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CONTROL SYSTEM FOR CYCLICALLY OPERATING MACHINES

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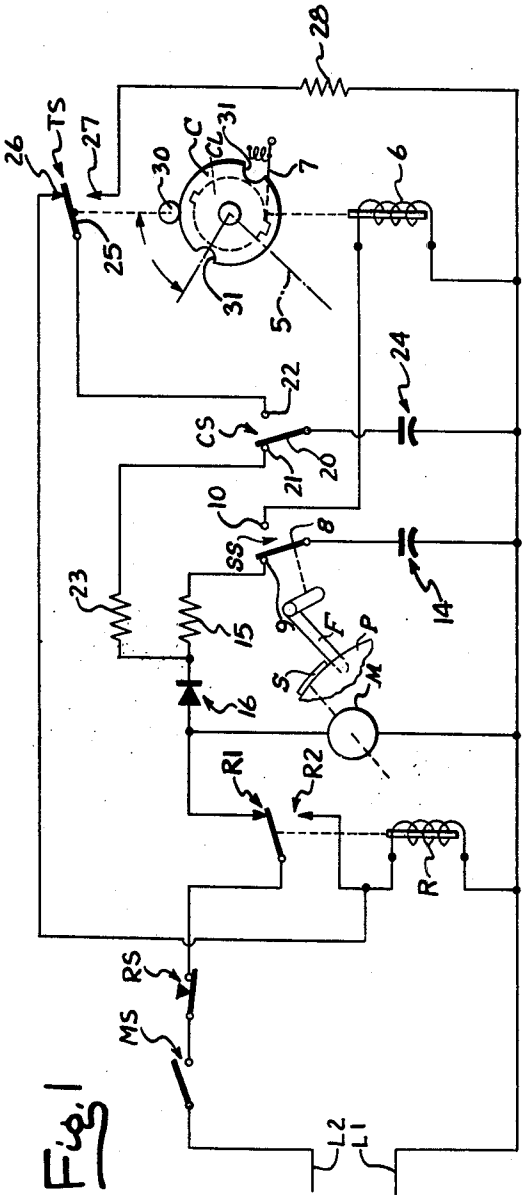


Fig. 1

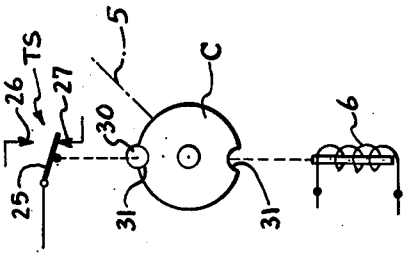


Fig. 2

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CONTROL SYSTEM FOR CYCLICALLY OPERATING MACHINES

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The present invention relates to machines for printing, perforating or otherwise treating sheet material such as checks, bills, cards and comparable items, and it is more particularly concerned with the control of the cyclic operation of such machines.

One object of the invention is to provide an improved control system for machines of the above general character embodying novel means for initiating an operating cycle in response to the presentation of a sheet or card thereto and for insuring single cycle operation for each item.

Another object is to provide a control system operative to insure proper registration of the item for perforating and printing and effective to shut off the machine in case the item gets out of step with the mechanism.

A further object is to provide a control system for cyclically operating machines which is simple in construction and efficient and reliable in operation.

Other objects and advantages of the invention will become apparent from the following detailed description of the preferred embodiment illustrated in the accompanying drawing in which:

FIGURE 1 is a circuit diagram of a control system embodying the features of the invention; and

FIG. 2 is a fragmentary view of the system showing the timing cam in the rest position.

While a single preferred embodiment of the invention has been shown and will be described herein, there is no intention to limit the invention to details of the exemplary embodiment. The intention is to cover all modifications and adaptations falling within the spirit and scope of the invention as more broadly or generally characterized in the appended claims.

By way of illustration, the improved control system has been shown in a form particularly suitable for use in a perforating machine P such as that disclosed in the copending application of William H. Dreyer, Serial No. 766,044, filed October 8, 1958. This and comparable machines are conventionally driven by an electric motor M which runs continuously while the machine is in operation. In the exemplary machine the motor M drives sheet feeding mechanism which carries a succession of sheets or cards S to a cyclically operating perforating mechanism.

The perforating mechanism, which is preferably rotary, is operated through a predetermined step or angle to effect the perforation of each sheet presented to the mechanism. The rotative step of the mechanism may correspond to a partial or a full revolution of the shaft by which it is driven. To insure perforation at the proper position in the sheet, the rotational cycle of the drive shaft must be synchronized precisely with the presentation of the sheet to the mechanism. For this purpose the perforating mechanism drive shaft indicated generally at **5** is driven by a clutch CL which may be of any suitable type having a driving member rotatable through a drive connection by the motor M. The driven member of

the clutch is mounted on or suitably connected to the shaft **5**.

