

June 5, 1928.

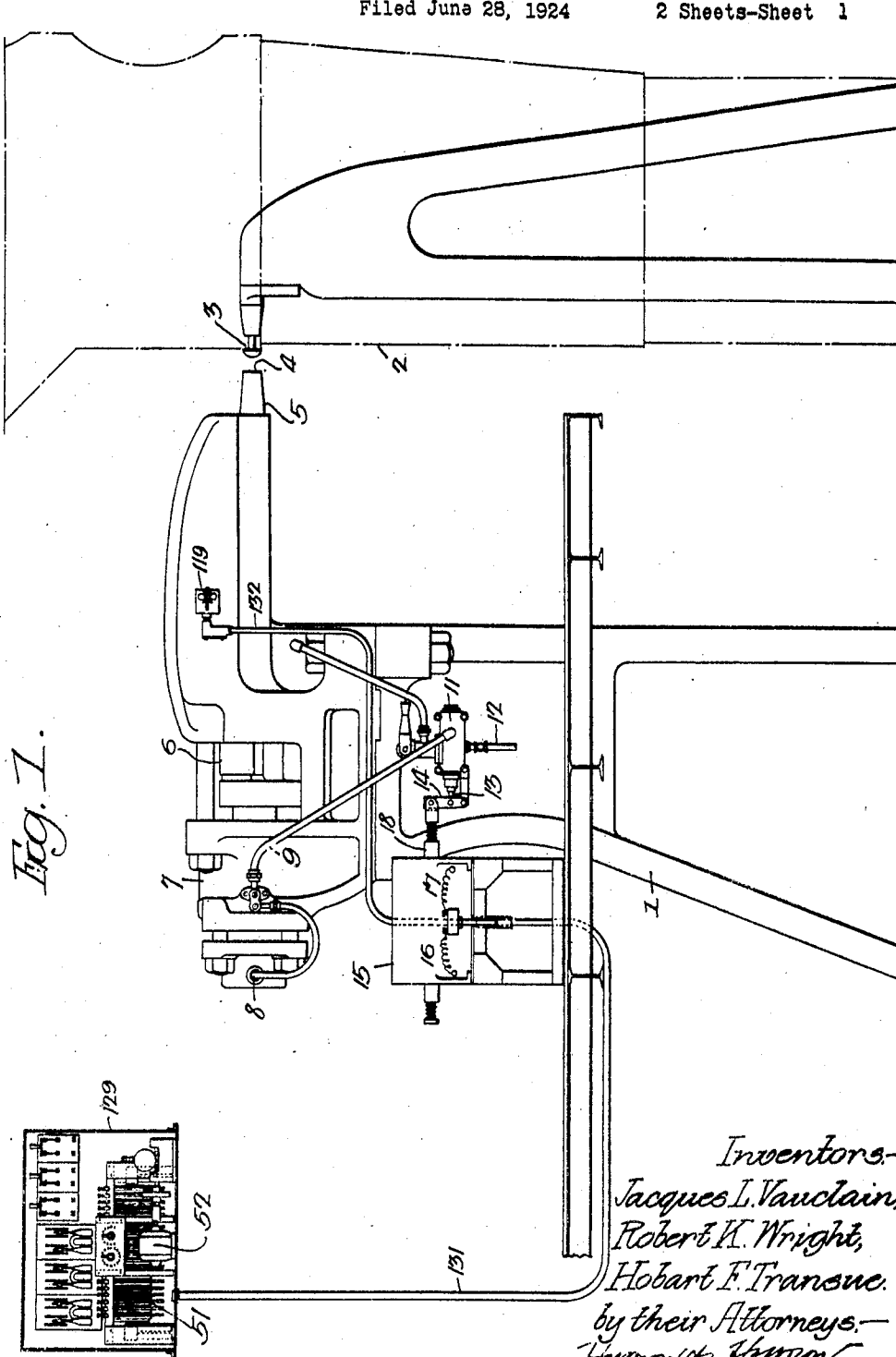
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J. L. VAUCLAIN ET AL

