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IMPROVED FORM OF COAL RAILROAD.

Our engraving represents a new form of coal railroad used for transporting the fuel from the boat and depositing it at desired points within the yard. The chief peculiarity of the invention consists in the utilization of the momentum of the car when filled, acquired by descending an inclined plane, to return the car, when emptied, back to the place whence it started.

As will be seen from the illustration, the coal is hoisted from the boat in buckets by means of an ordinary derrick. For this work horse power may be employed, or, what is more convenient, a small hoisting engine. The car, which rests on a scale platform at the end of the railroad, is, by this means, easily filled, but one man being required to empty the buckets as fast as they are elevated. As soon as the scale beam, previously weighted, indicates that a certain quantity of coal, one or two tuns for instance, is contained in the car, the latter is ready to start on its journey to deposit its load. The lower portions of the sides of the car are so arranged as to be held closed while the process of filling is going on, but on the arrival of the car at the point at which it is to discharge its contents, a projection on the side of the track strikes a lever which, acting on the mechanism, causes the sides to swing open, so allowing the coal to fall out. This projection is a block of wood moving in a groove on the side of the railway, which can be placed at any locality at which it is desired to drop the contents of the car.

The automatic arrangement which causes the empty carriage to return consists of an endless wire rope, which is first attached to the framework of a small wheel which travels on a rail underneath the main track. The rope then passes over a sheave at the loading end of the road, thence through openings underneath the car, the latter working freely upon it, thence over another sheave at the further end of the railway, and, finally, back underneath the track, until it is attached to the opposite side of the framework of the wheel first mentioned. To the axle of the latter is fastened, by means of hinged rods, the triangle of planks, shown in the engraving, to the lower side of which a heavy weight is applied.

The car, having received its load, is started by a slight push down the inclined track. It travels on until it strikes a metal block, which is immovably fastened to the endless wire rope. This block the car carries on with it, causing a strain to be applied to the rope which, passing over the sheave at the starting point, is communicated to the wheel under the track. The latter, yielding to the pull, travels along its rail, causing the triangle attached to it to tilt until the side on which the weight is fastened is raised to a nearly vertical position, the apparatus being prevented from being moved bodily by the hingeing of its forward angle to the ground. The car, meanwhile, continues its motion until the lever, holding its sides closed, strikes the projection before referred to. The coal is then allowed to drop out, and the moment the car is freed therefrom, the heavy weight on the triangle begins to fall. The latter, though overbalanced by the loaded car, is much heavier than the vehicle when empty, so that, in seeking to return to its original position, it moves the traveling wheel to which it is attached; this communicates motion to the endless rope, which starts the car on its backward journey. As soon as the weight reaches the ground, the pulling strain on the car ceases, but the acquired momentum of the latter is sufficient to carry it back to its original starting point.

It will be seen that the arrangement of the weight is such that, when the car strikes the block on the rope, the strain is made to act gradually, so that by the time the car is ready to discharge, its inertia is nearly overcome. The advantage of this is the avoidance of the great wear upon the moving parts incident to sudden stoppages or changes of motion. The apparatus accomplishes its work with great celerity and is easily attended by a single man, who has only to empty the buckets, as they are hoisted, and start the car when filled.

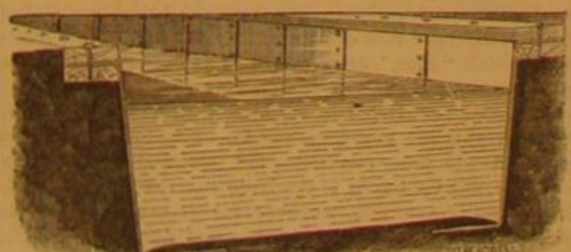
Trials made in our presence proved that a loaded car can travel a distance of 175 feet, discharge its contents, and return in the space of thirty seconds. The economy and comparatively small cost of this invention will recommend it to all practical men. It can be easily erected in any coal yard; it has no confusion of ropes, no switches or turn-outs, requires but a single track, and when compared with the more complicated arrangements now in use or with the old mode of transporting coal in wheelbarrows from point to point, cannot but result in a large saving of time and expense.

HUNT'S IMPROVED COAL RAILROAD.

Mr. C. W. Hunt, of West New Brighton, Staten Island, is the inventor, from whom any further information may be obtained, or the railroad itself may be seen in operation at his coal yard in the abovementioned village.

DOANE'S IMPROVED CANAL CONSTRUCTION.

William H. Doane, of Cincinnati, Ohio, has patented an invention which consists in applying to the banks and bottoms of canals a lining composed of smooth plates of sheet metal riveted together so as to prevent the passage of water between their joints, the upper edges being clamped between two stout sills or string pieces, by which arrangement the lining is secured in its proper position, and its upper portions protected from injury. It is preferred that these plates should



be long enough to extend from the top to the bottom of the embankments. In order that the upper portions of these plates may not be injured by the horses' feet, or otherwise, they are bent down to a horizontal position, and then securely confined between two longitudinal sills or stringers, which latter are united by spikes or bolts, as shown in our engraving. The lower portions of these plates may also be attached to sills, if preferred; or they may extend a suitable distance below the bed of the canal and be maintained in their proper position by the earth.

In some places it may be desirable to extend the lining completely across the bottom of the canal. The lining plates may be composed of copper, galvanized iron, or any other suitable sheet metal. This lining will not only preserve the banks from being washed by the passage of boats through the canal, but it will also prevent the percolation of minute streams of water through the earth, which are the well known cause of the most disastrous breaks. It will effectually prevent muskrats and other vermin from burrowing through and injuring the banks.

A canal provided with this improved lining would be especially adapted for steam navigation, and boats could be propelled in it at the highest speed without injuring the banks in the least; indeed, the more active the use of such canal, the better condition it would be in.

The lap of the joints should be in the direction of the flow, as such an arrangement will prevent eddies, and by inducing a more rapid current there will be less opportunity for sediment to deposit in the canal.

A patent has been granted to the inventor for lining the sides of a canal with metal plates united by rivets, and whose upper portions are secured between, and protected by, sills, as described. The only objection to the employment of such plates would be their first cost and the expense of replacing them, which would be at least partially balanced by the reduction of such repairs as are constantly required on canals with unprotected earth banks.

Railway Progress.

From the "Manual of the Railroad of the United States," for 1872-3—a useful volume issued by H. V. Poor & Co., 68 Broadway, in this city—we obtain the following statistics relative to the railroads of the country:

The United States now contain 60 852 miles of railway—nearly double as many as in 1860. The largest number of miles built in any one year was in that just passed, in which 7,453 miles were opened. The greatest mileage is in Illinois, reaching 5,904; the smallest in Rhode Island, 136. The State of Massachusetts has one mile of railroad to 4·86 miles of territory, this ratio being the greatest in the country.

The longest road in operation is the Chicago and Northwestern, extending 1,500 miles; the shortest, the Little Saw Mill Run Road in Pennsylvania, which is but three miles in length. The total cost of the railways in the country is $3,000,000,000, or an average of $50,000 per mile. The earnings for the past year amount to $454,969,000, or $7 500 per mile. The largest net earnings made on any road were gained by the New York Central and Hudson River, $8,260 827; the smallest on the Portland and Oxford Central in Maine and three others, all of which not only earned nothing but incurred a loss.

Hay Ventilator.

This consists of a wrought iron tube, about three inches in diameter, which is long enough to reach into the middle of the stack, and, like the Norton well tube, is provided with a conical point at the tip, and pierced for about two thirds its length with numerous holes. A screw arrangement is affixed to the posterior extremity, by which it can be connected with an accompanying discharge pipe.

For use, this apparatus is to be driven horizontally into the stack to be investigated, either by means of a mallet or by a screw arrangement, and the temperature ascertained after a short interval by introducing a self registering thermometer. Should the temperature be too high at any point in the stack, a tin tube is to be affixed vertically to the outer end of the iron tube, and an outward current of air from the interior of the stack produced, by means of which the heat is speedily carried off without any injury to the stack. Hooks may be attached to the tip of the instrument, by which small samples of the central part of the stack can be brought out.

DESTROYING CATERPILLARS.—According to Schmidt, an excellent remedy against caterpillars consists in a dilute solution (1 part in 500) of sulphide of potassium, the infested tree being sprinkled with this substance by means of a small hand syringe. This method has been used on a large scale in France, and, it is said, without any injury to vegetation,

DOMESTIC MOTORS.

M. Soulié has, in a recent paper, discussed the merits of various motive forces in relation to the above subject. He mentions the following:—Springs, electricity, heated air, compressed and rarefied air, water, and steam. Each of these may be briefly discussed.

Springs are sometimes applied in the working of sewing and other machines. They are a case of transformation of force, rather than a source of it. The spring, theoretically, gives out the work that was spent on it in winding up. But there is always a loss, and they return only 0·60 to 0·80 of the work at first expended. Suppose a steel spring, 1 kilogramme in weight, (—2¼ lbs.) can store up 12 kilogrammeters (—26¼ lbs. moved 3 feet) it will only be possible to utilize 7·20 of these, or about 16 lbs. The application of springs must thus be very limited. They are, further, inconvenient, inasmuch as they call for frequent winding up, and breakage is apt to take place. They are also fitted with a fly as regulator. This acts by destroying the excess of work, through resistance of the air against its arms, the resistance increasing with the square of the velocity. It ceases to act, or acts feebly, when the speed becomes low, and in this differs from the fly wheel of a steam engine, which then gives back the force previously stored in it. Now in a spring driven sewing machine, for example, the action of a regulator is very much needed as the speed diminishes.

Electricity.—The electromagnetic force is to be objected to for its cost, and for the small quantity of force produced in proportion to the apparatus. The force of a motor is heat transformed into work. In the case of the pile, the heat arises from the dissolution of zinc. Now, comparing carbon with zinc: one gramme of carbon, combining with oxygen, developes 8 calories. One gramme of zinc dissolving gives only 0·55 calories. Hence 14·5 grammes of zinc must be dissolved to develop 8 calories, and be the equivalent of 1 gramme of carbon. The price of zinc is, at lowest, $108 and that of coal $7, or 15·4 times less. If the cost of acid is further taken into account, it is found that one calorie developed by the action of acid on zinc costs 223 times as much as one from direct combustion of coal. Zinc is not found in a natural state like coal, but requires the expenditure of fuel and other outlay in its preparation. Thus the direct use of coal is more economical.

We have referred to the transformation of electricity into work; there is the opposite case of work transformed into electricity. This is done, and with the best results. Magneto-electric machines, driven by steam engines, supply a brilliant light to many of our lighthouses.

Electricity as a motive force is rather capricious in its action. The battery requires considerable attention, and acids are a source of danger in inexperienced hands.

Heated air.—This is sometimes used, the ordinary coal gas being the source of heat. The large and extended distribution of gas in towns, and the power of consumption only when wanted in the motor, are advantages. On the other hand, the cost—say 40 cents per horse power per hour—must limit its use to a small production of force.

Supposing 2 cubic meters of gas per horse power per hour to be consumed in the gas motor, each cubic meter representing a calorific power of 6,000 calories. This consumption would represent a theoretical force of 1,320,000 kilogrammeters (per horse power per hour). Practically it represents only 270,000 kilogrammeters. Hence, the proportion of actual to theoretical work is $\frac{270,000}{1,320,000}$ or 0·004.

Now in a steam engine, consuming 1 kilogramme of coal per horse power per hour (each of these representing 85,000 calories), it may be shown that the work corresponding to a calorie is 32 kilogrammeters, as against 22·5 kilogrammeters in the other case. And the utilization of heat in the gas engine does not compensate for this difference.

In motors with gas heated air, the pressure in the cylinder falls immediately on explosion, though this may be remedied somewhat by introducing a little water with the gas and air. Then the heating of the cylinder necessitates the application of a current of cold water to abstract the heat, which would otherwise make the action of the piston impossible. The apparatus is thus apt to be complicated, and it requires constant care. Carbon and sulphuric acid are, moreover, deposited in the cylinder—the latter from the sulphuretted hydrogen contained in the gas. The gas is apt to escape and vitiate the atmosphere; so much so, perhaps, as to become explosive. All these are objectionable features.

Compressed Air.—This may rather be called a mode of transforming motive force, as mechanical work has to be done in compression. The use of this kind of motor has hitherto been chiefly in such works as tunneling, bridge making and mining. In the works at Bardonneche, connected with the Mont Cenis tunnel, a column of water by its descent caused air to be compressed into a reservoir, from which it was used at will. In expanding, the air should, theoretically, give back the work done in compression. In reality, it returns only part of it. These are theoretical figures, but they show the necessity of cooling the compressing apparatus.

The distribution of compressed air, as motive force, in a city would be an expensive thing, requiring a powerful engine, reservoir, pipes, etc. M. M. Biez some time ago projected the supply of Paris in this way, upon the following data:

Works producing 945 horse power effective force, from 19,917,200 cubic meters of air compressed to 6 atmospheres by steam engines of 2,450 horse power in all, would cost two million four hundred thousand dollars. Allowing for loss through leakage, there would be 782 horse power remaining.

The net cost of the compressed air would be $·00116; and its selling price might be 2 cents to 3·6 cents per cubic meter. The expense per horse power per hour in consumption would be 15·16 cents.

Such a plan, if it could be carried out, would present many advantages. The consumption could be easily measured; the force would be an intermittent one; escape of air, instead of being hurtful, would be a benefit in ill ventilated places; and there would be no delicate apparatus to manage, as in the case of electric batteries.

Rarefied Air.—M. Bourdon has invented a motor working on this principle, the rarefaction being caused by the flow of water in pipes. It is also adapted for compressed air. The maximum pressure at disposal being that of the atmosphere, it would require a large volume of air to produce a given force, and the direct use of air would seem to be more economical.

Water Pressure.—In many towns there is a large distribution of water, the pressure of which depends on the motor furnishing the supply, and the difference of level between the extremities of the distributing pipes.

In some cases the water is not carried to the different floors of dwelling houses; and in some its use for industrial purposes is forbidden. The pressure in some parts of Paris is 70 to 80 meters (227 to 260 ft.), in others not more than 7 or 8, or 22 to 26 ft.

High prices are paid. For a quantity not above 20 meters daily, the price is $8 per cubic meter per annum for water from the Ourcq; $16 per cubic meter per annum for water from the Seine. For a quantity over 20 meters, the corresponding prices are $5 and $11.

In Lyons, a force of 20 kilogrammeters would cost $247 per annum. In Roubaix and Tourcoing, it could be had at 75 cents per day.

In London, water at a pressure of 45 meters is paid for at a rate of 4d. for 1,000 gallons (or 8 cents for 4,543 liters). This is $12 or 12 cents per horse power per hour. In some towns, though the distribution is large, the pressure is small; and in others the system is defective in both respects. In most cases a reduction in price would be necessary, before the water could be used in dwelling houses as a motive force. From many points of view, it offers advantages. It is a safe force to deal with, and is not injurious to health. It can be easily manipulated, and when the water has done its work, it can be utilized for other purposes.

Steam.—This is generally inapplicable for the purpose in view. There are two sources of danger in use—the presence of fire, and of confined elastic fluid. In the hands of inexperienced or careless people, these are apt to lead to accidents. It may be stated, however, that Mr. Fontaine has constructed a small species of steam engine for house use—the steam generated by gas, and giving various forces from 6 kilogrammeters (13½ lbs. moved 3 feet) upwards. It is said to be convenient and safe.

We have thus passed under review the various kinds of force utilizable for small industries; and it would appear, on the whole, that preference should be given to hydraulic force, which may be made good use of in this way, if the expense of obtaining water be somewhat lessened and the manner of its distribution improved. Further experiment is also desirable on the employment of compressed air, the capabilities of which do not appear, as yet, to have been exhausted.

Salt Manufacture in England.

An interesting notice under this heading is given in a recent number of the *Birmingham Daily Post.* The manufacture in Worcestershire is confined to Droitwich and Stoke Prior, a parish near that town, the chief establishments being that of Mr. Corbett at the latter, and of the Droitwich Salt Company at the former place. The sources of the product are the underlying beds of rock salt, and the brine springs from which the salt is extracted are formed by the percolation of water becoming saturated with salt from the rock.

The processes of manufacture are simple. The springs are reached by wells, lined with iron cylinders to prevent the intrusion of fresh water, in which the brine rises to within 30 feet of the surface, and whence it is pumped, night and day, with undiminished supply, at the rate of some ten or twelve thousand gallons per hour. The brine, containing from 26 to 30 per cent of solid matter, is pumped into reservoirs called "tuns," from which it is conducted through pipes to the evaporating pans, which consist of enormous constructions of riveted iron plates, with flues underneath for conveying the heat from the fires kept up for that purpose. As the water evaporates the salt rises to the surface in flakes, and then falls to the bottom of the pan, whence it is, at regular intervals, removed for drying. The salt is raked from the bottom of the pan and flung into lorries, which run upon metal rails by the side of the pan. These lorries, when full, are run to the stores, where they are tipped on to the floor about 20 feet beneath.

Some idea of the extent of the manufacture may be gathered from the following facts: The works at Stoke cover an area of 22 acres, with constant extensions, and represent a capital of more than £100,000. A reservoir is in course of excavation, to hold 4,000,000 gallons of brine; there are thirty-four evaporating pans, most of them 135 feet long by 25 feet broad; and there is storage for between seventy and eighty tuns of salt. The full weekly production at the two establishments named is six thousand tuns. There are three kinds of salt made, the difference in quality consisting chiefly of the difference of the size of the salt crystals, caused by the variations in the duration of the process of evaporation and precipitation: 1. "Butter salt" so called from its general use in curing butter, etc. 2. "Table salt," which is butter salt made into molds and, 3d, "Broad salt," of a coarser grain, and used largely for the manuring of land. In the "butter salt" pans the brine is heated to 212° Fah., the evaporation being rapid, but the "broad salt" brine is only heated to 180°. The "butter salt" is drawn several times each "shift," the broad salt only every other day.

Salt is molded into blocks for domestic use, by filling the salt boxes, called "tubs," fitted with perforated bottoms, which are set down to drain; when the salt is sufficiently consolidated, each tub is taken up, turned over, and brought down sharply on a wooden stool, to free the tub from the salt, and the block of salt, after being trimmed on the edges, is taken to the drying stove. This stove is a room about 180 feet long, 50 feet broad, and 40 feet high, the floor of which is traversed by iron flues nearly a yard in hight. The blocks are first placed on small raised platforms called "cat paths," by the side of the flues, and when partially dried, are placed on the flues themselves until the process is completed.

Both at Droitwich and at Stoke Prior, the proprietors manufacture their own vans, which are of iron, and cost about $400 each, as the railway companies decline to supply them on account of the action of the salt upon the iron. Each firm has, therefore, iron works, and employs several hundreds of these vans, the making of which, and the constant repairs required, keep the works in continual activity.

Mr. Corbett is the patentee of a new mode of preparing salt of superior fineness and hardness. By this method the pan is covered, and inside it are a number of rakes, made to revolve by steam power; the agitation of the brine and the greater heat caused by the retention of the steam combine to produce a more rapid deposition of salt, the crystals of which are consequently very fine and hard. The Stoke works being isolated from any town, Mr. Corbett has provided nearly 150 cottages, which are rented at moderate rates by his workpeople. There are also new and old school rooms, a master's house, and a dispensary.

Determination of Mercury in its Ores.

Eschka gives the following method as applicable to cinnabars, fahl ores, and in general all ores of mercury. The weighed sample is placed in a porcelain crucible whose edges are perfectly true and smooth. Half the weight of pure, clean iron filings, perfectly free from grease, must be added, and well mixed with the ore by careful stirring with a glass rod. The whole is then covered over with a layer of iron filings, from 0·5 to 1 centimeter in depth. The crucible is then fitted with a concave gold cover with perfectly true and even edges, so as to fit exactly, and carefully tared. The concavity of this cover or lid is next filled with distilled water. The crucible is then heated for ten minutes, by means of a flame whose point plays round its bottom. After this time the gold cover is taken off, the water poured away, the mercury adhering to the convex side is washed with alcohol to remove any bituminous matter, the lid is dried in a water bath and weighed when quite cold. The increase of weight gives the amount of mercury in the sample token.

The weighing is performed on a porcelain crucible, which in each case was weighed also. When the operation is complete, the lid is heated, at first gently and then strongly, till all the mercury is driven off. The weight of the lid and its support is found to have sustained only a very slight alteration. The edges of the crucible and the lid must fit exactly, or some of the mercurial vapor may escape. The concavity of the upper side of the gold lid must be large enough to hold a sufficiency of water to ensure the condensation of the vapors.

In rich ores, the quantity of mercury is so considerable that a semi-fluid amalgam of gold may be formed on the convex side of the lid, and when it is taken off, this may run in a drop from side to side. In such cases, care must be taken that nothing is lost; and in washing the amalgam with alcohol, the washings are collected, and any minute globules of mercury or amalgam are cautiously transferred to the concavity of the lid, so that they may be dried and weighed with the rest.

In poor ores, containing 1 per cent or under, the quantity taken for analysis should be 10 grammes; in those ranging from 1 to 10 per cent, 5 grammes; in from 10 to 30, 2 grammes; and in those containing above 30 per cent, 1 gramme.

BENZOIC ACID IN GAS LIQUOR.—According to Reinsch, on treating gas liquor with sulphate of lime at a temperature of 50° C., the carbonate of ammonia in the liquor is completely decomposed, with evolution of carbonic acid and formation of a yellowish solution of sulphate of ammonia, smelling strongly of tar. The tarry constituents are not easily separated from the salts of ammonia. If, however, the solution is dried at a moderate heat till no more aqueous vapors are given off, and the residue is then heated in a porcelain capsule covered over with a plate of mica, the mass assumes first a rose color, then a purple red, whilst the mica is coated over with benzoic acid in shining crystalline needles. Over this crust is a tender, woolly sublimate, consisting of sal ammoniac and sulphate of ammonia. If the residue is treated with water and filtered, we obtain a colorless solution of sulphate of ammonia, and on the filter remains an aniline brown coloring body.

THE electrical conducting power of a metal is diminished by heating it. A poor conductor is more easily heated by an electrical discharge than a good conductor. Thus a stroke of lightning that would fuse an iron rod would not injure a copper rod of the same dimensions. The conducting power of copper is 120, while that of iron is only 24.

Infection and Disinfection.

The water of low, moist and marshy places is productive of various maladies, particularly of dysentery and chronic diarrhœa, and many pernicious effects are produced by the exhalations of various gases rising in sewers, sinks, etc. When low and moist grounds and deep and rich soils, covered either by water or large trees, are cleared or exposed to the action of a warm sun in a hot climate, the emanations prove more noxious than in their unreclaimed state, and will remain so until a complete cultivation has taken place. The various exhalations and secretions formed in the course of disease are either entirely of insensible emanations from the bodies of persons affected by the earth emanations and specific fevers, which we may term *infectious*, or altogether of a consistent and palpable fluid, formed on the morbid surface of the diseased body (the itch may serve as example), and which we call *contagious*.

Many of the maladies propagate themselves both by impalpable or invisible emanations from the body floating in the surrounding atmosphere, and by the contact of a consistent fluid or virus formed in the diseased part as we see it in the small pox and plague, both of which are infectious and contagious. Typhus and scarlet fever are conveyed from one person to another by bringing substances capable of absorbing and retaining for a time the emanations given out from the diseased body; and among the materials known as the *media* of transmitting infectious diseases are such as woolen and hairy substances, furs, feathers, bedding and clothing. They all appear to imbibe easily the morbid effluvium, and to retain it longest. Cotton, flax, linen and other substances of a soft or porous nature exercise a similar property, but in a feebler manner. They consist in the destruction and exclusion of infectious agents, or preventing communication with infectious persons or things: by the quarantine or separation of the infected from the healthy; by the exclusion of infected articles, or destruction of all infection existing in them, and particularly by applying remedies which dilute or destroy the infection floating in the air or in any other medium, or by chemical agents, which are the hygienic safeguards against all infectious, malarious and contagious diseases, and which are called the disinfectants.

All substances which act more or less energetically on fetid and offensive effluvia, whereby their unpleasant odor is destroyed, are called by the general term disinfectants, or deodorizers, for they render *miasmata* inert, while another class, allied to them, are called antiseptics, because they check or prevent putrefaction. Warmth, air and water promote putrefaction, while cold, exclusion of atmospheric air, and desiccation are the best antidotes; also gases which do not yield oxygen to organic matters, coatings of oil, butter, tallow, wax, resin and sirup all act antiseptically, for they exclude the air.

Among the disinfectants employed for neutralizing contagious and malarious diseases, or destroying the germs of infection, either from ship fever, cholera, bilious and yellow fevers, small pox, typhoid and scarlet fevers, rinderpest, etc., are the following:

Chlorine acts energetically through its affinity for hydrogen; also on sulphuretted hydrogen, ammonia, phosphuretted hydrogen, and other fetid and offensive vapors arising from decomposition of animal matter, marsh gases, cesspools, sinks, and in the atmosphere surrounding dead bodies; but chloride of sodium is very frequently employed for the above purposes.

Nitrous acid is unquestionably one of the most powerful disinfectants on board ships where ship fever or cholera has broken out.

Salt baths are very useful and economical disinfectants, such as the nitrate of lead—half a pound to ten gallons of water is effectual; chloride of zinc for this purpose is in great use in England.

The sesquichloride of iron, with the addition of a small portion of carbolic acid, is now used in the city of New York by the butchers, night scavengers, and in small pox districts by order of the Board of Health; it is called the Metropolitan disinfectant. This preparation has become quite celebrated, and may easily be obtained by dissolving the native sesquioxide, a hematitic iron, in hydrochloric acid, and adding about 57 per cent carbolic acid.

Copperas is much used for disinfecting sinks; it is very cheap and useful.

The Girondin disinfectant is a French preparation, composed of sulphates of copper and zinc.

Condy's liquid is a solution of manganate and permanganate of potash. It is a very useful disinfectant for the reason that it readily parts with its oxygen in presence of organic matter.

The bromo-chloralum is a disinfectant of a late date, which is mostly employed for embalming dead bodies, principally in France.

The Egyptian powder is a composition of crude carbolic acid and pipe clay.

Infected clothing may be restored and made innocuous by exposing it to a temperature not below 200° F.; the infectious germs of certain diseases such as scarlet, yellow, typhus and ship fevers are entirely destroyed.

Ventilation is one of the most indispensible measures for producing disinfection.

Cotton, arriving from southern climates where contagious diseases prevail, and which might communicate such diseases, is said to be preserved by permanganate of potash, as it destroys effectually miasma, and also organic spores which cause fermentation and putrescence.

Dry earth cannot be surpassed as a disinfectant, and possesses many advantages over all others. It is the cheapest material, without odor, does not contain poisonous salts as do all other disinfectants, is an excellent fertilizer, requires but a small quantity to effect the object, and the apparatus may be easily applied in sick rooms, both in public, private, and school houses. Common street earth, charcoal, peat, bone-black and clay are all good materials for the absorption of bad odors and the promotion of decay of organic matter. Dry earth acts both physically and chemically, for it absorbs the water which would otherwise assist in fermenting the organic matter. If dry earth is intended to be used as manure, plaster of Paris, burnt lime and similar vehicles may be mixed with the street earth.

Blacksmithing in Germany.

In the interior towns and villages of Germany, it has been the custom for many years, says the *Coach Maker's Journal*, for the farmer to purchase the iron for his tires and horse shoes, and in some instances, when having a new wagon built, to purchase all the iron entering into the same, the lengths of every piece being furnished him by the smith. One part of the contract is that the smith shall return to the farmer all ends and cuttings from the iron, and it frequently occurs that the farmer remains at the shop until the iron is all cut up, in order that the smith shall not indulge in too much cabbage. Each smith shop has what is termed "the hell," and in cutting off a set of tires, if the farmer be not present, the largest half of the end cut off finds its way to "the hell;" the duty of putting it there devolves upon the youngest apprentice. From this always plentiful store, the smith furnishes his material for the manufacture of bolts, horse shoes, etc., for transient customers.

The horse shoeing part is also a feature; the farmer will bring with him the end of some piece of iron or tire, with which to make the shoes, or perhaps a dozen or more old horse shoes to be converted into new ones. The farmer must blow the bellows until the work is forged or the shoes all made, and must then hold up the horse's foot while the shoes are being driven on or fitted or taken off, and invariably carries the old shoes home with him, unless he prefers to give the old shoes in payment for the apprentice's services in holding up the feet.

The Cattle Plague.

Dr. Bouley, an eminent physiologist and veterinarian, who has given special attention to the cattle plague, has lately made a very important report, to the Academy of Sciences of Paris, of the proceedings of the International Sanitary Convention, held March 16 of the present year at Vienna. This has for its special object the determination of the best methods of preventing the cattle plague, and the taking into consideration the question of establishing proper sanitary regulations in regard to the cattle traffic between the countries represented in the convention. Delegates from eleven states were present at the convention, namely, Germany, Austro-Hungary, Belgium, France, Great Britain, Italy, the Roumanian Principalities, Russia, Servia, Switzerland, and Turkey.

The delegates included in their number some of the best veterinarians of their respective countries, as also various officers specially charged with the enforcement of sanitary regulations. There was but little contrariety of opinion as to the exotic nature of the disease (at least in regard to Western and Central Europe) and as to its mode of propagation. It was well established in the convention that, outside of Russia, it never develops spontaneously upon any race of cattle, not even that of the steppes; and consequently that, whenever it shows itself outside of its native home, it may be considered as imported.

It is also well established that, even after it has continued for a longer or shorter time in any given country, it is only transmitted by contagion, and that it always becomes extinct when the conditions favorable to its propagation cease to exist.

It was considered expedient by the convention to leave Russia entirely out of the sanitary agreement, and not to permit the exportation of its cattle except upon certain well established guarantees.

As to the general question of absolutely preventing the importation of cattle from Russia, it was found very easy so far as Germany was concerned; but very difficult for Austria and Hungary, owing to the great extent of the coterminous boundaries of the two countries, and the dependence of Austria upon Russia for this source of food. It was, therefore, recommended that a careful supervision should be exercised, and that cattle, after crossing the frontier, should be subjected to quarantine of ten days before resuming their journey.

The question being thus settled in regard to the importation of animals from Russia into Austria, the next point that came up for consideration was the nature of the conditions that the several governments should impose upon themselves toward doing their share to prevent the introduction or spread of the disease; and the measures concluded on as most essential were: first, the immediate slaughtering of all animals that had come in contact with the plague, as also of those which might be considered as under suspicion of having the disease, in consequence of the influences to which they had been exposed, this being accompanied by a proper compensation to the owners; secondly, the burial of the dead bodies of all animals affected with the plague, without attempting to utilize them in any way whatever; thirdly, the utilization of the flesh of sound animals killed under suspicion, but proved after death to have been healthy, this to be permitted only under special conditions rigorously determined; fourthly, the destruction of the germs of the contagion wherever they can be found, in the slaughter houses, on harness, in pastures, in railway trains, etc., as also the disinfection of all objects with which they have been brought in contact; fifthly, isolation, as complete as possible, of the places where the plague has been found to exist, so that no animal believed to be capable of carrying the contagion or of receiving it shall be allowed to enter the infected districts, this isolation to be put in practice on farms and all other localities, and to be of greater or less extent, according to the extension of the disease.

The convention found that, among the various countries that had had occasion to take measures for the proper disinfection of cattle cars and other vehicles of transportation, Germany had the most satisfactory arrangements. Here, after a train has been emptied of its contents, the cars are immediately deluged with warm water of at least 160° F. The shock and strength of the current, falling from a considerable elevation, detaches all organic material adhering to the wood work, and, by the elevation of temperature, annihilates all virulent activity.

The principal point established by the convention, according to Bouley, was the necessity of an obligation to slaughter all animals as soon as the disease made itself manifest, or as soon as there seemed a probability that an animal would be attacked. In this way the plague will be arrested by sacrifice of the smallest number of animals.

Chemical Fertilizers.

There are certain fertilizers, says the *New York World*, which are strictly chemical, being the result of chemical processes; there are others not usually so termed which should be thus designated because they act chemically in the soil, that is, they are inert and thus valueless unless some substance for which they have an affinity exists or is placed in the soil together with them. To the first class belong the various salts of ammonia, to the second, plaster and common lime, while in both classes may be placed sulphates of soda and potash. However and whenever we use any of the ammonia salts, they are of value in themselves, but plaster and lime and salt are little if any value in themselves; yet if the soil has in it any decaying vegetable or animal matter, and if it be desired to set free the silica, then these substances work actively and are of great value. We cannot see that sulphate of soda is of much greater actual value, except for cotton, than plaster, while it is much more costly. Sulphate and muriate of potash are of far greater value as, when their acid constituents are given up to fix any free ammonia, their potash is freed and is an element available and useful to almost every crop.

The multiplication of chemical works in our country has caused the production of many of these elements as waste products, and hence chemical fertilizers, once very costly, have now come down to a comparatively low rate. We know one concern which does a large business in these manures, which was directly forced into it to get rid of the vast accumulation of waste material. The supply created a use, and good results from use made a constant demand. And as there is an increasing demand, every day adds some new source of supply. There is now throughout this country millions of dollars worth of material going into apparent waste which might be caught up and made to do service for the present generation. The sewage of hundreds of cities, the ammoniacal waters from as many gas works, the excreta from thousands of privies in towns, villages and country homes: these are but part; the waters of the East and North Rivers, of the Merrimack and the Delaware, and numerous other streams all float off material, called refuse, which contains the great elements of fertilizing.

Chemical fertilizers are usually rapid in their action; the farmer who invests in them gets a prompt return for his money. Manuring for generations yet to come is good sound theory, but is an idea not appreciated in this fast age; it has been almost universally abandoned in England, where the chemical or concentrated manures are largely used and highly recommended by men of high reputation, both farmers and scientists. We are not yet willing to advise farmers to abandon the barn yard and compost heap which has done such good service, but there is an evident want of some more active direct fertilizer, or some elements to be combined with those bulky matters to add to their value or develop more rapidly the useful constituents they contain.

We have not alluded to the prepared superphosphates and poudrettes, which might be classed as chemical fertilizers as they are passed through a chemical process in their manufacture; they are more the result of object than the residue of a chemical process; nor have we spoken of the various fertilizers, derived from the earth, which are identical with certain chemicals; they are more fit to be classed as mineral fertilizers. We believe that the settlement of our great Western plains and mountains will develop there such masses of these substances as will amply make up to the farmers of the Western States their distance from the sources of fertilizers of that character from abroad, or the lack of vast chemical works whose waste materials afford the base of most of the strictly chemical fertillizers.

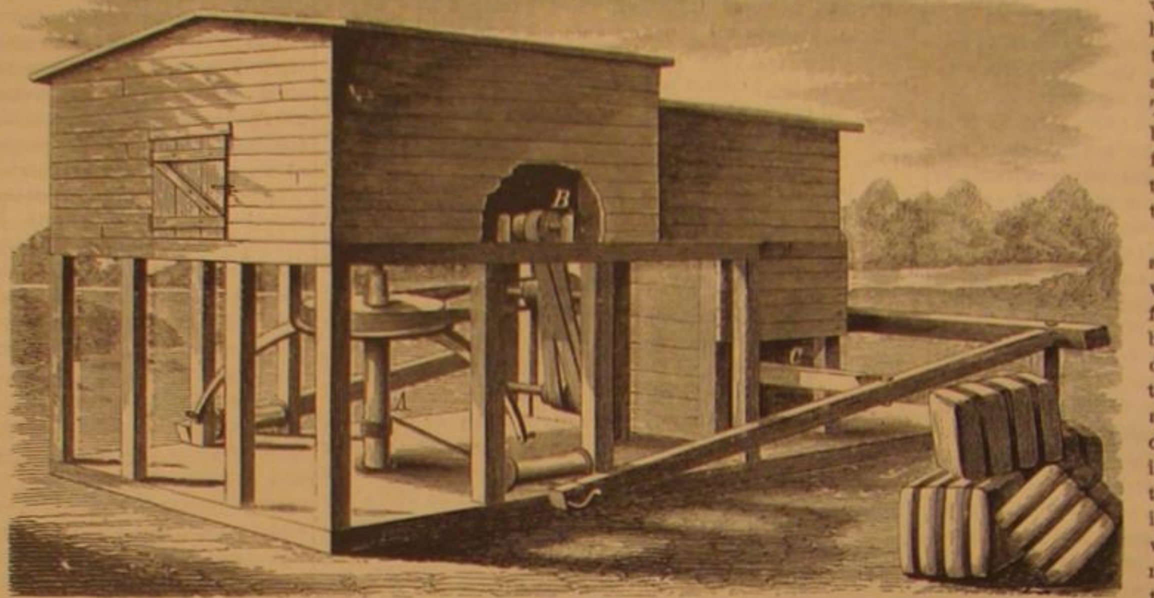
A VERITABLE earthquake was felt on the 11th of July in the vicinity of New York city, in Westchester county, and on Long Island. The shock is reported at the beginning to have been similar to that of a piece of artillery or heavily laden cart driven rapidly over frozen ground. It seemed to come from the south and roll away off toward the north. It was sufficiently loud to awaken nearly all the sleepers, to cast down piles of coal in the cellars, to shake the crockery in the rooms, and to give a very perceptible vibration to the houses.

THE financial report of the late Musical Jubilee at Boston, Mass., exhibits a deficit of one hundred and fifty thousand dollars.

COMBINED GIN HOUSE, HORSE POWER, AND COTTON PRESS.

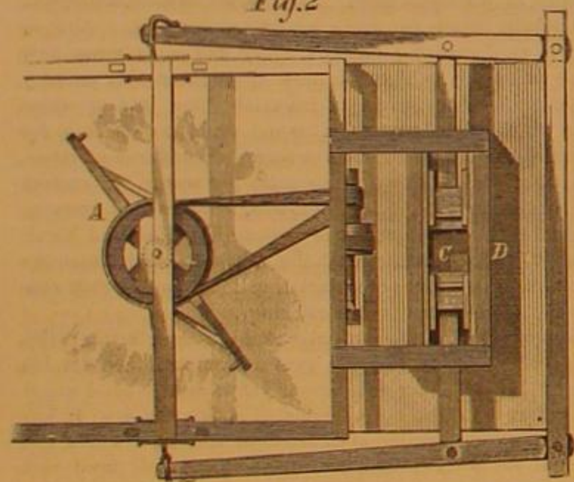
In the invention we now illustrate, the cotton raiser is supplied with an apparatus, for preparing his cotton for market, of an economic and at the same time effective character. It consists in the combination of a horse power with a gin and press, in such a manner that the gin discharges its cotton directly into the press, and the gin and the press are both worked by the one horse power.

Fig. 1 shows the general arrangement, which the following description will explain: A frame, such as represented, is erected for the working parts of the machine, and supports on its top the gin house. At A is the horse power and driving shaft and pulley. The latter is connected by belting, as shown, with the counter-shaft, B, from which the gin is run, so as to insure the requisite amount of speed. The gin is not shown in the engravings, but is so situated as to discharge its cotton into the press, C, which is shown in detail in the top view of the same in Fig. 2. The followers of this press are connected with the two outside levers seen in both figures; the ends of which are, in their turn, connected with the driving shaft. The operation is as follows: The levers are thrown outward so as to draw apart the press followers, and the gin is started and run until the open press, which holds enough for a bale, is filled with cotton. The gin is now stopped and the press completely covered in by means of a lid. The ropes are next wound on to the drawing shaft, and the horse power again started, this time to effect the pressing by pulling in the levers. When the compression of the bale is finished, the team is stopped, the levers secured in their then position, and the ropes loosed from the shaft. A curtain is next drawn between the gin and the press, so that the ginning of a second bale can be commenced while the first is being secured and withdrawn from the press through its face, at D, which admits of being removed for this purpose When this is done, the levers and press followers are thrown out to their original position, the cover taken off the press, and the curtain drawn back. The ginned cotton again falls into the press, and after enough has accumulated, a second bale is compressed by a repetition of the foregoing operation.



SHAW'S COMBINED GIN HOUSE, HORSE POWER, AND COTTON PRESS

Fig.2



The superiority of belting over gearing, as a mode of transmitting the power in this apparatus, exists in its non liability to receive damage by a variation in distance between the shafts, which would cause grinding or jumping, and perhaps breakage, in geared wheels. Such variation arises from the constantly changing quantities of seed cotton in the gin house. When full the floor beams, which also support the upper shafts, are deflected by the weight, and as the cotton is ginned out and the weight lessened, they recover their position. The difficulty here pointed out is obviated by the use of belts and pulleys, which have another advantage in the economy of their first cost.

As in this process the cotton goes from the gin into the press direct, no lint room is required, and labor is saved; and as the press takes no more timber to build it than does an ordinary lint room, its cost is reduced considerably—the inventor says to less than one half that of the majority of presses now used. He also claims that a better sample of cotton is produced by his than by the old method, in consequence of its not having to be handled at all on its way from the gin to the press, and that the compression of the bale is accomplished in much less time for the same reason.

The press was patented, through the Scientific American Patent Agency, for the inventor, Mr. James M. Shaw, of Water Valley, Miss. Further information may be obtained by addressing Shaw & Son, as above.

Luminous Electrical Tubes.

One of the most convenient methods of exhibiting the illuminating qualities of electricity is by means of the Geissler tubes, which now form part of the standard apparatus of colleges and other institutions of learning. The Geissler tube—so called after the inventor, Dr. Heinrich Geissler, of Bonn, Germany—consists of a glass pipe sealed at each end, and also provided at each end with a platinum wire which projects into the tube. The atmospheric air is exhausted from the tube, a small quantity of gas or vapor is introduced, and the tube is then sealed. When the two wires are placed in connection with a Rhumkorff coil, a stream of electrical light passes through the tube, taking various forms and colors, which vary with the kind and density of the enclosed gas. Hydrogen yields a white light; carbonic acid, green; nitrogen, yellow, etc. The most magnificent effects can thus be produced. A practical application of this discovery is a surgical lamp which consists of a small glass tube and bulb. The electric light is produced in the bulb, which may be introduced into cavities for medical examination.

Attention has lately been called to another kind of luminous tubes, also produced by Dr Geissler, in which luminosity is produced without the use of the coil and electric battery. Such tubes, which contain small quantities of certain gases, as nitrogen, carbonic acid, hydrogen, or ammonia, become luminous after being exposed to friction with any of the well known producers of electricity, as silk, wool, cotton or even paper; the best, however, are catskin and prepared india rubber, which is now largely employed in the manufacture of combs, etc., and which is also used in the Holz electric machine. This mass is so very sensitive that it is sufficient to make the tube luminous after it has passed a couple of times through catskin, when it is not even touched, but held two or three inches distant. When a rarefied spiral glass tube was inserted in a larger plain tube, spontaneous discharges of light would continue within the former, even after the luminous state of the whole length had ceased for some minutes, and the color of the light is dependent on the quality of the traces of gas left within the spiral tube. Thus with traces of nitrogen it is darkened, very much like the tint of the aurora borealis; with hydrogen it is a light rose, with carbonic acid a bright white, and the spontaneous discharges would be of much greater intensity at a low temperature in winter than in summer. The very curious researches of Dr. Geissler may possibly lead to a clue to the wonderful phenomenon of the aurora borealis.

Another curious discovery of Dr. Geissler was that mercury, when shaken in a rarefied glass tube, would also become luminous, and emit a strong light, so that in a perfectly dark room all objects could be distinctly seen; the color of the mercurial light could be modified by the presence of small traces of gases in the tubes. A minimum of nitrogen shows an intense red, and hydrogen a yellowish light. The capacity of mercury for producing light seems to depend on its purity, so much so that it was not luminous when it contained an admixture of tin, lead, zinc, or bismuth, but gold or silver did not affect it. It would be possible to utilize this peculiar quality of mercury for lighting up chambers filled with explosive gases, such as some parts of mines or powder magazines, instead of using the Davy lamp.

Ferment Fungi.

Dr. Engel, of Strasburgh, has ascertained that alcoholic fermentation is accompanied by the development of two different genera of fungus plants, while that of fruits embraces four kinds. These latter ferments are found almost always on the surface of the fruit, where they remain in a latent condition without development. When, however, the epidermis becomes cracked, or when the stem of the fruit is separated, the ferment (or its spores) comes into contact with the saccharine juices, and the ferment is then reproduced, but always in the form of ferment and never in that of mold Engel maintains that the alcoholic ferment exists in Nature, although the fact has been denied by others. Thus, as long as a cherry is intact, it has a particular savor; when, however, the stem is detached or the epidermis is cracked, the cherry not only changes its color, but assumes a vinous taste, and exhibits a large number of fermented cellules.

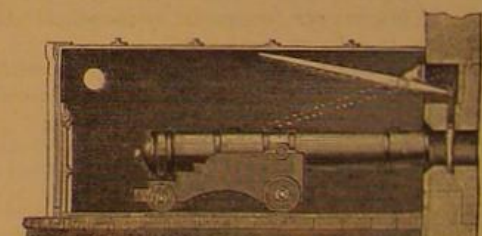
He also remarks that the ferment of bread is of a different species from the yeast of beer, and that he has never been able to germinate the spores of ferments in vegetables which contained but little sugar, or none at all; but that as soon as they come in contact with saccharine liquid, they germinate or reproduce the ferment.

Submarine Warfare.

In 1862, Mr. Thomas Page, of London, proposed to destroy the enemy's ships by means of cannon arranged to be fired below the water line. He proposed to have water tight gun rooms constructed in the hold of the vessel, to be filled with compressed air. At the moment of firing, a valve at the port hole was to be opened, the and gun run out and discharged. Our sketch shows the plan of Page, which, we believe, was never practically tried. Mr Quick, another ingenious Englishman, has devised a torpedo which is intended to be fired below water line into the unprotected bottom of an enemy's vessel, substantially as previously proposed by Page. Mr. Quick has enjoyed the advantage of a practical trial of his invention under the auspices of the British government. The trial recently took place at Shoeburyness; but the result was not very flattering, and must have been anything but entertaining to the spectators who were thereby endangered.

A 10 inch gun was laid on the beach at about 5 deg. elevation, at a spot which would be covered by about 3 feet depth of water at high tide. The bore was closed at the muzzle by a disk of glass fixed in a wood washer tightly sealed round the edge, while an electric wire led through the vent of the gun to a small igniting charge in the center of the base of the torpedo. The torpedo itself was a cylinder something over five feet long, with a sharp pointed head, and immediately behind it was a space intended to be filled with gun cotton. The after part of the body contained four rockets, which were in communication with the igniting charge, and whose gas escaped on ignition through spiral vents designed to give rotation to the torpedo and keep its axis steady while projecting it through the water. On this occasion, the gun cotton bursting charge was dispensed with, the object being to ascertain what range and direction might be obtained.

When the tide rose and covered the gun, the experiment took place. On firing, the torpedo burst open close to the muzzle of the gun, two rockets rising into the air, one of which descended again almost immediately, while the other flew high over the heads of the spectators. The conditions governing a rocket's motion under water are even more complicated than those in air; the pressure of the gas in every case, of course, increases with the depth of water above the rocket. In fact, to obtain the full development of force without risk of bursting the case, a certain given depth is required. Success could hardly be expected to follow a preliminary trial on a large scale. Even supposing such an engine to be desirable, Mr Quick's torpedo has hardly reached the stage of development desirable for a public trial; the same forces which cause the *ricochet* of a shot in water, or, in fact, the bounds of a stone thrown by hand to skim in "ducks and drakes," would always give a submarine rocket, if it moved with a high velocity, a tendency to rise like a Venus out of the sea.



PAGE'S SUBMARINE GUN.

THE NUMBER OF EGGS FROM A HEN.—A German naturalist answers the question, how many eggs a hen can possibly lay, as follows: The ovary of a hen contains about six hundred embryo eggs, of which, in the first year, not more than twenty are matured. The second year produces one hundred and twenty; the third, one hundred and thirty-five; the fourth, one hundred and fourteen; and in the following four years, the number decreases by twenty yearly. In the ninth year only ten eggs can be expected, and thus it appears that, after the first four years, hens cease to be profitable as layers.

PRODUCTS OF THE OSAGE ORANGE.—The wood of the hedge plant known as the Osage orange (*maclura aurantica*), if boiled in water, yields a handsome yellow extract, which is used in Texas as a dye. From it, a large percentage of tannin is also obtained. The seeds of the fruit also yield a valuable oil, abundant, bland, and limpid, resembling olive oil, and burning with a steady flame in an ordinary lard oil lamp.

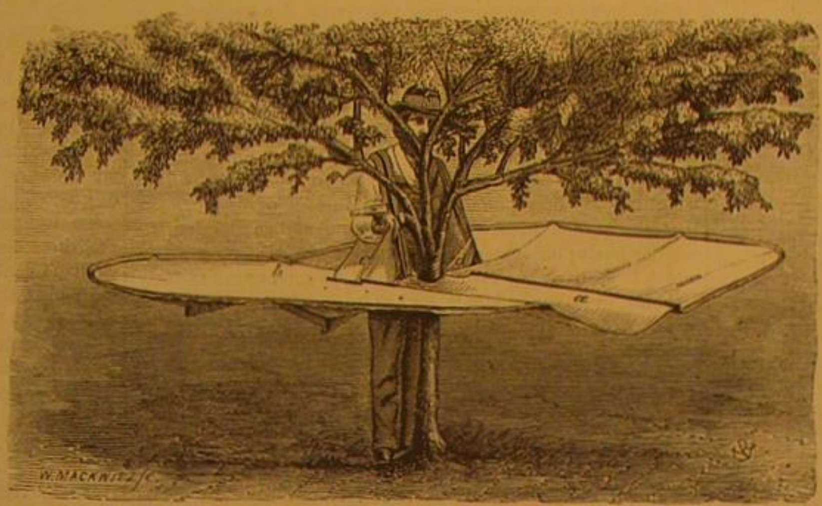
MR. G. G. PRINDLE, of Chittenden county, Vermont, has made an experiment designed to ascertain how far soil is protected from cold by snow. For four successive winter days, there being four inches of snow on a level, he found the average temperature, immediately above the snow, 13° below zero; immediately beneath, 19° above zero; under a drift two feet deep, 27° above zero.

[For the Scientific American.]

THE NATURAL HISTORY OF THE CURCULIO.

BY C. V. RILEY.

The annexed engraving represents an improvement by Dr. E. S. Hull—a well known and successful fruit grower of Alton, Ill.—upon his device, which was illustrated in Vol. XXI. of the SCIENTIFIC AMERICAN, for catching that destructive "little Turk" known as the curculio, or, more properly, the plum curculio. It may be briefly described as an inverted umbrella, and has long been in use among the growers of stone fruit in his part of the country. Several modifications of, and improvements on, the original machine have been made, and notably one which runs on two wheels, by Mr. L. M. Ward, of Benton Harbor, Mich., and one which opens and shuts, fan like, by Dr. M. M. Hooten, of Centralia, Ill.*



All these machines work on the same principle of jarring down and catching the beetles, and they are all intended to economize time and labor in the operation. The jarring is done either by a rubber bumper attached to the machine itself, or by a separate mallet. The former method was employed with the original Hull machine, but was very generally abandoned, as it was found to seriously injure the trees by bruising. Indeed, some years ago I became fully convinced that trees suffered too much from this bumping to make it practicable, unless a shouldered spike, against which the bumping might be done, were driven into the trunk of the tree.

Dr. Hull was wont to claim that he could use his machine without injury to the trees, but the present modification of it is an evidence that experience has taught him differently. In all rolling machines, whether upon one or two wheels, when the bumping was not done by the machine itself, it had to be done by a long pole tipped with rubber, and used by a second person. But where I have used such a pole and separately jarred the larger boughs, the trees have been much injured in the course of a single year's work, and, in some instances, killed outright.

The advantages of the present modification over the others may be thus briefly stated: It costs less, and enables the operator to get close to the tree, to which he can give a sudden jar with a hatchet or hammer. This is best done by striking a screw or spike previously inserted into the trunk and purposely made with a shoulder so as to prevent driving; or by striking the end of a limb previously sawn squarely off. Such a hard sudden jar with an iron instrument is far more effectual in bringing down the beetles than the more subdued bumping of a rubber mallet, as it is the sharpness and suddenness rather than the force of the blow which disturbs and alarms the little shy and cunning customers we have to deal with.

The working of the machine is very well indicated in the illustration. There is a bag, *d*, in the center, into which the operator can brush all fallen fruit, and a bottle of cheap alcohol may be kept in the vest pocket into which the beetles should be thrown.

Let me now give you a condensed history of the pest which may be, in great part, conquered by the proper use of such machines, as such an account will not only show the philosophy of the machine, but will render it impossible for paragraphs like the following, which I clip from a late issue of the SCIENTIFIC AMERICAN, to find their way into your columns without comment:

CURCULIO ON PLUMS.

A correspondent says that he wraps plum trees, below the lower limbs, with cotton, which he keeps wet with camphor and spirits of ammonia. He wets the cotton twice a week, and the result has been a good crop of plums and no curculio. A correspondent in another journal says:

"I have seen various methods for keeping these insects off plum trees, but none so simple or yet so effectual as the following: Soak corn cobs in sweetened water until thoroughly saturated, then suspend them to the limbs of the trees a little while after blossoming, being sure to burn the cobs after the fruit ripens, as they will be found full of the young insects. A good plan is to change the cobs every few weeks. My theory is this—that the insects deposit their eggs in the cobs in preference to doing so in the young plums. The first season I tried it upon one or two only, and in the summer was rewarded by a good crop of as fine plums as ever ripened, while those on the other trees fell off when about half grown. I have since tried it more thoroughly and have never known it to fail."

Now, as to the first remedy, your correspondent might just as well put the cotton round his chimney, under the delusive idea that he could thus keep the flies and mosquitoes out of his house. And as to the second, if persons will hang upon their trees sweetened cobs, as above described, they will, it is true, get eggs and larvæ enough, for some kinds of ants are attracted by the sugar and are very fond of consigning their eggs to the cozy and sweet recesses which such cobs afford. But they will get no eggs or young of the plum curculio, and of that they may rest assured.

You have the satisfaction of being in good company in tacitly giving credence to this absurdity, for the paragraph quoted has been extensively copied, and such being the case it is not to be wondered at that the deluded mortal who first hit upon the idea imagined he had made a grand discovery.

Suppose a naturalist were to make the following announcement:

GREAT DISCOVERY!!!

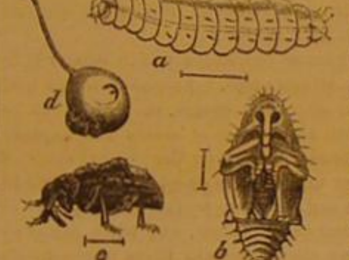
NO MORE CHICKENS KILLED BY HAWKS.

If gunny bags, after being dipped in diluted honey, are hung on the top of the chicken house, the hawks in the neighborhood will mistake them for nests and fill them with eggs. These bags, when full, are easily collected, the eggs destroyed, and the hawks thus exterminated.

What would be the result of such an announcement? Why every editor in the land, every ten-year-old lad, would scout the whole as a most absurd fabrication, or else consider the author hopelessly insane. And yet this suppositious announcement would not be a whit more ridiculous than is the curculio-corn-cob story in the eyes of an entomologist. Now, I ask, why is it that the one announcement would be so universally considered to indicate stark staring madness on the part of its author, while the other will pass muster with the majority of well educated people? Simply because the natural history of the higher animals is taught, in its rudiments, in our schools and colleges, while that of the more lowly—but none the less interesting and instructive—generally remains a sealed book.

NATURAL HISTORY OF THE PLUM CURCULIO.

The plum curculio (*conotrachelus nenuphar*—Herbst) in the larva state, in which alone it is found working *in* the fruit, is a pale, yellowish, footless grub (Fig. 2, *a*). In the pupa state, in which it is found underground, the color is about the same, but the members are distinctly visible (Fig. 2, *b*). In the beetle or mature form, it is roughened and warty (Fig. 1, *c*), and so colored with gray, brown, white, and black that, when resting on the rough bark of a peach or a plum tree, it almost defies detection, and when lying on a flat surface, with the legs drawn in, looks precisely like a dead bud. It often makes a peculiar creaking stridulation, by rubbing the tip of the abdomen up and down against the wing covers.*



To condense the history of its habits into the briefest possible space, let me give a series of what I know, from personal experience, to be well tested and incontrovertible facts:

1. It is more numerous in timbered than in prairie regions.

2. Under the hard wing covers of the beetle there are folded up two ample membranous wings, with which it can fly and *does* fly; so that cotton bandages, or other like contrivances, placed around trees as a safeguard against its attacks, are utterly useless, and result from ignorance of the insect's habits and nature.

3. It does not often use its wings, however, when alarmed, but has a habit, in common with many others of its class, of dropping and "playing possum" upon the slightest disturbance.

4. It hybernates in the mature or beetle form, principally in the woods, under the bark of trees, but also in any other shelter that presents, in the vicinity of the orchard. The same spring influences, which cause our orchard trees to wake from their winter rest, also rouse the curculio from its dormitory.

5. From this time on, till fruit sets, these beetles are more or less active, and instinctively make their way to our orchards, where they feed on the buds, leaves, and other tender parts of the trees. They are thus, at this early season, more frequently found on the outside rows of an orchard, and especially on those trees nearest the woods, and they may be captured under traps long before their depredations on the fruit commence.

6. It is nocturnal rather than diurnal in its habits, except during the egg-depositing season, when the female, more especially, may often be found at work during the day; both sexes, at that time, rest concealed on the underside of the more horizontal branches, or under whatever other shelter is afforded them in the orchard.

7. The female commences to oviposit as soon as the fruit is as large as a hazelnut. Oviposition is effected in the following manner: With the jaws at the end of her snout, she cuts just through the skin of the fruit, and, running the snout under the skin to the depth of about one sixteenth of an inch, moves it back and forth until the cavity is large enough to receive the egg it is destined to contain. She next changes her position, and drops an egg into the mouth of the cut; then veering round again, she pushes it by means of her snout to the end of the passage; and afterwards cuts a crescent in front of the hole so as to undermine the egg and leave it in a sort of flap, her object being to deaden the flap so as to prevent the growing fruit from crushing the egg. This egg is white, oblong oval, and three hundredths of an inch long. It swells slightly by endosmosis, and may easily be crushed by the thumb nail without injuring the fruit. The stock of determinable eggs in a female, even at the most pregnant season, seldom exceeds thirty, but doubtless ova continue to develop and are repeatedly impregnated, contrary to the more general rule in insect life, which is, that a single coitus suffices for the fertilization of the ova. The period of egg depositing extends over two months or more, and larvæ of all sizes may be found during the summer.

8. It is single brooded, that is, but one generation is produced annually; and, as a rule, no female lays eggs until she has passed the winter. I have kept specimens alive, and in a continued state of activity, over thirteen months.

9. During the beetle life, both sexes feed as long as the weather allows of activity. While fruit lasts they gouge holes in it, and after stone fruit has gone, pip fruit (apples especially) is badly attacked. At the proper season and under favorable conditions, these punctures and gougings are instrumental in spreading the dreaded peach rot, by forming proper *nidi* for fungi, such as that known by the name of *mucor mucedo*.

10. It prefers smooth skinned to rough skinned fruit, but will mature alike in plums, peaches, nectarines, apricots, cherries; in black knot on plum trees, and in some kinds of apples, pears, and quinces. There is also a larger phytophagic variety which breeds in the rind of walnuts and hickory nuts, but there is no evidence that this variety ever attacks the other fruits mentioned.

11. Varieties of the Chickasaw plum, such as the Miner, the De Soto, and what is known in some parts of Missouri as the Salt Plane plum, are almost entirely exempt from its attacks.

12. It is not subject to sudden decrease or increase, as are so many other noxious insects, for the reason that it is scarcely ever devoured by birds, and has not very many insect enemies.* Yet in a clayey soil, many perish while transforming, if the weather be very hot and dry, so as to bake and heat the earth to an unusual degree; and from this cause, together with the work of its few enemies, its numbers sometimes decrease so as to render it harmless. Such is the case in the vicinity of St. Louis in the present year.

In these twelve paragraphs, we have all the more important facts in the life history of our little Turk. Exceptions, to some of the rules stated, occasionally but very rarely occur.

From this history, we can appreciate the value of the curculio catcher, as there is no other remedy against this pest but to catch and kill. This may be done by the catcher and by the use of traps in the shape of pieces of bark or shingle set around the tree; and by causing all fallen fruit to be picked up regularly either by hand or by hogs.

Spectra of Gases.

M. Cailletet has investigated the influence of pressure on the spectra of gases. He fixed two platinum wires in the end of a thick glass tube, into which the gases were passed. The spark from an induction coil connected with three Bunsen elements passed between the wires. At ordinary pressure, the bright lines of the spectra of the gases appeared on a slightly illuminated ground; and as pressure was increased they grew brighter, but they by and by became merged in a continuous spectrum, whose brightness also increased with the pressure. At a certain pressure (between 40 and 50 atmospheres) the discharge suddenly ceased; and though the battery power was increased and the distance between the platinum wires reduced to $\frac{1}{4}$ millimeter, it was not possible to obtain the spark beyond this point. It is thus seen that a spark, which passes easily in the rarefied gas of Geissler tubes or the electric egg, meets with considerable resistance in compressed gas. The brightness of the spark at the point beyond which the discharge is unobtainable is 200 times greater than at ordinary pressure.

INFLUENCE OF VARIOUSLY COLORED LIGHT ON VEGETATION.—As the result of a series of experiments upon the influence of variously colored light upon vegetation, Dr. Bert has arrived at the following conclusions: 1. That green light is almost as fatal to vegetation as darkness. 2. That red light is very detrimental to plants, though in a less degree than green light. 3. That though yellow light is far less detrimental than the preceding, it is more injurious than blue light. 4. That all the colors taken singly are injurious to plants, and that their union in the proportion to form white light is necessary for healthy growth. This does not agree with the ideas of the Commissioner of Patents, who has granted a patent to Pleasanton for the use of blue glass as an improvement in the cultivation of plants.

*Descriptions of these machines were given in the third Missouri Entomological Report.

* If carefully examined, the elytra will be found to have, on their lower apical edge, a horny, slightly raised plate, about a third as long as the whole elytron, and transversely and obliquely ribbed by numerous parallel ridges. There is also a longer cord or carina near the sutural edge which may help to intensify the noise. The dorsal apex of the abdomen or pygidium forms a yellowish and roughened plate, with the sides horny and emarginate, so that when the abdomen plays up and down these horny edges grate or scrape at right angles against the rasp.

* Two true parasites (*sigalphus curculionis*, Fitch; and *porizon conotracheli*, Riley,) are known to infest it, while about half a dozen predaceous or cannibal insects have been found attacking it. Ants destroy the larvæ when they can get them, and a species of *thrip* destroys the eggs.

Correspondence.

Editors are not responsible for the opinions expressed by their Correspondents.

The Young Machinist's Query.

To the Editor of the Scientific American:

On page 20 of your Volume XXVII., "A Young Machinist" says: "It is hard to know that, after serving four years' apprenticeship to my trade, I can only get $3.50 a day for building and repairing an engine, while a man who has served no apprenticeship, and is ignorant of the working of the engine, gets $4.50 for running it. This, I think, is alike an injustice to the machinist and to the public," etc.

The above, boiled down, means that machinists are competent, and should be placed in charge of engines to run them, and no others are eligible to become engineers Many machinists arrogate to themselves (as mechanics) that they alone have a knowledge of the locomotive engine in all its parts, and the ability to repair the same; hence their claim to superiority as engineers. Let us examine some of their claims. The finishing, fitting and putting together the different parts of machinery can only give one a general idea of the principles of construction; others employed about the engine can gain this knowledge with equal facility, and what more can a machinist do, out on the road, in the event of a break down or other emergency, than an engineer who is ignorant of the use of tools? Nothing whatever. Beyond the ordinary work belonging to their trade and the ability to set the valves of an engine, there are but few machinists who know anything about the construction of the valve gear of a locomotive engine or the principle upon which it operates. Many will dissent from this, but I will answer their objections, Yankee-like, by asking a question or two: What causes the lead to vary when a shifting link is used? and why is more steam used in one stroke of an engine, when worked expansively, than the other, in making one revolution?

I would call the attention of the "Young Machinist" to these queries, as he so very bitterly complains of the ignorance and incompetency of others, and I suspect his ignorance of the management of a locomotive is the cause of his being in the shop instead of out on the road. The promulgation of the idea, that a man who is unable (so far as a knowledge of the use of tools is concerned) to build a machine is incompetent to operate or run the same, is absurd; according to this theory, the woman who runs a sewing machine should not only understand the principles of its construction, but should be compelled to build it; so should the telegraph operator, who presumes to run an instrument which he is unable to make, and others *ad infinitum.* "Young Machinist" asks: "Is there no way to prevent railway officials from filling such important places with ignorant men," that is, men who are not machinists? It is well for the public, in whose behalf he appeals so pathetically, that railway officials do not stultify themselves by taking out of the shop a machinist who is ignorant of the management of the locomotive, and putting him in charge of an engine, when they can employ a competent engineer who is not a machinist. Again, railway officials are not in the habit of paying premium rates for ignorance and incompetency, for labor is like any other commodity; it is bought and sold at market rates according to quality, and said officials are generally good judges of the article, though they are not infallible. I would ask, is there no way to prevent incompetent machinists from imposing on railway officials? There are a good many such men in the business.

In conclusion, I would say to "Young Machinist" that my acquaintance with railway officials enables me to know that they want sober, reliable, intelligent and competent men, more especially on their engines; and that there is no law preventing machinists from running engines, except the law against ignorance, and that he would display a better spirit by preparing himself to earn $4.50 a day than by vilifying the men, as poor wretches, who are already able to earn it; for merit has its reward all the world over.

Macon, Miss. OLD FOGY.

Deep Sea Soundings by Electricity.

To the Editor of the Scientific American:

The want of a means by which the depth of water at sea for soundings) may be obtained expeditiously, certainly, and without stopping the vessel's way, howsoever fast she may be going through the water, has been long felt by seamen. Doubtless many disasters, resulting in the loss of vessels, lives, and cargoes, might have been averted had the captain taken the precaution of frequently sounding, but when running "on time," the delay of getting a fair "up and down" cast is often too great, and captains prefer to, and often do, risk getting into shoal water rather than lose the time required to sound. Of all the contrivances now in use, so far as known, to obviate the difficulty, probably Massey's patent is the best, but even that is defective and liable to error.

Fortunately, by the aid of electricity, a ship running along a coast at night or approaching the land in thick weather may, without "luffing to" or "slowing down," keep constantly sounding and obtaining the depth of water with rapidity and precision. Indeed, should the vessel suddenly strike shoal water, the fact is made known the instant the lead touches the bottom, without waiting to haul it in.

It is known by experiment that a lead of a determined shape and weight, with its line attached, will sink in sea water at a certain rate per second. On getting a cast of the lead, then, it is only necessary to ascertain the time the lead takes to reach the bottom in order to know the depth of water.

This is accomplished as follows: The lead line contains a heart composed of two insulated copper wires. The inboard end is connected with a small battery, and, by means of an armature, with a clock. The other end is bent to the lead.

The lead contains two insulated copper wires passing through its length, the upper ends connecting with those of the line. The lower ends, tipped with platinum, are slightly exposed beyond the surface of a false bottom or upper section of the lead. The lower section of the lead acts as a plunger, with a play of about one eighth of an inch.

On striking the bottom the plunger is thrown up, so that a "button" on its upper surface comes in contact with the two platinum points, thus closing the circuit. This is known on deck by the instantaneous stoppage of the second hand of a clock, and the sounding of a gong attached to the clock, the purpose of the gong being to call attention,

The clock is an ordinary time piece with the addition of a second hand pivoting at the center, and long enough to reach the perimeter of the face where are marked the fathoms corresponding to the minutes.

Let it be supposed, for example, that a ship running along the coast at night should, at a certain hour, be, by the chart, in forty fathoms of water. The captain orders a cast of the lead and about forty fathoms of line to be used, the lead weighing say fifty pounds. At the instant of heaving the lead the second hand is set in motion and commences its regular beats; but instead of passing on to seventeen seconds, which is seen, on the face of the clock, to correspond to forty fathoms, the gong suddenly strikes its warning, and the hand is arrested at four seconds, which is seen to correspond to ten fathoms; the captain is thus warned of his dangerous proximity to shoal water and at once hauls off.

A reel fitted in some convenient place aft should be used for reeling in the line and for keeping it in good order. The battery used is simple and inexpensive, and will keep in good working order for eight or nine months, and the clock, gong, and battery may all be contained in a case not larger than an ordinary sized ship's binnacle.

Connected with the same, battery wires may be led throughout a ship for signal purposes, such as for communicating with the man at the wheel, with the engine room, etc., etc.; though if the wires be greatly multiplied, the strength of the battery must be increased in proportion. S. B L.

Watering Streets and Melting Snow.

To the Editor of the Scientific American:

I notice, in a recent issue, a description of a new plan for watering streets, lately tried in London. Said plan consists in pipes laid close to the kerb stones.

During the very severe snow blockades which occurred in New York four and five winters ago, I proposed to lay iron pipes in the gutters near the kerb stones, said pipes to be supplied with steam, from the boilers of steam fire engines or otherwise, for the purpose of keeping the gutters clear of snow and ice, and also for melting the street snow as it might be thrown to the gutters and thus run to the river by way of the sewers instead of being carted there; and when asked by a critic whether the pipes should remain there permanently I replied "yes," as the same pipes perforated properly would answer for sprinkling the streets in summer by attaching them to the water mains. I should like to see this plan tried on Broadway next winter for removing snow, either with fixed pipes or with a moveable pipe say 100 feet long resting on small wheels or rollers to facilitate its movement and also to keep it an inch or two from the pavement.

Portland, Conn. T. R. PICKERING.

Summer Heat.

To the Editor of the Scientific American:

In your article on summer heats, you state that the mercury rises to 120° in Calcutta; this is correct so far as regards the direct rays of the sun striking the thermometer, but I can assure you from a four years' residence in Bengal that the quicksilver rarely or never rises above 98° when protected from the direct and indirect rays of the sun. There is, however, a difference to be pointed out between the heat of that and this country, namely that, in Calcutta it is a damp heat, making it worse to bear than a free open dry temperature. I may add than in travelling northward to the arid country north of the Ganges where, in their season, the hot winds prevail, the shaded thermometer rises to over 100°; at such times the wind blows as if it had come out of an immense oven, making it painful to face the air, every drop of perspiration being evaporated before reaching the surface of the skin. HOWRAH.

An Optical Experiment.

To the Editor of the Scientific American:

In the SCIENTIFIC AMERICAN of July 13, Mr. R. B. S. expects that an image can be increased infinitely by photography. He is evidently neither microscopist nor photographer. Either of them knows that that idea and hope is as grand as the failure to realize it, simply because the material upon which anything is photographed is magnified in such a provoking degree that, for example, the moon, tele-photographed on glass or paper, would show her mountains imbedded in the fibers of the paper or ravines of the glass, if they could be seen at all, which, however, is impossible.

Let us find a material the surface of which, with a photograph upon it, will not alter or increase under magnifying power, then only Mr. R. B. S.'s hopes will be realized; otherwise our Mr. Rutherford or Mr. Woodward had given us long ago photomicrographs of foraminifers, diatoms, etc., from the chalk cliffs of the moon. CARL MEINERTH.

Newburyport, Mass.

BY simply scratching crossed lines on a cornelian, a white figure may be produced on a red ground.

RECIPES AND EXPERIMENTS.

The following recipes and experiments have not been practically tested by the editor of the SCIENTIFIC AMERICAN, but are published for the benefit of readers who may desire to try them. The editor would be glad to be informed of the results of such trials.

RELIEVING INSECT STINGS.—It is asserted that the intense pain caused by the stings of insects in sensitive portions of the body may be instantly relieved by injecting into the wound a drop of a solution of carbolic acid (1 to 100) by means of a hypodermic syringe. Less prompt relief may be obtained by applying ammonia or tobacco juice.

PRESERVING FISH.—A novel though rather odd method of keeping fish fresh any length of time during hot weather or a very long carriage is to fill the mouth and gills with a paste made of bread crumbs and spirit of wine; then wrap the fish up in fresh nettles and place outside an envelope of straw. This recipe originated in France, and has been put in practice in that country with considerable success.

TO DESTROY FOUL ODORS—The foulest smells arising from sinks or drains may be destroyed by pouring down one pound of green copperas dissolved in one quart of water.

TO PRESERVE LEMONS.—Lemons may be kept for any length of time by varnishing them over with a solution of shellac in spirit of wine. Query: Could the preservation be effected if the lemons were dipped in a solution of albumen or gum arabic?

TO SOFTEN PUTTY.—A paste of caustic potassa, made by mixing the caustic alkali or even carbonate of potash or soda with equal parts of freshly burnt quicklime which has previously been sprinkled with water, will be found of value to soften putty, around window panes, to be removed when the former has become hard by age.

TO PREVENT LEAD POISON—Workers in lead should wash their hands frequently in a strong decoction of oak bark, wear short hair, and, during work, cloth caps. The hands should be cleansed and the mouth well rinsed with cold water before eating. The food should contain a large proportion of fat, and milk should be taken in large quantities.

TO RENDER WOOD INCOMBUSTIBLE.—Soak the wood for four or five days in a solution of one pound of alum and one of sulphate of copper in 100 gallons of water.

HOW TO MOUNT CHROMOS.—Procure a stout piece of binder's or other strong pasteboard of exactly the size of the picture to be mounted. To this attach the chromo with any smooth paste. Do not use glue for this purpose, as it is apt to soak through the paper. Care should be taken that the picture is laid perfectly flat, and that all wrinkles are smoothed out. When nearly dry, cover the face of the chromo with a weak size made of the best white glue. Over this, when dry, lay on varnish which must be perfectly clear and pure. Chromos thus prepared will not need to be covered with glass for preservation, but may be treated in the same manner as oil paintings.

The Cause of Consumption.

Dr. Henry MacCormac, of London, in a new book, puts forth the theory that tubercular disease of the lungs is caused solely by breathing air which has already passed through the lungs of either brutes or human beings, or air that is deficient in oxygen. If we assume the quantity of air in the chest at about 230 cubic inches, and that from twenty to thirty cubic inches are changed and removed during each respiration, about ten breathings will suffice to renew or exchange the gaseous contents of the chest cavity. At each inspiration, from 4 to 8 per cent of the oxygen inhaled is, or should be, replaced by about the same quantity of carbonic acid, an amount which in a few hours would be represented by an appreciable weight of solid carbon. If any portion of the inhaled air be prebreathed air, says Dr. Mac Cormac, the dead metamorphic carbon will be retained *pro rata* unoxidised within the organism. This effete unoxidised carbon—this "detritus of degradation" being retained—speedily becomes "tubercle."

He says that without adequate ventilation we cannot possibly get rid of the ten or twelve hundred cubic inches of carbonic acid which the lungs eliminate hourly. He has also been at some pains to obtain the average death rate from consumption in various parts of the world. We learn from him that in the Austrian capital phthisis prevails to such an extent as to have been named *morbus Viennensis;* but he traces the cause readily enough to close stoves in stuffy chambers, to doubly glazed and padded windows, which are never opened, ventilation being entirely unthought of. A similar state of things he finds to exist nearly everywhere, the deaths being from 28 per cent in some parts of America to 10 per cent in Paris, while in St. Petersburg, out of 5,000 deaths, 1,900 are occasioned by phthisis! "Double doors and windows, every interstice being carefully closed with wadded cloth or *voilok*, exclude the current, and, along with the close stove or *petch*, render stagnant utterly the stinted, breath-fouled atmosphere, effectively hindering its replacement from without, and, in fine, entailing the direful scourge of tubercle, from which no class or condition of the community finds escape."

The Uses of Mineral Waters.

It would be a most desirable study in this country for a physician of experience in such matters to make a tour to our most renowned mineral waters, and to ascertain, more accurately than we can now learn, their real merits. Most of the published descriptions now extant are by proprietors, hotel keepers, or those in their interest, who are only concerned to brag as loudly as possible about the virtues of particular sources.

Certain it is that the prolonged use of any mineral water, in health or disease, is of doubtful efficacy, and is generally directly prejudicial.

Magnesia in large quantities is objectionable, as are also lime salts. They are liable to cause dyspepsia. It is said that horses acquire a rough coat if supplied with water containing a large quantity of sulphate of lime. Goitre and cretinism are attributed to these impurities in water; at least, the facts observed make this reference extremely probable. The goitre appeared in the Durham jail, afflicting a large proportion of the convicts. The spring water with which they were supplied was analyzed, and found to contain 77 grains of lime and magnesia salts per gallon. On substituting for this a water containing only 18 grains of these salts, it was found that the old cases rapidly improved, while no new cases made their appearance. It is a curious fact that in Ireland, on the Waterford side of the Suir, where sandstones and slates prevail, goitre and cretinism are almost unknown, while on the Kilkenny side, where limestones abound, goitre is not uncommon.

Still, perfectly pure water is not the best for a common beverage. Every one knows that distilled water is flat and insipid. It is probably not even the healthiest. Dr. Letheby, one of the highest authorities on the sanitary relations of water, considers water of moderate hardness preferable to very soft water for domestic purposes. About six grains of carbonate of lime per gallon is desirable. He finds that the death rate is less in cities supplied with moderately hard water than in those supplied with soft water.

It is a familiar fact that it is a great advantage in making tea or coffee to use water of about five degrees of hardness, that is, containing about five grains of carbonate of lime or its equivalent in the gallon. The fine flavor of tea made with such water is due to the fact that the carbonate of lime prevents the water from dissolving the astringent matter contained in the tea, without interfering with the extraction of the theine and the other desirable constituents of the leaf.—*Medical and Surgical Reporter.*

The New Pile Driver.

The *American Builder* (Chicago,) says that F. C. Prindle, civil engineer, has made a report of the marvellous success of the new method of shooting piles into the ground with cannon, now in use in the Government construction of the new landing wharf on League Island, in the Delaware. More than 800 heavy yellow pine piles, averaging ten inches middle diameter, have now been driven through mud and clay to a very hard bottom, twenty-one feet below mean low water. The machine was secured to a large scow, in the usual manner, assisted by a small engine to hoist the piles into position.

The gun, weighing 1800 lbs., has a 6½ inch bore, 24 inches deep, pointing upwards, and is recessed at the lower end to, receive the head of the pile, upon which it rests.

The ram, weighing 1300 lbs., moves in the same guides as the gun, and is provided with a piston, projecting from its lower end and neatly fitting into the bore of the gun, its upper end having a bore of greater diameter to receive a fixed piston secured to the top of the frame and thus form an air cushion to prevent its escape from the guides when the hight of its rebound is limited, as during the first blow with very long piles. The ram is caught and held at its highest ascent, and also released for the succeeding blow, by the operation of a friction brake at one side pressing it against the opposing guide—all at the will of the operator on deck.

The operation of driving is as follows: The engine hoists the ram, gun, and pile into position simultaneously, with one movement; the brake is then applied, holding the ram in place, uppermost, and the gun and pile are then lowered together until the pile rests in the mud; the gun is then lowered on the top of the pile, the recess securely holding the pile head in place directly underneath.

A cartridge is then dropped into the gun, the operator releases the brake, and the ram falls with its piston entering the bore of the gun (which is made slightly funnel shaped at the muzzle), and by compressing the air, exerts a gradually increasing downward pressure upon gun and pile, till the inertia of both is more or less entirely overcome, the cartridge is crushed by the piston, and ignited by the heat evolved by the sudden and severe compression of the confined air. An explosion immediately ensues, the result of which is to violently force the pile downward, and this is measured by the reactionary effort upon the ram—the hight to which it is thus thrown, practically, I suppose, from a state of rest. The force due to the fall of the ram, and the explosive force exerted to throw it again in position, are thus at once combined and applied to the pile.

The principal difference of effect, between this method and the ordinary hammer, appears to be just here: in the one case, the pile is already in motion when a tremendous force is suddenly brought to bear upon it in the same direction, and in the other case it receives a violent blow when at rest, and a considerable portion of the force is expended uselessly in the destruction of the pile head itself, before its inertia is overcome and motion produced. Hence the necessity of strongly banding the pile heads in the latter case, and the utter absence of any necessity for their protection in the former.

The ram, on its rebound, is caught and held by the brake, and the operation repeated at pleasure. On January 13th, twelve piles were driven in a single hour. The piles were all driven without the slightest injury, and none of them showed any marks of violence. An engraving of this novel device will be found on page 97, Vol. XXI of the SCIENTIFIC AMERICAN.

Chang and Eng.

The Raleigh *North Carolinian* says: "The Siamese twins Eng and Chang, who are now living in the western portion of this state, and one of whom is lying dangerously ill at the present time, were born in a small village on the coast of the Siam in the year 1811. We are in possession of some particulars concerning them which may be of interest to our readers. Their parents got their living by fishing. And until 1829, when Eng and Chang were brought to the United States, they made their living by selling shell fish. Their mother bore seventeen children. At one time she gave birth to three, and never less than two. But none of these children were deformed. While you may whisper in the ear of one without the other hearing, while volatile salts applied to the nostrils of one has no effect on the other, and while pinching the arm of one excites no sensation in the other; still, if you but stick a pin in the exact vertical center of their connecting link, both will flinch from the hurt. These twins are seldom observed to converse with each other. They play a good game of draughts, make pretty much the same moves, and at the same time, and frequently play against each other."

Remarkable Electrical Instruments.

At a recent meeting of the Society of Telegraph Engineers in London, first and foremost among the objects of interest was Lord Lindsay's giant electro magnet, by far the largest in the world. It stood in one corner of the largest room, and consists of several straight massive horizontal bars of soft iron, running upon wheels, and so arranged as to form a rectangle; the opening between the poles is narrow, only a few inches. Lord Lindsay had to jump over the bars to get into the open square space in the center, and observers stood outside watching his experiments. The magnet consists of more than 26 ft. of iron, each bar having a sectional area of about 36 inches; we were told, says the *Engineer*, that it weighs about six tons, and has fourteen geographical miles of conducting wire wound around it, the coils being then protected by outer casings of wood. It was charged by means of a powerful battery, but as the Grove's battery used for the purpose is not yet completed, only one fifth the power of the magnet was, according to Mr. Varley's estimate, developed at the *soirée*. Under these conditions, a plate of copper fell between the poles, at the rate, as nearly as we could judge, of ½ inch per second, this slow fall through the air being due to the mysterious action of the magnetic rays upon the electrical currents which those rays induced in the copper plate. One experiment which particularly attracted the attention of the observers was that of inserting a lighted taper between its poles, where it burnt freely so long as the magnet was charged, but directly the current was broken and the magnetism disappeared, the taper was extinguished.

The induced current produced in the wire by the cessation of the magnetism when the battery current is removed is so powerful that the shock would probably be fatal to any person who by an unfortunate accident happened to complete the circuit at the time. To guard against this, a very elaborate current reverser has been constructed by Messrs. O. and F. H. Varley, which breaks the circuit gradually by introducing resistances varying from nothing up to infinity. The magnet itself was designed by Mr. C. F. Varley. The conducting wire weighs about 600 lb. to the geographical mile, and is nearly ½ inch in thickness. We are told that the battery ultimately to be used with this magnet will consist of 150 of Grove's nitric acid cells, each platinum plate of which will expose a square yard of surface, both sides of the plate included. A battery of this colossal size has never before been constructed, nor indeed at all approached in in dimensions.

All the parts of the magnet, as already stated, run upon wheels, and the front bars are governed by a screw motion, so as to accurately adjust the distance between the poles.

In the course of the evening Mr. Ladd froze some mercury, and the solidified metal was allowed to fall between the poles to see what diamagnetic effects would result. There were none at all so far as we could see. Most of the observers had taken the precaution of giving their watches into the charge of attendants, lest their good time-keeping qualities should be destroyed by the action of the magnet upon the steel springs.

Another chief object of interest was Sir William Thomson's siphon galvanometer. The apparatus is now in practical use for the reception of messages through the Indian cables, and it is a good instrument for registering indications produced by feeble electrical currents.

Mr. C. F. Varley exhibited a battery, very useful for testing purposes where high potency combined with extreme uniformity from day to day is of vital importance. He exhibited 1,000 of these cells, as well as a number of condensers invented by him to enable long submarine cables to be worked rapidly and continuously. The sheets of tinfoil in these condensers are so completely insulated that once when they were charged with 1,000 cells and left for three months, at the end of that time, enough of the charge remained to give a brilliant spark. At the *soirée* he discharged the condensers through a sewing needle; the steel was blown into vapor and molten globules, with a loud report and a bright flash of light; some of the globules were blown to the further end of the room. Fine platinum wire was in like manner blown into vapor, but not into globules.

Mr. Apps, the optician, exhibited a very beautiful Gassiott cascade made by him for Lord Lindsay; the electrical stream passed over the edges of a vase made of uranium glass placed under the receiver of an air pump. He also exhibited a vacuum tube twisted into very large letters, constructed of uranium glass, and exhausted to a high degree so that only ½ inch spark was required to illuminate it; this was proved by allowing the spark to pass in air between the terminals of the coil. Mr. Apps also had on view several of his patent induction coils; one of them gave a spark 6 inches in length, though of the size only, he states, of an ordinary coil giving a spark of 1½ inch. One of the most useful instruments he had on view was De Wilde's electrical probe and forceps, as used in H. M's. military hospitals and by the Prussians during the late war. The principle of the probe is that it carries within it two wires connected with the opposite poles of a weak battery; a current cannot pass till the ends of the wires at the extremity of the probe touch the bullet; the circuit is then completed, and by an electromagnetic effect the existence and position of the bullet are made known to the operator. The apparatus is intended to make bullet extraction as easy an operation as possible, attended by the minimum of pain to the sufferer. Among the other things which Mr. Apps exhibited were tubes containing sulphate of strontium and sulphate of barium, which remained phosphorescent many minutes after the cessation of the spark; and an improved Wheatstone's bridge arrangement, giving a scale of differences from 1,000 to 1; there was also included a small ivory disk arrangement for reading off approximately very small resistances, to one millionth of an ohm.

