Dec. 9, 1941. W. E. STEEN 2,265,325

QUANTITY STOP MECHANISM FOR METERS

Filed Aug. 28, 1939 4 Sheets-Sheet 1

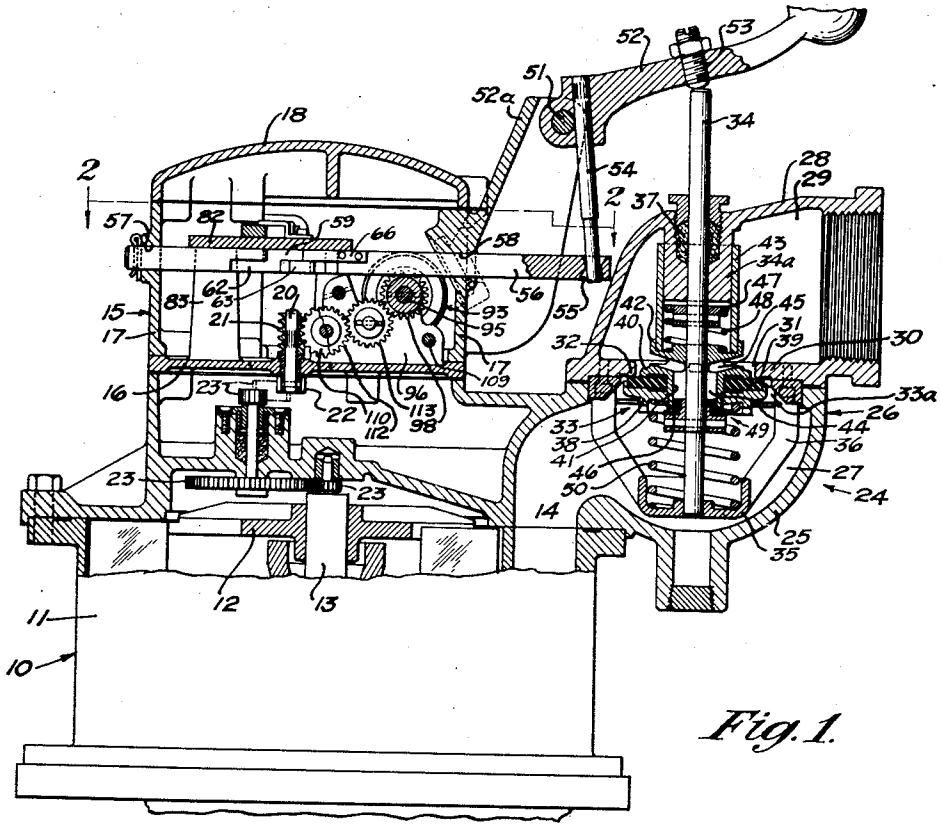


Fig. 1.

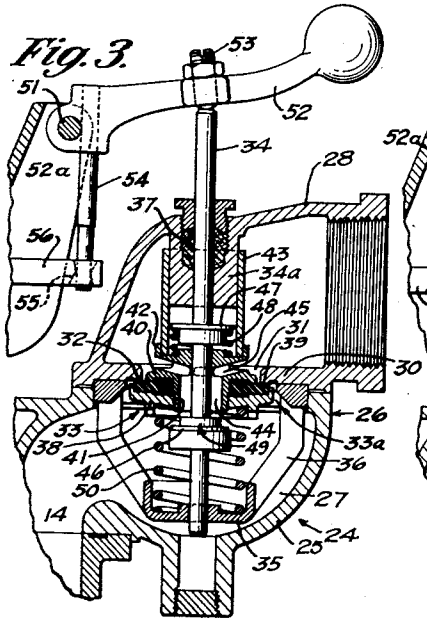


Fig. 3.

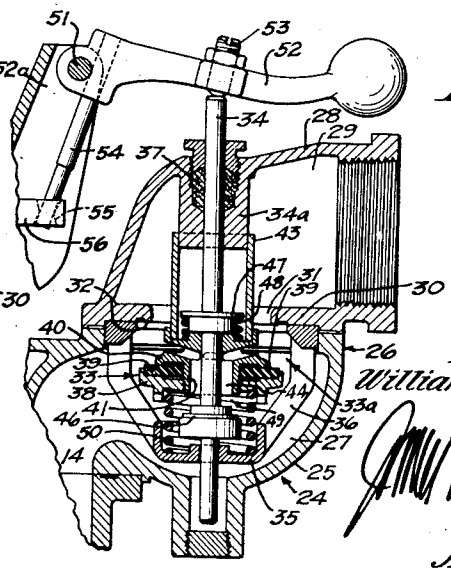


Fig. 4.

Inventor
William E. Steen.

Attorney.