TIME CONTROLLED RIVETER

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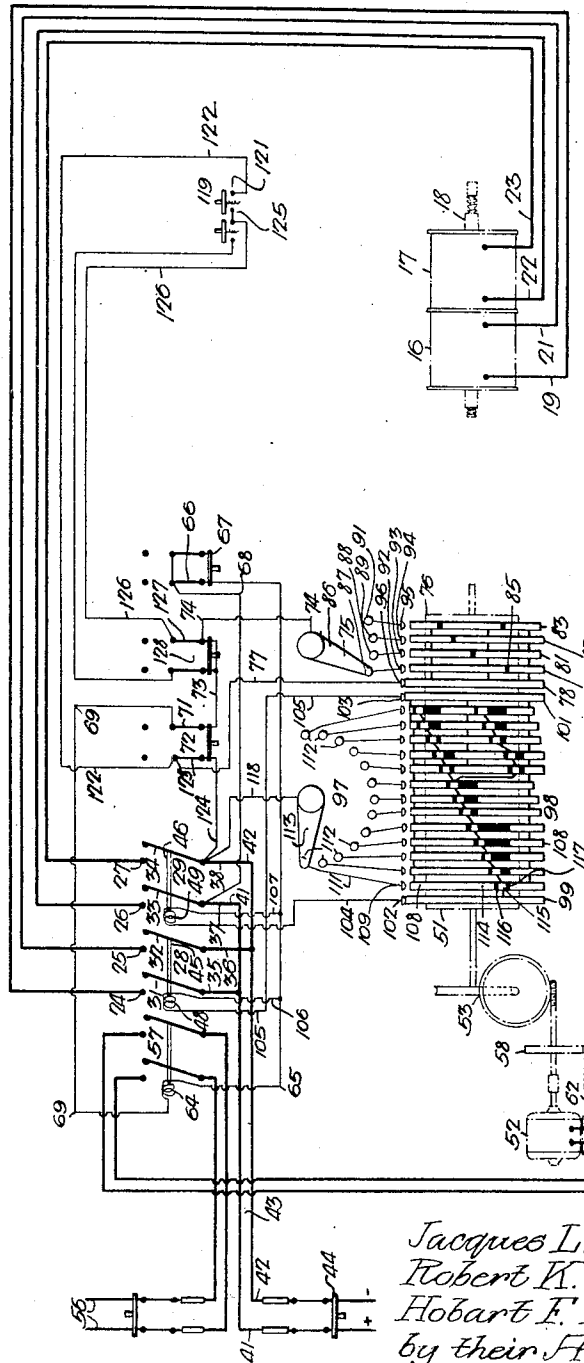
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Fig. 2.



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TIME-CONTROLLED RIVETER.

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Our invention relates to riveting machines, and it has particular relation to electrically controlled riveting machines.

In its broad aspect, one object of our invention is to provide a riveting machine, wherein the pressure period of the punch may be of predetermined value for each rivet and varied to suit different classes of riveting operations.

A more specific object of our invention is to provide an automatic electrical control for a hydraulic riveting machine, which includes a master control switch, a solenoid for opening and closing a hydraulic operating valve, and timing means for determining the length of time pressure shall be applied to the rivet while forming the head.

Other objects and applications of our invention, as well as details of construction and operation, whereby our invention may be practiced, will be apparent more fully hereinafter, when taken in connection with the accompanying drawings, wherein,

Fig. 1 is a side elevational view of one form of embodiment of our invention; and

Fig. 2 is a diagrammatic view of the automatic electrical control system embodying our invention.

In the illustrated form of embodiment of our invention shown in Fig. 1 of the drawings, a hydraulic riveting machine 1 is in operative relation to a vertically extending structure 2 which is to be riveted as at 3. The riveting machine 1 comprises a punch 4 which is formed on one end of a plunger 5 reciprocally mounted in a cylinder 6. A head end 7 of the cylinder 6 is provided with port openings 8 for the reception of fluid under pressure from a pipe 9, the latter being connected through an operating valve 11 with a supply pipe 12 leading to pressure apparatus (not shown).

