

and seaworthiness the British ships are superior; but it must be remembered that the French battleships and armored cruisers would probably never operate at any distance from the Channel or the Mediterranean.

In point of personnel, if past history is a sure guide, the British fleet is superior, possessing at least equal skill and certainly more tenacity. The seamen are largely recruited from the hardy fishermen of the Britany and Normandy coasts, and to-day, as in the time of Nelson, they would doubtless exhibit the splendid qualities which were too often handicapped in the days of the frigate and three-decker by lack of dash and skill on the part of the captains and admirals of the navy.

THE KEELY MOTOR FRAUD.

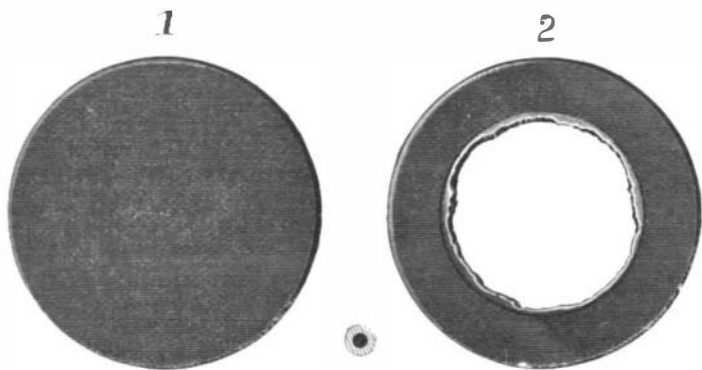
Ever since the death of John W. Keely, the fantastical collection of apparatus with which he puzzled the public, and incidentally diverted a golden stream into

tion to the Keely mania, and endeavored, we think, with considerable success, to check, if it could not wholly prevent, such obvious swindling of the public. We pointed out that all of the results obtained by Keely could be duplicated by using compressed air in suitable apparatus, and in 1884, in the case of the Keely gun, conducted experiments which proved that in this case, at least, we were correct.

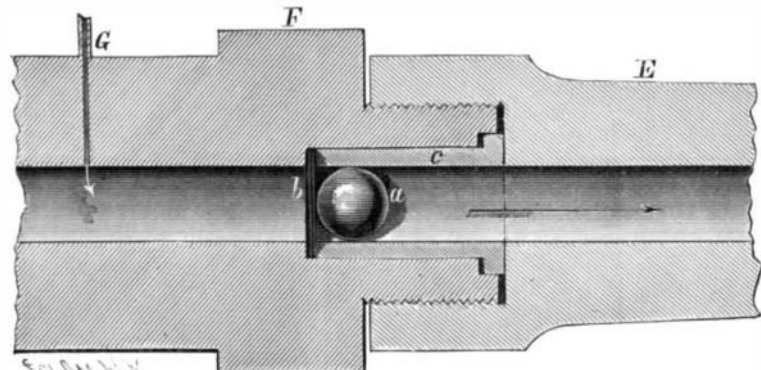
Keely had many different names for his newly discovered force, and just at the time of the famous gun experiments at Sandy Hook, he was pleased to call it "etheric vapor." Representatives of this journal were present on the occasion, and the accompanying illustrations were published in the SCIENTIFIC AMERICAN of October 11, 1884, in connection with an article exposing the trick by which the Keely Motor Company was able, in a single day, to send up its stock from nine cents on the dollar to fifteen cents, and swell its own bank account proportionately.

connected by a wire, *C* (so said Keely; the wire was actually another tube) to a second magazine, *B*. The supply from the small to the large magazine and from the large magazine to the gun was controlled by stop valves, as shown in the cut. These magazines, according to Mr. Keely, had been charged with "interatomic ether," which had been evolved by a "generator" set up in Mr. Keely's Philadelphia workshop.

In loading the gun the gas check was first placed in position and the muzzle screwed up tightly; then the ball was introduced at the muzzle and rammed home. Next the stop-cock was opened to admit the "etheric vapor" to the breech, and, after waiting a few seconds, the "vibrator," *H*, was struck with a wooden mallet, and the charge exploded, driving the bullet at a target 500 yards from the gun. Nineteen rounds were fired, and then a conical steel bullet was driven through 4 inches of pine plank placed a few feet from the gun. The noise of discharge closely resembled that caused by



GAS CHECKS BEFORE AND AFTER DISCHARGE OF GUN.



