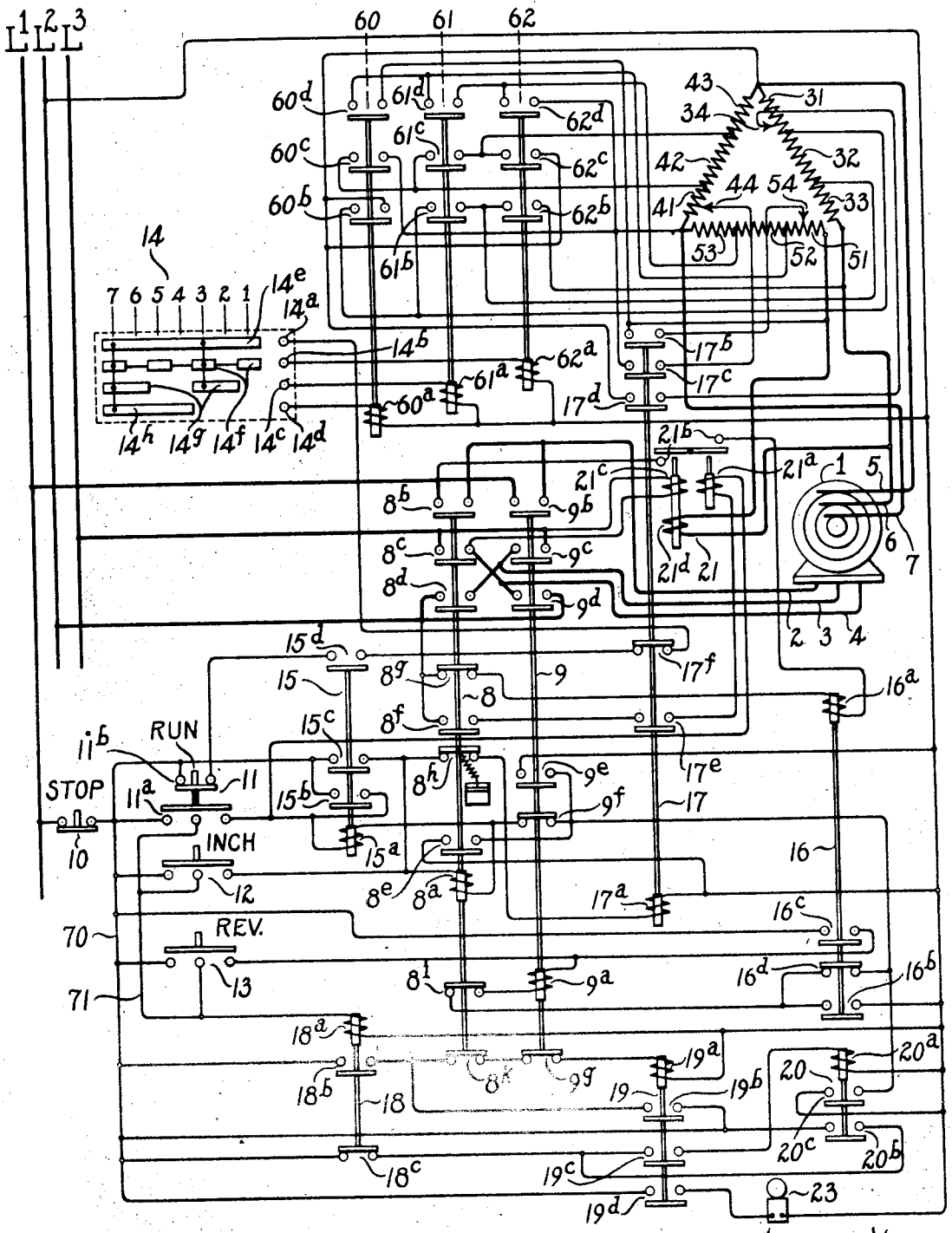
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CONTROLLER FOR MOTOR DRIVEN PRINTING PRESSES AND OTHER MACHINES

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CONTROLLER FOR MOTOR-DRIVEN PRINTING PRESSES AND OTHER MACHINES

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This invention relates to controllers for motor driven printing presses and other machines, and is particularly applicable to controllers which signal intent to start and which delay starting for at least a short period after commencement of signaling.

