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ELECTRICAL PULSATING DRIVE

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FIG 1

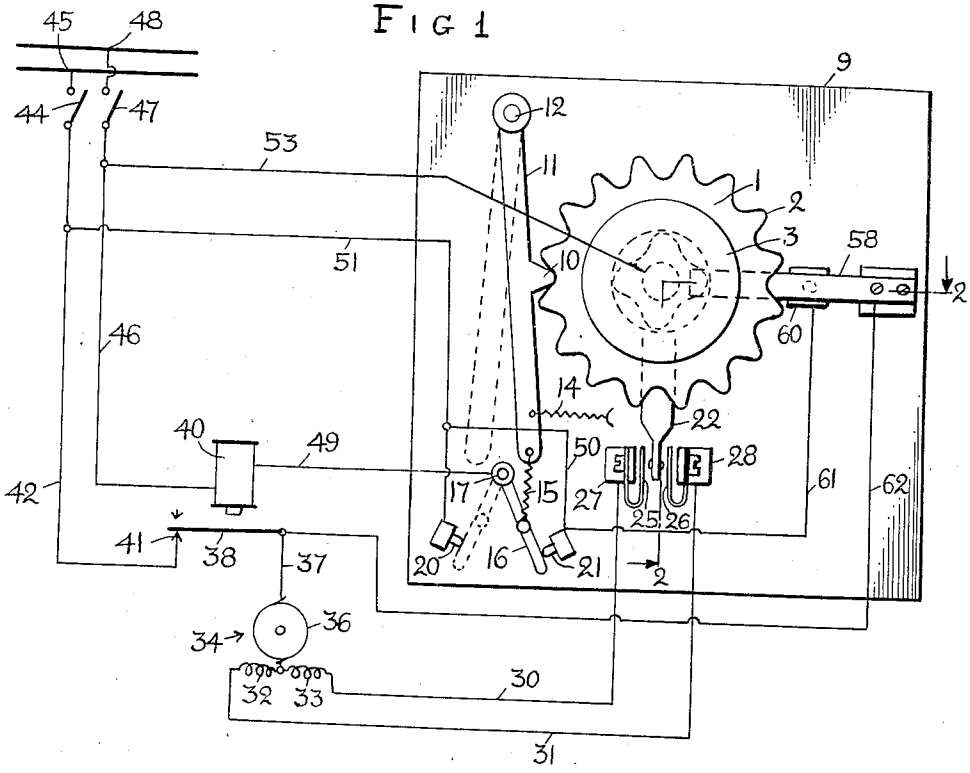
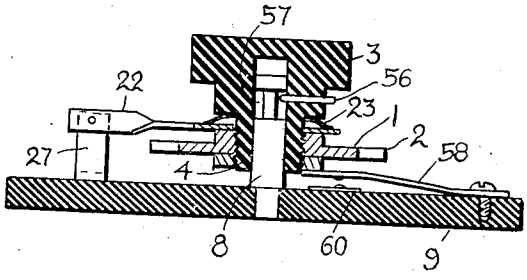


FIG. 2



MICHEL N. YARDENY
CHARLES PRINDLE
INVENTORS

BY Frederick E. Haynes
ATTORNEY

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ELECTRICAL PULSATING DRIVE

Michel N. Yardeny, New York, and Charles Prindle, Long Island City, N. Y.; said Prindle assignor to said Yardeny

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8 Claims. (Cl. 318—257)

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This invention relates to control devices, and has particular reference to control devices for supplying energy to electrical devices such as motors at a desired rate.

The main object of this invention is to provide a control apparatus of the foregoing general type adapted to be manually operated for controlling the flow of electric current to a motor or similar device in such a manner that the energy is supplied to the device by impulses so that the average amount of power delivered per unit of time may be varied by varying the number and/or duration of impulses per unit of time, thereby controlling, for instance, the speed of the motor.

An allied object of this invention is to provide means to prevent the flow of current to the motor when the control device is not operated.

A further object of the invention is to provide means to establish a continuous flow of energy when the control device is manipulated at a sufficiently rapid rate.

Still a further object of this invention is to provide supplementary means for connecting the motor directly to a source of current.

The foregoing and other objects, features and advantages of this invention are more fully described in the accompanying specification and drawing, in which:

Fig. 1 is a diagrammatic plan view showing a now preferred embodiment of a control device according to the invention and the electrical connections thereof; and

Fig. 2 is a sectional elevational view of the control device along line 2—2 of Fig. 1.

The control device according to this invention comprises a star or toothed wheel 1 having cam-shaped teeth 2, and threaded on a stem of an insulation knob 3 to which it is secured by a lock nut 4. The knob 3 is mounted for rotation on a vertical shaft 8 extending from an insulation base 9, and may be knurled at the periphery to facilitate its manual operation.