Lord Lindsay exhibited among other things a large induction coil, which gave sparks 20 inches long in air; this coil was made for him by Messrs. O. and F. H. Varley. The last mentioned manufacturers exhibited a vacuum tube 9ft long, which was brilliantly illuminated. They also exhibited a pencil writing Morse instrument, for which they claimed more cleanliness and a higher rate of speed than with an ink writer; and among their instruments was one of the vacuum lightning protectors for submarine cables, used to prevent lightning, which may strike the land wire, getting into any cable connected therewith.

Suint.

In nothing is the spirit of the age more clearly shown than in the efforts made to utilize waste substances. This is being done with such effect that what was formerly got rid of with great difficulty and at considerable expense may become one of the most important objects of manufacture. We need only point to such matters as sewage, the slag of furnaces, the fine coal of commerce, the waste of pyrites used in the manufacture of sulphuric acid, etc., as illustrations. Quite a recent instance of this improved economy is found in the treatment of the wool of sheep. It has been ascertained that sheep derive from the soil upon which they pasture a considerable amount of potash, which, after it has circulated in the blood, is excreted from the skin with the sweat, and remains, generally in connection with this, attached to the wool. Chevreuil discovered, some time ago, that this peculiar mixture, known by the French as suint, constitutes not less than one third the weight of the raw merino fleece, from which it is easily removed by immersion in cold water. In ordinary wools the suint is less, the amount being about 15 per cent of the raw fleece. Formerly it was considered as a kind of soap, mainly for the reason that the wool, besides this, sometimes contained about 8 per cent, or a not inconsiderable quantity of fat. This fat, however, is usually combined with earthy matters, mostly with lime, and consequently forms a soap which is very insoluble. The soluble suint is a neutral salt arising from the combination of potash with a peculiar animal acid, of which little more is known than that it contains saltpeter. Special effort has lately been directed to suint, in order to obtain as much as possible of the potash eliminated from the animal, and a special industry has been established in various portions of the great French wool district, such as Rheims, El Bœuf, etc.

A company purchases from the wool raiser the solution of the suint obtained by rinsing the wool in cold water, the price paid for it being higher in proportion as it is more concentrated. As a general thing it is maintained that a fleece weighing nine pounds contains about twenty ounces of suint, which should contain about one third part, or six to seven ounces, of potash, although not more than five and one half ounces are perhaps directly available.

In the wool manufactories of the towns just referred to, there are nearly 60,000,000 pounds of wool washed annually, the yield of about 6,750,000 sheep. This quantity should contain over 3,000,000 pounds of pure potash. Thus, the water in which the wool is washed, and which has been heretofore thrown away, is made to yield a product, adding appreciably to the value of the wool itself, and more than covering the cost of its treatment. It is, of course, not an easy matter to utilize this solution of suint on a small scale; but wherever the work is carried on by the wholesale, as it is in connection with all great manufacturing establishments, it will undoubtedly become a regular part of the process of manufacture.

Samuel C. Bishop.

Mr. Samuel C. Bishop, proprietor of the Bishop Gutta Percha Works, New York city, died here July 4th from prostration by the heat. Mr. Bishop was for many years connected with the production of gutta percha goods, and in fact was one of the earliest introducers of the gutta percha industry in this country, finally becoming the sole manufacturer. One of the most important uses of gutta percha is for electrical insulation. The gutta percha covered wires and cables made by Mr. Bishop are used everywhere for submarine telegraph purposes, in mines for blasting, etc.

SIGNOR G. A. Pasquale attributes the injury to vegetation, by the recent eruption of Vesuvius, to the injurious effects of the chloride of sodium which falls in considerable quantities with the ashes.

MASTERSUN'S CANADIAN TURBINE.

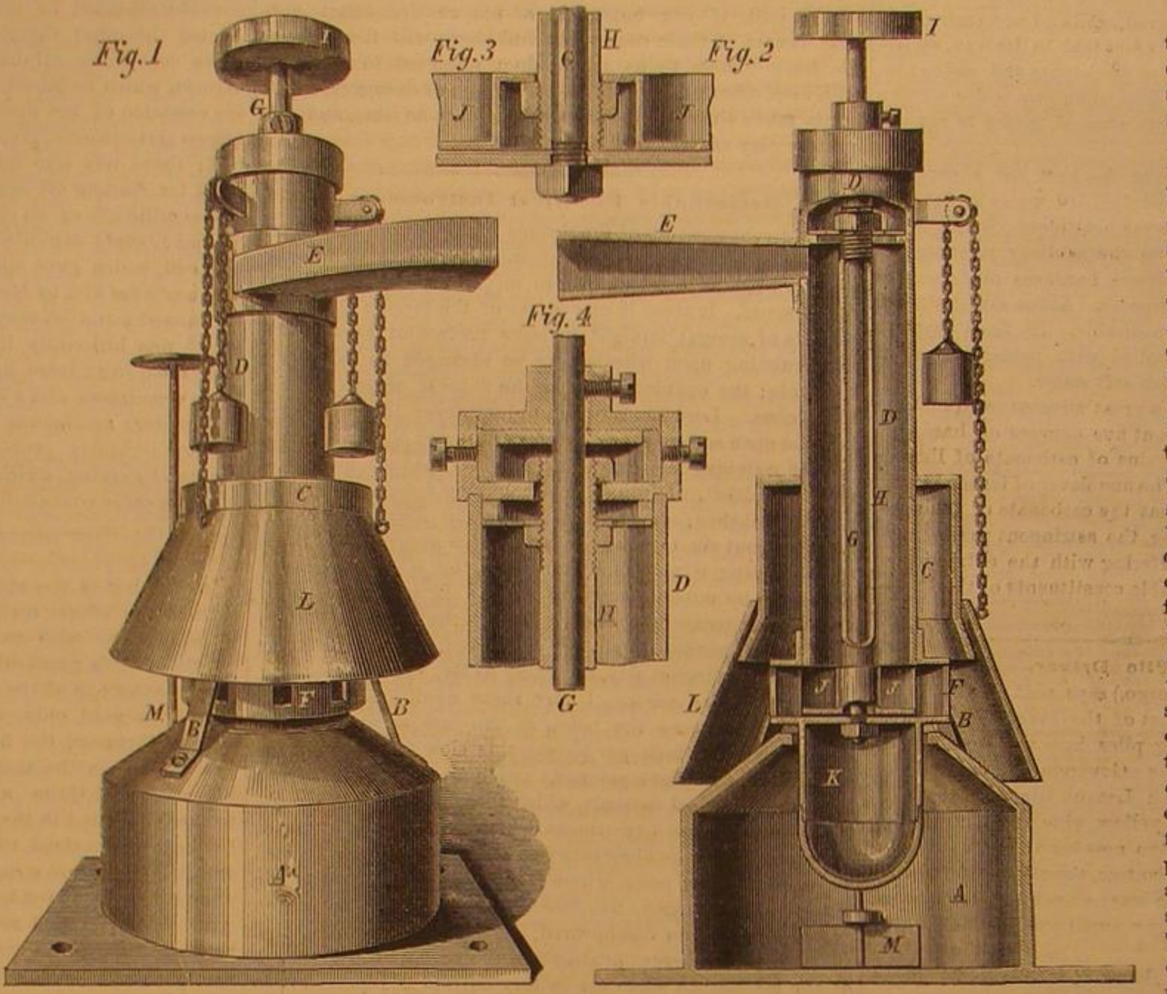
Our engraving illustrates a very ingenious invention, lately patented through the Scientific American Patent Agency by Mr. W. G. C. Mastersun, of Hinchinbrook, Huntington Co., Province of Quebec. By various skillful devices, which we shall describe, he supports a water wheel and chute independently of each other, but in such a manner as to allow of their both being raised by a float, so as to do away with the use of a step. He further arranges the buckets and outside rim of the water wheel so as to form receptacles for the water in corners situated beyond the outlet slots of the rim. The water driving the wheel is thus provided with water cushions to bear against, and the motion of the wheel is rendered steady and continuous. Another prominent feature of the invention is a self-acting grate for the water outlet.

Fig. 1 is a perspective view of the complete apparatus, showing the water gate alluded to, fully raised. Fig. 2 is a sectional elevation of the same, with the gate nearly closed. A is a water cylinder on which are supported, by the legs, B, the cylindrical air chamber, C, and the inner cylindrical water tube, D. E is a horizontal pipe, through which the water is supplied. F is the water wheel, which consists of a disk-like plate at the bottom, an annular plate at the top (between which plates the buckets are inclosed), and an outer rim, slotted to discharge the water, as shown in Fig. 1. By means of the bottom plate it is mounted on the shaft, G, in the manner shown at Fig. 3, which represents a detail section of the hub. The shaft, G, extends upward through the long tube, H, and carries the driving pulley, I, at its top. The upper end of the tube, H, is screwed into a nut which rests upon the bottom of a cup or chamber placed upon the top of the water tube, D. The shaft, G, passes through this cup and carries over it a collar which bears against friction rings placed within the cup. The whole of this arrangement is shown in detail in Fig. 4. The lower end of the tube, H, carries the chute, J, which is contained within the annulus of the wheel, F. There are plates in the chute which run in the same direction as the buckets in the wheel, and which guide the water into the corners formed in the buckets before alluded to. From the bottom of the water wheel is suspended an air vessel which is shown at K.

The operation is as follows: The water received from the supply pipe passes down the water tube, D, through the chute, J, into the buckets of the wheel, F, and forces the air contained in the tube and wheel into the air chamber, C, where it reacts on the water and gives additional pressure upon it in the direction of the water outlet, which is formed by the flaring mouth of the gate, L, and the slanting top of the water cylinder, A.

The top of the water cylinder, A, is open. It is provided at the bottom with a pivot gate shown at M. Before escaping through the gate, L, the water rises in the cylinder, A, and by floating the air vessel, K, supports the chute, water wheel, and shaft. On making its escape, the water raises the gate, L, which is balanced by weights as shown in Fig. 1, to a hight proportionate to the power exerted by it. By varying the area of the water outlet, by means of this gate, the power of the wheel is regulated.

The use of the water support in lieu of a step, and the provision made for water cushions in the buckets of the wheel must result in very easy motion and place the wheel under complete control. For convenience, should repairs become necessary, the chute is constructed so that it may be raised in the water tube above the inlet; thus allowing room for a workman to descend the tube and do what may be required. Patented March 19, 1872. Further particulars may be obtained of the inventor at Proctorville, Vt.



MASTERSUN'S CANADIAN TURBINE.

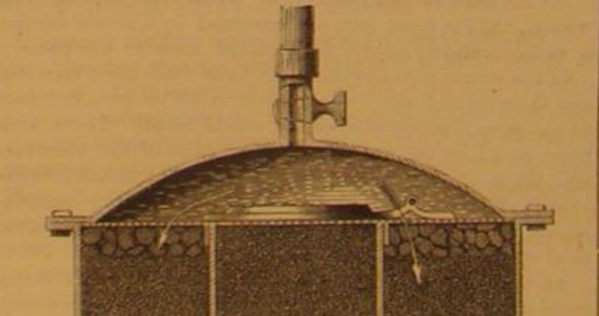
Paper from Wood.

Houghton's process is now being worked in England and on the Continent. The wood is cut up by mechanism into small bits, and then boiled in an alkaline solution. The pressure employed is 180 pounds to the square inch. The wood is introduced into the boiler in wire cages running upon a set of rails, so that, while one batch is being removed, another is ready for disintegration. When the boiling is completed, the small pieces of wood—which may be called fasces of wood fiber—are quite soft and of a dingy color, not dissimilar in appearance to a piece of rather coarse field rhubarb after it is cut up and baked in a pie. The material is now ready for bleaching in a vat, where it is treated with chlorine pumped into the liquor in such quantity as not to injure the fiber; and the operation is afterwards completed by the use of permanganate of soda. The condition of the material is that of a soft, pulpy, highly fiberous mass which, having been subjected to the action of a hydro-extractor, or, more simply, a "wringer," comes forth in the shape of a damp fleecy mass, in which only a microscopic eye could detect the pristine wood fiber.

The alkaline liquor, after the boiling, is of a clear brown color, about the tint of moderately strong tea, and is destined not to be thrown away as waste, but to be used again after the balance of the alkali absorbed by the fiber has been restored to it. This is effected by the use of sulphate of soda, so treated with coal as to produce a combined substance capable of restoring the necessary constituents. The material used for this purpose costs less than $25 per tun, and about 10 per cent of it will restore the lost alkali, for which it is substituted weight for weight—a trifling cost when compared with that of making up the deficiency with either caustic or carbonate of soda at the present prices. By this process, the liquor is made fit for reintroduction to the boiler, and on being removed is treated as before, so that it may be said to be constantly renewable.

REVERSIBLE WATER FILTER.

A filter that cannot be reversed, and thus made self-cleaning, is not worth much. A filter that does not allow the filtered water to rise, instead of falling, into the pure water chamber, is imperfect.



The accompanying engraving represents a filter adapted to all the purposes for which filters are used, which is essentially a self cleaning filter, in which the water leaves all its sediment behind as it bubbles up into the pure water chamber in the center of the filter. The filter is supported on central trunnions in a wooden frame, and is turned, end for end, by simply detaching the supply pipe. The valves act by their own gravity as the filter is reversed. The perforated heads, which confine the filtering material and secures the central cylinder, are loose disks held in place by the outside heads. For further particulars address H. N. Taft, 18 Lafayette Place, New York city. This filter was patented Dec 26, 1871.

Sandspouts in Nevada.

For several hours yesterday there were visible from this city, on Twenty-two Mile Desert, five or six tall columns of sand, sucked up by as many whirlwinds. At sea these would have been waterspouts, but upon the desert they were only what we might call sandspouts. The columns appeared to be ten feet in diameter and one thousand feet in hight. Although they waltzed about over the plain for two or three hours, they never came together and never lost their distinctive cylindrical form, and when they did go down they went down at once—all falling together. These sandspouts are well known to all old prospectors, and seem to indicate a change of weather. We have frequently seen in the Forty Mile Desert, east of the lower Sink of the Carson, not less than ten or fifteen of these tall sand columns moving about over the plains at the same time. It is seldom that they come together, but when they do, they dart forward like two flashes of lightning and an explosion like a heavy blast ends all, and the two columns of sand at once fall to the ground. Those who have not been upon our great deserts, and have never witnessed these grand sandspouts or the wonderful mirages, have but little idea of the romantic grandeur of these apparently uninteresting wastes of sand.—*Virginia (Nevada) Enterprise.*

A Waterspout in Colorado.—The spout empties itself over a carriage and drowns two persons.—A remarkable waterspout occurred on the Central City stage road, four miles above Golden city, on Sunday afternoon, July 14. The torrent of water struck a carriage containing G. Vierden, his wife, her sister, and a girl named Blood, who reside five or six miles up the cañon and were returning home. The two latter were drowned. The body of Miss Vierden was found some three miles below the scene of the disaster, covered with sand and *débris*. The road was badly washed out and rendered impassable.

The Planet Venus.

At a recent meeting of the Royal Astronomical Society, a very interesting communication relative to the markings on the planet Venus was read by Mr. Langdon, a "station master" on one of the English railways. It appeared that the author, wishing to devote some portion of his leisure time to astronomy, became possessed of a 6 inch silvered glass reflector with which he observed the planet Venus from May to November, 1871. At first he had some difficulty in obtaining good views of the planet, but by inserting a diaphragm of card, perforated with a fine hole by means of a red hot needle, in the eyepiece, and thus shutting off all extraneous light, he brought the planet into perfect subjection, and pursued his observations with ease and comfort. Having read some time last spring that doubts had been cast on the existence of markings on the planet, he referred to his notes and sketches and compiled from them the paper now communicated. In May, 1871, he noticed a dull cloudy mark on Venus, which was seen by some men to whom he showed the planet. One of them, a mason, declared that the object he was looking at was the "moon," and he knew it to be so, because of the dark mark upon it. On one occasion Mr. Langdon saw the southern horn rounded off, the northern horn being quite sharp and ending in a fine needle-like point. On another occasion, both horns were sharp and pointed, and once the northern horn appeared bent and turned inwards towards the center of the disk of the planet. The appearance of the terminator is described as being jagged, very like the moon, but sometimes hazy; the author, comparing the moon's terminator to net work, said that of Venus appears like fine lace. Near the time of inferior conjunction, the dark body of the planet was well seen. In concluding his paper, Mr. Langdon returned his thanks to Messrs. Proctor, Norman Lockyer, Browning, and others for having sown the seed of knowledge broadcast, some of which he had picked up and endeavored to turn to account.

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Contents:

(Illustrated articles are marked with an asterisk.)

CHANGES OF CLIMATE.

The question whether the climate of different countries has changed since historical times can only be answered with certainty when we shall have collected correct meteorological observations of several centuries. It is well known, however, that the invention of the thermometer was only made in comparatively recent times, and that only since the latter part of the last century regular observations have been commenced in regard to the temperature of different localities.

Glaisher, however, claims already to be able to determine, by the observations made in England, that a gradual rise of the mean temperature is taking place there. He finds, indeed, that from 1770 to 1800, the main temperature of the year was 8·72° Centigrade; 1800 to 1829, 9·17°; 1830 to 1860, 9·44°. According to Dove, the yearly mean temperature of Berlin, Prussia, from 1848 to 1865, differs only $\frac{1}{100}$ of a degree from that of the 137 years before that time.

According to Professor Loomis, the mean temperature of New Haven was, from 1778 till 1820, 7·60° C. and for 1830 to 1865, only 7·52° C., showing a gradual cooling.

Such results are, however, by no means reliable, because it cannot be proved that the instruments used during the different periods agreed exactly; and they may have been placed in different circumstances.

If, therefore, we wish at the present day to decide if any changes have taken place in the climate during, say, twenty centuries, nothing is left but to enquire if changes have taken place in the *flora* and *fauna* of the country in question.

The fossil remains of plants and animals show the most enormous changes since geological times; indeed, changes so great as to make a climate, once tropical, at present temperate or even polar. And this suggests the question of slighter changes visible in modifications in the *flora*.

From the fact that in Palestine, at the present day, the vine and the date palm tree are cultivated one next to the other, as we know was the case 3,300 years ago, Arago concludes that the climate there cannot have changed at all during that period. If ever, during that period, the mean temperature had risen a few degrees, the cultivation of the vine would at once have ceased; if, on the other hand, the mean temperature had descended a few degrees, the date palm trees would all have come to an untimely end. For similar reasons, Arago holds that the climate of Egypt, Greece, and Italy has not changed, while Biot proved the same for China, deducing it from the study of the Chinese records, which are very complete in regard to the condition of that country during past centuries.

In the meantime, it appears that several other countries show a decrease of temperature. For it is proved that in many regions of France and Germany the vine was cultivated many centuries ago where now it has been abandoned, for reason that the grapes do not attain full maturity. However we do not consider this as an argument as the abandonment of this culture, in localities not well adapted and which produced only sour wines, is not to be wondered at when, by the improvement in intercommunication, it became more economical to obtain good wines from elsewhere than to make poor wines at home.

In the Alpine region, however, there are many facts which point to a gradual descent of temperature and deterioration of the climate. So it has been proved that, in the former centuries, the Alpine glaciers were less extensive than at present. In the second half of the sixteenth century, people went to church from Wallis to Grindelwald, along a road which at present is entirely covered with ice. A chapel, which is marked on Schopf's map in 1570, was destroyed by the glaciers in the beginning of the seventeenth century, and its place is now covered by a glacier. The bell from this chapel, with the year of its manufacture cast in it, namely 1044, is to the present day preserved in Grindelwald.

At Guhannen, in the Hasli Thal, hemp used to be cultivated; this is at the present day, by reason of the early snow falls, utterly impossible.

Formerly the Engstlen Alp was covered with cattle from the 21st of June; since the beginning of this century, it is not possible to take possession before July, while the retreat in the fall must also be made some eight or ten days earlier.

There is also no doubt but that the upper limits of the mountain forests are many hundreds of feet lower than formerly; as, high above the present limits where all forest growth is at present arrested, there are found the remains of old forests, dead trunks, enormous roots, and other relics, witnessing a prior very vigorous vegetation.

It is evident that such changes must be the result of a lowering of the mean temperature of the country in general, so that, so far as concerns these mountain regions, a gradual cooling appears actually to be taking place.

THE CHIRONECTES PICTUS.

During the voyage of exploration of Professor Agassiz last winter to the West Indies, there was hauled on board of the *Hassler* one day a ball of gulf sea weed, in bulk about that of the two fists, which excited the especial attention of the Professor from the peculiar manner in which it was rolled up. On being placed in a bowl of water, it soon became evident that the ball was a nest of some kind, but what animal could have made it, and to what class it be longed, was the question. This was soon settled by the magnifying powers of a good lens. The sea weeds were bound together by numerous little elastic threads, which were uniformly beaded; and on examination of the beads under the lens, they were found to consist of embryo fishes, and exhibited the usual large eyes upon the side of the head and a tail bent over the back of the body, just like the embryo of ordinary fishes shortly before hatching. Some of the beads were placed in jars, and in a few days they had hatched out and become quite lively, when the Professor was enabled to ascertain, from the study of their pigment cells, that they were the progeny of the *chironectes pictus*, or fish having hand like fins.

By the favor of Captain Fisher, of the schooner *Isabella*, we have just received, in good order, from Mr. P. W. Humphreys, of the Aransas Pass lighthouse, Texas, a specimen of these singular fishes, which, he states, was picked up from a bunch of sea weed at the above place. The specimen is three inches in length, has irregular, black stripes, and is indeed a queer looking fish.

As its name indicates, says Professor Agassiz "it has fins like hands; that is to say, the pectoral fins are supported by a kind of prolonged, wrist-like appendages, and the rays of the ventrals are not unlike rude fingers. With these limbs, these fishes have long been known to attach themselves to sea weed, and rather to walk than to swim in their natural element. But now that we have become acquainted with their mode of reproduction, it may fairly be asked if the most important use to which their peculiarly constructed fins are put is not probably in building their nests."

DRAWINGS OF THE PATENTS.

We are glad to be able to state that the *Official Gazette* of the Patent Office, in which the Claims are now printed, is to be hereafter illustrated with the drawings of the patents, done on a reduced scale by the photo-lithographic process. The public will thus be placed in possession, at a cheap rate, of complete copies of the drawings of the patents, together with incomplete copies of the specifications. Part of a loaf is better than no bread, says the adage, and therefore we suppose we ought to be thankful for fragments of the patents. We trust, however, that Congress will now go a little further and order the printing of the entire specifications, instead of the mere tail ends which are now given. In the compact type, now used in the *Gazette*, only about two thirds more space will be occupied if the full specifications are printed, while the work will be rendered infinitely more creditable and valuable. By the full printing of all the patents in this manner, applicants will be enabled to inform themselves readily as to what has been previously done in any particular line of invention, much litigation will be avoided, and the general business of the Patent Office will be simplified.

A DECISION BY THE COMMISSIONER OF PATENTS.

"*Where a device, though simple, saves time and labor, and is not anticipated, the grant of a patent is warranted*"

The above simple and reasonable proposition was laid down by Commissioner Leggett in a recent appeal to him from a decision by the Board of Examiners-in-Chief.

It appears that George Richardson applied for a patent for an improvement in bobbins, which consisted in simply making a couple of holes through it so that the bobbin spindle could be conveniently oiled. The primary examiner rejected the case on the ground, first, that the invention lacked utility—was good for nothing; second, that it lacked novelty, it being common, and not an invention, to make oil holes in machinery.

The Board of Examiners-in-Chief coincided with this view, and assumed, furthermore, that there was no need for the holes, as the oiling could be just as easily done by removing the bobbin from the spindle; they were also of opinion that the oil would exude from the holes and injure the yarn upon the bobbin; the holes were therefore a damage and not an improvement.

In reply to these objections, it was shown by the applicant that, in practice, the oil did not exude, that his improvement saved time and labor in oiling and was therefore useful, and that as the examiner had been unable to produce a reference to a similar device, it was proper to assume that it was novel. The two conditions of patentability being thus established, namely, *novelty and utility*, the applicant asked that the patent might be allowed.

Commissioner Leggett granted the petition, reversed both of the decisions of the examiners, ordered a patent to be issued, and laid down for the guidance of examiners the sterling proposition here repeated: "*Where a device, though simple, saves time and labor, and is not anticipated, the grant of a patent is warranted.*"

This maxim is clear and correct. It ought to be painted in conspicuous letters, in blue and gold, upon the walls of all the apartments occupied by the examiners in chief and the primary examiners, as a constant reminder to duty. It seems to be difficult for some of these officers to remember that their first and most important function is to assist and encourage inventors by the granting of patents. Instead of doing this, they frequently commit the folly of improperly rejecting their cases; and in the study of excuses for maintaining such rejections, they are apt to exhibit more ingenuity than is found in the invention which they reject.

AIDS TO VENTILATION.

We have frequently called attention to the importance of heated flues as assistants in the ventilation of buildings, apartments, etc. It is proposed in Glasgow to connect the main street sewers with the chimneys of the principal manufacturing establishments, and thus to establish an upward draft from the sewers which shall carry off the foul gases that otherwise would escape into the streets. This is practical and may be easily effected. The employment of chimney drafts for such purpose is very simple and effective. We observe by a paragraph in the Oneida *Circular* that this plan has been adopted by the Oneida Community, with complete success, in the ventilation of their water closet apartments. Almost every other ventilating expedient had been tried without really satisfactory results. But as soon as the apartments were connected with the chimney, no further trouble was experienced. One of the earliest uses of this method that we remember to have seen was at the Asylum for the Insane at Hartford, Conn., where it has been in operation for many years. Dr. Butler, the able superintendent of that institution, had always experienced great difficulty in maintaining a pure atmosphere in the vicinity of the closets until he introduced pipes beneath the seats, which were made to communicate with an adjacent chimney. A draft up through the chimney was thus made, whereby the foul odors were entirely carried off.

In New York and other cities, nearly all the private dwellings are invaded by sickening odors from the sewers, which find their way up through the house drains in spite of the best arranged traps. This difficulty may be easily overcome by extending a small pipe from a point just below the usual trap into the nearest fire chimney. The pestilent gases will thus escape into the chimney instead of into the house. Such connections ought to be made in every dwelling house where drain pipes are used, and the faithful architect will see that they are included in the specifications.

TESTING ARMORED TURRETS.—A REMARKABLE EXPERIMENT.

The English Board of Admiralty has recently inaugurated a series of tests for the definite determination of the merits of the turret or Monitor system as a means of harbor defence.

The *Glatton*, the vessel selected as a target, is one of the latest specimens of British naval architecture designed by Mr. E. J. Reed, late Chief Constructor of the British Navy. Her length is 264 feet, breadth 54 feet and draft 19 feet. She is raised out of water 3 feet, which can be reduced to 2 feet by flooding. Her tunnage is 2,700 tuns. Her guns are contained in a single turret which is considered the heaviest and strongest afloat.

The object of the experiment, which took place July 5, was to determine whether, by the impact of a 600 pound shot propelled by a 12 inch rifled gun, this turret could be jammed, or prevented from working. There was also to be ascertained the probable damage that might be caused to the guns and other interior fittings of the turret.

The armor plating of the latter against which the shot was to be thrown consisted of, first, one rolled covering of iron 15 inches in thickness, disposed over the circumference of the outer face of the turret in two tiers, and secured to the backing and inner skin by four and a half inch india rubber washer-headed bolts. Behind this armor plating there is 14 inches of teak, then an inner skin formed of two six-eighth inch iron plates, and a quarter inch iron plating over the nuts on the tails of the bolts holding the armor plates. The turret wall is further strengthened, structurally, by two horizontal girders or frames, forming two shelves to the teak backing from the inner skin, each formed of three quarter inch boiler plate and 10 inches in depth.

The gun used was one of the 25 tun 12 inch muzzle-loading Fraser guns made at the Woolwich Arsenal. The projectiles selected were the Palliser 600 lb. shot, solid and chill headed and the powder charge was 85 lbs. large pebble. The vessel carrying the gun, the *Hotspur*, was moored at a distance of

200 yards from and on nearly a parallel line with the *Glatton*. In the turret of the latter, a kid, a rabbit and a fat hen were placed to try the effects of concussion.

The weather in Portland Roads, the locality selected, was in every way favorable. After a few trial shots, the first projectile was aimed at a mark on the extreme upper edge of the turret; but the sighting was untrue and the huge mass of iron skimmed over the top of the turret.

A second shot soon followed, striking the turret armor in its weakest part, in the center of the turret wall, upon a bolt head and upon the lower edge of the upper 14 inch armor plate at its longitudinal junction with the lower plate. It lifted the upper plate, or rather forced it upward and over the face of the backing, until its lower edge was separated from the upper edge of the lower plate to a distance of 2¼ inches, the upper edge of the lower plate where the shot penetrated being depressed nearly one inch by the sheer downward force of the shot.

The fracture extended upwards from the plate's lower edge in a three quarter circle form, measuring 17 inches vertically and nearly 20 inches along the plate's edge. Other effects of the shot's work outside the turret were seen in the broken-off head of the bolt struck, a starting apart of the plates in three longitudinal and vertical joints in the immediate vicinity of the blow, and also a starting of the two plates between the gun ports in their vertical jointing. Inside the turret, the inner end of the bolt struck by the shot was found to have driven in and fractured the inner skin or iron lining, its nut breaking off and lodging upon one of the trunnions of the starboard gun.

The depth of penetration was 15 inches. Still, with all the immense striking force of the shot, estimated at a little over 6,100 tuns, there was no through penetration, and the turret was found to revolve with the same facility as before the shot was fired. None of the gun fittings or gear was injured in any way. The kid, the rabbit, and the hen looked dazed, but they had sustained no other injury.

The second shot fired at the turret was lower than intended, taking the glacis plate in its entire breadth, making a deep indentation and cracking the plate through. From the plate the shot struck the bottom of the turret plating, penetrated to a depth of 15 inches, and then rebounded broken up on to the deck in front of the turret. The inner skin of the turret was not even bulged. This was thought quite sufficient as establishing, in the most indisputable manner, the free working of the turret under the heaviest fire without much danger of being jammed or of damage to the gun slides. The three unwilling occupants of the turret had also suffered no injury.

We are indebted to the London *Times* for the foregoing particulars.

THE DECREASE OF OUR FISH SUPPLY.

During the summer of 1871, Professor Spencer Baird, of the Smithsonian Institute, was authorized by Congress to examine into the state of the National fisheries and to determine definitely the question as to whether the fish indegenous to our waters were decreasing in number or not. After careful investigations, made principally along the Eastern shore of Massachusetts, the Professor has found that such diminution is constantly taking place, and that since 1860 fully nine tenths of the fish have disappeared from our fishing stations. This depreciation has been general, except in the matter of blue fish which, from the time of their appearance in 1847, have increased rapidly and are now as abundant as ever they were.

To account for this decrease, it was held by many that the food on which the fish subsisted had disappeared; and to ascertain the truth of the assertion, dredges were drawn over mussel beds, and the water in various parts of the bays and ocean was examined to see if it contained much animal life. The results obtained proved that the bivalves, crustaceans and similar creatures existed in great abundance on the bottom, while the water was literally teeming with infusoria, polyps, jelly fish and other animal matter; thus affording positive evidence that such varieties of fish as were bottom feeders or slow swimmers had around them more food than they could possibly consume.

Attention was next directed to the modes of destruction employed, and it was discovered that to the pound net was due the principal part of the decrease of fish. But sixty of these nets are in use along the entire New England coast, and they take almost all the fish that are captured. They have ruined the hook and line fishermen, nearly driven the fykemen out of the business, and now, having sole possession of the ground, control the supply of the market. The catch is often numerous; four men will manage a pound net with a leader of a mile in length, and the catch of a single period of six hours has frequently been as large as one thousand blue fish, or an equal quantity of other varieties, which realize to the net men only about a cent a pound. Professor Baird, after examining all the different devices for capturing fish, decided that the mode above described was the most destructive in use.

The increase of blue fish is another cause to which the diminution in numbers of the smaller fry may be ascribed. The former have augmented considerably,and the oil factories having destroyed the menhaden (their natural food) in vast numbers, they have been forced to feed on killies, porgies, young weak fish, striped bass and young shad. Professor Baird reports that these ravenous creatures fed even after they were in the pounds, and filled their stomachs with small fry which were along shore and which they could not have found in their accustomed haunts. He also states that, if the manufacture of menhaden oil were discontinued, the blue fish would be satisfied with the comparatively worthless food; but with their natural supply cut off, they have to seek support on fish that are more valuable than themselves.

The world of science in general is indebted to Professor Baird for the superb series of photographs, some eighty in number, which he has taken of the various species of fish examined by him. It has been customary heretofore to hang up the fish by a string or nail, the consequences being that its shape became distorted, and its natural proportions and form were lost. In this case, however, each fish was carefully laid on white paper and the camera arranged vertically above it. Then by pinning out the fins and placing a marked rule beside it, the Professor obtained an accurate photograph of the specimen, showing shape, size and characteristics. The scientific distinctions such as lateral lines, fin rays and divisions of the operculum are clearly represented, and can be more easily examined on these photographs than on the originals themselves.

We trust that our next Congress will take measures to arrest this alarming diminution of one of the most useful and valuable of our food supplies. If we consider how largely on fish and on their capture the livelihood of that portion of population dwelling on our coasts depends, the importance of the question will be appreciated and the necessity of some action by the General Government apparent.

[Special Correspondence of the Scientific American.]

LETTER FROM PROFESSOR R. H. THURSTON.

PITTSBURGH, Pa., June 25th, 1872.

The Inclined Railway and the Iron City. Coal, iron, and glass production. The puddling furnaces and iron rolling mills of Pittsburgh. Cold rolled iron, how it is produced. Manufacture of railway rails.

This city of Pittsburgh is well named "the Iron City." Climbing the neighboring hills, or, better, riding up in the cars of the Inclined Plane Company, on the Birmingham side of the Monongahela, the city, spread out below us, between and on both sides of the two rivers (the Monongahela and the Alleghany) can sometimes scarcely be seen through the drifting clouds of smoke from its hundreds of furnaces. The city is really composed of three municipalities, which will probably, ere long, be united in government as they are now in interest. Pittsburgh in the middle, with Birmingham and Alleghany on either side, together make up a total of, probably, 210,000 people who are principally supported by the work done here in working iron and in making glass.

IRON, GLASS, AND COAL STATISTICS OF PITTSBURGH.

The amount of iron made in the vicinity is not great, but the amount worked into plate, bars, rails and other "uses" is at present not far from 350,000 tuns per annum. There are nearly 600 puddling furnaces here, and roll trains of sufficient capacity to work off the product of these furnaces. The total number of rolling mills is about 45, and there are 75 founderies and machine shops which work over about 150,000 tuns of metal. The rapidity of the growth of the manufactures of Pittsburgh may be judged by the fact that the increase during the past eight or nine years, or since the effect of the first stimulus of our civil war began to be observed here, has amounted to nearly 200 per cent.

The production of glass has increased in nearly an equal ratio and now employs about 5,000 workpeople.

About 150,000,000 bushels of coal are mined near here, and the oil trade of the city foots up to about $12,000,000, per year.

THE FURNACES.

Although there are not very many blast furnaces running, those lately erected are of large size and are fitted with every valuable improvement that may be found in leading iron making districts at home or abroad. We visited, with the able professor of chemistry of the Western University of Pennsylvania, the Isabella furnaces, and were exceedingly pleased with their design and the arrangement of the plant. From the top of these great towers, which are 75 feet high and 20 feet in interior diameter, we obtained a fine view of the surrounding country, and, riding up on the smoothly working "air hoist," made the ascent without fatigue. Each of these furnaces is expected, when running up to its full capacity, to make 65 tuns of iron a day.

One of the most noticeable iron mills of Pittsburgh is that of Messrs. Lyon, Short & Co. The celebrated Sligo iron, which is so well known all over the country, is made here. This iron is probably not excelled by any in the world in strength, toughness, and uniformity, and "equal to Sligo" is a phrase that usually means much more than can safely be promised of other irons. The ore from which this iron is derived is found in middle Pennsylvania, among the Alleghanies, and it is smelted and to some extent puddled at the mines. The superiority of the iron is due to the excellence of ore and fuel, and perhaps quite as much, also, to the extraordinary care taken, from beginning to end of every process of its manufacture, to preserve it from injury by contamination with impurities or by carelessness in manipulation. The only noticeable peculiarity in working, aside from those mentioned, is that all iron made here goes under a very heavy hammer where it is very carefully worked before going to the rolls.

We found at these mills a well selected little library for the workmen, which gave good evidence of having been generally used, and a fine collection of samples of ores and metals, also placed where the workmen could reach them.

The great care taken here to secure the most scrupulous attention in every detail, and to the importance of doing careful and honest work, is fully equalled by the care taken to raise the character of the employees, securing steady industrious men and offering them every opportunity to improve themselves. These workmen, and I find the same characteristic in some degree of those in other establishments here, very generally are members of building associations, and their desire to invest their savings in real estate is one of the most pleasing and encouraging evidences of their intelligence and thrift.

MESSRS. JONES AND LAUGHLIN'S WORKS.

We had the pleasure of visiting the mills of Messrs. Jones & Laughlin, and of witnessing the manufacture of the cold rolled shafting. After rolling their shafting hot to nearly the size required when finished, it is carefully freed from scale and the reduction to finished size is accomplished by cold rolling. The shafting leaves the rolls with a beautifully smooth surface, perfectly round and wonderfully uniform in section, fitting Whitworth gages as accurately as the most carefully made lathe work. The most singular result of undergoing this process is a great increase in strength and stiffness, although the density is not appreciably changed.

The shafting is not rolled sufficiently to give it the immense accession of strength and stiffness, mentioned by Sir William Fairbairn in the account of his experiments, as that, at present prices, would probably be hardly remunerative; but for equal sizes it is far stronger and stiffer than any turned shafting, and the best evidence of this is the fact that a market is readily found for the ten or twelve tuns per day that comes from the rolls.

Another article of production in the cold rolling mills is the "finger bar" of mowing machines, of which immense numbers are made. They are found to be stiffer and more perfectly elastic than steel, and to possess the additional very great advantage of being as easily worked as the best of iron.

The light trains of rolls in the "new mill" are driven by belts from overhead shafting—a novel method of driving rolls.

These works are very extensive, containing 83 puddling furnaces and producing from 150 to 175 tuns of metal per day, as the result of the labor, in all departments, of 2,500 men. The rail trains, making rails weighing from 8 to 40 pounds per yard (for mines), and the nail machines dispose of that part of the puddled iron which does not go into the cold rolling mills.

The works are very conveniently arranged and the character of the work done in the cold rolling department is marvellously perfect.

MESSRS. PARK'S WORKS.

The steel works of Park Brothers interested us very much, not in consequence of the novelty of the processes in use, but as exhibiting another illustration of the fact, noticed at the Sligo Mills, that the most well known among manufacturers of the higher grades of iron and steel, owe their reputation to the skill and honest painstaking with which they have worked long known methods.

Here the iron is carefully chosen from among the best brands, worked carefully, and thoroughly inspected as it comes forth after each process, and none gets into market, as first quality steel, that is not really of the highest grade.

Considerable quantities are made for manufacturers of dentists' tools, a use to which only the very finest and strongest of steel can be put. Every one, who has ever been so unfortunate as to fall into the hands of a dentist, probably wonders how the art of man can produce such metal as that of which his instruments are made; slender as a needle, frequently, yet sustaining almost the weight of the operator while cutting the enamel of the tooth, the hardest substance found in organic nature. Here in Pittsburgh, we learn that the condition of success in its manufacture is the combination of the highest skill with the most scrupulous attention to each detail in the process.

This firm make large quantities of "low" steel for steam boilers, and are at present making some sheet steel for the great bridge across the Mississippi at St. Louis. R. H. T.

CHEAP RAILWAYS.

The advocates of narrow gage railways in this country, who seek to adopt the three feet gage as the standard, will do well to examine the plans of Mr. Fell, who has lately constructed and put in successful operation, at Aldershot, Eng., a railway of 18 inches gage, on which siege guns of seven tuns weight are easily transported. This railway, one mile in length, was constructed in 45 days. It is built on posts, in order to obtain the necessary levels, and cost $10,000 per mile. From the accounts given, it seems practicable to do nearly as much business on an 18 inch railway of this description as on the 3 feet road.

The concurrent opinion of the narrow gage people, at the recent St. Louis convention, was, that a 3 feet railway could be built for about half the cost of the 4 feet 8½ gage, which is the ordinary measure, and that therefore the 3 feet gage ought to have the preference.

The Wotton railway in England, 7 miles in length, having the usual 4 feet 8½ inch gage, cost only $7,200 per mile. It was built for light traffic, and proves to be very serviceable. The narrow gage estimates are usually higher than the cost of the Wotton railway.

M. HARTING, of Utrecht, has designed an instrument under the name of *physometer*, primarily for the purpose of rendering visible and measurable the variations in the air volume of a fish's air bladder during life, but applicable also for the determination of any changes in volume of a body, such, for instance, as those of the muscles under contraction, or those of caoutchouc under extension.

IT is proposed to construct fourteen new French ships of war. Of these, two will be armor plated vessels of the first rank, and two others will be armor plated monitors.

SCIENTIFIC AND PRACTICAL INFORMATION.

CHOLESTERIN.

This curious organic substance was first obtained by Conradi in 1775, from the so-called bile stone. Its chemical composition is represented by the formula $C_{26} H_{44} O$. It is a white, tasteless, inodorous substance, insoluble in water, sparingly soluble in cold alcohol, but easily soluble in boiling alcohol which, on cooling, deposits beautiful crystaline nacreous *laminæ*, soft to the touch and melting at 278·6° Fah. It is also soluble in ether, wood spirit, oil of turpentine, soap water, and neutral fats. A solution of cholesterin, in two volumes of alcohol and one volume ether, deposits, by spontaneous evaporation, laminated transparent crystals of hydrate of cholesterin ($C_{26} H_{44} O + H_2 O$).

Cholesterin resists the action of concentrated alkaline solutions at boiling heat, but lime decomposes it at 482° Fah.; hydrogen is given off and the cholesterin converted into an amorphous fatty body, nearly insoluble in alcohol. When strong sulphuric acid is gradually added to a slightly heated mixture of cholesterin and dilute sulphuric acid, it becomes soft, acquires a deep red color, and decomposes, giving off all its oxygen in the form of water.

Cholesterin is converted by the action of nitric acid into *cholesteric acid*, $C_8 H_{10} O_5$.

A biluary calculus, or bile stone, composed of nearly pure cholesterin and beautifully crystallized, was recently found in the smaller intestines of Mr. V. M. Griswold, a well known photographic chemist of Peekskill, N. Y. At the time of his death, this obstruction had reached an enormous size, being an inch in its smallest diameter, two inches long and five inches in its longest circumference. Mr. Griswold had been confined to his bed but four days, and died in the greatest agony.

LEAD GLAZING IN STONE AND EARTHENWARE.

It is well known that a lead glaze has long been used as a glazing for pottery. The danger to which the workmen are subjected in its use ought, before this, to have consigned it to that *limbo* whence no lost art returns. The dust given off by grinding the lead oxide is breathed by the workman, is brought into contact with him as a slimy mass floating on water when he dips the pot in glazing, and he absorbs its vapors while the vessels are burning. Hence it is that potters and manufacturers of earthenware frequently suffer from lead colic, which often proves fatal. A glazing, free from lead, has been invented and used by Alois Klammerth, of Znaim, Moravia, Germany, which, it is hoped, will save the lives of hundreds of workmen now sacrificed on the leaden altar. His glaze consists of two thirds of fusible brick clay, and one third of a clay which contains a large quantity of ocher or iron ore, the whole mixed with 8 parts of ley from wood ashes. This glazing, although requiring a high temperature in the burning, is so firm as to resist the action of mineral fully as well as glass. The operation is very simple and the results so satisfactory, after a six years' trial, that the process may already be called success, and not only are users of the ware safe against the insidious and cumulative poison, but the workmen too are safe from all danger in its use.

A New Objection to Patent Laws.

It has been our lot from time to time to hear a great many objections, good, bad, and indifferent, against the existence of a patent law, but it could only have occurred to a Scotchman to start what we have lately become familiar with under other circumstances as "the religious difficulty." During the sittings of the late Parliamentary Committee on Patents, Mr. Macfie, the well known advocate for abolition of patent right, managed on every possible occasion to bore his colleagues on the committee, and to puzzle the witnesses by making a long speech embodying his particular views in the guise of a question. One of the persons under examination happened to use the word "steal" in reference to those persons who used an invention without paying royalty to the inventor. Mr. Macfie was down upon the unfortunate witness in the following manner (Question 2250): "You use the word 'steal,' but I think God, in His providential arrangements, has so constituted mankind that one receives the benefit of that which another discovers, and *I think that the patent laws have a tendency to interfere with those divine arrangements;* I look on the patent laws as facilitating a denial to the nation of that which in their absence they would enjoy; do you really think the word 'steal' appropriate?" We have ventured to italicise a portion of this extraordinary "question," which places the matter in an entirely new light. With the fear of Exeter Hall before our eyes, let us remove the foul blot from our statute book without a moment's delay.—*Engineering.*

High Heeled Boots for Ladies.

A London surgeon, Mr. P. Hewlett, reports several cases of serious fractures of limbs indirectly caused by these heels, which had tripped up their wearers; and he refers also to the distortion and injury to the foot that they often induce. He says: "Last year I was sent for to see a young lady in one of our London hotels. She wished to consult me about her foot. On seeing it I thought its state depended upon her boots, and I asked to see them. The boots were brought in by the lady's maid, but the only thing I could observe about them was the immensely high heels. I said: 'It is the high heels of your boots that cause the mischief, and unless you diminish them I can do nothing for you.' She became quite angry, and said she could not alter them. 'I cannot do it and will not.' Suddenly she again toned down, and said: Pray, sir, what would people say if they saw me walking about the park without high heels?' I said: 'It is simply heels *versus* brains. If you have brains, you will cut off the heels; if you have no brains, you will continue to wear them.' She fortunately had brains, cut off the heels, and her foot got quite well."

GROWTH OF NAILS.—M. Dufour has made observations as to the rate of growth of the nails. Here are some of the results: The nails of the little fingers grow more slowly than those of the other fingers and the thumbs. The difference is about one ninth. The mean rate of these (excluding the little fingers) is about one millimeter (100th part of an inch) in ten days. The rate of growth on the thumbs is probably greater than that on the six longer fingers. There is little difference between the rates of growth in different animals. The nails grow at about the same rate on both hands. The rate of growth is not constant throughout the length of the nail; it is greater near the base. The rate of growth at the side parts is probably the same as in the middle part. The substance of the nail advances equally throughout its breadth. The rate of nail growth in an individual at intervals of several years shows sensible differences.

DEACON'S METHOD OF OBTAINING CHLORINE.—The process consists in passing a heated mixture of air and hydrochloric acid over sulphate of copper, or over pieces of pumice or brick saturated with the same. He finds that the action is essentially a surface action, and that there is a certain comparatively small range of temperature, between the critical limits of which the percentage of hydrochloric acid decomposed varies greatly. The velocity with which the mixed gases pass over the surface of the active material also causes considerable variation in the comparative amount of chlorine produced.

WE are asked by our correspondents for the addresses of makers of round leads for pencils and for a good book on the subject, for a good printing ink at 25 cents a pound, the price of a one horse power caloric engine, where to get a small brass engine of sufficient capacity to run a sewing machine or churn, and many other articles, for introducing which to the public our advertising columns are always open.

A NOVEL ESCAPE FROM PRISON.—A prisoner in the New York city prison, possessed of some medical knowledge, recently conceived the idea of producing artificial small pox for the purpose of being removed to Bellevue Hospital, where he would have a good chance for escape. He touched his face over in spots with croton oil, which quickly produced pustules. He was regarded as a small pox patient by Dr. Nealie, removed from prison and sent to the hospital, whence he duly made his escape. Four other persons confined in the prison then tried the same game, but were detected and remanded to their cells.

"LONGFELLOW," the fastest racing horse in America, was badly injured, during a race at Saratoga Springs, July 16th. One of his racing shoes became twisted and cut the adjoining foot and leg. It was a three mile race, with "Harry Bassett." Longfellow had made 2¼ miles in 3 min. and 59 sec.—the fastest time on record—when the accident occurred, and Bassett came in one length ahead.

A PATENT has lately been granted to B. F. Day, of Hazleton, Pa., for the separation of slate from coal by means of an ascending column of water. The lighter mineral is carried off by the water while the heavier, descends through the water. An apparatus working on this principle, for separating diamonds from other pebbles, has been in use for several years.

Notes & Queries.

[We present herewith a series of inquiries embracing a variety of topics of greater or less general interest. The questions are simple, it is true, but we prefer to elicit practical answers from our readers.]

1.—HARDENING SOAP.—What is the best thing with which to harden soap?—D. D.

2.—TESTING BOILERS BY HYDRAULIC PRESSURE.—How can I apply hydraulic power as a test to a boiler, which is intended to carry 100 pounds of steam to the square inch?—F. M. C.

3.—REMOVING THE CRUST OF SHELLS.—Can any of your readers inform me how to remove the outside crust of sea shells so as to show the natural color of the shell?—R. J.

4.—SAND PUMPING.—In your article of July 13, referring to the East River bridge, you say sand was discharged at a depth of 60 feet (removed from the caisson) by means of the air system through a 3½ inch pipe continuously. Will some one please explain the operation of the air system?—W. E. F.

5.—METAL DRILLING.—With what shaped point should small drills (from one thirty-second to one fourth of an inch) be made to make them cut the fastest and best, or to "take" into the metal most rapidly? I have an upright foot power drill, and usually the piece of iron to be drilled is the same thickness as the diameter of drill. Should they be made square and sharp pointed, or flat like a cold chisel or a common twist drill?—H. V.

6.—ELECTRICAL MACHINE.—Are there positive and negative poles to the induced current of an electrical machine such as is used by doctors? If there are, how can I tell which is which? Also, how must I make the coil so that, when the wire bolt is out entirely, I cannot feel any current?—R. P. P.

7.—PERMANENT MARKS IN ELECTRO-CHEMICAL TELEGRAPHY.—How can the marks on electro-chemical telegraph paper, which is moistened with solution of iodide of potassium, be made permanent and the paper be protected from the action of ozone which releases the iodine, coloring the paper and obliterating the marks? Should the liquid in which the paper is moistened be a saturated solution of iodide of potassium? The solution must be very sensitive to the passage of the current.—G. B. M.

8.—RHUMKORFF COIL.—I want to make a Rhumkorff coil that will give a three or four inch spark. I wish to know: 1st. The size, length and insulation of wire (iron or copper?) in primary coil, and whether it should be put on in one or more pieces. 2nd. Size and amount of wire (iron or copper?) in secondary circuit, and how insulated? 3d. The manner of constructing condenser, and how connected to the coil. 4th. What length shall I make it? I have made several small ones, but the effect is not proportionate to the amount of material used. So I want to proceed with the next one in a systematic way.—R. R.

Facts for the Ladies.—Mrs. H. B. Taylor, Putnam, Ohio, has used her Wheeler & Wilson Lock Stitch Machine 14 years without repairs. In two weeks she earned with it $40, besides doing her own housework; has stitched 80 yards in less than 2 hours. See the new Improvements and Wood's Lock-Stitch Ripper.

Answers to Correspondents.

SPECIAL NOTE.—This column is designed for the general interest and instruction of our readers, not for gratuitous replies to questions of a purely business or personal nature. We will publish such inquiries, however, when paid for as advertisements at 1·00 a line, under the head of "Business and Personal."

ALL reference to back numbers must be by volume and page.

F. C., of Dayton, O., has bestowed much thought on a contrivance for repeating by sound the matter on a printed or written paper. His first idea was to have letters printed in a conducting ink on a non-conducting material, and exhibit them by passing over the surface a metallic comb, connected with a wire; but he has since suggested the reflection of an ordinary book page or manuscript on to a plate chemically prepared, so that the writing or dark part of the reflection may etch through the film to the metal. Over this etched plate, a metal comb could be passed, indicating every completion of the circuit, and the signals could be read from a telegraph sounder or transferred to a specially constructed instrument with a keyboard. There is much ingenuity in our correspondent's elaboration of his idea, described by him in detail; but we cannot altogether agree with him in considering such an invention to be "of vast importance and infinite advantage." Mr. F. C.'s idea is "that a machine of this kind could read to multitudes," but we question whether the multitudes would not prefer the readily available human voice, of which the language is already known, and which speaks without any elaborate apparatus, however ingeniously constructed. The same inventor proposes to accelerate our speed in walking by attaching to our feet roller skates, the rollers being ratcheted to prevent their going backwards; also to make transparent paper "by forcing oil into the pores by a sand blast." The use of the sand blast must be considered superfluous, as paper and textile fabrics are only too accessible to the action of greasy matter, and no difficulty in saturating them has ever been found. Another suggestion is a plow with teeth acting in front of the machine to scratch up the soil and throw it backwards, an enlarged illustration of the mode of procedure of that indefatigable soil breaker, the hen. These, with one or two for increasing the buoyancy of ships, for teaching drawing, etc., show the diverse directions in which our correspondent's talent finds exercise.

F. W. H. asks: Can you inform me what will remove the stain which nitric acid makes upon green rep? The stain is upon the green rep covering of a sofa. Answer: There is no help for you. The nitric acid has destroyed the pigment and it cannot be restored. Stains made by sulphuric acid on such goods can be removed by ammonia. In such cases the sulphuric acid unites with the pigment and forms a compound. When ammonia is applied, the sulphuric acid unites with the ammonia and the pigment resumes its former condition. But nitric acid utterly destroys the pigment.

LOCOMOTIVE SPEED ON A DOWN GRADE.—To E. O. R.—Yes; a grade could be so steep that the engine would run down it at a greater speed than the steam would drive it on a level.

PROPELLING CANAL BOATS.—To R. P. P.—We have published many suggestions similar to yours, some of which we have illustrated.

CLEARING SNOW FROM RAILROAD TRACKS.—Has steam ever been tried for melting snow on railroad tracks? H. J. Answer: Yes; and it is found to be a rather expensive way of getting rid of the snow.

To W. B., of Ohio.—The specimen you send is galena or lead ore, the source of all the lead of commerce.

LARD IN TIN CANS.—In answer to W. H. C., query 2, page 416, Vol. XXVI., I would say that if the lard has no salt in it, tin cans are best to keep it in. Many of the pork houses in Canada use tin cans altogether.—H. J., of Mich.

COLORING IVORY.—To E. S. H., query 3, page 26, current volume.—Wash the balls free from grease, and steep for a few minutes in a dilute solution of muriate of tin; take out and rinse in clean water, and then put them into a clear infusion of cochineal, to which a little ammonia has been added. When of the proper color, take out, wash and dry, and polish with a piece of dry flannel.—E. H. H., of Mass.

SHOEMAKER'S INK.—To L. K., query 6, page 26, current volume.—Make a strong decoction of logwood, and add to it a very small quantity of chromate of potash.—E. H. H., of Mass.

COLORING LINSEED OIL.—To J. P. W., query 1, page 41, current volume.—For a red color, add alkanet root and digest with heat. Probably the addition of a little turmeric root to the red oil will give a brown.—E. H. H., of Mass.

SKIN DISEASES.—C. N., query 7, page 41, current volume.—In my capacity as a physician, I would say to C. N. and his friends that it would be ill advised on the part of any professional man to prescribe for an eruption as spoken of. It would be necessary to know the occupation of the patient and the possible presence of some special irritant; the appearance of the eruption; whether attended with much inflammation; whether of a dry and scaly character or the reverse; the state of the general health, and so on. Eruptions result from, and are very much influenced by, constitutional causes, as well as from some mechanical or chemical irritants. Knowing the causes and symptoms, the medical man will be able to make a correct diagnosis, and be able to prescribe with a fair certainty of effecting a cure.—E. H. H., of Mass.

TORCHES FOR NIGHT FISHING.—B. J. is informed that, in the Eastern States, the use of pitch pine torches has been discarded within the past few years and kerosene lamps substituted with much success. A large lantern with reflector—something like a locomotive headlight—is used. The fishermen find it far more convenient, economical, and useful than the torch such as B. J. describes.—A. E.

BLASTING UNDER WATER.—In answer to A. H. P., query 12, page 10, current volume, I send the following very simple plan: Use a tin cartridge of proper size, with a tube of length sufficient to bring it above the water. Charge the cartridge through the tube, and then insert a fuse and you are ready for work.—C. H. M.

Declined.

Communications upon the following subjects have been received and examined by the Editor, but their publication is respectfully declined:

BOILER CONSTRUCTION.—W. H. C.
CHOLERA AND SUN SPOTS.—J. L. N.
DAILY WEATHER BULLETIN.—D.
ELEGY ON THE LATE PROFESSOR MORSE.—J. T. S.
EXTINGUISHING FIRES.—J. A. N.
LAND DRAINAGE.—A. S. P.
LEGAL WISDOM.—T. H.
THE SEVEN DEGREE SYSTEM.—J. B.
VACUUM IN CASKS.—X.
WEIGHT, PRESSURE, ETC.—B. O.
ANSWERS TO CORRESPONDENTS.—P. E. McD.—F. E. M.—E. J. L.—C. O.—B. D. H.
NOTES AND QUERIES.—L. C. K.—M. McK.—J. W. S.

A Hint to the Working Man.—A man with a family, however poor he may be, owes it to his wife to save her health and strength in every way possible. He has no right to allow the mother of his children to wear her life out toiling with her needle to clothe her family. His duty is to buy the New Wilson Under-Feed Sewing Machine, the best machine for family sewing ever invented, and he can buy one for fifty dollars. More than this, he can buy the Wilson machine upon terms which enable him to pay for it in small monthly installments, that he can spare out of his wages without feeling the drain. He will get thereby a machine capable of doing every variety of family work in the most beautiful manner, a machine that even a child can operate, and which will prove a permanent family blessing. Salesroom, 707 Broadway, N. Y.; also for sale in all other cities in the U. S.

Recent American and Foreign Patents.

Under this heading we shall publish weekly notes of some of the more prominent home and foreign patents.

VENTILATOR.—Edward M. Greenway, Jr., of Baltimore, Md.—This invention relates to a new ventilator and air filter to be applied in the wall or in the windows or window frames of buildings; and consists in the arrangement of a box which is open to the outer air and to that within the house, and contains, between perforated sieves, one or more layers of cotton fiber. This fiber is known as the most perfect air filter, and by its use the air for human consumption is freed from dust, insects, organic cells, contagious germs, and other noxious material.

PLOW.—John Fox, of Oskaloosa, Iowa.—This invention is an improvement in the mode of attaching plows to wheeled axles, and consists in constructing and arranging the parts composing the clamping device and the plow coupling, so that the latter or the draft line is below the axle; the arrangement being also such that the plows can be adjusted to run deeper or shallower, as desired.

DOUGH KNEADER AND ROLLER.—Washington A. Snow, of Killingworth Conn.—This invention furnishes an improved machine for kneading and rolling dough, which is easily adjusted so as to roll the dough thick or thin, as may be required; it consists of a kneading board and rollers operated by suitable gearing. The dough is placed upon the board, which is moved backward and forward, and its thinness is determined by adjusting the frame of the machine.

BASE BURNING COOKING STOVE.—Andrew J. Caywood, of Poughkeepsie N. Y.—This invention consists of an elongated fire pot and a correspondingly shaped upper portion of the case or shell, in one end of which the magazine is arranged; the other end is utilized for a series of ovens which are placed one above the other. The lower oven has pot holes with covers in the bottom, and is directly exposed to the fire below and may be used for cooking on. It also comprises a series of ovens in a case above the top of the stove case proper, which are suitable for drying purposes, and a detachable foot rest for supporting the feet to warm, receiving the drip in a trough, and conducting it into the pit below the fire.

WASHING MACHINE.—Clark Turner, of Triangle, N. Y.—This invention furnishes an improved washing machine which consists of a box at the bottom of which is pivoted a frame carrying two rollers; against these the clothes are pressed and rubbed by a revolving cylinder arranged above them. Springs are arranged so as to hold the rubbing parts together firmly, and yet allow for varying thicknesses of clothes.

DEVICE FOR MENDING BROKEN SPOKES IN VEHICLE WHEELS.—Andrew J. Caywood, of Poughkeepsie, N. Y.—In this invention the broken spoke is joined by a screw threaded sleeve to one end of a screw rod or tube, the other end of which is inserted in the felloe and prevented turning therein by means of a projecting rib.

ORE SEPARATOR.—Frederik Cazin, of Frumet, Miss.—This invention relates to improvements in the arrangement of the actuating plunger sieve and operating mechanism of an apparatus for separating crushed and screened mineral rock, according to the specific gravity—that is, separating the several kinds of pure ore from the waste rock. It consists in a plunger which is arranged parallel to a row of sieves and pivoted at one end, so that the force or effect of its stroke upon the water is gradually increased thence to its free end. It also consists in arranging a slotted arm with the wrist pin of the driving shaft and the rod that connects with the plunger, so that the down stroke of the plunger is quicker than its up stroke.

WINDMILL.—Ovett B. Knapp, of Brandon, Wis.—This invention consists of a windmill which is provided with a tail for keeping the wheel to the wind and apparatus for automatically turning said tail to take the wind or not when it is desired to start or stop the mill; and also with another tail for turning the wheel edgewise to the wind when it is to be stopped. It also consists of a peculiar arrangement of the automatic shifting apparatus for the principal tail.

FOLDING FRAME FOR TENT.—Franklin A. Guthrie, of Addison, Ohio.—This invention furnishes an improved folding tent frame with sleeping berths, which is simple and strong in construction, light, and capable of being folded in a small compass, so that it may be conveniently transported from place to place.

WAGON BRAKE.—William D. Johnston, of Harrisville, Pa.—This invention consists in the arrangement of a locking mechanism with the brake and tongue of a vehicle in such a manner that, as the wagon, in going down hill, presses forward, the resistance of the tongue operates certain levers and connecting rods, and applies the brake with a power proportioned to the force with which the wagon presses forward. By the construction the wagon can be backed without applying the brake.

SAW CLAMP.—Thomas L. Kenworthy, of Collinsville, Ohio, assignor to himself and Armstrong Tweedy, of same place.—This improved saw clamp is made of two upright frames, the top side of which form the jaw. They are connected near the top by adjustable cross bars, and they are spread apart, as required, at the bottom by a frame which is pivoted to one of the upright frames and presses against the other. In this way the saw is tightly clamped along its whole length, and as the arrangement is portable it may be readily placed in a position to obtain the best light.

IRON FOR WHIFFLETREES AND NECK YOKES.—James Wood, of Lockport, N. Y.—This invention relates to the construction of the ferrules or caps and the ring or hooks of neck yokes and whiffletrees for wagons and other vehicles; and it consists in casting the hooks or rings into the lugs of the caps or ferrules instead of welding them in.

FENCE PANEL ADJUSTER.—Francis M. Ranous, of Yreka, Cal.—This invention is an improved device for forming an adjustable connection between the rails and posts of fences so that shrinkage or swelling of the timber may be compensated. It consists in a mortised socket which is attached to the post, and a hollow tenon which is fastened on to the end of the rail. The tenon is placed in the mortise of the socket, and the two are connected and adjusted by a right and left screw.

WATCH CASE SPRING.—James L. Wilson, of Woodstock, Canada.—This invention consists of an improved arrangement for preventing dust and foreign substances generally from finding their way through the case of the watch when the lid is opened, which object is accomplished by constructing the finger attached to the hinged case so as to make it fill the hole in the lower plate and close it up completely when raised.

COOKING STOVE.—Jackson Barnes, of Burlington, Vt., assignor to himself and A. C. Tuttle, of same place.—This invention relates to new and useful improvements in stoves for domestic use or cooking, and consists in such a construction and arrangement of the parts that the vapor and gases generated in the process of cooking are not allowed to escape into the apartment, but are conducted with the unconsumed gases to the chimney.

GIN SAW SHARPENER.—James McBride, of Lilesville, N. C.—This invention furnishes an improved machine for filing or sharpening the teeth of gin saws while upon the mandrel or shaft; it is simple and convenient in use, being so constructed as to give the proper form to the teeth and to hold the saw firmly and steadily while they are being operated on while it can be easily moved from one tooth to another.

PROCESS OF HARDENING EDGE TOOLS.—Leverett W. Stuart, Hawley, Pa.—The invention consists in a process of hardening edge tools by applying an edge face thereof under pressure against a revolving smooth faced metallic wheel.

CARRIAGE WHEEL HUB.—Jesse B. Bauman, Shepherdstown, Pa.—The invention consists chiefly in the combination of a wooden hub having a central row of spoke mortises arranged in a zig zag line, with two lateral clamping plates or collars which are provided with internal tampering lugs or projections, forming when applied to the hub mortises or sockets for receiving and clamping the spokes. The second part of the invention consists in the manner of attaching the clamping plates to the hub by imbedding or countersinking the horizontal flanges formed thereon into the surface of the same and then securing them in place by bands driven over them.

BRAKE FOR WAREHOUSE ELEVATOR.—Martin G. Gill and Claude L. Gill, Baltimore, Md.—The invention consists in a peculiar mode of connecting the brake lever with a hand lever that is pivoted to the platform frame of an elevator, whereby a person standing thereon can apply it readily at any story or distance from the first floor.

MAGAZINE FIRE ARM.—Andrew Burgess, Oswego, N. Y.—This weapon is a breech loader. The metallic or shell cartridges are inserted at the side, and elevated so as to be driven into the breech by a device operated by the breech block. The lever guard and breech block are formed in one piece, and the latter has lateral projections that fit and work in grooves formed in the bed piece and running at right angles to each other. The cartridge extractors are arranged in the horizontal grooves and are connected with the said projections so as to be moved forward and back simultaneously with the breech block. The hammer is set by means of a small rod or bar which connects it with the breech block. This arm is formed of few parts, and is little liable to get out of order; it may also be cheaply constructed and is very efficient.

POTATO DIGGER.—Julian Farlow, Harrison, Ind.—The invention consists in a potato digger with the teeth placed in a lever frame that is arranged on the axle of a two wheeled vehicle.

MINING PICK.—John Pearce, Barton, Md.—The invention consists in supporting and preventing the handle of a miner's pick from splitting, by means of a socket, while the portion around the eye is left thick and in its full strength to take the strain of percussion without cracking the metal.

COTTON CULTIVATOR.—Wilson Baker, Memphis, Tenn.—The invention relates to a means for scraping and chopping out cotton, which is a slow and tedious operation but must be performed once on every crop and in such a way as to leave plants in a row. The invention consists in cutting away at one operation a certain portion of soil from each side of a ridge by means of two plows, and clearing the edges with scrapers, while a double circular and revolving cutter makes two parallel lines, one on either side of the row, and also prevents clods or trash from falling on the young plants.

DOOR FOR MINES.—This invention provides means whereby the doors in the passages of mines are automatically opened and closed by the cars approaching and leaving the same, thereby saving time and labor in the operation of the cars. It consists in connecting the door by ropes or chains with links that slide on rails which are fitted into the sides of the mine passages. A car approaching a door comes in contact with one of these links and pushes it along, thereby actuating the rope so that the door is opened. After having passed the door, the car strikes the other link and moves it ahead, so as to shut the door behind it. The tracks for the links are bent at the ends toward the sides of the passage, to allow the links to be swung out of contact of the car when they have been moved the requisite distance. Mathias Jensen, of Caroon Station, Wyoming Territory, is the inventor of this improvement.

CLOTHES WRINGER.—Thomas G. U. Fisk, of Macon City, Mo.—This invention consists of a novel arrangement of levers, and a weight, or spring, with the rollers; whereby the requisite pressure is obtained on the rollers, and at the same time such a wide range of movement of the one roller toward and from the other is allowed that the action is alike, or nearly so, upon small quantities or large masses of clothes, and the increased pressure common to rollers governed by screws and the springs of the common arrangements is avoided, and the necessity of gearing the rollers together by cogs is obviated. It also consists of a long cam shaped clamping roller, which is combined with the frame in such a manner as to fasten the frame to the tub readily.

APPARATUS FOR DISTILLING.—Heinrich Druding, of Brieg, Prussia, assignor to Ewald Schmidt, of Hudson City, N. J.—This invention relates to a new distilling apparatus, which has for its object to obtain the largest practicable yield of spirits in the shortest time from a given quantity of mash; and which is more economical in its operation than the devices for the same purpose now in use. It consists in a new arrangement of mashing apparatus, rectifying column, condenser, and cooler, and various other improvements which we have not space to describe in detail.

SWITCH STAND.—Patrick Carrigan, of Sturgeon, Mo.—This invention provides an improved self acting latch for switches, which can also be used as a handle to move the lever. It consists of a latch which is hinged to the side of the lever and operates to lock the same by means of a projecting pin which passes through holes in the lever and its stand. Upon raising the hinged latch by its handle, the pin is withdrawn and the lever unlocked. Upon bringing the lever into its proper position, the holes in it and the stand are brought in juxtaposition and the latch falls of its own weight, and the pin passes through the holes and effects the locking.

CART TONGUE SUPPORT.—Elbert J. Weed, of Stamford, Conn.—The object of this invention is to provide an improved device for supporting the tongue of the common ox cart, and it consists in forming the support of two bars which are pivoted by their upper ends to the sides of a wedge shaped block. This block is attached to a hanger (which is rigidly bolted to the under side of the tongue) by a bolt or rivet, so that it can play thereon or turn to the right or left. Arranged in this manner, the supports can be inclined so as to brace in either direction, forward, back, or laterally, according to the inclination of the cart to move and the surface of the ground. When not in use, the supports are turned up to the under side of the tongue, where they are held by an iron bail.

RECIPROCATING STEAM ENGINE.—Samuel Smith, of Little Rock, Arkansas.—The object of this invention is, if necessary, to convert the slide valve of an engine into the working piston, and thereby to permit the repair or replacing of the main cylinder, piston, or connection without arresting the action of the machine. It consists mainly of three cylinders placed side by side. The first contains the piston proper, the second a slide valve consisting of two disks mounted on a rod, and the third a cut off valve. When the piston proper is in action, these parts perform their natural functions. When, however, the first cylinder is to be thrown out of action, it is shut, together with the space between the disks of the slide valve, entirely out of steam connections. Channels are opened which allow the steam to act on the slide valve disks as on an ordinary piston, and the cut off operates as a slide valve in connection therewith.

SCOURING BOX.—Warren W. Langdon, of New Hampton, Iowa.—This invention furnishes an improved box for containing the materials required for scouring knives, etc., and is constructed so that its opened door serves as a platform upon which the knives are scoured, while the contained scouring materials are placed within easy reach.

TOY GUN.—George Stackhouse, of Mount Washington, Pa.—This invention relates to a new toy gun, in which the trigger is connected with a crank shaft, which carries a swinging target in such manner that the target is brought to view whenever the trigger is drawn back, but withdrawn when the trigger is let go. The child can therefore always see a target to practice on without having any chance of hitting and destroying it.

NEEDLE THREADER FOR SEWING MACHINES.—John C. Vittum, of Pittsburgh, Pa.—This invention consists of an instrument similar in form to a pair of nippers, but with the handles so pivoted that the jaws are caused to pinch together with a spring. These jaws have grooves for griping the needle, situate perpendicular to the handles, and other grooves, for introducing the thread, traverse them. An adjustable gage is set to act in connection with the needle post so as to insure the needle being griped by the first grooves with its eye in a line with the threading grooves. The threading is thus rendered sure and easy.

PIPE JOINT.—William H. Hammond, of Tipton, Iowa.—This invention relates to a new manner of coupling stove, water, and other pipes at angles or in straight lines. For angular joints, the coupling consists of two flanged metal plates which are riveted to the sections of pipe by their flanges and joined by a tubular screw at their centers. For straight joints, a notched, flanged ring is riveted to one section of the pipe, and the other is provided with hooks which are passed through the notches and made to overlap the flange.

TOOL FOR DRESSING MORTISES.—Charles E. Littlefield, of Carver's Harbor, Maine.—This invention furnishes an improved tool which is so constructed as to adapt it for such work as has been heretofore done with the chisel, such as squaring mortises, etc., and it consists in a planing tool, which is formed of a stock, of appropriate size for entering the mortise, which carries the plane iron near one end and a straight handle at the other. The plane iron is made the same width as the stock and the tool is therefore enabled to cut close up to an angle or line.

FLOUR SIFTER.—Thomas I. Fontaine, of New Madrid, Mo.—This invention furnishes an improved flour sifter, and consists of a frame and box attached thereto, which latter is adapted to receive sieves of varying fineness; also of a cam and shaft by which reciprocating motion is given to the same.

WASHING MACHINE.—Jacob J. Smith and Charles B. Camp, of Middlebury, Ind.—This invention furnishes an improved washing machine which is simple, convenient, and inexpensive; it is so constructed that it may be secured to the bottom of an ordinary washtub, and it consists in the arrangement of corrugated rollers in a suitable frame, between which the clothes are passed to be washed.

LATCH FOR GATES.—George N. Sharp, of La Plata, Mo.—This invention consists of a catch of peculiar construction which admits of various modes of operation by means of a lever connected therewith. Provision is also made to work this lever from the inside of the gate by means of a spring push bar which passes through the gate post.

BUCKLE.—Jerome B. R. Hardeman, of Tehuacana, Texas, assignor to himself and E. W. Foster, of same place.—This invention relates to a new buckle, which is provided with two tongues on the same pivot, and with a guard for securing the same and the straps in position, by which means a simple and reliable fastening is produced.

FOLDING WASH BASIN.—Charles J. Nesbitt, of Plattsburg, Mo.—This invention consists of a wash bowl or other like vessel whose sides and bottom are made of sections of metal or other suitable substance, which are connected by leather, india rubber, or other flexible material, in such a manner that the basin can be readily folded up into a small, compact bundle, thus forming a useful and convenient article for travellers and others.

HOOP.—This invention furnishes a new article of manufacture in the form of hoops for pails, tubs, and analogous receptacles, and it consists in constructing hoop iron with semicircular cuts or tongues pointing alternately in opposite directions, which tongues are indented in the wood, after the hoop is driven on, by means of a punch and hammer. By this means the hoop is held in position, should it become loose even by the shrinking of the wood. Edward Hill, of Orange, Mass., is the inventor of this improvement.

VAULT COVER.—Theodore Hyatt, of New York city.—This invention relates to a new and useful improvement in covers for vault lights, whereby ventilation is obtained by simply raising the cover, without removing it from its bed plate. It consists mainly of an annular bed plate with a bar across its under side, and a cover for the same. A thumb screw passes up through the bar and is connected by a socket with the under side of the cover. By means of this thumb screw the cover is fastened down, or elevated so as to leave an annular aperture for ventilation.

CUTTING APPARATUS FOR HARVESTERS.—Calvin D. Read, of Ayer, Mass.—In this invention the construction of fingers and finger bars for mowing machines is simplified. The bar is rolled metal, of a peculiar form of cross section, and is notched at its front and provided with an upwardly projecting perforated flange at its back. Each finger is cut by one operation from plate steel, and is so formed as to enter a notch in the bar and conform to its peculiar figure; it is fastened to the bar by screwing a nut on to its rear end which passes through the flange.

CHURN.—Charles Harvey, of Cairo, N. Y.—In this invention, the dasher rod of a plunge churn is connected by a pitman and crank with a shaft carrying a balance wheel, and motion is given to the shaft by a second crank to which is attached a vertically sliding rod. This rod is provided with a handle above and a foot piece below by means of which the operator actuates the machine. By this construction, the churn is worked mainly by the foot and weight of the body, and the operation is, consequently, less fatiguing than when performed in the ordinary manner.

APPARATUS FOR STIPPLING METAL SURFACES.—Richard Dimes, of New York city, assignor to Tiffany and Co., of same place.—This invention is more especially intended for stippling and dressing the surfaces of silver ware, but it is applicable to the stippling of all kinds of metallic surfaces, and imparts thereto a frosted or a matted or a brightened finish as may be desired. The improved device is composed of a series of stippling points, made of metal or other material, which are loosely jointed to and swing from a chuck or mandrel that revolves with such rapidity as to cause the points to fly out radially from their chuck; so that when any metallic surface is brought into contact with them it becomes indented or stippled by their action.

PRESERVING MEATS, FISH, ETC.—Bartolomé Mosquera, of Santiago, Chili.—This invention provides a chemical solution by the use of which meats and fish are preserved in a fresh condition for any length of time. The meat may be either kept immersed in the liquid, or dried after an immersion of some hours.

AUTOMATIC FAN.—Joseph Ménonval Belcour, of Paris, France.—In this invention spring mechanism is placed within a box and is employed to produce vibratory motion in a tube which projects from the center of its top. A fan is held in the tube and by its waving motion cools the air in its vicinity.

KNITTING MACHINE NEEDLES.—Nathan H. Baldwin, Laconia, N. H.—This invention consists in certain improvements in the construction of knitting needles, by which their bulk is reduced so as to make them capable of doing finer work than ordinary.

PROCESS FOR PRINTING FABRICS.—Edouard A. D. Guichard, Paris, France.—This invention refers to a new process of printing on fabrics of all sorts, such as silk, wool, cotton, hemp, flax, etc., whether they are woven in combination with one another or separately, and it consists in the addition of certain compounds to the ordinary colors, by the aid of which they can be imprinted direct, without previous preparation of the fabrics, or after washing and fixing of the colors.

WIND WHEEL.—John Wirnek, Lake Mills, Wis.—This invention consists of a vertically revolving wheel on a horizontal axis, with the vanes or blades on the spokes, which are pivoted so as to turn on their own axes. The spokes are arranged tangentially to a circle which is considerably larger than a grooved hub at the center, and they have segmental toothed arms at right angles to them, on the inner ends, which gear with said hub. This hub is connected with two fans at the tail, which are forced together when the wind is strong, in such a manner as to turn the blades of the wheel to receive less wind. When the wind is slack, the blades are moved outward by a weight.

THREAD GUARD AND CUTTER FOR SPOOLS.—Lewis P. Laffray, Amsterdam, N. Y.—In this invention a small flat plate of metal is fastened by projecting points to the end of the ordinary thread spool. It has a notch near the periphery of the spool and a clip on its face, which are so arranged that the end of the thread may be readily held by them so as to prevent unwinding. The device also operates as a thread cutter or breaker.

RING TWINE CUTTER.—Lewis P. Laffray, Amsterdam, N. Y.—This invention furnishes an improved ring twine cutter which is designed to be worn on the forefinger of the left hand. It consists in pivoting a curved knife or cutter in a groove of the finger ring, and providing the same with a spring and thumb piece by which it is raised out of the groove and brought into position for use.

MOLDING MACHINE.—James S. Dewing, Orange, Mass.—This invention consists of an ingenious combination of a revolving table with a horizontal and two vertical cutters, all of which are adjustable; by means of which curved work can be turned in ogee form, or with any kind of grooves on the face, and various other operations performed which could not be done by the old apparatus. The machine is also readily adaptable for planing or cutting straight moldings.

CHAIN PROPELLER FOR CANAL BOATS.—Edwin T. Ligon, Demopolis, Ala.—This invention relates to endless chain canal boat propellers, and has special reference to the mode of forming the buckets and applying them to the endless wire ropes or cables. The improved buckets are composed of short sections of rubber tubes enclosed in metal tubes. The rubber tube is bound or secured to the cable by means of wire, or other suitable means; and the metal tube, which is of the same length, is formed with an internal screw thread and screwed upon the rubber tube, thus forcing the rubber to take a firm hold of and adapt itself to the form of the cable, so as to retain its position while passing through the water. The metal tube or cylinder also protects the rubber from the wear or injury to which it would otherwise be exposed.

WATER METER.—William Van Anden, Poughkeepsie, N. Y.—This invention consists in combining, with the water wheel of a meter, an auxiliary adjustable wheel, by means of which the pitch of the buckets is varied and the speed regulated without incurring loss of time in setting them to correspond with the measuring and recording apparatus. It also provides a water passage to the upper journal and its bearing, by which the same are lubricated, and simplifies the construction generally.

CAR COUPLING.—Alfred J. Jourde, Houston, Texas.—This invention furnishes an improved car coupling, which is so constructed as to couple the cars automatically as they are run together, hold them securely couple when upon the track, and uncouple them automatically should one or more of the cars run off the track or capsize.

BUSTLE.—Amos W. Thomas, Philadelphia, Pa.—This invention improves the construction of bustles or tournures of the class in which horizontal bows are connected with a continuous or circular rim, and consists, mainly, in the arrangement of braces for supporting the bustle upon the hips of the wearer.

MACHINE FOR MOLDING FLOWER POTS AND OTHER POTTERY.—Friedrich Heirmann, Milwaukee, Wis.—This invention relates to improved apparatus for manufacturing flower pots and other articles of pottery, and consists of a machine constructed so as to form the flower pot by the action of a mold and plunger, which latter is operated by a lever. A movable bottom, in combination with the mold, and other devices form part of the invention.

ARCH BRIDGE.—John Zelweger, Louisville, Ky.—This invention relates to a new manner of stiffening the two halves of the arches in an arch bridge, and to the proportionate distribution of the weight over the same. The improvements consist in connecting the middle of the arch to a point in its chord near the end of the bridge, and certainly within one third of the span, by a strut tie or crown brace, which is again connected by diagonals with the arch; and in further combining the system thus formed with a series of rigid uprights. By this construction two trusses are combined with the natural supporting line of the arch, and the material and cost reduced.

PLOW.—Glover G. Foreman, Stockton, Ga.—This invention pertains to the combination of a notched or perforated adjusting bar with the plow or shovel standards and a cross bar, which latter is pivoted to the draft beam, so that, when it is turned on its pivot, the standards, and with them the plows or shovels, are turned to keep them in proper position with reference to the line of motion or the desired operation on the soil. The arrangement appears to be effective as well as simple.

MUSICAL INSTRUMENT.—William Standing, Sr., Du Quoin, Ill.—This invention consists of a musical instrument in which the sounds are produced by air forced into a series of glass tubes which are made with contracted necks at one end and are closed at the other; they are graduated in size and length. It also consists in tuning them by means of glass stoppers or plugs, with which their ends are closed, and by which the length of the tube is determined.

SPITTOON.—John Hillin, Poughkeepsie, N.Y.—This invention furnishes an improved spittoon which is simple in construction and convenient in use; it is made without any hole in the side, and with the conical or funnel shaped part detachable. It is packed with rubber so as to prevent the contents being spilled, should it be overturned.

HOT AIR FURNACE.—Johnston Mealey, Ogdensburg, N.Y.—This invention is an improvement in hot air furnaces made principally of brick, more especially upon that patented by John Gwynn, May 8, 1869. It consists in so arranging the heating and combustion chambers, etc., that the cold air is divided into two currents, one of which passes up through the center of the furnace, and the other between the outer and inner walls, after which they unite in an inner chamber, between two combustion passages, before being discharged.

TRACE DETACHING WHIFFLETREE.—Robert P. Sims, Mexico, Mo.—This invention relates to a new whiffletree attachment for suddenly disconnecting the traces in case the horses run away or become shy. It consists in such a combination with the whiffletree of a pivoted trace holder and spring locking lever that, by pulling the lever, the trace holder is released and swings around its pivot, thereby instantly detaching the outer trace; the whiffletree then swings round and becomes detached from the inner trace.

DOUGH MIXER.—William Edward Damant, of West Hoboken, N. J.—This invention relates to a new machine for properly mixing, agitating, and shaking dough and paste for bakers or confectioners. It consists, first, in the use for the mixing purpose of two screws, which revolve in opposite directions and are twisted in reverse order, so that they not only agitate, but feed the matter to be acted upon. The invention also consists in the use of a sliding platform, upon which the dough is discharged by the screws and which is so lightly supported on rollers that it is moved ahead by the dough emerging from the machine.

CLOTHES DRYER.—Anson W. Phillips, of Fairfield, N. Y.—This invention furnishes an improved clothes bar or dryer, which is so constructed that it may be conveniently and compactly folded up out of the way, even without taking down the clothes; it consists in the following construction: A hollow standard is supported by two cross bars at its bottom, to which it is pivoted. A vertical iron rod is inserted in the top of the standard, and on it are placed, one above another, sleeves from which the arms to carry the clothes project. By this arrangement the lower cross bars and the arms, with the clothes on them, may be turned in any required direction so as to dry the clothes or be out of the way.

DEVICE FOR PREVENTING BACKLASH IN MILLS.—Alexis B. Rider, of Fairfield, Ill.—This invention consists in connecting the spur wheels of flouring mills and other machinery, wherever it may be required, to the shaft by means of wooden springs, in such a manner that the springs take up the backlash and thereby avoid the irregularity due to the positive connection of such wheels. Wood springs are much better for this particular use than metal springs, because, as they are not required to yield so much as to demand the greater elasticity of metal, the greater resistance of the wood against breaking force is made available.

FLORAL ORNAMENT.—Henry James Rogers, St. Denis, Md.—The invention consists in a metallic flower holder with one or more compressible soft metal tubes attached by a strip or hook, whereby the stems are clamped in the tubes and firmly held.

CAR COUPLING.—Samuel K. Paden, Pulaski, Pa.—The invention consists in a car coupling provided with a reciprocally fastening and double grapple which is unlocked by depression exerted from the platform, and has a lateral play adapting it to curves.

COMBINED HEADER THRESHER AND SEPARATOR.—John H. Robbins, Bethel, Oregon.—The invention consists in applying to a combined harvester a header which is braced against backward motion while it is allowed an upward front and side movement through a double joint, in connecting with an extension of the header a very simple mechanism which places said header under the complete control of the driver, and finally in means for exactly adjusting the throw of the rod which connects the pitman with the cutter bar, so as to prevent said rod from bumping against the guide.

