THE WATER WORKS OF PARIS.

The hall that attracts the most attention at the Exposition of City Hygiene is the one in which is exhibited the various apparatus used in connection with the public water supply of Paris.

One's attention is first struck by a large aquarium surmounting a reservoir, into the three compartments of each of which are directly led, by special conduits, the waters of the Ourcq, Vanne, and Seine.

The flow is continuous, and the water is constantly being renewed; so it is very easy to obtain an idea of the comparative purity of the waters of the three sources named. This ingenious arrangement is shown in Fig. 1. The very different and well defined tints of these three waters may be very clearly distinguished in the aquarium; but it is especially in the compartments of the reservoir, which are painted white internally, and which are about seven feet deep, that the difference is most manifest. The water of the Ourcq looks like pea soup; that of the Vanne is of an azure blue, reminding one of the color of the Swiss lakes; and that of the Seine is of a yellowish gray. One cannot leave this spectacle without having a very accurate idea of the comparative value of the waters that are used for public and private purposes in Paris. It is pleasing to think that those who have the administration of the city in charge will hereafter endeavor to furnish spring water exclusively for private consumption, and that they will not long defer substituting this for the impure water of the Seine and Ourcq, the aspect of which is so repulsive, and which unfortunately constitutes a large part of the public supply.

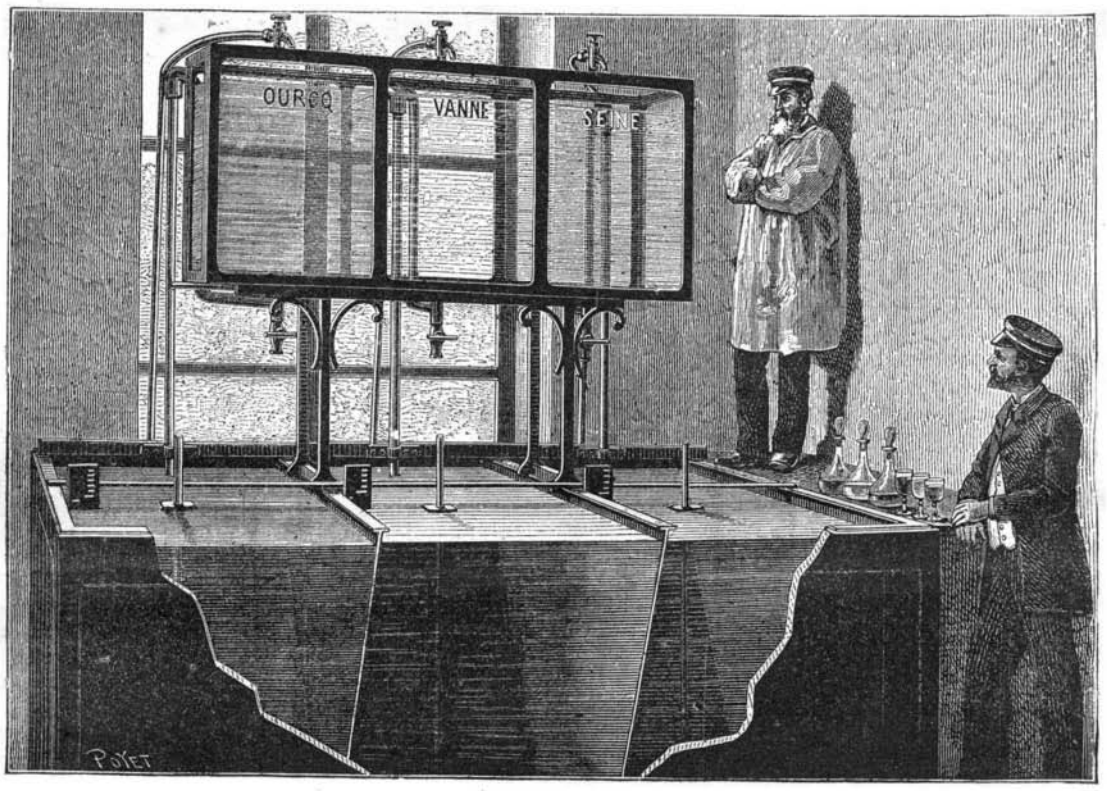


Fig. 1.—AQUARIUM SHOWING THE COMPARATIVE TRANSPARENCY OF THE WATERS OF THE OURCQ, VANNE AND SEINE.