Dec. 9, 1941. W. E. STEEN 2,265,325

QUANTITY STOP MECHANISM FOR METERS

Filed Aug. 28, 1939 4 Sheets-Sheet 2

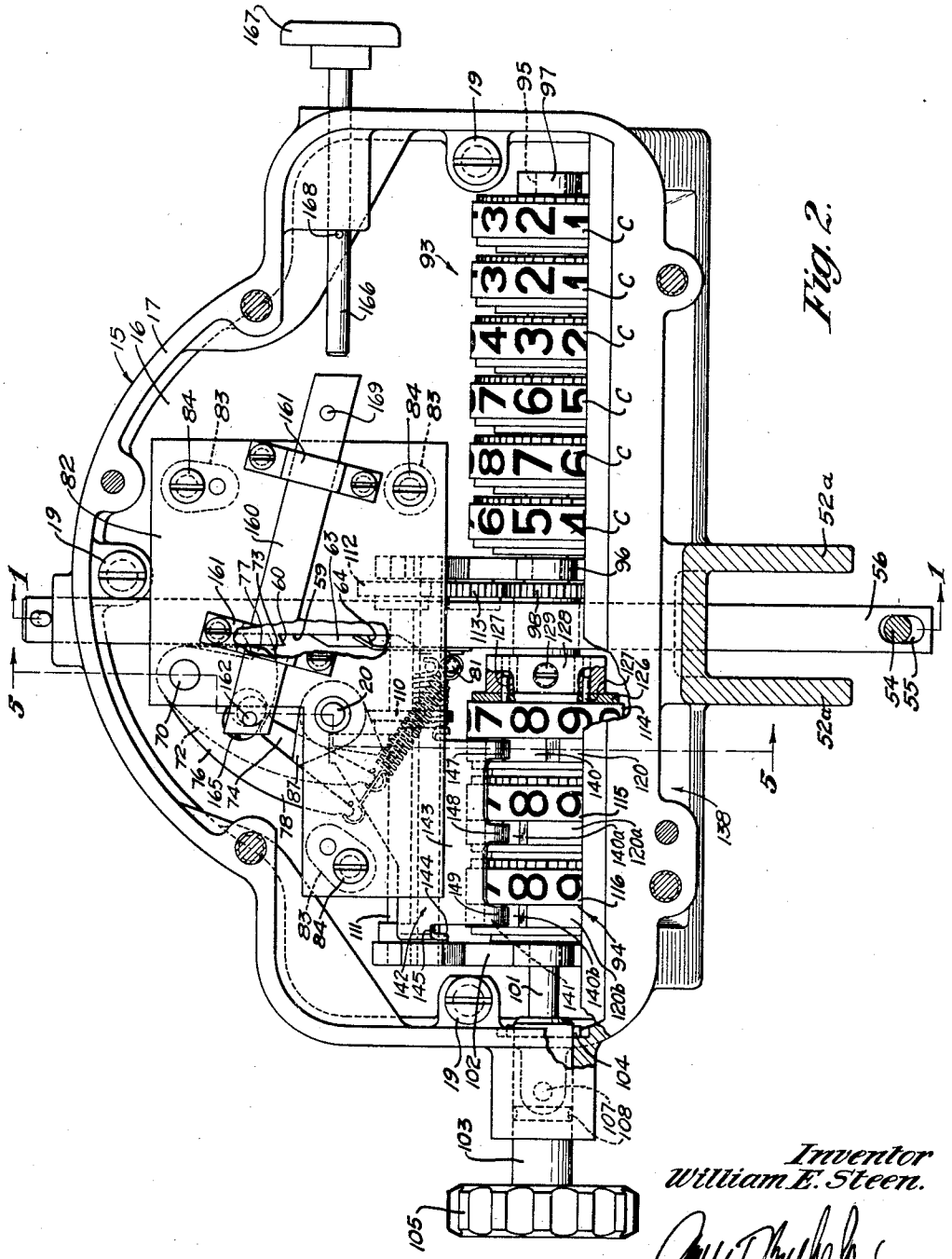


Fig. 2.

Inventor
William E. Steen.

Attorney.

Dec. 9, 1941. W. E. STEEN 2,265,325

QUANTITY STOP MECHANISM FOR METERS

Filed Aug. 28, 1939 4 Sheets-Sheet 3

Fig. 5.

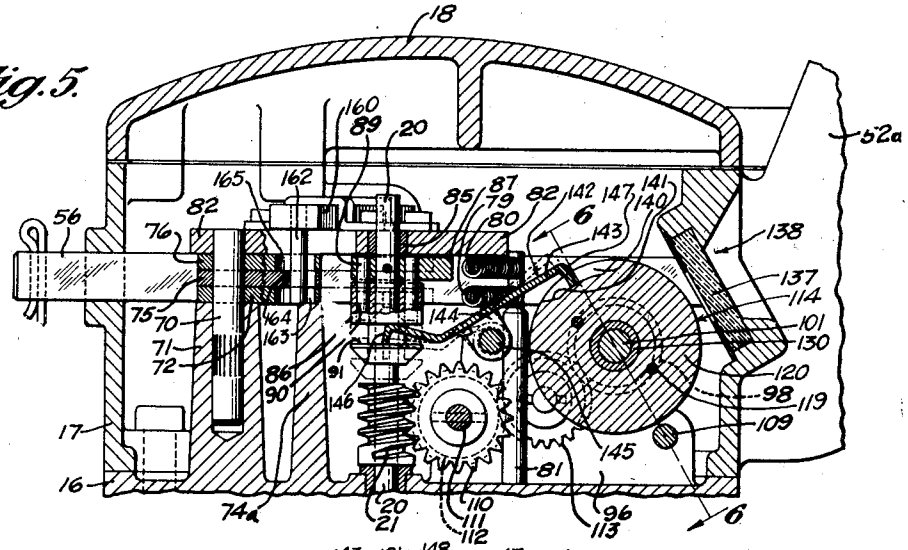
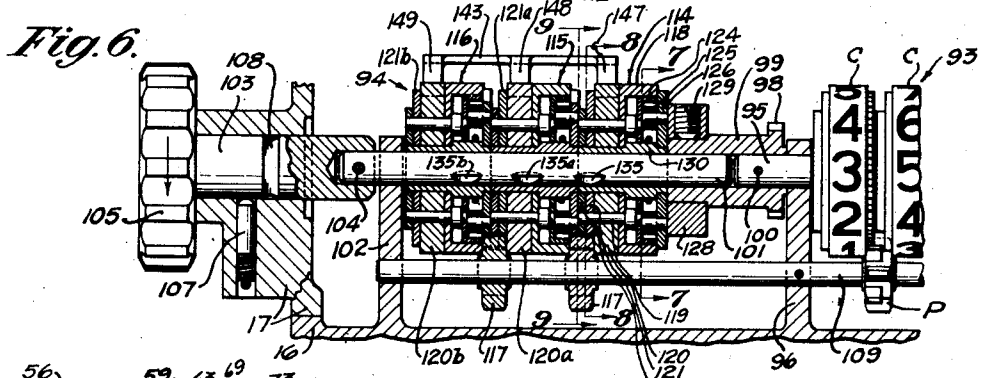


Fig. 6.



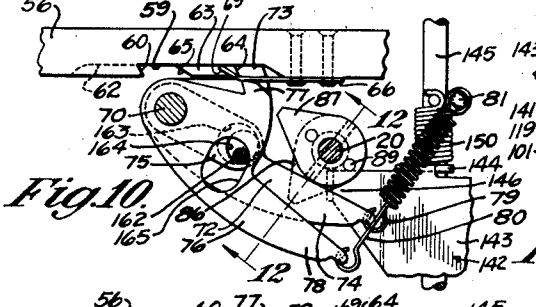


Fig. 10.

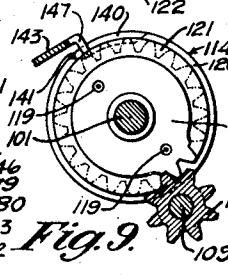


Fig. 9.

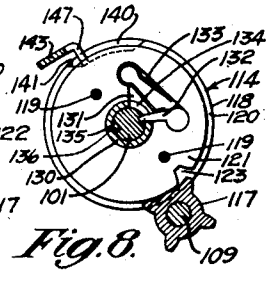


Fig. 8.

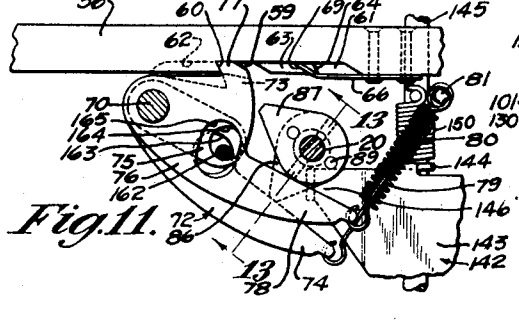


Fig. 11.

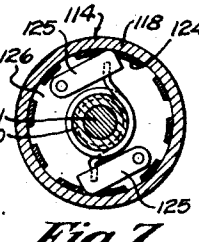


Fig. 7.

Inventor
William E. Steen.

Attorney.

Dec. 9, 1941. W. E. STEEN 2,265,325

QUANTITY STOP MECHANISM FOR METERS

Filed Aug. 28, 1939 4 Sheets-Sheet

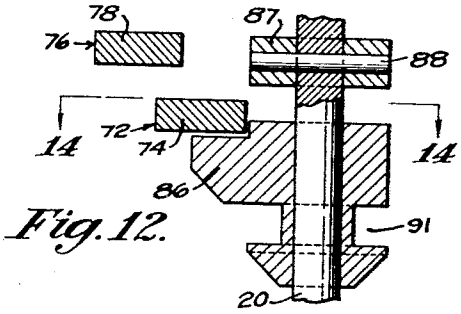


Fig. 12.