The operating valve 11 is provided with a stem 13 having an operative connection through linkage 14 with actuating means 15, which, in the present instance, has been shown as a solenoid having oppositely directed magnetizing windings 16 and 17 and a core member 18. The latter is operatively associated with the linkage 14, whereby the stem or spindle 13 of the hydraulic valve 11

may be oppositely actuated to cause the successive projection and retraction of the punch 4.

The solenoid magnetizing windings 16 and 17, which, when successively energized, result in the operation and inoperation of the riveting machine 1, are connected by conductors 19—21 and 22—23 (Fig. 2) to stationary terminals 24—25 and 26—27, respectively, of circuit-interrupting devices 28 and 29. The latter, for purposes of illustration, have been shown as double-pole switches having movable contact elements 31—32 and 33—34 respectively connected by conductors 35—36 and 37—38 to positive and negative conductors 41 and 42 of a direct-current energizing circuit 43. The energizing circuit 43 may be connected through a switch 44 to a source of direct-current energy (not shown).

The movable contact elements 31—32 and 33—34 of the switches 28 and 29, respectively, are mechanically connected by magnetizable elements 45 and 46. The elements 45 and 46 respectively co-act with actuating windings 48 and 49, whereby the switches 28 and 29 may be closed upon the energization of said windings.

As previously noted, an important object of our invention is to provide a system of electrical control which automatically determines, independently of the will of the operator, the time interval during which the punch 2 shall be in engagement with the rivet 3. One method of accomplishing this desired result involves the use of a rotary drum-switch 51 which automatically determines the period of energization of the actuating windings 48 and 49 and hence the projection and retraction of the punch 4.

The rotary switch 51, which will be described more fully hereinafter, may be actuated by a motor 52 through gearing 53 of usual design. The motor 52 is connected by conductors 54 and 55 to an energizing circuit 56 through a circuit-interrupting device 57 of the type previously described. The motor 52 may be quickly brought to rest by means of a brake 58, which is controlled by a solenoid 59, an actuating winding 61 thereof being electrically connected to the conduc-

tors 54 and 55 by conductors 62 and 63, respectively.

The operation of the contactor 57 may be controlled by means of an actuating winding 64, one terminal of which is connected to the positive conductor 41 through a conductor 65, a blade 66 of a double-pole switch 67, and a conductor 68. The other terminal of the actuating winding 64 is connected to the negative conductor 42 of the direct-current energizing circuit 43 through a conductor 69, a blade 71 of a double-pole switch 72, a conductor 73, a conductor 74, a dial-switch 75, a revolving switch portion 76 of the rotary drum-switch 51 and a conductor 77.

The dial-switch 75 and the revolving switch portion 76 are designed to permit of variations in the period during which the actuating winding 64 may be energized and, hence, in the period of operation of the driving motor 52 and the rotary switch 51, as will appear more fully hereinafter. The switch portion 76 of the rotary drum-switch 51 comprises a plurality of series of circular metallic segments 78, 79, 81, 82 and 83. The circular contact segments 79 to 83, inclusive, are provided with one or more insulating members, as shown at 85 in the circular segment 79,—the relative position of the several insulating members determining the period of operation of the motor 52.

The dial-switch 75 comprises a movable contact element 86 and co-operating stationary contact elements 87, 88, 89 and 91, said stationary contact elements being respectively connected to stationary contact fingers 92, 93, 94 and 95 positioned to engage the adjacent contact segments 79, 81, 82 and 83. The conductor 77 may be continuously connected by means of a finger 96 to the contact segment 78 regardless of the position of the dial-switch element 86. The actuation of the movable contact element 86 from one stationary contact element 87 to another, therefore, causes variations in the operating period of the drum motor 52.

The relative periods of energization of the contactor actuating windings 48 and 49 are similarly controlled by a dial-switch 97 and a cooperating drum-switch portion 98 of the rotary switch 51. The drum-switch portion 98 comprises a pair of spaced circular segments 99 and 101 which are respectively connected through contact fingers 102 and 103 and conductors 104 and 105 to corresponding terminals of the contactor actuating windings 49 and 48. The remaining terminals of the windings 48 and 49 are respectively connected by conductors 106 and 107 to the conductor 65 having an operative connection through the switch blade 66 and the conductor 68 to the positive conductor 41 of the direct-current energizing circuit 44.

