June 8, 1943. C. P. BERGMAN ET AL 2,321,062

REPEAT VALVE SHUT-OFF SYSTEM

Filed Sept. 13, 1940 2 Sheets-Sheet 1

Fig. 1

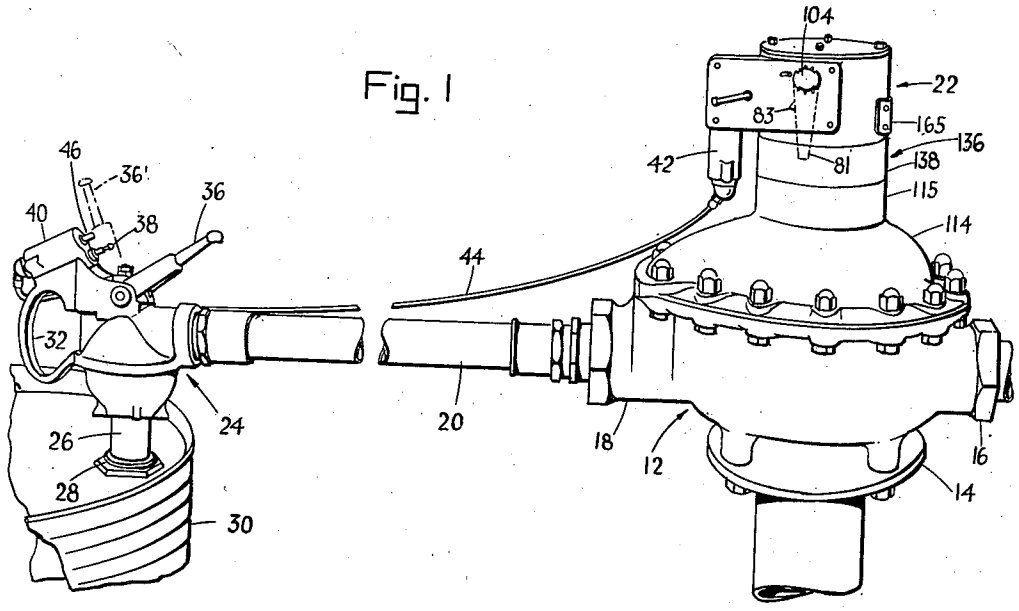
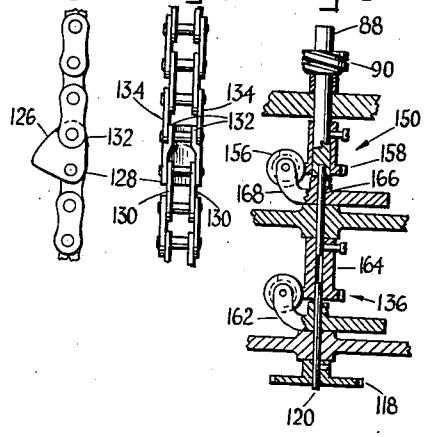


