C. A. DRESSER.

ELECTRIC CONTROL MECHANISM FOR DRIVING MECHANISM.

APPLICATION FILED NOV. 11, 1911.

1,046,057.

Patented Dec. 3, 1912.

4 SHEETS—SHEET 1.

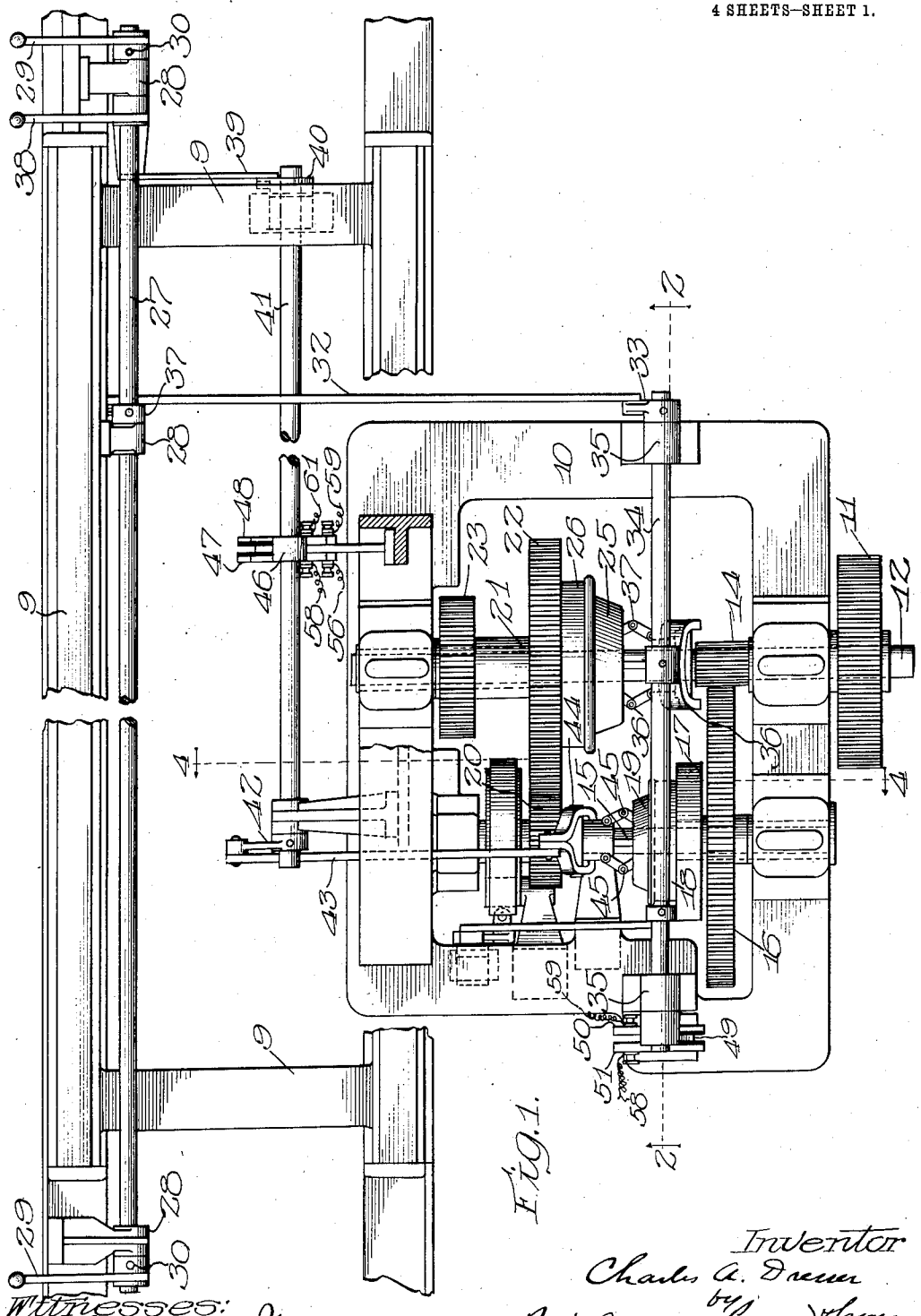

FIG. 1.