The water works of Paris comprise two services—a public one for streets and kitchens, and a private one for houses. Mr. Belgrand, as long ago as the time when the great works connected with the water supply were begun, demonstrated that, on the one hand, in view of the decreasing purity of most of the river waters and the increasing exigencies of the public, nothing definite would be effected at Paris if spring water were not served for domestic purposes; and that, on the other hand, at the distance Paris is situated from high altitudes, it would be ruinous, if not impracticable, to introduce enough spring water for the needs of the public service, which, moreover, would not utilize its qualities. A division of the service, moreover, was rendered necessary by the height of Parisian houses. The great extent of the street service causes the pressure to fall several times a day in the mains, so that the supply is cut off from the upper stories, and that it is necessary to have recourse to the water of the private service, without which, at certain hours, elevators would come to a standstill during their trip, and the stream from the nozzles of fire engines would not reach the roofs of houses.

Water for the private service is derived from the Dhuis and Vanne, whose sources were selected as being among the purest of those of the Paris basin. The water is collected with the greatest care, and stored in reservoirs surmounted by terre-pleins carpeted with turf. Closed aqueducts of ovoid or circular section, provided with manholes, keep this water in such a state of aeration and coolness that, after a flow of forty-eight hours, it reaches Paris just as it was collected, and without having varied more than one degree in temperature. As for the public supply, that is obtained, through the Ourcq canal, from the Seine, the water of which is pumped up by six establishments run by steam; from the Marne, the water of which is pumped up by the Saint Maur works; and from artesian wells. As we have stated, the aquarium and reservoir at the exposition show the incontestable superiority of spring water. That of the Dhuis and Vanne is, in fact, perfectly limpid and slightly calcareous, is excellent for all purposes, and its mean temperature allows it to be introduced into dwellings in a highly appreciated state of coolness. Dr. Miquel finds in it but 62 germs against 2,000 in the Seine water; and Mr. Albert Levy has shown that in the water of the Vanne, preserved for two days, the oxygen persists or increases, while in the water of the Seine it diminishes, this being a sure sign of the presence of animalcules in the latter. It is not the same with river water and that of the Ourcq. The latter marks from 30° to 40° by the hydrotimeter, that of the Marne, 19°, and that of the Seine 17°. The two last are nevertheless good enough for all the uses of the public service and for industrial purposes.

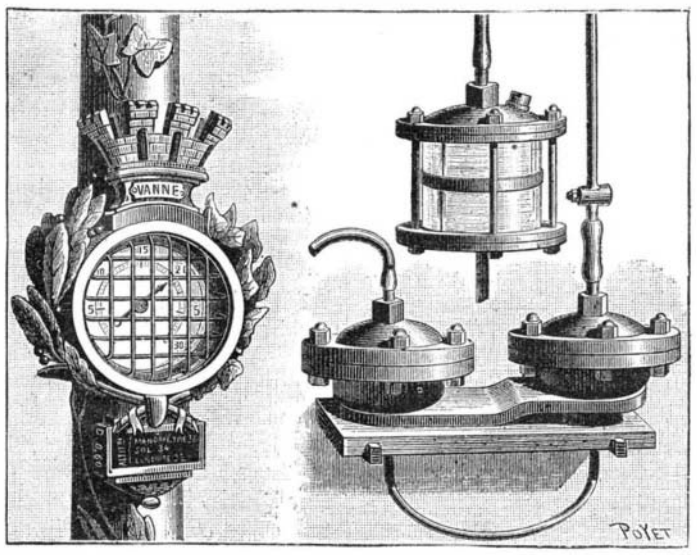


Fig. 2.—PRESSURE GAUGE FOR SHOWING LEAKAGES.

The water brought into Paris by conduits is received in 17 reservoirs, which have a total capacity of 11,655,600 cubic feet, and which are located at altitudes varying from 150 to 440 feet. All these are open except those of the Ourcq and that of the Seine at the Pantheon, so that the water may be kept limpid and cool. From these reservoirs start the distributing mains, all of which are of cast iron with ring joints. Most of these are laid in the sewers, so that they can be inspected, leakages be stopped, and junctions be effected without any digging having to be done.

The water is afterward distributed, according to its nature, by properly arranged piping. The lower part of Paris is now supplied with water from the Ourcq and Vanne; the middle part with water from the Seine and Vanne; and the upper part with that from the Dhuis and Vanne. Moreover, these various districts can come to each other's aid, the water being forced downward and upward by relay engines. In winter, the water unused by the private service is passed over to the public use. In summer, or in case of accident (but for a few days only), the Seine water pumped up at Ivry replaces that of the Vanne, and the latter, pumped up at the Villette works, replaces that of the Dhuis.

