CASTING A FIVE HUNDRED TUN ANVIL.

At Perm, a town situated on the banks of the river Rama, in the northeastern part of Russia, there is a gun factory, belonging to the Russian government and erected for the purpose of manufacturing cast steel guns of large caliber. Owing to the increasing requirements of the work carried on, it was found necessary to substitute for the 15 tun hammer ordinarily employed, a large double-acting 50 tun machine, calculated, when using top steam, to be equal in effect to a single-acting 100 tun hammer. To form the anvil block, the molding of a solid mass of iron, 500 tuns in weight, was necessitated, and the annexed engravings and following description, condensed from *Engineering*, explains how the operation was performed.

The geological characteristics of the ground selected for the erection of the hammer were first examined, and after passing through various strata of clay, sand, and boulders, a dense slate, capable of resisting a pressure of 680 lbs. to the inch, was reached. This was selected as a foundation, and the excavation was performed by the aid of a watertight caisson and compressed air. After the slate had been penetrated to a depth of 7 feet, two cross layers of heavy larch beams were laid and covered with tar and felt. Then came three courses of sandstone masonry laid in cement, *n n*, Fig. 1, each block weighing from 16 to 19 tuns. This change of wood and masonry was repeated twice, and the whole ultimately covered with a double course of larch beams, upon which the anvil block was to be placed. The construction of the hammer building (a tower-like edifice, consisting of an iron roof supported by four iron pillars) and of the adjoining structures was next finished, and the preparation for the casting of the great block were begun.

The latter has the form of a prism with a base 16½ feet square and 5 feet high, joining a pyramid 9 feet high, with a top 9 feet 8 inches square. The cubical contents of the mass are, therefore, 2,700 feet. To compress the iron on the top of the anvil block, it was decided to cast the same upside down, and hence two trunnions, *g g*, were provided, upon which it could be turned to its proper place after having cooled, and which also served as inlets for the molten iron. The block was cast on the top of its definitive foundation; and after the casting pit had been well dried and warmed, the molding itself commenced. First a framework, *i i*, of vertical cast iron beams covered with iron plates, and strongly braced, was erected at the sides of the pit. The hollow space in this structure was filled with molding sand. Four layers of common brick, provided with flues for the escape of gases, were placed at the bottom of the mold, then four courses of fire brick, *p*, the three upper layers forming an inverted arch. A mixture of fire clay and quartz served as filling material. Lastly came three more courses of large fire brick, the space between the latter and the iron framing being rammed with molder's sand. The pinions and channels for the liquid iron were similarly molded.

Fig. 1.