The drum-switch portion 98 further comprises a plurality of circular contact segments 108 which respectively engage a corresponding plurality of contact fingers 109, the latter being connected by conductors 111 to stationary contacts 112 of the dial-switch 97. A movable contact element 113 of the dial-switch 97 is adapted to engage the co-operating stationary contact elements 112.

Each of the circular contact segments 108 is provided with one or more independent contact portions, whereby the electrical engagement between the finger 109 and the circular contact portion 108 may be periodically interrupted. For example, the circular contact segment 108 immediately adjacent to the circular contact segment 99 is provided with independent contact portions 114 and 115, the former being electrically connected to the circular contact segment 101 and the latter being electrically connected to the circular contact segment 99. The contact portion 115 is insulatingly spaced from the opposite ends of the circular contact portion 114 by means of insulating members 116 and 117, the position of the latter corresponding to that of a similar insulating member 85 in the circular segment 79 of the switch portion 76, for reasons as will appear more fully hereinafter. The movable contact element 113 of the dial-switch 97 is connected by a conductor 118 to the negative conductor 42 of the energizing circuit 43.

The electrical timing system just described may be initially controlled by means of a normally open switch 119 of the push-button type. One terminal 121 of the manually controlled switch 119 is connected by a conductor 122, a switch blade 123 of the switch 72 and a conductor 124, to the negative conductor 42 of the energizing circuit 43. A remaining terminal 125 of the control switch 119 is connected to the positive conductor 41 of the energizing circuit 43 through a conductor 126, one blade 127 of a switch 128 of the double-pole type, the conductor 73, the blade 71 of the switch 72, the conductor 69, the actuating winding 64 of the solenoid 57, the conductor 65, the blade 66 of the switch 67, and the conductor 68. The function of the push-button switch 119 is, therefore, to control the initial operation of the contactor 57 and, hence, the starting of the drum motor 52 only.

The contactors 57, 28, and 29, the double-pole switches 72, 128 and 67, the rotatable drum-switch 51 and the motor 52 for actuating the same, as well as the electrical circuits immediately associated therewith, may be conveniently mounted in a protective casing 129, as shown in Fig. 1. The solenoid 15 is preferably positioned on the main supporting frame of the riveting machine, immediately adjacent to the hydraulic operating valve 11, the several conductors 19, 21,

22 and 23 thereof being positioned in a protective conduit 131 which extends to the housing 129. The push-button control switch 119 is preferably mounted on the upper portion of the frame of the riveting machine in a position accessible to the operator. The conductors 122 and 126 may be mounted in a protecting conduit 132 which extends from the push-button switch 119 to the solenoid conduit 131, all as shown in Fig. 1.

Assuming the apparatus in the position shown in the drawing, the punch 4 is projected from the riveting machine 1 into engagement with the rivet 3 to effect the desired riveting operation upon the closing of the push-button switch 119. The closing of the latter completes the circuit from the positive conductor 41 through the conductor 68, the blade 66 of the switch 67, the conductor 65, the actuating winding 64 of the motor contactor 57, the conductor 69, the blades 71 and 127 of the switches 72 and 128, respectively, the conductor 126, the push-button switch 119, the conductor 122, the blades 123 of the switch 72, and the conductor 124, to the negative conductor 42.

The actuating winding 64 being thus excited, the contactor 57 closes connecting the motor 52 directly to the energizing circuit 56. When currents are thus supplied to the motor 52, the brake actuating winding 61 is energized, thereby releasing the brake 58 and permitting the motor 52 to revolve freely. The operation of the motor 52 through the gearing 53 revolves the rotatable drum-switch 51.

When the dial-switch 97 is so set that the movable arm 113 thereof engages the stationary contact element 112 immediately adjacent to the end segment 79, as shown in Fig. 2, and the dial-switch 75 is adjusted so that the movable contact element 86 thereof engages the stationary contact element 87, the operation of the drum switch 151 causes the following sequences to occur. Immediately upon the operation of the drum switch 51, finger 92 engages contact segment 79 of the switch portion 84, completing a circuit through the actuating winding 64 of the contactor 57 independently of the push-button switch 119, as follows: from the positive conductor 41, through the conductor 68, one blade 66 of the switch 67, the conductor 65, the contactor actuating winding 64, the conductor 69, blades 71 and 127 of the switches 72 and 128, respectively, the conductor 74, movable contact elements 86 of the dial-switch 75, the contact finger 92, the circular contact segment 79, the adjacent segment 78, the contact finger 96, the conductor 77, the blade 123 of the switch 72, the conductor 124 and the negative conductor 42 of the energizing circuit 43.

