

July 22, 1930.

R. A. BROOKS

1,770,909

WATER SUPPLY REGULATOR

Filed Feb. 10, 1926

2 Sheets-Sheet 1

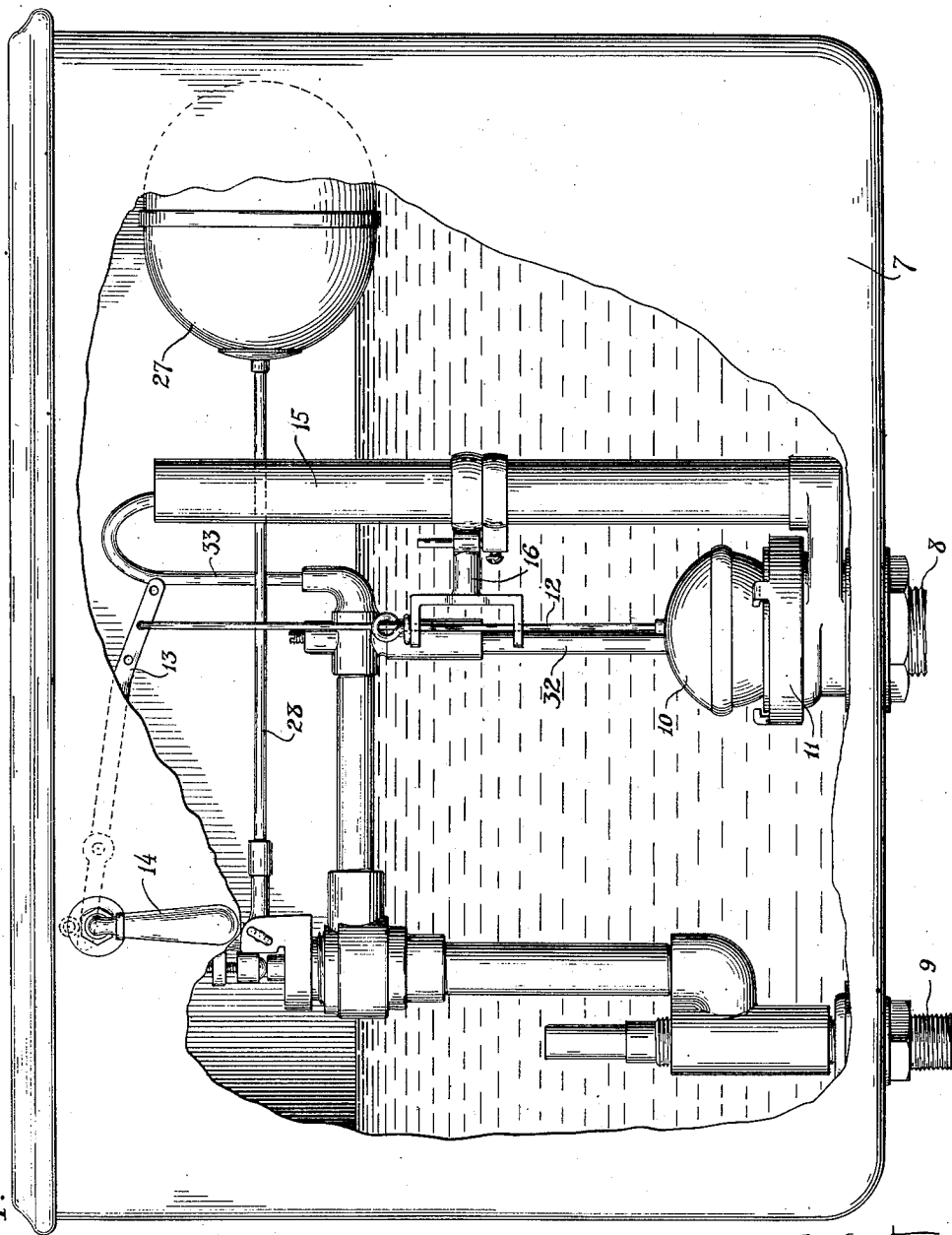


Fig. 1.

