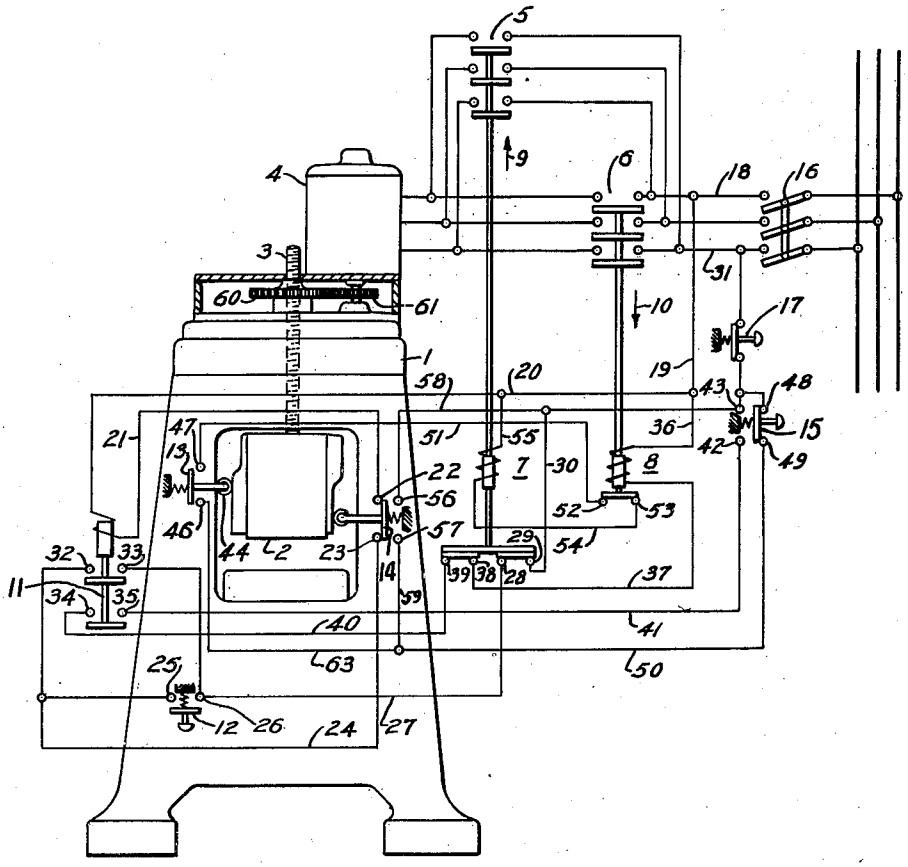
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SPINDLE PRESS DRIVE

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SPINDLE PRESS DRIVE

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Our invention relates to a drive for a machine press, such as, for example, a spindle press and to a control system for such drive.

An object of our invention is to provide a drive for a machine press, such as, for example, a spindle press in which the spindle is in permanent driving engagement with a reversible motor.

Another object of our invention is to provide a control system for said reversible motor such that the spindle press will automatically move upwardly after it has completed its downward movement.

Another object of our invention is to provide a control system for said reversible motor such that release of the "start" button for said system before the stamp press has completed its downward movement will effect stopping of said downward movement and automatic reversal of said motor, thereby effecting an upward movement of the stamp press.

Other objects and advantages will become more apparent from the study of the following specification when considered in conjunction with the accompanying drawing.

The upward and downward movement of the press stamp in machine presses, such as, for example, spindle presses, has heretofore been effected by providing the spindle with a disk on which a friction wheel presses from above or from below in accordance with the direction it is desired that the spindle should rotate. This type of drive for reversing the direction of spindle rotation is comparatively complicated, and since it causes comparatively rapid wear of the friction wheels, gives rise to frequent delay.

Our invention removes these deficiencies by a radical departure from the present types of drives. Our invention embodies a drive by a reversible motor which is continuously coupled with the spindle.

In the drawing, the single figure of which shows an embodiment of our invention, the reference character 1 denotes the frame of a spindle press which has a press stamp 2 which is moved up and down by a spindle 3 which is screw threaded to said press stamp. The spindle 3 may be set into rotation by a reversible motor 4 which is continuously coupled, through gears 60 and 61, with the spindle. The reversal of the motor 4 is effected by two reversing switches 5 and 6 which are actuated by relays 7 and 8, respectively. If the relay 7 becomes energized, thus causing the switch 5 to close, the motor 4 sets the spindle 3 into rotation causing an upward movement of the press stamp 2; on the other hand, if relay 8 becomes energized thus causing the switch 6 to close, motor 4 rotates in an opposite direction and, accordingly, moves the press stamp 2 downwardly. The direction in which the press stamp 2 moves when the switches 5 and 6 are closed is indicated by the arrows 9 and 10, respectively, disposed adjacent the relays 7 and 8, respectively, to facilitate the understanding of the circuit. The essential control and switching elements of the illustrated control system further include a "set up" relay 11, the energization of which is controlled by a "set up" pushbutton switch 12, two switches 13 and 14 movable in accordance with the movement of the press stamp 2, and finally a "start" pushbutton control switch 15. A main switch 16 serves to disconnect the whole system in case where necessity therefor arises. The control device, as such, may also be denergized by pressing down a "stop" pushbutton switch 17.

