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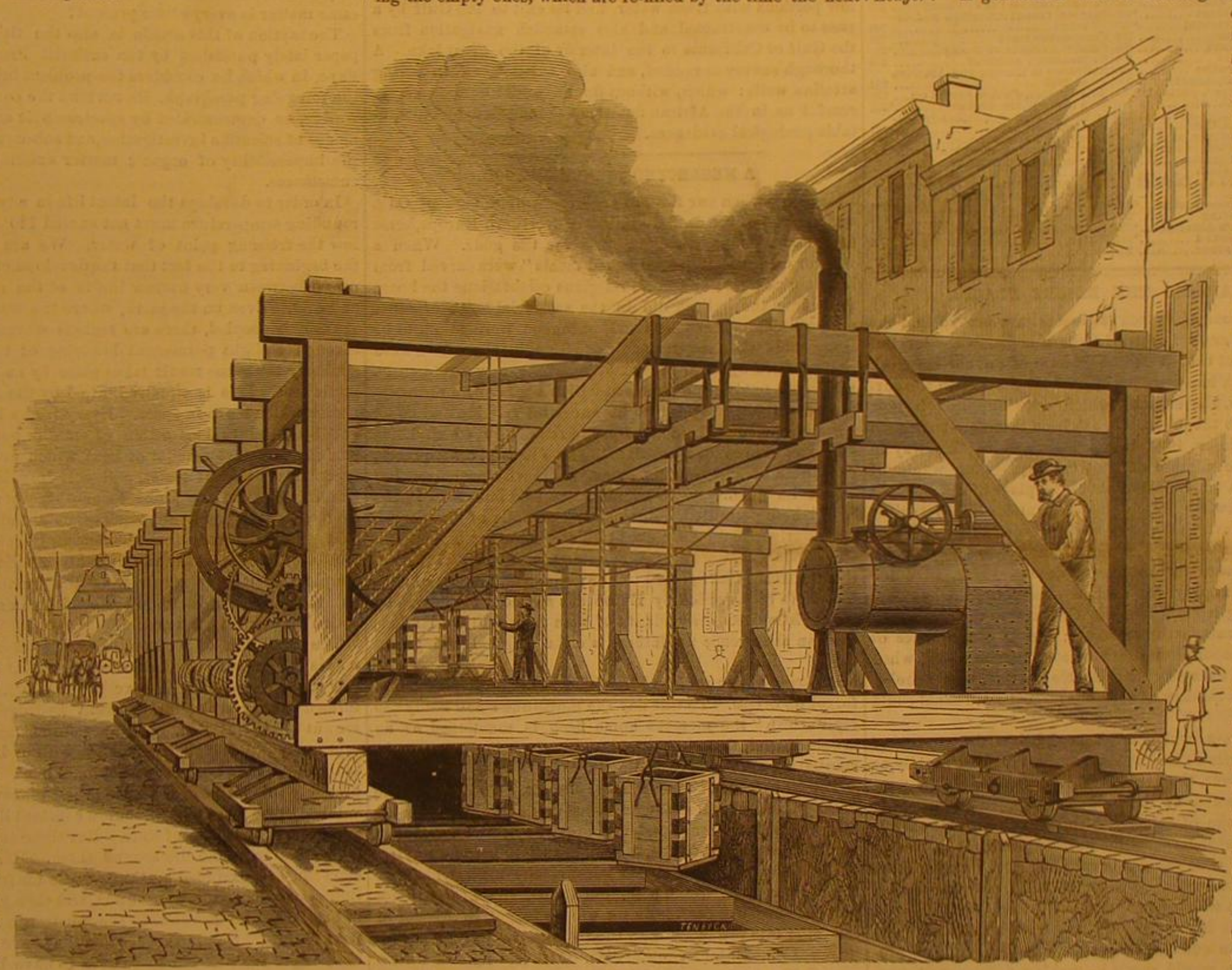
IMPROVED PORTABLE ELEVATOR AND CONVEYER.

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.

