July 21, 1942. C. H. MORE 2,290,198

ELECTRO-MECHANICAL RELAY

Filed Dec. 28, 1938

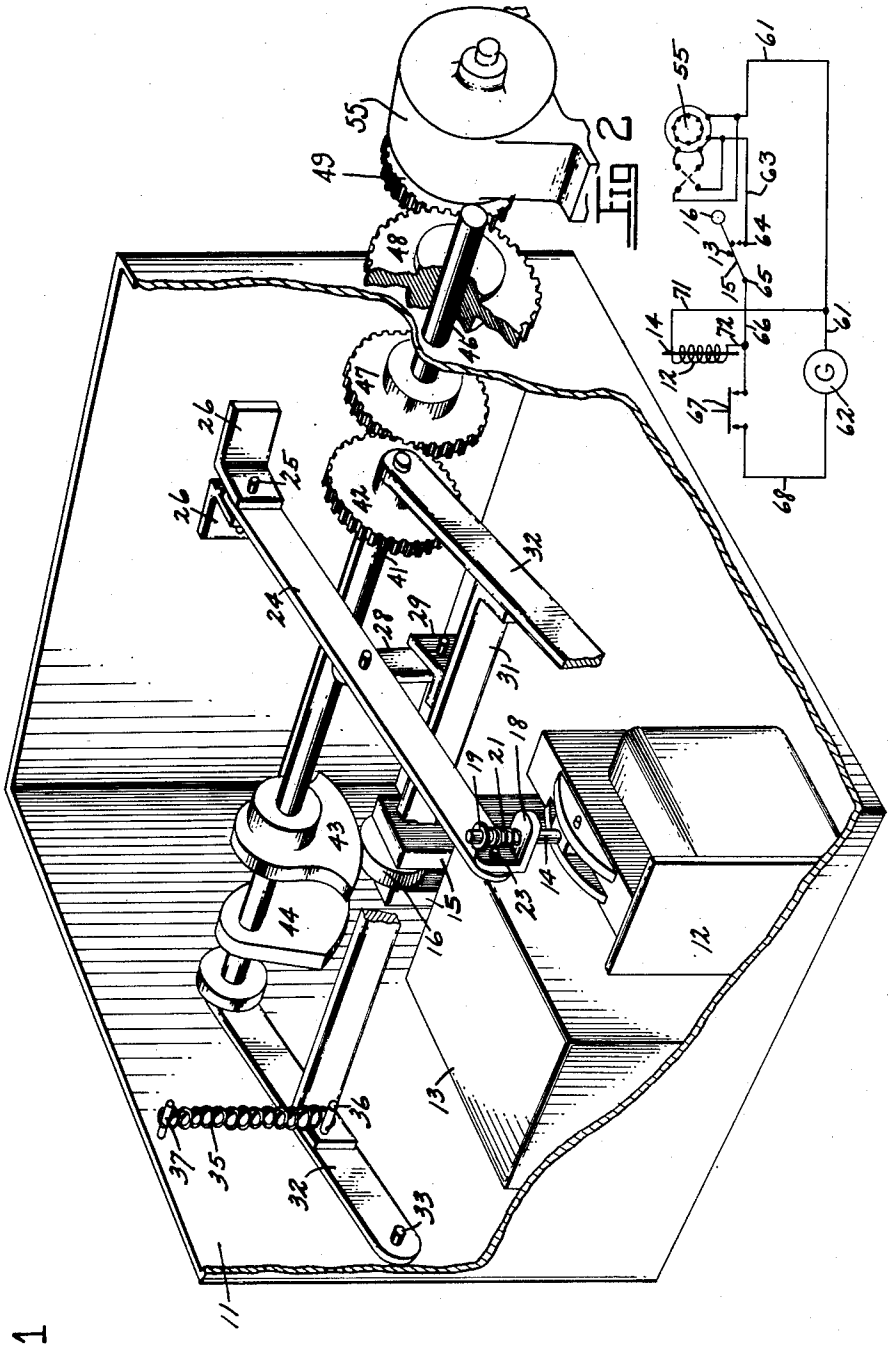


Fig 1

Fig 2

INVENTOR.
Charles H. More

BY Ivan D. Thornburgh
Charles A. Long
ATTORNEYS

Patented July 21, 1942 2,290,198

UNITED STATES PATENT OFFICE

2,290,198

ELECTROMECHANICAL RELAY

Charles H. More, Red Bank, N. J., assignor to American Can Company, New York, N. Y., a corporation of New Jersey

