June 25, 1968 D. E. BANKS ET AL 3,389,628

CONTROLS FOR CUTTING PRESSES

Filed April 15, 1966 13 Sheets-Sheet 1

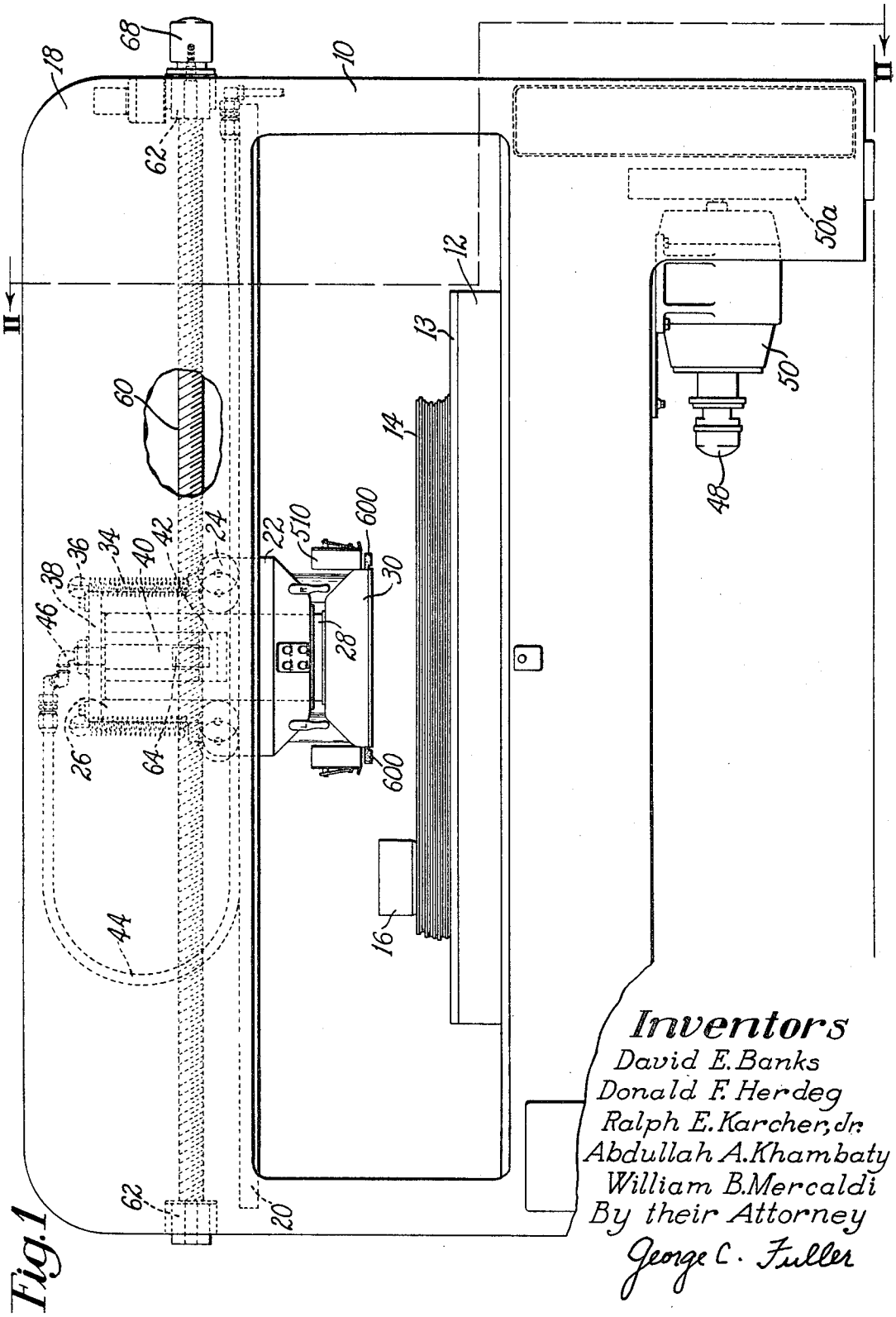

Fig. 1

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Ralph E. Karcher, Jr.
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William B. Mercaldi
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CONTROLS FOR CUTTING PRESSES

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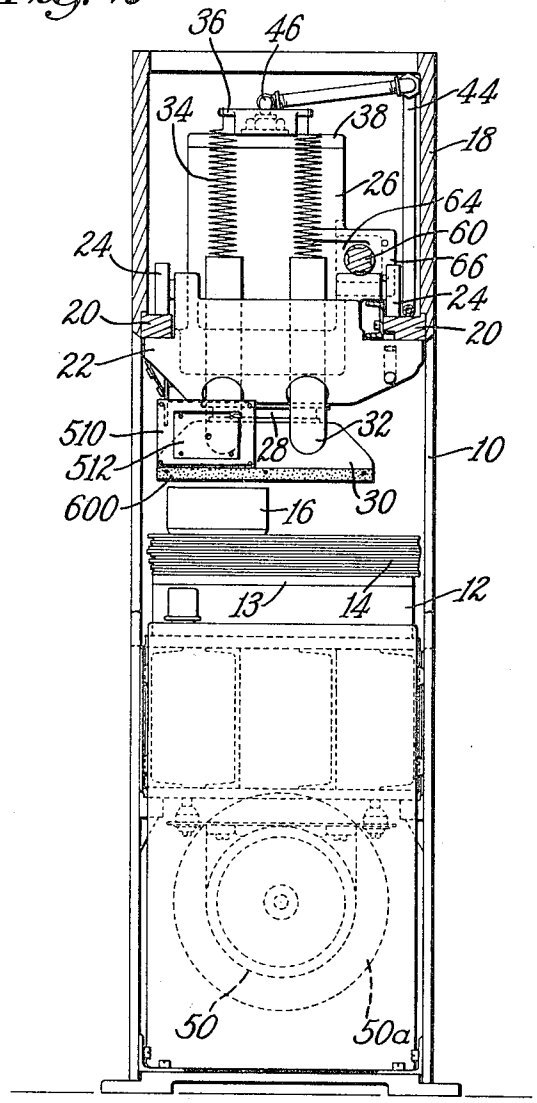
Fig. 2



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CONTROLS FOR CUTTING PRESSES

