F. W. MÜLLER.

BOTTLE FILLING APPARATUS.

APPLICATION FILED OCT. 28, 1919.

1,384,538.

Patented July 12, 1921.

2 SHEETS—SHEET 1.

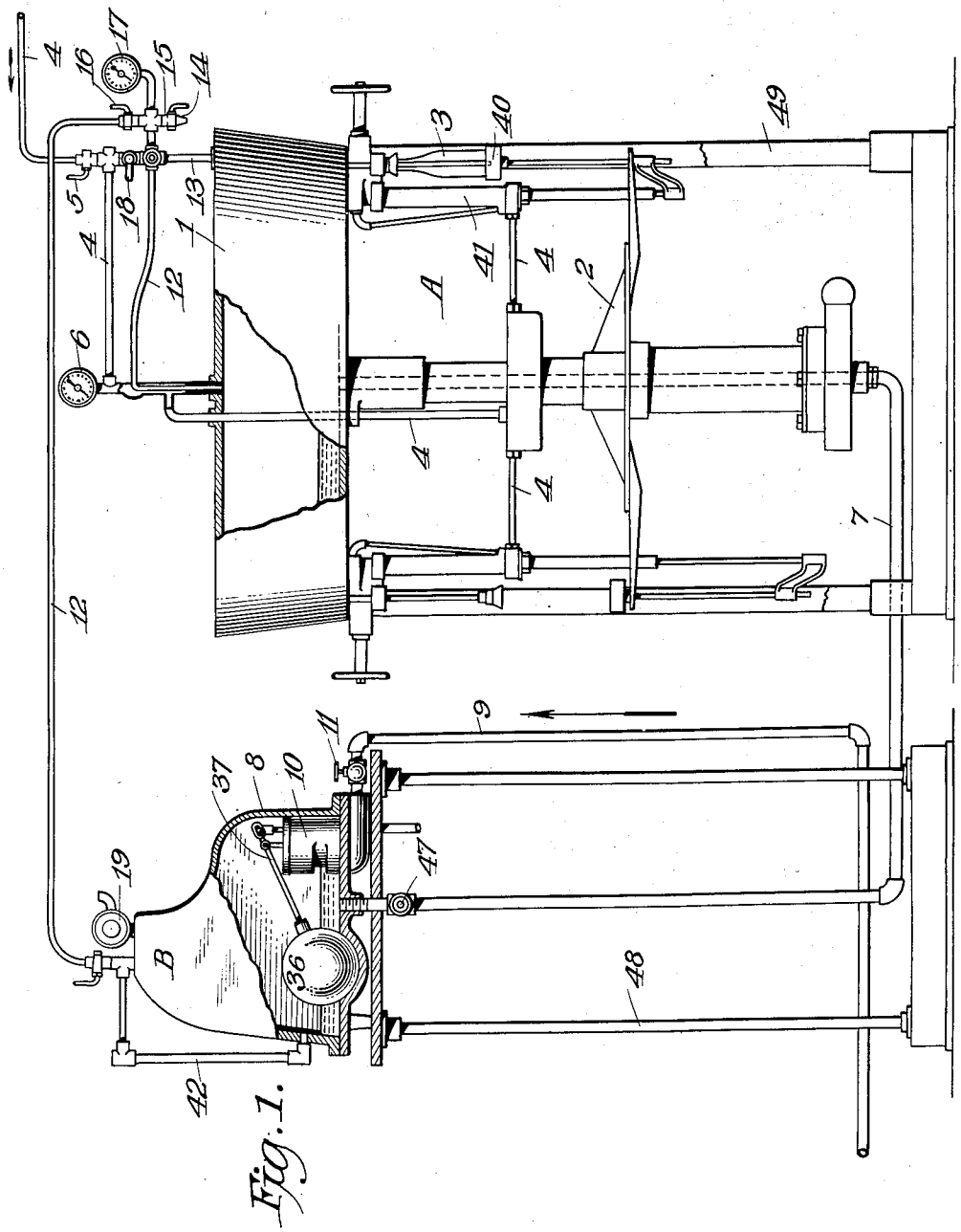


Fig. 1.

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2 SHEETS—SHEET 2.

Fig. 2.

