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①㉙ **Cutting press.**

①㉙ A hydraulically operated cutting press of the moving bed type has a cutting bed (24) supported at or adjacent each corner by piston-and-cylinder arrangements (C1 to C4), piston rods (48) of which are connected by swivel joint arrangements (50, 52, 54) to support members (20) on which the cutting head (22) is held against heightwise movement. The support members (20) are carried by a frame (10, 12, 14, 16) of the press. In one embodiment, the cutting head is supported on the support members, in the form of rail members (20), for receding movement to an operator-settable retracted position. The hydraulic circuitry includes a single pump which supplies fluid to both the arrangements (C1 to C4) and a piston-and-cylinder arrangement (34, 36) for driving the cutting head to-and-fro. Electronic control means controls the pressure of the pressure fluid in the system.

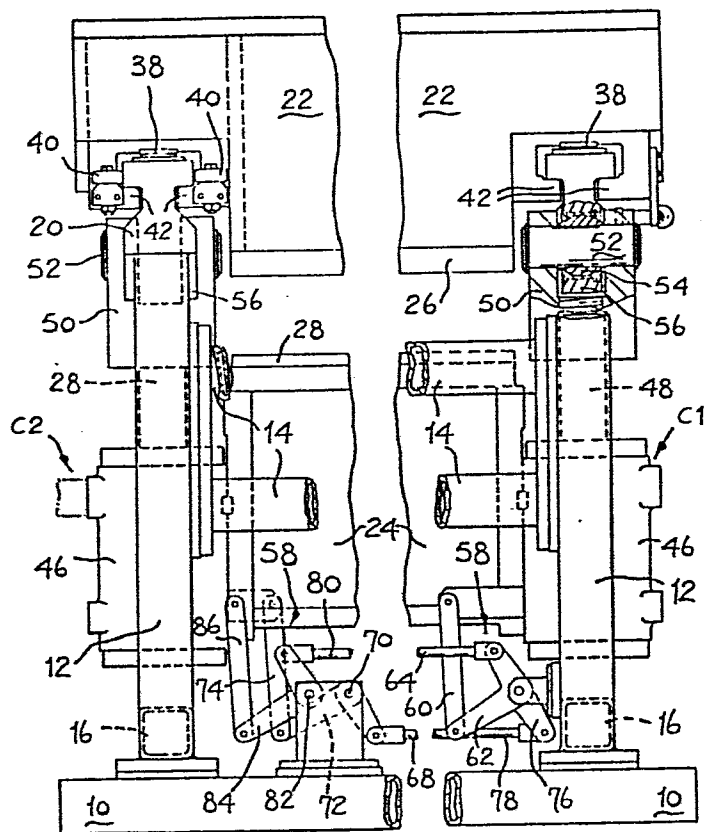


Fig-2

CUTTING PRESS

This invention is concerned with a cutting press comprising a frame, support members carried by the frame at opposite sides thereof, a cutting head which is supported at opposite ends thereof by the support members and held thereby against heightwise movement, a cutting bed which is mounted for heightwise movement towards and away from the cutting head thus to effect cutting and return strokes respectively of the press, and fluid pressure operated means for effecting such heightwise movement of the cutting bed, comprising four piston-and-cylinder arrangements mounted one at or adjacent each corner of the cutting bed.

Cutting presses of this type, usually referred to as 'moving bed presses', are generally known: see e.g. GB-A 1440075. In such moving bed presses, conventionally a frame is provided comprising side members which are floor-mounted and which support the cutting head on the one hand, and also on which the cutting bed is mounted for heightwise movement as aforesaid. Thus, these side members necessarily have to be so constructed not only to be able to support the weight of the press as a whole, but in addition to transmit the force applied between the cutting bed and cutting head in a cutting stroke of the press. It will be appreciated that the side members therefore have to be of relatively massive construction.

It is the object of the present invention to provide an improved cutting press in which the mass of the frame side members can be reduced without in any way diminishing the loads which can be applied between the cutting head and cutting bed in a cutting operation.

This object is resolved in accordance with the present invention, in a machine as set out in the first paragraph above, in that the piston-and-cylinder arrangements are suspended from the support members.

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It will thus be appreciated that by the provision of the support members on which not only the cutting head is supported but also the cutting bed is suspended through its piston-and-cylinder arrangements, the frame side members of the press can be constructed so as merely to support the weight of the press, and only the support members themselves need to be sufficiently massively constructed for transmitting the cutting loads.

In moving bed presses, furthermore, conventionally a balancing mechanism may be provided which is operatively connected to the cutting bed and is effective to counter any tendency of the cutting bed to tilt, and thus to maintain opposed surfaces of the cutting bed and cutting head parallel or substantially so, during a cutting stroke of the press. In the press in accordance with the invention, furthermore, because of the arrangement whereby each piston-and-cylinder arrangement is suspended as aforesaid from the support members, it is advantageous for such suspension to be achieved by means of a swivel joint arrangement, which, in combination with the balancing mechanism, enhances the effectiveness of the balancing mechanism, in particular in that any tilting of the cutting bed which arises does not tend to cause binding between the moving parts, so that the force applied by the fluid pressure operated means is not required to overcome any such binding forces, but rather merely to apply the cutting load, quite apart from any wear and tear on the moving parts occasioned by such binding. In a preferred construction, each piston-and-cylinder arrangement has an upwardly extending piston rod at the end of which is mounted a bearing block secured to one of the support members by said swivel joint arrangement.

Where the press in accordance with the invention is of the receding head type, that is to say wherein the cutting head is mounted for movement fore-and-aft of the press between a forward, operative, position and a retracted

position, conveniently the support members are provided by two rail members extending fore-and-aft of the press. Furthermore, conveniently in such case fluid pressure operated means is provided for effecting such fore-and-aft movement of the cutting head, said means and the fluid pressure operated means for effecting heightwise movement of the cutting bed being each hydraulically operated and each forming part of a hydraulic circuit which also comprises an electronically controlled relief valve for controlling the operating pressure of the hydraulic circuit according to which of the said fluid pressure operated means is in question.

It will thus be appreciated that a cutting press in accordance with the invention gives significant advantages both in construction and operation, in particular by enabling the mass of the supporting frame of the press to be reduced without detracting from the cutting loads to be applied, and in addition, in the case of a receding head press, especially by controlling the movement of the cutting head between its operative and retracted positions, without requiring a massive frame structure to withstand sudden changes in acceleration or deceleration. Furthermore, the efficiency and effectiveness of the balancing mechanism is significantly improved by facilitating tilting of the cutting bed without binding, thereby reducing the force requirements of the hydraulic circuit for operating the press. Also, where the cutting press in accordance with the invention is of the receding head type, the hydraulic circuit is enhanced, by the provision of the electronic relief valve which enables a single pump to be used for effecting both cutting and return strokes of the press and the movement of the cutting head between its operative and retracted positions.

