Feb. 19, 1946. W. E. SLOAN ET AL 2,395,150

AUTOMATIC FLUSHING SYSTEM

Filed Jan. 16, 1942 2 Sheets-Sheet 1

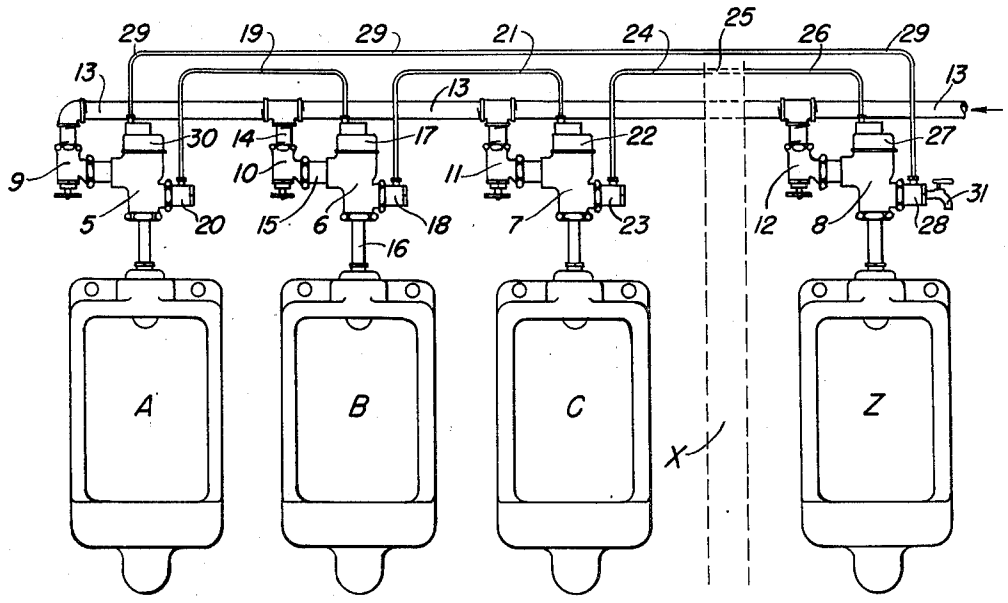


Fig. 1

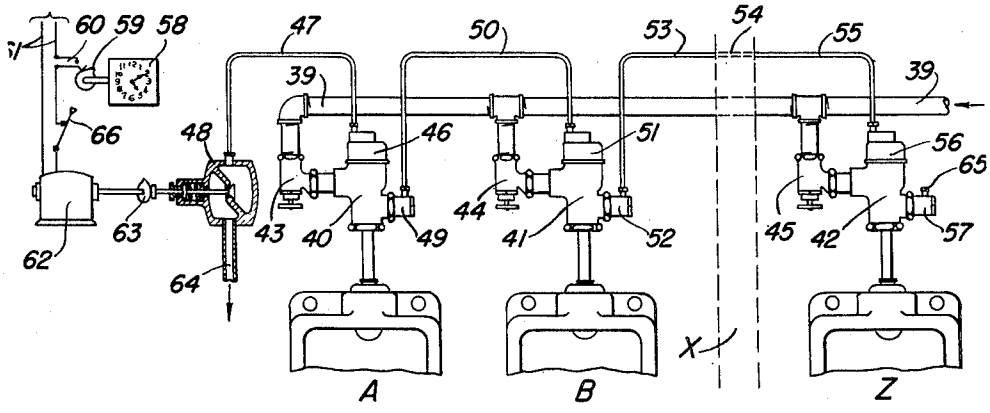


Fig. 2

INVENTORS
WILLIAM E. SLOAN
AND
JAMES J. SWARTZ
BY Parker & Carter
ATTORNEYS

Feb. 19, 1946. W. E. SLOAN ET AL 2,395,150

AUTOMATIC FLUSHING SYSTEM

Filed Jan. 16, 1942 2 Sheets-Sheet 2

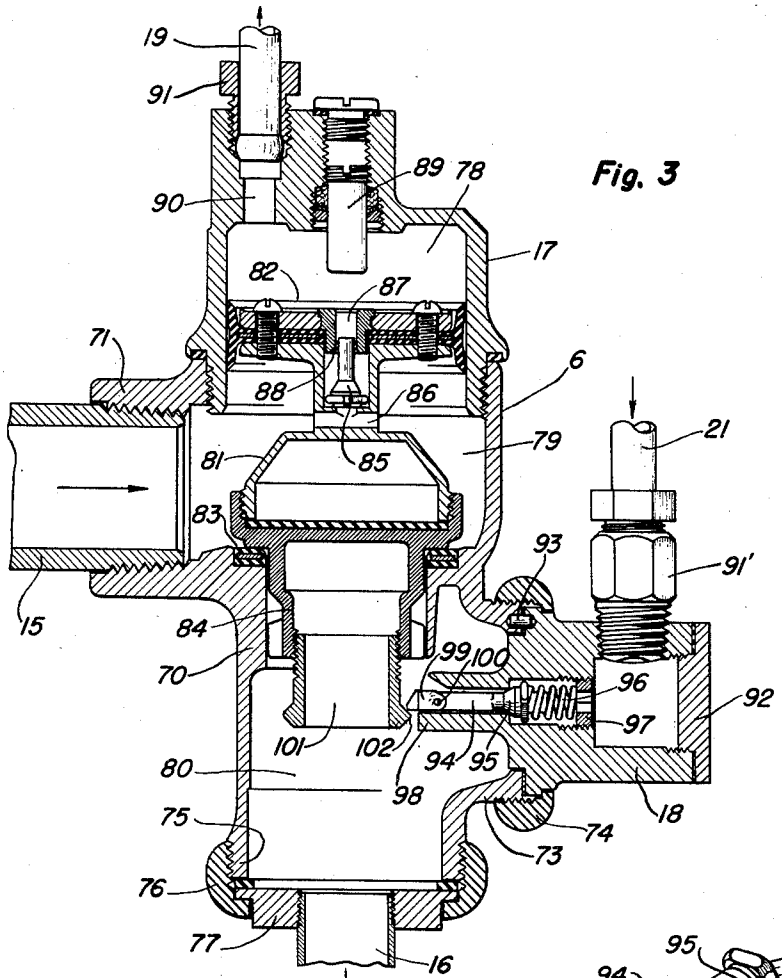


Fig. 3

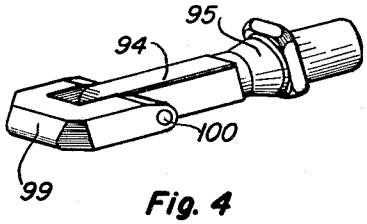
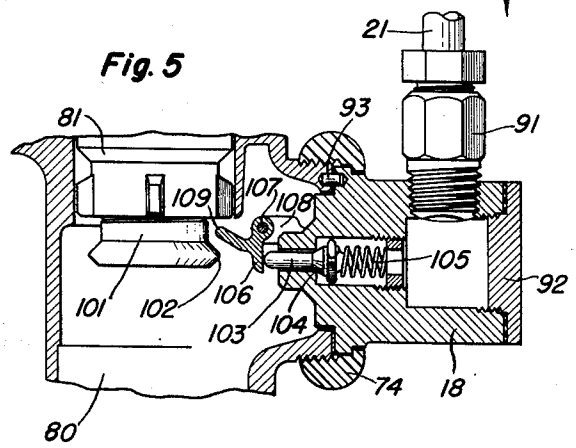


Fig. 4

Fig. 5



INVENTORS
WILLIAM E. SLOAN
AND
JAMES J. SWARTZ
BY Parker & Carter
ATTORNEYS

Patented Feb. 19, 1946

2,395,150

UNITED STATES PATENT OFFICE

2,395,150

AUTOMATIC FLUSHING SYSTEM

William E. Sloan, River Forest, and James J. Swartz, Berwyn, Ill., assignors to Sloan Valve Company, Chicago, Ill., a corporation of Illinois

Application January 16, 1942, Serial No. 426,982

8 Claims. (Cl. 137—78)

This invention relates to hydraulic systems for operating plumbing devices such as flush valves and the like, and the principal object of the invention is to provide a new and useful system for automatically operating a series of flush valves at recurring intervals. The invention is particularly applicable in connection with the operation of flushing devices for flushing plumbing fixtures such as urinals and toilets in schools, factories or other public places where the usual manual operation of flush valves is often neglected and the resultant insanitary condition of the plumbing fixtures constitutes a health hazard.