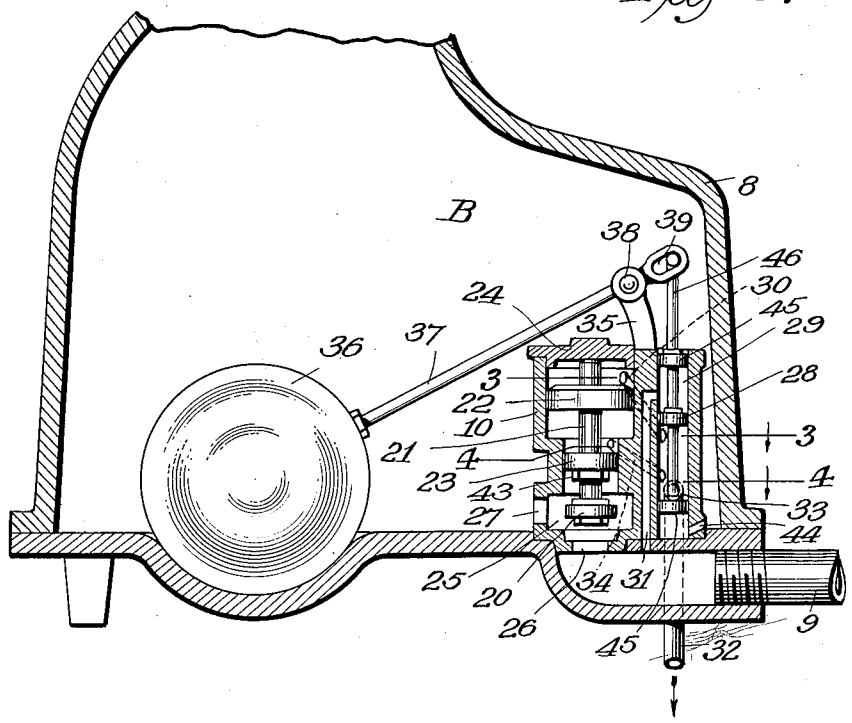


Fig. 3.

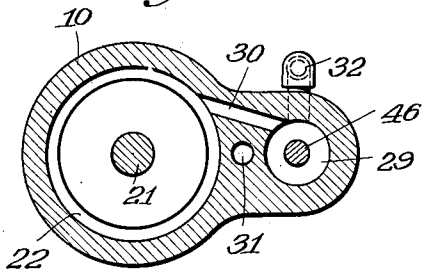
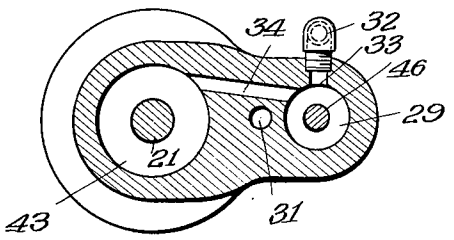


Fig. 4.



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BOTTLE-FILLING APPARATUS.

1,384,538. Specification of Letters Patent. Patented July 12, 1921.

Application filed October 28, 1919. Serial No. 333,922.

To all whom it may concern:

Be it known that I, FRED. W. MÜLLER, a citizen of the United States of America, residing at Hoboken, county of Hudson, State of New Jersey, have invented certain new and useful Improvements in Bottle-Filling Apparatus, of which the following is a specification.

My invention relates to bottle filling apparatus designed to operate with a gas charged liquid, such as any of the usual forms of carbonated beverages, and is particularly designed to handle said liquid in a manner that will reduce the loss of gas therefrom heretofore resulting from agitation of the liquid in the bottling process. Liquids of this character are usually manufactured and delivered to the bottle filling apparatus under considerable pressure, say about 60 pounds to the square inch. To avoid losses by leakage at the point of connection of the bottles to the apparatus, and to avoid danger of bursting the bottles, this pressure must be reduced in the bottle filling apparatus usually to about 20 pounds. Heretofore this has generally been accomplished by passing the liquid through a pressure reducing valve at its point of delivery to the apparatus. In such operation the liquid is violently agitated during its flow through the restricted passages of such valve and is delivered, practically continuously, to the bottle filling tank in a small jet of high velocity which causes a continuous and violent agitation of the body of the liquid already in the tank. As a result a considerable proportion of the carbonic acid or other gas with which the liquid is charged is freed in the tank and passes out through the safety blow-off valve and is lost, and the liquid is also delivered to the bottles in such condition that escape of gas continues therefrom during the period of time necessarily elapsing between the bottle filling operation and the bottle capping operation.

