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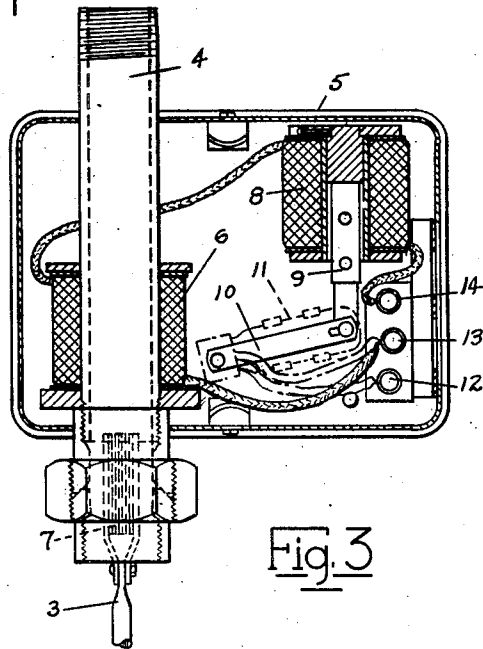
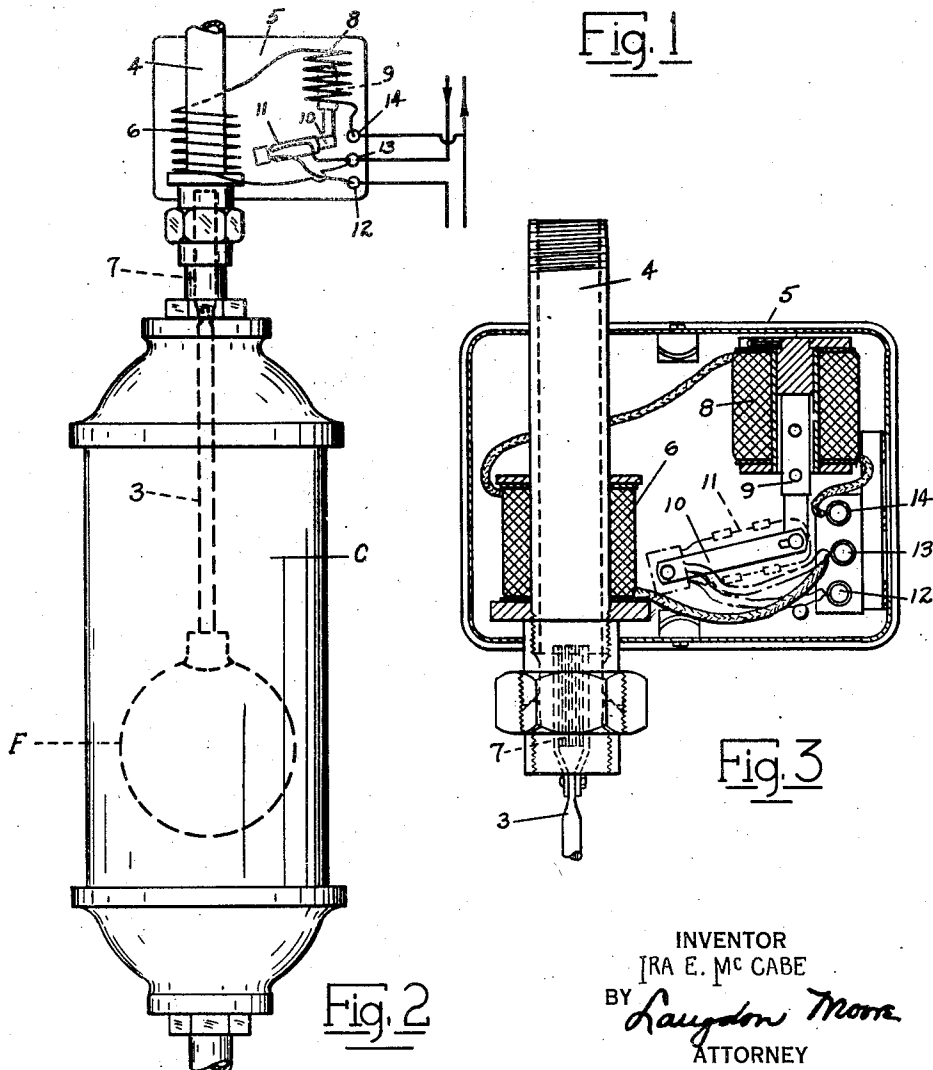
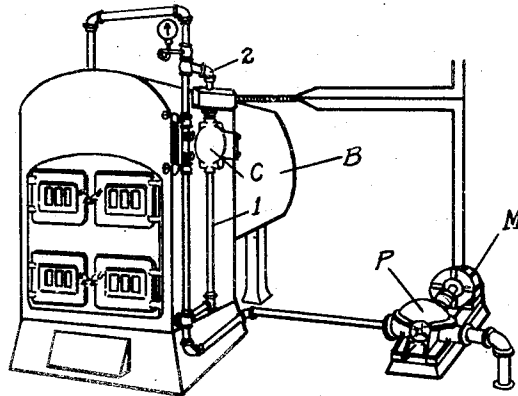
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1,906,702