The quantity of water thus daily introduced into Paris is as follows:

Spring water (Vanne and Dhuis)	4,205,000	cub. ft.
Canal water (Ourcq)	3,880,000	"
Seine water	6,000,000	"
Marne water	2,900,000	"
	16,985,000	"

Say about 48 gallons per head. In a lecture delivered by him, Mr. Bechmann has remarked that the spring water is inexhaustible, and that the supply is greater than the demand; but the above figures are averages, and on certain days, especially during the prevalence of great heat, it is a maximum that must be satisfied. There is, then, still an insufficiency, especially if we take into account the great increase that will be brought about by the suppression of privy vaults in Parisian houses. So, two years ago, excellent sources were acquired to the east and west of the city, and these alone will introduce 4,200,000 cubic feet of water marking 16° by the hydrotimeter. The projects for the introduction are all prepared, and it is reckoned that in 1889 Paris will have 230,000,000 cubic feet of water for its 2,200.000 inhabitants, or about 66 gallons per head. In 1789, a century ago, there were but 280,000 cubic feet of water to supply a population of 600,000 at Paris, say 2⅛ gallons per head; and instead of the 85 fountains to draw water from, and the 455 gratuitous and paying grants that existed at that epoch, there will be, in 1889, 17,000 public apparatus and 70,000 subscriptions. Besides, the water that was sold in the time of carriers at 5 francs is now down to 30 centimes; a household of three persons can be supplied by cock for 16·2 francs, and by meter for 20 francs per annum. In short, Paris, which was poorly supplied with water twenty years ago, and which has not yet the quantity desirable for a great capital, both elegant and industrial, is now the European city in which the public service is completest; and, moreover, it stands in the front rank as regards the quality of water supplied for domestic purposes.

This conclusion, which we borrow from Mr. Bechmann,

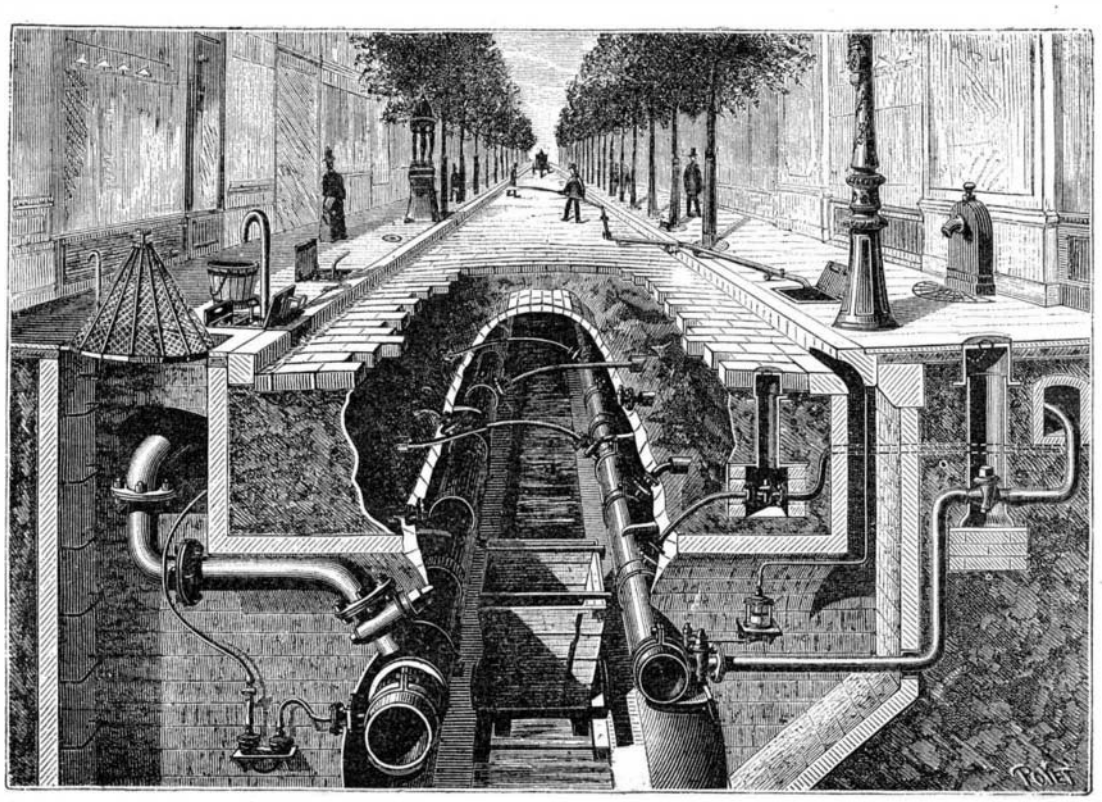


Fig. 3.—ARRANGEMENT OF WATER MAINS AND ACCESSORIES AT PARIS.

very justly expresses the present state of the water service at Paris, and it is a justification of the efforts that he has been incessantly making for several years, under the successive direction of Messrs. Belgrand, Alphand, and Couche, to perfect the double line of piping that constitutes one of the most interesting peculiarities of the service.