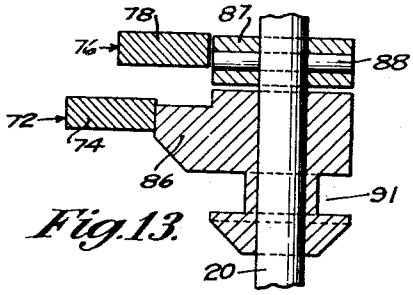


Fig. 13.

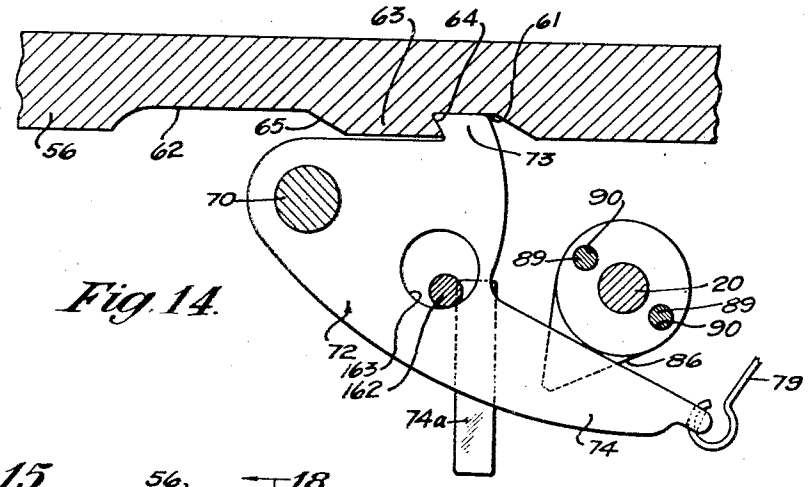


Fig. 14.

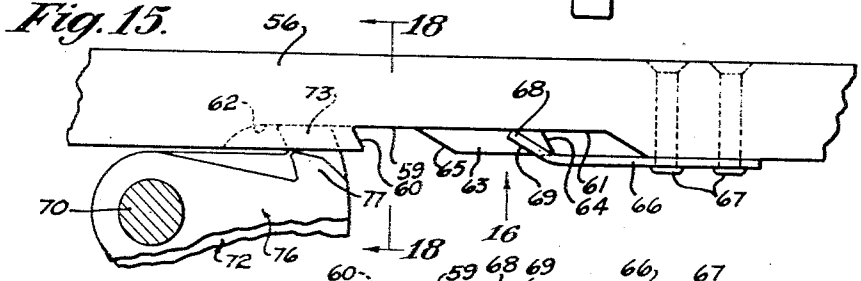


Fig. 15.

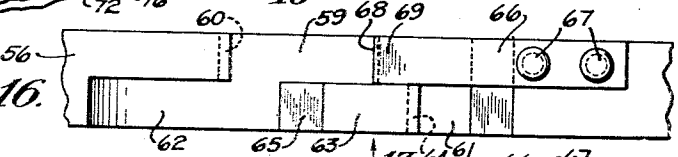


Fig. 16.

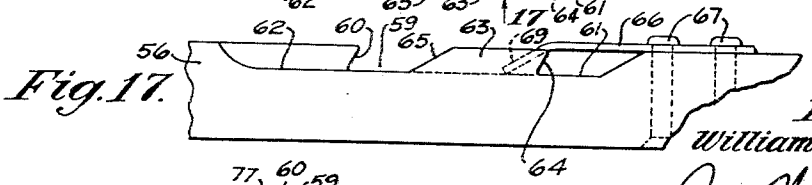


Fig. 17.

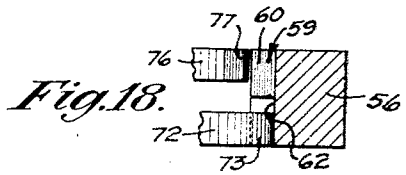


Fig. 18.

Inventor
William E. Steen.

Attorney.

Patented Dec. 9, 1941 2,265,325

UNITED STATES PATENT OFFICE

2,265,325

QUANTITY STOP MECHANISM FOR METERS

William E. Steen, Pasadena, Calif., assignor to Smith Meter Company, Los Angeles, Calif., a corporation of California

Application August 28, 1939, Serial No. 292,214

9 Claims. (Cl. 235—132)

This invention relates generally to quantity-stop mechanisms for meters or the like and is more particularly concerned with devices of this character which are especially well adapted to be applied to meters such as installed on gasoline delivery trucks, though not, of course, limited to this particular use.

Operation of devices of this character, involve the manual setting of a counter mechanism to indicate the number of gallons of fluid to be delivered to a given customer. Having set the counter, the operator merely has to open the valve manually. As soon as the predetermined amount of fluid has been delivered, the valve is automatically closed. This is accomplished without interfering with the totalizing unit which keeps a running total of all trip deliveries.

It is among the general objects of the invention to provide a device of this character which shall be extremely accurate and positive in operation, and yet one which may be set by the operator with great ease and dispatch.

It is another and major object of the invention to provide a device of this character which will permit of full-capacity delivery through the valve until just before completion of the run and then cause a "stage-closing" movement of the valve, the full and final closing occurring just at the completion of the predetermined run. By virtue of this stage-closing and the allowance of a short pause between stages, the valve, meter and counter are relieved of the shock incident to the sudden and full closing usual to the operation of other known types of automatically closed valves. Yet in spite of this stage-closing effect, there is a sharp cut-off of the flow when the predetermined delivery is completed and the pause between the stages is so short that there is no appreciable lag in the shut-off operation, it following that advantage is had both of the relatively rapid and automatic shut-off and of the shockless effect of the stage-closing.

In carrying out one aspect of the invention, there is involved the use of a pilot valve and a main valve, the valves being opened successively and in the order named, with a single, continued movement of the operating handle. Since the pilot valve is opened first and the effective area presented to the fluid pressure by this valve is relatively small, and further since the instant the pilot valve is opened there is a pressure balancing effect on the main valve, the complete opening operation can be accomplished very easily even against relatively high fluid pressure within the meter. On the other hand, the stage or delay closing of the valve spoken of above, is accomplished by releasing the main valve so it may fully close just before the predetermined quantity has been delivered, with the pilot valve still remaining open until the run, of predetermined quantity, has been exactly completed, whereupon the pilot valve is automatically tripped so that it is pressed to fully closed position.