[OFFICIAL.]

Index of Inventions

For which Letters Patent of the United States were granted

FOR THE WEEK ENDING JULY 16, 1872, AND EACH BEARING THAT DATE.

Inventions Patented in England by Americans.

[Compiled from the Commissioners of Patents' Journal.]

From June 28 to July 4, 1872, inclusive.

BEDSTEAD.—M. H. Glassie, J. C. Nash, G. A. Arms, Washington, D. C.
BRAKE.—G. Westinghouse, Jr. (of Pittsburgh, Pa.), London, England.
CAMERA STAND.—E. P. Spahn, Newark, N. J.
DRILLING MACHINE.—W. D'Silva, New York city.
LEVELS.—W. Kenyon, New Britain, Conn.
OSCILLATING ENGINE.—J. Robertson, Brooklyn, N. Y.
SHOE NAIL.—T. H. Fuller, Boston, Mass.
SIZING PAPER, ETC.—J. McC. Dorian, East Brandywine, Pa.
SPARK ARRESTER.—W. McK. Thornton, St. Louis, Mo.
STEEL.—G. Ames, Rochester, N. Y.
TOY.—W. W. Rose, New York city.

NEW BOOKS AND PUBLICATIONS.

CONSUMPTION: ITS PATHOLOGY AND TREATMENT. By Wade Minor Logan, M. D. Robert Clarke & Co., Publishers, 65 West Fourth Street, Cincinnati, Ohio.

In this little volume are given the results of observations made and conclusions arrived at by its author, in regard to the use of nitric and muriatic acids as remedial agents in the treatment of tubercular consumption. That they are invaluable aids to other appropriate treatment, he considers fully borne out by his experience.

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TO THE PUBLIC.

The NORTH-WESTERN (BABCOCK) FIRE EXTINGUISHER COMPANY having brought suit against the PHILADELPHIA (GARDNER) FIRE EXTINGUISHER COMPANY, for alleged infringement of the Carlier and Vignon Patent (dated April 18th, 1865), which the said Babcock Company professes to own, in the use of water impregnated with Carbonic Acid Gas as a means to extinguish fires, we desire to make the following statements, *all of which we are prepared fully to substantiate by proof:*
First. The so-called Carlier and Vignon Patent is invalid for want of novelty, in that a patent was issued to W. H. Phillips, in England, in 1844, and in this country in 1850, for a Fire Extinguisher, in which water impregnated with Carbonic Acid Gas was used as the extinguishing agent.
Second. The said so-called Carlier and Vignon Patent has no legal existence, no legal application ever having been made for it to the Patent Office; and its issuance therefrom was accomplished by gross fraud.
Third. The lawyers conducting this suit against us brought suit *for the same clients on the same Patent*, against one Duryea, in the U. S. Court in New York, 1870, and the answer of Duryea being filed, setting forth the facts herein alluded to, *said suit was dismissed at the cost of the plaintiffs.*
The Babcock Company expects to destroy the sale of the Gardner Extinguisher, which has so seriously interfered with their long enjoyed monopoly, by extensively advertising this suit, *and thus intimidating the public.* It is our purpose to defeat their fraudulent design, and to this end, we will shortly publish a history of the matter, which will undeceive the public and expose the worthlessness of that sham, called the Carlier and Vignon Patent. Copies will be mailed to any address on application. This Company will give guarantees against all loss, damage or trouble for use of the Gardner Extinguisher, and will, *at its sole expense,* defend all suits that may be brought against it. D. B. WAGGENER, Sec'y, Philadelphia Fire Extinguisher Co., 1306 Chestnut St., Phila., Pa.

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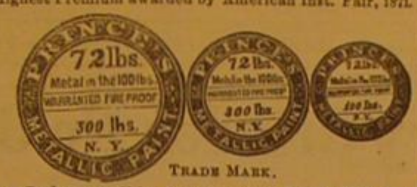

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A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

Vol. XXVII.--No. 6. [NEW SERIES.] NEW YORK, AUGUST 10, 1872. [$3 per Annum. (IN ADVANCE.)]

THE TYPE WRITER.

In the month of July, 1867, we published an article describing a type writing machine, invented by a Mr. Pratt, of Alabama, which had then just been placed on exhibition in England. Referring to the subject of writing by mechanical means, we stated that "its manifest feasibility and advantage indicate that the laborious and unsatisfactory performance of the pen must sooner or later become obsolete for general purposes," and concluded our remarks with the suggestion that any one who should devise a practical machine of this nature would find before him a wide field and large demand for his invention.

It seems that the seed thus scattered broadcast through our columns has, in this instance, fallen upon fertile soil, for its fruit is now before us in the shape of a really practical typographer, accompanied by a letter from the inventor to the effect that his inspiration was derived from the idea advanced in these columns, and that he considers it due to our enterprise to inform us of the tendency of our labors.

The difficulty which everyone, heretofore attempting to construct apparatus of this nature, has encountered has been so to govern the types making the impressions on the sheet that the characters should follow each other in even lines and at proper intervals, in the same manner as the letters on a printed page. The ingenious manner in which this problem has been solved is shown in Fig. 2, which is a sectional view comprising the essential portion of the device. A is a lever or key from which a wire leads to the short arm of one of the type levers, B. These type levers, at the lower ends of which, C, the types are attached, are arranged in a circle, a section of which is shown in the engraving, so that when they are at rest they form a sort of pot, shaped like the frustum of a cone. D is an inked ribbon passing over rollers and extending between the paper rolled on the cylinder, E, and the type. A pressure on the knob of the lever, A, pulls down the wire, which, drawing down the short arm of one of the type levers, causes the end of the corresponding long arm to rise up and strike against the ribbon, thus leaving the impression of the type on the paper. As these levers are arranged in a circle, and their long arms made equal to the radius of the same, it is evident that the type ends of all will strike exactly at the center, so that if a piece of paper be immovably held directly over that point, the entire alphabet, punctuation marks, etc., may be printed one letter over another on precisely the same spot.

The remainder of the instrument consists of various ingenious devices for moving the paper so that the characters may be printed in proper succession. Referring to Fig. 1, the operator is seen sitting before a keyboard or assemblage of knobs, each of which is marked with a letter or punctuation mark, and each attached to one of the levers represented by A in Fig. 1. The paper is placed on an endless belt and then passes over the cylinder (E, Fig. 2), situated on the top of the box inclosing the lower portions of the machine. This cylinder rests in a frame on wheels, and is made to move bodily in the direction of its length by means of a weight.

We will now suppose that the operator begins to write. As she presses a key, it not only causes a type to fly up and leave its imprint on the paper, but, at the same time, it moves a rock shaft and dog, which, acting on a rack, permits the cylinder to be drawn, by the falling weight, a space equal to the proper distance between the letters in a word. The word being finished, the longer interval between it and the one following is obtained by pressing down the square frame extending beyond the keys in front, on which the left hand of the figure in our engraving is represented as resting. As soon as the cylinder has traveled the length of a line, it strikes a bell, thus notifying the operator of the fact. By pressing down the treadle under the machine, the cylinder is drawn back to its starting point, the weight raised ready to descend again, and at the same time a lever is moved which, acting on a ratchet wheel on the side of the cylinder, causes the latter to rotate on its own axis a sufficient distance to place the paper, which rests on its surface, in a position to receive the impression of another line.

By means of other ingenious attachments, which we have not room to describe, the spaces between letters, words, or parallel lines can be altered at pleasure. Words or sentences may be underscored whenever it is required to do so. The instrument permits two or more copies to be taken at once, as in manifold writing.

It requires no especial skill in its manipulation. A child knowing its letters may use it after an hour's instruction, and indeed any one, after short practice, can easily become able to write from sixty to eighty words per minute. The motion of the hand is free, easy, and unconstrained, so that the monotonous movement of the pen is avoided and the labor of writing performed with far less fatigue to the muscles of the hand and arm. The resistance of the keys to the fingers is not more than from four to five ounces—the same as that of the keys of a piano—while their movement under the hand is about five sixteenths of an inch.

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SHOLES' TYPE WRITER.

The instrument, in its present practical form, was patented by Mr. C. L. Sholes, of Milwaukee, Wis., under date of October 29, 1871, applications, however, for other patents on further improvements being still pending.

Those of our readers desiring further information should call upon or address Messrs. Roudebush, Densmore & Co., No. 4 Hanover street, New York city.

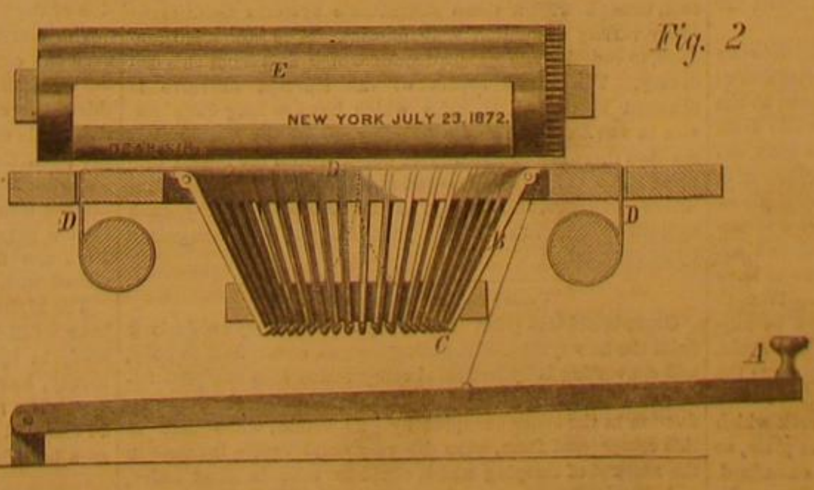


Fig. 2

ELECTRIC LIGHT.—The Alliance Company at Paris, are now manufacturing improved magneto-electric machines for the electric light. These are now made with four disks, and supply from 230 to 300 carcel jet burners, with a speed of 350 revolutions per minute, and driven by a 2¼ horse power steam engine. The machines certainly seem expensive, costing £320 each; but it is estimated that thereby the combustion of a few pounds of charcoal gives an illuminating effect equal to that of 25 pounds of colza oil. This mode of illumination, therefore, is ultimately inexpensive, especially when applied on the large scale, for ships, large halls, lighthouses, etc., for which it is well adapted; and we shall, no doubt, soon hear of new applications of the invention.

GLACIAL ACTION IN SOUTH AMERICA.

From Professor Agassiz's late report from the Hassler expedition to the Superintendent of the Coast Survey, we learn that his attention has been specially occupied with the glacial phenomena of the regions explored, and that his discoveries in this direction are of a most interesting character.

His observations, which extended along the coast of South America from Monte Video on the Atlantic side to Talcahuano on the Pacific coast, were more particularly directed to the situation and distribution of erratic pebbles and boulders, with the view of determining the agency by which they have been transported to their present resting places. It will be impossible in this article to follow our author step by step through all the very interesting details of his investigations, but, remarking that they have been most thoroughly pursued throughout, we will endeavor to give a brief general idea of their nature and results.

All over eastern Patagonia, including a portion of the straits of Magellan, are horizontal beds of tertiary formation which rise one above another. In consequence of disintegration, the harder beds form retreating shelves, like stairs, upon the slope of the shore, and wherever surface denudation has taken place, these shelves give rise to terraces which stretch, horizontally, at various hights all over the plains. The upper part of a cliff, situate at Cliff End in San Mathias Bay, which has not suffered denudation, was found to consist chiefly of sandy clay, with which alternate two distinct horizontal beds of considerable thickness formed entirely of pebbles. It is noteworthy that while these pebbles alternate thus in regular stratification in the upper part, they also form superficial deposits on the shelves below; and the Professor thinks that similar superficial deposits on such shelves elsewhere may have been mistaken by Darwin in some cases for indications of successive upheavals of the land. Here he sees no evidence of any upheaval, except one, which has taken place since the deposition of the tertiaries, and while shells found therein (now living) already existed; and still less does it appear to him that the country was submerged during the transposition of the erratics found here. Towards the west end of the bay, at San Antonio, where extensive denudations have taken place in the very formation just described, similar pebbles occur again; but instead of being in well defined beds above the sea level, they exist as shore pebbles, which cover, in a deep layer, the entire beach. Their position here shows, beyond doubt, that the set of beds above which they rest at Cliff End has been broken down and recently removed by the action of the sea, and the pebbles themselves thus brought down to the beach. It follows from this that they could not have been ground to their present shape upon the modern beach, but that they must have undergone that process upon an older foundation which corresponded at the time to the level of their beds at Cliff End.

From these facts, and from subsequent observations relative thereto made further south, the inference is drawn that these pebbles must have passed through the mill of a glacier's bottom before they were worked up by the floods into their present position; and there is no reason why the floods which denuded the shelves could not as well have been caused by melted ice at the close of the glacial period, as by a change of level between land and sea.

In Possession Bay, in the Straits of Magellan, was found, about a mile from the shore bluff and nearly 150 feet above the sea level, a salt pool, in which marine shells identical with those now living along the shore were abundant. They were perfectly preserved and many of them were alive. In this was evidence of a very recent upheaval, and a confirmation of Darwin's assertions of recent occurrences of a like nature on this shore. Upon further exploration, upon a tertiary terrace a little above the salt pool was found a distinct moraine (that is, a ridge of boulder-shaped stones always found at the foot of a glacier) in which scratched pebbles were mingled with rounded ones in as large a proportion as occurs in any moraine found fronting an existing glacier. Higher up, also, erratics were scattered over the plain, and at the highest elevation, 400 feet above tide water, a number of large, angular boulders were seen. The existence of this pool and moraine, in close proximity, is considered a fact of great significance. That no gradual upheaval has occurred is proved by the ground, which consists of tertiary beds without a trace of shore pebbles. Darwin was led to believe that the drift was scattered over Patagonia by icebergs while the country was submerged; but the presence here of this moraine shows that the upheaval must have occurred before the dispersion of the drift, and not after.

Many and almost exact similarities were remarked between the Patagonia and Alpine scenery, and the surface features of the straits were found to have much the same aspect as the glaciated surfaces of the northern hemisphere, while from the higher mountains of the Andes glaciers were seen, depending to the sea level, which may fairly be compared with the most impressive glaciers of the Alps. In many places the glacial marks were as plain as in the valleys of Switzerland, and the abrasion by ice was uniform, general and unmistakable. The grand general movement appears to have been from the south, northward; and the direction is such that glaciers from the adjoining mountains cannot be supposed to have caused the abrasions and furrows of the rocks.

All the erratic stones found in the entire survey possess the same character, and their geological identity is further shown by the presence of a certain very hard, compact rock which is never absent from them, and yet never found in place, so far as known, over the whole extent of country examined. Their present position therefore cannot have been due to the enlargement of the existing glaciers, as in that case the drift would consist mainly of the rocks in place and would differ according to locality. This distinctive nature of the drift led our author from the first to discriminate between the phenomena connected with the local glaciers and those belonging to what he designates the glacial period. To this period he refers a great part of the phenomena witnessed by him, and which he looks upon as palpable evidence that a prodigious mantle of ice was once spread over the southern part of this continent; and he further believes that future investigation will bring to light conclusive evidence of a southern circumpolar glacial agency.

Recent Astronomical Discoveries.

Dr. Huggins has communicated to the Royal Society a series of results of extreme interest, obtained by means of the fine telescope placed at his disposal by the Royal Society.

His work, according to the *Mechanics' Magazine*, has been divided into two main portions. First, he has been engaged in comparing one of the bright spectral lines of the gaseous nebulæ with the corresponding line in the spectrum of nitrogen. This line, as seen in the latter spectrum, is double. When using his own 8 inch telescope, Dr. Huggins was unable to determine whether the nebula line was double or not. He could not use sufficient dispersive power. He has now obtained definite results on this point, so far at least as the Orion nebula is concerned. In the spectrum of nitrogen, the components of this double line are rather broad and nebulous. In the spectrum of the Orion nebula, there is one line, narrow and well defined, which agrees in position with the less refrangible of the nitrogen pair.

It is possible, however, Dr. Huggins remarks, that this line in the spectrum of the gaseous nebulæ is not due to nitrogen at all; or else, one line of nitrogen fades out altogether.

The second series of results obtained by Dr. Huggins is more definite and important. It relates to the determination of the stellar motions of recession or approach.

Dr. Huggins had judged, when he used his 8 inch telescope, that Sirius is receding at the rate of about 25 miles per second. He now finds, with a telescope fifteen feet long, that the rate of recession is somewhat less, lying probably between 18 and 22 miles per second.

He has now been able to extend this method to several other stars. He finds evidence in favor of a general tendency to recession in stars occupying that part of the heavens from which our sun is known to be traveling; while on the opposite side of the heavens the stars seem in general to be approaching. But the rates of recession and approach accord very ill with the usually adopted value of the solar proper motion, and appear to support the theory, recently advanced, that the estimates of the stellar distances, on which that value has been based, are not trustworthy. We know that the sun's rate of motion has been set at five or six miles per second, and such a rate of motion could only account for a general excess of recession in stars lying in one direction, and of approach in stars lying in the opposite, by about the same amount. But Dr. Huggins finds motions of recession of from 15 to 40 miles per second, and motions of approach amounting even to the enormous rate of nearly 50 miles per second, in the case of Arcturus. It follows from this that Struve's estimate of the average distances of the brighter stars is altogether too low.

But even more interesting than this result, is Dr. Huggins's recognition of a community of motion in certain sets of stars.

It was to precisely such community of motion that Mr. Proctor invited attention in the paper on star drift, read before the Royal Society on January 20, 1870; and he expressed then, and has since repeatedly expressed, his conviction that whenever Dr. Huggins applied to certain stars the spectroscopic method of determining motions of recession or approach, he would find that they are either all receding or all approaching, and at the same rate.

This prediction has been fulfilled to the letter. Dr. Huggins finds that these stars are all receding at the rate of about 30 miles per second.

It is evident that Dr. Huggins' method of research promises results of exceeding interest and throwing a new light on the structure of the sidereal universe. He has now placed beyond question what Mr. Proctor has long maintained—the theory, namely, that within the stellar system there exist subordinate systems, surrounded by regions relatively barren. These systems of stars speed on their course, possessing a community of motion within the great star system, though within these subordinate systems themselves every variety of motion may subsist. It is wonderful, indeed, to consider the consequences which flow from this discovery. The whole aspect of the sidereal universe is changed by it. All theories which have so long done service in our text books of astronomy go by the board. We see that there is a complexity of detail within the stellar universe and a variety of aggregation, of structure, of motion, of interdependence, and finally, an exuberance of vitality, such as until the last two or three years had not been recognized by astronomers.

Compressed Gun Cotton.

Great benefits in point of economy and efficiency are derived from the new system of reducing the gun cotton fiber to pulp, and converting it by powerful compression into compact homogeneous masses. Important consequences of the large reduction in the space occupied by gun cotton, when used in this compressed form, were the very considerable increase in the amount of tamping which could be used in blast holes, and the greater concentration of the force applied; the destructive effects in hard rock were consequently much augmented, and the cool blast should be placed farther apart and reduced in dimensions. Large charges of compressed gun cotton occupied so much less space than the rope charges, and were so considerably lighter than powder charges, that the material became specially valuable for submarine operations. Other peculiar advantages were presented by the compressed material; thus, its cost of production was greatly reduced, because cotton waste could be employed in its manufacture, and because its conversion into the required forms required comparatively little time; its purification was more complete, as the finely divided fiber was much more readily washed than the long fiber required for furnishing rope charges; and its uniformity was much greater, because the products of a large number of successive small operations were intimately blended together in the pulping and washing processes.

When carried into the field for military purposes, compressed gun cotton is very decidedly safer than nitro-glycerin preparations; because if carts or packages containing the latter are fired into from accident or design with ordinary small arm bullets, their contents will be violently exploded as by detonation, while the gun cotton under the same circumstances would be simply inflamed.

Although gun cotton and nitro glycerin mixtures possess very important advantages over gunpowder, in all applications where suddenness and violence of action are desirable, there are some directions in which they do not possess superiority over powder, and others in which they cannot replace it, irrespectively of its applications to projectile purposes. In soft rock, in earth mines, and in some blasting operations, where it is desired to displace large masses of earth, rock, or stone, the gradual action of gunpowder gives it decided superiority.

The degree of safety with which explosive agents may be manufactured is an important question connected with their extensive application. The fact that the manufacture of gun cotton as now carried on involves not the slightest risk of explosion up to the final stage, when the material has to be dried, distinguishes it from most other explosive agents. In gunpowder manufacture, liability to explosion exists throughout all operations from the point when the ingredients are mixed, and with regard to nitro-glycerin it appears that up to the present time occasional severe accidents during manufacture have been inevitable. The immunity enjoyed by gun cotton is due to its being wet, and therefore absolutely uninflammable, throughout all stages, even after it has been compressed into cakes or disks. At this point it contains 15 per cent of water, the expulsion of which by desiccation is unattended by any liability to explosion, or even to ignition if very simple precautions are adopted. For storing large quantities with absolute safety, it is very convenient to preserve the compressed gun cotton damp, as it is delivered from the presses. It has been thus stored for very long periods without the slightest detriment, and its non-inflammability in this condition is aptly illustrated by the fact that the perforations required in some of the charges are produced by drilling the damp gun cotton, the drill revolving at the rate of about 600 revolutions per minute. The gun cotton employed in some extensive experiments recently made had been stored damp for nearly nine months, and was dried partly in the open air and partly in a hot air chamber, when required for use. On that occasion, says the *Mechanics' Magazine*, six cwt. of damp gun cotton, packed in 24 strong wooden boxes, were stacked in a wooden shed and surrounded by inflammable material. The building was then fired, and soon burned fiercely, which it continued to do for about half an hour, when the fire gradually subsided, and the building and its contents were entirely consumed. The gun cotton must have slowly burned away as the surfaces of the masses became sufficiently dry, but at no period of the experiment was there even any burst of flame, due to rapid ignition, perceptible.

Narrow Gage in Japan.

After three years' labor, the Japanese have succeeded in building one railroad for a distance of thirteen miles. The line was intended to connect Yokohama and Jeddo, these cities being seventeen and a half miles apart; but public travel has already begun upon it, in spite of its unfinished condition.

The road has but a single track of three feet six inches gage, and yet has cost nearly $120,000 per mile. Unless, as is most probably the case, there is an immense lack of engineering talent in the country, it is difficult to find an explanation for this state of facts. Labor is abundant and cheap; money and material are plentiful, and the construction of the line has been retarded by no physical difficulties.

The correspondent of the New York *Herald* states that even the completed portion of the route is but poorly built, notwithstanding its great cost. There are first, second, and third class cars. Those of the lowest class look like diminutive cattle cars with wooden benches in them, while those of the other classes resemble ordinary street cars, only they are narrower and in every way smaller. The first class cars are divided into three compartments by sliding doors, and carry twelve persons comfortably. The second class cars differ from the first by not being subdivided, and by being furnished with cane seats instead of leather ones.

The highest speed attained is about twenty-two miles per hour. Officials abound, there being two to each car. The road, in spite of all its shortcomings, is rapidly making money, having averaged since its opening some $500 per day. The rates of fare are absurdly high (1st class, $1·50; 2d class, $1; 3d class, 50 cents); but these, it is stated, will soon be reduced.

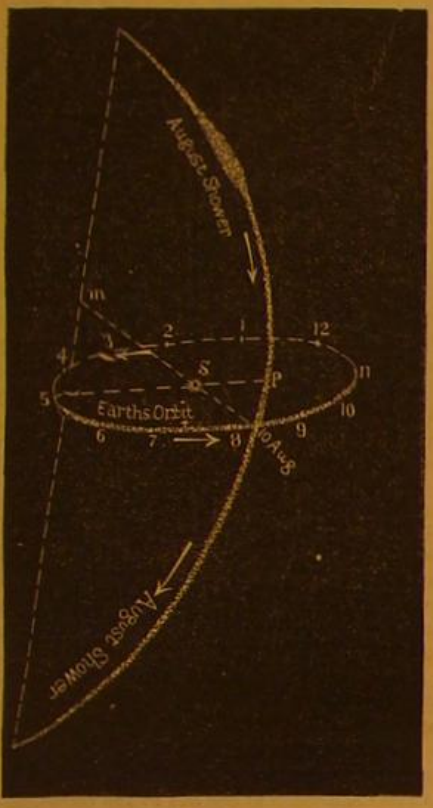
THE great bridge across the Mississippi at St. Louis, Mo., is almost done. It is to be finished during the present month of August.

THE ANNUAL AUGUST SHOWER OF METEORS.

It is now generally received and placed almost beyond doubt, by the recent observations of Schiaparelli, Le Verrier, Weiss, and others, that meteors, for the most part small but weighing occasionally many tuns, are fragmentary masses, revolving, like the planets, round the sun, which in their course approach the earth, and, drawn by its attraction into our atmosphere, are set on fire by the heat generated through the resistance offered by the compressed air.

Their chief constituent is metallic iron, mixed with various silicious compounds; in combination with iron, nickel is always found, and sometimes also cobalt, copper, tin, and chromium.

The hight at which meteors appear is very various, and ranges chiefly between the limits of 46 and 92 miles; the mean may be taken at 66 miles. The speed at which they travel is also various, generally about half as fast again as that of the earth's motion round the sun, or about 26 miles in a second; the maximum and minimum differ greatly from this amount, the velocity of some meteors being estimated at 14 miles, and that of others at 107 miles in a second.



When a dark meteorite of this kind, having a velocity of 1,660 miles per minute, encounters the earth, flying through space at a mean rate of 1,140 miles per minute, and when through the earth's attraction its velocity is further increased 230 miles per minute, this body meets with such a degree of resistance, even in the highest and most rarefied state of our atmosphere, that it is impeded in its course, and loses in a very short time a considerable part of its momentum. By this encounter there follows a phenomenon, which always takes place when the motion of a body is interrupted, designated by the expression "the conversion of the motion of the mass into molecular action or heat;" it is a law without exception that, where the external motion of the mass is diminished, an inner action among its particles, or heat, is set up in its place as an equivalent, and it may be easily supposed that, even in the highest and most rarefied strata of the earth's atmosphere, the velocity of the meteorite would be rapidly diminished by its opposing action, so that shortly after entering our atmosphere the vibration of the inner particles would become accelerated to such a degree as to raise them to a white heat, when they would either become partially fused, or, if the meteorite were sufficiently small, it would be dissipated into vapor, and leave a luminous track behind it of glowing vapors.

As this heat originates form the motion of the meteor being impeded or interrupted by the resistance of the air, and as this motion or momentum is exclusively dependent on the speed of the meteor as well as upon its mass, it is possible, when the rate of motion has been ascertained by direct observation, to determine the mass. Professor Alexander Herschel has calculated by this means that those meteors of the 9th and 10th of August, 1863, which equaled the brilliancy of Venus and Jupiter, must have possessed a mass of from five to eight pounds, while those which were only as bright as stars of the second or third magnitude would not be more than about ninety grains in weight. As the greater number of meteors are less bright than stars of the second magnitude, the faint meteors must weigh only a few grains, for, according to Professor Herschel's computation, the five meteors observed on the 12th of November, 1865, some of which surpassed in brilliancy stars of the first magnitude, had not an average weight of more than five grains; and Schiaparelli estimated, from other phenomena, the weight of a meteor to be about fifteen grains. The mass, however, of the meteoric stones which fall to the earth is considerably greater, whether they consist of one single piece, such as the celebrated ironstone discovered by Pallas in Siberia, which weighed about 2,000 pounds, or of a cloud composed of many small bodies which enter the earth's atmosphere in parallel paths, as shown in the engraving and which, from a simultaneous ignition and descent upon the earth, present the appearance of a large meteor bursting into several smaller pieces. Such a shower of stones, accompanied by a bright light and loud explosion, occurred at L'Aigle, in Normandy, on the 26th of April, 1803, when the number of stones found in a space of 14 square miles exceeded 2,000. In the meteoric shower that fell at Knýahinga, in Hungary, on the 9th of June, 1866, the principal stone weighed about 800 pounds, and was accompanied by about a thousand smaller stones, which were strewn over an area of 9 miles in length by 3½ broad.

The meteor shower of the 10th of August, the radiant point of which is situated in the constellation *Perseus* takes place nearly every year, with varying splendor; we may therefore conclude that the small meteors composing this group form a ring round the sun, and the earth every 10th of August is at the spot where this ring intersects our orbit, also that the ring of meteors is not equally dense in all parts; here and there these small bodies must be very thinly scattered, and in some places even altogether wanting.

The diagram shows a very small part of the elliptic orbit which this meteoric mass describes round the sun, S. The earth encounters this orbit on the 10th of August, and goes straight through the ring of meteors which ignite in our atmosphere, and are visible as shooting stars. The line, *m*, is the line of intersection of the earth's orbit and that of the meteors; the line, P S, shows the direction of the major axis of their orbit. This axis is fifty times greater than the mean diameter of the earth's orbit; the orbit of the meteors is inclined to that of the earth at an angle of 64° 3', and their motion is retrograde, or contrary to that of the earth.

The November shower is not observed to take place every year on the 12th or 13th of that month, but it is found that every 32 years an extraordinary shower occurs on those days, proceeding from a point in the constellation *Leo*. The meteors composing this shower, unlike the August one, are not distributed along the whole course of their orbit, so as to form a ring entirely filled with meteoric particles, but constitute a dense cloud, of an elongated form, which completes its revolution round the sun in 33 years, and crosses the earth's path at that point where the earth is every 13th of November.

Schiaparelli shows in a striking manner that, as a comet is not a solid mass but consists of particles, each possessing an independent motion, the head or nucleus nearer the sun must necessarily complete its orbit in less time than the more distant portions of the tail. The tail will therefore lag behind the nucleus in the course of the comet's revolution, and the comet, being more and more elongated, will at last be either partially or entirely resolved into a ring of meteors. In this way the whole path of the comet becomes strewn with portions of its mass, with those small, dark, meteoric bodies which, when penetrating the earth's atmosphere, become luminous, and appear as falling stars.

Schiaparelli has, in fact, discovered so close a resemblance between the path of the August meteors and that of the comet of 1863, No. III, that there cannot be any doubt as to their complete identity. The meteors to which we owe the annual display of falling stars on the 10th of August are not distributed equally along the whole course of their orbit; it is still possible to distinguish the agglomeration, of meteoric particles which originally formed the cometary nucleus, from the other less dense parts of the comet; thus, in the year 1862, the denser portion of this ring of meteors through which the earth passes annually on the 10th of August, and which causes the display of falling stars, was seen in the form of a comet, with head and tail as the densest parts, approaching the sun and earth in the course of that month. The difference between the comet's nucleus and its tail that has now been formed into a ring consists in that, while the denser meteoric mass forming the head approaches so near the earth once in every 120 years as to be visible in the reflected light of the sun, the more widely scattered portion of the tail composing the ring remains invisible, even though the earth passes through it annually on the 10th of August. Only fragments of this ring, composed of dark meteoric particles, become visible as shooting stars when they penetrate our atmosphere by the attraction of the earth, and ignite by the compression of the air.

Calculation shows that this ring of meteors is about 10,948 millions of miles in its greatest diameter. As the meteoric shower of the 10th of August lasts about six hours, and the earth travels at the rate of eighteen miles in a second, it follows that the breadth of this ring, at the place where it crosses it, is 4,043,350 miles.—*Dr. H. Schellen, in Spectrum Analysis.*

Steam Power in Carriage Building.

In New York city, only four carriage factories employ steam power for running machinery; and we have good reasons for believing that it pays the proprietors well—indeed so well that they would not dispense with it for many times the cost of the investment. Now, as it pays well in these four factories, why would it not pay in all other large factories?

A ten horse engine, with boiler and the following most common machinery: a cross cut saw, a rip saw, a band saw, a planer, a mortising machine, and a shaper, or variety molding machine, will cost, with shafts and belting, all up and ready for use, about $5,000; and the daily expenses, including fuel, engineer's wages, oil, etc., about $5. Now, what benefit would be derived therefrom? Every wood worker spends, we have been told, about one eighth of his time daily by such sawing as could be done by machine saws in less than ten minutes. By the shaping machine, it is but fair to estimate a similar saving of time; and the planer and mortiser would, we think, average more. Where a dozen mechanics are working, the said machinery will give a saving of three hours per man, or equal to three tenths of their wages, in the aggregate about $15 per day. We think that the saving would be far greater under an efficient foreman, which the system requires, as he can systematize the work so that he gives each workman the materials after they have been cut, shaped, and dressed by the machinery, and are nearly ready for connecting and finishing. If the foreman is unused to machinery, it will, of course, take him some time to use it expeditiously; but if he is a smart man, which a foreman always ought to be, he will soon master the difficulties. Experience has taught us that it is best from the start to hire a man used to run wood working machinery, as thereby a saving in time and expenses is immediately effected; while in the absence of a skillful machine hand, the erection of machinery driven by steam power generally results in a loss of money and materials the first year.

Of course wood working machinery pays best where several sets of work of the same shape are made. It needs not much penetration to understand that a dozen carriage bodies of one pattern can, by help of machinery, be made as cheaply as three bodies of different patterns. Nevertheless, we believe that, even in those shops where every carriage body has a shape of its own, wood working machinery will pay. The saws, for instance, are always handy assistants, no matter what work the maker is building.

In the smith shop, steam power is useful and labor-saving in a thousand ways. The old fashioned bellows may be discarded, trip hammers erected, and almost one half of the hands dispensed with.

In the paint shop and varnish room, steam can always be used advantageously, as thereby a uniform temperature, so desirable for their work, may be maintained.

Even in a trimming shop, steam power can be made available, for moving machinery, for cutting leather, skin, buckram, etc., and for driving sewing machines and other machinery. In fact, any establishment which has commenced to use steam power will soon learn that it is a general benefactor. The grindstones will always turn at a single movement of the hand, superior glueing, bending and veneering apparatus are within command, and a general elevation is always discernible where the steam engine is running. The constant movement around the mechanic awakens his speculative faculties. His mind will be turned in a direction that will gradually develop his mechanical ideas; and the result will be new mechanical devices, which will execute a certain amount of labor, stimulate him to greater achievements, and be a great use and benefit to him.

All mechanics cannot be Watts, Fultons, Morses, or Howes, but all should aim to be, and the more familiar they are with labor-saving machinery, the sooner will their latent genius come forth.—*The Hub.*

Use of Fruit.

Instead of standing in fear of a generous consumption of ripe fruit, one should regard it as decidedly conducive to health. The very diseases, says the *Country Gentleman*, commonly assumed to have their origin in the free use of all kinds of berries, apples, peaches, cherries, pears, and melons, have been quite as prevalent, if not equally destructive, in seasons of scarcity. There are so many erroneous notions entertained of the bad effect of fruit that it is quite time a counteracting impression should be promulgated, having its foundation in common sense and based on the common observation of the intelligent. No one ever lived longer, or freer from the attacks of disease, by discarding the delicious fruits of our country. On the contrary, they are very essential to the preservation of health, and are therefore given to us at the time when the condition of the body, operated upon by deteriorating causes not always comprehended, requires their grateful, renovating influences. Unripe fruit may cause illness, but fresh, ripe fruit is always healthful.

New Photographic Method.

M. Fargier, whom the editor of the *Moniteur* tells us was the first to render carbon printing practicable, is again in the field with a new carbon process. Some specimens were exhibited, and the following details communicated, at the last meeting of the French Photographic Society. The method seems to possess considerable novelty and interest. It is as follows:

A certain saline solution, the nature of which is for the present a secret, is prepared and put into a dish. Upon this bath a common sheet of paper is floated, then dried and exposed to light under a negative. The image comes out by degrees, and you can watch its progress. When sufficiently printed, this image is laid upon a bath of blackened gelatin, like that which is used for the preparation of pigment papers. The pigment only attaches itself to those parts which have been acted on by light. The paper is then washed in warm water, and the print is finished.

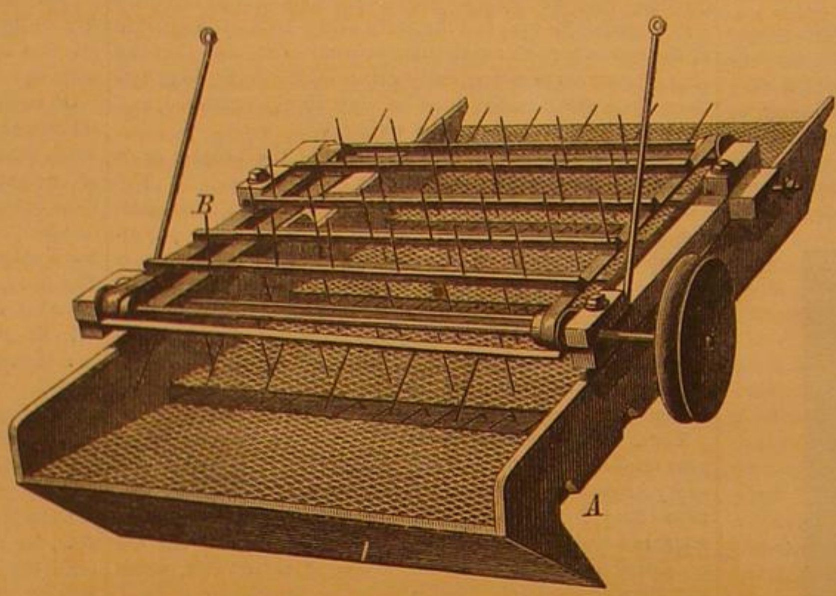
Channel Railway Ferry.

The Parliamentary Committee has rejected the bill authorizing the construction of a new channel railway ferry between France and England. At present passengers are carried across the English Channel, 20 miles, in small steamers not so large as some of our river ferry boats.

Mr. John Fowler, C. E., Engineer of the London Underground Railways, is the projector of the new channel ferry, and his scheme involves the employment of large steamers, 450 feet in length, on which the passenger cars are to be carried across. A train of sixteen cars containing 336 passengers is to be carried, the cars being raised from and lowered to the decks to the steamers by hydraulic elevators.

IMPROVED SEED CLEANER FOR THRASHERS.

The invention now illustrated is an improved apparatus for cleaning timothy and other grass seeds, which can readily be attached to the thrashers and separators in ordinary use. Our engraving shows the riddle and chain of rakes which compose the improvement, unattached to the machine. The side boards of the riddle, A, are notched and made of a shape suitable to fit on to the shoe of the thrasher, to which they are secured by screws or bolts. The riddle shown is provided with four screen plates, which are perforated so as to allow the blast to pass upward and the seeds downward through the perforations. They are made with steps between them, the uprights of which are pierced with numerous holes, above which teeth are arranged so as to carry the stalks, etc., on to the next plate and at the same time allow the blast to operate upon them properly as they are passing from one plate to the other. The carrier or stirrer, B, consists of the endless belts shown, which pass round pulleys attached to shafts at the ends of its framework, and to which are attached toothed crossbars. The rear shaft revolves in bearings which are firmly connected with the frame of the thrasher in such a position as to bring the rear end of the carrier over the forward end of the last plate in the riddle. The forward shaft runs in adjustable bearings secured by screws, by means of which the tension in the belts is regulated. The carrier is driven by a belt connection with the operating mechanism of the straw stacker. The teeth attached to the crossbars are of sufficient length to reach nearly to the screw plates of the riddle, and the belts and teeth are arranged so that the sides of the riddle do not strike against them as the shoe of the thrasher is vibrated.



CUSTER'S SEED CLEANER FOR THRASHERS.

By the construction described, the motion communicated to the teeth of the carrier causes them to carry backward the chaff, stalks, etc., while they and the seed are being moved from side to side by the vibration of the shoe and riddle. The seed which falls through the three forward plates of the riddle passes down through the machine to the floor or grain box. That which passes through the rear plate is received by a spout and carried back to the thrasher.

The improvement is the invention of Mr. John L. Custer, of Bonaparte, Van Buren Co., Iowa, from whom further information on the subject may be obtained. Patented through the Scientific American Patent Agency, May 14, 1872.

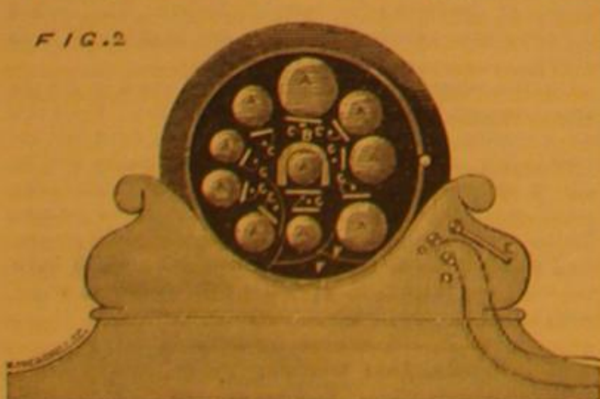
A MUSICAL BAROMETER.

A very interesting and useful application of the electro-motive force is seen in the musical barometer, invented by Captain Hans Busk, and patented in England. Within the case of an ordinary aneroid barometer, he arranges a series of

FIG. 1

musical bells, of different tones, having hammers that are operated by electro magnetic agency, the magnets of the hammers being brought into the battery circuit, and so made to strike, by means of the usual indicating pointer on the

FIG. 2



face of the barometer. To effect this closing of the circuit the face of the barometer is provided with a series of platinum conducting pins, and whenever, by a change in the atmospheric conditions, the pointer is moved it touches a corresponding pin, and the bell that is in connection with such pin is sounded.

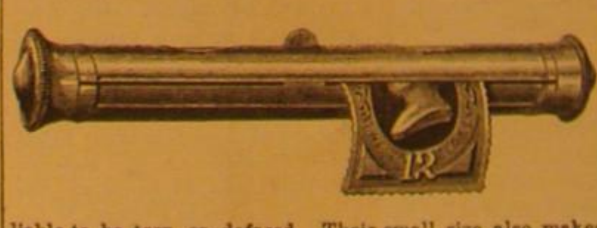
The general construction will be readily understood by a glance at our engravings, in which Fig. 1 shows the front of the barometer, and Fig. 2 the back thereof, exhibiting the bells and their magnets. All the bells have a different note. It is therefore easy to tell, even at a distance, whether the barometer is rising or falling. The deeper toned bell gives notice when the barometer falls from 29 50 inches down to 28, while the higher notes indicate a rise towards 31 inches. In variable and unsettled weather, more especially at sea, it is curious to note the rapidity with which these changes occasionally succeed each other.

Imported Sailors---Shall we Abolish the American Service?

It is a suggestive fact that the new American Steamship Company of Philadelphia think of going abroad for seamen to man their vessels. A comparison of English and American wages per month for seamen shows that, in the case of one of the new Philadelphia steamers, the annual difference in wages in favor of a competing English steamer of the first class will amount to about $25,000, or six per cent on the cost of construction. A first class English engineer gets, according to the current rates, $80 per month, while an American engineer asks $240 per month. An English fireman works for $20 per month, and an American fireman wants $40 per month; an English ordinary seaman has $12.50 per month; an American seaman, $40. Of course, no good American sailor could be tempted to work for less pay than sailor receives, and consequently the owners of American shipping seek the cheapest help they can get. The item of wages, in the case of the Philadelphia company, is one demanding serious consideration. If, as the New York *Bulletin* says, an American steamer be manned with American seamen at current wages, her annual expenses would be greater than those of an English steamer with a crew of the same size, and to build a ship at home and send abroad for a crew to man it is, so far as we know, without precedent in maritime history. If we are ever to have ships, we must have sailors of our own to navigate them; and how can we have sailors of our own if the seamen's labor market is to be perpetually depressed by unrestricted foreign, competition? Philadelphia is a strong "protective" city, and it would not look very well for the owners of the new steamship line to import its sailors.

POSTAGE STAMP HOLDER.

Every one has experienced the difficulty of carrying postage stamps about the person. If kept in the vest pocket or even in a portemonnaie, the warmth of the body is sufficient to make them adhere to their receptacle, thus rendering them



liable to be torn or defaced. Their small size also makes them easily lost or mislaid among the papers of a writing desk, so that there has been an actual need for some invention which, while retaining the stamps safely, should always present them in a convenient manner ready for use.

These requirements it is aimed to fulfil in the neat little device represented in the accompanying illustration. It consists of a small cylinder of metal in which the stamps, after being rolled up, are placed, the ends of the rolls projecting through slots cut in the side of the cylinder. These slots are covered by a sliding cover, which is kept in position by means of a spiral spring. This cover is represented in the engraving as drawn back. The ends of the cylinder are closed by two small caps which are readily removed when necessary

The end of a roll of stamps, after the latter is placed in the cylinder, is drawn out through one of the slots until the perforated portion, attaching a stamp to the roll, is held between the edge of the sliding cover, when closed, and a shoulder extending along the length of the cylinder. The stamp is then readily torn off. If now the cover be pushed back, the end of another stamp will be found protruding from the slot ready to be drawn out when required. The cylinder is made in two compartments, each pierced with a slot, so that stamps of two denominations may be carried.

The holder is small, may be easily carried in the vest pocket, and is, besides, a convenient addition to the writing desk. It can be made, if required, of sufficient size to contain tickets or similar small articles. Address, for further information, Mr. H. V. Dempster, 1,014 E street, Washington, D. C.

THE PATENT OFFICE GAZETTE.

The *Official Gazette* of the Patent Office is furnished at the government expense to Senators and Representatives in Congress; each of these persons may designate eight public libraries to which the *Gazette* shall also be sent free. All others who desire to receive the publication must subscribe. The rate is to be not less than five dollars a year, which is the price at present. The Commissioner of Patents may, we presume, increase the price should he deem it necessary. The publication of the drawings of the patents for the current year on a reduced scale has been commenced in the *Gazette*. They are admirably executed by the American Photo-Lithographic Company. The drawings are given in full, but such is the perfection of the reductions that, although the drawings of no less than thirty patents are in some cases presented on a single page of the *Gazette*, every drawing is clear and legible.

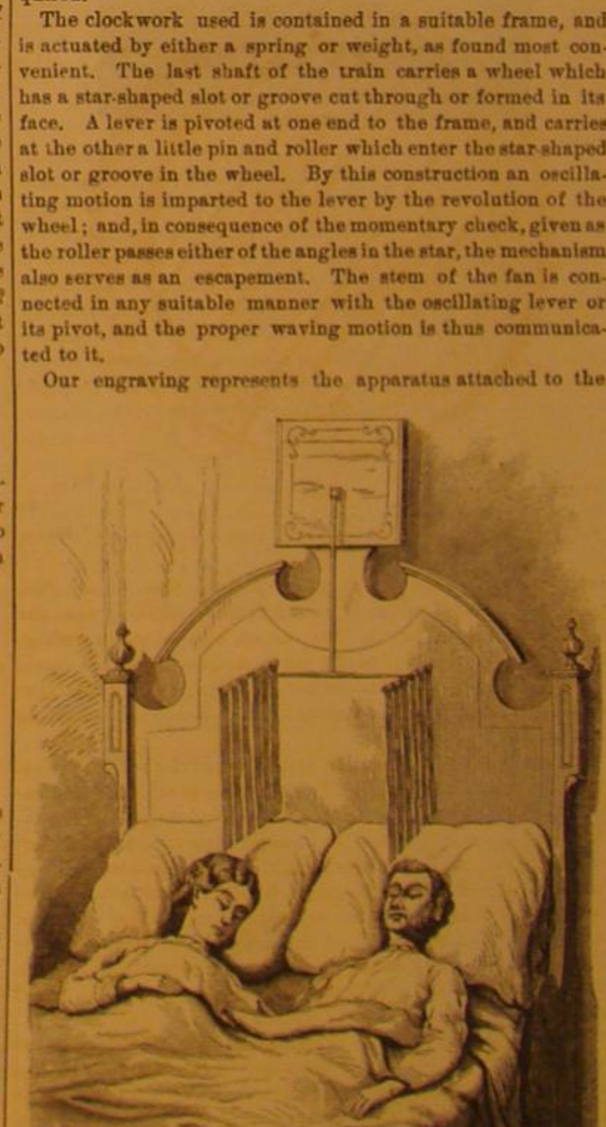
The success of this excellent and economical mode of publishing the patent drawings, will, it is to be hoped, induce Congress to provide the means for the printing of the specifications in the same concise manner. If fine types are used, and care taken not to waste space in the margins, it will be practicable for the Government to issue printed copies of all the patents, occupying only eight or ten volumes a year, at a cost to subscribers of from ten to twenty dollars. This will be a work of great public importance and value. At present the drawings are given in full but not the specifications. Only the concluding portions, or claims, of the specifications are now published.

AUTOMATIC FAN.

The invention we now illustrate is peculiarly applicable to the present season, as it is intended to provide simple and efficacious means for cooling the air in, and driving away insects from, the vicinity of the person. It consists in an arrangement of clockwork, by which fans of various forms can be conveniently operated in such positions as may be required.

The clockwork used is contained in a suitable frame, and is actuated by either a spring or weight, as found most convenient. The last shaft of the train carries a wheel which has a star-shaped slot or groove cut through or formed in its face. A lever is pivoted at one end to the frame, and carries at the other a little pin and roller which enter the star-shaped slot or groove in the wheel. By this construction an oscillating motion is imparted to the lever by the revolution of the wheel; and, in consequence of the momentary check, given as the roller passes either of the angles in the star, the mechanism also serves as an escapement. The stem of the fan is connected in any suitable manner with the oscillating lever or its pivot, and the proper waving motion is thus communicated to it.

Our engraving represents the apparatus attached to the



head of a bedstead and employed to swing a double fan for the two fold purpose of cooling the air and keeping off flies and mosquitoes. The inventor states that the machine, when actuated by a weight, will run for six hours and a half where the room is ten feet high. He considers the employment of such a fan in the sick room most advantageous.

Patented through the Scientific American Patent Agency, February 27, 1872, for Mr. J. B. Williamson, of Louisville, Ky., of whom further information may be obtained by addressing him through P. O. drawer No. 79, in that city.

THE BRITISH MONITOR "GLATTON."

Last week we gave an account of the cannonade of this new ship by the heavy guns of the *Hotspur*, at a range of 200 yards. We now present an engraving of the *Glatton*, together with sundry other illustrations, showing the effects of the projectiles upon the fourteen and fifteen inch plates composing the *Glatton's* turret.

The *Glatton* carries a single revolving turret in which are mounted two of the heaviest guns in the service. The vessel is 2,700 tuns measurement, 54 feet wide, 264 feet long, and draws 19 feet. The following particulars of the trial are derived from the *Engineer*:

The turret of the *Glatton* is roughly shown in horizontal section through the upper plates in Fig. 1. Her armor consists of plates laid on in two rings or tiers, each consisting of eight plates, the upper ring or belt having six plates of 12 inches thick and two plates of 14 inches thick, namely, those pierced by the portholes. The lower ring contains seven plates 12 inches, and one plate 14 inches thick, the last mentioned being that between and beneath the portholes. The backing, not being liable to cause injury from coming in contact with iron in the proximity of salt water, consists of oak, not teak. It is of such thickness as, with the plates, to make up a total of 29 inches everywhere—that is, 15 inches of oak behind 14 inches of iron, or 17 inches of oak behind 12 inches of iron.

Behind the backing comes 1½ inch of skin, consisting of two thicknesses of ¾ inch plate; then vertical girders, 5 inches in depth with spaces between, and finally, what may be termed an inner skin or mantlet skin of ½ inch iron, to prevent bolt heads and splinters from flying into the interior of the turret and injuring the men working the guns on service.

Against the strongest portion of this structure, the 12 inch gun of 25 tuns weight of the *Hotspur* was brought to bear at a range of 200 yards, firing "Palliser large cored shot," or, speaking loosely, "Palliser shell without bursting charges."

As regards the object of the experiment, it was clear that the turret would be subjected to such a test as it would hardly meet with on service; for should the *Glatton* be

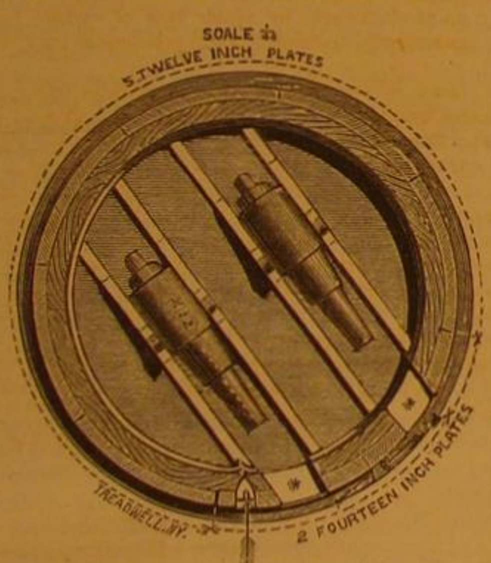


FIG. 1.—HORIZONTAL SECTION THROUGH TURRET AT LEVEL OF PORTION STRUCK BY SHOT I.

even exposed to the fire of guns equal to that of the *Hotspur* at 200 yards range, it would be very unlikely that she would receive so fair a blow as on this occasion; while, should she be closer than 200 yards, although the shot would strike harder, it would be rather less likely to be quite true in its direction, from not having time to steady after leaving the muzzle.

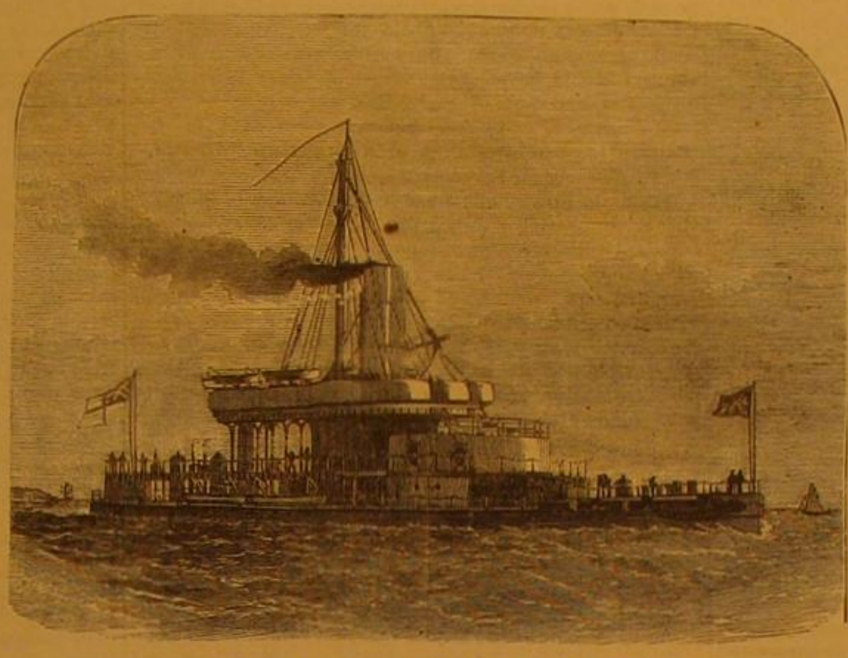
The first shot struck at the spot marked I in Fig. 2, with effects shown in Figs. 1 and 3. The shot stood well up to its work, the front portion, as far as the front ring of studs, remaining apparently intact and buried deep in the turret side.

We have presumed to show in Fig. 3 the place occupied by the shot's head and the depth to which the point has penetrated; we believe this cannot be far wrong on the following grounds: The rear edge of the front studs was about 6½ inches past the face of the plate, and the projectile, if a Palliser 12 inch shell, would measure from this to the point nearly 14 inches.

Supposing our estimate to be correct, the following are the effects produced, shown by the numbering and arrows in Fig. 3:—(1.) The entire upper plate forced back to a distance at point of junction with lower plate of 5½ inches; (2) shot penetrated to a depth of nearly 20½ inches; (3) horizontal joint between upper and lower plate opened to a width of 2 inches, the same effect being manifest in the corner of the top plate being lifted 2 inches higher than that of the adjacent plate; (4) the lower plate cracked in a vertical and laminating direction, if such a word may be allowed, and otherwise contorted at the edge; (5) a bolt driven some inches backwards, the head flying into the interior of the turret; (6) the double skin being bent back and forced open to a width of about 8 inches, the wood protruding; (7) the ½ inch or inner skin torn open and hanging down to the extent of about 4 feet by 18 inches, a number of rivet heads (as well as the bolt heads) being thrown into the interior of the turret.

Although a little below the spot intended, it was quite clear that this round gave a heavy contorting blow to the turret, the top of which had been so far forced back; it was, nevertheless, found that the turret revolved without the slightest difficulty, and for the object of the experiment the next round might be proceeded with.

Considering the spot struck by the first blow, it seemed advisable to pass on at once to the trial of a blow at the line of junction between the turret and glacis plate. This was done. By means of a mark painted at B (see Fig. 2) a shot was delivered at II, grazing the glacis plate at a point 3 feet from the turret and glancing into the turret, which it penetrated to a depth of about 15 inches, the shot, as before,



THE BRITISH MONITOR "GLATTON."

standing well up to its work and coming easily out of the hole, uninjured as far as the front row of studs.

The effects produced by this round are chiefly shown in Figs. 4 and 5. They are—(1) Penetration about 15½ inches; (2) glacis plate grooved to a depth of about ½ inch, and cracked; (3) flange ring covering joint of turret and glacis, cut through and bent; (4) lower side of glacis plate bent back, and split open to a width of about ¾ inch; (5) (not shown in figure) a sort of binding plate, fixed on the lower edge of the armor

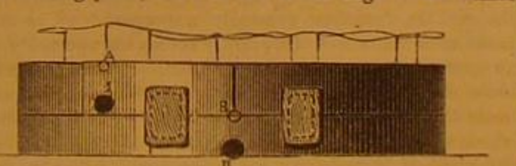


FIG. 2.—FRONT ELEVATION OF TURRET FROM FIRING POINT AFTER STRIKING AT I. AND II.

side beneath the deck, broken off for a length of some feet, and the edge bulged downwards.

This round again severely tested the working of the turret, not perhaps quite so severely as might be conceived were a similar blow to fall in a more downward direction, but quite

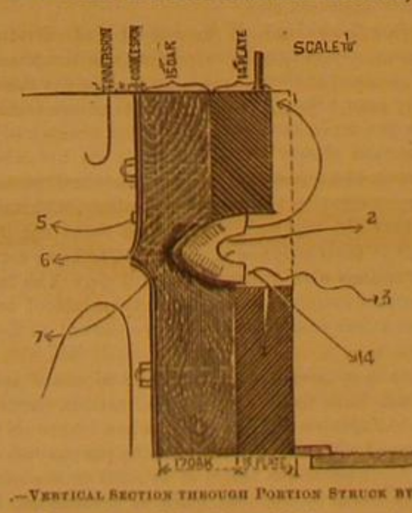


FIG. .—VERTICAL SECTION THROUGH PORTION STRUCK BY SHOT I.

the kind of blow intended. On trial the turret was again found to work freely and easily. The ports, which up to this time had been covered and plugged up with beams of wood, were cleared open, and two rounds were fired from each gun; one a full blank charge of 70 pounds of pebble powder, and one a battering charge of 85 pounds of pebble powder with shot. The turret revolved easily in about a

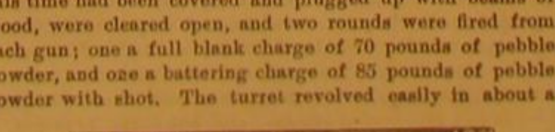


FIG 4.—VERTICAL SECTION OF TURRET THROUGH PORTION STRUCK BY SHOT II.

minute, and we are not aware that any effort was used to obtain speed. In short, the *Glatton* was in good fighting trim at the conclusion of the experiment. Considering how great are the chances against a second shot falling exactly on a spot already struck, it would hardly be going too far to say that the *Glatton* was in nearly as good condition to go into ctaion as before the trial. Yet, it would be difficult to put her through a more severe ordeal except by bringing the 35 tun gun to bear on her, and as for the object of the experiment, namely, injury to the working of the turret, it may be doubted whether much more effect would, even then, have been produced. A plunging fire we are inclined to believe the most likely to jam the turret.

Engineering says:—The result of the contest between the 25 tun gun of the *Hotspur* and the turret of the *Glatton* is almost an exact counterpart of that obtained by the trials which took place on Friday the 15th of June, 1866, when the armor of the *Royal Sovereign* was attacked by the 9 inch 12½ tun gun of the *Bellerophon*, and this trial again finds its counterpart in September, 1861, when Captain Powell conducted a lengthened experiment against the cupola gun shield of Captain Coles, on board the *Trusty*. In each case, the heaviest available artillery was brought to bear against the shield; in 1861 the 100 pounder Armstrong attacked the light cupola defence; in 1866 the 12½ inch gun was resisted by the 8½ inch plates and 14 inches of teak backing, which formed the protection of the turret of the *Royal Sovereign*, and in the recent trial (July 5th, 1872) the 25 tun gun, throwing the 600 pound shot was repulsed by the 15 inches of armor backed by 14 inches of teak, which was opposed to it on board the *Glatton*.

Satisfactory as these results are in one respect, pointing as they do to the continual precedence which the science of defence takes over that of attack, it must nevertheless be borne in mind that such a partial and peaceful experiment as that of Friday last cannot be compared to the rough realities of war. So far as it went, however, the trial was all in favor of the turret, and while we may congratulate ourselves upon the power of resistance it exhibited, we cannot regard with satisfaction the performance of the gun. True, the Palliser shot stood well to their work, the first one penetrating through 14 inches of armor plate and 4½ inches of wooden backing, and making a gap of 2

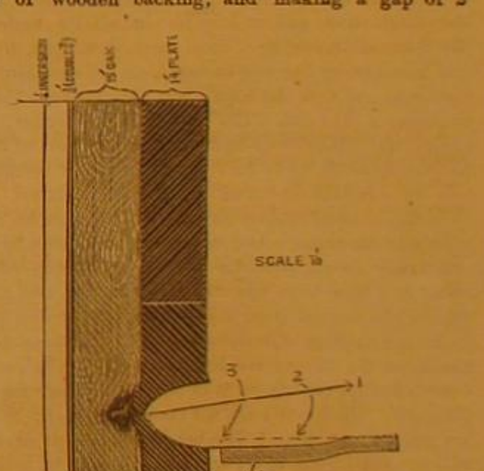


FIG. 5.—VERTICAL SECTION THROUGH PORTION STRUCK BY SHOT II.

inches between the upper and lower 15 inch outside plates; while the second shot, glancing on the glacis plate, penetrated 13½ inches into the armor. But the most unsatisfactory part of the trial lay in the difficulty experienced in getting the shots to go where they were wanted.

TWELVE LOCOMOTIVES DESTROYED.—On the 24th of July, the repair shops of the Erie Railway at Jersey City, N. J., were destroyed by fire, the loss of property amounting to nearly one million dollars. Five hundred men were thrown out of employment. Twelve locomotives were lost, together with many cars and much valuable machinery. Among the locomotives was a new one lately built by the Rogers Locomotive Works, at a cost of $40,000.

DURING a recent Sunday school convention held in Ballston, N. Y., one of the delegates hitched his horse in the street and allowed it to stand there in the hot sun from 8 o'clock in the morning until after 5 in the afternoon (nine long hours) without food or drink. It was a black, small pony with one white hind foot, hitched to a black gold mounted top buggy, in which was a white blanket trimmed with red. During the afternoon some one placed a card on the horse on which was printed: "I belong to a Christian; I have stood here since morning without food or drink."

THE caisson, on the New York shore, for the Brooklyn suspension bridge, is now filled in, and the erection of the stone tower will proceed as rapidly as possible. The tower on the Brooklyn side has reached the hight of 105 feet above high water. The towers are to be 150 feet high. The wire cables will be 120 feet above the water. The span of the bridge is 1,600 feet.

THE Croton lake from which New York is supplied with water is nearly forty miles distant from the city.

Correspondence

The Editors are not responsible for the opinions expressed by their Correspondents.

The Young Machinist Once More.

To the Editor of the Scientific American:

I noticed an article signed "A Young Machinist" on page 20, volume XXVII, saying that he was glad he learned a trade; but it would seem from his talk that he was sorry he did not learn the right one. It seems he is one of those who think no man should be allowed to run a locomotive unless he was a machinist. Now I think there are greater qualifications than that. No man, not even a machinist, can face off valves or build boilers on the road, and make his time. An engine must go into the shop for repairs, even if the engineer be a machinist. From his communication, it would seem that he believes that the companies take men right off the street, who know nothing about grades, running just fast enough and not too fast, nothing about fire, water, or making time and keeping out of the way of other trains. I am not a railroad man now, but some time ago I was fireman for nearly two years. We were on a branch road away from the shop. The man I fired for served six years as fireman, which was the average time on that road; and he did not have his engine in the shop but once and that was for a broken tire. What machinist could have done better? But there was more than this. Twice it seemed as though we were rushing to instant death, and, although his face was white, he showed no sign of fear but stood to his post like a man and brought his train out in safety. After we left that road, there was an engineer put on who was a machinist, a good man to repair engines, etc. One day, he was passing out of a station with a passenger train, running perhaps six or eight miles an hour around the first curve, when he met a freight train coming in; and without calling for brakes, without reversing his engine, without even shutting off steam, he took the leap and left his train to its fate, although had he stood at his post no accident could have happened, as the freight train was stopped when they came together. The engines were damaged and some of the passengers injured, although none fatally. Which of the men was the best engineer? Which the safest for the public or Congress to trust their lives with?

I clip the following from the *Brotherhood of Locomotive Engineers' Monthly Journal*:

"Now take two young men, each 21 years of age. One has served his time at turning tires, boring out cylinders, facing valves, and other work necessary for the building and repair of engines. The other has fired the usual time under the eye of some careful engineer, and has become familiar with the locomotive and railroading in all its various forms, has been on the engine in rain, snow, dew, fogs, in warm and cold weather, by day and by night, up hill and down, through the forest and over the open plain. He has seen the engineer overcome all the difficulties that are apt to occur; he has assisted him to take down and put up every part of his engine; he has been with the locomotive in all its vicissitudes; he has, by constant use and observation, learned how tires should be turned, valves faced, etc., and now he is declared master of his trade. And now they stand side by side, each one ready to compete for the championship of the iron monster. Now take the difference in the two men. The former one has not been accustomed to move his iron steed; he knows nothing of railroading and its ups and downs. In the latter, the locomotive has been his protégé, and he has traveled miles enough by it to carry him many times around the globe. And now I ask all manner of men: Which train are you going to take? Husbands and fathers, in whose care will you trust your wives and little ones to be whirled away into the midnight darkness?"

I do not wish it to be inferred that I think a machinist cannot be an engineer, for such knowledge would be a help to him; but I think they are two different trades, and I do not like to see a man of one trade call a man of another an "ignorant wretch" because he gets more pay than himself, or because he does not understand another trade than his own in all its details. ALECK.

Waterbury, Conn.

A Question in Architecture.

To the Editor of the Scientific American:

The county Board of Supervisors of this (Dickinson) county is rebuilding the court house of bricks which were in the walls of the original building burned last fall. The walls were then blown down by the wind. The bricks were cleaned off and relaid into a wall the second time, which was also blown down when it had got up to the middle or the second story windows or thereabouts. The bricks were then recleaned; again the wall was relaid with the same bricks, the inner course being filled up with pieces of brick. This wall for the court house and public offices is 30 x 50 feet on the ground, the partition walls being all lath and plaster. The wall is 24 feet high and only 12 inches thick from bottom to top; the former wall which was burned was 20 inches thick below and 16 above.

This building stands on the highest elevation, probably, in the State, with not a tree or shrub for miles to break the force of the terrible winds which sweep over our prairies. Now I contend that these walls are not safe, but, on the contrary, are a perfect mantrap and will probably kill somebody. What is your opinion? T. S. SEYMOUR.

Milford, Iowa.

[This is not surprising in view of the mania at the West for thin walls. No amount of experience in the disastrous results from weak structures seems adequate to insure stronger buildings. The thoroughness of the destruction of Chicago was owing in no small degree to a deficiency of the thickness of the walls. Party walls 8 inches thick were quite common there, and some were only four inches. Very few of the walls stood after the timber was burned so as to fall to the cellar. There was not sufficient substance in the walls to stand alone. They depended upon the timber for support; and as soon as this support was removed, the walls fell, leaving an open field for the flames. Chicago was essentially a *wooden* city, although apparently built with brick.

Buildings, to be durable, should have walls strong enough to stand alone. The walls of the court house above referred to, 50 feet long, unsupported with cross walls at any intermediate point, ought to be two feet thick in the principal story and twenty inches thence to the roof; and they should be built with new, hard, whole bricks well bedded in a sufficiency of best mortar. Built in this way, their stability would be unquestionable. But built as above described, the builders would have continuous employment in restoring them after each storm of wind.—EDS.

Estimating the Distance of a Lightning Stroke.

To the Editor of the Scientific American:

During the great thunder and lightning storm in Philadelphia, in the evening of July 4 last, frequent discussions arose in regard to the probable distance of thunder and the velocity of sound in air. Some maintained that sound travels over a mile per second, and others said that the velocity of light must be considered in estimating the distance of the thunder, all their opinions varying greatly from established facts in physics, for which reason I propose to send you a table on that subject, which you may consider worthy of publication in the SCIENTIFIC AMERICAN.

DISTANCES IN FEET WHICH SOUND TRAVELS IN AIR.

Time of travel.	Temperature of the air, Fahr. 50°.	60°.	70°.	80°.	90°.
Seconds	Feet.	Feet.	Feet.	Feet.	Feet.
1	1,109·6	1,120·6	1,131·1	1,142·5	1 153·2
2	2,219·2	2,241·2	2,262·2	2,885·0	2,306·4
3	3,328·8	3,361·8	3,393·3	3,427 5	3,459·6
4	4,438·4	4,482·4	4,524·4	4,570·0	4,612·8
5	5,548·0	5,603·0	5,655·5	5,712·5	5,766·0
6	6,657·6	6,723·6	6,786·6	6,855·0	6,919·2
7	7,767·2	7,844·2	7,917·7	7,997·5	8,072·4
8	8,876·8	8,964·8	9,048·8	9,140·0	9,225·6
9	9,986·4	1,008·5	1,018·0	1,028·2	1,037·9
10	1,109·6	1,120·6	1,131·1	1,142·5	1,153·2

The velocity of lightning is probably not less than the conduction of electricity through the best conductors, or about 200,000 miles per second, and the time occupied for only a few miles is so small that it could not be appreciated or recorded without extraordinary instruments for that purpose, for which reason it is disregarded in approximating the distance of thunder.

The occurrence of a lightning flash cannot be anticipated, and we are therefore generally unprepared to record the exact moment, which frequently comes unexpectedly, when no appropriate time keeper is at hand. In a room where the beats of a clock's pendulum can be heard or seen, it is easy to count the beats between the lightning and the thunder, by which the time can be approximated. With some practice, the beats of seconds can be counted with tolerable correctness without the aid of a time keeper, which practice has been of great service to me in astronomical observations. We should practice counting seconds with the second hand of a watch until the countings agree, without looking at the time keeper for a minute or two. The counting should not differ more than one second in a minute, by which means the time between the lightning and the hearing of the thunder can be closely approximated.

In observing the altitude of the sun or lunar distances, at sea, it is customary to keep a watch ready in the hand, or to station an assistant at the chronometer to note the time when the observer says "Stop;" but there are known cases when the captain has taken observations without a watch or assistant, and walked slowly and comfortably to his cabin and noted the time of his observation from the chronometer, with no little amusement to the mates and others, who naturally supposed that the captain's observation could not be very correct; but to their surprise it was found to be as correct as their observations with ordinary precautions. The fact was that the captain counted in his mind the beats of seconds, and deducted the sum from the time observed on the chronometer.

I have made a great many astronomical observations of different kinds in the interior of South America, particularly of eclipses of Jupiter's satellites; but when I have no instrument connected with the telescope for the purpose of recording time, I have never attempted to note the time of observation directly, but counted the beats of seconds and turned myself comfortably to the chronometer and deducted the counting, which generally amounted to four or five seconds. The practice of counting seconds correctly is very useful in a great variety of cases. In actions of very short duration, say less than three seconds, it is best to count half seconds, or even four times in a second, and the time may be determined with a correctness to less than a quarter of a second. JOHN W. NYSTROM.

Capacity of the Boston Coliseum.

To the Editor of the Scientific American:

The Coliseum was estimated by the Boston newspapers as capable of seating an audience of from eighty to a hundred and twenty thousand, besides a chorus and orchestra of twenty to thirty thousand; so that averages of "half houses" were expected to be sufficient to yield immense profits. The houses, however, averaged three quarters full and yet money was lost.

Now for the explanation by feet and inches. According to the lithographed plans of the building, the entire seating capacity of the auditorium was less than 17,000 persons, and that of the orchestra and chorus less than 12,000. Deducting the obstructions of posts and stairways a maximum of 28,000 persons might have been seated at one time, of whom 16,500 might be classed as audience. At no time was the number of persons standing at the concerts greater than the number of empty seats, and certainly the "deadheads" numbered 2,500, so that it were unfair to estimate for more than 14,000 paid tickets for a full house, or for an average exceeding 9,500 paid tickets to all the concerts. This, if substantially correct, accounts for the failure financially.

The space under the galleries was almost entirely occupied as reception rooms, offices and passage ways, so that we have only to deduct, from the total of some 200,000 square feet of surface, the rather small estimate of 50,000 square feet of stairways and passages, not under the galleries, and divide the remainder by the five feet which a person sitting requires. This gives a maximum capacity of 30,000 persons, and is quite near enough to prove the substantial correctness of the previous figures. B.

Demoralization by Leisure.

To the Editor of the Scientific American:

The article in your issue of July 21st, credited to the *Christian Union*, seems to me to demand some notice, as, I think, it contains more absurdities than I have ever before seen in the same space. The world would be much better off if every human being, who has the strength, would work from one to ten hours per day, as circumstances required, at some useful and productive employment. Mental strength can only be maintained by a proper amount of physical exercise, and it is far better that this should be useful than useless. When all do their part, an average of five or six hours' labor per day will supply all our wants, relieve the overworked, strengthen those who need it, banish sickness, and leave plenty of time for mental improvement and recreation. The "leisured class," with exceptions as rare as angels' visits, are worse than useless. For proof I point you to the aristocracy-cursed nations of the old world. The more society has of this class, the worse it is off, for the mere laborer sinks into a condition of stolid ignorance and brutality, while the "leisured class" plunges into a gilded debauchery, destructive of every good principle.

Society owes everything to labor, mental and physical; nothing to the "leisured class."

A pampered bigot may charge upon our Heavenly Father the inequalities caused by man's injustice, but such blasphemy can never emanate from the brain of any true Christian.

I could fill volumes with the sins and shortcomings of this so called "leisured class," but will only mention one or two. They make a mock of marriage; they tempt thousands, who would otherwise be ornaments to society, to a life of shame; and, after the poor victim has spent the best portion of life in pandering to their base passions, and a fresh one is wanted, she is turned into the street to sow the seeds of moral and physical pollution among the laboring classes. But enough of this. I am very glad to find a grain of sense and truth, at last, where he says: "The safety and progress of humanity, as a whole, depends on each man's serving faithfully;" but if he expects it to be done without murmuring, he expects too much. Where but little is given, but little is required, and the reverse.

I am a working man, but I believe all strikes, however they may terminate, injurious to the working classes, and I may give my reasons some day, when I have leisure, through the SCIENTIFIC. J. E. S.

Portland, Me.

The Underground Railway in Baltimore.

To the Editor of the Scientific American:

With all the advantages of education, engineers of public works appear to be at fault at times. The Potomac tunnel, now being constructed under one of our streets, passes through a variety of soils and, in some places, through solid rock. At first no counter arches were built on the soft clay soil; hence the great weight of superstructure and filling on top to line of strut was too great for the soft clay foundation, causing the whole superstructure to sink, throwing the clay up in the roadway. Of course there was nothing left but for the engineers to have counter arches built on all such soil.

A common observer would have supposed that, had they ever engineered a similar work, they would not have risked this one without the counter arches.

Baltimore, Md. J. W. L.

How to Destroy Wigglers.

To the Editor of the Scientific American:

I have a number of water barrels around my outbuildings, besides a cistern. The water in the barrels suits best to water plants, being warmer than cistern water.

But the wigglers breed in it by thousands. I have been trying to destroy them, and have found out what will kill every one in an hour. Pour a few drops of burning oil upon the water, sufficient to cover the surface; stir a little to be sure of completely doing this, and draw off the water below. Add oil if anything disturbs the covering. It has answered well with me.

Cleveland, O. W. WARD.

AT the recent exhibition of the Royal Agricultural Society Cardiff, Wales, an eight horse portable engine, made by Clayton & Shuttleworth, worked for five hours under a consumption of 2·92 lbs. of coal per horse power per hour—an unparalleled result for a non-condensing engine.

Small Fast Steam Propellers Again.

To the Editor of the Scientific American:

A plain working man, laboring 60 hours in the week, with but one day in that time to call his own, I had not expected, in publishing an article in your valuable paper on this subject, to provoke a correspondence from nearly every State in the Union, making enquiries how such a vessel can be procured, how she should be constructed, her cost, etc. At the risk of repetition, I will ask your kind assent to reply to these correspondents through your valuable paper. The boat described before is 50 feet long, 45 of which is hull and 5 feet of it overhang at the stern, beneath which the propeller is placed. She has a forecastle deck of about the same size (5 feet), is 7 feet beam, and 54 inches depth of hold. She is built of oak by a common house carpenter who had worked on canal boats in the State of New York. The stern and stern posts are very heavy and strong, as are the floor and side timbers, all well ironed, and as staunch as could be made. The hull is flat bottomed and a foot narrower at the bottom. A deck 40 feet long, 8 feet high from the bottom floor, protects the machinery and passengers from the weather. The vessel is propelled by a screw wheel having four fan-shaped blades 2 feet long, and 2 feet wide in the widest part, bolted to a wrought iron hub with flanges set at an angle of 45° with the shaft. The machinery has already been described. The whole cost of this boat has been about $1,500; and for general jobbing, towing, and pushing rafts, or work where speed is needed, she is better worth the money than many boats which cost four or six times as much.

We are indebted to your valuable paper for much information which has aided us in making this boat a success. Without any previous experience in building such craft, we found by reading the English article you published that the wheel was too large for the power. By cutting out one third of the filling, making the blades 2 feet wide instead of 3 feet, we took one third the labor off the machinery, and gave fully that much or more speed to the vessel.

In the former article, I said she would carry 20 or 30 passengers. On July 4th, the engineer had a benefit by going short excursions, and as her speed had attracted public attention she was crowded all day. She carried 46 passengers with perfect safety, and only seemed to run faster for being so heavily loaded. That day she repeatedly made a mile in 4 minutes, and in calm weather she regularly crosses the river, five eighths of a mile, in 2 minutes and 40 seconds. Her economy of fuel is remarkable, burning only 10 bushels of rather poor soft coal a day; and her entire crew consists of one man, who manages her with perfect ease and safety, the steering wheel being close to the engine, and everything very convenient.

As quite a number of your readers appear to want a boat of this sort, there are doubtless competent draftsmen in New York who would furnish complete drawings to build by. The circular slide valves are used on the engines of this boat with great success. J. A. G.

Force of Falling Bodies.

To the Editor of the Scientific American:

Since you are publishing a series of articles on "Weight, Pressure, Power, Force," etc., it would be useful to so explain the acting force of a body in motion, its momentum or striking force, that, if such a thing be possible, your readers may understand what it means, by what it is measured, and how determined.

While this is one of the simplest problems in physics, as well as one of the most essentially practical, it is one of those of which the majority of the people are most profoundly ignorant, as is shown by the frequent questions on the subject in your valuable paper, and by the replies, no two of which are alike, and which indicate that the correspondents are hopelessly befogged.

In your number of July 6, page 10, a correspondent—misled by Haswell probably—estimates the force of the hammer, weighing three tuns and falling four feet, at over 160,000 lbs. But what does he mean? What is a pound of force? To what is it equal? What work will it do? He does not say foot pounds, and if he means that, he is wide of the mark in his estimate. A blow cannot be compared with weight or pressure alone.

It should be universally known, if possible, that force is estimated by the measure of the work it is competent to perform, the number of pounds it will raise one foot high. The force which will lift one pound one foot is called a foot pound, and is the unit used to express the amount of a force. Gravitation, being a constant quantity, is a convenient standard, and force measured by the amount of gravitation it will overcome affords a statement quite intelligible to any intelligent person. Next, it should be known that this same one pound, in falling freely one foot, will accumulate the same amount of force, that is, gravity will impart to it in its descent the same amount of force which it took from it in its ascent, and therefore the force of the blow will be just one foot pound; and, if converted into heat, would produce exactly the amount of heat which would be required to lift the one pound one foot high again.

In general, the force with which any falling body will strike is precisely the amount required to lift the same body to the hight from which it fell. When, therefore, the weight and hight are given, their product is the force of the blow in foot pounds, and, in the case of this hammer, would be 6,000 × 4 = 24,000 foot pounds. The force of a "weight of one pound falling two feet" would be 1 × 2 = 2 foot pounds, while Haswell's "Engineers' and Mechanics' Pocket Book," page 419, gives it at 11·34 lbs., whatever that may mean.

If the velocity is given, we find the hight as follows: Dividing the velocity by $32\frac{1}{6}$ (the velocity acquired in each second) gives the time of fall in seconds, and multiplying the square of the time by $16\frac{1}{12}$, we have the hight from which the body must have fallen to acquire the given velocity, which, of course, is also the hight to which the body would ascend, if projected upward with the same initial velocity before its force would be expended in overcoming gravitation. Obviously, the force of the blow will be the same, with the same velocity, whether the motion be downward, upward, or horizontal; hence, to find the *force* with which it is moving, we only require to find the hight from which a body must fall to acquire the given velocity, and said hight, multiplied by the weight, gives the striking force in foot pounds, or the amount of work the body would perform, the resistance it would overcome, the weight it would lift one foot, or the heat it would produce; and also, what is the same thing, we have the amount of force expended in imparting to the body the given velocity.

The general confusion of ideas upon this subject is probably largely due to the fact that the text books differ widely, and the majority of them are entirely wrong, as they almost all teach that the striking force is proportional to the velocity, whereas it is, in fact, proportional to the square of the velocity, as is readily shown by the law of falling bodies enunciated in the very same books.

The formula above given is far more simple than the various arbitrary and fantastic ones so often presented by your correspondents, and has the peculiarity of being correct, and consequently consistent with all the laws of motion; and if you will give me space for a few examples, I believe its application will be perfectly plain to your readers. Instead of dividing the velocity by 32·16 and multiplying the square of the quotient by 16·08, we may, of course, obtain the same result by the shorter process of dividing the velocity by 8·02, and squaring the quotient.

1. A one pound ball moves 1,000 feet per second; $(1{,}000 \div 8{\cdot}02)^2 = 15{,}545$. Its force then is 15,545 foot pounds, and as it weighs one pound, if its motion were directly upward it would mount to the hight of 15,545 feet, and on returning would acquire in its descent the same velocity of 1,000 feet. The force expended, then, in imparting this velocity was equivalent to that required to raise 15,545 pounds one foot.

2. A twenty-four pound ball has a velocity of 50 feet per second; $(50 \div 8{\cdot}02)^2 \times 24 = 931{\cdot}44$ foot pounds. If this twenty-four pound weight were a hammer with a stroke of 38·81 feet, it would acquire a velocity of 50 feet, and would strike with a force of $38{\cdot}81 \times 24 = 931{\cdot}44$ foot pounds, and this amount of force, in any available form or mode of manifestation, would be sufficient to impart a velocity of 50 feet to a mass of 24 pounds, or to lift 24 pounds 38·81 feet, or to lift or throw one pound 931·44 feet high, or 931·44 pounds one foot high. In these calculations, there is no allowance made for atmospheric resistance. W. H. PRATT.

Davenport, Iowa.

Novel Experiment by Tyndall.---Ignition of Diamonds by the Electric Lamp.

In a recent lecture before the Royal Institution, Professor Tyndall said:—

Most of you know that wonderful prediction made by Newton respecting the diamond; his powerful mind, antedating the discoveries of modern chemistry, pronounced it to be an unctuous or combustible substance. We now know that the diamond, beautifully transparent, highly refractive as it is, is identical in its composition with charcoal, graphite, or plumbago.

A diamond is pure carbon, and when burnt as I am about to burn it, yields the same products as carbon would if burnt in the same way. I have a diamond held fast in a loop of platinum wire; I heat it to redness in this hydrogen flame, and then plunge it into this glass globe containing oxygen. The glow, which before was barely perceptible, extends and becomes brighter as you see. The diamond would go on burning in that quiet way until totally consumed, if the supply of oxygen were kept up. In ordinary air, the diamond will not burn; the oxygen is too much diluted by the nitrogen; its atoms are too few in number to carry on an effective attack, but when concentrated, each of the atomic projectiles is assisted by its neighbor, and as it strikes the surface of the diamond, its motion of translation is arrested and converted into the motion which we term heat, and the heat thus produced is so intense that the crystalline carbon is kept at nearly a white heat, so that the atoms of carbon and those of oxygen unite, and carbonic acid gas is produced.

Faraday describes the combustion of the diamond in oxygen, the necessary initial temperature having been derived from the rays of the sun. The experiment is described in the admirable life and letters of Faraday, by Dr. Bence Jones.

This experiment, he describes as being quite new to him, and as never having been seen before. I hope to show you an experiment of a similar character which has never been seen before—the ignition of the diamond by the concentrated rays of heat from our domestic sun, the electric lamp. In order to prevent chilling from currents of air, I have taken the precaution of surrounding the back of the diamond with a hood of platinum wire.

I now insert the diamond in the focus of the electric beam, and in a few moments the diamond becomes very hot. I think that will do. I now plunge it in the oxygen. There it glows, and so it would continue to glow, and would burn away just like coke, also leaving the same residue behind. In both cases the particles of oxygen impinge upon the carbon, grasp its molecules, and convert them into carbonic acid.