WATER LEVER CONTROL FOR BOILERS

Filed June 29, 1931

3 Sheets-Sheet 1



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3 Sheets-Sheet 2

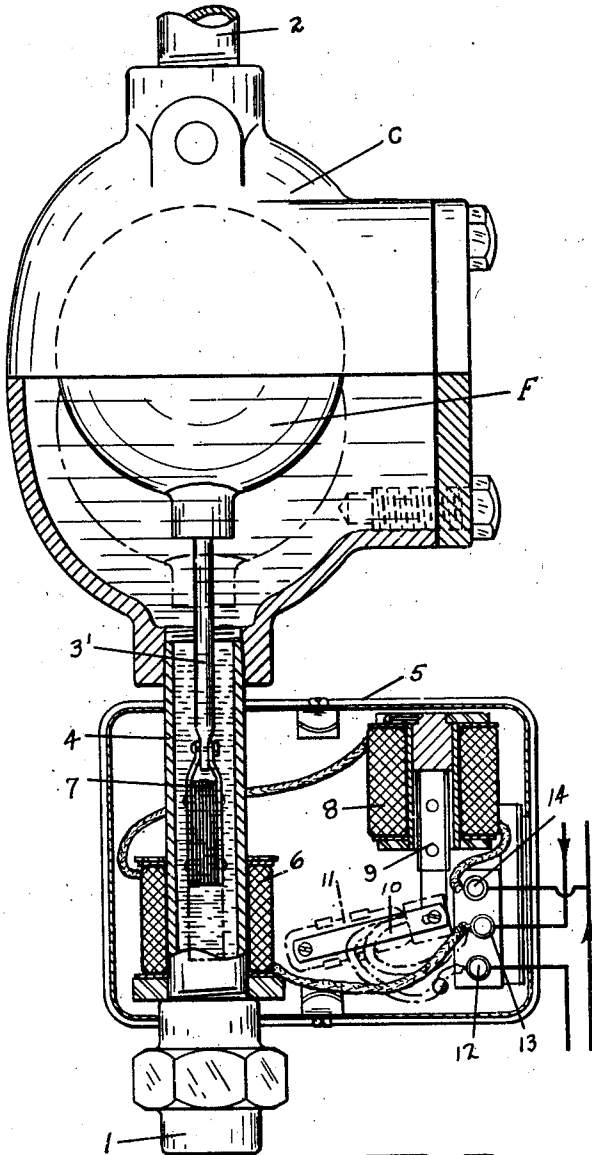


Fig. 5

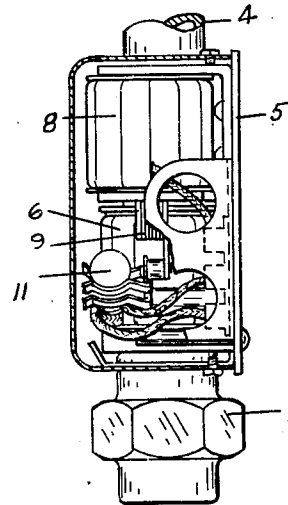


Fig. 4

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