There now follows a detailed description, to be read with reference to the accompanying drawings, of one cutting press in accordance with the invention. It will be

appreciated that this cutting press has been selected for description merely by way of non-limiting example.

In the accompanying drawings:-

5 Figure 1 is a left hand side view of the cutting press in accordance with the invention;

Figure 2 is a fragmentary view, taken from the front of the cutting press shown in Figure 1;

Figure 3 is a fragmentary plan view of part of the right hand side of the cutting press shown in Figure 1; and

10 Figure 4 is a schematic diagram showing a hydraulic circuit of the cutting press in accordance with the invention;

Figure 5 is a schematic diagram showing part of the electrical circuit of the press in accordance with the
15 invention;

Figure 6 is a schematic diagram showing details of a relief valve control arrangement by which the hydraulic pressure in the system is controlled;

20 Figure 7 is a schematic diagram showing details of a control arrangement for "head forward" and "head retract" movement;

Figure 8 is a schematic view of setting means for determining the limits of travel of the cutting head; and

25 Figure 9 is a schematic diagram of a light screen connection used in the press in accordance with the invention.

The cutting press in accordance with the invention now to be described comprises a fabricated frame made up of a base structure 10, upstanding leg members 12, cross straps 14 and fore-and-aft straps 16. The various integers of the
30 frame are made up of tubular steel, and the structure is designed to be able to support the weight of the operating parts of the press.

Carried by the frame are two rail members 20 which
35 extend fore-and-aft of the cutting press. The cross sectional shape of each rail member 20 can be seen from

Figure 2, from which it can be seen that each member has a re-entrant portion at opposite sides, for purposes to be described hereinafter.

The press in accordance with the invention
5 comprises upper and lower platens constituted by a cutting head 22 and a cutting bed 24. As is conventional, the cutting head 22 is provided on its under-surface with a striker plate 26 and the cutting bed supports a cutting pad 28. For facilitating feeding of material to be cut from a
10 supply (not shown) which may be located at the rear of the cutting press, a tray member 30 is carried by the frame and is pivotally connected at its forward end to the cutting bed 24. The work-supporting surface of the tray lies flush with the upper surface of the cutting pad 28, height adjustment
15 means 32 being provided (see Figure 1) for this purpose.

The cutting head 22 is supported by the rail members 20 for movement fore-and-aft of the cutting press between a forward, operative, position, in which it lies in opposed relationship with the cutting bed 24, and a
20 retracted position. Power means (fluid pressure operated means) for effecting such movement of the cutting head 22 is provided in the form of a hydraulic piston-and-cylinder arrangement a cylinder 34 of which is carried in the cutting head 22 with a rearwardly projecting piston rod 36 connected
25 at its rearward end to a cross strap 14 of the frame. For facilitating the movement of the cutting head 22 on the rail members 20, furthermore, the uppermost surface of each rail member is provided with a slide surface 38 on which a co-operating surface of the cutting head slides, and in
30 addition at the left hand end of the cutting head 22 are provided two rolls 40 which engage opposite sides of the rail member, above the re-entrant portion thereof, said rolls serving to determine the position of the cutting head laterally of the cutting press. The cutting head is in
35 addition held against heightwise movement relative to the rails by projections 42 which are provided on blocks

integral with the cutting head and project into the re-entrant portions of the rail members. The projections thus provide abutment surfaces which are urged against shoulders provided by the re-entrant portions on the rail members (see Figure 2) during a cutting stroke of the press and thereby determine the heightwise position of the cutting head.

The rail members 20 are preferably steel forgings which have undergone a heat treatment.

The cutting press in accordance with the invention is a so-called "moving bed press"; that is to say, cutting and return strokes of the press are effected by movement of the cutting bed 24 towards and away from the cutting head 22. For effecting such movement of the cutting bed fluid pressure operated means constituted by four piston-and-cylinder arrangements C1,C2,C3,C4 is provided. More particularly, cylinders 46 of said arrangements are mounted one at or adjacent each corner of the cutting bed 24 with a piston rod 48 of the arrangements extending upwardly. Secured at the upper end of each piston rod 48 is a yoke member 50 which is bifurcated, there being mounted in, and extending across, the leg portions thereof a trunnion pin 52 which passes through a swivel joint arrangement in the form of a spherical (or ball end) bearing 54. For accommodating the bearings 54 each rail member 20 has two integral downwardly depending lugs 56 appropriately spaced along the length thereof and having appropriately shaped recesses formed therein to receive the bearings.

It will thus be appreciated that the cutting bed 24 is suspended from the rail members 20 through the piston-and-cylinder arrangements C1,C2,C3,C4 and the swivel joint arrangements just described, so that the transmission of cutting loads takes place through the rail members 20 only and further the cutting bed 24 is capable of limited tilting movement during a cutting stroke, for reasons referred to later.

The cutting press in accordance with the invention also comprises a balancing mechanism generally designated 55 operatively connected to the cutting bed and effective to counter any tendency of the cutting bed to tilt, and thus to maintain opposed surfaces of the striker plate 26 and cutting pad 28 parallel, or substantially so, during a cutting stroke of the press. The balancing mechanism is generally as described in EP-A 67037, to which reference should be made for further details. Thus, the balancing mechanism of the press in accordance with the present invention comprises, pivotally mounted at the front right hand corner of the cutting bed 24, a link 60 which is pivotally connected in turn to one arm of a bell crank lever 62. The bell crank lever 62 is pivotted on a bracket on the frame and the other arm thereof is connected to a rod 64 (corresponding to the rod (or link) 38 of the mechanism described in EP-A 67037). Thus, through the rod 64 the front right hand corner of the cutting bed 24 is connected to the spool of a first balancing valve BV1 (Figure 4) to which the left hand rearward corner of the cutting bed 24 is also connected, through a further rod 68 (corresponding to the rod (or link) 44 of said EPC application) and a linkage including a pivot shaft 70 extending rearwardly of the press a first lever 22 mounted at the rearward end of said shafts 70, and a second lever 74 pivotally mounted at said left hand rearward corner of the cutting bed 24.

The rearward right hand corner of the cutting bed is similarly connected by a lever (not shown) and a bell crank lever 76 pivotted on a bracket on the frame and through a rod 78 to the spool of a second balancing valve BV2 (Figure 4) to which the forward left hand corner of the cutting bed 24 is also connected, through a rod 80, a forwardly extending pivot shaft 82, a third link 84, and a second link 86 pivotally mounted at said forward left hand corner.