My invention avoids this agitation of the liquid by delivering it to the bottle filling apparatus through conduits of relatively large cross section unobstructed by reducing valves or small nozzles or sections, and by intermittently cutting off completely this large, but relatively slow moving, stream with the result that there is practically no agitation whatever of the liquid while traveling through, and discharging from, this unobstructed conduit, less agitation of the body of liquid in the apparatus during the short periods while the larger, slower moving jet is discharging into it, and none at all during the relatively long intervening periods when no discharge whatever is occurring.

The best form of apparatus at present known to me embodying my invention is illustrated in the accompanying two sheets of drawings in which—

Figure 1 is a side elevation of the essential parts of a typical bottle filling apparatus with my invention applied thereto, parts being broken away or shown in section.

Fig. 2 is a vertical section on an enlarged scale of a smaller additional tank and an automatic quick acting valve controlling admission of liquid thereto which constitute part of my invention, and

Figs. 3 and 4 are detail cross sections of the valve on lines 3—3 and 4—4, respectively of Fig. 2.

Throughout the drawings like reference characters indicate like parts. A, represents generally a standard type of bottle filling apparatus having the tank 1, partly filled with the gas charged liquid supported by frame 49, which frame also supports a revoluble spider 2, carrying vertically reciprocating bottle supports or stirrups 40, raised and lowered automatically by compressed air motor devices 41, so that each bottle 3, is in turn lifted and connected to the interior of tank 1, in order that liquid may flow into and fill the bottle. Compressed air is supplied to the motor devices 41 by piping 4, controlled by hand valve 5, the pressure being indicated by gage 6.

7 is a conduit usually of about an inch diameter controlled by hand valve 47 supplying the carbonated liquid under high pressure to the liquid containing zone of tank 1. Heretofore this conduit has terminated in a pressure reducing valve which delivered the liquid to tank 1 through an eighth inch nozzle. According to my invention no such small nozzle or usual pressure reducing valves are used but conduit 7, discharges into the tank without reduction of its full bore and the quantity of liquid delivered by it is kept down to the requirements of consumption by reducing the velocity of outflow from conduit 7. The preferred means for accomplishing this consists of a device generally represented by B which I call an "equalizer" and which comprises a smaller tank 8, supported at approximately the same level as tank 1, as by frame 48, sup-

plied with liquid from conduit 9, controlled by an automatic quick opening valve in casing 10, and with the liquid containing zone of which tank 8 the other end of conduit 7, communicates. 11 is a hand operated shut off valve on conduit 9. A system of pipes 12—12 of preferably relatively small cross section connects the gas containing zones of tanks 1 and 8. This piping 12, 12 is controlled by shut-off valve 16. A standard 13 supports pipe systems 4 and 12. A connection 14, to pipe 12 controlled by valve 15, serves as a means for admitting carbonic acid gas, or other uncontaminated gas, to the pipe system 12, to create the requisite initial counter pressure in tanks 1 and 8, which pressure is indicated by gage 17. A cross-over connection between pipe systems 4 and 12 is controlled by valve 18. Normally this valve is closed, but if the aid of the compressed air used to operate the stirrups 40, is required to supplement a falling counter-pressure of the carbonic acid gas, the valve 18, is temporarily opened. 19 is an adjustable blow off valve for the counter pressure system preferably placed on tank 8, as shown. 42 is a glass sight gage for showing the higher levels of liquid in tank 8. The quick acting valve in casing 10 is automatically opened by rising of float 36 in tank 8, and closed by falling of the float. The general mode of operation of the apparatus so far described is as follows: Tanks 1 and 8, being partly filled with liquid, the required counter pressure of gas (say 20 pounds) being established therein, blow-off valve 19, being set to open at any excess above that pressure, and valves 11, and 47, being open, the bottle filling apparatus is set in operation, with the result of gradually lowering the level of liquid in tank 1. Liquid thereupon flows slowly, by action of gravity, from tank 8, through conduit 7, to tank 1. When the level of liquid in tank 8, has fallen to a predetermined point, say that shown in Fig. 1, float 36, operates to open the quick acting valve in casing 10, and a free flow of liquid from conduit 9, into tank 8, occurs, the valve having an opening of the full size of the cross section of conduit 9. The inertia of the liquid and its friction in the long conduit system 9 prevent its issuing at the velocity which should theoretically result from the difference between the 60 pounds pressure at its source and the 20 pounds of counterpressure in tank 8. Consequently the liquid in tank 8 is but slightly agitated during the admission of the liquid. In a short space of time the large jet raises the level in tank 8 to such an extent that float 36, causes the valve in casing 10 to suddenly close and the jet stops until the slow flow from tank 8 through conduit 7 to tank 1, lowers float 36 and again opens the valve. During this last described period the liquid in tank 8 is entirely quiescent. As the difference in level even between the full tank 8 and a partly empty tank 1 is small, the flow from one to the other through conduit 7 is very gentle. Also this slowness of transfer from 8 to 1, causes the liquid level in small tank 8 to build up rapidly when the inlet valve is open, and as the trapped gases therein cannot escape as rapidly through small pipe 12, the pressure rises slightly in tank 8, the blow-off valve 19, opens, and a considerable portion of the gases trapped in tank 8, escaped. During the period when liquid inflow is stopped and the level is falling in tank 8 a part of the air discharged into tank 1 from bottles being filled flows back through pipe 12, to tank 8, to be expelled through valve 19, in the next cycle. As a result of the foregoing mode of operation the liquid in tank 8 is only moderately agitated for a small portion of the time and that in tank 1 is practically not agitated at all at any time.

