condenser (worm) 24 feet long; the former one would be 96 feet.

H. W. G. replies to W. P. S. P.'s query as to the area visible from an elevation of 400 feet: The height you mention gives a range of 29½ miles all around giving a surface of, in round numbers, 1,280 square miles.

H. W. G. replies to R. H. D.'s query as to the sinking of the 1,000 feet tower: A sinking of $\frac{1}{2}$ inch on one side would throw it out of perpendicular 4° 30' inches at top. Settling $\frac{1}{2}$ inch on one side and raising $\frac{1}{2}$ on the other would throw it 9° 30' inches away at top.

G. W. says, in answer to C. W. B., who asked for a cheap and efficient method of building a house, which will make it warmer and drier than any other plan in use: Put the studs one foot apart, and board perpendicularly (outside and inside) with 1½ inch stock boards, making the joints on the center of the studs. Then put siding or battens on the outside, and for with lath over the cracks on the inside, before lathing and plastering. Blocks should be nailed between the studs on a level with the chamber floor to prevent the upward escape of warm air, and it is better if a course of bricks is laid on these before the inside sheathing is put on. A tall house should never be battened, for it will make it look out of proportion; for a similar reason, a low house appears better with perpendicular battens.

M. G. P. asks: How can I render a pair of buckskin gauntlets impervious to water?—A. D. asks: How can I prepare gelatin for molds to cast plaster of Paris under water?—A. B. asks for a formula for obtaining the force of the wind at different velocities.—F. H. S. asks: Of what metal can I make rivets for leather, which can be coated with a black color?—C. L. C. asks: How can I make a cheap barometer or instrument of any kind to foretell a storm by pressure? "I think those influenced by moisture are worthless, as often a damp night will change them as much as a storm."

COMMUNICATIONS RECEIVED.

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

On the Regulation of Patent Monopolies. By G. H. K.

On a Mathematical Problem. By H. M.

On Polishing a Parabolic Mirror. By W. B. C.

On Reclaiming the Colorado Desert. By R. d'H.

On Steam Engines and Turbine Wheels. By J. H.

On Drying Lumber by Steam. By H. G. B.

Also enquiries and answers from the following:

A. W. M.—F. G. H.—F. R.—E. B. W.—C. J. T.—N. A. W.—J. P. F.

Correspondents in different parts of the country ask: Who makes milking apparatus? Who sells leather splitting machines? Makers of the above articles will probably promote their interests by advertising, in reply, in the SCIENTIFIC AMERICAN.

Several correspondents request us to publish replies to their enquiries about the patentability of their inventions, etc. Such enquiries will only be answered by letter, and the parties should give their addresses.

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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FOR WHICH

Letters Patent of the United States

WERE GRANTED IN THE WEEK ENDING

March 24, 1874,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

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Dental drill and lathe, W. G. A. Bonwill	148,920
Ditching machine, B. J. C. Howe	148,955
Dolls, hands and feet for, J. Lacmann	148,835
Dovetailing machine, W. F. Moody	148,840
Dovetailing machine, J. M. Seymour	148,855
Drawer pull, J. C. McClellan	148,892
Drill, grain, W. Washbott	148,906
Drill, rock, J. A. Beamsdarfer	148,917
Drilling machine, rock, Brydon & Co.	148,924

Drilling machine, valve, J. B. Waring	149,015
Ear ring, G. D. Stevens	148,996
Eaves trough hanger, J. F. and L. Hess	148,932
Eggs, apparatus for cooking, H. Fowler	148,817
Elevator, J. Bernhard	148,902
Engines, reversing gear for, B. Chambers	148,907
Equalizer, draft, A. March	148,807
Faucet and air vent combined, J. Heilbronn	148,823
Faucet bush, G. B. Collis	148,819
Fire brick, J. D. Jones	148,897
Fire place, A. E. Smenner	148,995
Furnace grate, W. Brown	148,823
Furnace, steam boiler, W. H. Phelon	148,961
Furnace, straw burning, Head & Co.	148,822
Game apparatus, H. C. Griffin	148,881
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Gas check, gravitating, P. Keller	148,962
Gas retort charger, P. Munzinger	148,841
Gear wheel patterns, making, J. L. Hewes	148,854
Glass mold, S. G. Swain	148,959
Governor, M. Andrade	148,913
Grain dryer, C. & Holmes	148,931
Grain dryer, P. B. Hunt	148,886
Grate for fuel magazines, G. S. Horn	148,865
Hammer, drop, L. L. Whitlock	148,867
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Harvester rake, T. G. Glover	148,947
Heating drum, G. H. Pedlar	148,978
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Hook and clevis, W. Warner	148,905
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Horseshoes, manufacture of, R. Austin	148,916
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Lifting apparatus, portable, L. L. Whitlock	148,865
Lock for doors, etc., A. J. B. Berger	148,803
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Locomotive water feeder, M. N. Lynn	148,892
Loom picker, G. Crompton	148,906
Magnesia, hydrate of, L. Reld (r)	5,303
Meat scraps, pressing, S. Booth	148,870
Mechanical movement, H. C. Work	148,911
Meter, fluid, Swann & Connell	148,994
Meter, fluid, Ball & Fitts (r)	5,306
Mitten, knit, O. F. Tripp (r)	5,302
Mosquito screen, J. P. Miller	148,894
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Nail and bolt making tool, hand, W. F. White	148,907
Neck tie holder, E. A. Johnson	148,830
Newspaper file, A. L. Whitehall	148,908
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Oakum, manufacture of, M. Howe	148,825
Oil tank, J. Robinson	148,863
Ornamenting enamel, F. W. Rhineland	148,966
Paint compound, H. C. Metcalf	148,838
Pantaloon, shaping, E. B. Viets	148,863
Pantaloon, pressing, G. F. Pond	148,857
Paper barrels, head for, G. A. Houston	148,824
Paper collar die, J. E. Crisp	148,812
Paper file, H. W. D. Dunlop	148,878
Pavement block, J. C. Goodrich, Jr.	148,818
Photographic plates, drying, T. M. Saurman	148,900
Piano attachment, C. P. Zonca	148,821
Pipe for reservoirs, receiving, J. Osborn	148,974
Pipe tongs, A. Kotzum	148,889
Pistol barrels, drilling, etc., Johnson & Bye	148,960
Planter, hand corn, J. Hebe	148,900
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Pump filter, J. Christman, (r)	5,304
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Scaffold clamp, J. R. Crockett	148,875
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Stove, fire box, W. Tinsley	148,860
Stoves, etc., grate for, Salt & Cavanaugh	148,853
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Umbrella, folding, O. Heinrich.....	148,883
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Vault cover, J. Ryer.....	148,852
Vehicle hub, J. D. Old.....	148,973
Vehicle hub, D. B. Platt.....	148,982
Vehicle spring, G. B. Hamlin.....	148,949
Vehicle wheel, S. C. Gardner.....	148,980
Vehicle wheels, hub for, T. T. Lucas.....	148,967
Vessels, fender for, J. B. Treadwell.....	148,904
Washing machine, C. B. Hunting.....	148,947
Washing machine, W. G. Jeffery.....	148,938
Water closet, ventilating, F. Hainsworth (r).....	5,807
Water wheel, D. P. Blackstone.....	148,869
Water wheel, turbine, T. B. Coursey.....	148,935
Wheels, machine for planing, M. L. Sanders.....	148,988
Windmill, J. E. Chapin.....	148,977
Winnower, reciprocating, E. W. Tilton.....	149,008
Wire rolling machine, H. B. Comer.....	148,911
Wool dryer, B. Rathbone.....	148,983
Wrench, A. E. Lindsay.....	148,963

APPLICATIONS FOR EXTENSION.

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:

28,532.—PEGGING MACHINE.—J. J. Greenough, June 10.
28,574.—POST HOLE DIGGER.—J. Lee, June 10.
28,541.—SKELETON SKIRT.—S. S. Sherwood, June 10.

EXTENSIONS GRANTED.

27,609.—WRINGING MACHINE.—S. A. Bailey.
27,647.—CULTIVATOR.—C. M. Hall et al.
27,641.—HARVESTER.—F. T. Lombard et al.
27,661.—HORSESHOE MACHINE.—W. Tallman.

DESIGNS PATENTED.

7,231.—CLOCK CASE SASH.—G. Blakesley et al., Bristol, Ct.
7,232 & 7,233.—TYPE.—J. M. Conner, Greenville, N. Y.
7,234.—JEWELRY CASE.—S. Cottle, New York city.
7,235.—CARPET.—J. C. Johnson, Scarborough, N. Y.
7,236.—GLASSWARE.—T. C. Pears, Pittsburgh, Pa.
7,237.—GATE HINGE.—A. B. Tanner, New Haven, Conn.
7,238.—CADDY.—G. B. Wheeler, Brooklyn, N. Y., et al.
7,239.—COOK STOVE.—R. Wheeler, Utica, N. Y.
7,240.—ORGAN CASE.—J. R. Lomas, New Haven, Conn.

TRADE MARKS REGISTERED.

1,682.—FLOUR BAGS.—L. D. Benner, Boston, Mass.
1,683.—UMBRELLA STRETCHERS.—Dawes et al., N. Y. city.
1,684.—MOTH POWDER.—G. F. Gantz & Co., N. Y. city.
1,685.—ALE.—T. McMullen, New York city.
1,686.—GINGER ALE.—A. S. Miles & Co., Baltimore, Md.
1,687.—BUTTONS.—N. Y. Button Co., New York city.
1,688.—STOVE, ETC.—J. Reynolds & Son, Philadelphia, Pa.
1,689.—WIRE CLOTH.—Wood & Co., Lowell, Mass.
1,690.—PREFUMERY.—Young & Co., New York city.
1,691.—SHIRTS.—Marr Bros., Boston, Mass.
1,692.—YARNS.—Thames Worsted Co., Norwich, Conn.
1,693.—NEEDLE THREAD, ETC.—H. Wells, Woburn, Mass.

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
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On application for Extension of Patent.....	\$50
On granting the Extension.....	\$50
On filing a Disclaimer.....	\$10
On an application for Design (3½ years).....	\$10
On application for Design (7 years).....	\$15
On application for Design (14 years).....	\$30

CANADIAN PATENTS.

LIST OF PATENTS GRANTED IN CANADA.
MARCH 27, 1874.

3,228.—William Sharp, Portland, Cumberland county, Me., U. S. Improvements in preparing and preserving fish, called "Sharp's Improvements in Preparing and Preserving Fish." March 27, 1874.
3,229.—I. D. Spang, Dayton, Montgomery county, O., U. S. Improvements on portable toy race track for field and parlor amusement, called "Spang's Toy Race Track." March 27, 1874.
3,230.—A. B. Thomas and L. C. Thomas, assignees of E. G. Thomas, Huntington, Huntington county, Ind. Improvements on cut-off valves and link motions, called "Thomas's Cut-off Valve and Link Motion." March 27, 1874.
3,231.—W. F. Barnes, Rockford, Winnebago county, Ill. Improvements on mechanical combinations for converting motion, called "Barnes' Mechanical Movement." March 27, 1874.
3,232.—H. J. P. Whipple, Meriden, New Haven county, Conn. Improvements on attaching knobs to spindles, called "Whipple's Improved Knob Fastening." March 27, 1874.
3,233.—T. Whitwell, Thornaby Iron Works, Stockton-on-Tees, Durham county, England. Improvements on stoves and stoves, called "Whitwell's Ventilating Stove." March 27, 1874.
3,234.—Jas. T. Austin, St. John, St. John county, N. B. Machine for putting the paste on room or wall paper, called "Austin's Self-acting Wall Paper Paster." March 27, 1874.
3,235.—S. P. Barnum, Thurlow, Hastings county, Ont.—Improvements on a machine for fastening cords and ropes, called "Barnum's Cord and Rope Fastener." March 27, 1874.
3,236.—A. J. Somerville, Toronto, York county, Ont. Improvements in paint cans, called "Somerville's Improved Paint Can." March 27, 1874.
3,237.—T. Hall, Florence, township of Northampton, Hampshire county, Mass. Mechanical device for a bench vice or clamp, called "Hall's Improved Bench Vice or Clamp." March 27, 1874.
3,238.—H. A. White, Hamilton, Westworth county, Ont. Improvements in dampers for stove pipes and furnaces, called "The Excelsior Compression Damper." March 27, 1874.
3,239.—B. G. Devore and W. L. Walker, Kenton, Hardin county, O. Improvements on iron fences, called "Walker & Devore's Iron Fence." March 27, 1874.
3,240.—L. Miller, Jarvis, Haldimand county, Ont. Improvements on moldboards for plows, called "Miller's Improved Moldboard." March 27, 1874.

3,241.—H. E. Wells, Van Wert, Van Wert county, O. Improvements on lumber-drying houses, called "Wells' Lumber Dryer." March 27, 1874.
3,242.—G. A. Kittison, Quebec, P. Q. Improvements on overshoe and boot fastenings, called "Kittison's Overshoe Fastener." March 27, 1874.
3,243.—H. W. Carr and M. Turnbull, Hamilton, Wentworth county, Ont. Improvement in tool boxes and cutters, called "Carr & Turnbull's Improved Tool Box for Iron Planers." March 27, 1874.
3,244.—R. Smith, Sherbrooke, P. Q. Improvements on air furnaces, called "Smith's Improved Hot Air Furnace." March 27, 1874.
3,245.—F. Tarrant and I. P. Conkling, Saratoga Springs, Saratoga county, N. Y. Improvements on stove pipe thimbles, called "Tarrant's Stove Pipe Thimble." March 27, 1874.
3,246.—J. H. Thorp, Chicago, Cook county, Ill., assignee of J. P. Thorp, Southampton, Hartford county, Conn. Improvements on thill couplings, called "Thorp's Thill Coupling." March 27, 1874.
3,247.—A. Ungerer, Simmering, Vienna, Austria. Improvements on the process for preparing paper pulp, etc., called "Ungerer's Paper Pulp-making Process." March 27, 1874.
3,248.—W. Glen and W. H. Lynch, Shipton Township, P. Q. Machine for grinding, polishing, and finishing slate or other stone, called "Glen's Slate or Stone Finisher." March 27, 1874.
3,249.—L. A. Canteau, Borough of Léonville, France. Improvements in self-acting machinery for sowing potatoes, called "Canteau's Potato Sowing Machine." March 27, 1874.
3,250.—S. P. Willeby, Philadelphia, Philadelphia county, Pa. Improvements on keels for vessels, called "Willeby's Safety Keels." March 27, 1874.
3,251.—T. A. Davies, New York city, U. S. Improvements on signal hand lanterns, called "Davies' Signal Lantern." March 27, 1874.
3,252.—G. H. Davis, Boston, Mass. Improvement on upright pianofortes, called "The Soprano." March 27, 1874.
3,253.—R. Smith, Sherbrooke, P. Q. Improvement on the art or process of reducing wood or other kindred substances to fibrous pulp, called "Smith's Patent Superheater." March 27, 1874.
3,254.—W. C. Hobs, London, Ont. Improvement in metallic pipe bedsteads, called "Hob's Folding Pipe Bedstead." March 27, 1874.
3,255.—T. H. Carroll, Erie, Pa., U. S. Improvements on a machine for sawing lumber into strips, called "Carroll's Improved Sawing Machine." March 27, 1874.
3,256.—T. Alexander, Glenwilliams Village, Ont. Improvement on wagons, called "Alexander's Improvements on Wagons." March 27, 1874.

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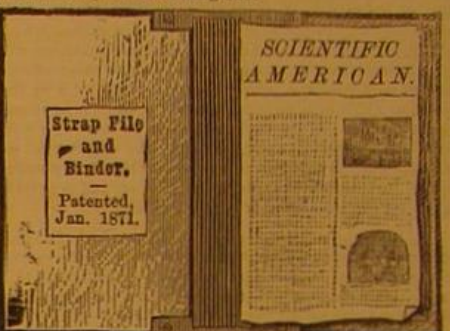
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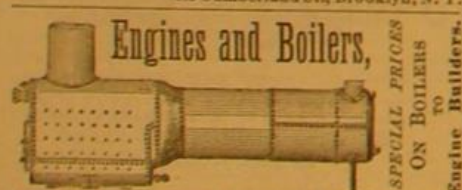
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privacy is secured. Private rooms and lavatories form part of the sleeping cars, while in each there is also contained a small room with a stove for warming the car by means of hot air pipes.

The minor details of the cars are too numerous to mention, though their neatness and ingenuity deserve notice. The windows, with convenient blinds and plated bolts to regulate their opening, are a pleasant contrast to those we usually see. The lamps—six in each car—are extremely elegant, as is also the metal work—that which is decorative being bronze, and that which is plain nickel plated. The black walnut woodwork, carved and gilded, and the neat Brussels carpet on the floor, cause the crimson velvet cushions and chairs to stand out perhaps a trifle too prominently, but with excellent effect, while the bright plated metal fittings, occasional looking glass, and the sides (almost all windows) give the interior of the cars not only a luxurious but a comfortable appearance.

Scientific American.

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THE EFFECTIVE POWER OF STEAM ENGINES.

It is rather the exception than the rule that manufacturing establishments have abundance of motive power. In those using steam power, a false economy in first cost is almost universally practised in purchasing insufficient boilers. An increased consumption of fuel is the result, which, for various reasons, becomes greater from year to year, until the losses from this cause aggregate a fearful rate of interest on the amount intended to be saved. In many instances, from one fourth to one half of the fuel would be economized by the introduction of boilers of proper proportions for the power required. From how many smoke stacks throughout the land can great volumes of smoke, as black as midnight, be seen, at almost all times, rolling upward, carrying with them the most valuable portions of the fuel! Each one of these advertises a great waste, which is generally produced by the boilers being too small. The amount thus lost on an average coal-burning Mississippi river steamer would be abundantly sufficient to furnish gas lights for a city of ten thousand inhabitants. When steam boilers are of suitable proportions and furnaces properly constructed, this waste should not occur. A genuine fear of loss of fuel from too much boiler surface is quite common with proprietors, but it is very rarely that such actually occurs. It is safe to provide twenty per cent more boiler than cylinder horse power, while equal power in each will often serve the purpose; and yet it will, in most instances, be found that the cylinder considerably exceeds the boilers in measurement.

Of equal importance is the size and construction of the steam engine cylinder. The naked rule that a certain pressure upon the number of square inches surface of the piston head will give the definite horse power, if followed out, will always cause failure. Omitting, for the present, the amount of friction, let us point out the principal reasons why this is so: It is well established that the economical use of steam forbids that the cylinder should be entirely filled at each half revolution with steam at the full boiler pressure. For this reason the flow of steam into the cylinder should be cut off at some portion of the stroke, and be allowed to exert itself expansively. There are two systems of accomplishing this: In the ordinary engine, by means of the slide or other

valve, closing the steam supply port at a fixed point; the other, as in the Corliss type, through a governor acting upon the steam supply valve, cutting off steam when sufficient has been admitted to accomplish the number of revolutions per minute required. With the first named engines, that regular speed may be had, it is necessary to use a governor. The principle upon which this governor always acts is that of securing less than boiler pressure in the cylinder by throttling the steam pipe, and rendering it impossible for the full pressure to reach the piston head. If a pressure gage be connected with the cylinder of an engine using a governor, less pressure will be registered than that shown by the boiler steam gage. When the pressure of steam in the boiler and cylinder becomes the same throughout the stroke, the governor is no longer of service, regularity of speed ceases, and the revolutions become less than those required.

With the Corliss type of engines, the full boiler pressure enters the cylinder at the commencement of the stroke, and the motion of the governor determines at each half revolution where steam is to be cut off, that proper speed may be maintained. When the full pressure is necessary for the whole stroke, this engine fails the same as the other, a considerable margin of power being always essential. Very little additional power is gained in any engine by allowing the steam valve to be open at over half stroke, and much less is lost in the crank and by dead centers than is generally supposed. From the above suggestion, the necessary failure of engines, when expected to yield the full boiler pressure power, in actual use is made quite apparent. If, besides allowing amply for friction, a further allowance of twenty-five or thirty per cent is made for the governor and for a reserve, sufficient power in engines will generally be provided. The omission to do this has caused many advertisements of "a good second hand engine for sale, having been replaced by a larger one." Some engine builders practice deception by claiming to secure, by patented improvements, great accessions in results. These pretensions are usually unfounded, and should not be allowed to reduce the sizes of cylinders.

Inattention to the temperature of feed water for boilers is entirely too common. When the escape steam of the engine can be brought into water heaters, no water should be supplied to boilers at much less than boiling heat. A heater that does not furnish it and a pump that fails to force it in at that heat should be thrown out at once.

We shall next week comment on the effective power of turbine water wheels.

COMPARTMENT SHIPS.

It will be remembered that last year a large and splendid French steamer, plying between New York and Havre, the *Ville du Havre*, was sunk in mid ocean, in the night time, by collision with a sailing vessel. A large number of lives were lost. The side of the ship was torn open, and the water poured in so rapidly that, in twelve minutes, the vessel went down. It was alleged that the doors in the dividing compartments of the ship were open at the time of the collision, and that influx of water was so rapid and unexpected as to prevent the closing of the doors, otherwise the ship would have floated much longer, and might finally have been saved.

We have now to record the loss of another French steamer, belonging to the same line, the *Europe*. Happily no lives were lost. This vessel sailed from Brest for New York, March 28, encountering rough weather and leaking a little from the start. It was alleged that she scraped her bottom in passing the bar.

On the fifth day out, a thousand miles from land, the leak had increased so much that the commander decided to leave the vessel, and all on board, four hundred in number, were transferred to a passing steamer, the *Greece*, and brought to New York. When finally abandoned, the *Europe* had 17 feet of water in her hold. Her cargo was valued at two millions of dollars.

The *Europe* was an iron ship: Length, 410 feet; breadth of beam, 44 feet; depth of hold, 37 feet; tonnage, 4,585; her engines were of 1,000 horse power, and she was divided into seven compartments.

It is now common in the construction of iron ocean steamers to subdivide the hull into compartments, each of which is intended to be watertight, so that, if leakage occurs in one, the others will not necessarily be affected.

It is obvious that, if the vessel were divided into a sufficient number of strong independent compartments, the chances of sinking by leakage or collision would be very much reduced. In fact there are many examples on record of vessels saved by means of compartments. On the other hand, large numbers of compartment ships have gone down, but of these it has too often appeared that the partition; were weak or leaky, or ports between them were left open or the compartments were too large. In a 400 foot ship, it is not customary to have more than seven compartments. But experience seems to show that this is too small a number. The engine and boiler space now required is much smaller than formerly, and there seems to be no good reason why an increased number of compartments should not hereafter be provided.

As an example in this direction, we may refer to the new British war steamer *Inflexible*, which is to have 127 watertight compartments.

For mercantile service, it would be unnecessary to employ so many compartments as this, but it is plain that the number might be considerably increased and the risks of disaster correspondingly diminished.

After the above was written, the sad tidings came of the loss of another ship belonging to the same line, the *Amérique*. This vessel was almost similar, in size, power, and construc-

tion, to the *Europe*. The *Amérique* sailed from New York, April 4, and encountered a hurricane, near Brest, April 14, when the captain, acting under the impression that his ship was leak, signaled another vessel, transferred passengers and crew, and abandoned the *Amérique*. The next day (April 15) she was found floating in the trough of the sea, by the captain of another steamer, who, on boarding, found 8 feet of water in the middle compartments, all the others being free. The *Amérique's* pumps were started, and she was then towed to Plymouth, England, vessel and cargo saved in good condition. The value of compartments is well illustrated in this instance. It is now believed that the abandonment of the *Europe* was unwarranted, and, as in the case of the *Amérique*, was an act of bad seamanship.

A TREE THAT KEEPS A STANDING ARMY.

Among the varied means of defense developed by plants in their ceaseless struggle for existence, there is perhaps none more wonderful or effective than that of a species of acacia which abounds on the dry savannahs of Central America. It is called the bull's horn thorn, from the strong curved thorns like bulls' horns, set in pairs all over the trunk and branches. These no doubt help to protect the tree from the attacks of browsing animals; but it has more dangerous enemies in the leaf cutting ants and other insects. Against these the tree maintains a numerous standing army, for which it provides snug houses stored with food, nectar to drink, and abundance of luscious fruit for dessert.

When first developed, the thorns are soft and filled with a sweetish pulp, much relished by a species of small springing ants, never found except on these trees. Making a hole near the point of one of each pair of thorns, these ants eat out the interior, then burrow through the thin partition at the base into the other thorn, and treat it in the same manner. The hollow shells thus formed make admirable dwellings, none of which are left untenanted, as any one may discover by disturbing the plant, when the little warriors swarm out in force and attack the aggressor with jaws and stings.

The leaves of the plant are two-winged, and at the base of each pair of leaflets, on the mid rib, is a gland which, when the leaf is young, secretes a honey-like liquid, of which the ants are very fond. This ensures their constant presence on the young leaves, and their most zealous service in driving off other insects.

A still more wonderful provision of solid food is made for a similar purpose. At the end of each of the small divisions of the compound leaflet, there grows a small fruit-like body, which, under the microscope, looks like a golden pear. When the leaf first unfolds, the little pears are not quite ripe, and the ants are continually employed going from one to another to see how they come on. As these fruit-like bodies—which appear to have no other use than as ant food—do not all ripen at once, the ants are kept about the young leaves for a considerable time. When an ant finds one sufficiently advanced, it bites the point of attachment, then, bending down the prize, breaks it off and bears it away in triumph to the nest.

These ants, a species of *pseudomyrma*, are found, as already noticed, only on these trees; and that the trees really keep them as a body guard seems evident from the fact that, when planted in localities where their little protectors do not exist, they are speedily defoliated by leaf cutters, which let them severely alone on the savannahs, while their honey glands and golden pears offer no attractions to the ants of the forest.

Apparently both acacias and *pseudomyrmex* have been mutually modified in the course of time, until they are now quite dependent on each other for support and protection.

PROGRESS OF UNDERGROUND RAILWAYS IN LONDON.

The length of underground railways now in operation in London is about twenty miles, and they are being extended in various directions. From a recent number of *Iron* we learn that the extension of the Metropolitan Railway from Moorgate street under Finsbury circus is proceeding with rapidity. The Metropolitan Inner Circle Railway is to be completed from Aldgate. One new branch is to extend from the Metropolitan Railway, Queen Victoria street, under Friday street, Cheapside, curving northeasterly under Philpot and Rood lanes, by Cullum street, under Fenchurch street to Aidgate, under that street, Whitechapel, Mile End, and Bow Road, to the North London Railway station at Bow. Another branch is from the line just described under Duke street, Houndsditch, to Roper's Building, to the Metropolitan extension, to Meeting house yard, under Petticoat lane, Mid-dlesex street, with a curved junction to unite with the Metropolitan proper. Two more junctions will be made with the East London line at Stepney and the North London at Bow. All of these lines will be underground, the tracks being from 25 to 40 feet below the surface. The total length of the new lines is about five miles.

A NEW COMET.

The discovery of a new bright comet is announced by the Academy of Sciences, Vienna, in 21 hours 23 minutes right ascension south, 6 degrees 56 minutes declension. An observer at Yonkers, N. Y., states that it is nearly globular, about two minutes in diameter, with a decided condensation toward the center. In brightness it is above the average, but it does not in other respects present any notable difference from objects of its class. Its position at 4 o'clock A. M., of April 14, was approximately: Right ascension, 21 hours, 16 minutes, 31 seconds; south declension, 5 degrees, 15 minutes. Its motion is toward the north and east.

An observer in this city states, April 17, that it rises at 2 A. M., east one half south. Half an hour earlier on April 24. It is a telescopic object.

ANOTHER NEW MOTOR.

We have to acknowledge the receipt of a pamphlet containing a description of the "Keely Motor," and a report upon the merits thereof, by Charles Haswell, C. E. This report is addressed to Messrs. Israel Corse and F. W. Foote, Jr., of this city, gentlemen of prominence in commercial circles. The new motor has become the subject of lively discussion among certain wealthy people here, by whom its success is considered certain. Every share of the stock has been taken, the offers of money having been greatly in excess of the supply of shares. The proprietors expect to reap a large harvest by the sale of rights when the invention is more fully developed—an event which is soon expected to take place. The following account of the invention is given in the pamphlet.

KEELY-MOTOR.

OR HYDRO-PNEUMATIC-PULSATING-VACUO ENGINE.

"Professor Faraday, of England, asserts that a grain of water contains electrical relations equivalent to a very powerful flash of lightning." Knowing that the equilibrium of these relations is sometimes destroyed in the heavens, merely by a change in conditions, resulting in enormous mechanical work: and, as we are constantly discovering means to change natural conditions: the question arises (which seems a legitimate one) why are not our locomotives and steamships propelled with grains of water, instead of tons? the only answer that can be given is: We have as yet no knowledge of suitable means to destroy the equilibrium of these relations."

"Mr. John W. Keely, of Philadelphia, has discovered a method of destroying this equilibrium, or something analogous to it, and made it the basis of an invention by which these conditions are changed."

DESCRIPTION.

"During a period of about two months, several tests have been made of the Keely-Motor power, at Philadelphia, in the presence of many persons, several of whom were among our ablest civil and mechanical engineers and experts; the main facts connected therewith are thus given:

"By a peculiar mechanical device hitherto unknown, a force is generated which can readily be applied to driving all kinds of machinery for which steam or other motive power is generated and applied, without cost other than the mechanical device or generating machine and the necessary wear of machinery. The generator is simple and comparatively inexpensive, occupying but a small space, and is light compared with the requirements of steam power; and since this power is produced without heat, electricity, galvanism, magnetism, or chemicals, it is destined at an early day to revolutionize completely the present motive powers of the world, by reason of the economy of its cost and space."

"The power, so far as at present evolved and tested, has shown a pressure of fully 10,000 pounds per square inch, as the following explanation will show: The principal part of this power generator, now in use, is made of metal, globular in shape, about fifteen inches in diameter, and hollow, having walls about three fourths of an inch thick, a strong iron tube, an inch in diameter, connecting the generator with a cylinder used as a receiver of the power or force from the generator. This cylinder is made of charcoal iron, forty inches in length, four and one half inches internal diameter, with screw-fitted and welded heads, two inches thick, tested to a pressure of 10,000 pounds per square inch; its capacity is about three and one fourth gallons. This receiver was charged from the generator of the power in five seconds, and the power remained therein at least eight days without any addition, and from it a great number of tests were made without any apparent diminution of its energy or force."

"At the end of the charged cylinder is attached a flexible brass conductor of drawn tubing, one fourth inch in diameter, with a bore of one thirty-second of an inch, passing from cylinder to ceiling, and thence to the other side of the room, for a distance of twenty feet to the test apparatus or force register; this apparatus consists of a thick bed plate of iron, to which was bolted and packed a cylinder four inches in diameter, having a plunger or piston, the area of which was a little less than one square inch in surface. Below this piston is a chamber of about two cubic inches, with which the tubing from the charged cylinder is connected. The plunger or piston, acting perpendicularly, was the point at which the power was applied to a compound lever, which, according to Mr. Haswell's measurement, was as one to fifty-two. The end of the short arm was securely bolted and fastened to the iron bed plate of the apparatus; upon the long arm of the compound lever was suspended an iron weight of 200 pounds. On opening the stopcock of the charged cylinder connecting the tubes, the weight of 200 pounds was at once raised to the limit of the upward movement of the lever; thus, with the weight of the lever and its connections, indicating a pressure power of about 10,400 pounds per square inch, as stated before. The power generator and receiver was supposed to be, when constructed, fully adequate in strength to generate and develop the full power of the invention, but it has been found too weak; the force has proved to be so enormous that Mr. Keely has not dared to apply more than half of the power he can attain. An apparatus is now in process of construction which will be able to generate and sustain a pressure greatly in excess of that already shown, without rupture, though Mr. Keely does not expect he will need one of more than 25,000 pounds to fully develop his power. When the full power is measured and balanced, it will then be comparatively easy to construct an apparatus of the requisite capacity and strength for engines of any desired power. When an apparatus of sufficient strength to allow the generation of the complement or maximum of force is constructed, and the vapor generated is applied to the working of an engine, the exhaust vapor is at once re-

solved into its original elements, and is easily returned to the generator for a "re-expulsion," thus making the action automatic, and requiring no additional element for continuous working of the power."

"The following named gentlemen have witnessed the exhibition of the above tests, and may be referred to for the correctness of this statement: Charles H. Haswell, civil and marine engineer, New York city, and formerly Engineer-in-Chief, U. S. N.; William W. Wood, Chief of Bureau of Steam Engineering, U. S. N., Washington, D. C.; S. Parrish, gas engineer, Jersey City, N. J.; Joseph Patten, engineer, Elizabeth, N. J.; F. Glocker, machinist, Philadelphia, Pa.; William Boeckel, machinist, Philadelphia, Pa."

In connection with the foregoing statement, a professional report is given in the pamphlet, by Mr. Haswell, one of the referees mentioned above. He certifies, as the results of two actual working trials of the invention, as follows:

"Mr. Keely developed a cold vapor of a density that enabled it, when admitted to a cylinder having a piston $1\frac{1}{8}$ inches in diameter, to raise a weight of 150 lbs. suspended from a compound lever, connected as 1 to 42, which, with the weight of the lever and the friction due to the absence of a knife edge or rotating joint, was fully equal to an energy of 7,800 lbs. per square inch."

"That the vapor under the piston had expansive energy. That the temperature of the vapor reservoir and of the vapor itself did not exceed that of the surrounding air. That to operate a 45 horse power engine, a supply of the vapor of 793½ cubic feet per minute, at 7,680 lbs. per square inch, would be required. That the inventor alleges that, by the introduction within the apparatus of a very small volume of water, he can generate a vapor having an expansive energy of from 1 to 20,000 lbs. per square inch in the brief period of a few seconds; the only obstacle to the generation of this vapor in great volume being the capacity of materials to retain it without rupture. That it is proposed to reduce the great pressure above mentioned by allowing the vapor to expand into an intermediate chamber, from which pipes will lead the vapor, which may then be employed in lieu of steam in ordinary steam engines, the use of steam boilers and the consumption of fuel being no longer necessary."

We consider it very kind in Chief Engineer Wood, Mr. Haswell, Mr. Parrish, and their associate mechanics, to serve as referees for this peculiar invention. In the absence of such capable referees, the public in general, and perhaps the investing capitalists in particular, might have looked upon the scheme in the manner we do, namely, as an arrant humbug from beginning to end."

Jugglery has a bewitching influence upon some minds. The learned Dr. William Crookes, of London, certified that the lever of his weighing machine was raised when the spiritual medium, Home, simply pointed his finger at it. [See engraving, SCIENTIFIC AMERICAN, 1871.] Several of the Doctor's associates, eminent people, corroborated the story. Mr. Haswell certifies that it was cold vapor, having a pressure of 7,860 lbs. to the inch, developed by Keely, that lifted his (Haswell's) lever. Home's trick being simpler we consider it the better of the two."

Among Mr. Keely's most recent predecessors in the "new motor" line was Paine, with his electric engine of 1871-2. Faraday said, you know, that every drop of water contains force elements equal to a streak of lightning. Paine developed this force by means of water, adding, however, a little acid and zinc. With a two quart cup, Paine claimed to be able to generate power enough to drive vessels of the largest class across the ocean at the highest velocity. But he required a brand new engine in every case, whereas Keely will use the existing steam engines."

We have before us the claims of still another aspirant for "new motor" fame. He is an unsophisticated genius from Virginia. He, too, has read about the Faradaic drop of water, and, like Keely, brings out the power by means of a mechanical device—a pendulum. A child may swing a pendulum of great weight. The pendulum works an air pump which compresses air to twenty thousand pounds per square inch if need be. Thereafter a small portion of the air or vapor is used to maintain the swinging of the pendulum, while the remainder of the gigantic power is to be used to drive an engine on the Keely plan."

It is barely possible that the capitalists who have been disappointed in obtaining shares in the "Keely Motor" might meet with better success in applying for the Pendulum stock. But should this likewise prove to be all taken, we are confident that Mr. Paine will be able to supply them. The reason we think so is because he is so kind-hearted, finding it less difficult to make new shares than to refuse to sell those on hand."

THE CREMATION QUESTION.

The question of the disposition of the dead by burning the bodies, after the manner of the ancients, is a subject which has for some years past been under discussion in the scientific circles of Europe. Various processes have been devised as substitutes for inhumation, among others petrification and preserving in antiseptic solutions; but in the end, it appears that the total disaggregation of the body by cremation has been considered and announced by many of the ablest foreign savants as the proper and indeed only way of avoiding the noxious effects resulting from the natural changes in the thousands of human remains buried in the neighborhood of thickly populated localities. Taking its origin in Europe, the movement during the last few months has, under the influence of Sir Henry Thompson and other eminent scientific authorities, who have strongly advocated its principles, taken a new life and has rapidly spread over the continent. The people of Switzerland, and Germany especially, have accepted

it to no small extent. At Zurich recently, 2,000 persons subscribed to an association having the burning of the dead as its sole object. At Basle, the orthodox clergymen publicly announced their approval of the movement, and in Germany a new apparatus for carrying out the operation of incineration has been invented and advertised. More important than this to us is the wide spread discussion which the subject has evoked at the present time also in this country. A society has already been formed in New York city, including among its members Mr. Henry Bergh, Drs. Sexton, Lorillard, and J. W. S. Arnold, with many other well known citizens, for the purposes of promoting cremation and securing its practical application, and columns of the daily journals are given up to correspondence and the views of the people upon the advantages and disadvantages of the system."

The reader unversed in the process, which it is proposed to substitute for slow moldering in the grave, will naturally think of the ancient pyre and probably suppose that it is the intention of the advocates of the plan to burn the bodies upon huge piles of variously scented wood, after the Greek or Roman fashion. Little would be gained in an æsthetic or even a sanitary point of view if such were the system, for the gases and fumes evolved would be far from healthy. The body of the poet Shelley was thus destroyed, and his biographer tells us that, so far from being the beautiful and poetic rite intended, the process was a very disagreeable and nauseous operation. Science provides a better plan for reducing "ashes to ashes" in the apparatus especially devised by Professor Brunetti for the purpose, and by that inventor recently described in the French *Revue Scientifique*. After having made several experiments on the human subject, in which the bodies were burned in the retorts of gas manufactories, in closed receptacles, and with free access of air, Professor Brunetti finds that an oblong furnace of fireproof brick is required, having 10 holes below, by means of which the intensity of the fire can be regulated. The upper part of this is hollowed to receive the coffin, over which a domed cover is placed, by which the flames as in a reverberatory furnace, may be directed upon the body. Within the coffin is a metal support or table on which the body rests, fixed by thick iron wire. The operation embraces three periods: the heating of the body, the spontaneous combustion, and the calcination of the bones. During the first period, and about half an hour after the pile of wood in the furnace has been lighted, the combustion of the body commences. If the wood has been well arranged, two hours suffice to produce complete carbonization. During the third period, the air holes being opened, the carbonized mass is collected and placed upon a fresh plate and the heat is urged to the utmost, a fresh supply of wood being inserted. By means of this arrangement, at the expense of about 150 pounds of wood, complete incineration may be effected in two hours. When the furnace has cooled, the cinders and bones are collected and deposited in a funeral urn."

So far as sanitary benefit to the people is concerned, we cannot but think the arguments of the advocates of cremation are cogent and forcible. It is well known that numbers have been rendered ill by water from springs and wells which have become contaminated by the near proximity of graveyards, and it is also a fact that there is a miasm arising from these receptacles which, as is universally recognized, renders their presence in crowded localities dangerous to health. We do not see the ground of the assertion that by burial the fertilizing properties of the bodies are lost to the earth, for it seems to us that they are in as good a condition for absorption as if sprinkled in the form of ashes over the surface. Neither can we incline to the belief, that by adopting cremation, a point of economy will be gained, in avoiding the expensive paraphernalia of modern funerals, since the latter are governed purely by the dictates of fashion, and that fickle individual would speedily make the jeweled urn as costly an affair as the sculptured stone."

Anything which seeks to subvert a settled popular custom strengthened not only by long usage but by a prejudice growing out of a religious feeling, presents, however, at best a doubtful prospect of success. There is not a person, we may safely say, who, when the horrors of possible living burial, the slow decomposition, and the changes of the form of a loved one to a loathsome thing, to poison the health of the living, are laid before him, will not admit that the closed furnace, the pure fire flame, and the final handful of dry clean changeless ashes are much the better of the two means of disposition; but his admission in the end will be found to apply to everybody in the world except himself and his family. It is a question of the heart in the end, not of the mind. Science, cold and passionless, may point out the better way; but if its adoption is to tear wider the wounds caused by separation from those we love, no amount of reasoning will induce us to follow it. A husband may give his wife, a mother her child, into the embraces of the earth, and endure the keenest sufferings as the dirt and stone rattle on the coffin lid; but this act, revolting as it may be, is connected in the imagination with the highest and holiest of thoughts—the hereafter. We may bury those nearest to us in our own bit of ground; we may imagine that their forms remain where we put them, and we may tend the flowers which bloom over their resting places as messengers from them to us. All this we can do; but there are few, we think, who would have the heart to hand his dead child or wife to a public official to be burned, or would care to see the ashes of his ancestors scattered over the earth as manure."

POSTAL CARDS are so extremely popular in this country that, although it is not long since they were introduced, the enormous number of one hundred millions have been printed and issued."

South African Diamonds.

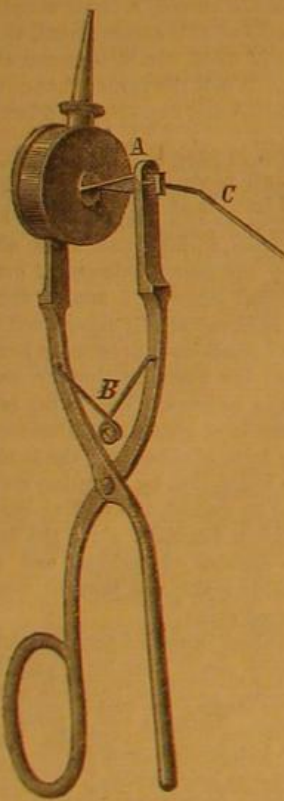
Hon. Theophilus Shepstone has pointed out that Africa, south of the equator, consists of a great central, irregularly shaped basin, the outer edge of which varies in height from 4,000 to 10,000 feet above the level of sea, and that through this rim the Orange River to the southwest, and the Limpopo River to the northeast, cut their way. It is near the exit of the former, from the enormous basin, that the diamond fields lie, while gold in large quantities is being obtained from the northeastern district. The author of this paper conjectures that this basin is the dry bed of an enormous inland sea, and that the diamonds which are found in it are formed by carbonic acid gas, ejected by the action of subterranean heat through fissures in the earth's surface, into the bed of the dried-up sea, the water of which was sufficiently deep to imprison and liquefy the gas after its evolution. The discovery of the process by which this liquid gas became crystallized, whether by electric or magnetic current, or by the potent influence of iron in some of its numerous forms, must be left to future scientific investigations.

Dr. Robert Mann, late Superintendent of Education in the Colony of Natal, states that, since the serious working of the diamond fields in 1871, large numbers of diamonds had been obtained, and it was estimated that in 1873 there were no less than 20,000 miners engaged in searching for them. So large had been the yield that a very material diminution had been brought about in the value of the larger gems in the home market, and the diggers are now leaving the diamond fields for the more profitable northeastern gold fields. The result of the discovery of these fields has been to develop South African commercial enterprise, and to civilize the wild tribes in that part of the continent.

Mr. Sopen, a diamond merchant, states that the number of diamonds of the purest water received from the Cape was very small, not amounting, on the whole, to more than two or three per cent, while of ten carat stones not one in 10,000 was perfect. In consequence of the large quantity of second class stones received from the Cape, such gems were now sixty or seventy per cent cheaper than they were three years ago. Stones which some time since would have realized \$7,500 would now only fetch \$1,000. The first class diamonds, however, were rather dearer than formerly.

IMPROVED PORTABLE OILER.

Our engraving illustrates a novel combination of an oiler with a pair of tongs, in such a manner that, by compressing the tongs, the oiler will be turned so as to bring its spout downward. The handles of the tongs are of sufficient length to enable a person to reach journal boxes overhead without the necessity of a step ladder. In the center of the flat sides of the oil can are secured journals, one of which is simply pivoted in an arm of the tongs, while the other, A, is made long and with a quarter turn twist. This, playing in a slot in the other jaw of the tongs, gives the oiler a quarter turn when the former are compressed. After the jaws are brought together so as to meet the side of the can, further pressure squeezes the latter, forcing out the oil, and this is continued until the handles are freed, when the spring, placed at B, pushes the jaws apart, and thereby causes the oiler to return to its upright position. The wire



pin or point, C, is designed for picking out the holes in boxes before oiling. This, when the tongs are compressed, turns around out of the way. This ingenious device was patented by Mr. Gabriel W. Crossley, of Cleveland, Ohio.

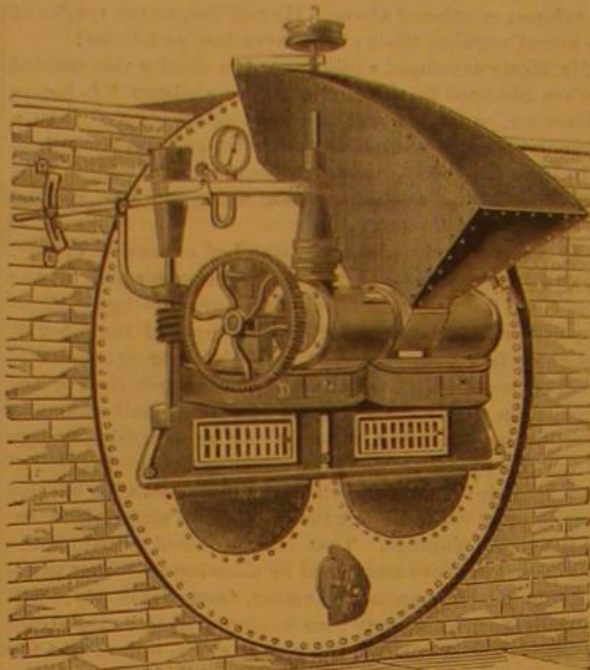
Mechanical Stokers.

Contrivances for mechanical stoking appear to be among the most promising devices for economizing fuel. The attempts to supply an automatic feed for furnaces are usually, and perhaps wisely, imitations of the hand method, which is in the main so good that, whenever volumes of smoke are perceived issuing from a chimney, it may be inferred that the stoker is somewhat in fault.

The patent mechanical stoker of Mr. Dillwyn Smith, illustrated herewith, is, like the others, an attempt to work the hand-stoking method by mechanical means. A hopper machine, known as Standley's, was in use forty years ago, and was considered to act well; but was so complicated in its parts that, owing to the rough nature of the material with which it had to deal, it was liable to continually get out of order. Mr. Smith claims to have entirely overcome these difficulties in his machine. The first object which he seeks to attain is the saving of coal. The first step towards this is by regular distribution of the fuel, which is brought from the hopper by a screw, and falls upon a pair of fans running at a high speed, which project it over the fire and spread it

with remarkable evenness. Consequent upon this regular feed, the gases, which are usually lost and go up the chimney as smoke, are consumed. Not the least advantage of improved methods of stoking is the boon of freedom from the dense smoke which now hangs over our manufacturing towns, especially when this now worse than useless substance is turned to profitable account. Another source of economy in fuel is found in the rocking bars supplied with the machine, which so far do away with the opening of the fire doors that, in some boilers, the doors are only opened when the works are stopped for meals.

From experiments with measured coal and water the results on land are stated to be, as contrasted with ordinary Cornish boilers with specially good hand firing, a saving of



from ten to twelve per cent by the use of this machine, apart from the avoidance of the smoke nuisance, and the saving to the boiler, and of labor to the fireman.

But beyond its value upon land, it is even of more importance in its application to steamers, especially those which sail to tropical climates. A strong recommendation of these mechanical appliances is the fact that, by their use, the heat in the stokehole on board the *Lisboness*, under the equator, was reduced by thirty degrees, and that this steamer made a faster run with six fires than she had ever done previously with eight. The saving in the cost of fuel alone is, in this case, alleged to have been 30 per cent. Anything which promises so favorably as this must be well worthy of the serious consideration of all steamship owners, especially as a decrease of stokers' labor to the extent of 70 per cent is also recorded in favor of the machine.

In mechanical, as in hand stoking, there are three principal points—a regular supply of fuel, its equable distribution over the bars, and a very carefully adjusted supply of air. Each of these is so intimately dependent upon the other two that all three must be effected together if the problem which mechanical stokers attack is to be solved at all. Mr. Smith's seems to be a praiseworthy attempt to deal with it, and the recorded performances of his machine appear to be very satisfactory.—*Iron*.

Labor Legislation in California.

The Legislature of California recently passed a bill providing that no conductor or driver of a street car should be compelled to labor more than twelve hours a day without extra pay. Governor Booth vetoed the bill, giving his reasons in the following language:

"I am clearly of opinion that under the operation of the inexorable law of supply and demand the wages of labor cannot be fixed by legislative enactment; and that the practical effect of this bill would be to reduce wages in the two instances specified, in the same proportion as the hours are reduced, and compel an additional reduction by the friction it creates. The laborer, too, often has to sell Monday's labor to buy Tuesday's bread, and every artificial obstruction in the sale of Monday's labor only tends to make the bread of Tuesday harder and scantier. The bill in effect says to the man seeking employment as driver or conductor: Whatever may be your necessities or hopes, you shall not labor for one employer more than twelve hours per day. All occupations are equally open to drivers and conductors with all other men. Can the law make a better contract for them than they can make for themselves? If a man prefers to work in his vocation fifteen hours for \$2.50, rather than twelve hours for \$2, is the law which prevents him a substantial kindness to him? That the necessity which lies behind such a choice, or which induces him to make either contract, is a hardship is too true. If the law could remove that, it would indeed be blessed. But, since it cannot, does not attempt it, cannot even judge of its extent in individual cases, is it wise to prevent the individual from making his own choice in his individual case? No man will accept employment for more than twelve hours per day, except to escape from some greater hardship. Is it right to close this avenue of escape—to cut off his right to choose for himself between want in his family and extreme toil for himself? The classes this bill seeks to benefit would hardly admit that there was anything in the nature of their employment to differentiate it from that of all other free labor, and assimilate it to that of servitude, which the law must of necessity regulate in the absence of

free agency. The fact that any man in a land of plenty is compelled to work more than twelve hours a day to procure bread for his family is a sad commentary upon our civilization and society—the more sad when we know there are hundreds of applicants for so poor a boon as the opportunity to do so. The great evil is not that a few men in one employment do this, but that there are so many who would be glad to. If the necessity for laboring for disproportionate pay, or of devoting the natural hours of rest and recreation to severe toil, were peculiar to the classes named, the law might possibly modify the wrong; or, it is more reasonable to think, society itself would soon supply a complete remedy. It is because the same unadjusted conflict between the right and wrong is active and clearly visible, in many other occupations, that legislation, looking only to one feature of a vast system, is of questionable power. To remember the car driver and forget the seamstress; to pity and provide for the conductor and forget the many who have equal claims to consideration; to guard one class against oppression and neglect a larger number, in whose tacit demands for relief precisely the same principle is involved, is to invent the statute with a character which is partial, and is to make the law invidious. Overwork and underpay are common factors in a great problem; they constitute an evil in all countries. This great central evil there is no attempt to reach. In the sharp competitions of society, in the relations between capital and labor, which are the outgrowth of our imperfect civilization, perhaps any attempt to reach it by direct legislation would be futile. It is a part of the theory of our government that its adult citizens are free agents; that they can select their employments and judge of their abilities and necessities to better advantage for themselves than the State can do for them. Deeply convinced that this is in contravention of that theory, and that it, in practical effect, would be an injury to the class it seeks to benefit, I am constrained to return it without approval."

IMPROVED COMBINATION SCISSORS.

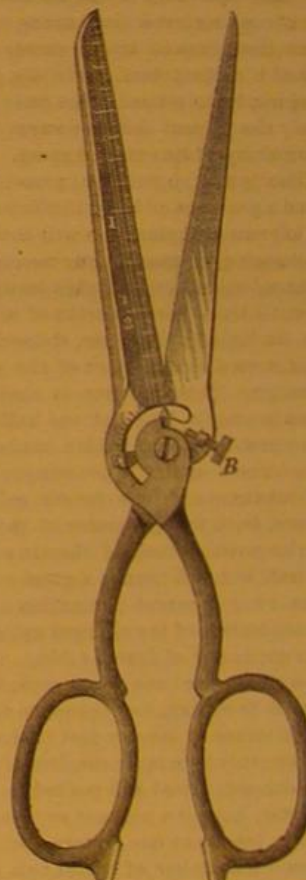
Mr. Casper Van Hoosen, of New York city, is the inventor of the novel form of scissors represented in the accompanying engraving, and has provided a device which, we imagine, will be found a quite convenient addition to the work basket.

At the inner edges of the blades, and near the pivot of the same, are formed curved slots, which cause said edges to terminate in sharp corners. The slot on the broad blade is shouldered at A, and the projection thus formed, when the scissors are sufficiently closed, strikes against the stop, B, which is a simple screw readily turned in and out of a nut. C is a stop which slides, and is held by friction upon the edge of one slot, as shown, the latter being suitably graduated.

The object of this arrangement is to enable a number of button hole slits to be cut with uniformity and accuracy after the scissors are once adjusted. The operation is as follows: The blades being widely opened, the cloth is carried between them, and its edge led into the curved slot. The distance from the sharp inner lower corners of the blades to the stop, C, measures the space of the inner end of the button hole from the edge of the cloth, and consequently, by moving the stop, C, along its slot, this space can be altered at will. The length of the button hole is governed by the stop, B, which is screwed in more or less, so that the shoulder, A, takes against it sooner or later. The proper adjustments once made, it is evident that the operator can cut as many slits as rapidly as he chooses, and all will be of the same size; and by noting the position of the stop, C, with reference to the divisions on the slot, and also that of the angle formed by the blades when brought as near together as the stop, B, will allow, with reference to the markings on the broad blade, the same adjustment may accurately be remade at any time. Upon the ends of the handles are formed two jaws, so located that, when the handles are brought together, a pair of pliers or tweezers is formed.

CEMENT FOR AQUARIA.—An adhesive cement for aquaria may be made, according to Klein, by mixing equal parts of flowers of sulphur, pulverized sal ammoniac, and iron filings, with good linseed oil varnish, and then adding enough of pure white lead to form a firm, easily worked mass.

DR. HANBURY SMITH writes to say that our mention of a gallon of water as containing 277-274 cubic inches is an error. The English imperial gallon is 277-274 inches, and is about one fifth more than the American gallon, which is exactly 231 cubic inches capacity.



AN INSTANTANEOUS LIFE PRESERVING RAFT.

The history of recent marine catastrophes, such as those of the Atlantic, Northfleet, and Ville du Havre, prove that vessels, after becoming severely injured, generally sink within half an hour. The unavoidable confusion which follows the occurrence of a sudden disaster renders such means of safety as the boats, which require care and some time to launch, of little value; but, on the other hand, devices which may be instantaneously set afloat, such as light rafts, would, if properly disposed about a vessel, be of the greatest efficiency in saving life. There are certain requirements, however, which such apparatus must meet in order to be of sure utility in the time of need, and which may be summed up as follows: They must be of sufficient capacity to support, say, from 400 to 600 persons, so located as to necessitate no alterations in the vessel or so as to interfere with her management, perfectly accessible, and, finally, so applied to the side of the ship as, when afloat, to be readily reached by the passengers.

In the illustrations herewith given is represented a new form of "instantaneous raft," which appears to be of considerable value, judging from its general design, and which may be arranged in connection with steamers of the largest size. Our engravings are drawn to the proportions of the Ville de Paris and Pereire, both transatlantic steamers of heavy tonnage.

Fig. 1 shows the apparatus hanging from its davits, ready for use, and Fig. 2, the same afloat. A reservoir of strong sheet iron, containing 106 cubic feet of air compressed to 15 atmospheres, is placed in the engine room, and kept always charged by means of the pump ordinarily used by divers in descending to repair the bottom or screw. Tubes pass through an expansion chamber, which is three fourths full of water, and discharge the air into the same through perforations in their sides, the blast finally escaping through a heavy iron pipe. The latter will be seen in the illustrations between the davits, as it extends up through the deck. It is filled with several cleats to allow of access to its outer extremity. This pipe, together with the reservoir and the expansion chamber, are carefully tarred inside or lined with rubber, so as to preclude any possible leakage. The column, D, is united by means of a strong screw sleeve, N, to the insufflation tube of a huge air mattress, M (length 26 feet, width 23 feet, and thickness 20 inches), which is contained rolled up in an envelope, E (Fig. 1), and suspended like a boat above the bulwarks. FF, Fig. 2, are strips of wood secured transversely across the upper side of the mattress, above which, again, is attached a cover or deck, P, of heavy canvas. To the latter is longitudinally secured three flexible tubes, G, Fig. 2.

When the command is given to lower the raft, the crew, of about a dozen men, cast loose the cords, H, thus allowing the mattress to unroll and hang (by the screw sleeve, N,) alongside the ship. While in this position, heavy iron rods are pushed into the tubes, G, thus holding the apparatus extended. A turn or two of the handles on the screw connection, N, admits the air from pipe, D, which speedily inflates the mattress. Another turn closes the connection and confines the air, and one more twist disengages the screws, when the raft drops into the water. Here it is held by wire ropes, J, which are secured to rings which travel on the vertical stationary guys, S, thus retaining the raft close up to the ship's side. In the rail are made two ports, V, which afford access to the Jacob's ladder leading down to the raft. The latter is finally set adrift, after being manned, by removing the pegs, R, which connect it with

the cords, T. The *Revue Industrielle*, to which journal we are indebted for our engravings, states that the device has been practically tested with considerable success. At the present day, when losses of ocean steamers are more than usually prevalent, such inventions are of especial and timely importance.

Full investigation of the merits of such devices, and prac-

the Comet, and with the beam of light brought to bear upon the bat, the *Times* newspaper could be read with the greatest ease.

Mr. Wilde's apparatus consists of two parts—an electro-magnetic induction machine for producing the electricity, and an arrangement for regulating the light produced by the current, and projecting it upon distant objects.

The electro-magnetic induction is founded upon a new and somewhat paradoxical principle discovered by Mr. Wilde—that magnets and electric currents indefinitely weak can produce magnets and currents of indefinite strength. The machine consists of a circular or cylindrical framing of cast iron, round the interior of which are arranged a number of electro magnets at equal angular distances from each other. A cast iron disk is mounted on a driving shaft running in bearings fitted to each side of the framing, and carries a number of armatures revolving before the electro-magnets. A slight charge of magnetism is imparted to the electro-magnets before the machine is used for the first time, by transmitting a momentary current through the wires surrounding the iron cores, or by touching their extremities with the poles of a permanent magnet. This initial charge is always retained by the electro-magnets, and is the basis of the augmentations of the electricity and magnetism produced by the rotations of the armatures. As the armatures revolve, they become slightly magnetized in their passages between the poles of the electro-magnets, generating weak currents in the insulated wires surrounding them. These currents are transmitted, by means of a commutator, through the wires surrounding the electro-mag-

nets, so as to increase their magnetism until, by a series of actions and reactions of the armatures and electro-magnets on each other, the magnetism is exalted to the highest degree of intensity, and the most powerful currents of electricity are produced. A small fraction of the current thus produced is sufficient to sustain the power of the electro-magnets, while the major portion of the current produces the light. The machine on board the Comet is 28 inches high, 34 inches in length, and 21 inches in diameter. Its weight

is 11 cwt. About four horse power is required to drive it at a velocity of 600 revolutions per minute, and this driving power is obtained on board the Comet from the fly wheel of the small engine that raises and lowers the eighteen ton gun and its platform. At this velocity the current will fuse an iron wire 6 feet long and 0.05 inch in diameter, and will burn carbons half an inch square. In this machine the alternating current is used for producing the light, past experience in lighthouse illumination having proved it to be greatly superior to the direct or continuous current, since it has the important advantage of consuming the carbons equally, and thus always retains the luminous point in the focus of the optical apparatus used in connection with the machine. The alternating current also dispenses with commutators, and the destructive spark on the rubbing surfaces is also avoided when the light may be accidentally extinguished, or when the circuit becomes broken from any other cause. Copper wire conductors are laid from the machine along the Comet's deck, from the position of the machine over the engine room to the fore part of the vessel, for the transmission of the electric current to the apparatus where the light is regulated and projected from. All the arrangements on board the Comet, in this respect, have been made to render the light available for naval purposes, whether as a torpedo boat detector or otherwise, and with this view a simple mechanical regu-

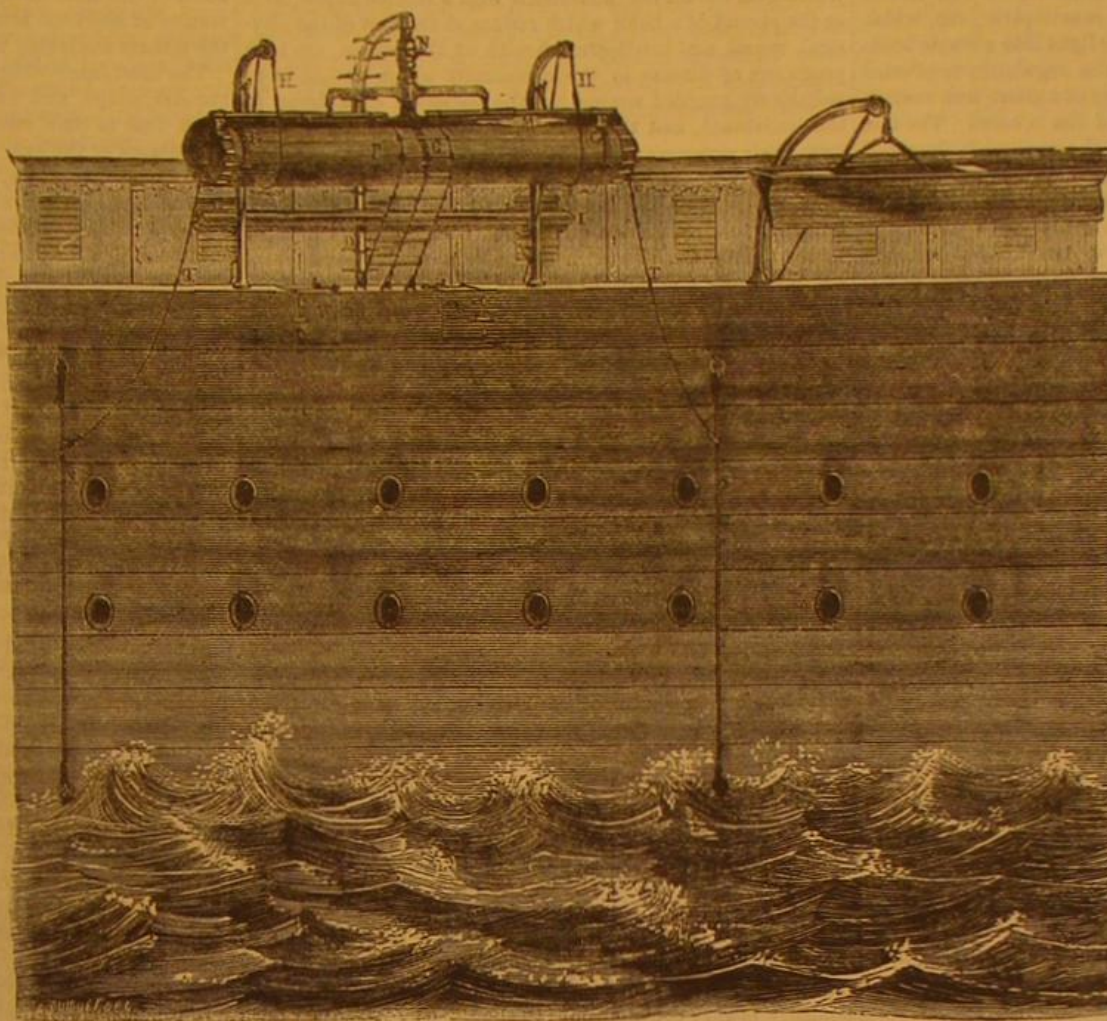


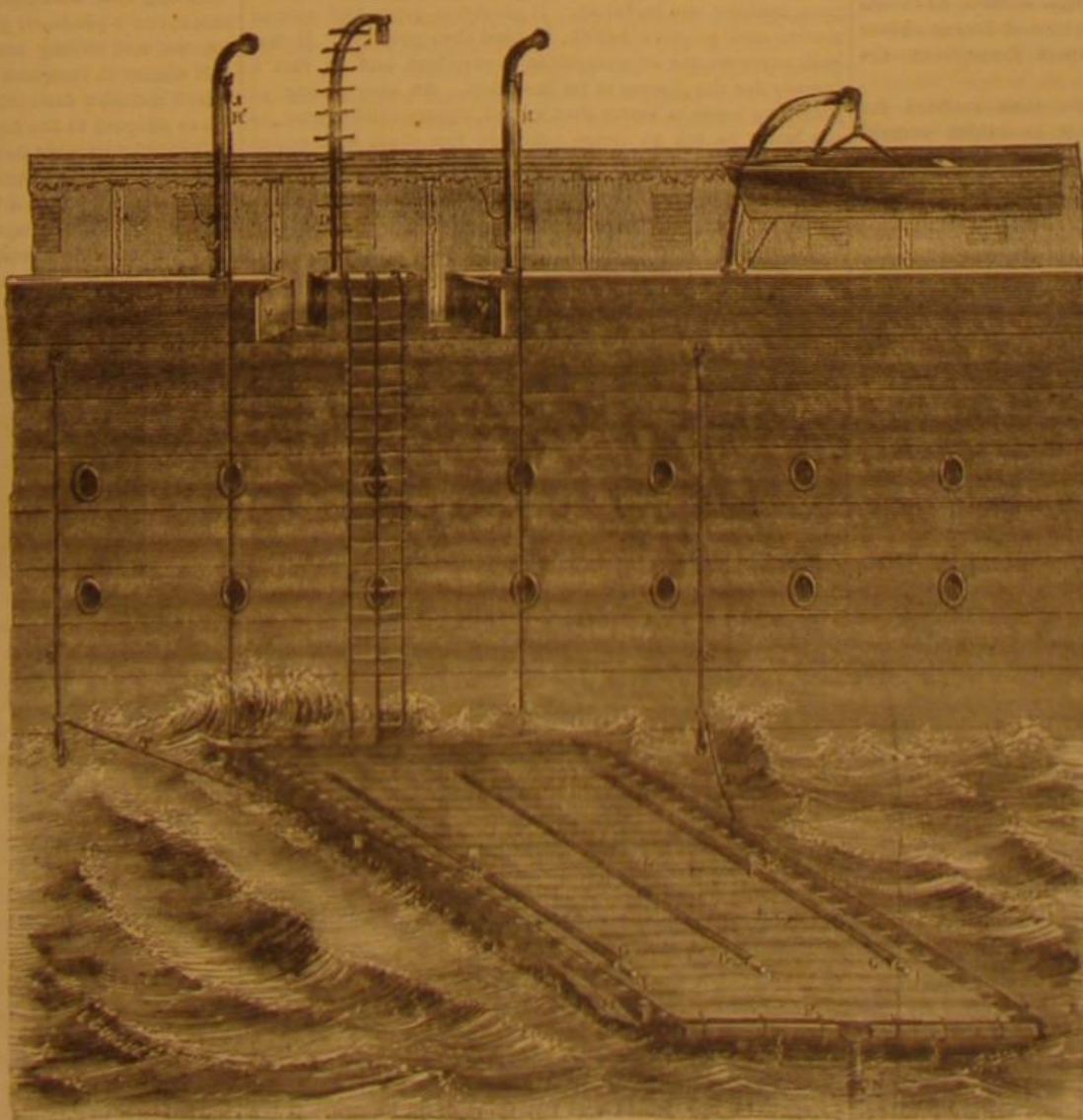
Fig. 1.—INSTANTANEOUS LIFE PRESERVING RAFT.

tical trials of the same, are among the most imperative duties of the owners of steamships.

Wilde's Electric Light.

The Comet, a British gunboat, has lately been fitted with one of Wilde's electric lights, which operates with great success. A recent trial showed that its power was immense, and that no boat could approach the light within a mile without being discovered. In a boat at 2,000 yards distance from

Fig. 2.



latter arrangement, worked by the hand, has been substituted for the delicate mechanism by which the carbon poles have hitherto been automatically adjusted. The carbons, as they consume, are made to approach each other by means of a right and a left handed screw, the screws being made to act independently of each other, so as to allow of the adjustment of the carbons to the focus of the optical apparatus used for projecting the light. The regulator, with its carbon points, is placed in the focus of a catadioptric lens, which parallelizes the divergent rays of the light into a single beam of great intensity. The lens, with the regulator, is pivoted horizontally and vertically on the top of a short iron column fixed on the fore-castle bulwarks of the Comet. The box holding the lens and regulator with the carbons is thus well elevated above the bows of the vessel, and the beam of light, by the action of a quick screw adjustment, may be directed to every part of the horizon, and cover any object within the vertical angle of its range. As the carbons only require regulating once in two or three minutes, this is effected by the man in charge without any interruption in the movements for directing the beam of light.

Mr. Wilde, in his official communications with the Admiralty, has estimated the cost of producing the light from his machine on board the Comet, exclusive of the driving power obtained from the vessel's engine room, at only 4d. per hour.

JAMES BOGARDUS.

Mr. James Bogardus, an inventor celebrated both for the multiplicity and variety as well as the value of his productions, recently died in this city in the 75th year of his age. The record of his life is one of continuous labors repeatedly crowned with substantial success, of a versatile genius which devoted itself to the origination of devices in widely differing arts and industries, and finally of unremitting toil in the search for the new and useful, pursued even to the day of his death.

Born in the first year of this century, at Catskill, N. Y., Mr. Bogardus quite early in life developed a strong taste for invention, and while still a young man obtained the highest premium for an eight day, three wheel chronometer clock; subsequently he devised a complicated time piece without dial wheels. In 1828, however, he produced his first generally useful invention, the "ring flyer," still largely employed in cotton-spinning machines; this was followed by an excellent form of sugar grinding mill, also now in use. The steel die of the first gold medal of the American Institute was cut by an engraving machine invented by Mr. Bogardus in 1831, about the time of his production of the transfer machine, now everywhere employed for printing bank notes from separate dies. In the following year he invented the first dry gas meter, and then modified his plans so as to produce an apparatus for the same purpose, of totally different construction. In 1833 he patented a pencil case of ingeniously novel design. Being in England in 1836, he answered a challenge in the public prints by inventing an engraving machine which made not only an accurate facsimile of the head of Ariadne on a medal, but also engraved from the medal comic facial expressions. This device was followed by an engine-turning machine, and in 1839 by his winning a prize of \$2,000, over 3,000 competitors, for the best machine for making postage stamps. Mr. Bogardus' plan for the erection of iron edifices, as shown in his own factory at the corner of Center and Duane streets in this city, has been largely adopted throughout the country.

The inventions of this remarkable man realized for him a large fortune, but the accession to wealth seemed to offer no inducement for him to remit his exertions. He was devising an apparatus for deep sea sounding at the time of his death.

PREVENTION IN PLACE OF CURE.

President Barnard, in his late address before the Health Association on the occasion of its meeting in this city, intimated that the advance of modern science was such that the physician would eventually find his occupation gone. The people would, it was considered, as they advanced further in knowledge of natural laws, become more and more able to dispense with the doctor, and in brief would learn so to apply the "ounce of prevention" as to obviate the necessity of the "pound of cure." We do not agree in the view that the physician will ever become a useless member of society, for the simple reason that, instead of decreasing the share of his duties, the culture of preventive medicine—of the knowledge of how to prevent diseases as well as to cure them after they are engendered—must tend to amplify and enlarge the same. His will be the task, not merely to recognize the forms of ill and endeavor to combat their effects, but to look into the future and, through the aid of circumstances of the present, predict possible evils and point out means of defense. Add to this the constantly increasing knowledge of drugs and their properties, of the wonderful relations of mind and body, of the nature and habits of disease, which Science is rapidly developing, and the physician of the future has before him not a narrower but a far wider field for the exercise of his skill.

