June 24, 1958 W. F. HURLBURT, JR 2,839,929

SOLENOID OPERATED TRIP MECHANISM

Filed Aug. 14, 1953 4 Sheets-Sheet 1

Fig. 1.

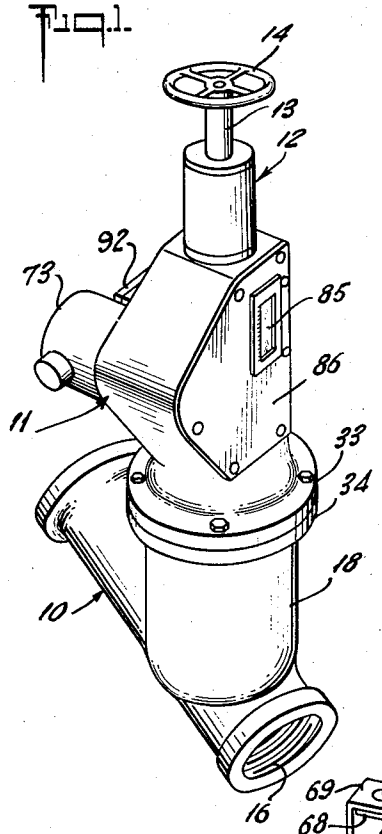


Fig. 10.

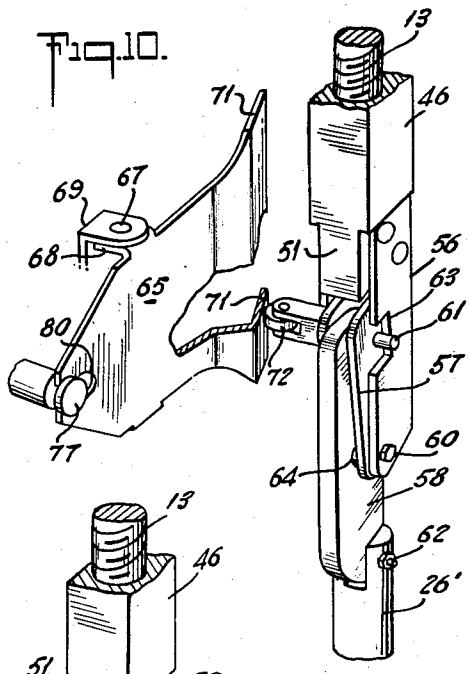


Fig. 11.

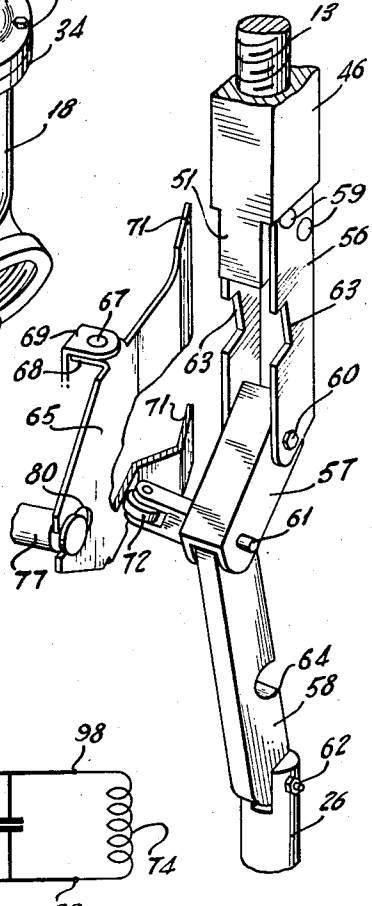
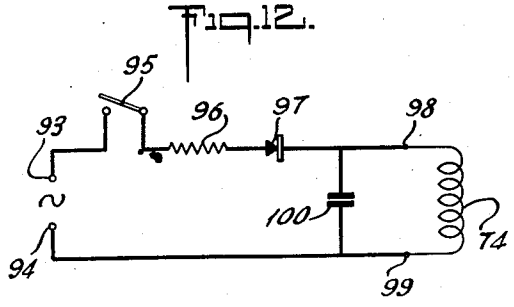


Fig. 12.



INVENTOR:
WILBUR F. HURLBURT, JR.
BY
Frederick Oppenfeld
ATTORNEY

June 24, 1958 W. F. HURLBURT, JR 2,839,929

SOLENOID OPERATED TRIP MECHANISM

Filed Aug. 14, 1953 4 Sheets-Sheet 2

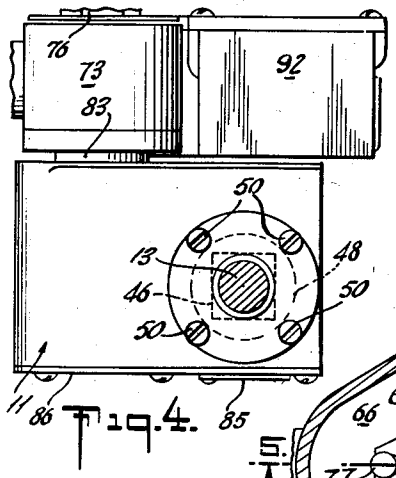


Fig. 4.