LONGITUDINAL SECTION AT BREECH OF GUN.

his private purse, has been as jealously guarded as ever it was in his lifetime. Recently the motor was removed, and the laboratory (Heaven save the mark!) in which for a quarter of a century he had conducted his so-called experiments was vacated. Whereupon Mr. Clarence B. Moore, whose mother had been the most generous of Keely's many victims, rented the premises, and calling to his assistance several gentlemen of high standing in the scientific world (some of whom, by the way, had been baffled witnesses of the Keely phenomena), proceeded to explore the premises in search of evidences of fraud.

The result proves not merely that the motor was a fraud, but that it was a fraud, as we pointed out fifteen years ago in the columns of this journal, of the very simplest and most transparent kind: in fact, the presumption is strong that this most colossal humbug of the century depended for its success upon that ever-fruitful theme of the bogus company promoter—compressed air. In the first place, hidden beneath the floor of the building was found a large and massive metal sphere, whose weight is given as three tons, and whose bursting strength under pressure is stated to be so many tons to the square inch. Apparently at one time connected with this was found, hidden in the brick wall, a quantity of small brass tubing, of just the size and strength

The "vaporic" gun used on that occasion (it was nothing more or less than an air-gun) had a spherical knob secured to the breech, from which projected a "vibrator" (!) *H*. The breech was 4½ in. external diameter, the bore 1½ in., and the total length was 3½ feet. Just forward of the trunnion, at the point, *F*, the muzzle unscrewed, this construction being adopted to permit the placing of a gas check, *b*, in position. A sleeve, *c*, with a bore equal to that of the gun, was fitted in an annular recess in the forward part of the breech, *F*.

It will be seen that when the muzzle was screwed home, the sleeve was forced in until it held the gas check firmly in place. The latter consisted of three disks, having a common diameter of 1½ inches. The two front disks were of common hard rubber, ¼ inch in thickness, while the third disk, which was placed next to the pressure chamber, was of soft rubber pack-

a common shotgun when loose powder having no ramming upon it is exploded. A small cloud of white vapor, which immediately disappeared, followed the discharge. The velocities of three consecutive shots were 482, 492, 523 feet per second. "The gun was then unscrewed," says the account of the proceedings, "the valve at the magazine was opened, and visitors were permitted to examine the 'interatomic ether' as it issued from the pipe. It had but a small trace of odor, no taste, and had no effect upon the lungs." Precisely; for there is not a question in the world but what the "interatomic ether" as it issued from the pipe was the common air at atmospheric pressure.