Application December 28, 1938, Serial No. 248,119

6 Claims. (Cl. 172—239)

The present invention relates to an electro-mechanical relay and has particular reference to a jog limit relay used for controlling the slow operating or turning over of automatic machinery in a step-by-step motion as when setting or adjusting the machine parts prior to full operation of the machine.

Some types of automatic machines require setting or adjusting prior to starting them in full operation and for best results such a machine is usually actuated or turned over slowly by hand and stopped at predetermined places in the cycle of its operation to effect the required setting or adjustments. Occasionally such machines are too heavy to turn over by hand with the result that frequent hit or miss adjustments must be made and numerous short trial runs must be effected before finally obtaining the required setting pror to full operation of the machine.

The present invention contemplates an electro-mechanical jog relay which may be operated to control the actuating of a machine in slow step-by-step manner as done by hand but under its own power. Thus the machine may be rapidly started and stopped at predetermined places in its cycle of operation or actuated through a definite number of revolutions or partial revolutions to bring certain parts of the machine into alignment or into a required position for proper setting or adjustment.

An object therefore of the invention is the provision of an electro-mechanical jog limit relay which is adapted, when once set in motion, of starting and stopping an automatic machine so that it will turn over a predetermined number of revolutions or a partial revolution as desired thereby bringing into position parts of the machine which are required to be set or adjusted prior to full operation of the machine.

Numerous other objects and advantages of the invention will be apparent as it is better understood from the following description which, taken in connection with the accompanying drawing, discloses a preferred embodiment thereof.

Referring to the drawing:

Figure 1 is a perspective view of an electro-mechanical jog limit relay embodying the instant invention, with parts broken away; and

Fig. 2 is a wiring diagram of the electric apparatus used with and in the relay.

As a preferred embodiment of the invention the drawing illustrates an electro-mechanical jog limit relay which is housed in a casing 11 (Fig. 1) and which includes a solenoid 12 and a toggle limit switch 13 which constitutes means for governing the operation of the relay. The solenoid is provided with a vertically movable core 14 and the toggle limit switch 13 has a movable element 15 carrying a roller 16. The upper end of the solenoid core 13 extends through a swivel link 18 and above the link it carries a collar 19. A compression spring 21 is coiled around the core between the link and the collar and thereby provides a yieldable connection between the core and the link.

The solenoid link 18 is mounted on a pivot pin 23 secured in one end of an actuating arm 24. The arm extends across the casing 11 and at its opposite end is mounted on a pivot pin 25 carried in lugs 26 secured to the inside of the casing. Intermediate its length the actuating arm is connected by a link 28 to a lug 29 secured to a transverse movable cross-beam 31.

The ends of the cross-beam 31 are secured to a pair of rocker arms 32 intermediate their lengths. At their inner ends the rocker arms are mounted on pivot pins 33 secured in the casing side walls, the arms and the cross-beam providing a pivotally mounted generally V-shaped frame member or support for movable parts hereinafter described. The said frame member comprising the cross-beam and the rocker arms is normally held in a suspended position within the casing 11 by a coiled tension spring 35. One end of the spring is secured to a pin 36 carried in the cross-beam while its opposite end is secured to a pin 37 secured in the casing side wall.

The outer ends of the rocker arms 32 carry a rocker shaft 41 on which is mounted a driven element or gear 42, an edge cam 43 which is in alignment with the limit switch roller 16, and a counter-balance weight or reset instrumentality 44. Parallel with the rocker shaft 41 there is provided a drive shaft 46 which is carried in suitable bearings formed in the side walls of the casing 11. Inside the casing the shaft carries a driving element or gear 47 which is in alignment with the rocker shaft gear 42 but is normally out of mesh with this gear. It is the tension spring 35 hereinbefore mentioned that holds these gears in this unmeshed relation.

