

AN IMPROVED DOUBLE-CYLINDER FORCE-PUMP.

The accompanying illustration represents a new force-pump invented by William G. Fetrow, of Mechanicsburg, Pa., for use in pumping water from shallow and deep wells, including artesian wells.

The pump comprises aligned upper and lower cylinders in which valved plungers reciprocate in unison. Between the two cylinders is a valve-holder provided with valve-seats, and with side openings and vertical

**A NEW PUMP.**

passages, *A*, forming part of a discharge-chamber. The valves on the seats open into the cylinders. A casing surrounds the lower cylinder, forming an annular space communicating with the lower end of the lower cylinder and with the passages, *A*, in the valve-holder. The upper cylinder is also surrounded by a cylinder, forming an annular space opening to the valve-holder passages *A*. These passages and the annular spaces constitute a continuous discharge-chamber for the lower cylinder and the upper end of the chamber leading to the pump-discharge-pipe.

A shell surrounds the valve-holder and the lower casing to form a suction-chamber, discharging into the side openings of the valve-holder. The upper end of the upper cylinder and the upper end of the discharge-chamber open into a discharge-pipe on the upper end of the upper casing.

On the down-stroke of the plungers the water in the lower end of the lower cylinder is forced out through the discharge-chamber to the discharge-pipe, and at the same time water is drawn into the upper part of this cylinder by means of the valve-holder and the suction-chamber. During the downstroke of the upper plunger the water previously drawn into the lower end of the upper cylinder passes through the valve in the plunger to the upper part of the cylinder; and on the upstroke of this plunger the water in the upper part of the cylinder is forced up through the discharge-pipe. During the upstroke of the lower plunger the water previously drawn into the upper end of the lower cylinder passes through the plunger-valve to the lower part of the lower cylinder, to be forced on the next downstroke of the plunger.

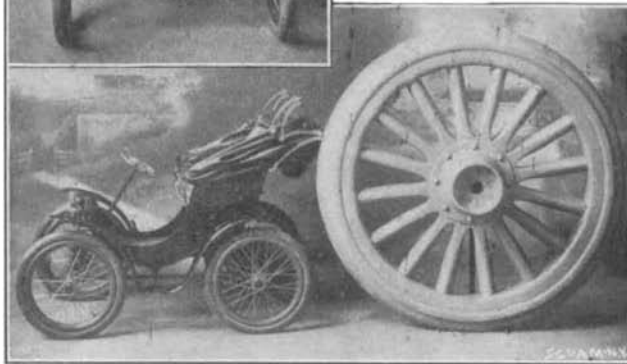
A New Compound Tartaric Acid.

M. L. J. Simon has recently discovered a new body which possesses some interesting properties. He describes his experiments in two papers read before the Academie des Sciences. In the calcination of tartaric acid in presence of bisulphate of potassium, besides the pyruvic and pyrotartaric acids usually formed, there is produced a new acid which the experimenter has been able to isolate in the following manner. The product of calcination is submitted to distillation under reduced pressure; as soon as the commencement of the decomposition prevents the formation of a vacuum, the residue of the distillation, brown and viscous, is taken up with alcohol and boiled for several hours with a gradual lowering of temperature so as to produce etherification of the acids in the mixture. The whole is again distilled under reduced pressure, and pyruvate of ethyl passes off, with a little free pyruvic acid, then diethylic pyrotartrate; the distillation is stopped and the residue transferred to a retort and distilled at the ordinary pressure. A yellowish oil passes over which partly solidifies when cold. It yields a crystalline deposit, whose weight is but 1-1000th of the original weight of the material. These crystals form a new compound which has been studied by the experimenter. The crystals, purified by crystallization from hot alcohol, melt at 164 deg. C. and resolidify at 156 deg. The new compound sublimes easily under the action of heat, forming white needles and sometimes transparent scales; it commenced to volatilize at 110 deg. It crystallizes from alcohol in small prisms. It is somewhat soluble in boiling water (about 4 per cent), and upon cooling it crystallizes in fine needles which melt also at 164 deg. Ether dissolves it, and will remove it from its solution in water; upon evaporation, it appears in very brilliant crystals, which have a high refracting power. It is also soluble in acetic acid. This body is a feeble acid; its potassium salt is prepared by dissolving caustic potash in a very little water; the acid is added and dissolved by heating; and the whole is evaporated until the brownish liquid is covered with a solid film. Upon cooling, the whole forms a solid mass, and when spread out dries rapidly, becoming perfectly white. This potas-

