

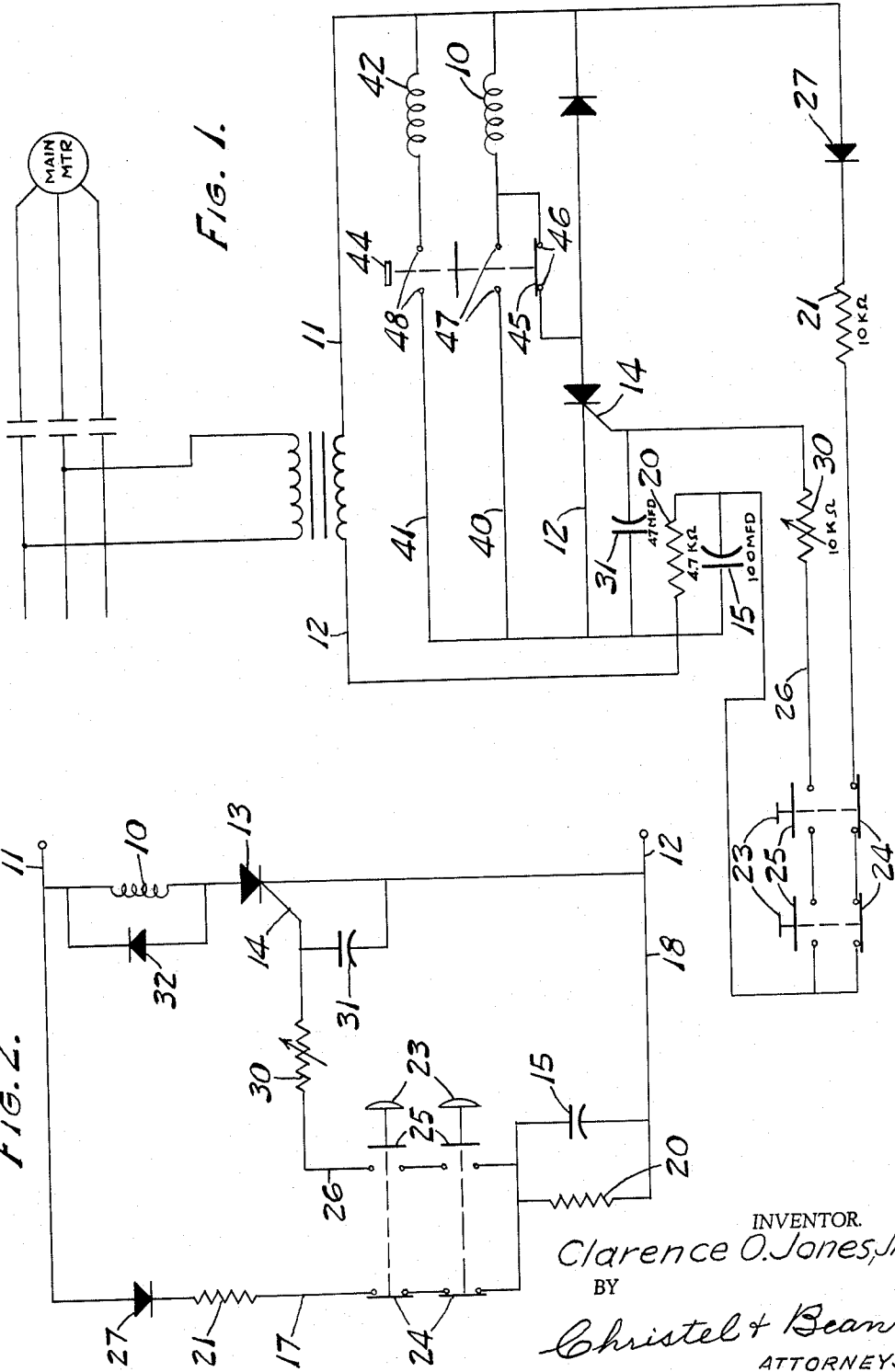
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TWO-HAND ELECTRIC CONTROL FOR MACHINES

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3,260,898 TWO-HAND ELECTRIC CONTROL FOR MACHINES

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This invention relates to novel electrical machine control means and particularly to a novel arrangement for initiating cycles of operation of a machine embodying a single revolution clutch or the like.