Fig. 6 Fig. 7 Fig. 8



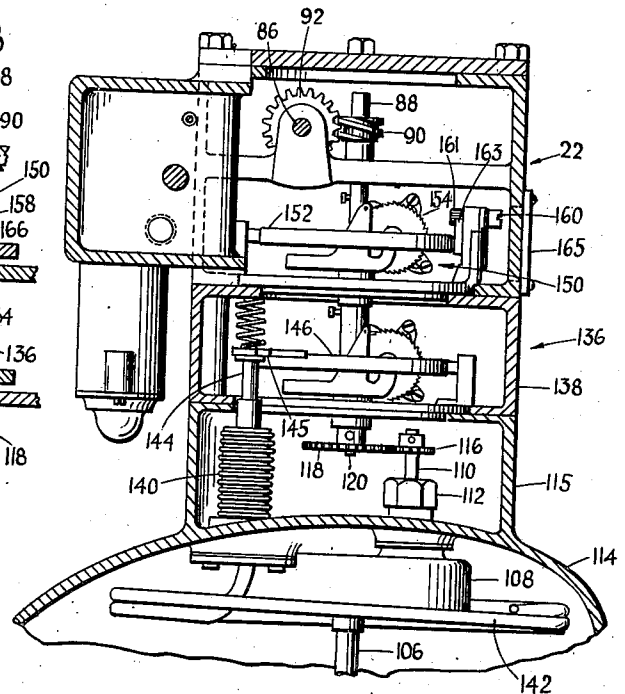


Fig. 9

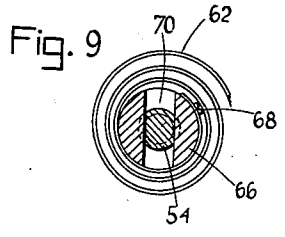


Fig. 10

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Fig. 4

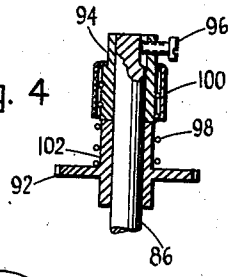


Fig. 2

Fig. 5

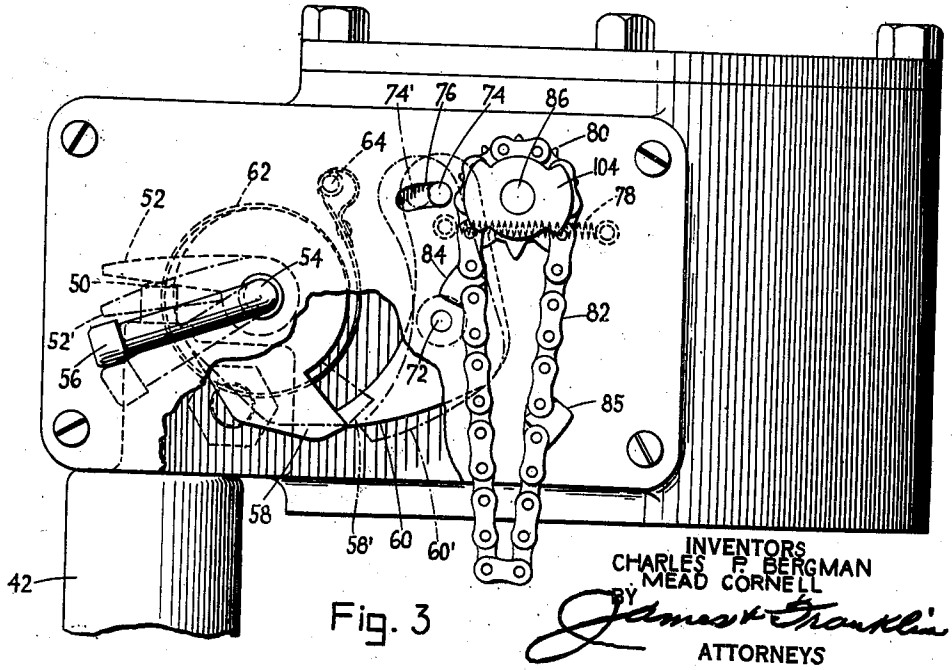


Fig. 3

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REPEAT VALVE SHUTOFF SYSTEM

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Application September 13, 1940, Serial No. 356,614

9 Claims. (Cl. 221—101)

This invention relates to liquid measuring apparatus, and more particularly to a repeating valve shut-off system, especially for the rapid measured filling of large containers such as barrels.

In our co-pending application, Serial No. 316,888, filed February 2, 1940, entitled "Repeating mechanical valve shut-off system," we disclosed a system of this character utilizing a valve at the nozzle end of a flexible hose, with all necessary starting controls centered at the valve, so that the operator may remain at the end of the hose and insert the nozzle into the successive barrels with no need to go to the trip register between filling operations. The complete shut-off system of the present invention is generally similar to that previously disclosed, but the trip register is wholly different. The primary objects of the present invention are to greatly simplify the trip register; to substantially reduce the cost of manufacture; and to make the same accurately operable over a large range or difference in container size.