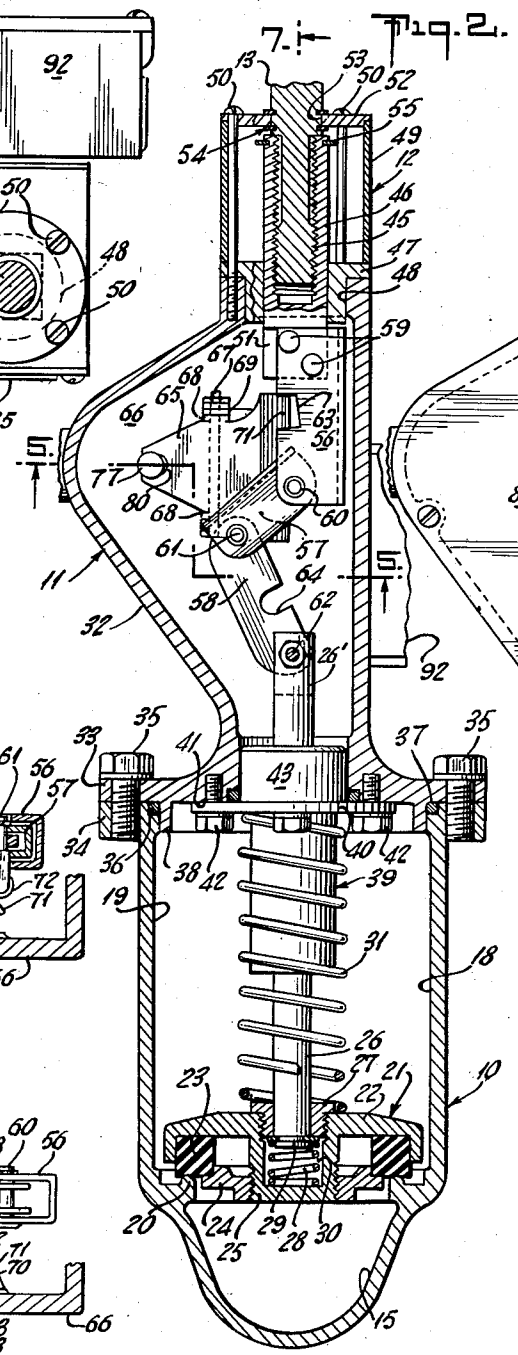


Fig. 2.

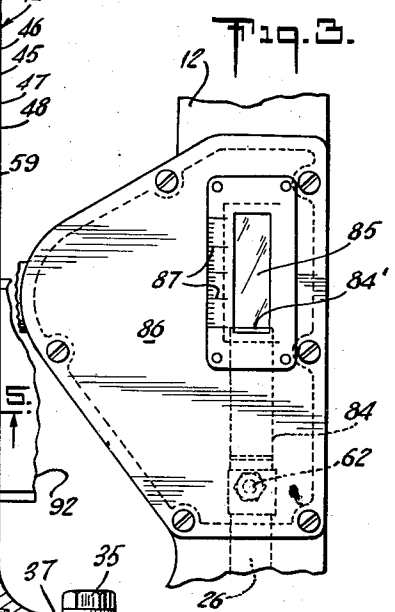


Fig. 3.

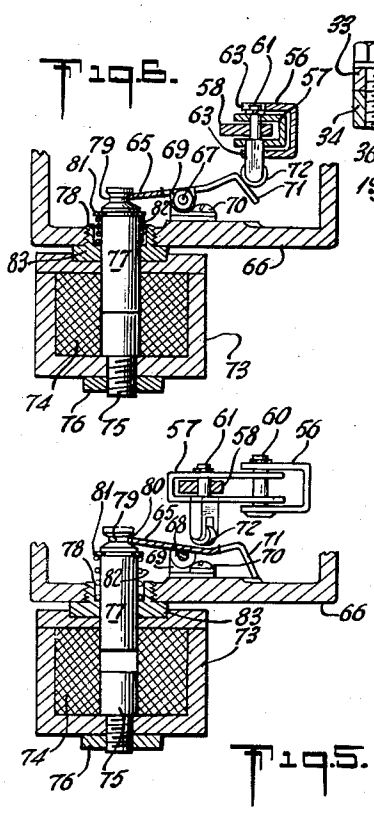


Fig. 6.

Fig. 5.

INVENTOR:
WILBUR F. HURLBURT, JR.
BY
Frederick Breitenfeld
ATTORNEY

June 24, 1958 W. F. HURLBURT, JR 2,839,929

SOLENOID OPERATED TRIP MECHANISM

Filed Aug. 14, 1953 4 Sheets-Sheet 3

Fig. 7.

