[International Review.]

THE CONSTITUTION OF THE SUN.

BY PROFESSOR C. A. YOUNG.

Number I.

THE CENTRAL CORE.

Probably no subjects of scientific research have ever attracted more attention than those relating to the sun. His preëminence in our system, as the controller of all planetary motions, and the origin and mainspring of all material energy in the earth and her sister worlds, invests with supreme interest every problem concerning his nature and modes of action.

As to the sun's central core, the opinion which now generally prevails, though not without some dissent, is that it is gaseous. The reasons which almost compel this conclusion are easily stated. In the first place, knowing the sun's distance, we readily compute its diameter, which turns out to be nearly 108 times that of the earth, or in round numbers 860,000 miles.* Now, since the bulks of different spheres are proportional to the cubes of their diameters, it follows that the volume of the sun, to use the technical term, is 108x 108x108 times greater than that of the earth; in other words, it would require about 1,250,000 of the earth to make a globe as large in volume as the sun.

According to the best determinations, we find that the sun is about 320,000 times as heavy as the earth; and since, as we have seen, it is a million and a quarter times as bulky, it follows that its average density is less than that of the earth nearly in the proportion of one to four; and this, although we know by means of the spectroscope that conspicuous among the materials of which the sun is composed are metals, whose density, even when not under pressure and in the liquid form, far exceeds that which has been mentioned. For since the earth has a mean specific gravity of about 5·5, it follows that that of the sun is only about 1·4, while the densities of iron, titanium, manganese, chromium. copper, zinc, magnesium, etc., range from 1·75 to 9. Of the substances known to exist in the sun, only sodium and hydrogen are lighter than the sun's mean density. It is to be remembered, also, that since the force of gravity at the sun's surface is twenty-eight times as great as on the earth, the effect of the weight of the strata near the surface, in compressing and increasing the density of the central parts must be correspondingly powerful. As things stand, then, there seems to be no possibility of admitting that the substances which compose the sun are mainly in the solid or liquid state, for in that case the mean density must almost necessarily far exceed that of the earth. This conclusion is strengthened by what we know of the intensity of the heat at the solar surface, where, although exposed to the cold of outer space, we find a temperature sufficient to keep the solar atmosphere charged with the vapors of the metals we have mentioned. We can hardly doubt, therefore, that in the interior of the sun the temperature must be such as to make the existence of the metals in the solid or even the liquid state quite impossible. And yet the theory that they are in a gaseous state is not without difficulties. A few years ago it would have been urged with great plausibility that, under such a pressure as must obtain at the center of the sun, every gas would necessarily be liquefied; and it would have been impossible to meet the objection by any knowledge then in our possession. The recent researches of Andrews have, however, shown that a vapor or gas, if above a certain critical temperature, refuses to be liquefied by any pressure whatever, but, growing denser and denser under the pressure, still maintains its gaseous characteristics, which are continuous expansibility under diminishing pressure without the formation of a free surface of equilibrium, continuous expansion under increasing temperature without the attainment of a boiling point, and, in the case of a mixture of different substances, a uniform diffusion of each through the whole space occupied, according to the law of Dalton and without regard to specific gravity.

These essential distinctions between liquids and condensed gases are often misunderstood; but it is the more necessary to keep sight of them, as in many most important respects the mechanical properties of gaseous matter, condensed by pressure to the specific gravity of water, are identical with those of liquids; especially if at the same time intensely heated—for then, as Maxwell has shown, the viscosity, or power of resisting motions, is greatly increased; so that a mass of hydrogen at the sun's center may very possibly in its mechanical behavior much more resemble pitch than what we are familiar with as gas and vapor.

It must be noted further, and is urged as an objection by many, though we fail to appreciate its force, that if the sun's central core is gaseous, then the temperature at the sun's center must be enormous—to be reckoned in millions of degrees, perhaps millions of millions. If it were not so, even the lightest gas, as hydrogen, at the temperature of the sun's surface, would, by the inconceivable (but not incalculable) pressure, be condensed so as to be hundreds of times heavier than platinum itself. We speak somewhat vaguely, because the numerical conditions of the problem are not very accurately known, though the general correctness of the result is certain. Heat, of enormous intensity, can alone counteract this effect, and give us the small density observed. For our own part, considering what we know of the amount, constancy, and permanence of the sun's radiation, we find no difficulty in conceding any internal temperature which may be necessary to account for the facts.