The drum 51 thus continues to revolve

independently of the operator until the insulating member 85 is actuated into engagement with the contact finger 92, whereupon the electrical circuit just described is interrupted. As soon as such interruption occurs, the actuating winding 64 becomes de-energized, so that the contactor 57 opens, allowing the motor 52 and the rotary drum-switch 51 to stop and the brake 58 to reset.

At the same time that the contact between the circular segment 79 and the finger 92 is made, the contact finger 109 of the switch portion 98 engages the contact portion 114 of the circular segment 108, to complete a circuit which extends from the positive conductor 41 of the energizing circuit 43, through the conductors 68, the switch blade 66, the conductor 65, the conductor 106, the actuating winding 48 of the contactor 28, the conductor 105, the contact finger 103, the circular contact segment 101, the contact segments 108, the contact finger 109, the dial-switch 97 and the conductor 118, to the negative conductor 42 of the energizing circuit 43, whereupon the contactor 28 closes.

The operation of the contactor 28 connects the energizing circuit 43 to the winding 16 of the solenoid 15 through the conductors 19 and 21, resulting in the energization of the solenoid winding 16. The latter then causes the spindle 13 of the hydraulic operating valve 11 to move so as to connect the hydraulic supply pipe 12 directly to the head end 7 of the hydraulic cylinder 6, whereby the punch 2 may be forced into engagement with the rivet 3.

The winding 16 remains energized and the punch 2 in engagement with the rivet 3 so long as the contact finger 109 remains in engagement with the contact portion 114 of the circular segment 108, regardless of the will of the operator and the position of the push-button switch 119. When the insulating member 116 is actuated into engagement with the contact finger 109, interrupting the energizing circuit of the contactor actuating winding 48, the contactor 28 opens, causing the de-energization of the solenoid winding 16.

Inasmuch as the energizing circuit of the motor 15 is still complete, the rotary drum-switch 51 continues to revolve. The contact portion 116 of the circular segment 108 is thus actuated in engagement with the contact finger 109, whereupon a circuit through the contactor actuating winding 49 is completed as follows: from the positive conductor 41 of the energizing circuit 43, through the switch 67, the conductor 65, the conductor 107, the actuating winding 49, the conductor 104, the contact finger 102, the circular contact segment 99, the contact portion 116 of the circular segment 108, the contact finger 109, the dial-switch 97 and the conductor 130

118, to the negative conductor 42 of the energizing circuit 43. The closing of the contactor 29 electrically connects the energizing circuit 43 to the other winding 17 of the solenoid 15, which causes a reverse movement of the valve spindle 13 to its original position, permitting the punch 2 to be retracted in the usual manner.

Simultaneously with the engagement of the insulating member 85 with the contact finger 92, the insulating member 117 similarly engages the contact finger 109, so that the energizing circuits through the actuating winding 64 and 49 are simultaneously interrupted, allowing the corresponding contactors 57 and 29, respectively, to open. The motor 52 then becomes inoperative and the solenoid winding 17 de-energized. This completes the cycle of operations and the motor 52 cannot be started again until the push-button switch 119 is actuated.

Thus the period during which the punch 2 is in engagement with the rivet 3 may be varied to suit different classes of riveting operation by actuating the movable contact elements 113 and 86 of the dial-switches 97 and 75, respectively, into engagement with the different stationary contact elements of said switches,—the switch 75 controlling the maximum cooling or operating period, and the switch 97 controlling the relative values of the riveting or pressure period and return or release period which periods together control the working period. Attention is directed to the fact that the dial-switches 75 and 97, which represent the adjusting means of the timing device, are remotely situated in the housing 129 out of reach of the operator. The immediate control of the riveting machine 1 is therefore limited to push-button switch 119.