How all the above is accomplished, as well as other objects and novel features of the invention, may be discussed to better advantage in connection with the following detailed description, reference being had to the accompanying drawings, in which:

Fig. 1 is a vertical, medial sectional view through a device embodying my invention, and, except for the showing of the valve, may be considered as a reduced section on line 1—1 of Fig. 2;

Fig. 2 is an enlarged section on line 2—2 of Fig. 1;

Fig. 3 is a sectional view of the valve shown in Fig. 1, but in changed position;

Fig. 4 is a view similar to Fig. 3 showing the valve shifted to still another position;

Fig. 5 is a section on line 5—5 of Fig. 1, but showing the quantity-stop wheels and release cams as having been rotated slightly from the position they occupy in Fig. 2;

Fig. 6 is a section on line 6—6 of Fig. 5, except that the quantity-stop wheels have been indicated as rotated sufficiently to bring their cross-pins into the plane of section line 6—6;

Fig. 7 is a section on line 7—7 of Fig. 6;

Fig. 8 is a section on line 8—8 of Fig. 6;

Fig. 9 is a section on line 9—9 of Fig. 6;

Fig. 10 is a fragmentary plan view of the latches and latch bar in positions somewhat advanced beyond the showing of Fig. 2;

Fig. 11 is a view similar to Fig. 10 but showing the latches and latch bar in changed relation;

Fig. 12 is an enlarged section on line 12—12 of Fig. 10;

Fig. 13 is an enlarged section on line 13—13 of Fig. 11;

Fig. 14 is a section on line 14—14 of Fig. 12 but showing the parts rotated sufficiently to return them to the aspect of Fig. 10;

Fig. 15 is an enlarged, fragmentary plan view of the latch bar and latches when in the relative positions of Fig. 2;

Fig. 16 shows the latch bar as viewed from the position of arrow 16 in Fig. 15;

Fig. 17 shows the latch bar as viewed from the position of arrow 17 in Fig. 16; and

Fig. 18 is a fragmentary section on line 18—18 of Fig. 15.

My invention may be applied with advantage to any suitable type of fluid meter, and I have thus merely conventionally illustrated meter 10 as made up of a housing 11 and a rotor 12 within that housing, the rotor having a shaft 13 whose extent of angular movement bears a known relationship to the quantity of liquid delivered through outlet 14.

A counter housing 15 is mounted on top of the meter housing, being made up of base 16, side walls 17, and removable top 18, attachment between the two housings being made through cap screws 19 (Fig. 2). Having bearing in base plate 16 is a vertical shaft 20, the shaft carrying a worm 21 above the plate and a pinion 22 below the plate. In Fig. 1 the shaft is shown as broken immediately above the worm in order that the shaft-carried mechanism above the break may not obscure the mechanism therebehind, though the complete shaft above plate 16 and the mechanism carried thereby is shown in Figs. 5, 12 and 13.

Gear train 23 interconnects rotor shaft 13 and shaft 20, the particular gearing shown being such that one revolution of shaft 20 is accomplished during the delivery of one gallon of fluid by the meter. Of course, other units of measure and other ratios between the extent of angular movement of shaft 20 and the quantity of fluid delivered, may be chosen at will, the above relationship being set forth merely for illustrative purposes. The gear drive between shaft 20 and the counter mechanism will be described at a later point.

The outlet valve is indicated generally at 24 and while, from some aspects of the invention, the nature of this valve is unimportant so far as its detail and type of operation is concerned, it preferably has certain features, to be described, which become important in connection with other aspects of the invention. These features may be generally typified as arrangements whereby, in spite of the fact that the valve is automatically released for spring-pressed movement from open to closed position when a predetermined quantity of fluid has been delivered, and in spite of the fact that full capacity delivery is maintained through the valve until an instant before the automatic shut-off occurs, that shut-off is accomplished without the jarring shocks usually characteristic of such arrangements. The same arrangement which permits of this rapid yet shockless closing, also contributes to the end that the operator may open the valve easily and quickly in spite of relatively high fluid pressures which may be resisting such opening.

The lower part 25 of valve housing 26 is integral with the meter housing, though this is not essential to the invention, and defines a chamber 27. The upper part 28 of the valve housing defines a chamber 29, the two chambers being separated one from the other by horizontal partition 30 and the valve-stopper structure to be described. Partition 30 has a large central opening 31 outlined by a downwardly facing, annular seat 32 for coaction with the main valve stopper generally indicated at 33. Valve stem 34 is vertically slidable through depending guide-boss 34*a* on housing part 28 and through the bottom of cup-portion 35 of stirrup 36, which latter is clamped between housing parts 25 and 28. The valve stem is packed off in the usual manner at 37.

Stopper 33 includes an annulus 38 supporting a ring 39 adapted to be pressed into fluid-tight engagement with seat 32 when the valve is closed, said ring 39 preferably being of a suitable fluid resistant material having proper self-seating characteristics. The ring is clamped between annulus 38 and flange 40 of nipple 41, the nipple being threaded into the bore of the annulus. Flange 40 is extended upwardly to form a cup 42, through the bottom of which is provided a bore to permit the sliding passage of stem 34 therethrough, and a tube 43 is secured to and extends above the cup, having sliding fit over boss 34*a*.

The bore 44 of nipple 41 is of sufficient diameter to allow fluid passage upwardly around stem 34 when the lower end of that bore is open, there being lateral ports 45 opening from the nipple bore to upper chamber 29.

Secured to stem 34 is a pilot valve stopper 46 adapted to seat on the lower end of nipple 41 and thus to close off bore 44 under certain conditions. Secured to stem 34 and adapted to play vertically through the bore of tube 43, is a collar 47, spring 48 being interposed between the top of cup 42 and the collar in a manner tending to elevate the stem and hence stopper 46 with relation to stopper 33, and thus tending to keep the pilot valve, generally indicated at 49, releasably in closed condition. Spring 50, interposed between stirrup cup 35 and the under face of stopper 33, tends to releasably hold the main valve, generally indicated at 33*a*, in closed condition. It will also be apparent that fluid under pressure within the meter tends to hold both the pilot and main valves in closed condition.

I provide the following means for sequentially opening the pilot and main valves, this means also serving as a part of the mechanism for releasably holding those valves in open condition until certain latch mechanism is automatically tripped after delivery of a predetermined quantity of fluid.

Pivoted at 51 on bracket arms 52*a* which extend integrally from counter housing 15, is an operating handle or lever 52, the lever carrying an adjustable contact screw 53 which is disposed immediately over the end of stem 34.

When lever 52 is depressed from the position of Fig. 1 to that of Fig. 3, it will be seen that stem 34 is pressed downwardly against the action of the spring 48 (relatively weak with respect to main spring 50) thus opening pilot valve 49, as clearly illustrated in Fig. 3. It will be realized that this relatively small valve may be readily opened even against relatively high pressures within the meter, and the flow of fluid through the nipple bore into chamber 29 tends to balance the main valve and thus renders it more readily openable.

Upon further depression of lever 52 toward the position of Fig. 4, the underside of collar 47 engages the upper face of cup 42 so that subsequent movement of the lever to the position of Fig. 4 moves stopper 33 against the pressure of main spring 50, to unseat that stopper and thus fully open the main valve, the pilot valve still remaining open so fluid may flow not only upwardly around the outer edge of the main valve stopper but also through the nipple bore 44.

Upon subsequent movement of lever 52 from the position of Fig. 4 to that of Fig. 3, the main valve recloses, while the pilot valve remains open to permit a continued but reduced flow therethrough. The flow through the pilot valve is not shut off until lever 52 has been returned to the

position of Fig. 1, the cut-off being thus completed rapidly but in stages, with a short pause between stages, so as to reduce closing shocks which are characteristic of usual quick-shut-off valves.

My invention contemplates an arrangement whereby, once the valve is fully opened, as in Fig. 4, it is automatically latched in that position. Then, after delivery through the meter of a predetermined quantity of fluid, the valve holding means is automatically released so that springs 48 and 50 may return their respective stoppers to closed position. But the arrangement is such that after the main valve has moved to closed position, which is timed to occur just prior to the full delivery of the predetermined quantity of fluid, the pilot valve is delayed in starting towards its closed position. As soon as the full complement of fluid is delivered, the pilot valve is released automatically for full closing movement. Thus, the "easing-off" effect usually accomplished painstakingly and slowly by manual operation, is automatically accomplished by my arrangement, with the added advantage that it is done much more rapidly and accurately than is possible by manual operation.

