

United States Patent

Picard et al.

[15] 3,679,909

[45] July 25, 1972

[54] HYDRAULIC DRIVE FOR ELECTRIC SWITCHES

[72] Inventors: Karl-Heinz Picard; Joachim Beierer, both of Berlin, Germany

[73] Assignee: Siemens Aktiengesellschaft, Berlin and Munich, Germany

[22] Filed: Jan. 29, 1971

[21] Appl. No.: 110,923

[30] Foreign Application Priority Data

Jan. 30, 1970 GermanyP 20 05 027.5

[52] U.S. Cl.307/144, 317/59

[51] Int. Cl.H01h 3/24

[58] Field of Search317/59; 307/139, 112, 140, 307/142, 143, 144

[56]

References Cited

UNITED STATES PATENTS

3,168,681	2/1965	Wilson.....	317/59 X
2,900,578	8/1959	Marbury.....	317/59 X

Primary Examiner—Herman J. Hohausner

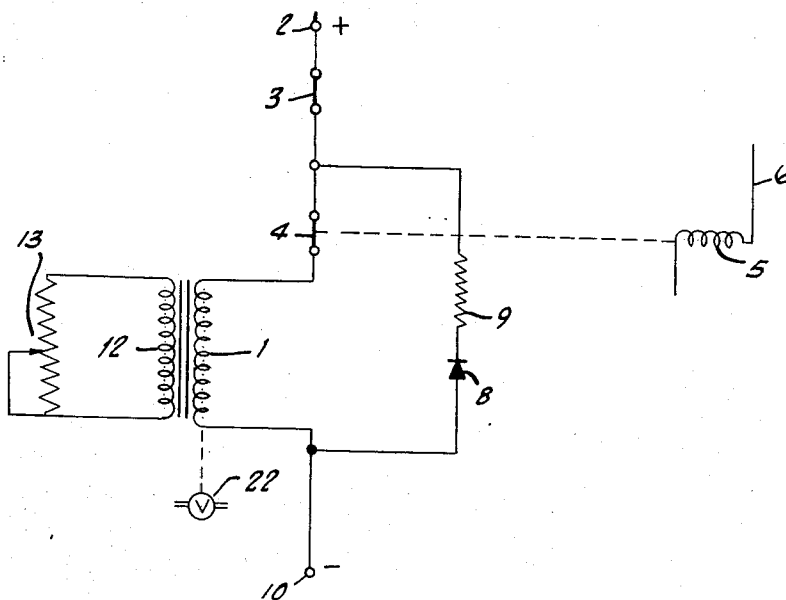
Attorney—Curt M. Avery, Arthur E. Wilfond, Herbert L. Lerner and Daniel J. Tick

[57]

ABSTRACT

The open time of an electrically controlled valve for the hydraulic drive of an electrical switch is prolonged according to the invention, by providing the excitation coil of the valve with a circuit wherein a rectifier produces a short circuit which delays the deenergization of the valve coil.