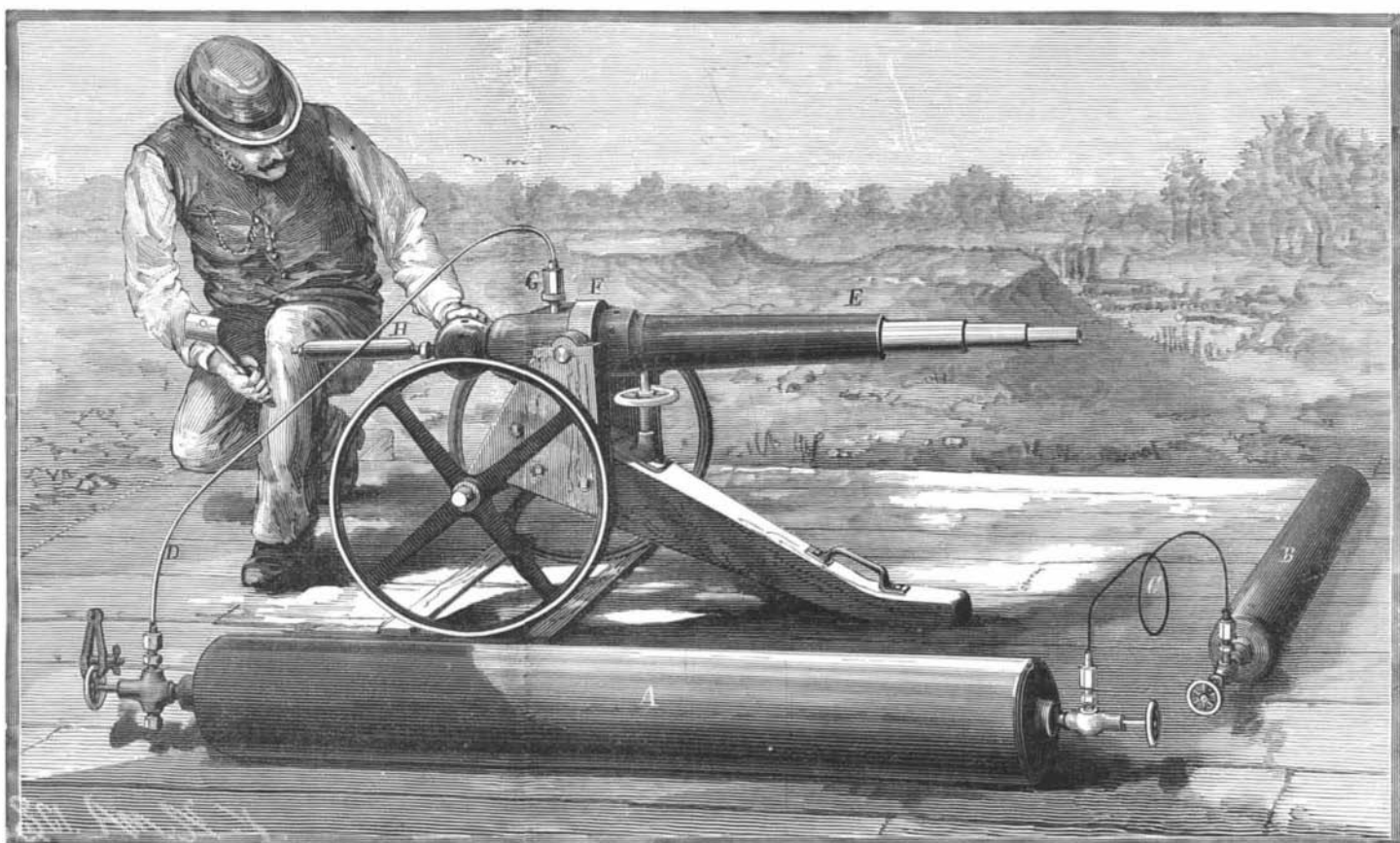
We declared at the time that the magazine, *A* and *B*, had been charged with compressed air at many thousand pounds pressure, and that when the stop-cock was opened, the air, owing to its high pressure, passed rapidly to the breech, behind the gas check, where it developed sufficient pressure to burst the check and expel the ball.

The tapping on the "resonator," *H*, had nothing whatever to do with the discharge, and was merely one of the charlatan "passes of the wand" by which this accomplished rogue bewildered his audience.

To prove the fact to his satisfaction, the representative of the SCIENTIFIC AMERICAN requested Keely to allow him to handle the wooden mallet (his purpose being to delay the tapping until after the discharge). It is needless to say that Keely refused.

Soon after Keely's gun experiments the editor of this journal conducted experiments in the same direction in New York, and an experimental gun was made of seamless drawn brass pipe of 1 inch bore and 2 feet in length, and set vertically under a skylight shaft several stories in height. A union joint was screwed to the bottom of the pipe, with a pipe connecting to a coil of about 100 feet of 1¼ inch pipe, placed beneath the gun.

A further connection was made with a hydraulic



TEST OF THE KEELY "VAPORIC" GUN AT SANDY HOOK, SEPTEMBER, 1884.

to match the strength of the steel reservoir, and corresponding to the tubing (see cut) used by Keely in his various public and private exhibitions. Underneath the upper floor of the house was found a false ceiling, well calculated to hide the necessary tubes for conveying the compressed air to the different air motors with which he produced his results; while a number of trap-doors were found scattered over the floor of this stage, from which, for a quarter of a century, this prince of humbugs played his part!