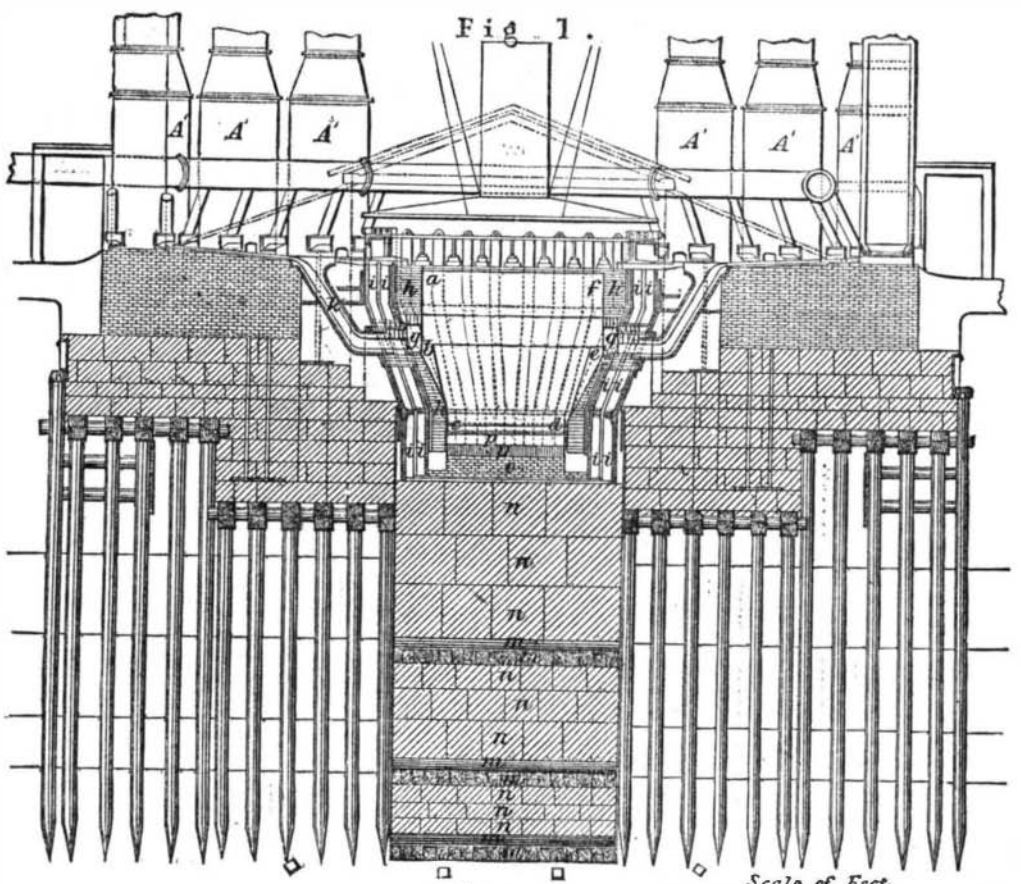

Fig. 2.

THE GREAT ANVIL AT PERM, RUSSIA—PLAN AND SECTION.

While this operation was progressing, fourteen Mackenzie cupolas, A', were erected around the mold and to supply them with the necessary blast of 4,000 cubic feet of air per minute, anthracite coal being mainly used, three blowing engines were used, of different construction, having, however, cylinders respectively 6½ feet, 6 feet, and 7½ feet in diameter, and making from 21 to 28 revolutions per minute; and 255,360 lbs. of fuel and 1,786,400 lbs. of pig iron were prepared. Within an hour after the cupolas were lighted, the three blasts being turned on during that period successively, the iron began to melt, and the first tapping took place. The work began at 3:45 A. M., and by 3 P. M. 880,000 lbs. of iron had entered the mold, reaching a hight of 10 feet from the bottom. By 7:21 in the morning of the following day, the whole operation was over, the cupolas having been cleansed and filled three times, and only ten of them being used toward the end.

After a lapse of two days, a thin crust appeared on the surface, and the iron underneath was found to be under a state of compression by the contraction of the cooling surface, so that, instead of forming the well known phenomena of hollows, the iron came bubbling up through the pierced holes. After the lapse of two months, the mass was cool enough not to affect zinc, while it melted lead inserted in drilled holes. According to trials of temperature, it was found that the heat diminished at the rate of 72° Fah. per day at the outset, then at the rate of 54°, and, toward the end of the cooling, at the rate of 32° per day.

The entire work cost about $48,400, or some $96 per tun.

The difficult operation of turning the anvil block was successfully accomplished in the month of October last by Mr. Woronzow, the engineer in charge of the factory. The great mass was revolved on its journals, by two steam engines, within two hours and a half.

To Make Paper Transparent.

The best kind of paper is the class known as wove, not laid, paper. A varnish formed of Canadian balsam dissolved in turpentine supplies an excellent means of making paper transparent. The mode by which we succeeded best was to apply a pretty thin coating of this varnish to the paper, so as to permeate it thoroughly, and then give it a good coating on both sides with a much thicker sample. Keep the paper warm by performing the operation before a hot fire, and apply a third or even a fourth coating until the texture of the paper is seen to merge into a homogeneous translucency. Paper prepared in this way has come nearer than any other to our ideal of perfection in transparent paper.—*British Journal of Photography.*

THE SOLAR COUNTER.