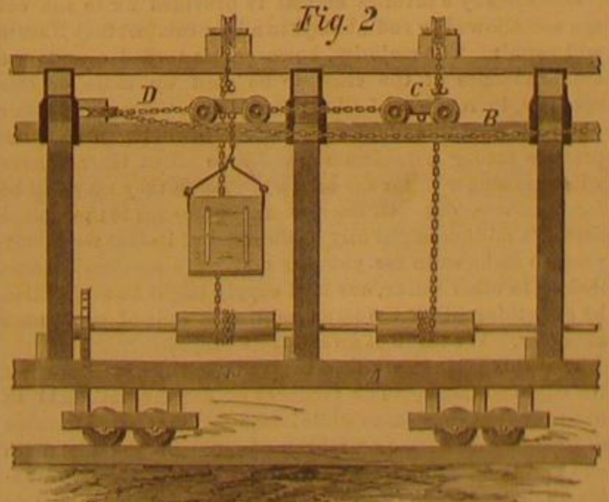


SHANKS' PORTABLE ELEVATOR AND CONVEYER.

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 bails 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 bails, 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 set are brought from the rear and lowered. By means of a friction cone and brake, when the buckets are raised to the desired hight, they are stopped and held until the truck hooks are attached to extra bails, when they are lowered by the brake swinging naturally under the trucks.

Fig. 2



The apparatus, it is stated, will excavate 32 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.

Patented through the Scientific American Patent Agency July 16, 1872. For further particulars address the inventor, Mr. William F. Shanks, sewer contractor, 174 Gray street, Louisville, Ky.

Amateur Railroading.

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 *modus 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 Cöoperative 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 Pekin.

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Contents:

(Illustrated articles are marked with an asterisk.)

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 wore 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 christain 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 ascendency, 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 mereorites, 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 develope 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 hrough 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 condtions 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 nebulæ, 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 marvellously 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, *o* 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 nebulæ,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 spectroscope, 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 spectroscope 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 crystalization 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 crystalizable 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 crystalized 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) crystalized 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,crystalization 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.

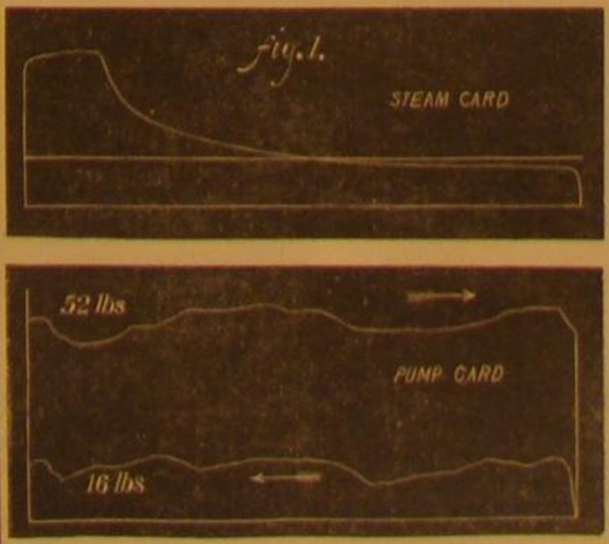
The crystalization of the sugar results from elimination of the potash, the salts of which are prejudicial, its place being taken by the magnesia, whose salts are favorable thereto. This invention we believe to be one of considerable importance in an economical point of view, and hence perhaps worthy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

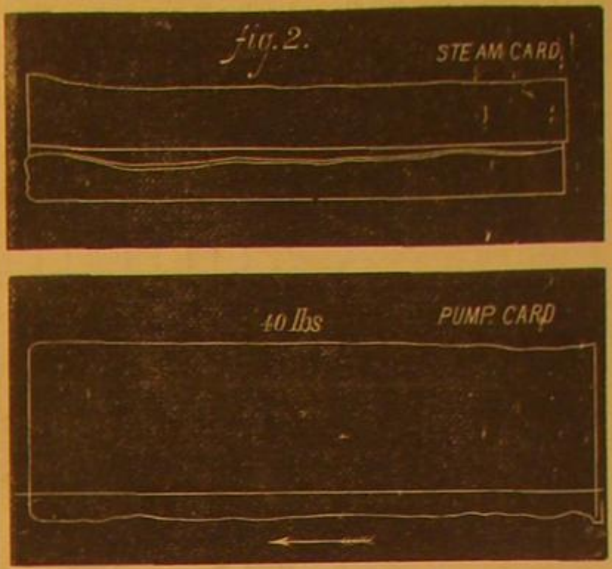
We based our remarks and strictures upon the report of the board, which we found published in the Providence *Journal* of March 2, in which the statements occur that: "The coal was not selected for any supposed superior quality, and was consumed just as it came from the yard without screening, picking 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 reëvaporation. 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 epizöotic. The discharge in the epizöotic 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 which he had made of the power required to move cars with different sized journals: A passenger car with 3½ 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 3¾ 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.

