

Sept. 29, 1936.

C. H. RIPPL

2,055,707

ELECTRIC CIRCUIT TIMING APPARATUS

Filed Jan. 28, 1935

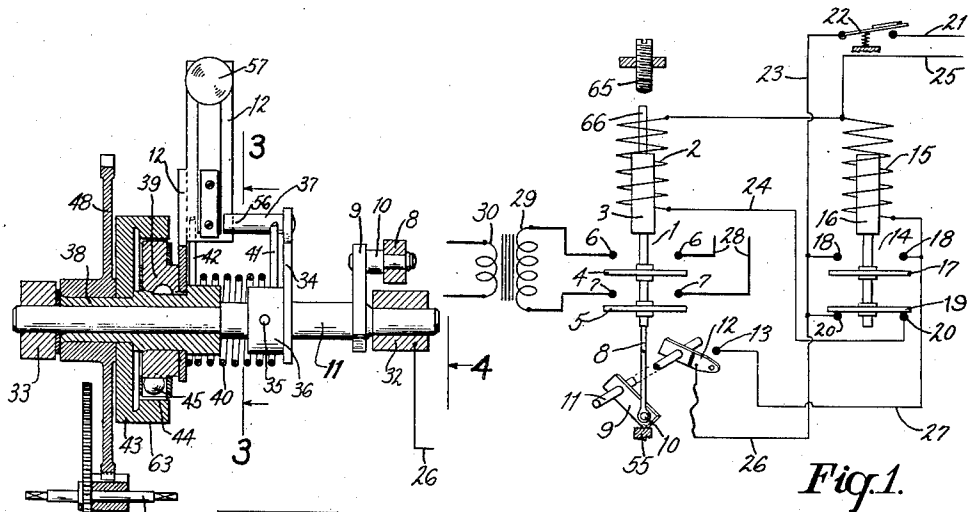


Fig. 1.

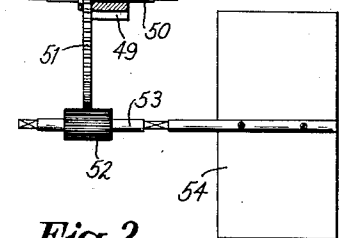


Fig. 2.

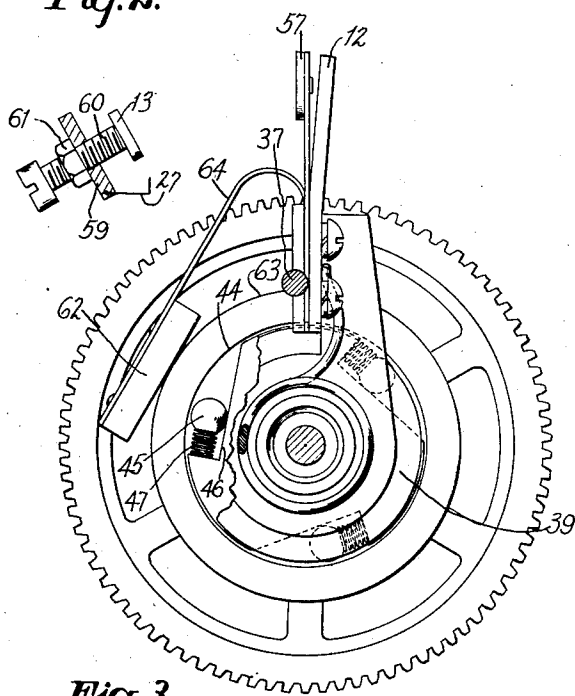


Fig. 3.

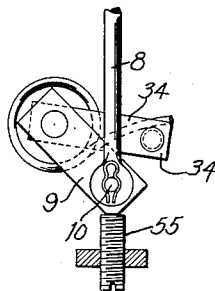


Fig. 4.

INVENTOR.

Charles H. Rippl.

b.

Slough and Caulfield
ATTORNEY.