"Preventive medicine," says Dr. Henry Bowditch, in an admirable and exhaustive paper on the subject, which we find in the fifth annual report of the State of Massachusetts, "is the natural outgrowth of modern thought and resources, stimulated by centuries of suffering and by the sacrifice of multitudes of human beings." The various lessons given us by Nature as to the possibility of checking or preventing disease have culminated in the fact that the State uses its moral power and material resources toward preserving the health of its citizens. As to how far the State may

thus exercise authority, there is a difference of opinion; but the views expressed in the paper before us (pointing out that the neglect of a city government to provide proper sewerage and the course of a common drunkard, both tending to disturb the public peace and the comfort of individuals, are alike crimes and should be considered as such in law), seem fraught with a deal of sound sense. The existence of vile deposits which overwhelm the inhabitants with a tainted atmosphere or the spread of a habit which strikes at the root of the physical, moral, and intellectual health of the people, are both producers of disease to the community which should be as sedulously guarded against as the visitation of a fever to the individual, and the means used to defend the people from their ravages are striking examples of pure preventive medicine.

In considering the best chances of a person having a tendency to consumption arriving at a good old age after a life of health, Dr. Bowditch discusses a few general topics and lays down a number of plain rules for sanitary guidance, which are mainly generally applicable to every one. Under the subdivision of residence, the first point urged is that the cellar should be always dry. No possibility should exist of drinking water becoming contaminated by refuse; and hence for the latter, closely cemented stone, brick or vitrified tile drains should be used, while the supply for drinking should be brought to the house from some distant spring or pond. The dwelling is best located on an elevated knoll, open to the south and west winds, but somewhat shielded from the north and east. There should be means of allowing sunlight to enter every room. As regards temperature, about 70° as a medium is the best, and this heat should be derived from open fire places connected with well constructed chimneys in every room.

With reference to clothing, the writer condemns sudden changes made in the spring of the year, and points out the well known objections to thin soled shoes, tight lacing, and low dresses. Bathing is recommended in moderation as a check to consumptive tendencies. Surf bathing, however, should be cautiously indulged in by all predisposed to pulmonary difficulties.

Dr. Bowditch condemns very strongly the neglect of recreation common to Americans. Children naturally weak should be compelled to play in the open air, and business men should make it a rule to leave work for a certain period each day and devote the same to exercise or other relaxation. In matters of education among people showing the slightest tendency toward consumption, it should be a steadfast law that the mind should be wholly subservient to the body's welfare.

The various kinds of physical exercise are considered by Dr. Bowditch in some detail. Walking, he believes, is the best form, and most generally applicable. It exercises the body better than any other method. The most favorable time is about midday in winter and in the morning and toward evening in summer. Late in the evening is less useful because of the liability to dampness and coldness in the absence of the sun's rays. Fast running, in the opinion of the writer, is pernicious to consumptives; it produces violent motions of the heart and too rapid breathing, and consequently great tendency of blood to the lungs. As regards dancing, it is said that, at appropriate hours and for a proper length of time, nothing can be better. It promotes grace and ease of motion and positive health, if used thus properly. Horseback exercise for consumptives is excellent, and in fact a remedy for the disease at its inception. An easy pacing or galloping horse is better than a hard, square, solid trotter, as the latter is apt to cause pains in the chest and undue fatigue. Driving for health should be in an open carriage; the back should never be rolled up while the sides are erect, because the draft thereby produced will be liable to cause a cold and consequent injury to the lungs.

Gymnastics, while increasing the power of the muscles, are of little advantage in warding off phthisis. Many stalwart gymnasts have been victims to consumption. The swinging of heavy clubs about the head cannot be recommended. Less exercise than that with the arms causes hemorrhage in those consumptively inclined. Boxing puts almost too much strain on the heart and lungs, and it is questionable whether severe blows on the chest are ever of use. Bowling should be avoided by consumptives. Rowing tends to expand the chest, and, if no racing be undertaken, may prove of great value. Swimming should be used with great caution, as too long a stop in the water is apt by itself to bring on consumption.

Dr. Bowditch, in conclusion, says that if these recommendations, with others that might be added by any family physician, could be thoroughly carried out by the patient during childhood, and by the man or woman when arrived at adult life, many that will now die of consumption would escape that calamity.

Correspondence.

The Analyzing Power of the Spectroscope.

To the Editor of the Scientific American:

The science of spectrum analysis is not yet a hundred years old, but the results obtained in this short time are surprising. The grandest principle evolved is, the uniformity of the elements composing the universe. The earth, metals, and gases, of which the planet on which we live is made up, have been found to be present in the sun and the fixed stars, and some of them also in nebulae and comets. By analysis of sunlight, several new metals have been discovered, whose presence in our world was not theretofore known. Some connection has also been found to exist between the spots

and glowing gas streams of the sun and electrical phenomena; although the subject has not been sufficiently studied for the laws governing this relation to be definitely established. When we think that, for many thousands of years, Nature has set the rainbow in the heavens, as a constantly recurring hint of the great laws of the light shut up in the tiny globules of water, it seems strange that man did not sooner grasp at some of this half concealed knowledge. But it is not of the results of spectrum analysis of which I wish to speak, but of the minute analyzing powers of the instrument itself.

The most interesting of these is the power of indicating the size, shape, and motion of the gas flames of the sun. From time to time, streams of glowing gas shoot out from the surface of the sun, to the height sometimes of one hundred thousand miles, and with a rapidity of one hundred miles or more in a second of time. They may have also a lateral motion, and develop into the most fantastic shapes. It is possible to measure with accuracy these swift twistings and turnings, to draw their contours, and to note not only the rate of velocity but also the angles which they make with the surface of the sun.

Another interesting power of this instrument is that of denoting the presence of extremely minute quantities of substances. The most common of all known substances is sodium, the base of common salt. Indeed so universally distributed is it that great difficulty is experienced in obtaining a spectrum without the characteristic lines of this metal. It will not be wondered at when we learn that the spectro-scope will demonstrate the presence of so small a quantity as one fourteen-millionth of a milligramme, or $\frac{1}{14000000000}$ of a gramme.

There are three other metals of which the spectroscope has the susceptibility of demonstrating even smaller quantities, namely, lithium, thallium, and strontium, the visible quantities being one forty, eighty, and one hundred millionths of a milligramme respectively.

It must not be supposed that the instrument is employed only in astronomical and chemical science. In many mechanical arts, it has become useful, as for instance in the preparation of dyes. It comes to the assistance of the public analyzer in testing the purity of wine, beer, cheese, butter, etc. It has opened an important field of research to the physician, diagnosing for him the condition of the tissues and fluids of the human body. It is moreover an aid in the administration of justice, in detecting the presence of blood or of poison.

In conclusion, let me give, as an illustration of its accurate and minute power, the examination of human blood. Blood may be burned, treated with acid, dried or washed or kept for an indefinite period of time, and yet this instrument will detect the presence of the constituents of the blood in the substance that remains.

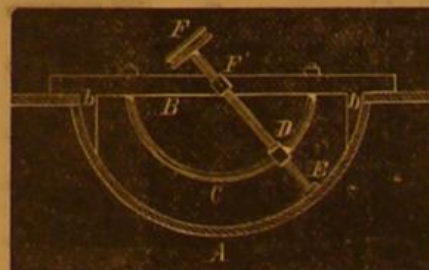
Moreover the fresh blood globules are so minute that, if three thousand of them be placed in a row, they will measure barely an inch in length; yet one half of one of these globules or one six-thousandth of an inch of blood, may be detected by the spectroscope. S. H. C., M. D.

Polishing a Parabolic Mirror.

To the Editor of the Scientific American:

Having read with much interest, in your recent issues, an account of a proposed plan for constructing a mammoth telescope, and having heard it stated that it would be a difficult matter to turn and polish a parabolic mirror of a large size, I inclose a drawing of a device which suggests itself to me as adapted to the requirements of the case; and I think it should be brought to the notice of any parties contemplating the erection of such a telescope:

A is the mirror, B a bar, extending across the top of the mirror and having lugs, *b b*; C is a guide, having the exact curve to which it is designed to turn the mirror, and on which a lug, on the journal, D, slides; E is the tool (which is de-



tachable), from which the shaft extends upwards through the journal, D, above which there is a collar. F is a pulley, from which the shaft receives its motion, the belt running at right angles to the plane of action of the shaft; F' is a journal, turning in a socket in the bar.

It is clear that, by imparting to the shaft a high velocity, and then rocking it slowly from side to side, at the same time slowly revolving the mirror, the whole of the surface will be traversed by the tool, and will have the exact curve of the guide, C. Probably the best mode of imparting the oscillating motion to the shaft would be by extending it above the pulley, attaching a pivoted rod at the top, and operating it by hand. WM. B. COOPER.

Philadelphia, Pa.

We see, in the London *Building News*, that it is proposed to construct a railway from Naples to the crater of Mount Vesuvius. The journey will be made in an hour and a quarter, and the line is to cost six or eight hundred thousand dollars. One of the promoters is said "to be enabled, by his study of the subject, to guarantee the safety of the passengers in the event of an eruption."

STRAIN DIAGRAMS—WHAT THEY ARE AND WHAT THEY TELL US.

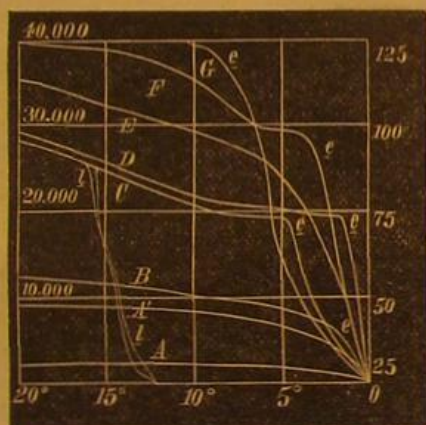
BY PROFESSOR H. H. THURSTON.

A strain diagram is a graphical representation of the variation, of the resistance of a specimen of any material, with the change of form which occurs when it is strained by external forces. It is usually a curve, sometimes of regular form, but generally of an irregular shape. Were the material always perfectly homogeneous, and absolutely uniform throughout, in composition, texture, and in the distribution of the molecular forces, this diagram would be a smooth, graceful, regular curve; but every variation from homogeneity and uniformity, in any of its properties, must affect the curve, and, as a strain diagram, it becomes a record from which an accomplished observer should be able to deduce the true physical character, and sometimes even the chemical nature, of the material represented.

Strain diagrams of the material of construction are best obtained, where accuracy and completeness of information are desirable, by means of an autographic recording apparatus, attached to a machine for testing by torsion, in the manner adopted by the writer and already several times referred to in the columns of the SCIENTIFIC AMERICAN; but, in the works of Rodman, Captain King, and others, may be found strain diagrams produced by plotting carefully the results of experiments made in the ordinary manner. The finest curves yet published are to be found in the account of the experiments of the Swedish Royal Commission, written by K. Styffe, of the School of Technology at Stockholm.

Referring to the illustrated article published in the SCIENTIFIC AMERICAN of January 17, the reader will readily see how to construct such diagrams for himself. To secure satisfactory results, however, great care must be taken, in observation and record of the first effects of the applied force, since the most valuable indications are often obtained from that part which represents the first six or eight degrees of twist.

Fig. 1 represents this portion of the strain diagrams produced at the Stevens Institute of Technology, by specimens of iron and other metals, of standard size, five eighths inch diameter and one inch long, in the reduced part, by the au-



graphic machine. It will be seen that they are so formed that each point of the curve is so situated that its height above the base line (that is its ordinate, as it is called), measures the force which strains the piece to a degree which is proportional to the distance of the point from the right hand border of the diagram, that is to say, the latter distance is the abscissa of the given point.

Space will not permit an extended explanation of the methods of determination of the meaning of each peculiarity of the curve, or of the operations of verification, as they are described in sufficient detail in the account of the research published elsewhere.* It is only necessary to state here that an early acquired familiarity with steam engine indicator cards and long practice in their interpretation, probably first prompted the critical examination of these diagrams; and, as with the indicator diagrams, careful observation and comparison led to interesting and useful deductions as to their meaning.

The curves, A, A' and E, are the regular lines, parabolic in form, which are given by metals of homogeneous character. A and A' are curved from the start, and are thus known to be the strain diagrams of inelastic as well as homogeneous metals. The line, E, which is at first straight and inclined, is, by that fact, known to be produced by an elastic material, while the regularity and smoothness of the succeeding portion of the curve indicates homogeneity of structure.

These diagrams are respectively those of forged and cast copper, and of the beautiful specimen of iron described and pictured as No. 22 in the article of January 17. B, in Fig. 1, is similar in its general character to A and A'. It is the beginning of the strain diagram of a soft bronze.

Diagrams C and D are so different from the preceding that the most careless observer notices their peculiarities, and can recognize the distinction, not only between these curves and A, B, and E, but also between themselves. C rises in a curve convex toward the base, turns a sharp corner at e , runs nearly horizontally some distance, and finally pursues a course which would be seen to be parabolic, could the remainder be shown. D rises more nearly vertically, but curves slightly to the left, turns a well marked corner also, and then also runs a little way, almost horizontally, before resuming the upward movement.

There is a strong resemblance, and yet an evident difference here. The diagrams are those of two well known brands of iron, good specimens both.

The striking peculiarity of C, its reversed curvature, is supposed to be produced by the existence, in considerable amount, of the internal strain of which the effects were described in the SCIENTIFIC AMERICAN of April 11, and which is there described as a lack of homogeneity as to strain. Were there not an appreciable amount of internal strain, this portion of the line would present the appearance seen in D and in E, and would be parallel to the elasticity line, ll . The degree of this reversed curvature, and the deviation from parallelism with ll , shows how much the metal is affected by this strain. It is noticeable that C is evidently weaker than D, which fact is, not improbably, a consequence, and perhaps a measure, of the ill effect of the observed fault.

After the piece has been strained to l , and the force-producing distortion is first removed and then renewed, producing the double line, ll , just referred to as the elasticity line, much of this internal strain has been relieved by the mere stretching of fibers, and ll is thus nearly made a straight line. It is now also seen that the latter line indicates more correctly the real elasticity of the material than does the initial part of the line up to e , where these internal forces interfere with elastic properties. We therefore always determine the elasticity of the material by forming lines like ll . One of the important discoveries which has followed these investigations is that the elasticity of the metal remains the same, quite up to the point at which rupture commences.

The point, e , at which the line turns and becomes pretty nearly horizontal, indicates where the change of form becomes considerable with comparatively small accessions of force, and where the set becomes approximately proportional to the amount of distortion, and it is called the limit of elasticity. In A, A', and B, it is not well marked; in E, it is more readily determined, and, in C, D, F, and G, it is well marked and is easily determined.

This is generally the point which it is considered most important to determine. Many experienced engineers think it more important to know the resistance at the limit of elasticity than even the ultimate strength of the material. It is extremely difficult to determine it accurately by the usual methods of test. Here, it is so well shown that, except with a few hard and, at the same time, very homogeneous materials, the most casual inspection of the strain diagram reveals it.

No materials should ever be subjected, in permanent structures, to stresses nearly approaching this elastic limit. A factor of safety, with reference to this point, of one half, that is straining the material to one half its elastic limit of resistance, is considered good practice.

Passing the elastic limit, the considerable deviation from the parabolic curve, and the consequent approach to the horizontal, which is observed so plainly in the strain diagrams C and D, and is less evident in F, and still less in G, shows a lack of another kind of homogeneity, a defect of homogeneity in structure. This is produced in irons, like C and D, by the presence of cinder, which cannot be perfectly expelled by the puddler, or by the subsequent processes of squeezing or hammering and rolling, and which produces the well known appearance of fiber. In E, this cinder has been so perfectly expelled, and the metal, by thorough and careful working, has been so purified, that no cinder is indicated, and the fracture, as already illustrated in an earlier article, shows excellent quality of metal and no fiber.

In the low steels, of which F and G are parts of the strain diagrams, this same want of homogeneity occurs, but usually in a far less degree, in consequence of the existence of porosity in the ingot. In the rolling mill these pores are drawn out into very minute lines or channels of microscopic dimensions, producing the same effect upon the mechanical properties of the metal as is produced by the fiber in iron.

Comparing the several curves, we see that the line, C, is from a slightly better worked iron than D, although working cold is probably the cause of the internal strain in C; that E is almost perfect in both kinds of homogeneity; that the Bessemer steel, F, is from a more porous ingot than the higher Siemens-Martin steel, G.

We see that the copper and bronze, of which A, A', and B are strain diagrams, are apparently perfectly homogeneous in structure as well as free from internal strain.

Comparing the angle made with the vertical by the part of each curve lying beneath the elastic limit e , we find that, in order of stiffness, they stand: D, F, E, C, and lastly G, B, A, A'. In elastic resistance, the order is: C, F, E, D, C, B, A', A. Could we follow the whole extent of each diagram, we should find this last to be also the order of ultimate resistance to rupture. As a general rule, the ultimate strength is pretty nearly proportional to the resistance at the elastic limit.

Thus, by constructing on paper the curves which will represent accurately the results of experiments made in the ways already described, we obtain strain diagrams from which we deduce useful information respecting nearly every valuable property of the material. The length of this article forbids entering upon an explanation of the method of determining the ductility of the material and its power of resisting shock, or describing the way in which the action of time, the effects of tempering, and other interesting subjects have been investigated.

It will be seen, by inspecting the figure, that the horizontal scale is one of degree, or of elongation; the vertical scale at the right is one of moments of torsion; and that on the left is an approximate scale of tension in pounds of stress per square inch of section on those lines of particles which are most strained.

STEVENS INSTITUTE OF TECHNOLOGY.

SCIENTIFIC AND PRACTICAL INFORMATION.

CURIOUS PROPERTY OF TARTARIC ACID.

M. Pasteur, in the course of his investigations, has noted a curious splitting of racemic acid into two tartaric acids, identical as to their composition, but one of which rotates the plane of polarization to the right, and the other to the left. M. Bertholdy has recently made some interesting researches into this subject, with regard to the quantity of heat evolved. He finds that the right acid dissolved in water absorbs 3,275, and the left acid, 3,270 calorific units. Racemic acid, on the other hand, absorbs 5,420 units. The combination of this same acid with two equivalents of water disengages 6,900 units. It results that the solution of this hydrate in water represents a movement of heat equal to the difference of the two preceding numbers, or 1,480 units. Now it is curious to note that this last exactly coincides with the number recently found by M. Desains as representing the heat of melting ice, and hence the odd result may be stated, that if solid tartaric acid were united with solid water, or ice, there would be no disengagement of heat.

TROILITE.

The above name is given to a sulphuret of iron largely found in meteorites. The majority of mineralogists have considered the substance as a protosulphuret of iron, but such, according to a note recently presented to the French Academy of Sciences by M. Daubrée, appears not to be its true constitution. The proper formula is said to be Fe_2S_3 . There is a variety of mineral known as magnetic pyrites, or pyrothene, found at Horbach, in Baden, in specimens identical, both in composition and density, with those which fall from interplanetary spaces. This conclusion is strengthened by chemical analysis, as the protosulphurets possess certain properties which render them readily recognized. Under the influence, for example, of bisulphate of potash, the pyrothene gives off sulphuretted hydrogen. This the meteoric mineral does not do.

A FLORAL CHAMELEON.

The French Bishop of Canton has just sent to the *Jardin d'Acclimatation*, at Paris, a plant whose flower changes color three times a day. It is spoken of as another wonderful evidence of Chinese art in leading Nature out of her customary paths. It appears, however, that it is, if not the same, at least not more remarkable than a natural floral freak found in Southern Australia. It is a beautiful flower, similar to our well known morning glory, with five streaks of color on its bell-shaped calyx. In the early morning the color streaks are pale blue. Toward noon they turn to a rich purple tint, which changes to a light pink during the afternoon. As the day declines the color fades, disappearing entirely after sunset, when the flower closes and dies.

How Sea Lions Enjoy Life.

Charles Nordhoff, in the April number of *Harpers'*, has this interesting account of the habits of sea lions:

It is an extraordinary, interesting sight to see the marine monsters, many of them bigger than an ox, at play in the surf, and to watch the superb skill with which they know how to control their own motions when a huge wave seizes them and seems likely to dash them in pieces against the rocks. They love to lie in the sun upon the bare and warm rocks; and here they sleep, crowded together, and lying upon each other in inextricable confusion. The bigger the animal, the greater his ambition appears to be to climb to the highest summit; and when a huge, slimy beast has, with infinite squirming, attained a solitary peak, he does not tire of raising his sharp-pointed, maggot-like head, and complacently looking about him. They are a rough set of brutes—rank bullies, I should say; for I have watched them repeatedly, as a big fellow shouldered his way among his fellows, reared his huge front to intimidate some lesser seal which had secured a favorite spot, and, first with howls, and if these did not suffice, with teeth and main force, expelled the weaker from his lodgment. The smaller sea lions, at least those which have left their mothers, appear to have no rights which any one is bound to respect. They get out of the way with an abject promptness which proves that they live in terror of the stronger members of the community; but they do not give up their places without harsh complaints and piteous groans.

Plastered against the rocks, and with their lithe and apparently boneless shapes conformed to the rude and sharp angles, they are a wonderful, but not a graceful or pleasing sight. At a distance they look like huge maggots, and their slow, ungainly motions upon land do not lessen this resemblance. Swimming in the ocean, at a distance from the land, they are inconspicuous objects, as nothing but the head shows above water, and that only at intervals. But when the vast surf, which breaks in mountain waves against the weather side of the Farallones with a force which would in a single sweep dash to pieces the biggest Indianman—when such a surf, vehemently and with apparently irresistible might, lifts its tall white head, and with a deadly roar lashes the rocks half-way to their summit—then it is a magnificent sight to see a dozen or half a hundred great sea lions at play in the very midst and fiercest part of the boiling surge, so completely masters of the situation that they allow themselves to be carried within a foot or two of the rocks, and, at the last and imminent moment, with an adroit twist of their bodies, avoid the shock, and, diving, re-appear beyond the breaker.

WOOD ASHES are stated to be an effective remedy for current worms. Dust the bushes in the morning with the dry ashes. Three applications, thoroughly done, will be sufficient.

* Trans. Am. Soc. C. E., March, 1874, et seq. Journal Franklin Inst., April, 1874, et seq.

IMPROVED MITERING MACHINE.

The inventor of the device herewith illustrated aims to supply a machine that not only will cut any desired miter, but can also be used for cutting gains and rabbets at any angle, and be used in place of the crosscut saw for light stuff.

Fig. 1 gives a perspective view of the machine, and Fig. 2 a sectional view of one of the guides. Upon the table and upon opposite sides of the saw, are formed two grooves, A, which receive the sliding bars, B. At C are semicircular plates, which are pivoted at their centers to the bars, B, and held in position, when adjusted by the hand screws, D. Upon the curved edge of the plates, C, are formed scales of division marks, as shown in Fig. 1. Corresponding with these scales is a mark or line on blocks which are fitted tightly on the bars, B, though sufficiently movable, very accurately to adjust the scales with the saw. These plates, C, are connected to the guides, E, by a sliding hinge, F, which serves to longitudinally adjust the inner end of the guide closer to or further from the saw, as may be needed, and also enables the face of the guides to be set at any desired angle to the table, as shown by dotted lines (Fig. 2), for mitering moldings that are not fastened upon a solid. In the face of the guides, E, are inserted step bars, G, held in position by the set screws shown. These bars are longitudinally movable, and serve to saw pieces to a given length, by pushing the stuff to be sawn against the hook, H, formed on one end of said bars. This hook is made elastic and will, when pressed upon, sink into the groove behind it.

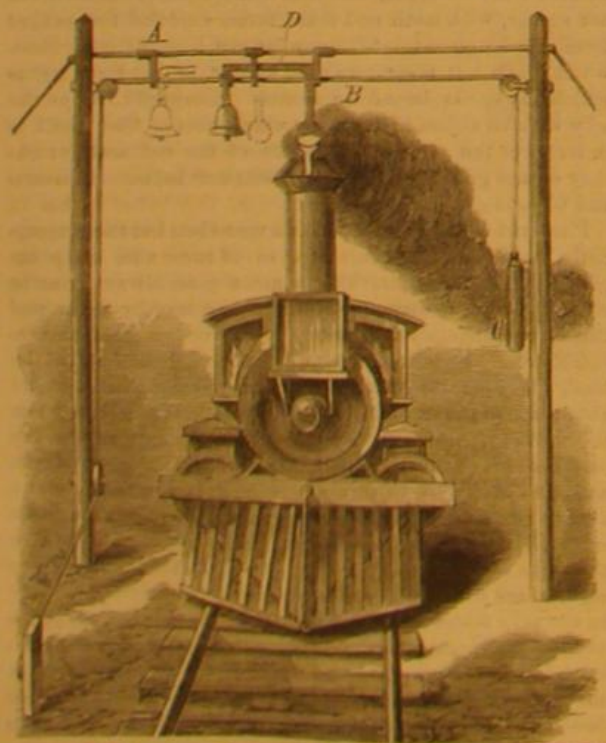
The operation of the machine will be easily understood by any mechanic, and no further explanation is, therefore, necessary.

By having two of these devices the operator is enabled to cut a different angle on each end of a piece of molding, thus saving the time of handling stuff twice. By exchanging them, the guides are made to face in the opposite direction, which is found desirable for many kinds of work. By putting a gaining head in place of the saw, the machine will do all the range of work in that line generally required in a shop. Among the other advantages claimed for this machine are easy and safe handling, susceptibility of accurate adjustment on all points, simplicity, durability, and cheapness.

Patented through the Scientific American Patent Agency, December 9, 1873, by C. Loetscher, 1,238 Jackson street, Dubuque, Iowa, of whom further particulars may be obtained. Patent for sale on reasonable terms.

SAFETY BELL SIGNAL FOR RAILWAYS.

At night and especially in times of dense fog, it may happen that a train traveling at high speed may run past a danger signal before the same is noticed by the engineer; or, in



case torpedoes are used, they may fail to explode, and thus not give a timely warning. In order to render the attraction of the engineer a matter of certainty, M. Scheppers, in the *Chronique de l'Industrie*, suggests the simple arrangement represented in the annexed engraving. Two posts are erect-

ed on each side of the track, at a suitable distance from the draw, switch, or other point, the connection of which the engine driver must be informed of before proceeding. Between the tops of these is a stout wire, on which are three travelers, A, the lower and vertical portions of which serve for supports for a line, B, which passes over pulleys on the posts, is connected with the switch lever, and carries at its free end a counterpoise, C. Secured to the line, B, which passes through and is secured to its vertical arms, is a double lever, D. One arm carries a bell, the other extends down and has a disk shaped end directly over the middle of the track. When the switch lever is properly adjusted, the counterpoise is raised, and the lever carried by the rope, B, over to the left of the track, as indicated by the dotted lines: should, however, the rails be wrongly placed or left open, the ar-

heads for locomotives, twenty-five or thirty can be made in a day. The molds are made of cast iron, and are used cold. The plungers are generally cast, and duplicates are kept on hand for use in case of breakage. The process is also successfully applied to forming of boiler heads, steam domes, etc., the large plates of Bessemer steel being forced through a ring, while a great number of spokes for locomotive wheels are also manufactured in this way.

The total production of pressed forgings in these works for nine months was 7,830 pieces, weighing 1,071,200 pounds.

Hydrogen a Metal.

M. Dumas has communicated to the French Academy some curious experiments of MM. Troost and Hautefeuille on the hydrates of mercury or combinations of hydrogen with that metal. These combinations, it is said, so strongly resemble those which constitute the amalgams of mercury, with silver and other white metals, that it is hardly possible to doubt that they are themselves amalgams, and hence that hydrogen is a metal, a fact apparently indicated in many other analogies.

CHRISTIE'S RAILROAD DETACHABLE CLAW BAR.

The invention represented in the annexed engraving is an improved railroad bar, provided with a detachable claw which is so applied as to cause the entire strain to be thrown upon a jog and shoulder on the solid portion of the implement. The device, it is stated, will pull spikes straight out of the tie, leaving the bolt ready to be immediately driven again.

The claw piece, the shape of which is plainly set forth in our engraving, fits firmly up against the main portion of the bar, and is secured by a bolt passing through. It will be noticed that the bar has two flat faces, a jog, and an under cut, which fit the corresponding surfaces of the claw so that, as soon as the bolt is set up, the parts are tightly united together. The entire strain comes on the jog and shoulder and not on the bolt, which merely serves as a means of junction.

The trackmen, working on a line of road, may be furnished with a number of claws, and in case one should break a perfect one could be quickly substituted, putting the bar again in working order. The claw is quite cheap; and, according to the inventor, costs about one tenth the price of the ordinary jaw bar. Its appearance from below is shown in Fig.

LOETSCHER'S MITERING MACHINE.

Arrangement of the connecting lever is such that the counterweight draws the bell lever into the position shown. As soon as a train comes along, a projection on the smoke stack of the engine strikes the disk arm of the lever and rings the bell, thus warning the engineer. The usual signals for the eye, may, of course, be connected to apparatus in the ordinary manner.

Pressure Forging.

At the State Railway Works, Vienna, Austria, two large hydraulic presses are in use, the largest, with a piston 14 inches in diameter, giving 1,500 tons pressure, and the second, with an 18 inch piston, giving 600 tons pressure. The pressure in the pumps is 600 atmospheres. The piston descends upon the work, and for forging ingots it is armed with a hammer-like head. If, for instance, an ingot of soft Bessemer steel, weighing 2,030 pounds, is placed upon the anvil, and the piston brought slowly down, it is crowded into the mass as if it were putty or dough. The piston is then raised, and the ingot is moved forward for a second squeeze, and so on until the first half has been reduced in thickness, when it is turned on edge and the operation repeated. It is then turned end for end, and forged until the whole length has been reduced to the required size. It is cut into masses of the proper length by a chisel forced through the bar by the press. There is no noise or jar in the whole operation, which requires less time than the ordinary method of hammering or rolling, while the pressure affects the very center of the mass; and there is no distribution of the blow by the vibration of the foundation of the anvil and the surrounding objects, as there is with the violent impact of a steam hammer. The masses cut from the forged ingots are taken to a heating furnace and are made nearly white hot, preparatory to the operation of pressing. The molds or dies, made in several parts, if necessary, are securely held together by bands of wrought iron. A plunger head or follower, called the stamp, is attached to the piston and descends into the cavity of the mold. All the parts being properly adjusted, and the inside of the mold and the surface of the plunger being smeared with thick oil, a block of hot steel is thrown into the cavity, the plunger descends and dresses the steel each way into all the angles and recesses of the mold. When the plunger has reached the proper depth, the piston is raised and the mold and contents removed from under the press. A few blows of a sledge liberate the forging, which is thrown aside to cool. If the work is well done, all the angles are full and solid. All pieces of the same kind are alike in dimensions, and there is no great excess at any part to be cut away. The rapidity with which intricate forgings are made is one of the greatest advantages of the method. Of such objects as cross-

Fig. 1

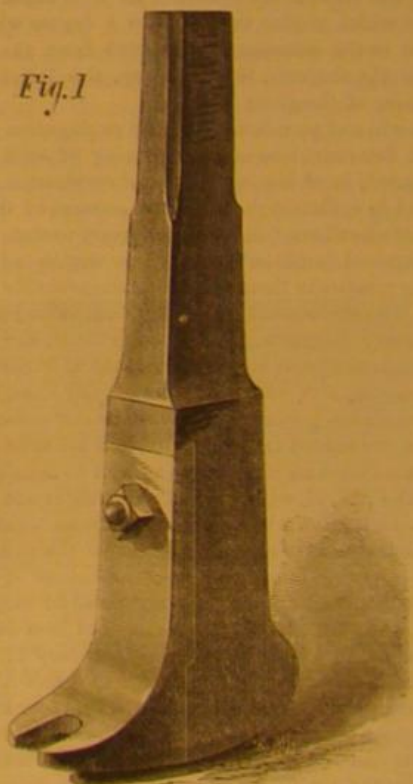


Fig. 2



2. We are informed that the device has been in practical use for two years past with excellent success.

Patented July 18, 1871. For further particulars see advertisement on another page, or address the inventor, Mr. David Christie, Chillicothe, Ohio.

THE PYROPHONE.

M. Frederic Kastner, of Paris, has recently devised a novel and very remarkable musical instrument, which, it is said, produces astonishing effects even in the midst of the largest orchestras. It is termed by its inventor the pyrophone, and we present herewith an engraving of it, taken from *La Nature*. The origin of the device is due to the curious discovery made by M. Kastner in the properties of singing flames. Many scientists have studied these interesting phenomena, but the peculiarities of two flames in conjunction seem to have escaped their notice. As a result of his investigation, M. Kastner finds that if, in a tube of glass or other suitable material, two or more isolated flames of proper size be introduced and located at a point corresponding to one third the length of the tube, reckoning from the base, such flames will vibrate in unison. The phenomenon continues as long as the flames remain separate, but the sound ceases the instant they are brought in contact.

The pyrophone, at first sight, resembles an organ; but instead of being operated by air blown in, it produces its notes by the singing of the flames within the tubes, the quality of the sound, its pitch, and intensity depending of course on the dimensions of the latter. The burners from which the flames emerge are so arranged that the flames run together, but may be separated instantly by pressing down a key on an ordinary key board, seen in front. The position of the key in relation to the sound is the same as upon the piano or organ. According to the law above cited, as soon as a key is pressed the separated flames, in the corresponding tube, give forth a note, continuing, as in the organ, as long as the key is held down.

It is said that the music thus produced is extremely beautiful, and that the sound close resembles, in delicacy and purity, that of the human voice.

Condensation in Steam Cylinders.

By the use of lead facings to pistons and cylinder lids, a considerable economy in the use of steam may be effected. An iron lid and piston will, other things being equal, condense more than three times as much steam as a lead-faced piston and lid. The thickness of metal heated and cooled at each stroke is not considerable, and not far into the metal, a zone of constant temperature, lower than that of the steam, will be found. The distance from this zone to the inside of the cylinder will depend on the conducting power of the metal, and will be about 9 for lead to 12 for iron. It may be shown that, in any case, the thickness of the lead facing may be kept within very moderate limits. Other materials may be used for the same purpose, as, for instance, tin, the specific heat of which is 0.562, its specific weight being a little less than that of iron. Its conducting power is, however, in excess of that of iron, being as 15 is to 12. Slate or hard pottery ware might also be employed, but on the whole the balance of advantage appears to lie with lead.—*The Engineer*.

THE STEAM SIREN OR FOG HORN.

Fog signals, many of which are required at different points on the Atlantic and Pacific coasts, are of several kinds. Some are steam whistles, the sound of which is made deeper or louder by being sent through a trumpet; but the most effective is probably the siren. This ingenious machine consists of a long trumpet and a steam boiler. The sound is produced by the rapid revolution past each other of two flat disks pierced with a great number of small holes; a jet of steam under high pressure is projected against the disks, which revolve past each other more than a thousand times a minute; as the rows of small holes in the two disks come opposite each other, the steam vehemently rushes through, and makes the singular and piercing noise which a siren gives out. One of these machines, of which we give an illustration, costs about \$3,500 complete, with its trumpet, boiler, etc.

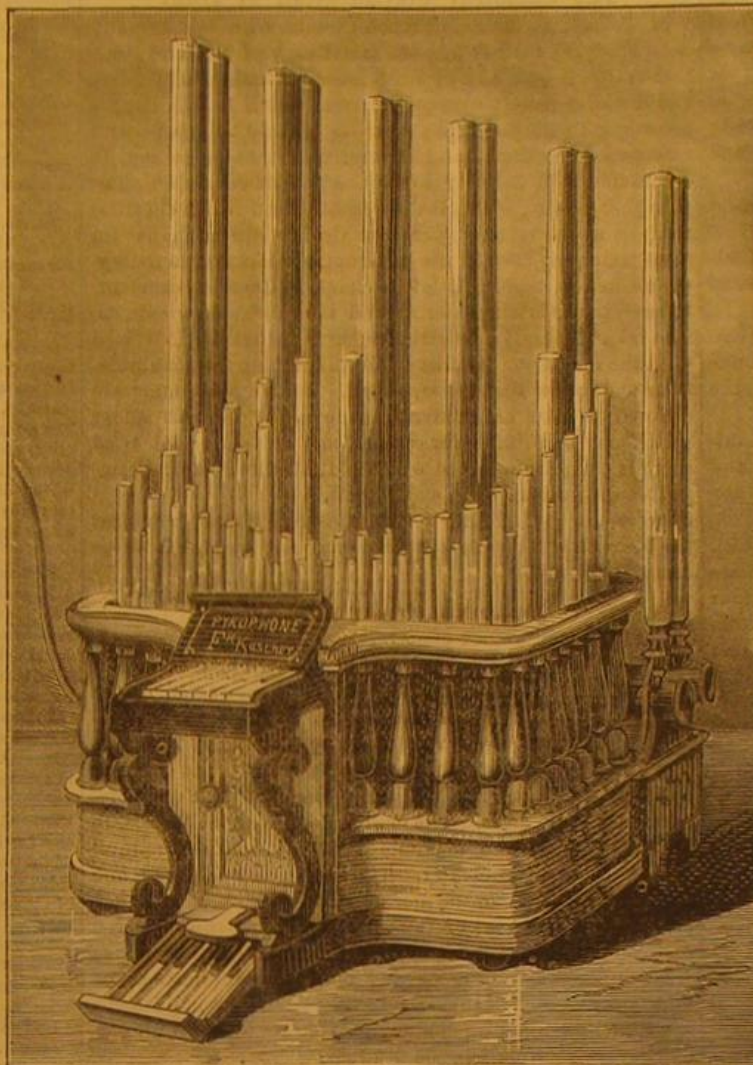
Daboll's trumpet is worked by an Ericsson engine, and requires no water for steam.

Congress rightly has great confidence in the scientific skill and integrity of the Lighthouse Board. At the last session, besides the usual appropriation for the maintenance of the lighthouse system, it gave the money needed to build forty new light-houses and ten steam fog signals. If we ever have a merchant marine of our own again, our seamen will find the stormy and rock-bound coasts of their country well lighted for them.—*Harper's Magazine*.

PRODUCTION OF LIGHT IN STONES.—When various kinds of hard stones are pressed by the workmen (with their hands) against quickly revolving grindstones, the transparent stones become pervaded throughout with a yellowish-red light, like that of red hot iron. Opaque stones give a red light, at the place of contact, with halo and sparks. Dr. Nöggerath thinks the phenomenon worth studying by physicists.

India Rubber for Steam Pipes.

As India rubber plates and rings, says the *Journal of the Franklin Institute*, are now used almost exclusively for making connections between steam and other pipes and apparatus much annoyance is often experienced by the impossibility of effecting an airtight connection. This is obviated entirely by employing a cement which holds equally well to rubber and metal or wood. Such cement is prepared by a solution of shellac in ammonia. This is best made by soaking pul-

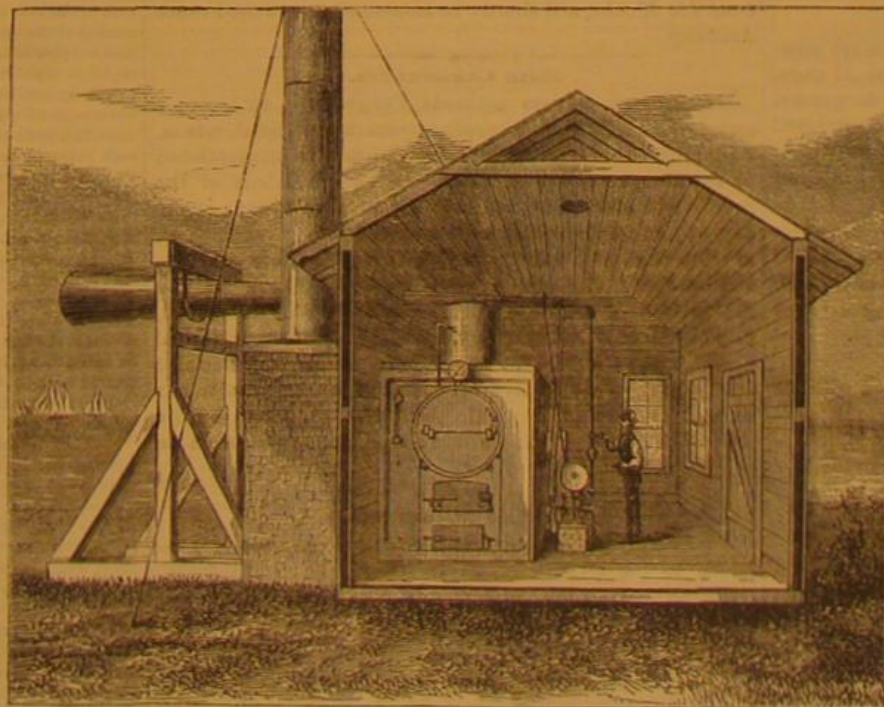


THE PYROPHONE.

verized gum shellac in ten times its weight of strong ammonia, when a shining mass is obtained, which, in three or four weeks, will become liquid, without the use of hot water. This softens the rubber, and becomes, after volatilization of the ammonia, hard and impermeable to gases and fluids.

Mineral Statistics of Great Britain for 1873.

The *London Times* gives the following statistics, showing the metallic and mineral productions of Great Britain for 1873. The total value of metals mined is \$110,800,000; of minerals, pottery materials, etc., \$9,000,000; of coal \$531,400,000. Total, \$651,200,000. The excess of value over 1872 is about \$66,400,000, and is due to the influence of the



THE STEAM SIREN OR FOG HORN.

combustible element, which has attained exceptionally high prices. The quantity of coal transported by railroads and canals shows an increase of production of 4,305,617 tons over the previous year. The increase of consumption by the metallurgical industries is but 6,073 tons, the smallness of which is accounted for by the stricter economy practised in all establishments on account of the high prices. The exports of fuel amount to 450,505 tons.

The Latest British War Ship, the Inflexible.

(From a paper recently read before the Institution of Naval Architects, by Nathaniel Barnaby, Esq., Chief Naval Architect of the Royal Navy.)

This is the ship which the progress of invention in artillery has finally driven us to resort to. Had the manufacture of enormous ordnance been stopped when the 35 ton gun was introduced, we might have been satisfied with the *Fury*, with her guns of this nature, and her 14 inch armor. But English artillerymen were ready to make guns of twice 35 tons, and foreign powers were known to be building ships to receive such guns.

There could be no question that we could not allow foreign seamen to have guns afloat more powerful than any of our own, however ready we might have been to allow them to defend themselves with thicker armor. Although, therefore, it was known that the ships in which these guns were to be mounted were to be protected by 22 inches of armor, thickness of armor was not made a ruling feature of the design of the first-class ship, which was to mark the next step in advance upon the *Fury*—but the first of the ruling conditions was that she should be able to mount the heaviest guns which could possibly be made now, and, by some easy modification in her construction hereafter, guns of twice that weight, when they can be manufactured. The other conditions were that she should have a speed of 14 knots at the measured mile, and that she should not exceed the dimensions and cost of preceding ships. It was found to be possible, in conformity with these conditions, to protect the hull by 2 feet of armor.

I may describe the *Inflexible* to you briefly in the following manner: Imagine a floating castle 110 feet long and 75 wide, rising 10 feet out of the water, and having above that again two round turrets planted diagonally at its opposite corners. Imagine this castle and its turrets to be heavily plated with armor, and that each turret has within it two guns of about 80 tons each, perhaps in the course of a few years, guns of twice 80 tons each. Conceive these guns to be capable of firing all four together at an enemy ahead or on either beam, and in pairs towards every point of the compass. Attached to this rectangular armored castle, but completely submerged, every part being 6 feet to 7 feet under water, there is a hull of the ordinary form with a powerful ram bow, with twin screws, and a submerged rudder and helm. This compound structure is the fighting part of the ship. Seaworthiness, speed, and shapeliness would be wanting in such a structure if it had no additions to it; there is, therefore, an unarmored structure lying

above the submerged ship, and connected with it, both before and abaft the armored castle; and as this structure rises 20 feet out of the water, from stem to stern, without depriving the guns of that command of the horizon already described, and as it moreover renders a flying deck unnecessary, it gets over the objections which have been raised against the low freeboard and other features in the *Devastation*, *Thunderer*, and *Fury*. These structures furnish also most luxurious accommodations for officers and seamen. The step in advance has, therefore, been from 14 inch armor to 24 inch; from 35 ton guns to 80 ton guns; from two guns ahead to four guns ahead; from a height of 10 feet for working the anchors to 20 feet; and this is done without an increase of cost, and with a reduction of nearly 3 feet in draft of water.

I cannot attempt to describe the numerous novel and interesting features of such a design, but I may say that no pains have been spared to protect her against under-water attacks, by the isolation of the independent engines, the subdivision of boiler compartments, and such further subdivisions as were possible with due regard to proper facilities for moving about. The result is that the ship is perfectly and easily workable, although she is divided into 127 watertight compartments. My belief is that in the *Inflexible* we have reached the extreme limit in thickness of armor for sea-going ships. The temptation is always great to secure more and more power by the expenditure of ever increasing sums of money, but it is my conviction that we shall not, in any future ship, go beyond this expenditure. Some of the ironclads designed ten or twelve years ago cost more than the *Inflexible* will. In the *Inflexible* provision has been made both offensively and defensively, for an enormous increase in the powers of artillery without any increase in the cost of the ship.

Iron, published in London in the interest of the metal manufacturers, says: "American hardware and machinery are being imported largely into Germany. The handy shape, the new contrivances, and generally good workmanship, are features in their manufacture which find many friends in Germany and in Russia." This is no new fact to us, but it is the first time we have known an English journal to acknowledge it.

Black currant leaf tea is recommended for dyspeptics.

THE ENGLISH TELEGRAPHS.

BY GEORGE B. FRESCO.

CONSTRUCTION OF THE LINES.

The construction of the English telegraph lines is uniformly excellent, and reflects great credit upon the Engineering Staff, in whose hands it is placed.

The timber used for poles is generally larch treated with sulphate of copper, or red fir creosoted.

The creosoting is accomplished by the Bethel process. The poles are placed in an iron receiver and the air exhausted from them, after which boiling creosote oil is forced into them by pressure. This process greatly increases the durability of the wood, pine and spruce being thus rendered as lasting as cedar. The odor of creosoted poles in some places is said to be offensive, but no objection is raised against them in England on this account.

The poles are never creosoted until they have been stacked a sufficient length of time to be thoroughly dry.

The cost of creosoting includes a certain margin for loading into trucks, or on board a ship, which is always stipulated for when the contracts are made.

It sometimes happens that a parcel of poles are exceptionally dry, in which case they are given an extra two pounds of oil per cubic foot, costing from six pence to eight pence per pole additional.

When poles are used, which are neither prepared with sulphate of copper nor creosote, they are well seasoned, and then painted, the butt ends being slightly charred from the bottom to a foot above the ground line, and tarred.

The cross-arms are made of English oak, two inches thick and twenty-four and thirty-three inches in length, and are placed alternately on either side of the pole. A twenty-four inch cross arm is placed on the front of the pole a foot from the top, and then a foot lower down a thirty-three inch cross arm is placed on the back of the pole, and so on. In some cases as many as seventeen wires are carried upon a single line of poles of twenty-five feet in length, and no cross arm carries more than two wires, except on the double pole lines, where seven feet cross arms are employed, and four wires are supported upon each cross arm.

All the poles are provided with earth wires, or contact conductors for carrying the wet weather escape directly to the earth, instead of permitting it to leak into the neighboring wires. The earth wire consists of a piece of No 8 galvanized iron wire, extending from the top of the pole to the bottom, and terminating in a flat coil attached to the foot of the pole, so as to expose as large a surface as possible to the earth. From the thick earth wire, branches, composed of No 10 galvanized iron wire, are carried in saw grooves sunk in the cross arms, and soldered to the insulator bolts. The work is performed at the factory before the cross arms are carried out on the line. The earth wires sometimes project above the top of the poles, and serve an excellent purpose as lightning arresters.

Great care is taken to keep the poles in a rigidly upright position; and in addition to placing them well in the ground and tamping the earth thoroughly around them, they are well supported with stays made of wire ropes attached to iron rods, which run into the ground about four feet. On straight lines and slight curves, where exposed to the winds, double stays are employed.

INSULATORS.

The insulators on the railway routes are uniformly of the Varley double cone brown ware pattern, and those upon the canals and highways of the single cone white ware, or porcelain. The Varley insulator is regarded as the best, but its greater cost has prevented its exclusive use.

THE CONDUCTORS.

The conductors employed upon the English lines are composed of zinc-coated iron wires of Nos. 4, 8, and 11 gage. The No. 8 gage—0.170 inch diameter—is the size in general use; the No. 4 gage—0.240 inch diameter—being employed upon a few of the long circuits between the more important points, while No. 11—0.125 inch diameter—is used for short lines only.

The method formerly followed of allowing the wires to pass freely through the insulators, and fastening them only at distances of half a mile, has been abandoned in favor of binding them at every pole, No. 16 charcoal wire being used for binding.

JOINING THE WIRES.

Great care is observed in the joining of the wires, which is invariably performed upon the line, no joints by the wire makers being permitted. The joint exclusively adopted is that known as the Britannia joint. This is made by slightly bending the ends of the two wires and placing them side by side for a distance of three inches, and binding them tightly together with No. 19 wire, and soldering them thoroughly. All joints are required to be soldered, whether the wire be old or new, galvanized or plain. The leading-in wires at the offices are insulated with gutta percha, covered with linen tape and varnished with a preparation made of linseed oil and Stockholm tar. These wires are re-tarred from time to time to prevent decay.

THE OVER HOUSE WIRES.

The over house wires are erected in spans, supported by iron poles attached to cast iron saddles, which are fitted at the ridge of the roof. The poles are light and well stayed by wire ropes. In London, cables containing 50 insulated wires are suspended by hooks from No. 8 iron wires, carried in the manner described above. The conductors in these cables consist of No. 22 copper wire.

At Newcastle-on-Tyne, a strand composed of seven steel wires, of No. 16 gage and 454 yards long, is suspended over the Tyne, and supports a cable containing fifteen conductors.

The cables rest upon ebonite chairs attached to the rope by means of rings placed at distances of 12 feet apart.

The over house wires are used principally for lines which are leased by the Post Office Department to private firms or individuals for the transmission of messages on their own special business between offices, factories, etc., and which make a system of nearly 5,000 miles.—*Journal of the Telegraph.*

The Chemical Classification of Iron.

M. Frémy, an eminent French chemist who has recently been studying further into the metallurgy of iron and steel, thinks that it would be of much more advantage to founders and metallurgists if commercial iron, which is still classed according to its physical properties, should be known with reference to its chemical characteristics, that is to say, in accordance with the very small quantities of carbon, sulphur, phosphorus, etc., which it may contain, and which chemical analysis would reveal. This chemical classification has for some time past been in use in Krupp's celebrated foundry, where, in fact, nothing is left to chance. Chemists constantly analyze the crude materials and the fabricated products. The scientific and industrial element is intimately connected with the military. Artillery officers examine the manipulations and follow their every detail. Considerable sums are devoted to new experiments, made on the different alloys which may be suitable for cannon, and of each metal tried there is compiled a record which indicates its chemical composition, its advantages, and defects.

According to M. Frémy's investigations, it appears that the best metal for guns is neither iron nor steel, but some combination of both.

New Street Railway Locomotive.

A trial recently took place on the Manchester, Sheffield, and Lincolnshire railway, between the Grange Lane and Tinsley stations, of a tramway engine, constructed by the Yorkshire Engine Company, upon L. Perkin's patent system, for the Belgian Street Railway Company, Brussels. The novel features of this engine consist in its not emitting any smoke or steam into the atmosphere, and making comparatively little noise. The engine used steam at 500 lbs. to the square inch, and maintained this pressure by natural draft without any difficulty. The engine is compound, and expands the steam to the most economical limits, and then condenses it by means of two air surface condensers placed one on either side of the machine. The engine can be driven from either end, all the driving gear being duplicate to obviate the necessity of turntables. The engine accomplished a speed of fifteen miles per hour, drawing its full load up gradients varying from 1 in 200 to 1 in 80.—*Iron.*

Ballooning Extraordinary.

We recently published a note of Mr. Croce-Spinelli to the French Academy of Sciences, in which he indicated the belief that existence could be maintained at very high altitudes by aeronauts, if they should provide themselves with cylinders of oxygen, to be breathed in the highly rarefied atmosphere. M. Spinelli and Sivel have lately demonstrated the truth of this view by ascending in the *Etoile Polaire*, a balloon of 98,840 cubic feet capacity, to the immense elevation of 25,841 feet without inconvenience. The barometer level descended 11.7 inches, showing the above altitude, which is higher than that obtained by Gay Lussac and nearly equal to the point reached by Glaisher in his famous ascension. The thermometer at minimum marked 7.6° below zero Fah. The aeronauts, having taken with them all necessary instruments, made a number of valuable observations which, we learn from *Les Mondes*, will shortly be communicated to the French Academy.

Rain Cannonades.

Mr. Edward Powers petitions Congress to authorize a series of experiments to produce rain by artificial means, during dry seasons. This, he points out, may be accomplished by the firing of heavy artillery. In back numbers of the *SCIENTIFIC AMERICAN*, we have given many specific examples of rain storms which have followed heavy cannonades, in connection with various battles, during the late rebellion and European combats. There is reason to believe that the concussions of artillery, when sufficiently long continued, may have a condensing or aggregating effect upon the aerial vapors, and so induce the fall of rain. When the national debt is paid, or specie payment resumed, we think it might be well to burn some public powder as suggested by the present petitioner. But we move that the experiments be postponed until then.

A Chance for Investors.

The attention of parties desiring to invest in patents is directed to the announcement of Messrs. F. A. Hull & Co., manufacturers of the Danbury drill chuck, published in our advertising columns. This invention was fully described and illustrated on page 214, Vol. XXIX. of the *SCIENTIFIC AMERICAN*, and is a three-jawed lathe chuck so constructed that all the jaws are simultaneously moved, in radial directions, by the revolution of a single right and left hand screw. The action is direct and positive, and it is claimed, cannot clog, set, or in anywise get out of order.

We are informed that, since the placing of the article upon the market, it has met with a ready sale, and has given general satisfaction. The owner, desiring to dispose of the patent in order to devote his efforts to a more important enterprise, offers the same at quite a moderate price. Judging from the representations of the manufacturers, we presume that any one, having the requisite capital, will find the investment highly profitable.

THE ST. LOUIS BRIDGE.—The iron work is now complete, two weeks in advance of the contract time. A grand banquet has been given by the Keystone Bridge Co., contractors, to their employees, some 200 in number, at the Grand Central Hotel. The approaches will now be hastened to completion, railroad tracks laid, and carriage ways finished as speedily as possible; and the indications are that the bridge will be thrown open to public traffic at a much earlier day than was anticipated.

Recent American and Foreign Patents.

Improved Stone Pavement.

Andrew Eichenberg, Columbus, Ohio.—This invention is an improvement in stone road beds, and consists in arranging an upper vertical layer with a horizontal layer of flat stones. Both break joints to insure a greater degree of stability of the individual pieces in their normal position. Sand or gravel is used to fill the interstices.

Improved Belt Shifter.

Harrison W. Curtis, Philadelphia, Pa., assignor to Joseph L. Ferrell, same place.—This invention consists of an arrangement of the idle pulleys used for turning a driving belt out of a right line for a belt shifter by mounting them on a swinging frame in a line cutting the center of the angle between the two lines in which the belt runs.

Improved Grain Tally.

George P. Fitts, Jacksonville, Oregon.—A carriage moves forward and backward on guide rails between stop pins. A measure is retained in position on the carriage by pegs, and placed under the spout of the threshing machine, passing under cross bars for equalizing the grain in the same. The attendant moves the carriage in one direction, when one measure is filled, and empties the same while the other measure is filled from the spout. He then moves the carriage back, taking off the second measure when full, and repeats this operation, a registering device keeping a correct tally of the grain measured off, forming thus a very convenient self-acting apparatus for counting the number of measures.

Improved Thill Coupling.

J. Russell Little, Jamaica Plain, Mass.—This is an improved coupling for connecting thills or a pole with the axle of a carriage. A retainer, which is a small bar of iron, the ends of which work in slots formed in the yoke of an axle clip, when pushed into the forward ends of its slots, comes so far over the hook head of the thill iron as to prevent the said thill iron from being raised from the bolt. The retainer is held forward by a spring, which will allow it to be pushed back when it is desired to attach or detach the thills or pole.

Improved Bobbin Winder for Sewing Machines.

Moses Cook and Moses G. Cook, Ashfield, Mass.—This invention consists of a traverse mechanism for a bobbin winder for sewing machines, in which a drum with a reversing cam groove for working the traversing guide forward and back along the spool has the necessary slow motion imparted to it by a pawl and a friction gripping strap. The pawl is worked by an eccentric on the bobbin turning shaft, which receives motion from the sewing machine wheel by a friction wheel. An adjusting screw regulates the extent of the pawl's movements so as to turn the drum fast or slow, according to the size of the threads, and the drum has a friction strap and spring for holding it when released by the gripping spring. The bobbin has a spring on its spindle for fastening the thread to it at the beginning. The spool holder has a tension spring to regulate the unwinding of the thread from it.

Improved Combined Gang Plow, Cultivator, and Chopper.

John J. Watrous, West Point, Ga.—This invention has for its object to furnish an improved machine which may be readily adjusted for breaking up and bedding land, and for cultivating and chopping the crop. By suitable construction no tongue is required, which enables the machine to be turned in a very small space, and the chopper is operated by its advance. The chopping hoes may be conveniently adjusted to work deeper or shallower in the ground, as may be desired. The chopper may be easily raised from the ground, and thus prevented from working, and, when not required for use, may be detached. The plows may be adjusted to work shallower or deeper in the ground. Any desired number of plow beams may be used according to the kind of work to be done. Suitable construction also allows the rear ends of the plow beams to have a free vertical movement.

Improved Pitman.

George L. Jones, Vanville, Wis.—This invention consists in a pitman having a side-notched eye at each end, and a collar bushing combined with a pin secured at both ends by a nut. By this construction, a washer and the eye of the pitman can be forced farther upon the pins to take up the wear, by screwing up the nut.

Improved Machine for Making Animal Shoes.

William Hamilton, Fallsburg, assignor to James L. Lamoree, Grahamville, N. Y.—This invention consists of an anvil, trip hammer, and two side hammers, for hammering the shoe on the sides and edges. The anvil is flat on the top, and the hammer has a face which is the same form in outline as that of one side of the shoe to be made, but wider, so as to insure the hammering of the upper side of the blank over all its surface. The hammer is also beveled or inclined to vary the thickness of the shoe and produce the requisite shape for the top. One of the side hammers is shaped in respect of the contour of its face to correspond with the required shape for the outer edge of the shoe; the other is shaped to correspond with the inner edge, and both rest on the face of the anvil, and work toward and from each other to hammer the edges of the blank. These hammers perform their operation while the trip hammer is raised, and then move out of the way when the trip hammer falls, to give the necessary space for it between them which is required by the greater width of the hammer than that of the blank. The side hammers are operated by the helve of the trip hammer, one being connected directly to an arm projecting from its axle by a rod or shank, so as to be thrown forward when the hammer rises, and the other being connected to the same arm by a similar rod, and an intervening rock lever, by which it is moved toward the other side hammer by the same operation of the trip hammer. A bar is arranged on the trip hammer helve, to be acted on by the tappet wheel for raising the hammer, which said bar is jointed to the shank, and arranged to swing out of the path of the tappets to throw the hammer out of gear, and into their path to put it in gear again.

Improved Adjustable Catch for Latches.

George W. Burr, East Line, N. Y.—This invention is an improvement in the class of catches for door and gate latches, which are made vertically adjustable to accommodate the various positions the door or gate may assume in consequence of shrinkage, swellings, or other cause. The invention consists in combining a T-shaped catch with a slotted holder or guard plate, which is secured to the gate post by screws, so that by means thereof the catch may be clamped and held by friction at any desired point.

Improved Corn Plow.

Jeremiah H. Trout, Kingwood, assignor to himself and Isaac S. Cramer, Sergeantville, N. J.—The shovel standard is made in two parts and jointed to allow an outward lateral movement to the lower part, with a spring on the outside and a lever on the inside. The draft bars, which are attached to the frame and run along through slots in the plow stocks, are connected to the stock by wooden pins, which are prepared, in respect of their strength, so as to break readily if the plow encounter too great resistance. The stocks are pivoted to the frame, so as to swing back in case the pins break.

Improved Ice Machine.

Thomas F. Peterson, Macon, Ga.—This invention consists of a boiler, condensing coil and cooling tank, receiver, freezing coil and tank, and pumps, all combined and arranged so that the ammoniacal gas expelled from the boiler by heat is compressed and condensed in the condensing coil, and then, after passing through the receiver, is let into the freezing coil, so as to expand therein and freeze the water in the tank by taking up the heat from it. It is then pumped directly into the boiler again for repeating the process, and takes with it the heat obtained in the freezer, and thus utilizes it instead of wasting it.

Improved Tube Welding Machine.

Joseph R. Lemen, Champaign, Ill., assignor to himself and T. G. Lansden, same place.—There is an anvil die and a hammer die for hammering down and reducing the end of the tube to be inserted in the piece to be welded on, or for receiving the ferrule on the end to be fitted in the tube. The anvil die has a part of its concave face made on a circle enough larger to equal the thickness of the metal of which the tube is made, so that the mandrel on which the tube is to be hammered, being entered in the end to be reduced, will hold the tube. When hammered by the die, it will rest thereon, so as to be suitably contracted and reduced, and not stretched or drawn out larger, as it would be if hammered on the mandrel alone. A shoulder on the under part of the anvil die forms the gage for length. The anvil die and hammer die for welding the tubes together are concave like the others, but of uniform size and shape from end to end, except a little convexity in the form of the hammer die, to avoid angular indentations in the surface of the tube. They also have a mandrel. The tubes are presented from the right hand sides, and held by the other end in the hand of the attendant, to be turned and shifted about, as required.

Improved Watchmaker's Tray.

Lyman B. Milliken, Saco, Me.—The object of this invention is to furnish for the use of watchmakers a convenient and handy tray, which enables the workman to take down a watch movement and keep the different wheels, each with its corresponding bridge, pins, and screws, separate, so that there is afterward no trouble or delay in putting the movement together. The invention consists of a concave tray of suitable shape provided with a series of concave indentations, and a central raised part with similar convexity, on which the plate is placed at different stages of the work, while the detached parts are arranged separately around the same.

Improved Seed Planter.

Simeon Smith, Jr., Newburgh, Tenn.—This invention consists in the combination, with a hopper and seed disk, of a beam having a recess filled with compressible material behind a spring, to keep the space full to exclude the grain, and allow the spring to work forward and back, to allow the grain to pass under the pad freely, and prevent any catching and cutting or breaking of the grain.

Improved Die for Forging Hammers.

James R. Lindsay, Chicago, Ill.—This invention consists in a device for cutting metal formed of two cutters bars connected by straps to a hand lever, and the cutters so shaped that bolts and rods of varying size, shape and configuration may be cut with equal facility.

Improved Knob Latch.

Walter Varah, New Haven, Conn.—A milled head being turned, a sleeve (by its spiral slot, in which is a pin) moves another sleeve inwardly or outwardly, thus throwing a stud into or out of the notch of hub. Thus the spindle may be connected with or disconnected from the hub that operates the bolt.

Improved Game Board.

Jacob Daring Spang, Dayton, O.—This is a toy race track upon which quite an amusing game may be played, serving, according to the inventor, to illustrate, on a small scale, the spirit and excitement of the turf. The race field track or platform is inclined when in use and surrounded by a mimic fence or enclosure. There is a starting station in which representative horses or balls are placed, the horses or balls being severally marked, and the number being optional. A bottom hinged gate is held across the outlet by cords which pass through holes in the platform or track. As soon as this gate is depressed the balls will pass out. They will first encounter posts, arranged in transverse rows, the individual posts of two rows not being opposite or in alignment, but each one occupying a median position between the two nearest posts of the opposite row. The balls will be retarded more or less by the posts, as well as diverted from their course, but will all come to the cross hurdle, which is inclined on the face that is opposite to the starting station. They next will move over this and pass through the three rows of posts to and over a second hurdle. In passing through the next section of the race course, two transverse rows of stables or stops will be met by some of the balls, which will be caught and stopped, while others will escape, though interrupted by another intermediate cross row of posts. They will now pass over another hurdle and more stops and finally reach the goal. Those which succeed in reaching the goal will not, however, arrive simultaneously, but successively, thus enabling the one arriving first to be accounted the winner and to score the highest number or count in the game, while others are allowed a count according to their relative time of arrival.

Improved Gas Stove.

Charles Witteck and William G. Steinfetz, New York city.—The base part of the stove contains four burners, and the draft passages are arranged above the same. The burner nearest the supply pipe produces the main draft through the passages, and is, therefore, allowed to burn continually with a full supply of gas, while the supply of the other burners is regulated by a suitable stopcock. A horizontal partition plate separates the lower part of the base from the upper part, which forms with the top plate the combustion chamber. The partition is vertically adjustable in slots. The admission of air to the combustion chamber is accomplished through the perforations along the upper part of the base. The quantity of air required for the full combustion of the gas is regulated by the higher or lower position of the partition by which the slots are partially opened or closed. The burners connect with the combustion chamber by pipes which open into metallic extension burners which extend along the side walls of the base. The air slots are provided with narrow slots, through which the blue heating flames of the gas issue. A large air hole is arranged in the base for the admission of a stronger current to the larger casing of the main burner.

Improved Ear Tube.

Henry B. Auchincloss, New York city.—This invention consists of a tube arranged in any seat of a hall, church, or similar public building, and having a funnel-shaped mouth, easily adjustable to suit the height of the ear of the user. The lower end of the tube is designed to pass down through the seat, and be connected with a tin tube passing beneath the seats or floor, and passing up near the speaker's desk, where it should terminate in a funnel-shaped mouth.

Improved Cam Slide for Sewing Machines.

Andrew Aldred and William Randel, Troy, N. Y.—This invention consists of a block of steel or other material on the end of the needle arm which works in the cam groove, so constructed as to slide in the groove as a substitute for the roller commonly used. The block is divided into two separate pieces, whose exterior faces are shaped so as to allow them to slide freely along the varying angles of the cam, and the interior faces are made to permit an independent oscillating motion of each part on the stud of the arm. The invention also consists of a spring between the blocks to keep them apart to take up the slack that may occur by wear, and cause them to fill the groove at all times.

Improved Lamp.

Bernard Faatz, Milwaukee, Wis.—This invention is a kerosene or petroleum lamp having a weighted sheet metal base, converging, and provided with a flange having a polygonal periphery suspended above the plane, which supports the base of the lamp. This prevents the effect of an overturn by catching upon the table or other adjacent article. Just after the center of gravity has passed beyond the base. A rebound is created that throws the lamp back, and causes it to regain its equilibrium, or affords the person who has caused the accident time to seize it before damage is done.

Improved Hoof Trimmer.

David Booker and Cornelius N. Tash, Palmyra, Ill.—This is an improved hoof trimmer, by which the horse's hoof may be neatly pared on the flat part, chased from the dirt, and trimmed at the outer edge, so that the hoof is quickly and fully fitted to the shoe. It consists of a main cutting knife at the end of a strong bar, with handle end. The knife is curved outwardly to a point, and serves with its end for paring and cleaning the hoof, while the lower part is used, in connection with a second smaller curved knife, which is pivoted to the larger, and operated by pivoted connecting rods and hand lever, like shears, for trimming the hoof.

Improved Spring Shank for Boots and Shoes.

Emil Briner, New York city.—This is an improved spring shank, which is not only stronger at the point of greatest strain, and more flexible at the fore ends, but which may also be adjusted to various degrees of elasticity, as required. Two spring shanks, of equal length and strength, are spread at the front ends, and are connected by a central pivot. Holes are provided at the heel ends for attaching them to the heel and adjusting their front ends without weakening the heel part.

Improved Plow.

Edward Walter, Salisbury, Mo.—The upper part of the standard is bifurcated, the main arm being pivoted to the beam, while the curved backward extending arm passes up through the beam, and is held thereon by means of a nut and washer. The beam is raised or lowered as the nut is turned, and thereby the share elevated or depressed accordingly. The increased strain which the beam has to bear thereby is met by a metallic strengthening rod, which is pivoted to the main arm of the standard, and extends below the beam.

Improved Bag Holder.

Erasmus D. Hix, Payne's Depot, Ky.—This is a bag holder for filling wheat, corn, and other cereals into sacks in the granary; and it consists of a strong supporting standard, in which slides adjustably the end of the curved steel arms which spread sidewise, and are bent at their front extremities, under suitable angles, into a connecting spring hoop, over which the hem of the bag is attached, and firmly secured by pointed hooks at the front end of the hoop.

Improved Organ Coupler.

Charles W. Fossler, Adeline, Ill., assignor to himself and Christian Fossler, same place.—This improved organ coupling device consists of a pivoted platform, to which the coupling arms are attached, bent in such shape that, on throwing the platform up, the keys will come in contact with the arms when depressed, and thereby couple the corresponding pins to those originally depressed by the keys.

Improved Grading Apparatus.

Ole Matson, Moline, Ill.—This is an improved apparatus for moving earth from one place to another, in grading roads, lawns, etc. The driving shaft revolves in bearings in a frame staked to the ground, and is connected by bevel gearing with a pulley around which passes an endless chain. The chain also passes around a grooved pulley, pivoted to one end of an arm, the other end of which has a hole formed through it to allow it to be placed upon a post. The other part of the chain is held out of the way by passing around a grooved pulley, pivoted to the end of a bar, upon the outer end of which is formed a hook or eye to enable the end of a rope to be conveniently attached to it. The rope passes over a pulley pivoted to a bow, which is passed over the end of a screw post. The line is held in place upon the pulley by a line holder, which consists of a wing pivoted in the fork of a plate, in such a way that the edges of said wing may shut down against the arms of the plate, and thus hold the said line. The line holder thus holds the endless chain in place, and enables any slack to be conveniently taken up. Scrapers, made of a single plate of iron, are provided with holes to receive wooden handles, and with ears to receive the draft chain, which is connected with the endless chain. The scrapers may be filled and emptied at any required points of the circuit of the endless chain, and the position of the said chain may be readily shifted by moving the screw posts from one place to another.

Improved Apparatus for Feeding Steam Boilers with Air.

Martin E. Bollinger, Littlestown, Pa.—An air pipe leads directly from the feed pump to the boiler through a heating coil surrounding the fire, to be used when a steam heater cannot be used, as on locomotive engines. This, with the air feed pipe, is provided with a check valve and stopcock, to let off the pressure for a short time when starting. The steam pipe enters the steam dome above the water line. The pipe for the circulation of the water is tapped into the boiler shell, near the smoke stack, below the water level, and into it again at the front above the water level.

Improved Variable Exhaust Valve.

David H. Seamon, New London, Conn.—The valve is in the form of a hollow truncated cone reversed, and is seated on the upper end of a tube. Guide rods, rigidly connected with the valve by means of arms, pass through ears of the tube, and are connected with a semicircle on the end of a lever which extends back to the engine room, so that the valve may be operated by the engineer or fireman, as occasion may require. For producing what is known as a "sharp" exhaust of steam into the chimney, the valve is kept closed, so that all the steam passes through the valve. For a less sharp exhaust, the valve is raised so as to make an annular opening between it and the seat. By raising the valve in this manner, the annular opening is graduated in size to suit the exigencies of the case, the lever being arranged so that the valve may be set and held in any desired position.

Improved Seal Lock.

Daniel T. Casement, Painesville, O., at present residing at the Fifth Avenue Hotel, New York city.—This invention consists in connecting a push pin and seal punch by a rock lever, so that, when the former is forced in to disengage the hasp, the other will be thrust out through the seal; also in constructing the end of the hasp with a notch of peculiar form, corresponding to that of one end of the locking bolt. The fastening is attached to the door by means of a screw bolt, and has a lip fitting over the open end of the card-holding frame. The bolt passes through a slot in the sliding hasp. The frame for confining the seal is provided with rough and jagged notches and points to make it impossible to cut out the card and then fit in another. A glass seal may be used as well as the paper card, if preferred, and, when used, the seal punch may be dispensed with, as the glass will have to be broken to work the push pin; and when the lock is adjusted for the use of the swinging hasp, the mouth will be suitably arranged for allowing the broken pieces of glass to fall out.

