veins of pure quartz in the rock, often gives out and has to be repaired. Owing to the restricted area of the tunnels and galleries, the work of excavation was almost exclusively that denominated heading, without the advantage of enlargement. The rock, after being blasted, was lifted by hand into a box resting on a truck car, which was run down to the place upon a rail track, and thence drawn by a mule to the shaft, where the box was hoisted by a derrick and its contents emptied into the dump cars, to be rolled away and deposited in the pile. Calling the cost of blasting and removing one cubic yard $1.00, the following gives the proportion of each item of expenditure:

Blasting	0.46
Transporting rock to shaft	0.17
Hoisting	0.0328
Dumping	0.0203
Pumping	0.1087
Incidental	0.2132
	$1.00

The work of excavation having been finished, the drills were set to work perforating the roof and piers with holes to receive the final charges which are to explode the mine. These holes were made from two to three inches in diameter, and from six to ten feet apart, and their average depth was about nine feet. The size of the holes and their direction and distances apart were made to vary according to the character of the rock to be broken. The drilling of these holes up into the roof of the mine soon increased the leakage of water into the works from 300 gallons per minute to 500, it being impossible to avoid tapping a seam occasionally. Many of the holes that were found to be leaking were plugged up temporarily, and the leakage thus reduced. The outside gallery and the No. 4 heading were deepened so as to concentrate all the leakage, and cause it to flow to the shaft end of that heading, where the pumps were placed.

THE COST OF THE WORK.

The following shows the amount of the appropriations made by Congress each year for the Hell Gate and East River improvement, and the whole amount expended up to the date of the last report of General Newton to the chief engineer:

1868	$85,000	1873	$225,000
1869	180,000	1874	250,000
1870	250,000	1875	250,000
1871	225,000		
1872	225,000	Total	$1,690,000

Amount expended, $1,434,129.99.

Since this report was made, Congress has appropriated $250,000.

Total amount of appropriations to date	$1,940,000.00
Total amount expended to August 1, 1876	1,686,841.45
Estimated cost of completing the entire work of improving Hell Gate and the East River	5,139,120,00

Care has been taken to test the various kinds of explosives. Up to the middle of 1874, nitro-glycerin had been principally used for blasting purposes. Several hundred lbs. of mica powder were then tried, some giant powder, several thousand lbs. of rendrock, and later considerable vulcan powder was used. All of these are nitro-glycerin compounds. Neither of them was found to be as powerful as the glycerin itself; but it was repeatedly demonstrated that, with 10 ozs. of rendrock or vulcan powder, they could break as much rock as they formerly did with 8 ozs. of nitro-glycerin, while the cost per lb. was less than one half that of the glycerin.

THE FINAL EXPLOSION.

The blast is to be effected by 96 batteries of 10 cells each, which are to be placed in a bombproof structure. The cells are charged with the fluid known as electropoion and bichromate of potash in dilute sulphuric acid. The zinc and carbon plates are 4x6 inches, and oppose an area when lowered into the fluid of 40 square inches each. The cells are connected for intensity, about 42 of them forming one battery, the intensity of which is sufficient to ignite simultaneously one set, consisting of eight groups of 20 fuses in continuous circuit, equivalent to 160 fuses. There are, in all, 23 sets to be exploded by 23 such batteries. In order to ensure the simultaneous explosion of these 23 times 160 fuses, a novel apparatus will be interposed into the circuit of each of these independent sets. The apparatus consists of a gravity circuit closer, a brass pin closing the open circuit when the batteries are lowered down, after the charging of the mines is finished, by dropping into a cup filled with mercury, both brass cup and pin being part of the circuit. It is understood that there are 23 brass pins and as many mercury cups in the instrument forming the circuit closer. The simultaneous explosion of all the mines will hence, if no accident changes the programme, be accomplished in the following way: After the wires are connected with the poles of the battery, and the brass pin and cup respectively, the plate containing the brass pin is to be lifted and held by a cord containing the fuse, the destruction of which, by a separate battery, will cause the closing of the circuit by the contact of the brass pins with the mercury in the cups, and the explosion must follow. It is appointed to take place on Thursday, September 21.

Discovery at Pompeii.