sium salt crystallizes in plates which are very soluble in water and alcohol, the solution being alkaline. It contains two molecules of water of crystallization, and corresponds to the formula $C_7H_5O_5K, 2H_2O$. The acid itself has a composition represented by $C_7H_5O_5$, as shown by analysis. This acid is not saturated; it takes up bromine at ordinary temperature, as does also the potassium salt. The acid and salt reduce a permanganate solution, but have no effect upon Fehling's solution. With acetate of lead a white precipitate is formed, and with acetate of copper a light green precipitate. Wislicenus and Stadnicki discovered in 1868, in the dry distillation of tartaric acid, an acid melting at 134.5 deg., soluble in 400 parts of boiling water, and to which they gave the name of pyrotartaric acid, with the formula $C_7H_5O_5$; this acid was afterward identified with the dimethylfurfurane-carbonic acid, prepared by other experimenters in different ways. The acid found in the present case is isomeric with the pyrotartaric acid, but is certainly distinct from it. In a second communication, M. Simon describes some later work with the same compound. The acid, to which he gives temporarily the name isopyrotartaric acid, has a characteristic property, possessed by none of the other compounds formed at the same time. Its solution in water gives with the ferric salts, especially the chloride, an extremely intense violet coloration which recalls that of permanganate of potassium. This reaction is very stable, and is not changed by heat or with time; it disappears upon adding a few drops of concentrated acid, but reappears by adding water. Diluted alkalis change the color to orange red, or in excess, precipitate ferric hydrate. Inversely, when an acid is now added, the hydrate is dissolved and the orange red color appears, then the violet, and an excess of acid causes discoloration. These variations of color are due to a ferric combination which the experimenter has isolated by digesting precipitated ferric hydrate with a hot saturated solution of the acid in question, and the solution thus obtained when dried in vacuo deposits small dark red crystals having the composition of a ferric isopyrotartarate, $(C_7H_5O_5)_3Fe, 2H_2O$; this salt dissolves in water and gives it a bright red tint. It constitutes a very sensitive indicator for acidimetry, the change from rose to yellow is very distinct and is well marked in both directions. The acid may be used to advantage to show the presence of ferric salts, as the reaction indicates 1-100,000 part if in neutral solution, and is as sensitive as that obtained with sulphocyanide of potassium. This reaction distinguishes it from the pyrotartaric, pyrotartaric and pyruvic acids; salicylic acid gives similar, but not identical, reactions.

A MINIATURE ELECTRIC CARRIAGE AT THE PAN-AMERICAN EXPOSITION.

The smallest automobile ever built is that made by the Jenkins Automobile Company, of Washington, D. C., for Chiquita, the little 26-inch morsel of humanity, who is now using it at the Pan-American Exposition. It is a little electric victoria, complete with leather top, fenders and cushions, electric lights, gong, and wheel steering gear. It is, in fact, so exact a miniature duplicate of a full-sized automobile that it is difficult to fix its real proportions in one's

**A MINIATURE ELECTRIC AUTOMOBILE.**

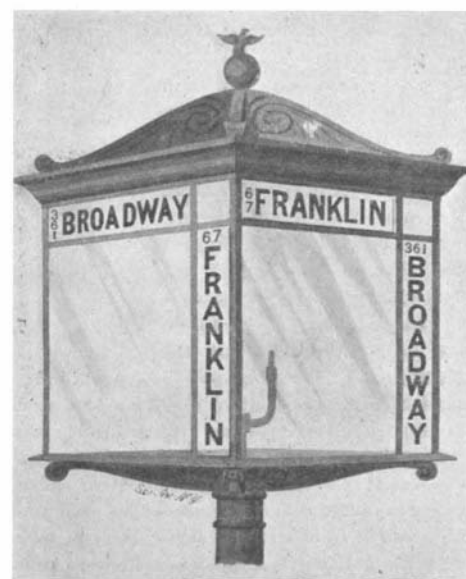
mind. It has 12-inch wheels, fitted with 1¼-inch Diamond pneumatic tires; electric lights showing red and green on sides; a top which raises and lowers. The cushion is 14 x 8½ inches, and but 14 inches from the ground; the step is but 4 inches up. The front and rear axles are 24 inches apart, center to center, and the truck is 24 inches wide. With top up it does not come up to one's elbow. It is guaranteed to run for two thousand hours over level surface with absolutely no attention except that required to guide and control

it. The motor is hung beneath the body on the truck and connects with the gear on the differential directly on the rear axle. Both rear wheels drive.