Depending from lever 52 adjacent its pivot point, is a shifter pin 54 entered in the socket 55 of latch bar 56, the latter being mounted in the counter housing at 57 and 58 for horizontal sliding movement through the interior of said housing. Lever 52 and pin 54 may be considered as making up a bell-crank. Latch bar 56 has a relatively long notch 59 sunk in one side of its upper part (as viewed in Figs. 1 and 18), the bar stock being undercut at one end of the notch to form a latch shoulder 60, while a pair of notches 61 and 62, separated by lug 63, are cut in the lower half of the same side of the latch bar. The stock at one end of groove 61 is undercut to provide latch shoulder 64, said shoulder being, in effect, at one end of lug 63, while the other end of the lug is fashioned to provide cam shoulder 65. It will be observed that notch 62 extends to the left (Figs. 15 and 16) a greater extent than does upper notch 59, and it will also be noted that latch shoulders 60 and 64 may be considered as spaced longitudinally of bar 56 though at different horizontal levels.

A filler strip for the right hand end of notch 59 (as viewed in Fig. 15) is provided in the form of a spring-steel leaf 66 secured to bar 56 at 67, the distal end 68 of the strip being bent into notch 59 and presenting a cam shoulder 69 which lies in opposition to latch shoulder 60. Pivot pin 70 is supported by and extends above housing-post 71, a lower main valve latch 72, having a latching nose 73 and a tail 74, being pivotally mounted on pin 70 in the horizontal plane of notches 61 and 62, latch shoulder 64, and cam shoulder 65. The latch 72 rests at its pivoted end on top post 71, while approximately midway between its pivoted end and the free end of tail 74, it is slidably supported from beneath by the upper end of post 74a, which is rectangular as viewed in plan (Fig. 14). A spacer 75 is interposed between latch 72 and the upper, pilot-valve-latch 76, the latter also being pivoted on pin 70 and having a nose 77 and tail 78. Nose 77 lies in the horizontal plane of notch 59, latch shoulder 60, and cam shoulder 69. Springs 79 and 80 extend from the tail ends of latches 72 and 76, respectively, to post 81 which projects upwardly from the base 16, these springs tending to rotate both latches in a counter-clockwise direction as viewed in Figs. 2, 10 and 11.

A plate 82, held down on posts 83 by screws 84, holds latches and spacer 75 in assembly, and also provides an upper bearing 85 for shaft 20.

Trigger or latch-release cams 86 and 87 are mounted on shaft 20 for selective cooperation with latches 72 and 76, respectively. Cam 87 is pinned at 88 to the shaft, and remains constantly in the horizontal plane of latch 76. On the other hand, cam 86, the effective portion of which is approximately 90° "behind" the effective portion of cam 87, is vertically or axially shiftable along shaft 20 to and from a position of coplanar relation with latch 72 (Fig. 12 and Fig. 13). Cam 86 is held against relative rotation with respect to cam 87 and hence with respect to shaft 20, by vertical pins 89 which are press-fitted in cam 87 but have free fit in sockets 90 of cam 86, so said cam 86 may slide vertically and still remain fixed against rotation with respect to cam 87 and shaft 20. Pins 89 form, in effect, part of the drive connection between shaft 20 and cam 86. The lower end of cam 86 has groove 91 to take a shifter element which will be described later.

The counter mechanism includes a totalizer unit 93 and an interconnected quantity-stop unit 94. Totalizer shaft 95 is journalled in brackets 96 and 97 and carries a gear 98 which has an elongated sleeve portion 99, said gear being pinned at 100 to the shaft. Quantity-stop shaft 101 is mounted for rotation and endwise movement through the outer end of the bore of sleeve 99, the other end of shaft 101 having bearing in but being movable endwise through bracket 102. Relatively large-diameter shaft 103 is rotatably mounted in but movable endwise through housing wall 17, being pinned at 104 to shaft 101. Shaft 103 has an external knob 105 whereby shaft 101 may be rotated manually or may be shifted endwise from the position of Fig. 6 to that of Fig. 2, the contact of the knob with the counter housing limiting the endwise movement in one direction, and pin 104 engaging the inner face of the housing to limit movement in the opposite direction. To establish an intermediate position of shaft 101, I have provided a spring-pressed detent 107 adapted to enter groove 108 in shaft 103 when shaft 101 is in said position.

On totalizer shaft 95 are provided usual counter wheels C. These wheels may be of any suitable stock variety, their nature being well understood by those skilled in the art, the connection between the shaft and wheels and the interconnection between the wheels through transfer pinions P on transfer shaft 109, being such that for each revolution of shaft 20 (representing the delivery of one gallon of fluid in the illustrated embodiment of the invention) the counter wheels will register a corresponding counteradvance, the wheel at the extreme right of Fig. 2 making one-tenth of a revolution to each full revolution of shaft 20 and each other wheel rotating one-tenth of a revolution for each full revolution of the wheel to its immediate right, all as is well understood.

The drive from shaft 20 to gear 98 and hence shaft 95, whereby this progressive advance is accomplished, includes a worm wheel 110 in mesh with worm 21 and pinned to shaft 111, the latter being journalled in brackets 96 and 102. Shaft 111 carries pinion 112 which drives gear 98 through an idler 113. The drive connection is

such that when rotor shaft 13 is rotating in a fluid-delivering direction, shaft 95 will be driven in a direction to rotate the counter wheels C in a proper addition-representing direction. On the other hand, counter wheels 114, 115 and 116 of the quantity stop unit 94, though driven in the same direction as wheels C during operation of the meter (a clockwise direction as viewed in Figs. 7 to 9), have their numerals arranged in reverse order so that as one gallon is added to the totalizer unit, representing an additional gallon delivered, the quantity-stop wheels indicate the subtraction of one gallon from the total quantity which has been manually set up on the quantity-stop unit. In other words, the quantity-stop unit, being initially set to indicate a predetermined quantity, shows a progressively decreasing total and will finally reach zero indication, the usual transfer pinions 117 causing a one-numeral movement of either wheel 115 or 116 for each full revolution of the wheel at the immediate right thereof, such one-numeral movement indicating a subtraction, rather than an addition.

It will be unnecessary to describe the counter wheels insofar as their transfer mechanism is concerned, since this is well understood, but a sufficient description of the drive of the first wheel (114) will be given to enable an understanding of the other co-related elements of the quantity-stop mechanism.

Counter wheel 114 includes the numeral-carrying ring 118 to which is pinned at 119 a drum 120, ratchet disk 121 (Fig. 8) and transfer wheel 122, the latter having teeth adapted intermittently to mesh with associated transfer pinion 117, disk 121 being notched at 123 to receive one of the mutilated teeth of the pinion when the transfer wheel is so rotated, all as is well understood by those skilled in the art. Pressed into numeral ring 118 is a usual ratchet cup 124 adapted to be engaged by spring-pressed ratchet pawls 125 pivoted on member 126 which is pinned at 127 (Fig. 2) to collar 128, the latter being non-rotatably held to sleeve 99 by set screw 129.