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2 Sheets-Sheet 2

Fig. 2.

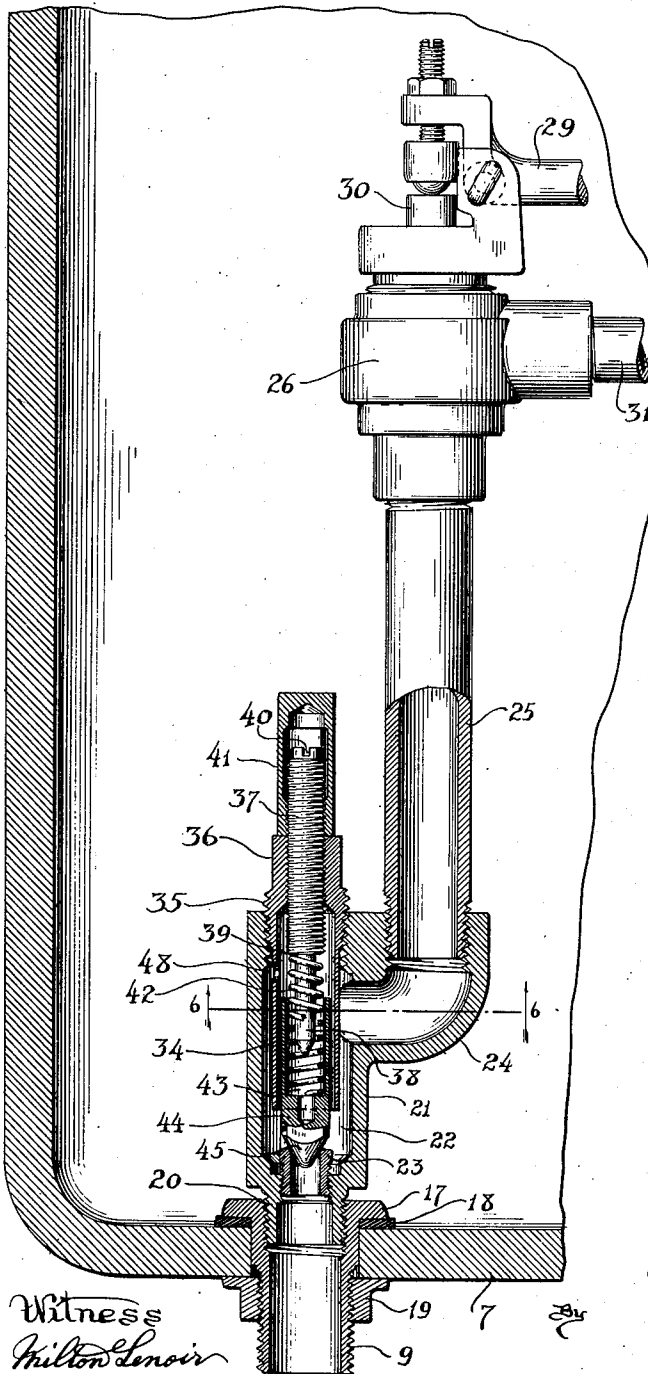


Fig. 3.



Fig. 4.

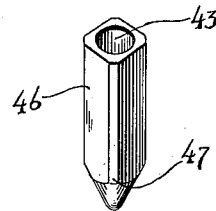
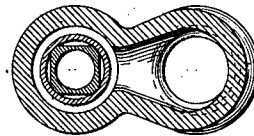


Fig. 5.



Fig. 6.



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WATER-SUPPLY REGULATOR

Application filed February 10, 1926. Serial No. 87,201.