The operation of the device is as follows: If the press stamp 2 is to be set into motion, then first of all the "set up" pushbutton switch 12 must be pressed. By this a circuit is closed which, assuming that the switches 16 and 17 are closed, may be traced from the bus 18 through conductors 19 and 20, the magnet coil of relay 11, conductor 21, bridged contact elements 22 and 23 of the switch 14, conductor 24, the bridged contact elements 25 and 26 of pushbutton switch 12, conductor 27, the bridged contact elements 28 and 29 of the relay 7, conductor 30, and finally switch 17 to the bus 31. The energization of relay 11 causes the bridging of "interlock" contact members 32 and 33, also the bridging of "set up" contact members 34 and 35. By the bridging of the interlock contact members 32 and 33, a shunting of the pushbutton switch 12 is effected by which relay 11 remains energized even though pushbutton switch 12 is released, allowing the opening thereof by its spring.

By the bridging of contact members 34 and 35, a preparatory or "set-up" circuit is completed so that the driving motor will be started just as soon as the "start" pushbutton switch 15 is pressed. When the "start" pushbutton switch 15 is pressed, relay 8 is energized effecting the closing of switch 6. The circuit which is completed by the pressing of "start" pushbutton switch 15 may be traced from the bus 18 through conductors 19 and 36, the magnet coil of relay 8, conductor 37, bridged contact members 38 and 39 of relay 7, conductor 40, contact members 34 and 35 of relay 11, conductor 41, bridged contact members 42 and 43 of the pushbutton switch

15, "stop" pushbutton switch 17 to the bus 31. The closing of switch 6 will effect starting of the motor 4 and a downward movement of press stamp 2. After the press stamp 2 has moved downwardly a predetermined amount, that is, as soon as roller 44 runs off cam 45, limit switch member 13 is moved to the right by its spring thus bridging contact members 46 and 47, but this bridging of contact members 46—47 has no immediate effect.

Now assume that while press stamp 2 is moving downwardly, in an abnormal operation of the device, as in a case of danger, that the "start" pushbutton switch 15 is released before press stamp 2 has completed its downward movement, thus permitting the spring and bridging element of "start" switch 15 to open the circuit between contact members 42 and 43 and to close the circuit between contact members 48 and 49, then by reason of the interruption of the circuit through the electromagnet coil of the relay 8 and the interruption of the circuit at contact members 42 and 43, relay 8 is immediately again returned to the position shown in the drawing. Switch 6 is thus opened and the motor is disconnected from the power source. Simultaneously, however, a circuit through relay 7 is closed. The circuit for this relay may be traced from bus 31, pushbutton switch 17, contact members 48 and 49 of the pushbutton switch 15, conductor 50, bridged contact members 46 and 47 of switch 13, conductor 51, bridged contact members 52 and 53 of relay 8, conductor 54, the actuating coil of relay 7, conductors 55, 20 and 19 to the bus 18. Relay 7 is thus energized effecting the closure of switch 5 which, in turn, causes reversal of the direction of rotation of the motor, so that the press stamp 2 will now move upwardly corresponding to the direction given by arrow 9. In other words, if, during the operation of the machine, any danger arises, as a result of which the operator through fright or otherwise releases the pushbutton switch 15, the downward movement of the press stamp 2 is at once arrested and the press stamp, in the next instant, is moved upwardly. After stamp press 2 has moved upwardly a predetermined amount, roller 44 will ride on cam 45, opening limit switch 13, thus interrupting the circuit through electromagnetic coil 7 which in turn opens switch 5 and stops the motor.