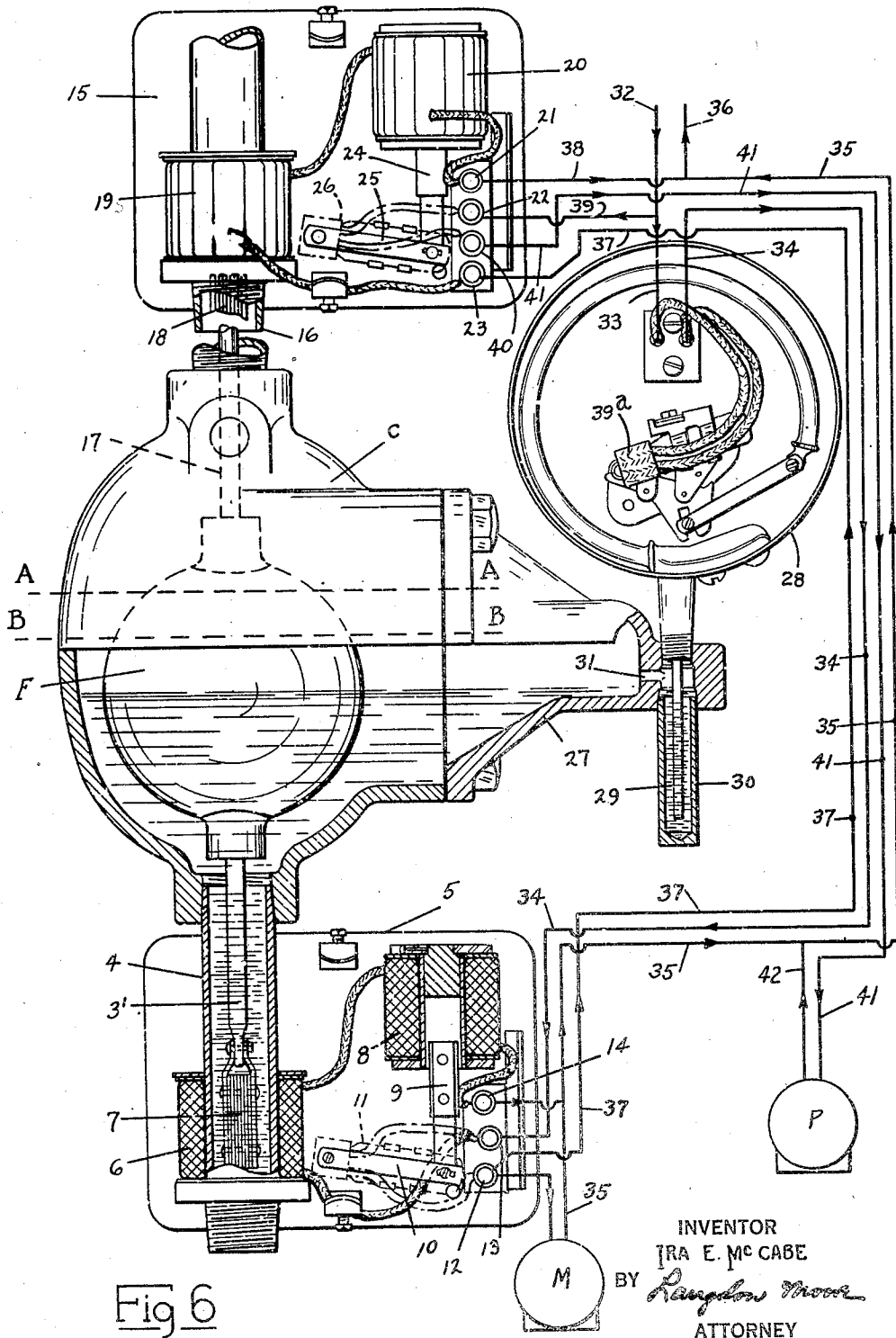
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3 Sheets-Sheet 3



UNITED STATES PATENT OFFICE

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WATER LEVEL CONTROL FOR BOILERS

Application filed June 29, 1931. Serial No. 547,581.