My invention relates to regulators for controlling the volume, pressure and velocity of water flow, and has for its object to provide an improved regulator which will be especially adapted for use with flushing tanks of water closets provided with the usual float controlled inlet valve, to insure the noiseless operation of the valve mechanism under all conditions, regardless of whether the water is supplied to the tank under high or under low pressure. The use of high pressure water supply in water closet installations has become quite extensive, but a serious objection that has been encountered in such installations is that the closing of the inlet valve under the action of the float is usually attended by whistling noises, or noise in the nature of water hammer, and although various attempts have been made to avoid this effect, so far as I am aware prior to my present invention none of them have been successful. In some instances it has been proposed to eliminate noise by cutting down or throttling the volume of flow by the use of compounding levers or by restricting the waterway, but while such devices reduce the noise to some extent it is at the expense of the volume of flow, so that when such constructions are installed for use under low pressure an insufficient flow is obtained and the results are not satisfactory. By my present invention I avoid the objections to prior constructions and not only eliminate noise practically altogether, but also provide for maintaining an adequate flow under low pressure as well as under high pressure. The nature of my invention will appear from the following description thereof with reference to the accompanying drawings, in which—

Fig. 1 is a side elevation of a flush water tank such as are commonly used in connection with water closets, one side being partly broken away to show the operating parts contained therein;

Fig. 2 is a partial vertical section of the tank showing the valve mechanism for controlling the admission of water thereto, including my improved regulator, the latter being shown in section;

Fig. 3 is a perspective view of a tubular member that constitutes a support and guide for certain parts of the regulator;

Fig. 4 is a perspective view of the regulator valve element;

Fig. 5 is a perspective view of the valve seat; and

Fig. 6 is a cross-section on line 6—6 of Fig. 2, looking up.

It will be understood that while I have shown my invention as applied to a water closet flushing apparatus and in this specification I shall describe such application thereof specifically, my improved regulator is not limited to use solely for such purposes, as it may be employed in other situations, and for controlling the supply of either cold or hot water, or steam or other fluids under pressure. The claims hereinafter made should therefore be construed accordingly.

Referring now to the drawings,—7 indicates a flush water tank, 8 the outlet therefrom through which the flush water is discharged, and 9 the water supply pipe through which water is admitted to said tank. The outlet 8 is controlled by a vertically moveable valve 10 adapted to seat in the open upper end of a fitting 11, said valve being arranged to be moved vertically to flush the closet by means of a rod 12 connected with a lever 13 adapted to be rocked by a handle 14 located at one side of the tank, in the usual way. An overflow pipe 15 is associated with the fitting 11, which supports a bracket 16 that forms a guide for the rod 12. These parts are preferably constructed and arranged as shown and described in my pending application, Serial No. 85,137, filed February 1, 1926, but they may be of any other approved construction.

As best shown in Fig. 2, the supply pipe 9 is fitted in an opening in the bottom of the tank 7 and is provided with a head 17 at its upper end which is drawn down against a washer 18 interposed between it and the upper surface of the bottom of the tank by means of a collar 19 screwed upon the lower end of said pipe and bearing against the under surface of the tank, thus providing a water tight connection. At its upper end the

pipe 9 is provided with internal screw threads to receive a screw threaded nipple 20 at the lower end of a casting 21 which forms the body of the regulator. Said body is
 5 mainly in the form of a cylinder having a vertically disposed chamber 22 between the lower end of which and the nipple 20 is a short sleeve 23 that forms a valve seat. Said seat is adapted to be screwed into the lower
 10 end portion of the body 21 above the nipple 20 and its upper end forms a seat for the valve hereinafter described. Said seat may readily be adjusted or removed owing to its screw-threaded connection with the body 21.
 15 The upper portion of the body is provided with a laterally disposed branch or elbow 24, with which the lower end of an inlet pipe 25 has screw-threaded connection. The pipe 25 carries at its upper end a valve casing 26 in
 20 which is mounted suitable valve mechanism, operated by the usual float, for controlling the admission and cutting off of the water supplied to the tank 7. Preferably such valve mechanism is of the construction shown
 25 and described in my pending application, Serial No. 56,296, filed September 14, 1925, but it may be of any other approved construction. It will suffice for present purposes to say that such valve mechanism is controlled
 30 by a float 27 connected by a rod 28 to a vertically swinging arm 29, the rocking of which controls the position of a valve 30 operating in the casing 26. When the float drops the valve 30 opens, and when the float rises to
 35 its normal position the valve closes. A pipe 31 leading from the casing 26 delivers water to the tank through a pressure jet 32 and also delivers water to the overflow pipe 15 through a refill pipe 33.
 40 Mounted in the upper portion of the body 21 and extending down thereinto in axial alinement with the valve seat 23 is a tubular guide 34 externally screw-threaded near
 45 its upper end, as shown at 35, to screw into the upper end of the body 21. It will be noted that the threaded portion 35 has a taper thread so that it may be screwed down tightly to prevent leakage around the guide, which is necessary in an apparatus of this type.
 50 Said guide is provided at its upper end with a boss 36 that is internally screw-threaded to receive an adjusting screw 37 which projects through said boss and at its lower end carries a stem 38 somewhat reduced in diameter to
 55 form a shoulder 39 at the lower end of the threaded portion of the screw 37. The upper end of said screw is preferably grooved as shown at 40, to receive a screwdriver. A cap 41 fits over the upper end of the screw 37 and
 60 is adapted to screw thereupon and to abut against the upper end of the boss 36, to make a tight closure at that point around the screw. Said cap being closed except at its lower end, leakage around the screw is prevented.
 65 At the lower end of the screw 37 and fitted