5 Claims, 3 Drawing Figures



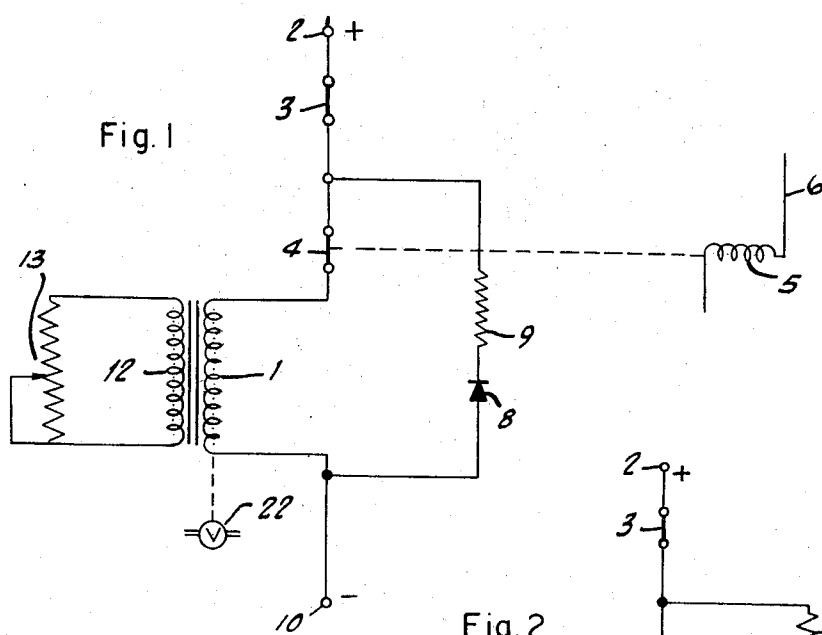


Fig. 2

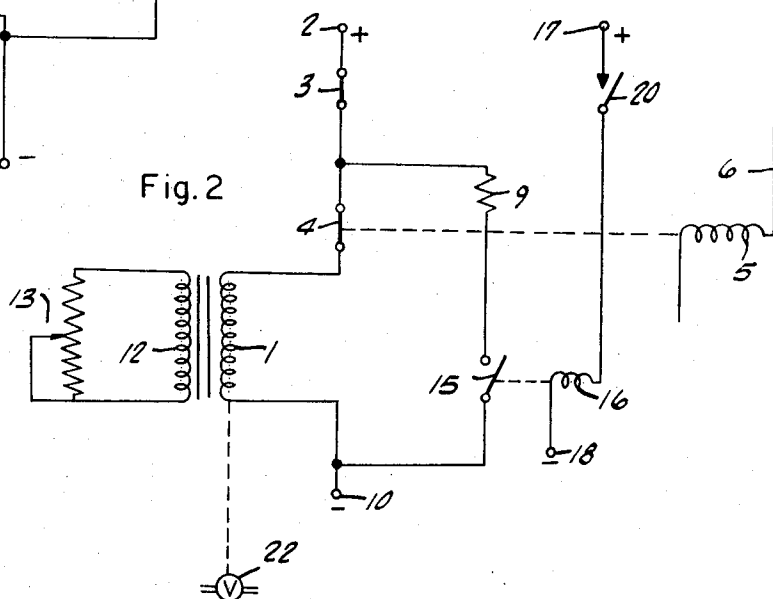
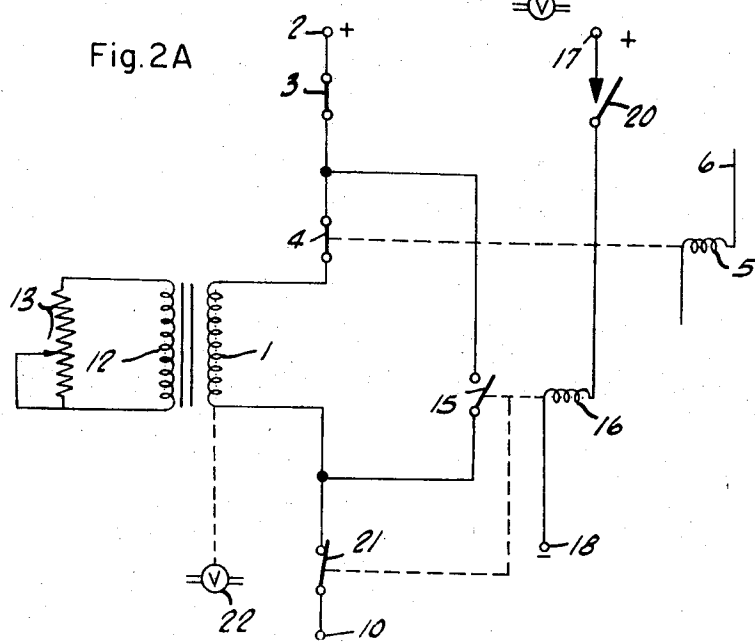


Fig. 2A



HYDRAULIC DRIVE FOR ELECTRIC SWITCHES

DESCRIPTION OF THE INVENTION

The invention relates to a hydraulic drive for electric switches. Such drives are now being used with increasing frequency, particularly for actuating high voltage switches. To this end, a piston is charged in a cylinder, usually through the control of a valve which is electrically actuated. For this purpose, the valve is equipped with an excitation coil which pulls up an armature for opening the valve, as soon as the voltage is applied to the coil, the voltage being applied with a control switch provided for issuing commands.