Many of our older readers will remember that from the very first this journal was emphatic in its opposi-

ing, ¼ of an inch thick. The disks are shown in full size in Figs. 1 and 2, the former figure representing the disk before discharge, and the latter after discharge. It will be noticed that the broken disk shows clearly the imprint made by the end of the sleeve. The bore of the gun was 1½ inches, and a spherical lead bullet, *a*, was used. A copper tube, *D*, ⅜ of an inch in external diameter and ¼ of an inch internal diameter, a full size cross section of which is shown between cuts 1 and 2, led the breech of the gun to the magazine, *A*, which was made of wrought iron and was 8½ inches external diameter by 4½ feet long. Another tube was

testing pump and high pressure gage. In the union joint were placed two disks of hard rubber, each about $\frac{1}{8}$ of an inch in thickness, and above the disks a lead ball, 1 inch in diameter, was placed. On the railing of the next story above was laid a target of five tiers of $\frac{1}{4}$ inch plank, directly over the range of the gun. The whole pipe being full of air at atmospheric pressure, the pump was put in operation, water being forced into the lower end of the pipe reservoir. This forced the air up through the pipe line and compressed it under the hard rubber disks. When a pressure of 1,500 pounds per square inch was reached, the disks ruptured and the gun was discharged.

The bullet passed through the $\frac{6}{8}$ inches of pine planks, making a clean cut through the first planks and badly shattering and displacing the last plank of the target, then struck and splintered a beam under the roof and rebounded to the floor. This was repeated several times, the disks bursting at between 1,300 and 1,500 pounds and showing the great power of compressed air in the discharge of the projectiles. The prestidigitator part of Keely's exceedingly small feed pipe to the chamber behind the disks and bullet, and his bogus tapping of the resonator, it is needless to say were not included in our experiment.

In conclusion we would remind our readers that the death of this prince of rogues does not imply that the type is extinct; and that "resonators," "vibrators," "etheric vapors," and others of that ilk, still walk the earth dressed in the ever-varying garb with which such human sharks as Keely are still seeking to catch the unwary.

Radium: A New Body, Strongly Radio-Active, Contained in Pitchblende.

BY M. P. CURIE, MME. P. CURIE, AND M. G. BEMONT.

Two of us have shown that, by purely chemical processes, a strongly radio-active substance can be extracted from pitchblende. This substance is near bismuth in its analytical properties. We therefore came to the conclusion that pitchblende might contain a new element, for which we proposed the name of polonium.

Our subsequent researches are in accord with the results first obtained, but, concurrently with these, we have met with a second substance, strongly radio-active, and entirely differing from the first body in its chemical properties.

Polonium is precipitated from its solution by sulphureted hydrogen. Its salts are soluble in acids, and are precipitated by water; polonium is completely precipitated by ammonia. The new radio-active substance we have discovered has, to all appearance, the properties of almost pure barium. It is not precipitated either by sulphureted hydrogen nor by ammonium sulphide nor by ammonia; its sulphate is insoluble in water and acids; the carbonate is insoluble in water; the chloride is very soluble in water, but insoluble in concentrated hydrochloric acid and in al-

cohol. It gives the barium spectrum easy to recognize. Nevertheless, we believe this substance, although in greater part consisting of barium, contains besides a new element which gives to it radio-activity, and which is close to barium in its chemical properties.

Here are the reasons which lead us to this opinion: 1. Barium and its compounds are not radio-active; also one of us has shown that radio-activity appears to be an atomic property, persisting through all the chemical and physical states of the substance. From this point of view the radio-activity of our substance, not being due to barium, should be attributed to another element.

2. The first substances we obtained had, in the state of hydrated chloride, an activity 60 times as great as that of metallic uranium (the radio-activity was measured by the amount of conductivity conferred on air in our apparatus). On dissolving these chlorides in water and precipitating a portion by alcohol, the part precipitated is much more active than the part left in solution. Taking advantage of this fact, we may, by a series of fractionations, obtain chlorides more and more active. We have thus obtained chlorides having an activity 900 times greater than that of uranium. We were stopped here by failure of material, but, from the progress of the operations, we could see that the activity would have augmented still more had we been able to continue. These facts may be explained by the presence of a radio-active element, the chloride of which is less soluble in alcoholized water than is that of barium.