The cutting press in accordance with the invention may also be provided with a stroke control arrangement as described in EP-A 67037.

5 The operation of the press in accordance with the invention, including the balancing mechanism, is controlled by a hydraulic circuit illustrated in Figure 4. From this Figure it will be seen that pressure fluid is supplied to the whole circuit by means of a single pump P driven by a motor M. An electronically controlled pressure relief valve
10 system generally designated 90 is also provided for controlling the pressure of the fluid in the system. This is achieved by the supply of appropriate signals to the valve system 90 (as will be described later).

The hydraulic circuit also comprises a three-way
15 solenoid valve SVC which, when in its central position (see Figure 4), closes off the four piston-and-cylinder arrangements C1, C2, C3, C4 from the source of pressure fluid and in addition from tank T.

With the press in its rest position (as shown in
20 Figure 4), actuation of the solenoid valve SVC to move its spool to the left (view in Figure 4) causes pressure fluid to be supplied along line 100, bypassing a restrictor valve arrangement 102 and passing through check valves 104 to the upper end of each of the piston-and-cylinder arrangements.
25 At the same time, pressure fluid passes along a line 106 to each of four cartridge valves CV12, CV32, CV42, CV22 to cause them to be closed and also along branch lines 108 to four further cartridge valves CV13, CV23, CV33, CV43, to close them also. In this condition, therefore, pressure
30 fluid is fed directly to the piston-and-cylinder arrangements. At the same time, exhaust fluid from piston-and-cylinder arrangements C3, C1 is exhausted respectively through further cartridge valves CV31, CV11 to the balancing valve BV1, and exhaust fluid from
35 piston-and-cylinder arrangements C4, C2 is exhausted respectively via cartridge valves CV41, CV21 to balancing

valve BV2. While the opposed surfaces of the striker plate 26 and cutting pad 28 remain parallel, the balancing valves remain in an equilibrium state (as illustrated in Figure 4) and thus allow a balanced flow of exhaust fluid therethrough
5 from each of the cartridge valves, such exhaust fluid exhausting through solenoid valve SVC to tank T. In the event that the opposed surfaces become no longer parallel, then through the balancing mechanism 58 the spool of the relevant balancing valve is appropriately shifted, thereby
10 varying the amount of flow of exhaust fluid therethrough such as to overcome the tendency of the cutting bed to tilt and to correct it.

It will be appreciated that, in order for the balancing mechanism to be effective, it is necessary for the
15 cutting bed to be able to tilt, and indeed without binding forces arising which then have to be overcome by the hydraulic system. It is for this purpose that the swivel joint arrangements are provided in the mountings for the piston-and-cylinder arrangements. By using the balancing
20 valves in this manner for controlling the exhaust fluid, furthermore, it is possible, in the case of a very off-set load between the platens, notably when the load is placed closely adjacent to one corner, to completely close off the exhaust fluid from the piston-and-cylinder arrangement,
25 associated with the opposite corner of the cutting bed, and at the same time allowing full flow from the piston-and-cylinder arrangement, associated with said one corner, and also while the other two piston-and-cylinder arrangements are operating under normal condition (with
30 their balancing valve in equilibrium), so that effectively there is added to the hydraulic pressure being applied to the piston-and-cylinder arrangement also a mechanical force applied by the other three arrangements through the cutting bed. In this way, therefore, where such an off-set load
35 arises, a pressure greater than the fluid pressure can be applied to the "affected" corner of the cutting bed.

In a return stroke of the cutting bed 24, the function of the balancing valves BV1, BV2 is altered so that they thereby become effectively flow distributor valves, since shifting solenoid valve SVC to the right (viewing Figure 4) is effective to channel the pressure fluid through the balancing valves to the piston-and-cylinder arrangements. In this case pressure fluid is supplied from the pump P along lines 110 to the valves and also through branch lines 112 to cartridge valves CV31, CV11, CV21, CV41 to close them, while switching solenoid valve SVC serves to open cartridge valves CV12, CV32, CV42, CV22. Pressure fluid is thus supplied via cartridge valves CV12, CV32 from balancing valve BV1 respectively to piston-and-cylinder arrangements C1, C3, and further via cartridge valves CV42, CV22 from balancing valve BV2 respectively to piston-and-cylinder arrangements C4, C2. Any tendency of the cutting bed 24 to tilt is thus again countered by the balancing mechanism 58, but in this case (since heavy loads will not generally arise, and in any event off-set loads present no problem), the balancing takes place using the supply fluid.

In the press in accordance with the invention, furthermore, during the return stroke, the branch lines 108 are exhausted, thereby causing cartridge valves CV13, CV23, CV33, CV43 to open whereby, in conjunction with the check valves 104, which serve to prevent exhaust to tank of the fluid exhausting from the piston-and-cylinder arrangements, the exhaust fluid is thus recirculated through the relevant cartridge valves, and combines with pressure fluid being supplied along the lines 114 connecting the balancing valves with the piston-and-cylinder arrangements, thus to cause enhanced fluid flow to the arrangements and thereby to provide an accelerated return stroke. This feature is of course facilitated by the use of the supply fluid for balancing purposes during the return stroke and clearly would not be able to be provided if balancing were to take

place utilising the exhaust fluid (as is the case with the cutting stroke). The system of cartridge valves thus enables the fluid flow paths to be reversed to give accelerated return strokes, while at the same time providing
5 for enhanced cutting (should the need arise in respect of an offset load) during the cutting strokes.

In the press in accordance with the invention the same pump P is used for not only effecting cutting and return strokes of the press, but also fore-and-aft movement of the
10 cutting head 22. To this end, the pump P thus supplies pressure fluid along a line 116, via a control valve arrangement generally designated 118 (to be referred to hereinafter) to a three-way solenoid valve SVH. In its
15 central position (shown in Figure 4) the valve SVH prevents the flow of fluid to the piston-and-cylinder arrangement 34,36, while shifting the spool of said valve causes movement of the piston of said arrangement in one direction or another, as appropriate.

For controlling the operation of the hydraulic
20 circuit, the press in accordance with the invention comprises an electrical/electronic circuit as shown in Figs. 5 to 9. This circuit has a 110V supply. For safety reasons, the circuit includes a light screen which, in the press being described is a Safety Light Curtain Model LVU,
25 supplied by Erwin Sick. This guard arrangement allows the press to be operated manually, or after a single break of the light screen, or after a double break of the light screen.