To the accomplishment of the foregoing, and other more specific objects which will hereinafter appear, our invention consists in the mechanical valve shut-off elements and the relation one to the other as hereinafter are more particularly described in the specification and sought to be defined in the claims. The specification is accompanied by drawings, in which:

Fig. 1 is a perspective view of the complete automatic valve shut-off system;

Fig. 2 is a plan view of the trip mechanism, with its cover plate removed;

Fig. 3 is a front elevation of the same with a part of the front plate broken away;

Fig. 4 is a section explanatory of a clutch shown in Fig. 2;

Fig. 5 is a side elevation of a piece of a cam-carrying chain shown in Fig. 3;

Fig. 6 is a front elevation of a modified cam or chain arrangement;

Fig. 7 is a side elevation of the same;

Fig. 8 is a vertical section explanatory of the shaft connections between the meter and the trip mechanism;

Fig. 9 is a vertical section taken approximately in the plane of the line 9—9 of Fig. 2; and

Fig. 10 is a vertical section taken approximately in the plane of the line 10—10 of Fig. 2.

Referring to the drawings, and more particularly to Fig. 1, the shut-off system comprises a meter 12 supported on a suitable pedestal 14 and supplied with liquid at the inlet 16. The liquid is discharged at outlet 18 into a flexible pipe or hose 20 of suitable length. A trip register 22 is mounted on top of the meter body and is driven by the piston or driving element of the meter.

At the remote or free end of hose 20, a valve 24 is connected, the body of which includes a downwardly directed nozzle 26 adapted to be freely inserted in the filling opening 28 of a barrel 30. The valve and nozzle may be moved about by means of a suitable handle 32. The flow of liquid into the barrel is controlled by means of a starting lever 36 which, for this purpose, is pulled from the right-hand position shown in full lines, to the left-hand position 36' shown in the dot and dash line, where it is held by a suitable detent 38.

A flexible motion transmitting means extends between the valve 24 and the trip register 22. In the present case this comprises a metallic bellows housed at 40 near the valve detent mechanism, and another metallic bellows housed at 42 near the trip mechanism, with a flexible tube 44 connected therebetween. By sealing a liquid in the bellows and tube assembly, movement applied to one bellows may be imparted from one bellows to the other. Thus, the opening of the valve by lever 36 may be used to press a plunger 46, and so compress the bellows at 40, and the resulting movement of the bellows at 42 may be used to latch the trip mechanism at register 22. Conversely, tripping at the register may later be used to release the valve handle 36 and to cause closing of the valve.

Referring now to Figs. 2 and 3, the bellows housed at 42 terminates in a plunger 50 disposed beneath an arm 52 secured to the rear end of a spindle or trip shaft 54. The forward end of this shaft may, if desired, be bent sidewardly to form a handle 56 for manual setting of the trip mechanism, but ordinarily the handle 56 need not be and is not used.

The shaft carries a stop 58 which is engaged by a detent or trigger 60. This holds the trip shaft 54 against the action of a suitable trip spring 62 which, in the present case, is a spiral spring coiled about the shaft and having its outer end secured to a stationary pin 64. The inner end of the spring is connected to the shaft or, more specifically, in the present case to a hub 66 (Fig. 9) formed integrally with the stop arm 58 (Figs. 2 and 3). The spring is secured to hub 66 in any suitable manner as by means of a screw 68 (Fig. 9), and the hub 66 is secured to trip shaft 54 in any suitable manner as by slotting the hub at 70 and providing the shaft with mating flats on op-

posite sides so as to fit non-rotatably within the slot 70.