Improved Device for Checking Horses.

Edwin R. Kay, Columbus, Ky.—Two bridle cheek rein pulleys and a pulley for a hand rein are made in one piece, having through their center a shaft. The ends of the shafts are made fast to the hames, reaching from one side to the other, with the pulleys revolving thereon. The cheek reins of the bridle are attached, in any suitable manner, to the first pulleys. To the other pulley a hand strap or rein is attached, and is wound around it. The difference in the diameter of the bridle and strap pulleys gives the driver a purchase on the bit, which controls the horse.

Improved Machine for Upsetting Tyres.

Mathias Schon, Englishtown, N. J.—This is a machine for upsetting or shortening wagon tyre or iron bars of other descriptions that may be operated by one man. A stand has on each side a bar. These bars support a stationary head and guide a hinged head. The stationary head is also attached to the edge of the stand. These heads are placed crosswise of the bars, each having a flange, against which the adjusting blocks are placed. Grips jaws, one on each of the heads, have levers, and are connected by the jointed bar which is attached to an operating jaw. By working the latter, power is applied to one of the grips jaws which first strikes the tyre, when the other jaws are also caused to gripe the tyre. The tyre is in a heated state, between the two jaws, and is firmly held, so that it can have no longitudinal motion, by the operator, while, with his left hand, he grasps a cam lever, and forces the movable jaw and head toward the other jaw. This movement causes the jointed bar to turn outward on its hinge and upsets the tyre. The anvil is fastened between the two bars, and the tyre rests thereon. In case it bends upward, it may be forced down with a hammer.

Improved Door Bell.

David Mosman, West Meriden, Conn.—A gong is screwed upon the end of a standard attached to the door. The standard is made with an offset, and to its angle is pivoted the hammer. The short arm of the hammer projects down into a slot in the shank of the standard, and to its end is pivoted a rod which passes out through the door and has a knob. Upon the inner part of the rod is a nut, which strikes against the base of the bracket to limit the movement of the rod, and thus regulate the force with which the hammer strikes the gong. A washer prevents the said nut from being turned upon the rod, and thus moved out of place by the concussion.

Improved Gate.

George C. Crum, Barr's Store, Ill.—This invention consists in a novel and very simple mode of opening a gate from the back of a horse or the inside of a vehicle without alighting or indeed any personal inconvenience.

Improved Carriage Curtain Fastening.

John Bannhr and Daniel H. Rhodes, Hempstead, N. Y.—This invention is a fastening for carriage curtains which will hold securely, and is not liable to become accidentally unfastened. Small slotted metallic plates are attached to the curtain at suitable points on the sides and bottom. These slip over buttons which are pivoted to the frame. The latter has a concave outer edge into which the inner rounded edges of the buttons fit, so as to press the curtain down in its place. Securing the button after the slotted plate is slipped over it, holds the curtain securely.

Improved Universal Joint.

Hiram Pitcher, Fond du Lac, Wis.—This invention relates to apparatus used for conveying power and motion by means of rods from the motor to the machinery driven; and it consists in a universal joint formed of a cup piece and a head piece, with intervening rollers. The outer ends of the rollers are made conical, to prevent undue friction. The rollers revolve independently of each other as they are touched by the head, and this allows the two coupling rods to be placed at an angle with each other without increasing the friction. The purpose for which this joint is more especially designed is for connecting horse powers with thrashing machines.

Improved Vehicle Wheel.

Benjamin Pearson and Horace W. Pearson, Newburyport, Mass.—The joint is made so far from the middle of the space between two of the spokes that the end of one segment will be supported by the spoke, and by cutting the ends or making the joint on a bevel, the other segment is caused to act as the key of an arch on the other segment, and be thus supported. While the joint is made beveling, the bolt is passed through at a right angle with the felly, and through the center of the bevel joint. This position of the bolt prevents lateral movement of the ends, and obviates the necessity of doweeling the ends together.

Improved Shoemaker's Shoulder Tool.

William L. Peters, Oxford, Mass., assignor to Charles I. Rawson, of same place.—This invention consists of a shoulder tool for smoothing and finishing the edges of the sole and the ball edges of the heel, in which file-cut faced disks of hardened steel are combined with the rubbing blade, so as to scrape, smooth, and finish the edges at the same time the rubber is used. The disks are adjustably attached to be shifted around as they wear dull, and several disks of different thicknesses are constructed alike, so as to be interchangeable for soles of different thicknesses.

Improved Mechanism for Actuating Punches.

Warren Lyon, Mamaroneck, N. Y.—This invention consists in a wheel provided with radial notches in the side of its rim, a lever provided with a projection upon its side, fitting into said notches, and a loose collar, in combination with the gearing by which the machine is operated. By operating the lever the wheel is turned in either direction, which gives motion to the gearing. The peculiar construction of the lever and notched wheel enables the said lever to be readily shifted at the end of a stroke to obtain a new purchase, so that immense power may be applied by a series of successive efforts until the desired effect has been accomplished. This power, when applied to a punching press, enables the punch to be readily forced through a bar five eighths inch thick, or even thicker.

Improved Operating Mechanism for Hatches.

William S. Harris, Brooklyn, N. Y.—This invention relates to the hoisting and lowering apparatus employed for simultaneous opening and closing a series of hatch covers by a windlass or other power; and it consists of the rope, chain, rods, or other device employed for connecting the hatch covers to the power apparatus, extended directly from one cover to another, from the topmost downward, and passing through a notch or eye in them, of peculiar construction. There is a knot above and below the covers, to prevent the rope from running through the eye without effect, said knots being placed such a distance apart as to allow of such little play of the rope as may be needed to each cover. The object is to simplify the arrangement and cheapen the cost of such apparatus.

Improved Log Turner.

William E. Hill, Erie, Pa.—This is an improved log turner, which is applied to the log, and the rolling motion of the log is produced by the continuous motion of the spur wheels without tearing or injuring the same, while allowing at the same time the immediate interruption of the rolling, and the placing in position of the log for sawing; the rolling mechanism is then carried back to rest on the supporting frame out of the way of the saw. Wheels with pivoted spurs are provided for simultaneously raising and rolling the log, which wheels are keyed fast to a shaft turning in bearings of a shield-like frame, which incloses the gear wheels and brake mechanism of the log turner. The casing, with its spurred wheels, is supported on a supplementary cushioned frame and thrown into gear with the driving power by suitable lever mechanism, which carries the wheel up toward the log. The brake is applied by a yoke with eccentric band, and lever connection to the upper wheel, its lever serving the twofold purpose of operating the brake and forcing the log into exact position for the saw on the carriage, and throwing the log turner into gear.

Improved Music Leaf Turner.

George Sweatt, Lebanon, N. H.—This invention consists of fingers, for turning the sheets, provided with a circular toothed base, and arranged, one above another, on a vertical pivot in a chamber, in or below the music board, along which a toothed bar is made to slide for throwing the fingers, said bar having a row of teeth for each finger arranged to operate them successively. There are foot treadles, for sliding the toothed bar forward and backward with pulleys, to be turned by them, and cords connecting said pulleys with the bar to move it by being pressed on them, one treadle and pulley being to pull the bar to the right, for turning the leaves from right to left, and the other being to turn them back again, when it may be required to do so. The music rack is adjustable forward and backward relatively to the fingers, for turning the leaves, and is held up to them by springs, so that the leaves between are always held in the proper relation to the fingers, whether the book be thick or thin.

Improved Portable Fence.

James M. Wallis, Rocky Comfort, Mo.—This is an improved stay for fences. One brace is set in an inclined position and extends to the top of the fence. The foot brace, the lower end of which rests upon the ground, is attached to the other brace, near its middle point. To the braces are attached vertical bars. When the stays are applied to a rail fence, the foot brace is attached in such a position that it may support the bottom rails of the fence at the proper distance from the ground. In this case two vertical bars are used, and the ends of the rails of the adjacent panels are placed upon each other alternately. The top rails are placed above the brace first mentioned, a block being notched and fitted into the space between the brace and vertical bar for the ends of the top rails to rest upon.

Improved Dumping Wagon.

Charles Campbell, Cambridge, Wis.—The hind part of the bottom is attached to a roller, suspended under the box sides. The front end rests on a cross bar fastened to the box sides, and the rear end is held up by a hook. The hounds of the hind truck are fastened to the cross bar. The fore part of the bottom is attached to another roller suspended under the box sides, and rests at the rear end on the reach. This reach is connected to the cross bar, so as to be detached when the load is to be discharged to let the hind end of the fore part of the bottom down. The connection is made by a staple which passes up through the bar so as to be fastened by a long rod which slides in from the side of the wagon box, so that it can readily be put in and taken out.

Improved Apparatus for Puddling Iron.

Joseph Davies, Knoxville, Tenn.—This invention consists of two puddling tools, one revolving and the other having a reciprocating motion within a rotary furnace. It is believed that, by the rotation of the hearth in this manner, the puddling tools can be worked by power in a simple way, because the iron is brought to them by the hearth; and by using power driven tools, the puddler's labor is much lessened.

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The recently discovered Evergreen, Frugiferous, Creeping Pine. For particulars, address (stamp enclosed) J. F. Lewis, Wyoming, Luzerne Co., Pa.

A Machine to cut the edges of Band Iron, making them straight, is wanted by the Wheeling Hinge Co. See advertisement in this column.

Bradley's Croquet has the Patent Socket Bridges. Examine this improvement.

For Sale—Several Screw Machines of different sizes, cheap; also, a second hand Press. Write, for particulars, to A. Davis, Lowell, Mass.

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Nail Maker's Band and Face Stones—Best in use. J. E. Mitchell, Philadelphia, Pa.

The Catechism of the Locomotive (which is now being published weekly) in the Railroad Gazette of April 15, will contain engravings and descriptions of the Steam Whistle, Throttle Valve and Gages, and accurate engravings, made to a scale of 3/4 in. to 1 ft., of 8-wheeled locomotive by the Grant Works, 3-wheeled, 10-wheeled, and Mogul Locomotive by the Baldwin Works. Single copies 10 cts. \$4 a year; \$2 for 6 months. Address The Railroad Gazette, 73 Broadway, New York.

A practical Machinist, competent by experience, would travel and sell machinery for some responsible company. Address F. S. Williams, Binghamton, N.Y.

Removal—J. & W. Feuchtwanger, of 55 Cedar St., have removed to 150 Fulton St., two doors above Church St., New York.

Position Wanted—To Teach Chemistry and Physics. Salary \$1500. Address A. M., Station H, N.Y.

Furniture Men and others—A new patent convertible cradle and crib; also two other patents in a wood article. The whole or parts will be sold for a small amount in either patent. Reed & Co., 835 Broadway, New York.

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Burglar Alarm wanted by N. W. Ader, Balbridge, Ind.

Forges—(Fan Blast), Portable and Stationary. Keystone Portable Forge Co., Philadelphia, Pa.

Patent for Sale—The best Burglarproof Door Lock in the world. F. Gys, 199 Greene St., N.Y.

Small turning in metals done to order by Hendey Brothers, Wolcottville, Conn.

Steam Whistles, Valves, and Cocks. Send to Bailey, Farrell & Co., Pittsburgh, Pa., for Catalogue.

For Sale—A "Burdick" Bolt heading Machine, improved—perfect order—at a low price. Address C. E. Hunter, Hinsdale, N. H.

Patent for Sale—Patent Knife, Pen and Penholder Combined. Has paid, and will pay, large profits. Address Patentee, Box 143, Hinsdale, N. H.

For Surface Planers, small size, and for Box Corner Grooving Machines, send to A. Davis, Lowell, Mass.

The "Scientific American" Office, New York, is fitted with the Miniature Electric Telegraph. By touching little buttons on the desks of the managers, signals are sent to persons in the various departments of the establishment. Cheap and effective. Splendid for shops, offices, dwellings. Works for any distance. Price \$5. F. C. Beach & Co., 263 Broadway, New York, Makers. Send for free illustrated Catalogue.

The most Perfect Power Hammer—Exclusive Right for sale, or built on Royalty. Particulars of Samuel Pennock, Kennett Square, Pa.

Engines 2 to 8 H.P. N. Twiss, New Haven, Ct.

Stephoe, McFarlan & Co., No. 212 to 220 West 2d St., Cincinnati, Ohio, manufacturers of Wood-working Machinery and Machinists' Tools. Send for circulars.

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Pattern Letters and Figures, to put on patterns of castings, all sizes. H. W. Knight, Seneca Falls, N.Y.

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

All Fruit-can Tools, Ferracute, Bridgeton, N.J.

Brown's Coal Yard Quarry & Contractor's Apparatus for hoisting and conveying materials by iron cable. W. D. Andrews & Bro., 314 Water St., New York.

For Solid Emery Wheels and Machinery, send to the Union Stone Co., Boston, Mass., for circular.

Lathes, Planers, Drills, Milling and Index Machines. Geo. S. Lincoln & Co., Hartford, Conn.

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

Temples & Oilcans. Draper, Hopedale, Mass.

Hydraulic Presses and Jacks, new and second hand. E. Lyon, 79 Grand Street, New York.

Peck's Patent Drop Press. For circulars, address Milo, Peck & Co., New Haven, Conn.

Small Tools and Gear Wheels for Models. Last free. Goodnow & Wightman, 25 Cornhill, Boston, Mr.

The French Files of Linet & Co. are pronounced superior to all other brands by all who use them. Decided excellence and moderate cost have made these goods popular. Homer Foot & Co., Sole Agents for America, 20 Platt Street, New York.

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Two 50 H. P. Tubular Boilers for Sale (Miller's patent) very low, if applied for soon. Will be sold separately or together. Complete connections and pump. Holke Machine Co., 279 Cherry Street, New York.

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Price only three dollars—The Tom Thumb Electric Telegraph. A compact working Telegraph apparatus, for sending messages, making magnets, the electric light, giving alarms, and various other purposes. Can be put in operation by any lad. Includes battery, key and wires. Neatly packed and sent to all parts of the world on receipt of price. F. C. Beach & Co., 263 Broadway, cor. Warren St., New York.

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Automatic Wire Rope R. R. conveys Coal Ore, &c., without Trestle Work. No. 61 Broadway, N.Y.

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Rue's "Little Giant" Injectors, Cheapest and Best Boiler Feeder in the market. W. L. Chase & Co., 93, 95, 97 Liberty Street, New York.

A Superior Printing Telegraph Instrument (the Selden Patent), for private and short lines—awarded the First Premium (a Silver Medal) at Cincinnati Exposition, 1873, for "Best Telegraph Instrument for private use"—is offered for sale by the Merchants' Mfg. and Construction Co., 30 Broad St., New York. P. O. Box 456.

Woolen and Cotton Machinery of every description for sale by Tally & Wilde, 20 Platt St., N.Y.

Dean's Steam Pumps, for all purposes; Engines, Boilers, Iron and Wood Working Machinery of all descriptions. W. L. Chase & Co., 93, 95, 97 Liberty Street, New York.

Parties needing estimates for Machinery of any kind, call on, or address, W. L. Chase & Co., 93, 95, 97 Liberty Street, New York.

Dickinson's Patent Shaped Diamond Carbon Points and adjustable holder for working Stone, dressing Emery Wheels, Grindstones, &c., 64 Nassau St., N.Y.

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For descriptive circulars, and terms to Agents of new and valuable mechanical novelties, address James H. White, Newark, N. J., Manufacturer of Sheet and Cast Metal Small Arms.

Paragon Gold Quill Pens—The best in use. C. M. Fisher & Co., 102 Fulton Street, New York.

Emerson's Patent Inserted Toothed Saws, and Saw Saws. See occasional advertisement on outside page. Send Postal Card for Circular and Price List. Emerson, Ford & Co., Beaver Falls, Pa.

Spools, Button Molds, and all small turned goods made by H. H. Frary, Jonesville, Vt.



T. D. W. can best adjust the pea of a scale by experiment with a known weight.—J. G. P. will find an explanation of the wire rope and sheave mystery on p. 191, vol. 29.—J. H. will find directions for waterproofing canvas on p. 122, vol. 27. Varnish for chromos is described on p. 154, vol. 27. A solution of gum dextrin is sometimes used on postage stamps.—E. H. will find directions for galvanizing wrought iron on p. 232, vol. 30.—K. will find a recipe for fine shoe polish on p. 73, vol. 26.—W. W. P. will find that marine glue, described on p. 202, vol. 38, will answer his purpose.

A. R. B. asks: What elements are removed from the soil by the growth of cabbage? A. The outer leaves of perfectly ripe cabbage are composed of albuminous substances, 1.16 per cent, woody fiber, gum, and sugar, 5.0 per cent, ash, 2.2 per cent, water, 91.1 per cent. The heart leaves contain a little more water, and a little less of the other constituents. It removes potash, lime, phosphoric and sulphuric acids principally from the soil. These acids are in combination with the various bases which are absorbed by the growing plant.

A. L. C. asks: 1. If I take a tube of suitable length and diameter, and on one end put a double convex lens of about 6 inches focus, and in front of this end a mirror, at the other end a triangle, is there any way by which I can project that triangle on to the mirror, so that I may be able to see it from the outside? A. Not when arranged in the manner stated. 2. Can you give me any information in relation to the different species and character of the marine vegetation of the Great Banks of Newfoundland? A. See the reports of the exploring expeditions sent out by England and the United States Government. 3. What is the best theory on the physical constitution of the sun? A. The sun is supposed to consist of a central solid or liquid mass, which is surrounded by two or more shells or envelopes, which consist of the vapors of the various metallic and other bodies constituting the sun, and of gases, especially hydrogen in a state of intense ignition.

F. T. H. asks: 1. Can I prepare ammonia arsenite as a reagent? A. Ammonia arsenite, $(\text{NH}_4)_2\text{O}, \text{As}_2\text{O}_3$, is produced, according to Pasteur, when very strong aqueous ammonia is poured upon arsenious oxide. It exists only in contact with ammonia, quickly giving off ammonia in contact with the air. It forms a yellow precipitate with silver salts. 2. What degree of heat can I obtain in an evaporating dish on an oval copper water bath over a Bunsen burner? A. You cannot obtain a heat of over 212° Fahr. in an ordinary water bath, whatever the containing vessel and the source of heat may be. 3. What are the specific gravity, hardness, and other mineralogical properties of borate of lime? A. The specific gravity of borate of lime is between 2.81 and 2.98. It is sufficiently hard to scratch fluate of lime, or calcium fluoride. Its color is white, shaded with gray or green, and sometimes milk white and translucent or nearly transparent. One variety is gray, white, and reddish in concentric stripes. Before the blowpipe it swells into a milk-white mass and then melts into a transparent glass, colorless, or sometimes pale rose colored. It is composed of lime, silicic, boric acid, and water.

J. T. asks: 1. What will dissolve ultramarine to make writing fluid? A. Ultramarine can be suspended in a mucilaginous liquid, like ordinary mucilage, for the purpose you mention. 2. Will soluble glass dry on an iron surface exposed to friction? A. We do not advise the application of soluble glass where metallic surfaces rub together. 3. Will a long belt transmit more power than a short one? A. No.

S. B. says: 1. We have a cellar heater, with three hot air pipes heating five rooms; one of the pipes runs into a flue which heats two rooms on the first floor and one on the second floor. There are no dampers in the hot air pipes or in the flue. When we want all the heat in the two rooms on the first floor, we close the registers on the other pipes and the upper part of the flue, which leaves a vacuum in those pipes and the flue. I think that, if we had dampers in pipes in the cellar by the heater, and one in the flue right above the register on the first floor, we should get more heat. A. It is usual to provide dampers in the hot air pipes near the furnace in the cellar; and you would save some heat by having them, namely, that portion which escapes from the pipes not used, by radiation from it, and by the register in the room not heated, which seldom or never closes tight. 2. Can you inform me what the string that plumbers put on the pipes, preparatory to wiping the joints, is made of? A. It is prepared with lamp-black and glue boiled in water, with sometimes a little lager beer put into it.

A. B. asks: What is the value of antimony, what is its use, and where is it mostly found? A. Alloys of antimony, with lead and tin, are largely used for type metal. An alloy of 90 parts of copper, 5 of zinc, and 5 of antimony is used for sockets in which the steel or iron pivots of machinery are at work. The gray antimony ore is found in the Hartz mountains in Germany, and also in Cornwall, Auvergne, Hungary, and Borneo. The oxide of antimony is found in Algeria and is melted in France. Red antimony, which is a compound of oxide and sulphide of antimony, is found in Tuscany. The mode of working the ores is too long to be given here.

A. E. F. asks: Will you give me a recipe for making a good quick dryer for oil paint? A. Linseed oil 1 gallon, powdered litharge 3 lb.; simmer with frequent stirring until a pellicle begins to form, remove the scum; and when it has become cold and has settled, decant the clear portion. This is used by house painters.

E. L. D. asks: How can I remove enamel from gold without heating? The enamel is the blue kind used for ornamenting jewelry. A. The enamel to which you refer, being a species of glass, can be removed without heat by the action of hydrofluoric acid. This is most easily applied by wetting the enamel with sulphuric acid and then sprinkling over it some finely pulverized fluor spar (calcium fluoride), by which means hydrofluoric acid is set free and attacks the glass, the gold not being affected by either acid. The sulphuric acid should be slightly warm, and care taken to avoid the fumes and getting the acids on the hands, as hydrofluoric acid is very corrosive to the skin. Several applications may be necessary. Wash off and dry after each application.

P. H. W. says: To heat water I placed a copper tube in a coal stove; the tube is 13 inches deep, 5 1/2 inches diameter, with a ball made on the circle of same diameter. It was filled nearly full; and while boiling rapidly, I attempted to take it out, but the steam was rising so fast that I could not place my hand near to it. I then poured a little cold water into it, which checked the steam entirely, so that there was no visible steam arising from it. I took it and set it on a cold plate of iron, where it stood 6 or 8 minutes, then took it by the ball again, holding it two minutes. There was no sign of steam arising from the water, but as soon as I attempted to pour it out, the steam burst forth in such volume that it was only with the greatest effort that I succeeded in keeping it from scalding my hand. Did the cold water remain on the top, and at a lower temperature, condensing the steam, until poured off? A. The explosion was caused by the power which water in a quiescent state has of retaining a large amount of steam, and setting it free when shaken or suddenly agitated.

F. M. B. says: 1. While on the roof of my house, watching the chimney burning out, I noticed a stream of electrical fire or light passing on to the point of the platinum arrow or weather vane attached to the lightning rod and passing off from the opposite end. I touched the point of the arrow with my hand and the light ceased; on removing my hand, the electrical current was again established. I reversed the arrow in direction, putting the point opposite to the wind; again the light ceased. On letting go of the arrow, the point turned toward the wind and the electrical light was resumed again. At the time the wind was blowing from southeast, rain and sleet were falling, and the barometer was low. The following questions arise: Does electricity go with the wind? A. Atmospheric electricity is caused by the advancing clouds. 2. No lightning being seen, was this voltaic electricity? And if so why did not the current pass from the arrow to the lightning rod, and thence pass to the ground instead of passing off from the reverse end of the arrow? All the connections of the copper rod are good and the lower end is nine feet in the ground, which is moist. The rod near to and below the arrow is coated with soot from the chimney: would this prevent the flow of electricity to the earth? A. It was not voltaic electricity.

J. D. S. says: I am informed that there is a method by which tracings made on tracing muslin can be reproduced on prepared white paper. I believe a negative is prepared directly from the tracing, and afterwards printed on the prepared paper by exposure to the sun. What solution is used, or how is the negative obtained? A. The drawing is properly mounted in front of the camera, and a photograph is taken in the usual manner. This negative is then employed for solar printing by direct contact with sensitized paper.

W. says: In Dr. Hayes' "Open Polar Sea," he states that he procured sufficient fresh water for the crew of his schooner by boiling sea water in a common tea kettle, using a cask as a condenser. Is it so easy a process to purify sea water? If so, what is the use of the expensive apparatus sold in Europe for this purpose? We hear of the crews of vessels perishing of thirst. Surely, if there is a simple process of purifying sea water, it should be made widely known. A. There is no difficulty in procuring water free from saline matter in the manner described. But water, so distilled, differs from natural water by containing no air and being free from certain small amounts of mineral matter, which make spring water lively and palatable. The aeration and filtration of distilled water complicate the apparatus and render it expensive.

G. W. asks: Can wood be petrified, and how is it done? A. One method is: After the tree is felled, place the root end in a solution of sulphate of copper and acetate of iron. After remaining for a few days, the wood is completely saturated. Another method is to place the wood in a vessel from which the air is exhausted; sulphate of iron or alum solution is then let in and pressure applied. The wood is then partially dry, and afterwards it is treated with a solution of chloride of calcium in the same manner. Or the wood can be impregnated with water glass, and then treated with an acid.

C. E. Y. asks: Can metallic zinc be obtained from the muriate of zinc, or can a coating of zinc be deposited on iron or other metal from the muriate of zinc? A. The muriate of zinc has been employed, but said to possess no peculiar advantage.

G. C. H. says, in reply to J. N. W.'s query as to the existence on the plank: The board was recently brought to Utica and shown to the scientific men of the place, among others to Mr. S. W. Chubbuck. He immediately said that it was the result of compression; and to convince the others, he selected a piece of clear pine, laid it upon a block of iron, and struck it one blow with a hammer. It was then placed in a vise and swelled down through the edge; immediately the compressed wood bulged out and assumed the shape it now has. I enclose you the piece. I think that the original one can be accounted for in the same manner. The tree either struck a stone or other substance in falling, and was thus indented at that spot, or the board has been prepared for a joke. A. Mr. Chubbuck has certainly succeeded in producing an appearance similar to that of J. N. W.'s board, and his explanation is correct.

S. asks: How thick is the earth's surface or crust? At what depth in the earth will it be hot enough to fuse all known substances? A. It is ascertained that at a depth of a very small proportion of the earth's diameter, all known substances would be in a state of fusion. Experiments made at Creuzot, France, led the observers to believe that, at a depth of 50 miles, the heat would reach 4,000° Fahr., more than sufficient to melt platinum. As to artesian wells, see p. 241, vol. 29.

E. E. asks: What can I use to make a joint steam tight? A. Use equal parts of white lead and red lead, and add as much boiled linseed oil as is required to make a putty.

G. N.—Animal vaccine virus can be obtained at all times and in any quantity from Frank P. Foster, M.D., Director of Vaccine Department, New York Dispensary, 137 Center street, New York city. It is furnished in three ways: On slips of quill, costing each 25 cents; in capillary tubes, costing \$2 each; and in entire crusts, costing \$2 each. The first is the most handy to use. The method of using it is so simple that it is within the power of every one to vaccinate: Bare the arm to be vaccinated to the shoulder, and, taking a large needle, scratch the skin two inches below the shoulder in cross lines until a place the size of a three cent piece looks watery; then dip the quill into warm water for a second, and rub the smaller end upon this spot for a few seconds. Allow the arm to remain bare for some minutes until the spot seems dry. Each quill is sufficient for one person; but the capillary tube contains sufficient virus, in a liquid form, to vaccinate ten or twelve persons. It is necessary to blow the lymph out of the tube upon a knife blade in minute quantities at a time, and rub the knife blade upon the spot prepared as before described. The crust may be macerated in water and then applied. Virus is prepared for use in this way: When the pustule upon the cow is full of matter, the small quills are dipped into it, allowed to dry, and rolled in tin foil. The capillary tube is simply a very fine glass tube, one end of which is dipped into the matter; the matter will nearly fill the tube, by what is called capillary action of the tube. Then the portion of the tube not filled with matter is broken off, the two ends sealed up with sealing wax, and the tube is now ready for transportation. Vaccine virus from the cow is the purest and most efficient known, first, because young and healthy heifers are the only animals from which the virus is taken, and secondly, because it can always be obtained fresh from the physician above mentioned. A letter, addressed to him enclosing 25 cents or \$2, will be answered by return post by a letter containing the quill or tube.—S. H. C., M.D.

W. H. J. asks: Will a siphon draw water 100 feet high, if it had 150 feet fall? A. No. The rise of water would be less than 54 feet.

M. C. asks: Is there any machinery for utilizing the power of water, as it is ordinarily laid on in dwelling houses? A. Yes. Water engines and small turbine wheels, for driving sewing machines and other purposes, are in the market.

E. L. S. asks: 1. Is it possible for gas to escape from a burner when lighted, unconsumed? A. No. 2. Is it the revolution of our earth which produces the atmosphere? A. It does not produce the atmosphere, but causes certain great movements in the atmosphere, such as the trade winds.

D. C. S. asks: Has heating with hot water been adopted in this country? A. There are several firms in this city who make heating by hot water a specialty, as also some in the other principal seaboard cities, and who have put their apparatus in a great many buildings, both public and private. The expense, however, of heating by this method is fully as great as that of steam.

E. M. B. asks: 1. What are the most powerfully explosive substances or compounds known, that can be obtained in large or inexhaustible quantities? A. Gun cotton, nitro-glycerin, dynamite, and dinitro. One part by weight of gun cotton is equal in projectile power to 5 parts of gunpowder; 1 part of nitro-glycerin to 8 parts of gunpowder. 2. Which of said explosives are the cheapest per unit of explosive power? A. Nitro-glycerin. 3. Which of said explosives burns or explodes with the least smoke or ashes? A. Gun cotton should leave no residue. 4. Is there any treatise upon explosives that will give me all the known properties of the principal explosives? A. See our advertising columns for booksellers' addresses.

G. S. R., H. B. G., and others question the accuracy of our answer to W. L. N., in which we stated that it is not a fact that all matters that form scale in a boiler float on the water as scum. A. Compounds of lime are precipitated from solution in water as the temperature increases, and the carbonate of lime, being light, rises to the surface of the water, if there is a good circulation in the boiler. The sulphate of lime, which is heavier, sinks almost immediately after precipitation. Both of these substances can be most readily removed by a surface blow, since they are formed more rapidly as the temperature of the water increases. When the boiler is not in use, the particles of carbonate of lime no longer rise to the surface, but settle down upon different parts of the boiler.

C. P. H. asks: How many pounds of nitrate of ammonia would be required to freeze a gallon of water? A. Theoretically, nearly 4 lbs. when the temperature of the water is 68° Fahr., but in practice a larger quantity, owing to the absorption of heat from the containing vessels.

J. G. H. asks: 1. Can sugar be kept liquid by any chemical process? A. No. 2. How can copying ink be made from common writing ink? A. By the addition of a little sugar. 3. Can water colors be made to copy, the same as copying ink? A. This can be easily tried.

L. says: 1. I want to make a heat governor for a hot air furnace. If I enclose, in a tube exposed to the heat, quicksilver, or simply the air in the tube, from which can I get the most expansion or pressure to act on the damper? A. Quicksilver expands the 0.0003 times its volume on being heated from the freezing to the boiling point, and air 0.0005 times, so that the expansion of air is much greater. 2. Can you suggest a way by which this pressure may best act on a lever? Pure rubber would answer the purpose if perfectly airtight. A. By means of an airtight piston.

M. asks: Is the mineral found with lead ore and known to miners as munda the same as iron pyrites? A. Munda is the name of copper pyrites among English miners.

C.H.S. asks: Had eighteen hundred and seventy-four full years of the Christian era passed on January 1, 1874? A. Not exactly. The years as reckoned by the calendar do not agree perfectly with those calculated on astronomical data.

F. C. C. asks: What can I apply to the back of sheet copper to prevent gold adhering, while I am electroplating the face? It must not come off into or injure the solution. A. Use a thin coating of varnish.

E. S. asks: What is the proper temper for a magnet, and how much of it should be tempered? A. It should be tempered at as high a degree of heat as possible, and the temper should be drawn to a violet-straw color.

S. S. S. asks: 1. Would a silver rod used for an anode (as in the illustration in your issue of January 31) be as good for plating a dozen forks or spoons as an anode of sheet silver? A. Some electroplaters use anodes of pieces or rods of silver. The general practice is to employ sheet silver; and while the former plan answers, the latter is on some accounts to be preferred. 2. How much silver by weight is calculated to be deposited upon a dozen forks, for single, double, and triple plate? A. Tablespoons are single plated when they are plated with 4 ozs. of silver to the gross, double plated with 8 ozs., and triple plated with 12 ozs. Forks in proportion, according to size. 3. What book do you recommend for traveling electroplaters? A. Roseleur's "Galvanoplastic Manipulations" is a standard authority.

G. P. L. asks: Is there any chemical or other way to remove hair from any part of the face without marring the face or leaving any injurious marks on it? A. Hydrochloric acid of sodium can be used, but care must be taken, lest the skin be attacked. See *Scientific Record* for 1874, p. 20.

N. A. M. asks: Can you give me a recipe for making nitro-glycerin? A. To prepare nitro-glycerin, very strong nitric acid, density 49° to 50° Baumé, is mixed with twice its weight of concentrated sulphuric acid; 6 lbs. of this mixture, thoroughly cooled, are poured into a glazed earthenware jar, placed in a pan of cold water, and there is next added gradually 1 lb. of concentrated and purified glycerin, having a density of at least 80° to 81° Baumé, care being taken to stir constantly. The mixture is left to stand for some time, and afterwards poured into five or six times its bulk of very cold water to which a rotatory motion has been imparted. The nitro-glycerin sinks to the bottom as an oily liquid.

C. S. D. asks: I. Where is the largest refracting telescope in the world, and what is the size of its object lens? A. At the National Observatory, Washington, D. C.; diameter of lens, 36 inches. 2. I wish to connect another boy's home with mine by a telegraph wire, and (as it is not convenient to have it suspended from the one house to the other) I want to know if I tar copper wire and put it under the sidewalk (fastened by staples), if the tarred wire will answer the same purpose as insulated wire? And if not, what can I put on the wire that will? A. Use an ordinary insulated gutta percha telegraph wire. 3. I have a blackboard on which it is difficult to leave any mark. What substance shall I put on it to remove that difficulty? A. Put on the blackboard liquid sold by most stationers.

R. E. W. asks: Is there any way of making oxygen gas, cheaper than the common method of using potassium and manganese? Nitrate of soda is much cheaper; cannot its oxygen be driven off? A. Nitrate of soda is readily decomposed at a red heat, and yields oxygen, which at first is tolerably pure, but becomes contaminated with increasing quantities of nitrogen.

A. B. asks: Is the white soft matter in the center of a corn kernel pure starch? A. It consists of more than 50 per cent of starch. The remainder is water, fat, cellulose, and nitrogenous substances.

K. K. K. asks: By what means can nitrogen be prepared in large quantities, cheaply, rapidly, and with simple apparatus, similar to a hydrogen generator, so as to be instantly ready? A. By heating nitrite of ammonia.

F. H. M. asks: Is there any sure way of ridding an old house of bedbugs, cockroaches, etc.? A. As to bedbugs, if you can locate their dwelling places, use strong mercurial ointment, soft soap, and oil of turpentine, in equal parts, triturated together. If they are secreted in the timbers, fumigation by burning sulphur is the best method. For cockroaches, make poison wafers of flour, red lead, and sugar, rubbed up with a little mucilage; spread out thin to dry.

W. S. X. asks: 1. How can I make lard oil in small quantities? A. Lard oil is chiefly obtained as a secondary product in the manufacture of stearin. It is purified first by agitation with sulphuric acid, and afterwards by steaming it or washing it by water. 2. Is there a polish that will adhere to such articles as a tin lantern of which the tin is worn off? If so, how is it made? A. See p. 315, vol. 23.

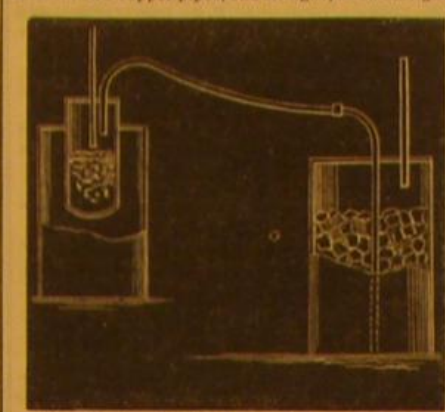
G. W. W. asks: How can canvas be prepared for oil painting? A. The canvas must be strained on a frame of thoroughly seasoned wood, so as not to shrink, and a thin oil filling must be put on till the texture of the canvas is completely hidden. All seams and projections must be avoided.

J. A. M. asks: How can I smooth and polish a piece of rough marble? A. Use (1) wet sandstone, (2) a piece of unglazed pottery (also wet), (3) pumice-stone, (4) lead filings and rouge, (5) a little powder of calcined tin, rubbed on with a linen rag.

Z. P. B. asks: 1. What is the best substance with which to clean common and undressed kid and dogskin gloves with, and how is it applied? A. Damp them slightly, stretch them gently over wooden hands, and clean them with a sponge dipped in benzole. As soon as they are dry, withdraw the hands, and suspend in the air till the smell has passed off. 2. What is the best to clean ivory with? A. Ivory can be bleached by exposing it to the fumes of burning sulphur or to chlorine gas. In answer to your other question, consult a cyclopaedia of manufactures.

C. W. H. Jr. asks: How can cloth or velvet be made to stick to cast iron? A. Try painting the iron with oil paint, letting it dry, and then attaching the cloth with glue.

A. A. W. asks: How can I make bisulphide of carbon? A. You can probably buy bisulphide of carbon more cheaply than you can make it, as it is now manufactured on the large scale. The following apparatus, however, may be sufficiently simple and cheap for your purpose: Bore two holes in the top of an iron bottle, such as mercury is imported in, and into these holes fix two copper pipes, one straight, as on the figure



and the other bent. The bent tube is connected with another tube leading to the bottom of a bottle filled with ice. The iron bottle is fitted into the top of a furnace, so that about two thirds is exposed to the action of the flame. The furnace should have a hole in its top so that the bottle may fit snugly into it, and the top be protected from the fire. The bottle is filled two thirds full of pieces of fresh charcoal; and when hot, a few fragments of sulphur dropped at intervals into the straight tube, which is immediately closed with a plug. The bisulphide of carbon is condensed in the bottom of the ice bottle, and sinks to the bottom of the water. It should afterwards be rectified by carefully distilling in a hot water bath, in contact with chloride of calcium, and condensed as before. Bisulphide of carbon is very volatile and inflammable, so that care must be used in making and handling.

N. H. F. says that J. P., who asked how to prevent a wooden screw from checking, should boil it in water with a little salt in it. It will then never check or crack.

H. G. B. says, to M. B. C., who asked how to increase the rapidity of the drying in his lumber kiln: You need no air at all, and consequently have too much already. Air is good for respiration, but was not made for drying grain, although it is well adapted to prevent too rapid desiccation. And air-dried lumber has a crust of dried wood on the outside, which retards the internal drying and prevents the thorough shrinking of the wood, leaving it liable to swell or shrink with every change of the weather. Again, air cannot season lumber, which operation is a chemical change of its albumen, preventing its future shrinkage, swelling, and decay. Even eggs can be so coagulated as to keep for 10 years, and I have some, thus prepared, which are thus old, as perfect as ever they were, as far as decay is concerned. It was (and still is) thought that the best way of preserving lumber was to extract the albumen, by soaking the lumber in water for 6 or 12 months, or by boiling or steaming. These processes kill the lumber for good work and good finish. The albumen should be coagulated and retained in the pores of the wood, and it will keep out water or damp air as well as if the pores were filled with shellac or other gum, evidently fitting the wood for a very superior finish. This operation is readily accomplished by the well known means of dry steam, requiring fewer days for its completion than the soaking and subsequent drying does months. In fact, it pays well to subject all lumber, no matter by what process it has been seasoned, to dry steam, by the use of which a black walnut tree may be cut in the forest on Monday morning, and worked into furniture by Saturday night, and be better fortified against any tendency to shrink, swell, warp, or decay, and it will show a better finish.

H. P. says: If W. D. B., who asked as to flow of oil from a wick, will lower the wick, when not lighted, below the top of the wick tube, the oil will not spread over the outside of the lamp, which is the case with some, if not all, oils when the wicks protrude out of the tubes.

J. E. D. says, in reply to several correspondents who ask how to gild on glass: First I see that the glass is free from dirt and grease; then with my tongue, I lick the place where I desire the figure or letter to be, and then press the dampened surface upon a piece of gold leaf of sufficient size, taking care to have it smooth and unbroken. After it has dried (which is indicated by its assuming a polished appearance), I place it over a marked board, and with a sharp instrument and ruler scratch lines for the top and bottom of the letters, and then (with quickly drying material) paint the letters, taking care to reverse them so that they will show right from the other side. When the paint is dry, I rub off the superfluous leaf and the job is done. If the work is to be done on large glass, like store windows, it is better to paint the letters first on the outside, as they are to appear, and this will show where to apply the leaf, and also how to paint on the inside, as the paint will show plainly through the leaf. When the job is done, the outside letters can be easily cleaned off. It will help most persons to paint the letters backwards, to mark them with pen and ink on paper, and, after oiling the paper, look at them from the other side.

P. H. B. says, in answer to W. E. S., who asked how a 20 horse power engine can be started and stopped by telegraph: If it be a single engine, it would have to be seen that the crank was in a position to start, and the steam pipe and the steam chest would have to be well provided with drip exits; and the throttle valve must be easily worked and well balanced. The throttle lever could be actuated by a magnet, or by weights and mechanism similar to that employed to trip the hammer in apparatus for striking the fire alarm telegraph bells in cities. A double engine could be so arranged as to be stopped or started, at any time, by the same arrangement.

K. L. H. says, in reply to J. J. G., who asks if there is any compound that will make the beard grow faster than it naturally would: The following recipe is perfectly harmless, and will make the beard grow like mushrooms in a hotbed: Cologne 2 ozs., liquid hartshorn 1 dram, tincture of cantharides 2 drams, oil of rosemary 12 drops, oil of nutmeg 12 drops, lavender 12 drops. Apply to the face daily and wait for the result.

T. A. C. says, in an answer to J. P., whose query about seasoning wooden screws is answered on p. 215, vol. 30: Bore a hole longitudinally through the center of the screw; it will not be apt to crack so badly in seasoning, because then the air can get to the center of the wood, the sap escapes therefrom, the center of the wood contracts, and the strain on the outside is lessened. Of course, the larger the hole, the better for the seasoning process; but it should not, and need not, be large enough to materially weaken the screw. In addition, you can boil the screw in water, the job will be bettered; if boiled in oil, it will be complete.

J. H. P. says: Tell G. C. B. that cracks and holes in cast iron kettles can frequently be filled by cement composed of glycerin and litharge made into a stiff putty. It requires 3 or 4 days to harden. I have filled holes in kettles an inch or more in diameter with this cement, and used the kettles for years afterwards.

C. D. S. says that R. H. F. can test squares with the dividers by drawing two circles one within the other, from the same center, of 15 and 12 inches diameter respectively; then set the dividers to 10 inches, insert on point in any part of the outer circle, and mark the point exactly where a circle (drawn with the dividers in this position) would intersect the inner circle; now draw a straight line through the center of the circles and through the point marked in the inner circle; and through the outer one, another line starting from the point where the dividers were inserted in the outer circle through the center of the circles until the outer circle is reached. If this is done exactly, the points where those lines intersect the outer circle will form the corners of a perfect square whose side is 11-3/16+ inches. If the square is correct, it will fit the square thus formed and also the lines in the center, which divide the circle into 4 equal parts, and the angles must be 90 degrees. This is based on the rule for finding the hypotenuse of a right angled triangle, thus: $6^2 + 8^2 = 10^2$, sum 100, the square root of which is 10. This is some times called the 6, 8, and 10 rule for squaring buildings.

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

D. H. E.—This mineral is compact soapstone.

D. B.—The mineral resembling gold, which is inclosed in the quartz, is iron pyrites.

J. K.—The crystal is garnet; it is a silicate of alumina and iron. The red stone is quartz rock, colored by a little oxide of iron. The gray one is siliceous.

E. L. F.—Your specimen consists of cubical crystals of iron pyrites, inclosed in gray quartz rock.

B. B. S.—Crystals of iron pyrites, inclosed in talcose schist.

H. S. B.—Your specimen consists of a solid mineral portion, and of volatile substances, the latter amounting to 17-76 per cent. Gives off water and oils on heating. The residue left after heating consists of siliceous grains, colored with oxide of iron. Contains a small amount of soda but no potash. We do not know of any use for it other than that of soap, and we can assign no value to it.

O. K.—Your sample of safety powder for use in petroleum oils consists of salts, mostly common salt, which have been dyed yellow, blue, and red in order to disguise their true nature. It is worse than valueless. It does not diminish the explosive nature of the oils, and should be exposed as a fraud calculated to do great injury.

R. S. asks: How can I remove the inside bark of the cocoa-nut, otherwise than by shaving it off?

—V. V. V. asks: What must I use to paint show cards with? The oil in ordinary paint discolors the card around the letters. I want something that paints very black, also white and light tints for dark grounds?—G. S. asks: What is the process of ferrotyping?—M. B. A. asks: What is the best way of removing tallow and white lead that has been applied to polished parts of machinery to prevent rust?—W. H. D. asks: Does powder of a coarse grain shoot more strongly than one of a fine grain?—M. F. B. asks: 1. Which will shoot the greater distance, a breech or a muzzle loading shot gun? 2. Is 30 inches long enough for a gun of 10 gauge? 3. What are the different strengths of the materials used for gun barrels? 4. Is Damascus twist as good as laminated steel for gun barrels?—P. J. F. asks: 1. What is the proper charge of powder for a No. 12 caliber shot gun? 2. How much powder will the same caliber consume without waste?

COMMUNICATIONS RECEIVED.

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

- On Kepler's Third Law. By A. L.
- On the Elasticity and Slipping of Belts. By J. T. H.
- On a Scientific Toy. By E. L.
- On Ascertaining the Width of Streams. By J. C.
- On the Manufacture of Leather. By D. S.
- On Car Building. By N. E.
- On Light. By T. H. C.
- On the Attraction of the Sun and the Earth. By H. K.
- On Ventilation. By E. H. S.
- On the Canal Problem. By J. H.
- On Foaming in Boilers. By G. C. P.
- On Shellac as a Dressing for Wounds. By W. W.
- On Squares. By M. T. C.
- On Spiders' Webs. By C. T.

Also enquiries and answers from the following:

P. T. F.—F. H.—J. R. P.—W. H. C.—T. H. F.—J. W.—T. C. H.—E. W. H.—P. S.—J. L.—F. H. E.

Correspondents in different parts of the country ask: Who sells a machine for testing the strength of the arm by striking a flat surface? Who makes jig saws for cutting out ship timbers? Makers of the above articles will probably promote their interests by advertising, in reply, in the SCIENTIFIC AMERICAN.

Several correspondents request us to publish replies to their enquiries about the patentability of their inventions, etc. Such enquiries will only be answered by letter, and the parties should give their addresses.

[OFFICIAL.]

Index of Inventions

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APPLICATIONS FOR EXTENSION.

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:

29,012.—HORSE RAKE.—F. Seidle et al. June 17.
29,035.—SEWING MACHINE.—J. First. June 17.
29,271.—STEAM ENGINE VALVE.—J. F. Hamilton. July 8.
29,285.—SEWING MACHINE.—D. Haskell. August 12.
29,790.—CATTLE TIE.—G. Hull. August 12.

EXTENSIONS GRANTED.

27,678.—FASTENING ARTIFICIAL TEETH.—A. M. Asay et al.
27,735.—GRINDING MILL.—E. Munson.
27,743.—BOILER FEED.—T. Snowdon.

DISCLAIMER.

27,678.—FASTENING ARTIFICIAL TEETH.—A. M. Asay et al.

DESIGNS PATENTED.

7,261.—CARPET.—H. Allan, Yonkers, N. Y.
7,262 to 7,264.—CARPETS.—O. Heinsigke, New York city.
7,283 to 7,299.—CARPETS.—H. Moran, East Orange, N. J.
7,300 to 7,302.—CARPETS.—H. S. Kerr, Philadelphia, Pa.
7,303.—LABEL.—J. Lippincott et al., Pittsburgh, Pa.
7,304 to 7,308.—CARPETS.—L. G. Malkin, New York city.
7,309 to 7,315.—OIL CLOTHS AND CARPETS.—C. T. Meyer et al., Bergen, N. J.
7,314.—FLOWER STAND.—J. E. Morris, Minneapolis, Minn.
7,315 to 7,332.—CARPETS.—E. J. Ney, Braintree, Mass.
7,333 to 7,339.—CARPETS.—H. Nordmann, New York city.
7,340 and 7,341.—CARPETS.—J. H. Smith, Endicott, Conn.
7,342.—BEER MUG.—B. Bakewell, Jr., Pittsburgh, Pa.
7,343 and 7,344.—CARPETS.—J. M. Christie, Kidderminster, England.
7,345.—CARPET.—J. Fisher, Philadelphia, Pa.
7,346.—CARPET.—A. Heald, Philadelphia, Pa.
7,347.—BUCKLE PLATE.—W. F. Osborne, Ansonia, Conn.
7,348 and 7,349.—TYPES.—R. Smith, Philadelphia, Pa.

TRADE MARKS REGISTERED.

1,694.—FLOWS.—B. F. Avery & Sons, Louisville, Ky.
1,695.—OYSTERS.—T. H. Carmine, Baltimore, Md.
1,696.—WRENCHES.—L. Coes & Co., Worcester, Mass.
1,697.—BOOTS, ETC.—T. H. Dodge, Worcester, Mass.
1,698.—YEAST.—Flack Brothers, Baltimore, Md.
1,699.—BITTERS.—Flint & Goldthwait, Salem, Mass.
1,700.—AXLE GREASE.—J. J. Hucks et al., S. Francisco, Cal.
1,701.—SHIRTS, ETC.—Johnston & Sutphen, Newark, N. J.
1,702.—THRASHING MACHINE.—Nichols & Co., Battle Creek, Mich.
1,703.—DRAW FRAME ROLLERS.—E. Page, Lawrence, Mass.
1,704.—BELTING.—E. Page, Lawrence, Mass.
1,705.—FLOWS.—J. L. Reed & Co., Dayton, O.
1,706.—HATS, ETC.—Thompson et al., New York city.
1,707.—SHIRTS.—B. Wechsler, New York city.

SCHEDULE OF PATENT FEES.

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CANADIAN PATENTS.

LIST OF PATENTS GRANTED IN CANADA.
MARCH 28 TO APRIL 4, 1874.

3,257.—L. H. Thorp, Chicago, Cook county, Ill. Improvements on brick machines, called "Thorp's Brick Machine." March 28, 1874.
3,258.—G. H. E. Dubelle, Montreal, P. Q. Art or process for the manufacture of butter, called "The Dominion Dairy Butter." March 31, 1874.
3,259.—T. S. Seabury, St. James, Suffolk county, N. Y. Improvements in wagon jacks, called "Seabury's Improved Wagon Jack." March 31, 1874.
3,260.—F. Nichols, New London, Conn., U. S. Useful acid pump and siphon, called "The Nichols Acid Pump and Siphon." March 31, 1874.
3,261.—D. Davison, New York city, U. S. Improvements on the construction, setting, and operation of retorts for the manufacture of coal gas, called "Davison's Improvements on the Construction, Setting, and Operation of Gas Retorts." March 31, 1874.
3,262.—D. Davison, New York city, U. S. Improvement on the manufacture of illuminating gas from coal and other substances, called "Davison's Improved Process of Manufacturing Illuminating Gas." March 31, 1874.
3,263.—G. Sweet, Danville, Livingston county, N. Y. Improvement on wheelwright machine, called "Sweet's Wheelwright Machine." March 31, 1874.
3,264.—G. Sweet, Danville, Livingston county, N. Y. U. S. Improvement on horse rake, called "Sweet's Improved Horse Rake." March 31, 1874.
3,265.—G. Sweet, Danville, Livingston county, N. Y. U. S. Improvement on plaster sowers, called "Sweet's Plaster Sower." March 31, 1874.
3,266.—S. T. Lamb, New Albany, Ind., and B. F. Avery, Louisville, Ky., U. S. Improvements in self car couplers, called "Lamb's Self Car Coupler." April 4, 1874.
3,267.—D. E. Fletcher, Lindsay, Ontario county, N. Y. Improvements on a machine for churning, called "Fletcher's Dairy Maid's Friend." April 4, 1874.
3,268.—William A. Lewis, Springfield, Windsor county, Vt. Improvements on churn powers, called "Lewis' Churn Power." April 4, 1874.
3,269.—T. Mathias and J. A. Coons, New Berlin, Sagamon county, Ill. Improvements in churns, called "Mathias' Improved Churns." April 4, 1874.
3,270.—O. F. Cook, Grant Island, Colusa county, Cal. Improvement on process of preparing grain for the manufacture of flour, called "Cook's Process of Preparing Grain for Manufacture of Flour." April 4, 1874.
3,271.—W. R. Macaulay, Hamilton, Wentworth county, Ont. Improvement in railway car couplers, called "Macaulay's Self Car Coupler." April 4, 1874.
3,272.—F. Green, Montreal, assignee of T. Holland, New

York city, U. S. Improved combination steam, water, and gas cock, called "Holland's Combination Safety Gage." April 4, 1874.

3,273.—S. Rodgers, Toronto, Ont. Improvements in tobacco cutters, called "Rodgers' Improved Tobacco Cutter." April 4, 1874.

3,274.—L. O'Brien, Quebec. Improvements on cards for photographic pictures, called "O'Brien's Papyrus Photograph Card." April 4, 1874.

3,275.—D. Larer and S. E. Grison, Borough of Pottsville, Schuylkill county, Pa., U. S. Improvements on diamond millstone dressing machines, called "Larers' Diamond Millstone Dressing Machine." April 4, 1874.

3,276.—R. Smith, Sherbrooke, P. Q. Improvements on a machine or apparatus for the purposes of navigation, called "Smith's Improved Aquapode." April 4, 1874.

3,277.—S. Mills, Madison, Dane county, Wis. Improvements in toilet tabourets, called "Mills' Improved Toilet Tabouret." April 4, 1874.

3,278.—R. J. Campbell, Toronto, Ont. Curtain ring and hook, called "Campbell's Imperial Curtain Ring and Hook." April 4, 1874.

3,279.—J. Horton, Philadelphia, Philadelphia county, Pa. Process for massing and combining granulated iron ore into lumps, called "Process for Utilizing Granulated Iron Ore." April 4, 1874.

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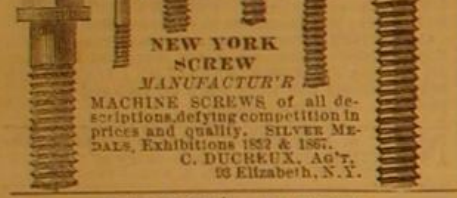
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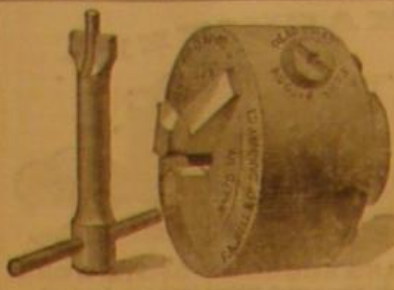
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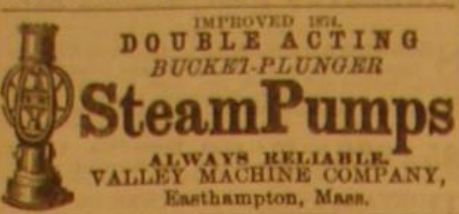
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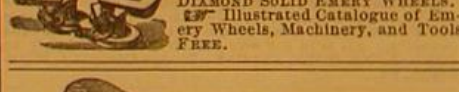
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NEW YORK, MAY 9, 1874.

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IN ADVANCE

A NOVELTY IN BOLT CUTTERS.

All machinists are aware that, in making bolts which require the face of the head or nut to be at exact right angles to the axial line, to insure accurate fits on finished work, it has been necessary to chase the threads on a screw-cutting lathe. To this operation there are many objections, among which may be noted the requirement of skilled workmen to grind properly and to set the tool, and also to watch the work, in order to obtain uniformity in size, through constant tests of each piece, as the chasing tool makes its last cut. With all these precautions, however, it is almost impossible to thread any number of bolts, in a screw-cutting lathe, to exactly the same diameter; variations of size occur, to the detriment of accurate fitting, so that, in fine, the process is comparatively imperfect and slow, and, as a consequence, far from economical.

With the above facts in view, Mr. Aurin Wood, of Worcester, Mass., has recently applied, to a bolt-threading machine, centers for holding the work exactly as it is secured in lathes, so that the finished bolts, while retained with the same axial accuracy as in the last mentioned machines, may be threaded by the dies with the certainty of the line of the thread having correct relation to the axial line of the piece. By combining this improvement with a bolt cutter of his own invention, Mr. Wood has produced the apparatus represented in our engravings, which, we are informed, has proved, in every particular, a complete success.

The reader conversant with this class of tool will require no explanation to aid him in perceiving the general arrangement and relation of the actuating mechanism; so that without considering details in this particular, we may at once pass to the notice of the important improvement above suggested. Fig. 1 affords a perspective view of the machine, and in Fig. 2 the same is shown tilted, to exhibit more clearly the essential portions. A is the die holder, which supports the dies for threading the bolt in the usual manner. The bearing, B, which is caused to revolve by proper mechanism, carries the head, through which passes longitudinally a mandrel, C, moving freely back and forth. D is the carriage which holds the bolt to be threaded, and which is so actuated as to slide to and from the cutting head. Parallel to the axis of the latter is a bar, E, which moves longitudinally in the supports shown. This bar is connected to the mandrel, C, and also to the carriage, D, by arms, so that, when the carriage travels toward the head, the mandrel will be correspondingly moved and vice versa. The mandrel has a center or point, F, which is the actual center of revolution of the head; and a corresponding point is arranged in the carriage, both centers being in axial line with the cutting dies of the head. The center to the carriage is made adjustable by means of the screw, G.

The bolt to be threaded is first centered and turned in the usual manner, as if to be cut in a screw-cutting lathe. It is then placed on the centers of the machine and secured so as to be run into the dies, guided only by the longitudinal movement of the movable center, F, and the carriage, D. For different lengths of bolts, the arm, in connection with the carriage, is disengaged from the bar, E, and the carriage is moved to the desired relative position and again secured. In order to prevent the work from turning, an ingenious device is provided in the forward end of the carriage, at H. The bolt is arranged upon the centers between the roughened faces of two cams, which, when two slides are adjusted rela-

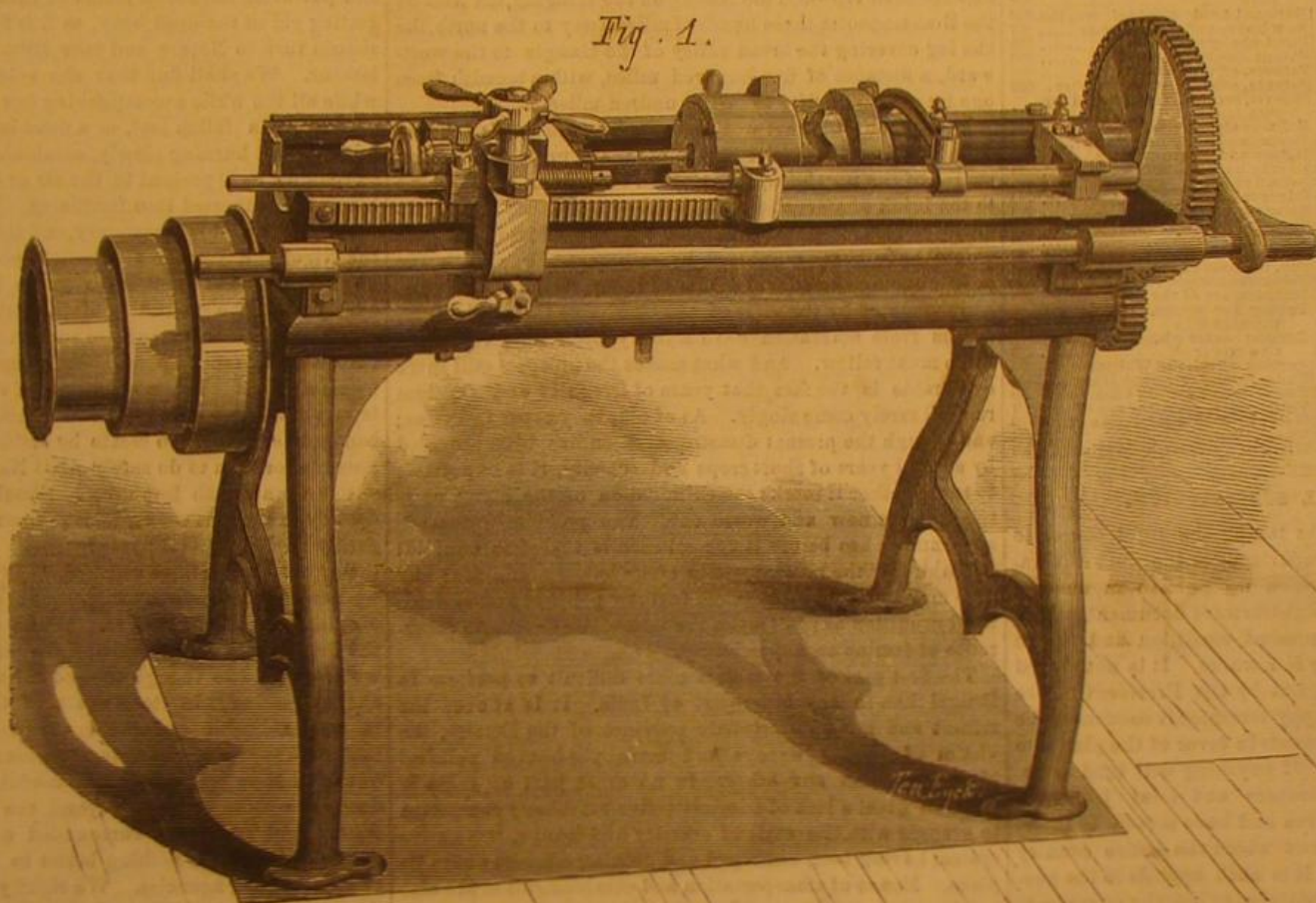
or variation often noticeable in machines in which the set of the dies is given by levers or other devices, uncertain in positive results.

Another feature of merit in this machine is the automatic arrangement by which the dies, after being set to the desired length of thread, are instantly opened at that point, and the bolt carrier thrown back to receive a new bolt. This arrangement, besides insuring uniform length of cut, avoids the danger of accident or breakage owing to running the holder against the dies, through inadvertence or inattention of the workman. One operator, through this device, readily keeps two or more machines continually at work.

This improvement, of adding centers, for the axial holding of bolts, to bolt threading machine, which we have now fully described, was patented in the United States by Mr. Wood, February 10, 1874, and similar protection has also been obtained in Canada and several European countries. These machines, as at first patented in July, 1868, without the centers, were exhibited at the American Institute Fair of 1869, and there, we are informed, gained a gold medal over several competing machines. They have since been successfully introduced in many prominent locomotive and railroad shops throughout this country and Canada.

These machines are made in three different sizes, ranging in cut from 5 16 inch to 2 1/2 inches; and, with or without the new improvement, are manufactured by the Wood and Light Machine Company, of Worcester, Mass., to whom inquiries for further information may be addressed.

WOOD'S IMPROVED BOLT CUTTER.



tively to the diameter of the piece, bear firmly against it. The tendency of the bolt to rotate with the cutting device causes, by contact, a corresponding motion of the arms, which finally, by their shape, offer a rigid resistance, and thus firmly hold the work. For considerable difference of diameters, a suitable bolt, joining the sides, allows of their proper adjustment, but ordinarily the apparatus forms a self-adjusting dog.

It is claimed that, by the aid of this machine, an ordinary hand is capable of threading bolts as accurately and nicely as,

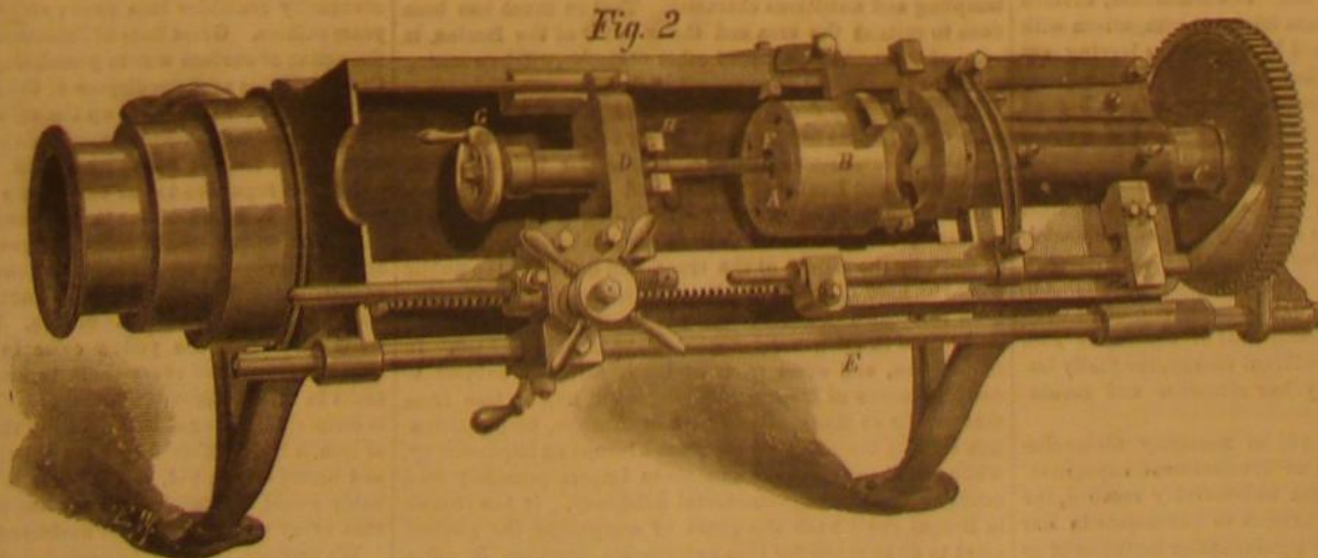
ter, Mass., to whom inquiries for further information may be addressed.

Practical Use of Velocipedes.

The bicycle, after going entirely out of fashion as a toy, is now being put to some practical use. Messengers, called "veloce men," thus mounted, convey dispatches in Paris from the Bourse—or stock exchange—to the central telegraph bureau. The distance is about six miles, going and coming, and is accomplished in 25 minutes, at a charge of 50 cents. A company is being formed to place a very large number of velocipedes upon the streets and to supply messengers to go to any part of the city. The Parisian journals are also using the bicycle to obtain quick reports. During the trial of Marshal Bazaine, the *Moniteur* employed daily a large number of vehicles, running from the palace of Versailles to Paris. The distance, about 13 miles, was made in 45 minutes, and quicker than the ordinary trains on the railroad. Carrier pigeons were also used by the papers, the birds easily traversing the distance above mentioned on clear days at the rate of a mile a minute.

J. P. F. suggests using a reflector (a tin plate will do), adjusted in front of the furnace door of a boiler, so as to throw light on to the flue sheets, when caulking leaks.

Fig. 2



and with greater precision in size and fit than, the most skillful workman with a chasing tool in a lathe. It is also stated that from four to ten times as many bolts can be cut in a given time as by the last mentioned means. The uniformity of size is the result of the method of holding the dies rigidly in the solid ring of the cutter head, thus avoiding the spring

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THE CENTENNIAL SUBSCRIPTION.

The centennial managers are taking the right course to impress upon the people the importance of the great celebration of 1876. The address which we publish in another column is a business-like, straightforward document, which sums up the past progress, present condition and future needs of the enterprise in very few words. It is not signed by an impersonal committee, but by the President of the Board of Finance; and with happy terseness, it condenses the gist of the most telling arguments in favor of the plan into the fewest possible sentences. If anything will tend to reconcile the unfortunate differences and local jealousies which have presented themselves and have served to interfere with the unanimous support which the entire country should give to the Centennial, it is such appeals to the people as this. Memorials to legislatures or lengthy arguments more theoretical than practical, scattered through the press, are of little avail in securing the necessary returns of cash which are needed, not at some future and indefinite period, but now, in order to ensure the success of the scheme. The people are told, plainly and succinctly, that if the United States is to commemorate its hundredth birthday by a grand celebration which will worthily testify its unexampled progress, it must not be left to politicians to dole out such appropriations as will make up the requisite number of millions, but that individuals must personally open their pocket books and buy the shares. Ten millions of dollars is the total amount needed; of this, four millions have been subscribed, and a good percentage of the balance Congress, it may be expected, will provide for. The remainder, divided throughout the country, is a sum trivial in comparison with merely the benefits to be gained by exhibitors leaving out patriotic considerations altogether.

There are scores of manufacturers who intend, beyond doubt, to be represented in the Centennial, who will partake largely of the advantages it offers and who are abundantly able to take up the remaining shares of stock without feeling the outlay. It is time that the jealous feeling against Philadelphia should die out; in this city it has disappeared, and there is an earnest desire for the unequivocal success of the work. Philadelphia has fully made good her claims to be the site of the exposition, by the subscription of \$4,000,000, tenfold her quota and nearly half of the entire sum needed, supplementing, by magnificent energy, the justly important advantages offered by her situation and revolutionary associations.

It is too late also to continue an unseemly dissension over the question of a national or international exposition. By its official acts, which cannot be honorably recalled, the government has invited other nations to participate in our festival, and many have already signified their intention of so doing. It would hardly be just to invite guests to our feast, and, after they have begun their preparations and set aside money for their coming, to request them to stay away. The Centennial was inaugurated as an international affair, and as such, we think, it should be carried out.

It is moreover to be the largest and grandest exposition that the world has yet beheld. In point of space alone, its

buildings are to cover 3,000,000 yards, against 2,530,400 and 481,500 square yards filled by the Vienna and Paris fairs. The time remaining is but two years, and the greatest activity will be necessary to complete preparations during that period. It is for this reason that the appeals now before the people are doubly urgent. We trust that the response will be both speedy and adequate.

THE FAMINE IN BENGAL.

Accustomed only to unbroken plenty, it is happily impossible for American minds to form any adequate conception of a state of things like that now prevailing in Lower Bengal. The haziness of our knowledge of Indian geography helps still more to lessen the effect of the pictures of human wretchedness outlined in the cable reports. We are incapable both of estimating the extent of the troubles there, and of supplying from our own experience the unreported details. Benares, Patna, Baugulpore, Rajshaye, Bardwan—what are they but heathenish names, standing for we know not what? Even when we translate them into familiar terms, and find that they represent a territory greater by a third than all New England, packed with a population equal to that of the United States and British America combined, the appalling fact that its swarming millions are pressed by want, if not face to face with starvation, loses most of its significance through our ignorance of what famine really means.

As mapped by Sir Bartle Frere, the stricken district is shaped somewhat like a clumsy boot with a thick foot and an expanded toe—the toe resting on the Hooghly, the heel on the Brahmaputra three hundred miles away to the north, the leg covering the broad valley of the Ganges to the westward, a distance of five hundred miles, with a breadth from one hundred and fifty to three hundred miles.

Throughout this vast area, protracted drouth last fall caused the almost total loss of the rice crop, the principal food resource of the people, who have been brought in consequence to the brink of starvation. Indeed had assistance from without been less prompt or less generous, the victims of famine would have been numbered by millions. Even with the most untiring and liberal efforts of the government of India, supplemented by the gifts of the charitable the world over, deaths from starvation have already been numerous, and more must follow. And what makes the prospect still more deplorable is the fact, that years of irregular and deficient rainfall rarely come singly. As of old, they occur in cycles; and though the present disastrous season has been preceded by several years of short crops and scarcity, it is impossible to say whether it marks the culmination of the series or is the first of a new and worse one. The problem which the government has before it for solution is therefore twofold: 1. To supply the present wants of its hungry millions; and 2, to make such improvements in their political and agricultural condition as shall make the immediate or remote recurrence of famine an impossibility.