When the press is initially switched on, a circuit
30 is made to relay RL9 (Fig.5) through normally closed contacts RL1/1 and RL4/1 (both to be referred to hereinafter), S2 and PB1/1, the latter being contacts of a "start" button. Energising RL9 closes its contacts RL9/1 to form a holding circuit. At this stage, the guard is
35 inoperative and its contacts S1 and S3 are open. Upon operation of the "start" button, contacts PB1/3 are closed

thereby rendering the guard arrangement operative whereupon normally closed contacts S2 are opened and normally open contacts S1 and S3 are closed. The guard is now effective to protect the operator, interruption of the light screen returning the various contacts to their rest position. Closing S1 causes relay RL8 to be energised, thereby closing its contacts RL8/1 and preparing a circuit to relay RL5. Closing contacts S3, in combination with closing contacts PB1/2 of the "start" button energises relay RL3 through a circuit including a rear limit relay CR1, which is actuated in response to part of the electronic circuit to be referred to hereinafter. Energising RL3 serves to energise its contacts RL3/1, thereby creating a holding circuit.

Energising RL3 also closes its contacts RL3/2, thereby energising solenoid SOL E, operating solenoid valve SVH whereby piston-and-cylinder arrangement 34, 36 is actuated to move the head forwards. The control of the speed of head movement will be described hereinafter. Energising RL3 also opens normally closed contacts RL3/3, thereby disabling relay RL1 by which retracting movement of the head is initiated.

When the head moves away from its rear limit, relay CR1 is switched, but RL3 is retained energised through its holding circuit. When the head reaches its front limit position, relay CR4 is energised, thereby energising relay RL2 which in turn, through its contacts RL2/1 is then effective to cause relay RL5 to be energised. Energising RL5 is effective through its contacts RL5/1 to energise solenoid SOL D by which solenoid valve SVC is switched to allow fluid under pressure to the piston-and-cylinder arrangements C1, C2, C3, C4. Energising RL5 also causes its contacts RL5/4 to close, thereby creating a holding circuit in readiness for de-actuation of lower limit relay CR5. SOL D remains energised until upper limit relay CR6 is actuated, whereupon relay RL5 drops out. At this stage the cutting stroke is completed.

When RL5 is energised, contacts RL5/2 are closed, thereby actuating a timer TR which in turn closes its contacts TR/1, thereby energising relay RL6. Energising RL6 causes its normally closed contacts RL6/1 to be opened, 5 thereby disabling relay RL4 by which the lowering of the bed is controlled, and in addition opening contacts RL6/2, disabling "head retract" relay RL1. In addition energising RL6 closes its contacts RL6/3, which is incorporated in a circuit together with relay contacts RL5/3, by which circuit 10 the pressure of hydraulic fluid in the system is controlled, and which will be described in detail hereinafter. At this stage, it is necessary to point out only that, upon de-energising RL5, the timer TR is effected for a pre-set period (in the illustrative example 0.2 seconds) to maintain 15 RL6 energised, thereby continuing to disable the "head retract" and "bed lower" relays RL1, RL4, while, in combination with now closed relay contacts RL5/3, allowing decompression of the hydraulic fluid in the piston-and-cylinder arrangements C1, C2, C3, C4.

20 When the timer TR times out, relay RL6 is de-energised, whereupon, through its contacts RL6/1, relay RL4 is energised which in turn, through its contacts RL4/1, cause solenoid SOL C to be energised. Energising SOL C operates solenoid valve SVC to cause the lowering of the 25 head to be initiated, this movement continuing until lower limit relay CR5 is actuated, thereby de-energising relay RL4. De-energising RL4 is effective to return its normally closed contacts RL4/2 and RL4/3 to their initial condition, thereby energising relay RL1 which, through its contacts 30 RL1/1, is effective to energise solenoid SOL F. This latter thereupon operates solenoid valve SVH to initiate return movement of piston-and-cylinder arrangement 34, 36. When the head reaches its rear limit, as determined by actuation of relay CR1, relay RL1 is de-energised and the press comes 35 to rest.

Various other contacts of the relays are provided, as indicated in the drawings, for interlock purposes.

Referring to Fig. 6, the electronic circuit comprises an electronically controlled pressure relief valve system 90 supplied by Abex Denison together with a driver board 130 (their reference number 701 00001-8), which enables different pressure limits to be applied in the hydraulic system according to the type of operation to be effected. To this end, the electronic circuit comprises an electronic control circuit which preferably includes a microprocessor and programmed instructions, which can be exchanged to set the press for the particular operator requirements. The driver board 130 has eight ports two (131, 132) of which are connected to a 24V supply taken from the main 110V supply, and two (133, 134) of which are connected to solenoid SOL A by which a valve 138 forming part of the valve system 90 is controlled. More particularly, the voltage applied to SOL A controls the size of the orifice of the pressure relief valve 138 so that, by varying the voltage the orifice dimensions are varied, and thus the pressure in the hydraulic system.

For controlling the voltage supplied through ports 133, 134 a sub-circuit is connected across ports 135, 136, 137 of the board. Connected across ports 135, 137 are three variable resistors (potentiometers) 140, 142, 144 in parallel, the pick-up contacts of each of which are connected back to port 136. Thus, by varying the resistances, the voltage applied to SOL A can be varied. Selection of which of the resistors is to be incorporated in the circuit is effected by relay contacts from the main electrical circuit, as will now be described.

The pick-up contact of a first (140) of the resistors is connected to port 136 through normally open relay contacts RL5/7. These contacts are closed when relay RL5 is energised, that is when the bed 24 is being raised, and variable resistor 140 thus controls the pressure in the

hydraulic system during the upstroking of the bed. In one embodiment, the voltage is so set that a pressure of 235 bar is achieved in the hydraulic system.

The pick-up contact of a second (142) of the
5 variable resistors is connected to port 136 through normally
open contacts RL4/4 or alternatively through the sub-circuit
previously referred to incorporating relay contacts RL5/3
and RL6/3. Thus, when relay RL4 is energised, namely when
the bed is to be lowered, variable resistor 142 is rendered
10 operative and thus controls the pressure of the hydraulic
system during the lowering of the bed. In addition, as
previously described, variable resistor 142 is also
operative prior to energising relay RL4, during the period
when timer TR is active, thereby allowing decompression of
15 the fluid in the piston-and-cylinder arrangements C1, C2,
C3, C4, prior to initiation of the downward movement of the
bed. In one embodiment, the voltage achieved through the
setting of resistor 142 is such that a pressure of 50 bar is
applied through the hydraulic system.

20 The third variable resistor 144 is connected to
port 136 through either normally opened contacts RL1/2 or
RL3/4, which respectively are closed upon energising relays
RL1, RL3, by which head retracting and head advancing
movement is controlled. Thus, resistor 144 controls the
25 pressure in the hydraulic system during head movement; in
one embodiment, this is set at 117 bar.