The trigger 60 is pivoted at 72 (Fig. 3) and carries a stud 74 which projects out of the casing through an arcuate slot 76. The trigger is normally urged into locking position by a pull spring 78. It will be evident that with this arrangement, the trip mechanism may be set with the bellows arm 52 in the upper position shown in dotted lines in Fig. 3, it being held in that position against the action of the trip spring 62 by the trigger 60. Movement of the trigger, however, from the solid line position to the broken line position 60' releases stop 58 which thereupon moves to the broken line position 58' under the influence of spring 62 which, at the same time, moves arm 52 down to the dot and dash line position 52', and so compresses the bellows housed at 42 by depressing the plunger 50.

The stud 74 is disposed adjacent a sprocket wheel 80 which carries a chain 82 having a cam 84, the latter being adapted to bear against and move the stud 74 from the solid line position 74 to the broken line position 74'. The chain 82 is hung over the sprocket wheel 80, and the amount of liquid delivered for each shut-off depends upon the length of the chain. A series of chains may be provided, appropriately marked for different quantities, and any one of these may be interchangeably placed on sprocket 80.

The sprocket wheel is carried on the outer end of a shaft 86 which is driven from the meter by appropriate gearing. In the present case, an upright spindle 88 (Figs. 2 and 10) carries a worm 90 which meshes with a worm gear 92 mounted on sprocket shaft 86.

It is convenient to provide a unidirectional motion-transmitting means between the gear 92 and the shaft 86. Specifically, in the present case the shaft carries a collar 94 (Figs. 2 and 4) secured thereto by means of a set screw 96. One end of a helical spring wire 98 is permanently secured to collar 94, as by means of a sleeve 100 driven thereover with a force fit. The free end of the helical spring is coiled about the hub 102 of worm gear 92. The spring 98 is wound in such direction that when the meter is running, the spring is frictionally tightened and causes immediate drive of shaft 86. However, the shaft may be turned in a forward direction faster than the gear, as by means of a knob 104 secured to the outer end of shaft 86. The knob and clutch are convenient when first setting up the mechanism for a changed measurement, as the new chain may be hung over the sprocket in any position, with the cam remote from the trigger stud, and the chain and sprocket may then be moved ahead by the knob 104 until the cam reaches the trigger stud.

It is convenient to make each tooth of sprocket wheel 80 correspond to a desired unit of measurement, for example, one gallon of liquid. Referring to Fig. 10, the meter includes not only the piston shaft or driving shaft 106, but also a so-called "intermediate" 108, which consists of a gear housing with appropriate reduction gearing therein terminating in a shaft 110 surrounded by a packing gland nut 112. The intermediate 108 is immersed in the liquid being measured, but leakage from the meter casing 114 is prevented by the packing around shaft 110. Additional gears 116 and 118 may be provided, leading to an upright spindle 120 which is coaxial with the spindle 88 previously referred to. The gear ratios of the intermediate 108, the spur gears 116, 118, and the worm and gear 90, 92, are so selected as to obtain the desired measurement value at the sprocket wheel 80.

In the specific case here illustrated, the sprocket wheel has ten teeth and each tooth corresponds to one gallon. If a fifty-gallon barrel is to be filled, a chain having fifty links and one cam is hung over the sprocket. If a twenty-gallon barrel is to be filled, a chain having twenty links and one cam is hung over the sprocket. In this way a large range of container size may be accommodated. However, with small containers, say, fourteen or less gallons, it becomes difficult to apply or remove the chain without opening a link. For this purpose, we prefer to use a longer chain with multiple cams. Thus, in Fig. 3, the chain is twenty-eight links in length, and has two cams 84 and 85 thereon, each corresponding to a delivery of fourteen gallons. Fig. 1 illustrates the more usual case of a chain 81 with a single cam 83 thereon.