A discovery has been made at Pompeii, consisting of a number of objects of gold and silver, and close to them the carbonized skeletons of two men, who would seem to have been borne down in the storm of ashes while endeavouring to escape with their valuables or plunder. Among the articles found are eight rings, six pieces of money, two pairs of earrings, two large armlets, each ornamented with thirteen pairs of half globes, with little shells upon them, held together by chainwork, and a necklace of chainwork, all of gold; a silver ring, 332 pieces of silver money, a *casserole* of the same material broken in pieces, and three large bronze coins.

The city of Pompeii, it will be remembered, was completely buried up in the year 79, nearly 1,800 years ago, by ashes from the neighboring volcano of Vesuvius. The ruins of the city were rediscovered in 1748.

CHEMICALS AT THE CENTENNIAL.

THE AMERICAN EXHIBIT.

Not only does America occupy a great deal more space with her chemicals, as with nearly every thing else, than any other country, but the display is more gorgeous and imposing. Large and handsome, we shall see whether it possesses as much intrnisic value and excites as much deep scientific interest as that of Germany, directly opposite.

Powers & Weightman, of Philadelphia, make the finest display of all the manufacturing chemists. In a little palace erected in a conspicuous spot on the transept or cross aisle, they exhibit the costly medicinal alkaloids by the bushel, and poisonous ones in quantities sufficient to destroy a city. The most beautiful things, however, that they show are two large dishes of crystallized nitrate of ammonia, the salt from which nitrous oxide is prepared. Then come beautiful crystals of caffeine, of nitrate of silver, of tartaric and citric acids, and other more common substances. In the center of this little palace is a cake of crystallized alum, as tall, almost, as a man, with openings cut through to show the beautiful interior. But these exhibitors, we shall find, are not so far ahead in the display of alum as they are in some of the more costly but less showy specimens, like lithium salts, tannate and ferrocyanide of quinine, bromide and iodide of iron, monobromide of camphor, nitrite of amyl, nitrate of cerium, codeia, prussic acid, and opium and its alkaloids, with numerous salts of each. The display reflects great credit on the enterprising firm which sent it there.

The next display on the right of this is that of Rosengarten & Sons, of Philadelphia, second only in size to that before described, and like that deriving its chief interest from the large quantities of the alkaloids and their salts exhibited. We also noticed several rare preparations, such as iodide of manganese, subsulphate of iron, sulpocarbonate of potassium and of ammonium, etc.

Adjoining this, again, is a very prettily arranged exhibit of oils in numerous tall bottles on an elevated stand. They embrace natural, mineral, vegetable, and animal oils for commercial, chemical, and medicinal purposes, and are exhibited by F. S. Pease, of Buffalo, N. Y. Next follows a good display of camphor, by William F. Simes & Son, of Philadelphia, and near this again an exhibit of paints by Charles Moser & Co., of Cincinnati, O. And here we may note, in passing, that, from the very nature of the exhibit, paints and colors, if tasefully arranged, present a pleasing sight and attract more attention than almost any other in this department. This is particularly true of the exhibit of C. T. Raynolds & Co., of this city, well known from their customary display at the American Institute.

Directly opposite to Raynolds & Co.'s is the no less attractive display of Harrison Brothers & Co., of Philadelphia. In the center rises a tall pyramid surrounded by bright mineral colors. In a case near it is a pile of wood on which are arranged the products derived from the wood by dry distillation: pyroligneous acid, wood spirits, methyl alcohol, acetic acid, white, gray, and brown sugar of lead, charcoal, etc. Then come some bones, with a group of the necessary chemicals for converting them into home-made fertilizers. There too are beautiful lakes, paints for brickwork, moist colors for paper staining, and lastly white lead, with the best illustration that we have seen of the process of manufacture known as the "Dutch method." First we have the ore, galena; then the metallic lead cut into grates, or buckles, as they are technically called; then the pots, resembling ordinary red flower pots, with the grates in them; then a bed of tan bark, in which the pots are set while the conversion takes place; and finally pots as they come from the tan, filled with white lead, still preserving the shape of the original grates, and adhering loosely to the undecomposed lead within.

Another first class display of paints and varnishes is made by John Lucas & Co., of Philadelphia, Pa. It embraces, among other things, zinc ores, spelter, white lead pots, and buckles, sugar of lead, gums, kauri, dammar, copal, shellac, etc. They exhibit some bright green paints comparing very favorably with Paris green, but claimed to be free from arsenic. They have also fitted up a miniature laboratory with sink, wash bottle, test tubes, filters, funnels, etc.