Further interlock relay contact RL5/8, RL1/3,
RL3/5, RL4/5, RL6/4, are provided whereby only one variable
resistor can be operative at any one time. These are
30 arranged in a line which connects the pick-off contacts of
each resistor to port 137.

When none of the resistors is operative, port 136
is shorted to port 137, and in such circumstance the voltage
applied to SOL A is such that the pressure of the hydraulic
35 system is sufficient to raise to bed under low pressure

only. In one embodiment, this is found to be of the order of 7 bar.

The electrical circuit also includes a further relay RL7 (Fig. 5) which is energisable by operation of a manual switch SS2 and which enables the operator to set the cutting stroke of the press while the press is operating under low pressure. To this end, energising RL7 cause normally closed contacts RL7/1 and RL7/2 to be opened thereby disabling respectively relays RL1, RL4, so that the head cannot be retracted or the bed lowered. In addition, normally open contacts RL7/3 are closed thereby making a circuit between ports 136, 137 of driver board 130 even when relay contacts RL5/8 are opened. Thus, during a low pressure adjust operation, the pressure in the hydraulic is retained at its idling level, namely in this embodiment 7 bar. Two interlock contacts RL7/3, RL7/4 are also provided, as indicated in the drawings.

Referring to Fig. 7, the control valve arrangement 118 by which fore-and-aft movement of the press head 22 between its retracted and advanced positions is controlled, is supplied by Abex Denison together with a driver board 150 (their reference number 735 10004-2). The driver board 150 has two ports 151, 152 which receive a 110V supply from the electrical circuit, and port 153 which is earthed. Output ports 154, 155 are connected in a circuit incorporating a solenoid SOL B, by which the control valve arrangement 118 is operated. The arrangement 118 is a two-port pressure-compensated proportional flow control valve arrangement and comprises a variable restrictor valve 122, the restriction in the through-flow passage of which is varied according to the control signal (voltage) received by SOL B, and a pressure-compensating valve 124 which has inputs connected both "upstream" and "downstream" of the restrictor valve 122 and serves to ensure that a constant flow of fluid takes place through the valve arrangement 118. A mechanical stop member 126 is also provided on the spool

of the restrictor valve 122, which member prevents the valve from closing completely and thus serves to determine a "creep" speed for the piston-and-cylinder arrangement 34, 36. The screw is adjustable so as to be able to vary the creep speed. Thus, by varying the voltage supplied to SOL B, the supply of fluid to piston-and-cylinder arrangement 34, 36 through solenoid valve SVH can be controlled, and thus the speed of travel and also the distance travelled.

The driver board 150 enables both the speed of travel (maximum velocity) of the head in each direction, and also its acceleration and deceleration in each direction to be separately controlled. Thus, for speed control ports 156, 157, 158 are connected to a sub-circuit comprising two variable resistors 160, 162 connected in parallel across ports 156, 158, while the pick-off contact of each resistor is connected back to port 157. More specifically, the circuit incorporating resistor 160 includes normally open relay contacts RL3/6 and normally closed relays contacts RL1/4, so that the resistor is rendered operative during "head forward" movement and thus controls the speed of such movement, through the control valve arrangement 118, while the circuit incorporating resistor 162 also includes normally open relay contacts RL1/5 and normally closed relay contacts RL3/7, so that resistor 162 is operative only during "head retracts" movement, and thus controls the speed of such movement.

Associated with the resistors 160, 162 are respectively control relays CR3, CR2 which, when actuated, connect the pick-up contacts of the resistor to port 157, but when de-actuated disconnect the pick-up contacts; in this latter case the voltage applied to SOL B is then controlled by the circuit through port 158 and provides the "creep" speed referred to above. Actuation of relays CR2, CR3 will be described hereinafter in detail.

The driver board 150 as supplied by Abex Denison has five trimmer potentiometers two of which, designated

"Fall" and "Rise", are removed in the present application to enable acceleration and deceleration in both directions to be achieved. Thus, "Fall" potentiometer is replaced by two variable resistors 170, 172 in parallel, resistor 170 being
5 connected in a circuit including normally closed relay contacts RL1/6 and resistor 170 in a circuit including also normally open relay contacts RL1/7. Thus, variable resistor 172 is rendered operative when RL1 is energised, and thus has a control function during "head retract" movement, while
10 resistor 170 is otherwise rendered operative, that is to say during "head forward" movement. Similarly, the "Rise" potentiometer is replaced by variable resistors 174, 176 which are likewise rendered operative respectively, through normally closed relay contacts RL1/8 and normally open relay
15 contacts RL1/9, to exercise a control function during "head forward" and "head retract" movement.

Thus, in the operation of the flow control valve arrangement 118 variable resistors 174, 176 are rendered operative to control acceleration respectively during head
20 forward and head retract movement, while resistors 170, 172 are respectively rendered operative to control deceleration during head forward and head retract movement. It will thus be appreciated that by this arrangement the conventional control provided by the "Fall" and "Rise" potentiometers has
25 been replaced by separate controls for acceleration and deceleration in each direction.

In operation, upon energising relay RL3, initially the acceleration, speed and deceleration of the "head forward" movement is pre-set by resistors 174, 160, 170
30 respectively, while similarly, upon energising relay RL1, acceleration, speed and deceleration in the "head retract" movement is pre-set respectively by resistors 176, 162, 172.

The press in accordance with the invention also comprises setting means whereby the operator can select the
35 retracted position to which the cutting head 22 is moved, said setting means comprising a linear potentiometer 120

(Fig. 3) which is mounted on the right hand side rail 20 and is operatively connected to the cutting head 22 whereby its output voltage varies according to the position of the cutting head 22 along the rail members 20. In addition, the setting means comprises four reference potentiometers (variable resistors) 180, 182, 184, 186 (Fig. 8) mounted on a printed circuit board on which also are mounted control relays CR1, CR2, CR3, CR4, together with a comparator circuit by which the output of the linear potentiometer is compared under microprocessor control with the pre-set outputs of each of the reference potentiometers, the arrangement being such that the control relays CR1, CR2, CR3, CR4 are energised respectively when the output of potentiometers 180, 182, 184, 186 match the output of the linear potentiometer 120.

Reference potentiometer 186 is set so as to determine the front position of the cutting head 22 and potentiometer 184 is pre-set to control the initiation of deceleration of the "head forward" movement at a rate controlled by variable resistor 170 and to provide for a final "head forward" movement at the "creep" speed. Since it is desirable that the front limit position of the head is fixed, the potentiometer 186 will not normally be accessible to the operator. Similarly, since the deceleration and the "head forward" speed will normally be fixed also, resistors 160, 168 will also not normally be accessible to the operator.