Outside the casing 11 the drive shaft 46 carries a drive gear 48 which is in constant mesh with a main gear 49. The main gear may be operated in any suitable manner from the machine to be controlled or may, if desired, be mounted on the motor shaft of the electric motor

or the like which operates the machine. In order to simplify the description in this specification it will be assumed that the gear 49 is mounted on the shaft of a reversible electric motor which is the main source of power for the machine to be controlled. This motor is indicated by the numeral 55 in the wiring diagram in Fig. 2.

Referring now to the wiring diagram in Fig. 2 it will be observed that one side of the motor 55 is connected by a lead wire 61 to a main source of supply of electric energy such as a generator 62. The other side of the motor is connected by a lead wire 63 to a terminal 64 of the normally open limit switch 13 disposed in the casing 11. An opposite terminal 65 of the limit switch is connected by a wire 66 to one side of a manually operated and normally open start switch 67. The other side of this start switch is connected by a wire 68 to the generator.

The solenoid 12 also receives energy from the generator 62. For this purpose one side of the solenoid is connected by a wire 71 to the lead wire 61. The other side of the solenoid is connected by a wire 72 to the wire 66.

Hence when the start switch 67 is closed there is immediately established a closed circuit which includes the solenoid 12 but which does not include the limit switch or the motor. Electric energy from the generator 62 passes along wire 68, through the closed start switch 67, wire 66, solenoid 12, wire 71, returning to the generator along wire 61. The solenoid thus becomes energized.

Energizing of the solenoid 12 draws its core 14 down within the solenoid and hence pulls down the connected end of the actuating arm 24. This action depresses the rocker arms 32 against the resistance of the spring 35 and thus brings the gear 42 into mesh with the gear 47. Depression of the rocker arms 32 also brings the high spot of the edge cam 43 down against the roller 16 of the limit switch 13. This depresses the movable element 15 of the limit switch and hence closes the switch.

Immediately upon closing of the limit switch a second electric circuit is established which includes the electric motor 55. Electric energy from the generator 62 passing along the wire 66 will continue on through the closed limit switch 13, wire 63, motor 55, and return by way of wire 61 to the generator. The motor is thus excited and hence starts operating the machine and also rotates the gears 49, 48, shaft 46 and gear 47. This rotates the gear 42 and its shaft 41 which carries the edge cam 43. The cam is thus also rotated until its high spot rides off the switch roller 16. When this happens the movable element 15 of the switch is released and moves up under spring action and thereby opens the switch. This breaks the motor circuit and hence the motor stops. The connected machine and the gear train of the relay also stop. Thus the machine is jogged along or turned over through a predetermined cycle.

When the motor 55 stops, the start switch 67 is manually opened and the solenoid circuit is thereupon broken. This de-energizes the solenoid 12 and hence permits the tension spring 35 to lift the rocker arms 32. The gear 42 is thus disengaged from gear 47. This unmeshing of the gears permits the counter-balance weight 44 to rock the cam shaft 41 and thus return the cam 43 to its original position ready for a subsequent jogging movement.

This construction of edge cam and counterbalance weight is designed to operate in either direction of the rotation of the shaft 41 and gear 42 so that when a reversible motor is used to operate the machine to be controlled the relay will operate equally well in either direction. For this purpose the edge cam 43 is constructed symmetrically the middle portion of its high spot being normally positioned over the cam roller 16 by the counterbalance weight when the latter is in its normal position.

It is thought that the invention and many of its attendant advantages will be understood from the foregoing description, and it will be apparent that various changes may be made in the form, construction and arrangement of the parts without departing from the spirit and scope of the invention or sacrificing all of its material advantages, the form hereinbefore described being merely a preferred embodiment thereof.

