

(No Model.)

2 Sheets—Sheet 1.

C. E. BENTLEY.
AUTOMATIC CUT-OFF.

No. 579,464.

Patented Mar. 23, 1897.

FIG. 1.

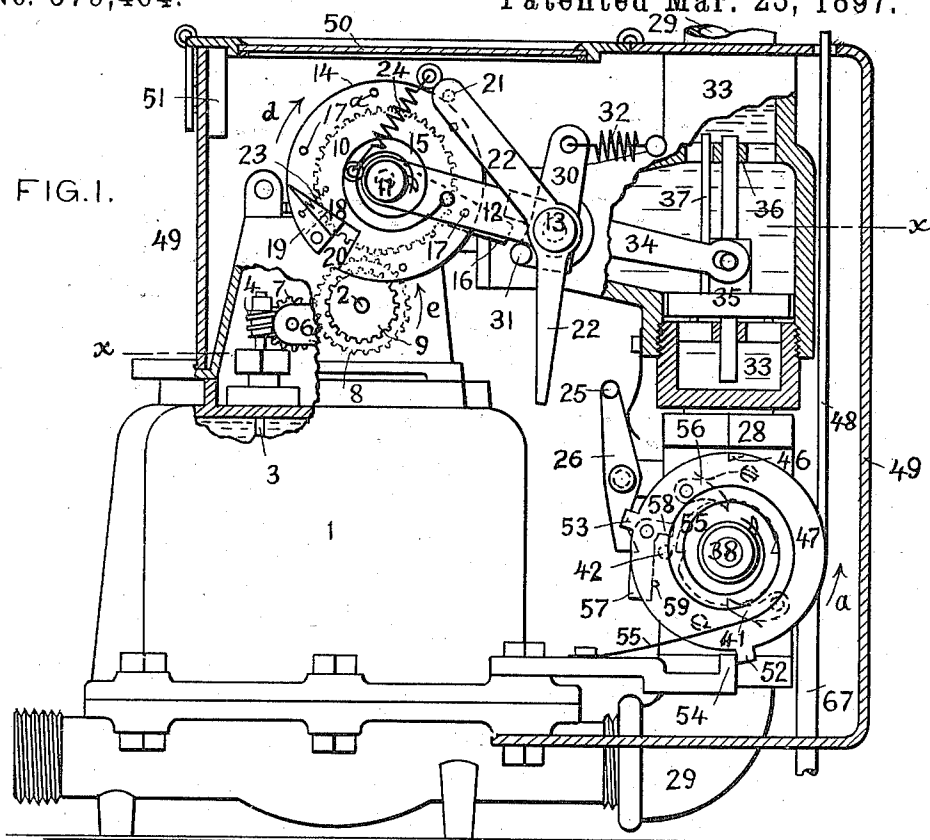
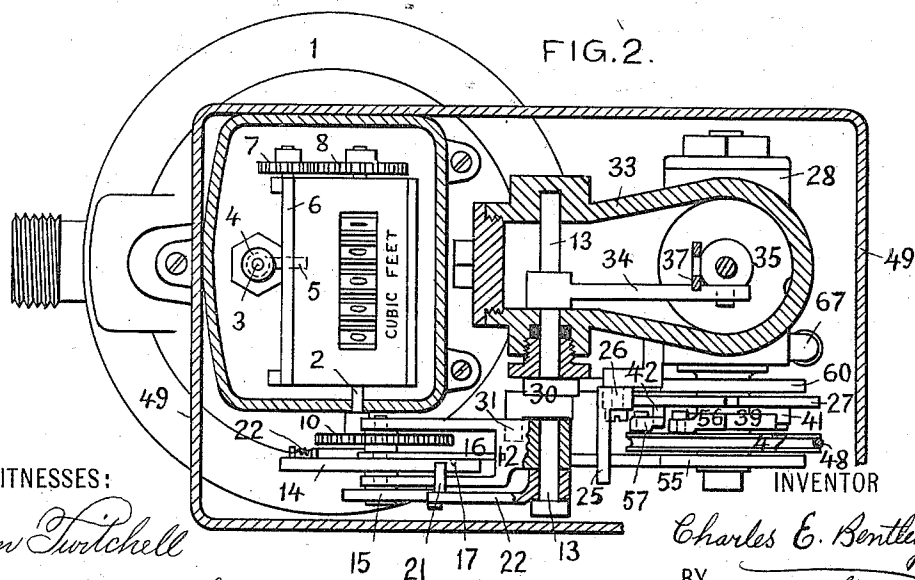


FIG. 2.