While the principles and circuit arrangements of the present invention may be variously applied and adapted, a particular use thereof is in conjunction with power presses, power squaring shears, press brakes, and like machines wherein the operator initiates a cycle of operation which then carries through and terminates automatically at the end of the cycle. This operation is effected most commonly by employment of a single revolution clutch which, after being tripped or engaged by manual actuation, continues through a single revolution and then automatically disengages. A clutch of this type is shown in Munschauer Patent No. 2,004,794, dated June 11, 1935.

It is common to operate single revolution clutches for this general purpose by electrical means and Munschauer Patent No. 2,404,980, dated July 30, 1946, shows a single revolution clutch wherein the usual throwout pin is actuated by an air cylinder which in turn is actuated by means of a solenoid valve in an air pressure line to the cylinder. Thus energizing the winding of the solenoid pulls the throwout pin to engage the clutch and deenergization of the winding releases the throwout pin so that it will effect clutch disengagement at the end of a cycle. For simplicity the clutch solenoid winding which is shown herein will be understood to be equivalent to the winding of the solenoid valve of this Munschauer patent.

It is an object of the present invention to provide a new and much improved and simplified two-hand electrical control means for machines embodying single revolution clutch mechanisms and electrical control means which insure against unauthorized continuous running of the machine. The manner in which these objects are attained and the means provided for such attainment will be clear to those skilled in the machine control art from a study of the following specification and the accompanying drawing which disclose a representative electrical control arrangement according to the present invention.

It is to be understood, however, that the electrical machine control arrangement shown in detail herein is by way of example only and that various modifications may be made therein without departing from the principles of the invention, the scope of which is limited only as defined in the appended claims.

In the drawing:

FIG. 1 is a wiring diagram showing one form of the electrical machine control arrangement of the present invention; and

FIG. 2 is a schematic diagram illustrating the novel operational arrangement of the circuitry of FIG. 1.

Like characters of reference denote like parts in the two diagrams. Referring first to the schematic diagram, FIG. 2, the numeral 10 designates a solenoid winding which when energized initiates a cycle of operation of a conventional single-revolution clutch of the type referred to in the preamble hereto. Accordingly, the solenoid winding 10 should be deenergized before the end of the cycle to insure clutch disengagement and machine stoppage at the end of a complete cycle.

In the schematic diagram the numerals 11 and 12 designate power supply conductors which may, for instance, supply 110 volt 60 cycle operating current to the control

circuitry. In series with solenoid winding 10 is a silicon controlled rectifier 13 which is a form of current rectifying semi-conductor having a gate connection 14. The operation is analogous to a Thyatron in that rectified current will not flow unless a sufficient threshold potential is applied at the gate connection 14 to "trigger" the rectifier 13.

The means for and the manner in which the operation of rectifier 13 is controlled by means of gate connection 14, which control determines the periods of energization of solenoid winding 10, will now be described. A charging circuit for a condenser 15 connects in parallel with the solenoid circuit by way of a lead conductor 17 and a return conductor 18. A resistor 20 is connected in parallel with condenser 15 and a resistor 21 is in series with both the condenser 15 and resistor 20.

A pair of push buttons 23 control a pair of normally closed switches 24 in conductor 17 and a pair of normally open switches 25 in a conductor 26 which extends from the charging side of condenser 15 to the gate terminal 14 of the silicon controlled rectifier 13. The push buttons are located, as is conventional in two-hand control arrangements, at spaced points so as to require the use of both hands of the operator, as for instance one on each side column of a power press.

A diode rectifier 27 supplies direct current to condenser 15. When the switches 24 and 25 are in the position shown in FIGS. 1 and 2 and the power supply 11, 12 is connected the condenser 15 becomes charged. The maximum voltage to which condenser 15 becomes charged is a function of the ratio of the resistors 20 and 21 and the time required for condenser 15 to become fully charged is determined by the resistance of resistor 21. Accordingly the switches 24 must both be closed for a predetermined time period between operating cycles of the machine to permit the accumulation of a predetermined operating charge on condenser 15.