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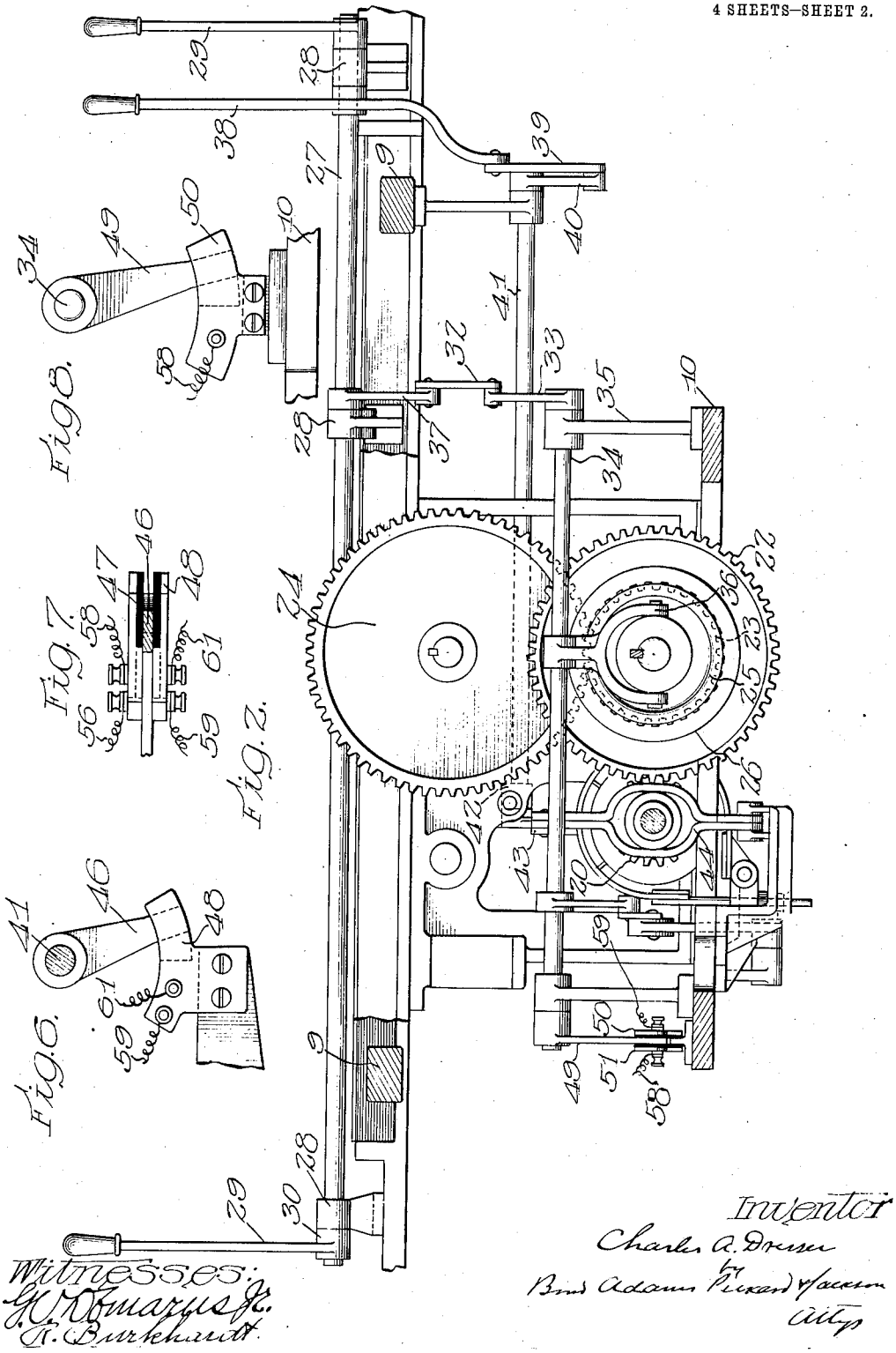

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4 SHEETS—SHEET 3.

Fig. 3.

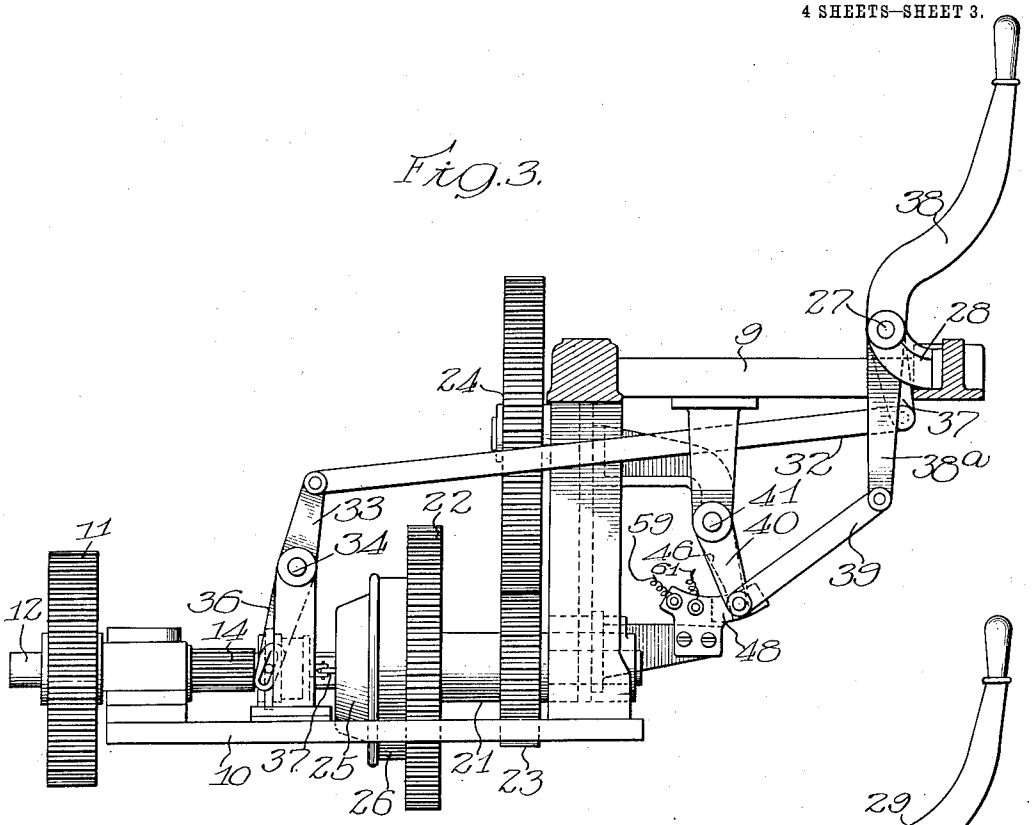
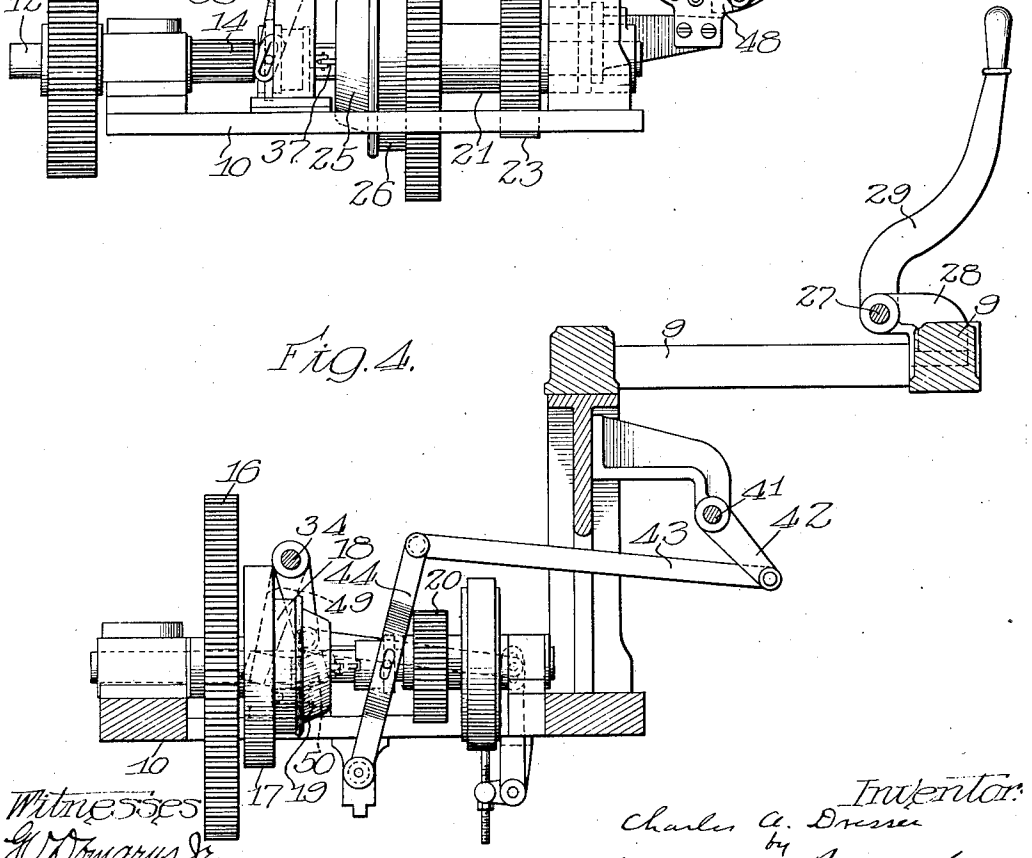