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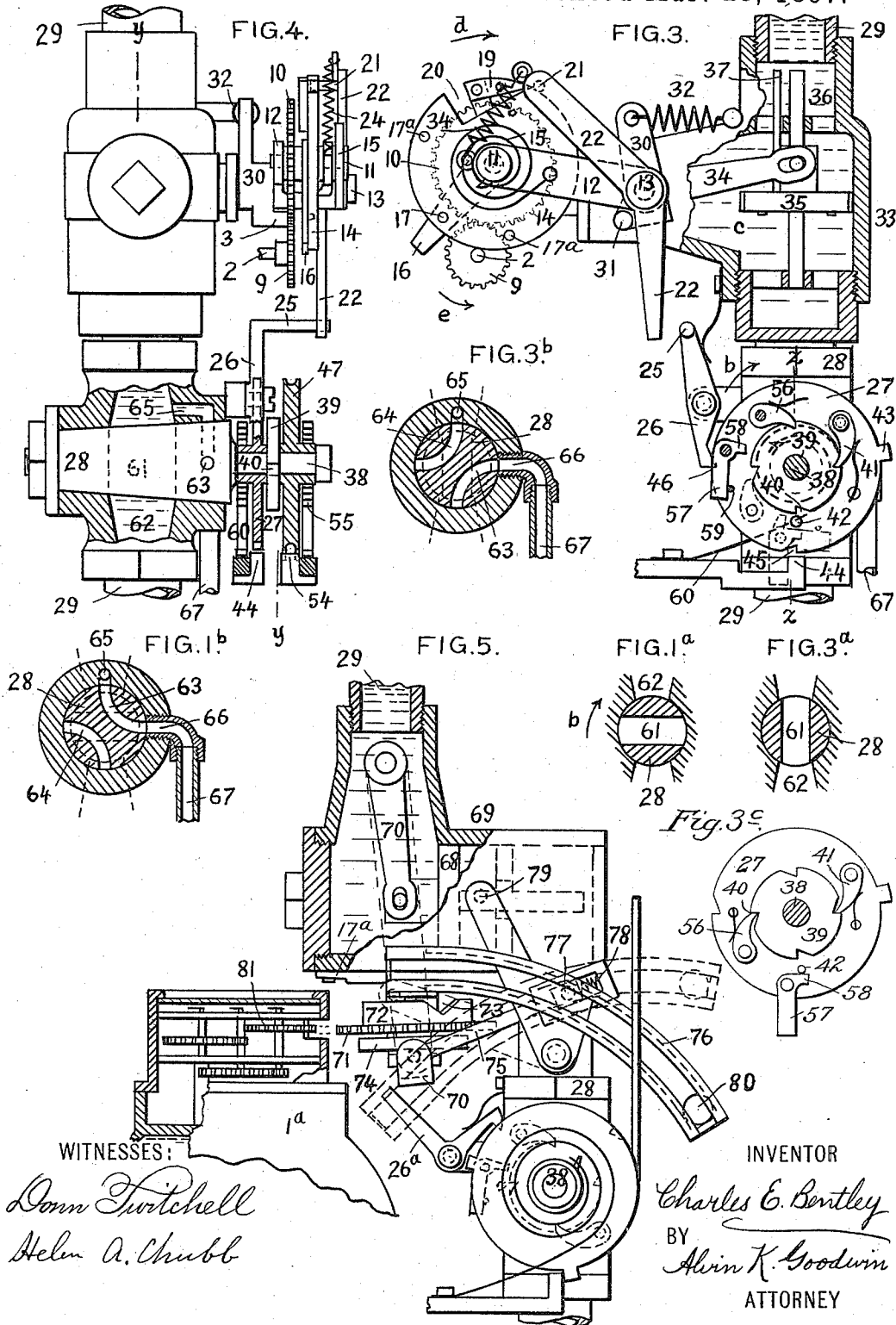
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2 Sheets—Sheet 2.

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UNITED STATES PATENT OFFICE.

CHARLES E. BENTLEY, OF NEW YORK, N. Y.

AUTOMATIC CUT-OFF.

SPECIFICATION forming part of Letters Patent No. 579,464, dated March 23, 1897.

Application filed March 18, 1896. Serial No. 583,846. (No model.)

To all whom it may concern:

Be it known that I, CHARLES E. BENTLEY, a citizen of the United States, residing at the city of New York, county and State of New York, have invented a new and Improved Automatic Cut-Off, of which the following is a specification.

This invention has for its main object to prevent damaging overflows of water from service-pipes caused, for instance, by leaving a faucet open or by gnawing of the pipes by rats or mice or by accidental bursting of the pipes.

In its preferred and most complete embodiment the invention comprises a water or fluid motor, preferably in the form of a meter, measuring the fluid passing through a service-pipe having a valve, preferably a self-closing valve, and controlling mechanism automatically closing the pipe-valve and actuated by pressure of fluid passing the valve and also by the motor or meter mechanism, and whereby the valve will be automatically closed when any predetermined quantity of water or other substance has uninterruptedly passed through the meter and valve. The hand-operated valve-opening devices are so made that they cannot be tampered with to prevent automatic closure of the valve by the mechanism at proper time.

The invention further comprises various novel constructions, combinations, and sub-combinations of parts of the cut-off mechanism alone and as combined with the motor or meter apparatus, all as hereinafter described and claimed.

Reference is made to the accompanying drawings, forming part of this specification, and in which similar numerals indicate like parts in the several views.

Figure 1 is a sectional side elevation of the combined meter and cut-off mechanism. Fig. 2 is a plan view thereof, with parts in horizontal section on the line *xx* in Fig. 1. Fig. 3 is a central vertical sectional view taken on the line *yy* in Fig. 4 and showing other adjustments of the parts. Fig. 3^a is a detail view of the stop-wheel and pulley pawl devices, more clearly showing different adjustments of the parts. Fig. 4 is a central vertical sectional view of parts shown in Fig. 3, the section being taken on the line *zz* in said

figure. Figs. 1^a, 1^b, 3^a, and 3^b are detail sectional views of the service-pipe valve at different adjustments hereinafter explained, and Fig. 5 is a detail vertical sectional front view sufficiently illustrating a modification.

In the following specification I will for greater convenience refer to the fluid-motor as a "meter," but it will be understood that any motor apparatus operated by water or fluid flowing through the service-pipe may be employed, and that in so far as concerns certain features of the cut-off mechanism hereinafter claimed any motor actuated by independent clockworks or other mechanism may be used within the scope of the invention.