The required waiting time between successive operations which this arrangement provides prevents operators from releasing the push buttons and immediately reclosing them to catch the clutch "on the fly" to produce unauthorized continuous running of the press. Furthermore, unauthorized avoidance of the desired two hand control is guarded against by requiring that both buttons be depressed simultaneously or relatively close together. This prevents staking or taping down of one button and other subterfuges which are practiced by workmen to avoid the desired safe two-hand operation. If one button 23 only is depressed the charge on condenser 15 will dissipate through resistor 20 in a predetermined relatively short time period depending upon the resistance of resistor 20.

Assuming that condenser 15 is charged to the required degree as indicated above, the substantially simultaneous depression of both push buttons 23 connects the positive side of condenser 15 to the gate terminal 14 of the silicon controlled rectifier 13. The potential of the charge on condenser 15 is calculated to apply a sufficient voltage to terminal 14 to trigger the rectifier 13 and permit pulsating direct current to flow in the conductor containing solenoid winding 10.

A variable resistor 30 in conductor 26 may be adjusted to vary its relative resistance with respect to resistor 20. When both buttons 23 are depressed and the charge of the condenser is applied to gate terminal 14, the charge of the condenser will begin to dissipate through resistor 20. The time required for the charge to dissipate to the minimum gate voltage depends on the relative values of the resistors 20 and 30 and the degree of maximum charge of the condenser 15, so that the period of energization of solenoid winding 10 is thus accurately controlled to provide a sufficient time period for initiating a cycle of operation of the single revolution clutch but a sufficiently limited

time to avoid initiating a second cycle even though the operator holds the two buttons 23 depressed.

A capacitor 31 which is connected from gate terminal 14 to the cathode of rectifier 13 provides a stabilizing gate bias and a diode 32 connected around solenoid winding 10 provides a surge protection which is commonly employed in semiconductor circuitry where inductive loads are present.

The foregoing describes the essential electrical arrangement and operation of the present invention. FIG. 1 is a conventional wiring diagram wherein representative or typical values of the resistors and capacitors are set forth by way of example and wherein certain ancillary circuitry is included. The elements of the schematic diagram, FIG. 2, are repeated in FIG. 1 with like characters of reference and this arrangement and operation need not be described further herein.

It is a common expedient in the power press art to employ a brake on the main shaft of a power press which is normally held constantly applied by spring means so that single operating cycles of the press are effected against the resistance of the brake. In such arrangements it is desired that the brake be released if the press is to run continuously so that overheating of the brake is avoided. FIG. 1 shows a control arrangement wherein provision is made for either single cycle or continuous running and for releasing a constantly applied brake during periods of continuous running.

When the controls are set for continuous running the silicon controlled rectifier 13 and its associated components are shunted out of the control system. In FIG. 1 the numeral 40 designates a conductor in parallel with silicon controlled rectifier 13 but which is also in series with the clutch solenoid winding 10. The numeral 41 designates a further shunt conductor which contains a solenoid winding 42 for effecting release of a constantly applied brake only during periods when solenoid winding 42 is energized.

A switch operating member 44 is shown in position for single cycle operation in accordance with the arrangement and procedure described in conjunction with FIG. 2. Switch operating member 44 is moved upwardly as viewed in FIG. 1 to condition the controls for continuous operation. In the illustrated position a switch 45 closes contacts 46 interposed between clutch solenoid winding 10 and silicon controlled rectifier 13. In this position of the switch operating member pairs of contacts designated 47 and 48 in the conductors 40 and 41, respectively, are open. When the switch operating member 44 is moved upwardly contacts 47 and 48 are closed and the circuit between winding 10 and rectifier 13 is opened, at contacts 46, whereby the clutch is continuously engaged and the brake is continuously held disengaged.

I claim:

1. A two-hand tripping control for cyclic actuation of machinery comprising a machine actuating solenoid winding and means requiring intermittent energization thereof for effecting successive cycles with predetermined time intervals between such intermittent energizations, said means comprising a silicon controlled rectifier in series with said winding and having a gate terminal, an operating circuit for applying potential to said gate terminal to render said rectifier operative to energize said solenoid winding, a pair of normally closed switches and a capacitor connected in series in said circuit for applying a positive charge to one side of said capacitor, a conductor between said side of said capacitor and said gate terminal and a pair of normally open switches in series therein, a pair of spaced switch operators each controlling one of said normally closed switches and one of said normally open switches, and a resistance connected in parallel with said capacitor.