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 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 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.

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 sulphate 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 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,

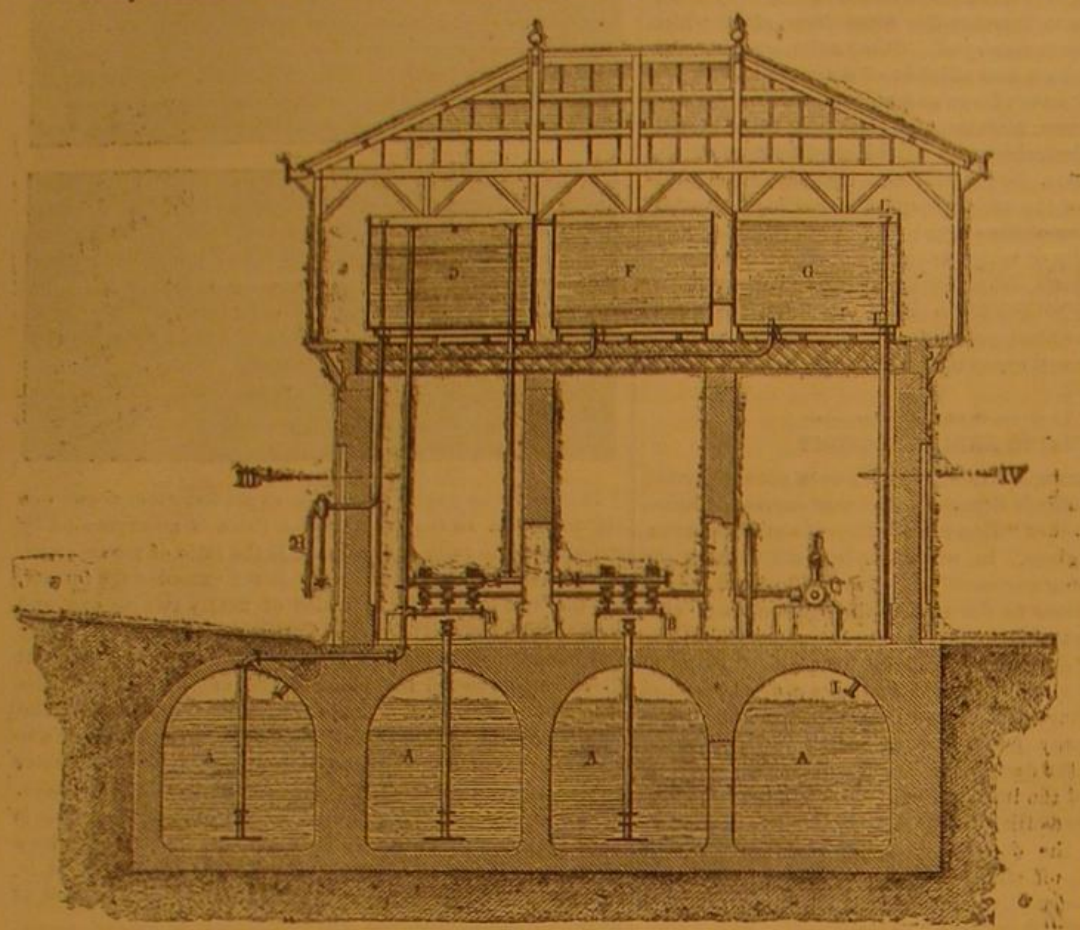


Fig. 1.—APPARATUS FOR DECANTING AMMONIACAL LIQUOR FROM COAL TAR.