The water or fluid meter 1 may have any approved construction as regards its internal measuring devices and its registering mechanism. In the preferred construction (shown in Figs. 1 to 4, inclusive, of the drawings) the several counter-disks of the meter registering mechanism are arranged as usual upon a horizontal shaft 2, rotated from a vertical shaft 3, actuated by the fluid-measuring devices within the meter. The shaft 3 carries a worm 4, engaging a toothed wheel 5, fast on a shaft 6, which carries a pinion 7, engaging a gear-wheel 8 on the counter-shaft 2, which at its opposite end carries a pinion 9. The pinion 9 is adapted to rotate a gear-wheel 10, fast on a shaft 11, journaled in the outer ends of a forked lever 12, which is fulcrumed loosely upon a shaft 13, adapted to be rocked by pressure of water in the service-pipe, as presently explained. On the shaft 11 is also fixed a gage-wheel 14, which thus rotates with the gear 10. A spring 15, held at one end to the shaft 11 and at the other end to the lever 12, returns the gage-wheel to initial position. This position of rotation is controlled by the special adjustment of an elastic stop-arm 16, which is loose on the shaft 11 and carries a stud 17, adapted to any one of a series of holes 17^a in the gage-wheel. When the gage-wheel is retracted by the spring 15, the stop 16 strikes a shoulder at the inner part of the lever 12. The gage-wheel is peripherally recessed to provide a radial shoulder and a tangential shoulder 18. To a plate fixed to the inner face of the wheel is pivoted a pawl 19, the inner end of which stands off from the radial shoulder sufficiently to form a radial

notch 20, and also stands off from the tangential shoulder 18 for a distance exceeding the diameter of a pin 21 on one end of a two-armed trip-lever 22. The point of the pawl 19 finishes about even with the circumference of the gage-wheel, to the curve of which the back of the pawl preferably conforms. A spring 23 normally holds the pawl-point close to the body of the gage-wheel, but allows the pawl to swing open about parallel with the wheel-shoulder 18 to permit outward escape of the trip-lever pin 21 after it has entered the wheel-notch 20, as hereinafter more fully explained.

The trip-lever 22 is hung loosely upon the shaft 13, and its upper arm may be weighted, but is preferably connected by a spring 24 with one limb of the forked lever 12 in order to throw the other pendent arm of the trip-lever forcibly against a pin 25, projecting from a pawl-detent 26, the opposite end of which engages a notch in a stop-wheel 27, which is loose on the stem of the valve 28 of the service-pipe 29. When the pawl 26 is tripped from wheel 27 by lever 22, the valve 28 is preferably closed automatically, as hereinafter described. To the shaft 13, on which the gage-lever 12 and trip-lever 22 are loosely hung, is fixed a rocker-arm 30, which has a pin 31 projecting outward beneath the inner part of the lever 12. A spring 32, held to the top of the rocker, readjusts the lever 12 and its gage-wheel 14 to normal raised positions after flow of water through the apparatus is cut off.

In the service-pipe 29 is interposed beyond the valve 28 a casing 33, accommodating within it a lever-arm 34, fixed to the rocking shaft 13, which projects through a stuffing-box of the casing to receive the parts 12 22 30 above mentioned. The free end of lever 34 has a pin-and-slot connection with a piston 35, adapted to a chamber of the casing, which communicates with the valve 28. The piston 35 is guided by passage of its rod through a bearing 36. An additional guide 37, fixed to the piston, may also be used if desired.

To the stem 38 of the valve 28 is fixed a ratchet-wheel 39, preferably having but four equidistant peripheral notches or shoulders 40, adapted for successive engagement by two pawls, one pawl 41 being pivoted to the above-named stop-wheel 27. This wheel 27 carries a fixed laterally-projecting pin or stud 42 and also preferably has a peripheral stud 43, adapted to engage a fixed stop 44 to limit backward turning of the wheel to about one-quarter of a revolution. The stop-wheel preferably has two peripheral notches 45 46, separated for about one-quarter of its circumference and adapted to receive the above-named pawl 26.

At the opposite face of the ratchet-wheel 39 is placed loosely on the valve-stem 38 a pulley 47, to which is fixed an operating-cord 48, extending upward through a casing 49, inclosing the gage and trip-lever and valve

mechanisms to prevent tampering with them. The casing is shown with a hinged and glazed lid 50, permitting reading of the counter-disks or dial through the glass. A lock 51 is preferably provided for the lid. The cord-pulley 47 carries two peripheral studs 52 53, adapted to a fixed stop 54 to limit rotation of the pulley to about one-quarter turn in opposite directions, and a spring 55 retracts the pulley to normal position with its stud 52 against stop 54. At its inner face the pulley 47 carries two pawls 56 57 and a pin 59. The spring-pressed pawl 56 engages one of the notches 40 of the valve-stem ratchet-wheel 39, while the gravitating pawl 57, having an angular finger 58, acts in connection with the pin 59 and the pin 42 of the stop-wheel 27 to turn the latter through the medium of pulley 47 when the cord 48 is pulled. A spring 60 returns the stop-wheel 27 to normal position.

I prefer so to construct the valve 28 that it may serve also as a means for draining off the water left in the service-pipe 29 when the supply-passage of the valve is closed, thereby preventing freezing of the pipes or mechanism at any point beyond the valve. I therefore provide the valve body or plug with a main straightway passage 61, adapted to register with the passage 62 of the valve-casing. I also form the valve-plug with two transverse drainage-passages 63 64, adapted upon successive half-turns of the valve to alternately connect the drainage-passages 65 and 66 in the valve-casing. The passage 65 opens to the passage 62 beyond the valve-plug, and the passage 66 opens to a drip-pipe 67, leading to any safe place of discharge. This self-draining feature of the valve is not new of itself, but is specially useful in combination with a pressure-operated means such as the piston 35 and the gage and tripping devices of the automatic cut-off.

The operation is as follows: After the valve 28 has last been automatically closed, the parts assume relative positions shown in Figs. 1, 2, 1^a, and 1^b of the drawings. The valve-passages 65 63 66 are now in communication and the water in the service-pipe is draining therefrom through the drip-pipe 67. To open the main supply-passage 61 of the valve, the cord 48 is pulled and then released with the following results: As the cord is pulled the pulley 47 is turned in direction of arrow *a* in Fig. 1 until the pulley-stud 53 strikes the stop 54. Shortly after the pulley begins to turn, the finger 58 of its pawl 57 strikes the pin 42 of the stop-wheel 27, and as the pawl 57 is now held against turning independently on its pivot by the pulley-pin 59 the pawl-finger 58 carries the pin 42, and consequently the stop-wheel 27, around with the cord-pulley 47. As the pulley about finishes its quarter-turn the pulley-pawl 56 drops into or is ready to enter the next rearward notch 40 of the valve-stem ratchet 39, (see the dotted position of this pawl in Fig. 3,) and the pawl 26 also enters the notch 46 of the stop-wheel