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Fig. 3

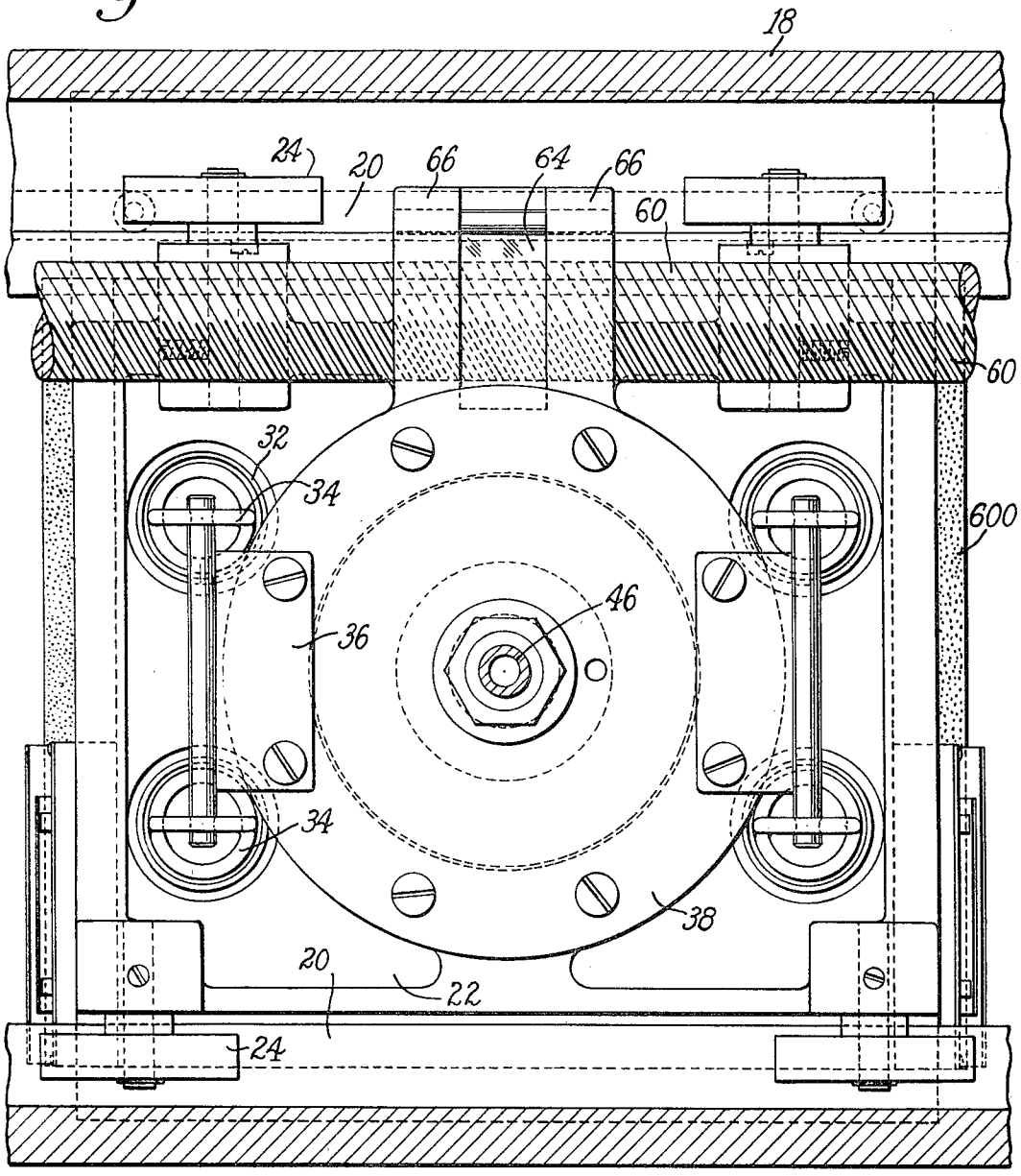
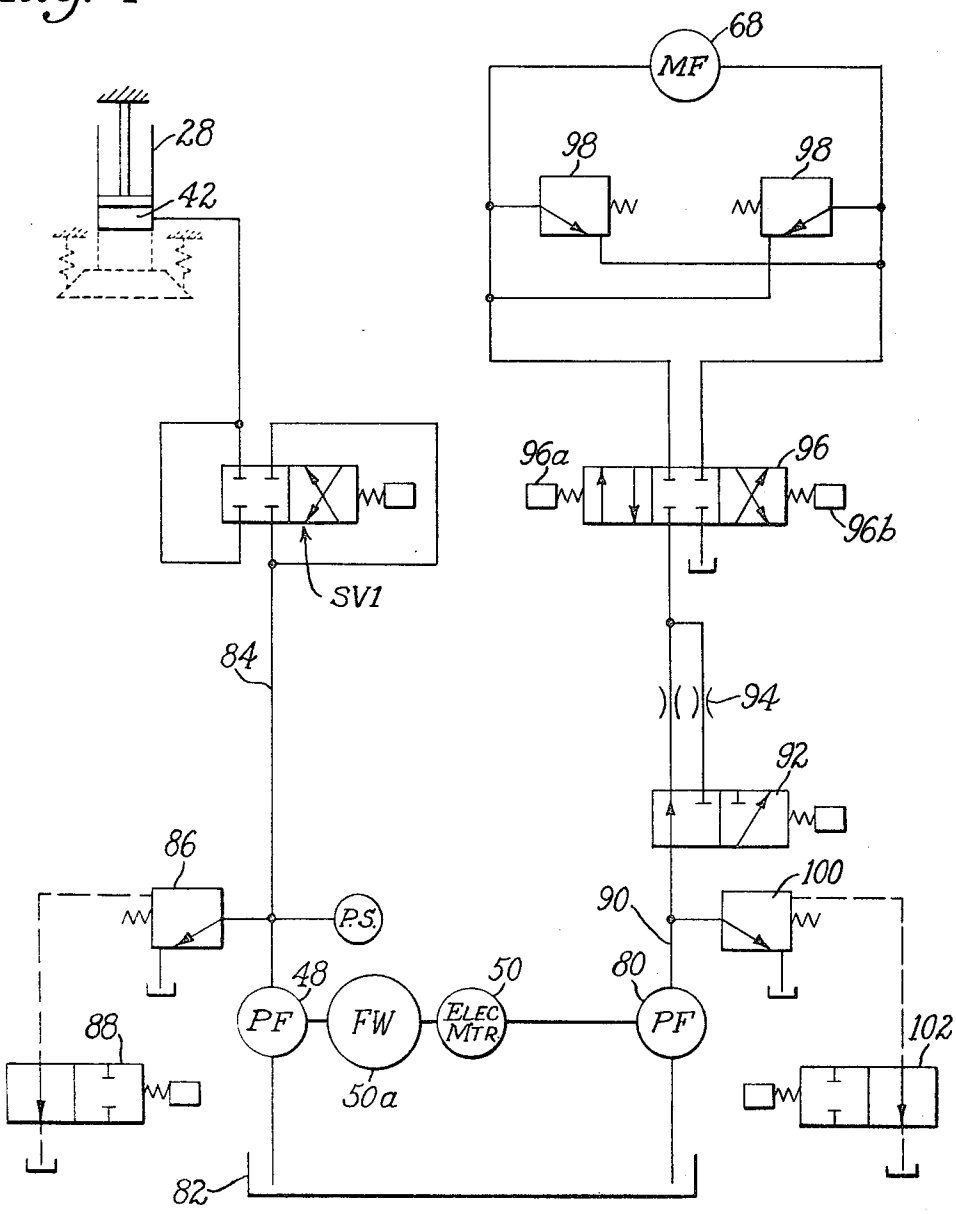


Fig. 4


68
MF
98
98
28
42
96a
96
96b
SV1
84
94
92
86
100
90
P.S.
48
50
80
88
PF
FW
ELEC MTR
PF'
102
50a
82

CONTROLS FOR CUTTING PRESSES

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Fig. 5a

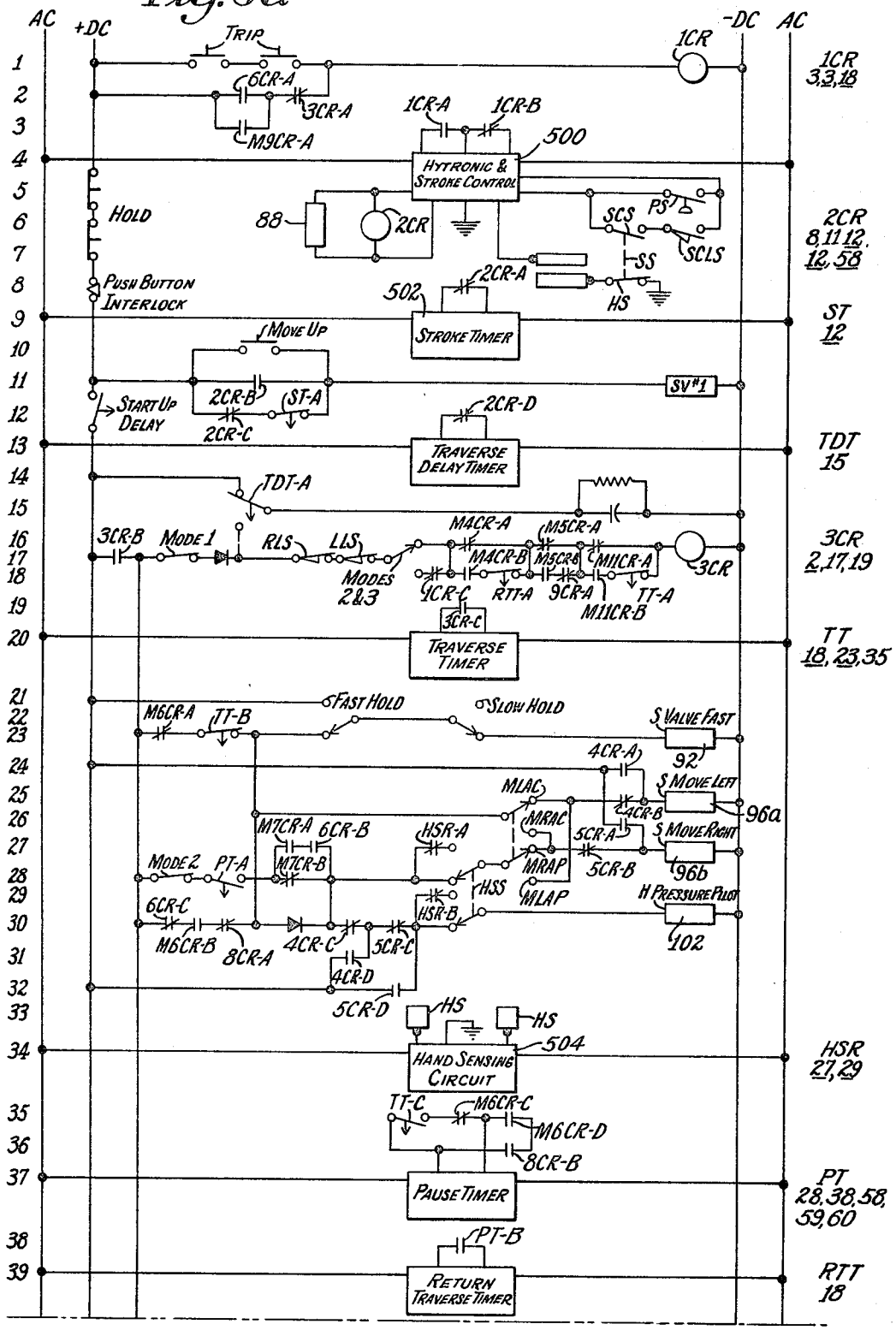
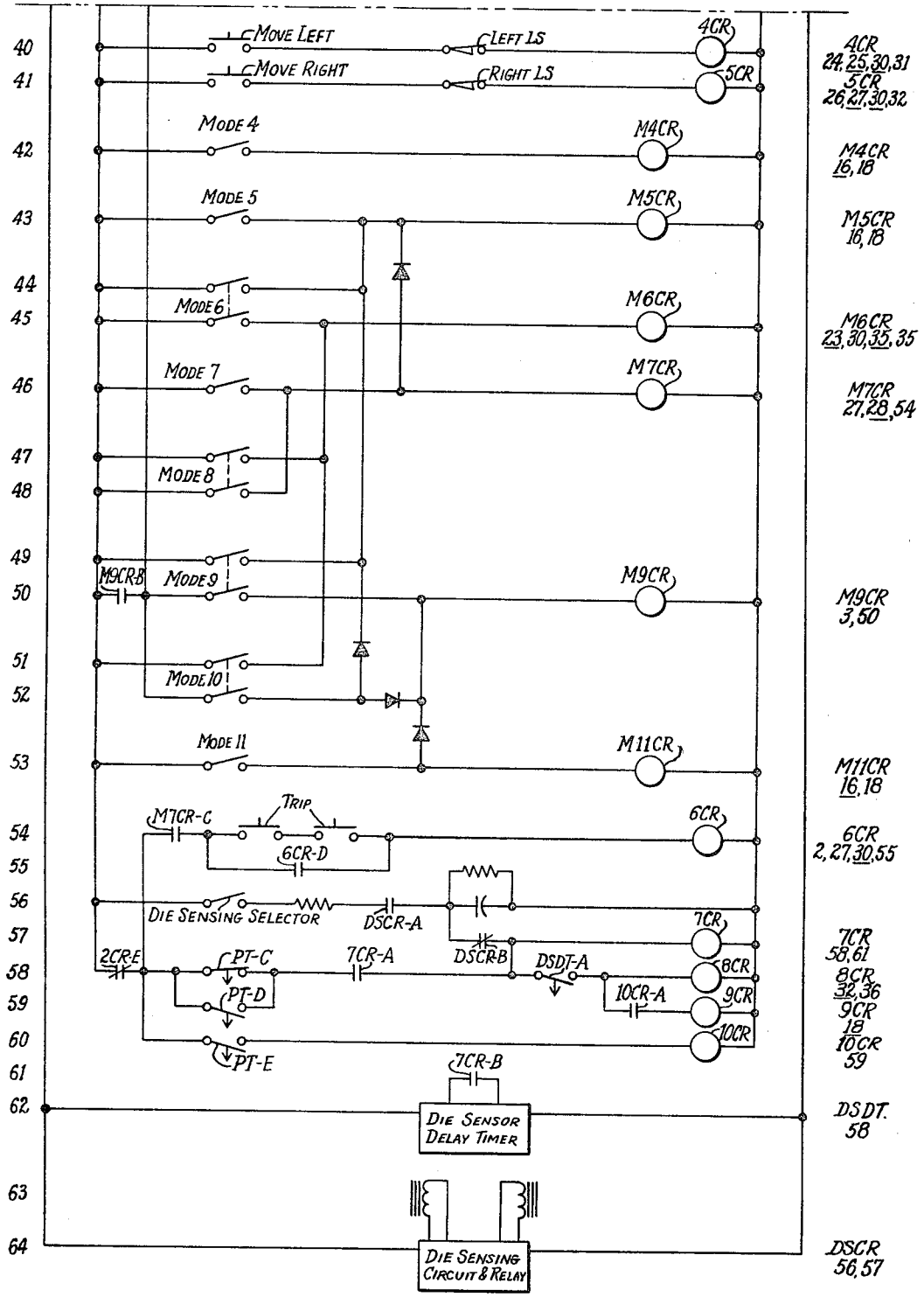