A controller of this general character is disclosed in the Feldhausen Patent No. 2,241,589, May 13, 1941, issued to the assignee of the instant application, this patent showing a non-reversing controller so designed that the inch button or the on button must be twice depressed to effect starting, the first depression being utilized to start signaling which is continued pending the second depression of the button for motor starting. In this system requirement of repeated operation of the starting button to effect starting only after at least a short period of signaling is effected through the medium of relays which are restored to initial condition only upon stopping, and due to this fact and to the fact that the signal control involves utilization of relays not used generally in control of motor driven machines a simpler and more readily and widely applicable signaling control of the character indicated has become desirable.

Also it has become desirable to render more readily applicable such a signaling control to reversing controllers, such for example as that shown in the Seeger Patent 1,878,334, September 20, 1932, also issued to the assignee of the instant application.

The present invention has among its objects to provide a simplified form of the aforementioned Feldhausen control which may be readily applied to controllers generally and to a reversing controller such for example as that of the type shown in the aforementioned Seeger patent, the signaling system to function for both forward and reverse operations.

Another object is to provide a signaling control of the type indicated wherein the means rendering the signaling device responsive upon the first actuation of the manual starting switch and delaying motor starting pending a second actuation of said switch will be reset immediately upon starting, rather than upon stopping as in the aforementioned Feldhausen system.

Another object is to provide a signaling system of the character last mentioned wherein the signal device will be free from influence by the manual control means while the motor is in operation in either direction.

Another object is to provide a reversing controller wherein a single set of relays to control the signal device and to compel the start button to be twice operated for motor starting will serve for both forward and reverse operations.

Various other objects and advantages of the invention will hereinafter appear.

One embodiment of the invention is illustrated in the accompanying drawing, it being understood that the controller shown therein which is especially designed for a reversing printing press is susceptible of various modifications without departing from the scope of the appended claims.

The controller diagrammatically illustrated in the drawing will now be described.

A three-phase slip-ring type induction motor 1, having primary terminals 2, 3 and 4, and secondary termnals 5, 6 and 7, is supplied with power from the three phase power mains L^1, L^2 and L^3, through a pair of electromagnetic reversing switches 8 and 9. The switch 8 is provided with an energizing winding 8^a, normally open main contacts 8^b, 8^c and 8^d, normally open auxiliary contacts 8^e, 8^f, and normally closed auxiliary contacts 8^g, 8^h, 8^i and 8^k. Contacts 8^h are provided with means to retard their opening for a short period after energization of relay 8. The switch 9 is provided with an energizing winding 9^a, normally open main contacts 9^b, 9^c and 9^d, normally open auxiliary contacts 9^e, and normally closed auxiliary contacts 9^f and 9^g.

The controller further includes a normally closed "stop" push button switch 10, a "run" push button switch 11, having three point normally open contacts 11^a, and normally closed contacts 11^b, a normally open three-point "inch" push button switch 12, and a normally open three-point "reverse" push button switch 13.

To set the speed at which it is desired to operate the press the controller includes a speed setting device 14, having stationary contacts 14^a, 14^b, 14^c and 14^d, and movable contacts 14^e, 14^f 14^g and 14^h. The movable contact 14^e is arranged to engage the stationary contact 14^a in all running positions of the speed setting device. The movable contact 14^f comprises spaced sections to engage the stationary contact 14^b only in the first, third, fifth and seventh positions. The movable contact 14^g comprises spaced sections to engage the stationary contact 14^c only in the second, third, sixth and seventh positions, and the movable contact 14^h is arranged to engage the stationary contact 14^d only in the fourth to the seventh position, inclusive. All of the movable contacts are electrically interconnected.