27. The valve 28 is yet closed and will not be opened until after the pulled cord 48 is released. When the cord 48 is released, the spring 55 at once retracts or turns back the pulley 47, and the pulley-pawl 56 having already engaged the next rearward notch 40 of ratchet 39 it is obvious that as the pulley is retracted by spring 55 until its stud 52 again strikes the stop 54 the pawl 56 will be carried around a one-quarter turn in direction of arrow *b* in Figs. 3 and 1^a of the drawings, thereby also carrying the valve 28 around to the position shown in Fig. 3^a and opening the valve supply-passage 61 to the service-pipe 29, and at the same time closing the outlet to the drainage-pipe 67, the closed drainage port or passage 64 then communicating with the valve-case passage 65, as shown in Fig. 3^b. As the valve is thus being turned to open position by the retracting-pulley the pawl 26 in the notch 46 of stop-wheel 27 prevents retraction of said wheel by its spring 60 and the pawl 41 of wheel 27 engages the next rearward notch 40 of the valve-stem ratchet 39, ready to give this ratchet and the valve rigidly connected with it another quarter-turn in the same direction to automatically close the valve after the pawl 26 is tripped automatically by the cut-off devices, as presently explained. While the valve 28 remains open after release of cord 48 the stop-wheel 27, its pawl 41 and pin 42, the detent-pawl 26 and ratchet 39, and the cord-pulley pawls 56 57 and pin 42 retain relative positions shown in full lines in Fig. 3 of the drawings.

When flow of water (or other fluid) through the meter 1 and along pipe 29 is permitted by an open faucet or by cutting or bursting of the service-pipe at any place beyond the cut-off devices, water circulation is established through the meter and service-pipe. This circulation exerts pressure on the piston 35 and forces it forward, as shown in Fig. 3, thereby permitting flow at *c* past the piston to the place of discharge. As the piston is thus advanced by fluid-pressure it rocks the lever 34, the shaft 13, and the arm 30, thereby lowering the arm-pin 31 and permitting lever 12 and gage-wheel 14 to fall by gravity until the gage gear-wheel 10 engages the now rotating pinion 9 on the shaft 2 of the meter counter mechanism. As the levers 12 22 both are loose on the rocker-arm shaft 13, said levers fall with the gage-wheel 14, while the spring 24 draws the pin 21 of trip-lever 22 against the periphery of the gage-wheel, which wheel with its stop 16 is now rotating in direction of arrow *d* in Figs. 1 and 3, as its driving-pinion 9 is rotated in direction of arrow *e* by the counter mechanism. This slow rotation of the gage-wheel continues until the trip-lever pin 21 rides over the gage-wheel pawl 19 and enters the wheel-notch 20, wherein it is quickly drawn by the spring 24, which thus rocks the lever 22 independently on the shaft 13 and throws the pendent arm of the lever 22 forcibly against the pin 25 of detent-pawl 26,

thereby positively tripping the latter from notch 46 of stop-wheel 27, whereupon the spring 60 instantly returns the stop-wheel to initial position with its stud 43 against the stop 44, and the pawl 26 enters the stop-wheel notch 45 merely to prevent overstrain of the pawl-spring. During retraction of the stop-wheel 27 its pawl 41 gives a one-quarter turn to ratchet 39 and valve 28, thus again closing the valve, as shown in Fig. 1^a, and simultaneously connecting the valve-passage 64 with passages 65 66 to drain off the water from the service-pipe system through the drip-pipe 67. Immediately the valve 28 is thus automatically closed the water circulation ceases and the meter-pinion 9 and trip gage-wheel 14 stop rotating, and the spring 32 now pulls the rocker-arm 30 back to initial position, thereby causing the arm-pin 31 to lift or swing the lever 12 and carrying gear-wheel 10 away from the pinion 9, whereupon the spring 15 at once returns the gage-wheel to initial position, when its stop 16 strikes the lever 12, as shown in Fig. 1 of the drawings. During this return movement the pin 21 of trip-lever 22 swings the pawl 19 open as the pin escapes along the gage-wheel shoulder 18 to the periphery of said wheel. As the spring 32 retracts the rocker-arm 30 the piston 35 is re-adjusted, as shown in Fig. 1, and water remaining in the pipe 29 and casing 33 escapes around the piston-periphery, which loosely fits within its final resting-place in the casing. The valve 28 will remain closed and the automatic cut-off mechanism remains inoperative but ready for the next pull and release of the cord 48 to open the valve as above described.

The distance the gage-wheel 14 turns before the trip-lever pin 21 enters the wheel-notch 20 will determine the time the valve 28 remains open. Hence by adjusting the gage-wheel stop 16 to have its pin 17 enter a different hole 17^a in the wheel the retracting-stop 16 will strike the lever 12 sooner or later, accordingly as it is desired to allow a lesser or greater volume of water to pass uninterruptedly through the open valve 28 into the service-pipe 29 before the valve is automatically closed. Any smaller volume of water than that passing uninterruptedly through the open valve 28 prior to entrance of the trip-lever pin 21 into the gage-wheel notch 20 will not cause closure of the valve. Hence any ordinary quantity of water may be drawn from faucets any number of times for cleaning or household purposes without danger of prematurely closing the valve. After drawing such lesser volume of water the spring 32 will readjust the piston 35 and raise the rocking arm 30 and cause the arm-pin 31 to again lift the gage-wheel gear 10 from the meter-pinion 9, and the spring 15 will then retract the gage-wheel until the stop 16 strikes the lever 12, as above described. The piston 35 may be moved forward varying distances by varying pressures of fluid in the pipe 29 on the piston 35 without injuriously affecting

the cut-off mechanism, this being illustrated in Fig. 3, wherein the piston is advanced farther than necessary to allow the gear 10 to engage pinion 9. In this case the rocker-arm 30 moves farther than necessary and its pin 31 drops from lever 12, which is stopped by engagement of the gearing 10 9.