Fig. 5b


40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60
61
62
63
64
MOVE LEFT
LEFT LS
4CR
MOVE RIGHT
RIGHT LS
5CR
MODE 4
M4CR
MODE 5
M5CR
MODE 6
M6CR
MODE 7
M7CR
MODE 8
M9CR-B
MODE 9
M9CR
MODE 10
MODE 11
M11CR
M7CR-C
TRIP
6CR-D
6CR
DIE SENSING SELECTOR
DSCR-A
7CR
2CR-E
PT-C
7CR-A
DSCR-B
DSDT-A
8CR
PT-D
10CR-A
9CR
10CR
PT-E
7CR-B
DIE SENSOR DELAY TIMER
DIE SENSING CIRCUIT & RELAY
4CR 24,25,30,31
5CR 26,27,30,32
M4CR 16,18
M5CR 16,18
M6CR 23,30,35,35
M7CR 27,28,54
M9CR 3,50
M11CR 16,18
6CR 2,27,30,55
7CR 58,61
8CR 32,36
9CR 18
10CR 59
DSDT 58
DSCR 56,57

CONTROLS FOR CUTTING PRESSES

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Fig. 6

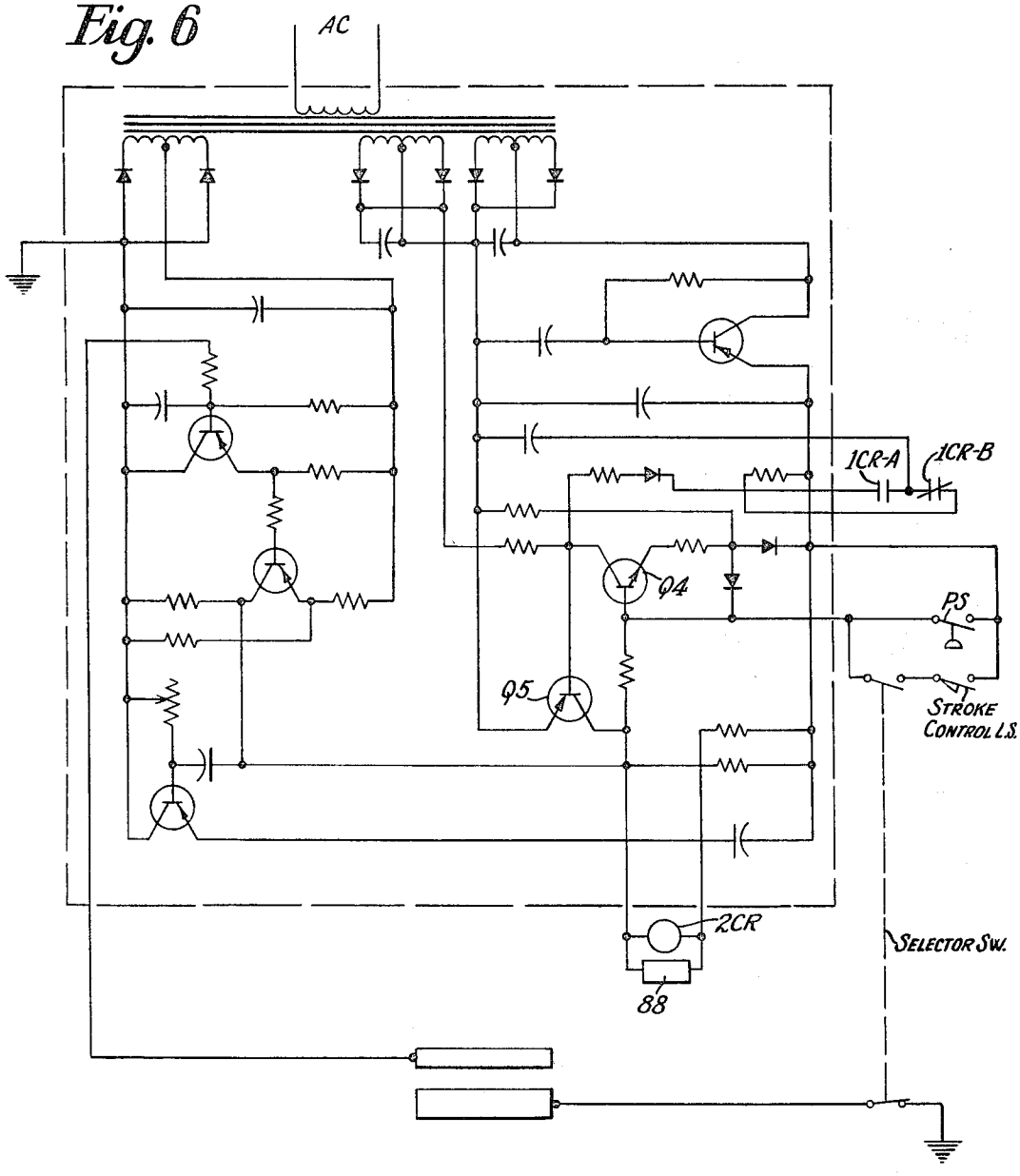

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Fig. 7

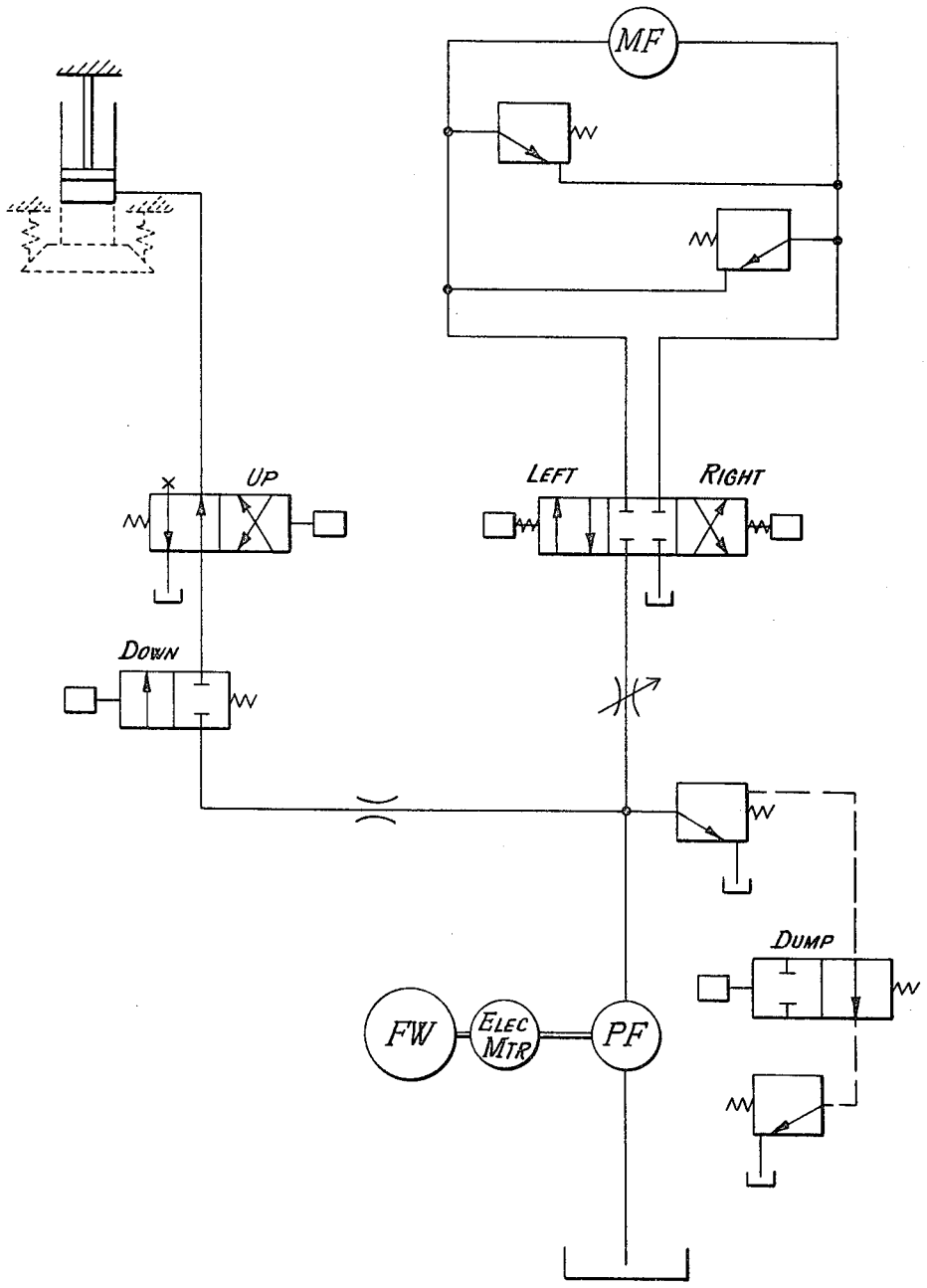