The controller also includes the following electromagnetic relays: Relay 15 having an energizing winding 15^a, normally open contacts 15^b, 15^c

and 15d; relay 16, having an energizing winding 16a, normally open contacts 16b and 16c and normally closed contact 16d; torque relay 17, having an energizing winding 17a, normally open main contacts 17b, 17c and 17d, normally open auxiliary contact 17e, and normally closed auxiliary contact 17f; initiating relay 18 having an energizing winding 18a, normally open contact 18b and normally closed contact 18c; signal relay 19 having an energizing winding 19a, and normally open contacts 19b, 19c and 19d; "compelling" relay 20, having an energizing winding 20a and normally open contacts 20b and 20c; and relay 21. The latter relay is provided with a center pivoted lever which is adapted to bridge a pair of stationary contacts 21b. The lever is so arranged that it is frictionally held in any position to which it is moved by an external force. In proximity to the right end of the lever is an electromagnet having a movable armature and an energizing winding 21a. When this winding is energized, the armature abuts the lever to move it counterclockwise to the circuit closed position. In proximity to the left end of the lever is another electromagnet having a shunt energizing winding 21c, which tends to move the armature upwardly to rotate the lever in a clockwise direction and open the contacts of the relay, and a series coil 21d, which is arranged to hold the armature in the down position and thus counteracts the pull of the coil 21c.

An electromagnetic bell 23 provides for an audible signal under certain conditions which will be explained hereinafter.

The speed of the motor is controlled through the medium of resistors which are connected in delta across the secondary terminals 5, 6 and 7 of the motor 1. In the present instance, the resistor of each branch of the delta comprises three sections. One resistor comprises sections 31, 32 and 33, another comprising sections 41, 42 and 43, and the third comprising sections 51, 52 and 53, the sections 33 and 51 being connected together through the winding 21d of relay 21. The sections 31, 41 and 51 may be short circuited by normally open contacts 60b, 60c and 60d of an electromagnetic switch 60, which is also equipped with an energizing winding 60a. The sections 32, 42 and 52 may be short circuited by an electromagnetic switch 61 having an energizing winding 61a and normally open contacts 61b, 61c and 61d. The sections 33, 43 and 53 may be short-circuited by an electromagnetic switch 62, having an energizing winding 62a and normally open contacts 62b, 62c and 62d. The three resistor sections 31, 41, 51 also are respectively provided with adjustable contacts 34, 44 and 54, providing for short-circuiting of variable portions of said sections by the contacts 17b, 17c and 17d, respectively, of the torque switch 17.

One terminal of each energizing winding 60a, 61a and 62a is connected to the line L^2 while the other terminals of said windings are connected to the contacts 14d, 14c and 14b, respectively, of the speed setting device 14.

When the lines L^1, L^2 and L^3 are energized and the controller is in the condition shown in the diagram, the wire 70 is energized, being connected to line L^1 through the normally closed stop push button switch 10. If now the inch push button is depressed a circuit is established from wire 70 over the center contact of push button switch 12, to wire 71 and thence through winding 18a of relay 18 to line L^2. The relay 18 thereupon completes a circuit from wire 70, through contacts 18b, 8k, 9e and winding 19a to line L^2. The relay 19 is thus energized and closes a circuit from wire 70 through contact 19d and the signaling bell 23 to line L^2, causing said bell to ring. Closure of contact 19b closes a maintaining circuit for winding 19a paralleling contacts 18b.

If now the inch button 12 is released the relay 18 will be de-energized and contact 18b will be opened, but the relay 19 will be maintained energized through the parallel circuit aforementioned. Relay 18 when thus de-energized closes a circuit from wire 70, through contacts 18c, 19c and winding 20a to line L^2. Thus the relay 20 is energized. If now the inch button is depressed a second time a circuit is established from wire 70 through winding 8a, contacts 9f and 20c to line L^2. This energizes the forward main switch 8 and closes the contacts 8b, 8c and 8d, to connect the primary winding of the motor to the lines L^1, L^2 and L^3 for forward rotation. Response of switch 8 opens the contacts 8k, thereby de-energizing the relay 19 which in turn opens the contacts 19d and terminates current supply to the signal device 23, which meanwhile has been signaling. De-energization of relay 19 also opens the contacts 19c, which opens the energizing circuit of the relay 20 and the latter drops out. A further circuit is established from wire 70 through push button switch 12, time delay contacts 8h and through winding 17a to line L^2. This energizes relay 17 and it responds to close its normally open main contacts 17b, 17c and 17d, thereby short-circuiting an adjustable portion of each of the sections 31, 41 and 51 of the secondary resistance of the motor. Response of the switch 8 also closes the contacts 8e, thereby establishing for winding 8a a connection from its lower terminal to line L^2 in parallel with the contacts 20c so that the switch 8 remains energized when the relay 20 is de-energized. The motor thus starts to accelerate with part of its secondary resistance short circuited to overcome the friction of rest of the machine. After a given time determined by its time delay device the contacts 8h open thereby de-energizing the winding 17a, whereupon the relay 17 reinserts the resistors aforementioned into the motor circuit. The press will thereupon move at its lowest speed until the inch button is released whereupon the motor is stopped and the controller is restored to the original condition.