The first part of the task is more difficult to perform in Bengal than in any other part of India. It is at once the richest and most unfortunate province of the Empire, the victim of greater wrongs and more pig-headed political blundering than any other. In no other part of India is there so great a lack of administrative machinery competent to grapple with the evils of scarcity and famine, the native system having been destroyed and nothing efficient put in its place. Means of transportation and communication are also lacking everywhere; so that, if left to itself, each petty district would be practically dependent on its own crops, and millions might starve while there was plenty all around, for the simple reason that food could not be brought to them. To provide for the distribution, at the right time and in the right places, of the thousands of tons of food, which the government has thrown into the suffering districts, has been and must be the most difficult portion of its gigantic charity.

The distribution of food is made still more difficult by the system of caste, stronger in rural Bengal than in any other part of India. The ordinary Hindoo is not only restricted to a very limited range of vegetable diet, but even that must not pass through the hands of one of lower caste. He will starve rather than touch forbidden food, though of the most tempting and nutritious character. That so much has been done to restrict the area and the severity of the famine, in spite of these and a thousand other obstacles, will be a lasting credit to the present government of Bengal.

It has also grappled with the second part of the problem with considerable earnestness. Many extensive works of internal improvement—railroads, canals for irrigation and commerce, and local roads which had been suffered to languish through false economy—are being pushed to completion by the thousands of agricultural laborers thrown out of work by the failure of the crops, and driven to the public works by need of food. Had these safeguards against famine been completed in time, it is safe to say that the greater part of the existing distress would have been prevented. In the Deccan, and other parts of India formerly subject to fearful seasons of famine, the people are now as free from that danger as those of any part of Europe, ample irrigation making the general destruction of crops an impossibility, while good roads make it possible to import promptly food enough to supply any accidental deficiency. If the trouble in Bengal shall have the effect of compelling the government to do as much for that unfortunate province, its affliction will not be an unmitigated misfortune.

G. W. P., M. D., writes to point out that Mr. R. B. Forbes' suggestion as to calming the sea by means of oil originated with Benjamin Franklin, who saw the effects produced by the accidental upsetting of a barrel of oil, while crossing the Atlantic. It is described in Franklin's autobiographical work.

EREMACAUUS VERSUS BURIAL AND CREMATION.

BY PROFESSOR ALBERT E. LEEDS.

Is there no other alternative in the disposal of the dead than our present practice of inhumation and the proposed cremation? The shortcomings of the former, and the long catalogue of hurtful consequences, are conceded; but are the superior advantages of cremation established? Passing by the social, aesthetic, and religious considerations involved, can the advantages which are claimed for cremation, by those who profess to advocate it on scientific grounds, be regarded as proven? Is the immediate conversion of the highly organized and nitrogenized tissues of the body into certain gases and water, the most economical method of returning to the earth the forces and substances needed for its fertilization? No: on the contrary, cremation would proceed in direct violation of well ascertained principles in the use and economy of natural forces; for all the power exerted by the burning fuel, to break up the animal tissues into carbonic acid and water, would have to be put forth again in order to recombine them into those compounds of carbon, hydrogen, and oxygen, which make up the cells and fibers of animals and plants. Nature, which has the vastly greater burden of disposing of all animals other than man, rarely resorts to the wasteful expedient of burning them by rapid combustion. She effects this end by slow combustion, or, as Liebig termed it, *eremacausis*.

It would be well, then, before resorting to artificial devices and patenting improved forms of furnaces for most rapidly getting rid of the dead body, as it is feelingly called, that we should turn to Nature and take from her a few preliminary lessons. We shall find that she seldom applies the torch, while all the while accomplishing her end. There is not a rotting log, a fallen leaf, or a dead insect, worm, or animal, which is not burning slowly, combining insensibly with the oxygen which is present in the air or dissolved in water, and becoming converted into fertilizers. Regarded in this aspect the whole world is a cemetery, and the tropical forests along the Niger and Amazon are densely populated ones. Yet we do not find that pestilences make life impossible to the survivors. The ground is black with organic remains, and furnishes beneath its surface such stores of food that it supports a subterranean population, almost as vast as that which teems above it. It is a magazine of vegetative power, sending up all shapes of luxuriant life just such a soil as the husbandman endeavors to create by artificial means. Is it not possible for man to do safely what Nature does on so much vaster a scale with impunity? Should he be compelled to destroy in hideous conflagration what Nature consumes so gently on her funeral pyres?

Our error is, and has been, that, in this as in other cases, we have done wrong by interfering with or only partially obeying the laws of Nature. While professing a belief in the immortality of the soul and the perishability of the body, we have acted as though the body should be immortalized; and, by placing it in stone vaults of Cyclopean masonry or in non-oxidizable metallic envelopes, have endeavored to thwart the operation of natural forces and prevent the return of the effete to the realm of the useful. In the burial of the dead, the coffin is sunk beyond the reach of infiltrating waters and frequently surrounded with impermeable clay, than which there is nothing better to exclude the operation of decomposing agencies. We rightly view with reverence the spot where a dear friend is laid, just as we do the ground where some great achievement was wrought, although we know that every vestige of his body has perished. Why then attempt to prolong by a few years the pitiful remains? This idea has had but the effect of populating the ground, and rendering it necessary finally to desert it, and seek some new cemetery. Instead of so doing, make the spot for ever hallowed, and let our cemeteries remain, while permitting Nature, untrammelled or assisted by means which she herself teaches, to dispose of the bodies.

This is not an empty suggestion. Chemistry points out to us what must take place, and suggests a variety of substances and means for accomplishing the desired result. The stoutest granite exposed to the action of air and rain eventually crumbles into sand; and for most rocks, a few years suffices. Great beds of limestone may be dissolved by the action of surface waters percolating through the ground. Cannot similar agencies dispose of the few pounds, mostly of carbonate of lime, making up the animal skeleton? It would not be necessary to employ chemicals having a violent caustic action, like lime or acids, which, in consequence, suggest operations repulsive to our sentiments of tender respect for the dead. It would suffice to surround the body with some substance which would carry oxygen to the tissues, and allow the products of the slow combustion thus effected to be distributed through the soil. Such a substance, for example, is the hydrated oxide of iron. This is the same material that gives the yellow color to the soil, and which Nature has diffused everywhere to sweeten the ground and assist in the oxidation of organic remains buried in it. There is certainly nothing objectionable in the appearance of oxide of iron, a body which forms the coloring matter of yellow and brown ochre; yet, as Professor Wurtz suggested, it probably would be sufficient to lay the body in this, in order that every vestige should be destroyed in a few years.

We propose, then, that cemeteries should not be transient, or banished to distant spots, or allowed to be located in unsuitable places, or managed (as at present) as successful speculations, frequently in defiance of well known sanitary laws. Instead, let them be made permanent, bearing a definite proportion in size to the surrounding population: not restricted to the outskirts of cities, and swept away by the advancing tide of humanity, but located upon sites well adapted

for them, whether in the midst of cities or in suburbs. Let the ground grow more sacred as the spot where were placed not one but many generations of those connected with us by the ties of filial love, and more beautiful by accumulated treasures of art erected as memorials of the unnumbered dead who have temporarily reposed there. We believe that some method similar to that which has been advocated above, and which is, to the best of our knowledge, brought forward for the first time in this place, is not open to the objections which are justly urged against our present methods of inhumation: that it is in accordance with the latest teachings of Science in this direction, and that it will serve to increase and not diminish the tender love and reverence for the dead, which has steadily grown with all that is most excellent and beautiful in poetry and religion.

THE EFFECTIVE POWER OF TURBINE WATER WHEELS.

The failure of turbine water wheels to supply the amount of power expected is not less common than that of steam engines, and the causes are more numerous. Before purchasing turbines, it is necessary to ascertain the head of water available, and that there is an abundant supply; after which large allowance should be made for the friction of shafting, as well as for the power necessary to drive the special machinery, and the whole determined in horse power. The selection of a wheel then becomes necessary. There are legions of makers, each of which is ready to warrant his to be the best wheel made. All of them publish artistic tables of sizes and powers, always guaranteed reliable. The uninitiated purchaser usually procures many of these tables, having voluminous descriptions and letters of commendation attached; and on examining them, he is surprised at the elaborate displays of figures, and often loses himself in contemplating the accuracy of the decimals. When comparing the tables of the various makers, he wonders why there is such uniformity of high powers in wheels so different. In studying the details, he finds that Smith's Excelsior Concave Fluted Turbine of forty-eight inches diameter will give him 84 71 horse power; while Jones' Scroll Flanged Baggy Wheel of the same diameter is fully warranted to yield 85.97, that being a gain in favor of Jones of 1.26 horse power, besides the further advantage of running with or against the sun, as desired. In continuing his comparisons to other wheels, it is needless to say that he becomes bewildered among so many wheels so far excelling each other, and finds himself unable to decide which wheel is the best. He is forced to seek the advice of some competent engineer, and, to his utter astonishment, learns that the figures of the tables so nicely prepared are in almost all cases totally unreliable, there being scarcely a maker's wheel that, in a test flume, under the most favorable circumstances, ever for a single hour indicated the power claimed, and almost none that in actual use approach the figures, many of them scarcely yielding half what is claimed. Under these circumstances, it becomes important, in selecting a good wheel, to be assured that it will furnish ample power. After ascertaining a reliable maker, in order to determine the exact size of the wheel it is necessary that at least one third should be allowed for variations in water levels, and for the loss consequent to the wear of wheels and gates; and, in addition, figures should be made, based on but a little more than a half gate of water to the wheel. The best wheels afford almost all of their power at a five eighths gate or under, and a difference between a half and full gate is not more than should be the margin necessary to regulate speed. In use it will be found that opening gates seven eighths or fully simply amounts to a large consumption of water, generally without producing five or ten per cent additional power. Some good wheels give less power when at full than at part gates. The rule should be to buy a wheel amply sufficient at about half gate, due allowance being also made for over estimate of power. We think the experience of all who have placed wheels with a less liberal allowance will bear out and confirm this rule. Allowing one fourth for the friction of the shafting of a cotton or woolen mill, without adding one third more for a reserve when in actual use, will scarcely fail to cause a manufacturer to wish that he had bought a larger wheel. Actual tests, accurately conducted, of thirty-one styles of turbines show the comparative range of effective force, under the best possible advantages, to be as follows: At quarter gate, from 13 to 50 per cent; half gate, from 11 to 71 per cent; three quarter gate, from 31 to 82 per cent, and at full gate, from 52 to 84 per cent, the best wheels giving out about all of their power at from five eighths to three quarters openings; while the lower classes give but little power unless flooded with water, and even then fall far short of the amount claimed for them. Another reason why large wheels should be used is that, almost universally, high and low points of the head and tail waters so reduce the force of wheels as to cause partial stoppages of machinery, unless there is surplus power when the water is at the ordinary stage. We are acquainted with a mill using ten independent turbines of various styles. Experience has here shown practically that the relative power of the wheels, to that necessary to drive the machinery under constantly occurring unavoidable disadvantages, has not been unduly stated, and that not meager allowances should be made as reductions from makers' over-estimates of the powers of their wheels, as well as farther liberal allowances for the friction of the shafting, loss of power in times of high and low water, and the margin necessary for the action of the governors. It has also been found true here that substituting large wheels, operating at from one fourth to one half gate, for small wheels, requiring seven eighth gates, results in the use of much less water for a given effect. Were wheels accurately tested in places of use, and actual power ascertained, such large fractions of allowances would not be

necessary; and a less rate of proportion between that wanted and that claimed by makers is accordingly found satisfactory with wheels where such claims are based upon tests. It will always be found to be by far the most economical, with both steam and water, to provide abundance of motive power.

ARMY ANTS.

It is a suggestive circumstance that, among the many varieties of animal forms, those which approach man most nearly in social and mental development are not his nearest allies, but creatures of an entirely different order, and those which stand at the head of their class, the articulate, as man does at the head of the vertebrates.

The closeness of formic mimicry of human civilizations is all the more surprising when we take into account the vast difference between the physical conditions of the two types of life. With nothing apparently in common, not even similarity of structure, men and ants have fallen into lines of development so nearly parallel in many instances as to suggest the existence of something far more imperative in the tendencies of life, and at the same time a much greater limitation in the possibilities of development, than are commonly suspected. Especially to those who regard mind as an unmixt product of material conditions, and would measure mental power by weight of brain, nothing can be more perplexing than to see the almost microscopic cerebral ganglia of the ant evolving products so like those of the immensely more bulky brain of man that their practical identity is unquestionable.

But our purpose is not to study the mystery of formic intelligence in general, but the peculiar manifestations of it by certain species whose modes of life have been recently investigated.

As a general thing, ants are found in settled communities, which change their habitations rarely, and then for causes not under their control. A remarkable exception to this rule is found in the *ecitons*, or army ants of Central America. These, while existing in thoroughly organized communities, numbering myriads if not millions, never make permanent settlements, but are constantly roaming about the forests in vast multitudes, scourging the insect world as the migrating armies of Attila scourged the less warlike nations of Europe.

The traveler's attention is usually called to one of these predatory swarms by the twittering of birds which follow their course to feast on the flying insects which they scare up. Approaching, he will discover a dense body of ants, in a column three or four yards wide and of enormous length, moving rapidly and examining every nook and corner where their game may hide. The captured insects are speedily torn to pieces and carried to the rear, or to their temporary camp, by relays of workers. On the flanks and in advance of the main army, smaller columns of skirmishers are thrown out to flush the insects they are in pursuit of, many of which, in their terror, bound right into the midst of the main column, to be torn to pieces instantly. The greatest catches occur in masses of brushwood. Here the cockroaches, grasshoppers, spiders and other insects take refuge among the branches, while the ants are occupying the ground below. But their security is brief. In a little while explorers are sent up, following every branch and driving the refugees to the ends of the twigs, to fly into the air and be snapped up by the birds, or drop among the throng of ants below. In this dilemma the spiders alone have any means of escape; they can suspend themselves in mid-air and remain in safety until their enemies have retired from the bushes and passed on to other conquests.

The individuals of this species of ants (*eciton predator*) are of various sizes, the largest being about a quarter of an inch long, the smallest less than an eighth of an inch. A much larger variety (*eciton hamata*) pursue their prey in a similar manner, but vary their tactics somewhat as occasion demands. When on a general hunt, they spread their columns over a considerable breadth and sweep everything before them, crickets, grasshoppers, scorpions, centipedes, woodlice, cockroaches, and spiders falling almost certain prey. Exploring parties are also sent up trees to look for nests of bees, wasps, and probably birds. The moment a prize is found the fact is reported to the army below, and a column is sent up to take possession. Mr. Belt, to whom we are indebted for these observations, and whose "Naturalist in Nicaragua" gives more numerous and valuable additions to the science of natural history than any book of travel since Wallace published the "Malay Archipelago," describes these ants as pulling out the larvæ and pupæ from the cells of a large wasp's nest, while the owners were hovering about, powerless, from the multitude of their invaders, to render any protection to their young.

When hunting in solid columns, these *ecitons* were found to be generally, if not always, in search of the young of another species of ants (*hypoclinea*) which make their nests in fallen timber. When a log is found, the column spreads out over it, searching all the holes and cracks, the smallest individuals pursuing the unfortunate *hypoclinea* to the furthest ramifications of their nests. The invaded ants rush out bearing their young in their jaws, and are despoiled of them so quickly that it is quite impossible to see how it is done. The *ecitons* do not harm the mature *hypoclinea*, caring only for the larvæ and pupæ, which are hastily borne to the rear of their column. What they do with their plunder finally does not appear. It would seem that they cannot rear the young *hypoclinea* for slaves, as certain northern ants do with their prey, since no mention is made of any such addition to the membership of their communities.

When marching, these *eciton* armies appear to be directed

by numbers of individuals, of a larger size and a lighter color than the regular workers, scattered at intervals of two or three yards. They stop often, and occasionally run back a little and touch some of the other ants with their antennæ, as though giving orders. At the headquarters there are individuals of still greater size and more ferocious aspect, which soon make any one molesting the nest acquainted with the efficiency of their enormous jaws. The temporary resting places of these ants are usually in hollow trees or underneath large fallen trunks that offer suitable hollows. One which Mr. Belt found in a hollow log, open at the side, must have contained a cubic yard of ants clustered in a dense mass, like a swarm of bees. And these were but a part of the whole community, as many columns were outside, some bringing in the pupæ of other ants, others the legs and dissected bodies of insects captured on their foray. These incomers proceeded directly into the interior of the living mass through tubular passages, which were kept open just as though it were formed of inorganic materials. Like the hunting races of mankind, these predatory swarms are compelled to make frequent removals to new hunting grounds. The migratory columns are easily known by all the common workers moving in one direction, the larvæ and pupæ of the community being carefully carried in their jaws.

Many observations and experiments were made by Mr. Belt, testing the individual intelligence of these wonderful creatures. Though inferior in some respects to ants which hunt singly, he does not hesitate to place them at the head of their order for intellectual and social development.

SCIENTIFIC AND PRACTICAL INFORMATION.

STEAM LIFE BOATS.

Mr. H. G. A. Mitzlaff, in a paper read before the Institute of Naval Architects, proposes the use of steam in life boats, and suggests the hydraulic propeller or rotary pump as best adapted for propulsion. He proposes the following dimensions for such boats: Length 45 feet, breadth 11 feet, draft 3 feet. The boat is provided with airtight chambers to prevent sinking.

THE HEAT OF THE SUN.

Father Secchi, the distinguished Italian astronomer, has recently published the result of his investigations in the solar temperature, made during last summer, and states that his efforts were directed toward the determination of the relation of the solar radiation with that of the electric light. The instrument used was a thermo heliometer of the investigator's own invention, and the conclusion reached was that the radiation of the sun would be 36½ times that of the carbon points. If, therefore, the temperature at the surface of the latter is fixed at 5,432° Fah., a number not exaggerated, and supposing the radiation proportional to the temperature, we obtain for the potential temperature of the sun 240 836° Fah.

ELECTRICAL FIGURES UPON CONDUCTORS.

M. Schneebeli has investigated the conditions on which depend the dimensions of Kundt's electrical figures, which result from the adherence of a fine isolating powder on a metallic conductor, from which a discharge is emitted. In the experiments, the discharge of a Leyden jar took place between a horizontal metallic plate sprinkled with lycopodium and an electrode in the form of a ball or cone above the plate. It was found that, the circumstances being equal, the diameter of the figure augmented with the distance from the electrode to the plate, but never in a constant ratio. The size of the figure augments also with the quantity of electricity which produces it. When the electrode is composed of a certain number of points, a regular circular figure is formed beneath each one. If in the path of the discharge a small plate of glass be introduced, a space clear of powder appears on the metal plate of exactly the form of the glass plate interposed. With electrodes of conical form, presenting an angle of 60° or 30°, it is stated that the electrical figure is larger as the angle at the summit of the cone is smaller. Finally, the diameter of the electrical figure is larger when the discharge takes place in a rarefied gas than at normal atmospheric pressure.

JAPANESE BRONZE.

A curious bronze is produced in Japan, which, when made in thin plates, resembles slate, and is covered with designs in silver. M. Morin has lately analyzed and examined the properties of the alloy, and finds that it contains, in addition to copper, from 4 to 5 per cent of tin, and on an average 10 per cent of lead. The combination is easily molded into thin plates. These are varnished, and through the covering the designs are scratched with a burin. The plate is then plunged in a silver bath, when the silver is deposited on the unprotected portions. Lastly, it is placed in a muffle furnace, when the copper blackens and the silver remains bright.

CURIOUS PHENOMENON OF ENDOSMOSIS.

If the membrane which lines the interior of an egg shell be used to close the tube of an endosmometer, the latter being filled with sugar and water, and its containing vase with pure water, an odd circumstance will be noted. If the external surface of the membrane is toward the pure water, endosmosis is very rapid, and the water rises at the rate of some 4 inches per hour. But if, on the contrary, the interior surface is turned to the water, the phenomenon is almost annihilated. Matteucci, it appears, has noticed a somewhat similar peculiarity in the skin of a frog. It would seem that the phenomenon is worthy of study, since it shows that a liquid does not traverse the interior of a cellule with the same facility outwards as in the contrary direction.

THE VERTICAL MULTIPLIER BORING MACHINE.

We have already laid before our readers three applications of that ingenious combination of gearing, the vertical multiplier, to woodworking machinery. By its use the band saw, the jig saw, and the circular saw have been adapted to run by the foot power of the operator, thus enabling the mechanic whose shop is not of sufficient extent to require the work of a steam engine to supply its place, on the machines most employed, by a device which affords a means of applying his available force at perhaps the best advantage.

We now present, in the annexed engraving, a representation of still another adaptation of the invention, recently made to the boring machine. The nature of the peculiar mechanism through which the power is communicated has already been fully described and explained in other connections, so that no further allusion to its construction is necessary. By its aid, however, in the present machine, forty revolutions of the shaft, actuated by the treadle, correspond to 1,640 revolutions of the bit, a four inch pulley being connected with the latter, making a proportion of one to forty-one. The general arrangement of the boring mechanism will be readily understood from the engraving. A table is provided which, by a slotted support through which passes a set screw, may be adjusted at a height suitable to the dimensions of the work to be operated upon. It has a longitudinal slot on its surface, in which travels a guide piece, against which the wood to be bored is held by the hand of the operator, as it is advanced toward the tool. This guide piece, by means of a slotted semicircular bar and set screw, may be placed at any desired angle so as to allow for the boring of inclined holes.

We recently had occasion to examine this machine, and found that the tool penetrated through knots or woods in any direction, with much facility and with the exercise of a quite small amount of effort on the part of the operator. It is evident that any sized bit, which can be adjusted to the shaft, may be used. This device will doubtless prove a useful addition to the shops of wood workers generally.

For further information, address the Combined Power Company, 23 Dey street, New York city.

IMPROVED FUEL ECONOMIZER.

Among many novel devices displayed at the recent exhibition of fuel-economizing appliances, held at Manchester, England, is a steam generator composed of three coils of cast iron piping, of four inches internal diameter. These coils are not cast whole, as stated in the inventor's descriptive circular, but are formed of a number of half circles, bored and turned to spigot and faucet joints. The ends of these half circles are reduced to three inches in diameter, and have ribs cast on the exterior surface. After the segments have been placed together an iron hoop or thimble is cast on over the joints, and, by the contraction of the metal in cooling, draws the ends of the pipe close together. The exterior of the thimble is of the same diameter as the pipes, and thus a perfectly smooth joint is obtained for scrapers to travel over; the pipes are held securely together, while all cement or rust joints are dispensed with.

Should a coil become fractured it can be repaired by splitting two hoops and removing the damaged segment.

The form of scraper will be readily understood by referring to the engraving. One half rests upon the pipe, embracing the upper portion of it, while the lower scraper is kept up to the pipe by means of a balance weight; these scrapers are pushed forward by arms or propellers fastened to a center shaft, driven by a worm and wheel at the top of the machine, and supported by a foot-step in the center of each coil; the scrapers follow the line of pipes until they reach the bottom, when, by the action of the reversing motion, they again ascend the coil to the top. These scrapers will, undoubtedly, clean the coils from soot, provided the pipes are cast truly cylindrical and the scrapers made to fit them exactly; but in the apparatus exhibited at Manchester this was not the case—the pipes being very rough castings and far from cylindrical, consequently many portions of the pipes were untouched by the scrapers, the points of which were frequently more than an inch apart. The inventor

states that this machine was not made in his own foundry, but that in all economizers now supplied by him he will guarantee the accuracy of the form of the coils.

Many advantages are claimed for this economizer over those with vertical pipes. The first is that the whole piping presents a surface for the heat to beat against, the back part of the coil being exactly opposite the front space. We can see no difficulty, says the *Engineer*, to which we are indebted for the engraving, in arranging vertical pipes, so that those in the second row should be placed exactly opposite the spaces between the pipes in the first row, and so on alternately. Another advantage claimed is the rapid and continuous circula-

tor to give as good results as an economizer comprising seventy vertical pipes.

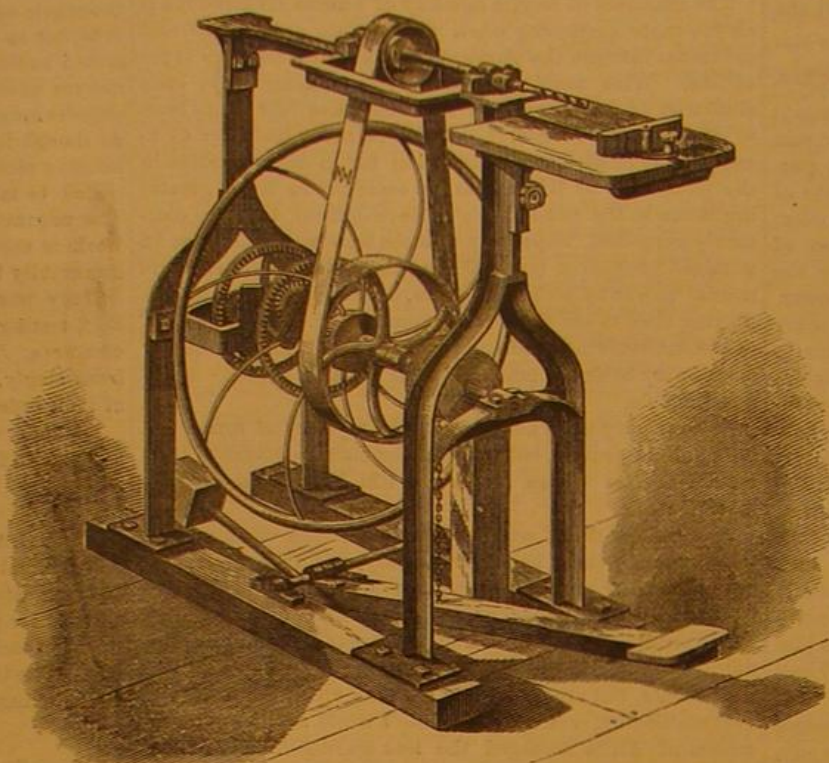
American and European Locomotives.

American engines have, as it were, gradually crystallized into certain definite and fixed forms. Outside cylinders and inside frames are now universally used here, whereas, on the continent, cylinders and frames are sometimes placed inside of the wheels and sometimes outside. The steam chests here are always placed on the outside and top of the cylinders; thus there are often placed on the side and inside the frames. Almost the only kind of pistons which seems to be used there is that made with solid heads, with simple grooves turned on the outside, into which steel, cast iron, or brass rings are sprung. Here the varieties of packing in use are numberless. For simplicity and cheapness the European is certainly very much superior to ours. Here the only valve gear now made is the shifting link motion worked from eccentrics on the main axle; there the shifting link, the suspended link, the Allen or straight link, the Walschaert, and several other kinds of valve gear are used. Some of them are worked from eccentrics placed outside of the wheels; and in at least one engine we notice that the axle bearings are outside of the wheels, and then the eccentrics are placed next the bearings, and a crank outside, to which the connecting rods are attached. All wheel centers are made of cast iron; there, of wrought iron. In the tyres of our truck wheels we are imitating Europeans, and steel tyres are now much used here for that purpose. The springs in American engines are, if we except the Boston and Albany railroad, always placed above the axles and frames. In Europe they are often below. Here they are, excepting in four-wheeled engines, always arranged with equalizing levers; there this is not always the case. The use of plate frames is universal in Europe, whereas in this country they are now never used.

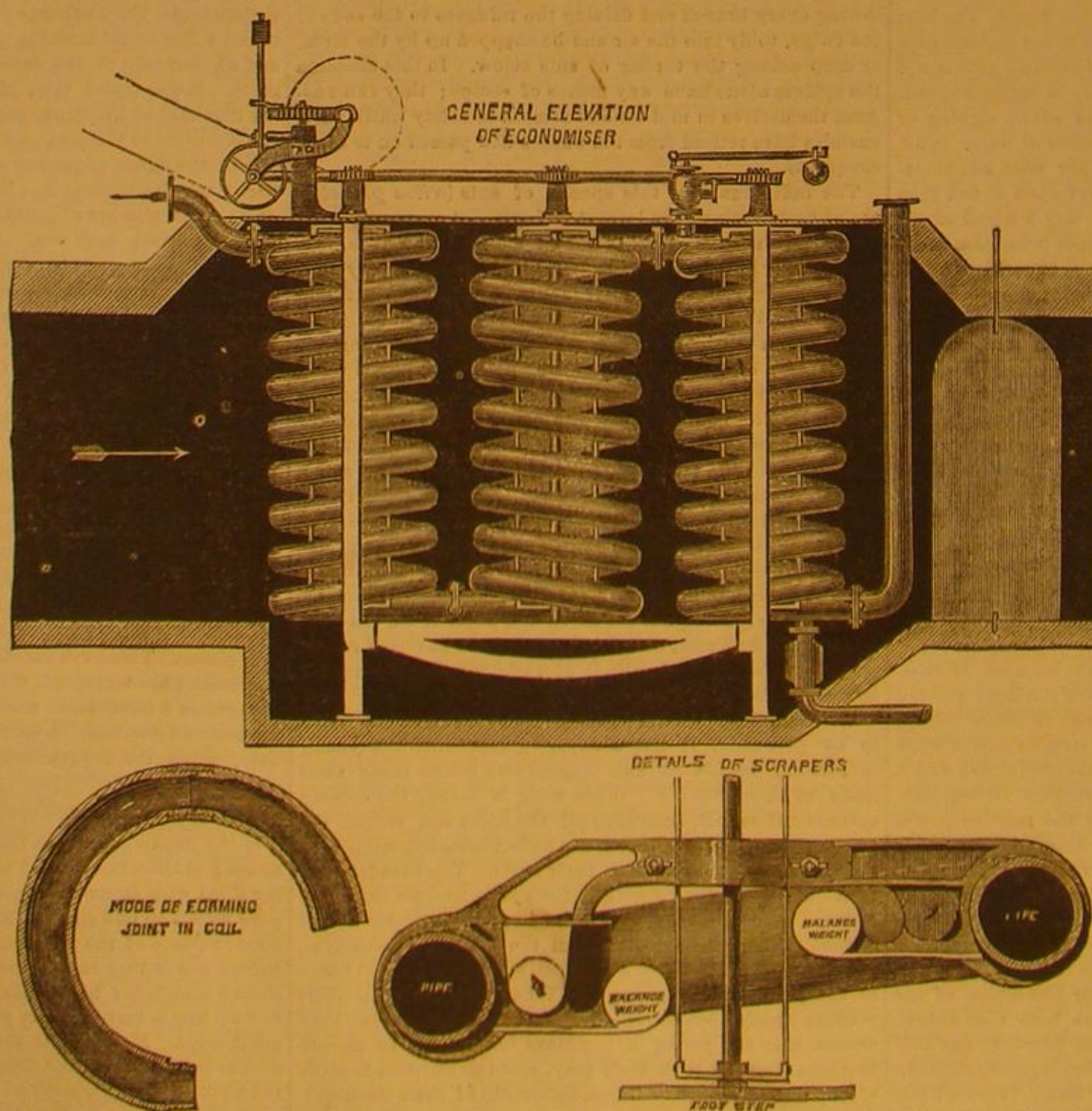
In the construction of locomotive boilers there is also a very great difference in their practice. The steam dome is there always placed either about the middle or near the front end or smoke

box. The Becker pattern of boiler is also much used, especially in Germany and Austria. In this plan the outside of the fire box, instead of being arched, is rectangular, that is, the top of what we call the wagon top, instead of being round, is flat, and is raised somewhat above the barrel of the boiler. The corners are, however, rounded somewhat. The crown sheet, instead of being stayed with crown bars and braces, is supported by long stay bolts screwed through the outside shell and the crown sheet. Some of the engines which are to be built at the Grant Locomotive Works, for a Russian road, are to be made in this way. This is, we think, a very excellent plan, and is quite certain to be adopted in this country when its merits become known. Shaking grates are, however, seldom shown in the illustrations of European engines; but grates very steeply inclined are still much used

there. It is very singular that in Europe the exhaust steam almost universally is allowed to escape at the base of the smoke stack instead of the bottom of the smoke box as is the practice here. It will also be observed that there many of the smoke stacks are made conical; that is, the base of the inside of the stack is smaller than the upper part. We have seen it stated that it is found that the steam blast is much more effective with this form than with a straight stack. We do not know, however, upon what the assertion was based, and would be glad to get some further information in reference thereto. The differences in points of detail are almost numberless, and are well worth study. The reasons for many of these differences would be very interesting if carefully examined, and we intend to return to the subject again. A very striking fact, however, is the much greater variety in the methods of construction adopted in Europe than is in use here. The reason for this we believe to be, singular as it may seem, partly political. The suppression, or rather repression, of individuality under republican governments has often been remarked. In this country, perhaps, no principle is more generally believed than that "the majority should rule." The result is that this axiom produces a kind of intellectual subserviency of the individual to the will of the majority, which thus, to a very great extent, becomes the standard of right and wrong

**VERTICAL MULTIPLIER BORING MACHINE.**

tion of the water, there being only one unbroken stream, free from all sharp turns and angles, thus avoiding strains upon the pumps and joints. By means of this rapid circulation it is maintained that incrustation and deposit of scale on the interior of the pipes are avoided, and their heating surface kept uninjured. The feed water enters at the bottom of the coil furthest from the boiler, which is the coolest end; it passes into the second coil at the top, and, descending through it, enters the third coil at the bottom, becoming gradually hotter until it enters the boiler at a temperature varying from 200° to 300°. From the absence of abrupt corners and bends, the coils can be well cleaned out by blowing through them with steam. It stands independent of all brickwork, and is self-contained in its own frame, which reduces the cost of fixing. The three coils are estimated by the inven-

**BELL'S FUEL ECONOMIZER.**

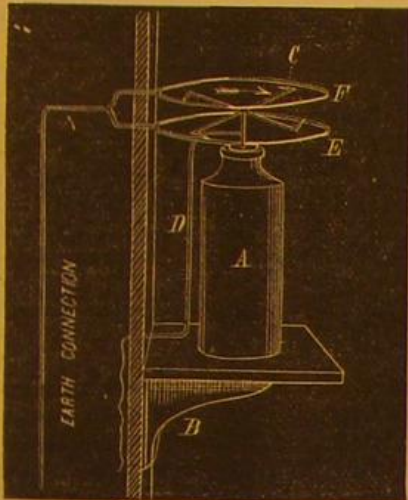
If, therefore, any new method of construction fails to be approved by a majority, it is abandoned. We will not undertake here to determine whether the suppression of individuality is a gain or a loss. It is quite certain that originality is very expensive when it exercises itself in the construction of locomotives or other railroad machinery, and that the Chinese virtue of uniformity has much merit, and is often profitable when great ingenuity and skill would not be.—*Railroad Gazette*.

Correspondence.

An Electric Toy.

To the Editor of the Scientific American:

I send you herewith a sketch of a scientific toy, which I have recently constructed and placed on a bracket in front of the desk in my engine room. The main belt of the engine is 30 inches in width, and about 120 feet in length, and runs from south to north, at an angle of about 45°, and with a velocity of 2,500 feet per minute; it is highly electrical.



The idea occurred to me that the electricity so developed might be made use of for mechanical or other purposes; and having seen an engraving of what is called an electrical wheel, I constructed one as shown herewith, but without the coils. A is a vial, about 6 inches in length by 1½ inches in diameter, the bottom of which is inserted in a cavity in the bracket, B. In the center of the cork is inserted the eye end of a darning needle, the point projecting upward about 2 inches, on which rests the wheel, C, which consists of two pieces of copper wire, 1-32 inch in diameter and 7 inches in length, placed at right angles to each other; their centers are flattened and soldered together, and half an inch of the end of each arm is bent at a right angle, all in the same direction, and filed to a point. D is a copper wire, one eighth inch in diameter, one end of which rests against the needle, the other running in front of and about 6 inches distance from the belt, and terminating in 5 or 6 points, 2 inches long, projecting toward it.

On connecting the conducting wire with the needle, my wheel immediately started off at a speed of 100 turns in 50 seconds. I soon ascertained that, by placing a good metallic conductor beneath the wheel and making an earth connection, I could add materially to its speed. Accordingly I placed a copper coil, E, 5½ inches in diameter, one inch below the wheel, connecting it with the gas pipe, which accelerated its speed to 143 turns in 50 seconds. Soon my wheel began to gyrate even to an angle of 20°. This annoyed and puzzled me. I eventually found that, by adding another coil, F, one inch above the wheel, and connecting it with the earth, I not only restored its equilibrium, but also increased its velocity to 173 turns in 50 seconds.

When the air is dry and frosty, I have had it running as fast as 280 turns per minute, and the ozone given off by the wheel is apparent to the senses at a distance of several feet. It also acts as a barometer, indicating (by increasing or diminishing its speed) atmospheric changes several hours in advance. It is especially lively on the approach and during the prevalence of a northeast snow storm; but with the wind anywhere from east to south, it will scarcely move at all.

The apparatus can be easily constructed by any person of ordinary intelligence, and it makes a very interesting scientific apparatus. It can as well be located in the counting room or office as in the engine room.

328 Delancy street, New York city.

EDWIN LEACH.

Elasticity and Slipping of Belts.

To the Editor of the Scientific American:

It is pretty generally admitted, though sometimes contested, that any belt running upon two pulleys, one the driver and the other the driven, must slip on both when any appreciable amount of power is being transmitted by it. It seems to be very evident that, if a belt is passing from a state of greater to one of lesser tension, or *vice versa*, in its passage around a pulley: in the former case it must undergo contraction, and in the latter case extension, in direction of its length; and we know that a belt always exists in a different state of tension in the parts entering upon and leaving the given pulley. If, then, in passing around the driving pulley, a belt undergoes contraction, and on the driven pulley, extension, there can be no point of the belt but must have a sliding movement on both pulleys, and thus result in the driven pulley having a lower velocity than would be mathematically due to the diameter of the pulleys. Thus, of two pulleys of exactly equal diameter, one driving and the other driven, the latter must have the lower velocity. In

cases where high speeds are to be obtained by means of belts and the prime belt, that from the first driver, has a low velocity, this may become an important consideration.

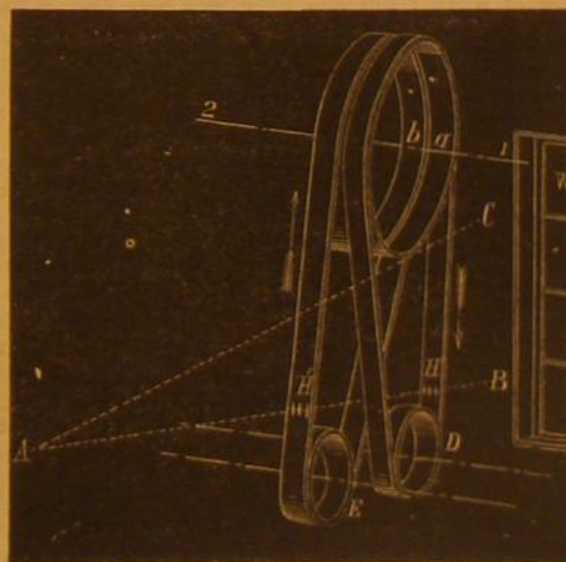
I recently, quite accidentally, observed a peculiarly delicate and interesting illustration of this property of belts, especially illustrative of the invariable slipping upon the driving pulley; and I think it will be of interest to your readers, as it establishes that fact in a very beautiful manner.

I have, in my factory, a number of pairs of spindles running at about 5,000 revolutions per minute. Each of the pairs is driven from one countershaft by two separate driving pulleys, situated nearly close together, as in the illustration, and the spindle pulleys are so situated, one in advance of the other, as to take the belts from them. The countershaft being directly over the median line between the two spindles, the two belts were practically of equal length. The spindles are alike in all material respects, and carried 4 inch pulleys, the drivers on the countershaft being 24 inches in diameter. The work done by the spindles alternated regularly about 60 times per minute, the belt of one spindle having—while the other was at work—nothing more to do than to turn the spindle in its bearings; and while the feed mechanism of the machine containing the spindles was not in operation, neither belt had any more to do than simply turning the spindles, which was practically equal.

In this case: owing to the great disparity in the diameters of the driving and driven pulleys, and consequently in the area of surface wrapped by the belt (the distance from countershaft to spindle being less than four feet), and the fact that the drivers were directly overhead, bringing the weight of belts to their aid: it is certain that, but for the elasticity of and the consequent difference in the tension of the two halves of the length of the belts, whatever slipping occurred from the resistance of the work would take place upon the smaller pulley. But this experiment shows indubitably that these belts always slip on the 24 inch or driving pulleys as well, and, of course, most when the work is greatest.

It so happens that, of one pair of the 24 inch drivers, one is slightly larger in diameter than its companion, but so small an amount that it can only, with great care, be detected with the callipers; and—although not essential to this illustration, as the same effect would be produced by a difference in the length of belt—but for this latter fact the following interesting observation would probably never have taken place.

In the engraving, 1, 2, is the countershaft with its pulleys, *a* and *b*; D and E are the pulleys of the spindles. The observer is situated at A, and at W is a window. The holes in the belts made for the fastenings,—which, from use, had become sufficiently enlarged to permit the passage of the light—when situated as at H H', would allow the passage of a ray of light through the downward side of one belt; and the upward side of the other, as at A B; and as the speeds of the belts were such as to cause these holes to cross the line of vision in periods of time less than the duration of the impression upon the retina, there appeared to be a permanent



opening through them. If the pulleys, *a* and *b*, were exactly of the same diameter, and the feed works of the machine not in operation, the points, H and H', would, after completing a circuit, reappear in the same position; but owing to the slightly larger diameter of the pulley, *b*, the ray of light, when both spindles were idle, had a very regular upward movement until cut off by the pulley, *a*, as shown at C A, and, after a short time had elapsed—a little less than a minute, by repeated timings—would reappear at B A; and as the belts were running at about 5,000 feet per minute, it will readily be seen how small was the difference in the diameters of the pulleys, *a* and *b*. Now, when the spindle, D, was at work, E being idle, the downward motion of the point, H, became at once retarded, and the upward motion of the ray would become suddenly accelerated; but when the spindle, E, was at work, and D idle, the point, H', became in turn retarded, and the ray would either come to a stand still or slightly descend, according as the material being operated upon by the machine offered more or less resistance to the cutting tools. The descent, however, was never so great as the ascent; and whether the ray passed upward regularly, as when the spindles were both idle, or intermittently, as when they alternated in their work, its recurrence at B A always took place in the same period of time. The intermittent motion of the ray of light could only be produced by the slipping of the belts on the upper pulleys, except that a small fraction of it might result from the stretching of the belts between pulleys, that is, between the leaving one pulley and

entering upon the other; but that this must be very small will be evident from the fact that, during one second (the period of one alternation of work from one spindle to the other and return), the belt would make about 21 complete circuits, or pass from pulley to pulley 42 times in that period; therefore the change in tension in the two halves of the belt's length must take place principally upon the surface of the pulleys.

I think this example shows conclusively that, in any belt whatever, the side in contact with a pulley has a greater velocity than the surface of the pulley itself.

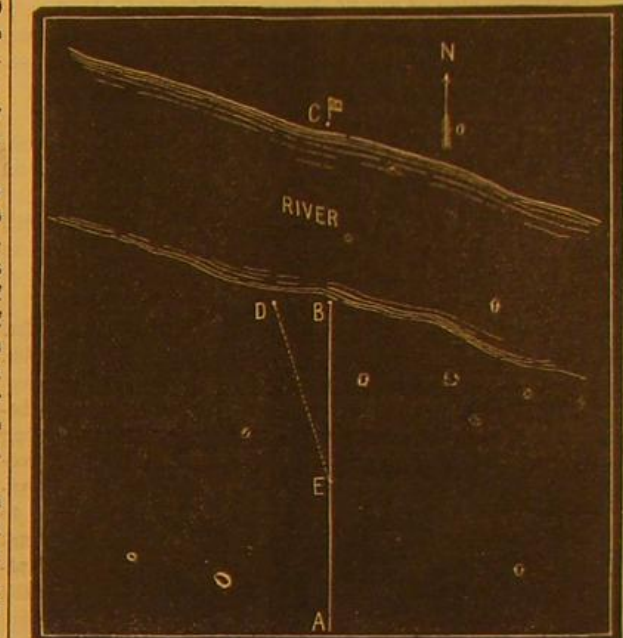
New York city.

JOHN L. HAWKINS.

Measuring the Width of a Stream.

To the Editor of the Scientific American:

In surveying, it is often necessary to ascertain the width of river, pond, or other body of water, with the least possible delay.



Let A B represent the line of survey (the course being due north), striking the river bank at B. Have a flag set on this line at C. Take your station at D, at a right angle with your line, B A, at any convenient distance, with or without measurement. Set your compass at D, and bring it to bear on your flag at C. By observation you find the course N. 13° E. Reverse your compass, taking your course S. 13° E. Send a flagman back on the survey line, keeping in range with B C, until he comes in range of your compass sight at E. Measure from B to E, and you have the distance from B to C.

Farmington, Iowa.

JOHN CROSS.

The Relative Attraction of the Sun and the Earth.

To the Editor of the Scientific American:

Permit me to correct a serious mistake contained in Dr. Vander Weyde's communication, published in your issue of April 18th. Your correspondent incorrectly asserts that I have constructed an apparatus for measuring the changes of terrestrial attraction, consisting of a heavy iron globe floating in mercury; regarding which he remarks "that a floating object is identical with a lever scale, as the liquid balances the floating body, and any change in the gravitation will equally affect both; so that such an apparatus would show no change whatever, even when transported to the moon or to Jupiter." Dr. Vander Weyde appends to his irrelevant remark the following unwarrantable conclusion: "It is, therefore, not in the least surprising that Captain Ericsson, according to his own showing, had no results." The reader will be surprised to learn that my apparatus, the principle of which Dr. Vander Weyde evidently does not understand, has been constructed for the sole purpose of proving practically that, at the rising and setting of the sun, solar attraction exerted on a body resting on the surface of the earth is exactly balanced by the centrifugal force acting in an opposite direction, called forth by the earth's orbital motion round the sun. The reader will find, on referring to my communication inserted in the SCIENTIFIC AMERICAN, March 14, 1874, that the result of the experiment with the floating iron ball was mentioned in my demonstration relating to solar attraction simply for the purpose of convincing Mr. W. B. Slaughter, by actual experimental test, that solar attraction is neutralized by orbital centrifugal force. The reader will also find, by referring to the said demonstration, that, while the sun's attraction on the iron globe exerts a pull of fully 748 grains, and that while a tractive force of a few grains suffices to move it across the vessel of mercury in which it floats, yet the globe remains perfectly stationary on the surface of the liquid metal when subjected to the stated pull of 748 grains exerted by the attraction of the rising sun. Consequently the instituted experiments with my apparatus, which in the opinion of Dr. Vander Weyde have produced "no results," prove incontestably that the centrifugal force, called forth by the orbital motion of the iron globe, exactly balances the attractive energy exerted on its mass by the sun at the moment of rising and setting. I will not detain the reader by commenting on Dr. Vander Weyde's criticism of my solar attraction apparatus, since it is based on the irrelevant fact that "a floating object is identical with a lever scale, as the liquid balances the floating body." Moreover, the reader cannot fail to perceive, without further discussion, that, according to his own showing, Dr. Vander Weyde does not comprehend the principle of the apparatus nor its object.

J. ERICSSON.

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.

Positions of Planets for May, 1874.

Mercury.

Mercury rises on the 1st a little after 4 A. M., and sets a little before 5 P. M. On the 31st, it rises about 5 A. M., and sets near 8 in the evening.

In the first week of May, it should be looked for before sunset, and near the last of May after sunset. It is too near the sun, in apparent position, to be seen between the 15th and 29th.

Venus.

Venus rises on the 1st at 5h. 50m. A. M., and sets at 8h. 20m. P. M. On the 31st, Venus rises at 6h. 7m. A. M., and sets at 9h. 21m. P. M.

On the evening of the 3d, Venus and Mars will have very nearly the same right ascension, and will differ little in declination, Venus being a little further south in declination. Mars passes the meridian one minute later than Venus.

Mars.

On the 1st, Mars rises at 5h. 53m. A. M., and sets at 8h. 27m. P. M. On the 31st, Mars rises at 5h. 8m. A. M., and sets at 8h. 12m. P. M.

Mars is very small at this time, but its ruddy light will enable one to recognize it after sunset, and its nearness to Venus on the 3d will be a very marked phenomenon.

Jupiter.

Jupiter rises on the 1st at 2h. 39m. P. M., and sets at 3h. 11m. the next morning. On the 31st, Jupiter rises at 0h. 41m. P. M., and sets a little after 1 the next morning.

Although we are moving away from Jupiter, and it is becoming smaller, it is still the great beauty of our evening skies, and its satellites, with their varied changes of position, can be seen with an ordinary ship's glass. On the evening of the 10th the second satellite will be invisible to glasses of small power by being between us and the planet until after 8 P. M., and the fourth will become invisible after 9 P. M., by the planet's passing before it, or between the satellite and the earth.

Saturn.

On the 1st, Saturn rises at 1h. 33m. A. M., and sets at 11h. 25m. A. M. On the 31st Saturn rises at 11h. 38m. P. M., and sets the next forenoon at 9h. 25m.

Saturn should be looked for in the morning, as it comes to the meridian at 6h. 25m. on the 1st, and at 4h. 29m. on the 31st. Although it is in southerly declination, and is only 31° above the horizon in this latitude, its ring can be seen with a glass of low power.

Uranus.

On May 1, Uranus rises at 10h. 45m. A. M., and sets at 1h. 10m. the next morning. On the 31st, Uranus rises at 8h. 51m. A. M., and sets at 11h. 15m. P. M.

Neptune.

Neptune rises in the early morning and sets about 6 P. M. on the 1st and 4 P. M. on the 31st. It requires a very good telescope.

Sun Spots.

The record is from March 14 to April 18. Observations have been seriously interrupted by cloudy weather, and high winds have in some cases prevented good definition. Spots have, with one exception, been small, and, like those of last month, have shown sudden and decided changes from day to day. This was noticed particularly on March 27, when there was not a trace of several spots which had been scattered over various parts of the disk on March 25. Again, all those seen on March 27 had disappeared by noon of March 28, and several new ones had broken out. On the other hand, a group which appeared on March 30, just within the eastern limb, remained invariable in its regular passage across the disk as long as the weather permitted it to be seen. This group was quite large, so that it could be seen through smoked glass. Faculae have usually been noticed.

Barometer and Thermometer.

The meteorological journal from March 15 to April 18 gives the highest barometer, April 13, 30.55; the lowest barometer, April 10, 29.56; the highest thermometer, March 18, at 2 P. M., 62°; the lowest thermometer, March 24, at 7 A. M., 11°.

AMOUNT OF RAIN

The rain which fell between the night of March 16 and the evening of March 17 amounted to 0.57 inches.

The rain which fell between the morning of April 7 and the morning of April 9 amounted to 0.82 inches.

American Agricultural Machinery in Germany.

A German correspondent writes in the New York Herald that, until a very recent date, Messrs. Ransome & Sims, with a few other English manufacturers of agricultural machinery, monopolized nearly all the trade of the European continent. Now American makers are running them hard. The imports of agricultural machinery from America into Germany commenced about seven years ago, and the business then has rapidly developed into an important branch of commerce. The chief depots of American agricultural machinery are Bremen, Hamburg, and Stettin. The principal articles sold are mowers and reapers. Lawn mowers are the largest item. Pitchforks come next. A very little has as yet been done in threshing machines.

In 1873 about 8,000 American mowers and reapers were sold on the European continent. During the present year, it is estimated that there will be orders for at least 12,000 mowers

and reapers, which will represent a sum of \$1,000,000, or thereabouts, payable to the United States as a net result of the transaction.

The firms at present doing the largest business are: Messrs. Adriaance, Platt & Co., of New York; D. M. Osborne & Co., New York; W. A. Wood & Co., Hoosick Falls, New York.

The German manufacturers cannot turn out good agricultural machinery. Many attempts have been made by them to copy American workmanship, but none have been satisfactory. Buyers on the European continent, though hard to convince, are now agreed that American cast iron is the strongest in the world. It has an advantage of twenty-five per cent over German cast iron in strength, and is nearly 16 per cent stronger than English cast iron. So the export of agricultural machinery to the European continent has become a prominent feature of American trade, and is susceptible of a still further development.

Wherever the emigration movement is active, a large number of agricultural machines are always salable. In the city of Breslau especially, where estates are large and farm laborers constantly becoming fewer, there is a promising market, which has already yielded good returns, and is likely to do so for a long time to come. The loss of hands in Germany during the French war, and the fact that the landlords have much money and few workmen, should induce American manufacturers of agricultural machinery to direct their attention to Germany with a careful and attentive eye. The profits of the business are satisfactory, and payment generally prompt or easily enforced, so that there is the smallest possible risk of bad debts.

Curious Origin of Fires.

Alfred Tozer, of the Chief Fire Station, Manchester, England, communicates the following paper, on the origin of great fires from a natural history point, to Hardwicke's *Science Gossip*.

At a recent meeting of the Lower Mosley Street Natural History Society, I submitted a piece of leaden water pipe, sent to me by Captain Drew, who received it from Mrs. Bakewell, St. Mary's Gate, in January last. It appears that Mrs. Bakewell's kitchen in St. Mary's Gate is infested with rats: they have, on several occasions, bitten through the water pipe and flooded the place. The pipe has been twice bitten through, and the hole soldered up. The rats, no doubt, being thirsty, bit through the pipe to allay it. Two instances have occurred at Phillips' warehouse, Church street, one in 1851, the other in 1856: in both cases the rat gnawed through a leaden gas main pipe a few inches above the floor. Other similar instances have occurred of rats gnawing a gas in mistake for a water pipe: it has been thought they heard the water bubbling in the gas pipe, and have not found their mistake until they have penetrated the pipe. Phillips' warehouse was on both occasions damaged by fire through some of the employees seeking for the escaping gas with a light.

A fireman, in the performance of his duty, often meets with many curious and interesting instances of causes of fires, a few of which I will give, which you may, perhaps, think worth while to find a corner for in your interesting *Gossip* on natural history, etc.

I have attended and traced several instances of fires occurring through rats and mice gnawing lucifer matches. Matches are now dipped in paraffin wax instead of sulphur, as before; the rats or mice have carried them under the floor for the purpose of gnawing off the wax; in doing so, their teeth have come in contact with the phosphorus at the ends, and so fired them. In 1856 I attended a fire at the Sultan's Palace at Scutari, Asia Minor. After the fire, I gathered under the flooring a quantity they had been gnawing. Some years ago a fire occurred in London, caused through a jackdaw getting at a box of lucifers, and pecking them until it set them on fire.

Fires have occurred through rats and mice conveying, under the flooring boards, oily and fatty rags, which have afterwards spontaneously ignited. This is rather a common cause of fires in cotton mills.

The following is an extract from the *Journal* of the United Service Institution, Whitehall yard, London, No. 52, for 1868: "One of the presents sent to the Museum of this Institution is a rat's nest and young. The nest was set on fire by a lucifer match, ignited by the old rat as she worked it into her nest. Lieutenant A. H. Gilmore, R. N., states that a fire occurred on board Her Majesty's ship *Revenge* from a similar cause."

Cats and dogs have caused fires in various ways; such as upsetting explosive and inflammable things into fires and lights, also through lying inside fenders and under fire places. Hot coals have fallen and adhered to their backs, which caused them to beat a hasty retreat, no doubt being anxious to get rid of the annoyance as soon as possible. They have sometimes succeeded by rolling or rubbing on carpets, curtains, beds, straw, shavings, and other inflammable things. The last instance I recollect occurred at a baker's shop in Albion street, Gaythorn. A dog was lying under an oven fire, a piece of chip fell from the fire on to his back; he immediately ran to some shavings, rolled upon them, at the same time setting them on fire before the eyes of his master. In 1863, three distinct fires were caused in one room of a gentleman's house in Canonbury, Islington, through a cat lying inside the fender, when some hot ashes fell out of the fire on to its back, which caused it to rush about the room, when the cinders were deposited in different places, which set fire to the carpet.

That mischievous animal the monkey has lent its aid to the devouring element. Fires have occurred through its agency, in a similar manner to cats and dogs, also through its playing with fire in various ways. In one instance a monkey upset a charcoal brazier, and set a room on fire. Many—yes, very

many—fires have occurred through our domestics hunting bugs and other small fry by the light of a candle or lamp. In their anxiety, especially, to hunt fleas, they forget they may produce an enemy much more to be dreaded. Many fires also occur through persons fumigating apartments to get rid of bugs and various kinds of vermin.

A few instances have occurred through the concentration of the sun's rays upon glass globes. On the 16th October, 1845, at two P. M., Mr. Phillbrook's residence, Mill street Worcester, was set on fire through the concentration of the sun's rays upon a water crock standing upon a table. Colored bottles in chemists' shops, cracks, and bull's eyes in glass have been known to focus sufficient heat from the sun to set buildings on fire.

Fires have occurred through the spontaneous ignition of pigeons' dung under the slates and tiles of houses. Professor Buckland traced two fires to this cause. See *Builder*, 28th September, 1844.

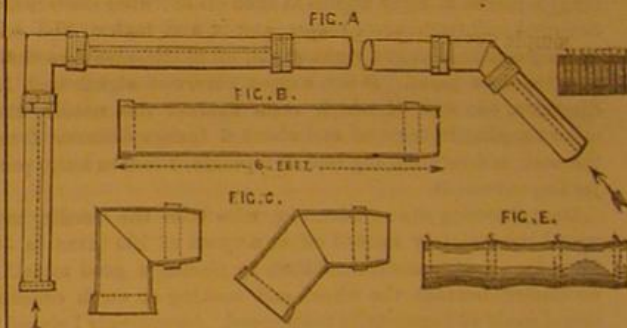
Birds' nests under the eaves and wooden crevices of houses have been frequently set on fire through sparks from a neighboring chimney, and have contained sufficient inflammable matter to set fire to the buildings.

Although I have given the dogs the credit of producing work for the firemen, still it would not be fair if I were to omit to mention that they have frequently discovered and given timely notice of fires; and many an anecdote can be told of the very great interest dogs take in and at fires.

Flexible and Wrought Iron Air Tubing for Mining Purposes.

A correspondent of the *London Mining Journal* states that air drifts have lately been driven by the aid of sheet iron tubes fitted into each other, spigot and faucet fashion. A great saving has thus been caused by doing away with the necessity of driving, in many cases, an expensive temporary drift as a return for the main drift, to be abandoned when the desired point is reached and the ventilation established.

The great difference in cost between driving an expensive air way and using the tubing will be appreciated by mining engineers; and in the case of the drift, it may not be required after the holing, while the tubes may be used over and over again. Good mining has often been done with a brattice wall, but the drift or heading has, in nearly all cases, to be made larger than eventually required, making the cost of the wall much more than the tubes, besides being a much slower and more tedious operation. In many cases these tubes are invaluable, such as opening places much broken and fallen, in which it is impossible to erect any of the ordinary modes of brattice. Being made of stout sheet iron (Figs. A, B, C, showing the lengths of pipe, angles, and



manner of joining), riveted and with well fitted joints, and having bends of all angles, we have an air way vastly improved over the old forms of brattice, either of timber or cloth, which cannot be made thoroughly airtight, being therefore, for long distances, quite useless, especially where strong currents of air are requisite to enable blasting powder to be used. The writer saw, in Belgium, a long single drift being driven to some workings on the opposite side of a synclinal, or basin, in the coal measures. Iron tubes were led in of about 15 inches diameter, and air was propelled through them by a small engine driving a fan. The drift was driven by means of the Villepique perforator, which was worked by compressed air, advantage being taken of this power to work the small engine. Large quantities of gunpowder were daily consumed, and the immense amount of smoke generated thereby was efficiently cleared away by these means.

A very handy tubing (Fig. E) made of brattice cloth, kept in a circular form by means of hoop iron rings, was also used; to each ring is fastened a hook, so that the tubing is easily and rapidly hung up to the roof. Their portability is a great recommendation to miners, as they pack up like a concertina, as shown in the engraving, hundreds of yards thus occupying a very small space.

Both of these air tubes are destined to be largely used in collieries; and for mines where the wooden box has so long been used, they will certainly be a great boon.

Perils of Ballooning.

A party of seven persons, two females and five men, under charge of the aeronaut Barbier, essayed an aerial excursion recently at San Francisco, in a balloon carrying 60,000 cubic feet of gas. A strong wind blew at the time. The ascension was a success, an altitude of 7,000 feet was attained. The descent was disastrous. The anchor rope caught on a building and the rope broke. Up darted the balloon 400 feet, when a crack was heard; the balloon burst open and down it came, thumping the passengers upon the ground with great violence, capsizing the car, entangling the passengers in the rigging and dragging them along the ground for a third of a mile. Finally they were rescued, bruised sadly, but no limbs broken.

THE MEETING OF THE NATIONAL ACADEMY OF SCIENCE.

The National Academy of Science, which held a meeting last October in this city, is again in session at the Smithsonian Institution in Washington. This body, as we before have had occasion to explain, is the highest scientific association in the country, and includes among its members all or nearly all eminent American scientists. The papers read are therefore of considerable importance, and in the abstract which we present below will be found a careful *resumé* of their contents.

Professor Joseph Henry presided over the deliberations, and recently rendered a graceful compliment to the President of the American Association for the Advancement of Science, Professor La Conte, in calling upon him to open the proceedings with the reading of his paper on the classification of the *rhizophorus coleoptera*. The American Association, by the way, is a body which is perhaps more popularly known than the National Academy; but we can hardly agree with a contemporary which alludes to it as a rival organization. The cause of Science is one that calls for cooperation and not competition; and while societies may have distinctive names, they all strive for the same object in unison.

Professor Le Conte makes a division of the insects above named into three series: (1) Haplogastra, having abdomen alike in both sexes; ventral segments not prolonged upward into a sharp edge. (2) Allogastra, abdomen dissimilar in the two sexes; ventral segments prolonged upward, forming a sharp edge. (3) Heterogastra, abdomen alike in both sexes; ventral segments prolonged upward to fit into the elytral groove. Many other distinctive characteristics were given, with a detailed description of the very numerous genera belonging to each of the series.

Professor Fairman Rogers followed with a paper on apparently an odd subject for scientific discussion, namely,

AN AUTOMATON TO PLAY TIT-TAT-TOO.

Babbage, he said, in speaking of his analytical engine, has suggested that a machine might be made which would play a game of combination, such as drafts, provided the maker of the machine himself would work out perfectly the sequences of the game. Professor Rogers finds that the sequences of tit-tat-too are easily tabulated, and hence an automaton may be made which will play the game as follows: The opponent to the automaton makes the first move in the game, and in so doing causes a certain cylinder or equivalent device to change its position. This, from the construction of the apparatus, causes the automaton to make that play which the proper sequence of the game requires, and at the same time moves the corresponding cylinder into position. The next play of the opponent moves the third cylinder, and the combination of the three cylinders determines the action of the automaton for the fourth; and so on throughout the sequence. If the player plays perfectly, the game will be drawn, as the automaton's play will be mathematically correct. If the opponent makes a mistake, the automaton, by a simple device, takes advantage of it, and makes such a play as to win the game. The object of the speaker was to show that such mechanism, applied to apparatus for registering physical phenomena or for performing geometrical or mathematical operations, may enable such mechanical devices to have a use much more extended than heretofore.

THE FUNCTIONS AND MECHANISM OF AUDITION

was the subject of a paper by Professor A. M. Mayer, in which he shows that the significance of the anatomical relations of the parts of the ear is to bring the sound vibrations to act with the greatest advantage on the co-vibrating parts of the ear, and to cause these parts to make one half as many vibrations in a given time as the tympanic or basilar membranes. This is demonstrated by an extended review of the functions and possibilities of different portions of the auditory apparatus. In the course of this train of argument, Professor Mayer advances the view that what are known as the hair cell cords, having swellings in the middle of their length which cause them to act like loaded strings, are probably so constituted that each hair cell cord is adapted to co-vibrate with only one special sound, and that a cord in the ductus of the ear will vibrate only half as often in a second as the basilar membrane to which it is fastened. In a second paper on

THE DURATION OF THE SENSATION OF SOUND,

Professor Mayer said that experiment proved that the residual sensation only occupied one five-hundredth of a second in the case of 40,000 vibrations per second; but in the case of 40 vibrations to a second, the residual vibration was one eleventh of a second. He concludes that the whole ear vibrates as one mass, and the durations of these oscillations of the whole ear are far too short to remain one thirtieth of a second. He thinks that this explains our inability to distinguish the actual pitch of sound when that pitch exceeds certain well known limits.

THE REFLECTION OF SOUND FROM FLAMES AND HEATED GLASSES

was the subject of another paper by the same author. Two similar resonators are placed with the planes of their mouths at right angles to each. Then in this angle Professor Mayer firmly fixes the tuning fork corresponding to the resonators, so that the broad face of one of its prongs faces the mouth of one resonator, while the space between the prongs faces the mouth of the other. Complete interference of the sounds issuing from their mouths is obtained, and the only sound that reaches the ear is the faint sound given by the fork's action on the air outside the angle included by the mouths of the resonators. If in these circumstances we close the mouth of either one of the resonators with a piece of

cardboard, the open resonator will strongly re-enforce the sound of the forks. If we now cover the mouth of this resonator with cardboard, we shall again have silence.

Now substitute for cardboard, when both resonators are open, the flame of a bat's wing gas burner, with one resonator, and use something more permeable to sound than the cardboard with the other. By trying a series of more and more permeable diaphragms, it was found that tracing paper just equaled the effect of the gas flame in guarding the mouth of the resonator from the entrance of sound. A sheet of heated air above the gas burner was found to be exactly equivalent to the gas flame. The passage of a sheet of cold coal gas over the mouth of the resonator produced a similar effect; and so also did carbonic acid gas, though in less degree; but cold, dry hydrogen closed the mouth of the resonator more effectively than either of the above gases, though not equal in this respect to the heated air above the bat's wing flame. Among other curious results, Professor Mayer has ascertained that there is an absorption of sound in the bat's wing flame; that the flame is heated by the sonorous vibrations which enter it as such, and issue as heat vibrations. He has endeavored to obtain a quantitative mathematical analysis of this absorption and hopes for exact results.

Professor Norton, of Yale College, referring to

TESTS OF THE STRENGTH OF PINE,

said that after repeated strains a molecular change took place in the wood, and the effect of strain, after an interval of rest, to a great extent not only passed away but even left the stick with less set than it had a short time before. As one of the results obtained, it appears that a load equal to one fourth of the breaking weight produces a permanent set, and that repeated applications of this load from day to day are attended with a continually increasing set. It results that such wood should never be subjected in any structure to one fourth of its breaking strain.

THE FUNCTIONS OF THE BRAIN AND NERVES

was the title of a very interesting discourse by Dr. Brown-Séquard. The theory ordinarily assumed is that sensation is conveyed through the body by the nerves, as the bells rung in any part of a hotel have the sound conveyed along wires to a central office where the fact is recognized from where the call may come. This assumption is as false as it is simple. There is no necessity for more than a very few fibers to establish communication between the brain and the spinal cord. It is more like a telegraphic communication than a movement along a wire, by which sensation is conveyed from the periphery to the brain, or the brain transmits its orders to the periphery. If, said the speaker, a piece of ice is laid upon my foot, I have at once the sensation of a contact, sensation of a temperature, the sensation of the extent of the surface of the ice that touches me, the sensation of the weight of the ice, and, if it is left upon my foot, the sensation of pain, and the sensation of the skin to which the ice is applied. All those forms of knowledge are communicated at once. I believe that all these impressions are communicated to the spinal cord, which as a single wire transmits it to the brain.

Now as to the two sides of the brain: The old view was that the left side of the brain governs the movements of the right side of the body, and the right side governs the movements of the left side of the body; and that there is a similar view respecting perception and sensation. Facts oppose this view. One third of one half the brain may be utterly destroyed without any symptom of the injury; then one third of the other half, and still no symptom. Still another third of either half may be destroyed without any indication of ill health. There are hundreds of the first named cases. With reference to the location of intelligence in the brain, the lecturer said that most physiologists are agreed that it exists in the gray matter of the upper parts of the organ. There is no case on record where the gray matter on both sides of the brain has been destroyed without the loss of intelligence, and we must regard that gray matter as the seat of the intelligence. But vast portions may be removed before the loss of intelligence becomes apparent. This the speaker had tested and proved by vivisection of the lower animals.

By the application of galvanism to certain parts of the brain, Dr. Ferrier has produced certain movements. This would seem to prove that there are in the brain certain centers of movement governing certain parts. But this is only a semblance. It is perfectly well known that the cutting away of a large portion of the brain does not produce the least alteration of voluntary movement anywhere. We now know that only a few fibers are necessary to make the connection between the spinal column and the brain. The brain, like the rest of the body, receives nerve fibers coming from other nervous centers, some along the blood vessels, for there are a great number of fibers starting along the blood vessels and going into the cellular tissue of the brain; some fibers coming from the sympathetic nerve; others coming from various sources. We find, for instance, that the prick of an exceedingly fine needle at the *crux cerebelli* will produce rotary movements, the animal whirling around with a rapidity impossible in a normal condition. The activity of the heart may be stopped by the prick of a needle point; convulsions may be similarly stopped by the action of carbonic acid on the mucous membrane of the throat. With these facts under consideration, we may see the vast field of research that yet lies before us, the mere questions arising from the activity of nerve cells affording an almost boundless subject for inquiry. But it is evident that we cannot locate the centers of either sensation or motion in specific parts of the nervous system.

Professor Simon Newcomb gave a description of the proceedings to be taken by the United States in observing

THE TRANSIT OF VENUS

next December. After referring to the various methods of observation and the difficulties pertaining to them, he said that, about two years ago, circulars were sent to American consuls in almost every part of the world where the transit is visible, to ascertain the condition of the weather at those points in November and December, and every other source of similar information was utilized.

The only satisfactory station in the southern hemisphere, in respect to weather, was found to be Hobart Town, in Tasmania. But from all the other proposed southern stations the accounts were very bad, notably at the proposed station at Hurd's Islands; the chances of observation there did not exceed two tenths. The most favorable station left at the south was Kerguelen Island, and that was selected. A party will also be landed, if practicable, at Croisette. Instead of sending four parties to each hemisphere, we shall send three to the north and five to the south, to equalize the chances as to weather. It is hoped to get complete results from two parties in each hemisphere.

To each party there are detailed two officers from the Observatory, two from the Coast Survey, one from the navy, and two civilians. Professors Hall and Harkness go to Hobart Town. Among them are the celebrated astronomers Professors Watson of Ann Arbor, Mich., and Peters of Clinton, N. Y. The constitution of each party is such that in case of disability on the part of its chief, the second officer can take his place. Each party will have three photographers—a chief photographer, who must have been of long experience in the business, an assistant who has had practice, and a second assistant trained only for the occasion. Nearly all the second assistants' positions have been filled by students or graduates of various schools and technological colleges throughout the country. The parties for the southern station will sail, we expect, about June 1. These are all ready; the photographers are to be in full practice here next week. The northern parties will go later and not all together. The Navy Department has furnished a ship, the *Swatara*, to go to the southern stations. The longitudes of the stations will be determined by occultations wherever telegraph communication is impracticable; but already there is such communication between Vladivostok and Hobart Town. Arrangements are made with the governments for exchanging longitude signals, and the prospect of the extension of cables to New Zealand and other points gives fair hope that there will be only a few points where occultations will be the sole resort.

Major J. W. Powell read a paper on the

COLORADO CAÑONS,

giving an account of the progress made in the survey of the Colorado river and its tributaries, under direction of the Smithsonian Institution. Among other wonderful natural phenomena is the Grand Cañon, the most profound chasm known on the globe. Were a hundred mountains, each as large as Mount Washington, plucked up by the roots to the level of the sea and tumbled into the gorge, they would not fill it.

Perhaps the most wonderful of the topographic features of this country are the lines of cliffs, escarpments of rock separating upper from lower regions by bold, often vertical and impassable barriers, hundreds or thousands of feet high and scores or hundreds of miles in length.

FLOATS FOR SHIPS' BOATS.