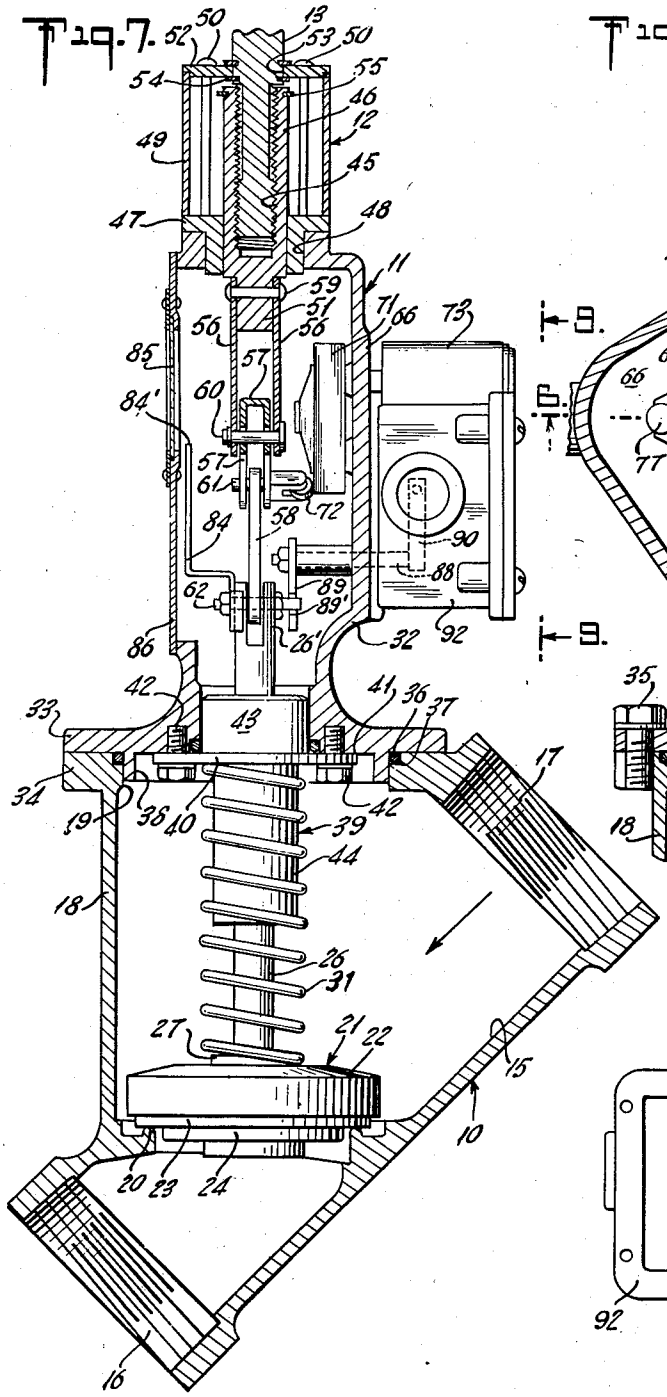


Fig. 8.

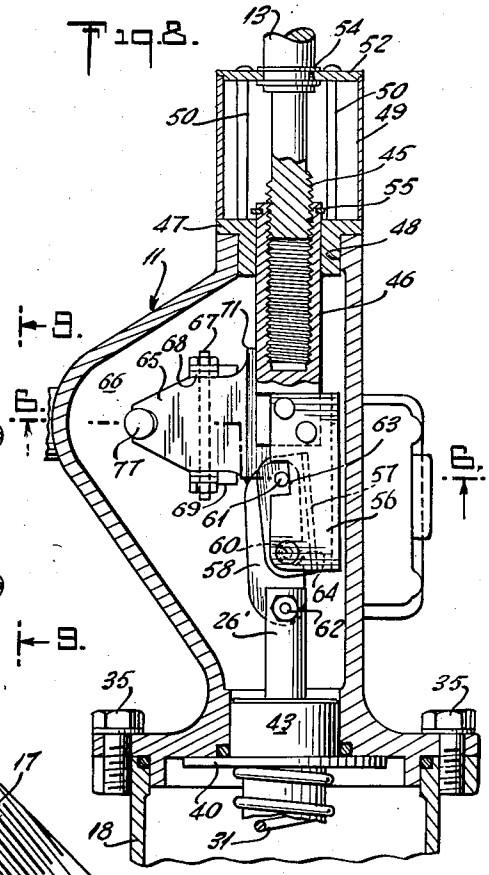
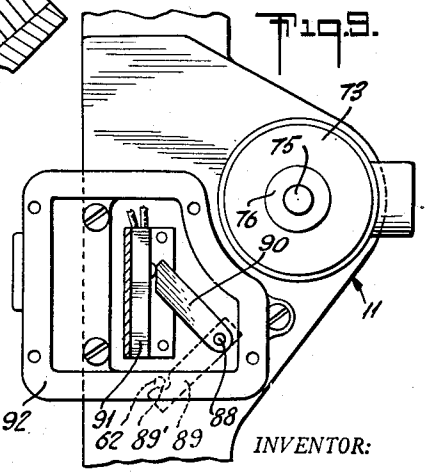


Fig. 9.



INVENTOR:
WILBUR F. HURLBURT, JR.
BY
Frederick Kreitzfeld
ATTORNEY

June 24, 1958 W. F. HURLBURT, JR 2,839,929

SOLENOID OPERATED TRIP MECHANISM

Filed Aug. 14, 1953 4 Sheets-Sheet 4

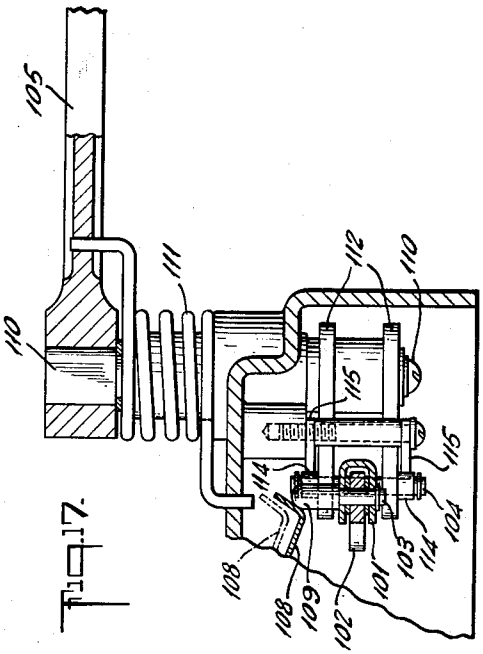


Fig. 17.

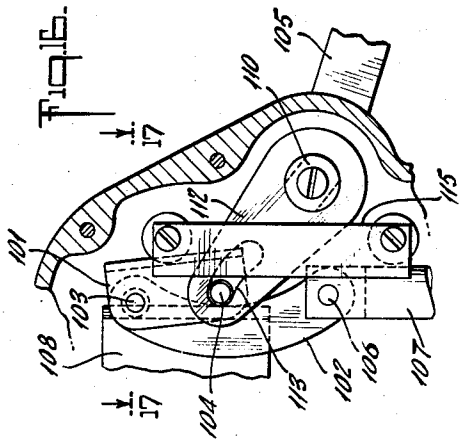


Fig. 16.