Fig. 8a

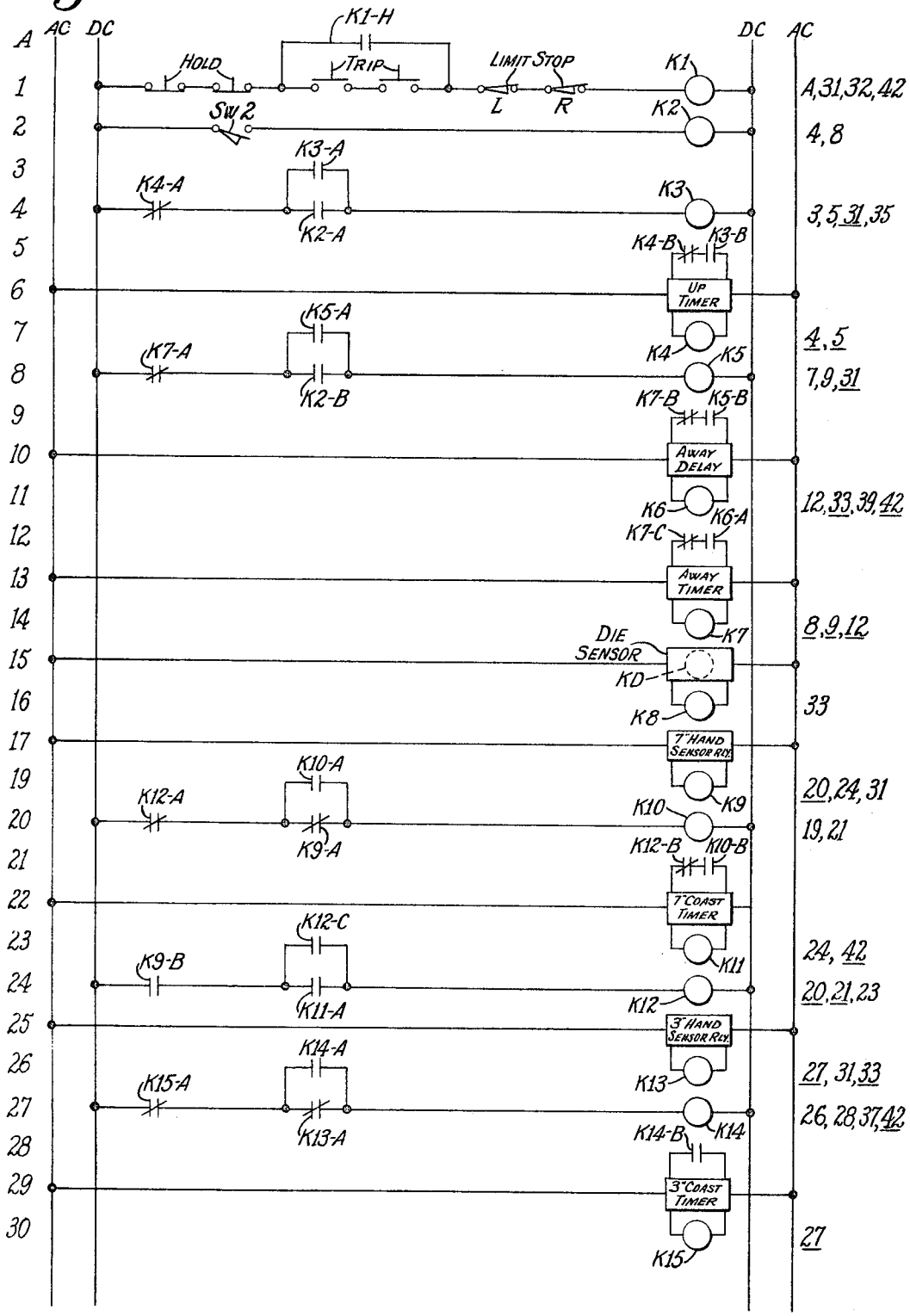

A
AC
DC
K1-H
HOLD
TRIP
LIMIT STOP
L
R
K1
SW 2
K2
K3-A
K4-A
K2-A
K3
K4-B
K3-B
UP TIMER
K5-A
K7-A
K2-B
K4
K5
K7-B
K5-B
AWAY DELAY
K6
K6-A
K7-C
AWAY TIMER
K7
DIE SENSOR
KD
K8
7" HAND SENSOR RLY.
K10-A
K12-A
K9-A
K9
K10
K12-B
K10-B
7" COAST TIMER
K11
K12-C
K9-B
K11-A
K12
3" HAND SENSOR RLY.
K14-A
K15-A
K13-A
K13
K14
K14-B
3" COAST TIMER
K15
A,31,32,42
4,8
3,5,31,35
4,5
7,9,31
12,33,39,42
8,9,12
33
20,24,31
19,21
24,42
20,21,23
27,31,33
26,28,37,42
27

Fig. 8b

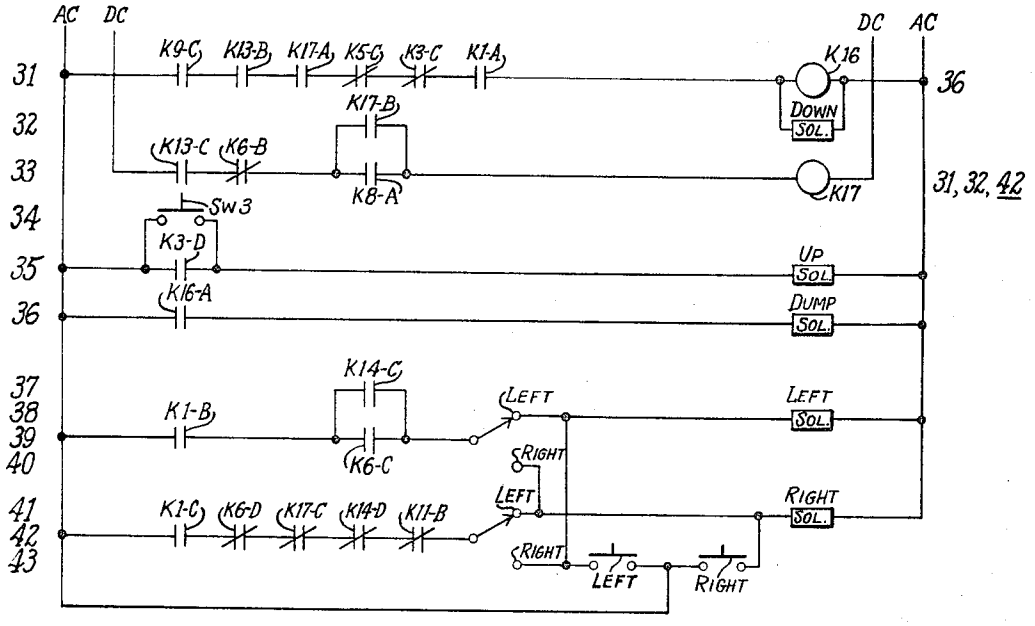

AC
DC
K9-C
K13-B
K17-A
K5-C
K3-C
K1-A
K16
DOWN SOL.
36
K17-B
K13-C
K6-B
K8-A
K17
31, 32, 42
SW3
K3-D
UP SOL.
K16-A
DUMP SOL.
K14-C
K1-B
LEFT
LEFT SOL.
K6-C
RIGHT
RIGHT SOL.
K1-C
K6-D
K17-C
K14-D
K11-B
31
32
33
34
35
36
37
38
39
40
41
42
43