The Brooklyn White Lead Works exhibit white lead and litharge, also a few pots and buckles. Wetherill & Brothers, of Philadelphia, exhibit red and white lead, litharge, and the like. Jemett & Son make the usual exhibit of white lead, as do also some others; but the above will, we think, be found to embrace the principal large exhibits of paints and pigments.

Nearly allied to the paints are the oils; but as they possess little or no novelty, we must pass them with mere mention. Gest and Atkinson, Cincinnati, O., draw attention to their exhibit of lard, tallow, and oils, by a large boar mounted above their case. Cotton seed oil is exhibited by Boyl & Lewis, Philadelphia. The petroleum oils are fairly represented by the Aladdin Company, of Pittsburgh, Pa., Elaine Oil Company, Charles Pratt & Co., Devoe Manufacturing Company, Oleophena Oil Company, and others. Charles Pratt & Co., of New York, exhibit a model of their works at Hunter's Point, and specimens of petroleum and its various products. The model, which is on a scale of ½ inch to a foot, is very interesting, as showing not only the extent of these particular works—some eight acres—but as giving a faint idea of capital invested and machinery, buildings, and apparatus required to make the Astral oil and other illuminating and lubricating oils.

The Elaine Oil Company exhibit, under the name of petrozcene, a greenish, odorless, solid substance with crystalline fracture somewhat like paraffin This, they state, is a new product of petroleum, and exactly what it is we are unable at present writing to say. In another place the same company have a working model of an oil well with a pump run by clockwork, and this conveys a good idea of this most important branch of American industry.

One of the best displays of alum is the alum cave exhibited by the Philadelphia Salt Manufacturing Company, Philadelphia. This immense cake of alum is said to weigh nine tuns. In the same case is a large mass of cryolite, a fluoride of aluminum and sodium, chiefly imported from Greenland, this company having a monopoly of all the cryolite brought from there. They exhibit models of the Esquimaux fishing boats, and of the cabins built of blocks of ice and moss, the ice being represented in the model by blocks of wood. This company also exhibits alumina, alum lyes, chloride of calcium, and soda.

Directly opposite we see another beautiful alum cave, with its stalactites of crystals, and on either side tall monuments of concentrated alum and sulphate of alumina, while round about are large and fine crystals of nitrate of lead and other salts. These constitute the exhibit of the Tacony Chemical Works, Philadelphia.

If alum seems omnipresent in the chemical section, what shall we say of acetic acid and its salts that greet us at every turn? We have referred to it several times already in connection with other exhibits. Browning & Brothers, Philadelphia, exhibit pyroligneous acid and a series of acetates, as also dye wood and naphtha. H. J. Baker & Brothers exhibit this acid along with camphor, saltpeter, and borax. A prettier display is that of O. S. Follett, New York, of acetic acid, vinegar, chloroform, and fine large crystal masses of sugar of lead.

The Philadelphia Quartz Company make a good show of water glass, dry and in solution of various strengths, for different purposes. Its use in cleaning the cotton waste used for rubbing off machinery was forcibly illustrated by the exhibition of quantities of the waste before and after treatment with water glass.

The only exhibit of cream of tartar and argols that we saw was by the well known importers Dreyfuss & Co., New York. H. Bower, Philadelphia, exhibited the largest, if not the only, mass of crystallized ferrocyanide of potassium, also small specimens of sulphate of ammonia and the fatty acids. Savage, Keyser, & Stovell, of Philadelphia, exhibit tin salts and the mineral acids. H. D. Gray, of New York, was the only exhibitor of sulphur, which he imports and refines, our own immense sulphur deposits not yet being worked, although magnificent specimens of pure native American sulphur are to be seen in the United States Government building. When we shall be independent of Italy for our supply of sulphur is only a question of time and transportation.

Nickel salts, batteries, and specimens of nickel plating on iron, brass, and tin are exhibited here by Condit; but the display of nickel and cobalt with the ores and salts, by J. Wharton, in the metallurgical section farther north, is still more interesting.