Fig. 4.



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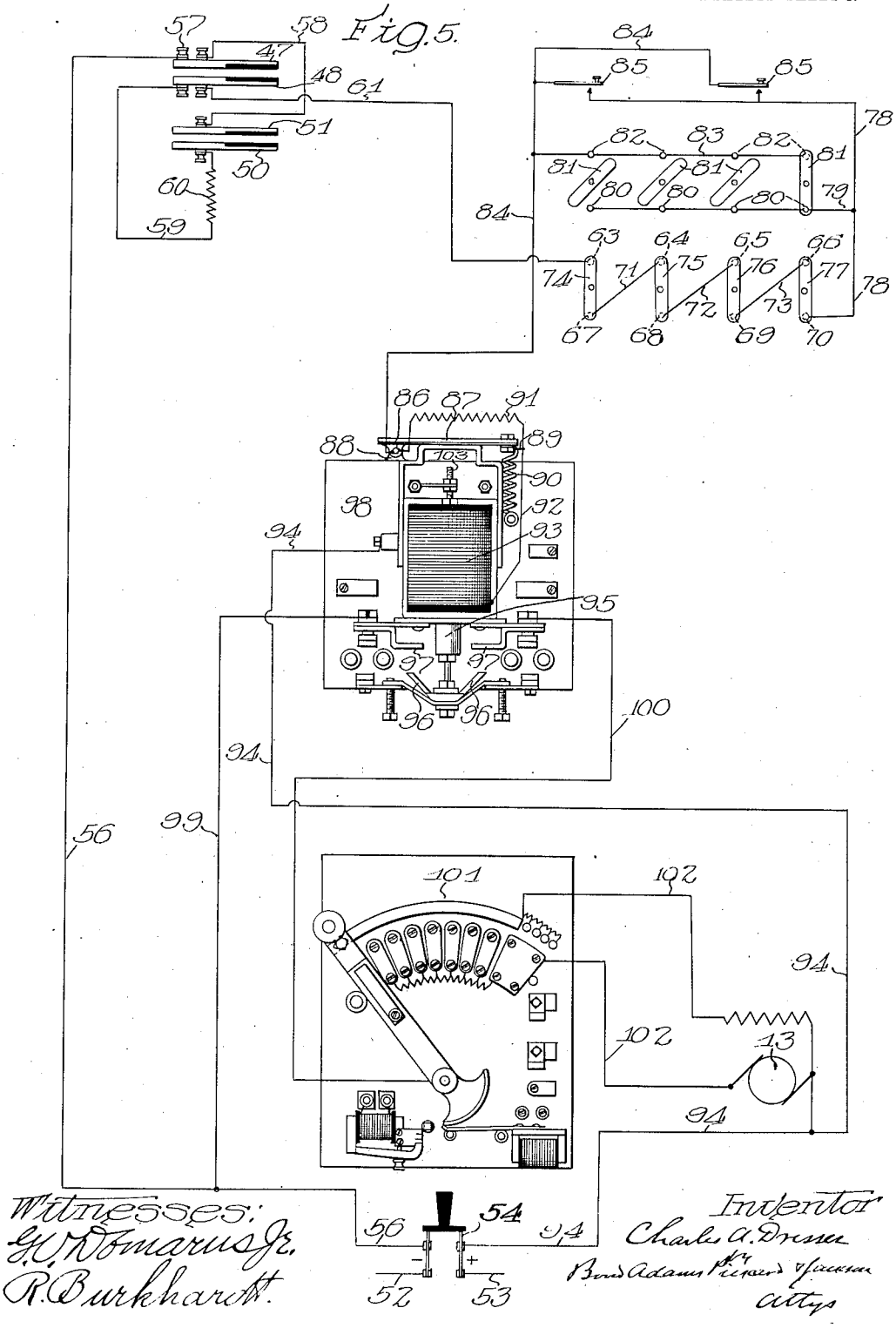
4 SHEETS—SHEET 4.