It has been customary to provide public toilet installations with individual storage tanks which were equipped with a float-actuated needle valve to automatically flush the receptacle periodically. This arrangement was unsatisfactory due to the difficulty of maintaining the periodicity of the flush constant, while continued supervision and maintenance was necessary to provide a reliable full flushing operation; also it was practically impossible to arrange a battery of storage tanks so they would operate at staggered intervals. This last disadvantage was a serious one inasmuch as the approximate simultaneous operation of a plurality of flushing tanks would result in a relatively large pressure drop in the water supply main, and the individual receptacles being flushed would receive a deficiency of water.

It is an object of the present invention to provide a flushing system wherein the use of external control devices for operating the flushing valves is entirely dispensed with and in which the operation of one flush valve of a group is controlled or is dependent solely upon the functioning of another one of the group of flush valves.

The invention has as a further object to provide a system for automatically operating a group or battery of flush valves in which the flush valves are all arranged to operate in sequential progressional order, and in which each flush valve is hydraulically actuated and controlled by the operation of the next preceding flush valve in the series.

The invention has as a further object to provide a new and improved flush valve structure for use in a hydraulic system in which the flush valve is arranged to be actuated by the operation of a preceding flush valve in the system, and when actuated it in turn controls the operation of a succeeding flush valve in the system.

Other objects and advantages are more fully pointed out in the following description to which reference is had in connection with the accompanying drawings in which:

Fig. 1 illustrated a hydraulic system for automatically flushing a plurality of urinals in sequence;

Fig. 2 is a modified form of the hydraulic system in which the cycle of operation of the urinals is clock controlled;

Fig. 3 is a cross-sectional side view of a flush valve having the novel operating mechanism therein;

Fig. 4 is a perspective view of a detail of the operating mechanism; and

Fig. 5 is a cross-sectional view of a fragmentary portion of a flush valve showing a modified form of the operating mechanism.

Referring more particularly to the drawings, Fig. 1 shows a sufficient portion of a system for automatically flushing a series of flush valves to enable the invention to be clearly understood. In this illustration, a plurality of plumbing fixtures, such as urinals, are arranged in consecutive order in a toilet room or floor of a building, or they may be located on different floors, for example. The battery of urinals are indicated at A, B, and C, a plurality of other ones are indicated generally at X, and the last one in the series at Z. Associated with each urinal is a flush-valve device of generally well-known construction except for slight modifications made therein to adapt it for the automatic flushing system. The flush valves indicated at 5, 6, 7, and 8, individual to the urinals A, B, C, and Z, respectively, are associated with conventional stops or throttle valves 9, 10, 11, and 12, respectively, for controlling the water supply rate to the flush valves. A common water-supply pipe 13 is connected in parallel to each of the stops for supplying the water to flush the associated urinal under control of the flush valve.

Since each of the individual plumbing fixtures and associated equipment is constructed exactly alike, only one of them will be described in detail. Referring to the urinal B, this plumbing fixture is supplied with water from the supply pipe line 13 through the nipple 14, and the flush valve 6 is connected to the stop 10 by nipple 15. A tail piece 16 connects the outlet of the flush valve with the urinal B. The flush valve 6 is provided with an upper removable cover 17 and a side coupling member or union 18 arranged in the usual handle opening position. Extending from the cover 17 is a small fluid connecting means which may be in the form of a piece of copper tubing 19 which leads into the coupling member 20 associated with the next preceding flush valve 5 in the series. A simi-

lar tube 21 leads from the coupling 18 to the cover 22 of the next succeeding flush valve 7. Another connecting tube 24 extends from coupling member 23 to the next succeeding flush valve in the series and in the same manner to others as indicated generally at 25. Eventually the tube 26 connects with the cover 27 of the last flush valve 8 in the series. From this point, the series connection extends from coupling 28 of the last flush valve 8 through tubing 29 and back to the cover 30 of the first flush valve 5 in the series. All of the tubes 19, 21, etc., connecting the flush valves in series relationship, are normally under the same hydraulic pressure as exists in the water supply line 13.