It is most desirable that the pull-cord 48 and the incased pulley and stop-wheel mechanism connecting it with the valve 28 should be so arranged that it will be impossible for any one by manipulating the cord from outside the casing 49 to prevent automatic closure of the valve by the trip mechanism. It is also desirable that the cord may be operated to permit intentional closing of the valve at any time. The pulley and stop-wheel mechanism shown and above described is specially designed to accomplish these results in manner next explained.

Suppose the cord 48 had been pulled and released and the valve 28 is now open and the pulley-pawls 56 58 and stop 59 occupy positions relatively to the stop-wheel 27 and its pawl 41 and pin 42 shown in full lines in Fig. 3 of the drawings. If now a malicious person should pull the cord 48 and then hold or fasten it up to prevent retraction of the pulley by its spring 55, thereby supposing that this would prevent automatic closure of the valve 28, it is obvious that the pawl 57, as the cord was pulled, would not strike the pin 42 of stop-wheel 27, as this pin now has the lowermost position shown in Fig. 3. Hence as the pulley 47 was being turned one-quarter around by pulling the cord the pawl 57 would hang plumb and finally take the vertical dotted position shown in Fig. 3 and full-line position shown in Fig. 3^c. Should the pawl 26 now be tripped from stop-wheel 27, the pawl 57 would allow the stop-wheel pin 42 to pass it as said wheel was retracted by its spring 60. Hence the valve 28 would without fail be closed as the stop-wheel was retracted. When the fastened-up cord later is released, the spring 55 retracts the cord-pulley 47, and toward the end of this movement the finger 58 of pawl 57 strikes the pin 42, now in the dotted position shown in Fig. 1, and passes the pin, and all parts now are readjusted relatively as shown in Fig. 1, ready for the next "pull and release" of the cord for again opening the valve.

To intentionally close the open valve 28 by means of the cord 48, at night, for instance, it is only necessary to pull and release the cord. In this case the pawl 57 would hang plumb and pass by the stop-wheel pin 42 and the pulley-pawl 56 would engage the next lower notch 40 of ratchet 39, as shown in Fig. 3^c, and when the cord is released the pawl 56 turns the ratchet and the open valve 28 one-quarter around and closes the valve. To open the valve again, say in the morning, it is only necessary to again pull and release the cord 48, which causes pawl 56 to give the closed valve another quarter-turn, thereby opening

it and leaving all the parts adjusted for automatic closure of the valve when the pawl 26 is next tripped from stop-wheel 27 in manner hereinbefore described.

Various modified forms of mechanism may be used within the scope or principles of operation of the invention. One modification (shown in Fig. 5 of the drawings) is briefly described as follows:

A horizontally-moving piston 68 in a casing 69, interposed in service-pipe 29, rocks a two-armed lever 70, supporting a horizontally-revoluble gage-wheel 71, having a flange 72, provided with a notch 73, and also having a retracting-spring 74. The lever 70 is coupled by a rod 75 with a rocking guide 76, having a pin 77, entering a slot of the rod, which has a spring 78 normally expanding against the pin. The guide 76 has a pin 79, adapted to bear on gage-wheel flange 72, and also carries a loose ball-hammer 80. In operation the water-pressure forces piston 68 forward, thereby rocking lever 70 and swinging gage-wheel 71 against a rotating gear 81 of the registering-train of a water-meter 1^a of different style from that shown in Figs. 1 and 2 of the drawings. Simultaneously the rod 75 tilts guide 76 and carries its pin 79 down upon the gage-wheel flange 72. When the index-gear 81 turns the gage-wheel 71 sufficiently to bring its notch 73 under guide-pin 79, the spring 78 gives a final tilting movement to the guide, which suffices to throw its ball-hammer 80 forcibly down upon the tail of pawl-detent 26^a and release it from the stop-wheel, thereby permitting the valve 28 to close automatically. When circulation stops, a suitable spring 70^a retracts lever 70, gage-wheel 71, and piston 68 and readjusts the tilting trip 76 80 to initial full-line position and the spring 74 retracts the gage-wheel rotatively. In this modification the piston 35 (or equivalent means operated by fluid-pressure) first automatically throws the gage device into operative relation with driving mechanism of the meter or motor, and this meter mechanism then actuates the gage device to control the time at which it shall permit closing of the valve, substantially as with the preferred construction first described. By adjusting the gage-wheel 71 to carry its notch 73 to position allowing a less or greater rotative movement of the wheel before the notch is presented to the tripper-pin 79 a lesser or greater volume of water will uninterruptedly pass into the service-pipe before the pawl 26^a is tripped to allow the valve 28 to close. The stop-wheel and cord-pulley with their pawls are arranged for operation with the valve 28 in manner hereinbefore described.

Other modifications may be made within the scope of the combinations and subcombinations specified in the appended claims, as, for instance, the gage device instead of being revoluble may be a straight or curved reciprocating bar having a notched flange moving along the trip-pin until the pin enters the

notch and permits tripping of the valve-detent, and weights may be used instead of the spring retracting devices 15, 24, 32, 55, and 60.

Wherever in this specification the word "pipe" is used it includes an ordinary pipe or a casing or conduit of any form through which any substance may flow under control of a valve.

My invention differs in two important respects from prior inventions of this class known to me, and as follows: First, the valve of my apparatus closes automatically only after a certain predetermined quantity of fluid has passed uninterruptedly through it or along the pipe, and, second, the gage or fluid-measuring devices, after being automatically thrown into operative relation with a driving mechanism of the meter or motor by pressure of the flowing fluid, are always automatically readjusted to their original positions after being either partially or fully operated, whereby the gage devices are always ready to automatically measure the same predetermined quantity of uninterruptedly-flowing fluid necessary to assure closing of the valve.