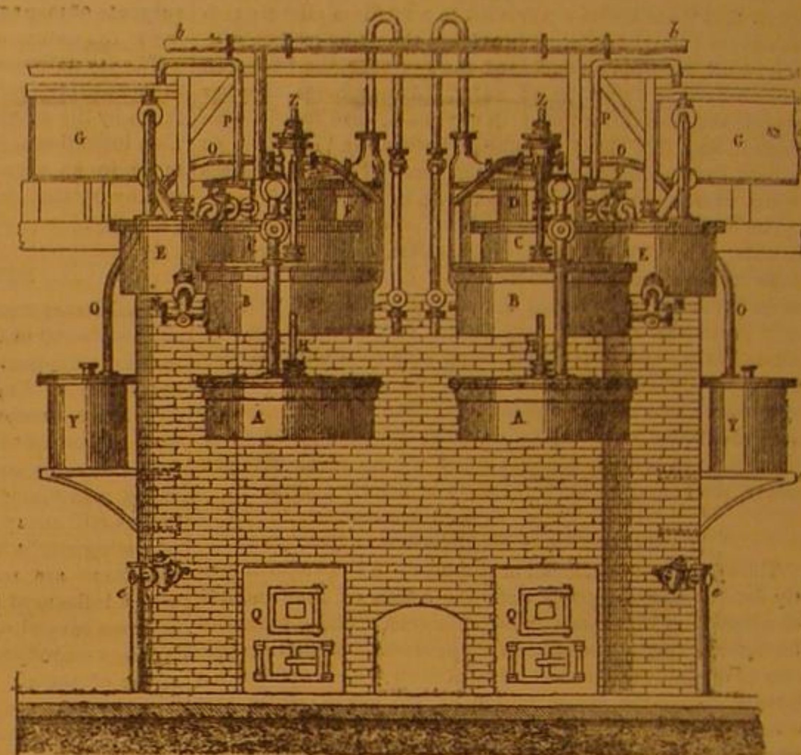


Fig. 2.—DISTILLER—END VIEW.

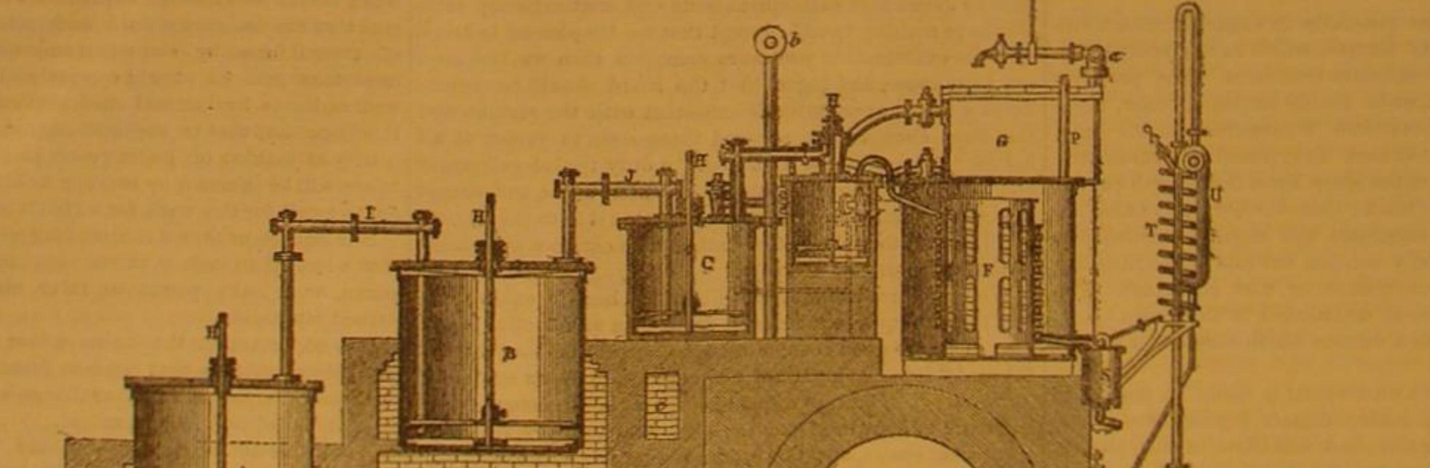


Fig. 3.—APPARATUS FOR MAKING SULPHATE OF AMMONIA

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 crystalizers, V. At U are devices