upon the stem 38 is a coiled spring 42 that extends down below the lower end of said stem and into a pocket 43 formed in the upper elongated bearing portion of a valve 44 arranged coaxially with the screw 37, as shown in Fig. 2. The lower end of the spring 42
 70 bears against the bottom of the pocket 43 and therefore tends to force the valve 44 downward when the spring is in operative position, as hereinafter explained. The valve 44
 75 is of the needle type, being provided with a pointed conical lower end 45 that seats in the upper end of the seat 23, and coacts therewith to form a tight closure. As best shown in Fig. 4, the sides 46 of the elongated bearing
 80 portion of the valve 44 are flattened to form longitudinally extending corners 47 that are flattened or bevelled to bear against the inner face of the sleeve 34, the diameter of the valve at such corners being such that when the valve
 85 is in place they will bear against the inner wall of the sleeve, which consequently serves as a guide for the valve during its vertical movement. Said valve extends up a considerable distance into the lower end of the sleeve,
 90 as shown in Fig. 2, so that the valve is at all times prevented from vibrating laterally. The needle portion, or pointed lower end of the valve also aids in preventing vibration because it breaks up the stream of incoming
 95 water and distributes it uniformly around the valve as it passes to the pipe 25. Above the upper end of the valve the sleeve 34 is provided with an opening 48 affording communication between the interior of said sleeve
 100 and the chamber 22 in the body 21, to equalize the pressure at opposite ends of the valve. It will be noted also that the lower end of the sleeve 34 extends down below the elbow 24 so that water flowing in either direction between the body 21 and the pipe 25 flows
 105 around said sleeve.

It will be apparent from the foregoing description that by adjusting the screw 37 vertically the tension of the spring 42 may be
 110 varied to regulate the pressure of the valve 44 upon its seat, or to relieve the valve entirely from spring pressure. Where the regulator is installed for use with a low pressure water supply the screw 37 is moved out of operative
 115 engagement with the spring by upward adjustment of the screw 37, so that the valve may move vertically freely, but where installed for use with a high pressure water supply the tension of the spring is applied
 120 to the valve, to hold it on its seat under the desired pressure, by downward adjustment of said screw.

The operation of my improved apparatus is as follows: Assuming that the installation
 125 is one using a low pressure water supply, the screw 37 is backed up out of operative engagement with the valve 44, so that the valve is held on its seat only by gravity, and may be lifted therefrom by the inflow-
 130