Fig. 5.



UNITED STATES PATENT OFFICE.

CHARLES A. DRESSER, OF CHICAGO, ILLINOIS, ASSIGNOR TO THE GOSS PRINTING PRESS COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF ILLINOIS.

ELECTRIC CONTROL MECHANISM FOR DRIVING MECHANISM.

1,046,057. Specification of Letters Patent. Patented Dec. 3, 1912.

Application filed November 11, 1911. Serial No. 659,765.

To all whom it may concern:

Be it known that I, CHARLES A. DRESSER, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Electric Control Mechanism for Driving Mechanism, of which the following is a specification, reference being had to the accompanying drawings.

My invention relates to electric control devices for driving mechanism, and particularly to electric control mechanisms for high and low speed driving mechanisms, such as are used on printing presses.

As is well known, driving mechanisms are used in connection with speed motors, particularly for printing presses, by means of which, with the motor running at constant speed, the press may be driven at a slow speed for purposes of threading the paper through or for other purposes when it is desired to run it at a slow speed, and also for starting the press, and by means of which, by the shifting of the mechanism, the high speed driving devices may be thrown into gear so as to drive the press at high speed. Generally speaking, such mechanisms contain a shifting lever, or similar device, by which the low speed driving gearing may be thrown in so as to connect the motor with the press and drive it at a low speed, and also another shifting lever by which the high speed gearing may be thrown into connection between the motor and the press so as to drive the press at a low speed.

It is the main object of my invention to provide electrically-operated mechanism in connection with high and low speed driving mechanism of such a character that the press cannot be started at the high speed; that is to say, of such a character that if the high speed operating lever should be accidentally thrown over to connect up the high speed gearing when the press is at rest the driving motor will not be connected with the circuit and the press will, therefore, not be started.

Further, my invention relates to electrical mechanism in connection with low and high speed mechanism by which the motor is connected with the circuit, when the press is in a state of rest, only by throwing into operation the low speed mechanism, and with the slow speed mechanism driving the movement of the high speed mechanism into operative relation between the motor and the press, will still leave the electric circuit in operative relation with the motor so that it drives the press.

It also has for an object to provide a new and improved mechanism by which the driving mechanism may be operated, when working under the slow speed motion, by push buttons at various parts of the press.

It also has for its object improvements in electric mechanism for controlling the starting, stopping, and slow and high speed driving mechanism, particularly when used in connection with a printing press in various respects hereinafter pointed out in the claims.

Referring to the drawings,—Figure 1 is a top or plan view of one form of a high and low speed driving mechanism, being the form which I prefer to use, showing portions of the framework of the press broken away and also the mechanism by which the shifting of the operating levers makes the electrical connections; Fig. 2 is a front elevation taken on line 2—2 of Fig. 1; Fig. 3 is a detail, being an end view of the driving mechanism, seen from the right in Fig. 1; Fig. 4 is a detail, being a section on line 4—4 of Fig. 1; Fig. 5 is a view of the electrical connections shown diagrammatically, showing also the switches, controller, and solenoid; Fig. 6 is an enlarged detail, being a view of the switch and switching arm on the slow speed mechanism; Fig. 7 is a top view of the switch shown in Fig. 6; and Fig. 8 is an enlarged detail, being a view of the switch and switching arm operated by the high speed mechanism.

In Figs. 1, 2, 3 and 4, I have shown a slow and high speed driving mechanism, which is the form that I prefer to use in connection with my invention. The driving mechanism there shown is the driving mechanism shown and described in Letters Patent of the United States, No. 988,560, granted to William Evensen, assignor to The Goss Printing Press Company of Chicago, and granted April 4, 1911. As this mechanism is fully shown and described in said patent and its operation fully detailed therein, and as the particular form of driving mechanism is not of itself my invention, it is believed that a general description, without