If it is desired to operate the press continuously the push button switch 11 is depressed. This again energizes relay 18, the circuit extending through the normally open contacts of push button 11, over the center contact thereof to wire 71 and thence to and through winding 18a to line L^2. Thereupon relay 18 responds to energize relay 19 in the manner aforedescribed and the signal bell will ring, the motor not starting. If now the running button is released relay 18 will again be de-energized and relay 20 will be energized as aforedescribed. If then the running button 11 is again depressed a circuit is established from wire 70, through the normally open contacts 11a, winding 15a, contacts 9f and contacts 20c to line L^2, and relay 15 will be energized to close a maintaining circuit for itself from wire 70 through contacts 15b, to winding 15a which has parallel connections through contacts 20c and 8e, so that relay 15 will remain energized upon release of the push button 11 following response of switch 8. A circuit is also established from wire 70, through contacts 15c, winding 8a, contacts 9f, contacts 20c, to line L^2, which energizes the main switch 8 to start the motor in a forward direction of rota-

tion, whereupon the switch 8 establishes again for itself a maintaining circuit paralleling contacts 20c, through contacts 8e, as aforedescribed and remains energized upon release of the push button 11. Energization of the switch 8 opens the contacts 8k, thereby de-energizing relay 19 which in turn de-energizes relay 20 and the bell 23 stops ringing. Also upon closure of contacts 15c, a temporary circuit is established through contacts 8h and winding 17a, to line L2, so that the torque switch again short circuits the starting or torque resistance as described before. Upon energization of switch 8 and relay 17 the contacts 8f and contacts 17e, respectively, are closed, thereby establishing a circuit from line 70, through push button switch 11, to and through winding 21a, contacts 17e and 8f to line L2. The armature energized by the coil 21a is thus lifted to move the lever of relay 21 to the closed circuit position if it is not already in that position. After a certain time during which the motor accelerates, the time delay contacts 8h open, thereby de-energizing coil 17a which causes opening of the contacts 17e and de-energization of the winding 21a of relay 21. It will further be observed that upon energization of the switch 8 the winding 21c of relay 21 is short circuited so that it has no effect upon the relay 21.

If it is desired to operate the press at a speed above the minimum speed the controller 14 is moved to one of the positions 1 to 7. Assuming that the controller is moved to position 4, then upon release of the push button 11 after the second depression thereof a circuit is established from wire 70, through contacts 11b, contact 15d and contact 17f, to contact 14a, through the segments 14e, 14f, 14g and 14h to contact 14d and thence through winding 60a to line L2. Thereupon the switch 60 closes its normally open contacts to short-circuit corresponding sections of the secondary resistance of the motor and to bring it up to a speed corresponding to such resistance commutation. If, on the other hand, the controller 14 has been moved to any other of its positions the speed of the motor will be different, depending upon the amount of resistance short-circuited.

If the machine is standing still and it is desired to operate it in the reverse direction at slow speed, the push button switch 13 is depressed, thereby energizing again relays 18 and 19 and signaling device 23. Upon release of the push button the relay 18 will be de-energized but relay 19 will remain energized through its maintaining circuit as described before. Also upon release of the push button 13 the relay 18 will through its normally closed contacts 18c, energize relay 20, while relay 19 remains energized to continue the operation of the signaling device 23. Upon the second depression of the push button 13 the relay 18 is again energized and thereby completes circuit from wire 70 to and through winding 9a and contacts 8l and 16b to line L2. This energizes reverse switch 9 for reverse drive and switch 9 in responding de-energizes relay 19 which in turn de-energizes relay 20. Reverse operation continues only so long as push button 13 is held depressed, its release de-energizing switch 9.