* Very few, we imagine, get from this bare statement any adequate conception of the vastness of the solar orb. Conceive the earth placed at its center so that the inner surface of the photospheric shell should be our sky; then the moon, which is distant nearly 240,000 miles, would pursue her accustomed orbit far within the bounding sphere; and indeed, if the earth had a second satellite at almost twice the moon's distance, this also would come within our firmament.

[The Telegraphic Journal.]

ELECTRO-DEPOSITION OF METALS.

BY J. T. SPRAGUE.

Number I.—PREPARATION OF THE ARTICLES.

The depositing of metals in the various forms required in the arts depends upon the practical application of the theoretical principles which have been frequently explained. The processes divide themselves into two general groups: 1. Electrotyping, the forming of a mass of metal intended to have a distinct existence of its own, and requiring therefore to possess a certain amount of strength or coherence. 2. Electroplating, in which a mere film of metal is to be employed as a covering to another metal, to beautify it or to protect it from atmospheric influences.

The essential distinction between the two processes is that in electroplating the two metals are desired to be brought into absolute molecular contact, so that they shall form one body, mechanically considered; this depends entirely upon the absence of any intervening substance, that is to say, upon the absolute cleanness of the surface to be coated. Under ordinary circumstances, every surface is coated with a very strongly adhering film of air, which appears to condense among the superficial molecules, and cling, as we see liquids do, to those surfaces which they can wet. This coating of air will prevent adherence unless it is very carefully removed; most metallic surfaces form either oxides or sulphides, and of course all collect a greasy film from the air, and the first and most essential operation is the removal of all these impurities, so as to present a pure metallic surface to the new metal to be incorporated with it.

In electrotyping, on the other hand, it is necessary to ensure the presence of an intervening film, which, while not resisting ordinary contact, will prevent true chemical or molecular contact. To effect this, after the surface to be deposited on (if metallic) is properly cleaned from everything which would deface the deposit, it should be lightly rubbed over with a leather or cloth moistened with turpentine in which a little beeswax has been dissolved—a piece the size of a pea to a quarter of a pint of turpentine will suffice—to prevent adhesion without filling up fine lines, etc.

The process of cleaning varies according to the nature of the objects and the solutions they are to be used with; these processes are mechanical and chemical. In mechanical cleaning, it is desirable, if the objects will permit, to expose them first to a red heat, and then to rub and polish them thoroughly by means of suitable brushes and polishing substances. The best apparatus for the purpose consists of circular brushes mounted on a spindle, driven by machinery or by a lathe. Circular pieces of wood, faced with leather, are also useful, as also the blocks of solid emery now so much used for grinding and polishing metals. A substitute for the latter may be usefully made by soaking a leather facing with glue, and coating well with emery, turning the wheel when nearly set against a roller, so as to consolidate the surface.

Most articles, however, are more rapidly and conveniently cleaned by chemical means. The first of these is the removal of grease by boiling in a solution of caustic soda, made by boiling 2 lbs. of common washing soda and ½ lb. quicklime in a gallon of water; after this they should be well brushed under water. The further processes will depend upon the nature of the objects.

1. Silver is washed in dilute nitric acid, then dipped for a moment in strong nitric acid, and well washed. Care must be taken that the water does not contain chlorine salts; if the ordinary supply does so, the first rinsing after acids must be made in water prepared for the purpose by removing the chlorine by adding to it a few drops of nitrate of silver, and allowing the chloride to settle.

2. Copper, brass and German silver are washed in a pickle of water 100 parts, oil of vitriol 100 parts, nitric acid (sp. gr. 1·3) 50 parts, hydrochloric acid 2 parts. Spots of verdigris should be first removed by rubbing with a piece of wood dipped in hydrochloric acid; they are then rinsed in water.

3. Britannia metal, pewter, tin, and lead cannot be well cleaned in acids, but are to be well rubbed in a fresh solution of caustic soda, and passed at once, without washing, into the depositing solution, which must be alkaline.

4. Iron and steel are soaked in water containing 1 lb. oil of vitriol to the gallon, with a little nitric and hydrochloric acids added. Cast iron requires a stronger solution, and careful rubbing with sand, &c., to remove scale and the carbon left by the acids. It is an advantage at times to connect them to a piece of zinc while cleaning. These metals should be cleaned just before placing in the depositing cell; and if they are placed in an alkaline solution, they should be rinsed and dipped in a solution of caustic soda, to remove all trace of acids.