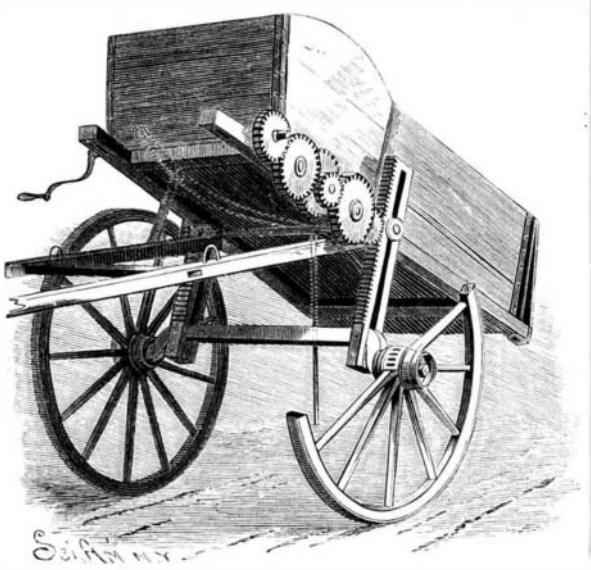
It is unnecessary to say that the two parts of this system are interdependent, so that one can supply the other in the case of a failure of either. Yet, when we examine the other kinds of water introduced into Paris, we experience a certain dread at the idea of a substitution or mixture of them in the mains.

The administration asserts that such a mixture never occurs, and we believe it; but a substitution of one of these waters for another is obligatory in certain cases. When an accident happens to the piping, or when the sources fail in summer, the Seine water is substituted for a short time for that of the Vanne in certain quarters, and after the public has been notified of it through the newspapers.

Such an occurrence, however, is extremely rare. In 1885, there were but ten days in which the spring water failed to such a degree as to make it necessary to substitute other water at certain points. We cannot help regretting, nevertheless, that the spring water mains have to ever be traversed, even momentarily, by so impure water as that of the Seine or other river.

The whole of one side of the water service exhibition hall is occupied by an immense model representing the processes employed in the distribution of water in Paris. This comprises a sidewalk raised above the floor, and which is reached by a lateral stairway. Along this sidewalk runs the public roadway, and beneath this is arranged a distributing main with which are connected a fire hydrant, a water post, and hydrants for washing and sprinkling. Visitors are thus easily enabled to obtain an idea of the way in which water is introduced for the various requirements of the public streets, for cleaning and sprinkling purposes, and for the fire service. At one point of the sidewalk is shown a sewer manhole, with a safety covering, invented by Mr. Boutillier, chief superintendent of bridges and roadways. This device serves to prevent people from falling into the sewer. It consists of a metallic ring, to which are affixed converging ribs that support a wire lattice work. By reason of its light weight (13 lb.), it can be easily carried about by one man (Fig. 3).

Such as it is, with its 1,020 miles of conduits, the piping for the water service of Paris is, as a whole, vaster in extent than any other in the entire world. London, to cite but that city alone, is supplied by nine companies, whose lines of piping are independent, so that, from this point of view, it forms nine distinct cities,



SCHALL'S IMPROVED DUMPING CART.

each of which is equal to a second rate capital only. It very naturally results that Paris is likewise the city in which it is most troublesome to discover leakages, and in which it is most difficult to prevent errors in the details of maneuvering, and to find them out soon enough to remedy them in time, after they have been committed. It is important, then, to know at every moment whether all is well with the distribution, that is to say, whether the pressure is anywhere lower than it ought to be. For ascertaining this, the administration, three and a half years ago, established manometer stations, designed for facilitating the search for leakages, and for the control of the distributing maneuvers. These stations comprise a pressure gauge, affixed to a lamp post, and connected in the sewer with an apparatus consisting of two superposed cylinders of thick glass separated by a rubber diaphragm, which forms a passive partition between the ascending column and the branch that communicates with the water main. A brass cage guards the glass against external shocks, and allows of a verification, at any time, of the state of the diaphragm, which should remain horizontal as long as the apparatus is in a condition for operating normally.