The preferred form of quick acting valve in casing 10, shown in Figs. 2, 3, and 4, comprises the puppet valve 20, on spindle 21, opening outward from its seat in port 26 at the end of conduit 9 and controlled by large piston 22 mounted on spindle 21, and reciprocating in cylindrical casing 10, which casing is closed at its outer end by cylinder head 24. The inner end of cylindrical casing 10 has an opening 43, of reduced bore in which the smaller piston 23, also on spindle 21, reciprocates and serves as packing means between spindle and casing to prevent liquid pressure from tank 8, or conduit 9 reaching the under side of large piston 22. Between casing 10, and valve port 26, is valve chamber 25, in which chamber valve 20, reciprocates, and which has a side port 27, opening into tank 8. The area of port 27 and of port 26 is each as large as, or larger than, the bore of conduit 9. Fluid pressure is admitted to and exhausted from the closed end of casing 10, to reciprocate piston 22, by pilot valve piston 28, on spindle 46, having pin and slot connection 39, with float lever 37, pivoted at 38 on standard 35. Valve piston 28 reciprocates in bore 29, of casing 10. End pistons 45, 45, on spindle 46, are exposed to pressure of the fluids in chamber 8, either directly or through port 44, and are therefore balanced. 30 is a passage from a middle port in bore 29 to the closed end of casing 10, and 31 is a passage from conduit 9 to an upper port in bore 29. An exhaust pipe 32 is connected to bore 29 by lower port 33. Bore 29, is also connected by passage 34 to the space between pistons 22 and 23, which is thus always open to the atmosphere, as lower piston 45 of the pilot valve is always below exhaust port 33 and valve piston 28 is always above the port of passage 34.

In operation the parts are so proportioned

that the pilot valve piston 28 is between the port communicating with the high pressure passage 31 and the port communicating with the passage 30 when the level of liquid in the tank 8 is low and the float 36 is in its lowermost position as shown in Fig. 2. This shuts off communication between the high pressure liquid in conduit 9 and the space in the end of cylindrical casing 10, closed by cylinder head 24, and opens communication between that space and the atmosphere through passage 30, exhaust port 33 and exhaust pipe or passage 32. As a result there is nothing to counterbalance the pressure of 60 pounds to the square inch on the under surface of the valve 20 and the same opens automatically, admitting fluid to the tank 8. As soon as the valve 20 lifts far enough so that the high pressure fluid can get around it, this fluid also begins to exert its pressure on the smaller piston 23, and so continues to lift valve 20 through its full limit of travel. The rise of the fluid level in the tank 8 gradually lifts the float 36 and gradually lowers pilot valve piston 28, so that in time it crosses over the port communicating with passage 30, opening said passage to the high pressure and closing it off from the exhaust. Thereupon the 60 pounds pressure upon the large area of upper surface of piston 22 promptly forces the valve 20 down onto its seat 26 and further inflow of liquid is temporarily cut off until the outflow through conduit 7 to tank 1 has reduced the level in tank 8 to a predetermined extent. Then the above described series of operations is repeated.