This invention relates to improvements in water level controls of the type usually employed in steam boilers and more particularly to a device of this character so constructed as to operate without the use of glands or packing.

In steam boilers of any character, it is necessary that the water be maintained at approximately the same level within the boiler and various devices have been employed to automatically operate a pump to supply water to the boiler when the level within the boiler lowers to such a degree as to approach the danger point. Heretofore controls of this character have employed a packing about a shaft operating the control mechanism and it has been found that particularly in the case of high pressure boilers the packing soon becomes ineffective. It is an object of this invention to provide a water level control of such construction that it will positively and continually operate without the use of any packing.

It is a further object of this invention to provide a water level control such as above described which may be connected to operate an alarm when the water in the boiler reaches a low danger level; may be connected to operate a boiler feed pump when the water level reaches a low danger point and thereby supply water to the boiler; may be connected in an electrically operated fluid fuel burner control system whereby the fluid fuel burner motor circuit may be broken upon the water level reaching a low danger point; and may be employed in an electrically operated and controlled fluid fuel burner control system whereby excessive pressure within the boiler will break the burner motor circuit and in which the low level of the water approaching the danger point will not only operate the boiler feed pump but also break the burner motor circuit until the feed pump has raised the level of the water within the boiler, where-

upon the burner motor circuit will be closed and the feed pump circuit broken.

In the drawings—

Figure 1 is a perspective view of a commercial boiler illustrating the application of this invention as connected to operate a motor driven feed water pump.

Figure 2 is an enlarged detail view in front elevation of the float casing, illustrating the float operated mechanisms in diagram.

Figure 3 is an enlarged detail view partly in vertical section and partly in side elevation of the mechanism operated by the float.

Figure 4 is a view in end elevation of Figure 3 with the cover thereof shown in section and with parts broken away.

Figure 5 is a view similar to Figure 2, partly in section illustrating the application of this invention in connection with a low water level alarm.

Figure 6 is a view in front elevation, partly in section and with parts removed, illustrating an application of this invention combining a pressure control, a feed water pump control and a fluid fuel burner motor control combined in the control system of an electrically operated fluid fuel burner heating system, the wiring of which is indicated in diagram.

The embodiment of this invention as illustrated in Figures 1, 2, 3 and 4 illustrate its application to a commercial steam boiler installation B and applied to control the operation of a motor M operating a feed water pump P connected to feed water into the boiler B.

The float valve casing C is connected to the interior of the boiler by means of pipes 1 and 2 which enter the boiler above and below the normal water line therein and so position the casing that the normal level of the water within the boiler is approximately opposite the horizontal center of the casing. A float F is mounted within the casing provided with an upwardly projecting stem 3

adapted to travel in a vertical direction within a tube 4 of non-magnetic material interposed between the top of the casing C and the pipe 2 leading to the interior of the boiler above its normal water level.

An instrument casing 5 is supported about the non-magnetic tube 4 and mounts a solenoid coil 6 about the lower portion of the non-magnetic tube 4. The upper extremity of the stem 3 supports a core 7 adapted to be reciprocated as the float rises and falls in accordance with water level of the boiler causing the core 7 to enter or be withdrawn from within the surrounding coil 6.

Another solenoid coil is mounted within the casing 5 surrounding a reciprocated core 9 the lower extremity of which is pivotally attached to the free end of a pivoted arm 10, which in turn supports and carries with it a mercury tube switch 11 of commercial construction. Three binding posts 12, 13, and 14 are also mounted within the casing 5. The coils 6 and 8 are connected in series with the binding posts 13 and 14, respectively, and the terminals of mercury tube switch 11 are connected to the binding posts 12 and 13, respectively.

The windings of the coils 6 and 8 are preferably of material that will allow a constant flow of current irrespective of the temperature of the surrounding atmosphere, and are of a sufficient number of turns to operate as solenoids irrespective of the normal variations in the commercial current.