The marine department of the London Board of Trade have been making experiments with the boats of coasters, and find that any old boat can be converted into an efficient lifeboat by using air casings outside. The marine department have for this purpose used air cylinders, which they have specially designed, fastened outside the boat by a netting; so that the boat can be used for an ordinary boat as long as wanted, and converted into a lifeboat when occasion requires it. The material used for these cylinders, and approved by the marine department, is a combination known as "Clarkson's." It consists of a layer of cork about a quarter of an inch thick between two layers of strong canvas. One cubic foot of air space in these cylinders will support about 60 lbs. The cylinders of this material are the cheapest, most efficient, and most durable means yet invented for converting an old boat into a lifeboat. Mr. Clarkson has made the experimental cylinders on models furnished to him by the marine department, and is, we believe, prepared to supply any number demanded. Air cases to place inside lifeboats, also made of this material, have been supplied to some of the mail steamers, and are much preferred by the marine department to cases of copper, iron, zinc, or wood, as they are practically indestructible, are not affected by heat, and are very light.—*Nautical Magazine*.

LEMONS WHOLESOME.

When people feel the need of an acid, if they would let vinegar alone, and use lemons or apples, they would feel as well satisfied, and receive no injury. A suggestion may not come amiss as to a good plan, when lemons are cheap in the market, to make good lemon sirup. Press your hand on the lemon, and roll it back and forth briskly on the table to make it squeeze more easily; then press the juice into a bowl or tumbler—never into a tin; strain out all the seeds, as they give a bad taste. Remove all the pulp from the peels, and boil in water—a pint for a dozen pulps—to extract the acid. A few minutes boiling is enough; then strain the water with the juice of the lemons; put a pound of white sugar to a pint of the juice; boil ten minutes, bottle it, and your lemonade is ready. Put a tablespoonful or two of this lemon sirup in a glass of water, and have a cooling, healthful drink.

THE WHITMORE TURBINE WHEEL.

The essential feature of the invention represented in the annexed engravings consists in the arrangement of the gates, which are placed in pairs on opposite sides of the wheel, and so controlled that the pairs open successively. This construction is claimed to be much more advantageous than that in which all the gates are worked simultaneously to present larger or smaller apertures, because an equal force is at once applied to both sides of the wheel at the same angle, derived from the power of a solid body of water of the full dimension of the gate opened.

The guides are secured in the usual manner between the plates. The pivot bolts of the gates, A, Fig. 1, pass up through the upper plate and have attached to them adjustable levers, B, Fig. 3, by means of set screws, as shown. The ends of the levers, B, are provided with friction rollers which enter slots or cam grooves, C, in the under side of the cam wheel, D. The arrangement of these cam slots is such that, by turning the wheel, D, by means of the rack and pinion represented, the gates numbered 1 (Fig. 3), on the opposite sides of the wheel, will be first opened, and pairs 2, 3, and 4 will follow successively.

In Fig. 2, the wheel is represented without the casing, and, as will be seen, is made in the form of a cone. This shape, it is claimed, adds to the strength and secures the best possible natural discharge, as it obviates downward pressure.

The manufacturers inform us that the apparatus is in successful operation in many localities. They state that they find that a 30 inch wheel, under a 14 foot head, uses, with all gates open, about 100 inches of water, but that with the gates half closed, requiring but 50 inches of water, the same speed is obtained, sufficient to operate a run of burrs and the machinery of a grist mill. The object of the large wheel is to use the water down to a head of 7 or 8 feet in case of drouth; and in the instance where it has been applied, it is stated that three bushels more of grain, per hour, are ground than was formerly done with the overshot wheel, for which the Whitmore turbine was substituted.

The gates may be readily adjusted in case of leakage; and in event of one becoming obstructed, the rest may be closed until the difficulty can be removed. The wheel is built as represented in our engraving in sizes under 10 inches; above this, the difference lies in the position of the set screw, which is arranged in the gate instead of in the levers, B. Each turbine, we are informed, is carefully constructed of the best materials, under the immediate supervision of the inventor, Mr. Titus Whitmore. For further particulars

wire is drawn, is composed of one quart of raw linseed oil to two gallons of Stockholm tar, and is applied warm.

The wires, when thus prepared, are cut into lengths of four hundred yards, and as many as are required to be laid in one tube are made into a loose cable, and tied together with tape at distances of six feet apart. When the wires are drawn into the tubes the tapes are removed and the wires permitted to lay loosely in the pipes.

The tubes into which the wires are drawn are cast iron socket pipes of two, three, and four inches diameter—the size employed depending upon the number of wires to be laid

when dry, 4.20 per cent potential ammonia. They are best added to compost heaps. The deposits from fermenting liquors are always highly nitrogenous. Sugar boilers' scum contains both nitrogen and phosphates; the scum from beet root sirups appears the most nitrogenous, containing when dry 4.6 per cent potential ammonia. The liquors obtained by "retting" flax and hemp are nitrogenous, the solid contents yielding 2.7 to 4.0 per cent potential ammonia.

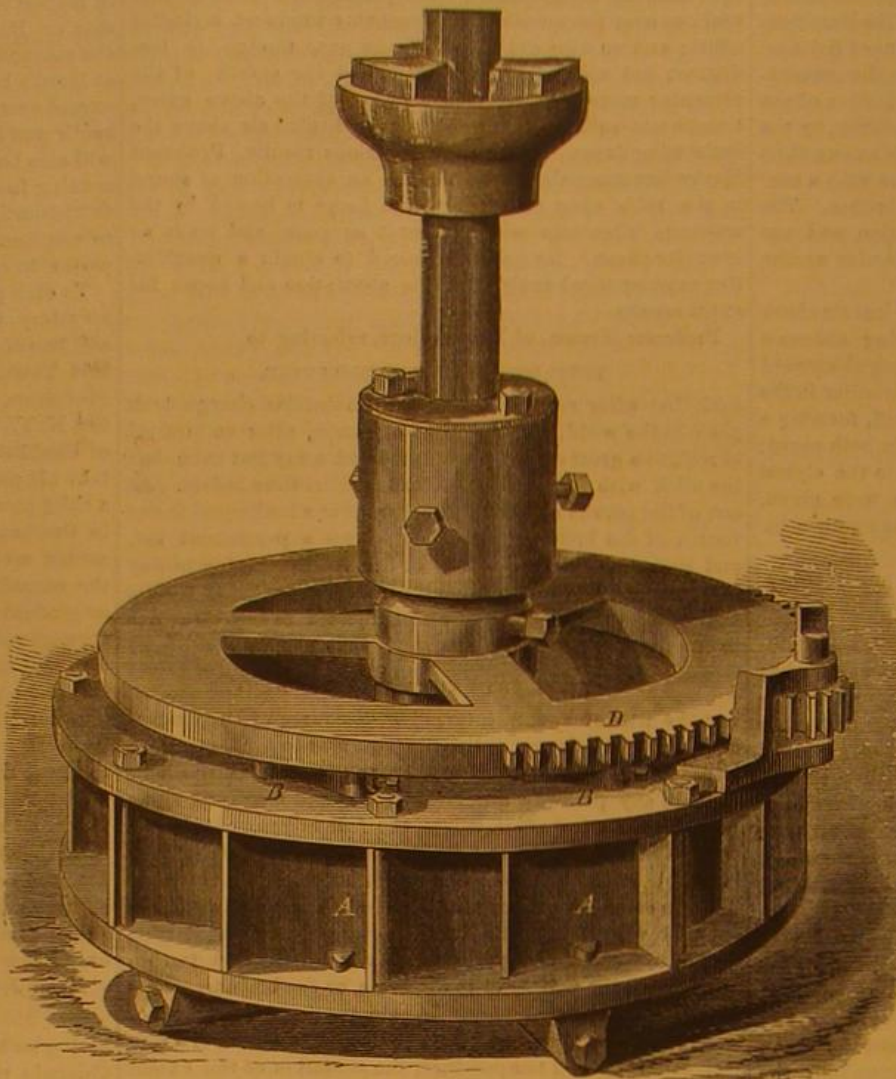
GARDNER'S IMPROVED WHEEL.

The novel form of vehicle wheel represented in our engravings is so constructed that, when broken or injured, any part may be easily removed and replaced, or the entire device may be taken apart and packed for shipping or other purposes. By suitable means below described, shocks and jars are, it is claimed, prevented from coming upon the spokes; and in fine, while a lighter and more graceful appearance is given to the wheel, its durability is considerably increased.

Fig. 1 is a perspective view of the device. Between the outer tyre and the inner and stronger tyre of iron, is placed a felly, A, of wood, india rubber, or similar elastic material, in order to form a cushion between the rims, and thus to relieve the spokes from shock. The latter are fastened by their outer screw ends into the inner rim, or may be driven into sockets on the same. Their inner ends are socketed in the hub, which is constructed of three sections (Fig. 2) or rings, one central, B, and two outer ones, C. The central ring, Fig. 3, is provided at both sides with semicircular grooves, of which those on one side are placed intermediately between those of the other side, so that one half the spokes may be socketed on either face. The outer rings, C, are provided with semicircular grooves corresponding exactly to those of the central ring, embracing thereby the spokes, and giving to them a firm support. All the rings are placed upon a box, D, and are firmly bound together by the screw nuts, E.

The hub is placed over the axle and protected against the entering of dust by suitable clasps or covering. Any injured portion of the wheel may be taken out and a new piece replaced by detaching the screw nut, E, the balance of the wheel remaining unharmed, being thus rendered still useful.

For military purposes, for mounting artillery, it would seem that this wheel is especially suitable. There is no shrinking or swelling, we are informed, and the heaviness and strength may be increased



THE WHITMORE TURBINE WHEEL.

down, the two inch pipe holding 25 wires; the three inch, 70 wires; and the four inch, 120 wires. The pipes are laid down under the flagstones at an average depth of twenty inches, and the joints are filled with lead.

The cost of laying down three inch cast iron socket pipe for underground wires is 90 cents per yard, or \$1,650 per mile. This includes the cost of the pipe and jointing with lead, the taking up of the pavement, putting the pipe in place and re-paving.

The cost per wire for drawing in the pipes depends somewhat upon the number of wires. The average cost of putting 60 wires in a pipe, including jointing and all other incidental work, is \$280 per mile.

The cost of conducting wire for underground lines, consisting of copper wire of No. 18 gage, covered with gutta percha to No. 7 gage, taped and tarred, is \$85 per mile.

The total cost per mile for sixty underground wires is \$7,030, or \$117.06 per mile of wire.

The underground system in England gives comparatively little trouble, and is more favorably regarded than the overhouse plan, the great defect in which is imperfect insulation.

For tunnels, copper wires, insulated with gutta percha, and then tarred, taped, and again tarred, are laid in a wooden trough and attached to the wall. The trough has a cover, coated with zinc, and fastened with tie wire, instead of nails, to prevent injury to the wires.

In addition to the underground lines in the large towns, several others have been laid down between London and the chief commercial and manufacturing towns in England.

Utilization of Certain Offal.

Professor A. H. Church, in a paper published in the transactions of one of our agricultural societies, refers to certain waste refuse matters, for the purpose of showing the economical products that may be obtained from them. According to this, fresh blood contains 3 per cent potential ammonia, 5 per cent potash, and 1 per cent phosphoric acid. Dry blood is five times as rich. Blood may be utilized as a manure by mixing with dry peat, or by coagulation with 3 per cent of quicklime, and then drying. Flesh, fish, hair, and wool are best prepared for manure by heating with steam under pressure. Horn, when gently roasted, may be powdered. Glue refuse is a slimy matter, containing in the fresh state 1.75 per cent nitrogen, and when dry 3.8 per cent. "Trotter scutch," a refuse of skin and hair from tanneries, is a cheap manure, containing in the fresh state 3.58 to 7.60 per cent of potential ammonia.

Refuse hops from breweries contain when fresh 1.91, and

Fig.2

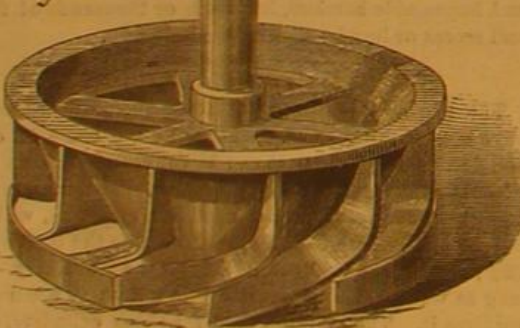
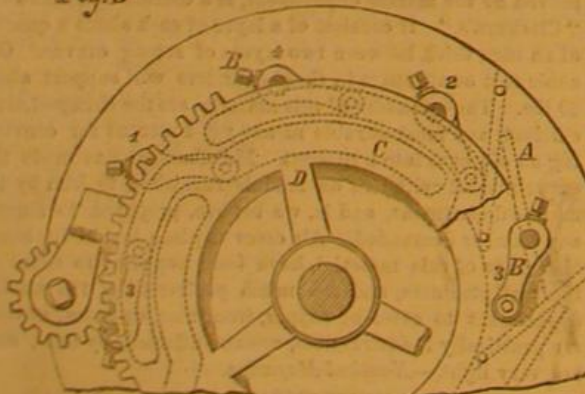


Fig.3



address the manufacturers, Messrs. N. A. Beebe & Co., Waterloo, Iowa.

Underground Telegraph Lines.

Mr. George B. Prescott states that the system of underground lines in England is both extensive and well constructed, embracing 3,000 miles of wire and nearly 100 miles of iron piping.

The conductors usually employed for underground lines consist of No. 18 copper wire, covered with gutta percha to the gage of No. 7. In order to keep the gutta percha from the atmosphere, the exposure to which would cause it to crack and decay, and thus destroy the insulation, it is tarred and then covered with linen tape and tarred again. The preparation of tar through which the gutta percha and taped

Fig.1

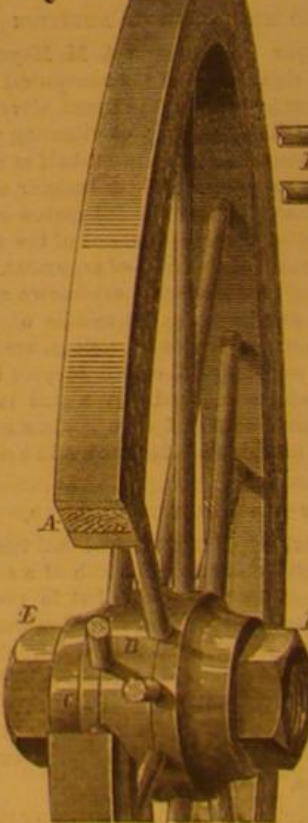


Fig.2

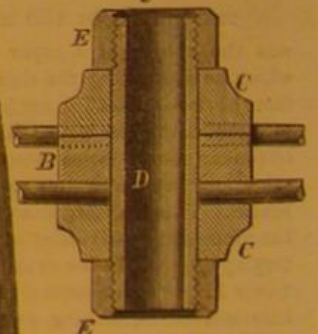
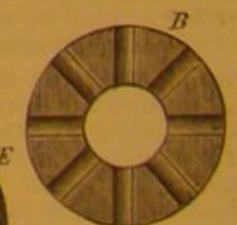


Fig.3



or diminished by suitable construction, as circumstances may demand.

Patented through the Scientific American Patent Agency, March 24, 1874. For further particulars address the inventor, Mr. Stephen C. Gardner, Eagleville, Tolland county, Conn.

PRIZE FOR AN ESSAY ON STEEL.—The Academy of Sciences of Berlin offers a prize of \$200, payable in July, 1876, for the best essay recording experiments as to whether changes in the hardness and friability of steel are due to chemical or physical causes, or to both. Papers, in German, Latin, English or French, are to be sent in before March, 1876.

CREMATION FURNACE.

We alluded last week to the subject of cremation, and in the course of our article briefly referred to Professor Brunetti's process for reducing the body to ashes. The large engraving, which we present herewith, represents the plan devised by Sir Henry Thompson, of London, which has been practically tested under the personal superintendence of that eminent gentleman. A cylindrical vessel, some seven feet long by five feet in width, is arranged in connection with a furnace, so as to be heated to about 2,000° Fah. The inner surface of the cylinder is smooth, almost polished, and nothing is visible in the receptacle but a pure almost white interior, the lining being raised to a white heat. The body, in a metal coffin, is laid upon a lattice work of fire brick, and the doors being closed, the process continues for about fifty-five minutes, reducing the body to a mass of white ashes some five pounds in weight. It is proposed to construct a cremation house, large enough to contain two or three halls and, separated from them, several powerful furnaces of the above mentioned description. The mourners are intended to assemble in an adjacent hall, where the usual funeral ceremonies could be conducted during the incineration, after which the ashes, inclosed in a suitable urn, would be taken away by the relatives of the deceased.

There is one drawback to cremation which the opponents of the process will not hesitate to bring forward in the strongest terms. We allude to the impossibility of detecting evidences of poisoning, now found by post mortem examination, in case such investigation be deferred until after burning. As a necessary result, the opening of every body and examination of the vital portions would probably follow; but this would involve considerable expense, beside arousing the powerful opposition of the relatives of the deceased. It is very questionable whether the majority of mankind would be induced to consent first to the mutilation of the remains of those nearest to them, and then to their subsequent destruction by fire. The impossibility of otherwise proving the existence of foul play would be apt to lead to crime.

The Cremation Society, which has recently been incorporated in this State, has held a meeting and adopted a basis of organization. It binds itself to perform the act of cremation on the remains of any shareholder, provided he or she shall express such a desire before death, and in case of no opposition from immediate relatives. The strictest measures will be taken to prevent the cremation of any person who has come to his death by any other than natural causes, and the process will be furnished at as near cost as possible. It is believed that the expense will be about from \$5 to \$8 for each body, and the company propose to erect buildings and furnaces, at a cost of \$10,000, in the suburbs of the city. The ashes will be at the disposal of friends or re-

latives, who may choose to bury or inurn them. At the recent meeting, Professor Barnard, Professor Seely, and other eminent gentlemen delivered addresses in favor of the system.

There is little doubt but that this movement is exciting an increasing degree of popular attention. There is a sort of morbid fascination about it akin to that which causes a person to read and calmly discuss the horrors of the dissecting room, from which, were they palpably presented to him, he would recoil in disgust and dismay. Cremation will doubtless bring forth a multitude of inventions, in the way of furnaces, urns, and similar paraphernalia, and perhaps corpse cremation companies will, in time, appear with patented processes for incinerating us in the quickest and cheapest manner. At present, however, the movement looks very like a grand sensation—to be talked about and argued—but to be scouted, we fear, when its actual practice is brought home to the masses.

The Hardness of Minerals and Metals.

In physics, one body is said to be harder than another when it is capable of scratching the specimen with which it is compared. In mineralogy, in which science the hardness is an important characteristic, ten bodies are usually taken as points of comparison—the softest being termed 1 and the hardest 10. These are: 1, talc; 2, gypsum; 3, carbonate of lime; 4, fluor spar; 5, phosphate of lime; 6, felspar; 7, quartz; 8, topaz; 9, corundum; 10, diamond. Hence, when scientific works speak of the hardness of a body being 6, 8, 4, etc., reference is made to the relative hardness expressed by the list above given.

The tenacity of metals is estimated by the resistance which wires of the same diameter experience when passed at equal temperature through the same hole of a draw bench. The following table gives the relative tenacity of various metals and alloys: Steel already drawn, 100; iron already drawn, 88; brass already drawn, 77; gold at 0.875, annealed, 73; steel annealed, 65; copper already drawn, 68; silver at 0.750, annealed, 58; silver at 0.875, 54; brass annealed, 46; iron annealed, 42; platinum annealed 38; copper annealed, 38; fine gold annealed, 37; fine silver annealed, 37; zinc, 34; tin, 11; lead, 4.

Sensitive Photo Paper.

Sensitive photo paper, which will keep for a considerable time without deterioration in any respect, is made by Mr. H. T. Anthony, of this city, as follows:

To thirty grains of nitrate of silver in an ounce of water, add two grains of citric acid. After this is dissolved, add ammonia until precipitation ceases. Then re-dissolve with nitric acid, and leave the solution so that a small proportion

of the precipitated citrate of silver remains. Let that settle perfectly, and then add ten drops of nitric acid to every two quarts of solution. Sheets of the ordinary albuminized paper may be sensitized by floating for a minute and a half. No trouble from bubbles. The paper is more sensitive in printing than the ordinary paper, and tones splendidly. The paper is fumed in the usual way with strong ammonia. Paper made in this way will be found just as white at the end of five days as when first prepared.

Moritz Hermann von Jacobi.

We regret to hear of the death of this eminent scientist, which took place on March 10, at St. Petersburg, Russia. He was born at Potsdam, Prussia; but his life was mainly spent in Russia, where his many important discoveries in the application of galvano-electricity to industrial purposes were made. He constructed a short line of telegraph in St. Petersburg in 1830, and ten years afterward his book, entitled *Die Galvanoplastik*, was published. He was for a long time associated with Klein in the investigation of the electro-deposition of iron, already described in these columns; and he suggested to the Czar Nicholas the formation of a regiment of galvanic engineers, to be trained in the management of electricity. This idea was carried out, and the learned doctor was made colonel of the galvanic regiment.

He constructed in 1834 the first electro-magnetic engine that was anything more than a model, and in 1838 he used it to propel a boat containing ten or twelve persons on the Neva. She was fitted with paddle wheels, and a speed of four miles an hour was maintained for several days. The power was supplied by a battery on the Grove principle, of 64 platinum plates, each having 36 square inches of surface.

His labors were highly appreciated in Russia, and were rewarded by many marks of imperial favor as well as by wide popularity.

A Simple Insect Catching Device.

A writer in *Les Mondes* says that he is enabled to materially reduce the number of insects which prey upon the flowers and fruits of his garden, by covering the inside of an old tub with liquid tar, and at twilight putting a lighted lantern within, leaving the whole out over night. The bugs, attracted by the light, try to reach the lantern and are caught and held fast by the tar.

DOGS AS SMUGGLERS.—Large dogs, bred and trained for the purpose, are taken across the Belgian and Swiss frontiers and are dispatched to French territory, under cover of the night, laden with tobacco and other colonial produce on which a high duty is leviable in France.



THOMPSON'S METHOD OF CREMATION.

THE CENTENNIAL EXHIBITION.

To the People of the State of New York:

It is right that the people of the United States should know that the day and year which closed the century of American Independence—July 4, 1876—will be commemorated with ceremonies expressive of the gratitude and pride of a great nation; and, in accordance with the act of Congress of June 1, 1872, which created the Board of Finance, the following report is made over the signature of the President of the board:

The original law of Congress, enacted March 3, 1871, provided for "the celebration of the Centennial of American Independence by an international exhibition of the arts, manufactures, and natural resources of this and other countries, under the auspices of the government of the United States."

And the act of June 1, 1872, fixed the capital to complete this great commemoration at \$10,000,000, which was by the Commissioners apportioned among the several States and Territories on the basis of population.

Of this sum the State of Pennsylvania alone, aided by a subscription of \$100,000 from the State of New Jersey, has raised, in the form of subscriptions to the stock and by appropriations from its Legislature and the Councils of Philadelphia, about \$4,000,000, or nearly one half the amount necessary to insure success. This provision having been made, designs for suitable buildings were approved, and other preliminary and incidental arrangements have so far advanced as to justify an immediate commencement of the work of construction.

The Commissioners have appealed to the Congress of the United States, on the basis of these subscriptions, appropriations, and preparations, to maintain the spirit of the two laws above referred to, and the correspondence of the State department with foreign powers has induced the governments of the Netherlands, Belgium, Switzerland, Germany, Sweden, Liberia, Ecuador, the Argentine Confederation, Chili, Mexico, Hayti, and the Sandwich Islands, to express their intention to participate, and they have every reason to believe that this appeal to Congress will be generously responded to.

Subscriptions to the stock have also been made by individuals in the States and Territories of Missouri, Illinois, Nebraska, Montana, Indiana, Nevada, Oregon, California, Louisiana, Florida, Maryland, Ohio, Wisconsin, Michigan, Arizona, New Jersey, Delaware, Rhode Island, Arkansas, Alabama, New York, Virginia, Iowa, and Kansas.

Such in brief is the condition of the organization for the international commemoration of the close of the century of American Independence.

The city of Philadelphia was selected as the most fitting locality at which to celebrate the birth of American Independence, for the reasons:

1. That from Philadelphia the Magna Charta of human liberty, the immortal Declaration was uttered. The buildings in which the convention sat remain substantially as they were on that day; and

2. Of all the points of revolutionary interest, Philadelphia is the most central and accessible to the whole country. It is the Republic's celebration of its birthday at the very place of its birth.

The Finance Board earnestly urge their fellow countrymen to keep in mind the great fact that the event to be commemorated is the grandest and most momentous in history, that the commemoration is to take the form of an exhibition of the stupendous progress made by the American people in the first hundred years of their independence, in everything relating to the natural resources of the country and their development, and especially its progress in those industries, arts, and institutions which benefit mankind.

How diversified are the objects which must enter into that exhibition—how vast the buildings and the space required to present them with full effect—are suggestions that need only to be mentioned to bring home to every American the colossal magnitude of the undertaking.

Consider for a moment the industries, products, and devices necessary to an adequate expression of the progress of your own State, and the space that will be essential to their full presentation, and you can hardly fail to perceive that your State alone will require an area in the exhibition buildings and grounds equal to that occupied at Vienna by England or France. This is true of not less than ten of the older States. The other twenty-seven States and ten Territories will each of them require space in proportion.

That the stock of the Centennial Board of Finance might be within the reach of every citizen, the Congress of the United States fixed every share at \$10, which will be represented by a handsome steel engraved certificate, executed by the Treasury Department of the Government, and fittingly designed in commemoration of the event. The board in soliciting subscriptions to its stock feels assured that there is a patriotic desire to render the exhibition worthy of the occasion.

Notice is hereby given that checks and drafts can be addressed to the Financial Treasurer, Frederick Fraley, No. 904 Walnut street, Philadelphia, for any number of shares at \$10 each, and certificates of stock will be promptly returned. The International Exhibition will commence on the 19th of April, 1876, and close on the 19th of October, 1876.

The undersigned, President of the Board of Finance, speaking for his colleagues, and, he believes, for the great body of the American people, does not doubt the answer of that people to this earnest appeal. They are not unmindful of the patriotic interest in the Centennial of their own independence, nor of the high duty of honoring it as it deserves. Philadelphia, the scene of the immortal Declaration, not

only in the old hall where it was written, and whence it was proclaimed, but in the extensive park where the exhibition is to be held, sacred as the resort of Washington and the revolutionary worthies, has given many times her share to the memorial. It is not her celebration—it is the nation's. History has simply designated that city as the spot where the national sentiment can be historically expressed.

Every other city and State is inspired by the same sentiment. Every man and woman, North and South, is stirred by the same impulse. All the peoples of the earth are earnest spectators and students of our progress. The work, therefore, is at once national and international. It reaches every class and every interest. It will be the most remarkable comparison and interchange of ideas and inventions, of art and science, of the products of the earth, the brain, and the hands—the most friendly and complete intercourse between the races of all countries in modern civilization. It is impossible to believe that any portion of the American people will hesitate to unite in what is a sacred memory and a sacred obligation.

JOHN WELSH,

President of the Centennial Board of Finance.

The March of Improvements.

The twenty-first anniversary of the London Association of Foremen Engineers and Draftsmen was held in that city, March 14, Thomas Brassey, M. P., in the chair. A large number of distinguished men, engineers and others, members of the Association, were present. Sir Edward Belcher responded for the navy. Among other things he expressed the belief that every captain who commands an ironclad ought to be a thorough engineer, otherwise he cannot perform his duty as he ought to be able to do in such a ship, propelled by steam power.

Mr. Joseph D' A. Samuda, M. P., responded for the House of Commons. He said:

At this moment I am only just reaching my sixtieth year, and yet I can recollect a series of improvements effected in my time which probably exceed in importance all the improvements witnessed for 600 years previously. I remember the first steamboat which ever plied between the Tower and Ramsgate; I remember when a boy going down to see it start from the Tower Stairs. I remember the rise of almost every great marine engineering establishment, and notably I remember the first marine engine ever made by a firm now of world-wide reputation—that of Messrs. John Penn and Sons. I remember the first railroad ever used on our shores for the conveyance of passengers. I remember the first introduction of telegraphy, which has so completely united together in one family the whole of these islands that you would scarcely believe that any distance separated the most remote and the nearest customers with whom we have to deal. I remember still more the culminating point of that particular science to which I have last referred, which enabled us to lay under contribution nations—no matter how distant—by passing under the broadest ocean the means of communicating with India and America, in about as brief a space of time as we can with our nearest neighbors. All these circumstances have tended to develop that great industry the heads of which are represented here on this occasion—I mean engineering in a general comprehensive sense. It is to those great inventions which have so startled the world that we owe so much; and yet I am convinced that they have not reached their maturity, but are only on the road to increased triumphs. How important then becomes a Society like yours, which must exercise a rapidly extending influence on the future of engineering for generations to come!

Mr. Brassey said:—Well, I know when I address a body of foremen engineers that I am speaking to one of the most intelligent classes in this country—to a class of persons who have contributed, perhaps more than any other, to establish the fame and reputation of our country. In whatever direction you look, you see monuments of their skill, their character, and their ability. The electric telegraph, the steam engine, the loom of Mr. Arkwright, and other improvements, are English inventions which have been the means of revolutionizing several great departments of industry to which the labor and ingenuity of man are applied, and which have established the claim of England to the pre-eminence as an engineering country. Speaking for myself as one owing so much to the invention of railways, I think I ought to be, and I assure you that I am, full of appreciation of the mechanical genius of my countrymen. While referring to railways, I would, before leaving that subject, just remark that, great and important as have been the inventions connected with the railway system up to the present period, we are still greatly needing a further development of ingenuity in order to make traveling by railways as safe as we must anxiously desire to render it. And speaking as a railway director, I can say to you, who, I am sure, very many of you, possess great capacities for invention, that if you can only discover a thoroughly satisfactory continuous brake, you will confer an almost unspeakable benefit on your countrymen.

I feel that, although at the present moment we are possessed of great eminence in engineering industry, we are threatened daily with great competition from abroad, and I am afraid that the competition may come, not, as we readily anticipate, from Germany, France, and other old countries of the world which command a cheaper supply of labor than we do, but possibly it may come from the United States, where, in spite of their most costly labor, they have the means, if they only properly adjust their tariff, to obtain raw materials better than we do; and they have also shown the most marvelous facilities for mechanical invention. Let us not then suffer ourselves to be outstripped in the race—let due provision be made for the technical education of our workmen; and if only they have the same chance as their brethren in other countries,

then I have no fear of their holding their own. I hope for a great deal of aid from the Government in the direction I have ventured to indicate; but I also feel that we in England have very rightly sustained the principle of self help as one of the most considerable of our national virtues; and I find in the existence of your institution, which is intended to contribute something toward the technical education of our engineers, a manifestation of the noble principle of self-helpfulness.

The Works at Creusot.

It is refreshing, in the midst of the financial difficulties of France, and considering the unsatisfactory state of trade, to hear of the continuous growth of the works of the Schneider Society at Creusot.

The surface now covered by shops and other buildings belonging to the works exceeds 50 acres, and the entire area of the property, including mines, is 440 acres; the length of rail laid down at and from the works is 53 miles, of which two thirds are double ways; the number of workmen employed is 10,000; the steam engines are 234 in number, and of 12,700 horse power. The production amounts to 190,000 tons of coal; 180,000 tons of pig iron; 90,000 tons of wrought iron; 60,000 tons of steel; value of the locomotives built, 100 per annum, \$1,400,000; and that of other machinery, with bridges, \$1,200,000.

The new works and extensions lately carried out and in contemplation consist, first, of providing an additional water supply. M. Droillard, who carried out the former waterworks, has planned others to bring the waters of a stream called the Rançon to Creusot. The supply required at Creusot is a volume of 4,000 tons, and the Rançon is calculated to supply that quantity in the driest season.

The main conduit will be more than twelve miles in length, and has been planned to deliver 10,000 tons at high water. It will be formed of cement, wherever the contours of the ground permit; but when the pressure surpasses fifteen or twenty meters, cast iron pipes will be substituted.

New Treatment of Cancer.

Another treatment of cancer has been brought out by Dr. Hasse, of Berlin. An account of it is given in the *Medizinische Central Zeitung*, February 18. Dr. Hasse injects, with a hypodermic syringe, pure alcohol, to which one per cent of ether is added, not into the new growth, but around its edges, thus obliterating, he claims, the vessels, especially lymphatics, which convey the infection, and causing the atrophy of the growth itself. The pain is rather severe, but is much reduced by ice bags, and lasts only about two hours. The injections are repeated every eight to fourteen days, and have no alarming reactions. He claims striking success in carcinoma of the mamma, and in cauliflower excrescence of the uterus, but has failed in epithelioma of the lip, which he attributes to the impossibility of obliterating by this means the large and closely adjacent coronary artery.—*Medical and Surgical Reporter*.

New Railway Signal.

MM. Lartigue and Laforest have recently invented a novel device, intended as a danger signal, which the *Revue Industrielle* states is now in successful use on some of the French railroads. A whistle is arranged on the locomotive so that it will, when once opened, continue sounding until shut by the engineer. The same device which turns the disk signal, so as to show the danger side, is extended to transmit a current of electricity to a little projection between the rails. When the engine passes over this spot, a metallic brush hanging between its wheels strikes on the projection and sweeps over it, at the same time transmitting the current to an electro-magnet which pulls the whistle open. The latter, by continuously sounding, warns the engineer.

Industrial Exhibition of the Franklin Institute.

The Franklin Institute of Philadelphia announces the celebration of the fiftieth anniversary of its foundation by an exhibition of arts and manufactures, to be held in the above mentioned city from the 6th to the 31st of October next. The plan is to secure as full a representation as possible of the mechanical improvements of the last half century, and all artisans, mechanics, manufacturers, and inventors are invited to contribute their best productions and to compete for the prizes which will be awarded to the most worthy. Facilities will be afforded for machinery in motion. All desiring to exhibit are requested to make early application for space, power, etc.

Mountain and Lake Surveys in New York.—A New Canvas Boat.

Mr. Verplank Colvin has recently submitted to the legislature of New York State his report for the past year of surveying operations in connection with the Adirondack mountain regions. Among other results he corrects the heights of several of the mountain peaks. Mount Marcy and McIntyre, he finds, are correctly given at 5,000 feet altitude. He reduces Mount Dix to 4,879 feet, Mount Seward to 4,348 feet, and Santanoni to 4,607 feet. He finds Mount Haystack and Mount Skylight to be higher than heretofore reported, and gives new measures of several other mountains of important altitude.

Mr. Colvin also gives the measures of some two hundred new lakes, covering from forty to fifty square miles. He describes a novel portable boat used by him upon these lakes. The boat is made of canvas, and weighs only 10 pounds 8 ounces. A new signal, of his own invention, visible at a great distance, was also employed by this enterprising explorer.

DECISIONS OF THE COURTS.

United States Circuit Court—Northern District of New York.

HARVESTER PATENT.—MARSH vs. THE DOG AND STEVENSON MANUFACTURING CO.

[In equity.—Before Woodruff, Justice.]

A claim to a result is not, *per se*, patentable; neither can a claim be sustained which covers every mode or means by which certain advantages can be secured in a harvester.

The mere location of an old apparatus upon a machine is not patentable.

If new devices are required in order to adapt an old apparatus to a new position on a machine, and the change produces a new and beneficial result, then the change is patentable in connection with the new device; not the result, but the means of producing it.

Or if such a change brings into existence a new combination of devices productive of a new and useful result, the new combination is patentable.

The patent will not be infringed in either case by a like change in the location of the apparatus, unless the new devices which adapt it to its new position are also used in one case, and unless all the material elements of the newly developed combination are employed in the other.

In changing the location of an apparatus upon a machine it seems not to be patentable to adopt such mechanical changes to render it practicable as mere judgment dictates or the necessity of the case demands.

Complainant dismissed with costs.

James O. Parker and D. Wright for complainant.

George Harding for defendant.

NEW BOOKS AND PUBLICATIONS.

HANDBOOK FOR THE ARTISAN, MECHANIC, AND ENGINEER: comprising the Grinding and Sharpening of Cutting Tools, Abrasive Processes, Lapidary Work, Gem and Glass Engraving, Varnishing and Lacking, Apparatus, Materials, and Processes for Grinding and Polishing, etc. By Oliver Byrne, Civil, Military, and Mechanical Engineer, Author of "The Practical Metal Worker's Assistant," etc. New Edition. Illustrated by 185 Wood Engravings. Price \$5. Philadelphia: Henry Carey Baird, 406 Walnut street.

This valuable volume is too well known to need eulogy from our pen, and our appreciation of it is best shown by the frequency with which we have occasion to consult its pages for details of technical processes. The artisan, desirous of learning the art of finishing metal and brass work to the highest perfection, will find it a compendium of the best modern practice both in this country and Europe; and its directions are rendered doubly valuable, for intelligibility and accuracy, by the profusion of excellent engravings with which it is illustrated.

A MANUAL OF EDEOGRAPHY, or the Art of Writing by Sound, being a Complete System of Phonetic Short Hand, adapted to Verbatim Reporting. Philadelphia: T. W. Evans.

This little handbook gives full explanations of an admirable system of stenography, one of the most useful arts which youths can devote their leisure hours to acquire.

Inventions Patented in England by Americans.

[Compiled from the Commissioners of Patents' Journal.]

From March 27 to April 6, 1874, inclusive.

BREECH LOADING FIRE ARM.—A. Swingle et al., San Francisco, Cal.

CAR BRAKE AND COUPLING.—H. E. Marchand, Pittsburgh, Pa.

CAR BUFFER AND COUPLING.—W. H. Skidmore, Philadelphia, Pa.

CRUSHING ORE, ETC.—S. R. Krom, New York city.

CULINARY APPARATUS.—J. S. Kidd, Brooklyn, N. Y.

DRESSING MILLSTONES.—D. Larer et al., Pottsville, Pa.

EMBROIDERER.—R. M. Rose, Williamsburgh, N. Y.

HORSE HAY FORK.—J. G. Williams, Fellowshap, N. J.

LOOM.—T. W. Harrison et al., Boston, Mass.

MELTING STEEL.—A. C. Lewis, Brooklyn, N. Y.

PAPER TWINE.—J. B. Wortendyke, Godwinville, N. J.

PLOW.—W. Donnelly, Calverton, N. Y.

PREPARING FLOUR.—O. F. Cook, Grand Island, Cal.

STEAM ENGINE.—E. Cope et al., Hamilton, Ohio.

STEAM ENGINE.—J. C. Nobles, Elmira, N. Y.

TRANSPORTING CASKS.—W. J. Reid, New York city.

Recent American and Foreign Patents.

Improved Copy Holder.

James B. Harper, St. John, Mo.—This invention relates to copy holders, whereby a newspaper or written sheet or strip may be held before the eyes of a copyist or compositor, and conveniently unrolled as he progresses with his work of transcribing or setting a type copy.

Improved Coffin Plate.

George Brabrook, Taunton, Mass.—This invention relates to a novel and useful construction of coffin plates whereby they may be not only adapted to receive the usual supercription, but also to hold the bouquet which is often placed upon the top of coffins.

Improved Piano Sounding Board.

Frederick Niederheltmann, Aix-la-Chapelle, Prussia.—This invention relates to a novel composition of matter whereby those properties of wood which adapt it to use for the sounding boards of pianos, guitars, and other musical instruments may be preserved for an indefinite period, such prepared sounding boards not only retaining their peculiar quality, but undergoing an actual change for the better.

Improved Mode of Propelling Street Cars.

George S. Grier, Milford, Del.—This invention relates to the well known plan of propelling street cars by means of an endless chain or rope placed below the cars or track, and actuated by friction pulleys, sprocket wheels, or spike wheels, over which it is made to pass. These drive pulleys or wheels are themselves set in motion by steam or other power applied through ordinary connecting mechanism. This mode of propulsion which has heretofore been tried and deemed impracticable is made, by this invention, easy of application and thoroughly effective.

Improved Heating Stove.

William Chelius, Paterson, N. J.—This is an improved heating stove, so constructed as to pass the air to be heated in thin sheets between two metallic surfaces, both of which are heated by the passage of the heated products of combustion, so that the air may be quickly heated, and so that all, or nearly all, the heat may be extracted from the products of combustion before they are allowed to pass off into the chimney.

Improved Middlings Purifier.

George W. Dellinger, Ripon, Wis.—This invention consists in the combination, with the suction fan and case, of the two oscillating sieves, the top one made smaller than the lower one, to allow the upward passage of light particles of matter from the lower sieve. These screens will be self-cleaning, in consequence of the lively action of the flour or middlings on them, and thus the brushes, knockers, etc., used with ordinary middlings cleaners and bolts will not be needed.

Improved Brick Machine.

Peter Harnist, Marine, Ill.—There are two mixing cylinders, which stand side by side, and are operated by means of bevel gears from the cam shaft. The box into which the prepared clay is delivered from the mixing cylinders has a sliding bottom. A stamper is raised twice at each revolution of the cam shaft, and drops by its own gravity, and in so doing compresses the clay in the trough. The sliding bottom is moved to the right and left alternately by means of a cord and working beam, which beam oscillates on a central pin. A ledge on the sliding bottom forces the clay into the molds, and vertical knives descend at the right moment and cut the brick to the proper length. At the next movement of the sliding bottom in that direction the brick is forced from the mold on the transferer, composed of hinged boards connected by a rod. When the transferer is full, it is carried away and deposited on the conveyor.

Improved Speaking Tube.

Theodore Niele, Pittsburgh, Pa.—This invention consists of a speaking tube in which is placed at the throat or near the mouth a hinged valve connected by a rod with a weight or knob. The gravity of the latter exerts a constant force through the rod, and tends to keep the valve closed until overcome by a greater counteracting power. By this means the air always finds a ready avenue of escape through the whistle. The indicator is located with respect to the whistle so that it will be actuated simultaneously with the sounding of the alarm, and, being raised, thus exhibit to view the precise tube from which a signal has been given. The opening of the valve, in order to answer the call has the effect of automatically closing the indicator.

Improved Mechanical Movement.

Henry C. Work, Brooklyn, N. Y., assignor to Alanson Work, Providence, R. I.—The object of this invention is to furnish a new combination of wheels for producing a new mechanical movement for the application of steam, or for elevating and forcing water, and for all the purposes for which it may be adapted; and it consists in a disk which rotates on a central axis or arbor, with two gear wheels pivoted thereon eccentrically to the center, which wheels engage or work together, with each an arm attached to the periphery thereof, or connected therewith, which sweep the surface of an irregular scroll cylinder.

Improved Water Wheel.

Dodge P. Blackstone, Berlin, Wis.—This invention relates to improvements in turbines; and consists, first, in forming a flume or free annular passage around the wheel, between its hub and the enclosing stationary part in which the chutes are located; second, in the arrangement of the gates for closing the chutes. The latter are hollowed out on the inner side, leaving only a bearing surface around the edge. They are provided with stems which pass through slots in brackets of the gate-operating frame, and on these stems are placed spiral springs which bear against the brackets, and are adjusted to greater or less tension by nuts. The bracket slots are so formed as to allow the gates considerable play on their seats or bearing surface, and the springs take off the pressure of the head of water, so as to relieve the gates of much of the friction that would otherwise exist.

Improved Apparatus for Pressing Meat Scraps.

Samuel Booth, New York city.—This is a tub for the pressing of meat scraps, having a surrounding jacket enclosing the tub in a space for heating it by steam, with pipes running through it from the orifices for the escape of the fat, and projecting a little beyond the outside of the jacket for discharging the fat into the receiving pan below. The press follower is provided with holes for the escape of some of the fat through it directly from the surface of the scraps, whereon the follower acts. The object of the jacket is to maintain the scraps at the proper degree of heat for obtaining the best results throughout the process of pressing, and thus save considerable loss now sustained, both in the quantity of fat obtained and time consumed, in consequence of the cooling of the scraps after being put into the press.

Improved Hay and Cotton Press.

George Mosteller, Walker, Ga.—This invention relates generally to all kinds of presses for baling cotton, hay, or straw, but more particularly to such as are transported upon wheels and to and through the field, thus enabling the crop to be baled without being transferred to the barn.

Improved Machine for Driving Brush Handles.

John Ames, Jr., Lansingburgh, N. Y.—This invention has for its object to improve the construction of the machine for which letters patent No. 112,137 were granted to same inventor August 25, 1873. To the table is attached a frame, in which a plate slides up and down in grooves, being actuated by suitable gearing. Means are provided to limit the downward movement of the plate, and insure the driving of all the handles of all the brushes of the same lot to exactly the same point. To the plate is attached a bracket, to which is secured the driver by which the handle is forced into the brush. In the table directly beneath the driver is formed a hole into which is fitted a thimble to receive and fit exactly upon the ferrule of the brush, and support it against the strain while the handle is being driven. To the lower side of the table, around the hole, is attached a downwardly-projecting tube which is slotted longitudinally, and surrounded by a collar. The latter is made with a bar passing through the slots of the tube, and with a rod upon its center which fits into the cavity of the said slotted tube. The rod is perforated longitudinally, and its upper end is concealed to receive the end of the brush handle, and hold it exactly centered while being driven. From the opposite sides of the collar two cords pass over guide pulleys pivoted to the upper part of the frame, and carry weights. A small rod passes longitudinally through the perforated rod, and its lower part fits into the cavity of the slotted tube when forced upward. To the rod is attached a cross bar, to the ends of which are attached cords which pass over guide pulleys, and also carry weights. A bolt which enters a notch in the side of the rod when pushed down keeps it from being raised by the weights. The bolt is held forward against the rod by a spring. To the outer end of the bolt is attached the lower end of a lever. In the upper end of the rod is formed a socket to receive a steel point, which is designed to force its way and guide the rod through the center of the brush, when the rod is released from the bolt and is forced upward by the weights. In using the machine, the point is inserted in the upper end of the rod, and the said rod is forced downward until caught and held by the bolt. The brush is then inserted in the thimble, and the lever is operated to release the rod, which is forced upward by the weights, forcing the steel point up through the center of the brush. The steel point is then detached; the point of the brush handle is inserted in the socket in the upper end of the rod, and the driver is lowered upon its base, so that by forcing the driver downward the rod will be forced downward, the handle following it through the center of the brush. As the end of the handle passes through the brush, its end is received by the end of the perforated rod, which holds it accurately centered while being driven.

Improved Stock Feeder.

Levi P. Cox, Breckinridge, Mo.—The box in which the corn is placed is formed of slats correspondingly notched and tongued at the ends, so that they cannot slide inward, while they are enclosed by posts so that they cannot slip outward. The table beneath the corn box is extended out on each side, so as to form, with the vertical edge pieces, a feed trough about the corn box. The slats are vertically movable within the posts, and may be held at any desired elevation by pins passing through the posts, and under the lowest slats. In order to render the feed automatic, the lowest slats rest upon metallic rods, whose ends project to a greater or less distance within the trough, and are of a size easy to be handled. These render the lifting of the slats to a higher adjustment very easy by a single person, who raises one corner at a time and fixes a pin thereunder. These rods also are moved by the noses of the animals in the trough, and tend to relieve any choking or stoppage of the flow of corn.

Improved Hand Nail and Bolt Making Tool.

William Franklin White, Orange, Ga.—This invention consists of a couple of steel bars, having a series of round notches in one side, and square ones in the opposite side, of different sizes, said bars being joined together at one end by a link, which allows the bars to close both their notched sides together, to constitute dies of the notches in which to head nails and bolts. The said bars are held together by handles at the ends opposite the joint, and a dowel pin on one enters a hole in the other near the handled end, to insure the coinciding of the faces. The notches are countersunk on one side to form tapered heads to the nails and bolts, and flush on the other sides to make flat heads. One series is countersunk upon one side of the bars, and the other upon the other side, so that the bars are not unduly weakened on one side, as they otherwise would be. The said bars are made of steel and duly hardened, to sustain the wear incidental to the hammering up of the heads in them.

Improved Electrolytic Apparatus.

Evans Casseberry, St. Louis, Mo., and Nathan H. Edgerton, Philadelphia, Pa.—This invention consists in combining with a suitable tank or tanks, for holding the liquid to be decomposed, electrodes having two or more bifurcated divisions, upon the surface of which the decomposition takes place, increasing with the increase of the said surface until the total strength of the current is utilized.

Improved Shank Laster.

Edwin Campbell, Bath, Me.—This invention relates to the arrangement of levers and springs with the jaws for gripping the edge of the uppers, whereby they are caused to take a firm hold, or to release it. One has a long arm projecting from outside, and the other jaw is pivoted to it. At the upper ends is a cam lever for forcing the lever ends together, and a spring is arranged between them to open them, to release the leather after the work is done. A suitable distance from the jaws the arms are fitted on the right and left hand screws, and beyond the screw they have a rod, parallel with the screws, to keep them parallel with each other when straining the leather, said rod being fastened in one arm and fitted to slide in the other. The screw rod has a handle by which to turn it for forcing the jaws to stretch the shank over the last. The arms are arranged to project to the right of the jaws, so that in use they extend along the sole of the last to carry the operating screw and the guide rod out of the way, and permit convenient tacking of the leather.

Improved Station Indicator.

George A. Brown, Locke, N. Y.—This is an improved indicator for indicating the stations along the line of the railroad, so constructed as to adjust itself automatically as the train leaves a station, and exhibit the name of the next station. The endless belt on which the names, distances, etc., are inscribed, is provided with suitable rotary mechanism, and connected with a lever which projects down through the car. This lever has a free movement longitudinally with the track, but cannot move crosswise of the track without rotating the roller in one or the other direction. Suitable means are provided to bring the lever back to a vertical position, should it be moved by its lower end striking an obstruction. Driven into adjacent ties of the track is a rod which may be inclined with respect to the track, and in such a position that the lower end of the lever may strike it and may be moved laterally to rotate the roller. One of the rods is designed to be secured to the track upon each side of the station, so that the indicator may be set as the train leaves the station in either direction.

Improved Clod Crusher.

Harm Feenders, Charles City, Iowa.—The object of this invention is to furnish an improved clod crushing and pulverizing implement by which the ground may be completely broken after sowing, for the purpose of retaining the moisture therein. It consists in the arrangement of a main supporting frame with a series of lateral knives, which are attached at the lower side thereof to step-shaped seats, so that each knife is back of and deeper than the other, and breaks the clods by repeated concussions with the same in connection with sharp projecting edges of the seat parts.

Improved Grain Dryer.

Pardon B. Hunt, Council Bluffs, Iowa.—This invention consists in the arranging of two cylinders so as to form a grain passage in the shape of an inverted cone or funnel, and so that the grain passage will enlarge as the grain awells, and the passage thus continue throughout to preserve the same relative magnitude to the volume of grain.

Improved Pipe Tongs.

Anton Kotzum, New York city.—The object of this invention is to produce a simple and effective pipe tongs, which may be quickly adjusted to pipes of various sizes and firmly retained in the required width. The invention consists of jaws with lever handles of the usual shape, of which one slides upon a pivot in a slot in the other, for adjusting it to the width of the pipes, and is firmly fastened in the required position by a slotted piece of the pivot, guide pin, and clamping screw.

Improved Machine for Pressing Pantaloons.

George F. Pond, Boston, Mass.—This is a machine for use in forming and pressing the bottoms of the legs of pantaloons. The base board is secured to a support, and to the ends are attached two standards, carrying the shaft, to the forward ends of which is attached a plate. The forward edge of the plate is so shaped as to give the proper form to the front of the pantaloons bottoms. Along the plate, and parallel therewith, extends a finger, the rear end of which is bent inward and extends along the inner end of the plate through a slot in the end of the shaft, and its end is pivoted to a lever. The forward end of the lever is notched to receive a pin attached to the forming plate, and which serves as a fulcrum to said lever. By this arrangement the pantaloons bottoms are stretched while being formed and pressed. The finger is held in place, when adjusted, by a set screw passing in through the end of the shaft and pressing against the said finger. The plate is supported, while the bottoms are being pressed, by a stand attached to the end of an arm, the other end of which is pivoted to the base, so that the said stand can be readily swung back when adjusting or forming the bottoms. One end of a spring is secured to the base, and its other end presses against the shaft to hold said shaft and the plate in any position into which it may be adjusted.

Improved Mosquito Screen.

James P. Miller, Ridgeville, Ill.—This invention relates to a self-closing swinging bar or frame having a netting attached, and operated by a weight having a double cord connection with it at the top and bottom. The invention also includes a peculiar arrangement of cranked or bent pivot rods with the bar to which the netting is attached, whereby the bar is supported and the netting kept stretched without supplementary devices.

Improved Harness Makers' Clamp.

Josiah Smith, Southold, N. Y., assignor to himself and Francis C. Landon, of same place.—The jaws are held together by a steel spring, the lower end of which is secured to the stationary lower part of the hinged jaw, and its upper end rests against the outer side of the upper part of the said hinged jaw. The upper part of the hinged jaw is drawn back, to allow the work to be inserted and released, by an arm and strap. To the lower end of the two jaws is attached a horizontal bar or plate for the operator to put his foot upon to hold the clamp erect when in use.

Improved Hook and Clevis.

William Warne, Huntington Mine, Dillon P. O., Canada.—The feature which distinguishes this hook and clevis from others is the device for preventing accidental separation of the two when they are in use. For this purpose two slots are made through the clevis and near the wrist. On the sides of the hook, near the end, are formed two lugs, which, when the hook is turned in a certain position, will pass readily through the slots, which allows the hook and clevis to be separated.

Improved Bottom Plate for Range Chimneys.

Hamilton C. Garwood, Jersey City, N. J.—This invention consists of a pyramidal or conical elevation of the middle portion of the plate at the bottom of a flue or chimney over a range. There is a large passage at the top either directly into the chimney or into a pipe extending a short distance from the top and discharging into the flue. A valve closes and opens said passage at will, giving a more efficient means of escape for the effluvia, smoke, etc., arising from the cooking on the range below, than is afforded by the ordinary flat plate with a passage in it.

Improved Folding Clothes Horse.

Elias Kimball, New York city.—This invention consists in the jointed brace bars, in combination with the pivoted horizontal and vertical bars of the sections of a clothes horse. In folding the horse, the sections are brought parallel with each other, and the braces of all the sections are raised at the same time, which allows the horse to be folded up. When the sections are opened out, the braces drop, or may be forced down into locking position.

Improved Beehive.

Josiah Barnes and William Barnes, Topeka, Kan.—This invention relates to that class of beehives provided with main and auxiliary honey frames, and consists in a false bottom for the main honey frame attached to a riser; in a sliding and reticulated false bottom; in putting a strip over the slide to prevent waxing of the joint; in a superposed and open-topped case for the auxiliary honey frames, and in a detachable slide between the two sets of honey frames.

Improved Middlings Purifier.

James A. Stewart, Atlanta, Ga.—The middlings are admitted into the upper part of a trunk through a spout, as fast as they fall from the dusting reels. While still in their loose or disintegrated state, and as they fall from one bucket to another of several attached to an endless chain, they are acted upon by the blast of air driven up through the machine.

Business and Personal.

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Patent Sewing Machine Treadle for Sale—Three different kinds in use—one foot pressure makes sixty stitches. The improvement can be applied to any machine. For information, send to Dr. L. Helms, Brunswick, Ga.

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Makers of Seine and Net Machines, please address G. F. Foster, Son & McFarren, corner Market, Lake, and South Water St., Chicago, Ill.

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Patent Portable Bevel Jig Saw—State Rights for Sale. No frames or fender posts required. For further particulars, address H. R. Baylis, No. 3 W. 10th St., Wilmington, Del.

The "Railroad Gazette" of April 25 and May 2 contains illustrated descriptions of Locomotive Cylinders, Pistons, Guides and Connecting Rods. 10 cents per copy; \$4 a year. Publication Office, 73 Broadway, New York.

Models made to order. H.B. Morris, Ithaca, N.Y.

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For Sale—Several Screw Machines of different sizes, cheap; also, a second hand Press. Write, for particulars, to A. Davis, Lowell, Mass.

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

All Fruit-can Tools, serrate, Bridgeton, N.J.

Brown's Coal-yard Quarry & Contractor's Apparatus for hoisting and conveying materials by iron cable. W. D. Andrews & Bro., 414 Water St., New York.

For Solid Emery Wheels and Machinery, send to the Union Stone Co., Boston, Mass., for circular.

Lathes, Planers, Drills, Milling and Index Machines. Geo. S. Lincoln & Co., Hartford, Conn.

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

Temples & Oilcans. Draper, Hopedale, Mass. Hydraulic Presses and Jacks, new and second hand. E. Lyon, 470 Grand Street, New York.

Peck's Patent Drop Press. For circulars, address Milo, Peck & Co., New Haven, Conn.

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Two 50 H. P. Tubular Boilers for Sale (Miller's patent) very low, if applied for soon. Will be so d separately or together. Complete connections and pump. Holke Machine Co., 279 Cherry Street, New York.

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Protect your Buildings—Fire and Water proof! One coat of Gilman's slate roofing paint is equal to four of any other; it fills up all holes in shingle, felt, tin or iron roofs—never cracks nor scales off; stops all leaks, and is only 80c. a gallon ready for use. Roofs examined, painted and warranted. Local Agents wanted. Send for testimonials. N. Y. Slate Roofing Co., No. 6 Cedar St., N. Y.

Important Decision.—The United States Circuit Court has decided, in favor of the Philadelphia (Gardner) Fire Extinguisher Co., the suit brought against them by the Babcock Company for alleged infringement, declaring the Babcock patents invalid. Certified copies of the opinion of the Court can be had of the clerk, U. S. Circuit Court at Philadelphia. Philadelphia Extinguisher Co., 424 Walnut St., Philadelphia, Pa.

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Dean's Steam Pumps, for all purposes; Engines, Boilers, Iron and Wood Working Machinery of all descriptions. W. L. Chase & Co., 93, 95, 97 Liberty Street, New York.

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For descriptive circulars, and terms to Agents of new and saleable mechanical novelties, address James H. White, Newark, N.J., Manufacturer of Sheet and Cast Metal Small Warps.

Emerson's Patent Inserted Toothed Saws, and Saw Swage. See occasional advertisement on outside page. Send Postal Card for Circular and Price List. Emerson, Ford & Co., Beaver Falls, Pa.

Fine Machinery Oils.—We believe that E. H. Kellogg's Spindle, Engine, Signal and Cylinder Oils, although costing a little more per gallon, are really the most economical for the consumer, for the reason of durability and freedom from injury to machinery. If parties requiring oils will make known the uses for which they are wanted, he will not only guarantee satisfaction, but that the goods shall prove precisely as represented. These oils are not only largely used and deservedly popular throughout the United States, but have considerable demand for export, from foreign manufacturers and agents.

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J. C.'s query as to a boiler in the shape of a half-moon, and E. P. J.'s, as to a vacuum, are incomprehensible.—J. C. H. can remedy the dampness of the walls by using the waterproof glue described on p. 8, vol. 25.—N. V. H. will find directions for gliding picture frames on p. 90, vol. 30.—L. D. is informed that we reprinted the recipe for mending rubber boots on p. 203, vol. 30. Figured fabrics fade in washing because they are not printed in fast colors.—H. H. Jr. will find the needed information as to the weight of flywheels on pp. 177, 388, vol. 28.—R. M. H. will find a description of making ice by means of heat on p. 243, vol. 30.—H. D. O. will find a recipe for aquarium cement on p. 202, vol. 28. Water colors are finely powdered pigments made into cakes with wax.—C. & A. will find full descriptions of nickel plating on pp. 157, 373, vol. 28.

J. W. Z. asks: How can I preserve eggs? A. Eggs may be preserved for any length of time by excluding them from the air. One of the cleanest and easiest methods of doing this is to pack them with the small end downward in clean dry salt in barrels or tubs, and to place them in a cool and dry situation.

G. F. P. asks: 1. Why does paint in Rockport, Texas, change color, white paint turning almost black in patches? A. The effects mentioned are such as would be produced by the presence of sulphuretted hydrogen gas, and it would be well to investigate the sewerage and drainage facilities, and any spots where decaying and putrescible matters might accumulate, in order to determine whether there were any sources of this deleterious gas. 2. Are chromos printed on cloth as well as on paper, and are they not more valuable? Are not the best printed on cloth? A. The best chromos are printed on cloth, which is more durable than paper.

S. V. C. asks: Is aluminum non-magnetic? Would its presence be indicated by a deflection of the needle? A. Aluminum is non-magnetic.

O. A. F. asks: Which kind of prussiate of potash, white or yellow, did H. J. B. use in making his explosive powder? What kind of sugar is necessary? A. The ingredients are yellow prussiate of potash and ordinary white cane sugar. They must be thoroughly mixed together in a dry state.

Q. V. asks: 1. How can I make good silver ink? A. Nitrate of silver, 11 parts; distilled water, 85 parts; powdered gum arabic, 20 parts; carbonate of soda, 22 parts; solution of ammonia, 30 parts. Dissolve the carbonate of soda, and afterwards the gum (by trituration in a mortar) in the water, dissolve the nitrate of silver in the ammonia and add to the carbonate of soda solution. Heat gently to the boiling point; the ink, at first turbid, becomes clear and very dark. 2. What

are decarbonized and Damascus steel? A. Damascus steel is steel made from an ore consisting of magnetic oxide of iron and silica, by the use of charcoal furnaces. The name is also applied to imitations of the original Damascus steel. Decarbonized steel is steel from which a portion of the combined carbon has been removed. 3. Is a breech-loading or a muzzle-loading shot gun the safer? A. Both are dangerous in the hands of careless people, and may be safely used with cautious handling.

J. L. S. asks: 1. Where can full and complete information respecting the grinding, polishing, and mounting of specula be obtained? A. We reiterate that Professor Draper's treatise affords the most available information on the construction of specula. John Browning's pamphlet illustrates the method of mounting them. 2. Has Professor Henry Draper improved his processes for the construction of glass specula since the publication of Vol. XIV., 1864, of the Smithsonian contributions for the diffusion of knowledge? A. No. 3. What is the method at present pursued by With, of Hereford, in the construction of silvered glass specula for Browning's telescopes? A. Extra thick glass is used to avoid flexure, and imperfect mirrors are repolished. 4. Of all the methods devised for the construction of specula, which produces the best results in the shortest time? A. The machine for local corrections (Draper, p. 24).

O. C. asks: 1. Why is it that people talk and write so much about the impossibility of the sun being a body of combustible material in a state of intense heat, alleging that, if such were a fact, it would long ere this have been consumed and have left a blank in space? There is no such thing as destructible matter, as this allegation would seem to imply, combustion being nothing more or less than the change of matter from one form to another without destroying one particle of it. A. The sun is really a combustible body, slowly burning, but its condensation supplies more heat. The oxygen and hydrogen, which will in time form the solar oceans, are dissociated by its high temperature. Eruptions throw these gases into the cooler chromosphere, they burn, and, forming water, show us steam lines in the spectroscopic. 2. As the attraction of the sun is sufficient to hold all this matter within its limits, how can this destruction of the sun take place? A. A velocity of 380 miles per second is sufficient to carry ejected material clear of the sun's attraction. The observed velocity of projection is 500 miles. Stars, therefore, are in constant interchange of missiles.

J. A. asks: 1. What is the formula for finding the area of a lune when the width of the lune and the respective diameters of the two curves forming the lune are given? A. Draw the chord corresponding to the two arcs of the lune; then multiply half of each arc by its radius, and subtract the least product (the area of the least circular sector) from the greatest. The remainder is the area of the lune. 2. Can you tell me of some of the double stars? A. A few double stars are: Gamma Leonis, orange and green yellow; Delta Corvi, yellow and purple; Gamma Virginis, white and yellow; Zeta Ursae Majoris, white and green; Iota Bootis, triple; Pi Bootis; Epsilon Bootis; Xi Bootis, orange and purple; Mu Bootis, yellow and lilac; Delta Serpentis, Zeta Coronae, white and blue; Epsilon Lyrae, multiple; Beta Cygni, yellow and blue. All double stars, nebulae, and clusters are marked in Proctor's "Atlas," price \$2.50.

N. B. says: 1. I have a 2 inches achromatic object glass of 30 inches focus, with which I wish to construct a telescope. What size of eyepiece, and of what focus, should I use? What power would such a glass have? A. Use a Huyghenian, or negative eyepiece, field lens about half an inch diameter, $\frac{1}{4}$ inch focus, the eye lens $\frac{1}{4}$ inch diameter and $\frac{1}{4}$ inch focus, both lenses plano-convex, plane side next the eye. The eye lens is placed its own focal length within the focus of the field lens, that is, they are half an inch apart. An equivalent single lens would be half the focus of the field lens or $\frac{1}{2}$ inch focus; therefore 30 inches $\div \frac{1}{2}$ inch = 60, the magnifying power of the eyepiece. 2. What is the difference (in construction) between a terrestrial and a celestial eyepiece for a telescope? A. The terrestrial eyepiece is provided with two additional lenses, to erect the image.

H. L. C. asks: Can I make a telescope, of sufficient power to show Jupiter's moons and Saturn's rings, with a double concave lens, 4 inches diameter and of 6 inches focus, and 1 meniscus lens, 4 inches in diameter and of 6 inches focus? I have a double concave lens, 2 inches in diameter and of 8 inches focus, and a meniscus of the same size and focus; they are from a magic lantern. I also have a double concave, $\frac{1}{4}$ inch in diameter and of $1\frac{1}{4}$ inches focus, and 1 double concave lens, $\frac{1}{4}$ inch diameter and of 1 inch focus. Would these lenses do better for a telescope or for a microscope? A. Your lenses will not answer, if your description is correct. A tolerable two inch achromatic object glass costs \$1.20, and a useful microscope, \$6.00. Either would be preferable to a chance combination of cheap lenses.

O. B. asks: 1. What advantage, if any, have the rotary engines over the ordinary piston engine, and why are they not in more general use? What is the principal objection to them? A. We have seen no accounts of thorough tests of rotary engines, and therefore cannot give a decided opinion upon their advantages. 2. Suppose the wheel of a rotary engine to have $\frac{1}{4}$ of a square inch effective pressure, and its mean distance from center of shaft to be $1\frac{1}{4}$ inches. It being under continual pressure; how will it compare with a piston engine having the same area of piston and a stroke of $3\frac{1}{4}$ inches under the same amount of pressure, making the same number of revolutions? Would such an engine be worth bothering one's brain over provided that, for cheapness of construction, simplicity, and durability, it will compare favorably with the piston engine now in use? A. If you can build such an engine, it will be worth your while to experiment. 3. How will gas do as a substitute for steam in experimenting on a small scale? A. It is used in several forms of engines.

E. F. M. asks: 1. How can I protect iron which is continually in salt water from dirt and barnacles? I have tried several paints now in market, but find that they all fail to keep the iron or wood free. A. The paint must be constantly renewed. 2. How can pitch or tar be reduced so as to make a paint, to be used cold? A. With turpentine, we believe. 3. How can I reduce copper to the fineness of flour? Can it be done with acids? A. By heating the copper in an atmosphere of hydrogen. 4. Is the Science Record composed of the copies of the Scientific American? A. No. 5. How much will it cost to have 1 year's copy of the Scientific American bound? A. In one volume, \$2; in two volumes, \$3.

J. H. P. asks: Can air brakes be applied to a train of cars if the engine is loose, or can they be applied without the power of the engine? A. In some arrangements they can only be applied from the engine; in others, they can be managed on each car, independently of all the rest.

C. A. J. says: I have a cellar about six feet deep that I cannot keep the water out of, and I wish you to tell me how and with what I can cement it to keep it dry. The cellar is dug in stiff clay, is walled up with brick 9 inch wall, laid in Louisville, Ky., cement; the floor had cement spread upon it an inch thick, with one course of brick laid upon it, and then well grouted with cement. A. The reason the water is forced into your cellar, notwithstanding the extraordinary precautions you have taken to prevent it, is because of the exterior pressure the former is subjected to, in being confined in the clay surrounding their foundations and rising around the house to a head equal to the depth of the cellar. If you remove this pressure and point up the breaks, you are very likely to overcome the difficulty. To do this, excavate a trench outside the walls, down as deep as the foundations will allow without undermining them, and fill in with stone of all sizes up to 18 inches diameter for about 2 feet in depth and 18 inches out from the house; then refill with the earth excavated, taking the precaution to place gravel or small stones against the wall all the way up for a few inches out. Now, from this lower deposit of stone, provide one or more drains leading away from the house and discharging at a lower level. These drains may be also made of stone like the one around the house, and to prevent their being filled up with dirt some straw or carpenter's shavings may be laid over the stones. In this manner the outward pressure may be removed; and if, when the trench is open, a coat of cement be put on the outside of the foundations in addition, then the prospect of a dry cellar may be reasonably indulged.

A. B. F. asks: How many cubic feet of water displacement does the United States government allow per ton for river steamboats, and for sailing vessels? A. About 35 feet.

O. N. E. asks: 1. What is the best battery for silver plating? A. Daniell's constant battery is a good one. 2. How can an old broken graphite crucible be made over into a new one? A. Powder fine, mix with water into a paste, mold, and dry or bake. 3. How can commercial zinc be purified so as to make suitable zincs for a battery? A. Zinc can be purified by distillation. 4. How much pure silver by weight is there in the United States dollar? A. A silver dollar weighs 412½ grains, and contains 900 parts of pure silver in 1,000; therefore $\frac{90}{100}$ of 412½ grains will give the pure silver by weight in a dollar = 371¼ grains. As to your other question, send to D. Van Nostrand for a catalogue.

J. W. B. asks: How can I grind a double convex lens accurately round, with a bevel on each side, to fit any sized frame? It is now done by hand. Can it be done by machine? A. Yes, by an iron wheel fed with sand and water, or a traversing emery wheel. Glass disks are cut out by a rotating vertical metal tube, fed with emery and water.

J. K. says: It is generally considered by scientific men that the sun is a body which emits heat as well as light. Now if the sun is a hot body, why are not the upper strata of the atmosphere heated to a higher degree of temperature than near the surface of the earth? According to the laws of heat, it decreases as the square of the distance increases: and by this law the upper strata of the atmosphere would be warmer than near the earth, which we know is not the case. Again, the annual mean average temperature of the earth in the warmest parts is 90°. The earth is 83,000,000 miles, and Mercury 38,000,000 miles from the sun. The square of the earth's distance is more than six times that of Mercury, nearly 6½ times, which would make the temperature of Mercury 607°-5°. It seems to me that Mercury must be in a state of fusion. I would like to know why it is colder as we ascend above the sea level for a distance of five miles, if the sun is a hot body? Is not the heat which we derive from the sun caused by friction of the rays of light passing through our atmosphere? A. The sun's rays are hotter at great elevations, but they pass through the air without warming it until absorbed and radiated from the surface. The aqueous vapor acts as hot house glass, preventing radiation.

M. J. T.—In reply to the answer given to W. M. W., which was to the effect that the end of the siphon that discharges the liquid should be on a lower level than the end into which it is drawn, M. J. T. says: "I have always supposed that a siphon would draw water to a level with the shortest leg. I don't see that it makes any difference which is the longest, or whether they are both of a length (or on a level). A. M. T. J. is substantially correct. The liquid will run so long as the discharge end of the siphon is below the level of the liquid.

W. R. B. asks: How is danger to the eye by burning prevented in looking at the sun with a powerful telescope? The eyepiece sun glass will not prevent the heat. Is it done by a diaphragm over the object glass, or how? Of what kind of glass is the sun glass made? Could not a large non-achromatic lens be connected by a small over-corrected lens placed near the focus of the large lens? A. A solar eyepiece may be made thus: Attach a short tube, which fits your eyepiece, at right angles to another which fits the eyepiece tube. Place a 1 inch plano-convex lens so that the center of the plane side forms an angle of 45° with the center of either tube. Ten per cent of the solar light and heat will then be reflected up to the eyepiece, and 90 per cent will pass out of the lens. A diaphragm over the objective may be used. Two sun glasses should be used together, a claret and a green one. The sun's image may be received upon a white sheet of paper with the full aperture.

J. M. D. says: 1. We find in Ray's "Astronomy," Chapter V: "If we would use a higher magnifying power, we must find some way to increase the light in the telescope this is done by enlarging the object glass." In constructing a cheap home made telescope would not a comoroma lens, 5 inches in diameter and of 72 inches focus, be a higher magnifying power and give more satisfaction for astronomical purposes than an achromatic lens 2 inches in diameter and of 30 inches focus? A. No, unless it were 90 feet focus. It would then bear a power of 190 only. 2. What is spherical aberration? A. Each zone of a spherical lens has a different focal plane, the outer zones having the shortest focus. 3. Is the sewing machine an American or an English invention? A. American. Howe took his first machine to London.