UNITED STATES PATENT OFFICE

2,055,707

ELECTRIC CIRCUIT TIMING APPARATUS

Charles H. Rippl, Cleveland, Ohio, assignor to
The Clark Controller Company, Cleveland,
Ohio, a corporation of Ohio

Application January 28, 1935, Serial No. 3,880

6 Claims. (Cl. 161—1)

This invention relates to electric systems and apparatus of the class in which a time interval producing means maintains a predetermined condition of an electric circuit for a predetermined interval of time.

Among the many uses to which my invention may be applied is to the control of the duration of the flow of electric current used in making an electric weld.

It is among the objects of my invention:

To provide an improved electric system and apparatus for maintaining a predetermined condition of an electric circuit for a predetermined time interval;

To provide an improved electric system and apparatus whereby a predetermined electric circuit condition may be initiated at will by an operator and automatically continued in said condition for a predetermined time interval, and then be restored, independently of the operator;

To provide an improved electric switch mechanism whereby an electric circuit may be closed at will by an operator and the running of a time interval initiated thereby, and whereby at the end of the time interval the circuit may be opened automatically;

To provide an electric system and apparatus having control means actuable by an operator to effect the closing of an electric circuit and to initiate the running of a predetermined time interval and to interrupt the circuit at the end of the time interval, and having improved means to prevent closing of the circuit again until after restoration of the control means by the operator.

Other objects will be apparent to those skilled in the art to which my invention appertains.

My invention is fully disclosed in the following description taken in connection with the accompanying drawing, in which:

Fig. 1 is a diagram of electrical circuits and apparatus illustrating one embodiment of my invention in a control system;

Fig. 2 is a sectional view of an actual apparatus illustrated diagrammatically and in simplified form in Fig. 1;

Fig. 3 is a cross-sectional view taken approximately from the plane 3—3 of Fig. 2;

Fig. 4 is an elevational view taken from the plane 4—4 of Fig. 2.

Referring to the drawing, I have shown at 1 generally an electro-magnetic switch comprising a winding 2 and an armature or plunger 3, movable switch arms 4 and 5 engageable respectively with stationary contacts 6—6 and 7—7 when the winding 2 is energized and the plunger 3 elevated.

A stem 8 connected to the plunger 3 to be lifted thereby is pivotally connected at its lower end to an arm 9 by having pivot connection with a pin 10 on the arm 9. Vertical movements of the stem 8, by oscillating the arm 9, oscillate a shaft 11, the oscillatory movements of which are communicated to a mechanism switch arm 12 through a time interval producing mechanism, omitted from Fig. 1 to simplify the diagram but shown in detail in the other figures of the drawing; the mechanism operating to move the switch arm 12 to engage a stationary contact 13 a predetermined adjustable time interval after the upward movement of the stem 8 caused by energization of the winding 2, and to disengage the arm 12 from the contact 13 upon downward movement of the stem 8 following de-energization of the winding 2.

Indicated generally at 14 is an electro-magnetic relay comprising a winding 15, an armature or plunger 16, a movable switch arm 17 normally disengaged from a pair of contacts 18—18, and a movable switch arm 19 normally engaged with a pair of contacts 20—20, the contacts 18—18 being engageable and the contacts 20—20 being disengageable by their respective switch arms 17 and 19 upon elevation of the plunger 16 when the winding 15 is energized.

Control current from a supply main 21 flows, under the control of a manually operable switch 22, by a wire 23 through the normally closed contacts 20—19—20 and by a wire 24 to and through the winding 2 and thence back to the supply by a main 25. Current may also flow from the main 21 under the control of the manual switch 22 by the wire 23 and by a wire 26 through the contacts 12—13 when closed and thence by wire 27 to and through the winding 15 and back to the supply main 25.

When the relay 14 has been operated, current may flow under the control of the manually operable switch 22 by the wire 23 and through the contacts 18—18 to the winding 15, thus providing a holding or maintaining circuit for the winding 15 under the control of the manually operable switch 22.