5. Zinc may be cleaned like iron, with a dip into stronger acids before the final washing.

6. Solder requires special care, as the acids used with the objects produce upon it an insoluble coating, and an obstinate resistance to deposit is set up at the edge of the solder. The same remark applies to soft metal edgings and mounts. These should be rubbed with a strong caustic soda solution, rinsed, and then treated as follows:—Make a weak solution of nitrate of copper by dissolving copper in dilute nitric acid; to a camel hair or other soft brush, tie three or four fine iron wires to form part of the brush; dip this in the nitrate of copper, and draw over the solder, taking care that some of the iron wires touch it; a thin adherent of copper will form, and upon this a good deposit will take place.

7. Old work for replating must have the silver and gold carefully removed; if this is not done, there is apt to be a failure of contact at the edges of the old coatings, which causes blisters and stripping under the burnisher. The best mode of stripping is with the scratch brush, etc., as described for mechanical cleaning, but chemical means may be used Gold is dissolved by strong nitric acid, to which common salt is gradually added; it may be collected afterwards by drying and fusing with soda or potash. Silver is similarly dissolved by strong sulphuric acid and crystals of saltpeter, and recovered by diluting and precipitating with hydrochloric acid, then reducing the chloride either by fusion with carbonate of soda, or by acid and zinc cuttings. Copper can be removed from silver by boiling with dilute hydrochloric acid, and tin and lead by a hot solution of perchloride of iron.

In preparing articles for silvering and gilding, a process of amalgamation is very commonly employed, by which a very thin film of mercury is formed over the surface, which makes a perfect connection between the two metals; this is effected by a solution of one ounce of mercury in dilute nitric acid, and then diluted to one gallon; there must always be a little free nitric acid present; articles dipped in this solution take a grayish color, which on brushing under water becomes a brilliant mercury surface. They must be at once transferred to the solution for coating, without exposure to the air. In the case of iron or steel articles, a similar process may be used, but in this case it is best to add to the solution an ounce of silver also dissolved in nitric acid. It requires great care to obtain a perfect mercury surface upon iron; occasionally sodium amalgam is rubbed over iron for this purpose; the iron must be very perfectly cleaned first.

Street Cars Propelled by Springs.

The winding-up of the spring barrels, which are carried under the car, is effected by engine power, located at suitable intervals along the track, as may be convenient for the run. The stationary engine drives by belt the horizontal shaft, carried in bearings, enclosed in a metallic tube or casing, beneath the roadway, and extending across the track; close alongside whereof a covered box is sunk in the roadway, enclosing a wheel, so shaped as to connect with the winding axle of the tramway car, and thus give the requisite motion thereto. On the arrival of a car at any station, the spring barrels are quickly wound up by the engine.

It has been computed that the actual tractive force, requisite to overcome the resistance of a street car weighing gross 5 tuns, is 60 lbs. on the driving wheels, corresponding to 720 lbs. on the periphery of the spring barrel; 24 lbs. and 288 lbs. respectively correspond to a gross weight of 2 tuns; and in like proportions for intermediate weights. So far as previous experience goes, a spring 6 lbs. in weight, exerting a direct pressure of 105 lbs., may be taken to represent the maximum in size and power of such steel springs. Under the stimulus applied by M. Leveaux's researches, the steel manufacturers of Sheffield, by special and improved plant, annealing ovens, and appliances, have turned out springs 50 to 60 feet long, capable when duly coiled of exerting a pressure of 800 lbs. to 900 lbs., without permanent set. In France, also, steel driving bands, with great elasticity, are made, 100 yards in length, so that the question of the possibility of obtaining springs of the requisite size and power is practically solved

M. Leveaux has had all the necessary mechanism and appliances made by a well known firm of engineers, so as to fit up a tramway car or cars for actual trial upon some of the lines of metropolitan tramways in London; for which indeed, the arrangements are now nearly complete, so that the practical working of the system will speedily receive a thorough public demonstration. We have ourselves had opportunities of seeing the potentialities of the principle, both in the model and full working size; and even in view of the sweeping change in the tramway system which is involved in its complete success and adoption, we cannot withhold the conviction that all the important practical difficulties have been effectually surmounted, reducing its practical realization to mere matters of detail. The working of the springs is entirely free from noise, perfectly smooth, easy, and effective, and completely under control, for application, cessation, and reversal.—*Iron.*

Wood Cutting by Electricity.