A curious invention, the device of Abbé Allegret, has recently been introduced in the *Jardin d'Acclimation*, in Paris. It is an instrument which indicates how long the sun shines (months, days, hours, or minutes), during any given period. The machinery operates only when the sun is visible, and transmits its movement to three dials which, connected together in a simple manner, show months, days, hours, and fractions of the latter.

The essential part of the apparatus is two balls, one of which is black and the other yellow, fastened on opposite arms of a lever, which is sustained by a central pivot. When the sun shines the black ball absorbs more heat than the yellow one, and hence the vapor of the liquid contained in the former is elevated to a higher temperature than that in the latter; consequently the fluid travels through the lever from the first ball to the second, which, becoming heavier, overbalances the equilibrium, and in so doing sets free a weight attached to clockwork mechanism connected with a pendulum. When the sun is obscured, the liquid resumes its normal position, and the arms of the lever once more balance, arresting the fall of the weight.

In addition to the three dials above noted, there is a fourth, which is combined with mechanism which shows how many clouds pass before the sun, how frequently, and the exact time they take in making the transit. This consists of a narrow band of paper extended on a light circular frame established around the face of a clock. The latter is actuated by the ordinary machinery. Its single hour hand carries a pencil. When the sun shines, the paper, on its movable frame, is carried up to the pencil through mechanism connecting with the motor already described. The leaden point then traces a portion of the circumference corresponding to the divisions on the face of the clock passed over by the hand. If, however, a cloud passes before the sun, the movement of the lever, regaining its balance, withdraws the paper circle from the pencil, leaving a blank, the length of which shows the time during which the sun was screened. A single band of paper will last for a month or more, as the hour hand is made in two parts, screwed together, and so combined that, at every revolution, the outer portion passes under a fixed rack so that the screw head is slightly turned, thus elongating the arm and causing the pencil to begin its mark on a fresh portion of the paper.

In connection with the apparatus the inventor has established a sun dial which strikes the hours, a paradoxical operation accomplished as follows: At every hour mark on the dial plate is fixed one of the ball and lever mechanisms that we have above described. When the shadow of the style arrives at any hour, one ball is shaded, the lever tilts, and clockwork mechanism, of simple construction, strikes the hour on a gong.

We should imagine that the solar counter might be of considerable use in extended meteorological observations. A large superficies of territory, for instance, might be provided with a number of these instruments distributed at equal distances apart, from which telegraphic communication might be established to a central station, and thus, say every twenty-four hours, the period of sunshine, for all the points of observation, might be known. From this could be ascertained the course of the atmospheric currents; and further, by noting the amount that the sun has warmed the soil and atmosphere of countries more or less temperate than our own, we might be able to predict either milder or colder weather, through the effect of the condensation or dilatation of the atmosphere in such regions, and the consequent effect of such upon that of our immediate territory. The knowledge of the direction and number of clouds (which exercise a notable influence upon the temperature), coupled with that of the direction of the wind currents, would also offer new elements of observation of considerable practical value. Finally, as the autumn is warmer in proportion as the sun has shone more or less during the summer, transmitting more or less heat to the soil, the solar counter would serve to indicate approximately the yield of fruit and other crops to be expected.

An Hotel on Wheels.

The American carriage and wagon builders have a world-wide reputation for light work, says the *Carriage Monthly*; and as our cousins across the water have repeatedly stated that we carry this idea of lightness to extremes, we are now prepared to inform them that we can build also an occasional heavy vehicle. To Philadelphia, justly celebrated for light work, please remember to give the credit for building the heaviest heavy carriage on record. The following dimensions will be sufficiently startling, but we can vouch for their correctness, inasmuch as we have seen the drawing and copied the sizes.