In the embodiment of my invention illustrated, the main switch 1 controls the current from a pair of supply mains 28 to the primary 29 of a transformer, the secondary 30 of which may energize any suitable apparatus such as the welding circuit of a welding apparatus.

When the embodiment of my invention illustrated in Fig. 1 diagrammatically is employed to control the flow of current used in making electric welds, the operation thereof is as follows:

To supply the welding current for a predetermined time interval only, the operator closes the manually operable switch 22 which for convenience may be of the treadle type, and holds it closed, regardless of the time interval desired. Current then flows through the switch 22 and contacts 20—20 of the relay 14 through the winding 2 of the magnetic switch 1 back to the main 25 whereupon the switch 1 operates, moving its switch arms 4 and 5 to closed switch positions, whereupon current from the main 25 flows to the transformer 29—30 and initiates a flow of welding current to the welding apparatus.

Upon elevation of the plunger 3 of the switch 1 to close its contacts as just described, the stem 8 sets into action mechanism to be more fully described to initiate the running of a predetermined time interval. At the end of that interval, the switch arm 12 will engage the contact 13 and thereupon current will immediately flow through the manually operable switch 22, by contacts 12—13 to energize the winding 15 and thence back to the main 25, causing the relay 14 to instantly operate to break the circuit of the winding 2 on its contacts 20—20 and to establish on its contacts 18—18 a maintaining circuit for itself to maintain the winding 15 energized.

The opening of the contacts 20—20 causes the switch 1 to open its contacts and discontinue the supply of the welding current which has been flowing for the predetermined time interval only.

The operator may now remove his control of the switch 22, allowing it to open, or opening it, whereupon the relay 14 will be restored, opening of the switch 22 breaking the maintaining circuit above described for the winding 15.

By this mode of operation above described, it will be observed that the operator, to produce a flow of current for a predetermined time interval, has only to close the switch 22; and that thereby only a single impulse or single current flow of predetermined time interval can occur without precautionary operation by the operator, because after the flow of current has occurred and been stopped, the apparatus cannot repeat its cycle so long as the operator holds the switch 22 closed. To restore the apparatus or another cycle, the operator has only to momentarily open the switch 22, or open it and leave it open.

In practice, therefore, where welds are to be made rapidly one after the other, the operator may hold the switch 22 closed, for example by his foot, and to make each weld he has only to momentarily open the switch 22 and then close it again to produce a current flow for each weld. Or, if the welds are to be made less frequently, the operator can for each weld close the switch 22 and hold it closed until the weld is completed and then allow the switch to open.

The mechanism for operating the switch arm 12 to engage the contact 13 at the end of a predetermined interval after operation of the switch 1 will now be described in a preferred embodiment in connection with Figs. 2 to 4 inclusive.

A shaft 11 is mounted to rotatably oscillate in a pair of spaced bearings 32 and 33 and adjacent the bearing 32 has secured rigidly thereto the arm 9 carrying the pivot pin above referred to, to which pin the stem 8 of the switch 1 is pivotally connected, the stem 8 as viewed in Fig. 2 moving toward the observer when the switch 1 operates.

A second arm 34 is rigidly secured to the shaft 31, preferably by a pin 35 in a hub 36 on the arm, and the outer end of the arm 34 has a pin

37 extending therefrom generally parallel to the shaft 31. A sleeve 38 rotatable on the shaft 31 has rigidly secured thereto the inner element 39 of a clutch, the inner clutch element 39 having rigidly secured thereto an arm 12. A coiled helical spring 40 wound around the hub 36 and an inner end portion of the sleeve 38 has one free end 41 thereof overlapping the pin 37 and the other free end 42 thereof overlapping the arm 12, the arrangement of the parts and spring being such that, as illustrated, upon rocking the arm 34 toward the observer, the spring 40 will be put under increased tension and will apply the tension thereof through the free end 42 to the arm 12, exerting resilient torque thereon to move it toward the observer as viewed in Fig. 2.

The inner clutch element 39 cooperates with an outer clutch element 43 provided with an inwardly facing cylindrical clutch surface 44, and the inner clutch element 39 has a plurality of balls 45 disposed in recesses 46 and constantly constrained by springs 47 to move toward a small end of the recess 46.