I made reference to the luminosity of flame proceeding from the presence of incandescent solid particles of carbon. An experiment has been devised by Mr. Cottrell which illustrates this, and as it is his experiment I will allow him to perform it.

He will fill this globe with oxygen from the iron bottle by displacement in the usual way. That being done, he now ignites a piece of boxwood charcoal, attached to the cap of the globe by a stout wire, and immerses it in the gas; it of course burns with those beautiful scintillations you have so often seen in this room. But instead of allowing this beautiful combustion to proceed as it is now doing, he directs upon the charcoal a jet from the bottle of compressed gas, the consequence being that the combustion is marvellously enhanced, and, from the currents created by the rush of the gas, the particles of ignited carbon revolve in perpetual orbits, at a little distance producing all the effect of a magnificently brilliant white flame. It is my firm conviction that the constituents of ordinary flame to which we owe its light are mainly these solid particles of carbon; though I must also state that a very distinguished friend of mine holds a different opinion.

My intelligent assistant, Mr. Cottrell, some little time ago arranged two circular gas jets of small bore, so that they should impinge directly the one upon the other; the two flames became blended into a horseshoe form, the extremities of which were spirals, and these spirals perpetually threw off particles of solid carbon. I take this as being another proof of the correctness of Sir Humphrey Davy's old notion that the luminosity of flame was due to the incandescence of some part of the matter which was burning.

Mosquito Manure--A Summer Yarn.

Nature has her compensations. At Stratford, Conn., where the mosquitoes are as thick as a fog, lives an ingenious Yankee, so they say, believe it who may, who puts these insects to profitable uses. He has invented a large revolving scoop net, covered with lace, which is put in motion by a windmill, water power, or steam. The lower half of the scoop is placed in water. The upper half moves through the atmosphere and at each rotation draws immense numbers of the 'squitoes down into the water, where they drown and sink to the bottom. Every revolution of the net draws in an ounce of mosquitoes, or a tun for thirty-two thousand turns of the machine. The mosquitoes thus collected make a splendid manure for the land, worth forty-five dollars a tun.

We know that other insects—the cochineal for example—constitute most valuable articles of merchandize; and it may be that this Stratford mosquito manure will yet become a standard article of commerce. The possibility of making mosquito sirups, glues, dyes, and other goods, from the insect mass, remains the subject for experiment.

Patent Infringement Case.

United States Circuit Court—District of Massachusetts, in Equity.

Alzirus Brown *versus* J. R. Whittemore and others.

This was a case of alleged infringement of the complainant's patent, applied for June 1, 1858, issued in October of that year, and reissued June 16, 1868. The case was argued on the specification of the reissue, which, taken with the drawing and model, shows an improved horse rake for raking hay and grain, in which the wire teeth are coiled round a rake head which is hinged to the rear ends of the shafts, just above and parallel with the axle; this rake head is connected with two levers and treadles which enable the operator to raise the rake with his right foot and to hold it down with his left; a handle is attached to one of these levers to work the same effect by hand. The second claim is for the combination and relative arrangement of the hinged rake head with the supporting axle and carrying wheels, whereby the head is supported above the rear upper edge of the axle; and the lower ends of the teeth, when gathering the hay, occupy positions in rear of the tread of the wheels and forward of a vertical plane on a line with the rear edge of the wheels; and the fourth claim is for the arrangement of the rake head and foot treadles, or either of them, in relation to each other and the axle.

In the opinion delivered by Lowell, circuit judge, the court held that a horse rake made and sold by the defendants came within the claims stated, unless they were construed very narrowly. The defendant's position was that in view of earlier inventions the claimant must either submit to such a limited construction or his claims were void; but they failed to show that the patentee himself, or any one else, had made the particular combination so early as to defeat these claims, if construed according to their plain and obvious meaning; and it was held by the court that there was, therefore, no occasion to restrain them to mean only a rake head hinged to the shafts in the precise way shown by the patent. In the plaintiff's rake, the hinges are attached to the outward lower corner of the rake head, and in the defendant's, to the upper inward corner. It was insisted by the defendants that this feature in the plaintiff's patented machine was the only one in which it differed from its predecessors, but it was shown in evidence that the relative position of the several parts, which is new, is attained and is useful whether the hinges are placed on the upper or lower edge of the rake head.

The opinion of the court was that the two claims were valid and were infringed by the defendants.

Decree for the complainant.

Thos. H. Dodge, Esq., for complainant; Chauncy Smith, Esq., for respondents.

A RAILWAY BRIDGE ELEVEN HUNDRED FEET LONG BUILT IN FOUR DAYS.—The Linden bridge over the Susquehanna river near Williamsport, Pa., was recently burned on a Thursday evening; workmen and materials were assembled next day, and on the following Tuesday the cars were running over the new bridge, 1,135 feet in length. The original bridge was of the Howe truss pattern, roofed and lined inside and out. Cost, $110,000.

IMPROVED SHEET IRON ROOFING.

Our engravings illustrate a good form of sheet iron roofing, which was patented by Mr. W. S. Belt, of Cincinnati, Ohio, Aug 8, 1871.

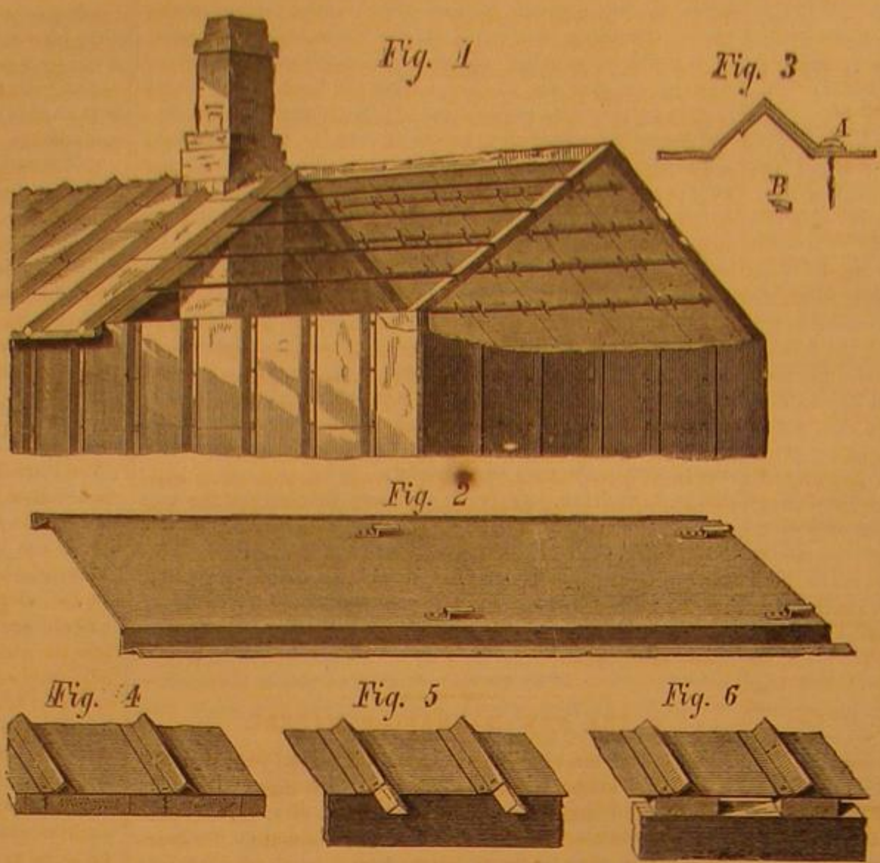
Fig. 1 represents the roofing partly applied to the roof and sides of a building. In Fig. 2 is shown the under side of one of the iron sheets of which it is composed. It will be observed that the sheet is triangularly crimped at its sides in such a way as to allow the crimped portion of one sheet to overlie the crimp of another, (in the manner shown in Fig. 3), and that the lower side is provided with fastenings which are riveted to the plate. The overlying crimp has a perforated flange, through which two adjacent sheets may be nailed to the sheathing or rafters of the roof, as shown at A, Fig. 3. It can readily be seen that, in thus employing the roofing, each sheet is fastened by both of its sides to the supports. The nail used is barbed, and as the fibers of the wood, into which it is driven, soon resume the position from which they are displaced, a very firm hold is taken by it. A lead washer, as at B, is placed between the nail and the plate, and by its use any unevenness of surface is accommodated and an air and water-tight joint formed on driving the head of the nail home into the lead. The sheets are eight feet long and two feet wide between centers of crimps, and, as manufactured, are coated on both sides with paint.

Fig. 4 represents the application of the sheets to a sheathed roof, in which case rough boards of an even thickness are all that is necessary for the sheathing. Fig. 5 shows the mode of applying the roofing to purlins where no sheathing is employed. In this case the purlins may be placed any distance less than eight feet apart, and triangular strips of wood are nailed to, and at right angles with, them, two feet apart between centers, so as to fit under the crimps and support the sheets. Or boards three inches wide may be nailed to the purlins, and the sheets applied to them in a similar manner to that shown in Fig. 6, which represents the mode of attaching the roofing when rafters without sheathing are to be covered. In the latter case, strips of boards are let in, on a level with the upper surface of the rafters, for the ends and centers of the sheets to rest upon. The triangular strip may be placed under the crimp in any case if desired. The ends of the sheets are joined by overlapping them, or by bending them so as to form a lock joint, which, as they are well annealed, can readily be done. The sheets are also easily made to conform to the angles of roofs of either ordinary or peculiar form, so as to make perfectly tight joints and fully preserve the effective character of the roofing. It is applied with such facility, aided by the inventor's directions, as to require no skilled workmen to put it on.

Mr. Belt has also devised a combination iron frame to support his roofing, by the use of which cost is lessened and its fireproof qualities hightened. Its construction will be understood from Fig. 1, where the rafters are seen to sustain bands stretched between them. These bands are made of strap iron and are placed 46½ inches apart. To these bands the fastenings on the under side of the sheets before alluded to, seen in Fig, 2, are hooked, and the roofing thereby secured in position as seen in that portion of Fig. 1 which shows the under side of the roof. By using iron for the rafters, a fireproof roof is made.

Many advantages are claimed by the inventor for this mode of roofing. He says that the crimp gives so much stiffness to the sheet, it is enabled to sustain itself and also considerable weight in the center, when supported only by its ends. There is, consequently, no liability to "bag."

Its fastenings are so secure as to prevent any wind affecting it, and, at the same time, if damaged, it can easily taken out and replaced. The entire roof can be taken off one build'ng and put on another, without damage and at trifling expense, for which reason it is considered admirably adapted for temporary buildings. In all these respects, it is superior to the plain sheet metal roofing, and it is claimed to excel the corrugated; while the same weight of metal in the crimped form covers twenty per cent more surface than if corrugated. In roofing warehouses and small buildings on this plan, from two thirds to three quarters of the wood usually employed could be dispensed with.



BELT'S SHEET IRON ROOFING.

Further information can be obtained by addressing the inventor at 56 and 58 East Third street, Cincinnati, Ohio.

ROTARY PRESSURE BLOWER.

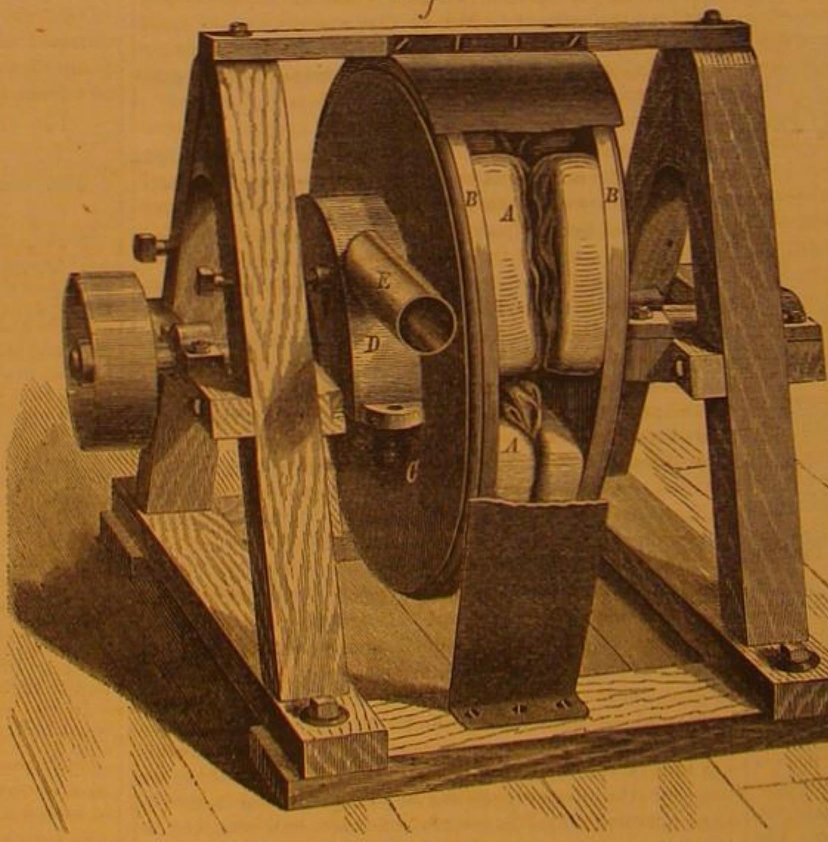
The great expense attending the use of the piston blower, in connection with blast furnaces, forges, etc., and the cumbrous nature of the apparatus itself, have led to the employment in its stead of various forms of fan blowers, notwithstanding that the latter have to be run at a high rate of speed, and consume a great deal of power without producing a proportionately powerful blast. This absence of effect arises from the fan not being positive in its action, the pressure of its blast resulting only from the momentum of the air. The production, therefore, of an effective positive pressure blower, which would compare favorably in convenience and expense with the fan, has long been aimed at by inventive skill, and there is no doubt that such an apparatus would be a valuable addition to the resources of the mechanic in many branches of industry. We this week illustrate a blower which is designed to meet this want, and which we think possesses points of merit.

The machine is represented, in Fig. 1, with a portion of a protective shield broken away to show the parts. It consists of a series of bellows, A, which are placed between and attached to the two disks, B. These disks are mounted on a jointed shaft, as shown in the horizontal section (Fig. 2), the halves of which are set at an obtuse angle in such a manner that the disks are caused to revolve in vertical planes which incline to each other. By the revolution of the disks in this position the opposite sides of the bellows are made alternately to approach and recede from each other, and the bellows are thus brought into action by direct rotary motion. In Fig. 2 are shown the points of greatest expansion and contraction consequent on this motion. The disk next the driving pulley is provided with an aperture, C, for each pair of bellows in the series (shown in detail in Fig. 3), through which the air passes into and from the bellows. D is an air chamber, which is open on the side next the disk, and covers that half of the circle of apertures from which the air is being expelled. The wind is conveyed from the air chamber to the place intended by means of the pipe, E. The apertures connected with those bellows which are expanding are always below the air chamber and open to the atmosphere. A joint, which is sufficiently tight for all practical purposes without causing much friction, is made between the air chamber and the disk by facing them to correspond, and holding the former against the latter by means of the set screws seen in Figs. 1 and 2. In order to prevent danger of bursting the machine, should the eduction pipe get accidentally closed up, india rubber or steel springs are placed between the air chamber and the set screws, so as to allow the air to escape should the pressure within become too great. From the construction described, it will be seen that (in the absence of the springs mentioned) all the air which enters the bellows is discharged through the eduction pipe, and by the positive nature of the action, the amount of pressure developed is only limited by the strength of the material and the power applied. The bellows are made of the best material, and are attached to the disks, which in practice are of cast iron, by means of screws, so that they may be readily removed for renewal.

The economy attached to the use of this blower will, the inventor says, well warrant the renewal of the hide or leather as often as may be necessary. In rare cases, where a large volume of air under heavy pressure is needed, it is better to run two smaller blowers, instead of one large one. They might be run on one shaft, with the driving pulley between them. The blower is, in practice, all cast iron with the exception of the leather and the shaft, which latter is made of wrought iron. The inventor says that it can be constructed for as little as one of the best kind of fan machines, and much more cheaply than blowers made on the rotary pump principle, while it is greatly superior to either. It is intended to be run at a low speed, say from two to three hundred revolutions per minute or less, according to size. The blower may be made to exhaust, either by reversing the motion, or by placing an air vessel, with an induction pipe attached, over the lower apertures.

The advantages which this apparatus is claimed to possess are cheapness of construction, saving in power, and increased pressure, volume, and steadiness of blast. When used with a blast furnace, the tweers are always kept free, which result is not obtained by a fan. It is noiseless in action and is applicable to all purposes to which a blower can be put. It is well adapted for blowing air through, or exhausting it from, pneumatic dispatch tubes, etc. For further information, address Mr. J. Pusey, 228 South 3d street, Philadelphia, Pa., who is the sole proprietor of the patent, and who is desirous of disposing of rights in whole or in part.

Fig. 1



ROTARY PRESSURE BLOWER.

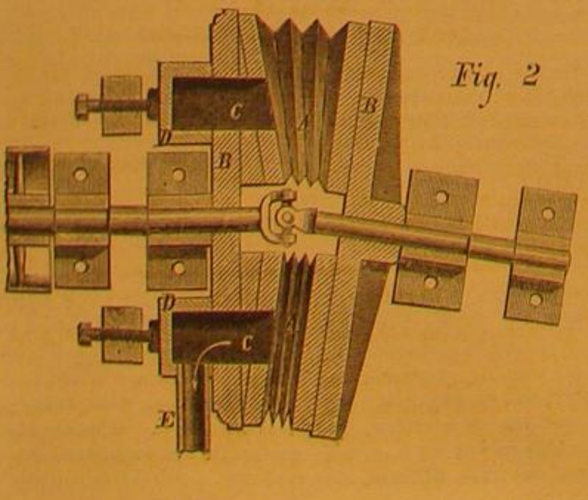
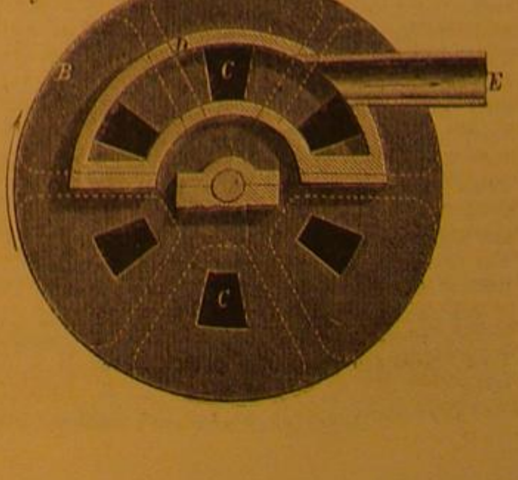


Fig. 2

Fig. 3



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Contents:

(Illustrated articles are marked with an asterisk.)

COSMICAL CAUSES OF CHANGES OF CLIMATE.

In a former article, under the head of "Changes of Climate," we have given some of the arguments adduced in favor of the haeory that our planet is still undergoing the cooling process, which geology proves that she was undergoing millions of years ago. Another argument in favor of this theory, not founded on observation, is the *a priori* consideration that our earth possesses, interiorly, a temperature far above that of the surrounding planetary space, and that, therefore, according to the laws of distribution and radiation of caloric, a slow loss of heat must take place, tending ultimately to make the temperature of our whole globe equal to that of the space she moves in; that is, according to Pouillet, 240° below the zero of Fahrenheit.

The solar caloric radiation, enormous as it is, is without influence on the temperature of the earth's interior, it having been proved that the whole effect penetrates the surface to a limited number of feet only, and is as easily lost by radiation during the night and the winter as it is received during the day and the summer season. The incapability, of the apparently powerful solar radiation, to prevent a planet from losing its own heat, is forcibly illustrated by the present condition of those tops of our earth's mountain peaks which are elevated above the snow line, where, even under the tropics, a perpendicular midday sun is unable to raise the temperature above 32° Fah. The present condition of our moon is another case in point; we know now that this satellite has cooled down far below the freezing point; that practically it has no atmosphere, and that all its water, long ago, has been chemically combined with the lavas of its surface into hydrated rock, similar to those of our earth, which contain, in solid condition, a mass of water perhaps equal to half that of our oceans. The opinion, of some astronomers of the former century, that the side of the moon turned towards the sun should be subjected to great heat, is sufficiently refuted by the observation of the effects of the sun on our mountain tops above the snow line referred to.

These arguments serve to show the incapability of the sun to prevent the cooling down of the planets and satellites under its influence. In fact, our whole planetary system is an illustration of this simple law of caloric radiation: that the smallest bodies will require the shortest time to cool down, while inversely, the largest will remain hot the longest. The smallest planetary body, with whose physical condition we are acquainted, is the moon, and this has cooled down far below the freezing point. The next planetary body, the only one, in fact, with which we are intimately acquainted, is our earth, and this has cooled down, exactly so far as to allow the solar radiation to develop vegetable and animal life on its surface; and a similar condition may perhaps exist on the surface of the planets Mars and Venus, not differing much in size from our earth. When we, however, look at the larger bodies of our planetary system, say Jupiter, which surpasses our earth in size more than 12,000 times, we find a very different condition of affairs. In the first place, its density is only one third more than that of water; while the density of our earth surpasses that of water five times. This proves from the outset that matter is on Jupiter by no means in the same condition as on our earth; that probably it has a much higher temperature of its own, so high as to keep in a gaseous condition many substances which are liquid or solid on our earth. Very recent observations with the spectroscope and telescope combined have indeed proved this to be actually the fact, and that this planet, as well as Saturn, Uranus and Neptune, possesses so high a temperature as even to shine with, besides the reflected solar light, some luminosity of their own.

If, finally, we look at the central body of our planetary system, the sun, which surpasses Jupiter in the same ratio that Jupiter surpasses our earth, we find that the cooling process has advanced the least; in fact, the heat of the sun is still so great as to be entirely beyond our present means of estimating temperatures.

Human life and even the historical record is short, while the changes spoken of extend over such long periods of time as to be an eternity compared with them. No wonder, therefore, that the practical evidences are slight, so slight indeed that we should feel inclined to disbelieve such changes, and to accept a theory of perfect stability of condition. There are indeed some who adhere to this belief; but unfortunately for them, there looms up the geological record, proving stupendous changes from the time when the most excessive tropical climate prevailed at the poles; while, between the tropics, an excessive torrid zone and boiling ocean formed an unsurpassable barrier for the vegetable and animal life around the poles of each hemisphere. Before that time, there was a period that the earth's temperature was so high as to occupy four times its present bulk, and to be self luminous. Then perhaps the moon was cooled to the temperature possessed now by the earth and she may have been inhabited; a condition similar to that of Jupiter at the present day, where the moons may have inhabitants, though the planet itself cannot.

If these above conceptions are correct, worlds have their times of preparatory development, of youth, of manhood, and of decay. Jupiter is in its preparatory stage; our earth has passed its youth and is just entering into manhood; our moon has had its time of decay and is now a dead planet. This will continue, with the difference that, after millions of ages, these conditions will be shifted from one set of celestial bodies to another.

THE NEW MANHATTAN MARKET.

One of the largest structures in the United States is the Manhattan market, situated between 34th and 35th streets and Eleventh and Twelfth avenues in this city. Its dimensions are 900 feet in length by 200 feet in breadth. Its foundations rest principally on piles driven to depths varying from 14 to 50 feet; on these, heavy beds of concrete are laid, above which, and level with the upper line of the foundation, the floor is placed. This is 160,000 square feet or over three acres and a half in extent. It consists of, first, a layer of concrete four inches, then two inches of asphalt, and finally a coating of Portland cement, one and a half inches in thickness. The latter is to be colored in various designs and all will be impervious to water. Drainways are provided on either side of the building, through which all refuse will be carried to the river as often as the water from the 1,000 Croton hydrants is allowed to play upon it. With such a flow, it is believed that the atmosphere and the market generally will be kept thoroughly pure and clean.

The walls are built of Philadelphia brick and light colored (Lockport) stone, the latter being used for trimming and for portions of the ornamentation. The architectural style of the building is what is known as the Lombard. The massive sides and roof are finely symmetrical, and it is claimed that they present some of the finest specimens of mason's and bricklayer's work in existence. On either front, the name of the structure and the date of the commencement of the work are inscribed.

From the walls rises the arch—of iron and slate—which forms the roof. The arch proper springs to an altitude of 135 feet, and extends to within 75 feet of either front. The ends of this archway are domelike in form, and the whole is covered with parti-colored slate, arranged in various figures and designs. The central tower of the building is 236 feet high, and will contain a clock, claimed to be the largest in the world, costing $37,000. The other towers are two on either of the façades, and two on the center line of the sides. All are to be of similar design, and to have dials small in size compared to that on the main tower. Eight elevations, constructed of iron and wood, and built along the crown of the arch, serve as ventilators. The windows are 1,500 in number and are on pivotal centers.

Between the walls and the inner line of pillars which sustain the roof and towers, there are to be ranged between ten and twelve hundred stalls, one half for wholesale and the other for retail dealers in meats and market produce generally, excepting only fish, for which another building is to be constructed. The larger of these stalls will be sixteen feet square, and the smaller, ten by eleven.

In addition to the main structure, which is to be opened to the public early in August, there are to be exterior roadways and a long dock constructed. A line of river steamers are building which, when completed, will be used for the delivery of orders to the shipping in the harbor, and to various predetermined points in Brooklyn and New Jersey, between which and the offices in the main building there will be telegraph lines. In addition to this, suitable positions are to be prepared for market gardeners and produce dealers from Long Island and New Jersey.

The cost of this great market enterprise, together with its docks and steamers, additional buildings, etc., is $3,000,000. Situated in a central position, it will be the great point of supply for the entire city. The structure forms one of the most conspicuous objects in New York, and is visible up and down the river at a distance of several miles.

SPONTANEOUS COMBUSTION.

During an investigation into the causes of a recent fire which broke out in a loaded warehouse in New York, the testimony showed that the fire originated in a case of silk twist, packed in a tight case, with two layers of thick paper and one layer of oilcloth between the inside of the case and the goods, thus wholly excluding the air from without. The goods had evidently been packed while damp, and, therefore, the heat of the weather favored the ignition in the manner supposed.

After the fire was extinguished, an effort was made to have the remainder of the goods removed from the premises, but it was not permitted. In the course of three days, fire was again discovered, and but for the promptitude and efficiency of the firemen, a heavy loss would have resulted. On investigation, it was discovered that this fire also originated in one of the same cases of silk twist, and was beyond question spontaneous.

The Fire Marshal is of opinion that goods packed like the above, no matter whether they be woolen, cotton, hemp or silk, are liable to ignite at any time when the atmosphere favors. In this case, it was shown that the goods had become valueless before the fire, as the process of combustion, which had been going on within the case, had made the silk so rotten that it could be broken with ease. It is believed that many vessels and places of business are destroyed by fire which originates in this manner.

CANAL BOAT TOWING BY ROAD STEAMERS.

We learn from the Troy *Whig* that a trial of Williamson's road engine "Enterprise" was recently made on the tow path of the Erie Canal between Albany and Port Schuyler. The machine is thirteen feet in length by seven feet wide, with an upright boiler. There is a double horizontal engine with two cylinders, each, with a ten inch stroke, enclosed in a box.

There are two driving wheels five feet in diameter, the tires of which are fifteen inches wide, covered with stout india rubber and protected by iron shoes about five inches wide and set about three feet apart. The steering wheel is three feet in diameter, with a tire twelve inches in width. The seat for the engineer is directly in front of the engine, which is managed by a double crank. On either side of this seat are water tanks, and in the rear are two coal bunkers. The machine can be turned on its own ground and works much the same as a velocipede. In hight, the engine is eight feet from the groudd to the top of the boiler. The smoke stack is hinged, so as to be lowered when passing under bridges. The engine is twenty-four horse power. Four boats, three loaded and one light, were hitched to the steamer and were propelled at the rate of about four and a quarter miles an hour. The first mile was made in thirteen minutes. The "Enterprise" is valued at $5,000, and was built about three years ago. It has worked successfully on roads, and the owners are confident of its success in canal boat towing.

The New York *Sun* remarks: "It is said that all who witnessed the trial were fully satisfied of the practicability of this plan of steam towage, and it appears that its economical advantages are very great. The pressure of steam required to enable the engine to draw three barges is ten pounds to the square inch, and that pressure can kept up with a consumption of one hundred and fifty pounds of coal per hour. By a careful comparison of the cost of towing three boats by the road steamer and one boat by horse power from Albany to Buffalo, in which interest, wear and tear, and all contingencies are taken into consideration, it is estimated that by the use of the road steamer the expense of towage would be $133.86 less for each boat than by horse power, while there would be a gain of four days in time. The usual time consumed in a trip between Buffalo and Albany is ten days; the road steamer would easily make it in six.

It may be that some system of water traction may be devised that will give even better results than these; but if not, it seems to have been fully demonstrated that the land tractor will do more than has generally been deemed possible Should it come into general use there can be little doubt that many improvements in its construction will be suggested by experience, and it is also probable that improvements will be introduced in the construction of boats which will reduce the resistance of the water and lessen the wash of the banks. At all events it is safe to assume that horse power on the large canals will eventually be generally superseded by steam, whether land or water traction is adopted as the substitute for the present system."

The steamer alluded to is known as Thompson's patent, in England where it has been brought into very extensive use, and has been subjected to the severest tests. Mr. Williamson is the owner of the patent for this country. An excellent engraving of the invention with full description will be found on page 319, Vol. XXI of the SCIENTIFIC AMERICAN. The capabilities of the engine for canal boat traction are there set forth. That it is well adapted to such a purpose, there can be no question.

LOOK OUT FOR THE METEORS.

On the 10th of August, unless the calculations of our astronomical *savans* fail us, the earth will pass through a ring of meteors—the remains of the comet of 1862—on which date those of our readers who are wide awake may expect a meteoric display of greater or less brilliancy. We give in another column a very interesting summary of Dr. Schellen's statements concerning meteors and the annual shower in August.

BECAUSE I AM SO LAZY.

An esteemed correspondent, who is a good writer, a good investigator, and who knows just what is useful and interesting for readers of the SCIENTIFIC AMERICAN, says that the only reason why he does not more frequently contribute to our columns is "because I am so lazy." This unfortunate condition besets thousands of the most useful people in the world, and in fact greatly hinders the mental and material progress of the human race. But it can be readily overcome, in every individual case, by a determined exercise of the will. We hope that our correspondent will turn over a new leaf, let us hear from him more frequently, and so set a good example to his fellow men in general and to other correspondents of our paper in particular, who are afflicted in the manner he describes.

STEAMSHIP NOTES.

Among the multitudinous shipping of New York harbor there is always occurring more or less of current interest from an industrial or technical standpoint. We cannot afford room for extended mention of all or even much of this, but some of the items are worthy of note, either as indices to commercial or engineering progress or as illustrations of the way things mechanical are sometimes managed. Of the kind last indicated is an incident that recently occurred to the *Great Western*, an English bluff bowed iron freight steamer on her first trip from Bristol to New York, laden with railroad iron. She had a four bladed propeller, but broke three blades on the voyage, and steamed into Gowanus with rather dilapidated propelling machinery. She carried the usual spare propeller, and on her arrival here was taken to the Erie docks to have it put on in the place of the old one. The usual method of removing a screw from its shaft is to drill a line of holes in the boss and then split it open. But in the present instance, the plan was adopted of removing the keys, taking off the nuts, and driving it off. While doing this, the other propeller was being hoisted out of the after hold. While being swung aft, the lashings broke and the ponderous apparatus fell, one blade going through the dock and another breaking off. This left the parties with a one bladed screw on the shaft and a three bladed one in the mud. All things considered, it was thought best to cut off the one blade of the former to correspond with the diminished length of the broken ones thereof, and so the vessel has started back with her jury screw. Had the affair been under Yankee management, possibly the spare screw would not have been broken, but if it had, there would have been ingenuity enough somewhere about the shop to have lengthened the broken blade with a wrought iron plate.

Nevertheless, however much we may justly claim superiority for inventive skill and adaptiveness, we have to make painful mention of British energy, shown in the progress of iron shipbuilding in England, a branch of industry which we hope to see returning to our own shores. For example, the Anchor line, hitherto almost wholly devoted to freight between New York and Glasgow, is about to increase their previously limited passenger traffic by the addition of new and superior steamers. The company is now building, on the Clyde, seven new vessels which, with those now running, will aggregate forty-three.

While upon the subject of steamers, we may speak of a pair of what may be termed historic marine engines, one of which is lying dismantled at the Continental Iron Works, while the other is doing duty in the *James Adger*. These engines were splendid examples of marine steam engineering, and drove the paddlewheels of Commodore Vanderbilt's famous steam yacht the *North Star*, in which he voyaged along the coasts of Europe a score of years ago, and which, if we remember rightly, so alarmed the officials of the port of Civita Vecchia that they ordered her off. These engines were of the vertical beam variety, of about 1,000 horse power each, with sixty inch cylinders and ten feet stroke. The one at the Continental Iron Works has some of the smaller portions missing; the bright parts are painted over, and it will doubtless some time find an obscure use as a stationary motor. The *James Adger*, in which the other was placed when removed from the steam yacht, will be remembered as the vessel employed in laying the first cable between Newfoundland and the mainland.

The Erie Railway is having built at Chester, Pa., a new iron ferry boat, said to be the first ever designed to cross the North river. The following are the dimensions: length between perpendiculars 180 feet, over all 190 feet. Beam over hull, 36 feet. The depth of the hold 13 feet 6 inches. The power will be furnished by a beam engine with a forty six inch cylinder and eleven feet stroke. The diameter of the paddlewheels is 22 feet and their faces 8 feet, 4 inches. The keel instead of being brought up inside the rudder to form a stern, as in the usual method of construction, is extended beyond the ends of the hull and made to form a rudder guard at each of the ends. The plates at the water line have a thickness of nine sixteenths of an inch, increased at the bows to ten sixteenths. The vessel is to have watertight bulkheads up to the main deck, and is to have iron paddle beams, that is, those supporting the guards at the ends of the paddle boxes. The spring beams which support the outboard bearings or ends of the paddle shaft are also of iron. The keelsons are box keelsons of heavy plate iron, arranged to distribute the weight of the engine upon the bottom. The carriage ways on deck are eleven feet in width. The bows are to be protected by extra framing as well as by the increase herein before referred to in the thickness of the plates. A drop return flue boiler will be put in, as is the case with nearly all or every ferry boat in New York waters.

BRIGHT'S DISEASE.

The medical profession generally divide this terrible disease of the kidneys into two forms, the acute and the chronic. The acute form is a simple congestion of the filtering tubes through which the kidneys perform their organic duty. The chronic form occurs when, through neglect or repeated attacks of congestion, granular degeneration, bringing with it structural alteration of the organ, has supervened. The first is curable; the second, though it may be temporarily alleviated, is fatal.

The New York Times publishes some valuable statistics, extending over a period of three years, which show that the disease is more rife in certain sections of this than in other countries, especially in New York city. During the first year covered by these statistics, the ratio of deaths from Bright's disease to the total number of deaths taking place in that period was as 1 to 66, the following year as 1 to 55, and the third year as 1 to 42. Comparing these figures with the ratios in other cities, we find that in Boston it is as 1 to 93, Rochester as 1 to 73; and in the old world, in London as 1 to 89, in Glasgow as 1 to 142, in Paris as 1 to 266.

It is considered that the prevalence of the disease in this country is due to two leading causes, climate and intemperance. The experiments of scientific men have shown that alcohol is partly cast off from the system, unchanged, through the kidneys. When alcohol is taken to excess, the circulation in the kidneys is disturbed and irritation and congestion ensue. Wine and beer, although exercising no beneficial effect on these organs, do not tend invariably to injure them, but rather to induce gout. Few are aware of the immense quantity of alcoholic liquors yearly consumed in New York From the 1st of May 1870 to the 30th of April 1871, 7,440 licenses were issued for the sale of intoxicating liquors, the annual fees on which amounted to $340,141.91. Estimating the population of the city at 1,000,000, there is one liquor saloon for every 134 inhabitants, men, women, and children. If all the liquor saloons in the city could be placed side by side they would extend a distance of 26 miles; or if situated on Broadway, they would reach the whole length of the street from the Battery to the end of the island, covering both sides of the way. Deducting the women and children who do not drink, an enormous quantity of liquor must be annually consumed by the remaining men in order to support 7,440 saloons. Whisky is the ordinary beverage drunk, and its effect on the kidneys is shown above. The records of the New York Hospital show that over fifty per cent of the cases yearly admitted for treatment were caused by intemperance in the use of alcoholic beverages.

The trying nature of our climate is another prolific cause of this disease. It has been demonstrated that the malady is confined to that part of the earth in which the change of seasons is most marked, and where the annual mean temperature of the air ranges between 46° and 57°. In the extreme northern part of this continent, where cold is the normal condition of the atmosphere, and in the Southern States, where heat is the normal condition, the disease is but little known. In Bombay, the proportion of deaths is 1 in 2,800; in New Orleans it is 1 in 329, and in Providence, where cold is more prevalent than in New York, 1 in 173.

The acute form of Bright's disease may be produced by any sudden chill of the system, undue exposure, or rapid change of temperature. Unseasonable changes of garments and rapid checking of perspiration both tend to bring it on. It is also induced to a certain degree by gout or disease of the heart; one or two trades are particularly liable to it, especially those who work in lead.

A careful study of the causes of the disease, together with the consideration by the facts advanced above, show plainly that vast numbers of persons who now suffer and die under it need never have known such an affliction. Care in keeping themselves warmly clad, avoidance of sudden chills and reckless exposure, and the observance of the simple rules of temperance, would have saved hundreds from premature graves.

THE BLACK ROCK BRIDGE OVER THE NIAGARA RIVER.

For three years past, both American and English engineers have worked to lay the foundations for the international bridge for the Grand Trunk and Great Western Railroads, at Black Rock, 4 miles below Buffalo, across the Niagara River, to Canada. The entire length of the structure is to be 1,400 feet, consisting of iron spans resting on eight abutments. The tremendous current in the river which rushes toward the falls has rendered the work one of unexampled difficulty. Caissons and foundations have been sunk and immediately swept away by the torrent, while the river banks below are strewn with the *débris* of wrecks, showing a loss of millions of dollars.

The entire past year has been unsuccessfully devoted to attempts to erect the three middle piers in a depth of from thirty-five to forty feet of water. Mr. Otto Meyer, of New York, who last winter was engaged to prepare and sink coffer dams, has finally, however, succeeded in sinking one dam so that the work on its enclosed pier has been commenced The length of this dam is 125 feet, width 32 feet, and depth, to suit the river, 36 feet. It is sharp on both ends, has double sides, closing at the bottom, forming a space three feet wide around the sides for depositing stones, leaving the center of the dam open for the caisson in which the pier is afterwards built. Eight of the largest anchors and chains from New York and Montreal being secured, one the 13th instant the "ship without a bottom" lay formerly moored six feet above the position of the pier to be built.

Preparations were then made for sinking several hundred tuns of stones, which were thrown in the apertures on the sides of the coffer dam until it had sunk to within eighteen inches of the river bed. A number of barrels had been arranged previously under water and fastened on the woodwork, their buoyancy lifting the structure about two feet; these were all held by one rope, which being cut, caused the barrels to float and submerge the coffer dam deep enough to strike the bottom. Six very heavy iron-pointed posts or "spods," running through sheaths or sockets, three on each side, were hoisted and ready to drop.

Everything being ready on shore and on board, the craft was quietly let "down stream" by her anchors until the engineer on shore signalled "in position." The flag was raised "all right," and with the order "cut away," the barrels floated up, the iron spods dropped, burying themselves in the river bed, and with a light shock the coffer dam rested securely on the bottom of the Niagara, on a deposit of gravel and stones. The gravel and stones have to be removed by a dredge, there ready for the purpose. Below the gravel the solid rock is found on which the piers are to rest.

Three divers from the new Blackfriars Bridge, London, are clearing away the obstructions around the shoeing. They now and then come in contact with pieces of wreck and sunken logs. Until the bridge is finished, the large steam ferry, near Buffalo, continues taking the trains across Lake Erie to the Canada landing.

THE AMANIANS.

The Amania Society is the name of a very flourishing community in Iowa, consisting of fifteen hundred members. They own everything in common, and present an admirable example of the success of the co-operative plan when intelligently administered. These people were formerly known as *Ebenezers*, and lived near Buffalo, N. Y., where they possessed six thousand acres of land. They sold out some fifteen years ago for the sum of five millions of dollars, and moved to Iowa. They are located near Homestead station on the Rock Island and Pacific Railroad, where they own thirty thousand acres of the choicest lands. They have seven distinct settlements, and their affairs are managed by fifteen trustees or fathers. The society is incorporated under State laws. At convenient distances in the settlements they have restaurants, to which the various families resort for food.

The Amanians cling to their good old German ways in dress and general habits, and are not in bondage to the outside world. All have an equal interest in the property; individuals are not allowed anything for their services, or furnished with money for their private use. Each settlement has a store, and all are allowed to draw a certain amount yearly from it for their private wants. A man with a family is allowed from $50 to $70, with $20 for his wife and $10 for each child. This is expected to keep them in clothing and household furniture and supply all their little personal needs. When persons find that the amount appropriated is not sufficient for their actual expenses, the matter can be laid before the Board of Trustees, who will exercise their judgment about making an additional appropriation.

They are a temperate, industrious, religious people, but it is difficult to define their theological views.

A leading principle of the society is that all will get along well together if every one will do right; and in this spirit, everything is managed harmoniously. There is no better theology than this, after all.

It is their custom to meet every day in small companies, about the settlement and in rooms provided for the purpose, to devote half an hour to religious exercises; on Wednesday they meet in the middle of the day; Sundays they all come together in their meeting house for religious services. They do not appear to specially favor marriage, and many of them are living single. When young people wish to marry, they generally receive the consent of the society if they have a reputation for good behavior. If the parties have not succeeded in commending themselves, they are not allowed to marry.

The society owns the whole settlement, and carries on all the business, including that of the lumber yard, store, hotel, etc. They hire considerably on the r farm and in their factories, and claim that even in Iowa, with their 30,000 acres of choice land, farming operations do not pay. About three miles from Homestead, on the Des Moines river, they have a fine water power, flouring and woolen mills, and manufacture an extra quality of yarns and fine flannels in colors. The latter goods stand high in market, and are mostly bought up by a few first class retailers in the large cities. The Amanians have a high reputation for uprightness in all their dealings with the outside world, and are much respected.

[Special Correspondence of the Scientific American.]

LETTER FROM PROFESSOR R. H. THURSTON.

PITTSBURGH, Pa., July 2nd, 1872.

Construction of Iron Bridges. Works of the Keystone Bridge Company. Manufacture of glass ware. New iron works. The coal and iron fields. The Siemens furnace.

At the upper part of the city and near the bank of the Allegheny, are the works of the Keystone Bridge Company, where are made a large number of the finest bridges in the country, and where is now in progress the superstructure of the great St. Louis bridge over the Mississippi. About three hundred men are employed here, and an immense amount of bridge work is turned out. The character of the work done at this factory has secured for the firm a reputation that can hardly be affected by anything that we may say; they are everywhere known as the builders of one of the best forms of bridges in use, and as giving the best possible work.

Many tools in use here were designed especially for their work, and are remarkable both for their ingenuity of design and for their simplicity and effectiveness.

In all the bridges built by this company from their own designs, the bolts and links are "upset" at their ends to take the thread or to form the eye; and this work being done in a powerful machine at a single heat, the utmost economy of material and greatest possible strength of connections are obtained. This is one of the most noticeable peculiarities of their bridge.

THE ST. LOUIS BRIDGE.

The work on the St. Louis bridge is going on finely and is well done. Every piece is carefully tested before it is put into the structure, the fits are well made and a careful inspection finally insures the rejection of any piece faulty in either construction or material. The "skewbacks" are very awkward shapes to forge and are very heavy. They are furnished by several of the larger forges of the country. Those that we examined were made by Lazell, Perkins and Co., of Bridgewater, Mass, and were well executed.

MANUFACTURE OF GLASSWARE

As was remarked in an earlier letter, the glass manufactures of Pittsburgh are very important and extensive. A large number of firms are making window glass, and the remainder are generally making a lime glass of such excellence that it requires an expert to distinguish it from flint. It is sometimes called a flint glass, but is made without lead, which was formerly supposed indispensable in the manufacture of a very clear glass. This lime glass lacks the weight and the metallic ring of true flint glass, but, if well made, compares very favorably with it in other respects.

We visited the establishment of W. A. Hamilton and Co., who were making druggists' prescription bottles of a good quality of lime glass, and we were much interested in watching the operation. The great beehive-shaped furnace, with its ten glowing pots and the forty or fifty men and boys clustering around it and hurrying to and fro, was a novel and entertaining spectacle. The skill displayed by the workman in taking from the liquid mass just the right quantity of melted glass upon the end of his hollow iron rod, in blowing it up to just the proper form and size to fit the mold and the rapidity with which the work was done were equally remarkable. The reheating of the necks of the bottles at the "glory hole" and nicely finishing the lip formed an appropriate side show.

A large proportion of the furnaces are now blown out for repairs. This requires some weeks, and the furnaces being rebuilt, their fires are lighted and are not extinguished until another year brings around again the season for repairs.

The O'Hara Glass Works, conducted by Messrs Jas. B. Lyon and Co., were formerly noted as the makers of the best flint glass manufactured in this country. They are now making a lime glass and are sustaining their reputation by the excellence of the new product. These were among the earliest glass works started in the United States, and were established by General Jas. O'Hara and Major Isaac Craig, in 1795, first making window glass. They began making flint glass in 1802. They have made their reputation, and are sustaining it, like the best iron masters of the place, by steady attention to the choice of the best materials and by doing the best possible work upon them, and then by a thorough system of inspection which prevents any, except perfectly satisfactory products, going into the market. Some of the cut ware made here is very beautiful. This work is done by grinding, the work being held in the hand of the workman; and the skill displayed in cutting the most delicate patterns is frequently perfectly marvelous, and appears the more astonishing when it is noticed that the work is done by no more elaborate apparatus than a little metal wheel, running with emery as the cutting material.

The molds in which the pressed articles are formed are quite remarkable specimens of metal work. They are cast frequently in several pieces in order that the article may be withdrawn from them when made, and the ingenuity displayed in concealing the joints, and the patience and the skill exhibited in giving their inner surface a perfection of polish, are equally notable.

COAL AND IRON DEPOSITS.

An excursion up the Monongahela to McKeesport, where a Boston firm are erecting extensive works in which to make iron tubes, afforded an opportunity to enjoy the beautiful river scenery above Pittsburgh, and some of it was very picturesque, and also to explore one of the coal mines from which comes the Pittsburgh coal. The deposits are usually several feet deep in thickness—averaging perhaps four feet and over—as level as a floor, and at sometimes a considerable hight above the river level. The mining is easily and safely carried on, the veins being of good hight and the rooms having a good floor and roof. The coal is loaded into cars where the bed outcrops on the river bank, and is let down inclined planes and dumped directly into the boats and barges which carry it down to the city or to ports lower down the river. It would be difficult to imagine how Nature could have more conveniently arranged these great deposits for the use of man. None of the expense and danger is incurred here, that attends the sinking of deep shafts and the hoisting of coal to the surface that is generally necessary elsewhere, and there is comparatively little expense for transportation where, as here, the coal is dug from the river bank itself.

There are 15,000 square miles of these coal fields; $15,000,000 of Pittsburgh capital is invested in mining and probably $25,000,000 in transportation, while the total of all interests dependent upon these coal fields cannot fall short of the enormous sum of $100,000,000.

Neither time nor space will admit of a description of our visit to the mill of Schoenberger and Blair, where we saw the best iron sponge—made directly from the ore by Mr. Blair's process—that we have seen anywhere, or to the Superior Mills, where we found probably the best arranged iron railing mill in the United States.

THE SIEMENS FURNACE.

We cannot describe the Siemens furnace that we saw in such common use where high temperature or economy of fuel was desired, nor even refer to the beautiful application, which the inventor has made in it, of well recognized scientific principles and of as well known practical engineering facts; and we must even omit a description of what we saw at the Allegheny observatory, where Professor S. P. Langley has arranged for the regulation of the time of the great Pennsylvania railroad and its branches by electrical clocks connected with his own standard at the observatory—the widest "distribution of time" in the world already, and in a fair way to be much further extended by the energetic astronomer who has commenced the work. The ten days of our visit were quite insufficient to satisfy our desire to thoroughly explore even a small number of the numerous interesting engineering establishments, or to witness the many attractive sights about this great human beehive. We must leave all until our good fortune shall offer an opportunity to revisit this place, and hurry westward and northwestward to see where the iron ores generally used here are obtained and how they are mined, and to see some of the great deposits of copper which feed our markets. R. H. T.

SCIENTIFIC AND PRACTICAL INFORMATION.

FIREWEED FIBER.

A plant, yielding a fiber capable of being spun and woven, called the *epilobium* or fireweed, has lately attracted the attention of manufacturers. It is very similar to the cotton plant, but the seeds are smaller and no ginning is required to separate them from the boll. Wicks, ropes, yarn, and even paper have been made from it, the last named application being especially successful, the product almost equaling the silk made paper of China and Japan. The most valuable characteristic of this plant is stated to be that it will grow in any soil, and it is said to have appeared spontaneously in evergreen covered lands which have been burnt over.

PREPARATION OF SILK.

Silk in its raw state, as spun by the worm, is either white or yellow, of various shades, and is covered with a varnish which gives it a stiffness and a degree of elasticity. For the greater number of purposes to which silk is applied, it must be deprived of this native covering, which has long been considered to be a sort of gum. The operation by which this coloring matter is removed is called scouring, cleansing, or boiling. Nothing agrees so well with the nature of silk and preserves its brilliancy and suppleness so perfectly, so far as European experience goes, as a rapid boil with soap and water. It appears, however, that the Chinese do not employ this method, but something that is preferable. Possibly the superior beauty of their white silk may be owing to the superiority of the raw material.

To produce the China white, a little annatto is mixed with the soap water, so strong as to lather by agitation, and the silk is passed through it. As to the other shades, they have only to be azured more or less with a fine indigo, previously washed in hot water and reduced to powder. After being withdrawn from the bath, the silk is introduced into the sulphuring chamber, if it is to be made use of in the white state. The silks intended for the manufacture of blondes and gauzes are not subjected to the ordinary scouring process, because it is essential in these cases for them to present their natural stiffness. For these the manufacturer selects the raw silk of China, or the whitest raw silk of other countries, which are steeped and then rinsed in a bath of pure water, wrung and exposed to the vapor of water, and then passed through the azure water.

The dull silks, says the *British Trade Journal*, in which the varnish has already undergone some alteration, never acquire a fine white, unless they are exposed to sulphuric acid gas. Exposure to light has also a very great effect in whitening silks, and is had recourse to, it is said, with advantage by the Chinese. The Chinese prepare their silk with a species of white beans, with some wheat flour, common salt, and water in the respective proportions of 5, 5, 6, and 25. It is difficult to discover what chemical action can occur between the decoction and the varnish of raw silk; possibly some acid may be developed wh'ch may soften the gummy matter and facilitate its separation.

A RAILWAY tunnel under the Mississippi river at Memphis, Tenn., is projected, to cost five millions of dollars.

A CUBIC foot of air weighs 523 grains. A cubic foot of water weighs 1,000 ounces.

Business and Personal.

The Charge for Insertion under this head is One Dollar a Line. If the Notices exceed Four Lines, One Dollar and a Half per Line will be charged.

To Excel in Improvement is the leading element of this country, and no other article of labor-saving machinery has equalled in this respect the sewing machine in rapid strides of improvement. Among them the New Wilson Under-Feed Machine may be counted the leading one in this connection. Mr. W. G. Wilson, its inventor, and President of the Company that manufactures it, makes its improvement his constant study. Everything has been added to it that constant experimenting and science could suggest, and it is offered to the public to-day without an equal for family use. Light, rapid, beautiful, durable and perfect, the Wilson holds the leading place among the best sewing machines in use. Salesroom, 707 Broadway, New York; also for sale in all other cities in the United States.

Notes & Queries.

[We present herewith a series of inquiries embracing a variety of topics of greater or less general interest. The questions are simple, it is true, but we prefer to elicit practical answers from our readers.

1.—Fly Paper.—Will any one give me a recipe for making the paper that, if flies alight upon it, they stick to it?—T. W. S.

2.—Strength of Citric Acid.—How much citric acid equals one dozen lemons?—T. W. S.

3.—Patent Leather.—What composition is used for glazing patent leather, and how is it put on?—S. B. D.

4.—White India Rubber.—Is there any way in which india rubber can be made perfectly white, without destroying its elasticity?—M. H. J.

5.—Wire for Sieves.—What kind of a wire sieve will withstand the action of salt and guano? Iron sieves or wire will do only for a few days; then they are rusted out and worthless.—A. C. S.

6.—Teeth in Wheels for Chain Belts.—Will some one inform me of a rule for laying out or spacing off teeth in wheels for chain belts to run on? Different wheels require different spacing for the same chain.—M.

7.—Grinding Lenses.—I wish to make a powerful lens for a microscope. The one I have is not strong enough. Can some one tell me how I can turn and polish the glass?—E. J. O.

8.—Centering Lathes.—How can the conical points of the centers of lathe arbors be ground so that their cross sections shall not vary from circles by more than one ten thousandth part of an inch?—G. M. T.

9.—Japanese Paper Ware.—Can any one tell me how his is made, or put me in the direction to acquire the information?—E. A. W.

10.—Permanent Aniline Ink.—Can I make permanent ink from aniline colors? I dissolved rosaniline in alcohol, and to get the proper tint, I mixed it with water and gum arabic. It is a splendid ink, but after a time it fades and washes away.—C. J.

11.—Anatomical Specimens.—How can I prepare anatomical specimens such as are seen in museums? They look as if they were dried.—G. H. J.

12.—Compressibility of Water.—Supposing you put water under a pressure of one, two, or three atmospheres; in what proportion does the volume of the water decrease and the specific gravity increase?—L. E.

13.—Magnetic Currents.—Will Mr. John Wise the aeronaut, or some other experienced philosopher, inform me whether there is any perceptible variation in the line of magnetic currents, when we rise above the earth, as indicated by the compass?—A. E.

14.—Impure Water.—Owing to the continued drought, the water in the storage lakes supplying our city has become very much reduced, and the water now has an unpleasant taste and smell. What can be put in our pitchers, etc., to purify before using?—J. W. L.

15.—Refrigerators.—Can any one give me general information as to refrigerators? I want to make one on a small scale for family use, and would like to know the materials used and their cost. Would the money required to build an ice house and the labor spent in filling it be as well laid out in a refrigerator?—W. A.

16.—Engine for Gang Plows.—Could not an engine be built of small power with elevating screws for the boiler, to keep it on a level, and so enable it to be controlled for the purpose of breaking prairie with two or more plows in gang?—A. J. D.

17.—Power for Steam Yacht.—I am about to build a screw propeller steam yacht, 30 feet long by 10 feet beam. What is the smallest single engine that can be used to run it 15 miles per hour? What ought the diameter of the screw to be, and how many revolutions ought it to make per minute?—W. S. B.

18.—Drying Fruit.—Can the heat of the sun be stored up to be used during the night? One of the great wants of the West is a cheap and convenient method of drying fruit. Could the sun's and the waste heat from the cooking stove be so stored that little fuel would be required?—E. E. S.

19.—Coffee Used in Dyeing.—I saw a statement some time ago in a paper (now mislaid) that a large quantity of coffee was used in the process of dyeing; it was submitted to a hot bath by which certain properties were extracted, then dried and sold for food. Please inform me how I may distinguish the genuine from the adulterated grain.—S. E. M.

20.—Fetid Water.—The water in my cistern has a very disagreeable odor; what can I do to remedy it? On standing a few hours in an open vessel, a scum rises to the top resembling iron rust in color. The cistern is new and so set as to receive no surface water; the roof is also new and is not shaded by trees. Three ordinary iron pumps which are used constantly are attached. The top is kept covered.—F. D. H.

21.—Tinning Iron.—Can any one, familiar with processes or tinning iron, tell me if glycerin will do for dissolving sal ammoniac or muriatic acid, so that the articles when properly cleaned can be dipped from this preparation into the melted tin? I have used a solution of sal ammoniac in diluted muriatic acid, and dipped the articles in powdered rosin before dipping into the tin. I have also used melted tallow instead of powdered rosin, but I wish to use something which is easy to remove from the articles after tinning, and which will not rust iron nor injure silver plate.—W. S. H.

22.—Priming of Boilers.—I have a boiler ten feet long with 40 two inch flues and a steam dome on top; the engine is estimated at 30 horse power, with 60 pounds of steam. As sure as we let steam get down to 50 pounds, the water gushes out at the safety valve and the cylinder chokes. Can you explain to me the trouble? I contend that the pipe from the engine is too long; it is 12 feet, and consequently I think it gives room for the steam to condense.—S. M. P.

23.—Red Ants.—In your issue of July 20 is an item informing the public that red ants throw out a liquid substance from their bodies. Now tell us, gentlemen, how we can throw out the red ants altogether from our cupboards. How shall we be rid of the red ants themselves? Salt has been said to be an antidote, but a trial of it proves that salt don't scare worth a cent. What will do it?—J. C. W.

Answers to Correspondents.

SPECIAL NOTE.—This column is designed for the general interest and instruction of our readers, not for gratuitous replies to questions of a purely business or personal nature. We will publish such inquiries, however, when paid for as advertisements at 1·00 a line, under the head of "Business and Personal."

ALL reference to back numbers must be by volume and page.

Madras Water Works.—J. S. L.'s Madras *Athenæum* has not come to hand.

A Shower of Pollen.—A. V. P., of Mich., says: We had a heavy shower yesterday, and with the rain there fell a large quantity of the yellow powder, a specimen of which I enclose. The impression here is that it is sulphur. One person claims that it is the sulphur that would have been burnt up had the cloud been accompanied by lightning. I have tried to burn it, but it does not burn; therefore I conclude that it is not sulphur. Thinking you might be interested, I send a sample. Answer: The substance sent is the pollen of a species of pine. A representation of the particles as they look under the microscope may be seen in Wood's "Botany," page 105, Fig. 367. Showers of pollen and *infusoria* are not uncommon, and are always interesting phenomena. The daily papers recently reported the fall of a shower of yellow sulphur at Saratoga Springs during a rain. But it was probably pollen, as above.

Mineral Specimen.—Enclosed I send you a stone, or something else found among hundreds of others in a small stream of water. They are not all alike. It is very hard indeed. Is it of any value? Answer: The specimen is a quartz pebble. No stone which will yield to the file and grindstone can be diamond. Quartz pebbles, when large and perfectly clear, are used by opticians.

Utah Obsidian.—I see a little notice on the African diamond fields. Please tell me whether, in those fields, Mr. Paterson has seen multitudes of the dark colored stones of which I send you herewith a specimen. When I found them (on top ground like gravel, and plentiful), I thought of Brazilian diamond fields. I have also seen them on marly soil and metamorphous clay slate shales and green sandstone, mixed with blendish formations of all colors. I had no time to lose, or I would have spent a week to dig and wash the marly ground. But if there be such stones in the African regions, I have every reason to believe I found similar fields here in Utah.—S. Answer: The specimens sent are of volcanic origin. The black is obsidian or black glass lava, which often occurs in nodules in river sand in Mexico and elsewhere. The other is a known variety. They are interesting to the mineralogist, and are sometimes used for jewelry, but they have an indifferent value. We were not aware that Mr. Paterson found obsidian in the African diamond fields.

Steam and Compressed Air.—To C. B. B.—Compressed air may be used in place of steam to work an engine.

Heating Feed Water for Locomotives.—To A. M.—Several devices have been employed for the purpose; but we cannot say which would be most suitable for your engine.

Boiler Scale, etc.—S. M. P. should consult our advertising columns. As an "Engineer's Guide," Bourne's "Catechism of the Steam Engine" is a good authority, and may be studied by beginners.

Stag Horn Beetle.—I send you a horned bug for inspection, as I see, by the Scientific American, that you write a chapter on such things occasionally. These bugs are numerous towards night.—J. F. W. Answer: The bug is the stag horn beetle or *lucanus dama*. Its larva or caterpillar has a rusty colored head, and lives in rotten wood.

G. H. C., of Conn., sends some mineral specimens, requesting to know their character. We reply: The golden spangles in the quartz rock are pyrites. The black specimen appears to be tourmaline, but the fragment is too small for safe determination.

Solid and Hollow Iron Shafts.—Which would sustain the greater weight, a solid cylinder of iron two inches in diameter and two feet in length, or a hollow cylinder of two inches external and one inch internal diameter of the same length? Each is supposed to rest horizontally, supported at the ends, and the weight rests upon, or is suspended from, the middle of each cylinder.—S. S. Answer: Assuming that average cast iron be the material employed, the quiescent breaking load of a solid cylinder of the specified dimensions would be about 5,040 pounds, while that of a hollow cylinder would hardly exceed 3,308 pounds.

L. S. F., of O.—The issue of June 22d closed the volume of 26 numbers commencing January 1st. The next issue was dated July 6, no intermediate paper being issued.

Printing Questions.—To M. W. Z.—Two of your questions are business enquiries, and could not be definitely answered by us or our correspondents. Every maker will recommend his own goods, and prices vary considerably. Pay a fair price to a reputable manufacturer, and stick to him as long as he sends you the right thing.

Aquarium Cement.—R. C., of Ill., will find a good recipe on page 267 of our Volume XXV.

Metal Lining in Cast Iron Boxes.—Let W. A., query 12, on page 416 of Vol. XXVI., drill a few holes at an angle on the inside of his boxes, partially through the metal. The melted Babbitt metal will run into these holes, forming lugs which will effectually keep the metal in place and be tight until worn out.—S. G. S., of N. Y.

Taking Impressions on Paper.—Query 19, page 10.—Impressions can be taken by coating a piece of thick paper with oil and holding it over the flame of a candle or lamp until it is smoked black. Any kind of oil will answer, though linseed is the best; little oil should be used.—E. E. S., of O.

Force of Falling Bodies.—In view of the difference between the two answers to J. E., query 12, June 8, and of my own ideas, somewhat different from either, I would say: The striking force of a moving body, in whatever direction it moves, is its momentum. Its momentum is the joint result of its quantity of matter and its velocity. The ratio of this momentum to that of other moving bodies is compounded of the ratio of its quantity of matter, which is indicated by its weight, and of its velocity at the instant in question. Its momentum, therefore, is not weight any more than it is space or time, and it cannot be expressed by pounds, in the ordinary sense of that word, any more than by feet or by seconds, nor is it expressed by any two of those terms. To obtain a statement of the momentum of a body for the purpose of comparison: Multiply its weight by its velocity—its number of pounds, for instance, by the number of feet it would move in a second if it should proceed for a second at the rate for the instant in question. The velocity of a falling body is continually accelerated, and it increases not as the space fallen over but as the square root (query? Ed.) of that space. Therefore to multiply the weight by the space fallen over will not give the momentum. The velocity of a falling body at the end of one second of its fall is 32 1-6 feet per second, and it has fallen one half that distance. It will fall 4 1-48 feet in half a second, and its velocity is then 8 1-24 feet in half a second. The velocity at four feet descent is nearly the same, but more exactly is 16·0312 feet per second. This multiplied by the weight in pounds gives the momentum. The general formula is: The square root of (64·38 multiplied by the distance fallen)—the velocity, and the velocity multiplied by the weight—the momentum. So much for determining the momentum. The extent of change produced by the blow of a hammer has a compound relation to the force of the blow and the ability of that which it strikes to resist. Some obstacles resist in proportion not only to intrinsic power, but also to the time during which they exert their resistance, and their resistance to a blow is less as the velocity of the blow is greater. Such are the different attractive, repulsive, and expansive forces, and such is substantially the case where springs are to be bent and where many forms of cohesion are to be overcome. In such cases, the change produced is as the weight multiplied by the square of the velocity, and in case of a falling body is as the weight multiplied by the distance fallen. Other resistances are independent of time, and are in proportion to the space over which the resistance operates. Such is substantially the case of friction. Here the change is as the momentum of the blow. It is so in the case of bodies resisted by the momentum or inertia of other bodies, or, as in greater or less degree is the case of a body moving through liquids, of the particles of bodies. The case of forging with a hammer presents a compound of both these kinds of resistance, varying in their proportions with the nature of materials, degree of heat, and other considerations.—G. M. T.

Recent American and Foreign Patents.

Under this heading we shall publish weekly notes of some of the more prominent home and foreign patents.

Argand Lamp Burner.—Joseph Ravoux, of New York city, assignor to himself and Lucien Knapp, of same place.—This invention relates to improvements in the construction and arrangement of lamp burners which are adapted for the reception of annular wicks, and has for its object to improve the flame by a more perfect system of admission of air. It consists in admitting air at the base of the flame of an argand burner by means of perforations in the concentric tubes which enclose the wick. The upper ends of the tubes are bent apart—the inner one inward and the outer one outward—to allow free passage to the air.

Bird's Nest.—John A. Deknatel, New York city.—This invention furnishes an improved wooden bird nest which is made in two pieces, each turned out of a single piece of wood, and japanned both inside and outside.

Painter's Palette.—The improvement in this invention consists in adjustably attaching to the palette a clamp, by means of which it can be attached to any suitable fixture and thereby rendered more useful in sign and ornamental painting. It may be used without the clamp, in the usual manner. Oscar Le Roy Andrews, of Boston, Mass., is the inventor of this improvement.

Cell Cover for Sewing Machine Table.—George Alfred Wheeler, Worcester, Mass.—This invention consists in arranging a series of cells, in sewing machine or other tables, in a row, and providing them with sliding covers which adjoin and all slide in the same direction when being opened or closed. A spring acts on one end cover, and through that communicates motion to any or all of the others so as to close them.

Automatic Bell Ringing Apparatus for Locomotives.—James S. Lamar, Augusta, Ga.—This invention consists of a crank shaft which is mounted on the locomotive and provided with a friction wheel or a gear wheel in such a manner that it can be readily geared or ungeared with one of the axles. The bell is connected to the crank by a cord and is rung automatically when the locomotive is in motion; thus saving the labor of ringing it by hand, which is considerable in large towns where the distances along which the bell is required to be rung are long.

Saw Guide.—James Arthur, Anoka, Minn.—This invention produces a saw guide which can have its jaws adjusted while the saw is in operation without exposing the operator's hands to dangerous contact with it, and in which, furthermore, either jaw can be adjusted independently of the other.

Wheel Plow.—Guy Tozer, Jackson, Mo.—This invention furnishes an improved plow which is designed more particularly for tight clay soils, but which may be used with advantage in other soils. It is so constructed as to open the bottom of the furrow so as to drain off surplus water from the roots of the grain and prevent them being chilled by it in cold weather or scalded in warm.

Rotary Steam Engine.—George H. Whitcher, South Brooklyn, N. Y.—This invention furnishes an improved steam engine, which is so constructed as to give a constant and steady motion, and which may also be used as a pump, if desired; it consists in combining two steam cylinders with two other smaller cylinders eccentrically shafted within them, and a horizontal piston. The construction, which would not be understood from a verbal explanation alone, insures the rotation of the inner cylinders and their shafts when steam is admitted.

Portable House.—Harvey W. Forman, Centralia, Kan.—The invention relates to an improvement in that class of house whose parts are detachable, in order to admit of being packed and transported conveniently and cheaply from one place to another. It consists in a new arrangement of parts with a view to increased lightness, strength and durability of the structure.

Hatchway Guards.—Edward H. Ball, of New York city.—This invention furnishes an improved guard for elevator and other hatchways which is so constructed as to be raised by weights automatically into position as the hatch is opened. When shut down, it is secured in place by a spring bolt which is released by the rising hatch.

Lifting Jack.—Charles Maynard, of North Topeka, Kas.—The object of this invention is to render more useful and effective the ordinary lifting jack for wagons and other wheeled vehicles; and it consists in connecting the parts so as to cheapen, simplify, and improve the construction without involving any material alteration in form.

Heddle Connection for Looms.—Thomas K. McIntyre, of Warner, N. H.—In this invention, metal straps are used for connecting the various parts of looms instead of the ordinary leather ones. They are cheaper and more durable. The strap is made in two toothed pieces which are joined by a sleeve which is drawn over the parts where the teeth mesh. By this construction its length is easily adjustable.

Milk Strainer.—Richard G. Kendall, of Fairweather, Ill.—This invention relates to a useful improvement in milk straining buckets or pails, and consists in a new mode of making the strainers detachable from the bucket, so that they may be changed or removed with facility. The strainers are made with a grooved frame which slides on to lips on the spout of the bucket.

Fence.—Israel L. Landis, Lancaster, Pa.—This invention is an improvement on a fence patented by S. H. Rose, September 25, 1866, and it consists in combining, with the pins that pass horizontally through the posts and support the panels in an upright position, other pins that pass transversely through bottom strips of the panels and prevent the panels being raised by small stock in its effort to pass under the same.

Fruit Dryer.—Judson Allen, of Everett, Mo.—In this improved dryer an air chamber is arranged below the drying chamber and above the heating chamber, which receives air from the sides of the case, and delivers it through its perforated vertical side walls to the drying chamber above, so as to prevent too much heat radiating through the bottom plate. At each corner of the dryer is a hot air conductor, which can be adjusted either to turn the heat into the dryer, or to allow it to escape through the top. On the front of each conductor are deflecting plates which cause an equal distribution of the heat in the drying chamber.

Medical Compound for Heart Disease.—Michael D. Britten, of Eaton, Mich.—This invention relates to a new and useful improvement in the curative art; and consists in a compound composed of the pitch of *pinus origida* beech bark and the heart of the iron-wood tree, all steeped in alcohol moderately for several hours.

Fruit Crate.—Elijah B. Georgia, Clifton Station, Va.—The invention consists in a fruit and vegetable crate consisting of top and bottom frame slatted and connected by slats nailed to their inner sides.

Adjustable Stand.—Matthews Stahn, Baltimore, Md.—This invention consists in a triangular stand for photographer's use, formed in two hollow sections, one of which is raised or lowered within the other by means of a windlass, and held by clamp screws.

Water Wheel.—John Frank, Chester, O.—The invention consists in adjusting a water wheel vertically by means of slotted uprights, a tenoned bridge tree, and an adjustable wedge support; in attaching the buckets by mortise and tenon to a central hub and then holding it by a single band and a bolt to each bucket; in giving a gradual curve, then a quick rise at the end, and then a relative hight and width to the buckets; and finally, in making the cup in sections, detachably held by cross rods on the inside and bands on the outside.

CULTIVATOR.—Frederick W. Tolley, of Coxsackie, N. Y., assignor to himself and Albert V. D. Collier, of same place.—This invention furnishes an improved cultivator, which is so constructed that it may be conveniently transported from place to place. It is provided with wheels which stand a little above the surface of the ground when in working position, and by the aid of which it is moved over obstructions. The frame also admits of being turned over forward so as to rest on these wheels, in which position the cultivator can be drawn about with the same facility as a cart.

DRAFT REGULATOR.—Joseph Woodruff, of Rahway, N. J.—This invention relates to a new apparatus for regulating the draft of the furnace in accordance with the steam pressure of a boiler, so that the furnace heat is automatically reduced whenever the pressure exceeds a given degree, and is augmented when the pressure falls below a desired point. It consists in an arrangement of flexible diaphragms, connected with a vertical stem, which when adjusted up and down, by the action of steam on the diaphragms, causes vibrations in a weighted lever, and the consequent automatic adjustment of a damper which is connected with it.

BRAID GUIDE FOR SEWING MACHINE.—Eddy T. Thomas, of Boston, Mass.—This invention consists in the arrangement, within a sloping or diagonal slot in the presser foot, of a cylindrical guide piece, which is provided with a circumferential V-shaped groove and adapted to be turned or rotated on its axis, so that the passage for the braid may be enlarged or contracted in width to accommodate wide or narrow braids.

ANIMAL TRAP.—George F. Lampkin, of Georgetown, Ky., assignor to himself and James Y. Kelley, of same place.—This invention furnishes an improved trap for catching rats and other animals, which is so constructed as to catch any number of animals without frightening the others, or leaving any scent in the trap to warn them of the danger.

BED BOTTOM.—Henry B. Ramsey, of Rockville, Ind., assignor to himself and Wells C. McCool, of Guthrie Center, Iowa.—This invention relates to a new arrangement of the supporting springs and cross bars of a bed bottom. The slats are, by screws or nails, firmly secured to the cross bars, and strips of leather or rubber are interposed between them to prevent wear and squeaking. To the middle of each cross bar is secured, at the under side, the middle of a supporting spring, the ends of which are free and project downwardly. The springs rest on the bedstead rails and are padded with rubber or leather. In order to strengthen the springs and give a more firm support to the cross bars, cushions of rubber, or spiral springs, are placed between.

GRATER.—Josiah A. Hard, of Lawrence, Kansas.—This invention relates to a new grater for nutmegs, horse radish, and other similar purposes; and consists in the use of a rotary grating cylinder contained within a stationary cylinder, and hung on a frame in such a manner that it can be withdrawn from the outer cylinder and detached from the frame whenever desired. See advertisement on another page.

RATCHET.—Thomas Searls, of Pottstown, Pa.—This invention furnishes an improved ratchet, which is so constructed that it may be readily adjusted to revolve the shaft in either direction, or to let the shaft stand still while the ratchet continues to work. It consists in a toothed wheel which is attached to the shaft, and two pawls which are placed on opposite sides of the wheel and turned in opposite directions. By the aid of springs and other appropriate mechanism, the pawls, or either of them, are made to engage with the wheel or not, as required.

BRICK MACHINE.—Henry Bulmer and Charles Sheppard, of Montreal, Canada.—This invention relates to an attachment to brick machines, by the operation of which the clay is pressed into the mold at suitable pressure and the molds, when filled, are pushed out from below the drum without manual labor. The machine may be worked by steam, water, or horse power, and will, with the same attendance, manufacture a greater number of bricks than the devices for the same purpose now in use.

MACHINE FOR THROATING SPOKES.—Joseph B. Stanley and Matthew D. Smith, of Tough Kenamon, Pa.—This invention relates to a new machine for throating the spokes of wagon or carriage wheels, facing the same, and tapering them toward the outer ends. It consists in the arrangement of an eccentric support for the spoke while in contact with the cutter, so that the cut may be tapering to make the spoke thinner on the face than at the back. The invention further combines various other details of improvement.

THILL COUPLING.—James T. Hards, of Geneva, Ill.—This invention furnishes an improved thill coupling which may be coupled and uncoupled without trouble. The clip and yoke of the coupling are constructed and attached to the axle in the ordinary manner. Upon the forward arm of the clip, above the end of the yoke, is formed a chamber having a rectangular hole formed through it to serve as a socket for the head of the thill iron. The front bar of the chamber is concaved upon its inner surface. The head of the thill iron is made convex upon its forward side when in working position, so as to fit into and rest against the concaved surface of the chamber and support the draft strain. The head of the thill iron is slotted transversely upon its rear side to receive a pin which passes through the side bars of the socket, and is riveted or otherwise secured to it. The pin serves as a hinge to the thill iron, and also to support the strain in holding back. By this construction the thill irons can be readily raised from the socket, but the coupling cannot become uncoupled when the thills are in any position in which they can possibly be while attached to a horse.

MITER BOX.—Andrew Clayton Hall, of Carbondale, Pa.—This invention relates to a new form of saw guides, and to a new combination of the same with the posts and swivel bar of a miter box, which greatly improves the general arrangement of the parts. It consists, first, in making the guides laterally adjustable on vertical slides, so that they can be fitted to any thickness of saw blades; and, second, in combining said guides and slides with two slotted posts, of which one constitutes the pivot of the horizontal bar to which the other is secured.

SAD IRON STAND.—George O. Ballou, of Fall River, Mass.—This invention consists of a sad iron stand made of metal or other suitable substance, the top of which is recessed so as to form a receptacle for an appropriate polishing composition; thereby forming a convenient and serviceable article for the laundress.

MACHINE FOR MAKING BARRELS.—William Brown, of St. Louis, Mo.—This invention relates to improvements in machines for crozing, chamfering, and levelling or trimming off the ends of the staves of barrels; and it consists in a hollow shaft which carries a radially grooved disk, in the grooves of which the sliding tool stocks are mounted, and a second shaft which works within the first and carries a cam arrangement for giving radial motion to the tool stocks. The latter is geared to the wheel that drives the hollow shaft by a wheel having a different number of teeth, so that the speed of the two are unequal. In this way the first shaft operates the tools and the second moves them to or away from their work, so that they may be easily inserted in or drawn out from the barrel. The machine is provided with a sliding table which carries the tools, and a ring in which the barrel is held.

STEAM BOILER.—James N. Paxman and Henry M. Davy, of Colchester, England.—In this invention an annular vertical boiler surrounds the fire box and vertical flue; and bent water tubes are placed in the fire box, which connect at their lower ends with the sides of the annulus and at the upper with the crown sheet. The improvement in these tubes consists in making them taper or contracted at their lower bent ends, where the colder water enters, so as to impart a scouring action to the current and prevent incrustation. They may also be provided with ribbed plugs so as to further lessen the passage and increase the effect. Deflectors are placed in their upper ends to direct the water laterally and downward, and various other improvements are made in the boiler generally.

CURTAIN FIXTURE.—Stewart Hartshorn, of New York city.—The object of this invention is to simplify, cheapen, and improve the stop motion of spring curtain fixtures, and it consists in attaching to one end of the roller a cap, or case, in which are placed several loose pawls, so arranged and of such form as to fall against and engage with recesses in the spindle of the roller by their own gravity. When quick motion is given to the roller, either in letting up or pulling down the curtain, centrifugal force throws the pawls outward from the spindle, but upon slackening the motion one or the other of them drops and stops the curtain.

STEREOTYPE BLOCK.—Robert P. Tickle, of London, England, assignor to George Holt Mason, of same place.—This invention relates to an improved means of mounting and securing stereotype and other plates in a printing press, whereby a great saving of time and labor is effected, inasmuch as the the use of the ordinary chases, leads, and other pieces, technically called furniture, is dispensed with. It consists in providing the bed with parallel oblique bars which are of T form in cross section, and to which are attached the plates by screw clips and nuts, or their equivalents.

SOLDERING ROD.—William M. Neill, of Bridgeport, Conn., assignor to himself and S. D. Roberts, of New York city.—This invention relates to soldering tin roofs more especially, but is adapted to other purposes. Tin roofs are generally soldered with resin and solder separate, and the resin frequently becomes displaced by jarring, or is blown away by the wind. These difficulties are overcome by making a tube of the solder and filling the same with resin, or by combining the resin with a rod of solder, in such a manner that both are applied at one time and in proper proportions.

CHAIR.—Randolph S. Mains, of New York city.—This invention consists in an adjustable chair of very ingenious construction which can hardly be explained verbally. It admits of being made to assume seventeen or more different forms, and of being put to nearly as many different uses. From the simple chair, it can be converted into several forms of easy and invalid chairs and sofas, and parts of the apparatus are so contrived as to act as tables, reading desks, etc., in combination therewith.

THILL COUPLING.—John H. Morgan, of Lebanon, Ind.—This invention furnishes an improved coupling for thills or shafts, tongues, etc., which is so constructed that, while coupling the thills or tongue securely, it may be easily and quickly uncoupled. A yoke, the forward end of which consists of two projecting lugs, is fastened by clips to the axle. The lugs have inclined slots formed in them, extending downward and forward from their upper edges, to receive a bolt which is attached to eyes formed upon the rear ends of the branches of the thill iron. The forward parts of the thill iron are secured to the rear end of the thill, and the rear parts are branched to receive the lugs between them. By this construction the bolt can be readily passed into and out of the inclined slots in the lugs. The fastening or unfastening is effected by means of a hook which is pivoted between the lugs and which falls over the bolt so as to hold it securely in place.

DOUGHNUT CUTTER.—John F. Blondel, of Thomaston, Me.—This invention furnishes an improved device for removing the dough from the cutter tube automatically; it consists in the combination of a spring and follower with the center tube in such a manner that the spring is compressed when the dough is cut, and the dough in the tube pushed out by the recoil of the spring.

PAPER PULP MACHINE.—John M. Burghardt, of Great Barrington, and Frederick Burghardt, of Curtisville, Mass.—The object of this invention is to provide improved means for reducing wood to pulp for the manufacture of paper; and it consists more particularly of a revolving grinding emery wheel which is hung on a horizontal shaft and surrounded by a curb or casing. The casing is provided with apertures on each side of the grinding wheel to admit the wooden blocks which are to be reduced, and which are automatically fed up to the wheel by an ingenious arrangement of mechanism.

IRONING BOARD.—Leander N. Vallett, of Providence, R. I.—This invention relates to a new device for fastening ironing boards to walls or upright standards and for bracing them, so that they will be securely held in place. It consists in a new form of sockets on the end of the board, and in their combination with hooks on the wall for entering the sockets; and also in a novel arrangement of ears under the board for receiving the projecting tenons of the supporting brace.

HARVESTER DROPPER.—Richard A. Roberts, of Salisbury, Mo.—This invention furnishes an improved side dropper for harvesters, which is simple in construction, light, and not liable to get out of order; it drops the grain in gavels at the side of the machine, so as to be entirely out of the way when making the next round.

BRIDLE BIT.—James Burns, of East Topham, Vt.—The object of this invention is to provide means for rendering the common bridle bit effective for controlling restive, vicious, and runaway horses, and it consists in attaching to one or both of the parts of the bit one or more lugs or staples, which bear against the roots of the tongue or other sensitive part of the mouth when the reins are drawn.

CIGAR MACHINE.—Webster H. Pease, of Fulton, Wis.—This invention relates to a new machine which prepares the tobacco to be used as a filler for cigars by rolling it into shape and binding and cutting it with great rapidity. It consists in a new arrangement with rotary knives for cutting the filler leaves into strips; of grooved rollers for collecting them into cylindrical form, and of a winding wheel for tying the filler with string or applying a wrapper. It also consists in the combination, with the foregoing, of an endless apron on which the filler leaves are fed along in the desired manner, and in the arrangement of rotary cutters for cutting the completed cigars or fillers in proper lengths.

MATTRESS AND CUSHION TACKER.—Thomas A. Watson and Alfred H. Phillips, of Brenham, Texas.—This invention was alluded to in our article describing the mattress stuffer invented by the same parties, at page 350, Vol. XXVI. It is an apparatus for finishing the mattress after it leaves the stuffer, and consists in a simple arrangement of a slotted sliding table (on which the mattress is laid) and gangs of needles which are made to pass through the mattress and the slots. The needles are then threaded in eyes near their points, and upon and by their withdrawal the tacking and stuffing is accomplished.

RAILWAY CAR TRUCK.—Jose S. Camacho, of Habana, Cuba.—This invention has for its object to insure the proper position of wheels of railroad cars while running on curves, and consists in the arrangement of a swivel frame holding two pairs of wheels in such a manner that each wheel can turn independently of the others.

TRACTION ENGINE.—Louis A. Herrmann, of Paris, France.—The principal feature in this invention consists in propelling the engine by four legs and feet, which are made to move, two and two, in the manner of a four footed animal. They are worked by steam power, and are compelled to sustain the weight of the engine in making the steps so as to cause the necessary adhesion of the foot to the ground. The invention is very comprehensive and includes all the parts necessary to a highly efficient and manageable traction engine.

HAT SHADE.—Marcus L. Battle, of Bainbridge, Georgia.—This invention relates to an improvement in shades designed to form extensions of the brim of a hat. The shade is made of linen, or any other suitable material and is kept distended by a circular steel hoop secured in its outer edge. It is made double, the upper part having a central aperture to receive the crown of the hat, and the lower part being made with a somewhat larger opening. An elastic cord is secured to each part around its inner edge and thus the tension of these, as opposed to the hoop, keeps the shade distended so as to be flat and smooth. The cord in the upper part serves also to keep the shade in position by embracing the crown of the hat.

LEGS FOR TABLES AND STANDS.—George H. Bell, of New York city.—This invention relates to a new construction of the bent legs used for the support of tables, chairs, etc. The leg is made of several layers of veneer glued together, and is bent to the requisite form and carved or ornamented in a suitable manner. Thus made, the legs are very strong and durable, the glued veneers holding shape far better than single pieces.

SPEAKING TUBE ANNUNCIATOR.—Robert May, New York city.—This invention relates to an improved mechanism, which, when connected with a speaking tube, constitutes an index and an annunciator to call an attendant and show at which tube response is required. It consists in combining a drop ball or swinging plate, which is set in motion by air blown through the speaking tube, with a balanced lever, which latter serves to establish, when moved by the displacement of said ball or plate, an electric circuit by means of which the annunciator is actuated.

PILE REMEDY.—Lizzie E. Brady, Gatesville, N. C., assignor to herself, John Brady, and Annesia Langston, same place.—This invention provides a medical compound for the cure of the disease named, composed of one fourth of an ounce of tincture of opium to three fourths of an ounce of water and half an ounce of pure gum arabic.

[OFFICIAL.]

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DESIGNS PATENTED.

5,980.—SPICE CASTER.—G. S. Adams, New York city.
5,981.—NETTED FABRICS.—W. Dexter, Brooklyn, N. Y.
5,982.—TYPE.—C. C. Hine, Newark, N. J.
5,983.—RUBBER MAT.—L. L. Hyatt, New Brunswick, N. J.
5,984.—TYPE.—A. Little, New York city.
5,985.—SODA WATER APPARATUS.—G. F. Meacham, Newton, Mass.

TRADE MARKS REGISTERED.