It is important for the drives of the afore-indicated type, that the opening time of the valve should last long enough, independent of the length of the command, so as to make a complete switching possible. Therefore, it was previously tried to open the valve only by means of an electrical command and to make the closing of the valve dependent on the termination of the switching of the hydraulically operated switch. This either requires special circuits between the hydraulic drive and the switch as disclosed in German published application (DAS No. 1,550,519), or the opening time of the valve must be controlled, in dependence on the flow passing through the valve. This necessitates a larger expenditure for the hydraulic installation within the region of the valve.

The object of the invention is to obtain an adequate opening time for the electrically controlled valve of an electric switch, independent on the duration of the command, with simple electrical components. According to a feature of the invention the excitation coil of the valve is provided with a short circuit which delays the deactivation of the valve.

According to another feature of the invention, the shunt circuit for the excitation winding is preferably provided with a rectifier, which is inserted therein since the latter constitutes the desired short circuit only when the voltage is produced by the self-induction of the coil, after the control voltage is switched off. However, for the direct voltage which is customarily used for the control of the valve, said rectifier represents a virtually infinitely high resistance. The rectifier may be provided with a resistance for limiting the current, in the event the rectifier fails.

Another embodiment for shunting, constitutes the use of a relay which is connected to voltage by a wiping contact of the switch to be actuated. The relay effects the short-circuiting of the excitation coil with an operating current contact, namely, at the time when the switch has already travelled a certain part of the switching movement, under the action of the hydraulic drive. Following another part of the switching movement, e.g. at the end of the switching stroke, voltage is again removed from the relay by the wiping contact, so that the short-circuit is lifted. In this case, too, the short-circuit is being used only to prolong the opening period of the valve.

A preferred embodiment of the invention is characterized by a winding inductively coupled with the excitation coil and having an adjustable load resistance. This winding is always present and defines with its mutual inductance, a means for delaying the pull-up time of the valve. This makes it possible to influence the opening time of the valve, within a certain framework. Thus, the adjustment load resistance represents a very simple possibility for adjusting the actuating time of hydraulically operated switches.

A more detailed disclosure of the invention will now be provided, with reference to the enclosed drawing which illustrates two embodiments.

In each embodiment, the valve that is provided for the control of the hydraulic operation of an electrical switch, more particularly a high voltage power breaker, is shown schematically in the drawing with its excitation coil 1. The drive which is energized via the valve, from a hydraulic storer or accumulator and has a cylinder as well as a piston which acts on the movable circuit member of the switch for switching on the latter is omitted from the drawing as is the device which issues the electric command.

In the embodiment of FIG. 1, the coil 1 is situated in a current path whose terminal 2 is connected to the positive pole of the control voltage. The current path contains a contact 3 of the switch to be actuated, which insures that the valve may be activated by coil 1, only if the switch is disconnected. Another contact 4 is subordinated to a relay 5 which is connected into a circuit 6, not shown in detail. The circuit 6 receives voltage when a switch-off command is issued, so that it is electrically safeguarded that the switch-on command will be cancelled, when a switch-off command is issued. The negative pole of the control voltage is connected to terminal 10.

It is obvious that the excitation coil 1 of the valve is short circuited through a parallel-connected circuit, having a rectifier 8 connected with a resistance 9, in order to limit the current. The forward direction of the rectifier 8 is between the terminals 2 and 10, in opposition to the control voltage which prevails at the excitation coil. Hence, the short circuit caused by the rectifier 8 is effective only for the self-induction voltage which occurs when the control voltage is disconnected. The self-induction voltage then causes a current to flow through the rectifier, against the action of the control voltage.

Furthermore, the excitation coil 1 is inductively coupled with a winding 12 whose ends are closed, through a regulating resistance 13. Winding 12 and resistance 13 define a mutual inductance with an adjustable load, for the excitation coil 1.