While the little machine is suitable for use in the streets, it is unequalled for stage or indoor use, kindergarten or playground. There is no fire, no water or boiler; no gasoline or other explosive or inflammable fluids; no acids or heavy lead batteries. It requires no expert attendant; a child can use it as safely as a bicycle. Some idea of the size of this little machine can be had from the photograph showing it standing beside the wheel used on a big steam coach made by the same company.

A NEW STREET SIGN FOR LAMP-POSTS.

Those who ride in city surface cars know that it is not the simplest thing in the world to catch a glimpse of the street signs which, in New York city, at least, are placed probably in the most undesirable and awkward position conceivable. For the convenience of street-railway passengers the avenue lamp-posts in New York were, some time ago, turned through a right

**A NEW STREET SIGN FOR LAMP-POSTS.**

angle so that the name of the street could be more easily read. But pedestrians were so confused by the turning of the lamp-posts and protested so hotly at the change that the city fathers were compelled to restore the lamp-posts to their old positions.

The difficulty of providing a clear street-sign which will answer the needs of both car passengers and pedestrians has been neatly overcome by Mr. John A. Sleicher, the editor of our esteemed contemporary, Leslie's Weekly, 110 Fifth Avenue, New York city. In addition to the usual horizontal sign which designates a street, Mr. Sleicher's lamp-post bears a vertical sign designating the street or avenue intersected. A passenger in a car can see at a glance that the avenue along which he is traveling is, for example, Broadway, and that the street which he has just passed is Franklin, the first legend extending horizontally and the second vertically. The pedestrian finds similarly that the street along which he is walking is Franklin and that the avenue which he is about to cross is Broadway. He need not walk around the lamp-post to ascertain the name of the avenue.

Mr. Sleicher's lamp-post is now under consideration by the Municipal Art Society of New York, and will doubtless meet with the approval of that organization.

The New Zinc Field.

BY WALDON FAWCETT.

The preliminary statistics covering a considerable portion of the year 1900 prove conclusively that there has been no exaggeration of the resources of the developed and undeveloped zinc and lead properties of the Missouri-Kansas district, constituting the great American zinc belt, and regarding which some seemingly remarkable predictions have been made during the past year or two. This district, which lies principally in southwestern Missouri, and will ultimately develop into one of the great mineral centers of the world, has been worked in a desultory sort of way for almost half a century, and it waited upon the advent of Eastern capital within the past couple of years to bring the ore production to its present yield, which approximates one million dollars per month.

It was not until 1874 that a geologist touring the district discovered the true nature of the mineral being scattered on the dumps. Then there was a rush to secure the stocks on hand at the various properties, and when the statistics for the decade were made up in 1880 it was found that there had been sold nearly sixty thousand tons of zinc, as against one hundred thousand tons of lead. In 1897 the district produced 5,000,000 worth of ores, or nearly as much as during the whole ten years from 1870 to 1880, and in 1898

the balance sheet showed an aggregate production estimated at \$7,000,000.

Meanwhile a change was wrought, and lead instead of zinc became the by-product. An increasing degree of attention was paid to the more recently discovered mineral, until at the present time ten dollars' worth of zinc is produced for every dollar's worth of lead taken from the ground. This new field has enabled the United States to become an important factor in the zinc market of the world. A few years since America contributed scarcely one-eighth of the world's supply. At the present rate of increase this country will ere long furnish more than one-fourth of the aggregate consumption. This little tract, which is now yielding as high as \$300,000 worth of zinc ore per week, is at present supplying fully seven-eighths of all the zinc used in the United States, and it must therefore be apparent that the export trade has not as yet undergone any considerable development, but this is only a question of time, and in anticipation of it a number of the smelters of Belgium and Wales have already established agencies in Joplin, the commercial center of the mineral belt.