There is no end of stale and uninteresting specialties distributed through this section, purely for advertising purposes; they are of no chemical value, although in some few cases a knowledge of chemistry has been invoked in their prepara tion. We refer to soaps, blacking, varnishes, perfumery, baking powders, mucilage, and printing and writing inks. The ink competition seems as lively as any, although one manufacturer claims to supply nine tenths or more of all the banks and offices, leaving a small field for other makers. Dr. J. S. C. Rowland, of Philadelphia, exhibits an indelible canceling ink which he claims has been adopted by the United States post office department. We omitted to mention last week an indelible black ink exhibited by Blackwood, John, & Co., London, under the name of jetoline. It consists of chloride of aniline, chlorate of potash, and chloride of the rare metal vanadium, and is in fact a kind of aniline black.

To return to the pharmaceutical and rarer chemicals, like those exhibited by Powers & Weightman and Rosengarten, we find in another part of the chemical section several very good displays. One of the largest, best mounted, and most interesting is that of Billings, Clapp, & Co., Boston, the manufacturers of the cinchoquinine which has been so much analyzed, and about which so many contradictory statements have been circulated. This firm exhibits two gallons of propylamine, C_3 H_7, HHN, one of those organic ammonias in which an atom of hydrogen is replaced by the propyl radical C_3 H_7, just as aniline, C_6H_5, HHN, is ammonia with one of the hydrogen atoms replaced by phenyl, C_6 H_5, the radical of carbolic acid. The chloride of propylamine is shown in large quantities, as are also the more common salts such as bromide of ammonium, citrate of iron pure protocarbonate of iron, bromide of potassium and sodium, bisulphite of soda (for making the hydrosulphite) valerianate of zinc, and other salts used in medicine.

Charles T. White & Co., of New York, make a good exhibit of pharmaceutical chemicals, including some very fine crystals of strychnin, valerianate of quinine, and other alkaloids. Charles Pfizer & Co., also of this city, exhibit pharmaceutical and chemical products in large and showy quantities, including refined borax and camphor. Kurlbaum & Co., of Philadelphia, exhibit camphor, cream of tartar, chloroform, mercurial compounds, and the essential oils. The finest specimen of crystallized monobromated

camphor is that exhibited by Hance Brothers & White, of Philadelphia. The rest of their exhibit, extracts and pills, belongs rather to pharmacy than chemistry. The latter statement may apply in part to the exhibit of Keasbey & Mattison, of Philadelphia; but some of their preparations, such as pancreatine, pepsine, crab orchard salts, Vichy salt, and compounds of lithia and bismuth, all on a grand scale, attract our notice.

The exhibit of Alexander Fries & Brothers, of New York, of artificial fruit and liquor essences, is particularly interesting as showing how far the chemist in his laboratory is able to imitate the natural productions of the plant. The number is very large, most of them being compound ethers derived from methylic alcohol or fusel oil, and imitate not only the flavor, but the composition, of the natural essences. The same exhibit contains a large specimen of carbamide, $CO(NH_2)_2$, a white crystaline solid, which has the honor of having been the first organic substance produced synthetically, a thing previously supposed to be impossible.

The United States Salicylic Acid Works, New York, exhibits the only specimen of American salicylic acid. The acid is both sublimed and crystalized, and compares favorably with the foreign specimens made under the immediate supervision of Professor Kolbe.

Aniline colors are exhibited by two firms only, and in such insignificant quantities as scarcely to deserve notice. The Silliman Chemical Works, of Philadelphia, exhibit six flasks holding about a quart each of as many different colored solutions of aniline dyes. The same company exhibit several other coal tar products, including the tar itself, dead oil, coke, benzol, toluol, xylol, rosolic acid, rosolate of lime, anthracene, and naphthaline: also a set of pure chemicals, designated in the catalogue as Fresenius' tests.

A much finer exhibit of coal tar products is made by Page, Kidder, & Fletcher, of this city. Besides the tar itself, they exhibit seventy-five different derivatives thereof, among which we noticed the latest product of the synthetical chemist, artificial oil of spirea or salicylic aldehyde. Professor Kolbe's discovery of a new and certain method of preparing salicylic acid cheaply from carbolic acid has caused chemists to direct attention to its ethers and other derivatives, the result being the production of artificial oil of wintergreen (also exhibited here), or salicylate of methyl, the substance which was previously the source of salicylic acid having come at length to be a product of the latter. In addition to these two new and curious synthetical products obtained from salicylic acid, we noticed the following rare and interesting scientific preparations: Benzylic aldehyde (oil of bitter almonds), pyrene ($C_{16}H_{10}$), stilbene ($C_{14}H_{12}$), chloranile, pyramic acid, pyridine (C_5A_5N), picoline (C_6H_7N), a substance isomeric with aniline yet of totally different properties, crude and refined anthracene, anthraquinone, alizarine, leucaniline, etc. A few aniline colors in small tubes are shown. One portion of this exhibit, and indeed the larger part, is devoted to creosote and its use in the preservation of timber. A model of the creosoting apparatus is shown; and numerous specimens, of wood decayed or bored by insects and wood protected by creosote, prove its efficiency.