3. M. Demarçay has been good enough to examine the spectrum of our substance. The results are given in a note following this. M. Demarçay has found in its spectrum a ray which does not appear to be due to any known element. This ray, scarcely visible with the chloride 60 times more active than uranium, is notable with the chloride concentrated by fractionation to an activity 900 times that of uranium. The intensity of this ray augments, therefore, with the radio-activity, and this we think is a very serious reason for attributing it to the radio-active portion of our substance.

These different reasons lead us to believe that the new radio-active substance contains a new element, to which we propose to give the name of radium.

We have determined the atomic weight of our active barium by estimating the chlorine in the anhydrous chloride. We have found numbers differing very little from those obtained with inactive barium chloride; however, the numbers for the active barium are always a little higher, but the difference is of the order of magnitude of experimental errors. The new substance certainly contains a very large proportion of barium. In spite of this, its radio-activity is considerable. The radio-activity of radium ought therefore to be enormous.

Uranium, thorium, polonium, and radium, and their compounds, render air a conductor of electricity, and

act photographically on sensitive plates. From these points of view polonium and radium are considerably more active than uranium and thorium. On photographic plates we obtain good impressions with radium and polonium in half a minute. It requires several hours to obtain the same result with uranium and thorium.

The rays emitted by compounds of polonium and radium render barium platinocyanide fluorescent. Their action in this respect is analogous to that of the Roentgen rays, but is considerably more feeble. To make the experiment place on the active substance a very thin sheet of aluminum, and on this a thin layer of barium platinocyanide; in the dark the barium platinocyanide appears feebly luminous over the active substance.

We thus realize a source of light, very faint, it is true, but functioning without a source of energy. There is here a contradiction, at least apparent, to the principle of Carnot.

Uranium and thorium under the same circumstances give no light, their action probably being too feeble. —Comptes Rendus.

A Cable Steamer for the Philippines.

The War Department has authorized the Quartermaster's Department to secure at once an iron ship of from 1,000 to 1,200 tons burden to lay cables to connect the islands of the Philippines. The War Department has already ordered 166 miles of cable, which weighs 525 tons. It will be coiled in skeleton tanks in the various holds in the vessel. It is considered very important by the government to connect the various islands of the Philippines by cable.

The Current Supplement.

The current SUPPLEMENT, No. 1204, is a very interesting number. It is begun by "The Beginnings of Plastic Art in Europe," in which some curious archaeological specimens are presented and a recent book is reviewed. "The Mineral Resources of Cuba" is a timely article. "Methods of Preparing Rubber" is an important technical paper. The work on the new buildings of the Paris Exposition is described in detail. "Acetylene," by Prof. Vivian B. Lewes, is an important and authoritative treatment of the subject. The usual three columns of notes are published.

Contents.

Contents.	
(Illustrated articles are marked with an asterisk.)	
Art critic and the tall building	50
Bacteriology, kitchen	52
Bears, strength of	51
Bogs	55
Boston elevated road	51
Brazil, American capital in	53
Civil engineers in session	51
Compressed air traction of New York	50
Dewey, recognition of	54
Element, new	50
French navy	49
Havana Electric Company	54
Inventions recently patented	60
Keely motor fraud	59
Librarian of Congress, death of	51
Medal, Manila	54
Mill, ore stamping	53
Moon, artificial	52
Navies of the world	56
Patent office business	50
Philippines, pirates and brigands	51
Pineapple fiber	52
Process, dry cleaning, dangers	54
Radium	50
Rice cultivation, Russia	52
Skates, ice	54
Steamer, cable	60
Supplement, current	60
Swiss, Dewey	54
Tea, combination	52
Trees, bread fruit	54
Typewriter, Chinese	55
Uranium	54
Wood-working machine	53
X rays, printing by	51

RECENTLY PATENTED INVENTIONS.

Agricultural Implements.

SUGAR-CANE WAGON.—MARK R. SPELMAN, New Orleans, La. This vehicle has fifth-wheels connecting the vehicle-body with the front and rear axles. A reach pivotally connects the axles with each other at their mid-dies. Frames, connected at their outer ends with the respective axles, extend inwardly toward one another; and the sides of the frames converge at their inner ends. Diagonal braces crossing each other are pivotally connected with the inner converging ends of the frames. A wagon thus constructed can readily turn in a narrow space.