890.—EMERY.—Baeder, Adamson & Co., Philadelphia, Pa.
891.—COFFEE, SPICES, ETC.—Chase & Co., Buffalo, N. Y.
892.—CORN MILLS.—H. D. Coleman, New Orleans, La.
893.—MEDICINE.—W. B. Douglass & Co., Washington, D. C.
894.—HAMS.—Evans, Lippincott & Cunningham, Cincinnati, O.
895.—FLOUR.—Farber, McPike & Co., Alton, Ill.
896.—MEDICINE.—J. and C. Maguire, St. Louis, Mo.
897.—SHIRTS.—Marley & Cook, Newark, N. J.
898.—BITTERS.—J. Niederlander & Co., Columbus, O.
899.—GINGER TONIC BITTERS.—W. M. Tileston, New York city.
900.—CIGARS.—E. W. Woodbury, New York city.

APPLICATIONS FOR EXTENSIONS.

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

16,814.—CIRCULAR SAW MACHINE.—C. P. S. Wardwell. Sept. 25, 1872.
21,734.—WATER CLOSET.—F. H. Bartholomew. Sept. 25, 1872.
21,762.—KNITTING MACHINE.—J. K. and E. E. Kilbourn. Sept. 25, 1872.
21,798.—SPELLING BLOCKS.—S. L. Hill. September 25, 1872.
21,846.—PLOW.—W. Reaney. October 2, 1872.

EXTENSIONS GRANTED.

20,960.—BOOT HEEL SHAVER.—V. Snell.
20,979.—ELECTROMAGNETIC ALARM.—W. Whiting.
21,026.—CAR COUPLING.—B. E. Sampson.

EXTENSION REFUSED.

20,865.—ROCKING CHAIR.—I. P. C 'Ter.

Inventions Patented in England by Americans.

[Compiled from the Commissioners of Patents' Journal.]
From July 6 to July 11, 1872, inclusive.

BEATING CARPETS.—A. A. Schlesinger, San Francisco, Cal.
BLOWPIPE, ETC.—J. Cook (of New York city), Liverpool, England.
CARPET PAD.—E. H. Bailey, Brooklyn, N. Y.
COTTON TIE.—J. E. Aiken, New Orleans, La., C. Swett, Copiah, Miss.
FIRE EXTINGUISHER.—J. J. Walton, Newark, N. J.
PAVEMENT.—C. W. M. Smith, San Francisco, Cal.
PRINTING TELEGRAPH.—M. F. Wessman, Brooklyn, N. Y.
PRINTING TELEGRAPH.—R. H. Gallaher, New York city.
PRINTING TELEGRAPH.—R. H. Gallaher, New York city.
SHIRT.—O. H. Keep, New York city.
STANDING RIGGING.—H. E. Townsend (of Boston, Mass.), London, England.
WELDING ALLOYS.—G. R. Meneely, West Troy, N. Y.

NEW BOOKS AND PUBLICATIONS.

THE ALDINE. James Sutton & Co. Publishers, 23 Liberty Street. New York. Subscription $5.00 a year, with oil chromo.

As usual, the *Aldine* is repletes with admirable engravings and light graceful literature. The August number has, for a frontispiece, a "Winter Sketch," by George H. Smillie, exquisitely designed and engraved; and there are contributions from Julian Hawthorne, E. C. Stedman, and others.

NATURE'S LAWS IN HUMAN LIFE. Boston: William White & Co. 308 pp. 8vo. Price $1.50. By the Author of the "Vital Magnetic Cure."

This is an exposition of Spiritualism, containing the various opinions of extremists, *pro* and *con*, together with the personal experiences of the author.

THE ECLECTIC MAGAZINE. New York: E. R. Pelton, Publisher. $5.00 a year.

The August number opens with a handsome steel portrait of George William Curtis, and presents its unusual excellent table of contents, mainly derived from the English periodicals.

VAN NOSTRAND'S ECLECTIC ENGINEERING MAGAZINE. Published by D. Van Nostrand, 23 Murray St., New York. $5.00 a year.

The August number contains Captain Ericsson's paper on "Radiation at Different Temperatures;" a valuable article on "Narrow Gage Wooden Railways;" another on the "Effect of Torpedoes on Naval Construction;" "Economical Marine Engines;" the "Use of the Magnetic Needle in Mineral Explorations on Lake Superior;" besides various other generally valuable selections on engineering and kindred topics.

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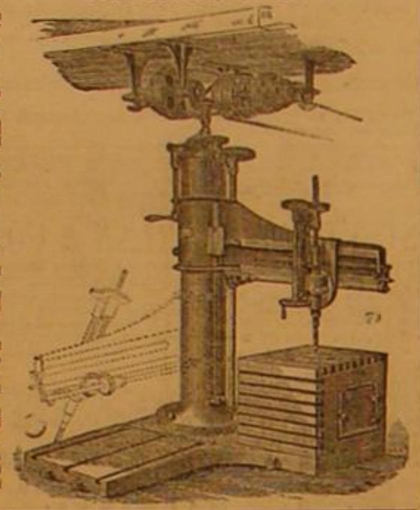

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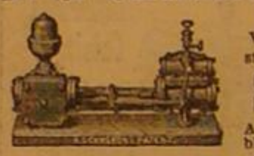

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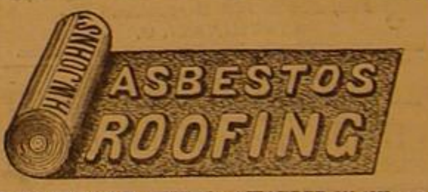

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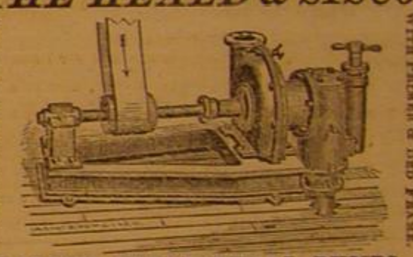

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SCIENTIFIC AMERICAN

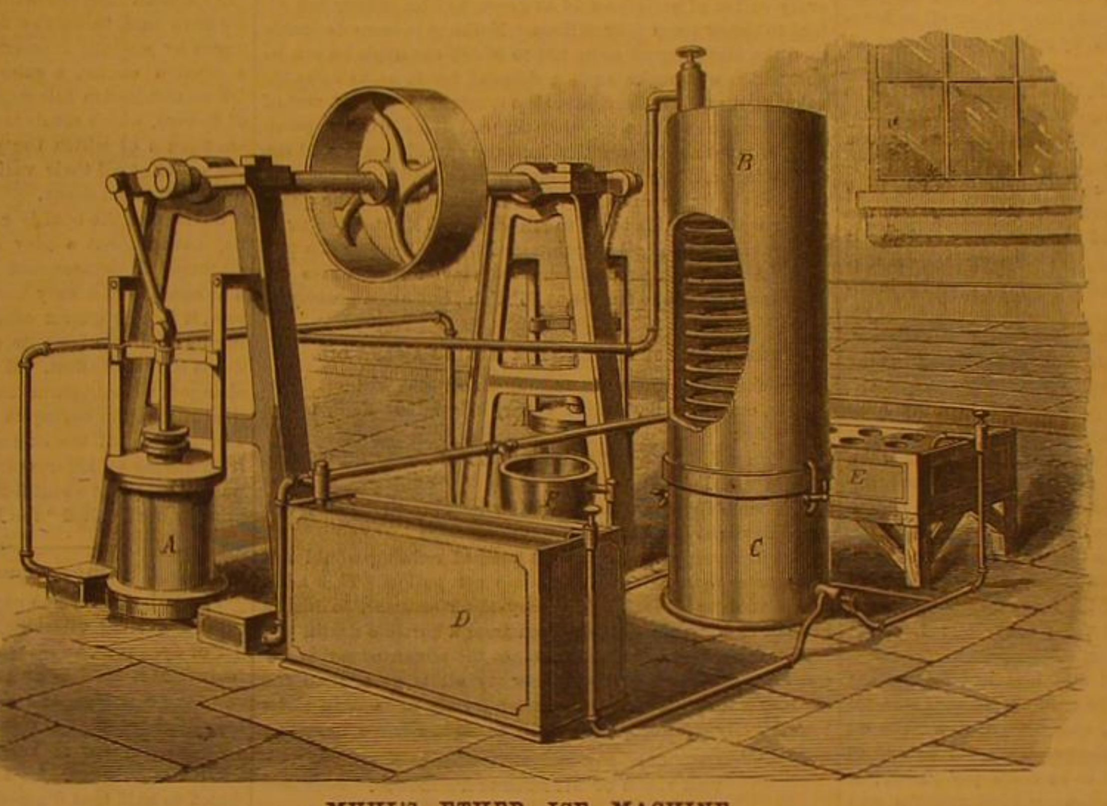
A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

Vol. XXVII.—No. 7. [NEW SERIES.] | NEW YORK, AUGUST 17, 1872. | [$3 per Annum. [IN ADVANCE.]

ETHER ICE MACHINE.

The improved ice making machine, illustrated in our engravings, is the invention of Mr. A. Mühl, of San Antonio, Texas, and was patented through the Scientific American Patent Agency, November 28, 1871. The apparatus is of the class in which volatile fluids, such as ether, are used for the freezing liquid, and in which the vaporized ether is again liquefied by means of condensation and pressure, and the improvements made are of a character to insure a ready, sure, and economical reduction of the vapor to a liquid state before it is allowed to reach the freezing vessels.

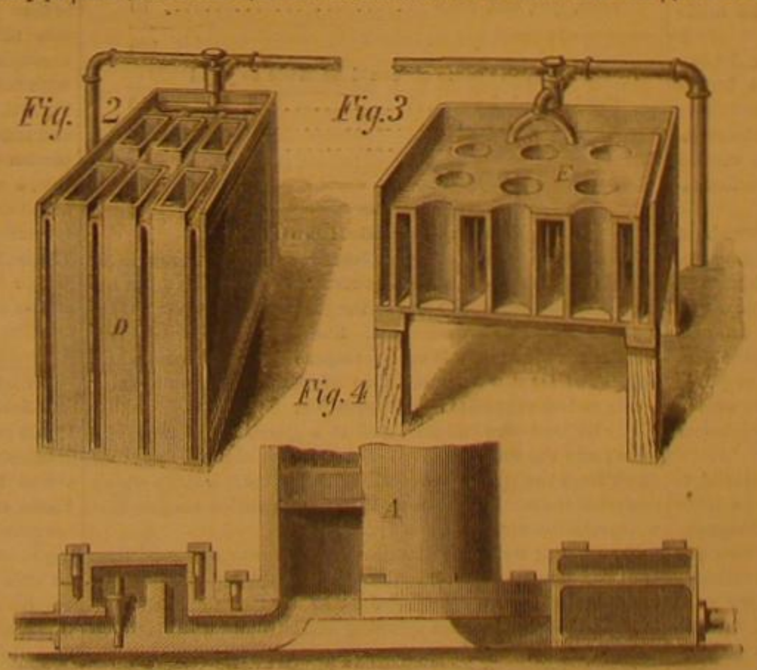
Fig. 1 gives a perspective view of the machine. At A are the pumps, which are connected with the driving shaft as shown. B is the condenser, which is broken away at the side in the engraving, in order to show the form of the contained worm. The latter communicates, through the pipe seen on the outer casing of the condenser, with the reservoir, C, below. At D, E, and F, are freezing vessels of various forms. The system of pipe connections between the pumps, condenser, and freezing vessels, by which the volatile fluid is kept circulating through the machine, will be understood by inspecting the engraving. The general operation may be described in a few words. Each pump, as its piston rises, draws in from the freezing vessels the ether which has been vaporized by the heat abstracted from the water or other liquids contained in them; as its piston descends, the vapor of the ether is forced into the worm of the condenser and thence into the reservoir, C, into which it falls in a liquid state; it then passes into the freezing vessels, where it is reconverted into vapor, and from them back into the pumps. The pumps have their induction pipes provided with suction valves (see Fig. 4) and their eduction pipes with exhaust valves.



MUHL'S ETHER ICE MACHINE.

It has been customary to make the worm, which is the principal agent by which the vapor is reduced to a liquid, of a pipe of uniform cross section throughout, but this method was objectionable for the following reasons: If a small pipe was used, it was difficult to force the vapor through fast enough, and an unnecessary amount of power was consumed without effect. On the other hand, if the pipe was of the customary size—from one to two inches in diameter—only the layer of vapor immediately in contact, or nearly so, with its sides, was condensed, and the remaining uncondensed portion was discharged into the reservoir, there to be condensed at the expense of considerable power; or was, perhaps, caused to enter the freezing vessel before condensation was effected, and thereby defeat the object intended.

To obviate these difficulties the inventor uses, in this machine, a worm composed of pipes of several different sizes. Several coils of the large pipe, say of one inch and a half in diameter, are used at the point of entry, and are followed by coils of inch, half inch, and quarter inch, by the last of which the exit is made. By this means no resistance is offered to the passage of the vapor at its commencement, and all parts of its body are afterwards brought sufficiently near the sides of the pipe to insure its condensation before the reservoir is entered. Thus power is saved, and the full effect of the freezing apparatus developed.



The condenser, B, is kept full of running water while the machine is in operation, and the action of the latter is regulated and kept under complete control by the aid of various valves and stop cocks attached thereto.

Three kinds of freezing vessels are shown in our engravings. The one at D, shown in detail in Fig. 2, contains cans, in which blocks of ice are produced. These cans stand between hollow metallic partitions, through which the freezer passes. The vessel, E, seen also in Fig. 3, is provided with receptacles for holding bottles or other small vessels, around which the other circulates. That at F is of conical form and has double walls for the passage of the ether. Within it may be placed a vessel containing the article to be frozen.

The machine has been in successful operation in Texas since 1867. Further information on the subject may be obtained by addressing E. Fivary, P. O. Box 350, New Orleans, La., or C. L. Gogia, 87 Custom House street, same city, or A. Mühl, Waco, Texas.

Separating Silver from Copper.

R. Palm prepared the nitrate of silver from small Russian coins containing a considerable percentage of copper. A rapid separation was necessary, and the utensils generally employed in effecting this separation of the two metals were wanting. Under these circumstances he restored to concentrated nitric acid, the different behavior of the two metals to the acid producing the separation.

The solution of the coin is evaporated to the consistency of a thick, oily liquid; it is then mixed with concentrated nitric acid (free from hydrochloric acid), when the silver salt will be precipitated in a crystalline form, while the copper remains in solution. The precipitate, which still has a bluelsh cast from adhering copper, is easily freed from it by washing it three or four times with concentrated nitric acid; it becomes then perfectly white and free from copper. The acid which still adheres to the silver salt evaporates by drying. It is absolutely necessary that the solution of the two metals is only evaporated to the oily consistency; for when we evaporate to dryness, the copper will adhere so firmly to the silver that it can only be separated from it with difficulty. The more concentrated the nitric acid, the more complete will be the precipitation; but even a specific gravity of 1·250 will answer. For every pa.. of solution of the metals, three to four parts of nitric acid are necessary.

Flower Gardens and Pleasure Grounds.

A writer in *The American Farmer*, a first class agricultural monthly, published by Samuel Sands & Sons, Baltimore, Md., says: "Unfortunately for those who delight in rural summer retreats, and take delight in Flora's offerings, the months of July and August are meager in trees and shrubs which produce flowers at that period; this lack does not arise because the necessary articles are unattainable, but rather that attention has not been drawn to them; and to this end we will here enumerate a few, promising to enlarge the list at no very distant date. As shrubs we have, first, the *Clethora utnifolia*, whose flowers are white and fragrant; hight of bush, 4 to 6 feet. Then there is the free growing *Vitex Agnus Castus*, better known as the chaste tree, and of which there are two varieties, one of them blue and the other pale lilac, both of which should be in every collection of any pretension. *Hydrangea quercifolia* has large branches of greenish white flowers, and lobed leaves like those of an oak, and is a conspicuous and well marked article; and so is its congener *H. nivea*, with white flowers and entire leaves, which are green on the upper and snow white on the under surface; both attain a hight of 3 to 6 feet. *Buddlea Lindleyana*, which grows from 6 to 8 feet high, is a very desirable bush, and should be more planted, producing, as it does, during most of the summer months, its long pendant spikes of blue flowers which come admirably into play when making up a table bouquet; to this we would add another beauty, namely, *Ceanothus thyrsiflora*, bearing flowers like an ostrich feather, of a pale blue color. *Spiræa callosa*, *S. callosa alba*, the first bearing pink and the latter white flowers, deserve a place here as well as in every garden.

Belonging to the small tree kind, we recommend *Kolreuteria paniculata*, or balloon tree, as some people call it, which bears yellow blossoms on long erect spikes; and as a suitable companion to this plant *Lagerstremeria indica*, of which there are three or four varieties, one bearing pink, another purple, and a third bearing scarlet flowers we have also got the white flowering kind, but cannot vouch for the latter proving hardy; in truth, all of the varieties require protection during the winter north of Baltimore, yet there is no plant that will better repay a little care than this same *crape myrtle*. The *althea* is a very popular tree or bush, and it embraces a great many varieties, both single and double flowered; but apart from the value of the flowers, there are two or three kinds very attractive by their variegated foliage, which latter feature in floricultural productions has of late years claimed more prominence than we think it deserves. While bringing forward to the light the above desirable trees and shrubs, we would, with great respect, remember as seasonable the Virginia and Chinese trumpet flower; the first so well adapted to cover stumps of trees or old walls gone into decay, the last just the thing to plant against a summer house, or as a solitary bush on a lawn, where its robust growth will soon produce a stem strong enough to support its head erect. A new plan of growing the wisteria is to train it to a stake, six feet high, and when it reaches the top, head it off. The second year, or the third, it will support itself and form an umbrella shaped head, with hanging flowers.

In looking over files of the Melbourne (Australia) *Leader*, we observe that there is considerable activity among inventors in that distant but enterprising colony. Several patents are granted every week, and improvements are the order of the day.

HOW KEROSENE OIL IS MADE.*

The dark offensive crude petroleum is first subjected to fractional distillation. The apparatus employed consists of an iron still, connected with a coil or worm of wrought iron pipe, which is submerged in a tank of water for the purpose of cooling it. When the still has been filled with crude oil, the fire is lighted beneath it, and soon the oil begins to boil. The first products of distillation are gases; at ordinary temperatures, they pass through the soil and escape without being condensed. By cooling the coil with ice or by compressing these gases by an air pump into a strong receiver, very volatile liquors called "rhigolene" and "chymogene" are obtained.

Soon the vapors begin to condense in the worm, and a stream of oil trickles from the far end of the coil into the receiving tank. The first oils obtained have a gravity of about 95° Baumé; as the distillation proceeds, the product becomes heavier, 90° B., 85° B., 80° B., 75° B., 70° B., and so on.

In most establishments it is customary to run the product into one tank till the gravity reaches 65° B. to 59° B.; the product, known as crude naphtha, being subsequently separated by redistillation into (1) gasolene, the lightest; (2) naphtha; (3) benzine. When the stream of oil runs from the coil with a gravity from 65° to 59° B., it is diverted into the kerosene tank and continues to run into this receiver till the gravity reaches about 38° B., or until the color deepens to a yellow. This second fraction is the burning oil or kerosene, and is subsequently purified by sulphuric acid and alkali.

After taking off the burning oil, the stream is directed to the paraffin oil tanks, and continues to run there till nothing remains in the still, save coke. The last products have a gravity of about 25° B.

This oil is chilled to crystallize the paraffin, and is then folded in cloths and exposed to pressure to squeeze out the oil. The solid paraffin is purified by repeatedly melting it in naphtha, chilling, and pressing; the oil separated from it is purified with sulphuric acid and alkali, and used for lubricating purposes.

While this is a general outline of the process of distillation, it should be remarked that refiners differ in the details of the operation.

When very large stills are employed, of a capacity from one thousand to thirty-five hundred barrels, the distillation is not continued till coke is formed; but is interrupted when there remains in the still a thick tarry residuum amounting to from five to ten per cent of the original oil. This residuum is afterwards distilled to coke in smaller stills.

By slow distillation in high stills, the heavier oils are "cracked" into lighter oils, so that the refiner need not produce any heavy oil. In many of the largest establishments only three products are obtained from crude oil: 1. Crude naphtha; 2. burning oil; 3. residuum.

The burning oil is deodorized and bleached for market with sulphuric acid and alkali; the crude naphtha is sold for from 3 to 5 cents per gallon, and poured down the oil wells, nominally to clean them, but practically to be sold to the refiner again in the crude oil at 14 cents per gallon; or it is sold to be redistilled for gasolene, refined naphtha, and benzine. The well owners are many of them dishonest enough to pour the naphtha into the crude oil tank. This adulteration averages fifteen per cent. The residuum is sold to be distilled for paraffin and lubricating oil, or it is cracked in high stills, and the product put into the large stills with the crude oil. In this case no lubricating oil or paraffin are manufactured. This is the practice at Cleveland and Pittsburgh. Some redistil the last ten per cent, the colored portions of the burning oil, with the crude oil.

Some place the crude petroleum in large stills and blow steam through it, and thus take off the crude naphtha, before the oil is run into the fire still.

Some manufacturers, who pride themselves upon the superior quality of their special brands of oil, separate certain portions of the distillate, and send them to market as unusually safe oils.

The "Astral oil" is probably the oil which runs from about 54° to 44° B., in other words, the "heart" of the burning oil. As it does not contain the lighter portions of the ordinary oil, its flashing point is 125° Fah., or 25° above the standard of safety, although its average gravity is 49° B. The "mineral sperm" is a heavy oil, which probably runs between 40° B. and 32° B., averaging 36° B. This is so heavy, and requires so high a temperature to volatilize it, that it does not evolve an inflammable vapor below 262° Fah., nor take fire below 300° Fah. Practically it is as safe as whale oil.

Treatment with Acid.—After the oil has been fractioned, it is subjected to the action of sulphuric acid to remove a little color, but more particularly to sweeten it, that is, to remove the disagreeable odor which it still retains. About two per cent, by measure, of acid is poured into the oil, the mixture is thoroughly agitated, and, on standing, a dark tarry sediment separates; this is removed, and the clear oil is then agitated with water, then with alkali, either caustic soda or ammonia. This neutralizes the last traces of acid, and, after removal by water, leaves the oil "sweet." Some of the more careful refiners then subject it to a somewhat elevated temperature to expel a small percentage of naphtha or benzine which it still contains, while a few subject it to redistillation.

Why most of the kerosene in the market is unsafe.—The crude naphtha sells at from 3 to 5 cents per gallon, while the refined petroleum or kerosene sells for 20 to 25 cents. As great competition exists among the refiners, there is a strong inducement to turn the heavier portions of the naphtha into the kerosene tank, so as to get for it the price of kerosene. They change the direction of the stream from the coil of the still when it reaches 65° to 63° Fah., instead of waiting till it reaches 58°. Thus the inflammable volatile naphtha or benzine is allowed to run into the kerosene, rendering the whole highly dangerous. Dr. D. B. White, President of the Board of Health of New Orleans, found that, experimenting on an oil which flashed at 113° Fah., an addition of

One	per cent of	naphtha	caused	it to flash	at	103° Fah.
Two	"	"	"	"	"	92° "
Five	"	"	"	"	"	83° "
Ten	"	"	"	"	"	59° "
Twenty	"	"	"	"	"	40° "

After the addition of twenty per cent of naphtha, the oil burned at 50° F.

It is, therefore, the cupidity of the refiner that leads him to run as much benzine as possible into the kerosene, regardless of the frightful consequences which result from the frequent explosions.

On every gallon of naphtha run into the kerosene tank, there is a profit to the refiner of 20 cents, or on every one per cent of naphtha added to the kerosene, a reduction of one fifth cent per gallon in the cost of production, which, with kerosene at 25 cents per gallon, amounts to 1¼ per cent. For every gallon of naphtha sold as kerosene, the refiner can afford to throw away four gallons. Nothing is more desirable than the discovery of some use to which the naphtha can be put, which will make such a demand for it as to raise its value above that of kerosene, that it might be the interest of the refiner to separate as much instead of as little as possible. It must not be supposed that the specific gravity of the oil can be considered a safe index of its quality; on the contrary, the specific gravity gives very little idea of the quality, for while naphtha tends to render the oil lighter, the average gravity of good oil is maintained by the heavier oils present. A poor, dangerous oil may be heavier than a safe oil.

Ordinary kerosene flashes at 86° Fah., but has a gravity of 47° B.

THE CHEAPEST PROCESS FOR MAKING A SAFE OIL.

The cheapest process for making an oil that will not flash, that is, emit an inflammable vapor, below 100° Fah., is the following:

1. Run off the naphtha down to 58° B., instead of 65° to 62°, the usual point.
2. Then expose the oil in shallow tanks to the sun or diffused daylight for one or two days.

The increased expense of this plan of refining would not reach more than three or four cents per gallon. This addition would be cheerfully paid by the consumer, to insure himself and his wife and children from a horrible death.

But, the refiner says, I cannot get the advanced price, because the consumer does not know my oil is safer than the cheaper article. This is true, and our only hope is in strict laws, rigidly enforced, which will make it a crime to sell an unsafe oil.

THE YIELD OF DIFFERENT PRODUCTS.

The yield of the different products from crude petroleum varies greatly in different refineries. The following is a fair average for Pennsylvania oil of about 45° B.:

Gasolene	1½
Refined naphtha	10
Benzine	4
Refined petroleum or kerosene	55
Lubricating oil	17½
Paraffin	2
Loss, gas, and coke	10
	100

By cracking, the same oil could be made to yield

Crude naphtha	20
Burning oil	66
Coke and loss	14
	100

*From a report to the New York Department of Health by Professor C. F. Chandler.

Gymnastic Balloonists.

The New Haven *Palladium* describes the performances of Miss Leona Dare, a Connecticut circus woman, who from being a humble performer under the tent has risen to remarkable experiences as an aeronaut. She has lately been thrilling the people of the West by trapeze performances while suspended from a balloon. One of these recent entertainments at Indianapolis is thus set forth:

The balloon was inflated, and at a quarter to 8 was cut loose; and the fine formed Leona, in circus clothes, dangling down from the trapeze bar, holding in her teeth a strap which encircled the waste of Tommy Hall, a companion for her first voyage in the air, left *terra firma*.

Everything was as still as death, and it was observed that Hall weakened a little, but the plucky "Queen of Antilles," Leona, was perfectly cool. Just as soon as they left the earth, Leona commenced spinning Hall around until it made us giddy. After this performance, and when about three hundred feet in the air, they commenced their highfalutin' performance, known in show language as the double trapeze.

They performed all the difficult and hazardous feats at an altitude of about half a mile, with the same reckless daring that characterizes their performances under the pavilion, where, if they were to tumble, their fall would not exceed thirty feet. Up, up they went, until they were scarcely larger than a person's hand, and, when looked at thro gh a glass provided for the occasion, it was seen that they had climbed upon their trapeze car, and were apparently enjoying a *tête-a-tête* while resting from their exciting and perilous exercises. The balloon descended very rapidly and landed about half a mile from the starting point, in an open field, and a party rode up in time to witness their alighting. Hall was silent and sober, while Leona, laughing, said to Warner: "How was that for high?"

The Opal.

The opal comes from Hungary and Mexico. The Hungarian opals are much the superior, and have not the disadvantage of deteriorating with time. For the perfection of an opal, it should exhibit all the colors of the solar spectrum, disposed in small spaces, neither too large nor too small, and with no color predominating. The opal is sometimes called the "harlequin," in allusion to the great variety of colors which it displays. The substance of the opal is of a milky hue and of a pale greenish tint. This milkiness is generally known by the term opalescence. It is the color of water in which a little soap has been dissolved. In order to explain the brilliant colors of the opal, we may imagine in the stone a great number of isolated fissures, of variable width but always very narrow. Each fissure, according to its width, gives a peculiar tint similar to the effect produced by pressing two plates of glass together: we may recognize violet, blue, indigo, red, yellow and green, the last two being exhibited more rarely than the others.

As a proof that the brilliant colors of the opal are due, as we have said, to narrow fissures, similar colors may be produced by partially fracturing, with the blow of a hammer or a wooden mallet, a cube of glass or even a rock crystal. Colors obtained in this way are of the same character as those of flowers, which result from the overlaying of the transparent tissues of which the petals are composed. Herein lies the secret of all their varied hues from their first opening until their final decay.

Sometimes the opal is colored only in its substance, and has not so great a play of light as when it is variously traversed by fissures, and then it is not so much esteemed. The opal is not a very hard stone. In its chemical composition, it is only quartz combined with water. Heat, expanding its fissures, varies its colors, and pressure obviously produces the same effect. M. Babinet states that he thus often changed, without permanent alteration, the colors of a beautiful Hungarian harlequin opal. The opal of the Roman senator Nonius, of the size of a hazel nut, which he selected from among all his treasures as the companion of his exile, was estimated at about 800,000 dollars. This gem has appropriately been called "the Koh-i-noor of Rome."

Improvements in Blasting.

T. Klerity, a German engineer, has lately introduced an improved blasting cartridge, which is said to save much powder or dynamite, and seems to be worth notice. The new feature of it consists of a cast steel cylinder, which is inserted in the cartridge, and replaces a part of the powder, which is ignited through a touch hole in the cylinder. At both ends the cylinder is very near the calibre of the bore hole, but its middle part, for about 2-3 of the whole length, is reduced to half that diameter. This thin part has a channel bored through it at right angles to its axis, while another vertical channel follows the axis from the top until it reaches the transverse passage, both of which are filled with fine grained powder and ignited in a suitable way. The length of the steel cylinder is 12 or 14 inches, and its diameter 1 to 1½ inches at the ends, and ½ to ¾ inch in the middle. It is inserted in a cylindrical paper bag, and the powder of dynamite filled between the reduced diameter and the paper; it is then placed in the bottom of the blast, covered with a certain thickness of tamping, and fired in the usual way through the channel in the centre. Another improvement with the use of dynamite has lately been made at Ra bl, in Carinthia, where the dolomitic limestone is very cavernous, and much of the power of the explosive is lost, its gases expanding uselessly into these cavities. In order to prevent this, a watertight dynamite cartridge is introduced into the bore hole, and before firing it, as much water pumped into the same as it and the next adjoining cavities would hold. Through this very simple expedient, a wonderful effect is said to have been produced, by which half of the former expenses of blasting were saved.

Coal in China.

According to Baron Richthofen and others, the Chinese coal fields cover an area of upwards of 400,000 square miles; 12,000 miles of coal have sufficed to make Great Britain the greatest workshop of the world. In the province of Hunan, a coal field extends over an area of 21,700 square miles. There are two perfectly distinct coal beds in Hunan, one bearing bituminous and the other anthracite: the latter being most conveniently situated with regard to conveyance by water, easily mined, and covering an area equal to that of the anthracite coal fields of Pennsylvania. In quality this coal will compare favorably with the best kinds of anthracite known.

The coal area of the province of Shansi is of the enormous extent of 30,000 square miles. This is capable of supplying the whole world, at its present rate of consumption, for thousands of years, and has unrivaled facilities for mining. The beds vary from twelve to thirty feet in thickness, while the system of coal bearing strata in this province is about 500 feet in thickness, and contains, besides, an inexhaustible supply of iron ore. Ping-ting-chau is conspicuous for an extraordinary and exceptionally favorable uxtaposition of coal and iron.

STRYCHNIA AND HEMLOCK.

The effects of strychnia are very simple; leaving the intellect unaffected, it chiefly seizes upon those parts of the nervous system from which flow the impulses that set the muscles in motion.

These impulses, which in the natural condition of the body result in the ordinary voluntary movements, are placed by the action of strychnia beyond the control of the will. Involuntary twitchings of the muscles and sudden jerkings of the limbs first occur; but if the dose of the poison be sufficient, these soon become general, and the body passes into a state of the most rigid spasm.

We do not observe those alternate contractions and relaxations which in a fit of ordinary convulsions—epilepsy, for example—allow of the bending and straightening of the limbs in rapid succession, but the whole of the muscles of the body are simultaneously locked by violent and continuous cramp.

From common cramp we may get some notion of the agony which racks the whole body of a person poisoned by strychnia. The effects of strychnia resemble those of tetanus (lock jaw) rather than those of epilepsy. The frightful *risus sardonicus* caused by cramp of the facial muscles, is, indeed, an expression common both to strychnia poisoning and to tetanus; and the jaws are as tightly locked in the one condition as in the other.

The rigor thus affecting the muscles of the head rapidly spreads over the whole body, which soon becomes stiffened with spasm and shaken with violent tremor; the trunk meantime is extended to the utmost, the feet are drawn into a straight line with the legs, and, at the hight of the paroxysm, the head is drawn backwards, the back is arched, and the body supported on the heels and the back of the head; the chest is fixed, and the breathing suspended. After a few seconds the cruel spasm ceases, and the muscles, which a moment before felt as hard as wood, are now flaccid and exhausted, and the suspended life returns with a long drawn sigh. Now the poor patient speaks, and in feeble, tremulous accents implores to be left undisturbed, and shudders or even passes into another paroxysm if any one approach him and attempt means for his relief.

Strychnia impresses the whole nervous system with such exquisite sensibility that the lightest touch is sufficient to evoke a fresh discharge of nervous power. Under its influence the nervous system is like an overcharged thunder cloud or Leyden jar; and disruption occurs on the faintest disturbance.

And terrible indeed are these electrical convulsions in the body. The intervals of respite and of seeming rest, but really of dread suspense, become shorter and shorter, and each succeeding discharge is more violent and prolonged. There is no gasping for breath, for the iron spasm holds the chest too rigidly confined to allow of even this niggardly relief. The interchange of gases in the blood is suspended, the air lies stagnant in the lungs, and the patient is suffocating even more rapidly than if a cord were firmly tied round his neck; the tongue grows purple, the poor heart meanwhile puts forth all its energy, and throbs almost to bursting. It avails not, however; the blood which it so hurriedly distributes wants vital air; and when the storm is over, the body falls lax into the hands of death. Then, if we look to it, we find the muscles torn by the violence of the fatal cramp.

Such are the simple effects of strychnia; and a quarter of a grain taken by the stomach, or the one sixteenth of a grain introduced under the skin, will, in a person of moderate size and strength, produce the whole of them.

And yet the mite of strychnia itself undergoes no change. We may separate the whole of it from the dead body, and therewith reproduce its effects in other living beings. Such, indeed, is the physiological test for strychnia; and it is readily applied. We take a frog fresh from the pond, and having removed the moisture, by means of a piece of blotting paper, from its back, we place thereupon a few drops of the suspected solution. It is soon absorbed, and if strychnia be present, the sensitive little animal is thrown into a state of tetanus.

Strychnia poisons all animals alike, from the tiny insect to the largest quadruped, and the hot blooded bird is as susceptible of its action as the cold blooded reptile. If a wild animal is killed by this poison, the vultures that eat the flesh are poisoned too. For several years past it has been an active instrument in the hands of the suicide and the avicide. Wheat steeped in water embittered by a minute fragment of strychnia and thrown broadcast over our fields has been, and we fear continues to be, the fatal device to which our feathered tribes fall an easy and indiscriminate prey. When will our farmers and horticulturists learn that these little laborers are worthy of their hire, and that the seed they consume is in value nothing as compared with what they save from the depredations of the fly and the canker worm?

We have spoken of strychnia merely as a poison. It is not difficult to see how, in the hands of the physician, its powerful properties may be directed to the relief of disease. As the most powerful excitant of the centers of motion, strychnia becomes the appropriate stimulant when those centers are paralysed. As a tonic it rivals quinine. Strychnia is derived from the nux vomica (*strychnos nux vomica*), a plant of the same natural order as the common blue periwinkles; but the poison abounds in many other species.

HEMLOCK.

From strychnia we pass to a consideration of its opposite, namely, hemlock. No poison claims a higher antiquity or a greater historical interest than hemlock. To the physician, there is none that surpasses it in physiological interest. The bare mention of the plant carries one back to the days of the Grecian republic, and recalls the undying names of Socrates, Theramenes, and Phocion—men who submitted to the baleful influence of hemlock rather than betray the liberty of their country. If we would learn the effects of the Athenian State poison, we may have Plato for our teacher, and for a subject him of whom Cicero justly said "that he was the first who called down philosophy from heaven to earth, and introduced her into the public walks and domestic retirements of men, that she might instruct them concerning life and manners." "Socrates," says Plato, "received the fatal cup without change of countenance or the least perturbation, and then, offering up a prayer to the gods that they would grant him a prosperous journey into the invisible world, drained it with perfect composure. His friends around him burst into tears. Socrates alone remained unmoved. He upbraided their pusillanimity, and entreated them to exercise a manly constancy worthy of the friends of virtue. His executioner directed him to walk about until he should feel his legs becoming heavy. He did so until the chilling operation of the hemlock compelled him to lie down; then it seized upon the more vital parts. The executioner approaching him, said to his friends, that when the effects of the poison should reach the heart, Socrates would depart. Then, uncovering him, he found the lower part of the body was cold. At this time Socrates spoke these his last words to his friend Crito: 'Crito, we owe Esculapius a cock; pay the debt, and do not forget it.' 'It shall be done,' replied Crito; "but consider whether you have anything else to say." Socrates answered not, but in a short time was convulsed. The man then uncovered him; his eyes were fixed; and when Crito observed this, he closed his eyelids and his mouth." In this account, we have ample proof of the action of hemlock. The legs grow heavy, and the chilling effects creep on. The victim, no longer able to stand, lies down; at last the respiration ceases, accompanied, as is usual in such cases, by a slight convulsive tremor, the mind remaining clear and tranquil to the last.

Hemlock is the exact opposite of strychnia. Strychnia excites the organs of motion; hemlock depresses them. Strychnia kills by causing intense and prolonged spasm of the muscles, by whose alternate contraction and relaxation air is drawn into and expelled from the lungs; hemlock kills by causing complete relaxation and paralysis of the muscles.

Here, then, we have two nerve poisons so completely opposed to each other that each is the antidote of the other, and a study of their action furnishes a good illustration of the principles that guide the physician in the administration of an antidote.

The Waste Products of Coal.

In the destructive distillation of coal for the production of ordinary gas, a quantity of offensively smelling water and a considerable bulk of tarry matter are also produced. These were formerly thrown away as useless and deleterious, but now they are utilized.

The noxious odor of the gas water is due to the presence of sulphur and ammonium compounds, and by simply adding sufficient quicklime the alkaline compounds are decomposed, and ammonia gas is liberated. This is conducted into chambers filled with carbonic acid gas, and thus the common salt, known as carbonate of ammonium, is produced. More than 2,000 tuns of this useful chemical are annually made from refuse gas water. If, instead of quicklime, hydrochloric acid be added, sal ammoniac is obtained, from which nearly all the medicinal preparations of ammonia are produced. The quantity of sal ammoniac thus manufactured from year to year, exceeds 4,000 tuns. If, again, sulphuric acid be employed in the place of hydrochloric acid, sulphate of ammonium is the result, about 5,000 tuns of which are annually used for manures. When to a solution of sulphate of ammonium one of sulphate of aluminum is added, the crystalline substance called alum is obtained, so generally useful in the arts. The sulphuric acid used in preparing alum may also be eliminated from gas water. The sulphur impurities referred to before are removed by means of a mixture of sawdust and iron, sulphide of iron and water being produced; air is then passed through the mixture, the effect of which is to convert the sulphide of iron back again into oxide, the sulphur at the same time separating in the form of powder. The sulphur is then burned in a properly constructed furnace, and, by causing the fumes to combine with nitrous and aqueous vapors in leaden chambers, sulphuric acid is obtained.

Let us pass now to the tarry matter, the other waste product of the distillation of coal. This is a very complex body, containing a large number of substances, most of which are volatile, some acid, some alkaline, and some neutral. By appropriate chemical means, these components of crude coal tar are obtained in a state of purity. The lighter portions, known as coal naphtha, consist principally of benzol, a liquid of great utility in the arts. By treating benzol with nitric acid, nitro-benzol is produced, which is used, on account of its sweet taste and almond-like odor, to perfume soaps and flavor confectionery. Anilin, the base of all the dyes bearing that name, is obtained from the action of nascent hydrogen on nitro-benzol. Carbolic acid is another product of the fractional distillation of coal tar. By the action of nitric acid, carbolic acid is converted into carbazotic acid, which is now used as a yellow dye. Perhaps the most interesting of all the products of coal tar is solid paraffin, a colorless crystalline fatty substance, which may truly be termed "condensed coal gas." It is found naturally in the coal measures and other bituminous strata, constituting the minerals known as fossil wax, ozokerit, etc. It exists also in solution in many kinds of petroleum, and may be obtained by distilling off the more volatile portions, and exposing the remainder to a low temperature. The greater bulk of paraffin is, however, obtained from coal tar. The oil produced from paraffin will only burn in the presence of a wick, and is therefore perfectly safe; when burning, it splits up into olefiant gas, thus producing a brilliant white light. To sum up: From the two waste products of coal, in the manufacture of gas, are obtained carbonate, chloride, and sulphate of ammonium, sulphur, and sulphuric acid, coal naphtha, benzol, nitro-benzol, anilin, carbolic and carbazotic acids, and solid paraffin.

The New Liverpool Central Station.

The Central Railway Station, now in progress at Liverpool, is owned conjointly by the Great Northern, Midland, and Manchester, Sheffield, and Lincolnshire Railways. These three great companies, for the purpose of extending their system west of Manchester, have for some considerable time formed an amalgamated committee, known as the Cheshire lines. Besides the above railway, a new and direct line between Liverpool and Manchester is being constructed under the direction of this committee. The Central Station is situated in Ranelagh street, and the front buildings are intended to occupy the whole side of the street between the Lyceum and the Adelphi Hotel. The platforms and other conveniences extend backward from Ranelagh street for the whole length of Bold street, being parallel to that fashionable lounge. Some idea of the extent of the works may be conceived from the fact that over six acres of property have been purchased for the purposes of this terminal station. The booking office and other buildings facing Ranelagh street are now nearly completed. The Italian style has been adopted in the architecture. The main building consists of three stories, and is 142 feet in length, 70 feet in width, and 60 feet in hight. The ground floor is of Tuscan order, with polished grey granite architraves. The first floor is Ionic, with polished red Aberdeen granite shafts and pilasters. The upper storey is in the Attic style, and will when completed be surmounted by a handsome clock turret. The stone chiefly used in the construction is of a fine cream colored appearance, and comes from the Ancaster quarries, in Lincolnshire. Behind the booking office the platform roof is in course of erection, with its supporting walls. Advantage has been taken of the good building stone (of the red sandstone formation) found in excavating for the works, by using it in the construction of these supporting walls. The roof over the platform, 700 feet in length, consists of one main span of 160 feet clear between supports and a side span of varying width. In the construction of this roof, for the purposes of combining strength with lightness, steel has been largely used, and this material, with a certain novelty of arrangement, will make the structure unique and one of the finest in the kingdom. In order to connect the station with the Brunswick Station at the south end of the town, and owned by the same committee, a line of a mile and a half is in course of construction. This line is chiefly in tunnel, with numerous openings for ensuring good ventilation, and passes nearly in a straight line between the two stations. The tunnel is of sufficient width for three lines of rails, and is already completed for the greater part of the distance. The line, it is expected, will be opened in the early part of the ensuing year.

How to Treat Battery Zincs.

The best rolled zinc should be employed; it gives a higher force than cast zinc, and is more economical, because cast zinc is subject to much more local action, owing to its porous condition. Cast zinc rods may be used with equal advantage in cells where they are only exposed to sulphate of zinc, or chlorides of sodium or ammonium, because these do not act by themselves on zinc.

The coating of zinc with mercury prevents the local action of the acid; it appears to effect this by giving a smooth surface, and so favoring the adhesion of hydrogen, which may be seen covering it in little bubbles; therefore, anything which tends to roughness of surface tends to increase local action and waste of zinc and acid, a point the learner should carefully fix in his memory as an axiom. The practical lesson is: keep your zincs thoroughly clean and well amalgamated. Care should be taken to use only pure mercury; much of that sold contains lead and tin, which are mischievous. The mercury should be kept for some time in a bottle, with dilute nitric acid over it, and occasionally shaken up. To amalgamate zinc, wash it first with strong soda to remove grease; then dip it in a vessel of water containing one tenth of sulphuric acid, and as soon as strong action takes place transfer it to a dish (such as a soup plate); pour mercury over it, and rub it well till a bright silver like film forms; then set it up to drain on edge, and before use, rub off any globules which are set free. Whenever the zinc shows a gray granular surface (or rather before this) brush it well and reamalgamate, remembering that saving of mercury is no economy, and free use of it no waste—for it may all be recovered with a little care. Keep a convenient sized jar or vessel solely for washing zincs in, and brush into this the dirty gray powder which forms and is an amalgam of mercury with zinc, lead, tin, etc., and forms roughnesses which reduce the protection of amalgamation. Let this powder collect for a time and then transfer it to a bottle, in which wash it with sulphuric acid first, and then with dilute nitric acid, and you will recover the mercury. This washing should be done whenever a plate is removed, and never less than once a day if in regular use; the cheap brushes are excellent for these purposes, but of course must not be left soaking with acids.

The new rate for postal money orders, now in operation, is 5 cents for an amount not exceeding ten dollars.

SILKWORMS.

[Compiled from the "Fourth Annual Report," by Charles F. Riley, State Entomologist of Missouri.]

Silk is at once the strongest and most tenacious of fibers, and makes the most beautiful, durable, and valuable of tissues. What gold is to metals, or the diamond to precious stones, that silk is to all other textile fibers.

Though we may not, at present, be able to compete, in their own markets, with the cheaper labor of parts of Europe and Asia, there is no reason why, with proper intelligence, we may not produce our own silk as cheaply as it can be brought here from those countries; and I am convinced that, should we ever be cut off by war from those countries on which we rely for our present silk supply, we can easily fall back on our own resources. Even now, there is no reason why the young people, and those unable to do harder work, in thousands of families, should not spend a few weeks each year in the pleasant work of producing cocoons.

Of the eight species which will be treated of, four, namely, *mori, cynthia, yamamai*, and *Pernyi*, are of foreign origin; and the other four, namely, *Cecropia, Promethea, Luna*, and *Polyphemus*, are native. When newly hatched, all of them, even to the mulberry species, are, in form and structure, exactly alike; and they differentiate more and more as they increase in size, until each acquires its specific characters.

All these silkworms cast their skin four times during the feeding period, and thus have five different stages of growth; the worm resting and fasting from one to three days, then gradually working off the old skin, and afterwards knocking off the head.

They all, when in the cocoon, are furnished with an acrid or bombycic fluid, with which they weaken the resisting force of their cocoons, and facilitate the exit of the moth; though those which make rounded or closed cocoons are much more amply supplied than those which form pointed or open ones.

All the cocoons, whether pointed or rounded, are spun in one continuous thread. In issuing, the moths of all of them rupture, more or less, the threads of the cocoon, thus rendering it valueless for reeling. Many writers assert to the contrary; but I have examined no deserted cocoon which has not shown some broken threads, and have witnessed the threads break during the emergence of the moth. Such as are naturally open are broken less than the others; but if only a half dozen threads are sundered, the cocoon is spoiled for reeling purposes. All the native cocoons are at times found drilled with large holes, and gutted by birds or squirrels; and those which fall to the ground are frequently destroyed by mice, rats, and moles.

In manufacturing silk, the cocoons are subjected to steam or to heat in order to destroy the vitality of the chrysalis, which would otherwise bore out and break the silk.

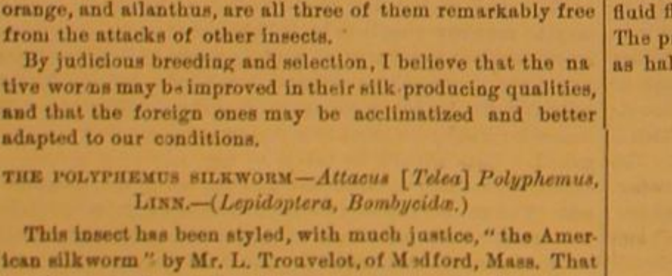
All the moths are night flyers. All the large heavy worms, when full grown and in a state of nature, hang on the under side of leaves and twigs, being too heavy to sustain themselves in an upright position. They are all of some shade of green—no matter what their color when younger—and in a measure similate the leaves of their food tree, so as to render detection difficult.

It is a little singular that the principal trees which may be used for producing the best silk, namely, the mulberry, osage orange, and ailanthus, are all three of them remarkably free from the attacks of other insects.

By judicious breeding and selection, I believe that the native worms may be improved in their silk-producing qualities, and that the foreign ones may be acclimatized and better adapted to our conditions.

THE POLYPHEMUS SILKWORM—*Attacus* [*Telea*] *Polyphemus*, LINN.—(*Lepidoptera, Bombycidæ*.)

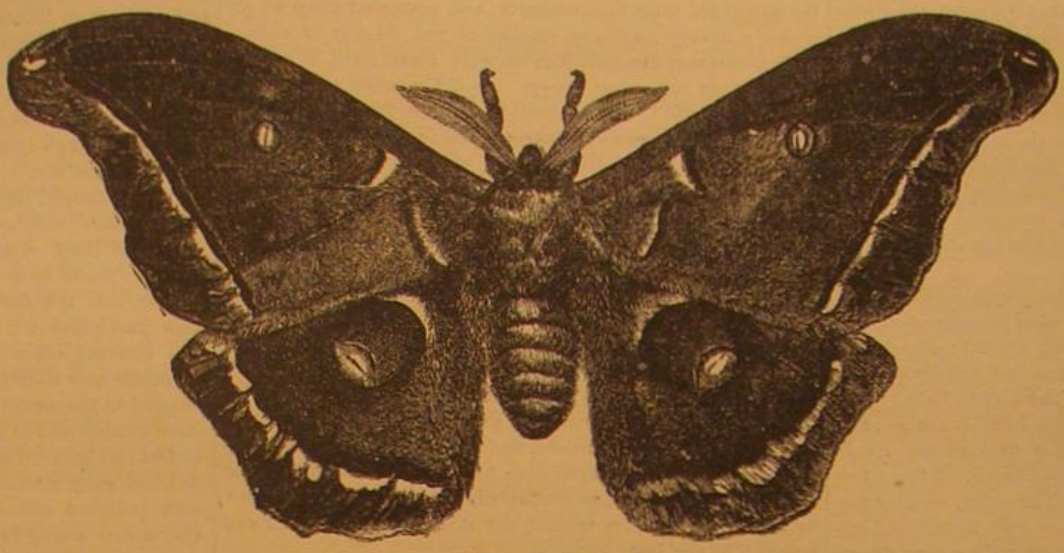
This insect has been styled, with much justice, "the American silkworm" by Mr. L. Trouvelot, of Medford, Mass. That gentleman made a series of very interesting experiments in rearing the worm in large quantities in the open air, and in 1865 he had not less than a million feeding upon bushes covered with a net. An interesting account of these experiments, but more especially of the natural history of the species, may be found in the first three numbers of that excellent periodical, the *American Naturalist*.



THE POLYPHEMUS SILKWORM.

The eggs of *Polyphemus* are deposited singly, or in twos or threes, on the under side of a leaf or upon a twig. They are whitish, inclining to flesh color on the top and bottom, and encircled on the sides by a characteristic broad band of amber brown, which is the natural coloring of the egg shell and distinct from the brown fluid which is secreted with them and fastens them to whatever object they are consigned. This brown band has a narrow pale spot at the two smaller ends. The moths issue with us the latter part of April or in May, and the female commences depositing very soon afterwards. The eggs hatch in about ten days after deposition.

The worm feeds on oak, walnut, hickory, basswood (*Pilia*), elm, maple, hazel, apple, rose, quince, thorn, plum, choke cherry, sycamore, poplar, birch, honey locust, blueberry, and willow, on the first nine of which I have found it myself. When full grown, it is a most delicate and beautiful object, being of a clear apple green color, with oblique yellow lateral lines, and tubercles tinseled with orange, gold, and silver. The head, spiracles, legs, and ends of prolegs are of a buff yellow, the front edge of the first joint sulphur yellow, and the edges of the anal shield purple.

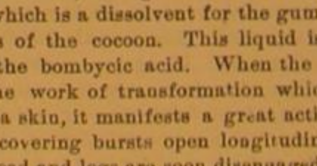


POLYPHEMUS MOTH, MALE.

COCOON OF THE POLYPHEMUS SILKWORM.

The cocoon is formed of strong silk which, when unwound, has a glossy fiber. It is oval and closed at both ends, dense and generally fastened to a leaf or leaves, with which it falls to the ground, though sometimes it is fastened to twigs and therefore remains exposed, during the winter, to its enemies. The exit of the moth has been well described by Mr. Trouvelot:

"The moth is provided with two glands opening into the mouth, which secrete, during the last few days of the pupa state, a fluid which is a dissolvent for the gum so firmly uniting the fibers of the cocoon. This liquid is composed in great part of the bombycic acid. When the insect has accomplished the work of transformation which is going on under the pupa skin, it manifests a great activity, and soon the chrysalis covering bursts open longitudinally upon the thorax; the head and legs are soon disengaged, and the acid fluid flows from the mouth, wetting the inside of the cocoon. The process of exclusion from the cocoon lasts for as much as half an hour."



CHRYSALIS COVERING OF THE POLYPHEMUS SILKWORM.

The moth is of a dull ocher yellow, shaded more or less distinctly with innumerable black particles, and with a broad gray band along the front, or costal edge, and passing over the thorax. There is a darker, reddish brown shade across the middle of the wings, and near this shade on each wing is a transparent eye-like spot, divided by a slender opaque line, and margined by a yellow and a black ring, the last much broader on the hind than on the front wings, being there widened on the inside into a large black spot with the part adjoining the eye-spot bluish white. Near the hind margin of each wing is a dusky band (bluish on the front ones), edged with pink white behind: and near the base of the front wings is a zig zag crimson line, edged inside with white. There is a great variation in the colors of this insect, dependent in some measure no doubt, on the food of the larva. Specimens occur which have the general tint either very dark or very pale; either brown, smoky yellow, cream color, rust red, or greenish; while the large black spot on the hind wings is sometimes replaced by rust red.

The male is easily distinguished from the female by his smaller abdomen and very broad antennæ, which are, in fact, broader than represented in the annexed figure, as they have been known to spread nearly half an inch. They have actually been mistaken for a third pair of wings by inexperienced persons.

The principal difficulty in the way of reeling the cocoon of *Polyphemus* is the hard matter which binds it; but it is not an insurmountable one, and the cocoon could no doubt be improved by a proper process of continued selection. The silk is strong and lustrous.

As with some of the other species already mentioned, two broods of this insect are frequently produced each year in this latitude, though it normally appears to be single brooded in the more northern States. In the South it is always double brooded, the first moths issuing about the middle of February in Louisiana. If it is ever grown for silk, the South will be the most favorable part of the country, for it often abounds in New Orleans in such numbers, on sycamore, elm and live oak, especially the latter as to be easily gathered by bushels.

Locomotive Boilers.

During the recent meeting of the Master Mechanic's Association, the subject of boiler construction for locomotives received earnest discussion. The merits of the plain circular boiler and the wagon top boiler were also examined. The form consists in a swell or elevation of the boiler above the fire box. On this and other features, the *Railroad Gazette* observes:

The location of the domes, too, is an element which must be taken into consideration. If there is but one, and it is located over the fire box, where the ebullition is most violent, there must necessarily be more steam room, to prevent the water being carried into the steam pipe, than would be required if the dome were over the tubes. The variation of water level due to the inclination of the track and the surging of the water will be greatest at the ends of the boiler and least in the center.

On merely theoretical grounds, therefore, it seems probable that the steam taken from a dome located in the center of the boiler would be drier than if taken from a point over the fire box, and this would seem to indicate that the evils complained of in straight top boilers are to a very great extent due to the fact of taking steam from a dome over the fire box instead of the center of the boiler. Now if we keep carefully in mind the importance of comparing the weights instead of the dimensions of boilers, and then remember that one with a straight top of a larger diameter will weigh no more than a wagon top boiler of a smaller size, we will see that, with the dome located in the center, the straight top boiler has an advantage over the other. The question thus becomes: whether steam taken from a dome located in the center of a boiler of larger diameter will be drier than if taken from one over the fire box of a boiler of smaller diameter with a wagon top. The advantage claimed for wagon top boilers of greater steam room and water capacity is gained equally well by the enlargement of the diameter of the straight boiler. The distribution of weight on the driving wheels, it must be admitted, with the present arrangement of boiler and engine is in favor of the wagon top, and locating the dome in the center increases the disadvantage in this respect of the straight boiler. It is also claimed that the wagon top gives more room, and consequently, makes the crown bars, crown sheet and braces more easy of access when they need repair or cleansing. The former advantage, we believe, could be more fully realized by a different arrangement of boiler, of which we will speak at some future time, and the latter by a different construction of crown sheet and braces. In this connection, it might not be unwise to observe that in European practice wagon top boilers are now almost unknown, and domes, or their equivalent, are almost always located on the centers of the boilers.

In considering the subject of locomotive boiler construction, we should never forget, what is now, we believe, generally admitted, that the larger the boiler, the more economically will it consume its fuel. For this there seem to be two reasons; first, the combustion is slower, and consequently more perfect, and the flames and smoke are thus in contact with the heated surface a longer time, and therefore impart more of their heat to the water; second, the water capacity of a large boiler being greater than of a small one, there is more hot water stored up for use when the maximum power of the engines must be exercised, and therefore the fire need not be forced so much as it would be if it were necessary to generate all the steam consumed at such times as fast as it is used.

HOW TO DESTROY THISTLES.—While giving botanical evidence in some thistle prosecutions, Dr. Daniel Bunce, curator of the Geelong Botanical Gardens, stated that an infallible way to destroy thistles was, just before the bud began to form, to cut the root through with a spade about 2 inches below the surface; also that the practice of cutting them above the surface was an utter waste of both money and labor, as thistles thus treated invariably sprang up again with a greater number of heads than before.

ENGLAND has as many people in the almshouse as she has children in schools.

THE MANORA BREAKWATER.

From previous accounts of works now being carried out under Mr. W. Parkes for the improvement of Kurrachee harbor, in Scinde, India, it will be remembered that a breakwater from Manora Point forms one of the most important features of the undertaking, its object being to protect the entrance of the channel leading into the harbor. The breakwater is not yet sufficiently advanced to have produced the full beneficial results to be expected from it, but its stability as a structure has thus far been already fairly tested. The general principle of the breakwater is that of a bank of rubble stone laid upon the natural bottom and brought up to a level of 15 feet below low water, but near the shore, where the original depth is less than this, to ten feet below low water. Upon this bank of rubble stone, a superstructure is raised, consisting of blocks of concrete each, 12ft. × 8ft. × 4½ ft. and weighing 27 tuns, set upon the narrowest side so that the whole superstructure consists of two blocks in width and three in bight, forming a solid wall, with vertical sides 21 feet wide and 24 feet high. The blocks are set in place by means of an overhanging crane.—*Engineering.*

THE MANORA BREAKWATER, KURRACHEE HARBOR, INDIA.

Old Rags.

First and foremost of the many applications of this humble material is the manufacture of paper; for this purpose England alone uses not less than 85,000 tuns of rags and waste, representing a money value of about $3,500,000. The transformation effected by the action of certain chemicals on paper is very striking. A sheet of common white blotting paper, which will scarcely bear its own weight when wetted, is converted in a few seconds, by the action of sulphuric acid, into a substance possessing all the properties of ordinary animal parchment, and so strong that it can be only broken with difficulty. Great as this change is, strange to say no chemical alteration has really taken place; the acid merely produces a molecular change, and is entirely washed away at the end of the process. Rags from woolen materials undergo many peculiar metamorphoses; old clo' criers first collect them; they are then successively converted into mungo, shoddy, and devil's dust, and reappear as ladies' superfine cloth; they then degenerate into druggets, and are finally used for the manufacture of flock paper. After undergoing all these transformations, they are used by the agriculturist as manure, on account of the large amount of nitrogen they contain. The presence of this element makes them of great use, also, to the chemical manufacturer; he boils them down with pearlash, horns and hoofs of cattle, old iron hoops, blood, clippings of leather, and broken horseshoes, and produces the beautiful yellow and red salts known as prussiates of potash. From these, again, the rich and valuable pigment called Prussian blue is made, and thus do our old rags enter upon a fresh career of beauty and usefulness, to form, in their turn, other waste products, which may again be utilized through the power of man's intelligence.

Bones and their Products.

Bones are composed of half their weight of phosphate of lime, about a third of their weight of cartilage or gelatin, and the remainder of earthy matters. The gelatin is extracted by boiling water under pressure, and is used to stiffen calico, etc.; when purified, it constitutes the nutritious aliment known as calf's foot jelly.

When the bones are heated without access of air, the organic matter of the cartilage is decomposed, oily products passing over, and a black, carbonaceous residue being left; this is bone black, or animal charcoal, greatly used as a deodorizer and disinfectant. Bones, when calcined and heated with sulphuric acid, yield superphosphate of lime, so highly esteemed as a manure. The last, and certainly the most important, application of bones is the manufacture of phosphorus. The bones are first burnt, to remove all traces of animal matter; the resulting bone earth, as it is called, is then subjected to the action of sulphuric acid, by which superphosphate of lime is produced. This acid phosphate is then mixed with charcoal and strongly heated in a retort, when it splits up into normal phosphate and phosphoric acid, the latter being finally reduced by the charcoal to phosphorus, while hydrogen and carbonic oxide are liberated as gases. The combustible and poisonous properties of phosphorus make it very dangerous to employ in the arts; but Professor Schröter discovered that when ordinary phosphorus was heated for some time in a closed vessel to a temperature of 470°, it lost its power of igniting spontaneously, and became of a deep red color. By making use of this discovery, matches can now be made without danger, either to those who manufacture them or to those who use them. The safety match is made by putting the oxidizing material alone on the match, the red phosphorus being mixed with emery and pasted on the side of the box.

The Luminiferous Ether.

Though compelled to think of space as unbounded, there is no mental necessity to compel us to think of it either as filled or as empty; whether it is filled or empty must be decided by experiment and observation. That it is not entirely void, the starry heavens declare, but the question still remains: Are the stars themselves hung in vacuo? Are the vast regions which surround them, and across which their light is propagated, absolutely empty? A century ago the answer to this question would be: "No, for particles of light are incessantly shot through space." The reply of modern science is also negative, but on a somewhat different ground. In support of the conclusion that the celestial spaces are occupied by matter, it is able to offer proofs almost as cogent as those which can be adduced for the existence of an atmosphere round the earth.

The notion of this medium must not be considered as a vague or fanciful conception on the part of scientific men. Of its reality, most of them are as convinced as they are of the existence of the sun and moon. The luminiferous ether has definite mechanical properties. It is almost infinitely more attenuated than any known gas, but its properties are those of a solid rather than of a gas. It resembles jelly rather than air. A body thus constituted may have its boundaries; but, although the ether may not be co-extensive with space, we at all events know that it extends as far as the most distant visible stars. In fact it is the vehicle of their light, and without it they could not be seen. This all pervading substance takes up their molecular tremors, and conveys them with inconceivable rapidity to our organs of vision. It is the transported shiver of bodies countless millions of miles distant which translates itself in human consciousness into the splendor of the firmament at night.

If the ether have a boundary, masses of ponderable matter might be conceived to exist beyond it, but they could emit no light. Beyond the ether dark suns might burn; there, under proper conditions, combustion might be carried on; fuel might consume unseen, and metals be heated to fusion in invisible fires. A body, moreover, once heated there, would continue for ever heated; a sun or planet once molten, would continue forever molten. For, the loss of heat being simply the abstraction of molecular motion by the ether, where this medium is absent no cooling could occur. A sentient being, on approaching a heated body in this region, would be conscious of no augmentation of temperature. The gradations of warmth dependent on the laws of radiation would not exist, and actual contact would first reveal the heat of an extra ethereal sun.—*Tyndall.*

Economical Steam Power.

The trial trip of the new screw steamer, *Torino*, built by Messrs. Oswald & Co., of Pallion shipyard, Sunderland, has lately taken place. The steamer is for the Italian Lloyd's Company, and of the following dimensions: Length between perpendiculars, 270 feet; breadth, 33 feet; depth of hold, 21 feet; register tunnage, 1,553 tuns. She has a draft of water forward of 7 feet 10 inches; aft, 11 feet 2 inches. The vessel is fitted with all modern appliances for increasing the comfort of passengers and the capacity for cargo, and is specially designed to attain a high speed under steam with a small expenditure of power. Her engines, which have been made by the builders of the vessel, are of 160 horse power nominal, of the inverted cylinder, compound, surface condensing type, the cylinders being 34 inches and 64 inches in diameter respectively, with a stroke of 3 feet. It was found that under 1¾ lbs. of coal per horse power per hour was used, which small quantity may be traced to the introduction of Messrs. Oswald's feed heating apparatus, which increased the temperature of the feed water to 185°, the heat being extracted from the exhaust steam by injecting the feed water through it in a vessel connected with the exhaust pipe, thus utilizing a quantity of heat which would otherwise have been lost. There are two boilers on the cylindrical return tube principle, constructed for a working pressure of 65 lbs. per square inch. It was observed as a result of the trial that the mean speed was 10.9 miles per hour, which included the time lost for priming, etc. The average revolution of the engines showed 67; average steam, 62; vacuum 26; indicated horse power, 753; temperature of feed water 185°, with patent feed heater. The trial was considered eminently satisfactory.

A HUMMING bird flew into a court room in Georgia during the session of the court one day recently, at 10½ A. M., and continued to fly within a few inches of the ceiling until six P. M., when it fell slowly and lighted on a mantelpiece, where it was captured. It was on the wing seven and a half hours without rest.

Correspondence.

The Editors are not responsible for the opinions expressed by their Correspondents.

Propagation of Roses.---Dwarf Pear Culture.---Ornamental Trees and Shrubs.---Manufacture of Ladies' Apparel.

To the Editor of the Scientific American:

Last week I took an excursion through Monroe and Wayne counties, N. Y., visiting several fruit nurseries and flower seed gardens, and one novel manufacturing establishment, and witnessing practical application of scientific principles to the production of fine fruits and flowers, not less interesting than those involved in the construction of steam engines or the propulsion of canal boats. Moreover, I found an evident willingness, on the part of those who have subjected theories to the test of experience, to impart their dearly bought wisdom to others, thus smoothing for their successors in the business the rugged way over which they have themselves achieved success, and contributing to the higher development of their noble calling. The method of

PROPAGATING ROSES

was minutely described and shown by Mr. John Houston, the skillful propagator at the extensive ornamental and small fruit nursery of A. M. Purdy, Palmyra. This work is done at any time during the season in the greenhouse. I saw plants which were set early in the season and had made considerable growth, others set at various times since, and others still, cut from the bushes and set while I was looking on. Good thrifty shoots from six to twelve inches long were cut and laid in a market basket, sprinkled, and covered with two or three thicknesses of wet paper. They were next taken into the workroom attached to the greenhouses and there cut with a thin bladed keen pocket knife into pieces from one inch to two inches in length, and thrown into water and left from one quarter to one half hour. These cuttings are made with a smooth, somewhat oblique cut, so as to leave but one bud to each, and that at the upper end. The leaf at the base of the bud is cut away, except the two lower leaflets. After having lain in water until all the pores are filled, they are set in coarse sand in the smallest crocks, one in each, or several in a large one. The subsequent treatment consists in keeping them uniformly moist and warm, too much or too little water being injurious. After the cuttings have taken root, they are transferred to larger crocks or to the garden beds. Persons wishing to propagate roses on a small scale may substitute a bottomless box with a light of glass over it for a greenhouse. A writer in *The Garden* says he has succeeded finely by putting a dozen or more cuttings in coarse sand in a marmalade jar, with water enough to stand about a quarter of an inch above the sand, and plunging the jar in a slight hot bed, giving all the light and sun possible, and adding a little water occasionally to replace that lost by evaporation.

Mr. Purdy has 130 acres of rolling land, with soil of sandy loam, devoted to small fruits and ornamental shrubs, probably the largest small fruit nursery in the country. The acres of Mammoth Cluster black cap bushes, literally covered with thimbles of jet, were a sight for an epicure.

From Palmyra, I rode north six miles through a fine farming section, along the line of a projected railroad from the Ontario iron mines by the New York Central to Walworth, a lovely little village which crowns the summit of one of several parallel north and south ridges. Almost encircling and imbosoming the village are the nurseries and orchards of T. G. Yeomans, Esq., to whom, with his estimable family, I am indebted for two days of rare enjoyment in studying the results of twenty years' thorough and systematic devotion to the cultivation of fruit trees and fruit. Though equally successful in raising all other orchard trees and fruits, Mr. Yeomans is without doubt unrivaled as a cultivator of

DWARF PEARS.

From 400 to 500 barrels of pears is the ordinary product of his orchards. The "Duchesse d'Angoulême" is his favorite variety. They are very large, a barrel having been filled with 125 pears. They are delicious and always marketable, $1,000 having been received for the product of one third of an acre for two years. Quince roots are imported from France. These are set in spring and budded in summer, or grafted the following winter and reset in spring. Clean cultivation follows for two or three years, when the trees are ready for the orchard. The "Bartlett," "Louise," "Bonne de Jersey," "Howell," "Seckel," "Sheldon," and "Vicar of Winkfield" are considered next in value to the "Duchesse."

Mr Yeomans relies on thorough preparation of the soil by underdraining, manuring, deep and frequent plowing before planting, and clean cultivation, frequent stirring of the soil, and skillful pruning afterwards for success in fruit raising. As an illustration, he has laid four miles of tile drain on fourteen acres of lately purchased land. Cultivators and small plows are kept in operation all the season through, the ground being thus kept mellow and clean as a garden. The most perfect system prevails in all parts of the establishment, and one who visits it is at no loss to know why the products of these grounds are so eagerly sought for. The reason is simply this: The very best varieties are cultivated in the very best manner and sold for what they really are. Varieties which he has thoroughly tested and found the best, Mr. Yeomans raises largely. Of the Baldwin apple, for instance, he has entire blocks in the nursery and over sixty acres of orchard. His entire apple, pear, and peach orchards contain over 14,000 trees. A full crop of apples is about 3,000 barrels; of peaches, 1,000 bushels. Every peach tree is full of fruit.

At Walworth, and also at several of the Rochester nurseries, I took note of such

ORNAMENTAL TREES AND SHRUBS

as pleased me most. Omitting those well known, I will name a few, any of which may be safely ordered by those who wish to add a rare and beautiful ornament to their lawns. The cut leaved birch has a graceful form, light drooping foliage, and smooth silvery bark which contrasts finely with the foliage. The red leaved beech is among trees what the *coleus* is among plants. The honey locust is a rapid grower and a beautiful tree. The *Salisburiana adiantifolia* is remarkable for its peculiar fan shaped leaves. The magnolia and catalpa are fine trees. The *Wigelia rosea*, *Spirea prunifolia*, *Deutzia crenata*, *Deutzia gracilis*, Japan quince, and red leaved barberry are very desirable shrubs.

While at Rochester I visited the establishment of Messrs. Elwell & Moseley, manufacturer of ladies' suits and underwear. They are pioneers in the business. They have already secured an extensive trade, their orders being from almost every State in the Union. In the machine room are stands for 120 sewing machines, which are run by water power, the operator starting or stopping the machine by a slight pressure on the treadle, one foot crowding the band wheel against a disk attached to the shaft, the other removing it. Hemming and puffing are done with the Wilcox & Gibbs machine at the rate of 2,000 stitches per minute. For other work, the Singer, Wheeler & Wilson, Howe, and some other machines are used.

Much of the more elaborately wrought parts of under garments is formed by carefully stitching together narrow strips of bias tucking, puffing, insertion, and edging. The tucking is prepared by laying fine tucks obliquely in two yard pieces of cloth, and then cutting into narrow strips lengthwise. The material used is Victoria lawn, linen, and grass cloth. The wonderful feature of the establishment is that by the aid of machinery and proper division of labor, beautifully wrought garments are made and sold at less prices than the very plainest articles can be made for by hand. Now that ladies' garments have begun to be manufactured by the dozen and hundred by machinery, we may look to see the needle banished to the garret along with the spinning wheel and loom.

C. H. D.

Warsaw, N. Y.

[For the Scientific American.]

NOTES OF ENGLISH SCIENCE.

The treatment of sewage is calling forth a good deal of enterprise. The method adopted by the Peat Engineering Company is to treat with charcoal, a tun of which, they calculate, is equal to the absorption of at least two tuns of solid sewage matter. The mixture is reduced to powder and packed in bags for conveyance or storage. This mode is being applied at Bradford to a sewage of 5,000,000 gallons daily, including waste liquors from numerous dye works and factories. The liquid will be filtered through charcoal arranged in several rows of beds 700 feet long and 4 feet wide, each particle of sewage passing through twelve feet of charcoal. The same company are about to treat the Paris sewage, and offer for the solid *excreta* the high price of 6 francs 7 centimes per cubic meter. The Nuneaton sewage is about to be treated by Anderson's process, in which the sewage is admitted into tanks, and sulphate of alumina, dissolved in water, is thrown in, followed by a little slaked lime. Sulphate of lime is formed, and the alumina is set free. Precipitation follows; the water is run off, and the mud discharged into baskets, of galvanized iron wire lined with flannel, which act as strainers. These, when full, are lifted and the deposit is thrown on a sheet iron floor, heated from beneath with hot air, which, after heating the plate, is drawn back over the surface of the mud, and carried into the flue of the engine furnace. The dried mud forms the manure. Dr. Anderson says that at Nuneaton eight to ten tuns manure can be produced weekly at a cost of £7, including everything.

The Council of the Society of Arts offer prizes of £60, £20, and £10 for the best improved cabs, to be exhibited at the International Exhibition in 1873. The London cabs are thought faulty in the following respects: 1. Want of room. 2. Seats in four wheelers too high, not commodiously made, and the space underneath lost. 3. Difficulty of getting in and out of hansoms from hight of step and interference of wheel. 4. Window arrangements in hansoms are bad. 5. The confined, ill ventilated space in hansoms when the window is closed. 6. Imperfect locking of wheels in four wheelers.

The Prince Consort memorial in Hyde Park is approaching completion. It was designed by Mr. Gilbert Scott, R A., and its estimated cost is £120,000. The monument is elevated on a pyramid of steps, on the upper platform of which rises a pedestal surrounded by sculptured figures. Four pillars of polished granite bear aloft the four main arches of the canopy. The upper part consists of a lofty spire of "tabernacle work," largely gilt and enameled, and terminating in a gilt cross which reaches the hight of 180 feet above the ground. Each side of the canopy is terminated by a gable containing a large picture in mosaic. Various sculptured groups represent Architecture, Painting, Poetry, Agriculture, Commerce, Engineering, etc. The figure of the Prince Consort is not yet placed, and is not likely to be for another year.

A remarkable method of preparing wood pulp for the manufacture of paper is exhibited by Mr. Houghton at the International Exhibition. The logs or blocks of wood, preferably pine, are cut into small pieces about one inch by one half or one fourth of an inch. These are treated with alkali at a temperature of 370° to 380° Fahr. (equivalent to a pressure of 175 to 180 pounds per square inch). All resinous and other matter is thus dissolved out, and the skeleton fibrous framework of the wood collapses into half stuff, under compression, with moisture. The wash liquor is treated (in accordance with a discovery made by M. Tessié du Motay) so as to be utilized again, and this is the essential principle of the process. Carbonic acid gas is forced through the liquor, forming a resinous precipitate, which falls to the bottom on application of heat. The supernatant fluid remains still colored by some vegetal acids, and these are removed by introducing sulphate of soda, a cheap salt. The caustic alkali is thus made fit for use again.

A new mode of paving, called lignomineral, is about to be tried in one of the London streets. It consists of wood blocks impregnated with mineral substances, which make them impermeable to wet and homogeneous. The foundation is prepared with concrete, and the interstices between the blocks are solidly filled in with gravel. The blocks are beveled at the end to an angle of 60°, and those of adjacent rows are inclined in opposite directions. Cheapness and endurance are said to be the benefits of the system. It has been tested in Paris, with excellent results.

The Australian Telegraph Company have announced their readiness to receive telegraphic messages for Australia and New Zealand, at the sender's own risk. The land line is not yet complete, but by means of an express service, news may be received in Adelaide five days after London dates. The work of construction in Australia has been divided into two parts, one from Port Darwin southwards, the other from Port Augusta northwards; of the former 400 miles have been constructed, of the latter, 1,176 miles, leaving 250 miles incomplete. Great difficulties have been experienced from floods. If one walks a mile or two from the camp, he may find, on attempting to return, that he is almost cut off by creeks and water courses, which before had no existence. The rainy season would thus seem to threaten interruption to the line when constructed. Iron poles will further be wanted all through tropical Australia, on account of the ravages of the white ant. The company wishes to carry a submarine cable from Port Darwin to join the Queensland lines in the Gulf of Carpentaria.

A. B. M.

LONDON, July 8, 1872.

Saliva.

The action of the saliva in turning the starch of the potato into sugar is tolerably well known to students of popular science; but few among the ordinary reading public are aware that this saliva consists of a variety of fluids, some of which prepare or predispose the food to change, while others merely serve mechanical objects. Of these the saliva secreted by the parotid glands contains a peculiar ferment named ptyaline, and this principle is the only agent in saliva which has the power of transforming starch into sugar. The diastase of malt has a similar action, and a knowledge of this fact led Baron Liebig to employ diastase in the preparation of a food for infants "brought up by hand," which food supplies efficiently the want of ptyaline and alkaline fluids in the digestive juices. But little is known of the character of saliva in disease; that it is very materially affected cannot be doubted, and further research will probably throw more light on the subject. It is known that the administration of mercury causes a change in its constituents; several medicinal salts, such as iodide of potassium, pass very readily into the saliva from the blood, and, as is well known, the saliva is the bearer of the poison of hydrophobia. From these facts we derive information of a nature probably unthought of by many; for if ptyaline be the only substance in the human economy which can turn starch into sugar—for the gastric juice cannot, and the pancreatic fluid has only a trifling influence in this direction—we see at once how necessary and important it is to thoroughly masticate all food containing starch, not only in order to obtain the full nutritive value of what we eat, but also to prevent overloading the stomach with a mass of food, much of which is probably indigestible.

Canadian Canals.

The New Dominion Government, with a wisdom and foresight which can hardly fail to promote the largest results, is turning its financial prosperity to good account by projecting a series of public improvements on an extensive scale. It is not generally known that the St. Lawrence River above Montreal is not navigable, and that transportation is chiefly by means of canals. These canals were constructed at intervals to meet local wants, and are without uniformity or system. Vessels fully loaded passing through the Welland Canal must discharge part of their cargo, nearly one half, in order to go through the St. Lawrence canals to Montreal. It is intended to enlarge all the canals to a uniform size and depth, so that vessels of 1,000 tuns can pass with full cargoes from the Upper Lakes to tide water. This will be the nearest approach to direct trade between the lake cities and Europe which has yet been attained, and opens up the prospect of a formidable competition between Montreal and New York. Comparatively few vessels will make the voyage from Chicago to Liverpool. It will rather be to the interest of shippers to forward grain to Montreal for reshipment by regular ocean vessels to Europe. The lengthy inland navigation, partly by river with strong currents, and partly by canal, will be only favorable to steamers which it would scarcely be worth while to adapt to the exigencies of the ocean. The consequence is that Montreal is likely to become a great grain distributing port in the immediate future.

THE new postal rate, on transient newspapers, pamphlets, circulars, cards, photographs, roots, cuttings, etc., is 1 cent for each two ounces.

The Magnetic Needle in Mineral Explorations.

Major T. B. Brooks, who has had much experience in the use of the compass as an aid in the exploration of iron bearing localities, recently gave a very interesting paper on the subject before the American Philosophical Society, Philadelphia. In these explorations, the ordinary compass and the dip compass may be used to advantage, and the author is of opinion that by their employment not only can the presence of underlying veins of iron ore be determined, on passing over the surface of the ground, but also the order of superposition or succession of beds of iron bearing rocks. He does not undertake to say that by means of the magnetic needle it is possible to tell whether we have a workable merchantable deposit of iron ore under our feet; but this is certain, that the needle will enable us to trace the course of the iron bed until we come to some outcrop of the mineral, and then we may be able to determine its value. The distance through which a local magnetic pole or bed of iron ore will affect the needle depends on the intensity of the attraction of the bed, and on the position in which the needle is placed. The maximum influence is observed when the needle is moved east or west of the ore bed. The influence of the magnetic rocks at Republic Mountain has been observed at a distance of 2,500 feet horizontally.

The thickness of rock or earth which covers the iron deposit can, the author thinks, be determined by the needle in the following manner:

Remote from any magnetic rocks, neutralize, by means of a bar magnet, the earth's influence on the needle of a solar compass. The needle will then stand indifferently in all directions, and will not vibrate. Record carefully the distance and position of the neutralizing magnet; the compass is then ready for use. Set it up near the magnetic pole to be determined, and fix the magnet in exactly the same relative position it had before. The earth's directive power on the needle will again be neutralized, and the needle will point as near towards the local pole as its mode of mounting will permit; mark the line indicated by the needle on the ground; remove the compass to one, or, better, two other positions, and repeat the operation. If there is no other local force to interfere, the three lines must intersect in one point, which will be directly over the pole whose position is sought. By using a dip compass in a similar manner, it is evident that the data to determine the depth, by the simple solution of a triangle, would be obtained.

A solar compass must be used to fix the position of the artificial magnet used in neutralizing the earth's force, or it may be fixed by an observation on the north star, or from a meridian line brought in from a non-magnetic area.

When considering the magnetism of the rocks of the four great geological epochs represented on the upper peninsula of Michigan, I observed that considerable magnetic variations were noted by the Federal surveyors, over rocks of silurian age, which had never been observed to be in themselves magnetic. In some instances these variations had been observed over a limestone, supposed to be Trenton, and at a distance of 75 miles from the nearest Huronian or other (known to be) magnetic rocks.

This phenomenon may be due either: 1. To the presence of magnetite in such rocks, due to local metamorphism or other cause. 2. To accumulations of magnetic sand in the drift. 3. To the underlying Huronian rocks, which may be supposed to exert their influence up through the overlying silurian.

Without having made a study of any of these localities, I incline decidedly to the latter hypothesis, as embracing the known facts better than either of the others.

Should this prove true—and I hope to settle it the present season—it may lead to a novel and interesting application of the science of magnetism to some of the most important questions of geology—the determination of the thickness of sedimentary rocks by magnetic triangulation in places where it would otherwise be difficult to arrive at such thickness. It might also enable us to work out the structure and distribution, in a rough way, of those oldest rocks which underlie great silurian areas, which would in no other way be possible, thus throwing light on the nature of the rocky bottom of the ancient seas.

On the same principle we can, of course, trace magnetic iron belts under water. I have in many instances made very satisfactory magnetic observations from a canoe in the inland lakes of the upper peninsula.

The bottom of Lake Superior may be partially mapped out in the same way. Silt and sand will make no difference with the needle; it looks through everything but iron.

New Material for Bricks.

During the last few years, experiments have from time to time been made with the view to utilize in some way the mounds of shale (the refuse of the coal mines) which cover an area of several thousands of acres in South Staffordshire, England, by converting them into bricks. Several enterprising firms have already embarked in this novel but profitable business. When properly pulverized, the shale is found to be an excellent material for the purpose, the bricks produced being hard and durable, resembling in color the fire clay bricks of the Stourbridge district, although for furnace and such like purposes they are not so valuable. For ordinary building, however, they are found to be of equal practical value to the ordinary red bricks. The material is to be had in any quantity for a mere nominal sum, and there is every reason to believe that this method of utilizing the innumerable dusky hillocks which disfigure the South Staffordshire landscape will gradually develop into an industry of some importance.

Cheap Concrete Houses.

The latest method of concrete building, as practised in Scotland, is thus described by the *Aberdeen Journal*:

The whole process of building houses of concrete is so exceedingly simple that the employment of skilled labor is quite unnecessary. A foundation having been laid, a double framework of wood, or paneling, 9 inches apart and 18 inches high, is placed above the foundations round the entire building, forming a kind of box. This paneling consists of pieces of wood, varying in breadth from 3 or 4 inches to over 1 foot, with a bead on the upper edge having an aperture by which the pieces are slid on to an iron rod. Being thus telescopic in construction, the pieces of wood can be lengthened or shortened according to the extent of the building. At intervals between the panels are placed upright bars, called separating posts, several feet high, through which the iron rods supporting the panels pass and are secured. At equal distances of 18 inches, ascending upwards, there are apertures in the posts for the insertion of the iron rods, and the paneling round the entire structure can be raised with great ease as the building advances. When operations are to be commenced, a quantity of packing, which may consist of rough stones of any shape, the more rugged the better, which forms the first layer of the building, is thrown in, care being taken to keep the packing 1 inch from the face of the work, so that it may not show through it. When the 18 inches of packing are filled up, the concrete, which is in a semi liquid state, like mud, is poured into the box and percolates down through the stones, thoroughly filling all cavities, and binding the stones and rubble together so tightly that the whole forms one solid mass. For a day, the portion of wall thus made lies encased within the paneling. By that time it has become quite dry, and the paneling or frame is taken off and lifted up other 18 inches, the bottom of the frame resting where the top was before. Thus another box is formed above the piece of finished wall, and identically the same process which we have described is repeated, stones and rubble being thrown in, and the liquid cement being poured over them. In this way 18 inches of building are finished each day if the weather be good, so that in the course of a week the walls of a cottage 8 or 9 feet high are strongly and firmly built.

When the paneling is screwed together to the separating posts, it is so mathematically exact, owing to its careful structure, that the wall is built as straight as if tested with a plumb line. Indeed, it cannot fail to be so, and it is interesting to note that the whole building is finished without the aid of a plumb line, which is quite unnecessary.