Professor Barnard, of Columbia College, writing to the New York *Times*, as an item of recent scientific news, says that the Abbé Moigno, in a recent number of his periodical, entitled *Les Mondes*, describes an invention which, he says, has recently been patented by Mr. George Robinson, of New York, for sawing wood by an entirely new, and what seems a sufficiently odd, process. The process consists in substituting instead of the saw a platinum wire, heated white hot by means of an electric current, etc.

The original account of this invention was published in the SCIENTIFIC AMERICAN, June 22, 1872. It was patented here in May of the same year.

Machinists in the Navy.

A regulation circular has just been issued from the Navy Department, defining more clearly the qualifications requisite for the position of machinist in the navy, as well as the pay and duties. There are three ratings established, namely, machinist, boiler maker, and coppersmith. The last two are on a level, so far as pay is concerned, and promotion lies from these grades to that of machinist, when sufficient proficiency is shown. Candidates for any position must be between the ages of twenty and forty years, and must successfully pass an examination in the presence of the commanding officer of any rendezvous or recruiting station, as to qualifications. There is also a medical examination, touching physical fitness, to be undergone.

Boiler makers and coppersmiths are examined solely as to their suitability for such special ratings. A machinist must be able to read and to write with sufficient correctness to keep a steam log of his watch. He must know the names of the various parts of a marine engine; understand the uses and management of the various gages, cocks, and valves, the mode of raising steam and starting and regulating the action of the engine. He must also know how to ascertain the hight and density of water in the boilers; how to check foaming, regulate the quantity of injection water, to guard against water in the cylinder, and against all dangers to the generators; understand what measures are to be taken in cases of hot journals; and, in short, know how to act upon the occurrence of any of the ordinary casualties of the engine room. In matters of repairs, the candidate is to be examined on the ordinary overhauling and repairing of machinery, the packing of the various joints and rods, grinding of valves, putting on hard and soft patches, putting in and plugging tubes, and all other work required in the management of marine engines.

The regular pay of a machinist is $75 per month; of a boiler maker, $40; and of a coppersmith, $40. To this is added $109 per year rations, and $18 extra per President's order; so that the aggregate annual salary of a machinist is $1,027, and of a boiler maker or coppersmith is $607.

The relative position of men enlisted for the above grades is that of petty officer—about the same as non-commissioned officer in the army. The duties are regular watch in the engine and fire room, managing the engines and boilers (of course, under the direction of the regular engineer officers of the ship). The pay is higher for machinist than that of any other petty officer; and, when it is considered that quarters are found, the recipient having only to supply his mess and uniform (which may be done at a very moderate sum), it will be seen that every opportunity is afforded for saving.

Cruising vessels on regular squadrons are at sea for a large proportion of their time, when no chance exists for spending money. In port, a moderate amount of liberty is granted to those whose duties do not interfere with the privilege. There is an excellent system of allotment in the service, whereby a man, before he leaves home, may authorize the paymaster of the station nearest his domicile to pay, to his wife or friends, a certain proportion of his pay. This amount is then out of his control, and will be deducted from his salary by the paymaster of his vessel

DECISIONS OF THE COURTS.

United States Circuit Court.---Southern District of New York.

PATENT REFRIGERATOR.—THE LYMAN VENTILATING AND REFRIGERATOR COMPANY *vs.* WILLIAM LALOR.

[Decided September 10, 1874.]

BLATCHFORD, *J.*:

This suit and several others are brought on reissued letters patent granted to Stephen Cutter, March 10, 1874, for an "improvement in methods of cooling and ventilating rooms." The title to this patent is vested in the plaintiffs for the whole of the United States, except the eastern district of New York, and that part of the city of New York lying westerly of Broadway and Fifth avenue, and a few counties in New Jersey, the title for such excepted territory being vested in the Lyman Patent Refrigerator Company. The original letters patent were granted to Azel S. Lyman, as inventor, March 25, 1856, and were extended for seven years from March 25, 1870, and were reissued to Lyman, December 26, 1871, and were then assigned to said Cutter, and reissued to him, as above stated, March 10, 1874.