In an application for another patent filed simultaneously with this one and having Serial No. 583,847 I have described a cut-off apparatus differing from the one herein shown in that the valve is automatically closed by trip devices controlled by a governor operated automatically by pressure of the flowing fluid and tripping the valve-detent to permit closing of the valve only after the lapse of a certain predetermined period of time and without regard to the quantity of fluid which passes the open valve during this time.

I claim as my invention—

1. The combination, with a valved pipe and means closing the valve, of automatic mechanism preventing closure of the valve until after a predetermined quantity of fluid passes uninterruptedly through the pipe, said mechanism being actuated by pressure of fluid in the pipe.

2. The combination, with a valved pipe and means closing the valve, of means operated by flow of fluid through the pipe and gaging or measuring said flow and preventing closing of the valve until a predetermined quantity of fluid has passed through without interruption.

3. The combination, with a valved pipe, a tripping detent holding the valve open, and means closing the valve, of a gage device operated by flow of fluid through the pipe and measuring said flow, and automatic mechanism controlled by the gage device, and tripping the detent and permitting closing of the valve after a predetermined quantity of fluid has passed uninterruptedly through the pipe.

4. The combination, with a valved pipe and means closing the valve, of automatic mechanism preventing closure of the valve until after a predetermined quantity of fluid passes uninterruptedly through the pipe, said mechanism actuated by pressure of fluid in the

pipe and thrown into action by the flowing fluid, and thrown out of action after cessation of said flow.

5. The combination, with a valved pipe, a tripping detent holding the valve open, and means closing the valve, of a gage device operated by flow of fluid through the pipe and measuring said flow, automatic mechanism controlled by the gage device and tripping the detent and permitting closing of the valve after a predetermined quantity of fluid has passed uninterruptedly through the pipe, and means readjusting to initial positions the gage device and the pressure-operated means which actuate it, after cessation of any flow through the pipe.

6. The combination, with a valved pipe and means closing the valve, of a meter measuring the fluid passing through the pipe, a gage device automatically thrown into connection with a driving mechanism of the meter by pressure of fluid flowing through the pipe, and connections between the gage device and the valve-closing means, substantially as described, whereby the pipe-valve will be closed by the uninterrupted passage of a predetermined quantity of fluid through the meter and pipe.

7. The combination, with a valved pipe and means closing the valve, of a meter measuring the fluid passing through the pipe, a gage device automatically thrown into connection with a driving mechanism of the meter by pressure of fluid flowing through the pipe, connections between the gage device and the valve-closing means, and retracting means for the gage device, substantially as described, whereby the pipe-valve will be closed by the uninterrupted passage of a predetermined quantity of fluid through the meter and pipe, and the retracting devices will disconnect the gage device from the meter mechanism after cessation of the flow and will readjust the pressure-operated means to original positions, ready for their next operation by fluid-pressure in the pipe.

8. The combination, with a valved pipe, a tripping detent holding the valve open, and a meter measuring the fluid passing through the pipe, of a gage or measuring device automatically thrown in connection with a driving mechanism of the meter by pressure of fluid flowing through the pipe, and means controlled by the gage device and tripping the valve-detent and preventing closing of the valve until a predetermined quantity of fluid has passed without interruption through the meter and pipe.

9. The combination, with a valved pipe, a tripping detent holding the valve open, and a meter measuring the fluid passing through the pipe, of a gage or measuring device automatically thrown into connection with a driving mechanism of the meter by pressure of fluid flowing through the pipe, means controlled by the gage device and tripping the detent and preventing closing of the valve until a prede-

terminated quantity of fluid has passed without interruption through the meter and pipe, and retracting means disconnecting the gage device from the meter mechanism after cessation of the flow and readjusting the pressure-operated means to original positions ready for their next operation by fluid-pressure in the pipe.

10. The combination, with a valved pipe, a tripping detent holding the valve open, and means closing the valve, of a movable notched gage device operated by flow of fluid through the pipe and measuring said flow, and automatic mechanism controlled by the gage device and having a part entering its notch, thereby tripping the valve-detent and permitting closing of the valve.

11. The combination, with a valved pipe, a tripping detent holding the valve open, and means closing the valve, of a bodily-movable revoluble and notched gage device operated by flow of fluid through the pipe and measuring said flow, and automatic mechanism controlled by the gage device and having a part entering its notch, thereby tripping the valve-detent and permitting closing of the valve.

12. The combination, with a valved pipe, a tripping detent holding the valve open, and means closing the valve, of means operated by pressure of fluid in the pipe, a movable notched gage device sustained by said pressure-operated means, and a meter or fluid-motor discharging into the valved pipe and having a moving part actuating the gage device and causing tripping of the valve-detent and closing of the valve.

13. The combination, with a valved pipe, a detent holding the pipe-valve open, and means automatically closing the valve, of means operated by pressure of fluid in the pipe, a shaft rocked by said pressure-operated means, an arm fixed to said shaft, a lever hung on the shaft and movable by its arm, a notched gage-wheel on said lever, means rotating the gage-wheel, and a trip-lever on the shaft having a part bearing on the gage-wheel and adapted to enter its notch, said trip-lever then releasing the valve-detent and permitting closure of the valve.

14. The combination, with a valved pipe, a detent holding the pipe-valve open, and means automatically closing the valve, of means operated by pressure of fluid in the pipe, a shaft rocked by said pressure-operated means, an arm fixed to the shaft, a lever hung on the shaft and movable by its arm, a notched gage-wheel on said lever, a meter or fluid-motor discharging into the valved pipe and having a moving part actuating the gage-wheel, and a trip-lever on the shaft having a part bearing on the gage-wheel and adapted to enter its notch, said trip-lever then releasing the valve-detent and permitting closure of the valve.