A noteworthy feature in connection with the building of these concrete houses is that the usual cumbrous and often dangerous scaffoldings which are used in erecting ordinary buildings is superseded by a much better, more secure, and much less unwieldy arrangement, by which ropes are entirely dispensed with. Little hollow iron tubes, called cores, are placed in the walls, through which iron rods are inserted, connected with brackets which are securely attached to the wall, being firmly screwed through the building with nuts. The brackets are just similar in form to supports used for shelving, and on the top of the brackets are laid the planks for the scaffolding, forming altogether a neat and strong support.

Two cottages, which are built as one, are 32 feet in length by 22 feet, and 8 feet high. In each cottage there are three rooms, those in the front being about 12 feet square, and the back rooms measuring about 7 feet by 12. The cottages are lighted by two windows in front, and four in the back. The flooring is of concrete, which, being thoroughly impervious to moisture, makes the apartments very dry and comfortable. It is intended to have the roof built in the ordinary way with rafters and slating, but it is not uncommon for concrete to be used as a roofing material, for which purpose it answers very well. The outside walls, when built, are finished with a coating of concrete, about a ½ of an inch thick, a little finer in the quality than that used for the ordinary building, which gives a smooth finished appearance to the structure. No supports are requisite for the lintels of the doors or windows, because after the concrete is hardened, it is stronger than any support of wood or stone. When the building is in progress, spaces are left for the joists, which are temporarily filled with sand, which is easily removeable at any time with a trowel. The spaces for the joifts are made, alternately 3 inches and 6 inches in depth, on each side of the building, which diminishes the pressure on the walls considerably.

Houses finished in the way we have described are much cheaper than those built in the ordinary way, the saving being from 35 to 40 per cent. The buildings, at the same time are more comfortable, because, being impervious to moisture and heat, they are warm and dry in winter, and cool during summer. The rooms can be papered over the bare walls, no lath or plaster being required, though a coating of plaster in no way affects the concrete, if it is preferred.

An important element, of course, in the process of building is the concrete or cement itself. It is burnt down from stone somewhat in the same way as lime, but, of course, is of an entirely different nature. When the cement is to be used, it is mixed with rough sand, generally for ordinary purposes in the proportion of eight pailfuls of sand to one of cement. The two are mixed simply in the ordinary way, water being poured over the sand and cement until they are in a semi-liquid state. When the sand is very sharp and shelly, the concrete can be made in proportion of nine pailfuls of sand to one of cement; while in other cases again, where the sand is of a soft inferior description, one pailful of cement is necessary to seven pailfuls of sand.

CAPITAL is only another name for the savings of society.

Aniline Black.

Aniline black is generated by the action of oxidising agents upon aniline, or the aniline oils of commerce. Its formation is consequently similar to that of other aniline colors. In these operations a molecular condensation takes place, in consequence of the more complex combination into which the atoms of aniline and toluidine enter. A like condensation occurs in the formation of aniline black.

These oxidation products of aniline and its homologues, namely, the aniline colors, are of a basic character. Aniline black is decidedly basic. As to the nitrogen, it either remains—as in magenta—in the new formed compound, or it is partially disengaged as ammonia. The latter reaction occurs in the formation of aniline black, or, as it may be called, nigraniline.

The author used as ingredients muriate of aniline, chlorate of potash, a trace of chloride of copper and water, mixed at common temperatures. The formulæ for the preparation of this color all contain sal ammoniac. The author finds, however, that a color equally fine and pure can be prepared without this addition. The mixture was evaporated at common temperatures in the air in a porcelain capsule and repeatedly remoistened till a dry, water repelling powder of a velvet blackness appeared—a sign that the process was complete. The aniline oil, muriatic acid, and chlorate of potash were used in equal weights, and at the conclusion a number of undecomposed crystals of chlorate of potash were found. No free aniline was detected in the acid liquid, but ammonia was found in its stead. After washing in hot water, the black powder was combustible without residue, giving off when ignited a smell, first of naphthylamine, and afterwards of cyanogen.

The aniline oil employed contained toluidine, and yielded 120·5 per cent of the washed black powder. This large yield, and the circumstance that the color, as fixed upon the tissues, is a deep green and does not become a violet black till after treatment with an alkali, led the author to suppose that it was a base, and contained when green a muriatic acid in combination. This proved to be the case. The dark green body is a muriate of nigraniline (aniline black), the deep violet being the free base.—*Rheinbeck.*

Solubility of Ozone in Water.

L. Carius has made the observation that ozone is, under proper conditions, appreciably absorbed by water, which fact he has communicated to the Chemical Society of Berlin. He recommends for the purpose that the water shall be near its freezing point, and that the vessel containing it shall have but a small neck. If these conditions are observed, and a stream of ozonized oxygen is conducted into it, the water will take on gradually the characteristic smell of ozone, and its presence may afterwards be proven by all the usual reagents.

The method of preparing the gas followed by the author was that of Soret, namely, by the electrolysis of cooled diluted sulphuric acid, using platin iridium poles.

The ozone solution so prepared may be brought upon the lecture table, and used to bring about all the oxidizing experiments usually performed with the gas itself. Several analyses, made by the author, gave the amount of the absorbed ozone at very nearly one half per cent by volume.

The City of New York.

The population is now about one million. Its territorial area covers New York city, twenty-two square miles. It has twenty-nine miles of water frontage, 300 miles of paved and 160 miles of unpaved streets. Twenty thousand gas lights nightly burn in the streets and public places, at a public expense of $43 per year for each lamp. There are 350 miles of Croton water pipes and 277 miles of sewers. There are over 2,000 men in the police force and 600 firemen, whose salaries together amount to a round sum of $3,000,000. 3,000 workmen are employed. The city contributed to the support during the past year of 51,466 criminals. It alleviated during the same time, by out door and institutional charity, the sufferings of 195,334 of the sick.

THE brain of a horse seems to entertain but one thought at a time; for this reason continued whipping is out of the question, and only confirms his stubborn resolve. But if you can by any means change the direction of his mind, giving him a new subject to think of, nine times out of ten you will have no further trouble in starting him. As simple a trick as a little pepper, aloes, or the like, thrown back on his tongue, will often succeed in turning attention to the taste in his mouth.

TEXAN RAILWAYS.—Texan railway progress is very rapid. The Central railroad is in working order to Dallas, and will be completed to the Red River by January 1. Large consignments of bar and plate railroad iron have recently been received at Galveston. Eight lines of road are now under construction in northern Texas. Many of these are extensions of Eastern lines, and three are links in the transcontinental system. Texas, with its internal resources and its immense prairies, is destined to become a great railway state.

PRESERVATION OF IRON BOLTS.—M. Maltrasse Duprez has introduced a process which may become invaluable in hydraulic works, namely, for the protection and preservation of iron bolts and ties embedded in wooden constructions. This consists simply in lining the bolt hole with a compound of grease and zinc filings, which is found to galvanize the iron, as it were, and so perfectly protect it.

THE Maryland Institute for the Promotion of the Mechanic Arts will hold its twenty fifth annual exhibition, to commence on October 1st, at Baltimore.

IMPROVED RAILWAY SYSTEM.

The object of this invention is to overcome the disadvantages attending the present mode of supporting railway rails on ties placed at intervals, by providing for them continuous and equalized bearing surfaces, which are yet of a sufficiently elastic nature to relieve the rolling stock of undue wear and tear. To enumerate the objectionable features of the present system would only be to repeat what we have said in former articles, so we will at once proceed to show how it is now proposed to meet them.

Mr. Connelly, the inventor, has devised, with the above end in view, two plans of construction; one consisting mainly in a system of longitudinal wooden sleepers, and the other in a semi-elastic concrete bed. We will first explain the former, which is shown at the lower side of Fig. 1, and, in detail cross section, at A, Fig. 2.

The sleepers are 10 by 12 inches in cross section. The crossties used are of either cast or wrought iron, and are formed with ribs on the under side and end ribs on the upper sides, while their ends are turned down to correspond with the beveled edges of the sleepers. A portion of one of the ties is shown at B, Fig. 3, from which its construction will be seen. The upper rib serves to support the outer edge of the rail clamp, C, and the lower ribs supply an anchorage for the bolts by which the clamp is fastened.

The ties for joints are eight inches in width and the others two inches and a half; and the clamps are made to correspond. Two of the wide and four of the narrow clamps are used for each length of rail (thirty feet), and the joints of the rails on each side of the track are laid on the broad ties alternately; which arrangement is seen in Fig. 1. The wide clamps are made sufficiently high to take the place of a fish bar, as shown in Fig. 3, and the outer one may, at the rail joints, be made heavier and extended up level with the tread of the rail, so as to take the bearing of passing wheels when the ends of the rails are separated by contraction, and, thereby, prevent their being battered down. The sleepers are mortised to receive the ties, which may be spiked to them through the beveled ends if necessary; and between the tie and the the clamps and rail, at D, is placed thin wood, gum, or other elastic material. A substantial road bed between the rails, and extending two feet outside, is made of ballast thoroughly tamped with gravel. The entire construction, as described, will readily be understood on inspection of Fig. 2, at A.

Fig. 1.

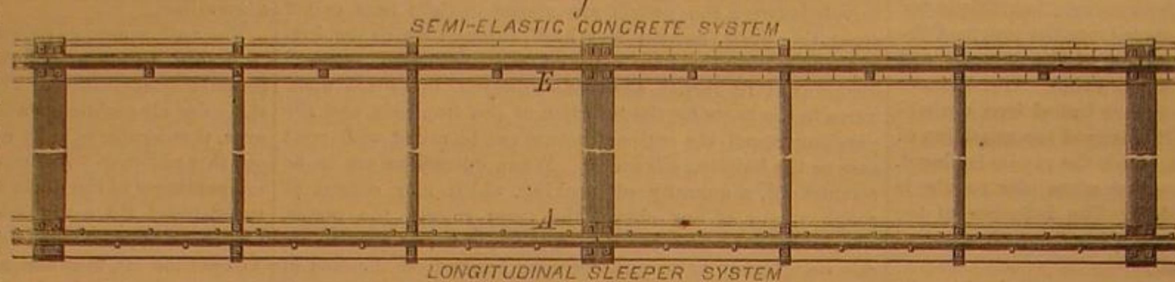
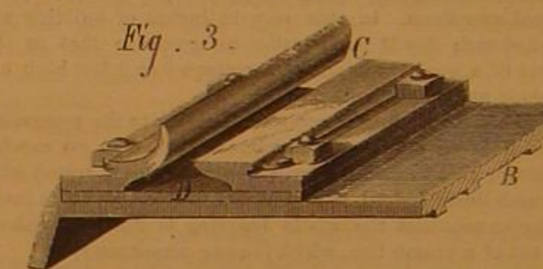


Fig. 2.

Fig. 3.



CONNELLY'S RAILWAY SYSTEM.

The concrete system is represented in the upper portion of Fig. 1, and at E, Fig. 2. A longitudinal bed of concrete, 14 inches square, is laid down, and is covered with what the inventor calls an "elastic boulevard," one inch thick. Coal tar enters into the composition of this covering and gives it the requisite elasticity. This is capped with a wrought or cast iron plate, which has its edges flanged down in such a manner as to secure the boulevard and itself upon the concrete bearing. The road bed is made as in the previous case, and the ties and clamps used are the same as in that. Oak plank is laid under the rail and clamps, and the cap, crosstie, plank, and clamps are bolted together, as shown at E, Fig. 2.

It is claimed that in this invention the chance of broken rails is reduced to a minimum, while an absolutely smooth and durable road is secured, and the rolling stock preserved from injury.

The inventor states, further, that in the system of longitudinal sleepers a 48 pound rail is fully equivalent, in all respects, to the 67 pound rail now used with the ordinary ties; and he estimates, thereby, to effect a saving in metal of over $1,000 per mile with iron rails, or of over $1,500 per mile when steel is used. The first cost of the concrete system is estimated to be the same as that of the present track, but the economy in its maintenance would, he thinks, give it a great advantage over the latter.

The proprietors of the patents on this invention, which were dated May 14 and June 18, 1872, are J. C. Tilton & Co., of Pittsburgh, Pa., who are desirous that the improvements should go into immediate use, and who will correspond with railroad officials, manufacturers of materials, capitalists, and others who may wish to become interested.

OZONE.—In the *Journal* of the Scottish Meteorological Society for January and April 1872, in addition to the usual records of temperature, pressure, rain, etc., is a report on ozone observations, which appears to be of considerable value. The following conclusions are interesting: "When the air had a pleasant sharpness to the feelings, exercising a stimulating influence on the spirits, the largest quantities of ozone were obtained. On the other hand, when the air was close and seemed to exercise a slightly depressing influence, little, if any, ozone was detected."

IMPROVED REPEATING RIFLE.

In the improved rifle we now illustrate, the skill of the inventor has furnished an example of simplicity, neatness and effectiveness rarely excelled. The piece is a magazine breech loader, and in it the intricacies of construction of such arms have been reduced to so low a point that a long detailed description of its working parts is rendered unnecessary. We may briefly say these parts consist of a sliding breech and cartridge extractor, which is connected by a link with a pivoted breech block, a lever which is moved by the action of the breech block, and a carrier block which is operated by the lever. The gun is also provided with a cartridge gage, by means of which a stop behind the carrier is set so as to accommodate cartridges of various lengths.

In Fig. 1, at A, is shown the opening through which the cartridges are inserted to charge the magazine. It has a spring covering, which yields readily to admit the cartridge and afterwards closes immediately by the recoil. In Fig. 2, at B, is the cartridge gage, which consists of a plate that slides in a shallow groove, and is connected with the stop before alluded to. In using the gage, the cartridge is laid with its point at an engraved line on the mounting, shown in the figure, and with its heel in the groove; the plate is slid forward until it touches the heel, and is then fixed in that position by the screw in its center. Only the length of cartridge gaged can be used unless the gage be altered.

On one side of the front end of the pivoted breech block is a projecting pin, by which the same is lifted up; and it will be observed, on inspecting Figs. 1 and 2, that this can only be done while the hammer is raised so as to clear the projecting tongue on the end of the block. It will further be noticed that by this construction the hammer cannot reach the firing bolt (which is situated under the tongue) while the breech block is raised, and thus all danger of premature discharge is avoided. Still another effect of the construction is that the breech block and all its appendages are securely locked by the hammer when firing. By raising and lowering the breech block, the operations of extracting the discharged shell and loading with a new cartridge, are effected. Upon raising it, the extractor is drawn back and the empty shell withdrawn from the barrel; and upon its attaining its highest point of elevation, its tongue strikes the lever before mentioned, by which the carrier block is raised and made to eject the shell and elevate a full cartridge on line with the barrel. The position thus arrived at is shown in the enlarged view, Fig. 3. Upon swinging down the breech block, the new cartridge is pushed home into the barrel, and the carrier is made to descend in line with the magazine to receive another.

Fig. 1

Fig. 2

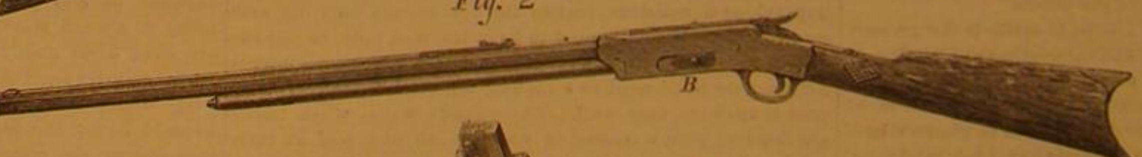


Fig. 3

ROBINSON'S MAGAZINE REPEATING RIFLE.

Fig. 4

In Fig. 4 are shown various samples of projectiles, full size, to the use of which the gun can be adjusted. It will be seen therefrom that the arm is adapted for cartridges of unusual length, and it is claimed that its range and penetration are increased accordingly. Its caliber is $\frac{44}{100}$ in., and loads of this size varying in length from $1\frac{1}{4}$ to $1\frac{5}{8}$ in. can be used.

We may remark that the barrel of this rifle may be separated from the stock by simply removing a pin. The weight of the weapon as manufactured is from 7 to 9 pounds, and its length from 42 to 47 inches—the barrel being from 24 to 28 inches; and it carries from six to eight shots.

Among other advantages claimed for it are its beauty of form, strength, safety and superiority of balance consequent on the perfect proportion of all its parts, and the fact that all its working parts are closed in and protected from injury.

The gun was patented through the Scientific American Patent Agency, April 23, 1872, by Mr. Orvill M. Robinson, a previous invention of whose in the same direction we illustrated at page 127, Vol. XXV. It is manufactured by the Adirondack Fire Arms Co., Plattsburg, N. Y., of whom further information may be obtained.

THE "HEATHEN CHINEE"—The San Francisco *Bulletin* says: A manufacturer of bird cages and other ware in the city, a short time since, thought to enlarge this revenue by substituting Chinese cheap labor for the white workmen he had in his employ. The Mongols did well enough, at $1 a day, for a short time, until they mastered the business, when the whole party resigned and set up for themselves, and are now "bearing" the bird cage market at a fearful rate. The author of this enlargement of their sphere of enterprise is prone to believe that "we are ruined by Chinese cheap labor."

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Contents:

(Illustrated articles are marked with an asterisk.)

THE APPRECIATION OF KNOWLEDGE.

It is an old observation that man generally appreciates only that knowledge which he possesses himself, even if this possession is quite limited; and that those branches of knowledge to which he is a total stranger are considered by him as not worthy of the expenditure of his own or any body else's time. We must, of course, make exceptions to some ornamental accomplishments; a man who never danced may come into a ball room, and then appreciate the value of dancing, and wish he could dance; or a young lady without any education whatever may ardently wish she could play the piano and talk French; but such a kind of appreciation proceeds not always from any love to the knowledge itself, but often from the reasonable and natural desire to make one's self agreeable and entertaining, or, what is worse, often simply from vanity and the selfish desire to shine and eclipse others.

It is this total ignorance of everything relating to the science of the present day, of those educated in our old fashioned exclusively literary colleges, which is the chief cause of the opposition to the introduction of scientific courses in our higher educational institutions. The knowledge of the classical languages and their literature, even when it is only limited, of course increases its appreciation more and more; and if the student, by an incomplete *curriculum*, is kept exclusively in this path, he must of course become one-sided; the result is seen in the opposition of the present day, found among many professors and students, to the innovation of devoting to the scientific course as much time as to the classics. It is perhaps little known that, 300 years ago, there existed as much opposition against a reform then introduced into the classical education as there is now manifested against the modern reform. The reform then introduced was the study of the Greek language and literature. The whole scientific world was then under the tuition of the scholastic lecturers in Latin, who, under pretence of teaching the philosophy of Aristotle, taught nothing but the rubbish under which the philosophy of Pythagoras and Plato were buried. When, after the overthrow of Constantinople in 1453, by the Moslems, the learned Christian Greeks had been driven to the cities of the west, and diffused the well merited admiration for that language and literature, the scholastics and Roman Catholic theologians, comfortably seated in their universities and pulpits, opposed vehemently the attention which was then commenced to be paid to Greek. Their opposition was bitter and most violent; the Christian faith, they said, was in danger. The Greek classics would undermine Christian Roman theology. The established and well tried mode of educational training were to be superseded by worthless empirical schemes. The humanities would supersede divinity, and society would be endangered by such a change, etc.

The changes, at last established in the system of study, came then as now, not from inside appreciation, but from outside pressure. Hamilton says: "The awakened enthusiasm for classic studies did not originate in the universities; it was only after a strenuous opposition from these bodies that ancient Greek literature achieved at last its recognition as an element of academical instruction." The new philosophy, so called, was considered a fifth wheel to a wagon, abominated as a novelty that threw the ancient Latin learning into discredit, diverted the studious from the universities, emptied the schools of the *magistri* and the *bursæ* of the colleges over which they presided, and rendered contemptible the once honored distinction of a degree. Greek in particular and polite letters in general were branded as heretical, and while the academical youth hailed the first lecturers on ancient Greek literature in the universities as messengers from heaven, the academical veterans prosecuted these intruders as preachers of perversion, and winnowers of "the devil's chaff," etc.

It is curious to observe the similarity of the objections made against the educational reform of that time, and those made in our time against the introduction of scientific training. It is also now asserted by the ultra orthodox veterans that religion is in danger, that science will beget infidelity, etc.

In the meantime, science manifests so powerfully its influence on our present social condition that opposition to its study is utterly useless. Every thoughtful man is reminded almost every minute of his life of what comforts he owes to scientific research, discovery and invention. We close with a quotation of George Gore, of Birmingham, England, from an article on "The Practical Importance of Scientific Education" He says: "Every man who eats his food with an electro-plated fork is indebted for the use of that article, not only to the labors of those inventors who developed the steam engine, by means of which the metal is rolled and stamped into forks, but also to Volta, Davy, Daniell and others who produced the voltaic battery, to Gay Lussac, who discovered cyanide of potassium, and to the various inventors and practical men who applied all those means to produce the final result." And this is only a single illustration out of scores which can be easily given.

PROTECTION FROM LIGHTNING.

The importance of metallic rods as a means of protection against lightning was well illustrated during a thunderstorm at Baltimore, on the 20th ult., when an electric discharge fell upon the rod of the Washington Monument. This structure has an altitude of 185 feet, stands upon high ground in an open square, and forms a conspicuous point for the convergence of electricity. The monument was protected by a common lightning rod, put up apparently in a bungling, imperfect manner, but it unquestionably saved the structure from serious damage. The Baltimore *Sun* says that "investigation shows that the damage to the statue and monument was very slight indeed when compared with the damage to the lightning rod, and infinitesimally so when compared with the damage that would necessarily have resulted if the rod had not been there. A careful examination developed the fact that the rod received the whole charge and passed it safely to a bad connection, five feet from the point at which a lateral explosion occurred, knocking some small fragments out of the statue; from that on, it followed the rod, exploding in its way wherever inferior connections obstructed its passage, blacking the top of the base between the shaft and the outer edge as thoroughly as though a large quantity of powder had been exploded upon its surface. From there to the earth, the lightning passed without further explosion until arriving at the terminus of the rod, at which point the flag pavement was torn up and broken into fragments. It then seized upon the iron railing surrounding the base of the monument, over which it passed, fusing it where it first came in contact with the metal. Wherever the connection was good in the lightni g rod, no damage was done."

In almost every example where buildings having rods upon them are damaged, it will be found that the connections or terminals of the rods are defective. One of the chief defects of lightning rods, as they are ordinarily put up, is in the ground terminals. The lightning-rod-man covers the house with neat looking rods and points, sticks the lower end four or five feet into the ground, pronounces the job a good one, receives his money and departs. But a rod thus left is almost as unsafe as it would be if its lower end were enclosed in a glass bottle and rested on the ground.

Ordinary earth is an exceedingly poor conductor of electricity as compared with iron; hence, in order to effect the safe discharge of electricity from an iron rod into the earth, the bottom of the rod should be provided with a large conducting surface, so that the electricity may be diffused and pass into the earth at many points simultaneously. The explosion at the pavement, in the example of the Baltimore monument, shows that the rod there employed was sadly deficient in the area of its ground terminal.

The necessary area of underground conducting surface for a lightning rod may be obtained in a variety of ways: (1.) Extend the rod itself for a considerable distance underground, away from the building. (2.) Connect the lower end of the rod with an iron pipe which extends in like manner underground. (3) Provide a trench and supply it with good charcoal well packed, and imbed the rod, for some distance from the building, in the charcoal.

As an electrical conductor, well burned charcoal ranks next to the metals. Metallic ores come next to charcoal. Water and moist earth, which are so frequently recommended as terminals for lightning rods, are among the poorest of conductors.

One of the best protected dwellings that we have heard of is that of Mr. John Knox Smith, an intelligent English merchant residing at Singapore. His country house is built on a prominence, upon a bed of iron ore, with which the house lightning rods are made to communicate. The lower ends of the rods thus have a very extensive conducting surface, and the protection afforded is considered perfect. Thunderstorms and lightning strokes are very frequent, but the house has never been injured.

A PETROLEUM FIRE.

A great conflagration of petroleum occurred at Hunter's Point, opposite New York city, during the forenoon of the 30th ult. Over thirty-five thousand barrels of crude oil and thirteen thousand barrels of refined oil were consumed, together with many valuable buildings, tanks, docks, and several vessels. Property to the value of over one million dollars was consumed. The fire spread over an area of ten acres, and lasted for twenty-four hours, emitting an immense quantity of flame and smoke, which rose in a column of great hight, visible in all directions for twenty miles or more.

The Standard Oil Works, one of the largest refining and storing concerns in this vicinity, were totally destroyed. The fire broke out in a canal boat which was being loaded at the dock in front of the Standard premises, and is alleged to have been caused by the careless throwing down of a match by a workman, after lighting his pipe. The spread of the flames was so rapid, owing to the explosions of the oil barrels, that the firemen and workmen were compelled to keep at a distance, and were able to do but little in arresting the fire.

Large flocks of tame pigeons were observed to approach and whirl as though maddened around the huge column of smoke, and then dart suddenly into the midst of the flames and perish.

During the progress of the flames, some of the burning vessels were carried by the tide into the East river and floated northward. One of them, burning at a furious rate, was thus carried through the narrow channel between Blackwell's Island and Astoria, through the fearful pass of Hell Gate, beyond Ward's Island to Port Morris, a distance of five miles, where it approached the extensive docks and storehouses at that place, threatening the whole with destruction. No escape seemed possible, as no means for preventing the collision were at the command of the inhabitants. Slowly the burning monster came on, belching forth horrible flames and smoke. At the last moment, when all hope of saving the Port Morris warehouses was abandoned, a United States steamer was observed to run in under the smoke, into the very middle of the burning vessel. Running in and backing out quickly several times, the officers of the steamer finally succeeded in casting an anchor and chain upon the flaming hulk, by which it was towed out into the stream, and Port Morris was saved. The steamer proved to be the United States revenue cutter *Bronx*, and her commander and men are entitled to great credit for the skill and courage they so successfully displayed.

We are glad to be able to state that the extensive Astra oil establishment of Charles Pratt, which was illustrated so fully in our supplement a few weeks ago, escaped all injury. The Pratt works are located next south of the Standard works, and only escaped by a sudden shift of the wind after the fire broke out.

The application of water for the purpose of extinguishing petroleum fires, appears in this, as in other examples, to have been of little service. The water simply buoys the flaming oil, and enables it to run off in different directions, carrying destruction in its course. It is evident that a more effective extinguisher than water must be brought into use before we can hope to prevent these terrible conflagrations. Whoever can discover an effectual agent for this purpose or find out some simple way of rendering the oils uninflammable while in transit or storage, will confer a great benefit upon the country.

A RAILWAY ACCIDENT EXPLAINED.

By a recent accident on the New York and Oswego Midland Railway, a freight train was completely wrecked and much valuable property destroyed, but no lives were lost. The accident took place near Oneida, N. Y., while the train was running at a speed of from twenty to twenty five miles an hour on a down grade. The train consisted of the locomotive and tender, two box cars, then two empty platform cars, followed by twelve or fourteen cars loaded with coal and other freight. The brakeman, a new hand, states that according to orders on down grades, he set the brakes on the box cars in front, and had just put his hand on the brake of the first platform car when he saw that the second platform car was off the track. In a moment more it was thrown athwart the track, a general crash ensued, and he jumped for his life.

Among the reasons assigned for the accident was the stereotyped one, "broken rail"; also slipping of a wheel on its axle; also dropping down of a brake. But Mr. Alfred Hawley, superintendent of the Oneida Community machine shop, who made a careful examination of the track and remains of the wreck on purpose to ascertain the correctness of these alleged reasons, gives a different report. He found the rails and road bed in perfect order, and no indications of a dropped brake or slipped wheel. "What then was the cause of the disaster? What caused the middle portion of a train to leave the track on a straight, level, well lined, well ballasted portion of the road? We are convinced, says a correspondent of the Oneida *Circular*," that the accident was caused by an improper application of the brakes to the forward part of the train when running at a high speed." He thinks that the checking of the front part of the train caused the heavy rear cars to crush against the light platform cars and lift them from the track; and with this opinion, probably most railway people will agree. The same correspondent takes occasion to observe that many of our railway accidents are due to the incompetency, carelessness or ignorance of railway employees; and with this view, almost everybody will coincide.

THE INTERNATIONAL PRISON CONGRESS.

An international congress is now in session in London, composed of representatives from all civilized countries, for the purpose of considering the questions of the repression and prevention of crime and the care of the criminal. The delegates number many distinguished persons, many of whom have made the subject of prison reform a life study.

The United States is represented by Rev. Dr. Washburne, Rev. C. L. Brace, General Pillsbury and others, of New York, Hon. Mr. Chandler of Pennsylvania, Dr. Wines and Governor Haynes of New Jersey, and Mrs. Julia Ward Howe of Boston. Among the members from the countries of Europe are Count Sollohub, director of a large prison in Russia, Count Scalia, Director of Prisons in Italy, Privy-Councillor Steinmann of Germany, Professor Marquardsen of Erlangen, Baron Von Holtzendorff, the great authority on criminal law in Prussia, and Miss Carpenter, one of the most celebrated philanthropists in England.

Various questions relating to the subject of reform and punishment have been discussed at considerable length. Corporal punishment, and especially the use of the "cat," met with hearty condemnation from the American and continental authorities, but the English, with some exceptions, advocated it as a means of discipline. The Austrian, Bavarian, and Swiss delegates stated that corporal punishment had been totally abolished in their respective countries with the best effect. The argument on the British side took the ground that the lash was a necessary requital for crimes of brutality, such as wife beating and garrotting. The latter species of robbery, which had become alarmingly prevalent in London, had almost disappeared since its perpetrators were punished by severe castigations.

The "treadmill," a most useless and degrading penance, was found to be still in use in British prisons, although it has been abolished for over forty five years in those of America. The continental delegates affirm that it is unknown in their countries. Several English members were eloquent in its denunciation. Colonel Colvill, a prison director, states that he had been obliged to employ the mill on an average of 600 prisoners yearly for eighteen years past, and that he had never known a human being to be benefited by it. On the contrary, its only effect was to harden and depress.

The question of the prevention of crime was also brought up, several members making reports of the labors of societies for that purpose. Reformatories of different types were discussed, the general conclusion being that the "Family Reform School" was superior in every way to the "congregated" system.

It was considered that the best mode of aiding discharged prisoners was by obtaining for them co-operative employment. Thirty-four aid societies are in existence in England, which have yearly provided for about 5,500 discharged convicts. Regarding the rehabilitation of the latter, the system of placing them under the surveillance of the police was condemned.

Mr. Sergeant Cox, in reference to the repression of criminal capitalists, stated that in his opinion the receiver of stolen property should receive double the punishment imposed upon the thief.

The industrial school system of New York was fully explained, and the value of the institution shown by the fact that 2,200 children had been sent to honest employment in the West. Compulsory education was defended and generally considered a valuable auxiliary in the prevention of crime. Baron Von Holtzendorff stated that, by the law of Germany, no child could come before a magistrate for crime until above the age of twelve, but all cases of crime under that age were reported to the schoolmasters, who punished. In that country, also, the children of prisoners who are without friends are taken care of by the State in the same manner as orphans. In the United States, it is customary to consider a child as a "ward of the State," and the prisoner, when his sentence has been served, can only regain control and possession by order of court.

A correspondent of the New York *Times* says that "the British delegates were amazed to hear from General Pillsbury, of Albany, that he had carried on various prisons not only without expense to the public, but saving a handsome surplus for permanent purposes; and that, in his experience, teaching a man a trade saved him from repetition of crime. Similar experiences, from Massachusetts, of self supporting prisons, were detailed, and produced a deep impression. Count Solloherb, director of a large prison in Moscow, stated that in three months he could give a man a trade; that the prisoner became better under it, and out of the thousands he sent forth annually, less than one per cent repeated their offenses, or came under the law again."

The results of the deliberations of this congress of philanthropists, composed of men and women who are thoroughly familiar with the darkest side of life and with the statistics of crime in both the old and new worlds, cannot but be of the greatest importance. By this interchange of views, the many and grievous faults of our present system of prisons and reformatories, which in a great measure are due to adherence to old and obsolete ideas, may be clearly seen and remedied; while valuable improvements and innovations will be suggested through the contrast of our methods of repression and prevention of crime with those adopted by other nations.

NEWSPAPER BENEVOLENCE.

Among the benevolent enterprises lately put in motion in New York was a subscription to pay the expenses of giving the poor children a holiday excursion. This was set on foot by the New York *Times*, and the holidays have been very properly designated the "Times excursions." Nearly twenty thousand dollars have been contributed, and perhaps forty thousand ragged youngsters have enjoyed the luxury of a steamboat ride, a romp in the woods, and a good time generally, with refreshments.

One or two of these excursions was exclusively devoted to poor mothers and their young children. Another notable excursion was that of the newsboys, of which the *Times* says: "The party was composed entirely of newsboys and boot blacks, than whom there is not a rougher and more irrepressible class in New York. Large posters announced the picnic and called for a thousand boys. When the manager of our picnics reached the *Times* office at 6¾ o'clock A. M., he found it besieged by boys clamoring for tickets. The crowd was quickly transferred by him to the City Hall Park, where the smaller boys were all picked out and badges pinned on their jackets, if they had any, but on their shirts as a general thing. Shortly before 7½, the superintendents of the various newsboys' lodging houses with their contingents marched into the Park; and till the order for the column to march was given, a scene went on such as perhaps has never before been witnessed in New York or any other city."

Hundreds of little ragged urchins, few of them possessing shoes and stockings and many having nothing to protect their close cropped heads from the sun, were dashing about in a high state of glee if they had secured a badge, or in a state of great anxiety if they had not yet done so. Those who were too big to go would beg and pray for a ticket. The boys danced, stood on their heads, turned somersaults from pure exuberance of spirits, and many a bit of roguish satire was sent at those who could not be taken. The steps of the City Hall were crowded with interested spectators of the scene; in fact the whole of the south side of the Park was crowded. At last the boys were formed in line, in three separate divisions, wearing red, white, and blue badges respectively. At 8 o'clock the band from Governor's Island entered the Park, and taking up their position, the order to march to the steamboat was given. The scene at this moment was really exciting. As division after division, each headed by its own banner, left the Park, the crowd cheered and waved their handkerchiefs, ladies appeared at the windows of the Astor House, every store on Broadway and Park Row was emptied in a moment, and the sidewalks were thronged. As the little fellows passed the *Times* office, they sent up cheer after cheer. Every moment the number of spectators increased, so that in Chatham street and up East Broadway the little army of ragamuffins was escorted by a crowd as large as that which attends the Seventh Regiment on dress parade days. The boys were carried to a fine grove on Long Island Sound, where they had a day of most hearty enjoyment.

WAVE POWER PROPELLERS.

Some fifteen or twenty years ago, we published in the SCIENTIFIC AMERICAN the drawings of a self propelling vessel, in which the sides of the ship were provided with hinged propelling blades, so arranged that by the roll of the boat the blades would alternately open and close, giving the vessel a forward push at every lurch.

This was a novel idea at the time, but it involved the attachment of considerable mechanism to the outside of the vessel, which, under the rough usage of the billows, would be likely to breakage or disorder. It is obvious that the use of ordinary masts and sails is a much better plan of propulsion. The flapping blade system, we observe, has lately been revived, and notices thereof are circulating through the press. It makes a good newspaper item, but has no other value.

WATER VAPOR NOT VESICULAR.

A recent experiment by T. Plateau disproves the commonly received theory respecting the vesicular nature of aqueous vapor. He provided a column of water, contained in a glass tube and held therein by atmospheric pressure, the bottom of the water column being exposed; small air bubbles, on being brought from the point of a small tube into contact with the exposed water surface, immediately rose through the water column. If water vapor is vesicular, it should do the same. But experiment shows that it will not. On directing a current of ascending vapor from boiling water against the bottom of the water column, no appearance of rising vesicles through the water could be detected.

INCLINED RAILWAY IN SAN FRANCISCO.

The steep elevation of the lands immediately adjoining the city of San Francisco and the desirability of providing convenient access thereto have induced some enterprising individuals to attempt the construction of an inclined railway. The incline will be 2,800 feet in length, traversed by cars drawn by steel wire ropes and stationary engines. The cars are to be provided with clutches whereby the rope may be grasped or released at the will of the conductor. At the top of the incline, the cars are delivered over to the horse railway.

Wood Carpeting.

A correspondent recently suggested that a substitute for matting for covering floors, cheap, durable, and cleanly, was desirable. The wood carpeting, made and laid by the National Wood Manufacturing Company, 942 Broadway, New York, is the best, cheapest, and handsomest material for halls, dining rooms, and kitchens that we have ever used. The expense is not so much as that of carpeting, and but little more than that of matting; and when properly laid, it will last a number of years. We have substituted it for matting in a summer residence, and find that it possesses all the advantages of a solid hard wood floor.

THE Fourth Annual Fair of the Carroll County, Md., Agricultural Society is to be opened at Westminster, Md., on September 30, and will continue till October 5. Among the premiums to be awarded are several subscriptionr to the SCIENTIFIC AMERICAN, rewards which are always acceptable to the recipients and welcome to their homes and families.

[Special Correspondence of the Scientific American.]

LETTER FROM PROFESSOR R. H. THURSTON.

CINCINNATI, Ohio., July, 1872.

Cincinnati and its approaches. The great suspension bridge of Roebling. The iron railway bridge over the Ohio. The Danks puddling furnaces; interesting particulars concerning their operation. The Cincinnati water and gas works.

The route to Cincinnati *viâ* the "Panhandle" line of railroad, although not presenting as many beautiful landscapes and such a panorama of picturesque scenery as the Pennsylvania railroad in crossing the Alleghanies, exhibits to the traveler not a few exceptionally fine views in the neighborhood of Pittsburgh. That of the confluence of the Alleghany and the Monongahela rivers to form the Ohio, and the long stretch of the latter river that can be seen just after leaving Pittsburgh, are especially attractive, possessing such beauty, when seen by the light of a sun just setting among gorgeously colored clouds in the west and throwing no less beautiful though quieter colors over the eastern clouds and along the further river bank, that those who have been fortunate enough to witness it will long hold it in remembrance.

En route, we pass through the city of Columbus, Ohio, a pleasant town with wide streets, having some fine public and many fine private buildings. The capitol would be a noble structure except for what seemed to us its very ugly dome. The city hall is a very neat building. There is not very much manufacturing done here, and we only remained long enough to see something of the city and to take the next train for Cincinnati.

This latter city can hardly claim to be a manufacturing place, although its manufactures, in the aggregate, employ a considerable amount of capital. The business of manufacturing furniture is becoming its leading branch of industry. The comparative low price of walnut and other kinds of wood used in the business enables it to reach profitably for its market as far east as Pittsburgh and all over the West and Southwest. Some of the furniture made here is extremely neat in design, well made and of beautiful finish, fully equal to any thing made east of the Alleghanies. Prices are not very far from New York figures.

THE GREAT SUSPENSION BRIDGE AT CINCINNATI.

In Cincinnati, we were particularly interested in the great bridges over the Ohio river and in the now well known Danks' revolving puddling furnace.

Entering the city by rail from Columbus, one of the first and most striking objects that catches the eye is the great suspension bridge stretching across the river to Covington, Kentucky. This immense structure has a greater span than any bridge yet built in the world.

It was built by the late John A. Roebling, the builder of the two suspension bridges at Pittsburgh, and of the almost equally wonderful structure at Niagara Falls. Considering the time at which it was designed and the difficulties with which he contended, its successful completion justly entitles its designer to be considered one of the boldest and most talented engineers that the world has yet known. At first view, the bridge impresses the observer by its magnitude, as well as by the neatness of its general design, and by the graceful sweep of the great wire cables which support the roadway; but a second visit is even more impressive than the first, and, after studying it from different standpoints, and after walking across it several times, one feels that, after all, the mind was quite incapable, at first sight, of appreciating this great engineering wonder of our age, or of understanding what difficulties are met in the general plans, to say nothing of those of detail, by the engineer who attempts to sustain a bridge like this between piers separated by a distance of nearly a quarter of a mile. Those who are now watching the progress of the East River bridge at New York—which was designed by the same great engineer, in the light of all the experience gained by a life time devoted to such work, and the construction of which is proceeding under the directions of a son who profits by his own special scientific and practical training as well as by his father's experience and teaching—can hardly appreciate the talent, the hard work and the mental anxiety and activity that must have been demanded of the engineer during the progress of the Cincinnati bridge, which has but about a hundred feet less span.

THE IRON RAILWAY BRIDGE.

Further up the stream is the great iron railroad bridge built by the Keystone Bridge Company. At the channel span, the bridge is 400 feet from pier to pier, and, were it not so near the great suspension bridge, it would at once awaken in the spectator the greatest interest and admiration. It is a beautifully proportioned and well made bridge. The members carrying a compressive stress are formed of the peculiarly strong and readily constructed built columns used by some of our leading constructors; and the tension members are rods and links with ends upset, to secure full strength at what are usually their weakest parts, and to distribute the extension of the metal throughout the whole length of the piece. The importance of this last advantage is too seldom understood and attended to by constructing engineers. It is a point of special consequence, in mechanical engineering and wherever structures are exposed to sudden strains and heavy shocks.

THE DANKS PUDDLING FURNACES.

A part of a day was spent at the mill of the Cincinnati Railway Iron Works Company, examining the Danks puddling furnaces and watching their operation. These furnaces have attracted the attention of iron manufacturers both here and abroad, for, although by no means the first "rotary puddlers," they are the first whose operations has been sufficiently satisfactory to induce proprietors to substitute them wholly for the old furnaces in even a single mill. The Danks patent is upon details; but the inventor is certainly entitled to much credit for skillfully proportioning them, and even more for his perseverance and tact in overcoming those difficulties that usually impede, for many years, the progress of the most meritorious inventions.

The ordinary process of puddling consists in melting cast iron upon the hearth of a reverberatory furnace and stirring it until the carbon has been burned out, and other impurities have passed into a slag; and malleable or wrought iron then remains. Many attempts have been made to substitute machine for manual labor in the process, but none have been hitherto successful, and, all over the civilized world, puddling is done by the same old process; and the severity of the labor, together with the intensity of the heat to which the workman is exposed, makes the life of the puddler a short one and the process comparatively expensive.

The Danks puddling furnace has an ordinary furnace grate, but, instead of the large chamber of the reverberatory furnace, a barrel shaped vessel receives the charge of pig metal, and through this the flame passes to the chimney. The metal once melted, the barrel is caused to revolve by steam power, and as the fluid metal flows around the interior, the carbon which it contains and the accompanying silicon are oxidized by contact with the passing oxygen in the furnace gases, and with that of the iron ore with which the barrel is lined. Gradually it loses its fluidity, becomes viscous and finally spongy, and is then malleable iron. One end of the barrel is movable, and that being removed, the great "ball" of spongy iron, weighing 600 to 700 pounds, several times the weight of an ordinary puddle ball, is taken out, carried, by tongs suspended from an overhead railroad, to the squeezers, where it is rolled and compressed into a billet of quite compact iron, and thence to the "muck train" of rolls in which it is given the shape of a long rough looking bar, which only requires additional rolling to convert it into such "merchant bar" as we see in the market. The process was a very interesting one to us, and the contrast between this and the ordinary method, so far as the comfort of the workman is concerned, was very marked and very gratifying. So satisfactorily have these furnaces done their work here that they have displaced all of the old furnaces in these works. English iron masters have considered the improvement so important and desirable that they some time since sent a commission to this country to determine the real value of this furnace.

The commission brought over many tons of the worst, as well as of some of the best, British irons and puddled them here. Their report is one that will interest and please every friend of American manufacturing industry. We saw very good iron which had been made from Yorkshire pig, and from even worse Welsh cast iron; and, during our visit, the furnaces were working with *stove scrap*, which is, probably, generally about as poorly adapted for the purpose as any iron that can be found; judging from the appearance of the bars produced, it made a good iron. Whether this particular furnace will ever become generally used is uncertain, and even a matter of little consequence to the world; but it is eminently desirable that, in some form, a machine may perform this very simple and yet essential detail in the process of iron making, and, at the same time, reduce its cost and relieve the workman from one of the severest tasks known in the arts.

THE CINCINNATI WATER AND GAS WORKS.

After visiting the water works, where we found five steam engines engaged in supplying the city with water, and where we were especially interested in the working of the largest—a great machine, 100 inches in diameter of cylinder and of 12 feet stroke of piston—we accepted the invitation of Mr. E. M. Breese, the engineer of the city gas works, and, under his guidance, examined that great establishment very minutely. Space will not, however, allow of a description of this or of other interesting establishments which may be found at Cincinnati. Some idea of the magnitude of the city itself is afforded by the facts, learned at the gas works, that they consume annually about 1,250,000 bushels of coal, making 700,000,000 of cubic feet of gas. Such a quantity of coal would warm, for the winter, the houses of about 6,000 New York mechanics, and the volume of gas made annually is perhaps four times as great as that of the 6,000 houses taken together.

R. H. T.

SLICING APPLES.

The wholesomeness of the apple as an article of food is not as widely known as it deserves to be. The fruit not only contains large quantities of nutritive matter, but has valuable antiseptic qualities which exercise the most beneficial effects on the system. In order to prepare apples so as to have them available for use at any time, a correspondent suggests the following method: A hole of about the size of an ordinary apple is cut in a block of wood. On the under side of the orifice, seven shoe knives are arranged, edges up, in such a manner that the middle blade is the lowest, the the pair on its either side on a higher plane, the next pair higher and so on—so that the edges form a curve. The knives are also inclined so that the edges are nearer together than the backs. A follower is fitted into the curve thus made, and is attached to the block of wood by a hinge on one of its sides; to the other, a handle is affixed. To make the plan clear, we should judge that the instrument, as described by our correspondent, resembles a lemon squeezer, with knife blades substituted for the perforated cup in which the lemon is usually placed. The apple, being placed in the orifice, is pressed down by the follower upon the knife edges. It is thus cut into slices which fall through the openings between the blades. In this manner, we are informed, a bushel may be sliced in two or three minutes. The slices are then spread upon a grass plat and "hayed" in the sun—covering them or raking them together at night. When thoroughly dried they may be stored away, when they will keep without spoiling for any length of time.

RECIPES AND EXPERIMENTS.

The following recipes and experiments have not been practically tested by the editor of the SCIENTIFIC AMERICAN, but are published for the benefit of readers who may desire to try them. The editor would be glad to be informed of the results of such trials.

BLEACHING FEATHERS.—First clean from greasy matter, then place the feathers in a dilute solution of bichromate of potassa to which a small quantity of nitric acid has been added. The greenish deposit of chromic sesquioxide which ensues may be removed by weak sulphurous acid, when the feathers will be left perfectly white.

RENDERING CLOTH WATERPROOF.—Put half a pound of sugar of lead and a like quantity of powdered alum into a bucket of soft water. Stir until clear and pour off into another bucket—into which place the cloth or garment. Soak for twenty four hours and hang up to dry without wringing. This process is said to be very effective.

FILTER FOR CISTERN WATER.—Perforate the bottom of a wooden box with a number of small holes. Place inside a piece of flannel, cover with coarsely powdered charcoal, over this, coarse river sand, and on top of this, small pieces sandstone.

ZINC WASH FOR ROOMS.—Mix oxide of zinc with common size and apply it with a brush, like lime whitewash to the ceiling of a room. After this, apply a wash, in the same manner, of the chloride of zinc, which will combine with the oxide and form a smooth cement with a shining surface.

HARDENING WOOD FOR PULLEYS.—After a wooden pulley is turned and rubbed smooth, boil it for about eight minutes in olive oil, then allow it to dry, after which it will ultimately become almost as hard as copper.

TO CLEANSE WOODEN FLOORS.—The dirtiest of floors may be rendered beautifully clean by the following process: First scrub with sand, then rub with a lye of caustic soda, using a stiff brush, and rinse off with warm water. Just before the floor is dry, moisten with dilute hydrochloric acid and then with a thin paste of bleaching powder (hypochlorite of lime); let this remain over night and wash in the morning.

MUCILAGE.—Glue, water and three per cent of nitric acid adheres well to metallic surfaces.

PRESERVING STUFFED ANIMALS WITHOUT ARSENIC.—Rub the flesh side of the skin with a composition of 1 lb. tobacco ashes, ½ lb. alum, 2 lbs. dry slaked lime.

CLEANING OIL PAINT.—Whiting is better than soap. Use warm water and a piece of soft flannel. Afterwards wash clean and rub dry with chamois.

MAKING CITRIC ACID.—Treat fresh lemon juice with powdered chalk until all the acid is neutralized. Citrate of lime will be precipitated, which wash and then decompose by means of diluted sulphuric acid. A precipitate of sulphate of lime will then be formed while the citric acid dissolves. Filter, and the citric acid will deposit itself in crystals when the concentrated liquid cools.

VERMILION PAINT.—The tendency of paint made from vermilion (cinnabar or sulphide of mercury), when mixed with white lead, to turn black or brown in a short time may be obviated by mixing with the dry paint, before adding the oil, one eighth of its weight of flowers of sulphur.

CLEANING GLASS.—The lenses of spectacles or spy glasses that have come scratched or dimmed by age may be cleaned with hydrofluoric acid diluted with four or five times its volume of water. The solution should be dropped on a wad of cotton, and thoroughly rubbed on the glass which should afterwards be well washed in clear water. Great care must be exercised in handling this acid, as it eats quickly into the flesh, often producing painful and obstinate sores.

PAINTING ZINC.—Oil paint may be made to adhere to sheet zinc by coating the latter with a composition of one part nitrate of copper, one part chloride of copper and one of sal ammoniac, dissolved in sixty-four parts of water; add to the solution one part hydrochloric acid. This should be left from twelve to twenty-four hours to dry. It acts also as a protection to the metal against atmospheric influences.

TO RENDER CORKS OR STOPPERS AIR TIGHT.—This can be accomplished by covering with a cement composed of red lead or finely powdered litharge mixed with undiluted glycerin.

What Fifty Thousand Dollars Will Buy.

The following advertisement appears in the daily papers, and we give it publicity, free of charge, for the benefit of all who have fifty thousand dollars to invest in perpetual motions:—

$50,000 WILL BUY ONE-FOURTH INTEREST IN A NEW AND wonderful invention, a self-acting Engine of great power, which I get from vacuum or air cylinder, attached to an endless chain or band, rising up through a tank or column of water from 10 to 500 feet high or more if desired. I shall give a full explanation and give it away to all the world, and trust to its sense of justice for my recompense, if I do not find some one to take an interest in it. Address J. W. SHIVELY, inventor, box 371 Saratoga Springs Post Office, N. Y.

This beats Niagara Falls, where we have a perpetual motion, in the form of a column of water three quarters of a mile wide and several feet thick, falling 160 feet, and presenting a force of millions of horse power. Would it not be cheaper for the inventor to avail himself of this natural column of water, and in it test the practicability of his machine, before going to the expense of erecting a special column 500 feet high, as he suggests?

Notes & Queries.

[We present herewith a series of inquiries embracing a variety of topics of greater or less general interest. The questions are simple, it is true, but we prefer to elicit practical answers from our readers.

1.—Hair Dye.—Will some one give a recipe for hair dye such as barbers use, that smells like bad eggs?—G. H. J.

2.—Ivy.—What are the actual advantages or disadvantages of ivy growing on brick walls?—J. H. L.

3.—The Magnetic Pole and the Meridian.—In erecting a sun dial, I am obliged, for want of proper instruments, to use a compass or to observe the pole star to find the meridian. I am aware that the compass, except on the line of no variation, points to a spot some distance from the north pole (to the east, I believe.) Moreover, the pole star is not exactly over the north pole of our earth. Will some one tell me exactly how much the needle deviates, in this longitude (23° 30" W. of Washington) from the true north, and how far the pole star is from the zenith of the north pole?—L. H.

4.—Composition for Matches.—Will some one inform me how to make a friction match composition which will not dissolve in damp weather, and will not be very expensive?—C. B.

5.—Increasing the Power of Boilers.—I have a plain boiler 28 feet by 30 inches, driving an engine of which the cylinder is 6 inches by 30 inches. The boiler works at from 50 to 63 pounds on the square inch, and the engine at 50 revolutions a minute, and her fly wheel is 7 feet in diameter. I do not get power enough, and I think of increasing the size of the pulley on the main shaft, and running the engine at 65 or 70 revolutions, I can obtain the requisite work. But the boiler will not supply the necessary steam; and how can I make it generate more, or use what I now get to greater advantage? My feed water is heated by the exhaust steam till the feed pipe is too hot to hold in the hand. I have seen a device consisting of hollow grate bars, etc., but it is too expensive. Would it be safe to attach anything to the bottom of the boiler, or would an improved feed water heater answer?—J. S. P.

6.—The Earth's Orbit.—Is the distance of the sun from the earth greater in summer (say July) than in winter (say January) or not?—O. F.

7.—Pure Vinegar.—One of your subscribers is very anxious to know about vinegar, whether we must eat eels that can be seen with the naked eye, or whether we can have good vinegar without the large animals. With a glass, I have found, in cider vinegar, large and lively eels; other specimens showed skeletons without life, and others, of good quality, a clear reddish liquor with a little sediment without skeletons or life. Can we have vinegar without eels?—J. E. H.

8—Steel Queries.—Is the fact, that a small blade of steel can be ground and brought to a perfect cutting edge, evidence that the quality of the steel is good? Also, is bar steel, as it is sold, hammered enough to stand well for making light dies, or does it require forging?—W. L. G.

9.—Power for Fan.—Can any one tell me how heavy a weight it will take to run a fan (18 inches in diameter by 18 inches long, with 4 arms) one hour? The weight is to fall ten feet and the fan to run 150 revolutions per minute. What is the rule for the calculation?—A. D. L.

10.—Mass Motion and Heat.—W. H. P., in answering I. E., query 18, page 285, last volume, gives the equivalent of force in units of heat. Will he or some one else say whether there are any mechanical or chemical means by which force can be converted to heat, or what the nearest approach in practice is to the theory? I have asked this same question in another shape last winter, when I was in Nebraska, where there was plenty of force and very cold weather, which forcibly impressed me with the need of such a converter.—I. L.

11.—Temperature in Ice House.—My ice house is built above ground, of two pens of logs, the space (two feet) being filled in with old wet sawdust. It is floored and covered with dust. The temperature is 140° or 150°. My ice all melted. Some knowing ones say it should have been ventilated. Will you please inform me in your paper the cause of the high temperature, and was it want of ventilation that caused the ice to melt?—J. C. McC.

12.—Spontaneous Combustion.—One evening last week came in from the road (I am an engineer) and laid my overalls in the tender box; they were very greasy. The next morning I opened the box, and found the entire contents a mass of fire. My fireman was clearing off the stack a day or two ago with a piece of waste saturated with linseed oil. After completing the job, he laid the waste in his tender box, and on opening it, in eight or ten hours after, he found it burnt out, the same as mine was. Were these cases of spontaneous combustion? I related the above circumstances to a professor in a college, and he said they were not cases of spontaneous combustion, as there were but four cases in the known world. If they were not caused from spontaneous combustion, what were they?—W. F. C. S.

13.—Expansion of Locomotive Boiler.—What is the use of the angle irons at the side of the fire box, which are slotted to allow the boiler to expand on the frame when the back braces, bolted to the boiler and frame have no slots, or other provision to allow the boiler to expand? Do not the braces or frame spring? If not, what does give, as the boiler certainly expands when fired up?—W. F. C. S.

14.—Extinction of Cab Lamp on a Locomotive.—What causes my cab light to go out when I blow the whistle?—W. F. C. S.

15.—Noise of a Locomotive.—What causes the rumbling noise, which a person can hear for three or four miles and feel in every bone of his body, when I drop the front damper and pull up the back one, or when my engine is working hard on a grade?—W. F. C. S.

16.—Setting Boilers.—I am an engineer, and my boiler arch stands north and south. The boiler is 11 feet long with a 5 foot shell, 64 flues. My grate (Tupper) surface is 3½ feet wide and 5 feet long. From the door to the bridge wall is 6½ feet. My fire passes through the boiler, back over the top and enters the smoke stack, 50 feet high, built of brick. My fuel, shavings and sawdust principally, is pushed into the arch with the head of a rake, the arch door being on a level with the floor. The ash pit extends about the distance of a foot beyond the front plate of the arch, and the draft is taken through that aperture to the under side of the grate. In order to economize fuel, I fire very often, the average being 28 times an hour. I run mostly with closed damper. The damper in the chimney does not fit perfectly close, and the one in the draft plate in the front of the door is generally kept ajar by the dirt getting underneath it. My grate becomes in the morning a cherry red, and sometimes before the day closes becomes a white heat. I have terrific carbon explosions; they occur oftentimes in putting in a half bushel of fuel, and seldom when the dampers are shut. I have been recommended to keep up a sharp blaze in the rear of the arch as a kind of gas-burning fire, but it gives me no relief. These explosions usually take place about two minutes after the fuel is put in, and sometimes so powerfully as to raise the draft plate, which weighs 300 pounds. These explosions are more terrific when burning sawdust or matching chips than when burning surface shavings. I endeavor to keep my grates constantly covered, and therefore pack my fire closely as possible. Can any one tell me the cause of the explosions and the remedy? Is there a remedy other than letting more cold air strike the grate?—J. D. H.

17.—Wooden Railways.—My attention has been called to an article in your issue of July 20 headed "Wooden Railways," and from your suggestions I am induced to believe that such railways would be best adapted to the short roads now in contemplation throughout this State. The great cost of iron railways has, in a measure, deterred individuals from embarking in such enterprises, and more especially does this apply to this portion of the State, which is just beginning to recover from the effects of the war. The citizens of this vicinity of our town, which is situated on the banks of the Mississippi, are canvassing the subject of building a railway to the Bayou Macon hills, at a point some 20 miles in the interior. The county through which this road would run is almost entirely uninhabited, owing to the annual overflow from the Mississippi. Previous to the war, when the levees were up, it was the largest cotton producing portion of our (Carroll) parish. As is usual on the Mississippi bottoms, the country is perfectly level, and little grading would be necessary. The country is thickly wooded, and the timber peculiarly adapted to any purposes requiring strength and durability. My object is to obtain all the information I can with reference to the cost of this wooden railway for the distance mentioned, the character of rails, cross ties, etc., as well as the cost and style of locomotives and cars best adapted to the same. Any suggestions your readers may make will be thankfully received.—C. M. P.

18.—Effects of Friction on a Running Belt.—In oiling a bearing, I have to put my arm through a belt. I often hear a snapping noise when I bring my oiler near the band, and when I take it away the noise would cease. (I used a copper oiler when I first noticed it.) I placed my ear close to the band and soon I felt a snapping sensation, as though something was pricking me. I placed my fingers close to the belt and there was a peculiar feeling like that of being pricked by nettles. I supposed it must be electricity, and I took some notice of it; when I held the nozzle of my oiler close to the band a fine stream, or shower, of oil would come out of it and fly to the belt. If I held it on the outside of the belt, it would go around into the inside of the belt before it would strike it. When I held the oiler between the belt, the oil would fly in a circle. The sound would be loudest after the machinery had been standing still for a space of time, and when it was coldest. A pricking sensation was distinctly felt, and oil would flow more freely from the oiler. I found a feeling, when I placed my face to the half of the band that came from the driver, different from the one felt when I placed it to the half that went to the driver. What makes the difference in the sensation? What makes the oil come out of the oiler, and why will it not fly on to the outside of the belt as well as on the inside? It was a leather belt four inches wide and about thirty feet long; and I notice it made some difference whether I used a tin oiler or a copper one, the copper one giving the best results, probably because it was a better conductor.—J. T.

Answers to Correspondents.

SPECIAL NOTE.—This column is designed for the general interest and instruction of our readers, not for gratuitous replies to questions of a purely business or personal nature. We will publish such inquiries, however, when paid for as advertisements at $1·00 a line, under the head of "Business and Personal."

ALL reference to back numbers must be by volume and page.

Bending Wrought Iron Pipe.—J. V. R., of N. J., will find a successful method described on page 122 of Vol. XXVI. of the Scientific American.

Hermaphroditic Poultry.—I address you a few lines to ask a question regarding a chicken that is on my place. In 1871, it laid and hatched two broods of chickens; it commenced crowing in the fall; in the winter it was a little stupid; in the spring it assumed the form and performed the offices of a fully matured rooster. The above can be substantiated by good authority, or the chicken can be produced. I would like to hear from you through your valuable paper, as it is a freak in nature that I don't understand. Answer: We advise our correspondent to produce the chicken and arrange with Barnum for its public exhibition. A chicken matinee in this city would be a novelty and doubtless draw a crowd.

Driving Power of Rubber Belt.—In your issue of July 27, page 58, the driving capacity of a two ply rubber belt is given as one horse power for every two inches in width, when the belt travels at the rate of 1,800 feet per minute. This, I think, is a low estimate; from my own observations I am satisfied that a two ply belt, running at the above speed, will drive double that amount of power without injury, or one horse power for every inch in width, and a three ply will do the same with every three quarters of an inch in width.—W. A. L. K.

Skin Diseases.—To C. N., query 7, page 41.—The trouble comes from your liver. Take podophyllin pills, one every evening for two weeks; if the bowels become too relaxed, omit an evening.—M. B. E., of Pa.

Black Ink.—To M. W. H., query 2, page 58.—Take tannic acid, 20 grains, and a similar quantity of gallic acid; dissolve in 2 ounces water. Then take copperas crystals and Monsel's salt of iron, each 15 grains, and dissolve in 2 ounces water. Mix the two solutions and add 2½ drams of mucilage and 2 drops oil of cloves. This ink will cost one dollar a gallon.—H. J. H., of Mich.

Ink.—Let M. W. H. (query 2, page 58) make a strong decoction of logwood, and add a little chromate of potash. No gum required.—E. H. H., of Mass.

Dissolving Gutta Percha.—R. J. (query 7, page 58), should use bisulphide of carbon.—E. H. H., of Mass.

Waterproofing Paper Pulp.—To W. R. H. (query 10, page 58.—Try a larger proportion of resin than usual, and when the paper is dry, pass between hot rolls.—E. H. H., of Mass.

Crystal Glass.—To G. T. P., query 15, page 58.—The following mixture will give good results: Carbonate of potash, 112 parts; red lead, 224 parts; sand (washed and burnt), 336 parts; saltpeter, 14 to 28 parts; oxide of manganese, from one fourth to three fourths of a part. Mix thoroughly and melt together.—E. H. H., of Mass.

Hardening of Rain Water.—To B. D. A., query 16, page 58.—Your trouble arises from the water, dissolving the lime of the cement used in the cistern. If the cement be painted, so as to protect it from the solvent action of the water, you will no longer be annoyed by its hardness.—E. H. H., of Mass.

"A Miser of Time."—If the writer over the above signature, in your issue of July 27th, will try the Eclipse Paper File, illustrated in No. 18, Vol. XXV. of the Scientific American, his complaint will be silenced.—A. S., of Ala.

Recent American and Foreign Patents.

Under this heading we shall publish weekly notes of some of the more prominent home and foreign patents.

Whiffletree Draft Eye.—Edward E. Tompkins, Sing Sing, N. Y.—This invention furnishes an improved draft eye for whiffletrees, which consists of a stem which is screwed into the end of the whiffletree, and which receives the eye of the tug. To the outer end of the stem is swiveled a cross head or button, upon the side of which is formed a toe or eccentric. The cross head is turned into line with the tug eye and the latter passed over it, when the pressure of the sides of the eye upon the eccentric forces it into one end of the eye, and thereby brings the cross head at right angles to its length; thus rendering it impossible for the tug to be accidentally detached, however much it may swing about.

Plow.—Alexander Rickard, Schoharie, N. Y.—This invention has for its object to improve the construction of shovel plows, so as to make them more generally useful, and consists in providing the foot of the plow standard with an adjustable shoe which admits of being set so as to bear squarely upon the bottom of the furrow at whatever angle the plow may be working in the ground. The plow thus draws steadily instead of hopping along upon its point when adjusted to run deep in the ground. The shovel is made with adjustable wings, which are secured to the stationary wings by bolts which pass through slots in the former, so that they may be set out or in as desired. Upon the central upper part of the shovel is formed or attached a colter to divide the soil as the plow is drawn forward and make it work easier in hard ground.

Windmill.—Arent Geerlings, Holland, Mich.—This invention relates first, to a new arrangement of devices for adjusting the wings automatically to take the breeze more or less, according to its force, so as to maintain a uniform rate of speed; and, secondly, to a new construction of the wings themselves; the same being bent forward at their forward edges and rear outer corners so as to cause the wind to pass inward and be discharged at their rear inner corners.

Brake for Light Machinery.—John M. Cayce, Franklin, Tenn.—This invention is more particularly applicable to sewing machines, where it is employed to regulate the speed of the needle. It consists of a cam attached to a sleeve which is placed on the shaft which drives the needle. The cam is operated upon by a spring lever which can be adjusted to have the required tension to a nicety. By means of the sleeve, the cam can be adjusted to operate in any part of the revolution, and thus retard or not the movement of the needle, as desired.

Toy Scroll Sawing Machine.—Samuel N. Trump, Rossville, Md.—The invention consists in holding the lumber with clamps while it is fed against the saw which then cuts in a straight or curved line.

Pump.—Wilson Barnes, Maquoketa, Iowa.—This invention consists mainly in a pump whose hollow parts are made of wrought iron galvanized tubing, the sections being connected together by internally threaded couplings.

Shoe Fastening.—Chas. E. Chinnock, New York city, and Christian G. Schneider, Washington, D. C.—The invention consists in an arc-shaped loop and extension applied to fasten and then hold the shoe securely buttoned.

Self Regulating Feed and Telltale for Mill Burrs.—John D. Mines, Moffatt's Creek, Va.—The invention consists in feeding grain into the eye of a mill burr runner through a reciprocating tube, cup, and vibratory funnel, in causing the vibratory funnel to operate the feed tube, and in providing the grain supply spout with a flexible valve attached to a lever operated from the discharge funnel, so as to ring a bell when the flow of grain ceases.

Brick Machine.—Daniel Hess, Des Moines, Iowa.—The invention consists chiefly in the employment of a yielding or self adjusting upper inclined plane or track, for operating the upper series of pressing devices whereby injury or breakage of the surrounding parts is prevented if the molds are too densely packed or contain a foreign substance, as the inclined plane will in such an event rise and allow of the passage of the pressing devices without injury and be immediately returned to its normal position by the action of a weighted lever connected with the same.

Coupling.—James Higgins, Montague, Mich.—The invention consists in a metallic coupling, formed of two reversely crooked hooks, and a sleeve which is tapered in the direction of the shanks of the hooks. The coupling is intended for use with the standing rigging of small vessels and in attaching wooden traces or shrouds without nails, rivets, or screws.

Side Saddle Tree.—Dudley M. Oliver, of Charleston, Ill.—The object of this invention is to improve the construction of side saddles, and it consists in a new arrangement of the pad bar and horn, whereby a shoulder is left in front of the horn, to which a leather spring is nailed. The seat is rabbeted so as to receive the straining piece. The tree is made of wood and covered as usual, and is stayed by strips of metal.

Cocoa Nut Grater.—William H. McCall, of Philadelphia, Pa.—This invention furnishes an improved machine for grating cocoa nuts, which consists in a cylindrical grater revolved within a box. The nut is placed in a hopper at the top so as to rest on the grater, and at the bottom of the box is a drawer to receive the grated nut.

Combined Buggy Pole and Shafts.—Gottlieb Stiener, of Deedsville, Ind.—This invention relates to combined thill and pole attachments for vehicles, of which some have already been patented, and consists in a new mode of combining the shafts or thills and double tree so as to form a very strong pole of the shafts when connected together.

Machine for Corrugating Metal.—John Moffet, of New York city.—This invention consists of a set of preparatory dies and a set of finishing dies for making square corrugations; the corrugations are formed by a preparatory operation, in which a set of oval dies form an oval groove in the iron about as deep as the finished groove is to be, and then the groove is completed by an operation of the finishing dies. When the final action upon the corrugation takes place, the finished shape is firmly retained, so that the subsequent action of the preparatory die does not draw the stock back and disfigure the completed corrugation as when a single set of dies is used to make the corrugation at one operation.

MOP HOLDER.—George Fliedner, Portland, Oregon.—This invention relates to a new mop holder that can be opened by a quarter turn of the compressing nut and closed by a similar movement of the same: the sponge or rag mop is therefore easily removed, for wringing or washing, and replaced. It consists in the arrangement of an elongated compressing nut, in connection with a slotted or forked lower jaw of the mop head, in such manner that when the nut is crosswise under the jaw it holds it closed, but allows it to be freely opened when turned in line with the slot or opening of the jaw.

GRAPPLING FORK.—Gaspar Hunziker, Summit, Miss.—This invention consists of the peculiar construction and arrangements of the parts comprising a cage for grappling a pile of wood or coal in a frame or holder on the ground, holding it while being hoisted and swung over a tender or other vehicle to be loaded, and then discharging it by the opening of the jaws of the grapple by the gravity of the load when the holding devices for the laws have been tripped.

SAWING MACHINE.—Joseph Smith, Woodburn, Oregon.—This invention consists of a table for a cut-off saw which is suspended on pivots above the saw, and of a latch for holding the table in advance of the same while receiving the log or plank to be sawn; they are arranged in such manner that, when the latch is tripped, the gravity of the table and its load feeds the work to the saw.

WATER WHEEL.—Orlando D. Wetmore, Claremont, N. H.—This invention furnishes an improved water wheel which is more readily controlled than wheels constructed in the ordinary manner; it consists more particularly in providing a movable chute which is arranged to be worked, watertight, between a fixed chute and the wheel, in such a manner as to serve as a gate for regulating or preventing the ingress of the water.

COMBINATION RIFLE.—Marshall Wood, Lewisburg, W. Va.—The invention consists in combining a toggle for reciprocating the breech bolt with a hand operating mechanism; in combining a series of cartridge carriers with the several guns so that they will feed all the guns simultaneously, in a peculiar construction of cartridge carriage with a zigzag chamber, so as to feed by a vibratory movement, in attaching to the carrier a sweep which discharges the spent cartridge in advance of the feed, and in operating a series of connected cartridge carriers by means of rods and cam-slotted levers.

COMBINED LIFTING JACK AND DERRICK.—The invention consists in forming a jack with a movable fulcrum, a spring that either retracts or presses forward the detent, and a pawl presser that forces the pawl into and holds it to rack while the lever is taking a new position to let down weights. It consists also in combining a jack with a derrick so that it may be braced in any position. Hiram Senseman and Washington F. Pagett, both of Tremont, Ohio, are the inventors of this improvement.

MICA WINDOW FOR STOVES.—Stephen Foote, of Jersey City, N. J.—This invention relates to a new and useful improvement in the mode of adjusting the mica windows of stoves. The mica is secured by wires which are cast in the frame and bent down on to the mica. These wires form stops, which prevent it fitting closely to the stove plate, thereby leaving an opening equal to the diameter of the wires. By thus allowing a thin current of air to pass between the mica and the stove, the mica is preserved bright and undimmed for any length of time, while windows attached in the ordinary manner soon become dimmed by the smoke and gases from the coal.

CONFLUENT COCK FOR FILLING SODA BOTTLES.—Charles G. Ferron, of New York city.—This invention furnishes an improved cock for soda bottling machines, which is so constructed as to discharge the soda and sirup at the same time through the same pipe, and which may be adjusted to admit exactly the required amount of sirup each time.

FOLDING BOAT.—John Hegeman, of Vischer's Ferry, N. Y.—This invention consists in improving the construction of the pontoon boat, patented by the present inventor April 23, 1867, so as to make it more convenient in use, and more reliable and serviceable in operation; the improvement consists in the use of certain stay or fastening devices with the hinged parts or sections of the boat, which are so constructed that they can be turned out of the way so as not to obstruct the folding of the boat and yet are always in place ready for use.

MACHINE FOR POINTING THE EXTREMITIES OF HORSESHOE NAILS.—Harry A. Wills, of Vergennes, assignor to Julia A. Wills, of same place, and Lucy S. Kingsland, of Burlington, Vt.—This invention relates to machinery for manufacturing horseshoe nails, and in improvements in a machine for shearing or tapering the point of the nail, many features of which are already secured to the present inventor by letters patent. It consists in a sliding finger for filling the die, so as to form a smooth and level surface for the nail to slide on when it is pushed over the die for clipping; the finger being withdrawn when the nail reaches its position.

CLOTHES WRINGER.—Micheal Mallon, of Rahway, N. J.—This invention relates to that class of clothes wringers which are arranged to twist the clothes in the manner of wringing them by hand, the clothes being attached at one end to a holder, and at the other to the end of a shaft with a hand crank for turning it; it consists of a novel construction of the case or frame of the wringer, which adapts it for being readily and firmly attached to the wash tub, and insures the escape of the water back into the tub. It also consists of a novel arrangement of the holder, to which the clothes are attached, and the apparatus for adjusting it for clothes of different lengths; and of an arrangement for holding the clothes, after being twisted, to let the water drip off.

CHILDREN'S CARRIAGE.—Daniel Troxell, of Newark, N. J.—This invention relates to an attachment to children's carriages or perambulators, whereby the same are prevented moving unless actually handled by the attendant, all possibility of accidents by the rolling of the carriages down hill or into gutters during the momentary absence or inattention of the persons having them in charge being thereby avoided. It consists in the use of spring pawls or arms which bear against projecting ears of the wheel hubs and are, by strings or rods, connected with the handle; so that when, together with the handle, such strings or rods are grasped, the pawls or arms are drawn up clear of the ears on the hubs; but, whenever the handle is released, the pawls or arms fall into the way of the ears on the hubs and prevent the rotation of the wheels.

VAPOR BURNER.—Charles Royle, of Brooklyn, N. Y.—This invention relates to burners employed for the combustion of hydrocarbon vapors. The feed pipe is placed at the side of the body of an upright burner, and its internal orifice is formed in a valve seat within the same. A screw passes through a screw hole in the lower end of the body and has a conical valve formed upon its forward end which fits into the valve seat, so that by turning the screw upward the valve is entirely closed, and by turning it less or more downward, less or more of the hydrocarbon is admitted to the burner. Upon this screw, at the lower end of the body, is placed or formed a collar and just below the collar is placed a packing of rubber, leather, or other suitable material. A cap is screwed upon the lower end of the burner which encloses the collar and packing and has a hole in it for the passage of the end of the screw. By this construction, the packing is forced down closely against the cap by the collar when the screw is turned down, and prevents any of the hydrocarbon finding its way out around the thread of the screw and dropping from the lower end of the burner.

PRUNING SAW.—Aaron Travis, of Peekskill, N. Y.—This invention furnishes an improved pruning saw which is attached to a long handle in an inclined position, so that when the handle is pulled the saw is drawn across the limb in proper position for sawing. The back or inner end of the saw plate is made inclined, and its rear corner projects in the rear of the handle and serves as a hook for drawing the limbs out of the trees after they have been sawn off. In the rear edge of the saw plate is formed a notch, the straight shoulder of which is sharpened and serves as a chisel for cutting off small limbs.

SHUTTLE FOR SEWING MACHINE.—Moses Cook and Moses G. Cook, of Ashfield, Mass.—In this invention, a retaining plate is hinged in and at one end of the shuttle. This is provided with a longitudinal rod which has a side spring. The thread from the spool is first passed under the spring, then coiled around the rod and finally carried out through a hole in the side of the shuttle at some little distance from the spring. By passing around the spring previously to being coiled on the rod, the several coils are prevented from crowding on one another and causing the thread to bind.

PLOW.—Francis Poindexter, of Franklin, N. C.—This invention furnishes an improved reversible plow which is simple, convenient, and effective; it is so constructed that it may be readily adjusted for use as a reversible or hillside plow, as a turn and subsoil plow, or as a single turn or cultivating plow, as may be desired.

THREE HORSE EQUALIZER.—Edmond K. Parish, of Shelbyville, Ind.—This invention furnishes an improved three horse equalizer, which is so constructed as to enable the draft to be distributed according to the strength of the horses; at the same time it may be so adjusted that the single horse may walk in the furrow, and the team upon the unplowed land, while each horse draws his proper proportion, and the plow takes the proper amount of land. It consists of two cross bars which are pivoted to the plow beam and connected together by the draft chains and rods, to which are attached the whiffletrees. All the parts and all their connections are adjustable.

FLUID PRESSURE REGULATOR.—William J. Fay and Thomas A. Cairns, of Denver, Colorado Territory.—This invention consists of a hollow cylinder attached to a globe or other like valve and communicating at one end with the chamber or pipe into which the water flows through the valve; in this cylinder is a piston, whose rod is connected to the valve; a coiled spring is placed behind the piston under such tension as to hold the valve open until the pressure becomes too great for the pipes beyond it, when the water pressure on the piston closes the valve and keeps it closed until the pressure on the piston and in the pipes to be protected falls below the power of the spring, which then opens the valve again.

COMBINED SLOP PAIL AND COMMODE.—David Patterson, of New York city.—The object of this invention is to furnish a cheap and convenient article for the household, which can be used as an ordinary slop pail or as a commode; it consists in constructing a slop pail with a movable seat, and with an annular space to receive water at the top. Into this space a flange attached to the cover, when open, projects, and thereby confines the odor.

STEAM GOVERNOR.—Anders Matson, of Quincy, Ill.—This invention relates to a useful improvement in governors for steam engines, and consists in so constructing the parts as to give facilities for the ready lubrication of the steam valve and working parts, and for the admission of oil into the steam chest and cylinder of the engine. A spring, also, is arranged to receive the concussion when the balls of the governor drop suddenly.

NEW BOOKS AND PUBLICATIONS.

THE WORKSHOP. Published by E. Steiger, 22 & 24 Frankfort Street, New York. Subscription $4.50.

The number for August presents an elegantly illustrated paper on the "Lion as an Art Subject," and furnishes its usual supply of exquisite designs, both in decorations and furniture, from the pencils of the first European artists.

THE ATLANTIC MONTHLY. Boston: James R. Osgood & Co., Publishers. $4.00 a year.

In its August number, this Monthly continues Hawthorne's pleasing novel; John A. Bolles tells why "Semmes was not Tried;" James Parton contributes a paper on "Jefferson;" and Dr. O. W. Holmes gives another instalment of his fascinating "Poet at the Breakfast Table." Altogether, the number is remarkably entertaining and brilliant.

LIPPINCOTT'S MAGAZINE. J. B. Lippincott & Co., Publishers, 715 & 717 Market Street, Philadelphia, Pa. $4.00 a year.

The number for August is unusually attractive. There are two illustrated papers—"A Switchback Excursion," and "Travels in the Air"—the latter furnishing some curious and valuable facts in aeronautics.

THE AMERICAN SYSTEM. Speeches on the Tariff Question, and on Internal Improvements, principally delivered in the House of Representatives of the United States. By Andrew Stewart, late M. C. from Pennsylvania. With a portrait. Philadelphia: Henry Carey Baird, Industrial Publisher, 406 Walnut Street.

This is a collection of speeches made by Mr. Stewart upon the above subjects, and in advocacy of what was called by Mr. Clay "the American System." It contains over 400 pages, and is fully indexed for reference. Free by mail to any part of the United States for $3.00.

We have also received, from the same publisher, the following:

GALVANOPLASTIC MANIPULATIONS. A Practical Guide for the Gold and Silver Electroplater and the Galvanoplastic Operator, with one hundred and twenty-seven Figures in the Text. Translated from the French of Alfred Roseleur, Chemist, by A. A. Fesquet, Chemist and Engineer. Philadelphia: Henry Carey Baird, Industrial Publisher, 406 Walnut Street.

The nature of this work is sufficiently indicated by its title. It is a handsome volume of 500 pages, in which the subject appears to be very fully treated. It is copiously indexed. Price, free by mail, $6.00.

THE SCHOOL OF CHEMICAL MANURES; or, Elementary Principles in the Use of Fertilizing Agents. From the French of M. George Ville, by A. A. Fesquet, Chemist and Engineer. Philadelphia: Henry Carey Baird, Industrial Publisher, 406 Walnut Street.

This little book is a *resume* of several larger works by the same author. It is intended for popular use, and is written in a familiar dialogue form. Price, by mail, $1.25.

TABLES AND DIAGRAMS RELATING TO NON-CONDENSING ENGINES AND BOILERS. W. P. Trowbridge. New York: John Wiley & Son, 15 Astor Place.

In this work are given the results of a great many experiments and calculations, in the form of tables, showing the power, etc., of non-condensing stationary steam engines and boilers of various dimensions, speeds, and pressures. They are particularly calculated to aid the manufacturer or purchaser in choosing a form of engine and boiler suitable for any special purpose required, ranging from 5 to 300 horse power. The subjects of boiler explosions, the safety valve and other matters, are also treated of. Price, by mail, $2.50.

NEW PATENT LAW IN CANADA.

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In order to apply for a patent in Canada, the applicant must furnish a model, specification and duplicate drawings, substantially the same as in applying for an American patent.

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All persons who desire to take out patents in Canada are requested to communicate with Munn & Co., 37 Park Row, N. Y., who will give prompt attention to the business and furnish pamphlets of instruction free.

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How Can I Obtain a Patent?

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

How Can I Best Secure My Invention?

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

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

Preliminary Examination.

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

To Make an Application for a Patent.

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

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DESIGNS PATENTED.

5,986 to 5,988.—CARPETS.—H. R. Campbell, Lowell, Mass.
5,989.—CARPET.—J. M. Christie, Brooklyn, N. Y.
5,990.—SASH LIFT.—O. F. Fogelstrand, Kensington, Conn.
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5,992.—DOOR BUTTON.—O. F. Fogelstrand, Kensington, Conn.
5,993.—CUPBOARD BOLT.—O. F. Fogelstrand, Kensington, Conn.
5,994.—CAMPAIGN MEDAL.—W. B. Gregory, La Fayette, Ind.
5,995.—SHOE.—A. H. Herring, Haverhill, Mass.
5,996.—SHAWL.—C. H. Landenberger, Philadelphia, Pa.
5,997.—BOOT HEEL PLATE.—C. Saunders, Philadelphia, Pa.
5,998.—CIGAR HOLDER.—O. F. Balston, Lake Mahopac, N. Y.
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APPLICATIONS FOR EXTENSIONS.

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

21,782.—ROTARY PLANING CUTTER.—J. Sperry. Sept. 25, 1872.
21,829.—PHOTOGRAPHIC SHIELD.—E. Gordon. Oct. 2, 1872.
21,977.—REFRIGERATOR.—B. M. Nyce. Oct. 16, 1872.
21,924.—PATCHING BULLETS.—L. H. Gibbs. Oct. 9, 1872.
22,028.—SHEET METAL SHEARS.—D. Newton, Oct. 23, 1872.
22,100.—BRAIDING MACHINE.—A. B. Clemons. Oct. 30, 1872.

EXTENSIONS GRANTED.

21,029.—CLOTHES WRINGER.—I. A. Sergeant. (In two parts.)
21,030.—QUARTZ CRUSHING MACHINE.—C. P. Stanford.
21,036.—GRAIN SEPARATOR.—B. T. Trimmer.

Inventions Patented in England by Americans.

[Compiled from the Commissioners of Patents' Journal.]

From July 12 to July 18, 1872, inclusive.

BOLT MAKING MACHINE.—G. C. Bell, Buffalo, N. Y.
CARD HOLDER.—B. Brower, New York city.
MANURE.—H. A. Hogel, New York city, H. B. Bigelow, New Haven, Conn.
SCREW BOLT.—G. C. Bell, Buffalo, N. Y.
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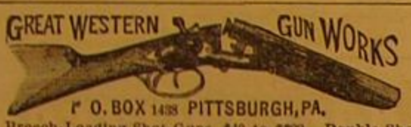

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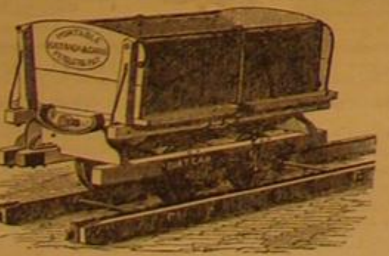

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SCIENTIFIC AMERICAN

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Vol. XXVII.--No. 8. [NEW SERIES.] | NEW YORK, AUGUST 24, 1872. | [$3 per Annum. (IN ADVANCE.)]

IMPROVED SUGAR EVAPORATING APPARATUS.

The sugar evaporating apparatus illustrated in our engravings was patented through the Scientific American Patent Agency, July 2, 1872, for José Guardiola, of Chocolá, Guatemala. We have already placed before our readers other inventions emanating from the same source, and expect ere long to present them with still further evidence of Mr. Guardiola's skill in devising means for the development of Central American and other productions.

The present invention relates to a novel form of evaporator and an improved means of rapidly and effectually defecating sugar juice. Its essential features are shown in Fig. 1, which represents one form of the apparatus. In this form two evaporating helices are used in combination with a receiver or defecator and two evaporating pans, all of which are heated by the furnace shown in the figure, part of the ground in which is broken away under the first pan in order to show the flue which connects the furnace with the chimney.

The peculiar construction of the evaporating helix will be better understood on reference to Fig. 2, which is a top view of the same, and to Fig. 3 where it is shown in vertical central section. The material is metal, and it is made so as to form a spiral channel, which descends gradually as it increases its distance from the center. The center, which is of course the highest part, consists of a vertical tube into which the juice is received and which is shown in detail in Fig. 5. It will be seen that the open side of the tube is provided with a gate, which is raised or lowered by a rack and pinion. By the adjustment of this gate the flow of juice into the spiral channel is regulated. The outer rim of the channel, throughout its entire length, is made so as to form a vertical wall with an outwardly projecting horizontal flange, which latter is terminated by an upwardly projecting lip; the construction is fully shown in the sectional view, Fig. 4, where A is the bed of the channel, and B is the outer rim.

GUARDIOLA'S SUGAR EVAPORATING APPARATUS.

Fig. 2.

The horizontal flange is perforated, as represented, and acts as a skimmer; for when the juice, in its downward passage through the channel, boils over the vertical wall, it is thrown upon the flange, upon the surface of which the impurities are retained, while the purified juice falls through the holes into a lower part of the channel. Along the lowest convolution the flange is not perforated, thereby preventing the lateral discharge of the juice for obvious reasons.