The chain here illustrated is a conventional chain having successive pairs of outside links and inside links connected by cross-pins. In Fig. 5 there are inside links 122 and outside links 124. The cam 84 replaces a pair of links, specifically a pair of inside links (although it may be designed to replace a pair of outside links). The distance between the pins is kept uniform. The point or operating part of the cam is solid, so that the outside of the cam presents a broad, smooth surface for operation of the stud 74. The inside of the cam, at least at the base, is hollow for free entry of the sprocket teeth. Fig. 5 shows the base or hollow side of the cam, that is, looking at cam 84 in Fig. 3 from the right-hand side.

The type of cam illustrated in Figs. 3 and 5 is suitable for use with chains having an even number of links. A cam which may be used with a chain having an odd number of links, is illustrated in Figs. 6 and 7. The solid outside cam surface 126 is substantially the same as before, but the base of the cam is so shaped at the end 128 as to fit around the inner links 130, while at the opposite end 132, the base of the cam is so shaped as to fit between a pair of outside links 134. The pins are, of course, all disposed at a uniform pitch. Chains are readily provided with odd as well as even numbers of links, so that any desired integer measurement may be provided.

If the requirements of the user necessitate measurements including a whole number of gallons plus a half-gallon, this requirement may be met in several ways. One is to change the gear ratio between the meter and the sprocket wheel so that each sprocket tooth corresponds to a half-gallon instead of a full gallon. In such case each link of the chain corresponds to a half-gallon, and a twenty-five link chain may, for example, be used for a twelve and one-half gallon measurement. Another method is to use the same gear ratio as before, and a twenty-five link chain with two cams thereon, because any odd-numbered chain with two cams will measure to a half gallon.

Another problem which may arise is where the trip mechanism is intended for use with a different unit such as an imperial gallon instead of a U. S. gallon. For constant use with imperial gallons, it is merely necessary to change the gear ratio between the meter and the sprocket shaft, so that each sprocket tooth will correspond to one imperial gallon. However, where the trip mechanism is to be used in an alternative manner

for either U. S. or imperial gallons, then we prefer to supply the mechanism with a ten-tooth sprocket wheel and a twelve-tooth sprocket wheel, both having the same pitch diameter so that the cams will be properly related to the trigger stud. One complete set of chains may be supplied fitting the ten-tooth sprocket wheel and appropriately marked for imperial gallons. Another complete set of chains may be supplied for the twelve-tooth sprocket wheel, these being appropriately marked for U. S. gallons. It will not be possible to confuse one set of chains with the other, because each set will fit only its appropriate sprocket wheel.

The housing of the trip mechanism **22** is preferably made large enough to receive a manually adjustable accuracy regulator generally designated **150** (Figs. 2 and 10). This comprises a tiltable ring **152** which oscillates a pawl-carrying arm **153** (Fig. 2) acting on a ratchet wheel **154** which is connected to a worm **156** (Figs. 2 and 8) which in turn meshes with a worm gear **158** (Fig. 8) secured to the lower end of spindle **88**. With ring **152** in horizontal position, the output of the regulator equals its input. When the ring is tilted, the output is varied slightly relative to the input, all as is explained in greater detail in Bergman Patent No. 2,079,197, granted May 4, 1937, and entitled "Accuracy regulator." The ring **152** may be tilted by means of an adjusting screw **160** (Figs. 2 and 10), turning a pinion **161** meshing with an arcuate rack **163** secured to the ring, the resulting adjustment being locked by means of an appropriate set screw or clamp. A scale may be provided to show the percent change caused by the regulator. A plate **165** may be removed for access to the adjusting screw and plate. The accuracy regulator, while perhaps not essential, is highly desirable in order to make it possible to accurately establish the desired one gallon or other unit of measurement at the sprocket teeth.