ing water whenever the float controlled valve is opened. When the water is first turned on the pressure lifts the valve 44 so that the water may flow up through the body 21 and elbow 24 to the pipe 25, whence it is admitted to the flushing tank under the regulation of the float controlled valve therein, in the usual way. When the pipe 25 has been filled and the float controlled valve 30 is closed, the pressure in the pipe 25 and chamber 22 becomes equalized with the pressure in the supply pipe 9 so that the valve 44 closes, but whenever the valve 30 is opened by the operation of the float the supply pressure again becomes effective to open said valve. Where the installation is one using a high pressure water supply, the screw 37 is moved down to make the spring 42 effective to seat the valve 44 against a predetermined pressure. Assuming that the pressure in the supply pipe is one hundred pounds to the square inch the screw 37 would be adjusted to cause the spring 42 to apply a pressure of say fifty pounds to the square inch to the valve 44. Consequently, when the water is first turned on the excess water supply pressure of fifty pounds would lift the valve from its seat and would fill the pipe 25. If the tank were full the float controlled valve 30 would be closed, and, therefore, as soon as the pipe 25 had been filled the valve 44 would be closed under the action of the spring 42, which would become effective in view of the balanced pressure above and below the valve seat 23. Upon the opening of the float controlled valve 30 during the flushing operation the water will flow into the chamber 22 under a pressure of fifty pounds, as the valve 44 would be lifted from its seat by the water supply pressure, and accordingly there would then be an unrestricted flow under full pressure into the tank. Upon the closing of the valve 30 the pressure above and below the seat 23 would again become equalized, permitting the valve 44 to close under the pressure of the spring 42, but as the valve 30 is closed gradually the valve 44 would also close gradually, due to the gradual increase of the reactionary pressure in the pipe 25 and chamber 22, so that noise or water hammer, which is ordinarily caused by sudden closure of a valve against considerable water pressure, would be avoided. Furthermore, as the valve is held against vibration by the sleeve 34 whistling noises from that source are avoided. Obviously the screw 37 may be adjusted to vary the effective tension of the spring 42 within rather wide limits, so that the regulator may be adjusted to operate properly under almost any practicable water supply pressure. In practice, using a valve seat of one quarter inch diameter I would employ a spring which would require a pressure of twenty pounds to fully compress it, and in an installation using a

water supply under one hundred pounds pressure a five pound spring pressure would be sufficient to close the valve. Therefore, by putting a tension of two and one-half pounds on the spring the valve 44 will offer a resistance of fifty pounds to the water supply pressure of one hundred pounds. When the tank is empty and the ball cock is fully opened the fifty pounds excess pressure of the water supply will cause the valve 44 to open fully and provide an unrestricted passage so long as water continues to flow into the tank, but, as above explained, as the water rises in the tank the float valve gradually closes and this in turn creates a pressure above the regulating valve 44, with the result that it starts to close automatically. The effect of these various actions is that as the ball cock closes the regulator valve will close simultaneously with it, developing pressure between the two valves which gradually equalizes the fluid pressure at opposite ends of the valve and effectively stops the noise that would otherwise be caused by the rush of water at high pressure, through the reduction in the area of the passage at the seat caused by the closing of the regulating valve. Should an obstruction interfere with the flow of water past the regulating valve the latter will rise sufficiently to permit a full volume of flow and allow the obstruction to pass through, after which the valve will resume its normal position. The sleeve 34 not only holds the valve 44 against vibration as above stated, but also removes it from the influence of the rapidly moving body of water, which would tend to cause vibration and noise, and makes it work smoothly and silently.

The parts may be made of any suitable material, but I prefer to make the spring of phosphor bronze or other non-corrosive metal. As there are no packings, such as discs, washers, hydraulic cups and packed stems in my improved regulator, when the parts are once adjusted and set no further care is required, and although the working parts are entirely enclosed and sealed, they can easily be removed for inspection or replacement. By providing the valve with flat sides, with corner bearings on the rounded sleeve 34, it has greater freedom of action and has no tendency to stick. The cap at the upper end of the screw not only serves to prevent leakage, but also acts as a lock nut to hold the screw 37 in its different positions of adjustment.

I wish it to be understood that while I have described with considerable detail the particular embodiment of my invention illustrated in the drawings, my invention is not limited to such specific construction, but includes such variations or modifications thereof as would occur to those skilled in the art. It should be understood also that

the term "float controlled valve" as used in the claims is used in a generic sense to indicate a gradually closing valve operating in any suitable way, whether used in connection with a water closet flushing tank or in some other appropriate situation.