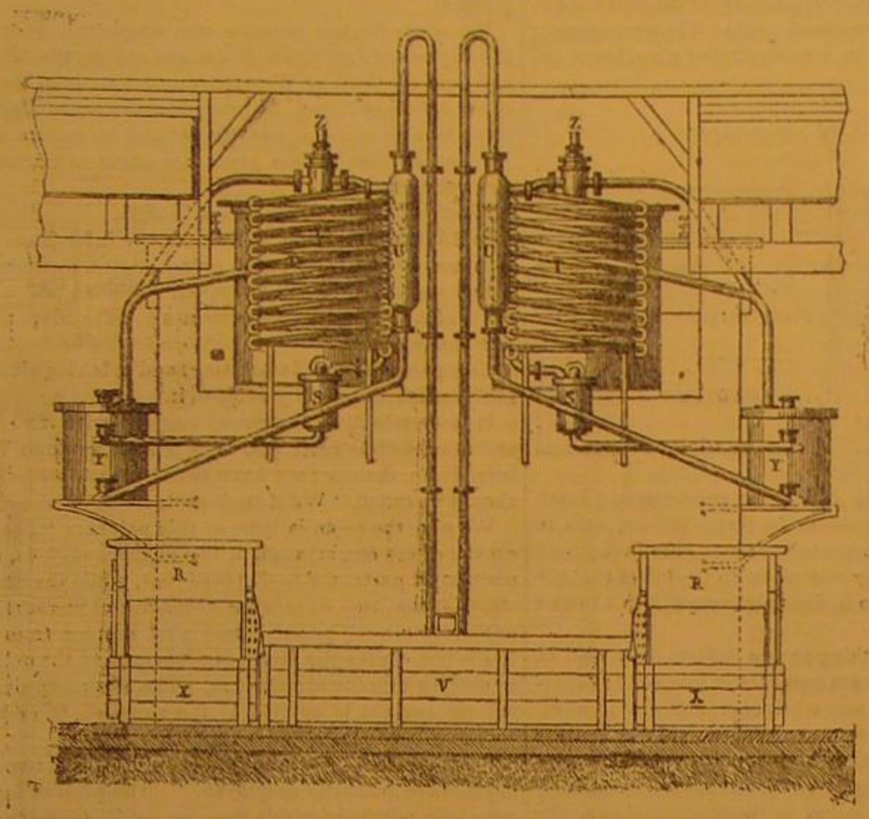


Fig. 4.—DISTILLER—SECTIONAL VIEW

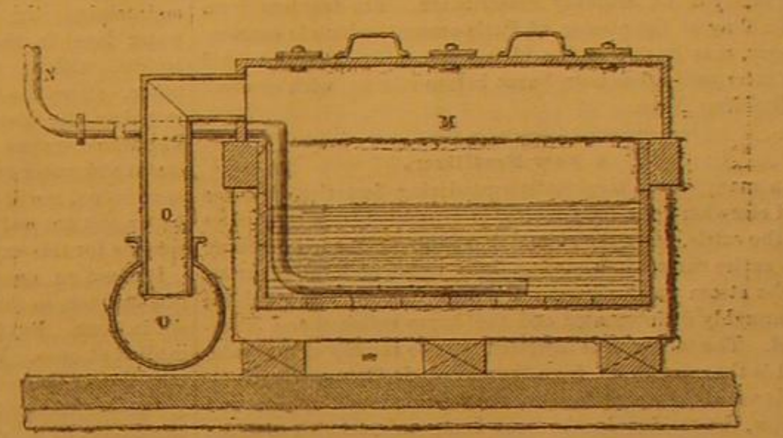


Fig. 5.—SULPHURIC ACID VAT FOR AMMONIACAL VAPORS.

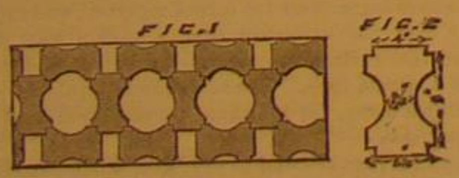
arranged to prevent the absorption of the water in the receivers into the crystalizers, and P are also safety tubes leading the vapors formed by the water in the cistern, F, back into G. R are the dropping boards for the sulphate of ammonia, and X, leaden vats receiving the mother liquor. Fig. 5 represents 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

FIG. 1 FIG. 2



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, 5½ inches broad at the widest part, and 2½ inches in the middle. It might be advantageously introduced into this country, and made in ordinary brick earth or in terra cotta.

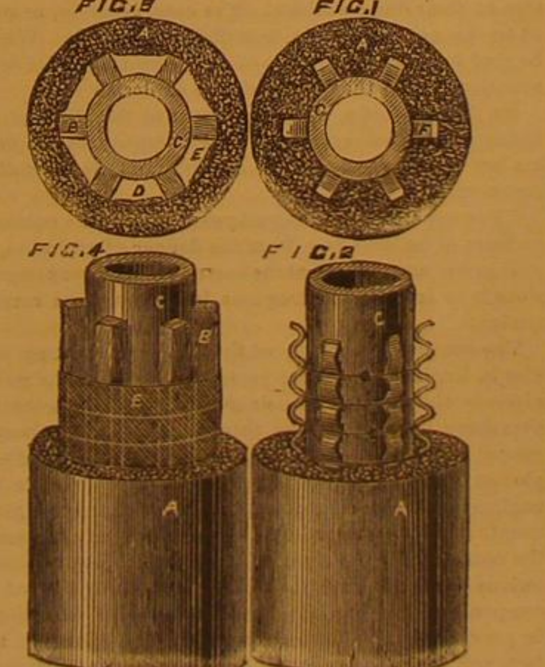
Iron and Fireproof Construction.