It may be desirable, in using the press in accordance with the invention, to vary the rear limit position of the cutting head 22 according to the size of knife being utilised. Thus, the "rear limit" potentiometer 180 is preferably accessible to the operator. Furthermore, since deceleration should take place at a distance spaced from the rear limit position, which distance is determined according to the speed of travel and rate of deceleration (determined respectively by resistors) 162, 176 the two

potentiometers 180, 182 are connected and operable by a common tuning knob (not shown).

In the operation of the press, upon actuation of the "start" button PB1, the head is accelerated from its rear limit position forwards up to the speed as set by resistor 160. This movement continues until control relay CR3 is actuated, whereupon control of the "head forward" movement is transferred to the head forward deceleration resistor 170, which reduces the speed to the "creep" speed, until relay CR4 is actuated, terminating the head forward movement. Similarly, at the end of the cutting operation the head retract movement is initiated upon energising relay RL1, acceleration being under the control of resistor 176, up to the speed as set by resistor 162, such head retract movement continuing until relay CR2 is actuated to bring the movement to the "creep" speed, which continues until actuation of relay CR1, which terminates the head retract movement. It will of course be appreciated that actuation of CR4 is effective, by energising relay RL2 and consequent opening of its contacts RL2/2, thus de-energising RL3, to terminate head forward movement. Similarly, CR1 is effective to de-energise RL1, thereby terminating the head retract movement.

It will thus be appreciated that, using the reference potentiometer 180, the retracted position of the cutting head can be set at any desired distance from the front position thereof. Preferably, however, pre-set end positions are provided using conventional microswitches.

The light guard arrangement is provided with a selector switch SS1 for selecting "manual", "single break" and "double break" modes of operation. Where operating the guard in either of the "break" modes, the self-checking of the guard arrangement takes place when the break, or the second break is effected, replacing the operation of push button PB1, and thereafter the operation of the press takes place as described above.

Claims:

1. Cutting press comprising
a frame (10-16),
5 support members (20) carried by the frame (10-16)
at opposite sides thereof,
a cutting head (22) which is supported at opposite
ends thereof by the support members (20) and held thereby
against heightwise movement,
10 a cutting bed (24) which is mounted for heightwise
movement towards and away from the cutting head (22) thus to
effect cutting and return strokes respectively of the press,
and
fluid pressure operated means (C1,C2,C3,C4) for
15 effecting such heightwise movement of the cutting bed (24),
comprising four piston-and-cylinder arrangements
(C1,C2,C3,C4) mounted one at or adjacent each corner of the
cutting bed (24),
characterised in that the piston-and-cylinder arrangements
20 (C1,C2,C3,C4) are suspended from the support members (20).

2. Cutting press according to Claim 1 wherein
the cutting head (22) is mounted for movement fore-and-aft
of the press between a forward, operative, position and a
25 retracted position, characterised in that the support
members (20) are provided by two rail members (20) extending
fore-and-aft of the press.

3. Cutting press according to either one of
30 Claims 1 and 2 characterised in that each
piston-and-cylinder arrangement (C1,C2,C3,C4) is suspended
as aforesaid by means of a swivel joint arrangement
(52,54,56), and in that a balancing mechanism (58) known per
se is provided which is operatively connected to the cutting
35 bed (24) and is effective to counter any tendency of the
cutting bed (24) to tilt, and thus to maintain opposed

surfaces of the cutting bed (24) and cutting head (22) parallel or substantially so during a cutting stroke of the press.

5 4. Cutting press according to Claim 3 characterised in that each piston-and-cylinder arrangement (C1,C2,C3,C4) has an upwardly extending piston rod (48) at the end of which is mounted a bearing block (50) secured to one of the support members (20) by said swivel joint
10 arrangement (52,54,56).

 5. Cutting press according to any one of the preceding Claims wherein fluid pressure operated means (34,36) is provided for effecting such fore-and-aft movement
15 of the cutting head (22) and wherein said means (34,36) and the fluid pressure operated means (C1,C2,C3,C4) for effecting heightwise movement of the cutting bed (24) are each hydraulically operated and each forms part of a hydraulic circuit, characterised in that said circuit
20 comprises an electronically controlled relief valve (118) for controlling the operating pressure of the hydraulic circuit according to which of the said fluid pressure operated means (34,36;C1,C2,C3,C4) is being operated.

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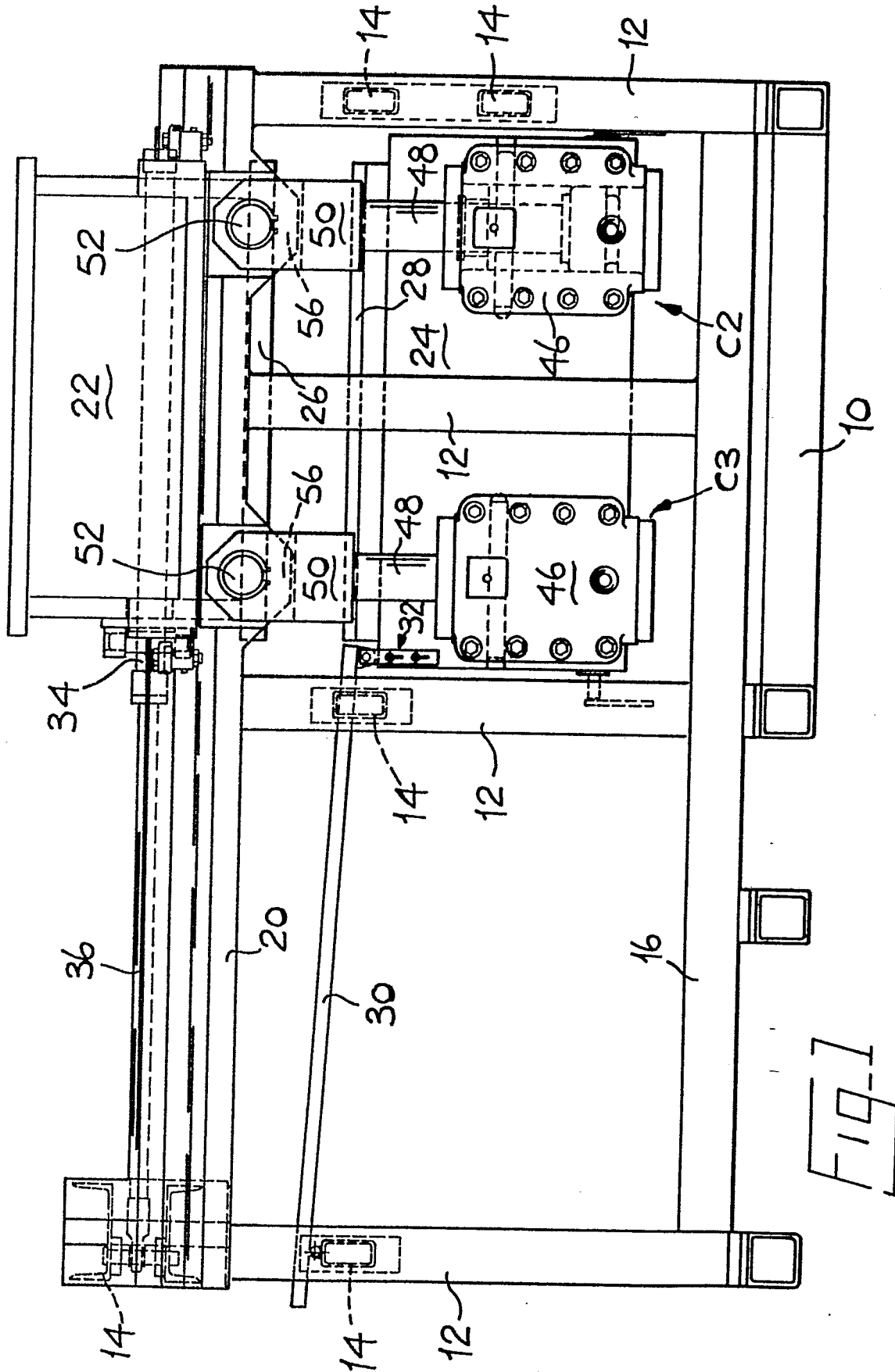