What I claim as my invention and desire to secure by Letters Patent, is—

1. The combination with a water supply pipe, an inlet pipe and a float controlled valve for controlling the discharge from said inlet pipe, of a regulator interposed between said supply pipe and said valve comprising a body having a chamber communicating with said supply pipe and said inlet pipe, a valve seat between the supply pipe and said chamber, a regulating valve in said chamber movable toward and from said seat, a spring tending to seat the regulating valve and effective to close the same by the closing of said float controlled valve, and means in said chamber for guiding the regulating valve and holding it against vibration.

2. The combination with a water supply pipe, an inlet pipe and a float controlled valve for controlling the discharge from said inlet pipe, of a regulator interposed between said supply pipe and said valve comprising a body having a chamber communicating with said supply pipe and said inlet pipe, a valve seat between the supply pipe and said chamber, a regulating valve in said chamber movable toward and from said seat, a spring tending to seat the latter valve and effective to close the same by the closure of said float controlled valve, and a sleeve extending into said chamber and surrounding the regulating valve for guiding it and holding it against vibration.

3. The combination with a water supply pipe, an inlet pipe and a float controlled valve for controlling the discharge from said inlet pipe, of a regulator interposed between said supply pipe and said valve comprising a body having a chamber communicating with said supply pipe, an elbow connecting said chamber with said inlet pipe, a sleeve mounted in said body and extending into said chamber past said elbow, a valve slidable in said sleeve, a seat for the latter valve, and a spring tending to close the latter valve.

4. The combination with a water supply pipe, an inlet pipe and a float controlled valve for controlling the discharge from said inlet pipe, of a regulator interposed between said supply pipe and said valve comprising a body having a chamber communicating with said supply pipe and with the inlet pipe, a sleeve mounted on said body and extending into said chamber, a valve slidable in said sleeve, said valve being polygonal in cross-section and having corner portions bearing on said sleeve, a seat for the latter valve, and a spring tending to close the latter valve.

5. The combination with a water supply pipe, an inlet pipe and a float controlled valve for controlling the discharge from said inlet pipe, of a regulator interposed between said supply pipe and said valve comprising a body having a chamber communicating with said supply pipe and with the inlet pipe, a sleeve mounted on said body and extending into said chamber, a valve slidable in said sleeve, said valve being polygonal in cross-section and having corner portions bearing on said sleeve, a seat for the latter valve, a spring tending to close the latter valve, and means adjustable to vary the tension of said spring.

6. The combination with a water supply pipe, an inlet pipe and a float controlled valve for controlling the discharge from said inlet pipe, of a regulator interposed between said supply pipe and said valve comprising a body having a chamber communicating with said supply pipe and with the inlet pipe, a sleeve mounted on said body and extending into said chamber, a valve slidable in said sleeve, a screw adjustably mounted in said sleeve, a spring interposed between said screw and the latter valve for moving said valve toward its seat, and a seat for the latter valve.

7. The combination with a water supply pipe, an inlet pipe and a float controlled valve for controlling the discharge from said inlet pipe, of a regulator interposed between said supply pipe and said valve comprising a body having a chamber communicating with said supply pipe and with the inlet pipe, a sleeve mounted on said body and extending into said chamber, a valve slidable in said sleeve, a screw adjustably mounted in said sleeve, a spring interposed between said screw and the latter valve for moving said valve toward its seat, a seat for the latter valve, and a cap mounted on the upper end of said screw and bearing against the upper end of said sleeve.

8. A regulator of the type described comprising a body having a valve chamber, a sleeve tightly connected with said body and extending into and spaced from the wall of said chamber, a needle valve slidable in said sleeve, a seat for said valve, a passage in said sleeve connecting its interior with said valve chamber at the opposite side of said valve from said seat, a spring tending to move said valve toward its seat, means for varying the tension of said spring, and an outlet passage communicating with said chamber.