If, as in a normal operation, the pushbutton switch 15 is pressed and held that way without interruption during the downward movement of the press stamp, then after the switch 13 has closed as the result of roller 44 moving off cam 45, limit switch 14 will be actuated by the downward movement of press stamp 2 by a similar roller and cam arrangement causing opening of the circuit between contact members 22 and 23 and bridging of contact members 56 and 57. The unbridging of limit switch contact members 22 and 23 effects an interruption of the circuit through the magnet coil of the auxiliary relay 11, causing the opening of the circuit through the contact members 34 and 35 in which circuit the electromagnetic coil of relay 8 is connected also the opening of the interlock circuit through contact member 34—35. The deenergization of relay 8 causes the opening of switch 6 and the stopping of motor 4. Briefly, the unbridging of contact members 22—23 stops the downward movement of the press stamp and at the same time interrupts the "set up" circuit. By the bridging of the contact members 56 and 57 which immediately follows, a circuit is closed through the electromagnetic coil of relay 7, extending from bus 31, switch 17, conductor 58, contact members 56 and 57 of switch 14, conductors 59 and 63, the bridged contact members 46 and 47 of switch 13, conductor 51, the bridged contact members 52 and 53 of relay 8, conductor 54, the electromagnetic coil of relay 7, conductors 55, 20 and finally 19 to the bus 18. The energization of relay 7 causes the closing of switch 5 so that the motor 4 from this instant onward sets the spindle 3 in rotation in an opposite direction so as to effect an upward movement of the press stamp 2. If the press stamp 2 moves upwardly, roller 44 of the switch 33 will be eventually guided to the left unbridging contact elements 46—47 of switch 13 so that the above-described circuit, in which the electromagnetic coil of relay 7 is connected, will be opened, and, in turn, switch 5 will be opened. The driving motor 4 is thus stopped in the position shown in the drawing. In the course of the upward movement of the press stamp, the switch 14 also assumes the position shown in the drawing in which contact members 22 and 23 are bridged. The bridging of these contact members 22, 23, however, at this instant, has no effect, since the holding circuit for the auxiliary relay 11 has already been interrupted by the unbridging of contact members 32—33. Since relay 11 is now deenergized, a pressing of the "start" pushbutton switch 15 up until the instant at which the contact elements 22 and 23 of the switch are again bridged cannot initiate a new cycle comprising an upward and downward movement of the press stamp 2. After each cycle of operation, it is always necessary that the "set-up" or auxiliary relay 11 be again brought into the operating (energized) position by pressing the "set-up" pushbutton switch 12 before the "start" pushbutton is pressed.

A particular characteristic of the described circuit is that once the downward movement of the press stamp is started and the "start" pushbutton is continuously held down, the press stamp can move through only one cycle of operation; that is to say, move only once downwardly and once upwardly, and that before a new operation can be started, there must first be provided a new starting impulse by pressing "set-up" pushbutton switch 12. Another important characteristic of the system is that upon release of the "start" pushbutton 15 during the downward movement of press stamp 2, as in case of danger, the downward movement of the press stamp is at once arrested and is immediately followed by an upward movement thereof.

We are, of course, aware that others, particularly after having had the benefit of the teachings of our invention, may devise other machine press drives and other control systems therefor embodying our invention and, therefore, we do not wish to be limited to the specific showings made in the drawing and the descriptive disclosure hereinbefore made, but wish to be limited only by the scope of the appended claims and such prior art that may be pertinent.

We claim as our invention:

1. In a machine press, in combination, a press stamp, a reversible motor and an electric power source therefor, means exclusive of clutch means providing a permanent driving connection between said motor and said press stamp, circuit means including a "start" switch which, upon pressing thereof, completes a starting circuit, starts said motor, thus effecting downward move-

ment of said press, a second circuit means including a second switch which is actuated by said press stamp and which automatically reverses said motor after said press stamp has moved downwardly a predetermined amount and a third circuit means including still another switch which is actuated by said press stamp after the latter has completed its upward movement, which last mentioned switch interrupts said power source and stops said motor.

2. In a machine press, in combination, a press stamp, a single reversible motor for effecting reciprocation of said press stamp and an electric power source therefor, means exclusive of clutch means for providing a permanent driving connection between said motor and said press stamp, circuit means including a "set-up" switch the closing of which switch partially completes a starting circuit, a "start" switch which, upon pressing, completes said starting circuit, starts said motor, thus effecting downward movement of said stamp press after it, a second circuit means actuated by said press stamp has moved downwardly a predetermined amount and which effects reversal of said motor, thus effecting an upward movement of said press stamp, and a third circuit means including a switch which is actuated by said press stamp after said press stamp has moved upwardly a predetermined amount and which switch interrupts said power source and stops said motor, and means which interrupts said starting circuit and makes the subsequent closing of said "start" switch ineffective to restart the motor until the "set-up" switch has been previously closed.

3. In a machine press, in combination, a press stamp, a single reversible motor for effecting reciprocation of said press stamp and an electric power source therefor, means exclusive of clutch means providing a permanent driving connection between said motor and said press stamp, circuit means including a "start" push button switch which, upon pressing, completes a starting circuit, starts said motor, thus effecting downward movement of said stamp press, a second circuit means actuated by the release of said "start" pushbutton which, if said stamp press has not completed its downward movement, will interrupt the starting circuit, stop said motor and effect a reversal of said motor, thus moving said press stamp upwardly.