When it is desired to stop the press when runing in forward direction the push button switch 10 is depressed momentarily. This de-energizes the switches 15 and 8 and disconnects the motor from the line in the forward direction. Upon reclosure of contacts 8g of switch 8, a circuit is established from line L1, through contacts 21b, which are closed by the prior action of the relay 21, through energizing coil 16a, contacts 8g, to line L2. The relay 16 then closes, and, assuming that switch 10 has been reclosed by manual release of its push button, a circuit is established from conductor 70 to and through contact 16c, winding 9a, contacts 8l and 16b, to line L2, whereupon the reverse switch 9 is energized to connect the motor to the line for reverse rotation. The high inrush current of the motor produces a strong pull of the winding 21d, opposing the pull of the winding 21c, which upon closure of the switch 9 has impressed upon it the full potential between the lines L1 and L2. As the motor slows down and the current in the secondary winding decreases, the pull of the winding 21c overcomes that of the winding 21d, and moves the lever of the relay 21 to the circuit open position. This de-energizes the relay 16 and the same opens the energizing circuit of the reverse switch 9, thus disconnecting the motor from the line and the motor comes to a standstill.

I claim:

1. In a motor controller, in combination, an electro-responsive motor starting switch, a manual switch through the medium of which the former switch may be rendered responsive, a signaling device, and means acting upon a given operation of said manual switch to render said signaling device responsive and acting upon subsequent given manipulation of said manual switch to effect response of said starting switch, said means being under the control of said electroresponsive starting switch for reset of said means immediately upon response of said starting switch, to be effective for the aforementioned functions when restarting through the medium of said manual switch is attempted.

2. In a motor controller, in combination, an electroresponsive motor starting switch, a manual switch through the medium of which the former switch may be energized, a signaling device, and means effective upon a given operation of said manual switch to render said signaling device responsive and effective upon subsequent given manipulation of said manual switch to energize said electroresponsive starting switch, said means being under the control of said starting switch for termination of signaling and for reset of said means immediately upon response of said starting switch, to render said means effective for the aforementioned functions when restarting through the medium of said manual switch is attempted.

3. In a motor controller, in combination, an electroresponsive motor starting switch, a manual switch through the medium of which the former switch may be energized, a signaling device, and means effective upon a given operation of said manual switch to render said signaling device responsive and effective upon subsequent given manipulation of said manual switch to energize said electroresponsive switch and to terminate signaling by said device, said means being under the control of said starting switch for reset of said means immediately upon response of said starting switch, to render said means effective for the aforementioned functions when restarting through the medium of said manual switch is attempted, and to remove said signaling device from influence by said manual switch while said starting switch is energized.

4. In a motor controller, in combination, an electroresponsive motor starting switch, a plurality of manual switches through the medium of any one of which the former switch may be energized, a signaling device and means effective to render said signaling device responsive upon a given operation of any one of said manual switches and effective upon subsequent given manipulation of the same manual switch to energize said electroresponsive starting switch, said means being under the control of said starting switch for reset of said means immediately upon response of said starting switch, thereby to render said means effective for the aforementioned functions when restarting through the medium of any one of said manual switches is attempted.

5. In a motor controller, in combination, an electroresponsive motor starting switch, a plurality of manual switches through the medium of any one of which the former switch may be energized, a signaling device, and means effective to render said signaling device responsive upon a given operation of any one of said manual switches and effective upon subsequent given manipulation of the same manual switch to energize said electroresponsive starting switch, said means being under the control of said starting switch for reset of said means immediately upon energization of said starting switch, thereby to render said means effective for the aforementioned functions when restarting through the medium of any of said manual switches is attempted and to free said signaling device from influence by any of said manual switches while said starting switch is energized.