In machines of the type under consideration the clutch CL is engaged to drive the shaft **5** under control of the sheet to be perforated incident to its movement by the feed mechanism to the perforating or other treating mechanism. Such control is ordinarily effected by means of a feeler or trip finger F positioned to be engaged by the moving sheet S as it approaches the perforating mechanism. Disengagement of the clutch is effected automatically upon rotation of the shaft through a predetermined angle.

In the exemplary control system, engagement of the driving clutch for the shaft is effected by energization of a solenoid **6** which acts to retract a spring biased stop pawl **7** normally positioned to engage an abutment on the driven clutch member to positively restrain it against rotation. When the stop pawl is withdrawn, the clutch immediately engages and drives the shaft **5**. Upon de-energization of the solenoid **6**, the stop pawl **7** is returned by its spring to clutch disengaging position and rotation of the shaft **5** is positively interrupted when the pawl intercepts the abutment on the driven clutch member.

In the exemplary control system, the motor M for driving the machine has one terminal connected to one conductor L1 of a conventional power line. The other conductor L2 of the line is connected by way of a main switch MS, a normally closed, manually operable reset switch RS and normally closed switch contacts R1 of a relay R with the other terminal of the motor. Switch MS is closed manually to place the machine in operation. It completes the operating circuit for the motor M which runs continuously as long as the machine functions properly or until the main switch is opened manually to stop the machine.

To synchronize the rotation of the drive shaft **5** with the movements of the sheets to be perforated, the sheet detecting feeler F of the machine is arranged to actuate a starting switch SS when the leading edge of the sheet S arrives at a predetermined position relative to the perforating mechanism. Upon reference to FIG. 1 of the drawings, it will be observed that the switch SS has a movable member **8** normally engaging a stationary contact **9** and adapted to swing away from that contact and engage another stationary contact **10** upon actuation by the feeler F.

In accordance with one aspect of the invention, the improved control system embodies novel means for effectively limiting rotation of the shaft **5** to one rotational cycle for each sheet S presented to the mechanism. More particularly, initiation of a second cycle of the shaft is effectively precluded until the sheet initiating a cycle has passed through the mechanism and a succeeding sheet is presented thereto. For this purpose provision is made for energizing the clutch engaging solenoid **6** momentarily as each sheet S approaches the perforating mechanism and for preventing re-energization of the solenoid until that sheet has passed and another one arrives at the trip point.

To provide for such momentary energization of the clutch solenoid, the movable switch member **8** is connected to one terminal of a capacitor **14** which has its other terminal connected to the line conductor L1. Stationary contact **9** is connected to the line conductor L2, the connection including a resistor **15**, a rectifier **16**, and

the switches R1, RS and MS previously referred to. Accordingly, when the main switch MS is closed and the other elements of the control system are in their normal positions, capacitor 14 is charged from the supply line.

Upon actuation of the movable switch member 8 into engagement with the stationary contact 10, the capacitor 14 is connected to discharge through the winding of the solenoid 6 which is accordingly energized. As explained before, the solenoid retracts the stop pawl 7 to engage the clutch CL for driving the shaft 5 which immediately starts to rotate. As the solenoid 6 receives only the discharge from the capacitor 14, its energization is only momentary and consequently the stop pawl 7 is quickly returned to its normal rest position to enable it to intercept and disengage the clutch by the time the shaft has rotated through the angle which corresponds to a full cycle of the perforating mechanism. In the exemplary machine the shaft 5 rotates through a half revolution, or 180 degrees, in each operating cycle.

It will be evident that the solenoid 6 can not be reenergized to again engage the clutch until the capacitor 14 has been recharged. As recharging requires switch member 8 to return to engagement with stationary contact 9, recharging is deferred until the starting switch is released by the associated feeler F. In other words, the sheet S which initiated the cycle must move on through the perforator until it passes out of contact with the feeler F. Only momentary closure of the switch contacts 8, 9 is required to charge the condenser and consequently, the system is quickly conditioned to initiate another operating cycle upon presentation of the next sheet to be perforated.

In accordance with another aspect of the invention, the improved control system includes novel means for shutting off the machine in case the sheet or card to be perforated gets out of step with the perforating mechanism as it is advanced by the feed mechanism. For this purpose the machine is provided with a second trip finger positioned for engagement by the edge of the sheet after it has moved a predetermined distance beyond the first feeler or trip finger. This second trip finger is arranged to operate a control switch CS herein shown as having a movable member 20 normally engaging a stationary contact 21. When the trip finger is engaged by the sheet, the movable member 20 is swung away from the contact 21 into engagement with a second stationary contact 22.