The first claim of the reissue sued on is in these words: The combination of a descending conduit or cold air flue, or either, with a reservoir for containing cooling materials, substantially in the manner and for the purposes described. This claim differs only in the addition of the words "or either" from the first claim of the reissue of 1871. The first claim of the reissue of 1871 was sustained in two suits in equity, on final hearing: one before Judge Hall, in the northern district of New York, in March, 1872 (Lyman *vs.* Myers), and the other before Judge Benedict, in the eastern district of New York, in January, 1874 (The Lyman Patent Refrigerator Company *vs.* Oswald.) In both of those suits it was sustained against the alleged prior invention of Thaddeus Fairbanks, a patent for which was applied for September 5, 1846, and rejected February 6, 1847, and withdrawn July 27, 1847. Long after such withdrawal, John C. Schooley obtained from Fairbanks, for the sum of five dollars, an assignment of Fairbanks' alleged invention, and an application was again made for a patent for it, and a patent was granted to Schooley, as assignee of Fairbanks, August 12, 1856. Judge Benedict, in the case against Oswald, says: The proofs show that Fairbanks abandoned his invention long prior to the issue of the patent upon it. His application for a patent, made in 1846, was rejected on the 27th of July, 1847, and he then withdrew his application. No subsequent effort to obtain a patent or preserve his invention or to put it in use appears ever to have been made by him. The patent for the invention, subsequently issued August 12, 1856, was obtained by one Schooley, as assignee of Fairbanks, who obtained an assignment of the invention from Fairbanks for the sum of five dollars, nearly ten years after the withdrawal of the application and abandonment of the invention by Fairbanks, the inventor.

To this it may be added that, on the present motion, nothing is shown in reference to the invention of Fairbanks, except the papers from the Patent Office and an affidavit by Schooley, showing the foregoing facts. It is not shown that, prior to the date of the original patent to Lyman, much less prior to the date of Lyman's invention, a refrigerator was actually constructed embodying what was set forth in the application of Fairbanks. The alleged invention of Fairbanks, as anticipating Lyman, must, therefore, be laid out of view. As regards anything shown in the original application of Fairbanks, made in 1846 and rejected and withdrawn in 1847, it is well settled that a written description of a machine, although illustrated by drawings, which has not been given to the public, does not constitute an invention within the meaning of the patent laws. Evidence that such a description was made does not show, of itself, a prior invention. Such a description has not the same effect as a printed publication. It lacks the essential quality of such publication; for, even though deposited in the Patent Office, it is not designed for general circulation, nor is it made accessible to the public generally, being so deposited for the special purpose of being examined and passed upon by the Patent Office, and not that it may thereby become known to the public. Although it may incidentally become known, the deposit of it is not a publication of it, within the meaning of the statute or the law. Moreover, although the description may be so full and precise as to enable any one skilled in the art to which it appertains to construct what it describes, it does not attain the proportions or the character of a complete invention until it is embodied in a form capable of useful operation (The Northwestern Fire Extinguisher Company *vs.* The Philadelphia Fire Extinguisher Company, 6 *Official Gazette* of Patent Office, 31.)

In answer to the present motion for injunction, various other alleged prior inventions are set up.

I have carefully considered all the matters presented in these cases, and am of opinion that the injunction asked for must be granted as to the first claim of the patent.

[*John J. Allen* and *Edward J. Cramer*, for the plaintiffs.
Edward N. Dickerson and *Charles C. Beaman, Jr.*, for the defendants.]

United States Circuit Court, District of Maryland.

PATENT GLASS FURNACE.—FREDERICK G. SCHAUM ADMINISTRATOR OF FREDERICK SCHAUM, DECEASED, *vs.* CHARLES J. BAKER, *et al.*, TRADING AS BAKER, BROS. & CO.

An assignment by a bankrupt carries with it all patent rights which the insolvent owns at the time of making the assignment; but does not include his inchoate right to an extension of a patent under the law of 1836.

The plaintiff proved that his intestate, Frederick Schaum, was the first and original inventor of certain new and useful improvements in the construction of glass furnaces, for which letters patent were granted to his said intestate on the 25th of April, 1854, application therefor having been made on the 7th of June, 1853. That said letters patent were extended to plaintiff, under the act of 1836, section 15, on the 23d day of April, 1868.