It follows that when shaft 95 is rotated by the drive from the meter, pawls 125 are bodily driven in a clockwise direction (Fig. 7) and, through ratchet cup 124, these pawls drive numeral ring 118 and drum 120 in a corresponding direction to give the described subtractive results on the quantity-stop unit while shaft 95 is simultaneously additively advancing the totalizer unit. During such times, wheel unit 114 rotates about shaft 101, the central thimble 130 of the unit having proper rotational bearing on said shaft and being integrated with the numeral ring and drum in the usual manner.

For manually setting counter wheel 114, means is provided for rotating that wheel in the same direction that it is rotated by the meter, but without necessitating coincident rotation of shaft 95. For this purpose, disk 121 is cut out as at 131 to receive a co-planar ratchet pawl 132 and its biasing spring 133, both of well known construction. Thimble 130 is cut through at 134 to allow the passage of the end of pawl 132 to a position where it may engage the periphery of shaft 101. This shaft is provided with a pair of diametrically opposed notches 135 which present square-cut shoulders 136. When wheel 114 is rotated through pawls 125, as has been described, and in which case shaft 101 is stationary, pawl 132 will ratchet in and out notches 135, assuming the latter are in alinement with said pawls, which may or may not be the case, as will presently appear. Notches 135 are so located on shaft 101 that they register with pawl 132 only when that shaft is thrust to the extreme right, as in Fig. 6. The notches have arcuate bottoms, as indicated in dotted lines in Fig. 6, and are so shaped that, as shaft 101 is shifted to the left in Fig. 6 and if pawls 132 are in the shaft notches, said pawls will be cammed out of the notches against the tension of spring 133.

When it is desired to manually set wheel 114 so a given numeral upon that wheel will appear through glass 137 in sight opening 138 (it being understood that when the wheels are in the position of Fig. 2, the zeros on all wheels of the quantity-stop unit will be in alinement and will appear through sight opening 138) shaft 101 is thrust to the position of Fig. 6 and then rotated in a clockwise direction, as viewed in Fig. 8, whereupon either one of the shoulders 136 will pick up pawl 132 and thus rotate disk 121 and hence the associated number ring and drum in the same direction, cup 124 causing pawls 125 to ratchet idly during this movement, said pawls being held from bodily movement due to the fact that they are mounted on member 126 which is held stationary by the drive connection between the meter and gear 98.

Counter wheels 115 and 116 are constructed similarly to wheel 114 and therefore need not be individually described. However, it will be understood that their disks 121*a* and 121*b*, correspond to disk 121 and have similar co-planar pawls 132 (not shown in connection with wheels 115 and 116). Shaft 101 also has additional notches corresponding to those (135) previously described, for the selective reception of the pawls carried by disks 121*a* and 121*b*. Such notches are indicated at 135*a* and 135*b*.

It will be seen that when notch 135 is in register with pawl 132 of wheel 114 (Fig. 6) notches 135*a* and 135*b* are out of the planes of disks 121*a* and 121*b* of wheels 115 and 116, respectively, and hence out of the plane of and out of operative association with the corresponding disk-pawls. Accordingly, manual rotation of shaft 101 will cause no coincident movement of wheels 115 or 116. On the other hand, when shaft 101 is moved to an intermediate position, as established by the entrance of detent 107 in groove 108, shaft notch 135*a* will be in register with the pawl carried by disk 121*a* and notches 135 and 135*b* will be out of register with the disk pawls of wheels 114 and 116. Thus, in this intermediate position of shaft 101, rotation of knob 105 will cause coincident rotation of wheel 115 without causing coincident movement of the other two quantity-stop wheels. When knob 105 is drawn to the extreme left (Fig. 2) notch 135*b* is lined up with the pawl (not shown but corresponding to pawl 132) of disk 121*b*, while notches 135 and 135*a* will both be out of register with the disk-pawls of wheels 114 and 115. Accordingly, when shaft 101 is rotated, it will pick up only the pawl of wheel 116 and cause rotation of that wheel only.

Drums 120, 120*a* and 120*b* of wheels 114, 115 and 116, respectively, have angularly extending notches or recesses 140, 140*a* and 140*b*, respectively, sunk in the drum peripheries. Notches 140*a* and 140*b* are of the same peripheral extent while notch 140 is about double length. The notches are so located that when the zeros on the three wheels of this unit are lined up and visible through sight opening 138, the three notches are so relatively located that their rearward end-defining walls 141 are likewise lined up, said walls

being inclined as shown in Figs. 8 and 9 to form cam faces for a purpose to be described. The uninterrupted portions of the drum peripheries will be termed the "dwells" of the drums.

A shifter 142 for cam 86 is provided in the form of a plate or leaf 143 having down-turned ears 144 whereby it is pivoted intermediate its ends on stationary shaft 145 which is end-supported in brackets 96 and 102. One end of lever or shifter 142 has an offset terminal portion 146 which is entered in groove 91 of cam 86, while the other end of the lever is provided with three down-turned fingers 147, 148 and 149 which are in line with drums 120, 120a and 120b, respectively.

A torsion spring 150 acts between stationary shaft 145 and lever 142 in a manner tending always to rotate said lever in a clockwise direction, as viewed in Fig. 5, thus constantly tending to urge fingers 147, 148 and 149 against the peripheries or dwells of their respective drums, or into the drum notches if they are in line with the fingers, and constantly tending to elevate cam 86 into the plane of latch 72 (Fig. 13).

When all the drum notches are lined up, as in Fig. 2, signifying that all counter wheels of the quantity-stop unit show zero through sight opening 138, said notches will be in register with the lever fingers and therefore spring 150 is free to hold lever 142 in such a position that cam 86 is at its upper limit of travel (full line position in Fig. 5; and Fig. 13) where said cam lies in the plane of latch 72.

When any one of the quantity-stop wheels has been rotated to a position where the corresponding lever finger is on the dwell of that wheel drum, lever 142 will have been rotated, against the pressure of spring 150, to a position where it will have caused end 146 to depress cam 86 to its dotted line position of Fig. 5 or full line position of Fig. 12, where it lies beneath latch 72 and may therefore rotate without effectively contacting that latch. The lever is swung to this cam-retracting position as any one of the wheels 114, 115, or 116 is rotated in a clockwise direction (Fig. 5) from its zero position, the cam 141 of the particular wheel involved causing such lever movement.

Thus, it will be seen that so long as any one of the drum notches is out of register with its corresponding lever finger, cam 86 necessarily remains depressed to a point where it lies below latch 72 and therefore rotation of shaft 20 and of cam 86 will have no effect on said latch 72.

In describing the operation of the device, it will first be assumed that the delivery valve is fully closed as in Fig. 1, that latch bar 56 is at its extreme right hand position, as illustrated in that figure, and that all the quantity-stop wheels are in zero position, it following that the shifter lever fingers are all in their respective drum notches and cam 86 is elevated into the plane of latch 72 (Fig. 13, though this figure does not illustrate cam 86 in its position of rotation corresponding to the starting point of an operative cycle). Cams 86 and 87 will then be in the relative positions of Fig. 2 while the latch bar and latches will be in the condition of both Figs. 2 and 15. Cam 87 will be holding the nose 77 of latch 76 flush with or just clear of the latch bar, against the tension of spring 80, while spring 79 will have rotated latch 72 in a counterclockwise direction (Fig. 15) to an extent which enters nose 73 in groove 62. The effective portion of cam 86, though in the horizontal plane of latch 72, is not, at this time, in a position of rotation to prevent such nose-entry.