This clutch construction is generally well known and without further description it is believed to be clear that if the inner clutch element 39 is rotated, counter-clockwise as viewed in Fig. 3, the balls 45 will effect a wedging engagement between the cylindrical face 44 of the outer clutch element and the walls of the recesses 46 of the inner clutch element to lock the clutch elements together, but that if the inner clutch element 39 is rotated clockwise as viewed in Fig. 3, the balls will be moved toward the larger end of the recesses 46 and disengage the clutch elements.

The outer clutch element 43 is rotatably mounted on the sleeve 38, and a gear 48 is secured to the clutch element 43 and rotates therewith and meshes its teeth with a pinion 49 on a shaft 50, the pinion 49 being connected to a gear 51 which meshes its teeth with a pinion 52 rigidly connected to a shaft 53 to which is also connected a fan 54 of the vane type.

A stop 55 of any suitable construction may be provided to stop the downward oscillatory movement of the arm 9 and therefore of the stem 8; and the pin 37 overlaps a portion of the arm 12 as shown at 56, Fig. 2 and the spring 40 is formed so that the free ends 41 and 42 maintain the pin 56 normally in engagement with the arm 12. By this construction, when the parts are in their normal positions and the oscillatory arm 9 rests upon the stop 55, a normal predetermined position will thereby be determined for the arm 12.

The arm 12 is provided with a resiliently supported contact 57 and spaced therefrom is a stationary contact 13 supported on a suitably disposed bracket 59 and rendered adjustable toward and from the contact 57 by being mounted on a stud 60 threaded in the bracket 59, a lock nut 61 being provided to fix the adjusted position of the contact 13.

In the operation of the mechanism of Figs. 2 to 4 inclusive taken in connection with Fig. 1, when the electromagnetic switch 1 is energized, its plunger 3 is instantly drawn upwardly for its full stroke as is common with such switches to instantly close the contacts 6 and 7. The oscillatory arm 9 is therefore quickly moved to an angle of oscillation determined by the stroke of the stem 8. This movement likewise oscillates the arm 34 causing the pin 37 thereof to leave the arm 12 and to put additional tension in the spring 40 by means of its free end 41 and applying

this tension through the free end 42 of the spring to the arm 12, resiliently thrusting it upwardly toward the observer as viewed in Fig. 2 and counter-clockwise as viewed in Fig. 3.

5 The arm 12 under the impulsion of the spring 48 then starts to move in the direction of the spring thrust and moves the inner clutch element 39, causing it to effect gripping action with the outer clutch element 43 in the manner above described and to turn the gear 48. The motion of
10 the gear 48 is transmitted to the fan 54 through the step-up gear train, rotating the fan 54 at a high velocity and causing the friction thereof with the air to retard the movement of the fan 54 thereby causing the gear 48 and the arm 12
15 clutched thereto to move with a retarded movement. At the end of the time interval, this retarded movement brings the contact 57 into engagement with the contact 13.

20 Upon engagement of the contact 13, the relay 14 is operated as described in connection with Fig. 1, de-energizing the winding of the switch 1 and causing the plunger thereof and the oscillatory arm 9 to be restored, the arm 9 into engagement with the stop 55. This movement
25 moves the pin 37 away from the observer as viewed in Fig. 2 and into engagement with the arm 12, and positively moving it along with the pin 37, clockwise as viewed in Fig. 3 and removing the contact 57 from the contact 13. During this
30 movement of the switch arm 12, the clutch elements 39 and 43 are disengaged from each other in the manner described hereinbefore, so that the gear 48 and the train of gears may stand still
35 without rotating to be in readiness for the running of another time interval.