A direct voltage of e.g. 60 V is applied to the terminals 2 and 10 by closing a control switch, in order to switch on the high voltage power breaker. When the power breaker is switched off, this control voltage is connected to the excitation coil 1, in order to effect a hydraulic actuation of the power breaker. Coil 1 actuates an armature, so that the valve 22 opens. At the same time, a pull-up time delay is obtained via the winding 12, with regulating resistance 13.

Normally, the issuing of a command with the control switch, will last long enough so that the power breaker will be reliably switched on. In this event, the excitation of the coil 1 will be interrupted by contact 3 of the power breaker which is switched on by hydraulic means. If the switch-on command is issued only for short periods, then a delay of the deactivation of the valve 22 by the self-inductance of the coil is provided by the short circuit of the excitation coil 1, the short circuit comprising the rectifier 8. The self-inductance drives a current through the rectifier 8 which keeps the valve open long enough to effect the actuation of the power breaker. Thus, an incomplete connection (switch-on) of the power breaker due to the briefness of a command, is impossible.

The relay 5 with its contact 4, insures that a switch-off command can always be issued, independent on the position of the control switch and of the excitation of coil 1, of the valve 22. As soon as a switch-off command is used, each circuit with coil 1, is interrupted, even the one through rectifier 8.

In the embodiment according to FIG. 2, the direct voltages between terminals 2 and 10, are again provided for the actuation of the excitation coil 1; the winding 12 with control resistance 13, provides the pull-up delay which may be utilized to adjust the opening time of the valve 22. The relay 5 which is connected into the circuit 6 of the switch off command, can interrupt the excitation of the coil 1 with its contact 4, at any time. Contact 3 of the power breaker to be actuated, cancels the excitation of the coil 1 (even when the switch on command is of long duration), at the latest when the power breaker assumes the switch on position.

The embodiment according to FIG. 2 uses in place of the rectifier 8, a contact 15 of a relay 16, which short circuits the excitation coil 1. The relay is excited by the DC control voltage at terminals 17 and 18, via a wiping contact 20 of the power breaker to be actuated. This results in the following mode of operation:

When a switch-on command is issued, the power breaker is set into motion as soon as the hydraulic fluid which is controlled by the valve, charges the piston of the power breaker, following the excitation of the coil 1. As a result, the wiper contact 20 is closed, following a specific length of travel. This excites the relay coil 16 and the relay coil closes the operating

contact 15. This produces a short circuit for the excitation coil 1, via resistor 9, which maintains the excitation of the valve for such time until the power breaker is reliably switched on. By the further switching movement, this short-circuit is cancelled, through the deenergization of the coil 16 when the wiper contact 20 is opened, but only after the power breaker is already switched on far enough or has so much kinetic power, that it will reliably assume the end position of the switch-on movement.

FIG. 2A shows, that the relay 16 may also be equipped with a steady current contact (opener) 21, which is connected in series with the excitation coil 1 and its short circuit relay. In this event, resistor 9 which only functions as a current limiter, may be eliminated.

We claim:

1. In a hydraulic drive for opening and closing an electric switch such as a high voltage circuit breaker or the like, a valve and an electric control circuit comprising an electric coil for actuating the valve, voltage supply means connected to the coil for momentarily applying a voltage to the coil for actuating the valve; and a shunt circuit connected in parallel with the

coil for delaying the deenergization of the coil after removal of the voltage applied thereto.

2. The electric control circuit of claim 1, said shunt circuit comprising a rectifier.

3. The electric control circuit of claim 2, said shunt circuit comprising a resistor in serial connection with said rectifier for limiting the current in said shunt circuit.

4. The electric control circuit of claim 1, wherein the hydraulic drive includes a movable piston for opening and closing the electric switch and wherein said circuit comprises a relay having a set of relay contacts serially connected in said shunt circuit for closing and opening the same, ancillary voltage supply means, and a wiper contact movable with said piston to momentarily connect said ancillary voltage supply means to said relay to energize the latter for closing said relay contacts thereby momentarily closing said shunt circuit.

5. The electric control circuit of claim 1, said circuit comprising a winding inductively coupled to said coil, and an adjustable load resistance serially connected to said winding.

* * * * *

25

30

35

40

45

50

55

60

65

70

75