DIMENSIONS OF BODY.—Length: 50 feet; width: 20 feet; hight: 16 feet. The carriagebody is two stories high. The first story is 8 feet in the clear, and the second story 7 feet exclusive of the arch of the roof, which at the center gives 8 feet head room. Entrance is provided for at the front and back ends. The roof has ventilators similar to a street car. There

are 16 arch top windows, on each side, 8 below and 8 above. Those in the first story are 2 feet 6 inches wide, and 4 feet 9 inches high. and in the second story, 2 feet 6 inches wide, and 4 feet high. They have each two sashes, which are arranged to be raised and lowered. Those in the first story are divided into four lights each, and those above into two lights each. The upper windows areprovided with shutters or blinds The immense body or house, whichever you please to call it, will be hung upon platform springs, which will be of in all sufficient strength to support 25 tuns weight. The wheels will be 8 feet 2 inches and 4 feet 4 inch es in diameter respectively. Hub: 18 inches in diameter; felloes: 9 inches on the tread, and 6 inches deep. The Brobdignagian wagon is intended for hotel purposes during the Centennial Exhibition. The first story will be used as a dining saloon, and the second story will contain 16 staterooms, with 2 berths in each. It is proposed to place this portable hotel somewhere on the exhibition grounds, there to remain stationary until the close of the exhibition. The gearing or carriage part will have no other labor to perform than to support the body in going to and from the exhibition grounds.

ASTRONOMICAL NOTES.

At a recent meeting of the Royal Astronomical Society, Mr. Burton, who was for two years an assistant to the Earl of Rosse, stated that, during that period, there had only been three hours of what might be called excellent definition for the great six-foot reflecting telescope. In general, they had to use the three-foot reflector for their observations.

With this instrument, on one occasion, during exceptionally fine weather, he had been able distinctly to detect that the fine markings on the planet Mars were composed of a texture resembling the stippling of a mezzotint engraving. On no other evening had the definition been sufficiently good to recognize the same details.

We hope that our Washington astronomers will turn the great refractor towards the planet when occasion offers, and let us know how the markings which Mr. Burton speaks of appear in that instrument.

Spots on the Sun.

The students of Vassar College report as follows:

Our record is from February 17 to March 14 inclusive. The period has been marked by an unusual degree of change in the spots. Between the noon of February 17 and that of February 18, two small ones near the center disappeared and a new one appeared. On February 20 a pair of spots were seen, a little to the east of the center, which seemed to have been formed by the division of one spot noticed on February 18. A new small one had also appeared, a little past the center. The next observation was made on February 26, when a good sized group was seen east of the center, and on February 28 the largest member of this group showed an umbra of peculiar shape, resembling a palm leaf. On March 2 the stem of the leaf had apparently separated and formed a new spot close to the first. Considerable changes had taken place since February 28. One circular spot, which on that day was on the eastern limb, had disappeared. March 3 showed a new spot to the west of the center, and between March 3 and 4 there was a still more decided change. Two groups, which on the 3rd were small, had resolved themselves into several spots, and a new group had appeared below the center. On the 4th two photographs were taken eleven minutes apart, and there were indications of change in the spots even in that short time. Owing to cloudy weather no observations were made after March 5 until March 14, when the spots were unusually large.

Faculæ were noticed February 17, 18, and 20, and March 5.

Joseph Harrison.