going too much into detail, is all that is necessary. Referring to these figures, therefore, 9 indicates the framework of a printing press. 10 indicates the framework on which the driving mechanism hereinafter described is mounted. 11 indicates a gear, which is secured in any suitable manner upon a shaft 12 which is journaled in the framework 10. The gear 11 is driven by any suitable motor, as 13, which is diagrammatically illustrated in Fig. 5, and is not shown in the other figures. 14 indicates a pinion, which is secured in any suitable manner to the shaft 12 so as to rotate therewith. 15 indicates a shaft, which is journaled in the frame 10. 16 indicates a gear, which is rotatably mounted upon a suitable bushing on the shaft 12 and meshes with the gear 14 so as to rotate therewith. 17 indicates a spider, which is rotatably mounted with reference to the shaft 15 of the gear 16 and which is driven by said gear when operating in one direction by means of suitable pawls and ratchets, such as are described in the said Letters Patent to Evensen, or in any other suitable manner. 18 indicates a clutch-member, which is revolubly mounted on the shaft 15, but fast with relation to the spider 17, so as to be driven thereby. 19 indicates a second clutch-member, which is feathered on the shaft 15 so as to engage or disengage with the other clutch-member 18, all as described in said patent to Evensen. This second clutch-member is moved back and forth upon the shaft by the mechanism hereinafter described. 20 indicates a gear, which is keyed, or otherwise secured, upon the shaft 15 so as to rotate therewith. 21 indicates a sleeve-hub, which is revolubly mounted upon the shaft 12 and carries secured to said hub a gear 22 which meshes with the gear 20. 23 indicates a driving gear, which is also integral with or secured to said sleeve-hub 21 and which meshes with any suitable gear, as 24, which is connected in any well-known manner with the driving mechanism of the press. It will be obvious from this and from the above brief description that when the clutch members 18 and 19 are thrown into engagement and the gear 11 is driven by the motor, the shaft 12 and the pinion 14 will be rotated, thus rotating gear 16, spider 18, and through the clutch members 18 and 19 the shaft 15, the pinion 20, gears 22 and 23, thus driving the press at a slow speed. As has been said, the full particulars of this are set forth in said Evensen patent and it is believed need no further description here. 25 indicates a clutch-member, which is feathered upon the shaft 12 so as to slide thereon and is operated by the mechanism hereinafter described. 26 indicates a second clutch-member designed to coact with the clutch-member 25 and which is formed integral with or rigidly secured upon the gear 22 so as to rotate with it and with the hub 21. It will be obvious from the above brief description that when the clutch members 25 and 26 are thrown into operation the gear 22, sleeve hub 21, and gear 23 will be driven at the full speed of the shaft 12 and the press driven, therefore, at fast speed. As is set forth in said Evensen patent, the construction is such that the slow speed lever need not be thrown off at all after the high speed is engaged, and the slow speed clutches may be afterward separated. 27 indicates a rock-shaft, which is mounted in suitable bearings, as 28, in the framework of the press and carries at each end operating arms 29 which are secured thereto in any suitable manner, as by set-screws 30. Depending from said rock-shaft is an arm 37, which, by means of a link 32, is connected with an arm 33 pinned to a rock-shaft 34 which is mounted in suitable bearings, as 35, on the frame 10. 36 indicates a clutch-shifter, which, by means of links 37, is connected with the clutch-member 25, whereby, when the shaft 27 is rocked by either of the hand levers 29, the clutch-member 25 is thrown into and out of engagement with the clutch-member 26. All these parts are operated in the same manner as shown and fully described in said Evensen patent above referred to. 38 indicates a lever, which is journaled upon the rock-shaft 27 and is provided with an arm 38^a extending downward below said shaft. By means of a link 39 the lower arm 38^a is connected with an arm 40 on rock-shaft 41 journaled in suitable bearings in the frame, whereby the rock-shaft 41 is rocked by the movement of the hand-lever 38. At the other end of the rock-shaft 41 is an arm 42 depending therefrom, which, by means of a link 43, is connected with a clutch-shifter 44, which, by means of suitable links 45, operates the clutch-member 19 so as to move it into and out of contact with the clutch-member 18. It will be obvious from the above description that when the hand-lever 38 is rocked in one direction or the other the clutch members 18 and 19 are engaged or disengaged from one another so as to throw the slow speed into and out of operative connection, as above described. All these parts, as has been said, operate in the manner shown in detail in said Evensen patent.

Coming now to my electrical mechanism by which the slow and high speed is controlled and its connection with the motor established, 46 (see Fig. 6) indicates a switch-arm, which is secured to the rock-shaft 41 (see particularly Figs. 1 and 7). The arm 46 operates between two members 47—48 of a switch so that when the shaft 41 is rocked to throw the slow speed clutches

into engagement the arm 46 is moved into the switch so as to establish electrical connection between the members thereof.

49 indicates an arm, which is mounted at one end of the rock-shaft 34 and operates between two arms 50—51 (see Fig. 5) of a switch which is supported in any suitable manner upon the framework. The arm 29, when the rock-shaft 34 is operated by rock-shaft 27 to throw the high speed clutches into engagement, operates to move the arm 49 between the switch arms 50—51 and electrically connect them.

Referring now particularly to Fig. 5, in which the electrical connections are illustrated—52—53 indicate the main circuit wires, in which is interposed a switch 54 of the well-known character and description adapted to connect the main circuit wires with the circuit wires of my device. 56 indicates a wire leading from the switch, from one of the switch blocks, to one arm, as 47, of the slow speed switch, to which it is connected by a suitable binding screw, as 57. 58 indicates a circuit wire, which, by means of suitable binding screws, is connected with one arm 51 of the high speed switch. 59 indicates a circuit wire having in it a resistance 60 hereinafter more fully described. The circuit wire 59, by suitable binding screws, connects the switch arm 50 of the high speed switch with the other arm 48 of the low speed switch. 61 indicates a circuit wire, which, by a suitable binding screw, is connected at one end with the arm 48 of the slow speed switch and at the other end is connected to a plug, as 63. 64—65—66 indicate a plurality of plugs. 67—68—69—70 indicate a plurality of plugs. By means of wires 71—72—73 the plugs 67—68—69 are connected, respectively, with the plugs 64—65—66. 74—75—76—77 indicate switches, which, respectively, connect plugs 63 and 67, 64 and 68, 65 and 69, and 66 and 70, so that when all the switches are closed the plugs 63 to 70, inclusive, are electrically connected in series, and when any switch is open there is a break in the circuit. 78 indicates a wire which leads from the plug 70. 79 indicates a wire having in it a series of plugs 80, which, by means of switches 81, are connected in parallel with plugs 82 on a wire 83. It is understood that the above-described switches and plugs vary in number and may be located at any suitable points in the press so as to be accessible to the several workmen operating the press, and in order not to cause confusion in the drawings, they are only diagrammatically illustrated here as their operation will be well understood. The wire 83 is connected with a wire 84 whose connections are hereinafter described. 85 indicates push-buttons, either one of which when pushed in electrically connects circuit wire 78 with circuit wire 84. These buttons are adapted to normally remain open and to be pressed in by the operator at convenient points in the press when it is desired to establish only a temporary and short connection between the motor and the electric circuit, as hereinafter described, for the purpose of "turning the press over"—that is to say, giving it only a very small degree of movement. The circuit wire 84 is connected by a suitable set-screw, as 86, with a switch 87 which is pivoted at one end in a suitable support, as 88, and at the other end is adapted to make electrical contact with a contact 89 with which it is normally held in engagement by a spring 90. 91 indicates a resistance in parallel with the switch 87. The switch and the resistance are both connected with a circuit wire 92 which connects with a solenoid 93. The other end of the solenoid coils, by means of circuit wire 94, is connected with the other arm of the switch 54 so as to complete the circuit through the solenoid. The solenoid may be of any well-known type and character, such as the well-known "Cutler-hammer" type used in similar printing presses. 95 indicates a core for the solenoid, which carries at its lower end conducting arms 96, which, when the solenoid is raised, are brought into contact with conducting arms 97 which are suitably mounted in any approved way upon the base 98 upon which the solenoid is carried. 99 indicates a circuit wire, which leads off from the circuit wire 56 to one of the arms 97. 100 indicates a circuit wire which leads from the other switch arm 97 to a controller 101, which may be of any well-known and approved type and which forms no part of my invention. From the controller a circuit wire 102 leads to the motor 13 in any well-known and approved manner, which forms of itself no part of my invention. It will be obvious that when the core 95 is raised by the operation of the solenoid, the conducting arms 96 will be brought into connection with arms 97, electrically connecting them, and allowing a current to pass through arms 97 and 96 into circuit wire 100 and thence through the controller to the motor, throwing the same into operation. 103 indicates a rod projecting upward from the end of the block 95, which is adapted, when said block is raised by the operation of the solenoid, to lift the switch 87 away from the contact 89, whereby the greater part of the current from the wire 84, instead of flowing through the switch to the solenoid, will flow through the resistance 91 into the solenoid. The resistance 91 is made of such ohmic resistance that when the switch 87 is open the current running through the solenoid will not be sufficient to raise the block 95 but will be sufficient to hold it in its place in the solenoid when it has once