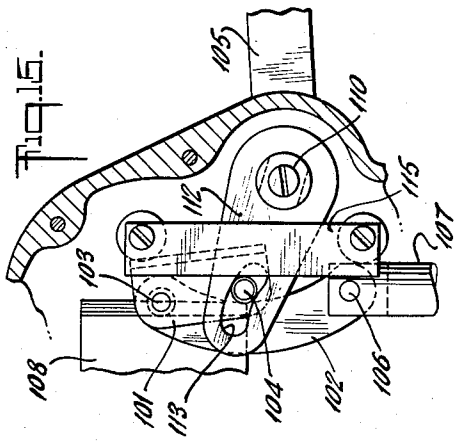


Fig. 15.

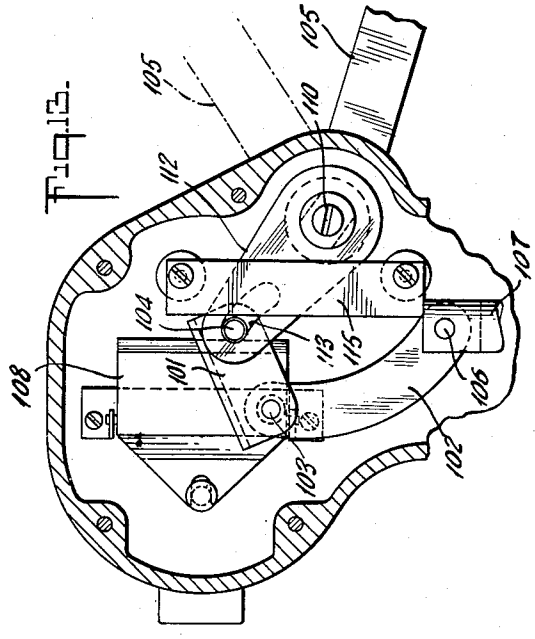


Fig. 13.

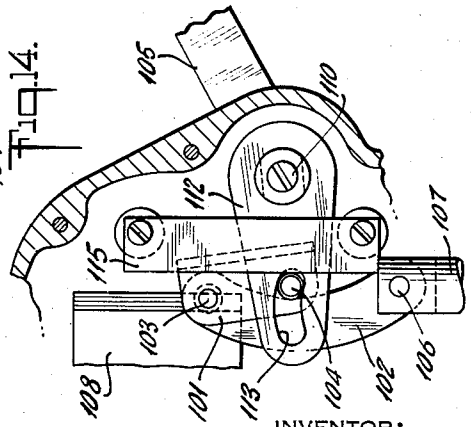


Fig. 14.

INVENTOR:
WILBUR F. HURLBURT JR.
BY
Frederick Breitenfeld
ATTORNEY

United States Patent Office 2,839,929
Patented June 24, 1958

2,839,929

SOLENOID OPERATED TRIP MECHANISM

Wilbur F. Hurlburt, Jr., West Orange, N. J., assignor to Automatic Switch Co., Orange, N. J., a corporation of New York

Application August 14, 1953, Serial No. 374,283

10 Claims. (Cl. 74—2)

My present invention relates generally to operating mechanisms for valve stems or the like, and has particular reference to operating mechanisms suitable for free-handle manual-reset valves.

In an installation of the character referred to, the setting of the valve into and out of various positions is under the manual control of an operator only so long as a certain condition, or a selected set of conditions, is maintained; and in the event that any of the conditions is or becomes different from what it should be, the valve automatically closes (or opens, as the case may be) and the manual control is rendered completely ineffective, and remains so, until the desired conditions are re-established.

The existence or establishment of the desired conditions is usually caused to manifest itself by the energization of an electromagnetic means such as a solenoid, and no manipulation whatsoever of the valve handle or other control is effective to re-open or otherwise reset the valve until the contemplated energization of the solenoid occurs.

While the invention is primarily directed to the opening and closing, or other setting, of valves, it will be understood that certain phases of the invention are of broader scope and may be applicable to the setting of other mechanisms or devices where it is desired that there be manual control under a pattern of predetermined conditions and an automatic rendering of the manual control ineffective whenever there is a deviation from such pattern.

While mechanisms of this type are of general utility, they are especially useful for the operation of valves that are to function automatically under predetermined faulty conditions to interrupt the flow of liquids or gases, such as fuel, or to initiate flow, as in sprinkler systems. This automatic operation functions to disengage manual operating means in a manner that requires manual reengagement thereof to return the valve to its normal position when the faulty conditions no longer obtain. The automatic operation may be caused to be in response to pressure or temperature changes, the presence or absence of water vapor or other impurities in a gas, electrical failure, or the happening of other events that may or may not be directly associated with the system being controlled.

Prior mechanisms of this nature have often involved relatively expensive and complicated structures which generally limited their use. Moreover many of the prior mechanisms required careful and delicate adjustment in order to insure stability and dependability, thus adding to the cost and complication of manufacture. Accordingly it is one object of this invention to provide an improved, relatively inexpensive, staunch and reliable free-handle reset valve that can be readily "tripped" in response to a departure from a normal or predetermined condition and which may be simply and easily restored to manual control upon the re-establishment of such condition.

Another object of the invention is to provide a new and improved valve of the free-handle type wherein

the handle releasing and valve operating means may be fabricated by relatively inexpensive procedures such as punch press operations and the like and yet provide a highly sensitive and stable mechanism virtually unaffected by frequent actuation and extended use.

Still another object of the invention is to provide a structure characterized by its simplicity and positive response to departures from predetermined or normal conditions.

A further object is to provide a releasable holding means or latch mechanism wherein very small pressures may be used to maintain engagement of the handle and valve to hold the valve in one position and wherein the absence of such slight pressure will effect positive and immediate disengagement of the handle and permit the valve to be instantly moved to another position.