We hear, with regret, of the death of Joseph Harrison, of Philadelphia, Pa., well known in engineering circles as one of the greatest American mechanics. Born in 1810, he showed proficiency at a very early age, and served as apprentice, journeyman, and foreman till he was 25 years old, and was then in the employ of Garrett & Eastwick, in Philadelphia, where he designed and built a locomotive. This was in the year 1835, and the business increased so fast (after the then unworted achievement) that he was taken into partnership. Some agents of the Russian government soon afterwards suggested to Eastwick and Harrison that one of them should go to Russia, where the government was about to invite proposals for the whole of the rolling stock for the great railway, 400 miles in length, from St. Petersburgh to Moscow. Mr. Harrison went to St. Petersburgh, arriving there in 1843, with the remainder of $500 in his pocket, Mr. Thomas Winons, of Baltimore, who had gone there to superintend the working of a locomotive, uniting with Mr. Harrison in making proposals. The contracts were ultimately awarded to them, under the firm of Harrison, Eastwick & Winans. They constructed 162 twenty-five tun locomotives; 2,000 eight-wheel cars; 500 eight-wheel platform cars; 70 eight-wheel passenger cars on the American plan; 6 eight-wheel post cars; the total of the contract amounting to $3,000,000. All this work was constructed in government shops, at St. Petersburgh, by Russian workmen, and was completed in five years. Mr. Harrison's high personal character obtained for him the means of carrying out this large contract on his very small capital; and after this great success and many others, he returned to Philadelphia in 1852, since when his greatest work has been the production of the Harrison boiler, one of the most highly esteemed of several inventions which defeat the danger by explosion of boilers by building them in sections.

He also introduced into Europe the American drop bottom cupola, for iron smelting, the smelters having previously, at the end of the heat, pulled the slag, etc., from a small door or the tap hole, instead of dropping the bottom as is now done. He patented the equalizing beam for distributing equally the weight of the locomotive on the drivers, and the Harrison stub end (without keys) for the connecting rods. He designed and first used the tool for boring both the crank pin holes at right angles at the same time, thus doing the work mechanically correct as well as much cheaper.

The integrity and moral courage of this eminent man laid the foundation of his success and his great fortune; and those who knew him, whether as a husband, father, son, friend, or citizen, will sincerely mourn his death.

Shell Heaps in Maine.

At a meeting of the New England Historic-Genealogical Society, held a few days ago in Boston, Professor Rufus K. Sewall, of Wiscasset, Me., read an interesting paper on the ethnological remains and shell heaps at Damariscotta. He prefaced his essay, says the Boston *Globe*, with a very graphic description of the inlets and bays along the coast in that vicinity, as well as a review of the discovery of that region, with extracts from letters written at various dates by the early explorers. He exhibited several specimens of oyster shells, as well as pieces of pottery, found in large quantities at the head of the Damariscotta River. The shells, he said, must have been piled there by a people who lived previous to any period of history referred to by documentary or traditional testimony. Skeletons were found at various points along the seaboard; but while several fragments of utensils for the performance of household work were found, no darts or spears seem to have been discovered. From the data at his disposal, the lecturer deduced the following conclusions: First, that there were oysters along the coast of Maine in the early ages of this country, and the shell heaps were piled up by human hands; secondly, the site of these huge deposits was the home of a primitive population; thirdly, these inhabitants were a domestic people, they cooked their food in a manner which bespoke civilization; fourthly, they had clear perceptions of the utility of mechanical appliances; fifthly, there were successive races in these localities, the latter of which were more nomadic than their predecessors, and lastly, these settlers came from eastern countries. He cited several additional facts in support of these theories, and closed with a summary of the proofs adduced, from which he claimed that it was clear that the aboriginal inhabitants of Maine came from the East, and brought with them the civilization which then prevailed. Mr. Kidder, a member of the society, made a few remarks in which he controverted several of the theories advanced by Mr. Sewall. He said that shell heaps, similar to those at Damariscotta, were found all along the coast from Canada to Florida. Professor Morse, of the Essex Institute, also bore testimony to the existence of such deposits at various points in this country, the exact counterparts of some discovered in Denmark.

DECISIONS OF THE COURTS.

Supreme Court of the United States.

GLYCERIN PATENT.—ROLAND G. MITCHELL *vs.* RICHARD A. TILGHMAN.

[Appeal from the Circuit Court of the United States for the Southern District of New York.—October Term, 1873.]

On the 3d of October, 1854, letters patent were granted to the complainant for a new and useful improvement in processes for purifying fatty and oily substances of animal and vegetable origin, and which contain glycerin (glyceryl) as their base. His invention, as the patentee states, consists of a new and improved mode of treating such substances in order to produce fat acids and solution of glycerin, which, as he says, was not known or used before his application, and the recital of the patent is that it shall take effect from the 9th day of January preceding the date of the instrument.