The teeth 2 engage a lug or tooth 10 on a lever 11 pivotally mounted at one end on a pin 12 extending from the base 9. A spring 14 urges lever 11 towards the star wheel 1. The other end of lever 11 is connected by a spring 15 to the contact arm 16 pivotally supported on a fixed pin 17 and positioned to engage one or the other of contacts 20, 21 mounted on base 9.

The knob 3 further carries a contact arm 22 frictionally retained in its place by a spring washer 23 pressing the contact arm against a hub of star wheel 1. The end of the arm 22 moves between stationary resilient contacts 25, 26 supported by posts 27, 28 extending from base 9. The contacts 25, 26 are connected by leads 30, 31 to the ends reversing field windings 32, 33 respectively of a motor 34. The other ends of the windings are joined together and connected to one terminal of the motor armature 36. The other armature terminal is connected by a lead 37 to an armature 38 of a relay 40. The relay armature 38 normally engages a contact 41 connected by a lead 42 through a switch 44 to a terminal 45 of a source of current. One terminal of the relay 40 is connected by a lead 46 through a switch 47 to the other terminal 48 of the source of current, the other relay terminal being connected by a lead 49 to the contact arm 16. The contacts 20, 21 are connected by leads 50, 51 to the supply wire 42. The contact arm 22 is connected by a lead 53 to the supply wire 46.

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As will be seen on the drawing, the contact arm 16 normally engages one or the other of the contacts 20, 21, thus energizing the relay 40 through leads 51 and 49, whereby the motor circuit is interrupted. For energizing the motor, the knob 3 is manually rotated, causing the successive teeth 2 to engage the tooth 10 thereby reciprocating the lever 11 about its pivot 12. It may be noted that the spring 15 urges the contact arm 16 into the engagement with one or the other of the contacts 25, 26, depending on the position of the lever 11, relative to pivot 17 of arm 16. When the lever 11 is moved from one of its extreme positions as, for instance, from the position shown in full lines in Fig. 1 into the position shown in dashed lines, spring 15 will continue to press arm 16 against contact 21 until the end of the lever passes to the other side of the pivot 17, whereupon the direction of the pull of spring 15 will be changed, causing the arm 16 to snap from its extreme right position to its extreme left position, in which it engages the contact 20. In either of these positions relay 40 will be energized, the current passing from supply wire 42 through lead 51, contact 20, or lead 50 and contact 21, contact arm 16, lead 49, relay coil 40 to supply lead 46. The energized relay will attract the armature 38, breaking the motor circuit at contact 41, thereby deenergizing the motor. The relay will be deenergized only during the short interval of time when the contact arm 16 snaps from one extreme position into the other, i. e. when it is disengaged from either of the contacts 20, 21.

The motor will be energized for rotation in one or the other direction, depending on the direction of rotation of the knob 3. Assuming that the knob is turned to the right, the contact

arm 22 will be pressed against the resilient contact 25, and the motor circuit will be closed while relay 40 is deenergized as follows: from the supply wire 46 by the lead 53, arm 22, contact 25, lead 30, winding 33, motor armature 36, lead 37, relay armature 38, contact 41, to the other supply lead 42. The motor will continue receiving impulses of current while knob 3 is rotated, the relay being alternately energized and deenergized. With the increase in the rotational speed of the knob, however, the relay will remain deenergized for a longer period after each energy impulse so that the motor will receive longer energy impulses, thereby increasing its speed. When the speed of the knob exceeds a certain limit, however, the relay will, due to its time factor or lag, cease to attract its armature and the motor will remain continuously energized.

The movable parts of the device can be so proportioned that at a sufficiently high speed of the manual rotation of the knob 3, the number of the current interruptions will be so large that the relay 40 will not be able to follow the current impulses, so that the armature 38 will remain in engagement with the contact 41, continuously energizing the motor. The latter will then receive a continuous flow of energy and will operate at a high speed for advancing a load to its final position. When the final position is approached, however, the rotation of the knob 3 is slowed down, causing the motor to receive a pulsating current with corresponding reduction in the speed of the motor. By gradually retarding the speed of the motor it becomes possible to stop the motor instantly when the exact desired position of the load is reached.

An additional attachment is provided for closing the motor circuit independently of the relay when it is desired to operate the motor at full speed without corresponding rapid rotation of the knob 3. For this purpose the knob 3 is made axially slidable on the shaft 8, being retained within certain limits by a pin 56 passing through the stem of the knob and engaging a recess 57 in the shaft 8. A resilient contact spring 58 normally holds the knob 3 in a raised position as shown in Fig. 2 separated from a contact 60.

In the event that it is desired to close the motor circuit independently of relay 40, knob 3 is depressed, thereby closing contacts 58 and 60, thereby establishing a motor circuit which may be traced from lead 51, through leads 59, 61, contacts 60, 58, leads 62, 37, motor armature 36, one of the motor windings, say winding 33, lead 30, contact 25, contact arm 22, and lead 53.