At all times the space between pistons 22 and 23 is open to the atmosphere as the exhaust port 33 is never closed. The pilot valve piston 28 is fully balanced at all times as the pressure existing in the tank 8 is equally applied to the upper surface of upper packing piston 45 and to the lower surface of the lower packing piston 45.

It is evident that the above described series of operations can take place with the least possible agitation of the carbonated liquid being handled by the apparatus. When the quick acting valve 20, opens, the column of such liquid in the relatively long conduit 9, is at rest. Its inertia must be overcome by the pressure in the source of supply before it obtains any considerable rate of speed throughout the conduit, and the friction of the conduit walls and bends will tend to retard the speed of flow through it at all times. As a result the column of liquid is discharged into tank 8, at gradually increasing but moderate speed, but on account of its large cross section rapidly fills the tank 8, to the point at which the valve 20, again comes into action and closes almost instantly. While the valve is closed, the liquid in the tank 8, is slowly falling by gravity and passing through the large conduit 7, to tank 1, so that little or no agitation occurs during this period of operation, which with the ordinary proportion of parts employed in my apparatus, is many times longer than the period of valve opening and fluid inflow.

The advantage of this procedure over that formerly employed in which the fluid supplied to the tank 1, through conduit 7, at full pressure passed through a reducing valve and was discharged continuously into the liquid body in tank 1 at high velocity in a jet one-eighth of an inch in diameter, is evident. Such high pressure, continuously acting jet kept the liquid in tank 1 in constant agitation and the liquid was also violently shaken up in its passage through the pressure reducing valve. Another advantage resulting from the use of my invention is that because the liquid is not agitated, even when handled in large volumes, it may be handled more rapidly, so that the bottle filling apparatus may be speeded up and its efficiency greatly increased.

It is evident that various changes could be made in the details of construction here illustrated and described without departing from the principle of my invention. Other forms of quick acting valve could be used and other apparatus for automatically operating them. It is not essential that the smaller tank 8, should be outside of the bottle filling tank 1, as shown in the drawings. The blow-off valve 19, might be placed in other positions than that on the tank 8, as shown, if it were desired to modify the action of the counter pressure gases. The invention can also be applied to other forms of bottle filling apparatus than that shown in the drawings, and the quick acting, intermittently operating valve 20, need not necessarily be located in a chamber separate from the bottle filling tank.

Certain advantages result from the use of a second tank to which the liquid is delivered before it is passed to the bottling tank when the second tank has a smaller area of horizontal cross section than does the bottling tank. The latter must have a considerable horizontal extension in a large machine so that many bottles may be in process of filling therefrom at one time. This, however, produces an extensive surface of liquid from which the gas can escape if the liquid is agitated. By employing a second tank, as 8, to which alone the liquid is first admitted under pressure as by any suitable form of automatically operating valve, or equivalent device, and by making said second tank of relatively small horizontal cross section, the area of surface of the body of liquid which is then subjected to such agitation as is produced by the valve controlled inflow, is reduced and the proportion of gas escaping is thereby reduced.

The placing of the blow-off valve on this

second tank, as shown in the drawing, is also beneficial, as it completes the localization of all of the liquid agitating phenomena in this separate tank so that only quiescent liquid exists in the bottling tank proper, and only such liquid flows into the bottles, each of which consequently gets its full measure of liquid, instead of being only partly filled with liquid, and partly with gas. In other words a good bottling apparatus should do two things: It should be capable of handling a gas charged liquid without allowing much of the gas to escape therefrom, and it should deliver to each bottle its full capacity of such liquid, and not deliver to the bottle any of whatever quantity of gas may have freed itself from the liquid in passing through the apparatus in spite of all precautions. The disturbances which produce liberation of the gases are due to two main causes, inflow of the liquid under pressure through an inlet valve, and outflow of the excess counter-pressure gases through a blow-off valve. By localizing both of these operations in a separate tank my invention insures the maintenance of quiescent body of liquid in the bottling tank proper, and a complete filling of each bottle with such liquid.

Having described my invention I claim:

1. In a bottle filling apparatus designed to handle gas charged liquids the combination, with the main tank to which the bottles are connected for filling, of a conduit for delivering the liquid thereto of relatively large and substantially unobstructed cross section and delivery port, a quick acting valve in said conduit of approximately the same area of opening, and pressure operated means controlled by the rise and fall of the level of the liquid supplied to the tank to quickly open and quickly close said valve.