4. In a machine press, in combination, a press stamp, a single reversible motor for effecting reciprocation of said press stamp and an electric power source therefor, means exclusive of clutch means providing a permanent driving connection between said motor and said press stamp, circuit means including a "set-up" switch, the closing of which partially completes a starting circuit, a "start" switch, the closing of which completes said starting circuit effecting the starting of said motor and downward movement of said press stamp, a second circuit means actuated by said press stamp after the press stamp has completed its downward movement and which automatically reverses said motor thus effecting an upward movement of said press stamp, and a third circuit means including a switch which is actuated by said press stamp after said press stamp has moved upwardly a predetermined amount and which switch interrupts said power source and stops said motor, and means which interrupts said starting circuit and makes the subsequent closing of said "start" switch ineffective to restart the motor until the "set-up" switch has been previously closed.

5. In a machine press, in combination, a press stamp, a single reversible motor for effecting reciprocation of said press stamp and an electric power source therefor, means exclusive of clutch means providing a permanent driving connection between said motor and said press stamp, circuit means including a "set-up" relay which relay comprises an electromagnetic coil, a pair of "interlock" contact members and a pair of "set-up" contact members, circuit means including said "set-up" switch, which, when closed, will effect energization of said electromagnetic coil thereby closing said "interlock" and "set-up" contact members, thus closing an "interlock" circuit which hunts said "set-up" switch and closing a "set-up" circuit which forms a partial starting circuit, respectively,—a "start" switch which, when closed, completes said starting circuit, starts said motor and effects downward drive of said press stamp, a switch which is operable by said press stamp after said press stamp has moved downwardly a predetermined amount and the opening of which switch effects deenergization of said "set-up" relay and opening of said "interlock" circuit and of said "set-up" circuit, a second switch which is adapted to be closed by said press stamp immediately after said first switch has been opened, said second switch, upon closing, completing another circuit which effects interruption of said downward drive and a reversal of said motor thus effecting an upward drive of said stamp press.

6. In a machine press, in combination, a press stamp, a single reversible motor for effecting reciprocation of said press stamp and an electric power source therefor, means exclusive of clutch means providing a permanent driving connection between said motor and said press stamp, circuit means including a "set-up" relay which relay comprises an electromagnetic coil, a pair of "interlock" contact members and a pair of "set-up" contact members, circuit means including said "set-up" switch, which, when closed, will effect energization of said electromagnetic coil thereby closing said "interlock" and "set-up" contact members, thus closing an "interlock" circuit which shunts said "set-up" switch and closing a "set-up" circuit which forms a partial starting circuit, respectively,—a "start" switch which, when closed, completes said starting circuit, starts said motor and effects downward drive of said press stamp, a switch which is operable by said press stamp after said press stamp has moved downwardly a predetermined amount and the opening of which switch effects deenergization of said "set-up" relay and opening of said "interlock" circuit and of said "set-up" circuit, a second switch which is adapted to be closed by said press stamp immediately after said first switch has been opened, said second switch, upon closing, completing another circuit which effects interruption of said downward drive and a reversal of said motor thus effecting an upward drive of said stamp press, a "limit" switch which is actuated by said press stamp after the latter has completed its upward movement and which effects deenergization and stopping of said motor.

7. In a machine, in combination, a press stamp, a single reversible motor for effecting reciprocation of said press stamp and an electric power source therefor, means exclusive of clutch means providing a permanent driving connection be-

tween said motor and said press stamp, circuit means including three relays, the first of which, when energized, effects the partial completion of a starting circuit for said motor, the second relay, when energized effects downward movement of said press stamp, and the third relay, when energized, effects upward movement of said stamp press,—a "set-up" switch, which, upon closing, completes a circuit through said first relay, a "start" switch, which upon closing, completes said starting circuit through said second relay, and a further switch which is adapted to be actuated by said press stamp after the downward movement of the latter has been completed to deenergize said first relay and to energize said third relay, thus effecting reversal of the movement of said press stamp.

8. In a machine, in combination, a press stamp, a single reversible motor for effecting reciprocation of said press stamp and an electric power source therefor, means exclusive of clutch means providing a permanent driving connection between said motor and said press stamp, circuit means including three relays, the first of which, when energized, effects the partial completion of a starting circuit for said motor, the second relay, when energized effects downward movement of said press stamp and the third relay, when energized, effects upward movement of said stamp press, a "set-up" switch, which, upon closing, completes a circuit through said first relay, a "start" switch, which, upon closing, completes said starting circuit through said second relay, and a further switch which is adapted to be actuated by said press stamp after the downward movement of the latter has been completed to deenergize said first relay and to energize said third relay, thus effecting reversal of the movement of said press stamp, and a limit switch which is adapted to be actuated by said press stamp after its upward movement has been completed effecting deenergization and stopping of said motor.

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