A particular feature of the invention, involving a special time-delay mechanism, is applicable not only to free-handle valves of the kind described but also to safety valves generally. (While the latter are usually referred to as safety "shut-off" valves, the action effected for safety purposes need not necessarily shut the valve off but might for example open it or otherwise adjust or operate it.) In the operation of such valves it is common practice to control the automatic functioning by an electromagnetic instrument such as a solenoid. In service, installations are frequently subjected to power fluctuations of merely momentary character, which despite their short duration are adequate in magnitude to activate the electromagnetic control instrument. For example, if the latter is arranged to hold the valve in a predetermined setting so long as electric power is maintained, and to release or trip it on power failure, any momentary power failure of even one second duration or less is a source of annoyance. An instance of this would be, for example, the needless shutting off of gas furnaces with a resultant undesirable cooling before the safety valve can be reset and the furnaces restarted. It is one of the objects of the present invention to obviate this disadvantage by means of a time-delay arrangement that bridges over such momentary power fluctuations or failures by delaying the activation of the electromagnetic instrument whenever it is conditioned to become operative to close or open or otherwise operate the valve.

The above and other objects and advantages will become more apparent in the following description and accompanying drawings forming part of this application.

In the drawings:

Figure 1 is a perspective view of a valve constructed in accordance with the invention, the operating handle being of the wheel type;

Figure 2 is an enlarged cross-sectional view of the valve of Figure 1; the handle being "free" and ineffective;

Figure 3 is an enlarged side elevation of part of the valve;

Figure 4 is a plan view of the valve;

Figure 5 is a cross-sectional view of Figure 2 taken along the line 5—5 thereof, the operating mechanism being in the released position;

Figure 6 is a cross-sectional view taken along the line 6—6 of Figure 8 with the operating mechanism in the engaged position;

Figure 7 is a cross-sectional view taken along the line 7—7 of Figure 2;

Figure 8 is a partial cross-sectional view similar to Figure 2 with the operating mechanism in the engaged position;

Figure 9 is a side elevation of the valve shown in Figure 7 taken along the line 9—9 thereof and with the cover plate removed;

Figures 10 and 11 are diagrammatic perspective views

of the operating mechanism in the engaged and disengaged positions respectively;

Figure 12 is one embodiment of an electrical circuit for operating the valve in accordance with the invention;

Figure 13 is a fragmentary view similar to Figure 2, illustrating a modified construction in which the operating handle is of the pivoted lever type;

Figures 14, 15 and 16 are fragmentary views showing the parts in the various relative positions they assume during manual control of the valve; and

Figure 17 is a cross-sectional view along the line 17—17 of Figure 16.

The valve operating mechanism of this invention provides a simple and positive structure for the attainment of desired safety features and has the advantage that only slight pressure is required to maintain operative engagement of the operating handle with the valve mechanism, a release of this slight pressure resulting in an instantaneous and positive disengagement of the handle. This operation involves the use of a collapsible link assembly between the valve handle and valve disc so that the major force exerted by the handle to open (or close) the valve against the pressure of a valve spring is carried by the links when in a folded or nested position. The links can be maintained in this nested relation by only a slight transverse pressure which when released permits the links to collapse and enables the valve to be operated instantaneously in response to the valve spring notwithstanding the position of the operating handle. Furthermore, positive disengagement of the handle is effected since the force of the valve spring which functions to close (or open) the valve also causes collapse of the links out of nested relation when the transverse pressure is released.

A perspective view of one embodiment of the invention is shown in Figure 1. In this figure, the valve body is denoted by the numeral **10**, and immediately above the body is the mechanism unit **11**. The unit **11** houses the handle engaging and disengaging apparatus which I have shown associated with a handle of the hand wheel type. The wheel **14** carries a threaded part **13** and cooperates with mechanisms within the cylindrical housing part **12**. While the illustrated embodiment of the invention is a hand wheel operated Y valve it is to be understood that the invention is equally applicable to other types of globe and gate valves such as those operated by a lever type handle (Figure 13) or wherein the valve and stem assembly are at right angles or otherwise arranged with respect to the fluid flow.

Referring more specifically to Figures 2 and 7, the valve body I have chosen to show includes a fluid conduit **15** having threaded end sections **16** and **17** for connection with a system to be controlled. Joined with the conduit **15** at an angle of about 45° is the valve housing **18** having a cylindrical opening **19** for receiving certain elements of the valve operating structure. The valve housing **18** is formed integrally with the conduit **15** and comprises part of the supporting structure for the valve and operating mechanism.

Within the fluid conduit **15** is a valve seat **20** formed in the conventional manner for cooperating with the valve **21**. The latter has a cylindrical body **22** containing a circular seat **23** of resilient material retained in position by a circular washer **24** threaded to the cylindrical center piece **25** of the valve body **22**. The valve stem **26** is coupled to the valve body **22** by means of a threaded plug **27** slidably surrounding the stem **26** and threaded into an opening **28** within the piece **25**. A flange **29** retains the stem in the plug **27** and cooperates with the plug to open the valve **21** when the stem is lifted. A small spring **30** is interposed between the flanged end of the valve stem **26** and the bottom of the cavity **28** and will give under the action of the stem to limit the pressure between the valve body **21** and the seat **20** to that provided by the main valve spring **31**.

The valve and stem assembly is supported by the housing **32** which has a flanged bottom section **33** secured to a corresponding flanged part **34** of the valve body **10** by means of bolts **35**. These flanges **33** and **34** are sealed one to the other by means of an O ring **36** retained within a groove **37** in the valve body **10** by a downwardly extending circular flange **38** formed integrally with the flange **33**. The valve stem **26** is journaled within a cylindrical bearing **39** having a flange **40** secured to the bottom wall **41** of housing part **32** by bolts **42**. An enlarged cylindrical section **43** of bearing **39** cooperates with a corresponding opening in housing **32**, and a downwardly extending part of reduced diameter **44** holds the spring **31** in alignment with the stem **26**. This spring **31** is interposed between the flange **40** and valve body **21** and the lower end of the spring is held in alignment by the head of plug **27**.