The general arrangement and operation of the installation briefly is such that responsive to the operation of the flush valve 6, for example, in performing a flushing operation of the urinal B, the mechanism of this flush valve functions, as will be hereinafter pointed out, to cause the hydraulic pressure in the coupling 18, tubing 21, and upper chamber of cover 22 of flush valve 7, to be exhausted or reduced, resulting in the automatic operation of the next succeeding flush valve 7. The foregoing action continues indefinitely with each flush valve operating in response to the operation of the next preceding flush valve and resulting when it operates in the subsequent operation of the next succeeding flush valve in the series. No external control or function except the hydraulic line pressure of the supply pipe 13 is required to automatically control the operation of the flushing system. The action will continue indefinitely with each valve functioning shortly after the flushing operation of a preceding flush valve has been completed, so that the flush valves are operated in timed sequence solely dependent upon the proper functioning of the preceding flush valve in the series.

When it is necessary to shut off the system for any reason, it is merely necessary to manipulate one of the throttle stops 9, 10, etc., to shut off the line supply from supply pipe 13 to the associated flush valve. This will stop the automatic operation of the system when the sequence eventually reaches the flush valve of which the associated stop is shut off. To start the operation of the system, it is merely necessary to open up the closed stop to prepare the system for operation and then to momentarily open up the pet cock 31 associated with the flush valve 8 of the last urinal Z in the series. This action "bleeds" or exhausts the hydraulic pressure from the return supply tube 29 to control the operation of the first flush valve 5 in the series. This action immediately initiates the automatic and continuous operation of the entire flushing system.

It will be seen from the foregoing description that the time interval between operations of each flush valve will be governed entirely by the number of flush valves connected in series in the system. That is, with a lesser number of flush valves in the system, each flush valve will be operated relatively frequently, whereas when a large number of flush valves are connected in a series, it will be clear that the interval of operation of each flush valve will be considerably extended.

It will be appreciated that with the automatic flushing system all of the urinals being flushed are not actuated simultaneously at any one time. Each one is operated in sequence independent of the operation of any of the others, that is, not more than one individual urinal is being flushed at any one particular time in the series. The advantages of this are that the drain or the demand on the water supply source is distributed evenly continuously, and no great demand is upon the system at any one particular time. This results in providing a full and satisfactory flushing operation for each individual urinal, and does not result in "robbing" others when one of them is operating. The system also insures that the automatic operation is performed at regular recurring intervals not dependent upon the whim of any particular person using the urinals or the uncertain operation of a reservoir or tank provided with a float-controlled needle valve.

Referring now particularly to Fig. 2, this arrangement discloses a system similar to that illustrated in Fig. 1, but in which the recurring operations of the flush valves are controlled entirely by time-controlled means external of the flush valve. The urinals A, B, C, indeterminate number X, and the last one, Z, are connected to supply pipe 39 and are associated with the flush valves 40, 41, 42, provided with the usual shut-off stops 43, 44, 45, respectively. In this particular arrangement, the flush valves are connected in series somewhat different than the continuous recurring cyclic operation of the arrangement in Fig. 1. In Fig. 2, the flush valve 40 constitutes the first one in the system, whereas the valve 42 is the last one. The cover 46 of flush valve 40 is connected by a tube 47 with an external starting valve 48 of any conventional construction. The side coupling member 49 of flush valve 40 is connected with a connecting tube 50, the other end of which extends to the cover member 51 of flush valve 41. Coupling member 52 of this flush valve is connected in turn to tube 53, and then through the tube 54 which indicates a plurality of connections between other flush valves in the series, and eventually includes the tube 55 extending to cover 56 of the last flush valve 42 in a series. The coupling member 57 of this last flush valve, however, is not provided with an outgoing tube but instead has the opening therefor plugged up by the plug 65. The starting external valve 48 is automatically controlled at recurring intervals by means of a clock 58, provided with a cam 59, which at predetermined intervals in its rotation closes a pair of contacts 60. These contacts 60 serve to connect a source of commercial electric power extending over wires 61 with a small electric motor 62. Motor 62 has a cam element 63 carried by its shaft, which upon rotation serves to open and then permit the closure of the starting valve 48. The outlet 64 of starting valve 48 may pass into a suitable drain or receptacle.