J. Bishop exhibits a large variety of costly platinum utensils for chemical use.

E. B. Benjamin, of New York, exhibits a few chemicals, with some fine chemical glassware, in the educational department, and also in the United States government building. In his exhibit in the Main Building may be seen two of those new scientific puzzles called radiometers, which are usually in motion on a clear day, a fact not equally true of the dozen or more exhibited in the English department, by Mr. Hicks, of London.

In the exhibit of the Stevens Institute of Technology, Hoboken, may be seen a large dish of beautifully crystallized nitrate of uranium, and a full set of the other uranium salts used by President Henry Morton and Dr. H. C. Bolton, in their recent researches on the fluorescent spectra of these bodies.

There are several exhibits of gunpowder, but none of nitroglycerin, although there are plenty of the harmless materials from which it is made.

A few chemicals are met with scattered about in most unexpected places, especially in the United States government building, but the above embrace the most interesting exhibits in the Main Building.

CENTENNIAL NOTES.

A THREE HUNDRED DOLLAR HAT.

There are two exhibits in the Peruvian section which attract an unusual share of attention. The first is the hideous collection of mummies and fragmentary portions of the bodies of ancient Peruvians; and the second is what appears to be an ordinary Panama hat, until the sight of the price label, inscribed $300, induces one to examine it more carefully. Close scrutiny elicits the fact that the article is woven with wonderful fineness; and by the aid of a lens, 108 stitches, or picks, as weavers would call them, may be counted to the inch, measured radially from the center. The hat is exhibited by Juan Daste, of Monte Christo, Peru. The material is *jipijapa*, a species of palm, the leaves of which are gathered before they unfold. After the veins and other coarse portions are removed, the leaves are made into bundles and macerated in boiling, and then in cold, water until they become white. Bleaching in the shade follows and then the hats are plaited from the straw by the Indian natives of the country. For so fine a fabric as the hat exhibited at the Centennial, the above process would be too rough. The only wetting the straw receives is done by the dew, to the influence of which it is exposed. Then the braiding is done in a dark damp room; and to produce a single hat, a woman often works from five to six hours daily for three or four months. When the article is finished it will wear indefinitely, provided there be no defective straws in it. Probably the $300 hat exhibited in Philadelphia would outlast the lifetime of its purchaser, and serve as an heirloom to his descendants for years afterward.

FLEXIBLE SHAFTING.

Imagine a workman handling the nozzle of a short section of hose. In place of the nozzle, substitute an auger; and then conceive the astonishing appearance of the man directing the auger toward a block above his head, then to the floor, then sidewise in every direction, twisting the hose meanwhile into all sorts of kinks and curls, while the tool, wherever it touches, sinks into the solid material as if the latter were putty. Yet the hose does not rotate. Certainly the invention is a remarkably ingenious one, and it is as simple as it is effective. A long section of wire is made into a close spiral. Over this is wound more wire, the turns being, however, in reverse direction; then follows a third spiral envelope, and so on until suitable thickness is attained. The extremities of the flexible shaft thus formed are brazed. One end is feathered into a driving pulley; the other has a clutch for the tool. A piece of hose or other suitable covering envelopes the shaft, which transmits rotary motion to any desired distance from the source of power and through any number of curves, so that the power may be taken to the work instead of the work to the power. We were told that the device has been successfully applied to marble, granite, and other stone surfacing, polishing, and working; iron drilling and surfacing; wood boring, carving, and facing; horse cleaning and clipping; casting, cleaning, and emery grinding of all kinds. It has been tested, we learn, up to the transmission of 9 horse power.

A NEW STEERING APPARATUS.

This is exhibited in the Russian section in Machinery Hall, and is the invention of M. Nozikoff. The helm being located directly above the propeller shaft, motion is communicated from the latter by a bevel gear to a vertical shaft, which rises immediately abaft the wheel. By turning the latter in one or the other direction, one of two clutches is thrown into action, the effect of which is to communicate the motion of the vertical shaft to an ordinary hand wheel which moves the rudder in the usual way. The essential feature of the device is the mechanism whereby the power of the main engines is utilized to manœuvre the helm, thus obviating the use of the additional small engine commonly employed in steam steering gear for a like purpose.