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 intervals 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 3½ 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 1¾ inches.

The relative value of these two arrangements will be perceived 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 7½ inches. The column, A, was incased with a solid mass of concrete 3½ 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 fleated on and the face troweled.

FIG. 3 FIG. 1 FIG. 4 FIG. 2



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 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 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 fireproof 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° Fah., 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° Fah. (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° Fah., 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,

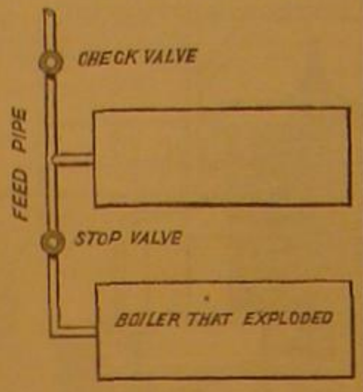
which is equal to a fair average guano.

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 develope 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 "Wolff 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 expence 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 the of low pressure cylinders a high pressure cylinder.

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

The compound marine Wolff engine is at present built in many English shops; 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	½ 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 analogues 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 $+3{\cdot}945°$ C $(=+38{\cdot}901°$ 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 spectroscope 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 $(N=23, K=39)$; 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_2.

NEW MODE OF DETERMINING TANNIN IN ASTRINGENT MATERIALS.

This process, communicated to *Les Mondes* by M. Terreil, 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 foundery 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; nowadays, 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 *régards*, by which the workmen can escape if the sewer gets flooded by heavy rains. As a means of escape, every *régard* 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 plates 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 *régards*, 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 Veii. 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 tuns. 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.

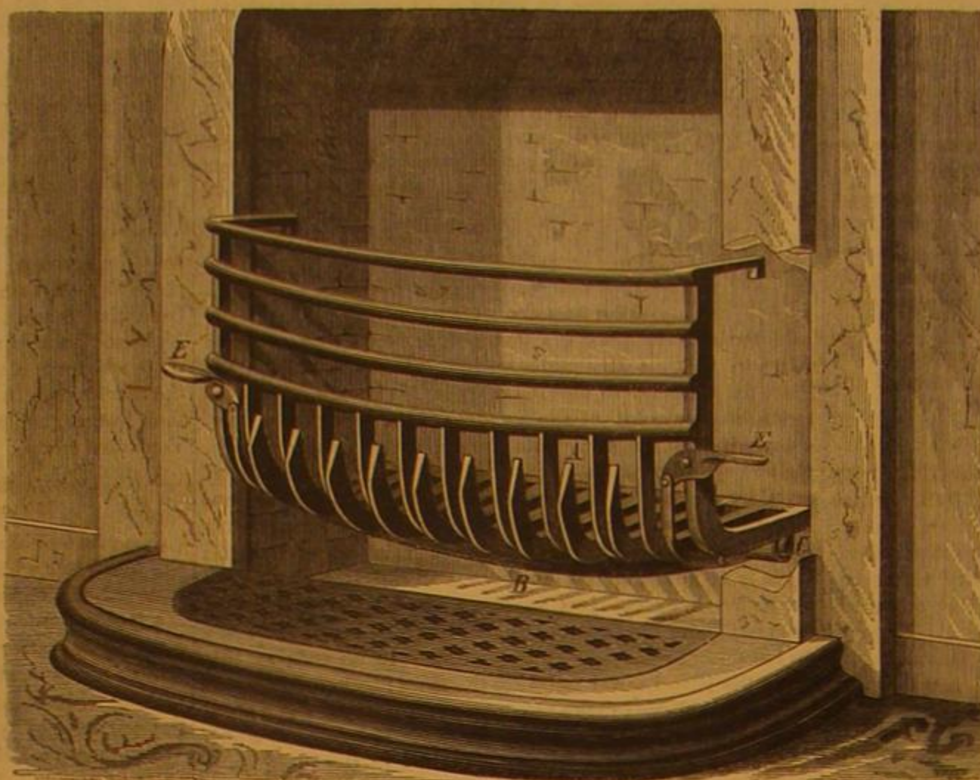
IMPROVED GRATE CLEARING ATTACHMENT.

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 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.