In the exemplary control system, the stationary contact 21 is connected through a resistor 23 to the rectifier 16 in parallel with the stationary contact 9 of the switch SS. Switch member 20 is connected to one terminal of a capacitor 24 which has its other terminal connected with the line conductor L1. Since the movable switch member 20 is normally in engagement with the contact 21, the capacitor is charged in the initial portion of the machine operating cycle.

Stationary contact 22 of the control switch is connected to the movable member 25 of a timing switch TS actuated by a cam C mounted on and rotatable with the shaft 5. Switch member 25 is engageable alternately with a pair of stationary contacts 26 and 27. Contact 26 is connected with one terminal of the winding of the relay R, the other terminal of the relay winding being connected to the line conductor L1. Stationary contact 27 is connected through a resistor 28 to the line conductor L1.

While the timing cam C may be of any preferred type, that shown is a circular edge cam with a cooperating follower 30. For use in the exemplary perforating machine, the cam is formed with two diametrically disposed recesses 31 dimensioned to afford clearance for movement of the follower 30 inwardly from its normal position in engagement with the peripheral edge of the cam. In that normal position, as shown in FIG. 1, the follower holds the movable member 25 of the timing switch in engagement with the stationary contact 26. When the follower drops into the recess 31, as shown in FIG. 2, switch member 25 swings away from contact 26 and engages contact 27.

The cam C is fixed to the shaft 5 in a position such that the recess 31 is presented to the follower at precisely the same instant a properly positioned sheet engages the second trip finger and actuates the control switch CS. If the timing of the sheet movement is correct, capacitor 24 is connected by way of switch member 20, contact 22, switch member 25, contact 27 and resistor 28 to line conductor L1, and its charge is dissipated through the resistor.

If the movement of the sheet is improperly timed and switch CS is actuated either too late or too early in the cycle, switch member 25 is in engagement with contact 26 when the switch member 20 is swung into engagement with the contact 22. Accordingly capacitor 24 discharges through the winding of the relay R and momentarily energizes the relay. Relay R when energized, opens switch contacts R1 to interrupt the operating circuit for the motor M. It also closes switch contacts R2 to complete a lock-up circuit for itself by way of switches RS and MS. Relay R will thus remain energized until released by manual actuation of the reset switch RS. Opening of the switch R1 interrupts the circuit for the drive motor M and accordingly the perforator stops to allow the attendant to correct the defect which caused the sheet to get out of time. Upon the release of the relay through manipulation of the switch RS, the machine may be started in a normal operating cycle by actuation of the switch MS as before explained.

It will be apparent from the foregoing that the invention provides a control system of novel and advantageous character particularly suitable for the control of machines operating in cycles. The improved control system insures single cycle operation of the machine. It is extremely simple in construction and efficient and reliable in operation. The improved system also includes novel means for stopping the machine in case the sheet or other item passing through it gets out of step with the mechanism for acting on that sheet.

I claim as my invention:

1. In a machine for acting on successive sheets of material fed through the machine, in combination, an electric motor, a power line supplying operating current to said motor, a relay operative when energized to interrupt the supply of current to said motor, a starting switch and a control switch spaced apart for actuation in predetermined timed relation by the sheets as they are fed through the machine, a shaft to be rotated cyclically by a clutch in timed relation to the movements of the sheets, a solenoid operative when energized to engage the clutch to initiate the rotation of said shaft and effective upon deenergization to disengage the clutch to interrupt the rotation after the shaft has rotated through a predetermined angle, a cam on said shaft, a timing switch actuated by said cam in predetermined angular positions of said shaft, a pair of capacitors, a circuit for charging one of said capacitors from said power line normally closed by the starting switch, a circuit for charging the other of said capacitors from said power line normally closed by the control switch, said starting switch when actuated connecting said one capacitor to discharge through said solenoid and momentarily energize the same to initiate the rotation of said shaft, and a circuit controlled jointly by said control switch and said timing switch for connecting said second capacitor to discharge through said relay and thereby stop said motor, said cam being operative to actuate said timing switch and open said relay circuit to prevent energization of the relay when said first and second switches are actuated in said predetermined timed relation.

2. In a machine for acting on successive sheets of material fed through the machine, in combination, an electric motor for driving the machine, a relay operated switch controlling the supply of operating current to the

motor, a cyclically operating shaft, a clutch for driving said shaft, a starting switch and a control switch spaced apart for actuation in predetermined timed relation by the sheets as they are fed through the machine, a circuit closed by said starting switch when actuated effective to engage said clutch to initiate the rotation of said shaft, a timing switch, a cam on said shaft operative to actuate said timing switch in predetermined angular positions of the shaft, and a circuit controlled jointly by said control switch and said timing switch for causing said relay operated switch to be actuated when said control switch and said timing switch are actuated other than simultaneously.

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