The three zinc ores found in the district are the sulphide, silicate and carbonate. The sulphide, which is at once the most abundant and most valuable ore, occurs in several varieties, distinguished chiefly by color. The purity of this ore is well illustrated by the fact that it seldom runs below sixty per cent metal, and in some cases it is practically chemically pure, running two-thirds metal and one-third sulphur. The future developments in the working of the zinc properties are difficult of prediction, not only because geologists contend that still larger bodies of ore will be found at greater depths than have yet been reached, but also by reason of the irregular distribution of the zinc ore; it being found in thin sheets in crevasses of limestone; in huge chambers; buried in clay; disseminated through solid brecciated rock which requires blasting, and forming a lining for cavities. Zinc and lead are very frequently mined together, the two ores being found in close proximity.

Not only do the peculiarities already noted exist, but the distribution of the zinc ore is by no means regular, and the test drills have pierced half a dozen strata. All the mining yet done has been at shallow depths. The Eleventh Hour, the deepest mine operated in the district, is only 240 feet deep, and the average shaft has a depth of not more than half that distance. Deep drilling has shown, however, that beyond the four hundred-foot level there are larger bodies of mineral deposits than in any of the shallow diggings now being worked. It is now estimated that it will require twenty years to exhaust the surface

workings and get down to the workings of only two hundred feet and over, so that it will doubtless be some time before the miners are ready to get at the five hundred foot level, which experts declare will contain more ore than all the shallow mines combined.

The formation of the district is such that very little timber support is required in any of the mines. The mines are free from fire damp, and the miners are subjected to none of the inconveniences which must be borne by coal miners, who necessarily operate in very cramped quarters. Frequently these zinc miners work in great caverns two hundred feet in length, perhaps a third as wide, and fully forty feet in height—a chamber of sufficient size to insure the presence of good air.

The cleaning of the ore is a somewhat complicated operation. Immediately upon its arrival at the surface it is transferred to huge bins in the mills, from which it is fed into the crushers, a good-sized stream of water being turned into the crusher simultaneously with the raw material. The ore after it has been crushed to the fineness of sand, is carried by the water into sluice boxes, which are provided with false bottoms that collect the ore and allow the dross to escape in much the same manner that gold is washed out of gravel by placer miners. It is during the cleaning process that the lead and zinc are separated, the former having nearly double the specific gravity of the latter. The average mill has a capacity of one hundred tons per day, but each one hundred tons of material fed into the crushers yields only about one-tenth that amount of pure cleaned ore. This may seem a surprisingly small proportion, and the mine operators themselves agree that there is a tremendous waste, but say that the loss will shortly be greatly reduced by the introduction of improved methods.

There has been in the history of the development of America's natural resources few instances to parallel the manner in which the prices of zinc have gone up within the past few years. The average for the year 1897 was slightly over \$18 per ton; for 1898, \$21 per ton, and for the year which closed in June, 1899, over \$34 per ton. More surprising still is the fact that in the first six months of 1899 the average price of all the zinc sold in the Joplin district was \$44 per ton, and in some instances sales were made at \$55 per ton. Some idea of the profits made possible to the producers may be gained from the fact that the average cost of production does not exceed \$14 per ton, and in many localities the ore can be cleaned and made ready for market at a total expenditure of \$10 per ton.

There are almost eight hundred mines in the Joplin district, and they give employment to over ten thou-

sand men. All classes of citizens have engaged in the mining operations, some with almost no capital. In other cases a group of miners will go into partnership with some local merchant, who furnishes the money with which to purchase powder and the necessary tools. Joplin, which a few years ago was little more than a village, now has a population of thirty thousand and there are in the district several other mining camps, all of which are connected by the longest electric railway in the world.

The Building Edition for July.

The SCIENTIFIC AMERICAN Building Edition for July is a beautiful number of this artistic periodical. In addition to houses of various prices there are a number of illustrations of the Pan-American Exposition and also a very important interview with Mr. John M. Carrère on the Pan-American Exposition. Among the other attractive features are a Spanish-American house at Alhambra, and two English gardens accompanied by two beautiful illustrations. An editorial is devoted to "The Situation of the House." The departments of this issue are "Monthly Comments," "Talks with Architects," "New Books," "Household Notes" and "New Building Patents."

The Current Supplement.

The current SUPPLEMENT, No. 1332, has many important articles. "Greek Gold Ornaments from Scythia" describes the remarkable examples of ancient gold jewelry presented to the Metropolitan Museum of Art by J. Pierpont Morgan, Esq. "The Rise and Development of Egyptian Art" is by Prof. W. M. Flinders Petrie. "The Sea Bottom—Its Physical Conditions and Its Fauna" is by Prof. C. C. Nutting. "The Making of a Great Atlas" is by Spencer Townsend. "The Manufacture of Portland Cement in California" is by Edwin Booth. "Historical Geology" is by Prof. W. B. Scott, of Princeton University. "Astronomical Laboratories" is an article by Arthur R. Hinks. "Installation, Operation and Economy of Storage Batteries" is by Ernest Lunn and is accompanied by a number of illustrations and diagrams.