The operation of this time-controlled system is such that at periodical timed intervals controlled by the clock 58, the motor 62 is operated, resulting in the cam 63 opening and then closing the starting valve 48. The operation of valve 48 results in the reduction of hydraulic pressure in the connecting tube 47 extending to the first flush valve 40 in the series. As a result, flush valve 40 automatically operates and in turn over the connecting tube 50, automatically controls the operation of the next succeeding flush valve in the series, which is flush valve 41. This action continues in sequence through all of the flush valves in the series until the last flush valve 42 is reached. Since the coupling 57 of flush valve 42 is plugged at 65, the sequence of operation ceases and the system comes to rest until the next time interval has elapsed when the clock 58 again functions to start the cycle of operations over again.

The advantage of this particular modification

is that a smaller number of urinals may be arranged in a battery, so that they can be operated at recurring time intervals, which are spaced sufficiently apart so as not to waste water by operating to frequently. By suitable adjustment of the clock in a manner which is well known and need not be pointed out here, the time intervals may be adjustable or arranged so that a changeover may be made between the day-time operation of the system and the night operation, the night operations being at less frequent intervals. Whenever it is desirable to completely halt the operation of the system, it is merely necessary to shut off the stop 43 associated with the first flush valve 40 to cut off the supply of water from the supply line 39 to the flush valve, thereby preventing the automatic operation of the system from the clock 58. When the system is to be started again, the stop valve is opened up and upon the next operation of the motor 62 by the clock 58, the system will function in a normal manner. A manual switch 66 in the motor circuit 61 can also be provided to stop and start the system if desired.

The particular structure of the individual flush valves involved in the system for performing the automatic operation will now be pointed out more in detail with reference to Fig. 3. This drawing illustrates the internal construction of a flush valve, for example the flush valve 6 associated with the urinal B of Fig. 1. This flush valve comprises a casing member 6 having the cover 17 screwed on the top thereof. A lower body portion 70 is formed on the casing 6, and a threaded inlet portion 71 extending from the left side, provides means for attaching the inlet pipe connection 15. At the lower end of the body 70, an outlet 73 is formed to which the coupling nut 74 clamps the coupling member 18 directly to the body. The lower outlet 75 of the body 6 has a coupling nut 76 threaded onto it which serves to clamp a spacing member 77 to the bottom outlet of the flush valve. The tail piece 16 extending into the top of the urinal B is threaded into the spacing member 77, as shown.

The cover 17 provides an upper operating chamber 78 for the flush valve which is normally under the hydraulic pressure of the supply pipe line 13, while the casing 6 provides a supply chamber 79 also normally under direct pressure from the supply line. The lower portion of the body 70 comprises a discharge chamber 80. Arranged for operation within the valve body 6 is a movable valve member 81 which at its upper end carries a rubber piston 82 slidable within the operating chamber 78. This piston and the valve member are of well-known construction and need not be further described. The movable valve member 81 normally seats upon the valve seat 83 arranged on the lower portion of supply chamber 79 and is also provided with a so-called refill head and guiding barrel 84 in the usual manner. A by-pass control valve 85 is arranged within a hollow portion of the movable valve member 81 and controls the passage of water from the supply chamber 79 to the operating chamber 78 through the by-passes 86 and 87. When the by-pass control valve 85 is away from its upper seat, a relatively wide passage for the water through by-pass 87 is provided, while when the valve is seated on its upper seat, only a small passage 88 is provided. In order to control the volume or amount of water which the flush valve is permitted to pass and flush the associated urinal B, an adjusting screw 89 is provided which is threaded and passes through the packing gland in the top of cover 17. The piston 82 at its upper limit of motion is accordingly limited by the position of this adjusting screw 89, thereby governing the amount of the flush. The desired rate of flow is adjusted by the associated stop valve. The cover 17 also has an opening 90 therein, and a coupling nut 91 is threaded into this opening for connecting the connecting tube 19 thereto. This provides a means for permitting the upper chamber 78 to be exhausted over the connecting tube 19 to start the operation of this particular flush valve.

