

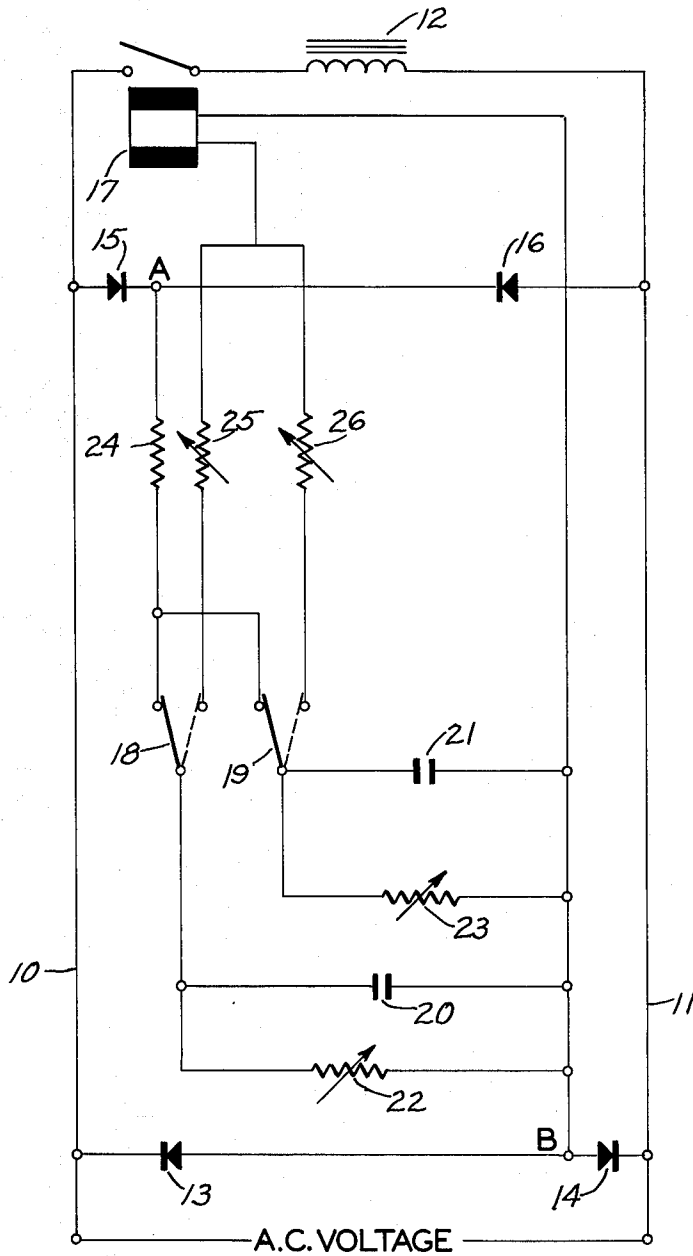
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SAFETY CONTROL CIRCUIT

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SAFETY CONTROL CIRCUIT

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5 Claims. (Cl. 317-135)

This invention relates to safety control circuits in general, and in particular to control circuits which must be actuated by both hands of the operator.

It is a well known fact that a large percentage of industrial injuries are caused by machine tools which perform their operations by impact, the most common of which is the punch press. Usually the injury is to the fingers and hand of the operator who forgetfully or carelessly actuates the machine with one hand, when his other hand is still under the die.

In an effort to stop such injuries many safety devices have been designed. The most common type have an actuating lever for each hand, both of which must be depressed before the machine will stroke. Obviously, if the operator must use both hands to operate the machine he cannot have one under the die when the plunger is making its stroke.

These safety devices, if used properly, would prevent accidents to the operators hands. However, since most operators believe that accidents happen only to someone else and since it is an unnecessary bother for them to have to use both hands to operate the machine, it is only natural that they eventually tie down one lever and return to one-hand operation.

It is therefore an object of this invention to provide means for actuating a machine such as punch press which requires both hands of the operator.

It is a further object of this invention to provide actuating means for such a machine which requires both hands of the operator and which becomes inoperative when one of the operating levers is held in the actuating position.

It is an additional object of this invention to provide a circuit for controlling the actuating device of a machine which has two operating levers, one for each hand of the operator, which must be manipulated concomitantly to be operative.

Further objects and advantages of the present invention will become apparent as the following description proceeds, and the features of novelty characterizing the invention will be pointed out with particularity in the claims annexed to and forming a part of this specification.

The invention comprises a circuit containing two single pole double throw switches having a first and a second position. The switches are arranged so that each switch is operated by one hand of the operator. In the first position, each switch connects a capacitor, a first variable resistor connected in parallel with the capacitor and a fixed resistor connected in series with the capacitor to a source of direct current. In the second position each switch connects the capacitor associated with it in the first position in series with a second variable resistor and the electromagnetic relay which operates the machine and again in parallel with the first variable resistor.

In operation, the switches are spring biased toward the first position where the capacitors are charged. When the operator desires to actuate the machine, he must concomitantly move both switches to their second position, which requires him to use both of his hands. In the second position the capacitors discharge sufficient current to energize the relay controlling the actuating mechanism of the machine. The amount of current flowing to the relay is controlled by the variable resistors in series and

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in parallel with each capacitor. These variable resistors are preadjusted to ensure that the machine cannot be operated by the current flowing from only one capacitor. These resistors also determine the length of time required to discharge the capacitors.

The invention will now be described in connection with the attached drawing which is a schematic representation of the control circuit in accordance with this invention.