While we have shown only one form of embodiment of our invention, for the purpose of describing the same and illustrating its principles of construction and of operation, it is apparent that various changes and modifications may be made therein, without departing from the spirit of our invention. We desire, therefore, that only such limitations shall be imposed thereon, as are indicated in the appended claims or as are demanded by the prior art.

We claim:

1. Control apparatus for the actuating mechanism of a riveting machine comprising an electrical operating device, an energizing circuit therefor, switches for so connecting said circuit and said device that the latter may cause said machine to pass through a cycle comprising a pressure period and a release period, means for automatically causing the operation of said switches so that said machine may pass through said cycle and come to rest, and control means for said last-mentioned means

initially effective to cause the operation thereof but thereafter ineffective until the termination of said cycle.

2. Apparatus of the character described comprising an electrical operating device having movements adapted to control respectively the pressure stroke and the return stroke of a riveting plunger, an energizing circuit, switches for so connecting said circuit and said device as to cause said movements, and means for operating said switches, said means including means for varying the operating period of one switch with respect to another.

3. Apparatus of the character described comprising an electrical operating device having movements adapted to control respectively the pressure stroke and the return stroke of a riveting plunger, an energizing circuit, switches for so connecting said circuit and said device as to cause said movements, means operative over a predetermined time interval to cause the operation of said switches, means for varying said time interval, and means whereby the operating period of one switch may be varied with respect to another.

4. Apparatus of the character described comprising an electrical operating device having movements adapted to control respectively the pressure stroke and the return stroke of a riveting plunger, an energizing circuit, a pair of switches for so connecting said circuit and said device as to cause said movements, means operative over a predetermined time interval to cause the operation of said switches, means for varying said time interval, means whereby the operating period of one switch may be varied with respect to the other, and a switch connected to cause the initial operation of said first-mentioned means and thereafter ineffective until the completion of said strokes.

5. Control apparatus for the actuating mechanism of a riveting machine comprising an electrical operating device, an energizing circuit, a pair of main switches for so connecting said circuit to said device as to cause different movements thereof, said switches having actuating windings, a control switch for connecting said windings to said energizing circuit to cause the successive operation of said pair of switches, mechanism for operating said control switch in accordance with a predetermined cycle and thereafter coming to rest, and means whereby the operating period of one of said pair of switches may be varied with respect to the other.

6. Control apparatus for the actuating mechanism of a riveting machine comprising an operating device, an energizing circuit, a pair of switches so connecting said energizing circuit to said device as to cause the latter to have different operating character-

istics, actuating windings for said switches, a switch for causing the energization of one or the other of said actuating windings, and means for varying the period of energization of said windings.

7. Control apparatus for the actuating mechanism of a riveting machine comprising an operating device, an energizing circuit, a pair of switches so connecting said energizing circuit to said device as to cause the latter to have different operating characteristics, actuating windings for said switches, a control switch for causing the energization of one or the other of said actuating windings, means for varying the period of energization of said windings, and means for operating said control switch for a predetermined time interval only.

8. Control apparatus for the actuating mechanism of a riveting machine comprising an electrical operating device, a pair of switches for so controlling said device that the latter has different operating characteristics, operating windings for said switches, a control switch for causing the successive energization of said windings, means for varying the energization period of one winding with respect to the other, means for operating said control switch for a predetermined time interval, and means for varying said time interval.

9. Control apparatus for the actuating mechanism of a riveting machine comprising an electrical operating device, a pair of switches for controlling said device, actuating windings for said switches, a control switch for causing the energization of said actuating windings, operating means for said last-mentioned switch provided with control means therefor having an actuating winding, and means for causing the energization of said last-mentioned actuating winding.

10. Control apparatus for the actuating mechanism of a riveting machine comprising an electrical operating device, a pair of switches for controlling said device, actuating windings for said switches, a switch for causing the energization of said actuating windings, operating means for said last-mentioned switch provided with a control switch having an actuating winding, and a switch for causing the energization of said last-mentioned actuating winding, said last-mentioned switch being actuated by said operating means.