The valve operating parts **14** and **13** are operatively supported within the housing **12** extending from the top side of the mechanism unit **11**. The part **13** is provided with single or multiple threads **45** which cooperate with an internally threaded rectangular sleeve or element **46** slidably mounted for longitudinal movement within a flanged guide bearing **47**. This bearing is locked in an opening **48** in the upper end of housing **32** by means of a sleeve **49** and screws **50**. The lower end **51** of the element **46** is rigidly secured by rivets **59** to an extension **56** that extends downwardly for cooperation with the link assembly. If desired, parts **46** and **56** may be formed of a single piece.

The hand wheel and operating assembly are retained in position on the housing **32** by a flanged plug **52**, closing the upper end of sleeve **49** and having a central opening **53** for receiving the hand wheel part **13**. With this arrangement rotation of the hand wheel **14** rotates the part **13** relative to the rectangular element **46**, moving the latter upwardly or downwardly depending on the direction of rotation of the wheel. The part **13** is retained against longitudinal movement by lock rings **54** bearing against the plug **52**; and the downward movement of the element **46** is limited by a lock ring **55** which cooperates with the upper side of the bearing **47**.

In operation, when the link assembly within the unit **11** operates to couple the end **51** of element **46** with the upper end **26'** of valve stem **26**, rotation of the hand wheel will function to open and close the valve **21** in the normal manner. The valve may be fully or partially opened, as may be desired. Under conditions when the link assembly is collapsed, however, the valve stem **26** is free to move downwardly under the influence of spring **31** to close valve **21**, and operation of the hand wheel **14** will have no effect whatever on the stem **26**.

The link assembly coupling the element **46** with the valve stem **26** comprises two links **57** and **58**. They are shown in the collapsed or disengaged relationship in Figures 2, 5, 7, 11 and 13. The upper or first link **57** is pivotally coupled to the lower end of extension **56** by a pivot pin **60**. The part **56** is in the form of a channel to accommodate the link **57** (Figures 6 and 10), and the latter is also preferably of channel cross-section so as to accommodate the second or lower link **58**. The link **58** is pivoted to link **57** by a pin **61** and is pivoted at its outer end by a pin or bolt **62** (Figure 7) to the slotted upper part **26'** of valve stem **26**.

The pivot pin **61** is somewhat longer than the width of the link **57** so that it can enter a pair of slots **63** in the sides of part **56**. The link **58** is also provided with a recess **64** to receive the pin **60** when the links are in the folded or nested position.

The pivot pin **60** lies and always remains in the line of valve movement which in this case is coincident with the axis of the valve stem **26**. Actuation of the handle moves the pin **60** up and down along the line of valve movement but these movements are transmitted to the valve itself only if the links are in their nested relation and are retained so.

With the links in the open position as shown in Figures 2 and 11, it is apparent that vertical displacement of the element **46** by operation of the hand wheel **14** will not function to control the valve. The handle is therefore completely free and ineffective and it cannot be operatively engaged with the valve until the operating links **57** and **58** are moved to and retained in the nested position as shown in Figures 6, 8 and 10.

To place the links **57** and **58** in the nested position the hand wheel **14** is operated to move the element **46** to its downward position. This action will cause the links to assume the nested relation, with the ends of the pivot pin **61** engaging the bottom of the slots **63**. The depth of these slots **63** is preferably such that the pin **61** will move to a position just approaching and closely adjacent to (but not in line with) the center line of the valve stem **26** and hand wheel element **46**. If desired, the slots **63** may be deep enough to allow the pin **61** to come into full alignment with the center line axis, but in that case provision should be made for some auxiliary force, such as that afforded by a light spring or the like, to push the linkage out of the dead in-line position when the solenoid is de-energized.

The links are retained in the nested position by a lateral pressure exerted upon them, preferably upon the connecting pivot **61**. I have shown a triangularly shaped cam or rocker element **65** secured to the wall **66** of housing **32** by a rocker pin **67**. The pin **67** is carried by ears **68** formed on the rocker **65** and supported by a bracket **69** fastened to the wall **66** by screws **70** (Figures 5 and 6). The broad end of the cam plate **65** is bent to provide a sloping surface or cam **71** extending generally in line with the folded link assembly. This surface **71** cooperates with a roller **72** (Figures 5, 6, 10 and 11) carried on one end of the pivot pin **61** so that when the links are in the nested relation and the sloping surface **71** is raised as shown in Figures 6 and 10, it will bear transversely against the pin **61** to hold the links in the nested position and against the action of the main valve spring **31**. The sloping surface **71** is made long enough to maintain sliding contact with the roller **72** through its entire travel from a closed valve position to a fully open valve position. When the plate **65** is rotated in a clockwise direction as viewed in Figures 5 and 6, the transverse pressure on roller **72** and pin **61** is released whereupon the links will fly to an open position as shown in Figure 11 under the action of valve spring **31**.