The usual handle opening for operating a standard valve manually, serves for the purpose of connecting the coupling member 18 thereto. The chamber formed in the coupling member 18 is closed by the end nut 92 and this chamber is also threaded to provide a connection for the incoming connecting tube 21 by means of coupling nut 91'. The coupling 18 is properly located and prevented from rotation in its supported position by means of a pin 93. The coupling member 18 serves to support a relief valve member 94, extending into discharge chamber 80, and which as shown in the enlarged detail view of Fig. 4, comprises a square-shaped shank portion having a valve portion 95 thereon which normally rests upon a valve seat formed in the coupling member 18. A spring 96 extending between a flanged portion of the relief valve 94 and a hollow threaded nut 97 in the opening for the relief valve member, normally urges the relief valve in a direction inward toward the discharge chamber 80. The threaded nut 97 permits removal and replacement of the relief valve assembly within the coupling member 18 after the end nut 92 is removed. The coupling member 18 is provided with an inwardly protruding portion 98 serving as a support for the end of the relief valve member 94, and which end is provided with a swinging U-shaped trip member 99 pivoted thereto by pin 100, so that the trip member 99 is free to swing upwards, but is prevented from swinging downward by the protruding portion 98. The forward end of trip member 99 is provided with a sloping nose portion as illustrated, which is arranged in the path of movement of a tubular member 101, in turn provided with a cam surface 102, adapted to engage the trip member 99. The tubular member 101 is adjustably screwed into the lower portion 84 of the movable valve member 81, and moves along therewith in the opening and closing movements of the flush valve.

In the normal operation of the flush valve as described, assume it to be connected into the system illustrated in Fig. 1, in which the normal line pressure from the supply line 13 is manifested in the supply chamber 79 of the flush valve. In a manner well known, this pressure likewise passes into the by-passes 86 and 87 to the upper chamber 78, resulting in the equalization of pressure upon both sides of the piston valve 82. Since the area exposed to this pressure is greater on the movable member 81, this valve member is tightly closed upon its seat 83, so that no water can pass through the discharge opening 80. Assume now that the pressure in the upper chamber 78 is momentarily relieved through the passage 90 and the incoming connecting tube 19. The hydraulic pressure within supply chamber 79 is therefore free to exert its pressure upon the lower side of piston 82, causing the immediate upward movement of the valve member 81 from its seat 83,

permitting the water supply to pass through the discharge chamber 80 and out of the tail piece 16 into the urinal B, to provide a flushing operation for the same. The relief of the upper chamber 78 likewise causes the by-pass valve 85 to contact its upper seat and restrict the by-pass 87 to the small amount permitted to pass through the restricted opening 88, as the movement of the piston 82 continues upward. At its upper limit of motion when the piston 82 encounters the adjusting screw 89, the by-pass pin 85 is caused to be forcibly moved from its upper valve seat thereby permitting a larger by-pass to prevail to clean out any accumulation of foreign matter which may exist in the by-pass. The water pressure from supply chamber 79 continues to pass through the by-pass into the upper chamber 78, and since the connection at the other end of tube 19 will now be closed, the pressure gradually builds up until it overcomes that on the lower side of the piston 82, whereupon the movable valve member again closes upon the valve seat 83 to shut off the flushing action.