2. A two-hand tripping control for cyclic actuation of machinery comprising a machine actuating solenoid winding and means requiring intermittent energization thereof

for effecting successive cycles with predetermined time intervals between such intermittent energization, said means comprising a silicon controlled rectifier in series with said winding and having a gate terminal, an operating circuit for applying potential to said gate terminal to render said rectifier operative to energize said solenoid winding, a pair of normally closed switches and a capacitor connected in series in said circuit for applying a positive charge to one side of said capacitor, a conductor between said side of said capacitor and said gate terminal and a pair of normally open switches in series therein, a pair of spaced switch operators each controlling one of said normally closed switches and one of said normally open switches, a resistance connected in parallel with said capacitor, and a variable resistor in the conductor between said capacitor and said gate terminal.

3. A two-hand tripping control for single revolution clutches comprising a clutch actuating solenoid winding and means preventing continuous energization thereof and providing predetermined time intervals between energizations, said means comprising a silicon controlled rectifier in series with said winding having a gate terminal, an operating circuit for applying potential to said gate terminal to render said rectifier operative to energize said solenoid winding, a pair of normally closed switches and a capacitor connected in series in said circuit for applying a charge to said capacitor, a conductor between said capacitor and said gate terminal and a pair of normally open switches in series therein, a pair of spaced manual switch operators each adapted to simultaneously reverse one of said normally closed switches and one of said normally open switches, and a resistance connected in parallel with said capacitor.

4. A two-hand tripping control for single revolution clutches comprising a clutch actuating solenoid winding and means preventing continuous energization thereof and providing predetermined time intervals between energizations, said means comprising a silicon controlled rectifier in series with said winding having a gate terminal, an operating circuit for applying potential to said gate terminal to render said rectifier operative to energize said solenoid winding, a pair of normally closed switches and a capacitor connected in series in said circuit for applying a charge to said capacitor, a conductor between said capacitor and said gate terminal and a pair of normally open switches in series therein, a pair of spaced manual switch operators each adapted to simultaneously reverse one of said normally closed switches and one of said normally open switches, a resistance connected in parallel with said capacitor, and a variable resistor in the conductor between said capacitor and said gate terminal.

5. A two-hand tripping control for cyclic actuation of machinery comprising a machine operating solenoid winding and means requiring intermittent energization thereof with predetermined time intervals between such intermittent energizations, said means comprising a silicon controlled rectifier in series with said winding having a gate terminal, an operating circuit for applying potential to said gate terminal to render said rectifier operative to energize said solenoid winding, a pair of normally closed switches and a capacitor connected in series in said circuit for applying a charge to said capacitor, a resistor in series with said capacitor for regulating the charging time thereof and a resistance connected in parallel with said capacitor, said resistors being proportioned to control the degree to which said capacitor is charged, a conductor between said capacitor and said gate terminal and a pair of normally open switches in series therein, and a pair of spaced switch operators each controlling one of said normally closed switches and one of said normally open switches.

6. A two-hand tripping control for cyclic actuation of machinery comprising a machine operating solenoid winding and means requiring intermittent energization thereof with predetermined time intervals between such inter-

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mittent energizations, said means comprising a silicon controlled rectifier in series with said winding having a gate terminal, an operating circuit for applying potential to said gate terminal to render said rectifier operative to energize said solenoid winding, a pair of normally closed switches and a capacitor connected in series in said circuit for applying a charge to said capacitor, a resistor in series with said capacitor for regulating the charging time thereof and a resistance connected in parallel with said capacitor, said resistors being proportioned to control the degree to which said capacitor is charged, a conductor between said capacitor and said gate terminal and a pair of normally open switches in series therein, a pair of spaced switch operators each controlling one of said normally closed switches and one of said normally open switches, and a variable resistor in the conductor between

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said capacitor and said gate terminal, the ratio of the resistances of said parallel connected resistor and said variable resistor controlling the time period for which operating potential is applied to said gate terminal before the charge of said capacitor is dissipated.

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