15. The combination, with a valved pipe, a detent holding the pipe-valve open, and means automatically closing the valve, of means op-

erated by pressure of fluid in the pipe, a shaft rocked by said pressure-operated means, an arm fixed to said shaft, a lever hung on the shaft and movable by its arm, a notched and shouldered gage-wheel on said lever having a yielding pawl providing an escape-passage along the shoulder, means rotating the gage-wheel, a stop for said gage-wheel, means retracting the gage-wheel to said stop, and a trip-lever on the shaft having a part bearing on the gage-wheel and adapted to enter its notch and escape between the pawl and shoulder as the wheel is retracted, said trip-lever releasing the valve-detent and permitting closure of the valve.

16. The combination, with a valved pipe, a detent holding the pipe-valve open, and means automatically closing the valve, of a piston 35, a rocking shaft 13, a lever 34, fixed to shaft 13, and coupled to piston 35, an arm 30 fixed to shaft 13, and having a pin 31, means retracting the parts 30, 34, 35, a lever 12, hung on shaft 13, a gage-wheel 14, journaled in lever 12, and having notch 20, shoulder 18 and pawl 19, means rotating and retracting the gage-wheel, a trip-lever 22, loose on shaft 13, and having a pin 21, bearing on the gage-wheel and adapted to enter its notch 20, and escape between shoulder 18 and pawl 19, and means such as a spring 24, throwing the trip-lever against the valve-detent and releasing it and permitting closure of the valve.

17. The combination, with a valved pipe, a detent holding the pipe-valve open, and means automatically closing the valve, of a piston 35, a rocking shaft 13, a lever 34, fixed to shaft 13, and coupled to the piston 35, an arm 30, fixed to shaft 13, and having a pin 31, means retracting the parts 30, 34, 35, a lever 12, hung on shaft 13, a gage-wheel 14, on lever 12, and having notch 20, shoulder 18, and pawl 19, means such as a spring 15, retracting the gage-wheel, a stop for said gage-wheel, a wheel 10, on the gage-wheel shaft, a meter or fluid-motor having a wheel 9, adapted to engage wheel 10, a trip-lever 22, on the shaft having a part 21, bearing on the gage-wheel and adapted to enter its notch 20 and to escape between shoulder 18, and pawl 19, and means such as a spring 24, throwing the trip-lever against the valve-detent and releasing it and permitting closure of the valve.

18. The combination, with a valved pipe, a detent holding the pipe-valve open, and means automatically closing the valve, of a piston 35, a coupled lever 34, a rocking shaft 13 having arm 30, a lever 12, a notched gage-wheel 14 on lever 12, and means rotating and retracting the gage-wheel, of an adjustable stop 16, hung on the shaft 11, of wheel 14, and adapted to engage the wheel at different points and stop at the lever 12, and a trip-lever 22, adapted to the gage-wheel and releasing the valve-detent and permitting closure of the valve.

19. The combination, with a valved pipe, a tripping detent holding the valve open, and means closing the valve, of a gage device op-

erated by flow of fluid through the pipe and measuring said flow, and automatic mechanism controlled by the gage device and tripping the detent and permitting closing of the valve after a predetermined quantity of fluid has passed uninterruptedly through the pipe, said pipe-valve and its casing having main passages and drainage-passages, substantially as described, whereby as the main valve-passage is opened the drainage-passages will be closed, and as the main valve-passage is automatically closed the drainage-passages are automatically opened, as set forth.

20. The combination, with a pipe having a valve, a meter or fluid-motor actuated by fluid passing through the pipe, a gage device automatically connecting with the meter by means actuated by flow of fluid in the pipe and controlling a trip device releasing the valve-detent and permitting closure of the valve after passage of a predetermined quantity of fluid uninterruptedly through the meter, a ratchet fast on the valve-stem, a loose stop-wheel having a pawl engaging the ratchet, and a pin; a pulley loose on the valve-stem and having pawls engaging the ratchet and stop-wheel pin, said pulley revoluble backward and forward, thereby giving intermittent forward rotation to the ratchet-wheel and valve, substantially as described, whereby the valve may be opened and closed independently of the action of the automatic valve-closing mechanism.

21. In an automatic cut-off, the combination, with a service-pipe and its valve, of a ratchet fixed to the valve-stem, a stop-wheel and a pulley loose on said stem, a detent adapted to the stop-wheel and holding the valve open, means retracting the pulley and stop-wheel, and a system of pawls and pins on the stop-wheel and pulley turning forward the valve-stem ratchet and closing and opening the valve by partial revolutions of both stop-wheel and pulley, said pulley adapted to turn the retracted stop-wheel forward with it and also adapted for retraction without retracting the stop-wheel.

22. In an automatic cut-off, the combination, with a service-pipe and its valve, of a ratchet fixed to the valve-stem, a stop-wheel and pulley loose on said stem, a detent adapted to the stop-wheel and holding the valve open, and means retracting the pulley and stop-wheel, said stop-wheel having a pawl adapted to the valve-stem ratchet and a pin projecting toward the pulley; said pulley having two pawls and a pin, one spring-pressed pulley-pawl adapted to the valve-stem ratchet and the other gravitating pulley-pawl adapted to strike the pulley-pin and forwardly rotate the retracted stop-wheel by contact with its pin, said pulley also adapted for retraction without retracting the stop-wheel while its gravitated pawl escapes past the stop-wheel pin.

23. In an automatic cut-off, the combina-

tion, with a service-pipe and its valve, of a ratchet fixed to the valve-stem, a stop-wheel and a pulley loose on said stem, a detent adapted to the stop-wheel and holding the valve open, means retracting the pulley and stop-wheel, said stop-wheel having a pawl adapted to the valve-stem ratchet and a pin projecting toward the pulley, said pulley having two pawls and a pin, one spring-pressed pulley-pawl adapted to the valve-stem ratchet and the other gravitating pulley-pawl adapted to strike the pulley-pin and forwardly rotate the retracting stop-wheel by contact with its pin, said pulley also adapted for retraction without retracting the stop-wheel while its gravitated pawl escapes past the stop-wheel pin, stops limiting forward and backward movements of the pulley and backward retraction of the stop-wheel, a casing inclosing the cut-off mechanism, and a cord fixed to the pulley and extending through the casing for operating the pulley, stop-wheel and valve.