Fig. 1

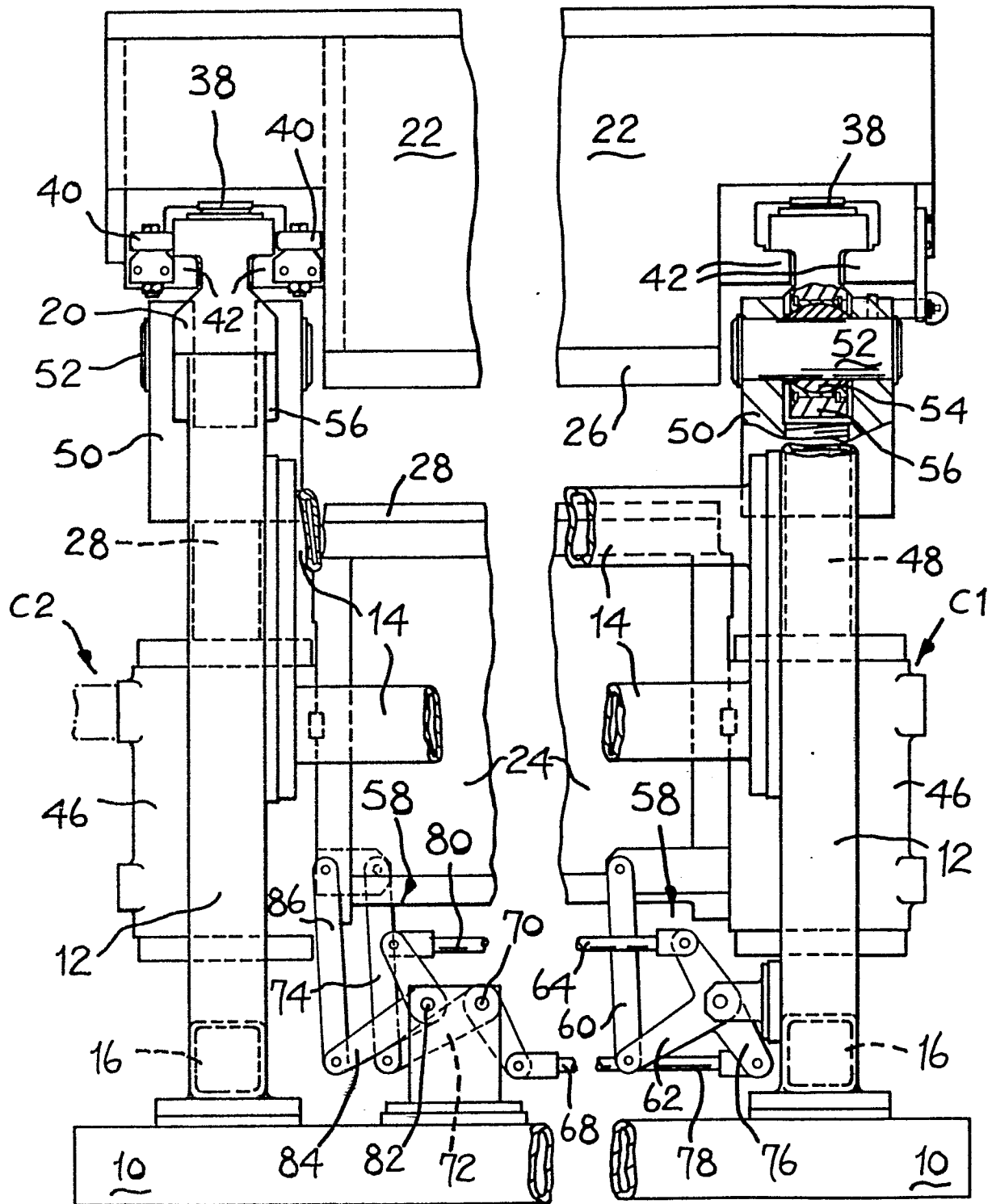


Fig-2

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