Referring now to the action taking place in the discharge chamber 80 during the foregoing operation, the tubular member 101 attached to the lower end of movable valve member 81 rises up with it, causing the cam portion 102 to engage the trip member 99, but since this trip member is hinged, it is caused to rotate about pin 100 freely until it slips off the cam portion 102 to its normal position again. The relief valve 94 remains inactive in this upward movement of the valve member 81. However, when the flushing operation is about completed and immediately prior to the closure of the valve member 81 upon the seat 83, the cam portion 102 engages the sloping end of trip member 99, and since this trip member cannot rotate downward due to its engagement with the projecting portion 98, it can only move outward or in a right-hand direction causing the relief valve member 94 to move from its seat 95 against the tension of spring 96. As soon as the end of cam member 102 passes beyond trip member 99, the spring 96 closes the valve 95 upon its seat and moves relief valve member 94 inward.

This momentary opening of relief valve member 94 causes the liquid within the chamber of member 18 and that which is under hydraulic pressure within the tubular member 21, extending to the opening of the next succeeding flush valve, to be relieved into the discharge chamber 80 of flush valve 6. This action results in the automatic operation of the next succeeding flush valve.

It will be apparent that by adjusting the tubular member 101 further up or down in the movable valve member 81, a slight adjustment of the time of operation of the next succeeding flush valve may be made with respect to the operation of the instant flush valve. Likewise, by proper adjustment of the adjusting screw 89 in the cover 17, the time of operation of the next succeeding flush valve may be slightly altered by changing the length of the flushing operation of the instant flush valve.

Fig. 5 illustrates a modification in which the form of the trip member has been altered. The relief valve member 103 is provided with a shank portion and also a valve portion 104 which closes upon a seat of the coupling member 18. A tension spring 105 normally exerts itself in a direction to close the relief valve 103 upon its seat. The end of relief valve 104 is in contact with a bell-crank member 106 which in turn is pivoted by pin 107 to a projection 108 formed on coupling 18. One end 109 of the bell-crank member 106 is arranged within the path of movement of the cam portion 102 of tubular member 101. The operation is similar to that described in Fig. 3, in that upon upward movement of the cam member 102, it engages the portion 109 of bell crank 106, resulting in the clockwise rotation of bell crank 106 without actuating relief valve 103. Upon the downward movement of cam member 102, part 109 is engaged, causing the bell crank to move the relief valve member 103 and its associated seat 104 in a right-hand direction, thereby exhausting the pressure within the coupling member 18, and that in the connecting pipe 21 associated with the next succeeding flush valve. This action results in the automatic operation of this next flush valve.

From the foregoing, it is seen that a novel system for automatically and hydraulically controlling a battery of plumbing fixtures has been devised in which no external operating or motive power is required for performing the automatic operation. The system can be economically produced, since no material changes in the standard construction and operation of flush valves is necessary, the connecting coupling 18, the tubular member 101, and the associated connecting tube being the only parts necessary to add to the standard flush valve. A considerable saving in the use of water is effected by the sequential operation of the flush valves one at a time, and by operating them in an automatic manner, no dependency upon human action is necessary to insure a flushing operation of any plumbing fixture after its use.

What is claimed is:

1. In combination, at least two flush valves connected to a common supply line and having individual discharge outlets, each flush valve having a movable valve member arranged to be normally held seated by a holding pressure acting against the supply line pressure tending to open the same and operable into open and closed positions to effect a flushing operation of said flush valve when the holding pressure of the flush valve is relieved, a cam member on said valve member and movable therewith, a relief valve in said flush valve operable to open and closed positions and when open to relieve the holding pressure of another flush valve, a trip member on said relief valve arranged in the path of movement of said cam member for actuating said relief valve, means for closing said relief valve each time after it is opened by said cam member, said trip member being arranged so that the cam member moves past it without effecting the actuation of said relief valve in the opening movement of said valve member, while on the closing movement of the valve member said cam member is effective to actuate the trip member to operate the relief valve, and means for adjusting the position of said cam member on said valve member so that the time of operation of the relief valve may be varied.