PLANTER.—CHIEVER C. and LEMUEL S. CAVES, Fremont, Iowa. This planter is especially adapted for planting potatoes, and is so constructed that the potatoes are introduced whole into the planter and automatically cut into proper pieces and planted. The planter is adapted to plant two rows simultaneously. Although designed primarily to plant potatoes, the machine can also be used as a corn-planter.

Bicycle-Contrivances.

BICYCLE OR SIMILAR MACHINE.—JOHN A. KELLY, Brooklyn, New York city. The bicycle of this inventor is driven by hand-power and is so constructed that both hands can be used at the same moment for driving and steering. A shaft or bar is connected with the driving-levers and with the steering-wheel, and has endwise movement in a direction transverse to the frame of the bicycle to effect the steering. The bar or rod, in steering the bicycle, is operated by moving the propelling levers in a line transverse to their driving motion.

BELL.—ORVEY PRICE, Forty Fort, Penn. The purpose of this invention is to provide a bicycle-bell which is arranged to permit a rider to throw the bell into gear with one of the bicycle-wheels in order to sound the gong. With this end in view, the inventor has provided his bell with a revoluble wiper, and with a loose clapper adapted to pass into the path of the wiper and to be thrown outward into contact with the gong, in order to sound the bell.

CHAINLESS GEAR.—KARMELL BROOKS, New York city. The bicycle-gear of this inventor is essentially a roller-bevel-gear, the novel features of the device residing in the peculiar construction of the shaft. The device is made so that it will constantly maintain a proper relation between the driving-gears. The shaft of the gear is of spring or flexible construction, and by reason of this construction is enabled to compensate for any deflection

of the frame, and to relieve the rider of the jar experienced when riding over rough roads. A novel brake is provided, which is applied by back-pedaling.

Mechanical Devices.

ALARM CLOCK.—ARTHUR C. REICHEL, Union Hill, N. J. To provide an alarm clock with two bells, differing in sound or pitch, and arranged that both alarms may be so sounded by one spring that one bell will ring alone for a short time, and then the two will ring together for a short time, is the object of the invention. The two alarms are respectively driven by primary movement gear-wheels. A lever coacts with one of the alarms to hold the alarm normally inactive. A slotted wheel has a projected portion engaging and normally holding the lever. A collar, driven by one of the gear-wheels, has a finger coacting with the slotted wheel, whereby the wheel is periodically moved so as to release the lever.

EXCAVATOR.—WILLIAM S. RUSSELL, Toledo, Ohio. This invention seeks to equip an excavator with an efficient device for supporting the front end of the machine and for turning the whole main car and frame completely around in order that it may work in both directions. The turn-table used supports the end of the machine while moving over the rails, and supports the whole machine while being swung around. The turn-table is detachable from the car-body, and, though loose, is held in place by flanged metal rings forming a seat to receive the upper ball-bearing ring of the turn-table. In order to turn the machine around, the front end of the car is raised by jack-screws until the flanges on the metal ring are clear of the turn-table. The table is then shifted back under the balance-ring, and the machine is lowered in place, the whole weight resting upon the turn-table.

DISH WASHING MACHINE.—ROBERT R. PARRY and EDWIN EVANS, Poultney, Vt. The machine has a reservoir and cover therefor. Two carriers are mounted to rotate in the reservoir and cover, and are adapted to be raised and supported above the water in the reservoir. A series of open-work receptacles contain the articles to be washed, and are arranged to conform with the outline of the carriers. Brushes are secured to one of the carriers. Means are provided upon the other carrier for holding the dishes so that they shall engage the brushes.

MERRY-GO-ROUND.—PETER J. SPRACKLEN, Kenton, Ohio. This invention provides a game-attachment for merry-go-rounds, which attachment is so constructed that a number of figures or articles may be brought, at the will of the riders, into the path of the striking section of

a wind-engine or other form of motor for the purpose of determining how many, if any, of the figures or articles can be dislodged by the action of the motor.