In many cases it may be desired to automatically correct the measurement for temperature variation, so that the measurement will be correct at a standard temperature, say 60° F., or will be correct even in terms of weight. Referring to Fig. 10, this is taken care of in the present case by a temperature compensating unit **136**, the casing **138** of which is disposed between the trip mechanism **22** and the neck of the meter body **114**. This mechanism need not be described in detail, it being substantially the same as that disclosed in Whittaker Patent No. 2,206,540, granted July 2, 1940, entitled "Temperature compensated fluid measuring system." It comprises a bellows **140** secured to the meter body at its lower end and there connected to a coil of tubing **142** with a closed end, this coil acting as a bulb which is surrounded by the liquid being measured. The bulb and bellows are filled with an appropriate liquid, and the bellows expands or contracts with temperature changes. The upper end of the bellows is connected through a post **144** to an arm **145** on a tiltable ring **146** which continuously appropriately varies the output of unit **136** relative to its input, in the same manner as was described for the accuracy regulator **150**.

Referring to Fig. 8, it will be understood that the worm bearing **162** of the temperature compensating unit is secured to the first spindle **120**, and that the worm gear **164** is secured to the second spindle **166**, but is freely rotatable relative to the first spindle **120**. Similarly, the worm bearing **168** of the accuracy regulator is secured to the second spindle **166**, while the worm gear **158** is secured to the spindle **88**, but is freely rotatable relative to the spindle **166**. It will also be understood that the accuracy regulator **150** may be used independently of the temperature compensator **136**, and vice versa.

It may be pointed out that the casing of the trip unit **22** is so dimensioned that it will fit directly on and may be secured to the neck **115** of the meter body **114**. That is to say, the bottom of the trip casing is the same (size and holes, etc.) as the bottom of the temperature regulating casing, and the top of the temperature regulator is the same as the top of the meter body. When temperature regulation is not needed, the entire temperature regulating unit may simply be omitted.

It will also be observed that the top plate of the trip unit is itself removable, and that the top of the trip unit is the same dimension as the top of the temperature regulator and the top of the meter body. In this way, one or more further units may be added. For example, it may be desired to mount a register, or a recorder, or a totalizer, or any combination of the same on top of the trip unit.

In the form disclosed herein, the chain is exposed and normally this is a preferred arrangement. However, if in any particular installation it is thought desirable or necessary to enclose the chain, this may be done by a suitable relatively flat generally upright housing which may be secured to the outside of the trip unit around the chain and sprocket. Such a housing may, if desired, be made of one of the modern transparent plastics, so that the chain may be observed as easily as when exposed. If the circumstances require special precaution, a suitable lock or seal may be applied between the chain cover and the trip casing, thus making it impossible for anyone other than a properly authorized person to tamper or change the chain.

It is believed that the construction and operation, as well as the advantages of our improved valve shut-off mechanism, will be apparent from the foregoing detailed description thereof. To set the unit up for any particular measurement, it is merely necessary to select a chain of proper size and to hang the same on the sprocket. The knob **104** is then turned until the cam reaches the trigger. The operator then stands at the end of the hose and inserts the valve nozzle in a barrel and pulls the operating handle to open the valve. This at the same time latches the trip mechanism because compression of the bellows **40** expands the bellows **42** and so raises the arm **52**, whereupon the trigger **60** engages the stop **58**. At the end of the desired measurement, the cam reaches the trigger stud **74**, and actuates the trigger to release the stop **58**, whereupon the trip spring **62** causes a downward movement of bellows arm **52**, thereby compressing the bellows **42** and so expanding the bellows **40**, which in turn dislodges or frees the valve handle **36**, thereby shutting off the valve. The operator then removes the nozzle from the barrel and inserts it in another barrel, whereupon the operating handle **36** of the valve is again pulled to open the same. Inasmuch as the stopping point of each valve operation is the starting point of the next valve operation, the arrangement is accurate regardless of the shape of the cam or/and its spacing from the trigger stud but, of course, where more than

one cam is used on a single chain, the cam profiles should be alike.

It will be apparent that while we have shown and described our invention in a preferred form, many changes and modifications may be made in the structure disclosed, without departing from the spirit of the invention as sought to be defined in the following claims.