2. In a flush valve having a liquid supply line connected thereto and a discharge outlet, a movable valve member controlling the passage of liquid from said supply line to said discharge outlet, a relief valve having an operating member arranged in said flush valve, said relief valve being normally biased to closed position and cooperating engageable means on the relief valve operating member and said movable valve mem-

ber for opening said relief valve only when said movable valve member has initially been moved to valve open position and subsequently approaches valve closing position.

3. A flush valve having a movable valve member and a relief valve associated therewith, said relief valve being normally biased to closed position, and cooperating means on said movable valve member and said relief valve for momentarily opening said relief valve in response to the movement of said valve member toward valve closing position.

4. A flush valve having a liquid supply inlet and a discharge outlet, a relief valve having an operating member arranged in the flush valve, a movable valve member in said flush valve controlling the passage of liquid from said supply line to said discharge outlet, and cooperating engageable means on said movable valve member and on said relief valve operating member effective to actuate the relief valve to assume an open position in response to the movement of the movable valve member into valve closing position, but ineffective to actuate the relief valve in response to the movement of the movable valve member into valve opening position and means for closing said relief valve after each opening movement thereof.

5. A flush valve having a liquid supply inlet and a discharge outlet, a relief valve having an operating member arranged in said flush valve, a movable valve member in said flush valve controlling the passage of liquid from the supply line to said discharge outlet, a cam means on said movable valve member, a trip member on said relief valve operating member positioned in the path of movement of said cam means, said trip member arranged so that it is ineffective to actuate the relief valve operating member when the cam engages it upon movement of the valve member into valve opening position, and is effective to actuate the relief valve operating member upon movement of the valve member into valve closing position, and spring actuated means for normally holding said relief valve seated and for seating the same after each opening movement.

6. A flush valve system including a plurality of flush valves wherein each flush valve is operated at a different time; each of said flush valves having a discharge outlet therein and being connected to a liquid supply line, a movable valve member in said flush valve controlling the passage of liquid to said discharge outlet, said valve member provided with means constructed and arranged so that the valve is normally held closed by the application of supply line pressure to said means, and opened upon the relief of the line pressure from said means, a relief valve in said flush valve associated with but one other flush valve of the system for relieving the supply line pressure of said other flush valve to cause its valve member to open, and cooperating means on the relief valve and the movable valve member for opening said relief valve only when the movable valve member has first been initially opened and subsequently approaches the position in which the liquid supply is shut off, said relief valve provided with means for closing the same each time after having been opened.

7. A flush valve system including a plurality of flush valves wherein each flush valve is operated at a different time, each of said flush valves having a discharge outlet therein, and being connected to a liquid supply line, a movable valve member in said flush valve controlling the passage of liquid to said discharge outlet, said valve member provided with means constructed and arranged so that the valve is normally held closed by the application of supply line pressure to said means, and opened by the relief of the line pressure from said means, a relief valve in said flush valve associated with but one other flush valve in the system, for relieving the supply line pressure of said other flush valve to cause its valve member to open, cooperating means on the movable valve member and on the relief valve effective to open the relief valve in response to the movement of the movable valve member into closing position, but ineffective to actuate the relief valve in response to its movement into opening position, said relief valve being normally biased to closed position.

8. In a flush valve system comprising a plurality of flush valves wherein each flush valve is operated at a different time, a common fluid supply and an individual discharge outlet from each flush valve, a movable valve member operable to open and closed position to effect a flushing operation of said flush valve, said valve member provided with means constructed and arranged so that the valve is normally held closed by the application of supply line pressure to said means, and opened by the relief of the line pressure from said means, a relief valve in said flush valve associated with but one other flush valve in the system, for relieving the supply line pressure of said other flush valve to cause its valve member to open, a cam means arranged on said movable valve member and movable therewith, a trip member on said relief valve positioned in the path of movement of said cam means, said trip member arranged so that it is ineffective to actuate the relief valve when the cam means engages it upon movement of the valve member into valve opening position, and is effective to actuate the relief valve upon movement of the valve member into valve closing position, and means for normally biasing said relief valve in closed position.

WILLIAM E. SLOAN.
JAMES J. SWARTZ.