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RECENTLY PATENTED INVENTIONS.

Mechanical Devices.

STRIPING AND ORNAMENTING DEVICE.—WILLIAM M. GLENZINGER, Fernandina, Fla. This device conveniently and effectively applies gold leaf and other thin sheets of material to woodwork, and may be used to apply any color or pattern desired. It comprises means for carrying a roll of the article applied, which is in the form of a long strip with a suitable cement on one side, the device having a moistening appliance so as to wet the cement.

COIN-CONTROLLED VENDING MACHINE.—CHARLES DUHAMEL, Rue Le Pelletier 11, Paris France. The discharge of the article is controlled by the insertion of a coin. The articles to be delivered are preferably of a uniform shape to facilitate delivery. To prevent fraud the coins must be inserted through a slit of a given length. Coins of smaller diameter than the length of the slit have no action.

TIRE REMOVING AND REPLACING DEVICE.—CLARENCE G. DINSMORE, Staatsburg, N. Y. This device comprises an arm adapted to engage with one end one side of a wheel-rim, the arm being fashioned to extend transversely over the tire. A lever is pivoted to the other end of the arm; and a presser-plate is carried by the lever and adapted to engage the tire at the side opposite the one on which the arm engages the wheel-rim. The tool is easily manipulated, and enables the operator readily to remove the tire from the rim.

DUPLICATE SALES-RECORDER.—JOHN T. GILBERT, Eufaula, Ala. The invention relates to devices for producing duplicates of memoranda, by the use of a number of paper strips with interposed carbon paper. The apparatus is provided with an efficient mechanism for feeding the paper a predetermined distance and, with another mechanism for perforating the paper, to facilitate the tearing off of the slips written upon.

SURGICAL TABLE.—CARLOS F. DARDANO, San Salvador, San Salvador. In this surgical table the various parts are adjusted to facilitate placing a patient in different positions. The table comprises a frame on which legs are supported; a table-top formed in two sections hinged together; a rack connected with the pinte of the hinges; and a pinion with which the rack is engaged, by which to move the rack.

Railway Appliances.

CAR-LOADER.—SAMUEL E. KURTZ, Sac City, Iowa. The apparatus carries grain or other

material into a car and simultaneously loads or discharges the material toward opposite ends of the car. The grain passes through a hopper into a conveyor tube extending through the doorway of a car. A screw-conveyor forces the material to the end of the tube where it will be thrown by a rapidly rotating fan toward opposite ends of the car. The apparatus is comparatively light, so that it can be readily handled.

Miscellaneous Inventions.

COMBINED FEED-BOX AND SEAT.—ROBERT C. JARVIS, West Pullman, Ill. This invention provides a feed-box for a team, which box, when not needed, can be used as a seat, and which, when required, can be quickly and conveniently secured upon the tongue of a vehicle. The construction is simple, durable and cheap.

HEATER.—JAMES M. JEFFREY, Waynesville, Ill. The heater is designed to be used in connection with brooding-rooms, and comprises a main flue under the floor of the room, leading from the furnace to a smokestack, and a number of risers on the main flue, these risers extending through the room and having removable caps for opening or closing their outer ends. When the caps are removed the products of combustion pass out through the risers. By manipulating the damper of the smokestack and the caps of the risers, the temperature of the room can be readily changed.

PROVISION-BINDER.—HENRY WEIL and SAMUEL SCHWEISHEIMER, Manhattan, New York city. The object of the inventors is to provide a device which may be quickly fastened around boned ham or other meats, and which will dispense with the usual binding strings. The binder consists of a skeleton frame formed of a series of straight wires laced to a series of circularly-bent wires which are separated at one side.

BADGE.—BENJAMIN HARRIS, Manhattan, New York city. This invention relates to certain improvements in the means for holding in place the pins of badges and like articles which are to be attached to one's clothing. To this end the invention comprises a pin, the shank of which is bent back preferably parallel with the body of the pin and held in a casing or sleeve forming part of the collet or annulus to which the base of the badge is generally fastened, this part of the annulus extending inwardly from and preferably across from one side to the other.