Fig. 9

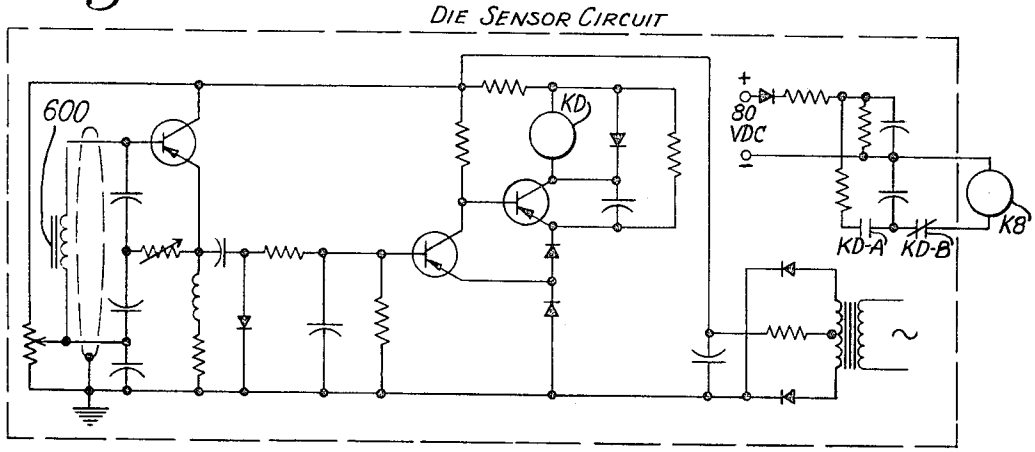

DIE SENSOR CIRCUIT
600
KD
80 VDC
K8
KD-A
KD-B

Fig. 10

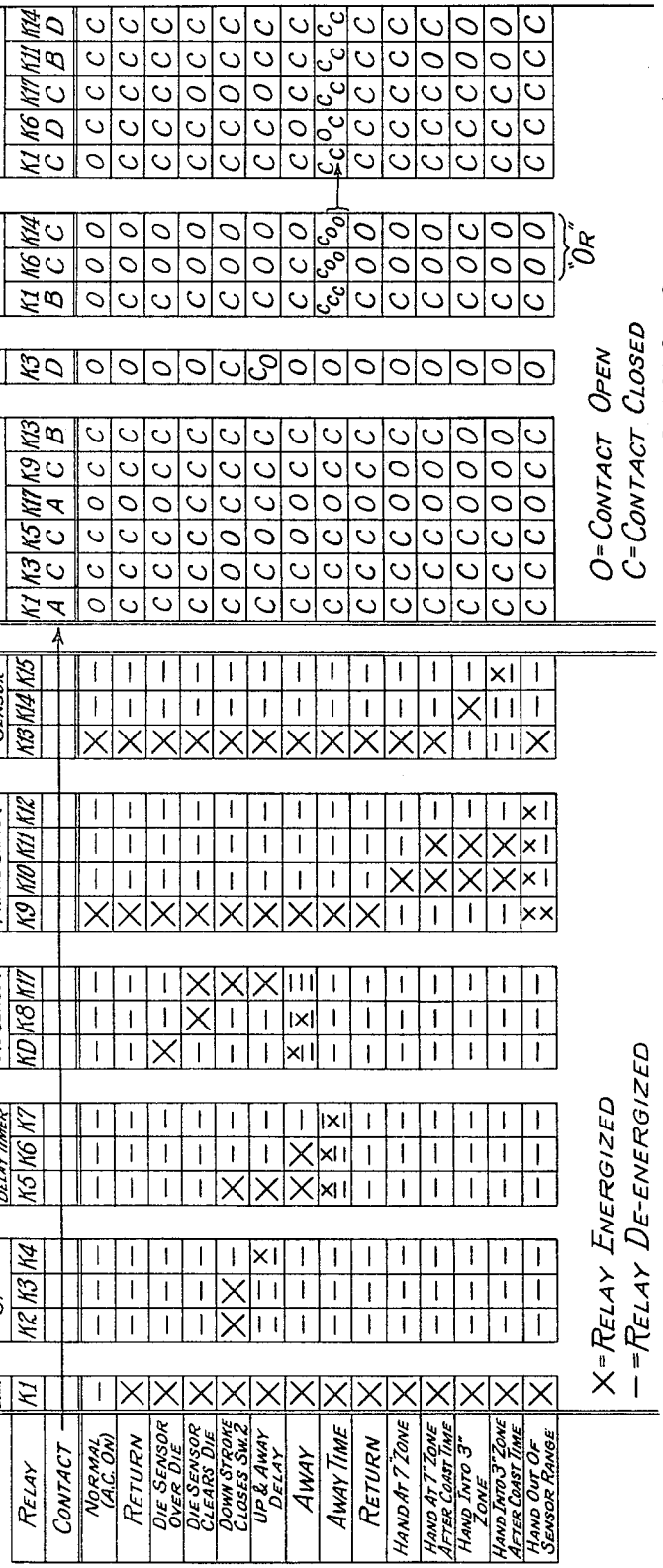

RELAY COILS
RELAY CONTACTS
RELAY
CONTACT
NORMAL (A.C. ON)
RETURN
DIE SENSOR OVER DIE
DIE SENSOR CLEARS DIE
DOWN STROKE CLOSES SW.2
UP & AWAY DELAY
AWAY
AWAY TIME
RETURN
HAND AT 7" ZONE
HAND AT 7" ZONE AFTER COAST TIME
HAND INTO 3" ZONE
HAND INTO 3" ZONE AFTER COAST TIME
HAND OUT OF SENSOR RANGE
DOWN
UP
AWAY DELAY TIMER
DIE SENSOR
7" HAND SENSOR
3" HAND SENSOR
AWAY
RETURN
"OR"
X = RELAY ENERGIZED
— = RELAY DE-ENERGIZED
O = CONTACT OPEN
C = CONTACT CLOSED
NOTE:- K2-A & K2-B CONTACTS ARE USED AS AN "OR" FOR K3 & K5 RELAYS IN THE "DOWN" FUNCTION

Fig. 11

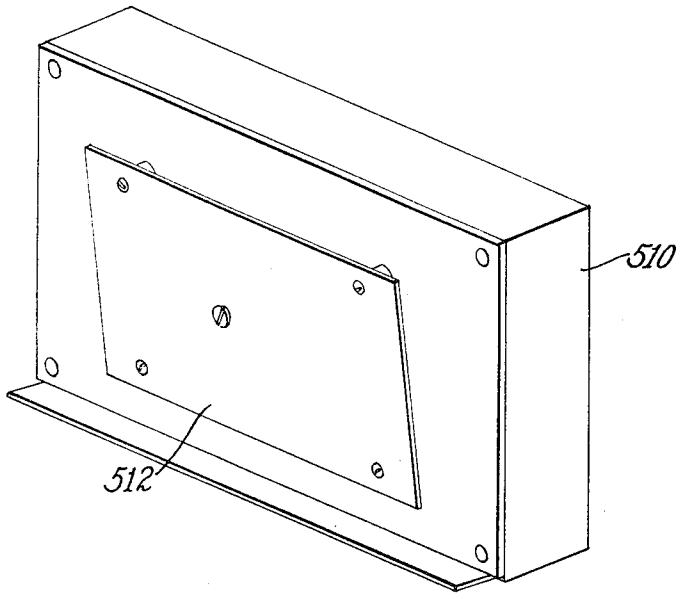


Fig. 12

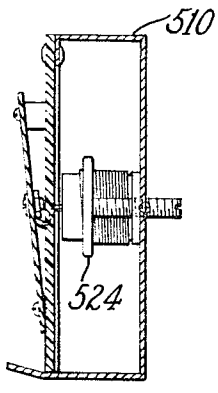
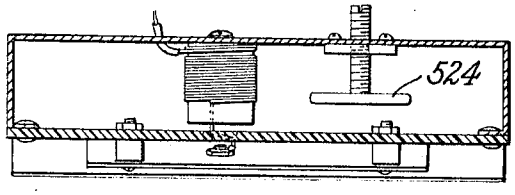


Fig. 13



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CONTROLS FOR CUTTING PRESSES

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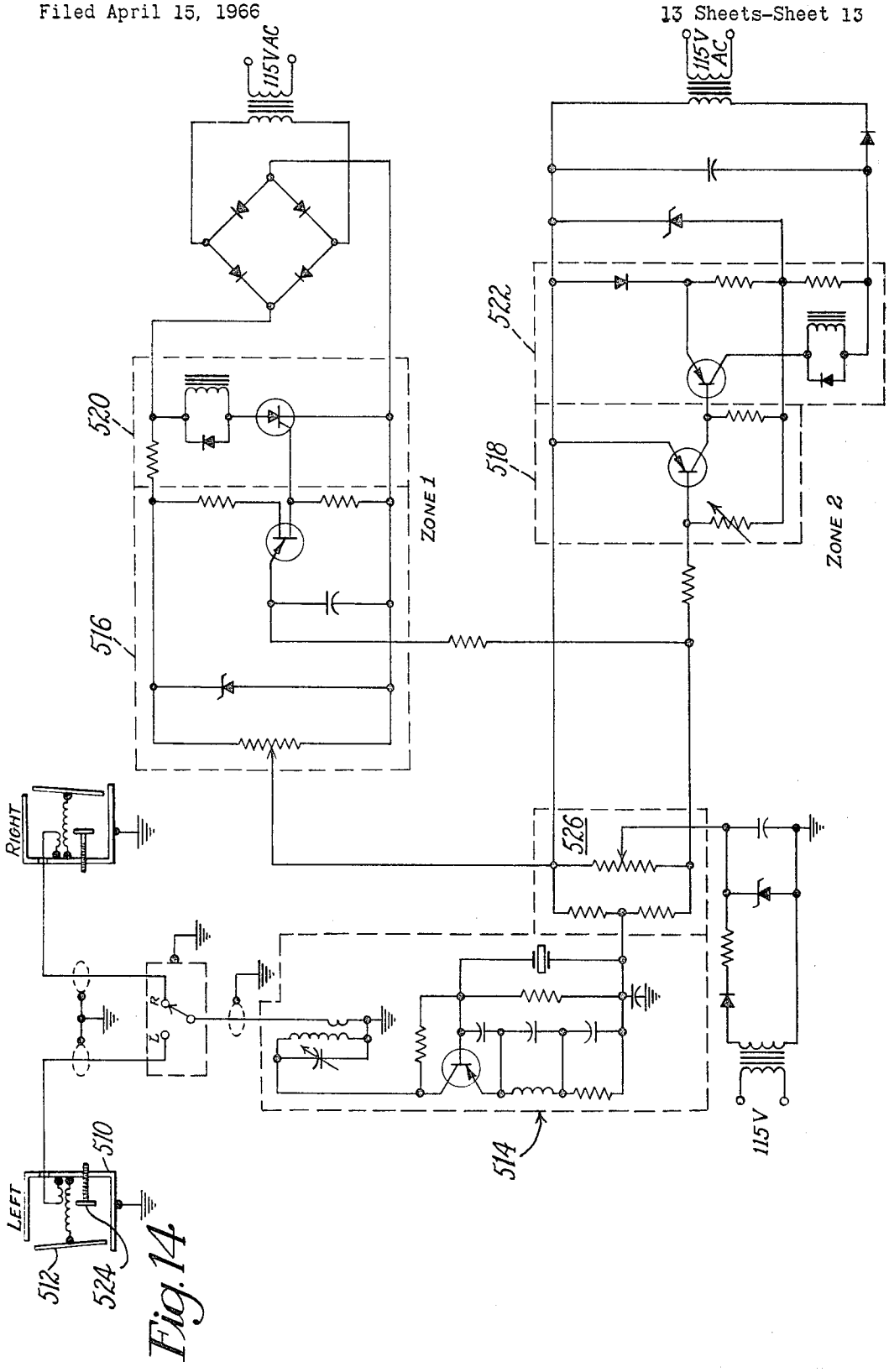