As the diaphragm acts only as a partition between two strata of liquid in equilibrium, it follows only the motions that correspond to those that occur in the pressure gauge tube. Such motions are necessarily almost imperceptible, and every apparent depression of the diaphragm is a sign of a leak in the branch ending at the pressure gauge, and is logically followed by an increase that confirms the necessity of an examination. The apparatus communicates, through the lamp post, with an external cast iron dial, electro-plated with copper, and protected by a wire screen, through which may be read the state of the pressure in the main. Plates in relief, forming part of the elegantly designed dial case, give the nature of the water, the number of the station, the diameter of the main, and the respective altitudes of the latter, of the ground, and of the axis of the pressure gauge (Fig. 2).

Another interesting apparatus is one that permits of boring a hole in the main under pressure, in order to form a new branch at any point, without interrupting the circulation of the water. This is shown in Fig. 4. The cock from which the new conduit is to branch is inserted in the main while the hole is being bored, and automatically as it were, and the connection is made without the loss of a drop of water. During the operation, the few iron shavings that are formed drop into the main and are carried off by the water. As may be conceived, such cocks are numerous in a city like Paris, and are still more so in the dwellings, for the various needs of daily consumption.

The water is now delivered, as per policy, either by gauge or by the meter. Paying for it at so much per cock, which was formerly so much in vogue, for domestic uses, gave rise to so many abuses that it is now abandoned, save in the case of apartments, where it is stipulated that the special cocks shall prevent a continuous flow. The various kinds of these cocks now used are shown at the exposition. Among them, there is one that is of very recent invention, and is due to Mr. H. Chameroy. This apparatus (Fig. 5) is thus put in place: The cap, H, is removed, and the piston, E, and clack valve, D, are taken out; both the valve, D, and its seat are carefully wiped, and the cock is screwed to a coupling affixed to the conduit. A glass of water is poured into the cock, in order to fill the lower chamber, M, the clack, D, is introduced, the chamber, F, is filled anew, and then the piston, D, is introduced with care up to the upper level of the cock, and the excess of water escapes through the upper orifice. Then, while the handle, L, is held back, the cap is screwed on again. This operation is indispensable in order to expel the air contained in the chamber; for without such a precaution, ram strokes would occur. The cock being charged, it suffices, in order to get water, to push the handle down. When once the flow is interrupted, the handle is raised, and then, on being depressed anew, the same volume of water will flow.

The internal mechanism operates as follows: When the handle is pushed downward, the cam repels the piece, G, which drives the upper piston, E; the water in the chamber, F, transmits this motion to the lower piston, C, which is connected with the clack, B, and the water escapes freely through the orifice, O; but the action of the spring causes the clack, B, to rise so slowly that the water in the chamber, F, finds it difficult to escape through the small clack, D, which closes the conduit, Z, more or less perfectly. If the water takes a minute to escape from the chamber, a volume of water will pass during the same time, under the direct pressure of the conduit, through the orifices, S, O, T. In order that the same volume shall flow under all pressures, a movable tube with apertures is introduced into the orifice, S, in order to reduce the velocity of the water according to the pressure to which the cock is submitted.

In this way the water may be distributed at discretion and without control; but it is impossible for subscribers to cause a continuous flow. They can get from 14 to 18 pints of water every time that they depress the handle, and stop the flow at will by raising it; and so too, by depressing the handle slowly, they can vary the velocity of the flow, and consequently regulate the discharge. Whatever be the volume that flows, it will never be able to exceed that for which the cock has been regulated, seeing that its construction prevents any constant discharge of water from taking place, and that, too, whatever be the position of the handle.—*La Nature.*

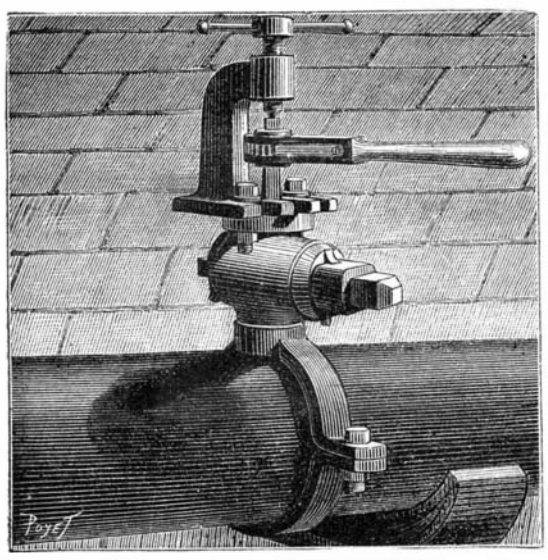


Fig. 4.—DRILL FOR BORING HOLES IN WATER MAINS.