The parts are so arranged that when the water level within the boiler is below normal, the float F will withdraw the core 7 from within the windings of the coil 6 reducing the reactance thereof, so that more current will pass from binding post 13 through coils 6 and 8 to binding post 14, thereby energizing the solenoid 8 to draw upward its core 9 and close switch 11 to connect the incoming current from binding post 13 through binding post 12 to operate the motor M of the pump P to supply water to the boiler. When the level of the water in the boiler reaches the normal level it will cause the float F to enter the core 7 within the windings 6 increasing the reactance thereof sufficiently to deenergize the solenoid 8 to drop its core 9 and thereby open switch 11 to break the circuit to the pump motor.

The construction above described illustrates an application of this invention to control the operation of a feed water pump. It is to be noted that the float causes the pump to operate whenever the water within the boiler descends below its normal level and to cease operating when the normal level is reached, and this operation is consummated without the use of glands or packing interposed between the float and operating mechanism.

Figure 5 illustrates an application of this

invention as a low water level alarm, in which the parts of the operating mechanism are the same as heretofore described and bear corresponding reference numbers. However, in this construction, the core 7 is carried upon the arm 3' depending from the float F so that while the water level is at normal, the switch 11 is held in open position, and when the level descends and approaches the danger point, the core 7 enters within the solenoid coil 6, reducing the current passing through the coil 8 so that the switch 11 rotates in a downward direction and closes the circuit to the alarm. When water is fed into the boiler and the level rises, the core 7 is withdrawn and the switch 11 will open.

Figure 6 illustrates the application of this invention to a domestic fluid fuel burner, such as employed in domestic heating plants of the steam heating type. In this application the parts above described are indicated by the corresponding reference numerals and an additional control box 15 is supported upon a tubular member 16 of non-magnetic material interposed between the top of the casing C and the pipe 2 leading to the interior of the boiler above the water level and the float F is provided with an upwardly extending stem 17 mounting a core 18 adapted to enter and be withdrawn from within the solenoid coil 19 which is connected in series with the solenoid coil 20 through binding posts 21 and 23. The core 24 of the solenoid 20 is pivotally connected to the free end of the pivoted lever 25 carrying a mercury tube switch 26, the terminals of which are connected to binding posts 22 and 40, respectively. The mechanism within casing 15 is of similar construction to that within the casing 5.

In addition the casing C mounts a support 27 having communication with the interior of the casing C and mounts at its outer end a pressure actuated switch mechanism of commercial design within a casing 28. The pressure actuated switch mechanism within casing 28 is preferably of the type illustrated in the McCabe Patent No. 1,734,016, October 29, 1929, which includes a Bourdon tube, the interior of which communicates through a stem 29 with the bottom of a receptacle 30 depending from the support 27 and communicating through aperture 31 to the interior of the casing C.

As the position of the float F changes with the rise and fall of the water level, the effect of the cores 7 and 18 upon the operation of their respective switch operating mechanism is such that the core 18 may enter and be withdrawn to open and close the feed pump circuit through switch 26 without the core 7 doing likewise to the burner motor circuit as long as the float is maintained between the normal levels, indicated on Figure 6 by the dotted lines, A and B. These levels are

the operating points or rather govern the supply of water desired during the period of combustion and the lower of these levels is slightly above the low water line of the boiler.

5 However, in the event the water should decrease to the low water line, the core 7 would enter the coil 6 resulting in the core 9 being released from the solenoid 8 and the opening of the circuit through the mercury switch 10 11, stopping the burner motor and also breaking the circuit through the solenoid 20 which releases the core 24 to open the circuit to the feed pump P, as indicated upon the wiring diagram.

15 By making the operation of the feed pump dependent on the burner motor switch 11 being closed it is possible to prevent the pumping of an unlimited amount of water into a boiler where the float becomes defective and sinks.