X. X. O. asks: Can you tell me of any combinations of chemicals that will remove the reddish cast of hemlock sole leather and give it the appearance of oak tanning? A. Try a neutral solution of perchloride of iron.

R. H. W. A. asks: 1. Can I use foil from chewing tobacco for coating a Leyden jar? A. Yes. 2. Please me a recipe for a cement for fastening glass to metal. A. Metals may be made to adhere to glass by a cement composed of powdered litharge 2 parts, white lead 1 part, boiled linseed oil 3 parts, mixed with 1 part of copal varnish to a thick paste.

G. E. K. Jr. says: In answer to E. D. E. you say that the earth turns on its axis 365 times in 365 days. I supposed that it only turned 364 times, the solar day being not a revolution of the earth once on its axis, but the return of the sun to a given meridian, which I think is less by about four minutes than a complete revolution (or sidereal day) on account of the onward motion of the earth in its orbit, which would necessarily make one day in a year if the earth did not turn on its axis at all. Am I not right? A. The tropical year, or interval between two successive passages of the sun through the mean vernal equinox, equals 365.2422 mean solar days, or 366.2422 sidereal days.

F. W. B. asks: 1. What chemical reaction takes place between carbolic acid and iodine, when they are mixed in solution? A. Little if any chemical action. The iodine colors the carbolic acid a dark reddish brown color. 2. Is it known whether the action of carbolic acid on iodine would produce such a change in the iodine as would alter the therapeutic action on the system? A. No.

J. H. B. asks: Can a man lift more with a rope over a large pulley than with one over a small pulley? A. In the case of a stiff rope, yes. It is harder to bend a stiff rope over a small pulley than over a large one.

F. A. says: I am told that the coins of the United States for one particular year are at present very scarce and valuable. Will you please tell me what year that is, and also what are the several present values of silver dollars of 1796 and 1799? A. Dollars of 1804, but three known. Dollars of 1794, very scarce. The rest are easily procured at a small premium, if at all rubbed or indented. No dollars were coined from 1805 to 1833. Half dollars of 1804, but one known. Of 1797, very rare. None coined from 1798 to 1800, or in 1816. Quarter dollars of 1823 and 1827, very rare. Coined irregularly until 1831. Dimes: Very rare for the four following years, varied in the order of their rarity: 1804, 1797, 1802, 1803. Coined yearly from 1827. Half dimes of 1804, but three known. Of 1794 and 1803, very scarce. None coined from 1806 to 1823. Three cent pieces of 1855, very scarce. Cents of 1793, 1799, and 1804, very rare. Coined yearly from 1793, except in 1815. Half cents of 1796, rare. Not coined in a regular series. But few of the gold pieces are very rare. The quarter eagle of 1797 is most valuable.

J. P. R. asks: How much power has an engine, 1 inch bore x 2 inches stroke, running at 200 revolutions per minute? How large a boiler should I have, and what kind of metal would be best? A. See article entitled "Indicating Steam Engines," in SCIENTIFIC AMERICAN for January 31, 1874. Allow about 20 square feet of heating surface for a horse power. You can make the boiler of copper or sheet or cast iron, whichever is most convenient.

I. S. S. asks: How thick should a cast lead sphere of 36 inches diameter be to stand a pressure of 35 lbs. to the square inch? How thick of 30 inches diameter? A. For the sphere, the bursting pressure is equal to the product of the tenacity of the material multiplied by the thickness, and divided by the diameter. For a cylinder, the bursting pressure is equal to the product of the first two terms, divided by the radius of the cylinder. From these rules you can find the necessary thickness.

W. D. G. asks: Why is it that in the block and tackle every additional pulley (the pulleys being all of one size) gives an increase of power? A. It is not true that every additional pulley increases the power, but it tends to increase the space over which the force acts in overcoming a given resistance; so that the same force can overcome more resistance, but requires a longer time. Thus the power developed, which is composed of force or pressure exerted over a distance, remains the same.

X. Y. Z. asks: 1. How can I make a small crucible? A. With fire clay, or a mixture of fire clay and plumbago. Your best plan will be to buy one. 2. What is laminated steel? A. It is a mixture of steel and iron. 3. Is $\frac{1}{180} \times 60$ = the chord of one minute? A. No.

M. E. asks: Why is it that, after digging a hole in the ground, the dirt will not fill it up as compactly as before? A. It will, if moistened and rammed.

C. E. M. is correct as to the weight of the 40 feet cube of granite. It should have been given at about 5,333 tons.

G. McK. asks: 1. How can I mend a hydraulic cylinder that has a very fine flaw in it? I cannot see the crack when I have no pressure on it. A. Possibly you can secure a patch with bolts, and braze the joint. 2. What is the best preparation for putting on a rope that has to run on or wrap around a small pulley under water, so as to make the rope last? A. Tar.

J. V. says: 1. We have a boiler of 40 inches diameter, 22 feet long, with two flues of 15 inches diameter. What should be the size of stack to insure the best draft? We have 16 square feet grate surface. Would that be enough to burn sawdust, provided the draft were strong enough? A. Make the area of chimney from $\frac{1}{4}$ to $\frac{1}{10}$ area of grate. 2. Which saw will cut the easier for both hard and soft wood, the one which is swaged sufficiently for clearance, or one in which the teeth are sprung for set? A. This is a question between rival manufacturers. It can readily be determined by experiment. 3. How can I make the most durable friction wheel, for the feed of a circular saw? A. Probably cast iron will be as suitable as anything.

E. B. L. says: 1. Some of our steamboat chimneys get very hot when running, and others keep quite cool. What are the cause and remedy? A. It is because of improper design in the boilers, or on account of unduly forcing the fires. 2. Is there anything I can put on pine plank to make it fireproof or incombustible? A. There are several varieties of paint that are said to make wood fireproof.

J. B. says: I have some young evergreen trees growing under some walnut trees, but they do not thrive. Can you tell me the reason? A. The reason is that the walnuts shade the evergreens and deprive their roots of proper nourishment. As an antidote, remove the trees where each may have abundance of air, light, and root space.

F. H. H. asks: Why does water form an exception to the law of contraction by cold? What are the principles of its expansion when turning to ice? A. One volume of water at 81° gives 1.102 of ice at the same temperature. There is then an increase of one tenth of the volume in passing from the liquid to the solid condition, the temperature remaining the same. But previously fixing themselves rigidly in certain positions so as to form crystals of ice, the particles of water take up relative positions with regard to one another, in which they occupy a larger volume.

A. T. R. asks: What is the principle on which the Giffard injector works? A. The steam imparts sufficient velocity to the water with which it comes in contact to overcome the resistance offered by the pressure within the boiler.

Z. Z. asks: 1. What is the coloring matter of the leaves of plants? A. The coloring matters of flowers are referred to three distinct substances by certain chemists, one of which is a blue or rose color, while the other two are yellow. The former is produced by a compound which has been termed cyanin. Cyanin may be obtained from the petals of the violet or of the iris. To the yellow matter which is insoluble in water the name of xanthine is given, and to the yellow matter which is soluble, the name of xanthone. See article "Chromatology," Quarterly Journal of Science, 1873. 2. Are not the metals of the highest specific gravity the scarcest, and is not this caused by their sinking near the center of earth when the earth was in its molten state? A. The rare metals, which are also noble metals, are of great specific gravity, and many geologists have supposed that this had a close connection with their slight diffusion. But it is a theory difficult of satisfactory demonstration.

J. C. M. asks: 1. How are the salts of nickel and ammonia used for plating? A. See pp. 91, 139, vol. 29. 2. How is wood stained in imitation of ebony? A. Steep the wood for two or three days in lukewarm water, in which a little alum has been dissolved; then put a handful of logwood, cut small, into a pint of water, and boil it down to less than half a pint. If a little indigo is added, the color will be more beautiful. Spread a layer of this liquor quite hot on the wood with a pencil, which will give it a violet color. When it is dry, spread on another layer, dry it again, and give it a third; then boil verdigris at discretion in its own vinegar, and spread a layer of it on the wood; when it is dry, rub it with a brush, and then with oiled chamois skin. 3. What is your price for binding two volumes (in one book) of the SCIENTIFIC AMERICAN? A. Two dollars.

W. T. says (in reply to J. H. P., who says: Astronomers tell us that the earth for ages past has been gradually cooling, but the glacial theory necessitates the belief that the earth was once much colder than it is at present. Has any attempt been made to reconcile the two theories?): Allow me to answer this question. Such an attempt has been made, and it seems, very successfully, by the celebrated geologist Oscar Von Heer. Astronomers tell us that the sun, with the earth and the other planets, is steadily progressing in space, moving in a very long period around its central body, very probably the star Alpha Centauri. It is almost certain that matter is not equally distributed in space, and that there are regions of the heavens where there are more celestial bodies in one given space than another, and consequently these regions are warmer from the heat coming forth from the stars, which all are surrounded by glowing gases, as the spectroscopic proves. But in the regions in which they are less abundant, the temperature is colder. O. Von Heer now suggests that formerly, especially during the eocene period, the sun (with the earth) was in a region thronged with stars, and therefore the climate on earth was warmer than it is now; and by gradually progressing to other regions, the climate became colder and colder, until the lowest temperature was reached in the glacial period, and that it moves now to regions that are warmer again. It is my opinion that the earth's heat has not affected its climate since the end of the jurassic period at least, and perhaps very much earlier.

J. L. R. says, in answer to F. O. C. H., who asked how to put a patch on a boiler with bolts so as not to leak: "I put one on a boiler about two months ago, and it does not leak and never will. The patch was 24 bolts long and 4 wide, over where the sheets were riveted. The inside sheet was cracked from one hole to the other for that length. Proceed as follows: Punch or drill your holes and fit the patch to the boiler; make the holes to fit well for $\frac{1}{4}$ bolts $1\frac{1}{2}$ inches long, with heads of 1 inch, made solid, and good threads. Put 4 rounds of candle wick with stiff white lead round each bolt and draw it tight. In putting the bolts in, have the heads square with the boiler, and hold them so; be sure not to let them turn. After screwing on the nuts, hammer the heads down hard and screw again, also hammer the patch after it is screwed tight. Caulk the same as a new boiler. It may leak a little before you get up steam; but when you get 30 lbs., and your engine started, it will be tight and will stay so."

M. Y. R. says that P. and G. G. can make a good invisible ink, that will appear upon the application of water, by dissolving powdered alum in the juice of a lemon; the density of the ink is procured by the amount of alum used, but half a teaspoonful to the juice of one lemon is enough.

C. D. S. says to J. H. P., who asks if any attempt has been made to reconcile the glacial theory with the theory that the earth was once in a molten state: The reason assigned by Benton for the change of climate which caused the glacial epoch (is that the axis of the earth may not have had the same inclination to the plane of its orbit during the glacial epoch as at present; at the early stage of the earth's existence, volcanic action must have been much more frequent and powerful than at present, and this volcanic action may have caused an upheaval at some point of the surface, accompanied by a corresponding depression at an opposite point, which would be sufficient to alter the center of gravity to such an extent as to change the inclination of the earth's axis to the plane of its orbit. As there is no trace of glacial action within the tropics, some geologists contend that the part of the northern hemisphere on which traces of glacial action are found may have occupied a position analogous to the poles of the earth at present. For a full and satisfactory explanation of this and many other points, read Benton's "Lectures on Geology in America."

S. T. says, in reply to H. C. R., who asks for a plan for an apron for a double ended ferry boat: "The first engine I ever handled was on such a boat on the Ohio river, and the two aprons were hung to the bow and stern decks, much as a barn door is hung, with the difference that the battens were of box timber and 24 feet long. The apron was 10 feet long. The apron boards were bolted to under side of timbers, and long iron hinges were bolted to apron and deck. This method throws the timbers near each side of the boat, out of the way of teams; and a large clevis on deck, looping over end of timbers, secured the apron up when crossing. On nearing shore, the clevis was dropped off, letting the apron fall on shore. The steering gear had a pin fast in its balance center, and a hole in the outboard of either apron to receive it, so that both ends of the boat could go ahead."

C. S. says that J. H. P. can cure the gapes in his chickens by taking a stiff horsehair, some eight inches long, making a loop of it, putting it down the chicken's throat, and withdrawing it quickly, two or three times, for as many days. This is a sure cure.

F. A. R. says, in reply to P.'s query as to hydrogen: Probably your zinc is too pure; sometimes we are compelled to use very pure zinc and sulphuric acid, and then the hydrogen will come out very slowly, the pure zinc resisting the action of the sulphuric acid. By adding a few drops of chloride of platinum, however, the hydrogen will be produced very quickly, and probably sulphate of copper would be just as well for your purposes as chloride of platinum.

W. S. X. says, in answer to J. H. D., who asks how to reverse an engine: First make a mark on the side of the eccentric, near the shaft, with a scribe or small chisel; make a corresponding mark on the shaft at the same point, then place one point of a pair of callipers on the mark on the shaft, and with the other point find the center of the shaft on the opposite side. Then, with a scribe, mark this point also. Now unscrew the eccentric and move it around in the direction in which the engine is intended to run, until the mark on the eccentric comes into line with the second mark on the shaft; then make the eccentric fast, and the engine will run in the opposite direction. It does not make any difference in what direction the crank is when the eccentric is moved.

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

A. M. G.—No. 1 is oxide of iron; No. 2, quartzose rock.

W. N. L.—These two specimens are iron pyrites.

J. W. Z.—No. 1 is clay ironstone; No. 2, sandstone impregnated with oxide of iron; No. 3, the same as No. 2; No. 4, brown ochre, a clay colored with oxide of iron. This might be of service as a pigment.

M. D. W.—This material is shale.

J. P. M.—This is an impure clay.

C. J. H.—The specimen sent is limestone. In answer to your other question: We know of no such process, but you can experiment.

G. W. S.—The sample is an impure silicate of alumina.

G. & W.—One of these specimens is a fossil bone, and the other argenteiferous galena. The subscription price of this journal is \$5 per annum, in all parts of the United States.

W. R. Jr.—Your specimen is an alloy consisting of copper and zinc, in other words, brass. It is possible that a piece of brass may have accidentally fallen into the stamp copper. Native brass has not as yet been found.

M. R. asks: 1. How are sewing machines japanned, what ingredients are used, and how are they applied?—O. S. asks: If 2,000 feet of 5 inch iron pipe is supplied by a pump driven by 24 horse power, will it be any advantage to attach a similar pump, driven by 18 horse power, at the other extremity of the main pipe, in throwing water from a hydrant placed in the center? If so, what?—J. C. C. asks: After being drowned, how long will a person lie under water before he will rise? Is there any difference in the time between fresh and salt water? What is the cause of the rising? If it be gas, what produces it? What is the theory of firing cannons over the water where it is supposed that a person has been drowned?—E. H. K. asks: In the drive wheel of the locomotive engine, where does natural philosophy place the fulcrum, the power and the weight respectively?—E. C. B. asks: What do jewellers use for cleaning diamonds? Is it a solution of arsenic or potash?—J. A. McC. Jr. says: Take a tube, 3-16 inch in diameter, of any length, and cut a round piece of pasteboard $2\frac{1}{2}$ inches in diameter. Make a hole in the center of the board, and insert one end of the tube in the hole;



then cut a round piece of paper of the same size as the pasteboard; place it on the pasteboard, and the other end of the tube in the mouth, and the strongest lungs cannot blow the paper off. Will you give me the philosophy of it?—D. says: I see in the SCIENTIFIC AMERICAN that Dr. Brown-Séquard advises people to cultivate the use of the left hand and left side of the body, thus exercising the left lobe of the brain, teaching it to think. He recommends learning to write with the left hand. Can any of the readers of the SCIENTIFIC AMERICAN give directions for the proper holding of the pen and the proper slope of the writing in left-handed penmanship?

COMMUNICATIONS RECEIVED.

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

On Steam Boiler Explosions. By W. M. D.
On the Attraction of the Sun and the Earth. By A. D., and by A. F.
On a Problem, etc. By G. W. E.
On an Aurora visible in Michigan. By B. B. S.
On Preventing Scale in Boilers. By C. L. E.
On the Beech Blight. By D. E. R.
On the Chameleon. By H. A. H. G.
On the Philosopher's Hunt. By T. H. C.
On a Double Lamb. By J. H. P.
On some Useful Recipes. By C. B. L.

Also enquiries and answers from the following:

T. O'D.—E. F. J.—J. B. S. H.—G. N.—D. F.
Correspondents in different parts of the country ask: Who makes back rests for holding lumber in a lathe? Who sells small brick-making machines? Who sells lath-splitting machines? Who makes artesian well boring machinery? Makers of the above articles will probably promote their interests by advertising, in reply, in the SCIENTIFIC AMERICAN.

Several correspondents request us to publish replies to their enquiries about the patentability of their inventions, etc. Such enquiries will only be answered by letter, and the parties should give their addresses.

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

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

April 7, 1874,

AND EACH BEARING THAT DATE.

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APPLICATIONS FOR EXTENSION.
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:

29,085.—CENTER BOARD VESSEL.—C. E. Ketchum et al. June 24.
29,126.—REVOLVING FIRE ARM.—A. J. Gibson. June 24.
29,300.—STEERING VESSELS.—F. E. Sickels. July 1.
29,321.—GRIDIRON.—J. S. Brooks. July 8.
29,409.—RAILROAD CATTLE CAR.—J. B. Shafer. July 15.

EXTENSIONS GRANTED.
27,781.—CLOTHES WRINGER.—E. Dickerman.
27,809.—WASHING MACHINE.—J. Johnson.
27,821.—EXTENSION LADDER.—G. B. Mickel et al.
27,832.—HARVESTER.—L. C. Reese.
27,839.—STREET SWEEPING MACHINE.—R. A. Smith.
27,846.—BELTING.—H. Underwood.
27,852.—HARVESTING MACHINE.—B. F. Witt.
27,855.—NIGHT LIGHT PROTECTOR.—J. Wyberd.
27,860.—LOOM.—J. C. Cooke.
27,866.—COTTON BALE TIE.—J. McMurtry.

DISCLAIMERS.
27,781.—CLOTHES WRINGER.—E. Dickerman.
27,832.—HARVESTER.—L. C. Reese.
27,839.—STREET CLEANING MACHINE.—R. A. Smith.

TRADE MARKS REGISTERED.
1,708.—BOBBINS.—J. H. Bullard, Chicopee Falls, Mass.
1,709.—WHISKY.—Harthill & Co., Louisville, Ky.
1,710 & 1,711.—WHISKIES.—G. W. Kidd & Co., N. Y. city.
1,712.—CANNED OYSTERS.—H. M. Rowe & Co., Balt., Md.
1,713.—PERFUMERY, ETC.—B. F. Ulmer, Savannah, Ga.
1,714.—FERTILIZERS.—Walton & Co., Wilmington, Del.
1,715.—STOVES.—Western Stove Mfg Co., St. Louis, Mo.

DESIGNS PATENTED.
7,350 to 7,354.—CENTER PIECES.—H. Berger, N. Y. city.
7,355.—LOUNGE BACKS.—H. S. Carter, Chicago, Ill.
7,356.—BIRD CAGE.—G. R. Osborn et al., New York city.
7,357 & 7,358.—COFFIN PLATES.—W. M. Smith, West Meriden, Conn.
7,359.—CENTER PIECE.—H. Berger, New York city.
7,360.—ARM HOLDER.—S. H. Cate, Watertown, Mass.
7,361.—SPOON HANDLES, ETC.—J. H. Galloway, N. Y. city.
7,362.—MAIL BOX FRONT.—W. Gorman, New Britain, Conn.
7,363.—CENTER PIECE.—S. Kellett, San Francisco, Cal.
7,364.—DISHES.—M. Sweeney, Wheeling, W. Va.

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
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On application for Extension of Patent.....\$50
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On an application for Design (3½ years).....\$10
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On application for Design (14 years).....\$30

CANADIAN PATENTS.
LIST OF PATENTS GRANTED IN CANADA.
APRIL 8 to APRIL 10, 1874.

3,280.—B. G. Martin, New York city, U. S. Improvements on presses, called "The Martin Press." April 8, 1874.
3,281.—H. Cobley, Toronto, Ont. Improvements on boots and shoes, called "Cobley's Anthydric Boots and Shoes." April 8, 1874.
3,282.—Edward Beanes, Toronto, Ont. Extension of patent No. 511. A process for improvements in brewing, called "Improvements in Brewing." April 10, 1874.
3,283.—D. N. B. Coffin, the Younger, T. H. Johnston, and B. Woodward, Boston, Middlesex county, Mass., U. S. Extension of a provincial patent for improvements in capstans and windlasses. April 8, 1874.
3,284.—A. Fritz, Dayton, Montgomery county, O., U. S. Improvements on car couplings, called "The Fritz Automatic Car Coupling." April 10, 1874.
3,285.—James Inglis, Montreal, P. Q. An article to be used in the process of sensitizing glass or other plates for photographic purposes, called "Inglis's Sensitizing Frame." April 10, 1874.
3,286.—J. A. Tripper and A. R. Giles, Ottawa, Ont. Improvements on a machine for washing clothes, called "The Canadian Washer." April 10, 1874.
3,287.—D. B. Wazgner and I. H. Breed, Philadelphia, Philadelphia county, Pa., U. S. Improvement on fire extinguisher, called "The Triumph Fire Extinguisher." April 10, 1874.
3,288.—W. F. Hale, Brockport, Monroe county, N. Y., U. S. Improvements on circular saws, called "Hale's Circular Saw." April 10, 1874.
3,289.—W. F. Hale, Brockport, Monroe county, N. Y., U. S. Improvements on circular gang sawing machines, called "Hale's Circular Gang Sawing Machine." April 10, 1874.
3,290.—I. Newton, Cleveland, Cuyahoga county, O. Improvements on carriage bolts, called "Newton's Improved Carriage Bolt." April 10, 1874.

3,291.—C. H. Thurston, Marlborough, N. H. Useful invention having reference to wooden knobs, closet pins, or handles, called "The Thurston Knob." April 10, 1874.
3,292.—R. Smallwood, Charlottetown, Queen's county, P. E. Island. Improvements on shingle sawing machines, called "Smallwood's Lever Feed for Shingle Sawing Machines." April 10, 1874.
3,293.—T. H. Marsh, Toronto, York county, Ont. Useful agitator to be used in pigeon and bird shooting from the trap, called "Marsh's Agitator." April 10, 1874.

Advertisements.

Back Page - - - - - \$1.00 a line.
Inside Page - - - - - 75 cents a line.
Engravings may head advertisements at the same rate per line, by measurement, as the letter press. Advertisements must be received at publication office as early as Friday morning to appear in next issue.

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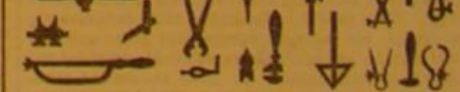
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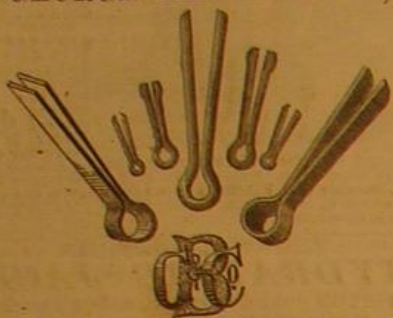
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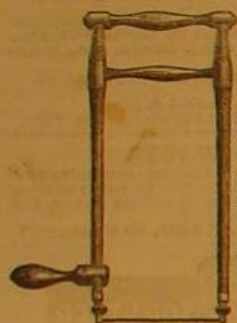
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Vol. XXX.—No 20.
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NEW YORK, MAY 16, 1874.

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THE DAYTON CAM PUMP.

Our engraving represents an improved direct and double acting steam piston pump, which, it is claimed, is absolutely positive in its action, simple in construction, and economical in the use of steam. The principal feature is the mode of working the steam valve by means of a cam bolted on the piston rod and moving with it. By the shape of this cam the stroke is rendered slower at each end, thereby giving time for the water cylinder to fill. A full stream is thus insured, and the pump is prevented from cushioning against the water when the cylinder is but half filled. The arrangement is such that the valve cannot be thrown into such a position as to shut off steam and stop the pump. The operation of the mechanism needs no further description, as the reader will readily understand the adaptation of the various parts to each other from an inspection of the annexed illustration. It will be seen that there are no dead centers and that the action is absolutely positive. The arrangement of the cam movement, in connection with the piston, causes the water valves to lift and to set easily and without jar, thereby saving the wear and tear of valves and seats. The maximum of speed is attained when the valves are lifted and the water is flowing.

The manufacturers, in enumerating the various advantages of the apparatus, point out especially the simplicity of its construction, strong and durable material being used, and the various parts so constructed as to be readily accessible. There are no small intricate steam passages to fill up with dirt and grease, and the water valve chambers may be easily opened to reach the valves. The steam valve, being of the plain slide description, is also not liable to become out of order.

The pump, it is stated, will start at any part of the stroke, discharging the condensed water, and will lift either hot or cold water equally well, without change of valves. It can be

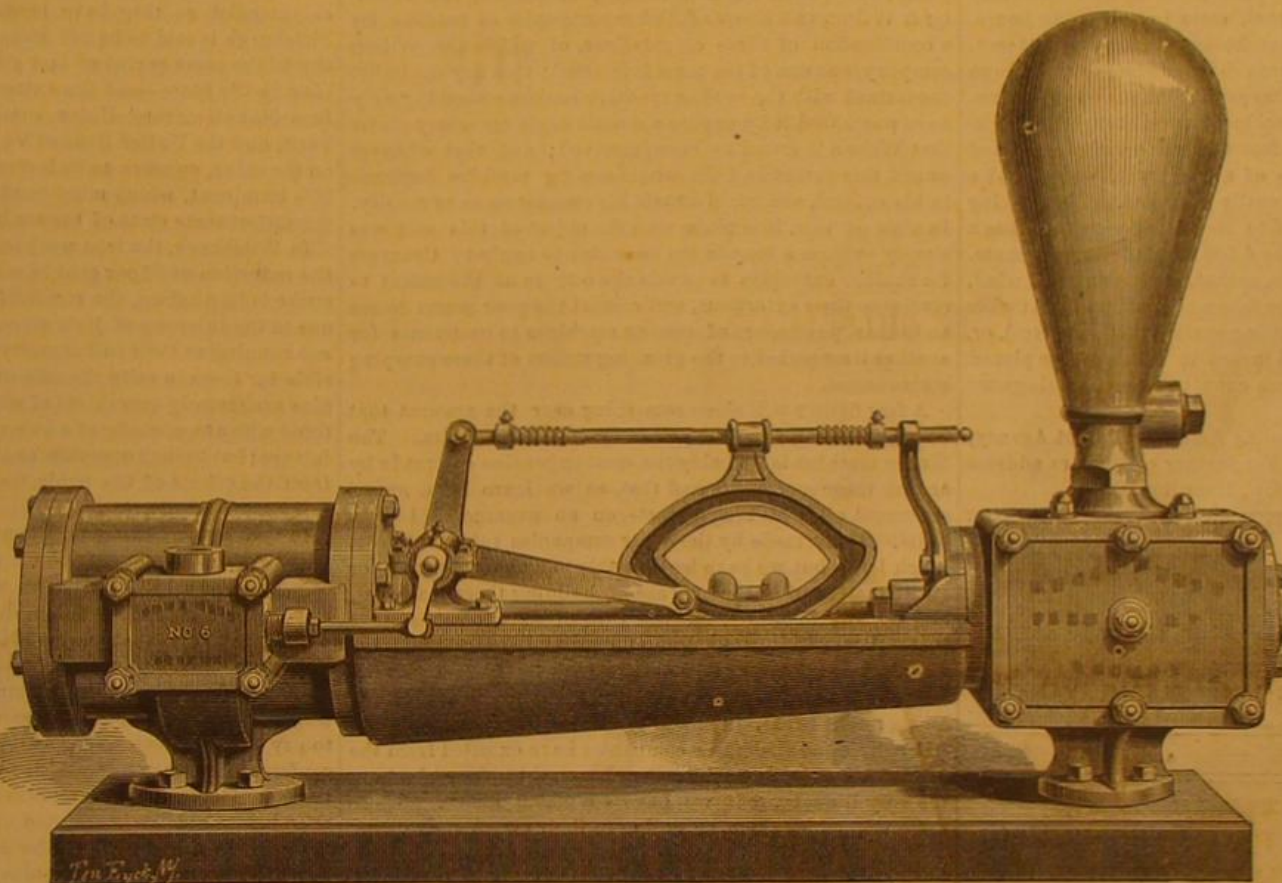
used as a boiler feeder, or a fire and marine pump combined, and, it is claimed, will pump water at a temperature of 211°. Either water or steam pressure may be used as a motive power; a No. 2 boiler feeder, it is stated, has run at 25 double strokes per minute with only 20 lbs. water pressure. The steam cylinders are fitted with a patent metallic spring packing, and the water cylinders with a packing of linen rubber.

The boiler feeders are well adapted for forcing water under great pressure or to a high elevation. One pump of this description, the manufacturers state, fed water at 210° from a heater, against 80 lbs. boiler pressure, and gained a medal

and those above described as boiler feeders, is that the steam cylinders are much smaller, as it requires less pressure to do the work.

A class of low pressure pumps is also manufactured, which can be used in connection with a low pressure heating apparatus, thereby saving extra boiler and machinery. These are quite useful in case of fire, as the areas of the steam cylinders are as 9 to 1 of the water cylinders. The fire pumps constructed on the same general model are adapted for use in high buildings and for throwing water to great elevations.

The machine is well adapted for all the various uses to which steam pumps are applied, for employment in industrial establishments of all kinds, and for lifting oils, acids, and, in brief, any kind of liquid. It is manufactured by the Barney and Smith Manufacturing Company, car builders, Dayton, Ohio, an old and well known concern, whose excellent reputation is, perhaps, the best guarantee of the superiority of their productions.



THE DAYTON CAM PUMP.

over four competing pumps at the Cincinnati Industrial Exposition, 1873. For supplying tanks at railway stations, a compact steam boiler is furnished for driving the pump, the whole cost of the apparatus, it is stated, being less than that necessary to equip a station for pumping by horse power or caloric engine. The boiler is fed by means of a plunger pump attached to the piston rod of the main pump. The only difference, between the machines thus adap-

quently planed from five inches to one sixteenth inch thick below the cylinder, thereby insuring straight, smooth and even surfaces, or it may be simply planed out of wurd, to a thickness, or smoothed off at the will of the operator. This improvement enables the machine to perform a large variety of work, and allows of the finishing of pieces after they are framed together, dispensing with bench finishing to a great extent.

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Fig. 1

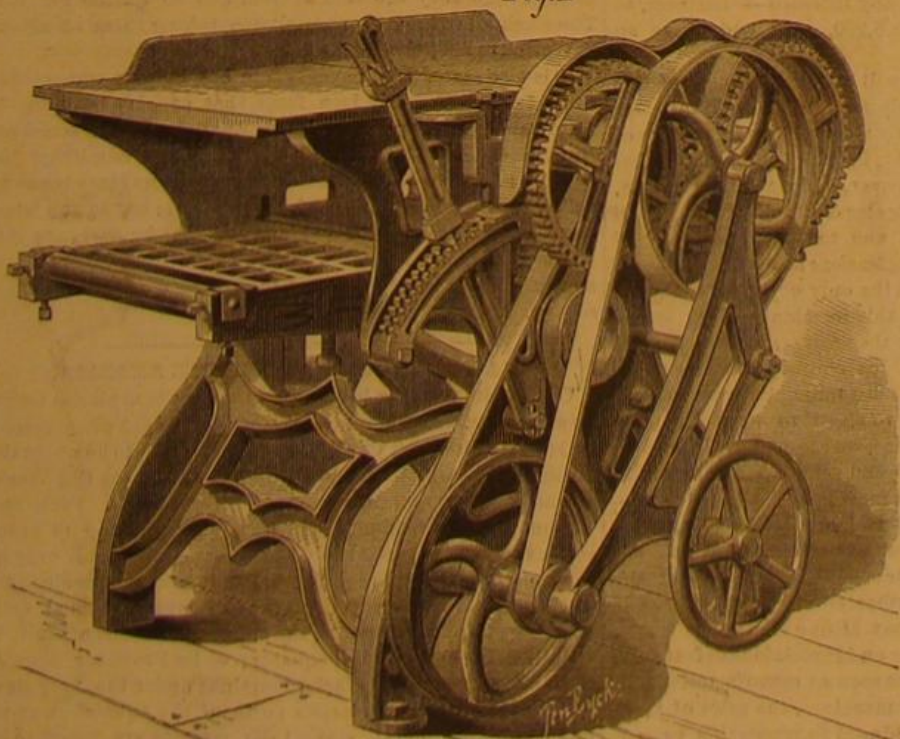
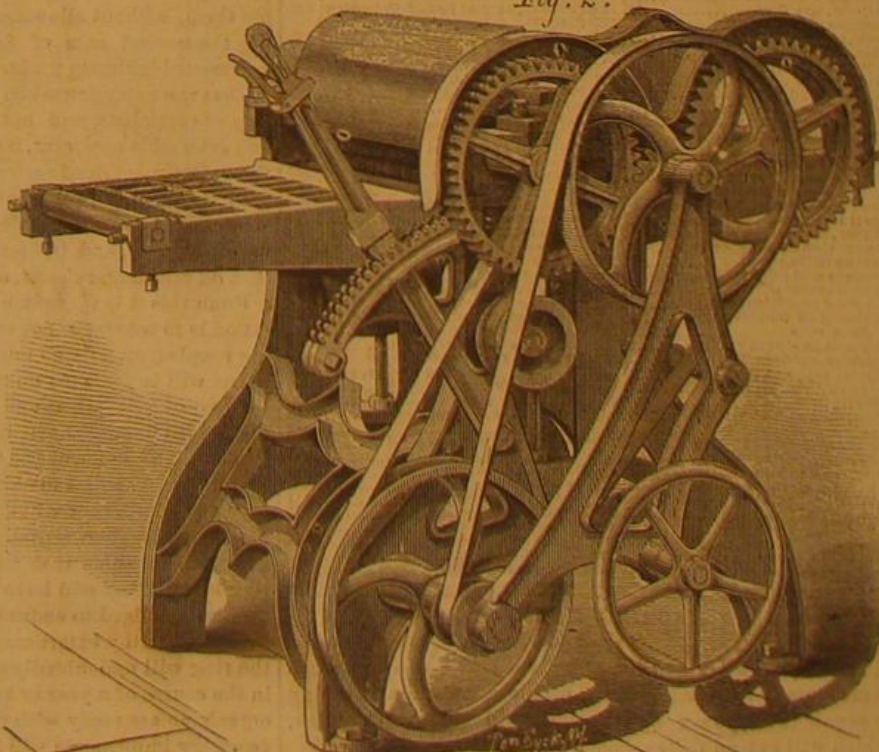


Fig. 2.



THE HAMILTON SURFACE PLANER.

Two different kinds of these surface planers are manufactured, with or without the attachment to plane out of wind above the cylinder. Referring to the accompanying engravings, Fig. 1 represents the surfacer, with attachment to plane above as well as below the cylinder. Fig. 2 represents the same planer without the attachment to plane above the cylinder, and only for planing below the cutter head. Three sizes of each of the two machines are made, to plane 24 inches, 20 inches, and 16 inches wide. The difference is only in the width, all working parts being the same. The frame of the machine is strong and heavy, the joints are carefully planed and then bolted together, and the table is cast in a solid piece, resting on two slides and screws, which are operated simultaneously by one hand wheel. An index attached to the table shows at a glance the different thicknesses to be planed, from five inches down to one sixteenth of an inch. There are six feed rollers, made of the best wrought iron, four resting in the solid table. The center feed rollers, of which one is fluted, are close to the cutter head, so that short as well as long material may be planed without clipping the ends. The gear wheels are very strong and are covered with a bonnet to keep them free from dust and shavings. An adjustable roller scraper is attached to the back feed roller to keep it free from gummy matter. The feed rollers are all adjustable, and the front and back pressure feed rollers are kept down by strong spiral brass springs, which can be easily adjusted and furnish an even yielding pressure. The pressure bar is also of a new construction and is held to its place and evenly forced down where the pressure is needed. The cutter head has a cast steel journal, rests in self oiling boxes, and is made with two or three knives, as may be ordered. The bonnet and feed roller apron can be swung to the side so as to enable the operator to sharpen the knives whenever necessary. The feed of the machine can be changed by a patent differential pulley, from fast to slow or *vice versa*, and started or stopped by means of a feed lever, which is of a new construction and very easily operated. The driving pulley on the cylinder is of five inches diameter and has a five inch face, and should make 4,000 revolutions per minute. The upper tables are adjustable, so that, in planing out of wind, a cut from 1-32 to $\frac{1}{4}$ inch can be taken on stuff up to 24 inches in width (the width of the cutting surface of the knives), or, in other words, stuff up to 24 inches in width can be planed out of wind, from 1-32 to $\frac{1}{4}$ inch cut at one time, passing over the cutter head.

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THE SEWING MACHINE MONOPOLISTS AGAIN AT WORK.

The sewing machine ring, not content with the enormous sums already extorted from the people, are again attempting to renew their power by lobbying a bill through Congress, which will extend their monopoly for seven years longer.

The A. B. Wilson feed patent was granted for one of the first abortive attempts to make a practical sewing machine;

but so imperfect and crude was the model, filed with the application, that we doubt if any machine constructed like it was ever used, or was capable of being used practically. Yet as it happens that this is the first case in the Patent Office that shows an approximation to the modern feed motion, the patent has been construed by the courts to cover all styles of feeding devices in which the cloth can be turned around the needle, or in which the cloth is fed between two clamping surfaces. In view of these decisions of the courts, although the patent was granted for an impracticable machine, the Commissioner of Patents extended it for seven years; and Wilson, with an eye to the present application for an extension, immediately sold, for the comparatively insignificant sum of \$50,000, all his rights to Messrs. Wheeler & Potter, as trustees for the Wheeler & Wilson, Grover & Baker, and Singer companies, and it has ever since been held and used in common by those companies as their most effectual instrument in monopolizing the sewing machine business, and in extorting millions yearly from the poorest and worst paid people in the land. On the strength of the small amount of money for which Wilson sold his patent, the combination now wants to have the privilege of plundering the people for seven years longer. In considering this sale of \$50,000, it should be remembered that this valuable patent was not owned by a poor man who was obliged to sell his rights for a mess of pottage; the wealthy Wheeler & Wilson Manufacturing Company were doing business amounting to millions of dollars yearly, of which three fourths were clear profit; the patent was sold to the presidents of the Wheeler & Wilson and Grover & Baker companies as trustees for a combination of three corporations, of which the Wilson company was one of the most interested; that any capitalist conversant with the sewing machine business would gladly have purchased it by paying a double eagle for every dollar that Wilson is stated to have received; and that whoever owned this patent had the whole sewing machine business in his control, and could dictate his own terms as to royalty. In view of this, it is plain that the object of this sale was simply to form a foundation on which to apply to Congress for another extension to enable the owners of the patent to continue their extortions, and compel the poor seamstresses and other purchasers of sewing machines to contribute for another long period to the groaning coffers of these grasping corporations.

A few figures will show something near the amount that has been wrung from the people by these cormorants. The Singer machine is probably the most expensive one made by any of these companies, and that, as we learn by a sworn statement of I. M. Singer, costs, on an average, \$11.83 to build. Those made by the other companies referred to cost much less; but we have been unable to find any reliable or sworn statement of the expense of building these machines, and we will therefore, for the sake of argument, estimate them at the same price. The plainest and cheapest of these machines are priced at \$55 dollars each. If from this we deduct \$25 as a fair selling price (which would be considered an enormous profit, in any other business, on a first cost of \$11.83), we find that these companies have extorted from the people \$30 on each machine they have sold, over and above the very liberal profit we have estimated above. These three companies alone, according to their sworn statements, sold, in 1872, 445,776 machines; and if one fourth of these were exported, the balance sold in the United States will amount to 334,332. Now multiply this by the \$30 above the fair profit, and the product gives the enormous amount of \$10,029,960. If, in addition to this, we deduct one fourth, for export, from the number of machines sold by the favored licensees of these companies, we have a balance of 289,788; and if we multiply this by the \$30 as before, we have a product of \$8,693,640, which, added to the above, will give us a grand total of \$18,723,600 as the amount extorted, mainly from the poorest and neediest of the people of the United States, in one year alone, by the operations of this ring, who, not content with this wholesale robbery so far, want the privilege of continuing it seven years longer; which will enable them, without allowing for any increase of business, to bag the modest sum of \$131,065,200, over and above an enormous legitimate profit.

That the extension asked for will be for the benefit of this ring of capitalists, and not solely for the poor (?) inventor and ostensible applicant, is clearly shown by an inspection of the before mentioned assignment, in which it is stated that "I have assigned, sold, and set over, and do hereby assign, sell, and set over unto said Wheeler & Potter * * * all my right, title, and interest in and to the same * * * with all renewals, reissues, and extensions thereof."

From this it is very plain that the only object of this application is to renew the power of this formidable ring; and if the people generally do not stir themselves, this mighty incubus will be fastened on them for seven years longer, as the best of legal talent and the most influential members of the "third house" have been retained to work the case through. The sum of \$50,000 has, we are credibly informed, been raised as a first instalment and sent to Washington to be "placed where it will do the most good;" and if the people do not let their representatives know their will on this point, it is possible that the weighty reasons of which the ring is so lavish will have their usual influence, and the people be obliged to endure another seven years' servitude to these wealthy extortioners; but if due efforts are made, the ring will undoubtedly suffer an ignominious defeat; and in the course of a year or two, as soon as manufactories now organizing are ready with their machines, the price of these necessary implements will be reduced to reasonable proportions, as machines can be built which may be sold at a good profit at from \$15 to \$20 each.

THE DEPRESSION IN THE IRON TRADE.

"The iron trade," says Mr. Samuel J. Reeves, President of the Iron and Steel Association, and also of the Phoenix Iron Works, the largest establishment in the country producing manufactured iron, "has not been so bad for fifteen years; and there is little prospect of improvement before the fall." Manufactured iron, according to the same authority, is a drug; the demand is less than that of three months since, and the delay of Congress to settle the vexed question of the currency, the late panic, and the strikes, past and impending, have, it appears, all contributed to produce a condition of affairs, in one of the most important branches of the national industry, which indicate widespread and alarming distress.

A brief review of the course of business during the past twelve months shows that, up to the summer of last year, trade was quite brisk and iron in demand at moderate rates. The year bid fair to be a prosperous one until the opening of autumn, when a falling off took place, followed by the financial crash which blocked business. Still trade dragged on until February of the present year, when, in the opinion of some, a very slight improvement took place, and has continued; others however, maintaining that such is not the case, and for a reason point to the fact that the demand for manufactured iron is far below the average. A correspondent of the *Tribune* says that new railroad improvements are at a comparative standstill; railroads in operation are doing only a limited carrying traffic; the coal market is dull and flat, and operations in improvements are not by any means as extended as they have been. The product of rails at Pittsburgh is said to be not more than one fourth the quantity of the same period of last year—630 furnaces are out of blast in the State—and the antagonism existing between the Iron Manufacturers' Union, composed of capitalists on one hand, and the United Sons of Vulcan, of puddlers and boilers on the other, appears to be increasing, rendering labor troubles imminent, which must tend still further to complicate the unfortunate state of the trade.

In Pittsburgh, the iron workers are becoming restive under the reduction of 20 per cent in wages since the panic, and a strike is impending, the result of which cannot but be ruinous to the interests of both sides. The leading houses are not running at their full capacity, and declare that is impossible for them to raise the rate of wages because their margins are scarcely two thirds of what they were last year. To those who are working at a loss, strikes are a matter of indifference; but to such operators as are striving to lift themselves from the effects of the panic, the closing of the works will bring renewed distress.

In the eastern section of Pennsylvania, the points of dispute between employers and employed are the sliding scale of wages and arbitration. The workmen, the vast majority of whom belong to the union, demand that their wages be so adjusted that when prices of iron advance they shall participate in the manufacturers' gains, and conversely share in the losses in times of depression. The employers are opposed to these conditions and assert their right and privilege to pay the men such wages as they choose. Arbitration is a conference between a committee for the Central Union and the manufacturers, which aims to settle difficulties which may arise before a strike is resorted to. Eastern operatives, it is said, dislike the unions and the established scale. West of the Alleghenies, both are quite widely recognized. Thus affairs now stand, and it is to be hoped that an amicable settlement may in the end be reached, though at the present time none seems clearly apparent.

The reports in the English journals show that the British iron trade is suffering severely from foreign competition, and that it is probable that the advantage of the increased imports to us, necessitated by the difficulties in our domestic productions, will be secured by continental manufacturers to a much greater extent than by those of England. The *Iron-monger* affirms that iron making in Great Britain is not only profitless but attended with loss. A ton of rails made in South Wales and delivered actually costs \$70.25, while at the present time they are sold at from \$45 to \$47.50 per ton. The slackness of orders necessitates taking them at almost any price to keep the works going.

It is also stated that never before has Belgian competition proved so severe. Bar iron from that country is offered in England at \$52.50 per ton, which English masters could not furnish at less than \$62.50. Iron, while admitting the state of affairs to be bad, predicted some time since renewed activity, owing to the falling prices of fuel; but in the latest issues received, the trade summary of that journal says that business is in a state of suspense, and will probably remain so until the prices of fuel and the wages question are again settled.

GLACIAL REMAINS IN CENTRAL AMERICA.

Until quite recently it has been thought that glacial action on any extensive scale was altogether a northern phenomenon. Its southern limit on this continent appearing to be about the latitude of Washington and St. Louis, and in the Old World a line of corresponding temperature, that of Paris and Vienna. Lately evidence has been accumulating to prove the prevalence of glacial cold at the same time, not only in the southern hemisphere but practically over the greater part of the globe. Professor Hart has discovered glacial drift all the way from Patagonia, its supposed northern limit, to within ten degrees of the equator; while Professor Agassiz claimed to have found glacial moraines under the very line. The development of glaciers north of the equator was no doubt equally general, since their remains are found to be abundant where they might have been least expected, in the most central part of Central America. At Libertad, the

center of the mining region of Chontales, on the northeastern shore of Lake Nicaragua, the author of "The Naturalist in Nicaragua" observed transported boulders that gave unmistakable proofs of ice action, while in the adjoining district of Matagalpa the evidences were overwhelming. All along the eastern flank of the sierra are ranges of boulder clay, some of them exceeding a thousand or twelve hundred feet in height, made up entirely of a brown clay mixed with angular and partly rounded blocks of stone derived from the higher mountains to the west. These ridges were particularly observed by Mr. Bell between San Rafael and Yales and northward to Ocotal, the capital of Segovia. A section of strata between Ocotal and Depilto, a small silver mining town nine miles nearer the boundary of Honduras, shows very clearly the depth and importance of the glacial deposits. At Depilto the rock appears to be Laurentian, great, bare, rounded masses of hard quartzite protruding through the scanty soil, while the river bed is filled with enormous boulders of granite-like gneiss. Descending the valley the massive beds of quartz and gneiss are soon succeeded by overlying, highly inclined and contorted schists, with veins of quartz running between the laminae. About a mile below Depilto unstratified beds of gravel, enclosing boulders of quartz and schist, begin to be exposed in natural sections, which deepen as the river is descended, until at Ocotal they are from two to three hundred feet in depth. The undulating plain on which the town is built is composed of the same material. Near the town the formation is almost level, excepting where it is worn into deep gulches by the water courses. Across the river the same gravel beds extend two or three miles to where a deeper deposit of gravel, with boulders of trap and conglomerate, overlies the schists.

The evidence of glacial action along this valley seemed to Mr. Bell—with a single exception—as full and clear as could be found in any Welsh or Highland valley. There were the same rounded and smooth masses of rock, the same moraine-like accumulations of unstratified sand and gravel, the same transported boulders that could be traced to their parent rock several miles distant. The exception was doubtless one of observation rather than of fact. His visit was a hurried one; and as he did not see any rock near Depilto that had been recently bared, his failure to see any glacial scratches is not surprising.

That the gravel and boulder clay formations were not due to floating icebergs is argued on zoological grounds. It is well known that the faunas of the two oceans have been distinct, certainly since the miocene period. Had icebergs floated in the neighborhood of Ocotal (now three hundred feet above the sea) during the glacial period, the low pass between the Atlantic and Pacific, through the valley of the San Juan and the lake of Nicaragua, must have been submerged something like twenty-eight hundred feet. That the faunas of the two coasts could have been kept separate under such circumstances it is impossible to believe.

DEAD SUBJECTS AND A LIVE DISCUSSION.

If the talk about cremation ever amounts to anything more than talk—and the present indications are that it must—it will afford a memorable illustration of the power of the press, if nothing more.

A gentleman not very widely known, and to most of those who have heard of him somewhat unfavorably remembered as the suggester of the "prayer test," publishes in a magazine of limited circulation a few more or less substantial reasons for radically changing a custom, more deeply rooted, perhaps, than any other in the prejudices, inherited sentiments, religious observances, and other conservative elements of Christian civilizations. The proposition is taken up and discussed in rapidly widening circles, and in half a year is a familiar topic wherever newspapers are read. Still more surprising: the reform is, in the main, not unfavorably considered, societies are organized for carrying it out; and in some cases, city corporations have made provisions for the exercise of the new rite by any so disposed.

As might have been expected in the general discussion by all sorts of people of a subject appealing to sentiment rather than reason, there has been a vast amount of nonsense uttered on both sides. Indeed, with the coolest headed, it is almost impossible to consider the subject dispassionately the moment we cease to think of the dead abstractly, or as belonging to some one else, and take ourselves and our own dead into account.

Burning has so long been associated with violence and accident, and burial with the undisturbable repose which we have learned to look forward to under grass and flowers, that few can compare them calmly. And though we may personally think with Laurens that our bodies are too good for the worms, and prefer that the elements of our cast-off frames may be quickly and surely dispersed by the purifying agency of fire, rather than slowly, uncertainly, and loathsomely by natural corruption, yet the most logical among us might shrink from the sight of a wife or child, parent or dear friend, thrust into the furnace seven times heated, and beg for the accustomed ministrations of earth and air in the quiet burial ground.

Unreasoning prejudice, it is true; but it is a power in the world none the less, and, like inertia in mechanics, it is an essential factor in all social calculations. A generation must grow up familiar with the thought from childhood before the practice of burning the dead can have a more than sporadic development among us.

The greatest difficulty, or rather danger, to the proposed reform is the wild and offensive extravagance of some of its advocates. The cessation of breath does not immediately convert the forms of our loved and lost into "loath-

some carcasses," "carrion," or anything of that nature; and to demand their treatment as such is not likely to make converts to the new rite—hideous wrong, the sensitive may rather say—except to the limited extent of applying it to its proponents.

It is true that a lifeless body may be represented chemically by a few symbolic letters and signs, which also stand for plant foods and manures. It is true that the sequestration of the bodies of our dead withdraws annually some hundredweights of fertilizers from our fields. But there are other and higher values than those quoted in the guano markets—higher to us, if not to the rabid utilitarian. Besides, it is slightly absurd, to say the least, for him to declaim so earnestly against our burying, once for all, a hundred pounds or so of loved remains, when he deposits yearly in the sewers a vastly greater weight of more available fertilizing material, and thinks nothing of it.

We are not opposed to cremation. Indeed there is one aspect of the case in which it is all but imperative; only let it be done decently, and with due regard to sense and sensibility. From a sanitary point of view, our present mode of disposing of our dead is anything but commendable. The ordinary graveyard is demonstrably dangerous to the living, and a source of possible poison to generations that are to come. Especially where the burying is rapid or unwisely done, as is too commonly the case, the air is tainted, and the underground water courses are polluted: a double evil made increasingly noxious by the tendency of modern society to congregate in cities, and consequently to accumulate great numbers of dead bodies within limited areas near centers of population.

As for the alleged cheapness of cremation, that is a matter altogether doubtful and of small moment. It is true that a couple of dollars' worth of coal, properly burnt, will speedily convert a corpse of average weight into a few pounds of clean ashes and an indefinite amount of invisible and inoffensive elementary gases; but funerals will be a burden none the less. Fashion will invade the pyre and the urn as surely as it has the cemetery and the grave; and it can be as lavish in expenditure in the one case as in the other. To expect that funeral rites will be done away with, and the possibilities of ostentatious grief prevented, by burning the dead, is to overlook some of the strongest impulses of human nature. It is more likely that burning would simply add another item to the expense of funerals, since a few eccentrics only would have their ashes scattered to the winds, while the multitude would retain their decorated burial plots, and have their ashes interred as formally as now. Indeed, if made harmless by fire, we are disposed to think the cemetery, with its shady walks and well kept shrubbery and flowers would and should be retained. It is well to leave some spots sacred to bereavement and tender recollections of the dead.

OLEOMARGARIN.

We recently published an illustrated description of the mode of manufacture of the oleomargarin; and so far as our investigation of the process by which it is made extends, so long as pure caul fat is employed, the resulting product presents no qualities either in taste or smell at all offensive or even disagreeable. It is unquestionably, when thus made, superior to the detestably bad low grades of revamped butter which are sold to the poor from corner groceries in this city, and to a large extent shipped South; but if, as is asserted, it be produced from soap fat and butchers' waste, then a more revolting mass could hardly be placed upon our tables, and the resolution of the Exchange, condemning its sale, has not come too quickly.

It has also been alleged that it has been sold for genuine butter, and that it has been employed as an adulterant for the same; hence the Exchange "emphatically condemns any process of adulteration or mixture and the fraudulent attempt to sell such product for pure butter."

SCIENTIFIC AND PRACTICAL INFORMATION.

THE BAMBOO A DANGEROUS POISON.

The *Strait Times*, a Javanese journal, publishes some novel information on the poisonous properties of the bamboo, which heretofore has been considered one of the most inoffensive of vegetables. The natives of Java use the poison against their enemies, and obtain it by cutting the bamboo at a joint, and detaching from the saucer-shaped cavity, formed by the cane at such portions, some small black filaments, which are covered with almost imperceptible needles. The filaments constitute the venom, against which no remedy has been found to act. When swallowed, instead of passing to the stomach, they appear to catch in the throat and work their way to the respiratory organs, where they immediately produce a violent cough, followed by inflammation of the lungs. The poison, tried upon dogs, produces loss of appetite, severe cough, burning thirst, and gradual emaciation. The animal froths at the mouth, and finally dies by suffocation as if under the influence of a deleterious gas.

FLOATING PARTICLES IN THE AIR.

When a ray of sunlight crosses a shaded room, an immense number of fine particles will be noted, apparently in suspension therein. M. Tissandier has recently made some investigations into the quantity of this dust contained in 35.3 cubic feet of air, by causing that quantity of air to pass through a tube packed with gun cotton, which filtered out the particles. He afterwards dissolved the gun cotton in ether, and thus was enabled to obtain the particles in a separated condition. After a heavy rain, M. Tissandier has collected 69 grains of dust in the above mentioned quantity of air, but during dry weather this proportion rose to 3 of a grain.

With regard to the nature of the material, he found that about one third was organic, another third silicious, and the rest composed of various substances and sulphate and oxide of iron.

AN ALCOHOL AND VINEGAR POLYPUS.

The Jardin d'Acclimation of Paris was recently presented with a medusan polypus, which, on its reception, was placed in a tank of water with similar organisms. To the surprise of the curators of the aquaria, it was found that after the lapse of twenty-four hours the creature had killed every other occupant of the vessel, and remained alone in the midst of a quite large empty space. After some speculation over the apparent mystery, the analysis of the water was made, proving that the liquid was water no longer, but vinegar. The polypus, it appeared, was one of a very rare species of mollusk, which when placed in pure water, has the property of changing the same into a strongly characterized acetic solution. The animal, it is said, produces alcohol, which it transforms into vinegar.

EGYPTIAN BLUE.

A remarkable and very beautiful shade of blue is noticeable upon many of the ancient ornaments found in the tombs of Egypt. Analysis sometime since proved the color to be formed by a combination of soda, sand, and lime, with certain proportions of copper, from which substances the Egyptians managed to produce three different products: first, a peculiar kind of red, green, and blue glass; second, a brilliant enamel, and lastly the color to which reference is above made, and which was used for painting. By synthetical experiments, M. Peligot has succeeded in reproducing this peculiar shade of blue, by heating together 73 parts of silica with 16 of oxide of copper, 8 of lime, and 3 of soda. The temperature should not exceed 800° Fah., as, in such case, a valueless black product is the result.

THE AKKAS.

The Italian Geographical Society has recently received news of the death of the African explorer Miani, and also a number of interesting objects forwarded to them by that traveler just previous to his decease. Among the curiosities were two African dwarfs belonging to the tribe of Akkas. These individuals, aged respectively 18 and 19 years, are but 28 and 34 inches in height, and belong to a peculiar race of people, the existence of which, first affirmed by Herodotus, has of late years been rediscovered by Du Chaillu and Schweinfurth. These strange beings are of a light copper color and noticeable for their extreme ventral prominence and very thin members. The lips are very long, the chin sharply recedes, and the hair, though tightly kniked, is very long and abundant. Their agility is said to be remarkable in view of their peculiar build.

ADULTERATION OF CHOCOLATE.

Chocolate is one of those articles of food which are rarely sold in an unadulterated condition. These adulterations are so considerable that frequently the spurious chocolate is a mere imitation, containing every ingredient except the principal one, the pure cocoa. Particularly is this the case with the imported material from France, a fact very evident considering that the poorest chocolate is sold in that country at wholesale for some three cents a pound, when the cocoa alone sells for 21 cents. The imitation chocolate is a mixture of cocoa shells finely pulverized, burnt flour, beef marrow, and a little spice, and such is the composition of much of the stuff for which medals have been awarded at fairs and expositions.

The purity of the chocolate can, however, be determined by very simple means. One part of the material to be tested is warmed with ten parts of water. The solution is allowed to cool; and on being thrown on a blotting paper filter, leaves a reddish brown deposit. The liquid should pass through promptly and be of a clear red, having an agreeable cocoa taste. The material on the filter should also on being dried yield a light powder of very little coherence. If, however, the chocolate is adulterated, the liquid passes through the filter slowly, and is of yellowish color, having a sweet taste. A viscous mass remains on the paper, which dries slowly into a solid form. The more viscid the residuum, the more burnt flour the chocolate contains. Glucose is frequently substituted in the spurious material for cane sugar.

A Fortunate Inventor.

Our readers will remember that not long since we devoted our first page to a description and illustration of Mr. E. F. Loiseau's machinery for the manufacture of artificial fuel from coal dust, and have since frequently alluded to the inventor's progress in introducing the invention. We have recently learned with much pleasure that Mr. Loiseau has disposed of the right to manufacture the fuel in Great Britain, under his English patents, for the sum of \$60,000 gold and a royalty of twenty-five cents per ton when coal sells at from 15 to 25 shillings per ton in London, the royalty varying with the price above or below these figures. The purchasers agree to manufacture a minimum amount of 100,000 tons the first year (!), and after that to keep the market supplied, on failure of which the inventor can manufacture for himself. This at the beginning, supposing coal to sell at the above figures, would give the inventor the neat income of \$25,000 for the English market alone. Mr. Loiseau is organizing a company for the manufacture of the fuel in this country.

TO GIVE IRON A TEMPER FOR CUTTING PORPHYRY:—Make your iron red hot, and plunge it into water distilled from nettles, acanthus, and pilosella, or else in the juice pounded out from these plants.

AN INEXHAUSTIBLE INKSTAND.

Mr. Adolphe Teyssonnière, of No. 18 King William street, Westminster, England, has recently patented in this country an ingenious inkstand, which, he says, is capable of yielding ink of a uniform color and quality, for a long period, by the simple application thereto, from time to time, of pure water.

The device, as shown in our engraving, consists of an inkstand divided into two compartments by a perforated partition. Access to both divisions is afforded by orifices above represented, covered with screw caps. In the smaller compartment a quantity of dry coloring matter, which may be aniline of any color, ink powder, ordinary ink evaporated, evaporated extracts of dye woods, soluble dyes, indigo, Prussian blue, or any other similar material, is placed, after being enveloped in a porous bag or envelope of unsized paper. In the larger compartment is an inverted truncated cone, A, which forms the dipping cup, and the lower end of which rests against a sponge, which serves as a filter to keep back



any particles of undissolved coloring matter which may escape from the envelope containing the pigment. When the case is thus fitted, the cover is secured in place, and the inkstand is ready for the market. In order to use it, water is poured, through the opening for the purpose, into the smaller compartment. A portion of the coloring matter is then dissolved, as the water thus turned into ink flows readily through the perforated partition and sponge, and rises sufficiently in the cone, A, to be taken up by the pen. When all the liquid is used, more may be made by simply adding more water, and this may be repeated until all the pigment is dissolved.

The inventor also proposes several modifications of the form represented herewith, but all are constructed on essentially the same principle.

THE COLORADO POTATO BUG.

The Colorado potato bug, or *doryphora decemlineata*, a representation of which we herewith present, has for several years past made alarming ravages in the potato crops of the western section of the country. Some forty years ago, it was known in the Rocky Mountains, where it seemed to be indigenous, feeding upon the *solanum rostratum*, or wild potato. When the common tuber was introduced in that region, the beetle soon attacked it; and spreading from one field to another, in 1859 it had reached a point one hundred miles west of Omaha. In 1861 it invaded Iowa, and, crossing the Mississippi in 1864-5, it has since proceeded eastward at the rate of about sixty miles per year; so that it will probably reach the Atlantic, unless some means be found for its extermination, during 1878.

Professor Hall, of Chicago, states that the beetle lays its eggs on the under side of the potato leaf. These are speedily hatched. The larva, when full grown, is over half an inch long, very thick in the middle, and tapering towards head and tail. It is of a pale yellow color, often dusky or freckled on the back, with small blackish dots, and along each side are two rows of large black dots. The legs are black, and the head black and shining.



The mature insect, the beetle itself, is nearly half an inch long and a quarter of an inch wide. Its shape is oval, very convex above and flat beneath; of a hard crustaceous texture, smooth and shining, and of a bright straw color, the head and thorax being sometimes tawny yellow; head and thorax marked with black spots; the wing cases with black stripes arranged longitudinally, five on each case. The antennae are twelve-jointed; the first five joints are pale or tawny yellow, the remaining joints black, the last joint being small, and sunk into the penultimate one. The legs are tawny yellow, the hips, knees, and feet being usually black. It requires less than a month to pass from the egg to the beetle state. The accompanying figure, for which we are indebted to the *Field*, is a representation of the insect on an enlarged scale, the line alongside showing its actual length.

Where the bug once gets a footing, it speedily destroys the entire crop. It is believed to effect all its transformations in fifty days, so that a single pair would, if unmolested, pro-

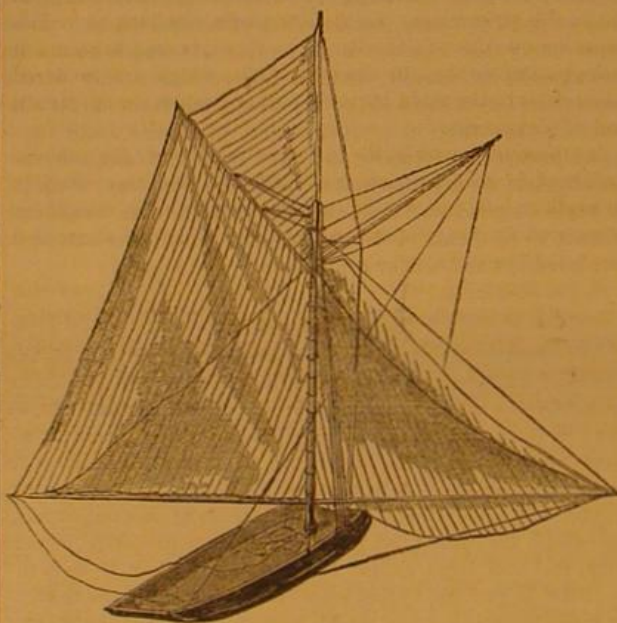
duce sixty millions of progeny in a single season. Various modes of preventing its ravages have been suggested. Brushing or shaking the larvæ from the haulm into a vessel is sometimes tried, but this is a laborious and dangerous operation. Dusting the leaves with white hellebore powder is an effective remedy when it is well done; the powder must, however, be freshly ground, as it loses its efficacy when kept too long. Paris green is also recommended, but both powders are irritating to those applying them, while the latter is extremely poisonous. Birds, it is said, will not destroy the bugs, as the emanations from their crushed bodies are noxious even to human beings, and, it is said, have caused several deaths. The symptoms resemble those caused by the bite of the rattlesnake. The beetle has several insect enemies, especially some varieties of ladybird, which prey upon its eggs and larvæ.

There has been considerable alarm in England, lately, lest the pest should be imported thither in American potatoes, and official investigations have been made in order to determine the advisability of prohibiting importations of the vegetables. The report, however, points out that the larvæ of the parasite are not deposited in the tubers or conveyed by them, and that with the exercise of proper care no danger need be apprehended from bringing American potatoes into the country.

THE SHADOW SAIL.

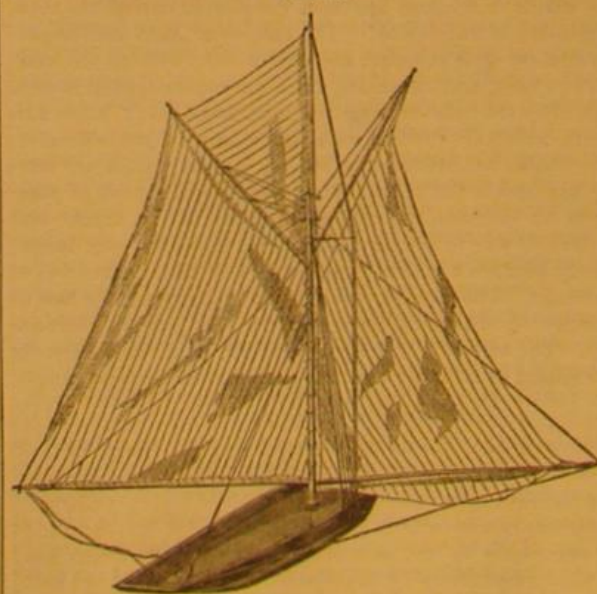
We extract from *Land and Water* the accompanying engravings of a new sail recently patented in England, and called the Shadow. It seems well adapted for racing yachts, as it allows of a remarkably large spread of canvas. The fitting is, however, not American fashion; and although when once distended, the sail would be of considerable assistance, we think that the extra quantity of gear required, and the cumbering of the masthead rigging with an extra gaff, will hardly secure for it much favor from American yachtsmen. We should imagine that the plan might be so modified as to get rid of much of the clumsiness, particularly if the gaff, as our contemporary suggests, could be arranged so as to be easily and quickly shipped and unshipped in any kind of weather.

FIG. 1.



As represented, the gaff is attached by a gooseneck to iron work fitted on the foreside of the mast. This iron work projects from the mast in such a manner as to allow the topmast to pass through it when requiring to be hoisted, and is fixed about two feet six inches below the hounds of the rigging, just above where the jaws of the mainsail rest. The length of the gaff is regulated by the hoist of the mainsail, but should, when hanging down from the gooseneck and in use, reach within about four feet of the deck. In cutters, and for the foremasts of schooners, two halliards are necessary, one on each side of the forestay; but on the mainmasts of schooners, one will be found sufficient. When the

FIG. 2.

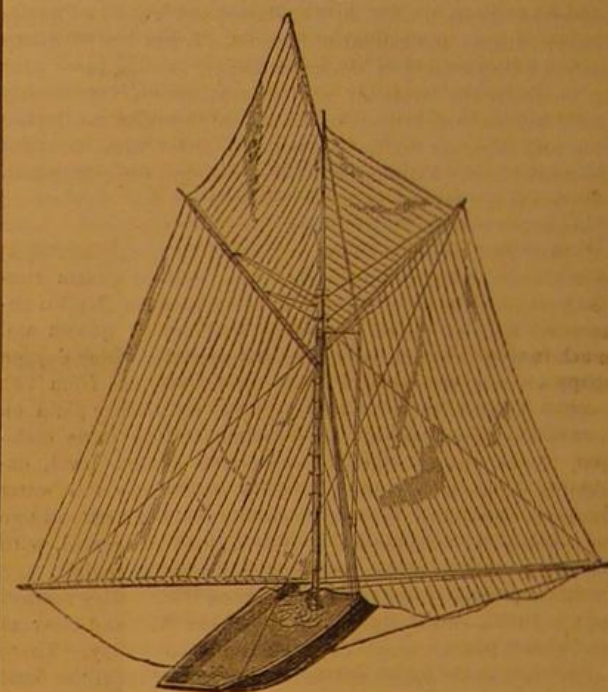


sail is not set, the gaff can be stowed either alongside the mast or lashed to the rigging as most convenient. The sail has hoops seized on it; and when being set, these hoops are slipped over the gaff before hooking on the peak halliards.

As the hoops are passed over the gaff, the throat of the sail is hauled up; and when all are on, the head of the sail is brailled close to the mast. The gaff is then peaked up on the proper side of the forestay, and the boom, which is exactly similar to a spinnaker boom, is rigged out, and the foot of the sail set on it exactly in the same manner as a spinnaker.

Fig. 1 represents the sail as it now is, or when close reefed. Fig. 2 shows the sail when half reefed, or while being set. When the sail is half reefed, the gaff will re-

FIG. 3.



quire more peak to set it. The sail, when fully set, is shown in Fig. 3, which also explains how a topsail can be set over the Shadow in light winds.

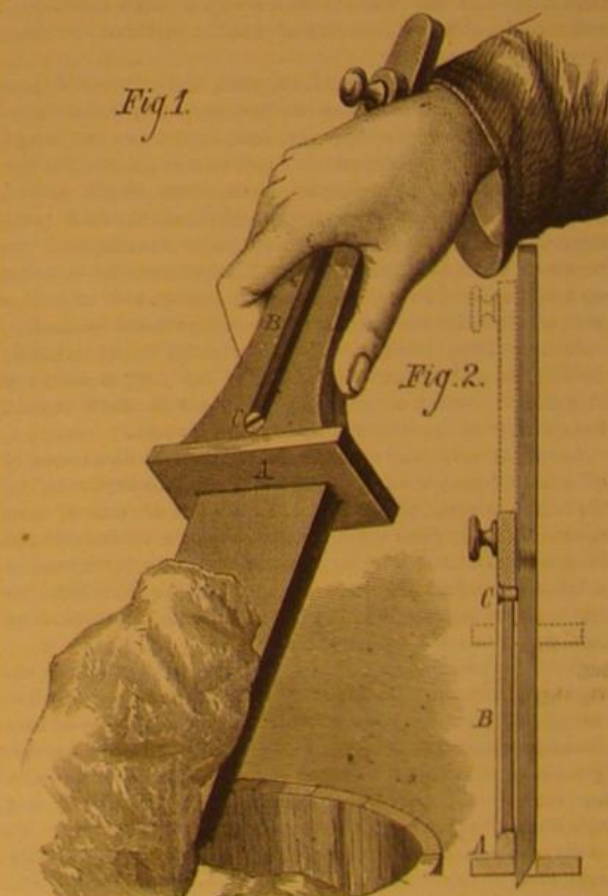
From the gaff end are fore and after guys, with which to brace the gaff to its proper position. When gybing, all that is necessary is to brail up the sail, lower the peak of the gaff, unhook the halliards and guys, pass it under the forestay, hook on again, and hoist away, of course having first shifted the boom.

IMPROVED LARD AND BUTTER CUTTER.

We illustrate herewith a new form of spatula adapted for removing lard, tallow, butter, or similar material from the tub, which provides an easy mode of freeing the ladle portion from the clinging material. The device is made of wood, and its lower end is broadened, beveled to a sharp edge, and passes through an opening in the sliding piece, A. To the latter is secured a bar, B, which is slotted and through the opening in which passes a confining stop, C. A button on the upper extremity of the bar allows it to be conveniently moved.

Fig. 1.

Fig. 2.



After the material is cut and lifted up upon the broad end, as shown in Fig. 1, the piece, A, is slid down to the extremity, as represented in section in Fig. 2, thus pushing the lard off upon the receptacle placed for it, leaving it in a smooth, attractive shape.