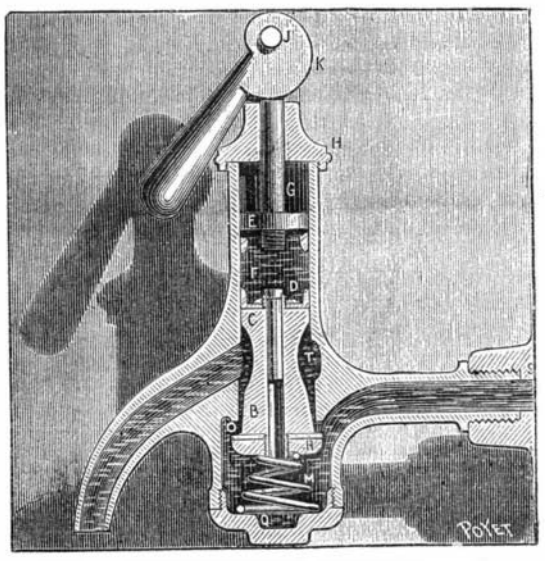


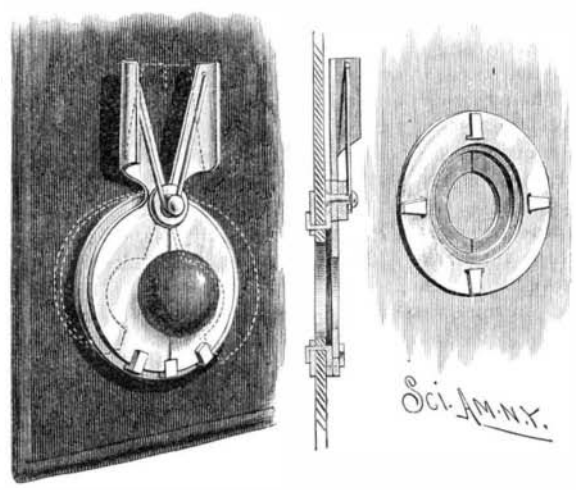
Fig. 5.—CHAMEROY'S INTERMITTENT COCK.

IMPROVED DUMPING CART.

The accompanying engraving represents a novel form of dumping cart, the invention of Mr. Reuben T. Schall, of Norristown, Pa. The axle is provided with two vertical racks, formed upon the forward faces of standards having longitudinal slots. Engaging with the racks are small gear wheels, carried by a transverse shaft mounted in bearings on the wagon frame. Upon one side of the frame is mounted a train of gearing, operated by means of a crank handle, and engaging with the wheel that meshes with the rack, so that when the crank is turned the gear wheels will travel up the racks, and raise the cart body and shafts. After the cart has been sufficiently elevated to permit of the dumping of its load into a chute, a properly arranged lever upon the side of the cart opposite the gearing is drawn down, and the body of the cart swung to the position shown in the engraving, the rear end being supported by a staff connected with the lever near its back end. The cart frame is provided with two studs, having disk-shaped heads, which ride within the slots in the standards, and thus guide the cart body, the disk-shaped heads fitting against the outer face of the standards. The shafts are pivotally connected to the frame, the forward parts of the side timbers of which are slotted to permit the passage of staples carried by the shafts, a bar being inserted in the staples above the frame to keep the cart from dumping.

CURTAIN FASTENER.

The curtain fastener herewith illustrated is the invention of Mr. Wm. Wiedemann, of Lawrence, Kan. To the base plate are pivotally connected two jaws; the inner portion of each jaw is formed with a semicircular recess and the outer portions form thumb wings, and are normally held apart by a spring. By pressing upon the thumb wings, the jaws are thrown apart to permit the head of the button to pass between them, so that when the pressure is released the jaws will close about the shank of the button and firmly hold it. In applying this fastener to a carriage or other form of curtain, ears on the base plate are forced through the curtain and passed through apertures made in a retaining ring, after which the ears are turned down to clamp the fastener to the curtain. This fastener will hold the curtain against displacement by the wind, and can be easily buttoned and unbuttoned.



WIEDEMANN'S CURTAIN FASTENER.