20 Referring to the wiring diagram, the current from the commercial source of electricity passes through wire 32 and divides. A part passes through wire 33 to the pressure switch 28 continuing through the mercury switch 39^a therein and by lead 34 to 25 binding post 13 in the lower casing 5. From binding post 13 a part of the current passes through the coil 6 and the solenoid 8 to binding post 14 and then through lead 35 to the return lead 36 to the commercial line. The 30 other part of the current from post 13 passes through the mercury tube 11, when closed, to binding post 12 from which point a circuit is completed through the burner motor M and another completed through wire 37 to 35 binding post 23 in the upper casing 15 and then through the coil 19 and solenoid 20 to 40 binding post 21 and then through wire 38 it returns by lead 36 to the commercial line.

The other part of the current from the commercial source of electricity in entering through lead 32 passes through wire 39 to 45 binding post 22 in the upper casing. From binding post 22 it passes through the mercury tube switch 26 to binding post 40, thence through wire 41 to the feed water pump and then through wires 42 and 35 to 50 the return lead 36 to the commercial line.

As shown in Figure 6, the float F has dropped, as the water reaches its lowest normal level, to place the core 7 within the coil 6 thereby increasing the reactance to reduce 55 the current passing through the solenoid 8 which releases the core 9 to drop and throw the mercury tube 11 to the open position. As stated before the incoming current from the commercial source in passing through 60 the pressure switch 28 and wire enters the casing 5 by binding post 13 and with the switch 11 open the circuit is broken to the burner motor M and through wire 37 and coil 19 to the solenoid 20 which will then 65 release its core 24 to drop and open the mer-

cury tube switch 26 stopping the feed pump motor.

As the causes resulting in the float sinking to make the burner motor and pump inoperative are remedied and the water has 70 been returned to its low operating level B—B the core 7 will then here have been withdrawn enough to allow the full current to pass through the solenoid 8 which 75 draws within it the core 9, thereby closing the mercury switch 11. Therefore, the current in entering the casing 5 passes from the binding post 13 through switch 11 and binding post 12 and then to the burner motor M and through wire 35 to the return lead 36. 80 The current also passes from binding post 12 through the wire 37 to binding post 23 in the upper casing and from there the full current passes through coil 19 to solenoid 20 and by wire 38 to the return lead 36. 85 The full current through the solenoid 20 lifts the core 24 to close the mercury switch 26. The current then entering the casing 15 through wire 39 to binding post 22 passes therefrom 90 through switch 26 to binding post 40 and thence through wire 41 to the feed pump and then through wires 42 and 35 to the return lead 36 to the commercial source.

When the feed pump P has supplied a sufficient quantity of water to raise the water 95 level to A A the float F will then have placed the core 18 within the coil 19 resulting in decreasing the amount of current passing through the solenoid 20 which causes the 100 core to fall and open the switch 26, thereby stopping the feed pump motor.

It is also to be noted that in the event of excessive steam pressure tending to exceed the safe working limits of the boiler, the 105 switch 39^a in the pressure switch casing 28 will be opened to break the circuit to the mercury switch 11, thereby rendering the burner motor and feed pump inoperative until the pressure is decreased.

It also should be noted that should the 110 float sink through causes other than that due to normal changes in water level, in all cases shown, the equipment controlled by the switches is rendered inoperative, excepting, 115 of course in the case of Figure 5, the alarm control, whose function it is to indicate such conditions.

What I claim is:

A boiler water level controlled electric switch, including a float chamber communi- 120 cating with the interior of the boiler above and below the normal water level therein, a float within the chamber, a non-magnetic connection leading from the chamber forming one of the said communications, a solenoid winding about said non-magnetic connection, a solenoid core actuated by said 125 float mounted to be reciprocated within the non-magnetic connection and solenoid winding, an additional solenoid connected in 130

series with the first solenoid and source of
electricity so wound that when the core is
inserted within the first solenoid windings
the circuit impedance is increased therein
5 and decreases the current flow through the
additional solenoid decreasing the magnetic
pull thereof, a reciprocating core mounted
in the additional solenoid, an electric switch,
and means actuated by the reciprocation of
10 the core of the additional solenoid to oper-
ate said switch.

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