The device is simply constructed and easily operated, and will doubtless form a convenient arrangement for the use of grocers, dairymen, and others.

Patented July 30, 1872. For further particulars, address the inventor, Mr. W. M. Bleakley, Verplanck, N. Y.

MOTTO FOR THE TEMPERANCE CRUSADE. "H₂O! every one that thirsteth!"

STRAIN DIAGRAMS AND THEIR REVELATIONS.

BY PROFESSOR R. H. THURSTON.

In the preceding article, a brief account was given of the method of formation of strain diagrams, whether made by plotting the results of experiments (made as described in the illustrated article published in the SCIENTIFIC AMERICAN of January 17, 1874) or by an autographic testing machine; and an explanation was given of the method of obtaining valuable and interesting information by the interpretation of the initial portion of the diagram.

In the figure here given are rough copies of several complete strain diagrams, produced by the autographic torsion machine at the Stevens Institute of Technology, by which this novel internal examination of materials, and its revelations, can be more completely exhibited.

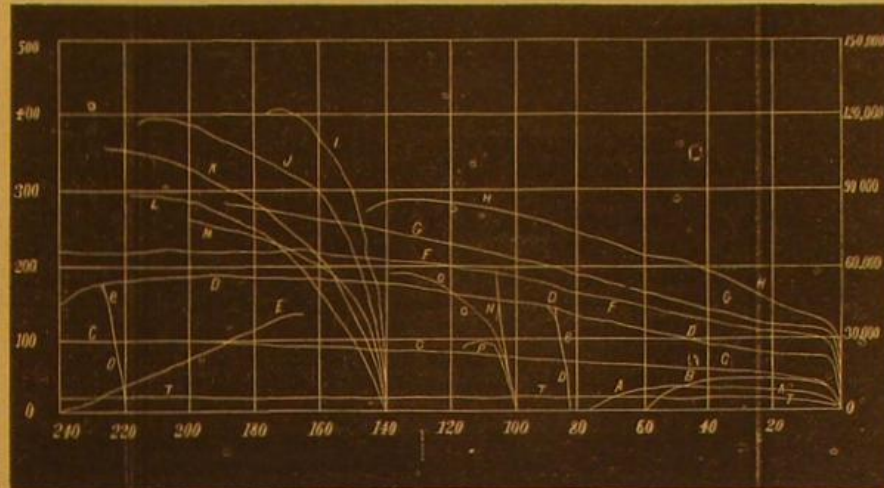
The curves here shown do not exhibit the effect of peculiarities in the material as perfectly as the originals, because it is necessary to reduce the horizontal scale very much in order to bring the figure into proper shape and size to enter the columns of this paper. The original strain diagrams of iron occupy a space nearly a yard long and but two and a half inches high. Those of steel are five or six inches high. The column of figures at the right of the engraving represents the maximum stress per square inch of section exerted upon the fibers of the metal by tension, when the product of the weight on the end of the lever by its leverage is equal to the figure at the opposite end of the plate.

Referring to the figure, the curve, A, is that of zinc. Its form at the commencement, concave toward the base, shows its inelastic nature. Its gradual rise shows that it may take a set under the action of the smallest forces. Its maximum height is small in comparison with its companion curves, and this shows its weakness; it actually has a strength, in tension, of but about 10,000 lbs. per square inch, and this was an unusually good specimen. Breaking off at about 65°, we learn that its ductility is slight, the metal only stretching about four per cent. Tin, T, is still weaker but vastly more ductile, and its strain diagram runs quite off the sheet, the metal twisting completely around before breaking; but its maximum resistance only reaches about 5,500 lbs. per square inch. B is the curve of cast copper, and C, that of forged copper. Could we follow the latter to the end, we would find that the specimen had yielded through more than 500°, its fibers stretching to three times their original length. It exhibited a resistance equal to over 28,000 lbs. per square inch. Its limit of elasticity, that is the point at which it begins to take a set nearly proportional to its distortion, is at a very low strain, less than 10,000 lbs., and it yields very considerably before it offers its maximum resistance. Its ductility is its most remarkable quality. Cast copper contrasts strikingly with the forged metal. Its limit of elasticity occurred at about 5,000 lbs. per square inch, its ultimate strength was between 12,000 and 13,000 lbs. per square inch, and its elongation was but two and a half per cent. This piece was from carefully selected ingot copper, cast in dry sand at the Stevens Institute of Technology. It, like the majority of the specimens here described, is therefore an unusually good example of cast copper; and were it of impure scrap, or had it been cast in green sand, its inferiority to forged copper would have been still more marked. Green sand seriously injures the metal by the production of porous castings, rendered spongy by vapors from the damp mold.

Good wrought iron gives the line, D. The beginning of the diagram, a line nearly straight but slightly curved in a direction the reverse of the preceding, and inclined toward the left, shows plainly that this is a somewhat elastic material, having a little internal strain. The short stretch of nearly horizontal lines, which appears far more distinctly in the original diagram, indicated that it is a fibrous iron, well worked and rather hard. It takes a set at very nearly 20,000 lbs. per square inch, and its maximum resistance is nearly 60,000 lbs. It finally breaks at some point beyond 240°; its maximum elongation is about one half, on some lines of fiber.

On this strain diagram will be noticed two of the lines exhibiting elasticity. They are apparently perfectly parallel, a fact which proves, what had already been suspected and almost proved by more than one distinguished philosopher, that elasticity remains unimpaired until fracture actually commences. Comparing the inclination of these lines, *c. c.*, with that of the initial part of the diagram, we find all very nearly of the same inclination; and the deduction, already made from the slight curvature of the beginning of the diagram, that this iron is very slightly weakened by internal strain, is thus confirmed. The line, E E, shows the form of the terminal portion of the diagram when the metal is very tough and ductile, like Swedish iron, for example. With ordinary irons and with steel, the curve ends abruptly, as shown in all those here given. The diagram, F F, is that of the excellent iron, referred to in the previous article as having given a curve of such beautiful regularity. The line exhibits perfection in quality by its great symmetry and smoothness. Were it shown *in extenso*, it would be seen that the specimen only broke after a complete revolution, and that the metal is as remarkable for its strength and ductility as for its homogeneity and purity. This is the specimen illustrated and described as No. 23 in the article of January 17, 1874.

The effect of the presence of carbon upon the properties of iron is shown by the succeeding diagrams. A low steel, containing 0.4 per cent carbon, and produced by the Bessemer process, tells its story at G. The line H, is that of a Siemens-Martin steel, containing one half per cent or a trifle more of carbon, while I and J are tool steels; K and L are medium and spring steels, and M is the strain diagram of double shear steel. It is seen, at a glance, that the introduction of carbon lessens the ductility of the metal, while increasing its strength and raising the elastic limit. The least ductile are the tool steels containing one per cent and upward of carbon. The most ductile is pure iron, containing no measurable quantity of that element. Intermediate degrees of ductility are produced by intermediate proportions of carbon. Their strengths vary in the opposite direction, increasing with the dose of carbon, in a pretty regular proportion, which is expressed quite accurately, for unhard-



ened steel, by a formula, constructed by the writer: $T = 60,000 + 70,000 C$, in which T represents the tenacity in pounds per square inch, and C, the percentage of carbon present in the given steel. In the low steels, the lack of homogeneity, due to porosity in the ingot, is seen to be much more noticeable than in the tool steels, which are rendered more quiet in the mold by their higher proportion of carbon and of manganese.

In these high steels, the limit of elasticity, for the unhardened, is seen to rise to 60,000 lbs. and the ultimate strength to over 120,000 lbs. per square inch. The elongation is reduced by the maximum dose of carbon to about one and a half per cent.

N and P are the strain diagrams of white and of gray cast iron. The one is stiff, hard, strong and brittle, its line rising steadily upward without a sign of curvature or ductility until it suddenly snaps, after sustaining a very heavy stress. The other offers barely a half as much resistance; the curve bends sharply and runs a little way to the left, and breaks after the piece has twisted less than 20°, indicating a strength of but a half of one per cent. It has, however, five times the ductility of the white iron.

Malleablizing the white iron, a material is obtained of which the line, O, represents the characteristics. It is very homogeneous, has lost no strength, and has gained immensely in ductility. For many purposes it is better than average wrought iron; and the readiness with which irregular forms may be made of it, if of small size, makes malleablized cast iron a very useful material. "Steel" castings are usually made of an exceptionally good quality of this metal.

Glancing over the collection of strain diagrams, it is easy to select the proper kind of iron for any specified purpose. If mere strength is required, it is evident that the tool steels are the best materials. If ductility is desired, something resembling Swedish iron is the proper metal. Comparing the qualities of several metals experimented upon with the price lists, we may readily determine which is cheapest for the specified work. When shocks are to be resisted, or blows sustained, strength alone is not sufficient. Tool steel is too brittle a material to be used in such situations, and even moderately hard steels were long ago found to be less valuable than moderately good iron for such purposes. That metal which is at once strong and ductile is the proper one to choose. The power of a substance to sustain live loads—its resilience—is measured by the product of its mean resistance into the distance through which it stretches before breaking. A close approximation may be obtained by multiplying two thirds the ultimate strength by the distance through which elongation takes place. The metal giving the highest product is the safest against rupture by blows. Of two metals giving equal products, choose that which is strongest.

An area of the strain diagram measures precisely the value of a material to meet shocks. It is exactly proportional to the product just referred to, and its construction affords the only means, yet discovered, of determining resilience with precision. Examining the diagrams, it is seen that, except the very purest and most expensive wrought iron, the low steels excel all other materials in this respect, while they are stronger than any iron; and we perceive a very excellent reason for the wonderfully rapid introduction of Bessemer and Siemens steels, in rail and machinery making, which has recently taken place. A steel containing less than one half per cent carbon is not affected injuriously by changes of temperature, cannot be hardened, has at once great strength and considerable ductility, and is the best known metal, all things considered, to be placed wherever a structure is liable to severe blows and heavy strains, and therefore must be both light and strong.

Much more could be learned by the study of our strain diagrams, but space will not permit further examination of this method of molecular inspection, which physicians might probably term a stethoscopic examination of materials used in construction. Should the opportunity offer, we may, at some future time, be able to discuss some of the more novel facts which have been learned by the application of this new method and apparatus to research in a field in which much has been done, but in which there still remains much to be discovered.

STEVENS INSTITUTE OF TECHNOLOGY.

A SIX ACRE ROLLING MILL.

The Phoenix Iron Company, whose great works are at Phoenixville, Pa., about an hour's railway ride up the Schuylkill from Philadelphia, have nearly completed a new rolling mill building, which is noteworthy in several respects. The *Ledger* says it is believed to be the largest single mill building, under one roof, in this country. The ground plan covers about six and a quarter acres of ground. Its longest dimension is nine hundred and thirty-eight feet, and its breadth is two hundred and ninety feet. The principal material of the building is wrought iron, the roof being slate. The building rests upon about two hundred and fifty wrought iron flange columns of three eighths thickness of iron, of the well known Phoenixville pattern. These rise about thirty feet to the eaves of the roof, and are but eight and a half inches in diameter through the cylinder, and about twelve inches in diameter from the tip of one flange to the tip of the flange on the opposite side of the column. At a short distance they look very slender, considering the great expanse and weight of the superstructure they have to support, but they have been proved

to be capable of sustaining many times the greatest weight or force they are ever likely to have to resist. The roof rises to the height of sixty feet at the ridge, the framework being exclusively of wrought iron, firmly braced and tied with rods and links. The furnaces, engines, and machinery will cost nearly a million of dollars. The cost of the building will be about \$280,000.

Elongation of Conductors by Electricity.

Various physicists have from time to time studied the modifications in the molecular state of conducting wires, due to the passage of the electric current. Wertheim arrived at the conclusion that the transmission of the current modified the elasticity of the conductor, but Edlund, on the contrary, by a long series of careful experiments, has determined such not to be the case. This latter investigator has found, however, that the elongation of the wire under the influence of the current is sensibly greater than the dilatation due to the elevation of temperature resulting from the passage of the electricity. Two calculations were made of the temperature of the wire, one deduced from the relation previously established between the galvanic resistance of the conductor and its temperature, the other from the elongation of the wire directly measured and of its coefficient of dilatation, equally known. The second mode of determining the temperature constantly gave higher figures than the first, and M. Edlund therefore concluded that the current produced a special elongation in the conducting wire which is added to the expansion resulting from the accession of heat.

Quite recently M. Streintz has taken up this subject, and, by further investigation, has sought to measure accurately the galvanic elongation for different metals.

The observations were made on wires 0.019 inch in diameter and 21 inches in length, the ends of which just touched two levers which carried mirrors placed in the prolongation of their axes of rotation. The divisions of a graduated scale were reflected in the mirrors, and thus the displacement of the extremities of the wires could be accurately read. All the wires except those of hard tempered steel showed a marked excess of expansion under the action of the current, which varied, according to the different metals, from 11 to 27 per cent of the dilatation of the wire under the action of heat alone when brought from the normal temperature, 68° Fah., to that fixed as a limit, 131° 4°.

M. Streintz sums up his results as follows: 1. The galvanic current causes no other modification of the elasticity of a conducting wire than such as results from the elevation of the temperature produced.

2. Under the action of the current, the conductor expands more than when it is carried to the same temperature without the current; tempered steel alone does not present this excess of dilatation.

3. Galvanic dilatation does not manifest itself immediately on the closing of the current, but gradually, as does calorific expansion.

4. Galvanic dilatation is not the consequence of an electro-dynamic repulsion, but probably results from a calorific polarization or an orientation of the calorific vibrations.

THE superior effect of kindness over brutality, in the management of balky or restive animals, is forcibly illustrated in the following incident, related of one Sam Jones, who lived up in Orange county, N. Y. Now Sam was an enormous eater, and it happened that he was one day hauling a load to the nearest village, when his team was stuck in a sand hill. Well, did Sam fret and scold his oxen or unload his team? Not he. He very coolly took down his dinner from the load and sat down and ate it, when his oxen started off with the rest of the load without further trouble.

PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCE.

We continue our abstracts of the papers read before the National Academy of Science at its recent session in Washington. Dr. E. Bessels gave some further scientific

RESULTS OF THE POLARIS EXPEDITION.

It is probable, he thinks, that Smith's Sound must be regarded as the best of the three gateways to the pole. A channel of almost 300 nautical miles in length and in some places scarcely twenty-five miles in width, separates Greenland from Gribbell Land and the archipelago south of it. This separation, as the nature of the land between 81° and 83° latitude demonstrates, took place in a south-north direction. The speaker then proceeded to explain various phenomena which tend to confirm this view, and pointed out the truth that the southern end of the strait is the older as is apparent from the fact that the southern portion of it is evidently broader than the northern; and also the fiords on the south-west coast of Greenland are by far more numerous and deeper than further north. According to the theory, a warm current must have moved along the east coast of America, and must have entered Baffin's Bay, having the full strength of an unweakened current in washing the end of that bay. Thereby considerable atmospheric precipitation as rain was occasioned, accelerating the growth of the glaciers, which moved on toward the valleys, and then formed spurs. The fiords we must consider as the former beds of these spurs.

What was the agency which caused the separation, we can only surmise. There are two probabilities: either the channel is a fissure which gradually widened because of the influence of the current, or it has been eroded by the action of a glacier, the south end of which gradually melted down. The latter hypothesis seems the more probable of the two, and we may regard the channel itself as formerly an immense fiord. But we know that the soundings of fiords are usually shallower at the mouth than at the head, while with Davis's Strait and its continuation exactly the reverse is true: the greatest depths are found at its entrance.

In reality, nothing else could be expected. We know that the bottom of the North Atlantic is slowly but continually sinking, and has been ever since the miocene period. Among other evidences is the fact that the Bermudas rest on a coral foundation. This motion reaches far north and includes a part of Greenland.

Professor Wm. Ferrel of the United States Coast Survey spoke upon

THE TIDES OF TAHITI,

the peculiarity of which is that the solar tide is for the most part greater than the lunar tide, although the force producing the latter is more than double that producing the former. There is only one other case of the sort in the world—at Courtown, Ireland. It is not, however, due to any exception in the general theory of the tides. Certain constants in the tidal expressions, which have to be determined by observations, are unusually large in this case. It is yet impossible to specify, however, what are the irregularities of ocean bottom and of coast outline which occasion the phenomena in this particular instance.

In a paper on

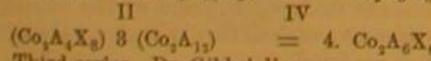
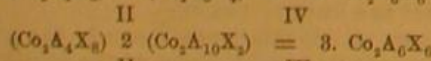
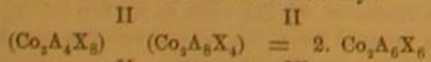
METAMERISM IN ORGANIC CHEMISTRY,

Professor Wolcott Gibbs, of Harvard, presented a novel and valuable discovery regarding metamerism, which has never before been observed in organic substances. Bodies are said to be metameric when they are of the same composition and atomic weight, but differ entirely in their properties in consequence of different molecular constitution. Professor Gibbs has discovered six such bodies, bearing such a relation to one another and to a seventh. The substance with which the series begins was discovered by Dr. Eidmann and is an exceedingly stable compound denoted by the formula: $\text{Co}_2(\text{NH}_3)_6(\text{NO}_2)_6$, or two equivalents of cobalt, six of ammonia, and six of nitric oxide. In the following formula, the ammonia is represented by A and the nitric oxide by X, for the sake of abridgement:

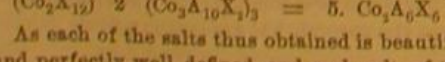
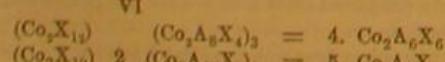
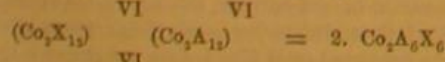
First series—Eidmann's discovery:



Second series—Dr. Gibbs' discovery:



Third series—Dr. Gibbs' discovery:



As each of the salts thus obtained is beautifully crystalline and perfectly well defined, and each salt of the second and third groups gives the reactions of each constituent with perfect distinctness, no doubt can exist as to their real chemical structure.

Professor Alexander, of Princeton, gave some brief remarks on the

COMPARATIVE VELOCITY OF LIGHT IN AIR AND IN VACUO,

relating to a small correction of the velocity of light as deduced from experiment. This, according to the undulatory theory, must be less in atmospheric air than in vacuo, in the inverse ratio of the index of refraction of atmospheric air to 1, that is, as 1 to 1.000294. The velocity then, as ascertained by experiment, under the air should be increased by just about 0.000294 of itself to be equal to that in

vacuo; that is, to the extent, almost exactly of 55 miles per second, a very small quantity indeed in comparison with the whole velocity of 185,000 miles per second; and yet, small as it is—and so small as to be below the limits of error of the experiments in question,—it is yet very closely equal to three times the velocity of the earth in its orbit.

Professor Hayden presented a general account of scientific explorations in the west and gave a brief summary of the forthcoming seventh annual report of the expedition under his charge. Professor Silliman described the

TELLURIC ORES OF COLORADO.

The mineral is found on the side of a dyke some fifty feet in thickness, and was introduced by a plutonic invasion of this formation. The speaker had found that, in many instances, telluric ores were associated with gold, and the association was very unfortunate for the gold miner, as in one instance \$3,000 worth of gold thus associated was thrown away (through ignorance), while the yield of the rest of the ore was only \$40 or \$50 to the ton. Professor Silliman asked Professor Edlich to perform an experiment, showing the presence of tellurium by using concentrated sulphuric acid. A bright purple color was rapidly obtained when the ore was thus treated with heat in a test tube. In one specimen of these telluric ores, there was \$55,000 extracted from a ton.

With reference to

THE LAWS OF CYCLONES,

Professor Ferrel reviewed the theories of Espy and of Redfield, Reid and others, and re-enunciated his own views published several years since.

Concerning

THE GREAT TELESCOPE AT WASHINGTON,

Professor Newcomb gave some interesting facts. The question is frequently asked, how does the new instrument compare with other telescopes? This is difficult to answer, since there are no refracting telescopes in this country of comparable dimensions. The question as to the comparative efficiency of refracting and reflecting telescopes is frequently raised. It must be admitted that great reflecting telescopes give very variable results and are very apt to prove unsatisfactory. As an instance of this, if we examine the record of Herschel's work, we find that nearly the whole of it was done with his two foot reflector; we shall almost arrive at the conclusion that all the work accomplished with the four foot reflector might have been done with the smaller instrument. The same comparison of results leads us to a similar conclusion with regard to the four foot reflector of Lassell—probably the largest ever constructed. He had under the clear skies of Malta made many important observations; but when he took his four foot reflector there, hoping with it to verify his discoveries, it does not distinctly appear that he succeeded. Struve, after looking through the four foot telescope, wrote that it was not in any remarkable degree more powerful than his 15 inch instrument at Pöltava. The only exception to this generalization is the fact that the four foot instrument of Lassell did really discover the two inner satellites of Uranus. Professor Newcomb having rediscovered these with the new instrument, and thus verified Lassell's discovery, thinks that they could never be seen with a 15 inch refractor. In the new telescope the outer satellites of Uranus look as if of about the size that *Uranus Minoris* appears to the naked eye. The smaller satellites, strange to say, have been best seen when the moon was shining, and its light was plainly apparent in the telescope; the first of these appears about half as bright, and the second about one third as bright, as Titania.

Our friends have asked whether there is difficulty in the Washington telescope on account of spherical aberration. This proves to be a very small factor; its total amount is less than that produced in the lens by ordinary atmospheric variations of temperature—an effect which is noticed when work is first begun with the instrument of an evening, but which rapidly wears away as the glass acquires the uniform temperature of the rest of the instrument. It seems to be only the rays near the edge of the glass which are thus affected. Professor Newcomb has looked through many other refracting telescopes, by way of comparison, and after full consideration believes the new instrument to be a great success.

PLANETARY SATELLITES,

Professor Alexander said, are claimed to resemble our moon in the coincidence of their times of rotation and revolution; and that in consequence every satellite presents always nearly the same side to its primary. One occasion for this belief is found on observing the special vicissitudes which the light of the satellites exhibits, each specified change recurring when they have again arrived at the same position in their orbits around their respective primaries. Another evidence is found in the remarkable phenomena of their apparent loss of light on certain occasions.

The loss of atmosphere is one of the supposable consequences of those stringent conditions, as indeed M. Laplace has intimated, when, after stating the distance at which the attractive force of the earth is in equilibrium with that of the moon, he adds: "If at this distance the primitive atmosphere of the moon had not been deprived of all elasticity, it would be carried to the earth, which would thus draw to itself. This is perhaps the reason why the moon's atmosphere is nearly insensible." We may fairly inquire whether this has not been the case with all the satellites, and their common experience.

Professor Loomis, in a paper on the

LAWS OF STORMS,

explained the process by which he computed the relative ve-

locities of the winds, etc., at high altitudes, such as that of the signal service stations at Mount Washington, coming to the conclusion that, at the height of 6,000 feet in the western quadrant of a storm, the velocity of the wind is more than double that of the storm. By another series of computations he obtained the forms of the isobaric curves in at least 200 cases. In 55 per cent of the whole number of cases, the major axis of the isobar exceeded its minor axis by half its length; in 30 per cent the major was double the minor; in 3 per cent the major axis was at least four times the minor. The storms of the United States are mostly of an oval form, with the longer axis most frequently in a direction about N. 40 E. About three quarters of the great storms originate in the extreme west. In a case of which the details were particularly reviewed, it seemed probable that the first development of magnitude in a storm began with the collision of moist air from the Pacific Ocean against the peaks of mountains in Oregon, resulting in heavy rainfall. But the most remarkable fact elicited was that the storm, once originated and organized, traveled over the highest mountain ranges without indicating sensible obstruction, proceeding eastward across the whole continent of North America.

An exceedingly interesting and valuable paper on the mode of formation of the earth, its condition as to interior fluidity, and the probable limits within which it was reduced from a fluid state to its present condition, under the title of "A Criticism on the Contraction Hypothesis of the Earth's Surface Changes," was read by Captain Clarence Dutton of the Ordnance Corps, U. S. A. Mr. James D. Warner of Brooklyn read a technical paper on a new set of Bernoulli's numbers, which are a mathematical invention for shortening certain processes by their application to the coefficients of development of expanding series.

At the conclusion of this paper, Professor Henry simply remarked "The Academy is now adjourned," and thus the session ended without the passing of resolutions or any other of the usual formalities.

Correspondence.

Freight Cars.

To the Editor of the Scientific American:

I notice, in your issue of April 11, an article headed "A Chance for Inventors," which article attracted my attention. Bearing as it does upon a matter of great importance, it ought to be called to the attention of car builders generally; and while I am compelled to differ with the author very widely in many respects, I fully concur in the belief that there is a need of improvement in this direction.

But where is the inventor who is able to overcome the the numberless difficulties that stare him straight in the face at every turn? We wait for him to appear. The author of the article referred to seems to exhibit a wonderful lack of knowledge in regard to the difficulties which must be met, when he supposes that the strength for carrying of a country wagon is to be placed in comparison with the strength for carrying of a freight car, and that its paying weight should be, in proportion, equal to the former.

For the past seventeen years, I have been a practical car builder, and have tried a great many experiments in building very light cars, both for passengers and freight, and every experiment has proved a failure. Some fifteen years ago, box freight cars weighed only from 15,000 to 16,000 lbs. and would carry 10 tons. These cars proved to be sufficiently strong and durable at that time, when the railroads were doing only a local business, running short trains and resting them at almost every station (a car requires rest as well as a man, if it is to last long). Then every railroad had its cars under the master car builder's care, who watched over them as carefully as over his children; and if they did not return when they ought, they were looked after in the same way. Our repairs were then very light. But since that time, the world has not only been revolving, but, moving in other directions; and today freight cars, formerly simply local carriers, are interchanged by nearly every railroad in the United States, and are drawn (in tremendous trains) thousands of miles, with but short stops and no rest from their loads.

It has been said that the steam engine is subject to fits and starts, and, when attached to one of these long trains, must of necessity test the strength of the most workmanlike and thoroughly built car to its utmost capacity, which would not be the case if only a few cars were taken. Couple even twelve or fourteen country wagons together, and I doubt very much if they will carry the load referred to (3,000 lbs. to a wagon) for very long, successfully.

Box freight cars have and can now be built to weigh not over 12,000 lbs., and I will guarantee to build them, not to exceed that weight, so that they will carry successfully 10 tons to the car. But they must be taken in very short trains, as they would be likely to receive injury by sudden starts and stops if taken in long trains. Consequently, as the rule and not the exception is long trains, we are placed under the necessity of building our freight cars about three times as strong as they were built fifteen years ago; but the weight has not increased in that proportion, being only one or two thousand lbs. more: we therefore have reason to be thankful for this improvement already made.

Freight cars are subjected to very rough usage; for example, an engineer couples his engine to a train of forty cars, and undertakes to start gently; he finds that this makes no impression on his train; he therefore backs up with as much force as possible, and then, putting all the force of the powerful machinery to work, starts up again, and perhaps may repeat this several times before succeeding. In view of these

severe tests that our freight cars are called upon to encounter, I think every engineer will say that the fault is not in their strength, but rather in their weakness. Wood or iron of a certain dimension has a capacity of overcoming a certain resistance; and when it is forced beyond its capacity, it breaks. Now the question is: In what form will a certain dimension of wood or iron resist the greatest force? This can only be settled by constant experiment.

How long would a train of country wagons stand the pressure above named? I am very anxious to learn how to build a lighter car than I am now building, to give me the same strength or power of resistance; and have therefore written this for the purpose of drawing out information.

Our box freight car bodies weigh 9,785 lbs., truck with brake, 4,445 lbs., truck without brake, 4,140 lbs., total weight of box freight car, 18,370 lbs. Our passenger car bodies weigh 27,390 lbs., trucks weigh 13,200 lbs., total weight of car, 40,590 lbs. The car will seat 72 passengers with a saloon and 76 without a saloon.

NEW ENGLAND.

Patent Affairs at Washington.

To the Editor of the Scientific American:

The past winter has probably been one of the busiest ever known in the Patent Office, and the work is still increasing, as will be seen by the fact that the number of fees of all kinds paid in during the first three months of this year is 19,528, being an increase of five hundred and twenty over the corresponding period of last year.

With this increase of business and the constant accumulation of material, such as files, drawings, models, etc., there is a great necessity for more space, especially in the model halls. The cabinets for exhibiting the models being full and running over, most of them having their tops covered, in some cases the models are piled, one on another, until the lower ones are broken with the superincumbent weight. Unless something is done soon, the models will be in such a terrible confusion that it will be almost impossible to examine them. The machinist is doing his best to make room by putting the models closer together, but this is a mere temporary expedient, and gives but little space. If the galleries in the South Hall were completed, a large number of cabinets could be added, but these, it is stated, cannot be built for want of money, although enough has probably been wasted in building a private conservatory over the roof of the West Hall to complete the galleries and have money to spare.

From the number of applications before Congress, it would appear that the lobbyists are endeavoring to run another Patent Office in the Capitol, as the following list of cases now before the Committee on Patents will show:

THE CONGRESSIONAL PATENT OFFICE.—LIST OF APPLICATIONS FOR EXTENSIONS OF PATENTS NOW BEFORE CONGRESS.

A. B. Wilson, Sewing Machines.
McClintock Young, Harvester.
J. Fritz, Rolling Iron.
J. Hazeltine, Water Wheel.
L. Ketchum, Harvester.
J. Nock, Inkstands.
T. W. Mitchell, Finishing Brush Handles.
C. W. Williams, Canal Locks.
J. Wyman, Setting Blind Staples.
Vinton & John, Furnaces.
Moses Marshall, Knitting Machine.
J. Lilley, Surveying Instrument.
A. Dillman, Corn Shellers.
Rollin White, Fire Arms.
Akin & Felthausen, Sewing Machines.
Rudolph Eickemeyer, "
Reynolds, Power Loom.
A. J. Hathaway, Converting Motion.
L. C. Chase, Buckles.
J. Haines, Harvester.
H. L. Cake, Coal Screens.
Ward, Bullet Machine.
" Molding Shell.
W. W. Burrell, Corn Sheller.
H. G. Bulkley, Kilns.
A. Attwood, Car Wheel.
T. B. Crosby, Wiring Blind Rods.
A. G. Batchelder and others, Car Brake.
J. Young, Washing and Wringing Machine.
J. A. Pickering, Boot Straps.
J. H. Butterworth, Bank Locks.
J. C. Cook, Webbing.
R. A. Marcher, Enameling Moldings.
Eliza Wells, Forming Hat Bodies.
A. S. Macomber, Straw Cutter.
S. Wethered, Carding Machines.
J. W. Marsh, Sewing Machine Attachment.
W. Wickersham, Sewing Machine.
A. J. Vandergrift, Grain Separator.

In addition to these cases, I find the following names of parties who have applications filed, but the records do not show the inventions protected by their patents: S. H. Hodges, Henry Lill, N. Whitehall, Alpha Richardson's widow and heirs, T. & L. Winans, J. Kirby, E. P. Torrey, J. G. Perry, and G. Wellman.

One of the most conspicuous of these jobs is the case of the Wilson sewing machine, which is up before Congress for the third time. This patent covers up every "roughened surface," "four motion" or "wheel feed," and the sewing machine rings have controlled it now for twenty-one years, thereby shutting off all competition, which has enabled them to wring millions yearly from the people; "and yet they are not happy," but want this pretty little privilege for seven years longer. It is rumored among the knowing ones that the promoters of this extension expect to dispense something nice among those who are disposed to help them, and that \$50,000 has already been sent down here as an earnest of the good things to come. The plan proposed at present, as near as I can learn, is to get Congress to pass an

act directing the Commissioner to examine and decide the case in the same manner as a first extension, and then bring their whole force to bear upon him to decide favorably. At the two previous attempts, the application has been kicked out, the Congressmen being afraid to face their constituents with the additional discredit such a palpable job would give them—the Credit Mobilier and "back pay grab" being as much as they could hope to carry comfortably—but, by turning the matter over to the Commissioner, they hope to be able to oblige their good friends of the sewing machine ring, and yet throw the blame on the former should their constituents make trouble about it. The ring hope to succeed with the Commissioner by means of a pretended sale of the first extension for \$50,000, so as to make out that this was all the benefit that Wilson received from it, and that he should therefore have another term of seven years as a compensation for being such a fool as to sell a patent worth millions for such a paltry sum. By means of this sale, and by tales of the hardships, sickness, and other troubles which Wilson encountered in his early days, they hope to work on the benevolent heart of the Commissioner and induce him to grant another extension. There are some persons who even go so far as to say that the same *weighty reasons* are to be employed with the Commissioner that are found so efficacious with the lobby, but, of course, people who know him will not believe a word of this; yet, in view of the rumor, it would give an ugly look to the matter to those unacquainted with him, should this extension pass.

In addition to this there is the Akin & Felthausen case, which, if extended, will also cover up the sewing machine business completely; but these parties, although formerly connected with the combination, appear to be—and I believe they are—working against them. They want Congress to extend their patent so that every one shall have the right to manufacture by paying them a small royalty. Such an extension, however, would have to be very carefully worded, or otherwise it would fall into the hands of the ring who bought of them the last extension, the assignment being so worded as to carry with it any future extension.

Besides these extension bills and the bills reorganizing the Patent Office, several bills have been introduced into Congress, affecting inventors and patentees. One of these authorizes the payment of \$100,000 yearly for ten years as premiums for meritorious inventions, in the sums of from one to ten thousand dollars. Another bill proposes the extension of any patent for seven years on the payment of \$100 by the inventor. Both of these, I believe, have been reported unfavorably. A third bill provides, first, that there shall be no more extensions; and, secondly, that any person or corporation shall have the privilege of manufacturing patented articles by paying a certain percentage (not yet fixed) on the selling price.

OCCASIONAL.

WASHINGTON, April 30, 1874.

Steam on the Canals.

To the Editor of the Scientific American:

If a man, using a lever, were to place his fulcrum on water when he had a chance to place it on dry land, he would not be considered fit for a juryman. But this is what inventors are doing in the Erie canal problem. If they would take one of the engines out of a boat which they are trying to run with a 200 ton cargo at three miles an hour, and put it on the tow path, it would take eighteen boats of 230 tons each (4,140 tons) two miles in an hour loaded, and go back light at four miles an hour, averaging on the round trip three miles.

Trains of boats could be drawn in this way, of such a length and so frequently that the capacity of the canal would be equal to the number of boats that could be got through the locks. A train every six hours would do a business of nearly 4,000,000 tons in the season, at a cost of about one dollar per ton, including river and harbor expenses.

Highland, Iowa.

WILLIAM SLOAN.

The Mercurial Telescope.

To the Editor of the Scientific American:

On page 20 of the present volume of the SCIENTIFIC AMERICAN may be found a communication on this subject from Mr. John Linton, of Baltimore. In reply let me state that if, on account of the instability of the mercury at the center of the revolving vessel, it is desired to dispense with a portion of the center, the loss will be only in point of illumination; in fact, if the mirror is large, there will be enough reflecting surface remaining. A diameter of three feet in the center of a ten foot mirror might be dispensed with, and at the same time the efficiency of the mirror would not be impaired; for we should lose only one eleventh of the entire reflecting surface.

One plane mirror would suffice for keeping the beam of light, from objects out of the zenith, always vertical upon the mercurial surface. Its width must be equal to the diameter of the mercurial mirror; and its length must be greater as the altitude of the object is greater.

By actual calculation, it is found that, when the latitude of the object is 30°, the plane mirror must be 19.99 feet long, in order to reflect vertically a beam of rays ten feet in diameter. If the object is 60° above the horizon, the length of the mirror must be 38.64 feet. Of course it is impracticable at present to construct an accurately plane mirror of these dimensions; consequently the great mercurial concave can be used only for the examination of objects when in the exact zenith. Nevertheless, its use would secure important results. At many available latitudes in the United States there are interesting celestial objects which culminate in the zenith; and even during the short time of their passing the

field of view, the distinguishing features of each object might be noted. That an object may pass through the zenith of any place, its declination—which may be found in the star catalogues—must be equal to the latitude of the place.

The concentration of light, also, would greatly facilitate an examination, by the comparison method, of the spectra of celestial objects whose illumination is feeble. These few facts are presented with the hope that Mr. Linton may continue the experiments he appears to have begun. Let him communicate to the SCIENTIFIC AMERICAN at some future time a few details of his method, whether the results attained were successful or otherwise.

Amherst College, Mass.

D.

The Reclamation of the Colorado Desert.

To the Editor of the Scientific American:

The possibility of the project of reclaiming the Colorado desert by turning the Gulf of California, or the river, into it, will be more readily understood when it is known that the whole desert is interlaced with high mountain ranges, leaving the valleys between them generally at considerable elevations above the level of the sea. The most traveled route from San Bernardino to Fort Mojave, nearly along the 35th parallel, shows this. After crossing the sierra at an elevation of about 5,200 feet, we steadily descend to and along the Mojave river, to about 1,100 feet above the level of the sea; we then rise until, at Marl Spring, it is above 4,000 feet; and it remains at or above 4,000 feet for fully 40 miles, when, after crossing Piute creek and the Mount Newberry range, it descends rather rapidly to the Colorado river, at about 500 feet elevation. Except part of the Arimagoza region and Death Valley, north of said route (said to be the only spot in the United States actually below the level of the sea—by about 120 feet), the whole vast extent hardly shows a depression below 2,000 feet. The lofty unbroken Wahsatch mountain range seems to prohibit, pretty effectually, any attempt to turn the waters of the Colorado from above the Big Cañon of the Colorado into the desert.

A government grant, ostensibly for that purpose, will no doubt benefit some interested parties speculating upon the monopoly of the mines embraced in the region in question; but it is more than questionable whether the alleged object will be accomplished.

R. D'H.

Fayetteville, N. C.

The Relative Attraction of the Earth and Sun.

To the Editor of the Scientific American:

In your issue bearing date March 14, I find an article from the pen of Mr. Ericsson, in which the subject of the relative attractions of the earth and the sun is presented in a most happy and satisfactory manner. Mr. Ericsson is right. The centrifugal force, as a factor in the calculation, was overlooked by me. I acknowledge my obligations to him for the correction.

W. B. SLAUGHTER.

Brownville, Neb.

Transparent Paraffin.

The paraffin of commerce is a colorless, translucent substance, perfectly inodorous and tasteless. It floats on water, and has a density of about 0.870, and melts at about 113° to 149° Fah., forming a colorless oil which, on cooling, again solidifies into a crystalline mass. It boils at about 698°, and volatilizes without decomposition. Paraffin does not absorb oxygen from the air, and is only slowly attacked by sulphuric acid, even at the boiling point of water. It is not at all attacked by dilute nitric acid, and only by the strong acid after prolonged boiling. In fact, chlorine or any part of our most energetic chemicals but slowly acts upon this curious substance, which may be considered to be as neutral to the general run of chemicals as our glass vessels. Lately it has been discovered that if paraffin be heated for some considerable time in a tube sealed up, the result is a more fusible paraffin, exactly similar in its apparent chemical composition, but much more soft and fusible—that, in fact, if the heat be continued for a considerable time, the paraffin being still under pressure, we obtain ultimately a perfectly transparent liquid paraffin.

Ascent of Sap in the Bark of Trees.

M. Falvre has recently performed a series of experiments on the mulberry, hazel nut, and cherry laurel, which he considers goes far to prove the fact that the substances which supply the food of plants have an ascending motion in the bark. For this purpose, he made perfect or imperfect annular incisions through the bark, or detached pieces of the bark, to which buds were attached, or removed entire cylinders of bark from the trunk. The result of the experiments was that the buds always continued to develop when the communication remained uninterrupted with the lower portion of the trunk; while when this communication was completely destroyed, the buds invariably withered away. If the bud was separated by a perfect annular incision, it withered the more slowly the greater its distance from the incision; and in these cases the starch disappeared entirely from the portions of the wood above the incision between it and the bud. When entire cylinders of bark with buds on them were removed, the buds continued to develop, and even produced branches bearing leaves.

A CHECK for \$60,000 was recently handed the inventor of metallic tips for children's shoes, in payment of his share in a release of the patent, which he had originally sold for \$100. And now, with such encouragement as this, suggests the *Commercial Advertiser*, why can't he win the everlasting gratitude of mothers by inventing some kind of brass knee plates for little boys' trousers?

THE NIAGARA DIRECT AND DOUBLE ACTING PUMP.

"Machinery so simple in its details of construction, that in new mining and oil regions, where mechanic shops are not yet opened, any man of ordinary intelligence may be able to put it together and take it apart as occasion may require." Such is the aim of the manufacturer in devising the various varieties of steam pump, many of which are doubtless already familiar to our readers under the name of Niagara, and as the work of Mr. Charles B. Hardick, of No. 23 Adams street, Brooklyn, N. Y.

In the annexed engraving will be found a representation of an improved form of one of these machines, known as direct and double acting, for which is claimed many advantages which will doubtless commend it to those engaged in the multitude of industries to which the steam pump is an indispensable adjunct.

So far as is consistent with durability, we are told, the pump is cast in separate parts, so that, in case of accident or breakage, the portion immediately affected need only be replaced, the cylinders being separate from bed plate, water valve chest, discharge, and air chamber. This independence of parts is claimed to be an important item of economy in severe climates where, by the action of frost, all metal vessels are liable to fracture. The arrangement of patented water valves is such that, in case of obstructions entering the valve chamber through the suction pipe, they may be taken out, cleaned, and repaired in very short time, access being had to them through the bonnet on the valve chest. It is only necessary to remove one nut, as the valves are simply four square pieces of metal kept in place by the bonnet. As the valves on each face present an accurately fitting surface in the seat in the chest, each of the four faces may be used; and when, in the course of years, these become worn away, hard blocks of wood, of like form, it is stated, may be employed with equal facility and reliability. The valves are made of composition, or may be faced with leather or vulcanized rubber.

In the type of pump illustrated, there are no piston rings or interior packing, hence no necessity of removal of the cylinder heads. One plunger operates both cylinders, to pack which it is only necessary to unscrew the nuts shown at the center of the water cylinder, slip the caps of the stuffing box back, insert the packing, replace the caps, and the work is done.

There is a patent steam valve which insures the starting of the pump, whenever steam is let on, without reference to the point of stroke at which the piston may be, and hence it is impossible to set the machine on the center. It can, we are informed, be run at any rate of speed, and is thus particularly useful in boiler feeding, giving a certain and steady supply of water.

For mines and quarries, the manufacturer claims the pump to have proved itself especially adapted. Should it become submerged in the mine, it will start upon turning on steam from the boiler at the top of the shaft, and work notwithstanding the condensation of steam incident to its being carried over so long a distance. It has worked, we are informed, in the mines of Pennsylvania, Colorado, etc., under from 15 to 40 feet of water. Finally it is well suited to the pumping of gritty or muddy water, and is claimed to serve thoroughly all the purposes to which steam pumps are now applied. For further information, address as above.

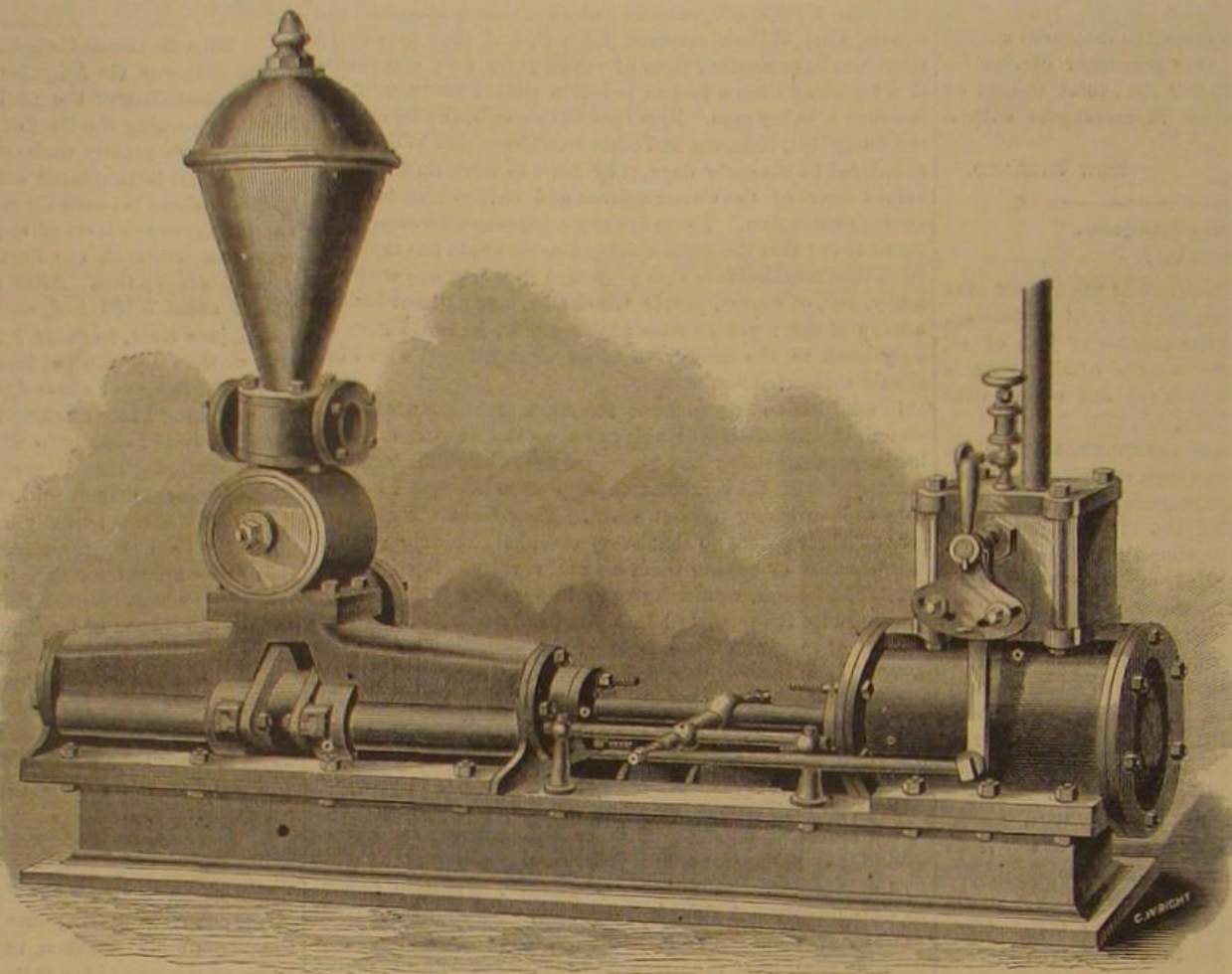
IMPROVED AUTOMATIC PACKING AND WEIGHING MACHINE.

The invention herewith illustrated is a machine adapted for use by spice manufacturers, in chemical works, tobacco factories, and in other establishments where powdered or granulated material is packed in paper, tin, or bottles. The apparatus is constructed entirely of iron, is simple, and does not require skilled labor to attend it.

It is claimed to insure uniformity of weights, with entire freedom from dust, and does not require the packages to be cleaned. The capacity of the machine is only limited by the number of tubes used and the speed with which it is run. Its working parts will be understood from the following description:

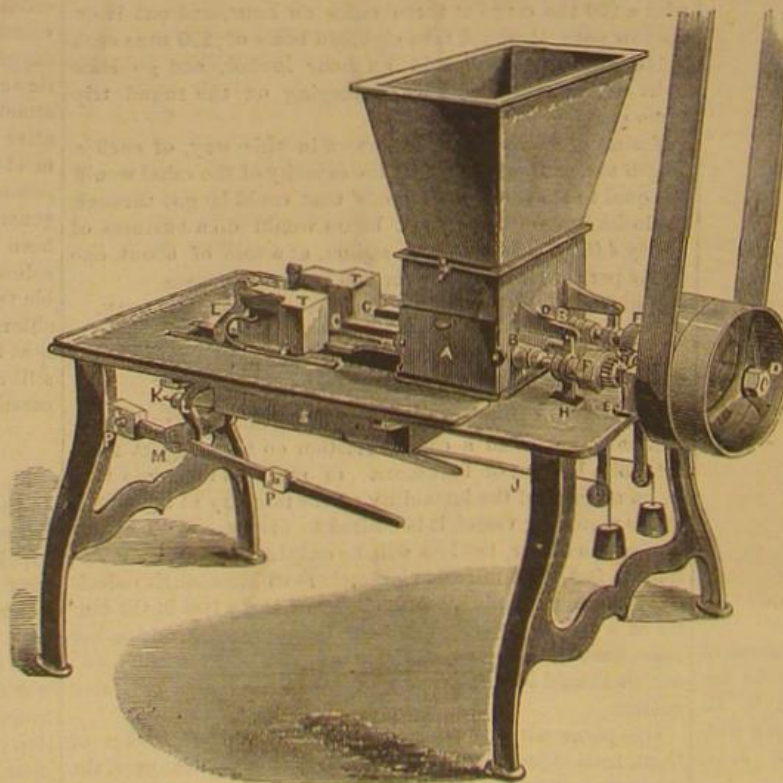
Through the hopper, A, run two horizontal screws, B, B, the threaded portions of which project through the left side, and their shanks through the right side of the hopper. On the screws are placed tin forms, C, C, corresponding to the inside

of package to be filled. D D is a driving shaft which imparts motion to screw shafts B, B, by gear wheels, E. On each screw shaft is placed a pair of cone friction pulleys, F, F, one of which is rigidly fixed; the other slides along the shaft on a key or feather. These pulleys are kept in contact by a lever, H, which extends through the table and has weights applied to it as shown. Connected with the lever, H, is the rod, J, running longitudinally under the table. On the other end of this rod is an adjustable nut, K. L L is a right angled graduating lever, with fulcrum at M; one leg of this lever, extending upwards through the table, presses against the following blocks, T, T. On the other leg slide compensating

**THE NIAGARA DIRECT AND DOUBLE ACTING PUMP.**

weights, P P, kept in position by set screws. The drawer, S, sliding under the table, catches any material that may drop from the tubes.

In operation, the attendant places an empty package on form, C. The follower blocks, T, are moved up against the bottom of the package, which brings the frictional pulleys, F, in contact, thus starting the screws, B, which force the material into the package on the form, C, causing the follower block T, and lever, L, to recede. The latter is brought in contact

**AUTOMATIC PACKING AND WEIGHING MACHINE.**

with the adjustable nut, K, carrying the same with it, separating the friction cone pulleys, F, and stopping the screws, B, instantly. In packing bottles, tin cans, etc., form, C, is removed and the package placed on the tubes surrounding the screws.

Patented September 9, 1873. For further particulars address Stewart, Marks, Ralph, & Co., 115 Arch Street, Philadelphia, Pa., where the machine may be seen in operation.

New Industries in Illinois.

A correspondent of *Inter Ocean* gives some interesting information regarding the pioneers of Western industries,

notably in the city of Rockford, Ill. A new watch factory is soon to be erected, the entire capital stock of which, some \$150,000, has been taken up by the citizens, and several establishments for the manufacture of farm implements are in successful operation. Emerson & Co., the largest house in this business, shipped, in 1873, nearly 200 car loads of agricultural goods, and employ some 150 workmen.

Thomas W. Bakewell.

We regret to learn of the death of Mr. Thomas W. Bakewell, an inventor and manufacturer quite widely known and a frequent correspondent of these columns. Mr. Bakewell

was of English birth, but emigrating to this country at an early age, he took up his residence in Cincinnati, Ohio. At this period steamboats were just appearing upon our Western rivers, and it was a problem to inventors to construct them to suit the requirements of shallow water and other local peculiarities, as well as to meet the demands of the large cargoes which they were required to transport. Entering with vigor into the solution of the question, Mr. Bakewell devised vessels on improved plans, which, proving successful, ultimately necessitated the erection of shops and shipyards. The increasing business soon called into existence extended facilities, and eventually added very materially to the prosperity of the city.

Mr. Bakewell did not confine his efforts, however, solely to boat building, but also erected a large manufactory, containing machinery of his own invention for spinning and weaving Kentucky hemp for making cotton bagging. The works were established in Covington, Ky., and proved highly profitable.

The subject of our sketch was well known as a finished

scholar, and an able theoretical and practical mechanic. Many very excellent papers, with reference to the use of steam and on kindred mechanical topics, have been contributed by him to our columns. He died at Pittsburgh, Pa., at the advanced age of eighty-nine years.

Improvement in Treating Photo-Negatives.

When, by means of a camel hair brush or otherwise, iodine is applied to the image, the atoms of metallic silver which formed the picture are acted upon by the iodine, and are converted into iodide of silver. Now, as metallic silver is not soluble in a weak solution of cyanide of potassium, but as iodide of silver is soluble, it follows that the application of this menstruum will instantly convert into clear glass every portion of a negative that has been touched by the tincture of iodine. Its use, then, will be obvious. Everything in a negative not desirable to be retained can be completely removed—a tree, a house, a background, a restless baby, or any other objectionable member of a group.

Iodine dissolves freely in alcohol, ether, chloroform, sulphide of carbon, petroleum, and in solutions of the iodides. It is the latter of these that we recommend as a solvent when the solution is to be employed in acting upon a negative. Drop a crystal of iodine into a little water, and no visible change takes place, the water remaining clear as before; but on adding a crystal of iodide of potassium, it will be found that, as soon as the latter has reached the bottom of the vessel, the iodine immediately becomes affected and dissolves readily, and the solution becomes of an intensely deep red color.

We find that if the iodine solution be thickened by the addition of a small quantity of mucilage of gum arabic, say a little more in proportion than is contained in common writing ink, all tendency to spread is destroyed. The solution may be applied by means of a delicate hair pencil, and in the most minute specks, lines, or stipples; and, after the clearing up application of the cyanide, these specks and touches will be found to be clear and sharply defined, showing that no extension has taken place.—*British Journal of Photography.*

C. B. L. send us the following recipe for a cement for mending steam boilers: Mix 2 parts of finely powdered litharge with 1 part of very fine sand, and one part of quicklime which has been allowed to slack spontaneously by exposure to the air. This mixture may be kept for any length of time without injuring. In using it, a portion is mixed into paste with linseed oil, or, still better, boiled linseed oil. In this state it must be quickly applied, as it soon becomes hard.

MODERN EGYPTIAN GARDENS.

Only those who have visited Egypt during the winter months can form any idea of the calm repose that almost invariably pervades that wonderful country at that period of the year. The clear blue sky and quiescent atmosphere cause such a dreaminess to overspread, as it were, the whole country, that, except near the cities, one may easily imagine one's self in a land of spectre palaces, villas, and mosques. The graceful heads of the date palm, poised calm and motionless in the air, relieve the towers of the country mansions of much of their monotony. It is winter, yet the orange trees are laden with golden fruit, the jessamine, rose, and geranium are still in bloom. The leaves of the vine and other deciduous trees have just begun to turn red and brown, and to prepare to fall.

Our illustration, for which we are indebted to *The Garden*, is a good representation of a modern Egyptian villa and garden of the Mameluke period. The square basin and stately cypress, the vine-embowered path, producing shade and grapes in abundance, and the little summer house or kiosque in which the owner and his family enjoy the grateful weed and aromatic coffee, are faithful delineations of Egyptian garden life. During the past thirteen years, gardening has made rapid progress in Egypt, the frequent visits of the Pashas, princes, and Khedive to Europe having given the Egyptians of high rank quite a taste for European horticulture; and gardeners from England, France, and Italy have been employed in various localities, but more especially in the neighborhood of Cairo and Alexandria, to carry it out.

The Gezira garden is the best imitation of an English establishment in Egypt, and it has been created at an enormous expense. Embankments, artificial mounds, rock work, and water are all very naturally introduced; good breadths of lawn, dotted with trees, shrubs, and parterres of flowers, produce, in this land of sunshine, a more pleasing effect than in our own country, on account of the scarcity of grass in Egypt. To achieve this desideratum, large tanks or reservoirs have been constructed of sufficient height to serve the fountains and to force water to every part of the garden, which, during summer, has to be kept in a state of perpetual irrigation. In the Gezira garden is a magnificent collection of tropical trees—palms of many kinds, ficus, catbartocarpus, musas, cycads, acacias and others too numerous to mention. Among the vast variety of climbing plants in this garden, the most notable is *bougainvillea spectabilis*, which grows with all the wild luxuriance of a wistaria in our own country, and is annually covered with thousands of spikes of its lovely mauve colored bracts. In few countries is vegetation more rapid or luxuriant than in Egypt, if the irrigation is attended to; consequently it takes but a few years to have a perfect garden.

THE BOW AND STERN SCREW PROPELLER.

Mr. Robert Griffiths, of London, the well known screw propeller man, has lately made a discovery in the propulsion of vessels which, he thinks, is likely to effect a revolution in the economy of steam navigation. His plan is to inclose the propeller in tunnels, and to place one tunnel propeller in the bow and one in the stern. From practical trials made with small models, he concludes and asserts that he obtains an improvement equal to nearly 50 per cent in the speed of the vessel, without increasing the power. At a recent meet-

ing of the Royal United Service Institution, Mr. Griffiths gave an interesting account of the progress of screw navigation, from which we select the following:

"It is generally admitted that barely 50 per cent of the power exerted by the engines is made available to propel the ship, by either screw, paddle wheels, or any other plan of propulsion which has yet been practically used, the other 50 per cent being lost in some way, to account for which there are a variety of opinions.

"I have for several years given up the idea that any further improvements were to be realized by any further change in the configuration of the screw propeller, and conse-

only one screw propelled the model; for since one screw propelled the model from 58 feet to 60 feet in sixty seconds with 600 revolutions of the screw, and with the two screws of the same pitch together, from 96 to 100 feet in the same time and with the same number of revolutions, there must, therefore, be at least 50 per cent more water pass through the tunnels in the same time, and the thrust given to the screw shafts must be in proportion to the quantity of water acted upon by the screws.

"I had the mouth of the stern tunnel enlarged to the extent of 50 per cent, and this enlargement came below the keel. This it might be supposed would be an obstruction

and cause a considerable loss of speed, but I was agreeably surprised to find when I tried it that I had a gain of 20 per cent in speed. I had found by my experiments that, as the supply of water to the screw is diminished, the power required to revolve it increases, and the speed of the ship diminishes.

"There are three important points to be considered in screw ships, namely, the propeller, the ship, and the engine. In the first there has been no improvements with regard to speed since 1840; secondly, with respect to the ships, the best types of ships were described by the old builders as having a cod's head and mackerel's tail, the length equal to three to four times her beam, and no better sea ships have been built than our sailing frigates of former days; but since the introduction of the screw the shipbuilder has been obliged to arrange his plans to suit the propeller, for experience has shown the deeper the immersion the more effective the propeller, and consequently steamships are now being made with an enormous draft of water in proportion to the beam. The keel might now be taken for the type of modern screw ships, which are made in length ten to fourteen times the beam; and had it not been for the introduction of iron for building ships, the screw would never have succeeded to the extent it has done. This great increase of length gives the shipbuilder no chance of improving the form of his ships, from a naval architectural point of view, which is not the case in my system, as whatever form or type the ship will be best for sailing will also be the best for the adoption of bow and stern screws.

"The great improvement in steamships during the last thirty years is to be found in the engines, from which about three times more indi-

A MODERN EGYPTIAN VILLA AND GARDEN.

quently turned my attention to the mode of applying it; my first patent in this direction, obtained in 1871, was for applying a screw at the bow of the ship within a tunnel in combination with the screw at the stern in the ordinary way; I afterwards found very great advantages in having both the bow and stern screws in tunnels, for which I obtained a patent in 1872. I was much surprised to find when I doubled the power by applying one portion to the bow screw and the other to the stern screw, each within a tunnel, the speed of the model increased nearly as the square root of the power, but if I doubled the power on either the bow or stern screws separately, the speed of the model in that case increased only as the cube root of the power. It is well known that the resistance to bodies propelled through the water varies as the square of the speed, while the power required is as the cube. At last it occurred to me that this great advantage must be due to the increased quantity of water that was passed through the screws within the tunnels, when both were at work, over what was due in the same time when

cated power is obtained now, with the same consumption of fuel than formerly, as well as other important improvements that have been made in this department.

"My attention was first drawn to the necessity of having bow and stern screws, on account of the danger attending the employment of ships of the enormous length in proportion to their beam; for every sailor must be well aware that, should an accident occur to the machinery in a heavy sea, or on a lee shore, there would be but a poor chance of saving the ship, especially if one of these long ships, with its machinery disabled, should get into a trough of the sea. I expected that the shipowners would have readily availed themselves of my arrangement on account of the safety it offered to the ship and passengers, and also that the Admiralty would have seen and promptly recognized the advantage and safety it would have been to the ships of war. Now that the high price of coal is being felt by the shipowners they may be induced to consider whether it will not be to their interest, as well as for the protection of their passengers, to



adopt my system. In this paper I have confined myself to the advantages gained in speed or the saving of fuel by my system; but I will briefly name eight other important advantages in connection with it. (1) Thorough protection to the propellers. (2) Smaller screws and engines only are required. (3) No vibration whatever is produced by the propellers. (4) Ships so fitted can be stopped much sooner in case of danger. (5) There will be no loss of speed through racing of the engines. (6) Greater facility for steering and maneuvering. (7) Greater safety through dividing the power. (8) Ship can carry more canvas, and sail better. To sum up the result of my experiments, I find that to obtain the advantages of my system the propellers must be placed in tunnels, by means of which an extra supply of solid water will be kept up to the propeller, which cannot be effected in open water, and the extra supply of water can be obtained by using the bow and stern screws together, or by single screw ships, either at the bow or stern tunnels, by having the tunnel mouths enlarged or bell-mouthed. It may be thought there would be a loss of speed through the friction of the water passing through the tunnels when the ship is under canvas only, which, however, is not the case."

It is proper for us to add that Mr. Griffiths' conclusions appear to be based upon experiments with small models, which may have led to deceptive results as compared with trials upon ordinary vessels. The subject is one of interest and we shall notify any progress made by thorough and practical experiments.

Skin Grafting.

Dr. R. J. Levis, of the Pennsylvania Hospital, gives, in the *Medical Times*, an interesting article on this subject. The operation of skin grafting, he says, is now conclusively accepted as one of the resources of surgery.

The utility of the transplantation of minute pieces of skin, to granulating surfaces, has been demonstrated in a vast number of instances. It is admitted that, by creating centers of eccentric cicatrization on extensively ulcerated surfaces, the rapidity of the healing process can be much increased. Ulcers of a chronic character, which have obstinately resisted cicatrization in a concentric direction, can be healed by the ingrafting of new centers of germination in the midst of the areas of ulceration. Experience has also shown that the procedure is applicable to plastic surgery in facilitating the cicatrization of surfaces denuded by gaping in the division of cicatrices, and in the sliding of flaps of integument.

Besides the increase in the rapidity of healing, due to extending the lines of cicatrizing edges, a decided and important physiological influence is exerted by the presence of the grafts on ulcerated surfaces. The surface of an indolent ulcer seems to be stimulated to renewed vital action, and the increased healing impulse even influences to active germination the peripheral limits of an ulcer in which granulation has long entirely ceased.

The utility of skin grafting has, in my observation, been in no instances more demonstratively shown than in cases of extensive denudation caused by destruction of skin, as in burns, and loss of large areas of integument from traumatic injuries. In the case of a man whose back was extensively charred at a lime kiln, while lying under the toxic influence of its emanations, the sloughing integument having left an immense area of ulceration over his dorsal and lumbar regions, the successful ingrafting of numerous minute pieces of skin healed the vast ulcer with astonishing rapidity. In an instance of the entire loss of the skin of a leg, caused by deeply burning with coal oil, which had filled a shoe and saturated a stocking, the healing process was by the same procedure rendered as surprising and satisfactory.

It seems now probable that amputation, which, as a final resource, is by surgical authority justified in certain cases of extensive ulcers of the leg which all expedients have failed to heal, may be substituted by the simple device of skin grafting.

All of the conditions essential to successful skin grafting I have not, after extended observation, fully determined. The most favorable condition for the development of the grafts is certainly that of healthy, active granulation of an ulcer; and the more nearly this state is approached, the greater, as a rule, will be the success.

One of the beneficial claims for skin grafting is with reference to the avoidance of the eventual contraction which disfigures, deforms, and impairs motion after extensive loss of integument. Observation seems to show that where cutification is rapid from a number of skin forming centers, the resulting cicatrix is less violently contractile in its tendency.

For successful skin grafting, it is simply essential that a minute portion of skin be removed from a sound part of the body of the patient, or from another individual, and placed on an ulcerated surface. It is customary to take the pieces to be transplanted from the patient's own skin; and I have generally chosen locations where the derma is thin, and not densely covered with cuticle, as on most of the front of the body, and, as a choice, from the inner surfaces of the arms and thighs. Grafts from the integuments of other individuals develop as readily, and I have frequently practiced removing them from limbs amputated for traumatic injuries, with apparently equal success. To avoid the possibility of conveying some form of specific infection by the process, it is certainly, as a rule, most advisable to transplant only from the patient's own skin.

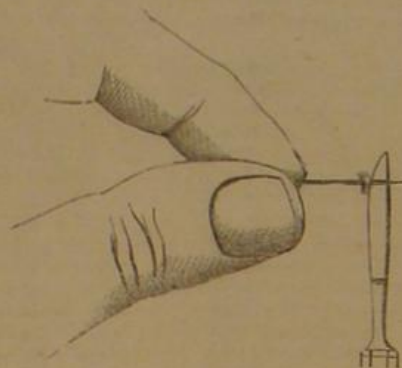
A graft of skin should merely consist of the simple structures of cuticle and derma, and should avoid the underlying fatty and connective tissues. That even the whole thickness of the derma is not essential is demonstrated by the

fact that successful grafting has been effected by using mere scrapings of the cuticle, in which are contained some cells of the superficial or papillary layer of the derma; but the practice is uncertain, and has not practical merit. The thickness of the true skin on the front of the body, it should be borne in mind, does not average more than from a quarter to half a line, and this depth should never be exceeded in the removing of grafts.

The operation of removing the portions of skin for grafting may be done by a knife or scissors, cutting off minute particles of the size to be used immediately in transplanting; or by taking a larger piece which is to be afterwards subdivided. I have adopted a method, first suggested to me by Dr. C. H. Thomas, of Philadelphia, which, for simplicity, convenience, painlessness, and effectiveness, may well displace all others.

It consists, as seen in the illustration, in merely penetrating the cuticle with a very delicate sewing needle, elevating a small point, and shaving off the minute elevation of cuticle and upper stratum of derma with a very sharp knife. The same may be accomplished, but hardly in so perfect and painless manner, by using fine scissors for the excision of the portion transfixed.

The operation, if properly performed, should be free from really painful sensation, and patients never object to its most frequent repetition. I have frequently done it without more than a tint of discoloration from blood, and blood need never actually flow from the very minute wound.

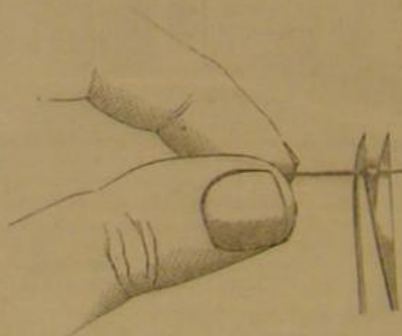


SKIN GRAFTING.

The graft is then immediately pushed from the point of the needle, and placed on the surface of the ulcer, the only care being to lay it with its epidermic surface upward. The graft need not be inserted into the granulating surface by making a wound for its reception, as has been advised and practiced, for such puncture allows a flow of blood that may elevate the graft from contact with the granulations.

As simple adhesion of the graft is all that is desirable, I have sometimes, with large and actively secreting surfaces, allowed them to be exposed to the desiccating influence of the atmosphere, so that the secretion may become viscid and hold the transplanted particles surely in position. To facilitate the same object of fixation after the grafts are deposited, I have occasionally allowed the ulcerated surface to remain uncovered until they became well agglutinated to it.

All active medication to the ulcer should be avoided, and the surface of ulceration be simply covered with a light pressing, for protection from disturbing influences. For this purpose the ulcer may be covered with a piece of muslin, saturated with oil or covered with cerate, or it may be merely protected with the waxed tissue paper, such as is extensively used for general purposes of a dressing in the Pennsylvania Hospital.



SKIN GRAFTING.

On most ulcers the dressing need not be removed for two or three days after the operation; but when secretion is profuse, the ulcer may be washed daily by allowing a stream of water to flow over it, carefully avoiding the wiping of the surface with sponges or cloths, which may disturb the grafts.

One of the earliest changes noticeable in the graft, after the first few days, is the detachment of its cuticle, which may occasionally be seen floating in the secretions of the ulcer, or it may be detached by a slight touch, leaving the true germinating material fixed in position. The graft, as it commences development as a germinal center, becomes so blended and identified with the granulations as to be for a time almost lost sight of, its re-appearance becoming evident in a bluish or lilac tinted pellicle, which indicates the progress of cutification.

In regard to the size of grafts for transplanting, I have, in several instances, grafted by removing, from recently amputated limbs, pieces of skin measuring one third or one fourth of an inch square; but such large pieces are very likely to fall in retaining their vitality, and I have had much more satisfactory success with quite small grafts; and for reasons already stated, this latter practice is certainly the best.

The number and position of the grafts will vary in accordance with the size of the ulcerated surface; and in large ul-

cers they may be distributed at short intervals, both centrally and near the periphery. Those near the circumference will stretch their granulations outward and stimulate the borders of the ulcer to activity; and with regard to the advantage of centrally located grafts, it will be well to remember their importance with reference to the difficulty often experienced in eventually healing the last of a chronic ulcer. A large ulcer, on which successful grafting has been performed, will soon present islets, from which cicatrization progresses in directions of the nearest healing points, until all are joined by an interlacement of newly formed tissue.

NEW BOOKS AND PUBLICATIONS.

A HAND BOOK OF THE LOCOMOTIVE, including the Construction and Management of Locomotive Engines and Boilers. With Illustrations. By Stephen Roper, Engineer. Philadelphia: Claxton, Remsen and Haffelfinger, 624-626 & 628 Market street.

The author of this work very truly believes that in a book, as in a clock, any complication of its machinery has a tendency to impair its usefulness and affect its reliability. Hence, in preparing a book which is intended to be a guide for the practical locomotive engineer, he avoids "mathematical problems and entangling formulae," and offers a pocket volume, full of information, theoretical as well as practical, succinctly and clearly condensed. There are chapters on heat, combustion, water, air, gases, and steam; others on the construction of the locomotive and of its various parts, entered into with considerable details; instructions for the care and management of boilers and engines, tables of strength of materials, and useful practical hints for the guidance of the engineer. In brief, the volume is, as its name indicates, a hand book to which the locomotive mechanic can turn for information regarding almost every branch of his trade. It is neatly illustrated and bound in morocco, in convenient pocket-book form.

Inventions Patented in England by Americans.

[Compiled from the Commissioners of Patents' Journal.]

From April 7 to April 13, 1874, inclusive.

ELECTRIC LIGHT.—M. Day, Mansfield, Ohio.
FIRE TELEGRAPH.—J. H. Guest, Brooklyn, N. Y.
FOOD FROM MILK.—B. Smith, San Francisco, Cal.
IRON, STEEL, AND FURNACE.—J. Henderson, New York city.
METAL ROLLING MACHINE.—H. W. Hayden, Waterbury, Conn.
OIL STOVE.—J. H. Thorp, New York city.
SOLE SCREWING MACHINE.—J. Mundell et al., Philadelphia, Pa.
WATER CLOSET BASIN.—J. Burns, New York city, et al.
WATER METER.—H. F. Read, Brooklyn, N. Y.
WATER METER.—J. S. Swan et al., Kalamazoo, W. Va.

Recent American and Foreign Patents.

Improved Railroad Signal.

Jane D. Evans, West Chester, Pa., executrix of Henry S. Evans, deceased.—This is an improved railroad signal, so constructed that the advancing train will itself set the signals to indicate its approach and departure. Two pairs of inclined bars are pivoted at the sides of one of the rails in such positions that the free ends of said inclines will be struck and pressed down by the wheels of the cars. The inner ends of the inclines of each pair are pivoted to opposite arms of a three armed lever, which is placed in a notch in the tie, with its third arm projecting downward. To each pair of levers is attached a chain, which passes over and is secured to a wheel formed upon the signals, which are pivoted to the upper ends of two posts. Either of said signals may be operated from the other, and both set or both withdrawn at the same time. The three armed levers are again raised to their former position, as soon as the pressure of the wheels is removed from the levers or inclines, by springs attached to ties.