2. In a bottle filling apparatus designed to handle gas charged liquids the combination, with a tank of relatively large horizontal cross section and bottle filling heads connected thereto, of a second tank of smaller horizontal cross section but considerable capacity located on approximately the same level as the first mentioned tank, a conduit connecting the lower or liquid containing zones of the two tanks, a pipe connecting their upper or gas containing zones, and means for delivering an intermittent supply of gas charged liquid to the second tank.

3. In a bottle filling apparatus designed to handle gas charged liquids the combination, with a tank of relatively large horizontal cross section and bottle filling heads connected thereto, of a second tank of smaller horizontal cross section but considerable capacity located on approximately the same level as the first mentioned tank, a conduit connecting the lower or liquid containing zones of the two tanks, a pipe connecting their upper or gas containing zones, and means for delivering gas charged liquid to the second tank together with a blow-off valve located on the second tank.

4. In a bottle filling apparatus designed to handle gas charged liquids the combination, with the main tank to which the bottles are connected for filling, of a second tank located on approximately the same level, a conduit connecting the lower or liquid containing zones of the two tanks, a pipe connecting the upper or gas containing zones of the two tanks, a pipe of relatively large cross section for supplying the bottle filling liquid to the second tank, a quick acting valve controlling said pipe and having an opening of approximately the same cross section, and pressure operated means controlled by the rise and fall of the level of the liquid in the second tank for intermittently and quickly opening and closing said valve.

5. A structure such as set forth in claim 4 combined with a safety blow-off valve connected to the gas containing zone of the second tank, and in which the pipe connecting the gas zones of the two tanks is of relatively small cross section, whereby upon any sudden rise of the liquid level in the second tank a portion of the gas trapped therein will be blown off before pressures can be equalized in the two tanks, with the result that the variations of the liquid level in the bottle filling tank will be less than those caused in the second tank by the intermittent inflow of liquid thereto.

6. In a bottle filling apparatus the combination of tank adapted to hold liquid under pressure, a pipe for supplying liquid to said tank at a pressure greater than that maintained therein, a puppet valve controlling the discharge port of the pipe leading into the tank, a piston of large area mounted on the spindle of said valve, a cylinder containing said piston which is closed at one end and has an opening in its other end through which the valve spindle passes, a connection from the pipe to the closed end of the cylinder, a pilot valve controlling said connection and a float in said tank operatively connected to said pilot valve, whereby when the puppet valve is lifted, liquid will flow into the tank, and when the float has been raised by the liquid to a predetermined level the pilot valve will be moved far enough to open communication between the pipe and the closed end of the cylinder with the result that the pressure of the fluid in the pipe acting on the larger area of the piston puppet valve spindle will quickly force said valve back to its seat and shut off the inflow of liquid to the tank.

7. A combination such as set forth in claim 6 in which the valve spindle and the cylinder head through which it passes are

equipped with liquid tight packing means, and in which that end of the cylinder is provided with a constantly open outlet passage.

8. In a bottle filling apparatus the combination of a tank adapted to hold liquid under pressure, a pipe for supplying liquid to said tank at a pressure greater than that maintained therein, a puppet valve controlling the discharge port of the pipe leading into the tank, a piston of larger area mounted on the spindle of said valve, a cylinder containing said piston which is closed at one end and has an opening in its other end through which the valve spindle passes, a piston of smaller area mounted on the spindle and fitting in said opening, a chamber between the cylinder and the pipe discharge port which has a side-opening into the tank, a balanced piston valve having a casing provided with three ports, that is to say, an inlet port communicating with the supply pipe, a second port communicating with the closed end of the before mentioned cylinder, and an exhaust port, and means actuated by the rise of the fluid level in the tank to move said piston valve to a position which opens communication between the inlet port and the second port, and by the fall of said fluid level to open communication between the second port and the exhaust port while closing its communication with the inlet port, whereby in the first described position full pressure of fluid in the pipe is applied to the larger piston to close the puppet valve, while in the second position any fluid above said piston is relieved from pressure and discharged through the exhaust port by the opening movement of the puppet valve produced by the then unbalanced pressure thereon of the fluid in the pipe.

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Witnesses:
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