The improvement claimed was the making of the external and internal configuration of the breastwork of the furnace wall with re-entering portion, so as to partly embrace the pots, and furnace room for additional or extra teaze or ring holes. That the defendants had, during a period of fourteen months, constructed and used furnaces embodying the configuration of the breast wall, as described in said letters patent, was not denied.

Plaintiff offered evidence to prove that, by the use of the said improvement, one third more wall could be made at the same expense, which was denied by defendants. Plaintiff further proved that the said improvement was extensively used by the defendants and others.

Defendants proved that, in 1856, plaintiff's intestate applied for the benefit of the insolvent laws of the State of Maryland, and executed an assignment of all his property, estate, rights, and claims to William Geo. Read, his permanent trustee, for the benefit of his creditors.

Defendants further proved that the said firm of Baker, Brothers & Co. was formed in July, 1872, the suit having been instituted in November, 1873.

The Court, Hon. Wm. Fell Giles, Judge, gave, among others, the following instructions:

1. That the patent of Frederick Schaum was for two purposes. The construction of glass furnaces, by making the external and internal configuration of the breastwork of the furnace wall with the re-entering portions, so as, first, to partly embrace the pots; and, secondly, to furnish room for additional or extra teaze or ring holes, more than were to be found in the glass furnaces known and constructed at or before the date of the patent.

2. That the plaintiff was entitled to recover, if the jury should believe that the plaintiff's intestate was the first and original inventor of a new and useful improvement in glass furnaces, for which he received letters patent, and that said letters patent were extended to the plaintiff, the administrator of the original patentee, then deceased; and should further find that the defendants had, since the granting of said extension, and since July 1st, 1872, constructed and used a glass furnace or furnaces, substantially embracing the improvement described in said letters patent.

3. That in considering the question of utility in the preceding instruction, the jury are instructed that the fact of extensive use by defendants and others is evidence of such utility.

4. That if the jury believe that plaintiff's intestate, Frederick Schaum, in 1856, applied for the benefit of the insolvent laws, and made an assignment to his permanent trustee, the plaintiff is not entitled to recover for breaches of the original patent.

The defendants also offered the following prayer, which the Court rejected: That if the jury find that the said Frederick Schaum applied for the benefit of the insolvent laws of the State of Maryland in 1856, and that William Geo. Read was duly appointed his trustee, then all the interest of said insolvent in said patent, and his right to an extension, passed to said trustee, and the plaintiff is not entitled to recover.

Verdict for plaintiff.

T. Alex. Seth and *Harry E. Mann*, for plaintiff.
Fred. W. Brune and *Fred. J. Brown*, for defendants.

Recent American and Foreign Patents.

Improved Trap and Cesspool Cover.

John Peter Schmitz, San Francisco, Cal.—The object of this invention is to provide a combined trap and cover for cesspools, to prevent foul air or odors escaping from the sewers. The frame or trap case is arranged to be on a level with the sidewalk, resting with its rim on the wall of the cesspool, its lower end sloping, and having a solid rim whereon the smooth flap, with its elastic lining, forms a tight joint when held up by a weight which is detachably connected with it.

Improved Wheel.

Henry Gwynn, Baltimore, Md.—This invention relates to certain improvements in wheels, and it consists in a socket plate cast in one piece with the shell or hub, and having triangular sections, forming sockets which are deepest and widest at the point where the spokes are introduced, in combination with an annular plate and nut, and the spokes having inclined ends and sides.

Improved Cultivator.

James M. Holladay, Twyman's Store, Spottsylvania county, Va.—This invention relates to certain improvements in cultivators, and it consists in the peculiar construction of right angular standards in combination with a metallic frame of double bars and break pins for fastening the said standards therein. It consists further in the peculiar construction of an adjustable bifurcated draft hook, and a brace on draft bar, in combination with the frame and standards.

Improved Stove.

Alexander Hamilton, Cresco, Iowa, assignor of one half his right to Aug. Beadle and Benj. Huntting, same place.—In this stove, straw, hay, or grass may be packed or compressed so as to burn slowly, and thus be profitably utilized as a fuel. Inside is a press follower adapted to be raised up to the top of the fire chamber, and receive fuel under it from a tubular feeder, and then be forced down on the fuel to press it into a dense mass. Shafts are provided for raising and lowering both the follower and the grate, and have a ratchet and pawl upon the outside of the stove to hold them at any required point.

