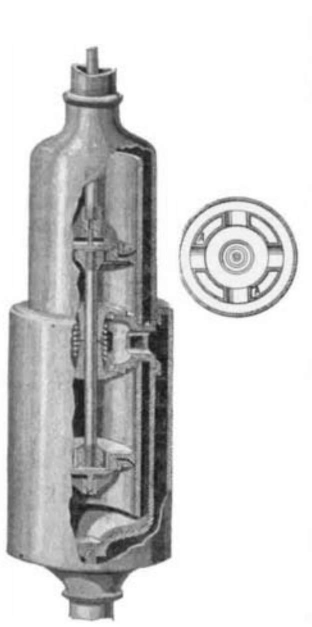
AN IMPROVED DOUBLE-CYLINDER FORCE-PUMP.

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 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 NEW PUMP.

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.

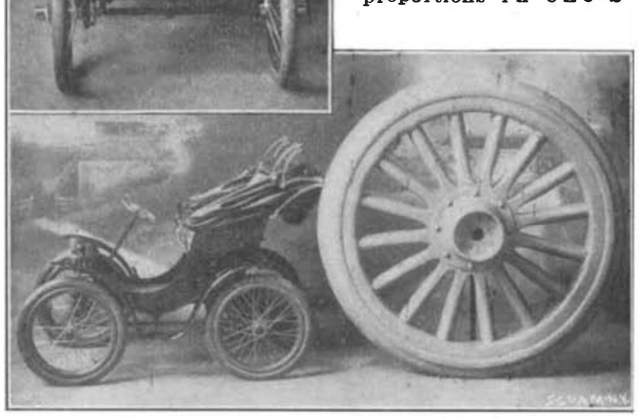
On the down-stroke of the plungers the water in the lower end of the lower cylinder is forced out through the discharge-chamber to the discharge-pipe, and at the same time water is drawn into the upper part of this cylinder by means of the valve-holder and the suction-chamber. During the downstroke of 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 pyruviate 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 potassium 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 $C_7H_7O_3K$, $2H_2O$. The acid itself has a composition represented by $C_7H_8O_3$, 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 $C_7H_8O_3$; 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 isopyrotritaric 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 isopyrotritarate, $(C_7H_7O_3)$ 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 pyrotritaric, 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 unequaled 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