Fig. 14

United States Patent Office 3,389,628
Patented June 25, 1968

3,389,628

CONTROLS FOR CUTTING PRESSES

David E. Banks, Hamilton, Donald F. Herdeg, Beverly, Ralph E. Karcher, Jr., and Abdullah A. Khambaty, Magnolia, and William B. Mercaldi, Beverly, Mass., assignors to United Shoe Machinery Corporation, Boston, Mass., a corporation of New Jersey

Filed Apr. 15, 1966, Ser. No. 542,954
13 Claims. (Cl. 83—62)

This invention relates to improvements in cutting presses and more particularly to improvements in controls for cutting presses for dieing out parts from sheet material.

The invention is illustrated as embodied in a cutting press of the traveling head type wherein a relatively small platen is supported by overhead beam means for movement across a relatively wide work support, but it will be understood that the invention in many of its aspects is not limited to presses of this type.

In dieing out parts from work pieces using die cutting presses, it is a common procedure for the operator to position the work piece on the work support, and to place, pick up, and replace a die on the work piece, using the cutting head after each placement to press the die through the work, until all the intended cuts have been made in that position of the work piece. After every cut, to permit the operator to pick up the cut parts and the die, the platen must be moved transversely to clear the die and for the next cut brought back over the die in its new position.

Past efforts to automate this procedure have provided means for causing the beam or platen of a cutting press to move from a retracted or inoperative position to an operative position over the die, to press the die through the work and then return to the retracted position. This mode of operation incurs a loss of time after the operator has placed the die, which loss is the time required for the operator to move to and operate the control and for the beam or platen to be moved over the die from its retracted position. In other words, the operator, after placing the die, has to move his hands, work the controls and await a comparatively large amount of time for the platen to move over the die, as well as the times for the platen to press the die through the work and get out of the way, before he can pick up the die and replace it. We have found that substantial operating time may be saved by a mode of operation in which the beam or platen, having automatically moved aside after a cut to permit replacement of the die by the operator, is automatically caused to return toward the next operative position. In this mode, with suitable timing of the sequence of movements, the platen will arrive over the die immediately after the operator has finished replacing it and the vertical cutting stroke may then be tripped by the operator or by suitable automatic means without having to await the return transversing movement of the platen.

It is accordingly an object of the present invention to provide a cutting press of the type having a laterally movable platen in which the platen, after pressing the die through the work piece, is automatically caused to withdraw transversely of the work support to clear the die and then return in the opposite direction for bringing the platen over the die in its new position.

It is a further object of the present invention to provide in a cutting press control means whereby the transverse and vertical movements of the platen are automated to a degree where the operator may give his full attention to the manipulation of the die.

To these ends and in accordance with a feature of the invention, there is provided in a cutting press of the foregoing type having a platen, a work support, means for supporting the platen for movement perpendicular to the

work-engaging surface of the work support and transversely thereof and power means for providing said movements, in combination therewith, control means for the power means comprising (a) stroke control means having trip means actuatable for initiating movement of the platen toward the work support to press a die thereon and stroke terminating means responsive to a predetermined signal for terminating the movement of the platen toward the work support and for initiating movement of the platen away from the work support and (b) traverse control means operative in response to said signal for causing transverse retreat movement of the platen to clear the die and thereafter transverse return movement of said platen in the opposite direction.

In accordance with a further feature of the invention the return movement termination is provided by the trip means which is also operative for initiating the perpendicular movement of the platen.

In accordance with still another feature of the present invention the trip means electric signal is provided by a die sensor carried by the platen adjacent its leading edge which is operative in response to movement over a cutting die. In accordance with yet another feature of the present invention the control means includes a hand sensor including a sensing element or plate carried by the platen adjacent its leading edge which is operative in response to sensing the proximity of a portion of the body of the operator in the path of movement of the platen to effect interruption of the return movement of the platen.

In accordance with yet another feature of the invention, the hand sensor is operative for distance discrimination between two zones of different extent from a sensing plate. This control is operative in response to sensing the body portion of the operator in the farther zone in order to interrupt return movement of the platen. It is operative in response to sensing of said body portion in the nearer zone to effect movement of the platen away from the body portion toward its inoperative position.

Other features and advantages of the invention will best be understood from the following description taken in connection with the accompanying drawings in which:

FIG. 1 is a front elevation of a cutting press embodying the present invention;

FIG. 2 is a side elevation partly in vertical section taken on line II—II of FIG. 1;

FIG. 3 is a plan view partly in section of a portion of the press shown in FIG. 1, on an enlarged scale;

FIG. 4 is a diagram of the hydraulic system for the press of FIG. 1;

FIGS. 5A and 5B, together illustrate a diagram of the electric circuits of the control for the press of FIG. 1;

FIG. 6 is a detailed schematic of a portion of the control indicated in FIGS. 5A and 5B;

FIG. 7 is a hydraulic diagram of a modification of the control means for the press;

FIGS. 8A and 8B, together illustrate an electrical diagram of a modified control operating with the hydraulic system of FIG. 7;

FIG. 9 is an electrical diagram of a die sensor circuit;

FIG. 10 is a chart relating to FIGS. 8A and 8B showing the condition of relay coils and relay contacts at different portions of a cycle of movement of the press;

FIG. 11 is an angular view of a sensing head comprising a portion of a hand sensor;

FIG. 12 is a vertical section of the apparatus shown in FIG. 11;

FIG. 13 is a horizontal section of the apparatus shown in FIG. 11; and

FIG. 14 is an electrical diagram of a hand sensor employing the sensing head shown in FIG. 11.

Referring to FIGS. 1, 2 and 3, the illustrative press comprises a frame **10** carrying a work support **12** provided

with a conductive cutting pad **13** adapted to receive work pieces **14** for cutting into work parts by means of a die **16**. The upper portion **18** of the frame **10** is provided with rail means **20** extending horizontally above the work support **12** for supporting a carriage **22** on rollers **24** journaled therein.

The carriage **22** supports a bearing tube **26** in which a platen bearing cylinder **28** is vertically slidable for raising and lowering a platen **30** in cutting strokes for pressing the die **16** through the work and against the pad **13**. Rotation of the platen bearing cylinder is prevented by the provision of four vertical slide tubes **32** connected at their bottom to the platen **30** and journaled through the carriage **22**. Platen return springs **34** extend through the slide tubes from the platen to the upper portion of the bearing tube **26** where they are secured to brackets **36** carried on a bearing tube cover **38** bolted to the tube **26**. A hollow piston rod **40** extends downwardly from the cover **38** and carries at its lower end a piston **42** adapted for a sliding fit with the inner surface of the cylinder **28**.

Means comprising a flexible hydraulic hose **44**, one end of which is connected to piston rod terminal fittings **46**, is provided for connecting, through the piston rod, the chamber beneath the piston with a source of pressure fluid through a pump **48** driven by electric motor **50** and flywheel **50A** so that when pressure fluid is admitted to the chamber the platen is caused to descend against the force of the springs **34** and finally the cutting force of the die **16**.

Movement of the carriage to effect movement of the platen **30** transversely of the work support is provided by a traverse screw **60** journaled in bearings **62** at opposite ends of the frame portion **18**. The screw **60** has threaded engagement with a nut **64** disposed between parallel ears **66** extending rearwardly of the bearing tube. The screw **60** is driven by a reversible hydraulic motor **68**.

Referring now to FIG. 4, the hydraulic system of the press comprises the electric motor **50** and flywheel **50A** driving the pump **48** for supplying hydraulic fluid to the piston **42** and cylinder **28** for providing vertical movement of the platen. The motor **50** drives a second pump **80** for supplying pressure fluid to the traverse motor **68**. Both pumps are supplied from a sump **82**. Pressure fluid from the pump **48** is supplied to the cylinder **28** through a conduit **84** and a solenoid valve **SV1** which is open only when the solenoid is energized. A high pressure solenoid valve comprising a piloted discharge valve **86** and a solenoid pilot valve **88** normally maintains the pressure in the conduit **84** at a minimum inoperative to effect downward movement of the platen, by discharging the conduit **84** to the sump unless the solenoid of the valve **88** is energized at which time the high pressure valve closes. The pump **80** provides pressure fluid to the motor **68** through a conduit **90**, a fast-slow solenoid valve **92** introducing a selected one of two restrictions **94**, and a right-left solenoid valve **96** having solenoids **96A** and **96B** controlling the direction of transverse movement. Relief valves **98** across the motor conduits are provided to limit the motor torque, for example in the event of mechanical stoppage of traversing movement, and also to dynamically brake the traversing movement.