A PAINTING MACHINE.

Everyone who has had to paint slats or laths, or like narrow work, knows that doing so is a tedious and not over easy operation. Plenty of paint is wasted in using a big brush, and to employ a small one is to throw away time. Mr. W. Roberts, of Liverpool, exhibits, in the English section of Machinery Hall, a very ingenious little apparatus which performs this work very rapidly and in a much better manner than it could be done by hand. The paint is poured into a lower tray. Above are located, first, a pair of rollers, which seize the slat and draw it in between a series of brushes, one of which paints the upper side, another the lower side, while two more cover the edges. To keep these brushes wet with paint, two wheels beside the grasping rollers rotate partially in the paint in the tray beneath. These are so grooved as to carry up the liquid at every revolution and dash it on the brushes. The machine, we learn, will paint 6,000 running feet of lath per hour, without the aid of steam power.

SWEDISH GYMNASTIC APPARATUS.

We can express no opinion as to the therapeutic value of the Swedish movement cure, other perhaps than to consider that the exercise which it provides for the muscles may be beneficial. We can express an opinion, however, on the machines employed in the various gymnastic exercises, a dozen or more of which are exhibited in Machinery Hall. Some of these are splendidly constructed; and as pieces of mechanism involving ingenious devices for obtaining odd motions, they are well worthy of study by mechanics. Some idea of what these motions are may be gained from the following brief description of the apparatus: One machine, when its handles are grasped by the patient, twists the arms, another exercises the flexor and extensor muscles of the wrist, a third pulls the arms back, a fourth exercises the knee muscles, a fifth exercises the muscles which carry the leg outward, and a sixth exercises the ankle muscles. On the seventh the patient lies down and is shaken up so that the extensor muscles of the back are exercised. Another machine is very complicated, and calculated to excite some dismay in the patient whose "thorax" (to quote the descriptive card) "is pulled upward by means of two levers, while a pad makes a horizontal pressure on the back. The trunk is thereby elongated a few inches, and the spine and walls of the chest are stretched." There is something about all this dismally suggestive of the rack. In another machine the patient is put through all the misery of horseback riding without any of the accompanying pleasures. He is seated on a saddle, and the latter then becomes possessed of a desire to shake him off. "This," we are informed, "causes the abdominal viscera to be kneaded and rubbed together against each other and the abdominal walls." There is still another machine, consisting of a couple of wheels having peripheries of padded bars. These, when revolved, serve to warm the feet, the latter being pressed against them. Lastly there is a hammering machine, which in any household might serve as a mechanical child corrector. There are a number of vertical beaters which are set in rapid vibration, so as to hammer the patient in the small of the back or at any desired point. The reader can form his own idea of the possible condition of the sufferer after being treated by so formidable a series of apparatus.

Recent American and Foreign Patents.

NEW MECHANICAL AND ENGINEERING INVENTIONS.

IMPROVED TUBING CHAIN WRENCH.

Orlando H. Smith, Kane City, Pa.—The object of this invention is the construction of a device whereby a section of the perpendicular tubing, such as that of oil wells, may be turned more or less on its axis, without danger of being cut, dented, bruised, or otherwise injured. The invention consists in joining together, by a reversible dog, a chain and hook; the latter, which is for the purpose of maintaining the hold of the chain on the pipe, has its point formed into an inwardly projecting claw, and is provided near the middle of its concavity with a slightly projecting blunt point. These projections form two of the bearing points against the tube over which the hook rests; the third is formed by the edge of the dog. To the free end of the chain is secured a ring, into which a lever is inserted when the device is to be used.

IMPROVED GRAIN CAR UNLOADER.

George M. Moulton, Chicago, Ill., assignor to himself and Joseph T. Moulton.—This apparatus is for unloading grain in bulk from railroad cars; and it consists in the employment of two sets of racks, so arranged that the first rack is operated by a crank placed on a shaft which receives its power from a convenient motor, the said rack giving motion to a pinion placed on a shaft which supports a larger wheel, that communicates a reciprocating motion to a longer rack supported on suitable frame work, and connected with drag ropes attached to scoops within the cars. The invention also consists in the peculiar arrangement of the supports for the guiding pulleys in the car. A hopper leads to the elevator leg, and is placed conveniently near the track, so that the grain may be readily discharged from the scoop into it. Two scoops are worked in each car, and a number of cars may be unloaded at the same time, and from both sides of the apparatus, by providing a number of sets of drag ropes.