TIENSCH'S IMPROVED GRATE CLEARING ATTACHMENT.

Intermitting Lameness.

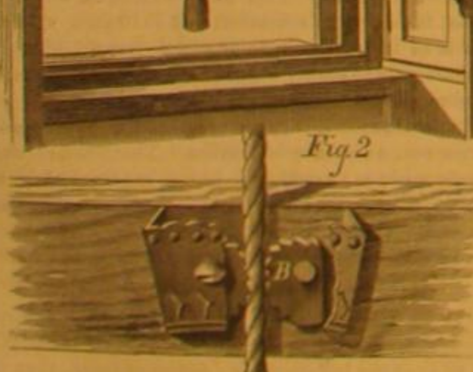
The *Doctor* remarks: "A very curious thing has been described by Dr. Sabourin, namely, that lameness may ensue from obliteration of arteries. Horse lameness is often so obscure that any light proves desirable. It is not, however, confined to the horse, but extends also to man. The cause, as observed, 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 device, 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.

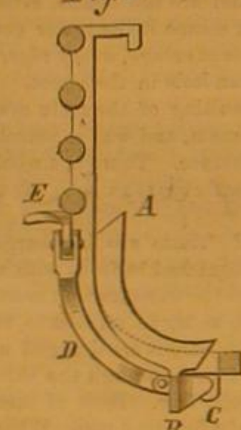
Fig. 1

Fig. 2



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 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.

Fig. 2



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

Fig. 1. Fig. 2.

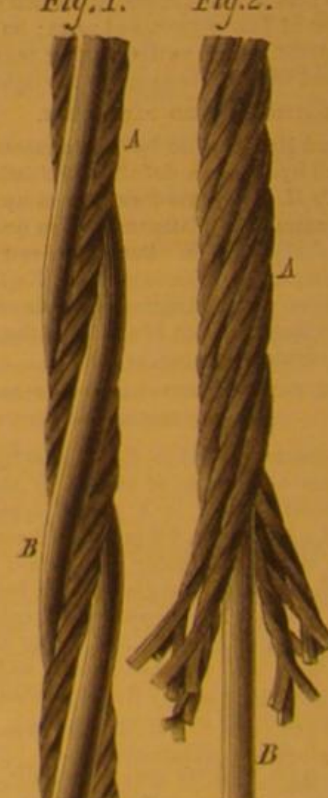


Fig. 3. Fig. 4.


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 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 (side 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 tuns). 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 hight, 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 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.

LIGHTHOUSE AT CLEVELAND, OHIO.

LIGHTHOUSE ON SPECTACLE REEF, LAKE HURON.

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.

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 crystalizations from boiling ether, it was obtained as a brilliantly white body, 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 tuns.

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, af c. vards 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 Médicale* says that in France the number of medical students, as well as that of practitioners, is on the decline, the medical recruital, 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 gummy 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. Neat'sfoot 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.	Area, 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	100	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 hundredweights, 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.
Cartridge Carrier.—J. H. Black, Columbia, Pa.
Castor.—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'Infreville *et al.*, New York city.
Thrust Bearing.—C. Godfrey, Huntington, N. Y.
Treating Hydrocarbon Oils.—R. 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. Beekman, 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 tie 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 Planer.

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 Helligendorfer, Belmont, Nev.—The object of this invention is to so improve the grates 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 sidewise 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 instep 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-papering 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 farther apart or closer together, as may be desired, and by removing pins the plow beams may be detached and exchanged, so as to throw the soil toward or from the plants, 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 hights 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-actingly. 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 Beazley, Houston, Texas, assignor of one fifth his right to Stewart and Barziza, 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 Suydam, 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, Tidioute, 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 Schnitzpan, Brooklyn, N. Y., assignor to Carsten Sierck, 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 concaved 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 grip'ng 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 reapplied 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 3-7 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 8 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 2,051 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 I. Cole, Hillsdale, N. J.—This invention is a chair made of severa 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. Dennett, 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 disk-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 136 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 inks, 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.—Bait 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 utilising 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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Patent Dish Washer—State Rights for sale. Made for six cents. Charles Bartlett, 98 West Exchange St., Providence, R. I.

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R. L. Galbreath, California, Moniteau 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. I. 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 "Edson'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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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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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, 23 Cornhill, Boston, Ms.

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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.

Answers to Correspondents

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. 378, 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, 90, 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. 399, 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 38,5 0,000, France 38,000,000. 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 animé 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 Photogenic 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, ½ lb. pounded 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 be 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 hight, according to the rapidity and amount of charge desired.