Improved Child's Carriage.

Charles F. Lauer, Pittsburgh, Pa.—This invention consists of a front bolster for a carriage for children, having a vertical socket in the center with a coiled spring in it, contrived for affording the necessary elasticity for the easy working of the carriage, and also for allowing the necessary oscillation of the front axle for running over uneven surfaces. The sockets, together with the clips, embrace the axle and the arms for bolting the bolster to the frame pieces, and are all cast in one piece. The socket is so contrived that a single spring serves for affording the elasticity and for laterally supporting the body.

Improved Hod Elevator.

William Mullen, New York city.—This is a sliding elevator frame with top cross bar and lateral side arms, supporting, at suitable hight above the lower end of the sliding side bars, longitudinal connecting bars with forked and inclined hod-supporting pieces or carriers. The last are suitably concaved along the recessed parts for bearing the collars attached to the hod shanks, and admitting the ready swinging of the hods away from or on to the elevator frame.

Improved Heating Stove.

Edward E. Gold, Brooklyn, N. Y.—This is a fireplace heater adapted for use as an ordinary stove. The fire pot is surrounded by large vertical tubes extending through the top and bottom plate for heating air. A curtain extends from the top plate nearly to the bottom plate, between the tubes and the outside plate, for causing the heat to pass from the upper part of the fire space and the heating tubes, to which it first rises, downalong said tubes to the bottom before escaping from them, so as to heat the tubes and the air passing through them. Said heater also has a wide open front, with sliding illuminated doors, whereby it can be used for an open or closed fire.

Improved Glass Furnace.

Samuel Richardson, Brooklyn, N. Y.—The two compartments of a double glass melting furnace are made in a single stack by separating the ordinary furnace with a double partition, with an air space for keeping one side cool while the other is hot. There is a passage through the floor of the oven to a pit below, for receiving the glass which escapes from the pots, and a passage in the floor leading to the pit. By making the furnace double, it enables the temperature in one part to be lowered greatly for tempering the melted glass suitably for working properly, while a higher heat is maintained in the other for melting the glass, thus enabling the melting to be carried on in one part while the working of the glass is going on in the other part.

Improved Whip Socket.

Henry A. Matthews, Waterbury, Conn.—This invention consists of spring hooks, combined with the socket, and contrived to hook it to the dash-rail detachably. The said hooks are made of double springs of flat metal attached to side of the socke

Improved Watchman's Time Check.

Theodore Hahn, Stuttgart, Germany.—This invention consists of the arrangement of a dial in connection with a disk, rotated by the action of the keys at the various stations on a ratchet wheel at the underside of the same, to produce the forward motion simultaneously with the action of the keys on the spring-marking devices.

Improved Mechanical Movement.

Robert E. Brand, of Plainfield, N. J.—This is a mechanical movement by which rotary motion may be readily transmitted from the driving wheel of a machine to an upright shaft placed in position under any angle of the quadrant, for the purpose of being used in hat ironing, polishing, and similar machines.

Improved Apparatus for Loading Cars and Vessels.

George Barclay, Fayette, Mich.—In carrying the freight up an inclined plane, the forward wheels run from the machine on to a platform, while a raised or curved portion of the track prevents the rear wheels from following. When the truck reaches the top of the incline, the rope ceases to draw it forward, and after it is discharged the rope will tip down the back end to allow the forward wheels to regain the track.

Improved Machine for Rounding Leather.

Laken D. Williams, Bethel, Ky, assignor to himself and James E. Letton, same place.—One of the two standards is made low, and to it is hinged a bar, the ends of which are bent downward nearly at right angles to meet the ends of the posts. The other end of the bar is rabbeted upon both sides to form a tenon, which enters a vertical slot formed in a higher post, where it is secured by a key. The journals of an upper roller revolve in half bearings in slots in the bent-down ends of the bar.

Improved Windlass Water Elevator.

George G. Howe and Silas L. Heywood, Faribault, Minn.—The invention consists in a chain wheel, formed with a double rim, connected by cross bars, and having alternate high and low ribs or lugs formed upon its sides, and arranged in pairs, to give a zigzag direction to the chain. There is also a double pawl, arranged with a ratchet wheel attached to the shaft that carries the chain wheel, to cause the said pawl to be shifted by the tilting buckets. To the upper edge of the buckets is attached a metallic ring cap, to prevent the mouths of the buckets from being worn by the wire, and to cause said buckets to move more readily when being tilted.