It will be assumed that the quantity stop unit is to be set so that it will check delivery of fluid after 22 gallons have been passed. Shaft 101 will be moved endwise by knob 105 either into the position of Fig. 6 or into an intermediate position as established by detent 107. The knob 105 is now rotated to turn shaft 101 in a clockwise direction (Fig. 5) which causes the drive shoulder of the particular groove 135 or 135a which is in line with its pawl 132 to engage said pawl and thereby set up clockwise movement of the corresponding wheel. During the initial movement of this wheel, the cam 141 at the end of the drum notch or recess will set up counterclockwise movement of lever 142 and thus move cam 86 downwardly and out of the horizontal plane of latch 72. The wheel will be rotated until the numeral "2" appears in sight opening 138, and shaft 101 will then be shifted endwise to engage its driving shoulder with the second counter wheel, whereupon the shaft is rotated until the numeral "2" of that wheel appears in the sight opening, it being obvious that the dwell of the corresponding drum is thus engaged with the opposing lever finger.

Operating lever 52 is now depressed, the first portion of corresponding stem movement opening the pilot valve (Fig. 3) and the finishing portion of the handle depression opening the main valve, all as has been previously described. During this depression or clockwise movement of lever 52 (Fig. 3) rod 54 shifts latch bar 56 to the left, as viewed in Fig. 1. During this leftwise movement, cam 87 may have been rotated sufficiently, by reason of the meter starting into operation immediately the valve starts to open, to allow nose 77 to drop partially into notch 59, but as the leftwise movement of the latch bar continues, cam 69 on strip 66 will force latch 76 outwardly to an extent sufficient to allow cam 87 to clear latch-tail 78 upon subsequent rotation of shaft 20. Also during this leftwise movement, cam shoulder 65 will engage nose 73 of latch 72 in a manner to swing that latch in a clockwise direction, as viewed in Fig. 10, but when the valve has been fully opened by the manual depression of lever 52, notch 61 will be lined up with nose 73 and the spring for latch 72 will thereupon swing that latch in a counterclockwise direction as viewed in Fig. 10, entering the nose in notch 61. When manual pressure is relieved from handle 52 and the valve-springs and fluid pressure therefor tend to close the valve and thus thrust upwardly on lever 52 in a manner moving latch bar 56 to the right in Fig. 1, shoulder 64 will be engaged by latch nose 73, the latch bar thus being held from further movement to the right and therefore holding both main and pilot valve open (see Figs. 4, 10 and 14).

As the meter now is operating, the drive of rotor shaft 13 is imparted to gear 98 through the drive connection previously described causing coincident rotation of counter wheel 114 and of the totalizer counter wheels. Since cam 86 is below the plane of latch 72 (Fig. 12) and since strip 66 is holding latch 76 clear of the rotative path of cam 87, rotation of shaft 20 does not affect the condition of the latches during this stage of operation, and valve 24 therefore remains held fully open, though its springs and the fluid pressure is tending to close it.

As wheel 114 reaches a position where its drum notch or recess 140 is beneath finger 147, there

will be no consequent movement of lever 142, since finger 148 is still on the dwell of wheel 115. However, as wheel 114 continues in its rotation beyond this position, the transfer mechanism will rotate wheel 115 to a position where its numeral "1" will appear in the sight opening. Upon another complete rotation of wheel 114, finger 147 will again line up with the recess in the drum of wheel 114 but finger 148 will still be on the dwell of wheel 115. However, as wheel 114 now revolves to a position where its numeral "9" appears in the sight opening, the transfer mechanism will rotate wheel 115 to a position where its zero appears in the sight opening and its drum recess will be in register with finger 148. However, finger 147 is by now on the dwell of drum 120 and therefore there is no change in the position of the shifter lever 142.

After wheel 114 has continued its rotation until there is only about ¾ of a gallon to be delivered (in other words, shortly after the numeral "1" starts to disappear from the sight opening) the leading edge of notch 140 will pass from beneath finger 147 and, since fingers 148 and 149 are in register with their respective drum-notches, spring 150 will immediately act to rotate lever 142 in a clockwise direction (Fig. 5) and thereby shift cam 86 back into the plane of latch 72. Immediately thereafter, said cam 86, in its rotation, will act against tail 74 and swing latch 72 in a clockwise direction (as viewed in Fig. 2) thus clearing nose 73 from shoulder 64. Immediately thereafter, valve spring 50 acts to close the main valve, as in Fig. 3, but as latch bar 56 is thus sharply drawn to the right, shoulder 69 rides from beneath nose 77 of latch 76 and spring 80 swings the latch in a direction to enter nose 77 in notch 59, cam 76 having by this time been rotated to a position where it will not interfere with such movement of the latch. Latch nose 77 thus is in a position to catch shoulder 60 as the latch bar 56 continues its movement to the right, checking that right-wise movement in time to prevent closing of the pilot valve. The pilot valve is thus held open in the condition of Fig. 3 so that, while the main flow of fluid through valve 24 has been checked to a large degree, there is still some after-flow through the pilot valve.

As the meter continues its rotation, wheel 114 finally reaches its zero position, signifying that the full predetermined quantity of fluid has been delivered, at which time cam 87 will have engaged tail 78 of latch 76 and will have swung said latch in a manner clearing nose 77 from shoulder 60. Bar 56 having thus been entirely freed from the latches, pilot spring 48 will have instantly closed the pilot valve to check all further delivery therethrough at just the instant the predetermined quantity of fluid has been completely delivered. With this complete stoppage of flow, the meter, of course, ceases to operate and all parts come to rest with the quantity-stop counter registering zero on all its counter wheels.

It will thus be seen that though full flow has been kept up until almost the last instant, the closing of the valve is in stages with a pause between the stages so that shock of a full and sudden closing is avoided. The advantage of this feature will be self-evident to those skilled in the art.

Occasion sometimes arises for manually tripping the hold-open latch mechanism before it has been automatically released. For this purpose I provide a releasing bar 160 which is mounted on plate 82 for longitudinal sliding movement through strap-retainers 161. This bar carries a depending pin 162 which extends downwardly through openings 163, 164 and 165 in latch 72, spacer 75 and latch 76, respectively. Opening 165 is oversize and plays no part in the release operation, while spacer 75 is free to pivot idly, within the limits, about pin 70. However, when the valve is latched fully open, pin 162 lies adjacent one side of the defining wall of opening 163 in latch 72 (Fig. 10). If occasion arises for tripping the valve manually, a leftwise shift of bar 160 (Fig. 2) engages pin 162 with the defining wall of the latch bore 163 and swings latch 72 in a clockwise direction, as viewed in Fig. 10, to clear nose 73 from shoulder 64 and thus to allow bar 56 to move to the right sufficiently to permit closing of the main valve under the impulse of spring 50. The meter will then continue in operation for a very short time, that is, the upper latch 76 will engage shoulder 60 and prevent the closing of the pilot valve until the meter has run sufficiently to cause cam 87 to swing the upper latch 76 to release position. The afterflow will be very slight in amount, and the disadvantage thereof is more than offset by the fact that this gives the assurance that the valve will not finally cut off until the quantity-stop wheels are in even-gallon positions and thus in proper condition for a re-initiation of delivery.