FIGS. 5A and 5B show diagrammatically the electric circuits of the press control. In accordance with a feature of the invention, the control provides means for selecting the mode of operation of the press from several modes provided which range from essentially manual to fully automatic through several degrees of automated cycles. The intermediate cycles are termed "semi-automatic" indicating that the head or platen moves horizontally and vertically automatically, while the placing of the die and the removal of the work isdone manually. Circuit lines are numbered in a column at the left while a column on the right indicates the lines where the contacts of the various components are located, the underlined numbers indicating closed contact points.

The schematic of FIGS. 5A and 5B is based on symbols such as those used by the J.I.C. standards, and is tied into the hydraulic circuit of FIG. 4 by appropriate labels. Accordingly, reference numerals will be used chiefly for identifying the main operating components and assemblies.

The control circuit comprises a transistorized stroke initiating and terminating control circuit **500** (line **4**) of the type disclosed in United States Patent No. 3,204,506, issued Sept. 7, 1965 in the name of Frank W. Reinhold (see FIG. 6B of said patent). Briefly, the circuit shown in FIG. 6 shows how closure of contact **1CR** causes energization of **2CR** and the solenoid valve **88** and shows a selector switch for selecting a predetermined stroke terminating signal from closure of a lower limit switch or from platen to cutting pad conductivity through a die.

The circuit of FIGS. 5A and 5B includes a number of adjustable timers, e.g. **502** (line **9**) which operate after closure of their operating contacts, e.g. **2CR** (line **8**) to transfer their contacts after a predetermined time period.

The circuit also includes a hand sensing relay circuit **504** (line **34**) whose circuit is shown in detail in FIG. 14 and which comprises a sensing head **510** (FIGS. 11, 12 and 13) carried by the platen **30** at each lateral edge (FIG. 1). The hand sensor has a quarter wave length antenna comprising a capacity plate **512** carried by the sensing head **510** which acts as a capacity sensor, an RF oscillator **514**, two amplifiers **516**, **518** and two switching circuits **520** and **522**.

With the sensor mounted on the head, the oscillator **514** is tuned to resonance by adjusting the capacitor in its tank circuit for minimum current. The antenna is then tuned to resonance by varying the capacitor **524** in its circuit for maximum current. Accordingly, any change in capacitance sensed by the plate **512** will reduce the current drawn by the oscillator. The change in oscillator current is communicated through a resistance bridge **526** to the amplifiers which are adapted to respond to different changes in oscillator current to effect their switching function. While the detector is particularly adapted for use with a modification of the control circuit illustrated in FIGS. 8A and 8B and the schematic of FIG. 14 is tied specifically into the latter schematic since the sensor is able to distinguish between positions of the operator's hand differently spaced from the capacitor plate, the control is suitable for use with the circuit of FIGS. 5A and 5B where only one level of sensitivity is employed. It is noted that the sensor head is mounted on the carriage in an attitude such that the capacitor plate does not sense a die carried by the work support.

The circuit of FIGS. 5A and 5B also includes a die sensor whose circuit is illustrated in FIG. 9 and which employs sensing heads **600** (FIGS. 1, 2 and 3) carried by the platen adjacent the leading and trailing edges and comprising a ferrite core coextensive with said edges. The core has a cross section in the form of the letter E, the core being mounted with the legs extending downward with their ends flush with the lower surface of the platen. Again the schematic of FIG. 9 is tied into the control circuit modification of FIGS. 8A and 8B, but is suitable for use in the circuit of FIGS. 5A and 5B where it is indicated at line **64**.

The mode switching system comprises a bank of single or double pole push button switches interlocked so that no two buttons can be depressed at the same time and arranged so that operation of any button will temporarily disconnect the D.C. supply, dropping out any latched relay.

The "Move-Up" switch (line **10**) permits application of power to the solenoid valve **SV1** for moving the platen upwardly. The "Move-Left" switch (line **40**) energizes the relay **4CR** whose contacts at line **24** energize the "Move-Left" solenoid of the "Right-Left" solenoid valve **96** and via the contacts in line **31** energize the pilot valve **102** of the high pressure valve **100** (FIG. 4). The "Move-Right" switch, line **41**, provides corresponding traverse in

the opposite direction through the contacts of 5CR. A double pole double throw switch (lines 25 and 27) enables the operator to select the direction in which the heading will move immediately following a cut. The upper armature is shown in the move-left-after-cut position and, following a pause of the head in its inoperative position during a cycle, the move-right-after-pause position. The lower armature is shown in the move-right-after-cut and move-left-after-pause position.

Mode 1: Manual.—This mode provides for operation of the press in which the operator, after positioning the die, positions the platen over the die using the "Move-Left" or "Move-Right" buttons. For this mode the operator actuates Mode 1 switch, thus opening line 17. The operator then presses the trip buttons of line 1 which, through 1CR causes Q5 (FIG. 6) to conduct and thus initiates operation of the stroke control circuit 500. The platen moves down onto the die, cuts, and then, by reason either of the die contacting the conductive cutting pad, or by closure of a lower limit switch, depending on the position of a selector switch shown at lines 6 and 8, the platen moves upward. The operator then uses either one of the "Move-Left" or "Move-Right" buttons to move the head aside. Upward movement of the platen is determined by the stroke timer 502 initiated by reclosure of the 2CR contacts of line 8. A traverse delay timer of line 13 is also caused to go through its cycle, but is ineffective to latch in 3CR because of the open mode switch.

Mode 2: Improved manual.—This mode, provided by actuation of the Mode 2 switches, is similar to Mode 1 with the additional feature that when the traverse delay timer of line 13 transfers its contact TDT (line 15), 3CR latches through its own contact in line 17 and initiates a traverse timer (line 20) causing the head to move to the side at the fast speed until the traverse timer times out when contacts TT in line 23 open.

Mode 3: Semi-automatic (catching head on fly) provided by actuating the Mode 3 switch.—After movement of the platen to the side under the control of the traverse timer as in Mode 2, and the opening of the contacts TT in line 23, a pause timer (line 37) times out closing contacts in line 23 to effect movement of the traveling head back toward the original position of the die at the slow speed. The head will continue moving until the operator presses the trip switches for the next cut. The operator presses a holding button to drop out relay 3CR, or one of the limit switches is opened when the traveling head reaches the end of its travel.

Mode 4: Semi-automatic with timed return.—For this mode, the Mode 4 switch (line 42) is closed energizing M4CR opening contacts in line 16 to incorporate normally closed return traverse contacts RTT of line 18 in the energizing circuit of 3CR. Accordingly, when the return traverse timer of line 39 times out during return movement of the head, the contacts RTT draw open dropping out 3CR and stopping the return movement.

Mode 5: Semi-automatic (die sensed only during return traverse).—This mode is provided by actuating the Mode 5 switch of line 45 energizing M5CR introducing into line 18 normally closed contacts of relay 9CR. Also, the die sensing selector switch of line 56 is actuated. Hand sensing can be used with this mode for improved operator safety and if required, actuate hand sensing selector switches of the hand sensor 504. In the operation of the press in this mode, after actuation of the trip switches the platen is moved downward to cut and returned while the head moves to the side at fast speed, pauses and returns at slow speed as in Mode 3, until the die sensor head passes over the leading edge of the die. The die sensor relay contacts in line 56 then close, charging the capacitor. The head continues traveling and the sensor moves over the center of the die beyond the sensing field of the sensor which drops out and the normally closed die sensor contacts of line 57 connect the charged capacitor across relay 7CR which latches in through its contacts in line 58. 7CR also initiates a die sensor delay timer in line 62 which, after timing out, closes contacts in line 58, energizing relay 9CR which opens normally closed contacts in line 18, stopping the traverse motion.

Mode 6: Semi-automatic die sensed as head moves in both directions.—In this mode the retreat of the head, as well as the return thereof, is controlled by the die sensor. For this mode the Mode 6 switch, lines 44 and 45, is actuated, energizing both M5CR and M6CR. M5CR incorporates 9CR normally closed contacts into line 18 while M6CR opens line 23, changes the pause timer initiation from TT to 8CR and closes contacts in line 30. The die sensing selector switch of line 56 is actuated. In operation, after tripping, the platen is moved in its cutting stroke and after the traverse delay timer times out contacts TDT effect latching of 3CR which initiates traverse movement of the traveling head. As the die sensor passes over the leading edge of the die, the die sensor relay closes, charging the capacitor in line 56. As the head continues, the ferrite core of the sensing head 600 moves over the center of the die. At this point a smaller length of the die is within the magnetic field, reducing the sensing coupling to a point where the die sensor relay drops out, this energizing relay 7CR initiating the die sensor delay timer of line 62 which on timing out energizes relay 8CR through contacts in line 58. 8CR opens line 30 stopping the head and initiates the pause timer which times out and initiates return of the traveling head at slow speed. This movement continues until the die sensor passes over the die, after which the return movement is stopped as in Mode 5.