At all times, in order to insure that the gear 48 and the train of gears associated therewith
40 may not continue to move or drift, a brake device is provided to bring them to rest comprising a brake shoe 62 engaging the outer cylindrical surface 63 of the outer clutch element 43 and is held in resilient engagement therewith by a spring
45 64 secured at one end to the brake shoe 62 and at the other end secured to the arm 12. The upward stroke of the stem 8 may, if desired, be definitely limited by a stop 65 engageable by the end of a pin 66 on the plunger 3; and both of the stops,
50 65 and 55, may be adjustable as indicated.

As will be clear from the foregoing description, the time interval will be determined by the distance from the contact 57 when in its normal position to the contact 13, and the time interval
55 therefore may be adjusted by adjusting the screw 60 to move the contact 13 toward or from the contact 57.

While I have shown a control switch 22 of the spring-opened manually closable form, it will be obvious that it may be operated to close and
60 open its contacts by other means, for example by mechanism means or by electromagnetic means.

My invention is not limited to the exact details of construction illustrated and described. Changes and modifications may be made therein
65 and my invention comprehends all such changes and modifications embraced within the scope of the appended claims.

I claim:

70 1. In an electric system and apparatus, a circuit to be controlled, a first electromagnetically operable switch comprising a winding and a movable member movable through a predetermined range of movement and controlling the circuit, a control switch, a source of control current supply,
75 a second electromagnetically operable switch

having a winding and having normally open contacts connected to the supply in series with its own winding and with the control switch contacts and having normally closed contacts connected to the supply in series with the winding of the first switch and with the control switch contacts, a delayed operation switch mechanism comprising mechanism contacts and energy storage means in which energy is stored by movement of the first switch member through its range of movement
5 and mechanically operable to initiate the running of a predetermined time interval by movement of the movable member of the first switch, and at the end of the time interval closing the mechanism contacts, the mechanism contacts being
10 connected to the supply in series with the second switch winding and with the control switch contacts, whereby upon closing the control switch contacts the first switch is caused to operate and start the time interval, and at the end of the time interval the second switch is caused to operate
15 to deenergize the first switch and maintain itself operated so long as the control switch contacts are maintained closed, and means to vary the time interval by varying the range of movement of the switch member to vary the amount of energy stored thereby.

2. In an electric system and apparatus, a circuit to be controlled, a first electromagnetically operable switch comprising a winding and a movable member and controlling the circuit, the movable member being movable from a switch open to a switch closed position, means to stop the switch in a predetermined open position, a control switch having normally open contacts, a source of control current supply, a second electromagnetically operable switch having a winding and having normally open contacts connected to the supply in series with its own winding and with the control switch contacts and having
40 normally closed contacts connected to the supply in series with the winding of the first switch and with the control switch contacts, a delayed operation switch mechanism comprising mechanism contacts and comprising energy storage means
45 in which energy is stored by movement of the switch movable member from its stopped to its closed position, the mechanism being operable to initiate the running of a predetermined time interval by movement of the movable member, and
50 at the end of the time interval closing the mechanism contacts, the mechanism contacts being connected to the supply in series with the second switch winding and with the control switch contacts whereby upon closing the control switch
55 contacts the first switch is caused to operate and start the time interval, and at the end of the time interval the second switch is caused to operate to deenergize the first switch and maintain itself operated so long as the control switch contacts are maintained closed, and means to vary the stopped open position of the first switch to vary the amount of energy stored in the mechanism by operation of the switch member to correspondingly adjustably vary the time interval.

3. In an electric system and apparatus, a circuit to be controlled, a first electro-magnetically operable switch comprising a winding and a movable member and controlling the circuit, the movable member being movable from a switch open to a switch closed position, a control switch having normally open contacts, a source of control current supply, a second electro-magnetically operable switch having a winding and having normally open contacts connected to the supply in
75

series with its own winding and with the control switch contacts and having normally closed contacts connected to the supply in series with the winding of the first switch and with the control switch contacts, a delayed operation switch mechanism comprising mechanism contacts and comprising energy storage means in which energy is stored by movement of the switch movable member from its open to its closed position, the mechanism being operable to initiate the running of a predetermined time interval by movement of the movable member, and to maintain the running of the time interval for a predetermined time by dissipation of stored energy, and at the end of the time interval closing the mechanism contacts, the mechanism contacts being connected to the supply in series with the second switch winding and with the control switch contacts whereby upon closing the control switch contacts the first switch is caused to operate and start the time interval, and at the end of the time interval the second switch is caused to operate to deenergize the first switch and maintain itself operated so long as the control switch contacts are maintained closed, and means to vary the time interval by adjustably varying the amount of energy dissipated from the storage means.