As a means for shifting release bar 160, I provide a plunger 166 having an external knob 167. Normally, knob 167 lies approximately in the position of Fig. 2, a limit pin 168 establishing the extent of outward plunger movement. This plunger is in horizontal alinement with the end of bar 160, so, if occasion arises for tripping the latch, knob 167 merely has to be pressed inwardly, the end of the plunger contacting bar 160 and finally moving it to the left (Fig. 2) sufficiently to release latch 72 from bar 56, as has been described. In order to limit the leftwise movement of bar 160 and thus prevent undue strain from being imposed on the latch or its spring, I may provide a limit pin 169 depending from bar 160 and adapted to engage the edge of plate 82 as a stop. Or, of course, the parts may be proportioned so that the contact of knob 167 with the outer face of the counter housing may serve as a limit stop for the plunger.

When pressure is relieved from knob 167 after a tripping operation, the spring on latch 72 will restore it to operative position and will, through pin 162, push bar 160 back to inoperative position.

It will be noted that, in moving from the position of Fig. 4 to Fig. 3, boss 34*a* and tube 43 (into which fluid may leak from the valve chambers) act as a dash pot to dampen the closing movement of the main valve and to relieve the entire latching mechanism from undue shock.

While I have herein described and illustrated a preferred embodiment of my invention, it will be understood that various changes in design, structure and arrangement may be made without departing from the spirit and scope of the appended claims.

I claim:

1. In a device of the character described, a shiftable latch member, a pair of pivoted latches pivotally and individually movable into and out of latching engagement with the member, a pair of cams, one for operating each of the latches, one of said cams being movable axially into and out of the effective plane of its latch and, when in said plane, being operative by virtue of its rotation to swing its latch out of engagement

with the member, means for shifting said one cam axially, and a rotative driving element carried by the other cam and engaging said one cam whereby said cams are constantly maintained in given angular relationship irrespective of the position to which the one cam is shifted axially.

2. In a device of the character described, a shiftable latch member adapted to have applied thereto means tending to shift it in a given direction, a pair of latches individually movable into and out of latching engagement with the member, with either of the latches, when in latching engagement, being adapted to hold said member against movement in said given direction, a pair of rotatable cams associated one with each latch and adapted by virtue of their rotation to operate the associated latch out of latching engagement with the member, common drive means for rotating the two cams, said cams being relatively timed to operate the latches successively upon operation of the drive means, one of said cams being bodily shiftable to a position where it is ineffective by virtue of its rotation to operate the associated latch, and means to restore said shiftable cam to a position where, by virtue of its rotation, it is adapted to operate its associated latch.

3. In a device of the character described, a shiftable latch member adapted to have applied thereto means tending to shift it in a given direction, a pair of latches individually movable into and out of latching engagement with the member, with either of the latches, when in latching engagement, being adapted to hold said member against movement in said given direction, means adapted to hold one of the latches out of latching engagement when the other latch is in latching engagement, means adapted to move said one latch into latching engagement when said other latch is moved out of latching engagement, a pair of rotatable cams associated one with each latch and adapted by virtue of their rotation to operate the associated latch out of latching engagement with the member, common drive means for rotating the two cams, said cams being relatively timed to operate the latches successively upon operation of the drive means, one of said cams being bodily shiftable to a position where it is ineffective by virtue of its rotation to operate the associated latch, and means to restore said shiftable cam to a position where, by virtue of its rotation, it is adapted to operate its associated latch.

4. In a device of the character described, a shiftable latch member adapted to have applied thereto means tending to shift it in a given direction, a pair of latches individually movable into and out of latching engagement with the member, with either of the latches, when in latching engagement, being adapted to hold said member against movement in said given direction, a pair of rotatable cams associated one with each latch and adapted by virtue of their rotation to operate the associated latch out of latching engagement with the member, common drive means for rotating the two cams, said cams being relatively timed to operate the latches successively upon operation of the drive means, one of said cams being movable axially to a position where it is ineffective by virtue of its rotation to operate the associated latch, and means to restore said shiftable cam to a position where, by virtue of its rotation, it is adapted to operate its associated latch.

5. In a device of the character described, a shiftable latch member adapted to have applied thereto means tending to shift it in a given direction, a pair of latches individually movable into and out of latching engagement with the member, with either of the latches, when in latching engagement, being adapted to hold said member against movement in said given direction, a pair of rotatable cams associated one with each latch and adapted by virtue of their rotation to operate the associated latch out of latching engagement with the member, a common shaft mounting and adapted to rotate the two cams, said cams being relatively timed to operate the latches successively upon operation of the drive means, one of said cams being bodily shiftable to a position where it is ineffective by virtue of its rotation to operate the associated latch, and means to restore said shiftable cam to a position where, by virtue of its rotation, it is adapted to operate its associated latch.

6. In a device of the character described, a shiftable latch member adapted to have applied thereto means tending to shift it in a given direction, a pair of latches individually and pivotally movable about a common axis into and out of latching engagement with the member, with either of the latches, when in latching engagement, being adapted to hold said member against movement in said given direction, a pair of rotatable cams associated one with each latch and adapted by virtue of their rotation to operate the associated latch out of latching engagement with the member, common drive means for rotating the two cams, said cams being relatively timed to operate the latches successively upon operation of the drive means, one of said cams being bodily shiftable to a position where it is ineffective by virtue of its rotation to operate the associated latch, and means to restore said shiftable cam to a position where, by virtue of its rotation it is adapted to operate its associated latch.

7. In a device of the character described, a shiftable latch member adapted to have applied thereto means tending to shift it in a given direction, a pair of latches individually movable into and out of latching engagement with the member, with either of the latches, when in latching engagement, being adapted to hold said member against movement in said given direction, a pair of rotatable cams associated one with each latch and adapted by virtue of their rotation to operate the associated latch out of latching engagement with the member, and common drive means for rotating the two cams, said cams being relatively timed to operate the latches successively upon operation of the drive means.

8. In a device of the character described, a shiftable latch member adapted to have applied thereto means tending to shift it in a given direction, a pair of latches individually and pivotally movable about a common axis into and out of latching engagement with the member, with either of the latches, when in latching engagement, being adapted to hold said member against movement in said given direction, a pair of rotatable cams associated one with each latch and adapted by virtue of their rotation to operate the associated out of latching engagement with the member, and common drive means for rotating the two cams, said cams being relatively timed to operate the latches successively upon operation of the drive means.

9. In a device of the character described, a shiftable latch member adapted to have applied thereto means tending to shift it in a given direction, a pair of latches individually movable into and out of latching engagement with the member, with either of the latches, when in latching engagement, being adapted to hold said member against movement in said given direction, means adapted to hold one of the latches out of latching engagement when the other latch is in latching engagement, means adapted to move said one latch into latching engagement when said other latch is moved out of latching engagement, a pair of rotatable cams associated one with each latch and adapted by virtue of their rotation to operate the associated latch out of latching engagement with the member, and common drive means for rotating the two cams, said cams being relatively timed to operate the latches successively upon operation of the drive means.

WILLIAM E. STEEN.