been raised. The purpose of this resistance will be hereinafter described. The resistance 60 is also of such ohmic resistance that when the current passes through it, as hereinafter described, sufficient current will not flow to the solenoid to raise the block 95, but will allow sufficient current to pass to hold the block 95 when the same has been raised, as hereinafter described.

The operation of the above-named devices is as follows: When the slow movement mechanism is thrown into operation by the movement of the arm 38, the arm 46 is moved between the two switch members 47 and 48 of the slow speed mechanism, electrically connecting them. The current thereupon passing from the circuit through wire 56, passes across the switch members and out by wire 61 to the contact plugs 63. If any one of the switches 74 to 77 is open (which, as has been said above, may be of any desired number and are located at parts of the press convenient to the workmen operating the same) or if all the switches 81 are open, no current will pass. The press, therefore, cannot be started, even if the slow speed mechanism is thrown in, unless all of the switches 74 to 77 are connected and unless one of the switches 81 or one of the push-buttons 85 is pushed in, thereby preventing the press from starting when any single operator, who may have previously disconnected his switch, is not ready. Assuming, however, that all of the switches 74 to 77, which, as has been said before, are in series, are closed and that either one of the switches 81 is closed, the current passing through wire 61 will pass across the several switches and connections into the circuit wire 78, thence to the wire 79 through whichever switch 81 happens to be closed to wire 83. The switch 87 being in contact with contact 89, the paramount part of the current will pass through switch arm 87, contact 89, circuit wire 92, through the solenoid and back to the circuit. The solenoid will thus be energized, lifting the core 95, and completing through arms 96 and 98 the connections between the main circuit wires 52—53 and the motor 13. The motor 13 is thereupon, of course, set into operation, driving the gear 11 and thus operating the press at slow speed. If, instead of closing one of the switches 81 for the purpose of causing the press to rotate for some time, it is desired to merely "turn it over", instead of closing one of the switches 81 the operator, at the point of the press from which it is desired to set it in motion, closes one of the push-buttons 85 and thereupon the circuit is closed through wire 78 and the wire 84 and thus through the solenoid, operating in the same manner as when one of the switches 81 is closed. The switches 81, of course, are all normally open when the press is silent, and one or the other is only closed when it is desired to run the press. Of course, the switches 81 being normally open, when the press is temporarily operated by one of the push-buttons 85, the releasing of the push-buttons at once breaks the circuit through the solenoid, the solenoid core 95 drops, breaking the circuit from the main circuit through the motor by separation of the arms 96 from the contact arms 97, and the motor is stopped. The driving mechanism is now running at slow speed. It being desired to move the press at high speed, the high speed mechanism is set into operative relation with the press by means of one of the arms 29. The arm 49 thereupon swings between the switch arms 50 and 51, electrically connecting them, and a portion of the current will flow from circuit wire 58 across the arms 51 and switch arm 49, through resistance 60 and circuit 59 to circuit wire 61, and thence through the several switches, if they are closed as above described, to the solenoid, and the press continues to run at high speed. The slow speed mechanism may be now thrown out, which electrically disconnects arms 48 and 47 so that the entire current will flow through circuit wire 58, switch arms 51 and 52, through the resistance 60, circuit 59 of circuit wire 61, and thence through the various switches to the solenoid, and since the resistances, as has been said, are sufficient to hold the core up in the solenoid but not sufficient to raise it when it is down, the electrical connections from the circuit through the motor will be preserved and the motor continue to run and the press be driven at a high speed. If, through any mistake, the high speed lever should be thrown into operation when the press is at rest, the current, of course, will pass from circuit wire 56, circuit wire 58, to switch arm 51, thence through the arm 49 to switch arm 50, through resistance 60, circuit 59, and the several switches to circuit 61. If the switches 74 to 77 should all be closed and one of the switches 82 be closed or one of the push-buttons 85 be closed, the current will flow to circuit wire 84 and thence through the solenoid and back to the circuit; but the resistance 60 being of such ohmic resistance that the solenoid will not be sufficiently energized to lift the core 95, the core would remain in its lower position, and consequently the circuit through wire 99 and contacts 97 to circuit 100, controller and motor will be broken and the motor will not be operated. It will thus be seen that not only can the press not be started when any one of the operators has one of the switches 74 to 77 open by some operator in another part of the press closing one of the switches 81 or either of the push-buttons 85, but also the press cannot be started even if all the connections were closed by the careless or

accidental throwing of the high speed mechanism into engagement when the press is silent.