11. Control apparatus for the actuating mechanism of a riveting machine comprising an electrical operating device, a pair of switches for controlling said device, actuating windings for said switches, a switch for causing the energization of said actuating windings, operating means for said last-mentioned switch provided with a control switch having an actuating winding, a

switch for causing the energization of said last-mentioned actuating winding, and means connected to cause the operation of said first-mentioned means and thereafter ineffective until a completion of the operating cycle thereof.

12. Control apparatus for the actuating mechanism of a riveting machine comprising a solenoid having a pair of windings, a pair of switches for controlling said windings respectively provided with actuating windings, a switch for causing the successive energization of said actuating windings, means for varying the energization period of one actuating winding with respect to the other, means for operating said last-mentioned switch over a predetermined time interval to cause said successive energization, and means for varying said time interval.

13. Control apparatus for the actuating mechanism of a riveting machine comprising electrical operating means adapted to cause said machine to pass through a pressure period and a release period, and electrical timing means for automatically causing said machine to pass through said periods and then come to rest.

14. Control apparatus for the actuating mechanism of a machine of the character described comprising operating means, and means for controlling the period of operation of said first-mentioned means, said last-mentioned means including an energizing circuit for said operating means, a contactor for opening and closing said circuit, said contactor being provided with an actuating winding, and a switch for periodically de-energizing said actuating winding.

15. Control apparatus for the actuating mechanism of a machine of the character described comprising operating means, and means for controlling the period of operation of said first-mentioned means, said last-mentioned means including an energizing circuit for said operating means, a contactor for opening and closing said circuit, said contactor being provided with an actuating winding, circuit-interrupting means for periodically de-energizing said actuating winding, and means for selectively varying the energizing period of said winding.

16. Control apparatus for the actuating mechanism of a machine of the character described comprising a solenoid having an actuating winding, and control means for said solenoid, whereby the period that a punch of the machine shall engage a rivet may be determined, said means including an energizing circuit, a circuit-interrupting device for said energizing circuit having an actuating winding electrically connected to said energized circuit through a rotary switch, and a motor for driving said rotary switch.

17. Control apparatus for the actuating

mechanism of a machine of the character described comprising a solenoid having an actuating winding, and control means for said solenoid, whereby the period that a punch of the machine shall engage a rivet may be determined, said means including an energizing circuit, a circuit-interrupting device for said energizing circuit having an actuating winding, said actuating winding being electrically connected to said energizing circuit through a rotary switch, a motor for driving said rotary switch, an energizing circuit for said motor, circuit-interrupting means for said last-mentioned energizing circuit, and an actuating winding for said last-mentioned circuit-interrupting means, said last-mentioned actuating winding being connected through an operating switch to said first-mentioned energizing circuit.

18. Control apparatus for the actuating mechanism of a machine of the character described comprising a solenoid having oppositely directed windings, and control means for said solenoid, whereby the period of operation of said machine may be determined, said means comprising an energizing circuit for said solenoid windings, circuit-interrupting means for connecting said solenoid windings to said energizing circuit, actuating windings for said circuit-interrupting means, and a switch for connecting one or the other of said actuating windings to said energizing circuit.

19. Control apparatus for the actuating mechanism of a machine of the character

described comprising a solenoid having oppositely directed windings, and control means for said solenoid, whereby the period of operation of said machine may be determined, said means comprising an energizing circuit for said solenoid windings, circuit-interrupting means for connecting said solenoid windings to said energizing circuit, actuating windings for said circuit-interrupting means, a rotatable switch for connecting one or the other of said actuating windings to said energizing circuit, and means for selectively varying the period of operation of said rotatable switch.

20. Control apparatus for the actuating mechanism of a machine of the character described comprising a solenoid having oppositely directed windings, an energizing circuit for said windings, a pair of circuit-interrupting devices for respectively connecting said windings to said energizing circuit, said devices being respectively provided with actuating windings, electrical connections associating said actuating windings and said energizing circuit through a rotatable switch, a motor for operating said switch, an energizing circuit for said motor, and a circuit-interrupting device for said last-mentioned energizing circuit provided with an actuating winding operably associated with said first-mentioned energizing circuit through a control switch.

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