The operation is as follows: The cane, beet, or sorghum juice passes from the mill in which it was made into steam defecators of ordinary construction, and is then elevated to and passed through suitable filters, whence it flows into a vat. From this vat, by proper connections, it is drawn into the central tubes of the two helix evaporators and skimmers seen in Fig. 1. It passes from them into the receiver or defecator, which is placed between them and the first pan. By means of a faucet in the receiver and a trough, both of which are shown in the engraving, it is thence conducted into either of the two evaporating pans, where it is brought to a density of from 25° to 30° Baumé, and rendered fit for the vacuum pan or other process. By means of the crane and dipper, as delineated, the sirup is removed from the pans and deposited in a tank for final treatment.

A separate furnace may be placed under each helix, with the flues meeting under the defecator, or a single furnace can be used under both. It is not necessary to employ two helices, as one alone would answer, though in that case the spiral channel of the one would have to be proportionately elongated. Various modifications of the helices, etc., are embraced by Mr. Guardiola's patent which also includes the introduction of a box into the bridge of the furnace for the production of hot air, should it be required for any purpose.

A large quantity of the water contained in the juice is evaporated while it is passing through the helix, and the sirup which comes out is comparatively pure. It takes but a few minutes for its passage and proper evaporation, and it is stated that the yield is greater and the quality better than in any other apparatus used for the same purpose. A boy with a rag or brush keeps the skimmer clean, and that is all the attention that part of the process requires.

Further information may be obtained by addressing Mr. Guardiola, care of Ribon and Muñoz, 63 Pine street, New York, or care of J. C. Merrill & Co., 204 California street, San Francisco, Cal.

The Drive Well.

The Hutchinson (Kansas) *News* says that a novel but highly successful expedient has been adopted by Mr. Criley, superintendent of construction of the Atchison, Topeka, and Santa Fé Railroad Company, for supplying his boarding trains and track layers with pure cold water. Providing himself with three drive wells, he placed one at the end of the track and the others along the line in advance, one mile apart. An experienced well driver was obtained in Hutchinson, and he contracted to take up, carry forward, and drive again two pumps per day, removing one after the morning's supply was obtained at the boarding train and carrying it forward one mile beyond the farthest pump. After dinner, for which the train moves forward one mile to the next pump, this pump is carried forward again to the front; and thus the men are constantly and cheaply supplied with fresh water. Excepting a few miles of the line beyond Cow Creek, one hundred miles west of Hutchinson, where the road leaves the valley and cuts off a bend in the Arkansas, striking it at Fort Dodge again, the pumps can be driven all the way to the State line, a distance of 280 miles. What other railroad line in the world can boast of a similar advantage, and where else is there so long a row of pumps?

[Toronto Monetary Times.]

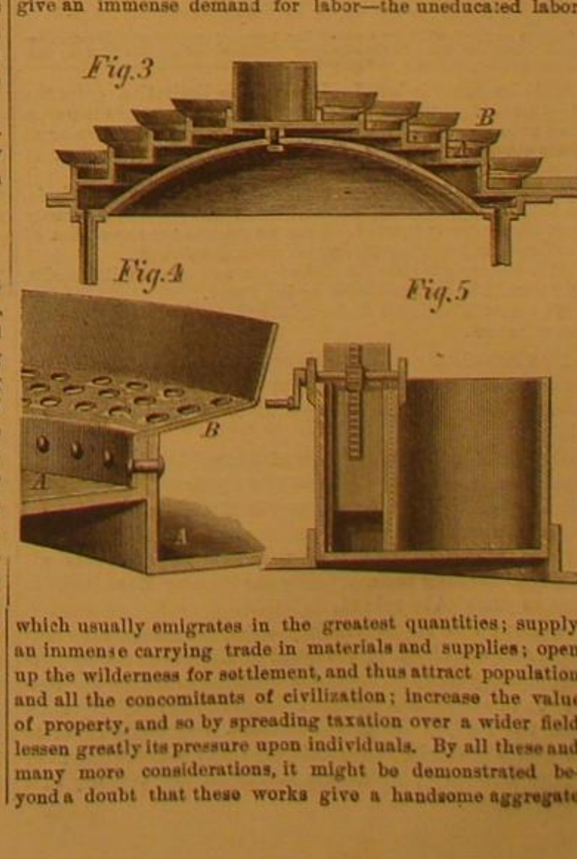
Railroad Progress---That is what is the Matter with Iron.

The building of railroads in the United States is one of those marvels of the sprightlier phase of civilization developed on this continent which it astounds one to contemplate. There are now in that country 60,000 miles of lines built at a total estimated cost of $3,000,000,000, being on the average $50,000 a mile. To this immense aggregate, new lines are being added at the rate of eight or nine thousand miles annually. The new constructions last year are estimated by Mr. Poor—the author of a series of valuable statistical volumes on this subject—to have cost $275 000,000.

It would be interesting to know—though we shall never know—how far these would have contributed to promote the settlement of the United States, and to cause the increase of 25 to 35 per cent, each decade in the total population of that country.

Instead of being compelled to seek a charter from Legislature, as is the case in this country, nearly all of the States permit the formation of railroad companies under a general act, so that any body of men, of the requisite number, upon filing articles of association with the proper State officers, become a corporation, and are invested with full authority to construct a railroad upon any route they may select. This is giving full effect to the law of competition; and loose as such a statute appears, it seems to have operated so satisfactorily that nearly all of the States, one after the other, have adopted it. It is claimed on behalf of this plan that the fear of competition is always before the eyes of railroad owners, who, therefore, are the more careful not to use their position so as too flagrantly to damage the interests of the public.

In any light that it is possible to view the subject, it will be seen that the American railroads have been a most profitable investment. This might be abundantly established by citing the incidental advantages arising from them; they give an immense demand for labor—the uneducated labor



which usually emigrates in the greatest quantities; supply an immense carrying trade in materials and supplies; open up the wilderness for settlement, and thus attract population and all the concomitants of civilization; increase the value of property, and so by spreading taxation over a wider field lessen greatly its pressure upon individuals. By all these and many more considerations, it might be demonstrated beyond a doubt that these works give a handsome aggregate though indirect return on their outlay. But it is not necessary to prove by this class of arguments how profitable is the investment of three hundred millions in American railways. In 1871, the 60,000 miles of lines earned $455,000,000, or at the rate of $7,500 per mile. Taking the estimated cost at $50,000, we find that the lines earned a sum equal to 15 per cent per annum on their cost. If we assume the working expenses to be 50 per cent, then the average dividend paid on the capital invested would be 7½ per cent per annum. But the financial prospect is even better than these figures indicate. Every year the traffic is rapidly increasing; in the decade from 1861 to 1871 the tunnage carried increased at no less a rate than 33 per cent per annum. And it is from tunnage that two thirds of the entire receipts are derived.

After the figures that we have given above, it will scarcely be necessary to ask: What is the matter with the iron market? Every car shop, rolling mill, and forge in the States is calling out for supplies which reach them too slowly to keep up with the demand. Russia is adding largely to her lines every year; France is replacing those lost by the war and building new ones. Canada's annual bill for railroad iron is beginning to assume considerable proportions; some other countries swell largely the demand, so that the question, "What is the matter with iron?" is pretty satisfactorily answered.

Recent Decisions by the Commissioner of Patents.

IMPORTANT DECISION IN RELATION TO THE RENEWAL OF APPLICATIONS UNDER THE ACT OF JULY 8, 1870.—REJECTED APPLICATIONS, NO MATTER HOW OLD, MAY NOW BE REVIVED.

Gordon.—Telegraph Wire.—Appeal.

LEGGETT, *Commissioner:*

This invention consists in inclosing a telegraph wire in a non-conducting covering formed of strands of fibrous material, saturated, if desired, with non-conducting substance, the strands being "laid up," as in rope making, and the whole coated with gutta percha, the objects being to strengthen and insulate the wire, and at the same time leave it flexible. The claims are first, the described method of insulating; second, the employment of fibrous strands "laid up" to give longitudinal strength; and, third, in such a cable, the use of gutta percha as an insulating substance.

The original application was filed by the inventor, Wm. Gordon, May 13, 1848, and was once rejected the same year. In 1863, his administrator, the present applicant, filed an amended specification and claim, which was rejected by all the tribunals of the Office and finally, on appeal to Judge Cartter of the Supreme Court of the District of Columbia, June 1, 1866, for want of novelty. Under the act of July 8, 1870, the present application was filed, which has been twice rejected by the Principal Examiner upon references, and appealed to the board.

A majority of the board take the ground that, so far as the Office is concerned, the question raised by the present application is *res adjudicata*, and they affirm the decision of the Primary Examiner *pro forma*, in order that, if the case is to be reconsidered at all, it may be by the tribunal which rendered the final decision against it. The minority opinion is that the question presented on appeal is a proper one for the board under the act of 1870, and it proceeds to consider the references and decides them insufficient. The majority of the board assume that the present claims are substantially those of the application of 1863, rejected by Judge Cartter, but those claims are missing from the record.

The argument of applicant denies that this case is *res adjudicata*, and asserts that it is a new case, and must stand upon its merits; that the strict rules of courts should not be followed by the Office; but even if they are, a subordinate tribunal may send a question a second time before an appellate tribunal when an error has been committed, as in this case. On the supposition that the present claims are substantially those rejected on appeal, the references are reviewed to show that they are impertinent, and a brief review of the old law is submitted showing that the practice has been to rehear applications after rejection. The question for the Commissioner seems to be simply whether an application filed and rejected in 1848, renewed in 1863, and rejected for want of novelty on appeal to the court in 1866, can be renewed and treated on its merits by the Office under the act of 1870; and if not, then whether it should be rejected *pro forma* and allowed to go to the court. The Examiner assumes the former, and the board, the latter.

The language of the act of 1870 is, that—

"When an application for a patent has been rejected or withdrawn prior to the passage of this act, the applicant shall have six months from the date of such passage to renew this application or to file a new one."

This language is broad. It places no limitation upon the signification of the word "rejected," which makes it necessary or proper for the Commissioner to inquire when or at what stage of proceedings a rejection occurred, whether in or out of the Office.

All renewed applications are, in one sense, *res adjudicata*, and it was to reach adjudicated cases and provide a remedy that the law was enacted. I see no ground for the action of the board in rejecting this application *pro forma*.

It is properly before the Office for action upon its merits, and should be so considered by the board.

The case is ordered to be returned to the board for such examination.

Farrow.—Thill coupling.—Appeal from the decision of the principal examiner, who held that every element that enters into the construction of a device must be mentioned in the claim.

Overruled by the Acting Commissioner, Thatcher.

Hammond.—Swaging Drop.—The applicant, in his appeal from the Primary Examiner to the Examiners-in-Chief, introduces several important amendments to his claims. Held by the Acting Commissioner that rule 43 precludes all amendments after the case leaves the Primary Examiner, except as provided by rule 31.

McDougal vs. Eames and Seely.—Carbolic Compounds.—Interference.—Decision of the board of Examiners-in-Chief reversed and priority of invention awarded to Eames and Seely. In this case, Commissioner Leggett says: "McDougal's patent of 1867, so far as it describes a soap, ought never to have been granted without an interference with the patent of Eames and Seely, which was issued on the very day that McDougal's application was filed. A little more care, upon the part of the Examiner at that time, would have saved the Office from a great amount of vexatious labor, and the parties from thousands of dollars of needless expense.

Butterfield.—Imitation button and button hole for leather work.—Decision of the Primary Examiner overruled. Held by the Commissioner:—"A device which is cheaper and more durable, although its novel feature is for ornamentation, is patentable as an article of manufacture when intended as a substitute for an article both useful and ornamental."

McClellan.—Fare-box for cars.—Appeal from the Primary Examiner, who held that the words "or their equivalents" must be erased from the claim. Decision of the Examiner overruled by the Acting Commissioner, Thatcher.

Allen.—Tube Joint.—Extension.—Held by the Acting Commissioner that any new matter found in the reissued specification was improperly allowed, and must be stricken out before an extension can be granted.

Corban.—Spring for watch cases.—Appeal.—The Board of Examiners-in-Chief being unable to perceive the novel and useful points in this case, Commissioner Leggett, on appeal, comes to the rescue, points out the patentable features, reverses the decision of the Board, and orders a patent to issue.

Packer.—Hand Drill.—Extension.—Held by the Acting Commissioner, Thatcher, that where a patent has been reissued by the patentee, the application for extension must be made upon the reissued patent and not upon the original patent.

A New Steam Street Car.

The Utica *Herald* gives the following account of the recent trial of a new steam street car at Ilion, N. Y.:

This car appeared at the first glance to differ not at all from the ordinary street car. Closer inspection revealed the fact that one platform was a trifle longer than the other, and could not be gained from the inside of the car. In the space ordinarily used as a doorway stood the compact boiler and engine. All the machinery does not occupy more space than an ordinary, modern base-burning parlor stove of the larger size, and does not use one foot of passenger room. The engineer stands upon the platform, occupying the place of the driver.

The engine, perfected by William Baxter and now in use at Ilion, is made on the principle of the English compound engine, in use on ocean steamers. It has two cylinders, and drives the car by direct crank connection without any intermediate mechanism. The steam is admitted from the boiler to the first cylinder, which is smaller than the other and which is, in fact, a "high pressure" cylinder. It escapes from this to a chamber formed by a jacket around the boiler, where it is superheated, and then it is used in the larger cylinder. As it finally escapes, it is reduced to about atmospheric pressure. By this means the entire force of the heat is used, and economy of fuel as well as of space for the boiler is obtained. The engine is arranged to consume its smoke, and with the low pressure of the exhaust both soot and noise are avoided. The engine, as ordinarily run, is a five horse power engine, and will take a load of thirty or more passengers over a reasonably level track at the rate of fifteen miles an hour, at least. The engineer can instantly and at pleasure throw the steam from the boiler directly into both cylinders, and give his engine, for the time, twenty-five horse power. It thus takes its load easily, and not without retarding its speed, up grades of four hundred feet to the mile. It is, in fact, a five horse power engine, with power to increase its power five times, without stop and without loss of speed. Having no gearing, cogs, or intermediate mechanism between the engine and the crank of the drive wheel, there is comparatively no danger from disarrangement in that quarter. The outer jacket of the boiler is shut in from the body of the car by a wooden screen through which no heat passes at any time. The exhaust in the summer goes under the car. In the winter it is taken through the car by pipes, which give give moderate but equal temperature to the atmosphere. Mr. Baxter has embodied in this engine another feature, by which the objections to reversing the engine are entirely done away. Running at the rate of six miles an hour, he stops the loaded car in eight feet. Going at the rate of twelve miles an hour, he stops in thirty-two feet. The great economy in steam gives equal economy in fuel, so that coal is consumed at the low rate of one tun to the thousand miles. As nothing precedes the car, all the windows can be opened without trouble from dust. Smoke, there is none; there is nothing to raise dust except the car itself, and what dust it raises is under the car and left behind. When the car is in motion, the front windows can be opened, and a refreshing breeze is felt, with none of the ordinary discomforts.

About twenty persons started from Ilion on Saturday; but before the ride was over, the number was more than doubled. The party rode first to Frankfort, dashing out of Ilion at a lively rate; but slowing just as the car seemed in imminent danger of running into a horse car which it overtook. The engineer seemed to have perfect control of the car, and handled it by steam far more easily than it could have been done by horseflesh. The road from Frankfort to Ilion needs some leveling, and the curves especially need attention, the outer and inner rails being often on a level; in some few places the inner rail was apparently the lowest. The real test came in going over the canal bridge between the villages. The bridge is reached on either side by a grade of about eight feet in one hundred, and the immediate approach to the bridge, each side, is by a very sharp, bad curve.

It will be seen that the combined curve and grade made this a bad place, but we rode safely up the grade, around the curves, and down again, and gaily away to Frankfort. The return from Frankfort to Ilion was made at the rate of fifteen miles an hour, in spite of rough roads, curves and grades.

After reaching Ilion, the car was run over a track still rougher than the first, but without grades, to Mohawk and return.

During the afternoon, the car met or overtook in the road, at no place very wide, from fifty to one hundred horses, without an accident, so far as we learn.

Refrigerator Cars.

The heat of the summer months does not prevent the shipment of Western produce to Eastern cities. The Blue Line Freight of the Michigan Central and Great Western Roads make a specialty of this class of traffic during the warm season, and guarantee to deliver butter and fresh meat at Eastern markets in as good condition as when received for shipment here. They use refrigerator cars both of the Sutherland and Davis patent. These are, without doubt, the best of the kind. The outside does not differ in appearance from other freight cars, with the exception of not having end windows and grated doors, and they are a little heavier. The Davis cars, which we examined, had been running about five years, almost exclusively in the beef trade. The floor is double, with heavy matched flooring; the sides are made air-tight with a lining of zinc, which stands off six inches from them, this space being filled with ice and salt, the ice broken in pieces about the size of an egg; the doors are of the same thickness, are double, and open into the car; the space within the doors is filled with charcoal and sawdust; an additional door of plank is outside of this, and when the car is loaded the space between the two doors is filled with sawdust. Fastened to the ceiling of the car with staples are iron rods, about three quarters of an inch in diameter, placed about one foot apart, longitudinally, from which the meat is suspended by means of hooks. A car will carry about 120 beef quarters, weighing in the aggregate from 16,000 to 20,000 lbs. A wooden rack extending about the sides of the car prevents the meat from swinging or resting against the zinc. The Davis car requires about four tuns of ice to render it a perfect ice box, and this is replenished at Detroit, Suspension Bridge, and Albany, and meat shipped in this manner brings the highest price in the Eastern markets.

The Sutherland car is built with packed sides of charcoal and other ingredients, to render it impervious to atmospheric influences. The casing is about six inches thick, and the interior lining is of zinc, the same as the Davis car; the ice is placed in a rack at each end of the car, and above the racks are openings in the roof to replenish the ice; a door drops from the roof of the car to the edge of the rack, which serves to retain the ice in its place; a conduit pipe carries off the water, none of which is allowed to stand on the floor. A rack will hold one tun and a half of ice, or three tuns to the car—one tun less than is required by the Davis method, and without the extra trouble of breaking it into small pieces. The Sutherland car shown to us was used for shipping butter. The kegs and firkins are piled up two thirds the hight of the car, between the racks; the doors are closed in the same manner as in the Davis cars, and the ice is replenished at the same points.

Judging from the quantity shipped East, we are justified in supposing that "Western grease"—which the Eastern dames are pleased sometimes to call our butter, as they peer at it over their specs and punch it with a parasol—is far more palatable than was supposed, and it now finds an appreciative market. In the freight depot, foot of Lake street, a long room is partitioned off; the space, four feet wide, between the outer brick wall and the interior board lining, is filled with ice; inside the room the butter kegs and firkins are piled up, and as soon as a car load has accumulated it is at once loaded and started eastward. The additional expense of running a refrigerator car from Chicago to Boston is about $30, and rates are the same as with ordinary freight cars; the shipper runs no risk; if his goods are in perfect condition when loaded, he can rely on finding them so when unloaded. And in regard to beef, he pays rates on that which is clear profit to him, without the extra freight on horns hide, and hoofs, when live cattle are shipped.—*Chicago Railway Review.*

THE great globe which we inherit is itself a magnet. On the one side of the magnetic equator, the north end of the needle dips; on the other side, the south end dips, the dip varying from nothing to ninety degrees. If we go to the equatorial regions of the earth with a suitably suspended needle, we shall find there the position of the needle to be horizontal. If we sail north, one end of the needle dips; if we sail south, the opposite end dips; and over the north or south terrestrial magnetic pole the needle sets vertical. The south magnetic pole has not yet been found, but Sir James Ross discovered the north magnetic pole on the 1st of June, 1831.—*Faraday.*

THE Nassau Gas Light Company is the title of a new corporation in Brooklyn, N. Y., for the supply of street gas. Its works are quite extensive. The gasometer is located at the corner of Keap street and Myrtle avenue. It will have a capacity of 385,000 cubic feet, adequate in all respects to receive and discharge the one million of cubic feet to be daily manufactured. The dimensions are: elevation 50 feet and diameter 104 feet. The retort and purifying house will be equal to the production of 2,000,000 cubic feet per day.

WRITING INK.—Adding a solution of yellow prussiate of potash, to any ordinary black ink, renders it incapable of being removed or altered. Oxalic and other acids convert it into Prussian blue.

HOW FELT HATS ARE MADE.

There is a legend among the hatters that felt was invented by no less a personage than Saint Clement, the patron saint of their trade. Wishing to make a pilgrimage to the holy sepulcher, and at the same time to do penance for sundry unexpiated peccadilloes, the pious monk started on his journey afoot. As to whether he was afflicted with corns or kindred miseries, the ancient chronicle from which this information is derived is silent; but, at all events, a few days successive tramping soon began to blister his feet. In order to obtain relief, it occurred to him to line his shoes with the fur of a rabbit. This he did, and, on arriving at his destination, was surprised to find that the warmth and moisture of his feet had worked the soft hair into a cloth-like mass. The idea thus suggested he elaborated in the solitude of his cell, and finally, there being no patent laws in existence in those days, he gratuitously presented to his fellow mortals the result of his genius in the shape of a felt hat.

The fur principally used at present in the manufacture of felt hats is that of the Russia hare or "coney." Hunting this animal is a favorite winter sport among the Russians, who pursue their game on horseback, killing it with a single blow of their long whips. Three kinds of the fur are known in commerce, termed back, belly, and side Russia, the latter being the finest.

The first process the fur undergoes is "carroting," which consists in applying to it a solution of mercury and *aqua fortis*, the object being to render its felting easier. The skins are then hung in a hot room until dry, when the fur is removed, sorted into the qualities before mentioned, and finally made up in bundles and sold by the pound, the price varying from about $1.50 to $5.00.

The fur, as it is taken from the bundles, is mixed, and fine carded cotton added in the proportion of $\frac{1}{2}$ oz. to $\frac{1}{4}$ oz. of cotton to 4 or 5 oz. of fur, that being the usual quantity required for a single hat. This mixing is done by a picking machine into which the material is fed. It is then immediately seized by a toothed picker which revolves with great velocity, creating a strong current of air, thus agitating the fur and cotton in the top of the box above the machine. This process is repeated by the mixture falling on an endless belt which conducts it to another picker.

The "stock," as it is now termed, is next passed through a machine which contains a number of rollers on which are short metal teeth. There is an opening of about an inch in width before each roller, and one at each end. The fur being carried to the rollers, on a broad belt, is subjected to their action, by which the coarse material and impurities are made to fall through openings in the bottom into boxes underneath, while the finer portions are forced to the top of the machine and out at its further extremity. The stock, which in technical parlance is now said to be "blown," is next weighed into quantities sufficient to form the desired number of hats of similar weight. It is then spread upon a broad belt and passed into the forming machine, an apparatus made of boiler iron and resembling a snow plow in shape.

A quantity just sufficient for one hat body is placed on the feeding apron of this machine. It is drawn in, between two horizontal feeding rollers covered with felt, and immediately seized by a cylinder which revolves about 3,000 times in a minute, and which is furnished with several longitudinal lines of stiff brushes. This generates a current of air which scatters the stock and blows it out of a vertical slot in the apex of the machine. The thin stream thus ejected strikes against a revolving copper cone which is thickly perforated with holes. A current of air, caused by an exhausting fan revolving with immense velocity under the cone, creates a suction which draws the fur closely to its surface. When the stock in the machine is exhausted, a wet cloth is placed over the cone, a metallic cover slipped over that, and the whole plunged in a tank of hot water. The mat is now removed from the cone, as the felting has begun to take place. This, as our readers are probably aware, is due to the fact that all fur is barbed, from root to point. As the hairs are thrown on the cone in every possible direction, they become interlaced, so that by warmth, proper moisture, and manipulation, they may be made into a firm close fabric.

Each body is first inspected in order to detect thin spots, which are strengthened by causing small portions of stock to adhere by the aid of hot water; then it is gently worked and rolled in a piece of blanket, and finally packed in the bale, twenty-four dozen at a time. It is in this condition that the body reaches the hatter, who sends it to the sizers. The sizing kettle or "battery" is constructed of copper, and, in large establishments, heated by steam. Around its edge are arranged eight planks, one for each workman. These planks are some ten feet long and eighteen inches wide, and are sloped at an angle to the kettle, to the edge of which they are fastened. The principal tool of the operator is a rolling pin some eighteen inches long, pointed at both ends and marked with rings for measuring. His hands are protected by "gloves" or thick pieces of sole leather covering the palms. Taking two or three bodies at a time, he plunges them into the boiling water, and then kneads them until a sufficient shrinkage in their dimensions takes place. Then he takes a single body and rolls it with his pin until it assumes the proper size, form, and consistency, and then, after allowing it to dry, pares off all its inequalities with a large sharp knife, made especially for the purpose.

Stiffening is the next process. The material is gum shellac, dissolved in boiling water by the aid of alkalies. Across the top of the tub in which it is contained are two rollers turned by a crank and pressed by the action of a weight closely together. The body, after being dipped to the depth of the brim, is passed quickly through the rollers; then it is refolded, the brim again dipped, again passed through, and this process is repeated several times. The crown of the hat is not dipped, as it gathers sufficient stiffening from that adhering to the rollers. When dry, the body has little resemblance to a hat. In fact, it is simply a wide mouthed bag, with a small rounded end and stiff edges. It is necessary, therefore, to begin to mold it into shape. A workman, termed a "blocker," is furnished with hat blocks and a trencher or small copper plate, four inches long and three inches wide, pierced with a hole in the center large enough to admit the thumb. After soaking the body in boiling water until it is soft and pliable, the operator places it upon a block and shapes it with his trencher, continually pouring hot water over it to keep it in proper condition.

The hat thus roughly modeled is now ready for coloring. If it is to be black, it is soaked in a dye of logwood, verdigris and copperas. It is not left permanently in the kettle, but is removed from time to time and suspended in the air, the effect being to deepen the color. This process occupies about twelve hours. The fancy colored dyes are prepared with mordants. Washing follows, and then the hat is reblocked and its size determined and indicated by notches made in the edge of the brim. Pounding or rubbing the surface smooth with fine pumice is generally done by hand; then the hat is ready for the finisher.

Each hat being placed upon its proper block and kept in position by a fine though strong cord, its surface is wetted and a hot iron drawn around it in the direction in which the nap is to be. Then the brim is trimmed to proper shape and curled according to the fashion. The lining is put in by girls, and finally the hat is ironed, packed in a nest of half a dozen in paper bandboxes, and thus supplied to the retail trade.

ADULTERATION OF CHEMICALS.

Acetic acid is frequently weakened with water and adulterated with sulphuric ether. Six samples tested with chloride of barium gave a precipitate of sulphate of barium in varying proportions.

Muriatic acid and sulphuric acid, sold as chemically pure, have both been found contaminated; the former with arsenious and sulphurous acids, the latter with a large proportion of sulphate of lead.

Tartaric acid has been met with containing 50 per cent of sulphate of magnesia. Alum is also said to be used as an adulterant, but the reporter had not met with a specimen.

Alum frequently contains iron, probably arising from carelessness in the manufacture. The presence of free acid has also been noticed, especially in the English article.

Carbonate of ammonia is sometimes substituted by a compound made from solution of ammonia, glue, and bicarbonate of soda, which forms when dry a hard translucent mass, resembling genuine carbonate.

Muriate of ammonia is sometimes met with of very poor quality; iron is often visible on the surface and becomes still more so when dissolved. The report recommends that the purified granular salt should be the only one sold at the dispensing counter.

Black sulphuret of antimony has been met with containing sulphite of lead (galena), quartz (30 to 40 per cent), clay, etc. A good article, however, is procurable.

Powdered arsenic is sometimes adulterated with sulphate of lime or sulphate of baryta; the pharmacist is, therefore, recommended to purchase the lump arsenious acid.

Bismuth (metal) generally contains arsenic. An instance is mentioned in the report where 400 lbs. of antimony were sold by a broker to a manufacturer for bismuth. Fortunately for the latter, he detected the error before the transaction was completed.

Subnitrate of bismuth has been reported as adulterated with 20 per cent of phosphate of lime; but it is believed that the salt made in the United States by the principal manufacturers is free from adulteration.

Citrate of iron and quinine is seldom found made strictly according to the United States formula, which does not produce a sufficiently soluble salt. Some manufacturers, therefore, add citrate of ammonia to make it soluble, and others leave out a considerable portion of the quinine to accomplish the same end. There is also a probability that in some cases cinchonine is substituted for the quinine.

Chloral hydrate has been met with containing the alcoholate. The tests pointed out are the difference in boiling point, sulphuric acid, which leaves pure hydrate colorless but turns alcoholate brown, and nitric acid, which gives little or no reaction with hydrate, but reacts violently with alcoholate, giving off nitrous oxide gas.

Chloride of calcium has been noticed at Chicago with a large excess of caustic lime, and it is known to have been sold in crystals without any allowance made.

Chloroform is sometimes met with diluted with alcohol, and sometimes not sufficiently purified, and, therefore, unfit for inhalation. There is also reason to believe that partially decomposed chloroform has been sold through ignorance on the part of the dispenser. Nitrate of silver is useful in detecting this decomposition, by giving a precipitate of chloride of silver with the liberated chlorine.

Cream of tartar is grossly adulterated, and the distinctive terms are said to be well known to mean varying proportions of *terra alba* and cream of tartar.

Epsom salt has been substituted in the Western market by finely crystallized Glauber's salt. As the prices, however, are now about the same, this is not likely to recur.

Ether is sometimes sold containing a large proportion of alcohol. This may probably arise from the druggist dispensing photographic concentrated ether, made to contain alcohol in order to dissolve the gun cotton.

Iodoform has been noticed of a light canary color, a considerable portion being insoluble in ether; probably iodate of lime.

Acetate of lead has been in the market containing a large percentage of crystallized nitrate of lead; one lot was offered to a maker of preparations for the hair as "damaged," which proved to be damaged sulphate of zinc, in lumps.

Precipitated carbonate of lime has been offered containing sufficient iron to give it a light fawn color; supposed to be ordinary chalk, dressed.

Sulphate of morphia is frequently open to suspicion. In one case the sample did not contain any morphia: placed on a red hot plate, it did not seem to lose any weight, and it was insoluble in water. A fraud in which sulphate of quinine was put into sulphate of morphia bottles has been lately detected in New York.

Phosphorus, according to Dr. Rademaker, sometimes contains arsenic.

Bromide of potassium has been observed to contain a considerable quantity of water of hydration.

Iodide of potassium is often adulterated with the bromide; some made in New York was found to contain carbonates in considerable quantity.

Sulphate of quinine has many adulterants, among them sulphate of lime; cinchonine, sold as "sweet quinine" or as "cinchoquinine;" muriate of cinchonine, sold as "light sulphate of quinine" and as "French quinine," salicine, etc.

Rochelle salt has been offered for salt containing at least 25 per cent of sulphate of soda.

Santonine was seen last year, in the New York market, contaminated with small particles of mica. This fraud may easily be detected by placing the suspected sample on a hot plate; the santonine will disappear and leave the mica.

Nitrate of silver (made for the Government), which contained five per cent of copper, was sold in Chicago. Pieces could be picked out emerald green in color; it appeared to have been made by simply dissolving coin or other alloy of silver in nitric acid, and crystallizing without any attempt at purification.

Precipitated sulphur is reported as usually free from sulphate of lime, and the United States pharmacist is congratulated on this superiority to the English article, but a proportion of 50 per cent of gypsum in flowers of sulphur is reported as having been noticed, and sometimes ground sulphur is sold for the sublimed.

Tartar emetic has been met with containing 11 per cent of cream of tartar.

Spices, on account of their widely extended use, are largely adulterated, and some startling revelations might be made if a spice miller could be persuaded to disgorge his ill-gotten knowledge. The only safe way to get pure powdered drugs is to pay a good price, and buy from conscientious persons who are above suspicion.

Cochineal is adulterated with sulphate of barytes, a heavy white powder, which, when shaken with the insects, lodges in the wrinkles and crevices on the surface of the body. The weight is thus increased sometimes from 15 to 25 per cent.

Balsam of copaiba is often mixed, and sometimes found entirely fictitious, being composed of a mixture of castor oil, resin, and oil of copaiba. Powdered ipecacuanha is sometimes so adulterated and weakened that tartar emetic is necessary to strengthen it. Oil of lemon mixed with 30 per cent of fixed oil has been met with.

Powdered opium is often mixed with powdered extract of liquorice. In fact, some dealers uniformly send to the grinders a certain proportion of liquorice with the opium, so that they might be ground together. Powdered rhubarb is frequently adulterated with curcuma. Sometimes senega root is mixed with cypripedium.

Castile soap frequently contains an undue proportion of water. It has been met with containing as much as 30 per per cent. Acetic acid is also mixed with water, acidulated with dilute sulphuric acid.

Subnitrate of bismuth has been found mixed with phosphate of lime to the extent of 20 per cent; and citrate of iron and quinine is adulterated with citrate of ammonia, and contains less quinine than called for, 10 or 15 per cent instead of 25 per cent. Quinine itself is frequently met with mixed with cinchona, muriate of cinchona, and salicine.

Santonine has been found adulterated with small particles of mica, and cream of tartar frequently mixed with tartar emetic. Cream of tartar is grossly adulterated; the terms "strictly pure, pure No. 1 and No. 2," being used to indicate varying proportions of cream of tartar and *terra alba*, the latter material being largely imported from Europe for the express purpose of adulterating, the importations amounting to many tuns annually.

Chloroform is sometimes diluted with alcohol, and iodide of potash in crystals mixed with bromide, and occasionally with bicarbonate of potash. Solid extracts are also much adulterated.

In the manufacture of sirup, a considerable portion of the sugar is replaced by glucose, especially in making fruit sirups.—*Proceedings of the American Pharmaceutical Association.*

WHETHER we see rightly or wrongly, whether our intellection be real or imaginary, it is of the utmost importance in science to aim at perfect clearness in the description of all that comes, or seems to come, within the range of the intellect. For, if we are right, clearness of utterance forwards the cause of right; while, if we are wrong, it ensures the speedy correction of error.—*Tyndall.*

NEVER use a hard word when an easy one will answer as well.

DIRECT-ACTING STEAM ENGINE.

The invention which forms the subject of this article is applicable to that class of steam engines known as direct-acting, and the improvements consist in a peculiar form of steam valve and piston, which is packed tight enough by steam pressure to prevent leakage, and is yet sufficiently relieved from the same to insure ease in running and certainty in action. It is, at the same time, of simple construction, is easily accessible for repairs, and admits of accurate adjustment.

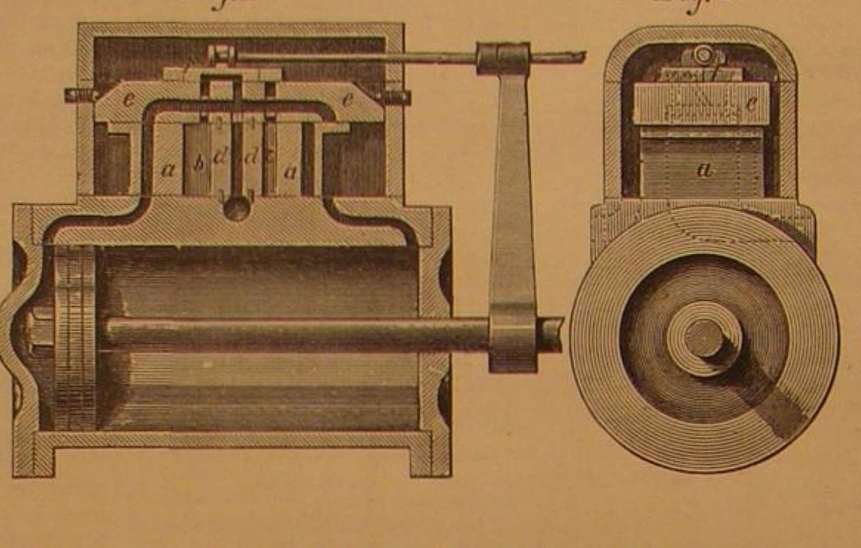
Fig. 1 is a central longitudinal section, and Fig. 2 is an end view, with the end of the valve chest removed.

The steam valve is shown at *a*. Its bottom sides operate the ports of the cylinder by connecting each, alternately, with the steam in the chest and with the exhaust passage, the latter being effected by means of the vertical passage through the valve, as shown, and their connections. In the center of the valve, *a*, is a chamber, the two ends of which are shown at *b* and *c*. In this chamber is placed the exhaust port, *d*, the passage up the center of which forms a communication between the main exhaust and the exhaust passage in the plate, *e*. The exhaust port, *d*, fits the sides of the the chamber, *b c*, and is the same hight as valve *a*, so that when the plate, *e*, is in place, the two parts of the chamber, *b* and *c*, may be alternately filled with and exhausted of steam by means of the supplemental valve, *f*. The valve, *a*, and the exhaust port, *d*, are ground to fit the top of the cylinder and the plate, *e*, and all the parts are then accurately adjusted by means of the screws which may be seen passing through the ends of the valve chest in Fig. 1. The ends of the plate are beveled, and the screws have their bearings in the center of the bevels, thus allowing the plate to move sufficiently to make the adjustment, notwithstanding ordinary imperfections in the construction of the parts. The ports of the supplemental valve, *f*, pass through the plate. The various passages for steam and exhaust cannot be shown in full detail in the engravings, but their course will be readily understood from the following description of the operation of the engine, taken in connection therewith.

In Fig. 1, the piston is supposed to have finished its stroke to the left, and to have carried the valve *f*, into the position shown; under which conditions steam is admitted through a port in the plate, *e*, into the end of the chamber, *c*, and at the same time steam from the other end of the chamber, *b*, is permitted to escape, by means of passages through the plates and the cavity, shown in the valve, *f*, to the main exhaust port. The effect of the foregoing is to force the chambered valve, *a*, to the right, and thereby to connect the right hand cylinder port (through the passages in the valve and plate) with the exhaust port, *d*; at the same time and by the same motion of the valve, *a*, the left hand cylinder port is opened to the steam chest, and a reversal of the engine is effected.

The improvements were patented June 4, 1872, and further information may be obtained of the inventors, H. A. Benson and William Avery, of Warren, Mass.

Fig. 1 Fig. 2



BENSON & AVERY'S DIRECT-ACTING STEAM ENGINE.

Cutaneous Absorption of Poisons.

In a recent note to the Paris Academy, M. Bernard describes a series of experiments for the purpose of testing the degree of cutaneous absorption which took place in a bath impregnated with the substances to be tested. Every precaution was taken to prevent the possibility of the substances entering the system of the patient by any avenue except the skin. He was then submitted for a short time to steam vapor charged with iodide of potassium, and two or three hours afterwards the urine gave unmistakable evidence that the iodide had been absorbed and was passing through the system.

In these experiments the medicinal agent reached the skin in hot aqueous vapor, and therefore acted more readily than an ordinary cold solution; but the fact of cutaneous absorption was very definitely illustrated. M. Bernard adds:

"M. Colin has described an experiment in which he allowed water charged with cyanide of potassium to fall for five hours on a horse's back. This caused the death of the animal; the sebacious (fatty) matter having been destroyed through percussion, and cutaneous absorption taking place.

The Study of Nature as a Means of Intellectual Development.

Some affirm that the study of natural science is fatal to the development of our higher emotions, and tends towards gross utilitarianism. But who can study the harmony existing in the works of Nature, the manifest order and design displayed in endless changes and variety, and the immutable laws which govern the physical world, without having his thoughts and aspirations lifted to Him who inhabiteth eternity, the Alpha and Omega? "The heavens declare the glory of God! Day unto day uttereth speech, night unto night showeth knowledge!"

Astronomy writes, in the motions of the stars, poetry more glowing than human pen ever produced. Botany leads us among the flowers, the most unpretending of which is arrayed in glory greater than that of Solomon and teaches Divine goodness and love to every thoughtful observer. Chemistry, unfolding to us wonderful and mysterious changes, excites not only emotions of beauty but of sublimity. And what shall we say of that marvellous agent, vital force, which still eludes the analysis of the latest science? In autumn it withdraws its power and all Nature is clad in the habiliments of decay and death. In the spring time, with magic hand, it robes the earth in living beauty.

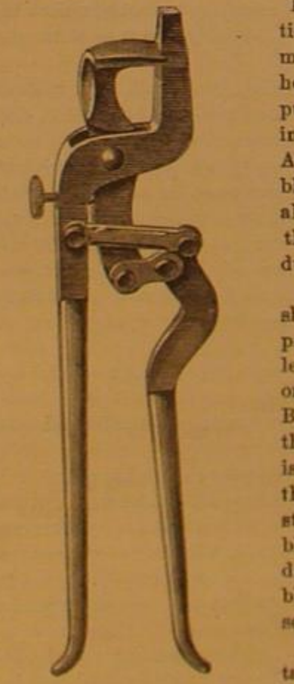
Adding, to a thorough knowledge of any one science which might be chosen as a particular field for research and study, a knowledge of the most important principles of the others, we have sufficient matter for the development of the most susceptible and retentive memory.

By constantly observing facts, drawing conclusions from them, and verifying these conclusions by observation or experiment, we form the habit of correct reasoning, and thus gain the same kind of discipline which geometry or any other abstract science affords. Nor is discipline alone the result of the study of Nature as is often the case in absolute sciences. Nature rewards her students not only with discipline but with knowledge the most practical, pleasurable and profitable.—*Rhode Island Schoolmaster.*

BLACKSMITH'S BUTTERIS.

We illustrate in the annexed cut John H. Rhamy's improved butteris, patented June 11, 1872, which appears to be a very good tool for the purpose intended.

It is constructed of three levers which are combined, in the manner shown in the engraving, so as to obtain considerable power in the jaws of the implement. The jaw on the left is provided at its end with a steel paring knife, and the right hand one forms an anvil block and projects considerably beyond the front of the knife.



In practice, the projecting portion of the right hand jaw is made to restagainst the horse's hoof, and the paring knife is put in operation by compressing the handles of the levers. As the knife approaches the block, it pares off the hoof and also cuts off the nails therein, thereby performing the double duty of butteris and pincers.

On the left of the tool is shown a thumb screw, which passes through the arm of one lever and presses against the one immediately opposed to it. By adjusting this thumb screw, the distance between the jaws is regulated and the blade of the paring knife prevented striking the face of the anvil block and thereby becoming dulled. The latter is preferably made of copper or other soft metal.

The increased leverage obtained in the arrangement shown is said to render the action of the tool so sure and easy as to make it invaluable in the blacksmith's shop. It is manufactured by J. H. Rhamy and C. W. O'Neal, at Findlay, Hancock county, Ohio, of whom further information may be obtained.

Petroleum in Alsace.

The value of Alsace to Germany and the consequent extent of the loss to France, commercially considered, are alike enhanced by the probable development of a large petroleum industry in that celebrated province. Oil works on a small scale already exist in the valley of the Rhine, near the village of Schwatwiller, within and on the borders of the forest of Hagenau. A thick alluvial deposit has first to be penetrated, beneath which are alternating strata of indurated clay and micaceous sandstone, with seams of compacted sand. These last named seams contain the petroleum, and are found at a depth of seventy or eighty yards. Indications of the presence of petroleum are observable in various parts of the forest, and bitumen is found and worked in the adjacent country. Borings to test the presence of the petrolliferous sand have been multiplied to some extent, and in all cases with satisfactory results. The mode of working very much resembles that of a colliery, only on a much smaller scale. We believe that at present there are only two oil pits existing, and one of these is of very recent date. In fact the whole affair is in its infancy, but is most likely destined to undergo very great extension, so as to become of considerable importance. The pits are sunk in the ordinary way, and the seams of sand are worked by means of galleries, in a manner similar to that of getting coal. As the workmen cut their way through the compacted sand, the oil oozes out of it, running down the walls of the gallery on to the floor, where it accumulates in shallow wells dug for the purpose. From these wells the crude petroleum is conveyed to the surface to be properly treated. But this process of draining does not remove all the oil, and the sand itself is accordingly taken to the surface to be distilled in retorts. The crude oil which oozes from the sides of the gallery, and that which is distilled from the sand, are subsequently rectified by a further distillatory process, and the product is understood to be in no degree inferior to the best American petroleum. In working the existing pits, it is a singular fact that no water is met with. Of the extent to which the petroliferous sand prevails, it would be premature at present to judge, but there seems no reason to doubt its presence over a considerable range of ground. Now that attention has been drawn to the subject, we may expect further discoveries will be made. It is reported that Mr. Keates, the well known analytical chemist, has recently visited the oil producing district in Alsace, and examined the works. So far as we can learn, there is every prospect of the oil proving abundant. The cost of production, it would seem, is so moderate that the competition of American oil need not be feared, and the demand is such that Alsace will consume all she raises for some time to come, unless the produce is very largely increased.

It has been said that petroleum, as found in different parts of the world, is not confined to any particular stratum, and that consequently there is no such thing as a "petroleum rock," properly so called. Petroleum has been found in rocks of all ages, from the lower silurian to the tertiary period inclusive. The oil wells of the United States are for the most part sunk in the sandstones which form the summit of the Devonian series. The oil of Alsace, it will be observed, is limited to certain seams of compacted sand, and it would appear that in this region the oil is found solely in these seams It is a general theory, with regard to the origin of petroleum, that it has been produced by the slow distillation, at low temperatures, of coal and other bituminous minerals. The theory would seem to accord with the fact, already named, that bitumen in various forms is found in the country bordering on the oil region of Alsace. Further explorations in this territory may lead to still more important discoveries, and the commercial importance of the inquiry is one guarantee that it will not be neglected.—*Engineer.*

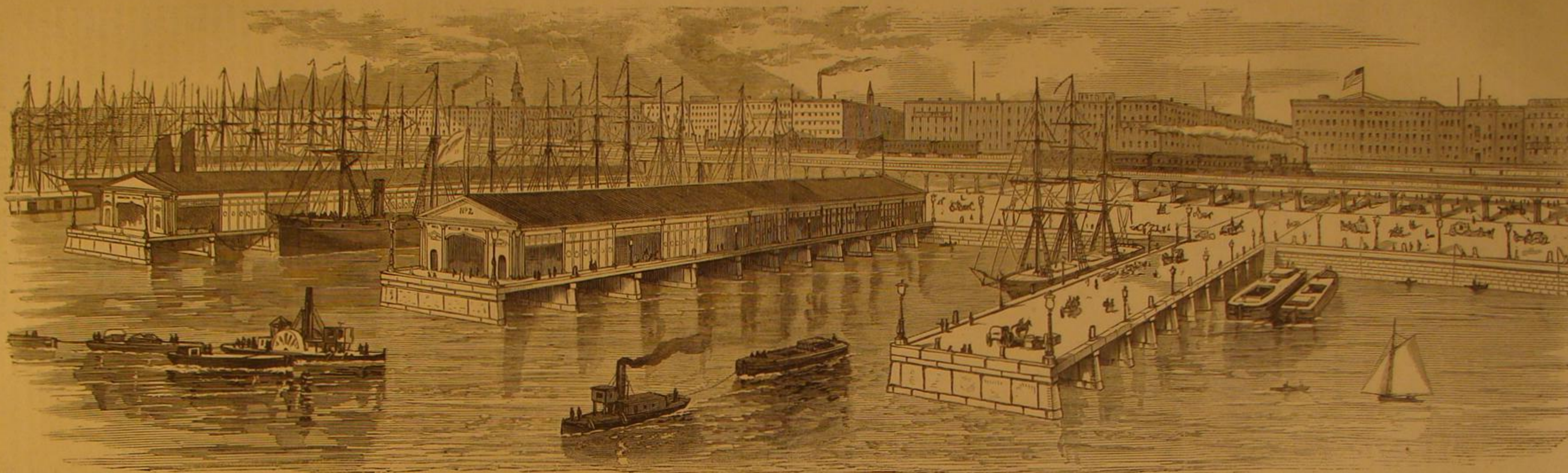
American Bismuth.

Bismuth is one of the rare metals, having many useful applications in the arts, which have been hitherto restricted to but few localities, principally in Saxony and Bohemia, in the Erzgebirge range of mountains. These mines have become so nearly exhausted that, even with no increase in the demand, a growing scarcity has been felt. It is said that discoveries of native bismuth have been made in Utah, in the town of Beaver, about two hundred miles south of Salt Lake City; and if the accounts which have been given of the existence of the ore are reliable, they are destined to attract no small share of attention. The deposit is said to be very extensive, and a well defined lode seven feet in thickness is reported to have been traced for a distance of more than twelve hundred feet. If these assertions be true, this discovery is a matter of great importance. The metallurgical treatment of the native bismuth is very simple. According to Makins, the ores are placed in tubular iron retorts arranged in a horizontal row, slightly inclined from the upper to the lower end. Heat is applied to the exterior of the retorts, when, in a few minutes, the metal begins to flow. A small rake is thrust into the end of the retort, and the heated ore stirred, which promotes a more rapid flow of the molten metal, which runs into iron dishes, where it is protected from the oxidising influence of the air by a covering of powdered charcoal. In this manner a charge of a series of retorts, holding fifty-six pounds each, may be worked off in less than an hour. When no more metal runs off, the siliceous matrix is raked out of the upper end and allowed to drop into water, when the retorts are recharged and the operation continued.

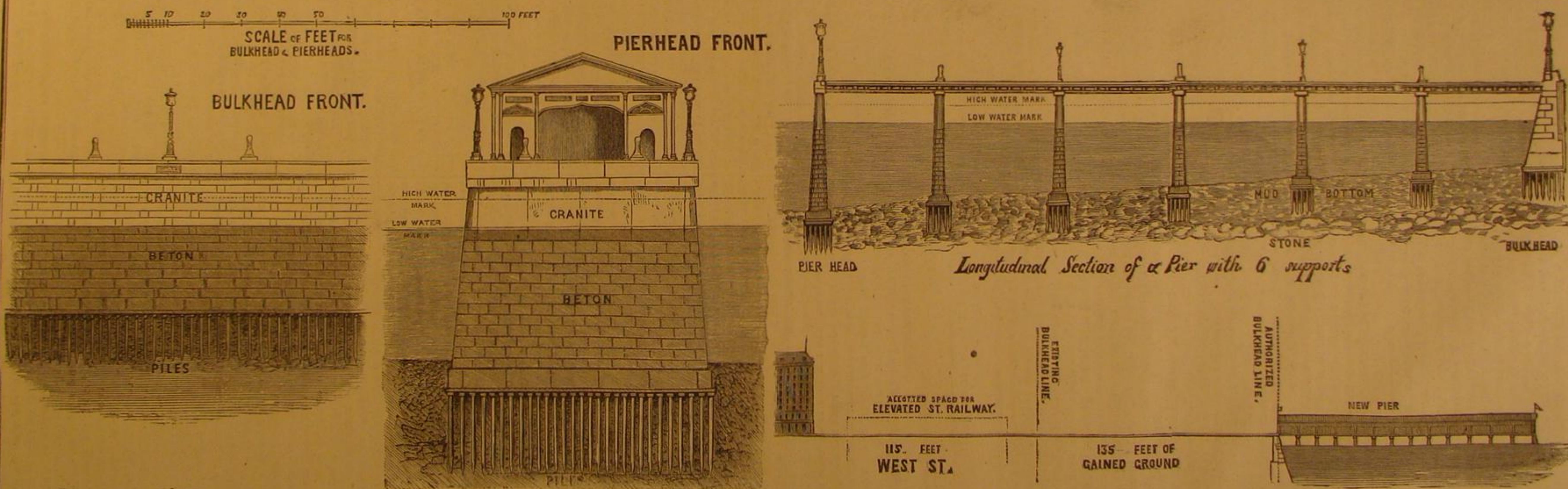
Boiler Explosions in Belgium.

M. Robert Vinçotte, a Belgian engineer, recently read a paper before the Liège Association of Engineers, in which he states that there are in Belgium about 11,000 steam boilers, and that there is an explosion of 1 out of every 1,274 boilers annually. In England there is annually 1 explosion out of every 2,000 boilers. In Belgium five out of every six explosions are due to the fact that the boilers have become too weak to resist the regulation pressure, and the sixth is attributable to the excess, over the proper pressure caused by the negligence of those in charge or the inefficient state of the safety apparatus or the gages.

A LIVE turtle, lately found on Long Island, had inscribed upon its shell "S. H. Rogers, 1801." It is therefore supposed to have lived more than three score years and ten.



NEW YORK CITY.—THE CONTEMPLATED IMPROVEMENTS ON THE RIVER FRONT—PERSPECTIVE VIEW SHOWING THE NEW SYSTEM OF PIERS AND BULKHEADS.



SKETCHES SHOWING THE FUTURE PIERS AND BULKHEADS.—[See next page].

THE NEW WATER FRONT, NEW YORK CITY.

[*See Engravings on page* 115.]

General McClellan has submitted his report upon the proposed new system of wharves and piers, and the Dock Commissioners have filed a demand with the City Comptroller for $1,500,000, wherewith to begin the work. With his own worldwide experience, and with the efficient aid of General A. A. Humphreys and General Q. A. Gilmore, he has elaborated a system of improvements which will place New York city very far in the lead of all other American ports, and on a par with the grandest and oldest port cities of Europe. General McClellan shows that our metropolis is unrivaled in its position as a great maritime and commercial mart, having far greater natural advantages than either London or Liverpool as a seaport. These latter ports both suffer from a contracted river front and from the great daily variations of the tide, while New York has a total available water front of 24½ miles. With these facts in view, he comes to the conclusion that the London system of enclosed docks—necessary there on account of the rapid and great tide variations—is not only unnecessary here, but would be expensive and pernicious. He therefore discards that system, and proposes a solid river wall, widening the river side avenue 200 feet on the East river and 250 on the Hudson, with piers of *béton* (artificial stone) or masonry projecting therefrom at the requisite distances from each other. Outlets at the pier heads will be made sufficient for sewerage purposes. In brief, the general system proposed is thus summed up by General McClellan himself:

First. To construct a permanent river wall of *béton* and masonry, or of masonry alone, so far outside of the existing bulkhead as to give a river street 250 feet wide along the North river, 200 feet wide on the East river, from the Battery to Thirty-first street, and 175 feet wide north of that point.

Second. To build piers projecting from the river wall of ample dimensions, adequate construction, and, so far as possible, affording an unobstructed passage for the water.

Third. Whenever it is necessary, to cover these piers with substantial sheds suitable to the requirements of each case.

As regards the expense, the report says that dock facilities equal to those in Liverpool can be obtained, under the arrangement proposed, at a cost incomparably less than that of those superb constructions. The General's conception includes an elevated railway, forming an *enceinte* around the river front. The possibility of such a road has long been regarded at once as one of the greatest advantages which a reconstructed wharfage system could offer, and one of the strongest reasons for undertaking it.

Commencing on both sides of the Battery, the first object is to increase the depth of water at the bulk heads. To effect this, as the work progresses, West street, fronting the North river, will be widened, by filling in and advancing the present line of bulk heads, until the street, from the warehouses to the shore line, has a width of 250 feet from the Battery to Eleventh street.

From the foot of West Eleventh street, going northward, the position of the channel will not permit of increasing the width of the river street until a short distance south of Twenty-third street, where the widening will again begin, and be continued to Fifty-ninth street, far enough, it is supposed, to provide for all the requirements of the commerce of the port for many years to come.

Along South street, fronting the East river, from the Battery to Gouverneur street, it will be 200 feet wide, thence, around Corlear's Hook to Grand street, 175 feet wide. Along this new shore line will be constructed a bulkhead of the general pattern shown in our artist's sketches. The soundings and surveys made by the engineer corps develop the fact that overlying the bed of the river the depth of mud varies from 8 feet near the Battery to 20 feet at pier 15, North river, and increases so rapidly that, in the vicinity of the gas houses, the depth is nearly 60 feet.

The engravings represent, in perspective, in elevation and profile, the alteration in the wharfage of New York. Our principal perspective view shows, in a telling manner, the extension of the piers into the water (represented at low tide in order to display as much as possible of the system) and the liberal boulevard gained to the city by the widening of the external avenue. The façade views of a pier and a bulkhead display the style of architecture contemplated. The profile of a pier exhibits the combined lightness and strength of the construction, and the free ingress and egress of the tide. A diagram displays, with the utmost effect, the ground gained by pushing out the wharfage to a more distant limit. The commencement of operations near the Battery will be anxiously looked for, and the progress of the work will meet with hearty coöperation from the mercantile community of New York, who see in this great plan of operations the one practical method of aiding to restore to this city its wandering merchant marine.

We are indebted to Frank Leslie's *Illustrated Newspaper* for the view and description of these important works.

CABMEN'S RESTS.—At Birmingham, England, the first of a series of movable waiting rooms for the use of cab drivers while waiting for hire has been presented by the Local Town Mission to the men on the rank near the Town Hall. The structure, which is of oval shape and mounted upon small wheels, is of stained wood and glass, and contains sitting accommodation for about a dozen men. It is furnished with a coke stove, at the door of which meat can be cooked in a Dutch oven, a boiler, and a locker for food. The current expenses of maintenance and cleaning will be defrayed by a small subscription among the men using the box.

Correspondence.

The Editors are not responsible for the opinions expressed by their Correspondents.

The Influence of Forests and General Vegetation upon Rain Falls and Climate.

To the Editor of the Scientific American :

Having for many years noticed in a dry season, in summer, where there was no dew on the open fields before sun rise, that, in entering a wood or a grove, the leaves of the trees, shrubs, and weeds were covered with moisture, and, also, that the thermometer ranged higher on the open land than it did amongst the trees, etc., I was induced to try the following experiments:

1. I took a small orange tree which was growing in a glazed flower pot—gave it two coats of shellac outside—sealed the hole at the bottom, and covered the earth on the top with a thin cake of putty, so as to prevent any moisture escaping therefrom.

2. I made a bell receiver with blotting paper, large enough to cover the tree without touching its leaves, and long enough to reach within two inches of the bottom of the pot on the outside, dried it by the fire and weighed it correctly.

3. I made another bell receiver larger than No. 2 and long enough to reach within half an inch of the bottom of the flower pot on the outside, and then placed it over the smaller one, No. 2. This one was well covered with shellac on both sides.

4. Before I sealed the top of the pot with putty, I set it on a tin roof in the sun from 6 A. M. to 6 P. M. so as to dry the earth in it and to exhaust the superfluous moisture of the tree itself.

5. I now recorded the weight correctly and then added 8 ounces of well water to the earth in the pot, placed it on a plate of glass, and set it on a table in my workshop; the hygrometer then indicated but little moisture in the building, as the wind was northwest. I then suspended over it the bell receiver of blotting paper; and, then over this one, I placed the shellac-covered receiver, and suspended both with a silk cord from the ceiling, leaving a clear space of two inches between the two receivers. The inside receiver came within two inches and the outside within half an inch from the bottom of the flower pot on the outside. I suspended a thermometer in the center of the orange tree under the receivers, and one of the same make was suspended with a silk cord from the ceiling of the room.

6. I kept them in this state 24 hours, then weighed the whole before I took off the receivers. The loss of weight was one dram avoirdupoise. I took off the receivers, and weighed the blotting paper one, which had increased in weight 6 drams avoirdupoise; there was no increased weight in the outside one which was coated with shellac. Water was condensed on the leaves of the orange tree, but I had no means of ascertaining its correct weight.

7. I dried the leaves of the tree, and weighed all again. The loss of water by the condensation of the leaves was 3½ drams avoirdupoise. This was as near as I could ascertain, without special apparatus.

8. The tree, itself, then, had taken up 9½ drams of water in 24 hours. None could have escaped from the soil in the pot, into the open air and the receivers, as it was hermetically sealed at both ends.

9. Those 9 drams of water, then, had passed from its roots through the tree, whose evaporation by heat had passed it into the atmosphere, to aid in forming rain falls, snows, etc.

Are not trees and forests then, one of the means, in the economy of Nature, to supply the air with moisture? The thermometer when first removed from the orange tree was at 68° Fah., the one suspended from the ceiling by a silk cord was at 71½° Fah., and the hygrometer indicated but little moisture in the room where the experiments were performed. According to these experiments, trees draw their water from the earth by means of their roots. And, if you investigate this subject strictly, you will find that in dry soils, the roots strike deeper in the earth than they do in swamps, so that they can obtain a sufficient supply of water for their growth and existence. I experimented with the spruce pine, the magnolia, the currant bush, and the sugar maple, all of which proved the truth of the conclusions I have mentioned above.

I hope some of my fellow citizens who are lovers of science will try these experiments on a larger scale for the benefit of all nations. JAMES QUARTERMAN.

New York city.

When does an Engineer's Duty Cease in Case of a Collision?

To the Editor of the Scientific American:

In several of the late numbers of the SCIENTIFIC AMERICAN I have read articles upon the question "When does an engineer's duty cease in case of a collision?" On this subject, let me remind your readers of a law as to friction in stopping of a train by reversing the motion. It is this: If two surfaces slide upon each other, the friction will increase as the motion decreases, and decrease as the motion increases. That is, if two surfaces move upon each other at a slow rate the friction will be much greater than if they move at a rapid rate. Apply this law to stopping of a train of cars running at a high speed: When an engineer sees a train ahead of him, into which he must inevitably dash unless he brings his own to a stop, there are three things he does as rapidly as physical nature will permit: He whistles "down brakes," reverses his valve motion and pulls wide open his throttle. What is the result? If he will look at his drivers, he will see that they make but few revolutions in the direction in which the train is moving, but will immediately commence to turn in an opposite direction, at a high speed. Now it will take no great mathematician to calculate the speed which the driving wheels of his engine are slipping over the track when the train is moving at the rate of 30 miles an hour and the drive wheels spinning in the opposite direction at the rate of four or five hundred revolutions per minute. According to the above law in friction, the power of the engine is doing comparatively little to overcome the momentum of the train, even on a well sanded track. The point at which this power is in the greatest degree effectual is just as the wheels are about to slide or to reverse their motion, and if he partially closes the throttle and only gives his cylinders such an amount of steam as will exert the greatest reverse force on the driving wheels and not reverse their motion, he is doing the utmost in his power to stop his train.

I hold, then, that it is the duty of an engineer, if there are a few seconds of time left after whistling "down brakes" and throwing back his reverse lever, to remain on his footboard, watching closely the action of his drive wheels; and by keeping his hand on the throttle, he should regulate the supply of steam, as the drivers are inclined to slip or reverse their motion, until within two or three seconds of the crash, when his duty to humanity and his employers is fairly and bravely done, and ends, and it becomes him then to look to his own safety by abandoning his engine or otherwise. If the time is short, as is often the case, between the moment of first catching a glimpse of the coming danger and the final crash, there will be little or no time to exercise judgment in regulating the flow of steam to the cylinders; but in such cases, nine times out of ten, it would be better to let the throttle remain, after the valves are reversed, as it stood while the engine was being propelled on its forward course, as the steam thus supplied would do far more towards stopping the train than if flowing through a full throttle.

E. B. WHITMORE.

Rochester, N. Y.

Rubber or Leather Belts.

To the Editor of the Scientific American :

I notice, on page 48 of the present volume, an article on the relative merits of rubber and leather for belts. One would be led to suppose from this that the precise merits of both were to be fairly laid down, in which case it would be highly interesting to many of your readers; but on the contrary, it goes on to explain the many careless ways in which a rubber belt may be ruined in a short time, by running off into the gearing, by the lacing giving out, and in various other ways; and the writer forgets to state whether a leather band would be damaged under similar circumstances. He winds up by saying that a well made leather band, if properly looked after, the width and pulley surface being proportional to the amount of work done, will last 12, 15, or 20 years. Now, in comparing the two kinds of belts fairly, I think it is perfectly safe to say that rubber belts are better balanced than leather, and run more smoothly; they will also run in line after being used a long time, while a leather band will run first to one side and then to the other side of the pulley, owing to the soft spongy spots stretching most. We have large rubber belts made to order (which are endless, no lacing being used) running on pulleys, the diameter and face being proportional to the amount of work done, which do not require so much looking after as a leather band would in the same place, and costing much more money.

GEORGE B. DURKEE.

Chicago, Ill.

Clay and Fossils from Texas.

To the Editor of the Scientific American :

E. G. W. sends us from Texas some mineral specimens and fossils, and says: I send you a sample of clay from a bed we have here. Seeing an article on the subject in the SCIENTIFIC AMERICAN induces me to do so. The deposit is quite an extensive one, cropping out from the side of the bank where I took the sample from. It is subject to the wash of the tide; you will find in it a little salt, probably. I will also send you a sample of what I take to be the tusk or tooth of some monster. I dug it out of the bank near the clay. I measured the diameter; the large end was 10 inches, the small, 6 inches. It had been broken off at both ends, and was 8 feet long after I squared up the ends. Judging from the general appearance, it must have been upwards of 20 feet in length. I would like to know what the clay is, and what good for; and whether sample No. 2 is bone, or what it is.

Answer.—The clay is from the tertiary formation, extensively deposited along the Gulf and Atlantic borders. It is of no particular economic value. The fragments of fossil bone are of greater importance. You have probably found either the jaw bone of a whale or the tusk of an elephant. You will do well to make diligent search for more fossils, and you will undoubtedly be rewarded by the discovery of sharks' teeth and other remains of great scientific interest. If you will send us minute descriptions with drawings (lengthwise and sectional), we will aid you in identifying them. Look for a bed of lignite coal underneath the clay beds.—EDS.

The Young Machinist Replies.

To the Editor of the Scientific American :

On page 52 of your present volume, I find two answers to my "Young Machinist's Query." The first says that an engineer, to become a member of the brotherhood of locomotive engineers, "must be sober, truthful, moral, reliable, ever ready, and have good judgment." Let the man that has those qualifications serve from 3 to 7 years in any machine shop, instead of on the top of a cab, a wood pile, or the soft side of a hemlock plank (as our friend would have us believe he did), and you have a thorough engineer, one capable of taking care of the "thousands of dollars worth of property and the precious lives entrusted to his care."

No. 2 says that he knows first class machinists who can build and repair an engine but cannot take charge as engineer. I hold that a man is surely wooden-headed who can build and repair an engine but cannot learn to run it. If the machinist is, as he says, only a first class laborer, I would like to know in what class he would put the man that does the work he has evidently been accustomed to, namely, pitching coal or wood into the furnace. So I say: Give me a man that can make his own calculations, in regard to the engine and boiler, and the use of steam, and who is a practical machinist, rather than a man who has served 20 years at pitching wood or coal into the furnace.

A YOUNG MACHINIST.

Galveston, Texas.

Ignition by the Rays of the Sun.

To the Editor of the Scientific American:

A singular case of fire occurred in this village a short time ago, which has caused considerable inquiry and discussion as to its cause; and as there are diverse opinions on the subject, we would be pleased to hear your views. On the 20th of last June, there was a piece of bituminous coal, containing about one cubic foot, lying on some dry pine board, against the south side of a wooden building, and out of the influence of stirring air, but where the rays of the sun shone fair upon it. At about 4 o'clock, P.M., the boards and side of the building close to this piece of coal suddenly burst into flames, and had it not been seen by a person standing near by, the building would have been burnt up; but as it was, the fire was extinguished with a few pails of water. The day had been cloudless and intensely hot, the thermometer ranging from 100° to 105° in the shade. The piece of coal had lain in the same situation for the last six months, and when water was thrown upon it to extinguish the fire, there was a hissing sound, as if just taken from a burning furnace. If this fire arose from the absorption of the rays of the sun, it becomes a matter of importance to avoid exposing solid blocks of coal in like situations.

H. W. S.

Millport, N. Y.

The Emma Suit.

The Emma Mining Company comes off conqueror in a suit instituted by it to restrain a rival company, whose workmen, last April, broke into the Emma works. This was the Cincinnati and Illinois Tunnel Company. When they made their appearance in the Emma, the workmen of the latter blocked up the opening, but shortly afterwards the "cave" in the Emma occurred, and cut the owners off from that part of their workings where their rivals had entered. When, after some delay, the fallen rock was penetrated, they found the Illinois men in possession of all that part of the Emma works, and the workmen of the latter mine were resisted in attempting to take possession of it.

The Illinois men claimed that the ground on which they stood did not belong to the Emma mine, but was separated from that vein by a clear space of about thirty feet, which was filled with barren rock. The present suit was then brought to decide the ownership of this part of the property. The Illinois men produced affidavits from some gentlemen who professed to be experts, and also from a number of discharged workmen, formerly in the employ of the Emma company. These gentlemen went into the mine and, peering around in places where the ore had been altogether removed, declared that they found no ore. Measuring the foot wall, they found it 30 feet wide at that spot, and assumed that for that distance there never had been any ore, and that the ground held by the Illinois people was accordingly separate and distinct from the real Emma vein.

On the other side, the owners of the Emma brought up men who had been constantly familiar with the mine during the time when that part of the ground was worked out, and who declared that ore had been taken out at every foot of the distance said to be barren. Assayers also went into the mine and, taking samples from spots at distances of two feet along the whole width of the so called barren space, found that all that rock carried silver, the lowest assay being more than $75 per ton. On this evidence Chief Justice McKean declared that the testimony failed to prove any disconnection between the ground acknowledged to be the Emma mine and that in dispute. He also gave expression to the opinion that the Emma company had a right to follow their ore outside of their own surface limits into neighboring ground, in accordance with the law which says that the patentee may follow the "vein or lode, with its dips, angles, and variations, to any depth, although it may enter the lands adjoining, which shall be sold subject to this condition."

This tunnel business, as we have before said, ought to be disposed of, once for all, by Act of Congress. If any man wishes to run a tunnel and can point to a definite body of ore which he expects to reach, he ought to have the right to that ore for the length of time it takes him to reach it by reasonable diligence. But how many of the tunnel claims in the Territories have been prosecuted with what, by any stretch of the imagination, can be called "reasonable diligence?" Not one in a hundred. Whoever examines that country finds, in every district, tunnel "stakes," marking locations that have never had a pick struck into them, or else have been seriously neglected. This style of mining has not borne fruits sufficient to entitle it to the protection it enjoys. It is extremely hazardous to the other, which we may call, in contradistinction, the *straightforward* style of work. We can but feel pleasure at the victory of the Emma company in this case. Whatever criticism that concern is open to on other points, it at least deserves the credit of having worked its property with fair diligence. This is the only return the American people ask for the free gift of their mining property, and to this they are certainly entitled.—*Engineering and Mining Journal.*

Gravitation, Light and Heat.

The law of gravitation enunciated by Newton is that every particle of matter in the universe attracts every other particle with a force which diminishes as the square of the distance increases. Thus the sun and the earth mutually pull each other; thus the earth and the moon are kept in company; the force which holds every respective pair of masses together being the integrated force of their component parts. Under the operation of this force, a stone falls to the ground and is warmed by the shock; under its operation, meteors plunge into our atmosphere and rise to incandescence. Showers of such doubtless fall incessantly upon the sun. Acted on by this force, were it stopped in its orbit tomorrow, the earth would rush towards and finally combine with the sun. Heat would also be developed by this collision, and Mayer, Helmholtz, and Thomson have calculated its amount. It would equal that produced by the combustion of more than 5,000 worlds of solid coal, all this heat being generated at the instant of collision. In the attraction of gravity, therefore, acting upon non luminous matter, we have a source of heat more powerful than could be derived from any terrestrial combustion. And were the matter of the universe cast in cold detached fragments into space, and there abandoned to the mutual gravitation of its own parts, the collision of the fragments would in the end produce the fires of the stars.

The action of gravity upon matter originally cold may in fact be the origin of *all* light and heat, and the proximate source of such other powers as are generated by light and heat. But we have now to inquire what is the light and what is the heat thus produced? This question has already been answered in a general way. Both light and heat are modes of motion. Two planets clash and come to rest; their motion, considered as masses, is destroyed, but it is really continued as a motion of their ultimate particles. It is this motion, taken up by the ether, and propagated through it with a velocity of 185,000 miles a second, that comes to us as the light and heat of suns and stars. The atoms of a hot body swing with inconceivable rapidity, but this power of vibration necessarily implies the operation of forces between the atoms themselves. It reveals to us that while they are held together by one force, they are kept asunder by another, their position at any moment depending on the equilibrium of attraction and repulsion. The atoms are virtually connected by elastic springs which oppose at the same time their approach and their retreat, but which tolerate the vibration called heat. When two bodies drawn together by the force of gravity strike each other, the intensity of the ultimate vibration, or, in other words, the amount of heat generated, is proportionable to the *vis viva* destroyed by the collision. The molecular motion once set up is instantly shared with the ether, and diffused by it throughout space.

We on the earth's surface live night and day in the midst of ethereal commotion. The medium is never still; the cloud canopy above us may be thick enough to shut out the light of the stars, but this canopy is itself a warm body, which radiates motion through ether. The earth also is warm, and sends its heat pulses incessantly forth. It is the waste of its molecular motion in space that chills the earth upon a clear night; it is the return of its motion from the clouds which prevents the earth's temperature on a cloudy night from falling so low. To the conception of space being filled, we must, therefore, add the conception of its being in a state of incessant tremor. The sources of vibration are the ponderable masses of the universe. Let us take a sample of these and examine it in detail. When we look to our planet we find it to be an aggregate of solids, liquids, and gases. When we look at any one of these, we generally find it composed of still more elementary parts. We learn, for example, that the water of our rivers is formed by the union, in definite proportions of two gases, oxygen and hydrogen. We know how to bring these constituents together, and to cause them to form water: we also know how to analyse the water, and recover from it its two constituents. So, likewise, as regards the solid portions of the earth. Our chalk hills, for example, are formed by a combination of carbon, oxygen and calcium. These are elements, the union of which, in definite proportions, has resulted in the formation of chalk. The flints within the chalk we know to be a compound of oxygen and sil cium, called silica; and our ordinary clay is, for the most part, formed by the union of silicium, oxygen, and the well known light metal, aluminium. By far the greater portion of the earth's crust is compounded of the elementary substances mentioned in these few lines.—*Tyndall.*

How to Kill Weeds.

By attending the following directions, weeds may be completely extirpated:

1. Study their habits. Without this, you are working in the dark. You are shooting without taking aim, and are more likely to miss than to hit.

2. Have faith that weeds can be killed.

3. Should you, for the first year or two, see little benefit from your labor, do not relax your efforts. You will certainly triumph in the end. This is the experience of all gardeners; and a firm conviction of this truth is one of the strongest incentives to perseverance.

4. Be forehanded with your work. This is exceedingly important. It is so not merely because weed plants can be killed easily just as they begin to grow, but it often happens that many weeds actually go to seed before they get large enough to attract attention. Chickweed (*stellaria*) is quite a pest in many gardens. We have known much labor and time spent, year after year, in efforts to keep this little plant in check, but all in vain, because the work was not commenced early enough in the spring and continued late enough in the autumn. The plant will flower in the snow, and tens of thousands of seeds were matured before the ground was cultivated in the spring. The garden was forked over and hoed repeatedly during the summer, and every weed raked off (after they had gone to seed), but during the wet weather, thousands of little plants would spring up, but were not thought to be injurious, and were suffered to remain to grow all winter and seed the land again early in the spring. The gardener declared it was impossible to get rid of chickweed. And so it is with many other weeds. We could get rid of them if our labor was directed by a little correct knowledge of the habits of the plants, and was applied at the right time. Many think it impossible to free the land of couch or quick grass (*triticum repens*), and their experience seems to them to justify the opinion. But it will be found that they are not forehanded in their work. They apply labor enough, but it is too late. They let the plants grow until the ground is covered with the leaves of the couch, and then they hoe and rake and cultivate, and may be fork out as many roots as possible. But they cannot get out the whole. The roots are broken into small pieces, and each piece produces a new plant, which soon pushes out its roots in all directions in the loose and mellow soil Had the work been commenced before the couch plants pushed out their leaves, and been kept up so vigorously and continuously that the young shoots could not get to the surface, and the soil constantly cultivated during the hot dry summer months, every couch plant would be destroyed. We have tried the plan, and know that couch can be effectually got rid of in this way. But no half way measures will succeed with it.

5. Burn all the thistle heads and other weeds that are cleaned out of the garden. Many seem to think the best place to put these weeds is in the roads. The man that does it should be indicted for a nuisance. He forgets that these weed seeds will stick to the feet of horses and other animals. Another plan is to feed these seeds to the fowls. All that are not digested will grow. If there is so much grain among the weed seeds that you do not like to burn them, boil before feeding.

6. Look to the manure. This is a fruitful source of weeds. If the crops are foul, the manure will certainly be full of weed seeds. Fermenting the manure will not kill these seeds unless the seeds themselves are decomposed, which is seldom the case. The better plan is to pile the manure, turn it, and get it thoroughly rotted, and then apply as a top dressing.—*London Farmer.*

Glacial Phenomena in the vicinity of New York.

The evidences of a glacier once moving over the island of New York are of three classes: 1st. The grooves, or striæ, and other results of the abrasion of the rocks of the island, wherever they are visible. 2d. The mantle of drift which partially conceals the rocks. 3d. Facts observed over the hills of the neighboring island of Long Island. All the evidences of the first class show that the movement and agencies causing them proceeded from the northwest towards the southeast. Following this northwest direction from this island over the highland range of "Archæan" rocks at the Ramapo Gap, N. Y., we find the same general evidence that we do elsewhere eastward. The same evidences can be seen in the Pompton Gap, Dover, and at Lake Hopatcong, N. J.

Some years ago I traversed the hights from this lake to West Point on the Hudson, and everywhere the evidence of some agent moving southeastward over them, rounding their summits, tossing them on their western slopes, was always present before me. The sum of all this evidence confirms Professor Dana's theory of a glacial plateau on the highlands of Canada.

The second class of evidence—the material composing the mantle of drift—always shows it to have been transported from the northwest. Both on this island and Long Island the material is from rocks known to lie to the northwestward. Thus on the island we find boulders and huge masses of the serpentine and trap rocks of New Jersey blended with the red sand rock of the same State. In Brooklyn on Long sland, we find, in addition to the rocks of New Jersey, those from New York island blended with the others. I have seen huge masses of anthophylite in Atlantic street, Brooklyn, which must have come from the parent bed of this rock, on Tenth avenue and from West Fiftieth to West Sixtieth street, New York. Careful measurement of the direction of the movement which must have transported these rocks shows it to have been from N. 10° W. to S. 10° E. This course tallies with measurements made on the palisades by Professor Cooke. The agency which threw this mantle over the island had power to take up and transport immense masses of red sandstone from New Jersey to New York and Long Island. Many blocks in the city, as at East Seventy-third, East Seventy fourth, East Seventy fifth, and East Seventy-sixth streets, Third avenue, New York, lying beneath the surface soil, are four, six, and eight feet thick, giving in the excavations an appearance of being independent red deposits in the drift.

The third class of evidence is the immense drift deposits on Long Island. These stretch from Oyster Bay, S. 60° W. to Fort Hamilton, and over to Staten Island. Was not this ridge a terminal moraine? Through this moraine the Hudson river breaks at the Narrows at almost right angles to the trend of the Hudson valley.—*R. P. Stevens, M.D., American Journal of Science and Arts.*

THE annual State exhibition of the Kansas Board of Agriculture will take place at Topeka Sept. 16th.

FIRELESS LOCOMOTIVE.

Dr. Emile Lamm, of New Orleans, whose invention of the ammonia engine was described and illustrated at page 290, Vol. XXV., of the SCIENTIFIC AMERICAN, has lately been giving his attention, with very successful results, to the economic and absolutely safe propulsion of street cars by steam power.

He was satisfied from the collected experiments of the past century that the efficiency of steam, together with its intrinsic cheapness, could not be called in question. The objections to its use lay, first, in the constant danger attending its generation in a boiler placed over an active fire; and, second, in the consequent expense incurred when such a boiler is used with a small engine doing but little work; for the ever present danger has to be guarded against with a care equal to that required for a much larger apparatus, and a skilled attendant must therefore be employed at a very disproportionately high price. From this he concluded that if the danger attending the ordinary steam engine could be avoided entirely, a skillful attendant would not be needed to drive it, and the problem of working steam cheaply on a small scale would be near solution.

These conclusions led him to the invention of the "thermo-specific" or fireless locomotive, which forms the subject of the present article, and which is illustrated in the annexed engraving.

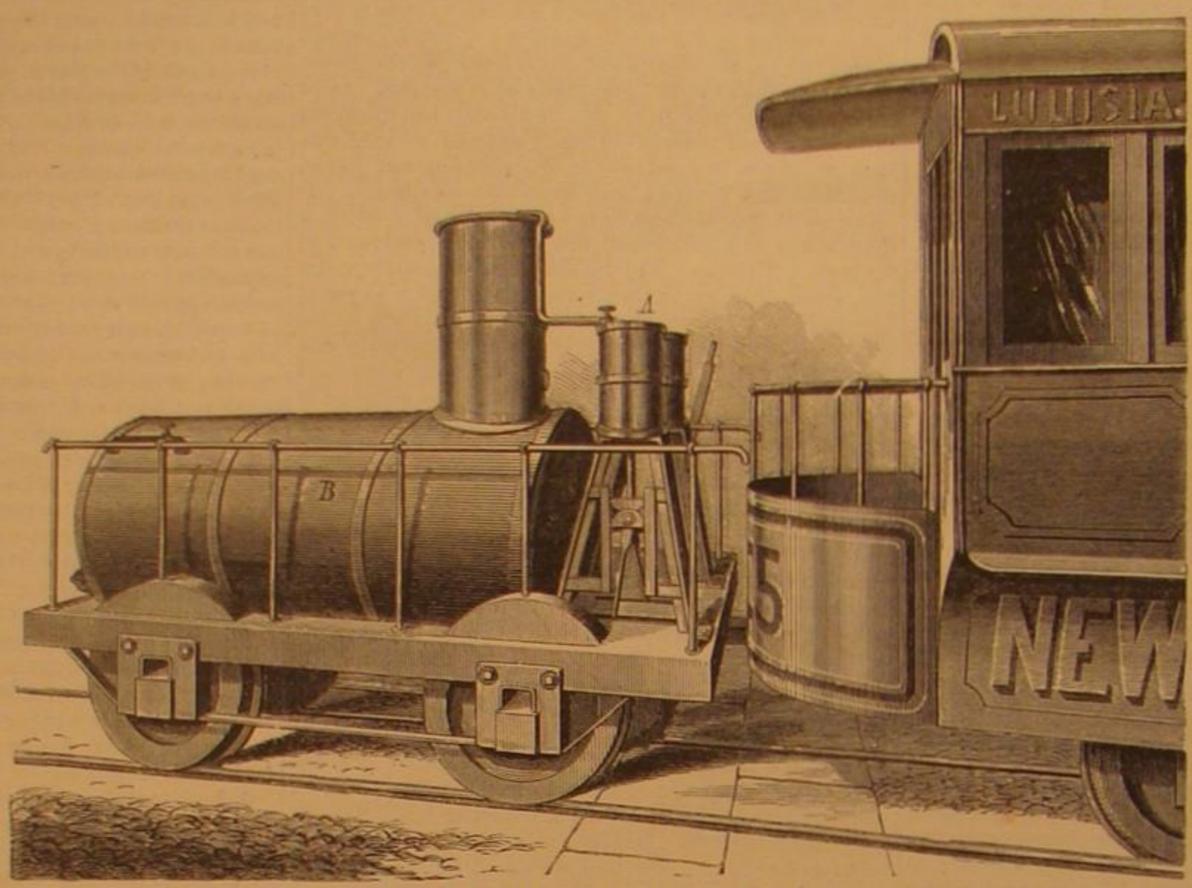
The driving engine, shown at A, is a steam engine of ordinary character, and does not require explanation. B is simply a reservoir large enough to contain about 300 gallons of water and leave steam room above it. It is made of steel, and is well covered with non-conducting material so as to prevent the radiation of heat. Inside, from end to end, near its bottom, runs a pipe which is perforated with numerous small holes in its periphery, and which is connected with a universal coupling attached to the front of the reservoir. It is also provided with a water cock, etc., steam drum, and proper steam connections with the engine. The operation of the apparatus is as follows: By making suitable connections with a stationary steam boiler, it is first heated throughout, and then a sufficient supply of water of the requisite temperature is forced into the reservoir. When properly charged, the water is flush with the water cock, and its temperature is about 380° Fah., the pressure in the reservoir being about 170 lbs. to the square inch. The locomotive is then ready to be started on its trip, there being sufficient power stored up in the reservoir to enable it to run the attached car a distance of nine miles without expending the whole of it. Before beginning the next trip, the charge is renewed by again coupling the reservoir with the stationary boiler, from which steam is forced in for about four minutes through the perforated pipe; by which operation the temperature and pressure are restored, and the water which went off in the form of steam during the previous performance of the engine is replaced.

The rationale of the foregoing need not be dwelt upon. Suffice it to say that, in obedience to well known laws, as the pressure within the reservoir is relieved by the passage of the steam into the engine, a portion of the water in the former is converted into steam by the heat with which it is surcharged. This conversion would go on until the temperature in the remaining water had fallen to 212°. It is calculated that with the reservoirs as now used, about fifty gallons of water is converted into steam before this point is reached. The steam given off develops sufficient power to make a nine mile trip easily, and leaves a pressure of 60 lbs. in the reservoir at its completion.

The absence of danger of explosion in using this apparatus is apparent, and it is real, also. The pressure in the reservoir can never rise above the point reached at the time it is charged; and after that, it is necessarily continually diminishing as the power is expended. It requires even less skill to drive this locomotive than it does to drive a horse or mule car, and the economy sought in this direction appears to be fully attained. Our space will not allow us to go into the details of the advantages and general economy claimed for this system of propulsion over the regular horse railroad system. General G. T. Beauregard, who is president of the New Orleans and Carrollton Railroad Company, on whose road Dr. Lamm's fireless locomotive has been running, and who have just adopted his invention, has made a comparison between the relative expenses of the two systems, and finds a difference of 33½ per cent in favor of the new over the old.