Mode 7: Semi-automatic (die sensed only during return traverse and with inactive part of machine cycle occurring when the machine head is away from the die).—For this mode the Mode 7 switch is actuated, energizes M5CR and M7CR. M7CR closes contacts in line 54 and reroutes line 28 to pass through 6CR normally open contacts in line 27. The pause timer is set to zero delay and the die sensing switch is actuated. The trip buttons are pressed and the platen moves downward and upward in a cutting stroke and the traveling head is moved aside as formerly at high speed until the traverse timer times out, cutting off the power from the traverse valves and initiating the pause timer. This timer times out and de-energizing 7CR, energizes 10CR and closes contacts in line 28. The machine is now inactive with the head away from the die and the circuit is conditioned so that actuation of special trip buttons (line 54) will initiate one full cycle by energizing relay 6CR. 6CR then latches and closes contacts in line 27 effecting transverse return movement of the head at slow speed. The head continues until the die sensor passes over the leading end of the die, charging the capacitor and then over the center of the die where the die sensor drops out, latching in 7CR which initiates the die sensor delay timer. The timer closes contacts, pulling in relay 9CR which drops out 3CR stopping the traverse motion. 3CR, in combination with 6CR, energizes 1CR to effect a cutting stroke after which the head is moved away from the die at fast speed as previously described.

Mode 8: Semi-automatic (die sensed as head moves in both directions and with the machine inactive at the side).—In this mode the Mode 8 switch is closed, energizing M5CR, M6CR and M7CR. M5CR incorporates M9CR normally closed contacts in line 18; M6CR opens line 23, changes pause time initiation to 8CR and closes contacts in line 30; M7CR incorporates 6CR normally open contacts in line 27 and closes contacts in line 54. The pause time is reset to zero and the die sensing switch is actuated. In the operation, the regular trip buttons are pressed to cycle the machine as in Mode 7 to a condition where it is inactive with the head away from the die and the circuit conditions so that actuation of the special trip buttons will initiate one full cycle. It is believed from the foregoing descriptions that the operation of the con-

trol to provide the Mode 8 cycle will be apparent without detailed repetition.

Mode 9: Full semi-automatic (die sensed only as head moves toward the die).—For this mode the Mode 9 switch is actuated energizing M5CR and closing the switch contacts in line **50**. M5CR incorporates M9CR contacts into line **18**, the die sensing selector switch is actuated and so are the hand sensing selector switches of lines **28** and **30**. In operation, upon closing the trip switches of line **1**, the platen is moved in a cutting stroke and after the traverse delay timer times out the traveling head is moved aside at fast speed until the traverse timer times out as previously described. Then, after the pause timer times out energizing **10**CR and closing the contacts in line **28**, the head moves back toward the die at the slow speed until the die sensor passes over the die to its center, energizing 7CR. 7CR initiates the die sensor delay timer energizing 9CRXO relay, 9CR pulls in its normally closed contacts in line **18** are opened, thus dropping out 3CR and stopping the traverse motion. Also, 7CR, 8CR and 9CR are then dropped out. 3CR, in combination with M9CR, energize 1CR and the system continues to cycle until the hold buttons are depressed. Should the operator's hands be in the way of the platen during its return traverse, the traverse motion will be stopped by operation of the hand sensor until the path is clear.

Mode 10: Full semi-automatic (die sensed as head moves in both directions).—This mode is provided by actuating the Mode 10 switch energizing M5CR, M6CR and closing contacts in line **52**. The die sensing selector switch and the hand sensing selector switches are actuated. This mode provides a continuing cycle controlled by the die sensor which will be clear from the preceding descriptions of other modes. However, if the operator's hands get in the way of the return movement of the head, the traverse motion will stop until the path is clear. The operation can be stopped by pressing the hold button.

Mode 11: Full automatic using time increments.—In this mode the die is carried by the platen. The Mode 11 switch is actuated energizing M9CR and M11CR. In the operation of this mode, after actuation of the trip switches, after the platen has moved down until stroke termination and then up until the stroke timer times out and sideways after the traverse delay timer times out, the traveling head moves to the side for the preset distance determined by the traverse timer. When this times out the contacts TT in line **23** stop the traverse motion and drop out 3CR whose normally closed contacts in line **2** close to initiate another stroke.

Referring now to the modification of the control disclosed in the schematic of FIGS. 8A and 8B, a semi-automatic mode of operation is provided in which the head starts to move toward the die when the trip switches **202** in line **1** are actuated and will continue to travel toward it until the die sensor has gone over the die. When the platen is over the die, the head comes to a stop as previously described and the platen moves down on the die and makes the cut. After the cut is made the platen lifts up to a predetermined height, the head moves away from the die a predetermined distance, stops there for a predetermined time and then starts to return toward the die.

During the above cycle when the head starts moving away after the up action and when it has cleared the die, the operator reaches for the die, removes the cut material and places the die in a new position. While the die is being relocated, the head may be on the return portion of the cycle. If the operator's hand is not near the die the head will continue to go over the die. However, if the operator's hand is near the die, but is more than a predetermined distance, for example, 7", away from the sensing plate (in Zone 1 of the two-zone hand sensor), the head will continue to travel toward the die until the distance between the hand and the plate is equal to the predetermined distance, i.e., 7" in the example, then the head will stop. If the hand is removed the head goes over the die and completes the cycle. However, if the hand is moved toward the head and enters Zone 2 at a second predetermined distance, for example 3" less than the Zone 1 distance, then the head moves away from the hand a preset distance and comes to a stop. It remains there as long as the hand in the example is more than 3" but less than 7" away from it. Thus smooth operation of the head is accomplished by providing a "dead zone" (here 4") where the head stays stationary when the hand is moved within the zone. Again, when the hand is removed the head returns over the die and completes the cycle. In the operation of the hand sensor, just as the hand enters Zone 1, the zone which extends farthest from the capacity plate, its amplifier **516** deactivates K9 in the switch circuit **520** which, in turn, through sequencing of the Coast Timer and energizing K11, stops the head. No further action of the head will take place if the hand is between Zone 1 and Zone 2, i.e., is in the "dead zone," because biasing of the Zone 2 amplifier is set to de-energize the switching circuit **522** at minimum current drawn by the oscillator. Now, if the operator's hand enters Zone 2, its amplifier deactivates the Zone 2 switching circuit which sequences the head to move away from the hand a set distance determined by the 3" Coast Timer which would place the hand in the "dead zone." When the hand is removed the oscillator becomes loaded and draws more current, thus activates the amplifiers and switching circuits to allow the head to return to the die.

The operation of the control circuit of FIGS. 8A and 8B is believed to be clear from the schematic. However, a relay chart is provided in FIG. 10 to facilitate an understanding of the operation by showing the conditions of the relays and their contacts at different stages of the machine cycle. The relay contacts shown in FIG. 10 are arranged in columns under the functions Down, Up, Away and Return. It will be understood that each horizontal group under a given function represents a logic expression in Boolean algebra. Thus all the contacts under a given function must be closed in order for the function to be initiated, except where an "or" term is indicated.

Having thus described our invention, what we claim as new and desire to secure by Letters Patent of the United States is:

1. In a die cutting press having a work support, a platen, means for supporting the platen for movement toward and away from the work support and transversely thereof and power means for effecting such movements, in combination therewith, control means operatively connected to said power means for causing said power means to effect cyclical movement of the platen, said control means comprising

(a) stroke control means having trip means actuatable to cause movement of the platen toward the work support and having stroke terminating means responsive to a predetermined signal for interrupting said movement and for causing movement of the platen away from said support, and

(b) traverse control means operative in response to said predetermined signal for causing transverse movement of the platen of retreat in one direction for a predetermined distance and then of return in the opposite direction.

2. Apparatus as in claim **1** in which said traverse control means additionally has means operative to interrupt the return movement of the platen.

3. Apparatus as in claim **1** in which said traverse control means additionally has means operative to interrupt the return movement of the platen after a predetermined return distance.

4. Apparatus as in claim **1** in which said traverse control means additionally comprises variable timing means for at least one of said traverse movements and is operative to interrupt said one movement after a predetermined time interval.

5. Apparatus as in claim 1 in which said traverse control means additionally has means operative at a predetermined position of the platen in its path of transverse movement to interrupt the return movement of the platen.

6. Apparatus as in claim 1 in which said traverse control means additionally includes means operative in response to actuation of said trip means to interrupt the return movement of the platen.

7. Apparatus as in claim 1 wherein the traverse control means additionally comprises means for providing a speed of retreat greater than the speed of return.

8. Apparatus as in claim 1 wherein the traverse control means additionally comprises timing means operative to establish a predetermined variable interval between the movements of retreat and return.

9. Apparatus as in claim 1 wherein the traverse control means includes a hand sensor having a sensing element carried by the platen, the traverse control means being operative in response to movement of the element into predetermined proximity with a portion of a human body to interrupt the return movement of the platen.

10. Apparatus as in claim 9 wherein the traverse control is responsive to a body portion in a first zone extending a given distance from the sensing element to interrupt the return movement of the platen, and is also responsive to a body portion in a second zone extending a shorter distance from said element to cause the platen to retreat.

11. Apparatus as in claim 1 in which said control means additionally comprises die sensing means including a sensing element carried by the platen, said control means being operative under the control of said sensing means to interrupt said return movement and initiate movement of the platen toward the work support in response to movement of said element over a die as the platen passes thereover on its return movement.

12. Apparatus as in claim 11 in which the traverse

control means additionally includes means controlled by die sensing means in response to movement of the platen clear of the retreat portion of the traverse cycle to interrupt the movement of retreat.

13. In a die cutting press having a platen, a work support, means for supporting the platen for movement toward and away from the work support and for movement transversely of said support, power means for providing said movements of the platen, in combination therewith, control means for said power means comprising means for initiating movement of said platen transversely of said support to a predetermined position to bring said platen over a die positioned on the work support, sensing means operative in response to disposition of a body portion in a zone adjacent said platen for temporarily interrupting said transverse movement of the platen until said body portion is out of said zone, means comprising a die sensor operative responsively to movement of the platen over a die on the work support and operative at said predetermined position for initiating downward movement of the platen toward the work support to press said die through a work piece, stroke terminating means responsive to a predetermined electrical signal for interrupting the movement of the platen toward the work support and means acting in response to said last signal for thereafter effecting movement of the platen away from the work support and transversely thereof.

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