4. In an electric system and apparatus, a circuit to be controlled, a first electromagnetically operable switch comprising a winding and a movable member movable through a predetermined range of movement and controlling the circuit, a control switch, a source of control current supply, a second electromagnetically operable switch having a winding and having normally open contacts connected to the supply and controlling its own winding jointly with the control switch contacts, and having normally closed contacts connected to the supply and controlling the winding of the first switch jointly with the control switch contacts, a delayed operation switch mechanism comprising mechanism contacts and mechanical energy storage means in which energy is stored by movement of the first switch movable member through its range of movement and mechanically operable to initiate the running of a predetermined time interval by movement of the movable member of the first switch and at the end of the time interval operating the mechanism contacts, the mechanism contacts being connected to the supply and controlling the second switch winding jointly with the control switch contacts whereby upon operating the control switch contacts the first switch is caused to operate and start the time interval and at the end of the time interval the second switch is caused to operate to effect deenergization of the first switch and maintain itself operated so long as the control switch contacts are maintained operated, and means to vary the time interval by varying the range of movement of the switch member to vary the amount of energy stored thereby.

5. In an electric system and apparatus, a circuit to be controlled, a first electromagnetically operable switch comprising a winding and a movable member and controlling the circuit, the movable member being movable from a switch open to a switch closed position, means to stop the switch in a predetermined open position, a control

switch, a source of control current supply, a second electromagnetically operable switch having a winding and having normally open contacts connected to the supply and controlling its own winding jointly with the control switch contacts and having normally closed contacts connected to the supply and controlling the winding of the first switch jointly with the control switch contacts, a delayed operation switch mechanism comprising mechanism contacts and comprising energy storage means in which energy is stored by movement of the switch movable member from its stopped open to its closed position, the mechanism being operable to initiate the running of a predetermined time interval by movement of the movable member, and at the end of the time interval closing the mechanism contacts, the mechanism contacts being connected to the supply and controlling the second switch winding jointly with the control switch contacts whereby upon operating the control switch contacts the first switch is caused to operate and start the time interval, and at the end of the time interval the second switch is caused to operate to deenergize the first switch and maintain itself operated so long as the control switch contacts are maintained operated, and means to vary the stopped open position of the first switch to vary the amount of energy stored in the mechanism by operation of the switch member to correspondingly adjustably vary the time interval.

6. In an electric system and apparatus, a circuit to be controlled, a first electro-magnetically operable switch comprising a winding and a movable member and controlling the circuit, the movable member being movable from a switch open to a switch closed position, a control switch, a source of control current supply, a second electro-magnetically operable switch having a winding and having normally open contacts connected to the supply and controlling its own winding jointly with the control switch contacts and having normally closed contacts connected to the supply and controlling the winding of the first switch jointly with the control switch contacts, a delayed operation switch mechanism comprising mechanism contacts and comprising energy storage means in which energy is stored by movement of the switch movable member from its open to its closed position, the mechanism being operable to initiate the running of a time interval by movement of the movable member, and to maintain the running of the interval for a predetermined time by dissipation of stored energy, and at the end of the time interval closing the mechanism contacts, the mechanism contacts being connected to the supply and controlling the second switch winding jointly with the control switch contacts whereby upon operating the control switch contacts the first switch is caused to operate and start the time interval, and at the end of the time interval the second switch is caused to operate to deenergize the first switch and maintain itself operated so long as the control switch contacts are maintained operated, and means to vary the time interval by adjustably varying the amount of energy dissipated from the storage means.

CHARLES H. RIPPL.