We claim:

1. Repeating valve shut-off mechanism comprising a casing adapted to be secured to a meter body, a horizontal shaft having one end projecting from the casing, means for driving said shaft from the meter, a sprocket on the exposed outer end of the shaft, a readily removable chain hung on said sprocket, a cam on said chain, a trip, a trip spring, trigger mechanism for holding the trip against the action of the spring, and means connected to said trigger and disposed adjacent the sprocket in such position as to be actuated by the cam to release the trip for movement by the trip spring.

2. Repeating valve shut-off mechanism comprising a casing adapted to be secured to a meter body, a horizontal shaft having one end projecting from the casing, means including a unidirectional clutch for gearing said shaft to the meter, a sprocket and a knob on the exposed outer end of the shaft, a readily removable chain hung on said sprocket, a cam on said chain, a trip, a trip spring, trigger mechanism for holding the trip against the action of the trip spring, and means connected to said trigger and disposed adjacent the sprocket in such position as to be actuated by the cam to release the trip for movement by the trip spring.

3. Repeating valve shut-off mechanism comprising a casing adapted to be secured to a meter body, a vertical shaft therein to be driven by the meter, a horizontal shaft having one end projecting from the casing, means for driving said shaft including a worm on the vertical shaft, a worm gear on the horizontal shaft, and a unidirectional clutch between said gear and shaft, a sprocket on the exposed end of the shaft, a readily removable chain hung on said sprocket, a cam on said chain, a trip shaft, a trip spring connected to said shaft, trigger mechanism including a stop on said shaft and a trigger for holding the same against the action of the trip spring, and means connected to said trigger and disposed adjacent the sprocket in such position as to be actuated by the cam to release the stop and trip shaft for movement by the trip spring.

4. Valve shutoff mechanism comprising a shaft, a sprocket on said shaft, means for driving said sprocket from a fluid meter, a chain on said sprocket, valve latching means including a trigger for holding a valve in open position, means biasing said latching means in one direction, and at least one tripping cam on said chain co-operating with said trigger to trip said latching means.

5. Valve shutoff mechanism comprising a shaft, a sprocket on said shaft, one-way driving means for driving said sprocket from a fluid meter, a chain on said sprocket, valve latching means including a trigger for holding a valve in open position, means biasing said latching means in one direction, at least one tripping cam on said chain co-operating with said trigger to trip said latching means to close the valve and stop operation of the meter.

6. Valve shutoff mechanism comprising a shaft, a sprocket on said shaft, means for driving said sprocket from a fluid meter, a chain on said sprocket, valve latching means including a trigger for holding a valve in open position, at least one tripping cam on said chain co-operating with said trigger to trip said latching means to close said valve and stop operation of the meter, and manual means for retaining said valve in open position to initiate operation of said meter and cam until said cam passes said trigger, and means of moving said latching means into latching position to latch the valve in open position.

7. Repeating valve shutoff mechanism comprising a valve in the fluid line of a meter, a shaft, a sprocket on said shaft driven by the meter, an endless band on said sprocket, at least one cam on said band movable therewith, means for maintaining the valve in open position, and valve closing means actuated by said cam at a predetermined position thereof in its movement.

8. Repeating valve shutoff mechanism comprising a valve in the fluid line of a meter, a shaft, a sprocket on said shaft driven by the meter through a variable ratio drive connection, a chain on said sprocket, at least one cam on said chain movable therewith, means for maintaining the valve in open position, and valve closing means released by said cam at a predetermined position in its movement, whereby closing of the valve stops operation of the meter.

9. Repeating valve shutoff mechanism comprising a valve in the fluid line of a meter, a shaft, a sprocket on said shaft driven by the meter through a temperature compensated variable drive connection, a chain on said sprocket, at least one cam on said chain movable therewith, means for maintaining the valve in open position, and valve closing means released by said cam at a predetermined position in its movement, whereby closing of the valve stops operation of the meter.

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