L. A. G. says: 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 successively applied? A. The ark.

J. C. asks: Of what horse power will an engine of the following dimensions be: Cylinder 1[illegible] 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 (78·54), and by the piston speed in feet per minute (240), 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 tuns, 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 tuns.

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 × 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, 1¼ 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 under it? 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 be 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 ⅝ 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 xyloidin, but the very slow combustion rather precludes such a theory. The gages 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 $C_{12}H_5O,HO$.

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 fluid 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 a 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° Fah., and the heat being then carefully raised to about 250° Fah., 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 ½ 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 blued. In washing fine flannels, wet but one piece at a time; soap the dirty spots and rub with the hands, as washboards full the flannels. When half clean, add three times as much blue as for cotton clothes. Use plenty of soap. When clean, have ready a rinse 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 embroidered, 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 calking 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 calking tool, so that they were tight under any pressure.

A. W. W. says: C. W. B. asks, on p. 202, 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 2½ inches diameter of pipe, if kept cool by a continuous stream of cold water, will condense easily 3,000 gallons of proof spirit per day. A worm of ¾ 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 hight you mention gives a range of 20·25 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 ¾ inch on one side would throw it out of perpendicular 4·90 inches at top. Settling ¾ inch on one side and raising ¾ on the other would throw it 9·80 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 12 inch stock boards, making the joints on the center of the studs. Then put siding or battens on the outside, and fur 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 undercut work?—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.]

Index of Inventions

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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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:

28,853.—Pegging Machine.—J. J. Greenough. June 10.
28,874.—Post Hole Digger.—J. Lee. June 10.
28,941.—Skeleton Skirt.—S. S. Sherwood. June 10.

EXTENSIONS GRANTED.

27,609.—Wringing Machine.—S. A. Bailey.
27,627.—Cultivator.—C. M. Hall *et al.*
27,641.—Harvester.—F. T. Lomont *et al.*
*7,656.—Horseshoe Machine.—W. Tallman.

DESIGNS PATENTED.

7,251.—Clock Case Sash.—G. Blakesley *et al.*, Bristol, Ct.
7,252 & 7,253.—Type.—J. M. Conner, Greenville, N. J.
7,254.—Jewelry Base.—S. Cottle, New York city.
7,255.—Carpet.—J. C. Johnson, Scarborough, N. Y.
7,256.—Glassware.—T. C. Pears, Pittsburgh, Pa.
7,257.—Gate Hinge.—A. B. Tanner, New Haven, Conn.
7,258.—Caddy.—G. B. Wheeler, Brooklyn, N. Y., *et al.*
7,259.—Cook Stove.—R. Wheeler, Utica, N. Y.
7,260.—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.—Stoves, etc.—J. Reynolds & Son, Philadelphia, Pa.
1,689.—Wire Cloth.—Wood & Co., Lowell, Mass.
1,690.—Perfumery.—Young & Co., New York city.
1,691.—Shirts.—Marr Bros., Boston, Mass.
1,692.—Yarns.—Thames Worsted Co., Norwich, Conn.
1,693.—Needle Threader, etc.—H. Weels, Woburn, Ms.

SCHEDULE OF PATENT FEES.

On each Caveat $10
On each Trade Mark $25
On filing each application for a Patent (17 years) $15
On issuing each original Patent $20
On appeal to Examiners-in-Chief $10
On appeal to Commissioner of Patents $20
On application for Reissue $30
On application for Extension of Patent $50
On granting the Extension $50
On filing a Disclaimer $10
On an application for Design (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 fireplaces and stoves, called "Whitwell's Ventilating Stove." March 27, 1874.

3,234.—Jas. T. Bustin, St. John, St. John county, N. B. Machine for putting the paste on room or wall paper, called "Bustin'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 vise or clamp, called "Hall's Improved Bench Vise or Clamp." March 27, 1874.

3,238.—H. A. White, Hamilton, Wentworth county, Ont. Improvements in dampers for stove pipes and furnaces, called "The Excelsior Compression Damper." March 27, 1874.

3,239.—B. G. Devoe and W. L. Walker, Kenton, Hardin county, O. Improvements on iron fences, called "Walker & Devoe'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's Lumber Dryer." March 27, 1874.

3,242.—G. A. Kittson, Quebec, P. Q. Improvements on overshoe and boot fastenings, called "Kittson'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, Southington, 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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