I claim:

1. An electro-mechanical jog limit relay for controlling the turning over of a machine under its own power in a step-by-step movement, which comprises a driving element, driving element actuating means, a driven element normally out of driving engagement with said driving element, devices for bringing said driven element into driving engagement with said driving element and for establishing a driving relation therebetween, a cam member operable by said driven element for limiting the duration of drive between said driven and driving elements so that the latter will operate through a predetermined jog cycle, and a counter-balance weight cooperating with said cam member for re-setting the latter so that it will be ready for a subsequent operation after the completion of a jog cycle of said driving element actuating means.

2. An electro-mechanical jog limit relay for controlling the turning over of a machine under its own power in a step-by-step movement, which comprises a pivotally mounted frame member, a driving element, electric actuating means for said driving element, a driven element carried by said frame and normally out of driving engagement with said driving element, a solenoid adapted to be energized for bringing said driven element into driving engagement and relation with said driving element, instrumentalities for energizing said solenoid, an electric limit switch for energizing said electric actuating means so that the latter will operate through a predetermined cycle, and a cam member carried by said driven element for operating said limit switch and for controlling the duration of drive between said driving and driven elements.

3. An electro-mechanical jog limit relay for controlling the turning over of a machine under its own power in a step-by-step movement, which comprises a pivotally mounted frame member, a driving element, electric actuating means for said driving element, a driven element carried by said frame and normally out of driving engagement with said driving element, a solenoid adapted to be energized for bringing said driven element into driving engagement and relation with said driving element, an electric switch connected in circuit with said solenoid for energizing the latter, an electric limit switch for governing the operation of said electric actuating means so that the same will operate through a predetermined jog cycle, a cam member carried by said driven element and operable by pivotal movement of said frame for operating said limit

switch, to establish the aforesaid driving relation between said driving and driven elements, said cam member being further operable to control the duration of drive between said driving and driven elements, and a counter-balance weight associated with said cam for re-setting the same so that it will be ready for a subsequent switch actuating operation after the completion of a jog cycle of said electric actuating means.

4. An electro-mechanical jog limit relay for controlling the turning over of a machine under its own power in a step-by-step movement, which comprises a driving gear, an electric motor for rotating said driving gear, a movable swing, a driven gear mounted in said swing in alignment with but spaced apart from said driving gear, an electric solenoid having a movable core connected with said swing, said solenoid being adapted to be energized for moving its core and the swing to bring said driven gear into mesh with said driving gear, an electric switch connected in circuit with said solenoid for energizing the same, an electric limit switch connected in circuit with said electric motor for starting and stopping said motor so that it will operate through a predetermined jog cycle, a cam mounted in said swing and adapted to be shifted into engagement with said limit switch for operating the same when said swing moves to bring said gears into meshed relation, said cam also being rotatable by said driven gear in either direction for releasing said limit switch after a predetermined jog cycle of said motor, and a tension spring connected with said swing for withdrawing said driven gear out of mesh with said driving gear at the completion of a jog cycle.

5. An electro-mechanical jog limit relay for controlling the turning over of a machine under its own power in a step-by-step movement, which comprises a driving element, driving element actuating means, a driven element pivotally mounted adjacent said driving element and normally out of driving relation therewith, devices for moving said driven element bodily on its pivotal mounting into driving relation with said driving element, and means operable by said driven element for controlling the duration of drive of said driven and driving elements so that the latter will operate through a predetermined jog cycle, said controlling means being further operable to render effective said driving element actuating means.

6. An electro-mechanical jog limit relay for controlling the turning over of a machine under its own power in a step-by-step movement, which comprises a driving element, driving element actuating means, a driven element pivotally mounted adjacent said driving element and normally out of driving engagement therewith, devices for moving said driven element bodily on its pivotal mounting into driving engagement with said driving element for establishing a driving relation therebetween, a rotatable cam member carried by said driven element and bodily movable therewith, and an electrical switch operable by the bodily movement of said cam member to energize and de-energize said driving element actuating means for controlling the duration of drive thereby.

CHARLES H. MORE.