6. In a motor controller, in combination, electroresponsive means to start the motor for either forward or reverse operation, manual means through the medium of which the former means may be rendered responsive, a signaling device, and means effective upon operation of said manual means in attempt to effect starting in either direction, to render said signaling device responsive and upon subsequent given manipulation of said manual means, effective to energize said electroresponsive starting means for motor operation in the selected direction, said starting means being effective upon response thereof, to reset the third mentioned means to be effective for the aforementioned functioning thereof when restarting through the medium of said manual means is attempted.

7. In a motor controller, in combination, electro-responsive means to start the motor for either forward or reverse operation, manual means through the medium of which the former means may be rendered responsive, a signaling device, and means effective upon operation of said manual means in attempt to effect starting in either direction, to render said signaling device responsive and upon subsequent given manipulation of said manual means effective to energize said electroresponsive starting means for motor operation in the selected direction, said starting means being effective upon response thereof, to reset the third mentioned means to be effective for the aforementioned functioning thereof when restarting through the medium of said manual means is attempted, and the third mentioned means when reset preventing further control of said signaling device by said manual means while said starting means is energized.

8. In a motor controller, in combination, electroresponsive starting switches for forward and reverse operations respectively, individual manual control switches for said electroresponsive switches, a signaling device and means rendering said signaling device responsive upon a given initial operation of any of said manual switches and rendering the respective electroresponsive starting switch responsive upon a subsequent given manipulation of the same manual switch, each of said starting switches upon responding effecting immediate reset of said means, thereby to prepare said means for functioning as aforesaid when restarting through the medium of any of said manual switches is attempted.

9. In a motor controller, in combination, electroresponsive motor starting switches for forward and reverse operations respectively, individual manual control switches for said electroresponsive switches, a signaling device and means rendering said signaling device responsive upon a given initial operation of any of said manual switches, and rendering the respective electroresponsive starting switch responsive upon a subsequent given manipulation of the same manual switch, each of said starting switches upon responding effecting immediate reset of said means, thereby to prepare said means for functioning as aforesaid when restarting through the medium of either of said manual switches is attempted, and said means while either of said starting switches is energized freeing said signaling device from influence by any of said manual switches.

10. In a motor controller, in combination, an electroresponsive motor starting switch, a manual switch through the medium of which the former switch may be caused to respond, a signaling device, and means comprising two relays responsive progressively to effect response of said signaling device in response to a given operation of said manual switch, one of said relays releasing in response to another given operation of said switch and the other being self-maintaining to continue signaling, said means also comprising a third relay energized by the first mentioned relays when the one releases and the other is self-maintained, said third relay when energized rendering another given operation of said manual switch effective to render said electroresponsive starting switch responsive and the latter in responding de-energizing and self-maintained relay to discontinue signaling and also de-energizing said third relay.

11. In a motor controller, in combination, an electroresponsive motor starting switch, a plurality of manual switches through the medium of any one of which response of said starting switch may be effected, a signaling device, and means comprising two relays responsive progressively to effect response of said signaling device in response to a given operation of any of said manual switches, one of said relays releasing in response to another given operation of the same manual switch and the other relay being self-maintaining to continue signaling, said means also comprising a third relay energized by the first mentioned relays when the one releases and the other is self-maintained, said third relay when energized rendering another given operation of said same manual switch effective to energize said starting switch and the latter in responding de-energizing said self-maintained relay to discontinue signaling and also de-energizing said third relay.

12. In a motor controller, in combination, separate electroresponsive motor starting switches respectively to afford forward and reverse operations of the motor, manual switches

individual to said forward and reverse switches to effect response of the latter selectively, a signaling device, and means comprising two relays responsive sequentially to effect response of said signaling device in response to a given operation of any of said manual switches, one of said relays releasing in response to another given operation of the same manual switch and the other relay being self-maintaining to continue signaling, said means also comprising a third relay rendered responsive by the first mentioned relays when the one releases and the other is self-maintained, said third relay when energized rendering another given operation of said same manual switch effective to cause response of its respective starting switch, and the latter in responding de-energizing said self-maintained relay to discontinue signaling and also de-energizing said third relay.

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