It will be obvious from the above description that if the press is running at a low speed it may not only be stopped by the breaking of the circuit by means of any one of the switches 74 to 77 or by the breaking of the circuit by any one of the switches 81 or one of the push buttons, but may also be broken by throwing the slow speed mechanism out of engagement, which electrically disconnects switch arms 47 and 48, thereby opening the circuit through both solenoid and motor and stopping the press. If the press is running at high speed, and the slow speed lever is thrown out, which is always the case after the press has been speeded from slow speed to high speed in order to prevent the racing of the parts, as is described in said Evensen patent, the press may be stopped not only by the opening of the several switches under the control of the workmen, but also may be stopped by the throwing of the high speed mechanism out of operative connection with the press, which electrically separates switch arms 50 and 51 and thereby breaks the circuit through the solenoid, allowing plunger 95 to drop, and thus breaking the connection through the motor circuit.

I have described above and illustrated in the drawings a slow and high speed mechanism like that shown in the Evensen patent above referred to, and this is the form of mechanism that I prefer to use in connection with my invention. It will be obvious, however, that this slow and high speed mechanism of itself is no part of my invention and that I may use in connection therewith any other and well-known form of high and slow speed mechanism, the only essential feature being the electrical connections between the devices for throwing on and off the high and slow speed, respectively, and my improved electrical devices. In other words, the high and slow speed mechanism may be of any type, it being essential to my invention only that when the slow speed is thrown into and out of operation electrical circuits should be made or broken, and that when the high speed mechanism is thrown into and out of operation electrical circuits should be made and broken so as to set in operation, maintain in operation, or throw out of operation the electrical mechanism by which the motor is thrown in and out of the main circuit. Therefore, I do not confine myself, of course, to this particular form of variable speed driving mechanism, as my invention may be equally applied to other well-known forms.

That which I claim as my invention, and desire to secure by Letters Patent, is,—

1. The combination with a driving mechanism having both high and low speed driving devices and a motor for driving the same, of a motor circuit, a controller in said motor circuit, and mechanism adapted by the throwing of said low speed mechanism into operative relation with said motor to close that portion of the motor circuit not opened and closed by said controller, said circuit being adapted to be completely closed by the operation of said controller.

2. The combination with a driving mechanism having both high and low speed driving devices, of a motor circuit, mechanism adapted by the throwing of said low speed mechanism into operative relation with the motor to simultaneously close that portion of the circuit controlled by said mechanism and by the throwing of said low speed mechanism out of operative relation with the motor to open the said portion of said circuit, and a controller interposed between said mechanism and said motor and adapted by its operation to open and close said circuit.

3. The combination with a driving mechanism having both high and low speed driving devices and a motor for driving the same, of a motor circuit, mechanism adapted by the throwing of said low speed mechanism into operative relation with said motor to simultaneously close that portion of the circuit controlled by said mechanism, mechanism adapted to cause said portion of said circuit to remain closed when said high speed mechanism is put into operative relation with said motor but not to be closed unless said low speed mechanism is first put into operative relation with said motor, and a controller interposed between said mechanism and said motor and adapted by its operation to complete the closing of said circuit.

4. The combination with a driving mechanism having both high and low speed driving devices and a motor for driving the same, of a motor circuit, electrically-operated mechanism adapted when said low speed mechanism is thrown into operative relation with said motor to simultaneously close the portion of said circuit controlled by said mechanism, and a controller interposed between said mechanism and said motor and adapted by its operation to complete the closing of said circuit.

5. The combination with a driving mechanism having both high and low speed driving devices and a motor for driving the same, of a motor circuit, electrically-operated mechanism adapted when said low speed mechanism is put into operative relation with said motor to simultaneously close said portion of said circuit as is controlled by said electrically-operated mechanism and when said low speed mechanism is thrown out of operative relation with said motor to

simultaneously open said portion of said circuit, and a controller interposed between said mechanism and said motor and adapted by its operation to complete the closing of said circuit.

6. The combination with a driving mechanism having both high and low speed driving devices and a motor for driving the same, of a motor circuit, and electrically-operated mechanism adapted to close said circuit when said low speed mechanism is thrown into operative relation with said motor and mechanism adapted to cause said circuit to remain closed when said high speed mechanism is put into operative relation with said motor but not to be closed unless said low speed mechanism is first put into operative relation with said motor.

7. In combination, a motor, a slow speed driving mechanism adapted to be put in operative relation with said motor, a high speed driving mechanism adapted to be put into operative relation with said motor, a motor circuit, electrically-operated mechanism operated by the moving of said slow speed mechanism into operative relation with said motor and adapted when closed to effect the completion of the circuit through said motor, and further adapted when said high speed mechanism is thrown into operative relation with the motor, only after said slow-speed mechanism has been thrown in, to maintain the circuit through said motor.

8. In combination, a motor, a slow speed driving mechanism adapted to be put in operative relation with said motor, a high speed driving mechanism adapted to be put into operative relation with said motor, a motor circuit, electrically-operated mechanism operated by the moving of said slow speed mechanism into operative relation with said motor and adapted when closed to effect the completion of the circuit through said motor, said electrically-operated mechanism being further adapted when said high speed mechanism is thrown into operative relation with the motor, only after said slow speed mechanism has been thrown in, to maintain the circuit through said motor after said slow speed mechanism is thrown out.