MACHINE FOR SHAPING PLASTIC MATERIAL.—GUSTAV STOFF, Berlin, Germany. The machine is designed automatically to roll, form, and cut round-shaped pieces from rods of plastic material, such as march-pane, chocolate, caramel, and clay. The rods are placed above a pair of horizontal rotating rollers, each having several annular furrows or channels divided by sharp edges. The rollers are constructed to engage and to roll the rod placed above them, to change the rod by squeezing and forming while rolling into round-shaped pieces, and to cut the rod into sections.

Railway-Appliances.

CAR-BRAKE.—ERNEST B. and ADOLPH L. GESCHE, Bingham Lake, Minn. The brake provided by this invention is controlled mainly from the draw-heads of the car and is applied upon the inward movement of the draw-heads, the movement being caused by the stopping of the locomotive and the bumping together of the several cars of the train.

GRAIN-DOOR FOR CARS.—BENJAMIN W. DAVIS, Rock Springs, Wyo. Vertical guideways are arranged adjacent to the door-opening, which guideways are continued at their upper ends by a curved portion and a horizontal portion having a drop at its inner end. Offsets or supports are arranged without the guideways and adjacent to the curved portion, the upper surface of the offsets forming a portion of branch guideways extending outwardly from the main guideways. The door is provided with pins mounted to move in the guideways and branch guideways. By reason of this construction, the door can be held open, completely out of the way, when the car is being unloaded.

METALLIC RAILWAY-TIE.—GEORGE A. and THOMAS F. PENROSE and WILLIAM R. WARE, Meredith, Ark. The purpose of this invention is the provision of a tie, designed to be held in place without the use of spikes, the adjacent ends being fastened together without the use of fish-plates. The tie is made in longitudinal sections, each formed with a pair of lugs, arranged so as to engage opposite sides of the rails. The lugs extend over the corresponding base, web, and under side of the rail. Each lug is provided with an extension. Bolts pass through the lugs, extensions, and webs of the rails.

Miscellaneous Inventions.

ELASTIC TREAD HORSESHOE.—ARTHUR W. CROZIER and GEORGE SMITH, New York city. The

horseshoe is fitted hot to the hoof, so that the rubber pads will form part of the shoe, the pads being removable and being provided with side calks. The pads lie snugly in panels made in the bottom face of the shoe between the heel and toe calks, and are held in position by nails driven through the shoe. The nails pass through eyelets which serve to prevent the pads from becoming lacerated by the nails, should they work loose.

AUTOMATIC LOCK FOR DUMB-WAITERS.—GUSTAVE SEABERG, Brooklyn, New York city. This invention seeks to provide a hoisting and operating mechanism which will hold a waiter at any point, and which will operate as well with the waiter supported from one side of the pulley as from the other. By means of a novel arrangement of two disks provided with interlocking inclines, of sheave-wheels and collars, the rotation of the supporting shaft in either direction is prevented when power is applied by the pulley carrying the hoisting rope. The shaft can nevertheless be allowed to rotate in either direction when the hand-operated rope is pulled.

ACETYLENE GAS-APPARATUS.—EUGENE BOURNONVILLE, Jersey City, N. J. This apparatus comprises essentially a generating-chamber, a gasometer, and automatic means for controlling the generation of gas. The generating chamber has a tapering bottom to permit the ready withdrawal of the lime residue, and is provided with a carbide-receptacle, wheel-like in form, and divided into a number of radial, carbide-containing compartments. The gasometer, by its action in rising and falling, automatically controls the generation of gas by means of a system of levers and rods connecting the carbide receptacle with the gasometer. In order to prevent the escape of gas from the generator, a layer of oil is used, which constitutes an effective seal and renders the generator air-tight.

FOLDING BED.—JACOB LEVY, Brooklyn, New York city. The purpose of this invention is to provide a cheap and strong crib which may be made of iron and which may be readily folded into a small space. Each side and end of the bed is made as a frame. The parts are hinged together at the corners, so that when the bottom is removed or swung up these frames may fold so as to lie parallel to each other, and thus occupy less space than when opened out.

SPECTACLE ATTACHMENT FOR EYEGLASSES.—JOHN J. MUNDORFF, New York city. It sometimes happens that, in violently moving the body, eyeglasses fall off. For this reason an attachment has been devised which can be temporarily secured to the glasses and which converts them into a pair of spectacles. The attachment consists of spring-arms extending along opposite edges of the lenses, and