By virtue of the said letters patent, as the complainant alleges in his bill of complaint, he acquired the exclusive right to make and use the described improvement, and to vend the same to others to be used; and he also alleges that the respondent, prior to the time when the bill of complaint was filed, without his licence and in violation of his rights, engaged in making and using his patented process, and that he, the respondent, intends to continue to make and use the same, as set forth in the bill of complaint.

Service was made and the respondent appeared and filed an answer setting up several defences, as follows:

1. That the complainant, on the 9th of January, 1854, was not the original and first inventor of the improvement described in the said letters patent.

2. That the result described in the specification and claims of the patent cannot be accomplished, so as to be practically useful, by the method and apparatus described in the specification.

3. That the respondent never practiced or used the patented process of the complainant as charged in the bill of complaint, or in any other manner. He admits that he is engaged in manufacturing candles, and that in manufacturing such articles he uses water and steam at high temperature, and that he also uses such pressure as arises from the expansive force of hot water or steam in a close vessel; but he denies that he uses any such method, process, or apparatus as those described in the letters patent of the complainant.

4. That the patented processes described in the specification were well known to chemists and men of science and to manufacturers long before the alleged invention of the complainant, and were also used and practiced by them, and were described in printed publications before the complainant filed his application for a patent.

5. That the use of a close vessel of sufficient strength to resist the pressure of water when heated, or any pressure needed when using water to decompose other substances, was known to, and practiced by, men of science and manufacturers in this country and elsewhere long before the alleged invention; that highly heated water, when used as described, is an elementary principle open and free to all, and that such a principle is not one that is subject to a patent; that a prior knowledge of the alleged invention was possessed by many other persons, and that the same was described in many printed publications, as fully set forth in the answer.

On the 23d of November, 1867, the patent of the complainant was extended for seven years from the expiration of the fourteen years for which the original patent was granted. Subsequently, to wit, on the 6th of March, 1871, the complainant instituted a second suit against the respondent, founded upon the extended patent, which is No. 340 on the calendar. Both cases were heard at the same time. Suffice it to say, in respect to the latter, that the pleadings, issues, and proofs in the two cases are substantially the same, and that the latter must be disposed of in the same way as the preceding case.

Decrees were entered in these cases, respectively, in the circuit court in favor of the complainant, each of which must be reversed.

The decree in each case is reversed, with costs, and the cases are, respectively, remanded, with direction to dismiss the respective bills of complaint.

The Court held substantially as follows:

The claim in every patent must be construed to be limited to the method or process described in the specification.

A claim in these words, "The manufacturing of fat acids and glycerin from fatty bodies by the action of water at a high temperature and pressure," interpreted on reference to the specification to mean a process for decomposing fats, and converting them into oleate, margarate, and stearate, and a solution of glycerin, by, among other measures, mixing the fat thoroughly with one half or one third as much water by means of a perforated piston forced through the mixture back and forth, and by subjecting it for ten minutes to the temperature of from 510° to 612° Fah., in a close vessel capable of resisting the consequent pressure, and which is filled by the mixture, and into which nothing else is admitted.

Thus interpreted, the claim is not infringed by a process consisting of mixing melted fat and water by forcing the water up through the mixture, and spraying it over the top whence it settles through, and by subjecting the mixture for several hours in a close vessel to such a heat that the pressure equals that of from ten to twenty atmospheres.

Dictum. A newly discovered principle or property of matter may be patented provided a new and useful result has been obtained from the application of it, and the specification describes how the result is to be obtained.

Dictum. A patent is invalid if the result which is predicted cannot be obtained by the means described.

Dictum. Or, if the process cannot be performed without da to the operator.

NEW BOOKS AND PUBLICATIONS.