SHADE-ROLLER.—CHARLES F. FLOS, New York city. A portion of the shade-roller

is so constructed that a retaining device is longitudinally formed therein. In this device one end of a shade can be quickly and conveniently entered. The device serves to hold fast the entered portion of the shade without the aid of cement or tacks. The retaining device does not tear or mutilate the cloth.

BOTTLE-STOPPER.—JOSEPH FELDMANN, Manhattan, New York city. This stopper is especially adapted for beer-bottles, and effectually seals the mouth even though the glass may be chipped or broken. The stopper and its attached gasket are made to enter the mouth of the bottle to a much greater extent than the ordinary stoppers, the gasket itself bearing against the inner face of the neck of the bottle from the upper edge to some distance within the neck.

STOOL.—ALBERT F. CURRIER, St. Regis Falls, N. Y. The stool is a piano-stool of improved construction, and is arranged to move horizontally to enable the user to reach about in the immediate neighborhood without leaving the seat.

SWINGING HOSE-RACK.—REUBEN D. WIRT, Independence, Mo. The invention provides a hose-rack or swinging support for folded hose, which rack is adapted to prevent the hose from leaving the rack in a mass when pulled upon at the upper end, thereby preventing the hose from becoming entangled when it is quickly withdrawn.

CONVERTIBLE TRUNK AND WRITING-DESK.—LAURA E. BUCKINGHAM, Manhattan, New York city. This convertible trunk and writing-desk is arranged to be conveniently converted from a trunk into a writing-desk, or vice versa, so that the owner may use the structure as a trunk when traveling, or as a writing-desk when at home.

PUMP-BOX.—JOSEPH H. RODGERS and JOHN A. POWELL, Pittsburg, Penn. The pump-boxes of ships are built from deck to floor and are intended to receive the pumps by which the vessel is kept clear of water. Ordinarily these boxes are built of wood, and are liable to be broken by the cargo, especially in loading and unloading the vessel. This invention seeks to overcome the objection by forming a box of metal pressed into the proper form.

COMBINED NECKTIE-FASTENER AND COLLAR-BUTTON.—ORIN H. PEAK, Parsons, Kans. The invention relates to improvements in necktie-fasteners and collar-buttons in which a spring, levers, and pins or points hold the necktie in position, the whole constituting a collar-button. The invention provides novel

levers and points to hold the tie and bow in place.

APPARATUS FOR THE DESTRUCTIVE DISTILLATION OF WOOD.—GEORGE O. GILMER, New Orleans, La. By the simple construction invented by Mr. Gilmer, the vapors from the closed retort are drawn from the bottom, while the heat is applied to the top of the retort, so that the top portion of the wood will give off its vapors first. These vapors are made to descend through the cool wood below, so that the turpentine vapors, which are first given off, are discharged uncontaminated by the tarry or creosote vapors.

PROJECTILE.—ALVIS F. CROOM, 180 Bryan Street, Dallas, Texas. The cylindrical body and conical point of the projectile are provided with two opposite spiral semi-circular grooves. When fired from a smooth-bore gun, the inventor states that the projectile will rotate once in every eight or ten inches of its flight and maintain a flat trajectory for a comparatively long distance. The invention is designed to reduce the cost of manufacture of guns by providing projectiles which, when discharged from the muzzle, will rotate as if discharged by a rifle.

KNOCKDOWN CAMP-STOVE.—STEPHEN J. COCHRAN, Silcox, Mo. The body of the stove is composed of six separable parts connected by sliding joints. The body of the oven is composed of four parts which are supported by and between the sides of the body, the sides forming the ends of the oven. The detachable connection between the parts of the oven and stove body is constructed upon the principle of tenon and mortise.

CARTRIDGE-CARRIER.—EDWARD T. GIBSON, U. S. A., Fort Harrison, Helena, Mont. The object of the invention is to provide paper cases in which are placed the number of cartridges required to fill the magazine of a Krag-Jorgensen rifle, or any other suitably constructed breech-loading gun. The paper case is so shaped as to bunch the cartridges together compactly so that they cannot pound each other; but in order to be prepared to interpose strips of paper between them, should it be deemed advisable, and at the same time not interfere with the free "running" of the cartridges from the paper, an intervening piece is provided. The cartridges will readily roll out of the case when the intervening space is formed as the inventor desires.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.