Operation of the cam plate **65** is controlled by an electromagnet contained within a housing **73** on the side of the mechanism unit **11** as shown in Figures 5 and 6. The magnet includes a coil or winding **74** having a central pole piece **75** terminating at one end within the coil and having its other end threaded for engagement with and support by the housing **73**. A nut **76** may be used to secure this pole piece in place. The plunger **77** extends through an opening **78** in the wall **66** and through a corresponding opening in the housing **73** in line with the center pole piece **75** and the central opening of the coil **74**. The outer end of the armature or plunger **77** is provided with a circular groove **79** for engagement with a recess **80** in the rocker **65**, and is held in the upward position as shown in Figure 5 by a collar **81** and a spring **82** encircling the plunger and held between the collar and the spacer **83** between the housing **73** and wall **66**. Thus when the coil **74** is not energized the plunger **77** moves upwardly, lowering the sloping surface or cam **71** and permitting the links **57** and **58** to fly open. When the coil is energized the cam **71** is raised as shown in Figure 6 to hold the links in the nested or engaged position.

This embodiment of the invention includes visual means for indicating the position of the valve **21** relative to the seat **20**. This is accomplished by means of a bracket member **84** (Figure 7) carried by the valve stem **26**. The upwardly extending arm **84'** of this bracket lies behind a window **85** in the cover plate **86** of housing **32**

as seen in Figures 3 and 7. The window **85** may be provided with markings **87** which cooperate with means on the bracket arm **84** to indicate the amount the valve is opened.

In order also to provide a remote indication or signal of opening and closing of the valve, means are provided in the form of a bell-crank comprising a shaft **88** (Figures 7 and 9) and a pair of arms **89** and **90**. The shaft **88** is journaled in the wall **66** of housing **32** and carries on its inner end the lever arm **89** which cooperates with one end of the pivot pin **62**. The outer end of shaft **88** carries the arm **90** which cooperates with a microswitch **91** within the housing **92** carried on one side of housing **32**. When the valve stem **26** is in its lowermost position as shown in Figure 7, the pin **62** contacts the recess **89'** in arm **89** to move it in a counter-clockwise direction as viewed in Figure 9. This moves the arm **90** to actuate the microswitch. When the valve stem **26** is lifted even a few thousandths of an inch the switch is disengaged by arm **90** and returns to a position indicating that the valve is open. Any suitable signaling system such as lights, buzzers and the like, well known in the art, may be operated by the switch in any desired manner.

As pointed out above, the solenoid **74**, **77** functions to control the engagement and disengagement of the valve handle **14** with the valve **21** and usually it is desirable to have engagement effected when the magnet is in the energized condition. Experience has indicated that disengagement of the handle and closure (or opening) of the valve often results from brief temporary interruptions of the energizing current. In most cases it is therefore desirable to interpose a delay system so that transient effects like these will not operate to actuate the valve. While this may be accomplished in a variety of ways (as for instance the use of a dash pot mechanically coupled with the solenoid plunger **77**), it has been found that electronic procedures provide the greatest latitude in attaining the desired delay time for a given valve. For this purpose a direct current magnet is employed and means in the form of a condenser is bridged across the coil. In view of the prevalence of alternating current a typical circuit for attaining this is shown in Figure 12. An alternating current is connected to terminals **93** and **94** and the latter is connected to one terminal **99** of the coil **74**. The other terminal **93** is connected to terminal **98** through the series-connected switch **95**, resistor **96** and rectifier **97**. When switch **95** is closed, coil **74** will be energized by the rectified current which is limited by the resistor **96**. Delay is effected by bridging a condenser **100** across coil **74**, and the extent of the delay is a direct function of the capacity of the condenser.

The switch **95** may be used to control the operation of the coil **74**, and thus of the valve itself, in response to any condition such as temperature, pressure, humidity, etc. In cases where the valve is to respond to the failure of electric power, the switch **95** can be omitted and the terminals **93** and **94** can be interconnected directly with such power source.

To illustrate the applicability of the features of the invention to valves of varying kinds, I have shown in Figures 13–17 how the basic linkage can be employed with a handle of the pivoted lever type.

The links **101** and **102** are pivoted to each other at **103**. The outer end of the upper or first link **101** carries a pin **104** by means of which it is articulated to the operating handle **105**. The outer end of the lower or second link **102** is pivoted at **106** to the valve stem to be moved. Except for the mode of articulation of the linkage to the handle, it may be assumed for the purpose of this description that the valve and all its parts are essentially the same as hereinbefore described.

The pin **104** lies and is maintained in the line of movement of the valve which is, as before, coincident with the axis of the valve stem **107**. When nested in overlying relation the links **101**, **102** overlap, as shown in Figures

14–16, and the connecting pivot pin **103** lies in, or almost in, the line of valve movement. (If absolute alignment, is provided for, a small auxiliary spring or other force, as hereinbefore mentioned, is needed to push the pin **103** out of the dead-center position when collapse of the links is to be effected.)

The releasable holding means is the same as that hereinbefore described, comprising a pivoted cam plate **108** having a dimension of adequate magnitude in the direction of valve movement. A cam follower **109** (here shown as a rounded end on the pin **103**) remains in contact with the cam plate in all settings of the valve, so long as the cam is held by the electromagnetic instrument, such as a solenoid, in the effective position in which it bears laterally against the follower **109**. Whenever the cam plate **108** is shifted aside (e. g., by de-energization of the solenoid) the lateral pressure on the nested links is removed and they fly open into the collapsed relation of Figure 13 in which the handle is completely ineffective. As in the structure shown in Figures 1–11, the movement of the holding means, viz., the cam plate, from a link-holding to a link-releasing position, is along a direction transverse to its effective direction of pressure against the links so that it withdraws immediately from the path of linkage collapse.

The handle **105** is pivoted to the housing at **110** and is adapted to move between the full-line and dotted positions indicated in Figure 13. In the construction illustrated a spring **111** (Figure 17) constantly urges the handle into the full-line position, but the use of such a spring is not essential.