THE PRINCIPLES OF CHEMISTRY AND MOLECULAR MECHANICS. By Dr. Gustavus Hinrichs, Professor of Physical Science in the State University of Iowa, etc. New York: B. Westermann & Co.

It has been stated by a modern savant that the science of mechanics is universal, ultimate, and all-including, and that chemical action is as certainly a matter of mechanical arrangement as are light, heat, and electricity. To this view modern research is constantly tending, and the current literature of the schools is beginning to recognize recent progress in this direction. The book now before us is a compendium of what has already been discovered and laid down in the form of general laws according with the above mentioned theory, and is a most valuable contribution to our higher scientific literature, which we cordially commend to our readers as worthy of attentive study, and as a most excellent text book.

INSTRUCTIONS IN MODERN AMERICAN BRIDGE BUILDING, with Practical Applications and Examples, Estimates, and Tables. By G. B. N. Tower, formerly Chief Engineer in the United States Navy, and Chandler Instructor in Civil Engineering at Dartmouth College. Illustrated. Price $2. Boston: A. Williams & Co., 135 Washington street.

A handy little book, full of information clearly and concisely expressed.

THE UNITED STATES LAW DIRECTORY FOR 1874, containing the Names of One or More Reliable Law Firms, Banks, and Real Estate Agents in each of the Principal Cities and Towns of the United States and Canada.

We have here a portly volume, compiled with great care and considerable labor. Each State has a section of the work devoted to it, which is preceded by a digest of the laws and court calendar. The work is revised and reissued annually, and deserves the attention of the legal profession on account of the information it contains concerning all parts of the United States.

THE SECTORIAN SYSTEM OF RAND RAILING, Elucidating the Whole Subject by Fifteen Plates. By William Forbes, Architect. Price $5. New York: A. J. Bicknell & Co., 27 Warren street.

This work exemplifies a new method of laying out stair and other railings, by the use of a sector, which the author describes as "a mathematical instrument founded on Euclid I, 6, and adapted to this system." The tool can be readily made by any workman; and the system, admirably illustrated and described in the book before us, will, no doubt, soon be put to a practical test.

Inventions Patented in England by Americans.

[Compiled from the Commissioners of Patents' Journal.]

From March 10 to March 12, 1874, inclusive.

BREECH LOADING FIRE ARMS.—B. Burton, Brooklyn, N. Y.
DRYING BONE BLACK.—P. Farley, New York city.
GAS MANUFACTURE.—D. Davison, New York city.
GRIPPING TOOL, ETC.—D. L. Kennedy, New York city.
HOISTING DOOR, ETC.—J. W. Meaker. Detroit, Mich.
HOSE COUPLING, ETC.—D. Ashworth, Wappinger's Falls, N. Y.
ICE MANUFACTURE, ETC.—S. B. Martin, San Francisco, Cal.
METAL BOOT SOLE.—J. A. Punderford, New York city.
ORDNANCE.—N. Wiard, Washington, D. C.
ORGAN STOP.—T. Winans, Baltimore, Md.
PROPELLING BOATS AND CARS.—T. J. O'Toole, Brooklyn, N. Y.
PUMP.—W. J. Silver *et al.*, Salt Lake City, Utah.
STEAM GENERATOR.—W. E. Kelly, New Brunswick, N. J.

Recent American and Foreign Patents.

Improved Millstone Driver.

Moor Holden, Cincinnati, O.—This invention relates to an improved form of sockets and bushings in one piece or casting which are embedded permanently in the eye of the runner, and which operate to balance and drive the same, while serving as an inlet for the grain. The improvements are designed to combine in the most perfect manner the advantages of easy and certain feed with a firm yet delicate poise of the runner, whereby the latter is enabled to readily accommodate itself to the face of the bedstone without binding or raking, and, consequently, without loss of power or the liability to overgrind, scorch, or "kill" the flour.

Improved Fertilizer.

George J. Popplein, Baltimore, Md.—This invention consists in a fertilizer made of phosphate of lime and powdered tripoli in mechanical mixture.