The calculations for the new system were based on fifteen locomotives supplied by one set of stationary boilers. One particular advantage claimed by the inventor, who has already made over a thousand trips of six miles each with his locomotive, is the latitude allowable in its construction and application by reason of the absence of the furnace.

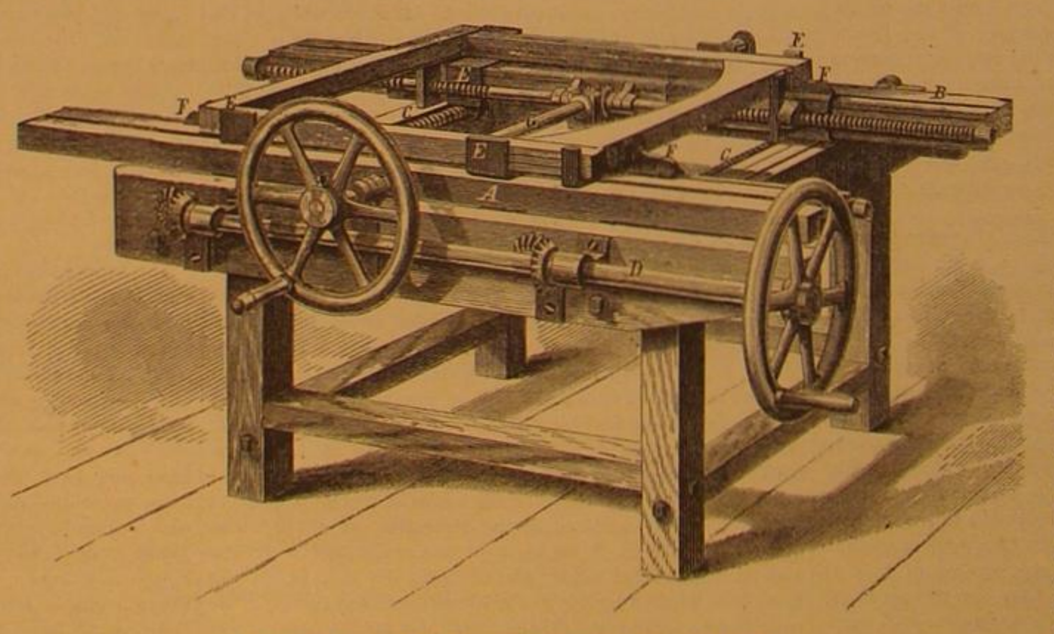
Patented April 9, 1872. Further information may be obtained of The Ammonia and Thermo-Specific Propelling Company of America, 175 Common street, New Orleans, or by addressing the inventor, P. O. Box 1,493, in that city.



LAMM'S FIRELESS LOCOMOTIVE.

SASH COUPLING MACHINE.

The improved sash clamp represented in our engraving is the invention of Mr. James H. Phillips, of Troy, N. Y., and was patented by him through the Scientific American Patent Agency, June 18, 1872. Its construction we proceed to describe:



PHILLIPS' SASH COUPLING MACHINE.

Upon a suitable frame, such for instance as depicted, are mounted two head blocks; one of which, A, is stationary, and the other, B, is movable toward or from the first, on the grooved ways shown on the top of the frame. These movements are produced by operating the two screws, C, which are geared to the hand crank shaft, D. The head blocks are provided with adjustable metal clamping pieces, E, upon which is laid, in the manner indicated in our illustration, the sash or other frame which it is intended to square up and press together. The peculiar form of these clamping pieces will be understood by inspecting those seen on B; they conform to the rectangular figure of the head block on three sides, and on the fourth are turned up perpendicularly so as to clamp the frame perfectly square. By properly arranging the clamps, E, the tenons of the side pieces of the sash frame are left room to project beyond the mortises in the end pieces through which they are driven, on being compressed by the machine.

The clamps by which the sides of the frame are held shown at F, are mounted on ways in the head blocks and are operated by two pairs of twin right and left hand screws which are fitted to them. One of the pairs of screws runs in bearings attached to the head block, A, and the other in bearings connected with the movable block, B, the latter pair being so distinctly shown in the engraving that no further explanation is needed. Both pairs are geared to the crank shaft, G, so as to be actuated simultaneously by its rotation, and the middle wheel of the gearing next B is arranged so as to slide with the block along the shaft, G.

When the clamps, E, are suitably adjusted, the machine is made to conform to any size and shape of frame, within its limits, by simply working the hand cranks, and the squaring and compressing of the frame is performed by it with ease and certainty.

In order to allow the frames to be bored and pinned while yet clamped in the machine, the upper sides of the head blocks are made with longitudinal grooves, as represented, of sufficient depth and width to allow the boring tool to work clear through the frame to afford clearance for the chips and room for the pin to project when driven. In securing the joints of doors, which is commonly done by splitting the tenons and driving in wedges, ample access is given to them between the clamps, E, and the wedges can be driven while the door is clamped.

The machine has received practical trial, and is claimed to be much superior to others hitherto used in sash finishing, saving both time and labor; a boy may operate it effectively.

The inventor, who wishes to dispose of a part or the whole of his rights, may be communicated with at 116 Congress street, Troy, N. Y.

Vibration of Glasses Cracked or Containing Effervescing Liquids.

It is known that a glass containing effervescing liquid will not give a clear note when struck, and that as the effervescence subsides the tone becomes more and more clear. When the liquid is perfectly tranquil, the glass will ring as usual, but on re exciting the effervescence, the musical, tone again disappears.

The phenomena presents itself to my mind as being due to a certain amount of vibration communicated to the glass by the agitation arising from the effervescence This vibration—which can be easily heard by placing the ear close to the glass—interferes with that caused by striking the glass, and destroys more or less the proper rhythmic movement necessary to the production of a musical note, according as the intensity of the agitation of effervescence is greater or less.

The dead sound of a cracked glass is probably owing to a similar cause. For in that case, as soon as the vibrations traveling round the glass arrive at the crack, the edges of which are wholly or partially in contact, they are transmitted from edge to edge; and as, owing to the friction of the edges one against the other, their vibrations do not synchronize, a reflex wave is impinged upon each, having a less velocity than the original wave. This reflex wave will correspond to the vibration caused by effervescence. If the crack be cleanly cut out, so as to separate the edge by a well defined interval, the glass will again emit a musical note. In the latter case, the sonorous vibrations, on arriving at the cut portion, return by the way they came, synchronizing with those which they meet.

The dead sound of the glass, when filled with honey or treacle, is probably owing to the circumstance of these fluids being not sufficiently mobile to vibrate in unison with the glass; and thus they destroy its musical tone as effectually as if they generated an independent and non-synchronous vibration.—*Allen Beazeley, in Nature.*

THE SEWAGE OF PARIS.—The question as to the treatment of the sewage of Paris has been settled, by its concession for fifteen years to the London Peat Engineering and Sewage Filtration Company. For a long time the sewage has been dealt with by the Le Sage company in the most primitive manner—namely, by spreading the solid matter upon the ground to dry, causing fearful annoyance for miles around and provoking general outcry against the barbarous practice

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NEW YORK, SATURDAY, AUGUST 24, 1872.

Contents:

(Illustrated articles are marked with an asterisk.)

THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

This body of the prominent scientific men of the United States commences (as noticed elsewhere) this year's meetings on August 22d, at Dubuque, Iowa. It was at first intended to meet in San Francisco, if found practicable by the committee in charge of selecting the place of meeting; but such urgent invitations were received from Dubuque that the latter place was chosen. By the hospitality of the citizens, all the members will be privately entertained, and arrangements have been made for free excursions to different places of scientific interest in the neighborhood, so that this meeting promises to be as satisfactory to all concerned as any previously held elsewhere.

Perhaps no association is so little understood by the public and even by the press as this; and this is the reason that, after every meeting, most absurd criticisms are indulged in by the reporters. People complain that the subjects discussed are not popular enough to be understood by the visitors who may drop in; but it ought not to be lost sight of that this association was by no means founded for the popular diffusion of knowledge. The latter object would require permanent courses of elementary lectures, in place of the meeting of some two hundred of the prominent scientists of this continent in a single city for only one week in a whole year. If the people anywhere feel the want of popular and continuous diffusion of knowledge, they ought to found, in the different cities and towns, local institutions, where, by means of lectures and experiments, given free to all by competent lecturers, the public may receive the needed scientific information. Such institutions would without doubt have the good wishes of all the members of the American Association for the Advancement of Science; but they would labor in an entirely different field, the diffusion of information obtained, while the said association labors, like the Smithsonian Institute in Washington, for the increase of our stock of scientific knowledge. This diffusion, or the instruction of the people, or teaching in general, is a field of labor entirely foreign to the purposes of the association, notwithstanding that most of its members are publicly or privately engaged therein, as their regular occupation.

That the meetings are held with open doors is not with the expectation that ignorant people, who happen to drop in, will learn anything or be pleasantly entertained, as many appear to expect; but simply because science has no secrets. Uninstructed visitors have about as much right to expect to obtain information or amusement when dropping in upon a Congressional session in Washington. The members of the association can think as little about entertaining occasional visitors as the members of Congress. In both sessions are duties to be performed, regardless of audience or visitors, namely, bringing facts and honest opinions before the body of the house, which in one case is political, in the other, scientific.

Certain subjects treated are uninteresting not only for the public, they are so even to those members who have not made a study of them. Therefore the meetings are divided into sections, so that, in section A, Mathematics, Astronomy, Physics and Chemistry are discussed, in section B, Geology and Natural History, in section D, Microscopy. This is also done in order to save time, as otherwise the time occupied by the meeting would be protracted to four weeks in place of one. The objection, however, is that it frequently happens that such interesting subjects are discussed in several sections that often members regret their inability to attend more than one section at the same time.

Upon the surface, however, the great benefits of these meetings do not appear. One is the profit, to men engaged in a common pursuit and who love that pursuit, of being brought together for private conversation, discussion, and interchange of opinions. The discussions arising after the reading of a paper are often the most important part of the proceedings, and it is to be lamented that no note is kept of these, except by newspaper reporters, from whom of course, it cannot be expected that they will be able to distinguish matter of genuine value from the chaff which occasionally runs among it.

The wisdom of keeping up the migratory character of these meetings has been doubted. There are two reasons: One is that no city should claim preëminence as a scientific center, as this would make the association less national by existing local jealousies, and science must try to be eminently cosmopolitan. Another reason is that, in the city where the meeting is held, the representatives of science in the United States will stimulate a love for scientific research, and this has been, thus far, actually the case in almost all places where the meetings have been held.

A very striking feature in the character of the discussions is the peace and harmony which pervades all from beginning to end. There may be different opinions in regard to the explanations of observed facts, but there is constantly a tendency to unification as the erroneous opinions are constantly being given up, when truth prevails and all agree in the end. Compare this with meetings where prominent men of different schools of politics or religion are brought together; would they discuss for a whole week the subjects of their devotion, and separate with such perfect good feeling, and leave behind them in the place where they met, so favorable an impression as is the case with the men of science?

CANADIAN PATENTS.

We again remind our readers that the new patent law of Canada goes into effect on the 1st of September, on and after which date all citizens of the United States may take patents in the Dominion without let or hindrance.

Patents will be granted in Canada for periods of five, ten, and fifteen years. The two first periods may, before their expiration, be enlarged to fifteen years, on simply filing a petition for an extension and paying a small fee.

A model is also required, and on this subject the rule established by the Canadian Commissioner of Patents is as follows:

Rule 7. Models must be neat and substantial ones, not to exceed eighteen inches on the longest side, unless otherwise allowed by special permission; such models must be so constructed as to show exactly every part of the invention and its mode of working. In cases where samples of ingredients are required by law, they must be contained in glass bottles properly arranged; but dangerous or explosive substances are not to be sent. Both models and bottles must bear the name of the inventor, the title of the invention, and the date of the application; and must be furnished to the Patent Office free of charge and in good order.

It will be observed that the foregoing rule only requires that every part of *the invention*, and its mode of working, shall be exhibited in the model. If the invention consists of an improvement upon some part of a known machine, it will not be necessary to make a model of the whole machine, but only those parts that are needed to show the intended working of the improvement. For example, if the invention relates to vehicles, and consists in an improvement in the construction of the wheel and axle, it will not be necessary for the inventor to furnish a complete model of a vehicle, but only a model of a wheel and axle, made according to the improvement. This is also the rule at our United States Patent Office.

For the information of those who contemplate taking out Canadian patents, Messrs. Munn & Co. have prepared a circular containing full directions, copies of which can be had free of charge by simply addressing them at the SCIENTIFIC AMERICAN Office. The Dominion of Canada is a splendid field for the introduction of new inventions. Her population is 5,000,000, and rapidly increasing. Her people partake of the spirit of enterprise which governs here. The Canadians are now building a railway from the Atlantic to the Pacific, and everything indicates a spirit of progressive activity.

THE AURORA.

On the evening of the 3d instant, occurred one of the most magnificent auroral displays that have ever been witnessed in these latitudes. Many of the principal phases of the phenomenon, previously noticed by observers at the polar regions, were here brilliantly produced, the convoluted curtain clouds excepted.

The display began with the formation, at the northern horizon, of the bright arching bank or auroral bow, having a greenish yellow tint which illuminated the earth as if the full moon were shining. Pencils, brushes, columns and streamers of light, of various shades and fantastic forms, shot upwards with amazing rapidity to the zenith, where they converged, forming a remarkable nucleus or crown of glory. The eastern portion of the columns and streamers now glowed with transparent crimson colors; and then began a general upward undulating, waving, flickering and radiating movement of the luminosity, of indescribable beauty. The most remarkable part of the display lasted for about fifteen minutes, when its force appeared to have been somewhat spent; but some two hours elapsed before the aurora had wholly disappeared.

The Utica (N. Y.) *Herald* says: "The skies over Utica and other equally favored places presented a peculiar and most beautiful appearance. Directly overhead, a central whirl of fire, assuming different forms and tinted at times with red or purple, was surrounded by straight shoots and sheets of pale flame, constantly varying and shifting, which reached from the zenith to the horizon, except in the extreme south. At one time the form of an angel with outstretched arms and spread wings could be plainly traced in the flaming center of this grand display."

The precise origin of the aurora borealis, how and why it makes its appearance, is not fully understood, and still forms an interesting subject for investigation among the students of science. Many theories have been put forth, some of which we will briefly mention, together with a few facts.

A number of intelligent observers, stationed in polar regions such as Greenland and Iceland, aver that the aurora is sometimes accompanied by hissing and crackling sounds, the latter resembling electrical sparks. The Esquimaux natives also say that these sounds are very often heard in connection with the lights. But Kane, Richardson, Parry, and other arctic travellers were unable to detect any sounds, while Wentzel attributed the noise to the contraction of the snow from sudden increase of the cold.

The hight of the aurora is differently estimated by various observers, ranging from one mile to five hundred miles from the earth. Some of the best observations bring the light within the limits of the clouds, and indicate that the auroral pencils may even be swayed by the winds and currents of air. It is believed that the auroral light has a considerable thickness or body. It is visible at immense distances. The same aurora has been seen at the same time in Europe, Asia, and North America, on a parallel as low as Cuba and Spain.

Professor Olmsted has attributed the aurora to the sudden plunging of the earth into what might be termed a cosmical atmosphere or vapor, composed of atoms of nebulous matter, the light being produced by the friction of this matter against the earth's atmosphere. This coincides with Biot's theory, who was of opinion that the atoms were composed of iron and served as conductors between various atmospheric beds, unequally charged with electricity: when the tendency of the electricity to get into equilibrium surpasses the resistance of the imperfect conductive powers of the atoms, an electrical discharge ensues, and the nebulous molecules sparkle, thus producing the aurora. This curious theory is altogether surpassed by that of the editor of the New York *Herald*, who, in commenting upon the recent aurora says: "The most satisfactory explanation of these splendors in the northern skies seems to be that which connects them with the reflection of electric discharges from the microscopic ice crystals, which compose the delicate cirrus clouds in the upper atmosphere. These crystals of condensed vapor, so minute as to defy any but the most practiced observer, act as a screen for the reflection of light; and the deposition of watery vapor from the lofty equatorial current produces the lightning discharge."

In a previous number of the same newspaper, the phenomenon is explained as follows:—"The origin of the aurora borealis is simply this, speaking sensibly:—It is caused by the refraction of the rays of the sun upon the vast fields of ice which line and fill up the shores of Labrador Behring Straits and the Hudson Bay Territory."

Leaving these amusing, not to say absurd, theories, it may be remarked that magnetism and electricity are in some way connected with the auroral development. The auroral lights, pencils, and streams may be artificially produced by means of a glass tube containing rarefied atmospheric air through which electricity from a machine is passed, or in which tube it is excited by friction. A description of the tubes was recently published in the SCIENTIFIC AMERICAN.

Another device for the artificial production of lights which appear to be analogous to the aurora consists of an iron bar, enclosed within a rarefied air chamber. Luminosity, of different kinds, is here produced at will, either by the electrical machine, or by the contact of the iron bar with one of the poles of an electro-magnet.

De la Rive says that luminous effects similar to those of the aurora may be obtained if a continuous current of ordinary electricity is made to arrive at the pole of a powerful electro-magnet in moist, rarefied air.

The magnetic needle is almost always deflected and agitated during the continuance of the auroral display.

During the aurora, the telegraph wires often become charged with electricity which in its nature appears to resemble galvanic electricity. Mr. Culley, the distinguished English telegraph engineer, stated that the aurora was a kind of lightning, differing from ordinary lightning in being a gentle and gradual flow, instead of a violent and sudden discharge. Telegraph wires that run east and west are said to be most affected during the aurora. Humboldt regarded the aurora as an electric activity which manifested itself by the fluctuation of the magnetic needle and by the appearance of the auroral light. Faraday suggested that the aurora was connected with currents of electricity induced by the earth's rotation and urged towards the poles, whence it is endeavoring to return, by natural and appointed means, above the earth to the equatorial regions. The results of experiments indicated by him confirm the correctness of this suggestion.

Dr. Nichol says: "It is vain to search at present for a theory of the aurora. What is known is this: The direction of the auroral *jets* or *rays* and the position of the *crown* have a connection with the magnetic meridian; and the aurora produces great magnetic perturbation."

Professor Loomis gives the following particulars:—Auroral exhibitions take place in the upper regions of the atmosphere, since they partake of the earth's rotation. All the celestial bodies have an apparent motion from east to west, arising from the rotation of the earth; but bodies belonging to the earth, including the atmosphere and the clouds which float in it, partake of the earth's rotation, so that their relative position is not affected by it. The same is true of auroral exhibitions. Whenever an auroral corona is formed, it maintains sensibly the same position in the heavens during the whole period of its continuance, although the stars meanwhile revolve at the rate of 15° per hour.

The grosser part of the earth's atmosphere is limited to a moderate distance from the earth. At the hight of a little over four miles, the density of the air is only one half what it is at the earth's surface. At the hight of 50 miles the atmosphere is well-nigh inappreciable in its effect upon twilight.

The phenomena of lunar eclipses indicate an appreciable atmosphere at the hight of 66 miles. The phenomena of shooting stars indicate an atmosphere at the hight of 200 or 300 miles, while the aurora indicates that the atmosphere does not entirely cease at the hight of 500 miles. Auroral exhibitions take place, therefore, in an atmosphere of extreme rarity; so rare indeed that if, in experiments with an air pump, we could exhaust the air as completely, we should say that we had obtained a perfect vacuum.

The auroral beams are simply spaces which are illumined by the flow of electricity through the upper regions of the atmosphere. During the auroras of 1859, these beams were nearly 500 miles in length, and their lower extremities were elevated about 45 miles above the earth's surface. Their tops inclined toward the south, about 17° in the neighborhood of New York, this being the position which the dipping needle there assumes.

COUNTRY CHURCHYARDS.

An English journal of recent date complains of the uninviting and desolate appearance so common in the plots, set apart in villages and towns, for the interment of the dead. If the remarks made by our contemporary are applicable to the rural churchyards of England, where every hamlet, from its very age, supplies the elements of the picturesque, they are doubly true in reference to the barren and forbidding enclosures found in the newly built villages which abound in our own country.

We do not of course refer to those magnificent cities of the dead which adjoin our great towns, for on these every resource of art and skill has been unsparingly lavished; but to the simple acre or two of land, which either surrounds the rural church or else is fenced off, solitary and alone, on the outskirts of the populated quarter. Every one is familiar with its appearance; bleak, bare and desolate, totally devoid of ornamentation, the surface of the ground broken and irregular with heaped up mounds of earth, and covered with headstones and monuments standing stiff and white, like ghosts, over the graves. If trees there be, they are generally clumps of pines, lugubrious and solemn in their dark shades. The grass is long, and coarse, rank weeds abound, while the few flowers that bloom here and there are wild and uncultivated. Perhaps a few plots within the enclosure, the family burial places of the magnates of the village, are surrounded with cheap iron railings which, while adding to the prim formality of the spot, convey the impression that its occupants maintain their exclusiveness even in the tomb.

It is a beautiful idea, taught us by science that, our bodies after being buried in the ground are consumed and reappear in the shape of the fragrant flowers that bloom over our resting places. Even this consolation, if so it may be termed, is denied us in the modern burying ground, for the mind cannot but revolt at the thought of sleeping beneath rank weeds or moldering in the damp heavy shade, away from the clear bright sunshine. The practice of making mounds over graves is one which should long since have been abolished. They doubtless served in the beginning as marks of locality, but now they simply disorder the ground. We could rest as calmly under the turf of a smooth level lawn as under a surface of ridges and hollows, while the proper keeping of a flat graveyard would be easy compared with that of an uneven one.

Niggardliness of space within the limits of a city may be a matter of necessity, but in the country, thus prescribing limits as to render the making of a few walks or the planting of a few ornamental trees an impossibility is without reason. In churchyards already in existence, this defect may not well be remedied; but where new ones are constantly being laid out, it is a question worthy of consideration whether a sufficiency of space should not at once be obtained so as to admit of some pleasing effect being produced by the exercise of taste in its arrangement, instead of making calculations with a view of utilizing to the utmost, for burial purposes, every available inch of ground. In monuments and gravestones, we hardly hope to see any change. Save the magnificent memorials which mark the graves of the wealthy, there has been but little alteration in their general style during the past century. The matter of designing inexpensive yet beautiful headstones is worthy of the attention of our architects, if only to relieve us from the grotesque or painfully plain pieces of sculpture which emanate from the workshop of the rural stone cutter.

In laying out a piece of ground for a burial lot, paths should be at first formed, and then the planting of suitable trees should follow. Among the latter, the weeping varieties, from the habit of growth they display, consort best with the character of the place. Flowering trees, especially, should be set out. Soft colors or whites should be selected, but not yellow, as the laburnum, as that would be inappropriate. For foliage trees, the beech, horse chestnut, weeping ash, birch, elm and others of graceful outline should be preferred, while a very few pines or dark toned shade trees may be interspersed for the sake of contrast. Evergreens of low growth, such as the *arbor vitae*, together with flowering shrubs, hollies, may bloom, syringas, lilacs or elders would form a pleasing variety, and at the same time furnish the bare sward without adding dullness or density. Creeping vines, twined around monuments, make even the plainest of stones an object of beauty. The trumpet creeper, sweet honeysuckle, woodbine, climbing roses, German ivy, and especially the hardy English ivy, are all graceful and appropriate. If we dispense with mounds, the places of interment might be covered with flower beds, of the shapes of the graves might be marked out on the green turf with flowery plants. Nothing could be prettier than a margin of snowdrops or lilies of the valley, inside of which might be a small cross of white crocuses. In spring time, exquisite designs may be worked out in purple and white hyacinths. The more delicate tinted flowers should be selected or else those of deep toned hue, neither brilliant nor gaudy. Pure white lilies, callas, purple violets, drooping white and pink fuchsias, cape jessamine, moss roses or white pinks, with candytuft for borders, can be arranged with exquisite effect.

These are all Nature's ornaments, and they were given us to brighten those spots which to the mind carry the most sombre reflections. "God's Acre" should be pleasant and cheerful, and not a place to be avoided as only suggestive of gloom and death.

INFLUENCE OF VARIOUSLY COLORED LIGHT ON ANIMAL AND VEGETABLE GROWTH.

This subject is at present attracting a good deal of attention, and strange to say it is regarded by many as a new matter for investigation, a patent even having been recently granted for the use of blue glass in the cultivation of plants. Several years ago, a committee of the British Association for the Advancement of Science investigated the whole question very thoroughly, and at various times individual observers have devoted their attention to the subject. The general result seems to be that growing plants thrive best in white light, while seeds, during the process of germination, do best under blue rays. The well known seedman, Charles Lawson, of Edinburgh, thus details the results of some experiments made by him in 1853: "I had a case made, the sides of which were formed of glass, colored blue or indigo, which case I attached to a small gas stove for engendering heat; in the case shelves were fixed inside, on which were placed small pots wherein the seeds to be tested were sown. The results were all that could be looked for; the seeds freely germinated in from two to five days only, instead of from eight to fourteen days as before. I have not carried our experiments beyond the germination of seeds, so that I cannot afford practical information as to the effect of other rays on the after culture of the plants.

I have, however, made some trials with the yellow ray in preventing the germination of seeds, which have been successful; and I have always found the violet ray prejudicial to the growth of plants after germination."

PLASTER CASTS.

If the ordinary plaster of Paris of commerce, which is sold in the form of a dry white powder, be mixed with water to the consistency of a moderately thin batter, the compound will in a short time become solid and firmly set. By this means, accurate impressions or casts may be taken of almost any object. The first step in making a cast is to prepare the mold, and in order to render this process clear, we will suppose that a simple object such as an apple or a plum is to be copied. A pint of plaster is placed in a bowl or similar vessel, the interior of which has previously been oiled. Water is then added until a paste is obtained. Now oil the fruit and press it down into the mixture until its part of greatest breadth is even with the surface of the liquid. An apple, for instance, should be inserted, calyx end down, and allowed to sink about half way—the middle of the fruit in most varieties being its largest portion. The plaster will soon set, when the object may be lifted out. With a sharp knife pare off all inequalities, fill up air bubbles with fresh plaster, smooth off the top of the mold perfectly level and make three or four countersinks in its surface—carefully oiling the latter, as well as the matrix left by the object. Replace the original in its socket, oil its upper portion and lay on plaster with a case knife, as fast as it will solidify. Continue to add material until the mold is brought to the proper form, nearly square and flat on top. When the plaster is perfectly hard, lift off the upper portion of the mold and remove the object; then oil the entire interior surface with linseed oil and allow it to dry.

The mold being completed, the cast is easily obtained. Fasten the two parts of the former together and bore a small hole of about three quarters of an inch in diameter in the side. Through this opening pour in the liquid plaster, which, after being allowed sufficient time to dry, will harden into the shape of the mold.

Those attempting the process for the first time should begin by making molds of simple objects until the necessary deftness of manipulation is obtained. Casts of heads, particularly of living subjects, should not be essayed until after considerable practice. A life size metallic bust may be used for the beginner's first efforts in figure molding; or, if he can obtain access to the dissecting room of any medical college, he may attain much greater skill by copying directly from the cadaver.

In making a mold of the head and face, the hair and whiskers should be mingled with potter's clay, brushed smoothly and oiled. The back of the head is taken first. This is done by pouring a quantity of the mixed plaster into a shallow tray and laying the head back into the mixture, allowing it to remain there until the plaster sets. It is then removed, the mold smoothed and oiled and countersinks made in its edge. Then oil the face and apply the plaster, a little at a time, being careful to see that it enters all wrinkles and indentations. In modelling from a living person, the breathing is done through the nostrils. When the material sets, lift the mold from the face and carefully smooth its interior surface. If the eyes are to be represented as open, carve depressions for the eyelids and also for the brows. Now fill up all indentations with overhanging edges which would catch the cast and prevent its extraction. Brush the interior of the mold over with linseed oil, let it dry, and fit the two sections accurately together. The casting liquid is poured in through the orifice left by the neck. Use but a little of the plaster at a time and roll the mold around so that the mixture will be evenly deposited in all its indentations. Finally fill the mold and set it aside to dry. When the sections are removed, the hardened cast may be finished with a sharp pen knife.

For delicate and accurate castings, the best method is that proposed some time since by Mr. Boyd Dawkins, F. R. S. The mold is made of artist's modeling wax, which, though soft and plastic when heated, becomes perfectly rigid when cold. The object to be copied is first covered with a thin powder of steatite or French chalk, to prevent its adhesion to the mold. The wax, which has been heated to a proper plasticity is then applied and carefully pressed into all the cavities of the original. When it is necessary, from the shape of the latter, to make the mold in two or more sections, steatite powder should be placed between to render them easily taken apart. The object should be removed from the mold before the latter becomes perfectly hard and rigid, as in that case it is very difficult to extract. After wetting the interior of the molds, to prevent bubbles of air lurking in the small interstices, pour in plaster of Paris. The casts, when dry, may be painted in water colors, which must be fainter than those of the original, because the next process adds to their intensity. After drying the cast, steep it in hard paraffin. The ordinary paraffin candles, which can be obtained from any grocer, will serve the purpose. Finally cool and polish the cast by hand, with steatite. By this process, casts of fossils or other objects in natural history may be made with such accuracy that it is with difficulty that they can be distinguished from the originals

The Corundum Region of North Carolina.

Professor Shepard, of Amherst College, Mass., in an article in the *American Journal of Arts and Sciences*, says that corundum has been recognized for above thirty years at several of the gold washings in the mountainous counties of North Carolina and Georgia, though rarely occurring in masses larger than would be called a coarse gravel. Within the last two or three years, however, under the stimulus of discovering an improved description of emery, many new localities of corundum have been brought to light.

The corundum localities are already known to occupy a stretch of country at least 170 miles long, with a breadth of about ten miles. As the region is little inhabited and very mountainous, it is probable that the corundum zone, as it has been called, will hereafter be much extended. It is situated in a subalpine country, partly within the northeastern corner of Georgia, and extending thence, in the direction of the crest of the Blue Ridge, into several contiguous counties of North Carolina.

The principal exposure of the corundum has been effected at what is known as the Culsagee mine, situated in the township of Elegée (sometimes written Elijay) situate eight miles southeast from Franklin Court House, in Macon county. This is the center of operations of the American Corundum Company, whose works are superintended by Colonel C. W. Jenks. The chief excavations have been made on the northern slope of a mountain, at an elevation of about 2,700 feet above tide water.

To Detect Sulphuric Acid in Vinegar.

An ounce of the vinegar to be examined is put into a small porcelain capsule, over a water bath, and evaporated to about half a drachm, or to the consistence of a thin extract; when cool, half a fluid ounce of stronger alcohol is to be added and thoroughly triturated. The free sulphuric acid, if present, will be taken up by the alcohol to the exclusion of any sulphates. Allow the alcoholic solution to stand several hours and filter; to the filtrate add one fluid ounce of distilled water, and evaporate the alcohol off by gentle heat over a sand bath; when free from alcohol, it is set aside for several hours and then again filtered. To the filtrate, acidulated with hydrochloric acid, add a few drops of a solution of chloride of barium, and a white precipitate of sulphate of barium will result, if the sample of vinegar has been adulterated with sulphuric acid.—*American Journal of Pharmacy.*

We wish that some of our readers would suggest a more easy method of detecting the sulphuric cheat in vinegar.—EDS.

SCIENTIFIC GARROTERS.—Dr. F. Kirkpatrick, Vice President of the Royal College of Surgeons, Ireland, while proceeding to visit a patient at ten o'clock at night, recently, was garroted in one of the most fashionable streets of Dublin, and deprived of his watch and chain. One of a gang of three men quickly rendered Dr. Kirkpatrick insensible by pressing firmly on the carotid arteries on both sides.

[Special Correspondence of the Scientific American.]

LETTER FROM PROFESSOR R. H. THURSTON.

CINCINNATI, Ohio., July, 1872.

A peculiar ferry boat at St. Louis. Visit to the wonderful iron deposits. How the ore is mined and transported. Progress of the great bridge at St. Louis. Engines and machinery of the Mississippi steamboats.

The railroad between Cincinnati and St. Louis takes the traveler through a pleasant level and partly wooded country, which, however, presents so little variety in its scenery that it becomes monotonous long before the end of the route is reached. The terminus is in East St. Louis, and the passengers are taken across the river by an oddly designed ferry boat, having a double hull with the single wheel placed between the two parts. The craft is about as broad as it is long, and it is quite remarkable that it should allow of such skillful manœuvering. The city of St. Louis is more of a commercial than a manufacturing city, and its levee is lined, nearly the whole length of the city front, with steamers which run to all the principal points upon the Mississippi and its tributaries. There is, however, in a city so large, and situated, as is St. Louis, at a point from which an extensive market can be readily reached, necessarily a considerable amount of manufacturing; and the proximity of those wonderful deposits of iron ore at

IRON MOUNTAIN, SHEPHERD MOUNTAIN, AND PILOT KNOB

has given rise to quite extensive iron works. The Laclede Iron Works at the north end of the city are quite large rolling mills and turn out excellent iron. The pig iron used is made from Iron Mountain ore. At Carondelet are to be found quite large and well managed blast furnaces which are supplied with ore from the Iron Mountain.

Having heard Pittsburgh manufacturers speak of this ore as fully equal, if not superior, to any ore found in the country, and having so frequently heard of its wonderful extent and remarkable location, a day was taken to visit the ore mountain. It is situated 85 miles from St. Louis, and a line of railroad leads directly past it. The ores mined at Iron Mountain and at the other almost equally noticeable deposits of Shepherd Mountain and Pilot Knob are thus readily brought to St. Louis, and are thence distributed, by rail and river, to all parts of the country west of the Alleghanies and south of the Lake Superior mines. The deposit is well named. It is a hill rising high above the general level of the country, and composed nearly entirely of an ore of iron that is almost absolutely pure. It is pure enough to make excellent Bessemer metal, a test which very few ores can successfully pass. This great hill, for it is hardly high enough to be called a mountain, contains millions of tuns of ore that can be obtained by simple quarrying and without the expenditure of a dollar for drainage or hoisting. The miners have attacked it at three points, and have been, for some time past, getting out and shipping about 1,500 tuns a day. As may be readily imagined, they have made immense cavities in the great mass of ore, and yet they are insignificant when compared with what remains untouched. The process of mining here is the simplest possible. After "stripping" off a few feet of earth, a mixture of ore and disintegrated rock is reached from which is obtained a large quantity of ore, in masses of some considerable size occasionally, but usually finely divided. This, Mr. Aubuchon, the superintendent, informs me is of as fine quality as the "bluff ore," and is preferred by some iron makers. After working through this deposit, which is usually of no great thickness, the hard solid "mountain" of ore is reached. Here the hammer, drill, and gunpowder are necessary, and the whole work is done by blasting. The scene presented here is strangely attractive and interesting. Six hundred men are employed at the mine, and they cluster among the loosened rocks and upon the unloosened crags like so many bees. The air is filled with the ringing sound of scores of hammers striking upon dozens of steel drills. Occasionally, in one or another of the three chasms, the sound of hammering suddenly ceases, and, while a minute curl of smoke commences to rise from the fuse in some hole which has just been charged, the whole body of miners employed in the cut scatters in all directions to find a safe retreat in which they cannot be reached by flying "spalls." A few moments pass, moments of suspense, usually, to the spectator unaccustomed to such work, and the sound of the explosion is heard. Sometimes it is a dull, smothered, almost unheard sound, and the sudden cracking and slight displacement of great masses of the mineral are the principal evidences that the tremendous forces brought into action have done useful work; at other times, a loud crash accompanies the report, and great pieces of ore fly in all directions, and then the miners emerge from their hiding places as suddenly as they disappeared, and go on with their work at hammer and drill or transporting the "won" ore to the railroad. Sometimes, but very rarely, some poor fellow is struck by a falling mass and severely injured or even killed; but such accidents are much less frequent than would naturally be imagined, and when they do occur are, almost invariably, the result of gross carelessness on the part of the sufferer. At the Iron Mountain such occurrences are almost unknown.

The ore, having been blasted out and broken up into pieces of proper size, is loaded into small cars or "buggies," as they are called, and these are pushed out of the cut and let down the mountain side on a track which guides them to the loading docks where they are dumped, the ore falling into the waiting cars on the siding; and the latter, when full, are made up into trains and drawn away by locomotives. Were the "buggies" allowed to run down the inclined plane without control, it would, of course, be quite impossible to prevent their destruction at the bottom. A strong iron wire rope is therefore made fast to the loaded "buggy" and, passing around a drum which is controlled by a powerful brake, the other end is attached to an unloaded buggy at the foot of the incline, which is thus drawn up by the loaded one as the latter descends. A man stationed at the brake has their speed under perfect control. There is probably not another mine in the country which possesses so many advantages for mining and for getting its ore to market as the one just described, and probably none in the world combines such advantages with the additional one of producing such excellent ore. Shepherd Mountain and Pilot Knob, in the same range, one or two locations as yet unworked in the Lake Superior range of iron ores, and a deposit in Rhode Island may at some future time compete, pretty closely perhaps, in some points.

There are two small charcoal blast furnaces at the mine, making iron from this ore mixed with a small proportion of a "leaner" ore obtained from a point distant about thirty miles from Iron Mountain. The iron is of excellent quality.

THE ST. LOUIS BRIDGE.

Returning to St. Louis, we visited the office of the Illinois and St. Louis Bridge Company, and were kindly allowed to inspect the plans of the great bridge which has already been referred to more than once. It promises to be a splendid work, and its completion will entitle Captain Eads and his ingenious and able assistants to a place by the side of the most celebrated engineers of our own or earlier times. They have so successfully surmounted every obstacle that has yet presented itself that it cannot be doubted that those which certainly still lie before them will also be as readily conquered. The substructure is so nearly completed that nothing really difficult remains to be done. The approach upon the St. Louis side is very nearly finished, the piers and abutments are all well up, and the approach upon the Illinois shore has made some progress. The really serious work remaining to be done is upon the superstructure and in its erection rather than in its construction. The bridge, when completed, will be a splendid structure and one that will be of great value to the whole country as well as to the city of St. Louis.

THE MISSISSIPPI STEAMBOATS AND THEIR ENGINES.

We were much interested in the engines and machinery of the steamboats on the Mississippi, but have no space in which to describe their peculiarities in detail. There is evidently frequent application of the "rule of thumb" in construction, and, particularly on tow boats, some risks accepted in management. Steam is carried fully up to the point prescribed as a limit by our faulty navigation laws; and, under the circumstances, it can hardly be expected that the most conscientious attention on the part of the inspectors can entirely prevent accidents.

Some good work has been done, however, and among other noticeable facts is the introduction of the compound engine on one or two steamboats. Properly designed, well built, and intelligently managed, compound engines and surface condensers should work well with the high steam and the muddy water of Mississippi steamboat boilers.

R. T. H.

Estimating Distance by Sound.

To the Editor of the Scientific American:

In a communication published by you on page 84, from J. W. Nystrom, he gave a table of speeds at which sound travels at different temperatures. It should not be forgotten that it was discovered more than ten years ago that, for very loud sounds, the velocity of propagation depends on its strength; so that while Mr. Nystrom's table is correct enough for ordinary sounds, it is by no means correct for claps of thunder, which are among the strongest sounds with which we are acquainted, and which therefore are propagated with much greater velocity than ordinary noises. Your correspondent is therefore as far wrong as the parties in Philadelphia whom he writes to correct. It was the Rev. E. S. Earnshaw, of Sheffield, England, who first published, in the *London, Edinburgh, and Dublin Philosophical Magazine* (for June, July, and September, 1860,) a profound mathematical investigation of the laws of the propagation of sound, by which he proved that the accepted view of nearly 1,100 feet per second at 40° Fah. is only correct for sounds of moderate intensity, whatever be their rapidity of vibration or wave length. He proved that the numerical value of a certain function in the theoretical consideration becomes much larger, in case of a loud clap of thunder, than it is for ordinary sounds; and he then brought in practical evidence showing that the crash of a thunderclap, striking the earth at more than a mile distant, was heard almost at the instant that the flash of lightning was seen. And, probably, it is not an uncommon observation during a violent thunderstorm to hear the sound simultaneously with, or very shortly after, the flash of lightning; we are then accustomed to conclude that the lightning fell very near to us; but if we take the trouble to investigate afterwards into the circumstances, we shall sometimes find that we have to deal with an identical case, as adduced by Mr. Earnshaw, in which the lightning stroke could not be less than a mile distant; so that the assertion of some that the sound of thunder travels a mile a second, as mentioned on page 84, may be true, and not only so, but this velocity may even be surpassed.

These theoretical and experimental considerations of Mr. Earnshaw were also practically confirmed by observations made during Captain Parry's arctic expedition. During artillery practice, it was found by persons stationed at a considerable distance from the guns, that the report of the cannon was heard before the command to fire from the officer, which latter in this cold and dry climate could also be heard at very great distances. Recently, Mallet took the matter up and made a series of experiments on the velocity with which sound is propagated in rocks, by observing the times which elapsed before blastings, made at Holyhead, were heard at a distance. He found that the larger the charge of gunpowder, and therefore the louder the report, the more rapid was the transmission. For instance, with a charge of 2,000 pounds of gunpowder, the velocity was 967 feet in a second, while with a charge of 12,000 pounds, it was 1,210 feet in the same time.

In the air, the differences between the propagation of an ordinary and violent sound appear much more considerable than in rock. But the fact that thus far we have no numerical measure for the comparative intensity or loudness of different sounds makes it impossible to find a numerical estimate for the velocity at these different degrees of loudness. This part of the investigation, therefore, will have to be postponed till we have found a real measure for the intensity of sound in place of the mere impression on our ears. In the meantime, let us be satisfied to know so much as that there is, and must be, a difference in the velocity of propagation; this makes it probable that, near the gun with which we experiment, this velocity is somewhat greater, diminishing as the distance becomes longer or shorter in proportion to the greater or less loudness of the explosion.

I will close by expressing the hope that some experimenters may take up this subject again, in order to verify or annul the last suggestion. I regret to notice that the writers of nearly all of our text books on physics content themselves with copying one another, so that it takes twenty years or more for an important discovery to become incorporated in their publications. I refer here not only to this special subject but to scores of others. I ought, however, to add that Professor B. Silliman, of New Haven, is in this respect an honorable exception. See, for instance, the last edition of his "Physics." P. H. VANDER WEYDE.

New York city.

MISCELLANEOUS ITEMS.

The *Commercial Bulletin* says: "The question of paying workmen on Monday instead of on Saturday, has attracted considerable attention at the West of late, and some of the manufacturers of Pittsburgh and elsewhere have adopted the plan. That such would be a reformatory measure, all thinking persons will at once acknowledge. With the present custom a workman is too often enticed into dissipation on the Saturday night because he has not to work on the following day, and he has also the financial ability to cater to his immoral and low tastes. This habit thus contracted is the worst enemy to the working man's prosperity and happiness that he has to encounter. In one night and the following day the hard toiling mechanic, who has labored faithfully and intelligently for six days, to earn a few dollars, dissipates away what really represents a portion of his life. Week after week he dives into the filth of dissipation, and each time his constitution and worth as a mechanic are impaired. If he did not receive his earnings on Saturday evening he would not have them to spend on Sunday, and the day would be to him what it was designed to be—a day of rest. It is true there are obstacles in the way of this reform, but none that really prevent it from being placed in execution in our manufacturing towns and cities, and we shall therefore look to see it yet in force in many of them."

The Winchester Arms Company, of New Haven, Conn., recently shipped their first instalment of 90,000 rifles to the Turkish government. Mr. Winchester is now in Europe arranging for another large contract.

The great building for the industrial exposition to be held in Louisville, Ky., commencing September 3, is finished, and pronounced sufficiently substantial for all the demands that may be made upon it. It covers a ground area of nearly two acres.

A portion of the nickel used at the United States Mint, Philadelphia, comes from Mine-la-motte, Mo. An exploration of the Missouri mines show a deposit five feet deep of a mixture of nickel and copper. It is estimated to be worth $600 per ton. Preparations are being made to ship these ores to England.

In South St. Louis, Mo., blast furnaces are soon to be erected. With the great expenditure of money and all the most modern appliances, it is expected these furnaces will be equal to any in the world. The yield from each furnace will be about seven hundred tuns per week of the best foundery iron.

The firm of W. H. Beach & Co., at South Bend, Indiana, will soon erect one of the largest paper mills in the country. It will occupy three acres of ground and cost $450,000.

George Washington Hinckley, of San Francisco, has recently obtained a patent for an ingenious oscillating combination of levers for the purpose of effecting, upon the stages of theaters, the rising, sinking, rolling and pitching motions of vessels at sea. So perfect is the imitation that, in connection with the sheet iron thunder, saltpeter lightning, and bellows wind, it makes the actors and actresses sea sick in a short time, and thus spoils the progress of the play. This, however, is not a serious objection, provided the sea sick scene be introduced for the finale.

ERRATUM.—In our illustration Fig. 3, on page 86, current volume, of the rotary pressure blower, the bases of the air chamber, D, should be represented of thickness sufficient to cover the apertures, C, while passing those points, thereby preventing escape of air from the chamber.

Notes & Queries.

[We present herewith a series of inquiries embracing a variety of topics of greater or less general interest. The questions are simple, it is true, but we prefer to elicit practical answers from our readers.

1.—IRON RUST STAINS.—Will some one inform me of the best article for removing iron rust from white cotton and linen goods, and give directions for use?—R.

2.—FLYING MACHINES.—Has there ever been a successful flying machine invented? Has any book on aerial navigation ever been published? Has any reward for an aerial ship, to fulfil certain conditions, ever been offered?—J. G.

3.—ROOT BEER.—Can ordinary herb beer be made to run through a soda draft apparatus, from under a counter or from a cellar without the aid of compressed air, pump, or any such device? Can any chemicals be put in to create a pressure, and what are they?—G. W. E.

4.—MILLING COINS.—Will some of your correspondents please inform me through your valuable paper how half and quarter dollars are held while their edges are milled?—C. A.

5.—SPECTROSCOPE AND MICROSCOPE.—Can any of your readers give me plain directions for constructing a spectroscope, giving size of prism, and of the telescope required to use therewith in observing ordinary phenomena, spectra of chemicals, etc. I should like, also, directions for constructing a compound microscope of power great enough to detect the *animalculæ* in water.—J. W. W.

6.—THE RIVER ST. LAWRENCE.—Can any one inform me if the St. Lawrence discharges more water into the sea than the Mississippi or any other river on the North American continent?—J. O. A.

7.—WHITE VINEGAR.—Can you tell me of a process for discoloring cider vinegar, to answer the purpose of pickling as the white wine vinegar does? Where can I obtain a reliable treatise on pickling and canning fruit?—L. C. M.

8.—AIR PUMP.—In making an air pump, are the glass and the plate it sits on ground together so as to be air tight, or is there leather on the plate under the glass? How can I make a single barrel into a double acting pump?—J. N.

9.—SPONTANEOUS IGNITION.—Can any one inform me of any chemicals which, when combined, will produce an instantaneous flame or light, sufficient to illuminate a dial about 10 or 12 inches diameter?—G. T. R.

10.—LINSEED OIL FOR WATERPROOFING.—Can any one tell me how to prepare linseed oil so that, when put on muslin, it will make it waterproof and will not crack when bent? I intend to use the muslin in the construction of a boat, and would like to have it black. I wish to make the boat air tight.—B. B. B.

11.—POSITION OF ECCENTRIC ON CRANK SHAFT.—I have had an argument with my foreman about the position of the eccentric on the crank shaft of a steam engine. He holds that the eccentric should, in all slide valve engines, be placed at right angles to the crank, while I hold that it should be in that position only with a valve without either lead or lap, and should be removed from that position according to the amount of lap and lead upon the valve. Will some one decide the case?—M.

Answers to Correspondents.

SPECIAL NOTE.—This column is designed for the general interest and instruction of our readers, not for gratuitous replies to questions of a purely business or personal nature. We will publish such inquiries, however, when paid for as advertisements at $1·00 a line, under the head of "Business and Personal."

ALL reference to back numbers must be by volume and page.

GILT DIP AND BLACK DIP.—T. H., of Conn., sends an answer which is an advertisement. See notice at the head of this column.

WATERPROOFING COTTON CLOTH.—A. B. C. should make a dough by dissolving 1 pound india rubber in 1½ pounds coal naphtha, and spread this on the cloth as thinly and evenly as possible. Five coats should be put on, and the cloth doubled together with the rubber coating inside, when it will be found to be airproof and waterproof.

GRINDING LENSES.—If E. J. D. will go to a good optician and work with him a year or two, he will learn that turning and polishing the glass is only the alpha of knowing how to make a high power lens.—C. M., of Mass.

RED ANTS.—To J. C. W., page 90.—Mix a teaspoonful of crystals of carbolic acid with an ounce of lavender water or any perfume and sprinkle well on your shelves, and the ants will undoubtedly skedaddle. An occasional sprinkle will keep you free from the pests. The perfume is not necessary, but is used to cover the unpleasant smell of the acid.—E. H. H., of Mass.

HARDENING SOAP.—To D. D., page 73.—Add hyposulphite of soda while the soap is hot. Twenty-four parts of this salt added to 112 of a softish soap will make a firm article on the addition of thirty parts or even more of water.—E. H. H., of Mass.

REMOVING THE CRUST OF SHELLS.—To R. I., page 73.—You may remove the outside crust of shells, by immersing in dilute muriatic acid until the layers are dissolved off. Protect the inside if you wish by brushing over with a little wax and turpentine.—E. H. H., of Mass.

PERMANENT MARKS IN ELECTRO-CHEMICAL TELEGRAPHY.—To G. B. M., page 73.—I would suggest brushing, over the prepared paper, a little thin starch, or passing the paper through the solution of starch, gum, or dextrin; or even wheaten flour might answer. Either would act as a protecting coat from the action of ozone, and would probably be no detriment in practical working, but possibly an advantage.—E. H. H., of Mass.

STRENGTH OF CITRIC ACID.—To T. W. S., page 90.—Average lemon juice contains six to seven per cent of citric acid. Lemons vary in size; find out the quantity of juice and calculate.—E. H. H., of Mass.

FLY PAPER.—To T. W. S., page 90.—Equal parts of molasses and Venice turpentine melted together and spread on paper.—E. H. H., of Mass.

PATENT LEATHER.—To S. B. D., page 90.—This is produced by a double operation. First, several coats of linseed oil and ochre, etc., are applied so as to fill up the pores of the leather, and the surface is rubbed smooth. Four or five coats of a mixture of boiled oil and copal varnish are put on very thin, rubbed smooth, and dried at a moderately high temperature. In this way the fine gloss is obtained and the surface will not be liable to crack. Care and experience in this, as in all manufactures, are required to produce a perfect article.—E. H. H., of Mass.

WIRE FOR SIEVES.—To A. C. S., page 90.—Use No. 16 or larger copper wire, and you will find your sieves tolerably durable.—E. H. H., of Mass.

ANILINE INKS.—To C. L., page 90.—Generally you will find them to fade on exposure to light, especially to the direct rays of the sun.—E. H. H., of Mass.

ANATOMICAL SPECIMENS.—T. G. H. I., page 90.—These are both dried and preserved in various menstrua. Some are injected in various ways, so as to show distinctly the arteries, veins, capillaries, etc. Imitations are made in leather, wax, etc.—E. H. H., of Mass.

COMPRESSIBILITY OF WATER.—To L. E., page 90.—Practically, water is not compressible, and this peculiar property renders it of great service where an elastic or compressible medium would be useless.—E. H. H., of Mass.

IMPURE WATER.—To I. W. L., page 90.—Put into your pitchers a lump or two of fresh charcoal, and allow it to remain a while, or, better, filter the water through a good charcoal filter. There is a filter called the silicated carbon filter that I know to be a first class instrument for this purpose. It probably can be got in any large city.—E. H. H., of Mass.

DRYING FRUIT.—To E. E. S., page 90.—Make a frame building with glass top, like a hot bed frame for raising early plants. Have the whole inside painted black and arranged with shelves on which to place your fruit. The sides and bottom being made thick, of brick, etc., will retain the heat absorbed during the day from the sun's rays, and gradually give it off when he is out of sight. Near the bottom there should be a few holes to admit air, and at the top a few to let off the moisture laden atmosphere; that is, a current will result, and can be regulated by stopping up as required. I know two such frames used most successfully in this neighborhood for drying a wet paste, and have no doubt it will do for fruit. Take the flue pipe of your stove round such a building, and so utilize what now is so much waste heat.—E. H. H., of Mass.

FETID WATER.—To F. D. H., page 90.—You do not say of what material your cistern is made, nor where the water comes from, what sort of paint about it, etc. Are the pipes from the pumps of iron? Give more particulars, and I will try to help you.—E. H. H., of Mass.

Recent American and Foreign Patents.

Under this heading we shall publish weekly notes of some of the more prominent home and foreign patents.

PISTON PACKING.—Crawford Tibbets and Daniel L. Weaver, of Riverton, Ky.—This invention relates to new and useful improvements in packing the pistons of steam engines, and consists in a hollow piston, which is formed of a body and ends, between which is placed a perforated flanged ring. Outside this ring are placed metallic packing rings which are furnished with steel spring rings. Each end of the piston is provided with a passage and valve opening inward. The steam which enters one of the passages opens the corresponding valve and is discharged into the interior of the piston, from which it passes through the flanged ring and expands the steel and packing rings. This interior pressure also closes the valve in the opposite end of the piston. This occurs while the piston is traveling in one direction. At the end of the cylinder it changes its direction, and the action of the valves is reversed. When the steam is shut off from the cylinder the pressure inside the piston closes both the valves and keeps the packing rings set out to the cylinder.

WASHING MACHINE.—Moses Walker, of Keeseville, N. Y.—This invention relates to a new and useful improvement in machines for washing clothes, and consists in an endless revolving washing board which is formed by connecting fluted wooden slats with canvas and other straps, and is supported on a driving shaft or roller within a box. A piece of fluted rubber is arranged above the washboard in such a manner that a vibratory motion is imparted to it by revolving the driving shaft. The clothes are placed between the board and the rubber. By means of the endless washboard it will be seen that any particular portion of the clothes may be retained on the board and rubbed as long as desired.

CULINARY POT.—John S. Kidd, and Mrs. Mary Melville, of Brooklyn, N. Y.—This invention consists of a cluster of two or more independent boiling pots, adapted for use, singly or together, in one ordinary pot hole of a stove. The form of the sectional pots varies somewhat according to the number of sections in a cluster, but it is always such as to form a suitable figure with the projecting bottoms where they enter the stove hole. The stove cover is made with a corresponding cluster of holes, and a cover for each, so that when all the pots are not used the unused holes can be covered. To use the improved pot on stoves with the ordinary round pot holes, a cover with appropriate holes in it may be employed, but this is not essential when all the pots are used. These pots are very useful with parlor cook stoves having only one hole: also on ordinary cook stoves in summer, when it is preferred to have a small fire concentrated under one hole only.

RAILROAD SWITCH.—John Shafer, of Tunnel Hill, Pa.—This improvement in switches consists of a novel arrangement whereby the rails for the main line maintain their complete form, and do not have the tongue or frog common to ordinary switches. One part of the switch consists of a widened and elevated piece on the outside of one of the main rails, which is so formed that, in connection with an opposite guard rail, the wheels are thereby forced over from the branch line on to the main line. A siding is used to adjust the opposing rail ends. In running from the main track on to the branch the proper adjustment, of the siding alone, effects the object.

Washing Machine.—Francis M. Ellis, of Galva, Illinois.—This invention improves the construction of the washing machine for which letters patent were granted to the present inventor June 13, 1871, and makes it more convenient in use and effective in operation.

Pocket Flask.—Rogers George, of New York city.—This invention furnishes an improved pocket flask which is simple in construction and convenient in use; it is so constructed that the cup may be secured to the flask by the same cork or stopper that closes the flask.

Plow.—Lewis B. White, of Norfolk, Va.—This invention relates to a new plow, which is provided with an adjustable share, mold board, beam, and weeding attachment, in order to render it adjustable to all kinds of soil and manners of preparing the same. It consists, first, in providing the share and mold board with backwardly projecting slotted ears, whereby they are secured to the standard, and, owing to the slots, are made adjustable thereon. The invention also consists in providing the mold board with detachable extension pieces or wings; also in the use of reversible up and down adjustable weeders, applied to a longitudinally adjustable stock or holder; and finally, in making the beam adjustable on the standard and handle so as to regulate the width of furrow and the inclination of the plow share.

Paddle.—Calvin C. Everson, of Palmyra, N. Y.—This invention furnishes an improved paddle or oar for propelling boats, which is so constructed as to encounter great resistance from the water when moving in the direction to propel the boat and very little resistance when moving back for another stroke; it consists in making the blade of the oar of two swinging paddles, set in a frame. When pulling the paddles rest on the frame and resist the water. When the motion is reversed, the paddles are thrown outward and the water passes through the frame.

Silverware Box.—Edmund Steinle, of New York city.—This invention consists in making the bottom of a silverware or other show box adjustable and supporting it upon the cover, which is made to correspond in size and to be detachable for that purpose. The cover is not hinged to the sides, but is constructed so that it fits inside of them. The bed or bottom for the support of the ware is not attached to the sides, but is fitted so that it can rise up to their top, or nearly so, and it is connected with the side by straps to prevent it rising too high. By this construction the cover can be taken entirely off so that it will not be in the way and obstruct the view of other pieces in the show case.

Polishing Powder.—Thomas R. Hubbard, of Brooklyn, N. Y.—This invention has for its object to utilize the deposits of topaz found in the United States. Being found in a comparatively pure state and of great hardness, it is admirably adapted to the abrading and polishing of metals and other mineral and other substances, and its heat-resisting qualities make it useful in fireproof structures of every kind. The invention consists in reducing the topaz to a powder more or less fine, and in incorporating it with alumina and silex or clay as cementing materials.

Stair Rod.—Edward Schlichting, of New York city.—This invention relates to a new manner of constructing stair rods by making them extensible, so as to fit them to carpets of suitable width; and it consists in constructing them in sections which are made to slide one within another telescopically.

Dado Plane.—Rufus H. Dorn, of Port Henry, N. Y.—This invention produces a grooving plane which can be adjusted, without change of knives, to cut narrower or wider grooves; and it consists in the application, to the plane, of a pivoted cutting blade which can be swung more or less to one side to enlarge the scope of its action. It also consists in several other details of improvement, and in the combination with the swinging blade of a laterally adjustable spur or marking blade, which is set in accordance with the position of the swinging blade.

Tile.—George A. Davidson, of Malden, assignor to himself and Horace T. Caswell, of Troy, N. Y.—This invention consists in beveling the edges of stone tiles by the saw, so that they can be laid as they come from the sawing machine without any additional labor whatever.

Sewing Machine for Boots and Shoes.—Nathan M. Rosinsky, of New York city.—This invention relates to improvements in machines for sewing the uppers of boots and shoes to the soles; and it consists in certain arrangements of a loop holder with the needle or awl, and in the apparatus for operating it; also, in a novel construction of the feed apparatus. It is more especially designed to perfect the machine patented by the present inventor May 16, 1871.

Mosquito Net Frame.—Seymour Hughes, of Jersey City, N. J.—This invention relates to a novel apparatus for suspending mosquito nets over bedsteads and for contracting and expanding the same whenever desired. It consists principally in the arrangement of a rectangular frame about as large as the bedstead, and in the application to it of a sliding cross bar, to which the side of the top of the mosquito net is secured. The remaining three sides of the top of the net are fastened to the rectangular frame and can slide on the sides of the same. The frame is suspended from the ceiling in such manner as to vibrate easily to protect the net, in case it is stepped upon, and prevent it from being torn.

Combination Lock.—James Pigot, of Brooklyn, N. Y.—This invention furnishes an improved combination lock, in which any combination of four letters can be used to guide the operator in actuating the lock, and as many different combinations of four may be had as twenty-six are capable of.

Electromagnetic Motor.—José S. Camacho, of Habana, Island of Cuba.—This invention relates to a new electromotor, which is applicable to the propulsion of vehicles, such as railroad cars, small or large vessels, and to the operation of machinery, and other useful purposes. It consists principally in such a combination of a wheel, containing a series of electromagnets that have an unvarying direction of electric current, with a series of stationary electromagnets, in which the direction of the current is reversed at regular intervals, that, by the changed polarity of the stationary electromagnets, their respective power of attraction is so changed or rather transmitted from one to the other that the wheel magnets are caused to follow such transmission, whereby the wheel is turned. The invention also consists in a new current-regulating mechanism; and also in a novel construction of electromagnets for the purpose of obtaining a larger ratio of power from a given length of coil than could be derived by the plain cores of ordinary electromagnets.

Washing Machine.—Jonathan Hunsberger, of Shippack, Pa.—This invention is an improvement on those washing machines using a fixed and a swinging board, and consists in so arranging the mechanism which operates the movable one that the ribs of one board are made to enter the spaces between the ribs of the other.

Fruit Box.—William Nicklin, of Marlborough, N. Y.—This invention furnishes, as an article of manufacture, a berry box made of pasteboard by riveting together the hoop, bottom, and cleats.

Fish Hook.—Edward Pitcher, of Brooklyn, N. Y.—This invention furnishes an improved fish hook, which is so constructed as to prevent the fish getting off the hook and being lost; it consists in so arranging a double wire spear with the line and hook that, upon the fish taking the latter, the spear is pulled down and pierces him.

Drawing Frame.—Samuel Brooks and John Standish, of West Gorton, England.—This invention furnishes an improvement in machinery for preparing cotton and other fibrous substances, and consists principally in a construction and arrangement of the devices which constitute the stop motion of drawing frames, by which their operation is made more perfect than heretofore.

Sash Holder.—Daniel J. La Due, of Carroll city, Iowa.—In this invention both side edges of each sash have corrugated or roughened strips of metal fitted into them. In one side of the frame is inserted a small metal box which contains a pivoted jaw and a spring. The spring connects with the lower part of the jaw, and tends to draw the roughened upper part of the same off the sash. A screw, having a pointed end and fitted through the side of the frame and box, enters with its point a hole in the jaw. When the screw is forced further in, so that the larger part of its conical point gradually passes through the jaw, the latter is thereby swung against the sash to lock it at whatever hight it may be desirable to hold it. When the screw is withdrawn, the spring withdraws the jaw from the sash, allowing the latter to be raised or lowered at will.

Crane.—Gasper Hunziker, of Summit, Miss.—This improvement consists in pivoting a horizontal crane arm to a vertical shaft below its plane by crossed arms, which extend below the pivot and terminate in a toothed segment, with which a crank shaft and pinion are connected. At each end of the horizontal arm is a grooved roller, and the hoisting rope hangs from one end for engaging the weight and passes over the other end down to the drum. The loads are raised by the drum and cord, the crank shaft being locked fast. The loads are balanced on the upper part of the shaft, or nearly so, by the extension of the horizontal arm across the top of the shaft so that the side draft on the vertical shaft, common to ordinary cranes, is mostly obviated. The arm is shifted forward and backward by the segment pinion and crank shaft to adjust it to the work in hand, and the end from which the weight is suspended is thus raised or lowered, as circumstances may require.

Beefsteak Chopper.—Elizabeth Atkins, of Monroe, Louisiana.—This invention consists of a pair of rollers or cylinders which are made with acute angular flutes and arranged horizontally in the same plane for rolling together, one being turned by a crank; they are provided with a clearer or discharger below for preventing the meat being carried around with the rollers. One of the rollers is adjustable toward and from the other, and is provided with an adjusting screw and a spring for allowing it to be self adjusting to some extent as the meat varies in thickness or resistance. The fluted portions overhang the housings, so that the bones in the meat are guided along the ends while the meat passes between them. The steak is presented to the rollers by suspending it by the hand above and between them.

Water Closet Seat.—Charles Ledwich, of Fishkill Landing, N. Y.—The object of this invention is to improve the mode now in common use of setting the bowls of water closets. The usual mode is to set the flange of the bowl in putty, which is liable to become loose and get displaced, and render instant repairs necessary. The difficulty of getting at the source of the trouble renders the services of the plumber expensive, while the gases thus liberated are a constant source of annoyance, as well as detrimental to health. In this invention all this trouble is avoided by applying a double rubber packing ring to the flange of the bowl so as to make a perfectly tight joint.

Strainer Pipe.—Amos Harris, of Minneapolis, Minn.—This invention relates to a new manner of perforating pipes to be used in oil wells and other places, so that they will serve as strainers for water or other liquids. The invention consists in grooving the pipe longitudinally on one side, and in cutting a screw thread along its other side to such a depth that the spiral grooves are deeper than the material left under the longitudinal grooves. This causes a perforation to appear at every crossing of a spiral and longitudinal groove. A very fine and regular system of strainer is thus produced, which is cheap to produce, of great strength, and more convenient to handle than the tubular strainers now in use.

Barn Door Hanger.—William W. Soden, of Unadilla, N. Y.—This invention relates to an improvement in door and gate hangers, and consists of a grooved rail in combination with a beveled or oval faced roller; the side walls of the groove are cut or notched down to the bottom at suitable intervals along the rail, and, preferably, on the opposite sides alternately, to allow the water or other matters collecting in the groove to escape and not to obstruct the rollers. Grooved rails with oval or beveled head rollers are used in preference to the oval rails with grooved wheels, to save the expense of forming the grooves in the wheels, as the rails can be cast with the grooves without any cost for the groove beyond the cost of the simplest form of casting.

Cloth Cutting Machine.—Fredrich Koch and Robert Brass, of Williamsburg, N. Y.—This invention relates to a new machine for cutting cloth of suitable thickness by means of a reciprocating blade, which has its cutting edge parallel to its line of motion. It consists chiefly in the arrangement, around the reciprocating cutter, of a circular table which carries the feed mechanism, and which, when turned, causes also the rotation of the cutter in an equal degree, although it does not interfere with the up and down motion of the same. The invention also consists in the arrangement of a yoke shaped swivel arm, which holds the upper part of the mechanism, and which is swiveled so that it can be swung to either side out of the way of the cloth which is being fed. This is an important item, as it permits the cutting of large pieces on the machine and in suitable direction. It also comprises a new and peculiar manner of imparting motion to the double feed, and to a new combination of the concentric tubes that embrace the reciprocating cutter.

Low Water Indicator for Steam Boiler.—Clement Brooks, Norfolk, Va.—The invention is an improvement in the class of low water indicators for steam boilers wherein a ball or weight is employed, and the object is to increase the reliability of the operation of the actuating devices without correspondingly increased complication or number of parts.

Hydrant.—John W. Murphy, Baltimore, Md.—The invention consists in connecting with a water tight plunger a central water-conveying pipe and a valve so that the same movement which unseats the valve allows the water to pass directly up. 2dly. In placing, between an adjustable cap and its supporting cylinder, the packing that keeps the plunger watertight, whereby a turn now and then on the clamp screw will take up all wear for a long time. 3rdly. In placing the end perforated flange by which the hydrant is firmly held in its box diagonally across the bottom thereof, so as to prevent splitting said bottom.

Plow.—Edward S. Cook, Laurel Grove, Va.—The invention consists in new modes of locking the landside, moldboard, and share to a skeleton frame so that they cannot be forced by any strain out of their desired relations to each other, in providing an intermediate brace by which the handles and mold board may mutually react and support each other against pressure; and finally in a peculiarly constructed skeleton frame which admits of a subsoiler being readily converted into a turnplow.

Locomotive Smoke Stack.—Keyran J. Duggan, of Montgomery, Ala.—In this invention the improved construction is calculated to economize the cost and to dispense with inside pipes, which greatly interfere with the removal of the stack for cleaning and repairs. It consists principally in joining the opposed cones of the stack by angle iron rings, by which is supported a cone formed of two plates of sufficient size to leave an annular passage for the smoke of about ten inches in width in large stacks. A wire gauze spark arrester is arranged at the top of the stack.

Car Coupling.—Nathan Swigart, of West Richfield, Ohio.—The object of this invention is to improve the apparatus for coupling cars together on railroads; it consists in a device, for rendering the cars self separating in case of accidents, which operates as follows: The coupling pin is provided with a lug pin, which stands at right angles with it, a short distance above the end of the link, and is so placed that if the other end of the link drops, or the car falls from a bridge, or by any means becomes so depressed below the level of the track as to lower one end of the link, the other end strikes the lug pin and the link acts as a lever to pry the coupling pin up, the mouth of the drawhead being the fulcrum. As soon as the lower end of the pin is raised from the lower part of the drawhead, it releases the link and the cars are separated.

Grain Meter.—Archibald McBride, of Fayette, Pa.—This invention furnishes an improved grain meter which consists essentially of the following parts: A tilting hopper made in two parts and provided with a shifting weight; automatic opening and closing gates through which the hoppers are discharged; spouts or hoppers for holding bags; a shifting or moving bar for working a registering apparatus, and a regulator for controlling the movement of the weight.

Hand Seeder.—Barton W. Harris, of Williamsport, Ohio.—This invention comprises a long light trough provided with a strap or cord by which it is suspended from the shoulders of the sower; the bottom of the trough is divided lengthwise into several short concave sections with a feed hole at the bottom of each which is covered by a curved oscillating gate with holes for the seed to fall through and with projections for pushing away any objects too large to pass through the holes in the bottom of the trough; the gates swing on pivots and have arms extending above the pivots to a reciprocating bar at the top of the trough, which is worked by a hand lever.

[OFFICIAL.]

Index of Inventions

For which Letters Patent of the United States were granted

FOR THE WEEK ENDING JULY 23, 1872, AND EACH

BEARING THAT DATE.

Air by the pressure of water, condensing and storing, J. Cochrane... 129,791
Alarm, portable burglar, Webster and Fey... 129,698
Bale tie and straining lever, J. C. Colt... 129,715
Bales, hoop tie for, J. F. Milligan... 129,851
Bedstead, invalid, H. A. Scott... 129,754
Belt shifter, S. Forsythe... 129,745
Belt tightener, elevator, W. Merson... 129,806
Bench, wash, L. Streeter... 129,690
Bevel, carpenter's, W. H. Laughlin... 129,737
Billiard register, J. Lee... 129,670
Bleaching wool, yarn, etc., E. C. Haserick... 129,819
Boat detaching apparatus, T. S. Seabury... 129,755
Bobbin, G. Richardson... 129,682
Bolts, machine for cutting screws on, D. McGuire... 129,847
Boot, riding, B. C. Young... 129,776
Boot and shoe soles, burnishing machine for, S. H. Hodges... 129,663, 129,825
Boot and shoe soles, machine for trimming, S. H. Hodges... 129,824
Boots and shoes, mock button and button hole for, W. Butterfield... 129,785
Boots, nail presenting mechanism for, Knowlton and Fairfield... 129,834
Boots and shoes, sole for, S. J. Shaw... 129,757
Bottle, H. Codd... 129,852
Bottle, siphon, J. E. Willman... 129,652
Brush handles, machine for driving, P. Peartree... 129,748
Bureau, bracket, O. Andrews... 129,704
Calcimine, E. B. Benedict... 129,645
Can, oil, C. J. Brown... 129,783
Canister, E. Mather... 129,842
Car brake, W. Naylor... 129,855
Car brake, S. E. Clouser... 129,789
Car brake and starter, combined, C. B. Broadwell... 129,868
Car brake, steam and air, J. Y. Smith... 129,782
Cars, coupling, C. B. Knowles... 129,668
Car, steam, H. F. Knapp... 129,833
Car wheel, T. C. Craven... 129,655
Carding machine, Hindle, Milton, and Arnold... 129,662
Carpet fabric, Hunter and Kerr... 129,829
Carpet stretcher, A. C. Ellis... 129,802
Carriage wheel, Shute and Starr... 129,686
Carriage running gear, W. A. Lewis... 129,838
Carriages, head block for, F. V. Patten... 129,768
Case, spool thread, L. O. Smith... 129,688
Celery collar, J. Simpson... 129,758
Chair, extension, J. H. Travis... 129,873
Charcoal, process, etc., for the manufacture of, L. S. Goodrich... 129,815
Charcoal, apparatus for the manufacture of, L. S. Goodrich... 129,814
Cigar molds, machine filling, F. C. Miller... 129,674
Compound for clarifying beer and other liquids, C. Hefft... 129,732
Compound for polishing metals, glass, etc., M. C. Bland... 129,708
Coupling and steering apparatus, J. McCreary... 129,844
Coupling and steering apparatus, W. Frick, (reissue)... 5,000
Cultivator, A. Thompson... 129,693
Cultivator, J. B. Skinner... 129,759
Cultivator, Parmele and Curkendall... 129,859
Cultivator, W. H. Griffith... 129,730
Cultivator, Ayres and Hunt... 129,642
Cultivator, E. T. Bussell... 129,712
Desk, adjustable, M. Stahn... 129,870
Distilling pine wood, apparatus for, W. Messan... 129,849
Door check, H. D. Weaver... 129,875
Door hanger, A. G. Arnold... 129,777
Drag or floating anchor, marine, Wilson and Crawford... 129,878
Drill, ratchet, A. G. Vottier... 129,696
Drilling machine, metal, W. H. Jordan... 129,831
Dryer, W. E. Wright... 129,775
Dryer, R. Kidd... 129,736
Dyeing with indigo, L. Scala... 129,753
Electrical pole changer, J. E. Smith... 129,867
Electro magnetic apparatus, R. Sayer... 129,752
Electro magnetic engine, W. H. O'Dell... 129,857
Emery wheels, etc., machine for molding, J. S. Elliott... 129,801
Engine for propeller, H. Whitaker... 129,700
Engine, portable garden, W. B. Robins... 129,750
Engine, reciprocating, S. D. Tillman... 129,694
Engine, rotary, E. P. Jones... 129,830
Engine, rotary steam, R. T. P. Allen... 129,703
Engines, slide valve steam, Cooper and Emery... 129,794
Eye glass, A. Sus... 129,765
Eyeleting machine, L. Gondin... 129,812
Fan, J. McLaughlin... 129,848
Fare box, J. Blackadden, (reissue)... 4,996
Fastener, shutter, T. Houghton... 129,664
Faucet, J. W. Trafton... 129,872
Faucet, W. B. Hersman... 129,823
Feed trough, A. Simkins... 129,687
Fence, I. L. Landis... 129,837
Fence, I. N. Lerick... 129,738
Fertilizers from night soil, manufacture of, D. J. Loewenstein... 129,739
Floor, fireproof, Hodgson and Brown... 129,827
Food, preparing wheat for, M. H. Kollock... 129,835
Fork, guard, H. D. P. Cunningham... 129,796
Furnace, glass, G. W. and C. W. Foster... 129,657
Furnace, puddling, J. A. Stearns... 129,762
Furnaces, apparatus for feeding blast, L. S. Goodrich... 129,813
Gas works, condensing apparatus for, H. H. Edgerton... 129,723
Gas mains, machine for tapping water and, H. Mueller... 129,853
Gas, manufacture of illuminating, Disterich and Schuessler... 129,720
Gas, purifying illuminating, R. J. Everett, (reissue)... 4,998
Gate, D. D. Wisell... 129,702
Gate, G. Hungerford... 129,733
Glass blower's mold, S. R. Bowie... 129,709
Glass decoration, W. Neilson... 129,856
Glass mold, Over, Robinson, and Faupel... 129,679
Governor for water wheels, etc., W. M. Bailey... 129,707
Grate bar, furnace, W. H. Settle... 129,756
Grate bar for furnace, A. Rawson... 129,8[illegible]2
Gun carriage, J. Ericsson... 129,804
Handkerchief and fan holder, G. D. Stevens... 129,871
Harvester, M. Hallenbeck... 129,817
Harvester dropper, O. Dorsey... 129,798
Hat ventilator, G. B. Smith... 129,866
Hatchways, mode of closing, J. M. Bradner... 129,646
Heating and ventilating buildings, B. R. Hawley, (reissue)... 5,001
Heddle actuating mechanism, J. Crawshaw... 129,718
Heddle frame, J. Dyson... 129,722
Heel nailing machine, C. W. Glidden... 129,811
Hoist, cellar, P. Coble... 129,790
Horse power, water supported, A. James... 129,734
House, portable, H. W. Forman... 129,805
Jar, fruit, L. F. Betts... 129,780
Lamp, J. J. Hoyt... 129,828
Lamp, Gordon and House... 129,728
Lamp, H. W. Hayden... 129,821
Lamp burner, G. Lavere, (reissue)... 5,002, 5,003
Lamp, hydrogen, J. Pusey... 129,681
Lamp mold, glass, J. Bridges... 129,781
Lamp, oil, J. Calkins... 129,786
Lamp, street, McDowell and Bates... 129,846
Lathe chuck, C. Archer... 129,705
Lift, exercising, R. Forward, (reissue)... 4,999
Lightning rod, D. Munson... 129,675, 129,676, 129,677
Lightning rod, J. Robertson... 129,683
Locomotive, H. Whitaker... 129,701
Locomotives, signal light for, A. Dick... 129,797
Loom shuttle, E. A. Thissell... 129,692
Lounge, extension, G. H. Thomas... 129,766
Lubricator, axle, E. W. Smith... 129,760
Lubricator for steam engines, E. McCoy... 129,843
Matches, friction mat for lighting, J. B. Colt... 129,716
Metal in mining sluices, apparatus for collecting precious, J. Beers. 129,644
Mill, grinding, Loy and Baker... 129,741
Milling machine, J. Wheelock... 129,876
Mosquito nets, adjustable frame for, E. Howard... 129,665
Motion, device for converting, P. Wernl... 129,771
Musical instrument, A. L. Mora... 129,746
Musical instrument, M. H. Collins... 129,653
Needle sharpener, J. M. Mason... 129,673
Nut lock, F. C. Hays... 129,822
Nut lock, F. H. Bradley... 129,710
Nut lock, Arnold and Atwood... 129,706
Oil can cap and nozzle, J. R. Hathaway... 129,820
Ores and minerals, machine for washing, R. R. Osgood... 129,678
Organ, reed, L. K. Fuller... 129,810
Oven, coke, Erichsen and Maardt... 129,803
Oven pipe, hot blast, J. K. McLanahan... 129,744
Packing case, Cadwell and Case... 129,713
Packing, piston, G. Dryden... 129,799
Packing, piston, J. H. Cooper... 129,793
Padlock, W. Wilcox... 129,879
Paper, etc., in rolls, apparatus for winding, G. D. Harrington... 129,660
Pavement, S. C. Prescott... 129,861
Pavements, process of manufacturing artificial stone, G. L. Eagan. 129,800
Pianoforte, P. Gmehlin... 129,727
Picture case, A. R. Stone... 129,764
Pipe coupling, S. P. M. Tasker... 126,691
Pipes, device for tapping, L. Spaulding... 129,869
Plane, bench, T. Vaughan... 129,695
Press, cider and wine, O. Kromer... 129,836
Press, cotton, C. C. Conner... 129,792
Press, cotton and hay, R. Ball (reissue)... 4,995
Press, portable revolving screw, R. M. Brooks, (reissue)... 4,997
Pump, W. Barnes... 129,779
Pump, rotary, G. W. Rogers... 129,864
Pump, steam vacuum, W. Burdon... 120,647
Rake, horse hay, Lynd and Tousley... 129,742, 129,743
Railroad crossing, frog for, S. L. Phelps... 129,680
Railway rails, chair for street, W. Warner... 129,697
Reel and swift, L. Weins... 129,770
Refrigerator, H. D. Little... 129,671
Refrigerator, J. H. Munday... 129,854
Reins, fastening for, R. L. Fraser... 129,808, 129,809
Roof, fireproof, Hodgson and Brown... 129,826
Rope clamp, T. Pimer... 129,860
Ropes and cables, machine for making covered, H. Greenway... 129,816
Sash and fastener, window, S. W. Cox... 129,654
Sash balance, C. Lamson... 129,669
Sash holder, Wright and Cooke... 129,774
Sash holder, T. McDonough... 129,845
Saw frame, W. Hankin... 129,731
Saw jointer, W. R. Close... 129,788
Sawing machine, J. C. Nelson... 129,747
Screen for washstands, C. A. Johnson... 129,667
Sewing machine, W. H. Hanna... 129,818
Sewing machines, tension device for, G. Stackpole... 129,761
Shoe, gaiter, A. Baron... 129,643
Shutter worker, S. Duff... 129,656
Signal, railway, W. Wickersham... 129,877
Sky light, ventilating, J. W. Geddes... 129,658
Sleigh runner, T. A. Whiting... 129,772
Spark arrester, E. Rehling... 129,863
Stand, lady's, J. N. Miller... 129,850
Steamer, agricultural, W. M. Gordon... 129,729
Steel ingot molds, stopper for, S. T. Willman... 129,699
Stereotyping and telegraphing machine, combined, M. Gally... 129,725
Stone gatherer, B. R. Tupper... 129,767
Stone, manufacturer, of artificial, J. W. Snyder... 129,789
Stone, machine for breaking and cubing, Brown and Hope... 129,784
Stove, base burning, J. T. Durkee... 129,721
Stove cover lifter, L. D. Lathrop... 129,740
Stove, heating, H. Maranville... 129,672
Stove, parlor, E. Brown... 129,711
Sunstroke preventer, W. M. Pegram... 129,749
Telegraph apparatus, printing, G. L. Andes... 129,641
Telegraph receiver and transmitter, automatic, G. Little... 129,840
Telegraph transmitter, automatic, G. Little... 129,839
Telegraph wire, insulating, J. Olmsted... 129,858
Telegraphic use, insulator for, M. G. Farmer... 129,724
Telegraph paper, preparing, etc., G. Little... 129,841
Textile and other material, machine for cutting, A. Warth (reissue) 5,004
Tobacco, manufacture of, E. and C. F. Robinson and E. E. Andrew 129,751
Toy, N. D. Clark... 129,651
Toy, S. N. Trump... 129,874
Trap, fly, F. Stengel... 129,763
Trap, hog, R. Kieler... 129,832
Trunk, D. J. Clark... 129,787
Tuck creaser, S. P. Babcock... 129,778
Valve, slide, Glasson and Gilfillan... 129,726
Vault, safe, J. Crump... 129,795
Vehicle wheels, hub for, J. B. Hubbell... 129,661
Vehicles, wheel for, H. Silvester... 129,865
Ventilator, J. H. Karman... 129,735
Wagon bed, V. Wasem... 129,769
Wagons, mode of attaching springs to, J. H. Cornwell... 129,717
Wall, fireproof, S. M. Graff... 129,659
Washing machine, T. J. Wilkinson... 129,773
Washing machine, C. H. Sawyer... 129,684
Washing machine, J. C. Chase... 129,714
Water elevator, W. Burdon... 129,648, 129,649
Water wheel, J. Frank... 129,807
Weather strip, S. J. Cilley... 129,650
Wells, casing T for oil, J. C. Dickey... 129,719
Wells, device for extracting broken tools from, H. Harris... 129,661

DESIGNS PATENTED.

6,002.—GLASSWARE.—A. H. Baggs, Wheeling, W. Va.
6,003.—CARPET.—W. Mallinson, Halifax, England.
6,004.—CARPET.—A. McCallum, Halifax, England.
6,005.—FAN.—J. McLoughlin, Morrisania, N. Y.
6,006 and 6,007.—CARPETS.—J. Patchett, Halifax, England.
6,008 and 6,009.—CARPETS.—D. Paton, Halifax, England.
6,010.—CORNER PIECE.—A. Soper, Whitestown, N. Y.
6,011.—CARPET.—G. C. Wright, New York city.

TRADE MARKS REGISTERED.

921 and 922.—WRITING INKS.—Adams & Fay, Cleveland, O.
923.—AXES.—Biddle Hardware Co., Philadelphia, Pa.
924.—SOAP.—J. Buchan & Co., New York city.
925.—WHISKY.—M. Crichton, Baltimore, Md.
926.—LINIMENT.—W. Crow, New York city.
927.—CIGARS.—Gaullieur & André, Key West, Fla.
928 to 930.—PLUG CHEWING TOBACCO.—Harris, Beebe & Co., Quincy, Ill.
931.—MOLASSES.—A. Thomson & Co., New Orleans, La.
932.—BOOTS.—J. H. Walker, Worcester, Mass.

DISCLAIMERS.

20,959.—RAILWAY SWITCH.—M. Smith. Filed July 18, 1872.
20,927.—JOINT FOR CONDENSER.—H. Allen. Filed July 20, 1872.
20,649.—VAPOR LAMP.—A. M. Mace. Filed June 19, 1872.

APPLICATIONS FOR EXTENSIONS.

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

21,936.—LOCOMOTIVE TRUCK.—Levi Bissell. Oct. 16, 1872.
21,952.—CAR SPRING.—P. G. Gardiner. Oct. 16, 1872.

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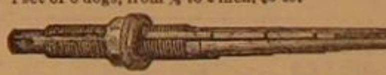

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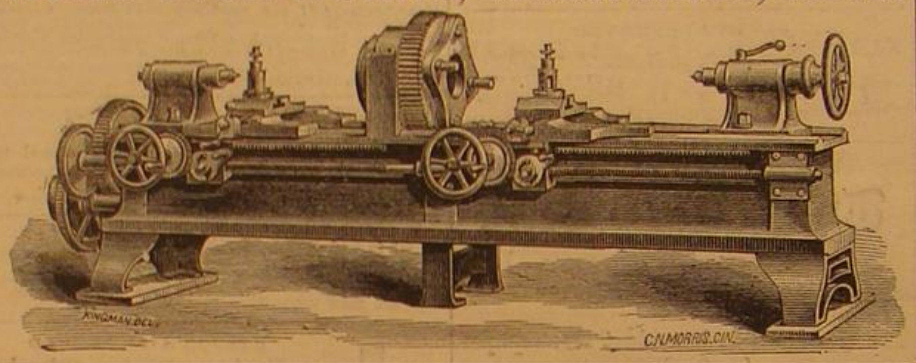

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