IMPROVED BREECH-LOADING FIRE ARM.

Henry J. Altman, Birmingham, Great Britain.—This invention consists in a breech block, arranged to slide in grooves in the solid slides of the breech piece at right angles with the bore of the barrel, as it is carried up and down by the breech block holder. The arrangement of the lock lever is such that an accidental blow that might discharge the gun only pushes the lower end of the lock lever back and locks the trigger. Another advantage claimed is that, when the trigger is locked and the fore finger is placed upon it to discharge the arm, the said finger comes in contact with the lock lever, and can push it forward to unlock the trigger without being removed from the position required for firing the arm.

IMPROVED WATER WHEEL.

William H. Rector and Henry C. Black, Santa Rosa, Cal.—This invention consists of a reaction wheel of the S-shaped type, receiving water from the under side, and having a water tank or chamber on the shaft, subject to downward pressure of water to counterbalance the upward pressure on the under side. The chamber is packed watertight to prevent leakage.

IMPROVED NUT LOCK.

Thomas C. Conrad, Philadelphia, Pa.—This invention is an improved nut lock for rail joints, and other parts exposed to vibratory motion, the nut locks being so arranged and connected that the tendency of any one nut to work off tightens the other nuts, and that the expansion and contraction of the bolts, and change of position in the ends of rails by the difference in temperature, exert no influence upon the lock. It consists of a washer with recess for the nut to fit in slots in the circumference, and a circumferential recess at the back, along which a stiff locking wire is passed that is bent outwardly through the top slot, and then downwardly to the next washer, and around the same to the top slot, and so on.

IMPROVED NAIL-FEEDING MACHINE.

Frank Toepfer, Milwaukee, Wis.—This invention consists of a descending trough, in which the nails hang by the heads, points downward, arranged so as to drop the nails horizontally into a hopper in advance of the sliding driver. The driver is to be worked by a foot treadle, and, in practice, a number of drivers, each having an automatic feeder, will be connected to a cross head or slide of suitable form to work as many drivers as there are nails to be driven into one side of the box to be nailed, and the drivers will be adjustably connected for shifting toward and from each other, according as the nails are to be driven more or less distant from each other.

IMPROVED STEAM BOILER.

Robert M. Beck, Westminster, Md.—This invention is an improvement in the class of vertical steam boilers, and consists in a dome, flue head, and smoke box formed of one casting, and certain peculiarities of shape, whereby certain functional and economic advantages are attained. The invention also relates to a tapered cast iron fire box.

IMPROVED CAR COUPLINGS.

Richard A. Kelly, Manchester, Iowa.—The first of these inventions is an improvement in the class of automatic car couplings, and consists in a hook and draw bar pivoted at their rear ends to a swiveled cross bar, and suspended free at their front ends from a sway bar or lever which is pivoted to the end of the car, so that it may be tilted to adjust the hooks and draw bars, for coupling or uncoupling. The invention also includes a peculiar device for adjusting the said sway bar. The second invention belongs to the same class of automatic car couplings as the above, and it relates to certain peculiarities in the coupling whereby ease in working and reliability and safety in its operation are obtained.

IMPROVED WATER WHEEL.

Reuben D. Sayre, Westville, Ohio.—This invention consists of the buckets of an overshot or breast wheel, pivoted to the wheel rims so as to remain upright and hold the water until the center is reached at the bottom, when they are tilted by a cam to empty the water, by which the wheel retains all the water as long as it can do any good, and the weight can be applied farther from the center of the wheel by pivoting the buckets at the periphery of the wheel rims. The buckets are pivoted to the wheel rims at or near the periphery so as to remain upright and hold all the water as long as it is efficient, when they are tilted by a crank and cam and the water emptied, after which they return to the upright position again while ascending to the place for receiving the water, the cam being continued up to the top to prevent the buckets from tilting too far to come back again to the upright position. In front of each bucket is a cross bar, to prevent it from being overturned by the water falling into it from the spout. In practice, the cam for tilting the buckets will be constructed so as to revolve, to lessen the friction as much as possible.