9. A regulator of the type described comprising a body having a valve chamber, a sleeve tightly connected with said body and extending into said chamber, a valve having an elongated stem portion polygonal in cross-section to provide corners engaging the inner face of said sleeve and slidable longitudinally thereof, a seat for said valve, a

spring tending to move said valve toward its seat, means for varying the tension of said spring, and an outlet passage communicating with said chamber.

5 10. A regulator of the type described comprising a body having a valve chamber, a sleeve tightly connected with said body and extending into and spaced from the wall of said chamber, a needle valve slidable in said
10 sleeve, a seat for said valve, a passage in said sleeve connecting its interior with said valve chamber at the opposite side of said valve from said seat, a spring tending to move said
15 valve toward its seat, a screw mounted in said sleeve and adjustable to vary the tension of said spring, and an outlet passage communicating with said chamber.

11. The combination with a water supply pipe, an inlet pipe and a valve for controlling the discharge from said inlet pipe, of a regulator comprising a regulating valve interposed between the supply pipe and the inlet
20 pipe valve and operating to reduce the pressure of the water admitted to the inlet pipe, and to cut off the admission of water thereto when said inlet pipe valve is closed, said regulating valve being adjustable to vary the pressure of the water discharge from the inlet
25 pipe.

30 12. The combination with a water supply pipe, an inlet pipe and a float controlled valve for controlling the discharge from said inlet pipe, of a regulator comprising a regulating valve adapted when seated to cut off the flow
35 of water from said supply pipe to said inlet pipe, and to be opened by the opening of said float controlled valve to admit water at reduced pressure to said inlet pipe, and adjustable spring means dependent upon reactionary
40 pressure in said supply pipe due to the closing of said float controlled valve for seating said regulating valve.

45 13. The combination with a water supply pipe, an inlet pipe and a valve for controlling the discharge from said inlet pipe, of a regulator interposed between said supply pipe and said valve, comprising a body having a chamber communicating with said supply
50 pipe, an elbow connecting said chamber with said inlet pipe, a sleeve mounted in said body and extending into said chamber past said elbow, a regulating valve slidable in said sleeve, a valve seat between said chamber and
55 the supply pipe, and a spring tending to move the regulating valve into engagement with said seat.

14. The combination with a water supply pipe, an inlet pipe and a valve for controlling the discharge from said inlet pipe, of a
60 regulator interposed between said supply pipe and said valve, comprising a body having a chamber communicating with said supply pipe and with said inlet pipe, a sleeve mounted on said body and extending into
65 said chamber, a regulating valve slidable in

said sleeve and having an elongated stem portion bearing thereon, a valve seat between said chamber and said supply pipe, and a spring tending to move said regulating valve into engagement with said seat.

15. The combination with a water supply pipe, an inlet pipe and a valve for controlling the discharge from said inlet pipe, of a regulator interposed between said supply
70 pipe and said valve, comprising a body having a chamber communicating with said supply pipe and with said inlet pipe, a sleeve mounted on said body and extending into
75 said chamber, a regulating valve slidable in said sleeve and having a stem portion polygonal in cross section, the corner portions thereof bearing on said sleeve, a valve seat
80 between said chamber and said supply pipe, and a spring tending to move said regulating valve into engagement with said seat.

16. The combination with a water supply pipe, an inlet pipe and a valve for controlling the discharge from said inlet pipe, of a regulator interposed between said supply
85 pipe and said valve, comprising a body having a chamber communicating with said supply pipe and with said inlet pipe, a valve seat between said chamber and said supply pipe, a regulating needle valve movable into and
90 out of engagement with said seat, and spring means effective to move said regulating valve to its closed position when said first mentioned valve is closed and to permit said regulating valve to open when said first mentioned
95 valve is opened.

17. The combination with a water supply pipe, an inlet pipe and a valve for controlling the discharge from said inlet pipe, of a regulator interposed between said supply pipe
100 and said valve, comprising a body having a chamber communicating with said supply pipe and with said inlet pipe, a valve seat between said chamber and said supply pipe, a regulating needle valve movable into and out of engagement with said seat, and adjustable
105 spring means effective to move said regulating valve to its closed position when said first mentioned valve is closed and to permit said regulating valve to open when said first mentioned valve is opened.

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