9. In combination, a motor, a slow speed driving mechanism adapted to be put in operative relation with said motor, a high speed driving mechanism adapted to be put into operative relation with said motor, a motor circuit, a switch device operated by the moving of said slow speed mechanism into operative relation with said motor and adapted when closed to effect the completion of the circuit through said motor, said switch device being further adapted by the throwing of said high speed mechanism into operative relation with the motor, only after said slow speed mechanism has been thrown in, to maintain the circuit through said motor.

10. In combination, a motor, a slow speed driving mechanism adapted to be put in operative relation with said motor, a high speed driving mechanism adapted to be put into operative relation with said motor, a motor circuit, a switch device operated by the moving of said slow speed mechanism into operative relation with said motor and adapted when closed to effect the completion of the circuit through said motor, said switch device being further adapted by the throwing of said high speed mechanism into operative relation with the motor, only after said slow speed mechanism has been thrown in, to maintain the circuit through said motor after said slow speed mechanism is thrown out.

11. In combination, a motor, a slow speed driving mechanism adapted to be put in operative connection with said motor, a high speed driving mechanism adapted to be put in operative connection with said motor, a motor circuit, a switch in said motor circuit, and electric mechanism operated only by the throwing of said slow speed driving mechanism into operative connection with said motor to close said switch and connect said motor with said main circuit.

12. In combination, a motor, a slow speed driving mechanism adapted to be put in operative connection with said motor, a high speed driving mechanism adapted to be put in operative connection with said motor, a motor circuit, a switch in said motor circuit, a solenoid, a circuit adapted to connect said solenoid with said main circuit, a switch in said solenoid circuit adapted to be closed by the throwing of said slow speed driving mechanism into operative relation with said motor to energize said solenoid, and means operated by the energizing of said solenoid to close the switch in said motor circuit.

13. In combination, a motor, a slow speed driving mechanism adapted to be put in operative connection with said motor, a high speed driving mechanism adapted to be put in operative connection with said motor, a motor circuit, a switch in said motor circuit, a solenoid, a circuit adapted to connect said solenoid with said main circuit, a core for said solenoid adapted when said solenoid is energized to close the switch in said motor circuit, and a switch in said solenoid circuit adapted to be closed by the putting of said slow speed mechanism into operative relation with said motor.

14. In combination, a motor, a slow speed driving mechanism adapted to be put in operative connection with said motor, a high speed driving mechanism adapted to be put in operative connection with said motor, a motor circuit, a switch in said motor circuit,

a solenoid, a circuit adapted to connect said solenoid with said main circuit, a core for said solenoid adapted when said solenoid is energized to close the switch in said motor circuit, a switch in said solenoid circuit adapted to be closed by the putting of said slow speed mechanism into operative relation with said motor, a second switch in said solenoid circuit adapted to be closed by the movement of said high speed mechanism into operative relation with said motor, and a resistance in series between said high speed switch and said solenoid of sufficient ohmic resistance to prevent the lifting of said core into said solenoid but to permit said core to be retained in its upward position in said solenoid when said high speed switch is closed and said slow speed switch is open.

15. In combination, a motor, a slow speed driving mechanism adapted to be moved into operative relation with said motor, a high speed driving mechanism adapted to be placed in operative relation with said motor, a motor circuit, a switch normally open in said motor circuit, a solenoid, a core for said solenoid, connections between said core and said switch whereby, when said core is lifted in said solenoid, said motor circuit switch will be closed, a circuit adapted to connect said solenoid with said main circuit, a switch in said solenoid circuit adapted to be closed by the throwing of said slow speed driving mechanism into operative relation with said motor, a switch and resistance in parallel with each other in said solenoid circuit between the slow speed switch and the solenoid, said resistance having sufficient ohmic resistance to prevent the lifting of said core into said solenoid when the electric current is passing to said solenoid solely through said resistance, but to hold said core in lifted position when already lifted, and means operated by said core when lifted into said solenoid to open said switch in said solenoid circuit and cause the current to flow into said solenoid solely through said resistance.

16. In combination, a motor, a slow speed driving mechanism adapted to be moved into operative relation with said motor, a high speed driving mechanism adapted to be moved in operative relation with said motor, a motor circuit, a switch normally open in said motor circuit, a solenoid, a core for said solenoid, connections between said core and said switch whereby, when said core is lifted in said solenoid, said motor circuit switch will be closed, a circuit adapted to connect said solenoid with said main circuit, a switch in said solenoid circuit adapted to be closed by the throwing of said slow speed driving mechanism into operative relation with said motor, a switch and resistance in parallel with each other in said solenoid circuit between the slow speed switch and the solenoid, said resistance having sufficient ohmic resistance to prevent the lifting of said core into said solenoid when the electric current is passing to said solenoid solely through said resistance, but to hold said core in lifted position when already lifted, means operated by said core when lifted into said solenoid to open said switch in said solenoid circuit and cause the current to flow into said solenoid solely through said resistance, a second switch in said solenoid circuit adapted to be closed by the movement of said high speed mechanism into operative relation with said motor, and a resistance in said solenoid circuit in series between said switch and said solenoid of sufficient ohmic resistance, when said slow speed switch is open and said high speed switch is closed, to prevent the lifting of said core into said solenoid but to retain said core in its lifted position when already lifted in said solenoid.

17. In combination, a motor, a slow speed driving mechanism adapted to be put in operative connection with said motor, a high speed driving mechanism adapted to be put in operative connection with said motor, a motor circuit, a switch in said main circuit, electric mechanism operated by the throwing of said slow speed driving mechanism into operative connection with said motor to close said switch and connect said motor with said circuit, and electric mechanism operated by the throwing of said high speed driving mechanism into operative relation with said motor to maintain said switch closed after said slow speed driving mechanism has been disconnected, said electric mechanisms being adapted to open the switch in said motor circuit when both the high speed and slow speed driving mechanisms are thrown out of operative relation with the motor.

CHARLES A. DRESSER.

Witnesses:
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CHARLES E. PICKARD.