Improved Railway Car Brake.

Moses P. Kimball, Randolph, Mass.—Two sleeves work loosely upon the axle. Upon one end of the sleeves is formed a part of a friction clutch, the other part of which is attached to and revolves with the axles. By this construction, when the sleeves are moved up to the clutch, they will be revolved by friction, and will wind up chains applying both brakes.

Improved Lock Spindle.

Albert Kirks, Canton, Ohio.—This invention is a combination of a spindle having a double conical form at or about the center, and recessed laminæ of the safe door with elastic packing rings, applied to said spindle on opposite sides of the point of largest diameter. This prevents breaking open the safe by introducing gunpowder in the door.

Improved Horse Hay Rake.

Samuel G. Hurlbut, South Union, Ky.—The heads, to which the spring tines are applied, are pivoted to a rock shaft, operated by a lever mechanism, so that the tines may be raised and the hay dumped by the driver. The rock shaft is provided with guide plates, so that the heads may be thrown to either side of the shaft. A stop flange, at the rear end of each guide plate, defines the angle of greatest inclination of heads and rock shaft, while a spring pin and hand lever, operated by the driver, locks in perforations of the guide plates and secures thereby the heads and tines at any suitable angle to the rock shaft.

Improved Nut Lock.

Finis L. Bates, Carrollton, Miss.—This nut has a screw thread which does not extend through the nut, but acts as a smoother to cut the outer threads from the bolt and bind the nut.

Improved Device for Multiplying Motion.

Francois Marie Eugene Helmer, Nancy, France.—This invention consists in a means for multiplying motion by utilizing the increased velocity of a secondary rotation produced in a sliding connection moving on one side in a guide attached to an actuating axis, and on the other in a guide at right angles to the first, upon an axis placed in a different plane from the first. The sliding connection is of such construction as to keep the two guides at the same angle to each other, by means of which the two guides revolve in the same direction with the same velocity. The connection also runs a circumference, the diameter of which is the distance between the axis of the two guides, and with a velocity twice that of the said guides and actuating shaft.

Improved Heel-Polishing Machine.

Charles H. Helms, Poughkeepsie, N. Y.—Upon vibrating a bar back and forth, arms are moved over the surface of an arch, which gives the polishers a corresponding motion on the heel. The heel is raised up to the polishers, when the shoe has been affixed to the slide, by means of a foot lever. The arch and arms are heated to a high temperature, and the polishers are raised to the desired temperature by heat conductors therefrom. The heel is held rigid while receiving the polish.

Improved Rock Drill.

William Hoar, Floyd, Iowa.—The main portion of the drill is attached to the shank by means of a socket and screw. A section has a long mortise and a wing on each side, secured by a tenon, which extends half way through the mortise, and fills it in length and width. Through each of the wings are two mortises, which receive each a gib and key. The outer ends of these mortises are made angular, and the gibs are made to fit, so that they cannot work longitudinally when the keys are driven, while angular portions serve to hold the two wings together. The wings as well as the main part have each a cutting edge with right-angled lips.

Improved Ironing Machine.

George Francis Parent, Rockport, Tex.—The ironing board is arranged to reciprocate in ways, said board having one end connected by a chain to a drum, and the other end similarly connected to another drum. The chains pass over a guide plate, which keeps them from interfering with the driving shaft. These drums are mounted on a tilting frame. Stops alternately strike a lever on opposite sides, tilt the frame so as to bring first one pinion and then the other into connection with a spur wheel. The iron is connected to arms mounted on a post, so as to move up and down to some extent, and has a spring and a lever to pull it down and press it on the board, and also a cam lever, to raise it and hold it by a button.

Improved Sewing Machine.

Chaim Groubman, Odessa, Russia.—The needle bars are connected with an actuating rock shaft by means of a wrist pin and vibrating arm, the latter having a slot in its free end in which the pin works. The object of the invention is to distribute the wear or friction incident to such connection of the needle bar and rock shaft arm over a larger surface, and to furnish a guide for the needle bar in its reciprocating movement. Two rectangular blocks are pivoted on the pin of the needle bar, one of which slides vertically in a groove of the head of the machine, and the other in the slot of the arm of the rock shaft.