The inner lever arm of the handle **105** is provided with a slot with which the pin **104** engages. In the illustrated embodiment of the invention the inner arm of the handle is forked, consisting of two spaced arms **112** (Figure 17) and each of these arms is provided with the slot referred to, but since the slots are identical and in alignment, and the arms **112** move and function as a unit, the inner part of the lever is referred to hereinafter as a single "arm" **112** having a "slot" **113** formed in it.

In order that the pin **104** shall always remain in the line of valve movement its ends are provided with rolling parts or elements **114** that are caused to ride along fixed guide rails **115**, the slot **113** being curved, as shown, so as to urge the elements **114** constantly against these rails.

When the parts are in the relationship shown in Figure 13 and the conditions required to be met by the particular installation are faulty or unfulfilled, the handle **105** is ineffective to control movements of the valve stem **107**, and the latter will remain under the influence of a valve spring (not shown) or other forces to hold it in the position illustrated. The handle **105** can be moved, but this merely shifts the links **101**, **102** back and forth between the collapsed and nested positions and imparts no lifting force to the valve stem **107**.

Once the required conditions have been established, the cam plate **108** will be pivoted from the dotted to the full line position shown in Figure 17, this being accomplished by a solenoid or other electromagnetic instrument as hereinbefore described. The handle is then moved to the dotted position shown in Figure 13, and during this manipulation the links **101**, **102** fold up into nested overlying relationship and the follower **109** snaps into a position behind the hump in the cam plate (Figure 17). The oblique extended margin of the latter is a holding means that now bears lightly against the follower **109** and thus maintains the links in nested relation. This condition obtains so long as the solenoid keeps the holding means effective. In this relationship of the parts the handle can be moved downwardly (Figures 14, 15, 16) and this will transmit an effective force to the valve stem **107** to lift in into the desired position.

A release of the holding means to shift it laterally to the dotted position of Figure 17 will immediately result in a collapse of the linkage into the ineffective condition shown in Figure 13.

The operating mechanism as described herein may obviously be used to operate devices other than those technically designated valves and has the important advantages of simplicity of structure, complete dependability, and low cost. Moreover the holding mechanism may be readily set and reset without the application of large forces and the only stresses supported by the mechanism in the case of the valve shown, for instance, are those produced by the valve operating spring.

While the manually operable handle has been shown in one case in the form of a hand wheel, and in another case in the form of a lever, it will be understood that the valve may be caused to move by other well-known manually operated elements or devices. The term "handle" as used herein and in the appended claims is intended to include all such instrumentalities within its scope.

While only two embodiments of the invention have been illustrated and described it is apparent that many changes and modifications may be made without necessarily departing from the true scope and spirit of the invention as expressed in the appended claims.

Having thus described my invention what I claim as new and desire to secure by Letters Patent is:

1. In a mechanism for moving a valve stem or the like along a predetermined line, a handle, a linkage between the handle and stem comprising a pair of links joined end to end by an intermediate pivot, one of said links having its outer end articulated to the handle and the other link having its outer end pivoted to the stem, said links being movable into and out of an overlying relation in which said intermediate pivot is substantially aligned with the line of stem movement, a housing enclosing said linkage, and releasable holding means within said housing and independent of said handle and linkage and adapted to bear laterally against said intermediate pivot to hold the links in overlying relation and thereby render said handle effective to move said stem.

2. In a mechanism of the character described, the combination of elements set forth in claim 1, said holding means comprising a cam having an operative surface of substantial dimension parallel to said line of stem movement.

3. In a mechanism of the character described, the combination of elements set forth in claim 1, said holding means comprising a cam mounted for pivotal movement on an axis parallel to said line of stem movement and adapted to swing into and out of link holding position.

4. In a mechanism of the character described, the combination of elements set forth in claim 1, said holding means comprising a cam mounted for pivotal movement on an axis parallel to said line of stem movement and adapted to swing into and out of link holding position, said cam having an operative surface of substantial dimension parallel to said line of stem movement.

5. In a mechanism of the character described, the combination of elements set forth in claim 1, said holding means comprising a cam mounted for movement into and out of link holding position, and an electromagnet having an armature coupled to said cam to control its movement.

6. In a mechanism for operating a valve stem or the like by movement of the stem along a predetermined line, a handle, a pair of links pivoted to each other end to end, the first link having its outer end articulated to the handle and lying in the line of movement of the valve stem, the second link having its outer end pivoted to the valve stem, said links being movable into and out of an overlying relation in which their outer ends are in proximity and the links are substantially in alignment with said line of valve stem movement, and releasable holding means adapted to bear laterally against said links

to retain them in their overlying relation and thereby render the handle effective to operate the valve stem, said holding means having a substantial dimension parallel to the line of stem movement so that said holding means so long as it is unreleased remains effective in all positions of the stem.

7. A stem operating mechanism as set forth in claim 6, said handle comprising a lever mounted for pivotal movement and provided with a slot, said articulation with said first link comprising a pin carried by said link and engaging within said slot.

8. A stem operating mechanism as set forth in claim 7, in combination with guide means constraining said pin to remain constantly in the line of stem movement.

9. A stem operating mechanism as set forth in claim 8, said guide means comprising a rail against which said pin bears.

10. A stem operating mechanism as set forth in claim 9, said lever slot being contoured to press the pin against said rail in all positions of the handle.

References Cited in the file of this patent

UNITED STATES PATENTS

925,673	Zook	June 22, 1909
1,644,171	Caldwell	Oct. 4, 1927
1,672,049	Almquist	June 5, 1928
2,014,101	Bryan	Sept. 10, 1935
2,218,606	Foster	Oct. 22, 1940
2,301,876	Hurlburt	Nov. 10, 1942
2,456,078	Paille	Dec. 14, 1948
2,630,832	Lutherer	Mar. 10, 1953

FOREIGN PATENTS

191,599	Great Britain	Jan. 18, 1923