Improved Rotary Harrow.

James W. Hanger and Joseph H. Ryan, Clinton, Mo.—This invention relates to means for adjusting the pivoted harrows, so as to cause one side thereof to work deeper in the ground than the other; also to a spring connection between the tongue and axle and a caster wheel, the same also supporting the driver's seat, whereby the weight of the driver effects little change in the pressure on the harrows in passing over rough ground, while yet exerting a constant spring leverage on the tongue; and lastly, to the means of adjustment for the pivoted axles of the harrows.

Improved Steam Boiler.

Joseph Shackleton, Rahway, N. J.—This invention relates to an improvement on the improved steam boiler upon which the same inventor received a patent dated April 5, 1870. The water receptacle is provided with a water induction pipe at the lower part, and a steam induction pipe at the top. A system of pipes extends through in horizontal direction, and is arranged symmetrically to the horizontal axis of the system in such a manner that an intermediate series of pipes is placed diagonally between and sidewise of the adjoining series of pipes. Every two corresponding horizontal pipes are connected in vertical direction by elbows to form pipe rectangles, which extend gradually from the smallest innermost tier to the larger outermost series, each rectangle being placed in separate connection with the water receptacle. A horizontal plate is immediately below the upper pipes of the innermost rectangles, extending laterally to the full width of the receptacle, and causing the impinging of the fire thereon, so that it is deviated from its direct upward course toward the chimney at the top of the furnace and thrown sidewise, passing between and around the vertical pipes toward the upper corner of the rectangles, and thence along the top of the furnace to the chimney. The upper parts of the pipe rectangles are thereby fully brought into effective participation, and the heating power of the fuel and the gases of combustion utilized.

Improved Post Hole Digger.

James W. Thomson, Portland Mills, Ind.—The post hole diggers now known to the public have the ends of the blade or the two blades pressed farther and farther apart until the lowest portion of the cut is reached, and leave a long slip on one side of the tool uncut, in which are often roots that bind the parts of earth together. This causes these old tools to stick, and to be raised with so much difficulty that they are thereby rendered impracticable in actual use. To avoid this difficulty the ends of the tool are, in the present invention, caused to overlap each other, so that they are only in line, and end to end at the bottom of cut, every particle of the sides being thoroughly excised, and the whole core coming out clean and without obstruction from the sides.

Preparing Transfers for Panel Sign Painting.

Charles H. Gordon, Brooklyn, N. Y.—Paper is first covered with a coat of starch, then calendered, and another coat applied, followed by a wash of gum arabic. The whole is next covered with a coating of clear white varnish. When the varnish is thoroughly dry it is dusted over with French chalk, and the letters or figures printed from the first plate with strong clear varnish. Said letters or figures are dusted with first color, say gold or red. When dry, and all superfluous color cleaned off, the foundation for the next color is laid, say blue, using the same process as for the first color (printing in varnish), and so in each color, till the whole of the picture or sign is printed on the transferring medium. When quite dry a solid ground is printed, of white or color, which, when transferred to the panel, will form the groundwork or base of the picture, etc. After this has stood some time to dry, but before it is quite dry, it is laid on a smoothly planed panel and passed through a machine, which causes the printed matter to adhere to the wood. It is afterward slightly dampened and the paper removed, when the whole, groundwork, color printing, and varnish will be found transferred to the panel. Any and every kind of printing, is claimed, can be treated in the above manner, lithographic, letter press or the finest steel engravings.

Improved Flocking Machine.

Edwin C. Gould, Bridgeport, Conn.—A shaft which revolves in bearings in the middle part of the frame is so arranged that one of its revolutes will oscillate a second shaft. To the latter are attached two pairs of arms projecting from its opposite sides. To the ends of each pair of arms is attached a striker, the edges of which, when the shaft rocks or oscillates, strike against the under side of the cloth as it passes from the flock box or after to the roller. The strikers should strike the cloth in as nearly a perpendicular direction as possible, and the effect of their action is to straighten the flock, spread it evenly over the cloth, and at the same time knock off the surplus flock. The oscillating striker renders unnecessary the roller by which, in the original machine, the flock was pressed down upon the cloth, and produces a better article than when said roller was used.

Improved Brick Machine.

John S. Derby, Leavenworth, Kas.—This invention consists of a rotary brick press with radial molds, which turn in a mold ring supported on a suitable frame, and are rotated by a radial arm with pivoted catch. The bricks are molded in the ordinary manner and placed into the molds, and undergo successively the operations of pressing by means of an upper and lower press board, worked by suitable hand lever power, of cutting off to size, and of smoothing the upper surface. The lower press board of each mold is then carried up by means of its sliding piston and spring top, in connection with the hand lever, so that the bricks may be removed, and the board, by passing under stiff brushes, be cleaned, with the top of the mold, from sand and other impurities. The contact of the spring top with a projecting pin releases the lower press board, and carries it back into position for receiving a new brick. A shield or casing of the upper press board retains the clay therein, while suitable adjusting devices regulate the size to which the bricks have to be pressed.

Improved Brake and Rest for Carts.

William C. Jardine, Westchester, Pa.—This invention consists in arranging, on an ordinary tilting cart or dray, a brake and rest, so that when a cart is propelled down an incline the brake will hold and check the speed, and at the same time the front part of the body of the cart will be supported and the body retained in a horizontal position, thus relieving the weight and strain from the horse's back.

Improved Billiard Table Leveler.

Lyman A. Hunt, North Adams, Mass., assignor to himself and Sylvester N. Gardner, Troy, N. Y.—This invention consists of an inverted metal cup resting on the floor, with an oval-headed screw screwing up and down in a hole in the vertical axis of said cup, and carrying on its head a disk on which the table leg rests. The disk has a socket in the center of the under side, in which the head of the screw fits to keep said disk from jarring off. Each leg being provided with a foot, the screws are turned either way, as required, by a wrench applied to the head to raise or lower the table, and thus adjust it most accurately with but very little labor, and in a short time.

Improved Tree Protector.

Dwight Hitchcock, New York city.—In straps of light sheet metal, three or more of which are used, according to the required height of the protector, are cut pairs of short parallel slits. The metal between the slits is bent outward to form a half-round transverse groove, and at the sides inward to form a half-round transverse groove. In this way are formed sockets to receive the wires, the arms of the loops or bends of which overlap or interweave with each other. Upon one end of each strap is formed a small tongue, which fits into a short transverse slot, formed in said straps near their other ends. Holes are also made in the straps, in such positions as to coincide with each other when the ends are overlapped, to receive a short bolt, which is secured in place by a nut screwed upon it. The outer arm of the last wire loop at each end of the straps overlaps the last arm of the loop at the other ends of the said straps. This construction enables the protectors to be opened out flat for convenience in packing for storage or transportation, and to be conveniently placed around the trees when required.

Improved Wash Boiler.

William Kolb and Mathias Kolb, New York city.—A partition wall divides the boiler into two divisions, the lower parts of which communicate with each other, while their upper parts only do so by means of a valve. After the boiler has been filled with soap suds up to the grate, it is set over the fire. As soon as steam forms, the suds will be forced out of one compartment into the other and through the wash. When nearly all the water has been forced out of the first compartment, a buoy connected with the valve will no longer be supported; the valve will, therefore, open, the steam will escape, and the suds will rush back into the first compartment. When the suds have risen so high therein that they float the buoy, the valve will be closed again, and the confined steam will again force the suds out of the compartment, and a continuous circulation will thus be maintained.

Improved Felt Cleaner for Paper Machines.

George Dunn and Robert McAlpine, Lee, Mass.—This invention consists of a section box and a pump, in combination with the first felt of a paper machine, for cleaning it, mainly on the under side, of the matters collecting upon and adhering in the progress of the work, by suction continuously applied to the felt while in the performance of its function. It also consists of a perforated jet pipe, in combination with the felt and the pump, also for cleaning the felt, but more particularly its upper side, by blowing jets of air against the under side and up through it. The object is to enable the felt to be cleaned without stopping the regular work of the machine; also, without removing the felt for washing, as is required in some cases, and it is also designed, by acting continuously on the felt while it is at work, to keep it clean and in its best state at all times.

Improved Steam Boiler.

Nicolas D. Harvey, New Orleans, La.—The sides of the fire flue, back of the bridge wall, or the back ends of the boilers, are jacketed, and the mud drum is connected therewith. In this arrangement the feed water is pumped into the jacket, and not directly into the boiler. Before the feed water enters the boiler it is heated to the boiling temperature, and the sediment is deposited in the jacket, and readily finds its way to the mud drum, and is blown off. The water in the boiler is, therefore, kept comparatively pure.

Improved Water Feeder for Locomotive Tenders.

Mirabeau N. Lynn, New Albany, Ind.—The first part of this invention consists of a jointed arrangement of the spout, of peculiar construction, to adapt it for swinging laterally to the well in the tender, in case the latter does not stand directly in front of the spout, and thus save the adjusting of the tender so exactly as is now required, and which is difficult to do. The second part of the invention consists of a float open to the water below, and closed to the air at the top, with a pipe to admit air to the surface of the water in the interior space, so that the water will not be prevented by atmospheric pressure from flowing out through the spout when the surface is inclosed airtight by a strong cover of ice. A description and illustration of this device will be found on page 102 volume XXVIII, of this journal.

Improved Revolving Swing.

William A. Lowery, John A. J. Lowery, and William W. Lowery, Salem, Ind.—The swing seats are carried by arms attached permanently to the shaft: the latter is arranged in a step at the bottom, and a bearing at the top, to be revolved for carrying the seats around. The guys, for supporting the outer ends of the arms, are connected at the upper end with the top of the shaft by a cap, to revolve with the shaft, so that the latter is rotated by horse power, communicated to a sweep, below the arms.

Improved Cutlery Handle.

George A. Beaver, New York city, and John C. Milligan, South Orange, N. J.—This invention consists of two concavo-convex pieces of sheet metal, with flat margins, combined with the tang of a knife, fork, or other article, to form a handle. The pieces are placed on one side of the tang, with the convex side outward, and secured by lapping the edges of one over the edges of the tang and on the margins of the other, and stamping or pressing them together, thus making a strong and durable handle, with the requisite amount of swell, out of thin sheet metal.

Improved Wheel Plow.

John R. McConnell, Waterloo, Iowa.—The bent axle arm may be moved up and down to adjust the machine to run level. The furrow wheel works between the rear part of the mold board and the land side of the plow, and its lower side supports the downward pressure of the plow, and thus diminishes the friction, and consequently the draft. The draft bar and beam are made of such a length that the furrow may be turned by the rear plow just in the rear of the furrow wheel. The rear plow may be readily adjusted to take more or less land, as may be desired; and by suitable mechanism, governed by a hand lever, the plows may be raised from the ground, or adjusted to any desired depth in the ground.

Improved Spindle.

William G. Bartley, Rochester, Minn., assignor to himself and Anson H. Beach, of same place.—This invention consists of a funnel on the under side of the bolster rail, extending into a cup on the top of the pulley, to receive the oil which drips from the bolster bearing above; also, holes through the pulley to conduct the oil down, and also a tube on the under side of the pulley, extending down the spindle for some distance, to conduct the oil which drips from the bolster rail down to the step, and prevent it from getting on the face of the pulley and on the band. The invention is designed for the spindles of jacks, mules, and other spinning machinery.

Improved Fender for Vehicles.

Washington Bryant, Batesville, Ark.—This invention is an improved device for keeping the wheels of a wagon free from mud, to prevent it from clogging the brakes or loading down the wheels. The invention consists in the arrangement of scrapers attached to extensions of the rear ends of hounds, with the wheels of a wagon. They extend along the inner side of the wheel to the periphery of the inner end of the hub, so as to scrape both it and the felly, and also the spokes.

Improved Graining Roller.

William H. Burns, Chicago, Ill.—This is an improved roller for transferring the natural graining of any desired wood to a wood or other surface, so constructed as to enter the corners of panels and work close to the floor, thus enabling roller graining to be applied in places where the ordinary graining roller cannot be used. To this end, it is made with a shoulder at a sharp angle.

Improved Plow.

Thomas M. Allen, Macon, Ga.—This invention is an improvement in the class of plows whose standards and the braces therefor are made adjustable to vary the inclination of the share, and thereby regulate the depth it shall enter and run in the ground. The plow plate may be detached when desired, and the beam, standard, and brace may be readily adjusted to cause the plow to work deeper or shallower, as may be desired.

Improved Machine for Making Gear Wheel Patterns.

Joseph L. Hewes, Newark, N. J.—By this invention, it is proposed to do all the fitting of the rim, the teeth, and the finishing of the teeth of pattern wheels by mechanical devices, and thus to secure exact uniformity of shape and dimensions for special work, but largely economize in time and labor as well. The wheel rim of an ordinary gear cutting machine is fitted with teeth on the arbor whereon the wheels to have teeth cut in them are placed, to utilize the dividing apparatus for spacing the rim for the grooves; then, in place of the slide carrying the gear cutter, a slide is applied having a saw capable of adjustment, so as to saw the face of the rim for dovetail grooves. With the same sawing apparatus, but with several different interchangeable cutters and an adjustable clampholder for holding the blocks of which the teeth are to be formed, mounted on the mandrel for holding the rim to have the grooves cut in it, said rim being removed, are fitted the teeth with tenons for the grooves of the rim, so that all are finished expeditiously and alike.

Improved Printing Press.

Riason B. Cooper, Monticello, N. Y.—One of two toggle jointed arms is pivoted to the stationary type bed, and the other is mounted on a support, which is movable in slots in the frame toward and from the stationary pivot of the first, and springs are attached to draw it up toward said stationary pivot. This movable support is connected with arms which carry the platen. The arms are connected at their joint by a yoke and connecting rod with the foot treadle for forcing the treadle up to the type bed by pressing the foot treadle down, which slides the support away from the bed, and, at the same time, brings down the joint so that the powerful action of the arms comes into use when the platen comes to the bed. By connecting the toggle jointed arms to the platen arms by the movable support, greater movement is obtained with arms of a given length than a connection with the joint would give.

Improved Pressure Regulator for Fluids.

Harmon S. Young and William H. Berger, Danville, Pa.—The object of this invention is to regulate the flow of gas or other fluids in conducting pipes, and consists in valves applied to the same stem or rod, and having different areas, and so located within a shell or case with reference to its inlet and outlet orifices as to rise or fall, according as the pressure of the fluid varies below or above a given number of pounds to the inch. The pressure is determined at will by a tension spring and nut, applied to the stem of the valves.

Improved Percolator.

Laurent Dursse, Grafton, W. Va.—This invention relates to glass percolators used in the preparation of medicines, and consists in novel means which enable the tendency to a too rapid evaporation to be entirely overcome.

Improved Attachments to Carpenters' Squares.

Charles H. McKee, Oakdale Station, Pa.—This invention consists in a carpenter's square of novel structure. One great object of this device is to enable a true diameter to be obtained by simply placing the legs so that each is tangential to a circle with the bisecting arm in place; and another to enable different radial lines to be made from the same center, without any change in the adjustment of the instrument, but by simply pivoting it at one end and turning it over the desired distance or part of a circle.

Improved Middlings Purifier.

Joseph E. Gardner, Mt. Gardner, Va.—This invention relates to purifying middlings, and consists in centrally apertured friction disks placed in the case, and having a spout combined with an inclined revolving cloth belt with subjacent conveyer chamber.

Improved Self Corking Bottle.

Henry Miller and Thomas Miller, Pittsburgh, Pa.—This invention relates to an improvement in soda and other self stoppered bottles. Hitherto these have been provided with stoppers in spherical form and of specific gravity as to require the bottle to be inverted in order to be filled. In this invention the stopper is of less specific gravity than liquids, which adapts the bottle to be filled without inversion. The neck of the bottle is also constructed in a peculiar manner, conducing to strength and providing a suitable support for the stopper when the contents have been discharged.

Improved Scaffold Clamp.

John R. Crockett, Oso, Tex.—This invention consists of a clevis which is placed around the upright post of the scaffold, secured by a bolt, and provided with a central curved projecting part, to which the supporting piece of the joists is hung by means of a loop. The supporting piece is secured to the main post by an arm with a forked sharpened end, while a forward projecting U-shaped arm takes up the joist, pressing the forked end strongly into the post by the weight upon the joist.

Improved Car Starter.

William T. Beckman, Petersburg, Ill.—This invention relates to improvements in car starters of the class in which the draft is applied to a segment pivoted on the axle, and so arranged as to be connected therewith by a pawl and ratchet when moving backward. The improvement consists in the combination and arrangement of a draft bar of peculiar construction with segments placed contiguous to or against the inner sides of the wheels, so that they may take up no extra space but project upward into the same box with the wheels. It consists, also, in stops with the wheels arranged to lift the pawls off the ratchet wheels when the segments rotate backward.

Improved Saw Jointer.

George S. Prince, West Salisbury, N. H.—A short flat bar of steel, not quite as long as the radius of the saw, has a crotched end adapted to rest on the saw arbor. It also has clips attached to the edges to form guides, in which another short plate is fitted to slide forward and back. This last plate has a head on the outer end, in which a short flat file is secured by set screws, so that the points of the teeth of the saw may be caused to run against the sides and be filed off to dress them all to the same length. The arrangement of parts is such that a screw rod serves both to adjust the one plate on the other, and to hold it fixed in any position to which it may be adjusted, while screws are so arranged with the head that the file may be adjusted higher or lower on either side, or at either end, according to the bevel required to be given to the saw teeth.

Improved Book and Music Stand.

Julius E. Ulber, Port Huron, Mich., assignor to himself and Frederick I. Merryman, same place.—A sector shaped plate is hinged by its back strip to a standard, in relation to which it may be arranged under any suitable angle. A slatted side piece is applied to the plate, and is moved up or down, as required. The music rest is pivoted to the lower end of the slide, and may be turned again under any angle to the slide. The music, book, or other article which is intended to be used or exhibited on the stand, is placed on the rest, and the same then adjusted in the exact position desired, which is easily accomplished by means of set screws.

Improved Press for Hay, Cotton, etc.

Christopher D. Findlay and David D. Craig, Macon, Ga.—This invention consists in providing the tube or nut of a press follower with simple recesses and a single ball in each recess, the whole series of recesses and balls being arranged in spiral order corresponding to the thread of the follower screw, and also in combining, with the flanges of the tube and nut, conical rolls and a top-apertured and side-notched ring.

Improved Furnace Grate Bar.

William C. Wren and William Meyrick, Jeddo, Pa.—This invention consists of short parallel bars for holding the coal, mounted above a long supporting bar extending across the furnace, by short transverse plates, which sustain the heat so far above the supporting bar that it is kept comparatively cool, and is not, therefore, liable to be warped, bent, or burnt, or to crack; and the bars which are subject to the heat, being made in short pieces, do not strain the supporting bars. The short bars break joints at the meeting ends, to prevent a straight open space across the whole; also to guide the rake used by the fireman in cleaning the fire.

Improved Rocker for Cradles, etc.

Wendell Wright, Philadelphia, N. Y.—The object of this invention is to convert at will a rocking cradle or chair into a standing crib or standing chair; and the invention consists in adjustable feet attached to the rocker, which, when the rocker is in use, are turned inward, so that they do not in any manner interfere with the rocker. When it is desired to have the cradle stand firm, the feet are turned down.

Improved Cultivating Plow.

William C. Bell, Orange Court House, Va.—This is an improved plow for cultivating tobacco, corn, and other crops planted in hills or rows, so constructed as to cut up and destroy grass, weeds, briars, etc., which may be growing among the plants, and which will allow the parts subject to wear to be readily detached and replaced by new ones, or by others better adapted to the state of the plants to be cultivated.

Improved Lamp Holder.

James Telfer, L'Ance, Mich.—An arm of S shape is screwed directly into the standard of a sewing machine. The arm swings in its socket in every direction, and allows thereby the adjustment of the same, as required. The base part of the holder is provided with downward-extending feet, on which the lamp holder rests when screwed on, forming a neat base for the lamp, without requiring the taking out of the latter, which is retained on the holder by band springs, which enclose the lamp firmly until spread for taking the same out for refilling, cleaning, etc. By means of a shade, the light is thrown to the needle or part of the article to be sewn.

Improved Harvester Rake.

Eraamus H. Donaldson, Staceyville, Iowa.—To the forward end of a rotating shaft is rigidly attached a cross bar, to the ends of which are pivoted rakes, made in two parts or halves, which are placed upon the opposite sides of the bar. Rods slide longitudinally in keepers attached to the cross bar, and have cross heads formed upon their outer ends, which, when the said rods are pushed outward, catch upon the shanks of the rakes, and hold said rakes extended while sweeping the grain across the platform. As the gavel is swept into the receiving trough or upon the ground, the rakes are released by the inward movement of the rods. Suitable mechanism is provided to withdraw the catch rods to release the rakes at the proper time. The platform, which is curved into the arc of the circle, and through which the rake heads sweep, starts a little above the level of the cutter bar, passes below the same, and rises, at its inner end, above the drive wheel, and with its end is connected a trough to receive the gavel from the rake, and from which it is taken by the binders. A guide is attached to the outer end of the platform, to prevent the rakes from swinging outward, and to cause them to descend in proper position at the outer end of the platform.

Improved Shipper Lever.

Isaac F. Hoyt, Glenville, Conn., assignor to himself and J. R. Pilling, of same place.—This invention consists of the handle portion of the lever joined to the main portion, and provided with a curved extension beyond the joint in a slot in the other portion. This raises the spring catch out of the notches of the quadrant bar, when the handle, after being taken in hand by the operator, is turned into line with the principal part of the lever.

Improved Feed Water Heater.

Robert O'Neill, Negaunee, Mich.—The casting is divided into four sections, from one of which the water is taken for the supply of the boiler. Flanges project inward from the inner surface of the shell, which support the heating plates. The plates are provided with a series of tubes, through which the water passes in descending from one section to another. These tubes are about three fourths of an inch in diameter, and each plate is provided with a large number of them, so that the water is divided and exposed to the exhaust steam from the engine, and is heated by condensing and absorbing the heat thereof.

Improved Sulky Cultivator.

Ephraim Ives, Pleasant Hill, Ind.—This invention relates to an arrangement of means for adjusting the plows toward and from each other, and for locking a pivoted portion of the frame. In this way the driver has complete control over his plows, so that he can guide them in plowing crooked rows, in avoiding irregular hills, and in plowing closer to or farther from the plants, as circumstances may require. The wheels and axle may be adjusted forward or back, according to the weight of the driver, so that his weight may balance the machine.

Improved Ratchet Drill.

William M. Ellison, Kingston, N. Y.—This invention consists of a sleeve on the upper part of the drill spindle or stock, with a screw cap and a collar, so formed that when the feed screw is adjusted to its bearing at the upper end it can be bound fast to the sleeve. The latter extends down to a chamber in the head of the drill handle, where it has a toothed wheel rising on another toothed wheel on the drill stock, and geared with it by a little shaft and two pinions. The wheel of the sleeve has a few more teeth than the one on the drill stock, so that it turns slower, and thus causes the feed screw to turn slower than the spindle does, and thus slowly to screw out of it and feed the drill. The pawl of the handle acts on the wheel of the spindle for turning it. By loosening the screw cap at the top of the sleeve, the screw is freed so as to be turned readily by hand for setting the drill and releasing it.

Improved Reversible Plow.

John P. Dexheimer, Lawrenceburg, Ind.—The pivots of an extension mold board are fixed in bearing brackets, one of which is arranged to slide in a bearing in the bottom of the plow, and is provided with a bolt to hold it at any desired point. The mold board may thus be extended more or less to regulate the turning of the furrow, as may be desired for different kinds of work.

Business and Personal.

The Charge for Insertion under this head is \$1 a Line.

Dry Steam, dries green lumber in 2 days, and warms houses. H. G. Bulkley, Cleveland, Ohio.

Nickel Plating—A superior, warranted mode for sale and references given by A. Scheller, 113 Forsyth Street, New York.

Brass Plating on Zinc without Battery—Instructions for sale by A. Scheller, 113 Forsyth St., N.Y.

B. A. Jenkins, La Crosse, Wis., makes Iron Slat Blinds for buildings.

Hydrostatic Presses—Best in use. John Rodgers' Sons, Machinists, Engineers, and Iron Founders, Albany, N. Y.

Wanted—A Mangle for ironing plain goods. Send description and price to J. F. Edgar, Corinth, Miss.

In playing Croquet, a rigid and upright bridge is essential to Scientific play. Bradley's Patent Sockets insure this.

For Sale—Steam Engine, 500 horse power—Cylinder 36 in.—Stroke 4 ft.—Condenser—Wrought Iron Shaft—25 ton Fly Wheel. Made by Hewes & Phillips, Newark, for the Fagin Flour Mill. Used scarcely any. Gave best results ever attained in Flouring. Apply to Henry Hill (late Fagin & Co.), P.O. Box 226, Newark, N. J.

Who will manufacture this Bit? See Scientific American, Feb. 14, 1874. Address Christian Monson, Moscow, Wis.

The Right to Sell and Manufacture Broughton's Lubricators, Faucets, &c. All Territory West of Kansas for Sale. The most perfect goods in market. Apply to H. Moore, 48 Center St., New York.

Wanted—The address of makers of wooden match boxes. S.R., 447 N. 7th Market St., Philadelphia, Pa.

Money Partner Wanted—To work Jenner's Patent New Principles of Propelling on Canals, with boats now in use, without changing their form. Four miles per hour guaranteed with a 12x12 Engine or its equivalent. Call and see a working model, or send for circular. C. H. Jenner, Brockport, N. Y.

Wanted—Capital to patent an article needed by every traveler. Address J. W. S., Box 16, Woodbury, New Jersey.

Iron Planers, Lathes, Drills, and other Tools, new and second hand. Tully & Wilde, 20 Platt St., N.Y.

Wanted—Agents for the last and best Fire Rinder in use. Sample sent to any address for 50 cents. Address R. D. Dodge, De Soto, Iowa.

The finest Machinery Oils, combined from sperm, tallow and lard, suitable for all machinery, are now being furnished to consumers at from 40 to 75 cents per gallon, by Wm. F. Nye, New Bedford, Mass. His famous Sperm Sewing Machine Oil received the highest award at the Vienna Exposition.

Horizontal Engine, 6x15, second hand, good order, little used. Price, complete, \$325. E. P. Watson, 42 Cliff St., New York.

Amateur Astronomers can be furnished with good instruments at reasonable prices. Address L. W. Sutton, Box 218, Jersey City, N. J.

To Investors—Wanted, by a Hardware House in New York, some small and useful article in their line to manufacture, either on royalty or otherwise. Address, with full particulars, D. & Co., 5 Beekman St., Room 27, New York.

Patent Sewing Machine Treadle for Sale—Three different kinds in use—one foot pressure makes sixty stitches. The improvement can be applied to any machine. For information, send to Dr. L. Heins, Brunswick, Ga.

Microscopes, Spy Glasses, Lenses. Price List Free. McAllister, Optician, 49 Nassau St., N. Y.

For Sale—Several Screw Machines of different sizes, cheap; also, a second hand Press. Write, for particulars, to A. Davis, Lowell, Mass.

Removal—L. & J. W. Feuchtwanger, of 55 Cedar St., have removed to 159 Fulton St., two doors above Church St., New York.

Chemicals, Drugs, and Minerals imported by L. & J. W. Feuchtwanger, No. 159 Fulton St., removed from 55 Cedar St., New York.

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The "Scientific American" Office, New York, is fitted with the Miniature Electric Telegraph. By touching little buttons on the desks of the managers, signals are sent to persons in the various departments of the establishment. Cheap and effective. Splendid for shops, offices, dwellings. Works for any distance. Price \$5. F. C. Beach & Co., 363 Broadway, New York, Makers. Send for free illustrated Catalogue.

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

All Fruit-can Tools, Kerracut, Bridgeton, N.J.

Brown's Coal-yard Quarry & Contractor's Apparatus for hoisting and conveying materials by iron cable. W. D. Andrews & Bro., 411 Water St., New York.

For Solid Emery Wheels and Machinery, send to the Union Stone Co., Boston, Mass., for circular.

Lathes, Planers, Drills, Milling and Index Machines. Geo. S. Lincoln & Co., Hartford, Conn.

Engines 2 to 8 H.P. N. Twiss, New Haven, Ct.

Steptoe, McFarlan & Co., No. 212 to 220 West 44 St., Cincinnati, Ohio, manufacturers of Wood-working Machinery and Machinists' Tools. Send for circulars.

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Diamond Carbon, of all sizes and shapes, for drilling rock, sawing stone, and turning emery wheels; also Glaziers' Diamonds. J. Dickinson, 61 Nassau St., N.Y.

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

Temples & Oilcans. Draper, Hopedale, Mass.

Hydraulic Presses and Jacks, new and second hand. E. Lyon, 470 Grand Street, New York.

Peck's Patent Drop Press. For circulars, address Milo, Peck & Co., New Haven, Conn.

Small Tools and Gear Wheels for Models. List free. Goodnow & Wightman, 35 Cornhill, Boston, Mass.

The French Files of Limet & Co. are pronounced superior to all other brands by all who use them. Decided excellence and moderate cost have made these goods popular. Homer Foot & Co., Sole Agents for America, 30 Platt Street, New York.

Winans' Boiler Powder. Box 6 N.Y.P.O. 19 years a practically safe & successful "Scale" prevention.

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Engines, Boilers, Pumps, Portable Engines, Machinists' Tools, J. H. Shearman, 45 Cortlandt St., N.Y.

Automatic Wire Rope R.R. conveys Coal Ore, &c., without Trestle Work. No. 61 Broadway, N.Y.

A. F. Havens Lights Towns, Factories, Hotels, and Dwellings with Gas. 61 Broadway, New York.

Best Philadelphia Oak Belting and Monitor stitched. C. W. Aray, Manufacturer, 301 & 303 Cherry St., Philadelphia, Pa. Send for circular.

Rue's "Little Giant" Injectors, Cheapest and Best Boiler Feeder in the market. W. L. Chase & Co., 93, 95, 97 Liberty Street, New York.

A Superior Printing Telegraph Instrument (the Selden Patent), for private and short lines—awarded the First Premium (a Silver Medal) at Cincinnati Exposition, 1871, for "Best Telegraph Instrument for private use"—is offered for sale by the Merchants' Mfg. and Construction Co., 50 Broad St., New York. P. O. Box 496.

Dean's Steam Pumps, for all purposes; Engines, Boilers, Iron and Wood Working Machinery of all descriptions. W. L. Chase & Co., 93, 95, 97 Liberty Street, New York.

Steam Fire Engines—Philadelphia Hydraulic Works, Philadelphia, Pa.

Bone Mills and Portable Grist Mills.—Send for Catalogue to Tully & Wilde, 20 Platt St., New York.

Waterproof Enamelled Papers—all colors—for packing Lard and other oily substances, Chloride of Lime, Soda and similar Chemicals, Cartridges, Shoe Linings, Wrapping Soaps, Smoked or Dried Meats, and Dehydrated Vegetables, Shelf Papers, and all applications where absorption is to be resisted. Samples on application. Crump's Label Press, 75 Fulton St., New York.

For descriptive circulars, and terms to Agents of new and saleable mechanical novelties, address James H. White, Newark, N. J., Manufacturer of Sheet and Cast Metal Small Wares.

Emerson's Patent Inserted Toothed Saws, and Saw Swage. See occasional advertisement on outside page. Send Postal Card for Circular and Price List. Emerson, Ford & Co., Beaver Falls, Pa.



B. W. F. is informed that an American gallon contains 231 cubic inches; an English Imperial gallon, 277.274.—F. D. L. will find a description of a process for black enamel on iron on p. 203, vol. 26.—P. S., who asks questions as to roofing, etc., should send his name and address.—H. E. J. should consult our advertising columns for books on carpentry.—J. F. F.'s reply to V. C. is incomprehensible.—W. H. S. will find directions for making vinegar on p. 58, vol. 30. Solid opodeldoc can be made by using more soap in the mixture.—G. O. D. will find recipes for gliding on glass on p. 283, vol. 30. Asphaltum varnish is described on p. 233, vol. 26. For painting on glass, see p. 123, vol. 30.—T. F. will find directions for a cement for mending china on p. 241, vol. 27. Tempering springs is described on p. 251, vol. 29. Black asphaltum varnish for cast iron is described on p. 233, vol. 26.—J. T. B. will find a recipe for jet black ink on p. 203, vol. 29.—S. A. M. will find directions for making marking ink on p. 251, vol. 29.—For whitewash, see p. 250, vol. 29. For paper boats, see p. 168, vol. 27.

W. F. H. asks: 1. How can I find the velocity of water in any sized flume? A. By experiment. 2. What percentage of power do overhead wheels usually yield? A. From fifty to seventy-five per cent. 3. Can you give me a rule for laying out bevel gears? A. You will find it in any treatise on mill work.

A. M. B. says: 1. In vol. 30, No. 12, you speak of an ice boat going nearly three times as fast as the wind. B. says that this is against common sense. Can you explain it? A. You will find the matter clearly explained on p. 176, vol. 28. 2. What would be the real lifting power of an engine of 4 horse power? A. It would be able to lift 132,000 lbs. one foot high in a minute.

In our answer to L. E. L., in the SCIENTIFIC AMERICAN for April 4, 1874, the sentence that "port area one half that of the piston" should read: "port area from one twentieth to one fifteenth the area of the piston."

G. A. B. says: We use two kinds of brake shoes on our cars, one of wood, the other of iron. My friend says that the iron ones are the best, for the reason that he can screw down brakes as hard as he pleases with the iron shoes, and the wheel will scarcely ever slide on the rail; but with the wooden one, half the force expended will cause the wheel to slide. I, on the contrary, say that the wooden one is the best, for it is the one which retards the revolving of the wheel most with the least expenditure of "elbow grease;" we do not question which is the best material for shoes for general usage, but which will stop a train in a given time with the least power expended by the brakeman. Who is right? A. The friction between the wheel and the wooden shoe would ordinarily be greater for the same pressure, than when the iron shoe was used. 2. What gum can I get which will dissolve in alcohol and after drying be again soluble in water? A. We do not know of any.

G. W. M. asks: About how deep will cast or wrought iron rust, if exposed to all weathers? A. Experiments have not been very extended, but it is supposed that, if the metal is not subjected to strain, it will rust about 1-16 of an inch deep in 25 years.

S. H. D. asks: Why is it that a common portable pump, used on a portable steam engine to feed the boiler, will not take hot water but will take cold water? A. The vapor formed by the hot water creates such a pressure that the valves cannot open.

G. R. B. asks: Is the weight or pressure upon the valves of a steam engine the area of the ports or openings which are covered by the valves multiplied by the pressure per square inch, and are the valves balanced when the ports or openings are not covered by them? In short, is the theory of no port, no pressure, correct, and do the rules which apply to the figuring of the weight or pressure on the valves of an engine also apply to the pressure upon the piston packing? In other words, can the rings of the so-called steam piston packings be set out by steam? A. The pressure of the valve is that due to its own weight and the unbalanced pressure of the steam on it. Thus, if an equal area is pressed on top and bottom of the valve, all the pressure will be taken off. There are several styles of piston in which the packing rings are set out by steam pressure.

W. C. M. asks: 1. Is tallow the best thing for lubricating an engine cylinder? Is there anything that will improve it for the purpose? A. Some prefer oil. 2. How can I bleach tallow without injuring it? A. Melt and strain it before using.

H. W. says: 1. We attribute to Newton the discovery of the law of gravitation. Is there an opposite law of repulsion? A. Yes, but it acts at very small distances. Molecules repel each other according to the amount of heat they contain; the temperature of space, supposed to be 300° Fah. below zero, is sufficient for ether vibrations. 2. Newton dignified his discovery by declaring the law of gravitation to be a principle inherent in matter. In the same sense, is there not also an opposite law of repulsion which is a principle inherent in matter? A. No. 3. I suppose it may be said that gravitation is not now considered to be a principle, but an effect of force. In this view of the case, is there not repulsion which is in the same sense an effect of force? A. No. 4. Do or can astronomers explain the movements of cosmical bodies satisfactorily upon the theory that they are balanced between the centripetal and the centrifugal forces, or do they offer any satisfactory explanation of such movements on any basis which ignores the existence of a law, a principle or an effect, of repulsion which is independent of the above named forces? A. The moon falls toward the earth one twentieth of an inch every second, instead of going off at a tangent. See Loomis' "Treatise on Astronomy." 5. If the earth swings around the sun in an orbit predetermined only by its momentum, its centripetal and its centrifugal force, why is it that, when its orbit is once disturbed or varied, as it has been thousands of times by the planet Mars, for example, that the variation does not remain a permanency? [A. Where two bodies have exactly commensurate orbits, the orbit of the smaller body is entirely changed. Hence the gap in Saturn's ring has been caused by one of its satellites. In the formation of a solar system, only those orbits survive which are incommensurate with each other. 6. Comets which come to the center of our system are hurled back into the depths of measureless space. What is the power which operates with such irresistible certainty? Can their eccentric orbits possibly be referred to the equal and unvarying centrifugal force? Is not every known mechanical supposition opposed to such a theory? A. All bodies move with their greatest velocities at the perihelion passages. Hence their ability to get away again. 7. But all orbits of all cosmical bodies are like those of comets, namely, they have an ellipsoidal form of revolution. Does not this indicate the idea that the laws which compel them to retain their orbits are in all cases the same as those affecting cometary revolutions? Here end the questions I desired to ask. The theory of a principle of repulsion has already been announced. It remains to ascertain how this law or principle or effect comes into existence. Take two balls of some light substance, dried pith is as good as any. Let one of these be surcharged with electricity, and it will attract the other. Let the two balls remain in contact with each other a short time, long enough for their electrical condition to become equalized, and they will repel each other. Now suppose the sun to be a highly charged electrical body, and a comet to be relatively an uncharged body, it follows that the comet will be drawn toward the sun by electrical attraction. It is true that the comet will be drawn by the force of the attraction of gravitation also, and will be governed by its centrifugal force, but the electrical attraction will supplement these forces. Arriving near the sun, the electrical condition of the comet becomes changed by reason of its proximity, and hence is repelled just as one pith ball is repelled by the other when the condition of the two has become equalized. It is proper to say here that while many various phenomena of electrical action are recognized, yet the whole subject of electricity, its connection with heat motion, the contraction or expansion of bodies by heat or from other causes, its development by motion or from contiguity of bodies, in short, the whole theory of the correlation of forces, can hardly be said to be understood, and in many respects is halting and unsatisfactory. Whether the sun is surrounded by what may be called an atmosphere of electricity, which reaches beyond the boundaries of the outermost planet, or whether the electrical condition of cosmical bodies is excited by their expansion by heat when they arrive at their points of closest proximity to the sun (which appears improbable), one thing is certain, which is that there is a law or principle or effect of repulsion which is a necessary law, and which defines those circular boundaries in space which the worlds may not overpass. A. Electrical forces appear to play a very subordinate part in Nature. Stars are seen to drift about in currents and vortices with an occasional collision. The resulting combinations are in exact accordance with the law of gravitation. The notes in a sunbeam, the shining noctiluca miliaris in the sea, or Brownian movements of minute particles under the microscope, may serve to illustrate these currents of circulating stars.

E. B. W. asks: 1. What is the rule for finding the area of a segment of a circle? A. It is equal to the area of the circular sector, bounded by the same arc, diminished by the triangular portion of the sector. 2. Also of an ellipse? A. The area of an ellipse is equal to 0.7854 times the long diameter multiplied by the short diameter. 3. What causes a liquid to circulate when running downwards through a hole, as, for instance, through an opening in the bottom of a vessel? A. The motion is given to it by the spiral form of the hole, or the position of the hole in reference to the center of the vessel. 4. What is the best recent work on surveying? A. Trautwine's works are among the latest and best.

T. G. asks: 1. How can I solder or braze two pieces of brass together steam tight? A. See p. 251, vol. 28. 2. What is the best thing to remove scale from a boiler? A. Try putting about two ounces of muriate of ammonia in the boiler twice a week. 3. Ought a person who wishes to be an engineer to study any books, or is practice alone sufficient? If not, what books are the best? A. By all means study good books. Begin with Bourne's "Catechism of the Steam Engine." 4. What is the best paint for a smoke stack? A. See p. 295, vol. 28.

C. R. asks: 1. How can I make a good cement for filling air holes in cast iron? I want something that will stand heat. A. You can tap the hole, and screw in a piece of metal. 2. Which draws the most water, a side wheel steamer or a propeller, both 1 mile being of the same size and shape? A. Generally there is no drag in either case.

D. B. S. says: 1. In a lecture on electricity, a piece of money was placed in a saucer of liquid that looked like water, and a person could have it if he could pick it out. In one hand was to be placed a ball connected with the wire of a battery, which did not have any effect on the person until the other hand touched the liquid, when that hand would immediately fly upward the length of the arm. What was the liquid? A. Probably water. 2. Why did the effect take place? A. The water in the basin was connected with the other pole of the battery, so that, on touching it, a violent shock was given to the system, with the result you describe. 3. Are caoutchouc and gutta percha the same? A. No. 4. Will a bell give the same volume of sound if struck on the outside that it will when struck on the inside, the blow being equal in both cases? A. Depends upon the size and form of bell. Small bells, we believe, give better sound when struck upon the outside.

M. asks: 1. Do you think I can master mechanical drafting without the aid of a teacher, other than books? Whose work would be the best on drafting? A. You can learn a great deal from a book, but there are many things that a draftsman should know that can only be acquired by experience. We can recommend Professor Warren's works. 2. Why will a screw propeller make more turns, other things being the same, in running against the tide than in going with it? A. We would like some good evidence that this is a fact before seeking for a reason.

M. W. H. asks: 1. Will vegetable or any freezable bodies freeze in alcohol? Will they freeze as soon as the alcohol gets below 32° Fah.? A. When the temperature of the alcohol sinks below the freezing point of the substances contained in it, they will freeze. 2. Why does a telescope magnify if we look through from the big end at anything close to the little end, while, when looking at anything a few feet off, it makes it smaller? A. In the former case the rays proceeding from the object glass enter the eye as a diverging beam. 3. Is there such a thing as a single glass telescope, or thing that can be used as a telescope? A. A single glass telescope is not possible. 4. Will nitro-glycerin explode as soon as the acids and glycerin are poured together, or does it have to be stirred together and left to stand for a while? What are the proportions of chemically pure nitric acid, sulphuric acid, and glycerin, by weight, to make nitro-glycerin? A. See p. 283, vol. 30.

M. M. asks: 1. Where gas from the city works can be bought for \$3 per thousand feet, would it be economy to generate hydrogen by the action of sulphuric acid at 3 cents per lb., upon iron turnings at 1 cent per lb., and give it luminosity by passing through a filter saturated with coal oil at 20 cents per gallon? A. If these figures represented the entire expense of the manufacture, it would be. 2. What is the cheapest method of procuring oxygen upon a large scale without expensive apparatus? A. The oxygen companies use chlorate of potash heated in iron pots. The simplicity of the plant employed and the purity of the gas compensate them for the cost of an expensive material. 3. Is the calcium light made by a jet of common air through a flame of illuminating gas upon a piece of chalk of sufficient intensity to use as an illuminating agent? A. No.

J. H. says: I have two coal shafts, both sunk to the same vein, one for downcast and the other for upcast. I am using for a ventilating power, at the bottom of the upcast, a large furnace; and in addition to the furnace I have the upcast elevated 45 feet above the level of the down cast; both shafts are of the same size, 7x14 feet. If I make the mouth of the downcast 18 feet square in place of 7x14 and bring it down to the regular size at 15 feet down the shaft, which I think would make a kind of receiver, would it add to the weight or pressure of air in that shaft, and be any help to the furnace? A. No. 2. Is coal tar injurious to wire rope? A. No.

G. E. D. asks: How can I make sensitized paper? A. Take albumen paper, and float (prepared side downwards) on a bath of 1 oz. nitrate of silver in 18 oz. distilled water; add a few drops of citric acid to dissolve the first precipitate. Float for half a minute and dry in a dark room.

E. D. B. asks: 1. Are the grounds of cameos colored artificially after being cut, especially the beautiful green ones? If so, by what means? A. No. The different colors belong to the various strata of the stone. 2. What work on geometry has a full description of the curves of the fourth order? I have heard that, by the use of the discoid, an angle could be trisected; is this so? A. In treatises on the calculus. The discoid is a curve of the third order. It is described in Newton's "Universal Arithmetical." 3. Has there ever been a supposed metallic base of hydrogen discovered, or is any such supposition entertained by Science? A. It is considered a reasonable hypothesis by some scientists; but so far as we know, no such metallic base has been discovered. 4. Is the ultramarine water color made from the stone lapis lazuli? If not, what is the reason of its great cost? 4. Yes. Artificial ultramarine is also made, and sold much cheaper.

D. B. asks: 1. Where is the proper place to bolt a portable engine to a boiler, on the side or on top? A. Either place will do, if the boiler is properly braced. 2. Is a portable engine, placed on the top of the boiler and using a double crank, as strong as one bolted to the side of the boiler, using a single crank? A. Yes, if well proportioned. 3. I have a portable engine, cylinder 5 x 10 inches and speed 130 revolutions per minute; the firebox is 10x19x19 inches, with 32 flues (1 1/2 inches) of copper, 32 inches in length. I use the exhaust blast, contract 4 to 5 1/2 inch, in a stack 8 inches in diameter and 17 feet high. The pressure is 30 or 40 lbs. Would it be more economical to lengthen the boiler to 4 feet, using the same number of flues? A. We would not recommend this change.

C. O. asks: 1. What is the difference between the actual and nominal power of a steam engine? A. Actual power depends upon actual conditions under which the engine works. Nominal horse power is obtained from assumed conditions. 2. What would be the power of an engine that has 36 inches stroke, 16 inches diameter of cylinder, and 45 revolutions a minute worked with 70 lbs. of steam? A. You do not send sufficient data. See article on "Indicating Steam Engines," p. 64, vol. 30. 3. How much is to be deducted for friction? A. From 20 to 50 per cent. The precise amount can only be determined by experiment. 4. Is half the power lost by the crank in converting rectilinear into circular motion? A. No.

S. A. R. asks: In making steam connections using the globe valve, which end of the valve should be placed next the steam pressure? A. It is generally placed so that the pressure is on top of the valve. Some engines, however, prefer to arrange it in the other way, so as to be able to pack the stem under pressure.

J. H. H. asks: 1. What causes zinc to bubble and leave blow holes when poured into a plaster of Paris mold? A. It may be caused by impurities, or by insufficient vent in the mold. 2. What kind of anti-mony is used to harden zinc? I bought some, but it turned black and would not melt. A. You probably have a compound or an impure article. 3. I took a bottle and filled it with water, and then put in a cork with just enough lead on it to make it sink very slowly. I then connected a force pump to the bottle, supposing that when the pressure became great enough the cork would rise to the surface. I put 35 lbs. pressure on the bottle, but the cork stayed down. I then took off enough lead so that it would just float; then when the pressure was put on, the cork went down and would come up when I lessened the pressure. A. When the pressure was increased, the air in the cork was compressed, and sufficient water entered to make it sink. When the pressure was taken off, the air expanded and forced out the water.

H. S. H. asks: If a quantity of air be compressed to half its bulk, what pressure will it exert against the sides of a vessel? By what rule of proportion is the pressure governed? A. If the temperature is constant during the compression, the pressure varies inversely as the 1/408th power of the volume.

T. W. M. asks: Can you tell me of a cheap and simple method of reproducing manuscript music? A. Write it of lithographic transfer paper, have it transferred to stone, and printed by a lithographer.

R. U. asks: How is phosphor bronze made, and what percentage of phosphorus does it contain? A. Phosphor bronze is made by adding a small portion of phosphorus to common bronze or gun metal. The latter is composed of 90 parts of copper, and 10 parts or less of tin. To this, from 5 to 10 per cent of phosphorus is added, to make phosphor bronze.

C. R. asks: How can I make French polish, and how should it be applied? A. Dissolve 1 1/2 ozs. shellac and 1/4 oz. sandarac in 1/2 pint naphtha. Wet a piece of flannel with polish, stretch a clean linen rag over the flannel, apply one drop of linseed oil to the linen, and rub in a circular direction.

P. H. B. asks: What kind of roof will a composition, said to be composed of French asphaltum, hydraulic cement, salt, coal, tar, and sand (of such consistence as to be easily spread with a plasterer's trowel upon paper felting) make? What is the difference between French and American asphaltum? What is and what are the uses of an oil called dead oil, said to be mixed with carbolic acid for disinfecting purposes? A. There is no asphalt called French asphaltum as distinguished in any peculiar quality from any other asphalt. The combination of ingredients specified by you is useless for the purpose indicated, as the salt would destroy its efficiency by continually attracting moisture from the atmosphere. Dead oil is the last that comes over in distillation, and is a fatty oil that is not likely to dry well in such a composition. A great deal of the material complained of is sold to be put on by the purchaser, and unless properly laid is not likely to give satisfaction; cases have occurred, we are informed, where the material has been sent out with the plainest directions, and where, nevertheless, the preparation of felting, etc., has been laid with the upper side down, thus exposing to the weather a surface never intended and not prepared for it.

A. D. B. asks: Will copper wire, which is covered with cotton and then with beeswax, do for a primary coil? A. Two thicknesses of it may be used. 2. I have a coil which is too small, the covering of the wire of the primary of which is worn off in some places, and the secondary coil has been cut in several places. Can I mend the fine wire, and, with more added to it, use it for the one I wish to make? A. There is no reason why the wire should not answer when properly joined. 3. Is it necessary to put layers of oiled silk or other insulator between the layers, it being covered with cotton? A. The oiled silk will perfect the insulation.

A. A. W. asks: What kind of wood are gutters made of? A. Well seasoned pine is frequently used.

C. G. asks for a recipe for making furniture polish. A. Take pale raw linseed oil 10 ozs., lac varnish and wood spirit each 5 ozs. Mix well, and it is ready for use. This is a restorer for French polished wood.

C. R., and Mrs. G. W. P. ask: 1. How can I make a light gray color to color a brown wall so that it will stand the weather? A. Put a very little blue black in ordinary whitewash. 2. How can I make a dark brown color for the same purpose? 2. Use umber or ochre in whitewash, to the shade required.

A. H. W. G. asks for a recipe for turner's cement, for holding small articles in the lathe. A. Take Burgundy pitch 2 lbs., resin 2 lbs., yellow wax 2 ozs., dried whiting 2 lbs.; melt and mix.

D. E. R. asks: How can I put a fine polish on walnut in a very short time, say 3 hours? A. Melt 3 or 4 pieces of sandarac, each the size of a walnut, add 1 pint boiled oil, and boil together for 1 hour. While cooling, add 1 dram Venice turpentine, and if too thick, a little oil of turpentine also. Apply all over; and after a few hours, rub it off.

G. F. F. asks: What is the best thing to use in cleaning silver plated goods? A. Prepared chalk in cold water: apply with a plate brush, chamols leather, or soft woolen rag.

Mr. E. Kireersky, of Penza, Russia, and many other correspondents ask for further particulars as to burning brick with petroleum, described on p. 53 of our current volume. Will our "Old Subscriber" send us the details?

J. S. G. asks: 1. Has the exhaust steam of a high pressure engine ever been used as a source of power? A. Yes. In the compound engine, its expansive power is utilized. In other inventions, it is used to run a second cylinder with vapor of a liquid of a low boiling point. 2. How is a compound engine constructed? A. See pp. 116, 391, vol. 25.

C. R. McC. asks: I. Can water be raised and thrown with a hydraulic ram to 250 feet elevation and 1,600 feet distance through 3/4 pipe with a strong spring and 21 feet of fall from springhead to ram? Would such a situation afford a reasonable supply of water for a dwelling and barn, by using the most improved ram? A. You can make a good ram answer the purpose, if you have plenty of water in the spring. A manufacturer will give you instructions as to the proper size of pipes.

C. F. B. says: I have a room 14x15, heated by a stove, which I wish to ventilate by leading a register into an air passage between the boarding and plastering. Where should the register be put, at the top or bottom of the room? A. You should have two registers, one at the top and one at the bottom.

R. A. M. asks: Would it be practicable to plate steel pens with zinc, tin, or other metals, either by dipping them in the molten metal or by electricity? Would it prevent them corroding without injuring the temper? I have succeeded in tinning a few without injuring their writing qualities, with a common soldering iron, with the aid of muriate of zinc. A. Steel pens plated with different incorrodible metals are largely manufactured.

P. H. W. asks: 1. What is tin foil, such as is used for wrapping tobacco, composed of? A. An analysis of a piece of tobacco tin foil in our possession showed that it contained mostly tin with some lead. Seven other samples obtained from different sources had the same composition. 2. What are storm glasses, indicating changes in the atmosphere in advance of storm, wind, etc., filled with? A. See p. 121, vol. 29.

J. W. B. says: I wish to make a Ruhmkorff induction coil. I have 10,000 feet of No. 22 silk covered wire for the secondary coil. Of what size and length of wire should the primary coil be? A. Forty feet No. 12 copper wire, silk-covered and varnished with shellac in alcohol. 2. What should be the diameter of the iron core? What should be the length of the coil? A. A bundle, 1 inch in diameter and 1 foot long, of No. 16 soft iron wire. 3. What amount of surface should the condenser have? Are tin foil and paper the best to make it of? A. 30 square feet of tin foil and 50 square feet of paper soaked in melted paraffin is the best known. 4. What is the best material for the ends of the coil? A. Glass or hard rubber. 5. About what length of spark will I be able to get from a coil of that size? A. If carefully drawn, pure copper wire is used, well insulated with paraffin or shellac, you will get a spark 1 inch through air, with two cells of Grove's battery. 6. What is used for polishing black rubber with? A. French polish. 7. Do you think I could make a Ruhmkorff on this plan, without loss of power or other defects? A. Yes; it is better to have less metal around the secondary coil. 8. What book on electricity and magnetism do you think the best? A. Noad's is a good work.

W. H. B. asks: Is there any quick way of finding the number of diameters which a small compound microscope will magnify? A. For scientific purposes, it is generally determined experimentally by means of a micrometer. If you can find the focal of the object glass and the eyepiece, the magnifying power of each can be determined approximately by dividing 10 by the focal distance. The magnifying power of the microscope is equal to the product of the two magnifying powers so found.

M. M. S. asks: 1. What load will a thimble sketched wagon bear, with 4 inch spindles, the wheels being three feet and one half in height? A. We are not familiar with wagons of that kind. 2. What is the largest sized cube that can be cut from a globe whose diameter is 12 inches? A. One having a face about 6.93 inches square. The rule is to multiply the radius of the sphere by 1/1516, to find an edge of the cube. It is given in nearly every work on mensuration.

M. & S. ask: What is best to use on chills to prevent blowing? A. You do not need sufficient details to enable us to give you any information. Matters of this kind are best learned by experience. They may be considered secrets, akin to the secret of Ogle, who was asked how he mixed his colors, and replied "with brains." We have seen it stated, however, that it is a good plan to cover the mold with a mixture of red lead and oil.

L. T. W. asks: 1. Will you give me the formula for ascertaining the number of square inches of heating surface in cylinder and flue boilers? A. Heating surface of cylinder boiler in square feet = $3.1416 \times \text{radius in feet} \times \text{length in feet}$. Heating surface of flue boiler in square feet = $3.1416 \times \text{radius of shell in feet} \times \text{length in feet} + 3.1416 \times \text{twice the number of flues} \times \text{radius of flues in feet} \times \text{length of flues in feet}$. 2. How do you estimate the horse power of a boiler, either cylinder or flue? A. We can give you no definite rule. 3. How can I compute the area in square inches of a square fire box? A. The area is equal to the product of the length and breadth, supposing the surface to be flattened out. 4. How many horse power would vacuum add to an engine, or, in other words, if a high pressure be converted into a low pressure engine, how would you estimate the added horse power? A. It would increase the mean pressure in a certain ratio, and the horse power in the same ratio, other conditions being the same.

J. B. asks: Can a concavo-convex lens, 1 1/2 inches in diameter, be made to throw a focus 1/4 inch in diameter at a distance of 48 inches? A. The focal image of a star is a bright point. The diameter of the image compared with that of the object is proportional to their respective distances from the lens, if aplanatic.

A. S. says: 1. We put steam from a small engine into a tank for supplying the boilers, likewise the steam from pump at boilers; we use olive oil for lubricating. Will it hurt our boilers or cause them to scale? We use terra japonica as a boiler purge, and find it very effective in removing scale. A. The oil will not injure the boilers, unless you use a very large quantity. 2. When you speak of heating surface (in calculating horse power), do you mean all the parts exposed to the action of the fire or heat, such as the tubes, back end of boiler, and all below the brick work? A. All this surface is ordinarily counted. Some persons, however, do not estimate all. 3. Is there any means of finding where there is water for a well without digging for it? A. If the soil is not rocky, you can make borings with very little trouble. 4. Does a broad belt on a pulley cause more friction if only the same weight be applied, as a narrow one? A. No. 5. What is the best material for preserving belts and keeping them in working condition? A. Castor oil is often recommended.

E. S. W. asks: What is the amount of resistance per foot of cross section to a body moving in the air at a given rate, say 100 feet per second? When the velocity is equal to that at which air will flow into a vacuum, is the resistance equal to our atmosphere? Does much depend upon the shape of the body? What reliable experiments have been made, and where can the results be found? A. Experiments on this subject are far from complete. A resume of the most important is given in the *Encyclopaedia Britannica*, and the rule is deduced that the resistance of the air to the motion of a plane surface, in grains per square foot, is equal to 16 times the square of the velocity in feet per second. A sphere does not encounter more than one fourth the resistance that would be opposed to the motion of a plane surface with the same cross section.

P. O. T. asks: How can I estimate the amount of tannic acid in bark, leaves, and roots of different kinds? A. By precipitating the tannin with protochloride of tin mixed with chloride of ammonia, and measuring the precipitate.

L. W. E. asks: How many gallons of water are required, per horse power, to run a small engine for a day? A. From 50 to 75 gallons per day of 10 hours.

G. G. C. says: I am running an eight horse engine with coal. The furnace has a poor draft; would the pipe referred to in a recent issue of your paper, to throw steam direct from boiler to stack, be of any use? We run the engine all the time, and exhaust into the stack. Would it be of any use to reduce the size of the exhaust nozzle? It is large, I think 1 1/2 inches in diameter. How small shall we make it? A. Generally, the exhaust can be arranged to make enough draft.

G. E. S. asks: Will a tin boiler, 2 feet long and 18 inches in diameter, be large enough and strong enough to run an engine cylinder 5 inches stroke and 3 inches diameter, at 30 revolutions per minute? A. Yes.

J. T. and others: Foaming in boilers is especially caused by impurities in the water, insufficient steam room, and too heavy firing.

W. S. W. says: 1. In your issue of March 14, the statement is made that the combustion of 1 lb. of coal in one minute is productive of a force equal to the work of 300 horse power during the same time. A. The work represented by 300 horse power is the same as that required to raise 3,600,000 lbs. 1 foot high in a minute. Now every unit of heat produced by the combustion of coal, if it could be converted into work, would be capable of raising 772 lbs. 1 foot high, so that the number of units of heat required for the production of 300 horse power would be about 13,600 a minute; and the total heat of combustion of ordinary coal exceeds this. 2. Have not theory and practice shown us that 2 1/2 lbs. consumption of coal to the horse power per hour is a very favorable result? A. The large ocean steamers at present consume about 2 1/2 lbs. of coal per hour per horse power. Better results are obtained in some cases.

W. W. B. asks: 1. Will a gun with a long barrel shoot straighter than one with a short one? A. Other things being equal, probably one will shoot with as much precision as the other. 2. What was the name of the first newspaper printed in the world, and where was it published? A. The first periodical newspaper whose existence is not disputed; was published at London, May 22, 1622, by Nicholas Bourne and Thomas Archer. It was called *The Weekly News*. 3. Where was the first balloon voyage made, and who made it? A. At Paris, November 21, 1783, by Pilatre de Rozier, and the Marquis d'Arlandes. 4. How much does the atmosphere surrounding the earth weigh? A. About 11,000,000,000,000,000 lbs.

COMMUNICATIONS RECEIVED.

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

On a Theory of the Sense of Smell. By D. E. G.
On laying out Teeth of Gears. By H. I. C.
On a Museum of Natural History. By J. G. L.
On the Cause of the Tides. By W. M. D.
On Steam on the Southern Rivers. By G. W. S.
On Drying Lumber. By H. R. T.
On a Boiler Explosion. By A.
On Using Old Tin Cans. By J. P.
On Hydrogen. By V. P.
On Modern Telegraphy. By G. L.
On the Keely Motor. By D. D. P.

Also enquiries and answers from the following:

C. W. Y.—D. E. G.—J. T. B.—C. W. B.—H. G. H.—W. W. H.—R. H.

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

Correspondents in different parts of the country ask: Who makes ax helves and similar wooden articles? Who sells electric gas-lighting apparatus? Who makes cotton seed hullers and linters? Who makes a wood engraver's ruling machine? Makers of the above articles will probably promote their interests by advertising, in reply, in the SCIENTIFIC AMERICAN.

Several correspondents request us to publish replies to their enquiries about the patentability of their inventions, etc. Such enquiries will only be answered by letter, and the parties should give their addresses.

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

April 14, 1874,

AND EACH BEARING THAT DATE.

(Those marked (r) are reissued patents.)

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APPLICATIONS FOR EXTENSION.

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:

29,157.—CAR COUCH.—W. A. Brown. July 1.

29,162.—FLOW.—L. Greene. July 1.

29,180.—HOISTING APPARATUS.—J. Lemman. July 1.

29,212.—SPRING HINGE.—A. Acker. July 1.

29,264.—BOAT LOWERING.—W. Flowers et al. July 8.

EXTENSIONS GRANTED.

27,898.—REFLECTOR.—L. P. Frink. In two divisions.

27,901.—HARVESTER.—M. Hallenbeck.

DISCLAIMER.

47,118.—MAKING BOLTS.—W. J. Lewis.

DESIGNS PATENTED.

7,365.—TEA SET.—J. Jepson, West Meriden, Conn.

7,366.—SHRIMP BRACKETS.—A. Tuttle, Boston, Mass.

7,367 to 7,375.—CARPETS.—J. T. Webster, Philadelphia, Pa.

7,376.—TEA SET.—D. C. Wilcox, West Meriden, Conn.

7,377.—SPOON HANDLE.—B. D. Belders, New York city

TRADE MARKS REGISTERED.

1,715.—BRAIDS, ETC.—Arnold et al., New York city.

1,717.—CATARENE MEDICINE.—J. E. Dotch, New York city.

1,718.—LIQUORS.—E. C. Hazard & Co., New York city.

1,719.—FERTILIZER.—J. Horner, Jr., Baltimore, Md.

1,720.—PETROLEUM PRODUCT.—E. F. Houghton & Co., Philadelphia, Pa.

1,721.—PICTURES, ETC.—Petree et al., New Bedford, Mass.

1,722.—GIN.—Richardson et al., Cincinnati, O.

1,723.—HATS.—S. Shethar & Co., New York city.

1,724.—WORM PROOF PAINT.—J. D. Stanley, Wilmington, N. C.

1,725.—WHISKY.—Anderson Distillery Co., Louisville, Ky.

1,726.—FERTILIZERS.—Walton & Co., Wilmington, Del.

SCHEDULE OF PATENT FEES.

On each Caveat.....\$10

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On issuing each original Patent.....\$20

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On appeal to Commissioner of Patents.....\$20

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On application for Design (7 years).....\$15

On application for Design (14 years).....\$30

CANADIAN PATENTS.

LIST OF PATENTS GRANTED IN CANADA.
APRIL 15 TO APRIL 17, 1874.

3,294.—J. H. Thorp, Chicago, Cook county, Ill., U. S. Portable burglar alarms, called "Thorp's Revolving Bell and Taper Lighting Burglar Alarm." April 15, 1874.

3,295.—T. K. Knapp, Danville, Livingston county, N. T. Knife and scissor sharpener combined, called "Knapp's Knife and Scissors Sharpener Combined." April 15, 1874.

3,296.—T. K. Knapp, Danville, Livingston county, N. T. Improvements in mops, called "Knapp's Improved Mop." April 15, 1874.

3,297.—T. Piper, Hamilton, Wentworth county, Ont. Improvements in clutching devices for driving sewing machines, called "Piper's Improved Clutching Device for Driving Sewing Machines." April 16, 1874.

3,298.—R. Porter, Bothwell, Kent county, Ont. Machine or auger for boring pumps and other tubing, called "Porter's Improved Hollow Auger." April 16, 1874.

3,299.—B. L. Rowley, New Britain, Hartford county, Ct. Improvements on bridle bits, called "Rowley's Bridle Bit." April 16, 1874.

3,300.—T. T. Pearson and C. A. McLane, Hopewell Corner, Albert county, N. B. Steam generator, called "Pearson's Magic Steam Generator." April 16, 1874.

3,301.—H. Mackinnon, Toronto, York county, Ont. Improvements on coal oil cooking stoves, called "The Novelty Stove." April 16, 1874.

3,302.—I. Birks and J. C. Jouffray, Montreal, P. Q. Composition of matter, to wit, an effervescent drink, called "Ginger Porter or Ginger Stout." April 16, 1874.

3,303.—T. Robertson, Toronto, York county, Ont. Machine for shaping lozenges, called "Robertson's Lozenge shaping Machine." April 16, 1874.

3,304.—C. R. Shelton, New Haven, New Haven county, Conn., U. S. Improvements on driving whips, called "Shelton's Driving Whip." April 16, 1874.

3,305.—R. G. Little, Halifax, Halifax county, N. S. Improvements in churns, called "The Dalrymple's Friend." April 16, 1874.

3,306.—A. Thomson, Hamilton, Wentworth county, Ont. Improvements in the draft power of plows and other agricultural implements, called "Thomson's Extension Swivel." April 16, 1874.

3,307.—G. Boucher de Boucherville, Quebec, P. Q. Arrangement simple et facile autant que sur et commode d'attacher une corde et de sortir de la fenêtre d'un étage supérieur, pour descendre en cas d'incendie, sans être exposé à se frotter aux aspérités du mur ou à se hâter aux saillies de la bâtisse, au moyen d'un crochet et d'un gond. (New mode of using a rope and hook to escape by windows or other openings of any buildings in case of fire, called "Crochet Projecteur.") April 16, 1874.

3,308.—D. D. Tennant, Yonge township, Leeds county, Ont. Improvements on hand seed sower, called "Tennant's Hand Sower." April 16, 1874.

3,309.—D. C. McDonald and I. B. Gordon, Rushford, Alleghany county, N. Y. Improvements in horse hay forks, called "McDonald & Gordon's Horse Hay Fork." April 16, 1874.

3,310.—E. Marshall, Iola, Allen county, Kan., U. S. Improvements on washing machines, called "Marshall's Washing Machine." April 16, 1874.

3,311.—A. Strain, Greenfield, Highland county, O. Improvements on car couplings, called "Strain's Improved Car Coupling." April 16, 1874.

3,312.—I. Hanrahan, Ottawa, Carleton county, Ont. Improvement on rock drills, called "Hanrahan's Rock Drill." April 16, 1874.

3,313.—I. G. Covey, St. John's, N. B. Improvements on coal oil lamp stoves, called "Covey's Lamp Stove." April 16, 1874.

3,314.—G. B. Pettengill, Hebron, Oxford county, Me., U. S. Improvements on kitchen implements, called "Berry's Kitchen Implement." April 16, 1874.

3,315.—W. A. White, Toronto, Ont., assignee of J. F. Ross, same place. Clothes bracket, called "The Double Bracket Clothes Dryer." April 16, 1874.

3,316.—E. A. Smith and E. H. Roberts, Toronto, York county, Ont. Burglar-proof lock attachment, called "Smith & Roberts' Burglar-Proof Lock Attachment." April 16, 1874.

3,317.—I. B. Camyré, Montreal, Can. Improvements on boilers for washing clothes by steam, called "Camyré's Combined Steam Washer and Rinser." April 16, 1874.

3,318.—I. Gray and H. F. Teeter, Teeterville, Ont. Improvements on springs for all kinds of vehicles, called "Gray's Improved Elliptic Spring." April 16, 1874.

3,319.—C. Parker, assignee of G. Geer and O. L. Range, all of Meriden, New Haven county, Conn. Improvements on bootjacks, called "The Parker Adjustable Bootjack." April 16, 1874.

3,320.—C. Lockman, J. M. Davies, and A. Hammond, Hamilton, Wentworth county, Ont. Device for uniting strips of cloth, rags, salvage, etc., for rag carpets, called "The Ladies' Favorite Rag Carpet Joiner." April 16, 1874.

3,321.—A. F. Burnham, Borough of York, York county, Pa., U. S. Improvements on turbine water wheels, called "N. F. Burnham's 1874 Turbine Water Wheel." April 16, 1874.

3,322.—A. Wynne, Indiana, Indiana county, Pa. Improvements on fireplaces, called "Wynne's Fire Grate." April 16, 1874.

3,323.—A. Smeaton, Quebec, P. Q. Improvements on tailors' squares, called "Smeaton's Oblong Tailors' Square." April 16, 1868.

3,324.—M. Day, Jr., Mansfield, Richland county. Improvements in electric lights. April 16, 1874.

3,325.—J. H. Bean and W. H. Fisher, Cincinnati, O., U. S. Improvements in hemmer attachments for sewing machines, called "Bean's Hemmer Attachments for Sewing Machines." April 17, 1874.

3,326.—R. Mackenzie, Montreal, P. Q., assignee of W. Perry, Jr., same place. Improvements on machine for making spiral springs, called "Perry's Spiral Spring Machine." April 17, 1874.

3,327.—J. M. Wilder, Croxton Kerrial, Leicester county, Eng. Improvements on thrashing machines, called "Wilder's Improved Thrashing Machine." April 17, 1874.

3,328.—R. H. Brown, J. M. Callier, and W. A. Perkins, Salem, Essex county, Mass.; J. A. Enos, Peabody, Essex county, Mass.; and O. C. Smith, Ipswich, Essex county, Mass. Improvements on leather-dressing machines, called "The Union Leather Whitening and Buffing Machine." April 17, 1874.

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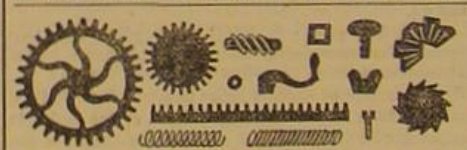
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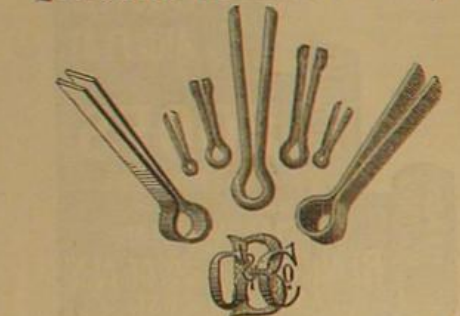
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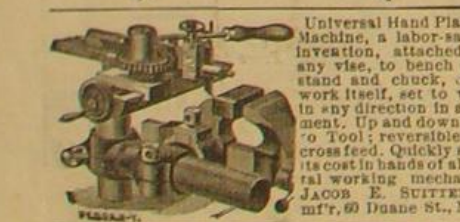
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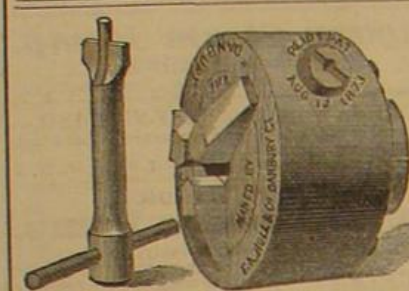
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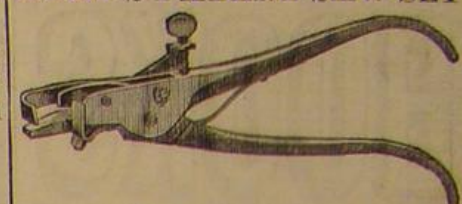
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