While the invention has been described in detail with respect to a certain particular preferred example, it will be understood by those skilled in the art after understanding the invention, that various changes and further modifications may be made without departing from the spirit and scope of the invention and it is intended therefore in the appended claims to cover all such changes and modifications.

What is claimed as new and desired to be secured by Letters Patent is:

1. An electric control apparatus comprising contact means; a contact arm movably supported and adapted to engage the contact means; means to periodically and alternately move the contact arm into and out of engagement with the contact means; means to render the position of the contact arm unstable between alternate positions; circuit means including the contact means for supplying electric current to an electrical device during the period of unstable arm positions and interrupting the current during the period of stable arm positions; and means included in the circuit means to vary the period of current supply relative to the period of current interruption in response to a variation of the speed of the contact arm moving means.

2. An electric control apparatus comprising contact means; a contact arm movably supported and adapted to engage the contact means; means to periodically and alternately move the contact arm into and out of engagement with the contact means; means to render the position of the contact arm unstable between alternate positions; circuit means including the contact means for supplying electric current to an electrical device during the period of unstable arm positions and interrupting the current during the period of stable arm positions; and means included in the circuit means to increase the period of current supply relative to the period of current interruption in response to an increase of the speed of the contact arm moving means.

3. An electric control apparatus comprising contact means; a contact arm movably supported and adapted to engage the contact means; means to periodically and alternately move the contact arm into and out of engagement with the contact means; means to render the position of the contact arm unstable between alternate positions; relay means; circuit means including the contact means and the relay means for supplying electric current to an electrical device during the period of unstable arm positions and interrupting the current during the period of stable arm positions, said relay means having a lag selected to increase the period of current supply relative to the period of current interruption in response to an increase of the speed of the contact arm moving means.

4. An electric control apparatus comprising a pair of contacts; a contact arm movably supported for engaging one or the other of the contacts; means to periodically and alternately move the contact arm into engagement with the contacts; means to render the positions of the contact arm between the contacts unstable; a relay for controlling an electrical device; and circuit means including the contacts and the relay for supplying electric current to the electrical device during an unstable position of the contact arm and interrupting the current when the contact arm engages one of the contacts, said relay being constructed to have progressively increasing lag in its responses to a closing of the relay circuit, thereby progressively increasing the length of current impulses to the electrical device with an increase in the frequency of the movement of the contact arm, until the current becomes continued above a certain speed.

5. An electric control apparatus comprising a pair of contacts; a contact arm movably supported for engaging one or the other of the contacts; a rotary member for periodically and alternately move the contact arm from one contact to the other; resilient means to urge the contact arm into engagement with one or the other of the contacts and to render the positions of the contact arm unstable between the contacts; circuit means including the contacts for supplying electric current to an electrical device during the period of unstable arm positions and interrupting the current during the period of stable arm positions; and means included in the circuit means to increase the period of current supply relative to the

period of current interruption in response to an increase of the speed of the rotary member.

6. An electric control apparatus comprising a pair of contacts; a contact arm movably supported for engaging one or the other of the contacts; a rotary member for periodically and alternately move the contact arm from one contact to the other; resilient means to urge the contact arm into engagement with one or the other of the contacts and to render the positions of the contact arm unstable between the contacts; relay means; circuit means including the contacts and the relay means for supplying electric current to a motor during the period of unstable arm positions and interrupting the current during the period of stable arm positions, said relay means having a lag selected to increase the period of current supply relative to the period of current interruption in response to an increase of the speed of the rotary member.

7. An electric control apparatus comprising a pair of contacts; a contact arm movably supported for engaging one or the other of the contacts; a lever pivotally supported at one end; a resilient member connecting the lever with the contact arm; a toothed rotary member; a spring urging the lever into engagement with the rotary member for urging the contact arm towards one contact or the other depending on the position of the lever and to render the positions of the contact arm unstable between the contacts; relay means; circuit means including the contacts and the relay means for supplying electric current to a motor during the period of unstable arm positions and interrupting the current during the period of stable arm positions, said relay means having a time factor selected to increase the period of current supply relative to the period of current interruption in response to an increase of the speed of the contact members.

8. An electric control apparatus comprising a pair of contacts; a contact arm movably supported for engaging one or the other of the contacts; a lever pivotally supported at one end; a resilient member connecting the lever with the contact arm; a toothed rotary member mounted for axial displacement; a spring urging the contact arm towards one or the other of the contacts depending on the position of the lever, and to render the intermediate positions of the contact arm unstable; a reversible electric motor; circuit means including the contacts and the motor for energizing the motor when the contact arm is in an unstable position; a second contact arm frictionally engaging the rotary member for rotation therewith; a pair of resilient contacts connected with the motor, the frictional contact arm being mounted and positioned to engage one or the other of the resilient contacts in response to a rotation of the rotary member for controlling the direction of the motor rotation; and circuit means to cause the motor to rotate continuously by axially moving the rotary member while maintaining engagement of the first contact arm with one of the resilient contacts.

MICHEL N. YARDENY.
CHARLES PRINDLE.