24. In an automatic cut-off, the combination, with a service-pipe and its valve, of a ratchet 39, having notches 40, and fixed to the valve-stem, a stop-wheel 27, and pulley 47, loose on the valve-stem, said stop-wheel having spring-pressed pawl 41, and pin 42, and said pulley having spring-pressed pawl 56, and gravitating pawl 57 with finger 58; a detent 26, engaging the stop-wheel, means tripping the detent, and means retracting the pulley and stop-wheel.

25. In an automatic cut-off, the combination, with a service-pipe and its valve, of a ratchet 39, having notches 40, and fixed to the valve-stem, a stop-wheel 27, and pulley 47, loose on the valve-stem, said stop-wheel having spring-pressed pawl 41, and pin 42, and said pulley having spring-pressed pawl 56, and gravitating pawl 57 with finger 58; a detent 26, engaging the stop-wheel, means tripping the detent and means retracting the pulley and stop-wheel, a stud 43, on stop-wheel 27, studs 52, 53, on pulley 47, and fixed stops 44, 54, for the stop-wheel and pulley respectively.

26. In an automatic cut-off, the combination, with a service-pipe and its valve, of a ratchet 39, having notches 40, and fixed to the valve-stem, a stop-wheel 27, and pulley 47, loose on the valve-stem, said stop-wheel having spring-pressed pawl 41, and pin 42, and said pulley having spring-pressed pawl 56, and gravitating pawl 57 with finger 58; a detent 26, engaging the stop-wheel, means tripping the detent and means retracting the pulley and stop-wheel, a stud 43, on stop-wheel 27, studs 52, 53, on pulley 47, fixed stops 44, 54, for the stop-wheel and pulley respectively, a casing inclosing the cut-off mechanism, and a cord connected to pulley 47, and extending through the casing for operating the pulley, stop-wheel and valve.

27. An automatic cut-off, comprising a meter or fluid-motor, a connected valved pipe, controlling mechanism automatically closing

the pipe-valve and actuated by pressure of fluid passing the valve and by the meter mechanism, a ratchet fixed to the valve-stem, a stop-wheel and pulley loose on said stem, a
 5 detent engaging the stop-wheel and holding the valve open, means retracting the stop-wheel and pulley, and pawls and pins on the pulley and stop-wheel coöperating with them and the valve-stem ratchet and detent and
 10 opening and closing the valve, said pulley adapted to turn the retracted stop-wheel forward with it and also adapted for retraction without retracting the forwardly-turned stop-wheel.

15 28. In an automatic cut-off, the combination, with a valved pipe, a detent holding the pipe-valve open, means operated by pressure of fluid in the pipe, and a trip device actuated from said means which are operated by
 20 pressure of fluid in the pipe and tripping the valve-detent, of a ratchet fixed to the valve-stem, a stop-wheel and pulley loose on said stem, said valve-detent engaging the stop-wheel, means retracting the stop-wheel and
 25 pulley, pawls and pins on the pulley and stop-wheel coöperating with them and the valve-stem ratchet and the detent and opening and closing the valve, said pulley adapted to turn the retracted stop-wheel forward with it and
 30 also adapted for retraction without retracting the forwardly-turned stop-wheel.

29. In an automatic cut-off, the combination, with a valved pipe, a detent holding the pipe-valve open, means operated by pressure
 35 of fluid in the pipe, a trip device actuated from said means which are operated by pressure of fluid in the pipe, and a gage device controlling the trip and at proper time tripping the same and releasing the valve-detent
 40 and permitting closure of the valve, of a ratchet fixed to the valve-stem, a stop-wheel and pulley loose on said stem, said valve-detent engaging the stop-wheel, means retracting the stop-wheel and pulley, pawls and pins
 45 on the pulley and stop-wheel coöperating with them and the valve-stem ratchet and the detent and opening and closing the valve, said pulley adapted to turn the retracted stop-wheel forward with it and also adapted for
 50 retraction without retracting the forwardly-turned stop-wheel.

30. In an automatic cut-off, the combina-

tion, with a valved pipe and a detent holding the pipe-valve open, said valve having a pas-
 55 sage opening and closing the pipe and passages open for drainage of the pipe when the valve is closed and closed when the valve is open, of means operated by pressure of fluid in the pipe, a trip device actuated from said
 60 means which are operated by pressure of fluid in the pipe and releasing the valve-detent, a gage device controlling the trip and detent and permitting closure of the valve, a ratchet fixed to the valve-stem, a stop-wheel and pulley
 65 loose on said stem, said valve-detent engaging the stop-wheel, means retracting the stop-wheel and pulley, and pawls and pins on the pulley and stop-wheel coöperating with them and the valve-stem ratchet and the de-
 70 tent and opening and closing the valve, said pulley adapted to turn the retracted stop-wheel forward with it and also adapted for retraction without retracting the forwardly-turned stop-wheel.

31. In an automatic cut-off, the combination, with a valved pipe, and a detent holding
 75 the pipe-valve open, said valve having a passage opening and closing the pipe and passages open for drainage of the pipe when the valve is closed and closed when the valve is open, of means operated by pressure of fluid
 80 in the pipe, a trip device actuated from said means which are operated by pressure of fluid in the pipe and releasing the valve-detent, a gage device controlling the trip and detent, a ratchet fixed to the valve-stem, a stop-wheel
 85 and pulley loose on said stem, said valve-detent engaging the stop-wheel, means retracting the stop-wheel and pulley, pawls and pins on the pulley and stop-wheel coöperating with
 90 them and the valve-stem ratchet and the detent and opening and closing the valve, said pulley adapted to turn the retracted stop-wheel forward with it and also adapted for retraction without retracting the forwardly-
 95 turned stop-wheel, and a meter or fluid-motor discharging into the valved pipe and having a moving part actuating the gage device and causing release of the valve-detent and closure of the valve.

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