Lines 10 and 11 furnish a source of electrical energy to the actuating member 12 of the machine being operated by the control circuit. This energy may be either alternating or direct current, but if it is alternating it must be rectified for the control circuit. Since in the drawing the current is shown as alternating the rectifiers 13, 14, 15, and 16 are placed in the circuit to provide full wave rectification of the alternating current for the control circuit.

The actuating member 12 may either be a solenoid which controls a pneumatic or hydraulic valve or it may be a magnetic clutch depending upon the type of power used to operate the machine. It is connected to the source of electrical energy and is controlled by the electromagnetic relay 17.

Illustrated schematically are the hand operated switches 18 and 19. As shown they are in position to connect the capacitors 20 and 21 to the pulsating direct current produced by the rectifiers 13-16. Connected in parallel with each capacitor are the variable resistors 22 and 23. Connected in series with the capacitors is the fixed resistor 24 which has a relatively low resistance value and therefore has very little effect on the circuit. It is placed in the circuit simply to protect the rectifiers 13-16.

When the switches 18 and 19 are moved by the operator to the position indicated by the dashed lines, the capacitors 20 and 21 are each connected in series with the relay 17 through variable resistors 26 and 26 respectively. These variable resistors combine with the variable resistors 22 and 23 to adjust the rate of discharge of the capacitors and the amount of current passing through the relay.

In operation, the circuit will function as follows: With the switches 18 and 19 in the position shown, the capacitors 20 and 21 will be charged by the pulsating direct current received through the rectifiers 15 and 16. The voltage across the capacitors will be approximately line voltage since the drop across the fixed resistor 24 is negligible.

When the switches 18 and 19 are moved by the operator to the second position, the capacitors discharge through the variable resistors 22, 23, 25, and 26 and energize the relay 17 to actuate the press. The amount of current passing through the relay 17 and the length of time that it flows depends on the setting of the variable resistors. For example, if they are all set at the same resistance value, one-half the current produced by the capacitors will flow through the relay 17, neglecting the resistance offered by the relay. This arrangement provides flexibility to the system and allows it to be adjusted for most any application.

When adjusting the resistors, two things must be accomplished. First, the amount of current flowing from each capacitor to the relay 17 must be insufficient alone to actuate the relay. Second, the length of time required for the capacitor to discharge must be sufficient to provide ample time for the machine to perform one cycle of operation, but not sufficiently long that the machine can perform two cycles. These objectives can all be accomplished by adjusting the variable resistors. Obviously, one of each pair of variable resistors could be replaced with a fixed resistor.

Once adjusted, the entire circuit can be enclosed in some convenient manner to prevent the operator from

changing the setting of the resistors. This makes the circuit completely "fool-proof" whereas the previous safety devices were not. For example, in the other safety systems designed to require both of the operator's hands to actuate the press, the operator could tie one of the actuating handles or levers in the actuating position and return to a "one-handed" operation. With the circuit of this invention this cannot be done. Should the operator tie down or otherwise hold one of the switches 18 or 19 in the actuating position, he would prevent one of the capacitors from functioning and since the other capacitor alone could not energize the relay 17, the press could not be actuated. This very effectively eliminates any possibility of the operator changing this control system to a "one-hand" operation.

While there has been illustrated and described what is at present considered to be a preferred embodiment of the present invention, it will be appreciated that numerous changes and modifications are likely to occur to those skilled in the art, and it is intended in the appended claims to cover all those changes and modifications which fall within the true spirit and scope of the present invention.

The invention claimed is:

1. A control system for a machine comprising:
 - a source of direct current;
 - a pair of switches connected in parallel having a first position and a second position;
 - a capacitor associated with each of the switches and arranged to be connected to the source of direct current when its associated switch is in the first position;
 - means for discharging the capacitor associated with each of the switches when the switch is in the second position;
 - an electromagnetic relay for controlling the machine arranged to be actuated by the capacitors when the switches are in second position; and
 - resistance means for controlling the amount of current flowing to the relay from the capacitors and the length of time required to discharge the capacitors, so that the capacitors must be discharged concomitantly to produce sufficient current to operate the relay.
2. The circuit of claim 1 in which the resistance means comprises a first resistor means connected in series with the capacitors and the relay.
3. The circuit of claim 1 wherein the resistance means comprises a variable resistor in parallel with each of the capacitors.
4. In a control circuit having a source of electrical

energy, and electromagnetic switch means arranged to interrupt the flow of electrical energy, the improvement, in combination therewith comprising

- a pair of switches, each of the switches having a first position and a second position, and connected so that they will be in parallel across the source of electrical energy when they are in the first position;
 - a capacitor connected in series with each of the switches so that when the switches are in the first position the capacitors will be charged and when the switches are in the second position the capacitors will be connected to the electromagnetic switch means;
 - a first resistor means connected in parallel with each of the capacitors; and
 - a second resistor means arranged to be connected in series with the capacitors when the switches are concomitantly moved to the second position for discharging the capacitors and energizing the electromagnetic switch means.
5. In a control circuit for controlling the operation of a machine, the combination of
- a source of direct current,
 - a pair of capacitors connected in parallel to one side of the source of direct current,
 - a resistor connected in parallel with each of the capacitors,
 - a pair of switches having a first position for charging the capacitors and a second position for discharging the capacitors,
 - electromagnetic means for controlling the operation of the machine, and
 - means connected in series with the electromagnetic means for altering the discharge rate of the capacitors whereby upon movement of the switches to the first position the capacitors are charged by the source of direct current and upon movement of the switches concomitantly to the second position the pair of capacitors energizes the electromagnetic means and initiates operation of the machine.

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