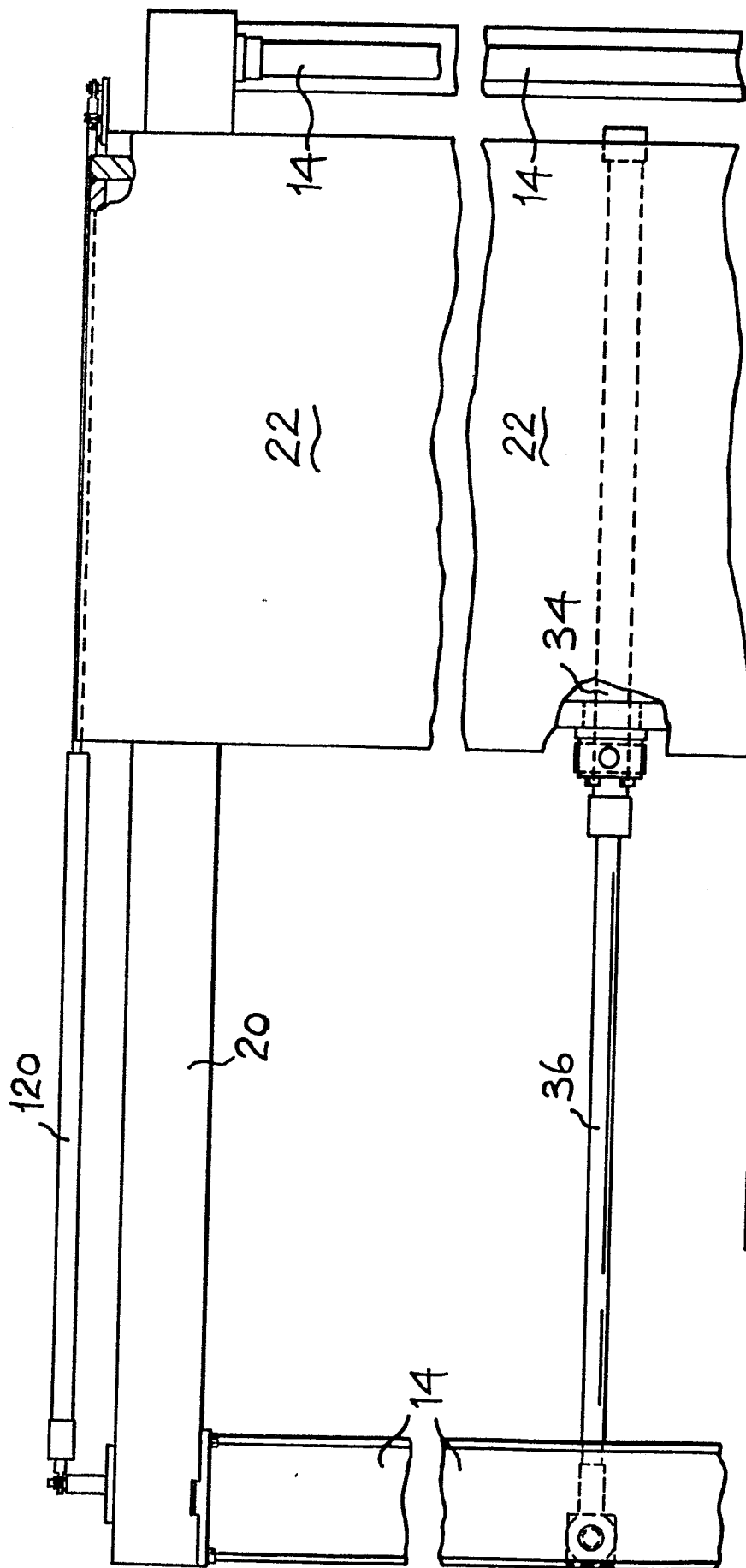


FIG-3

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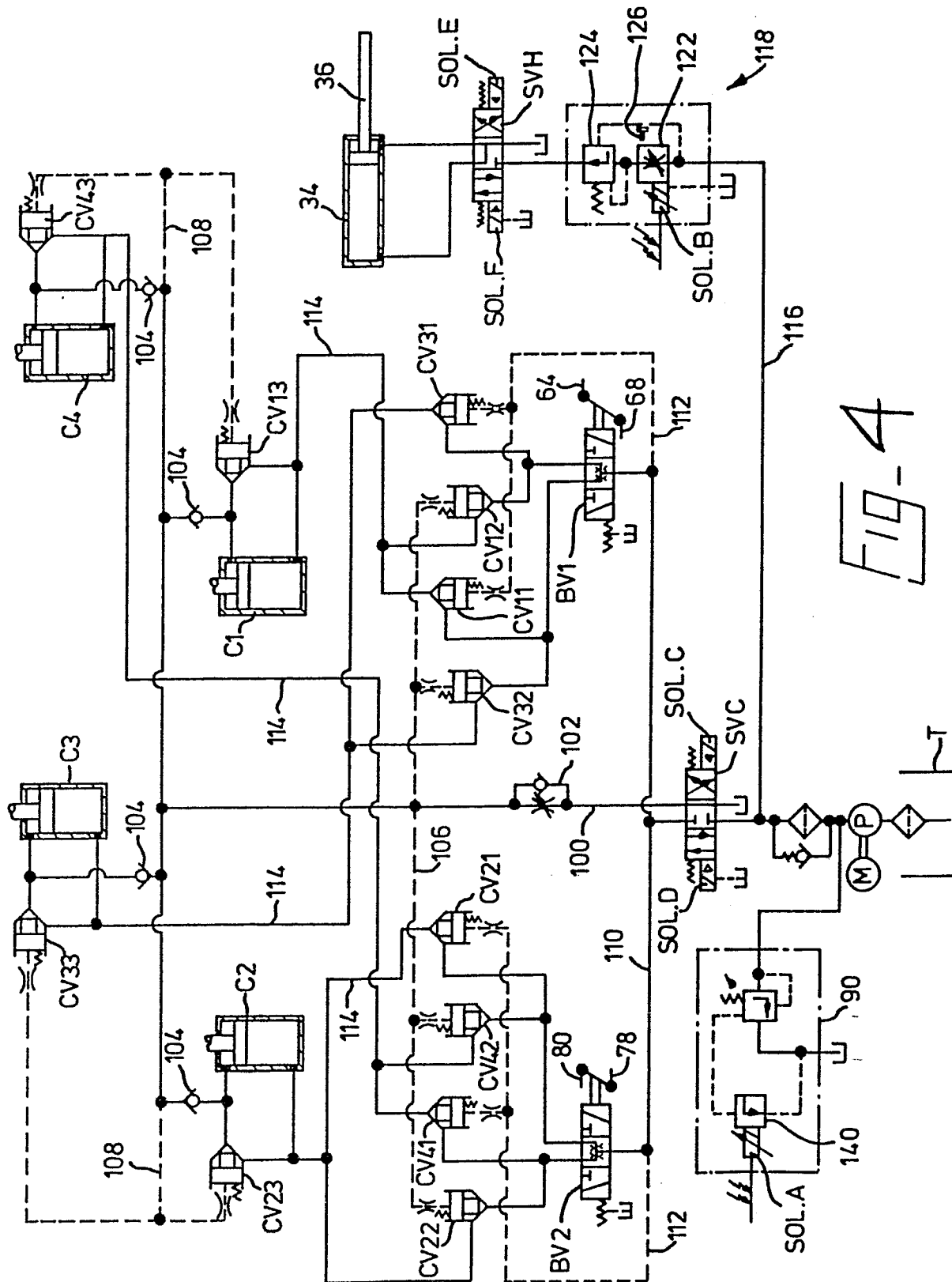
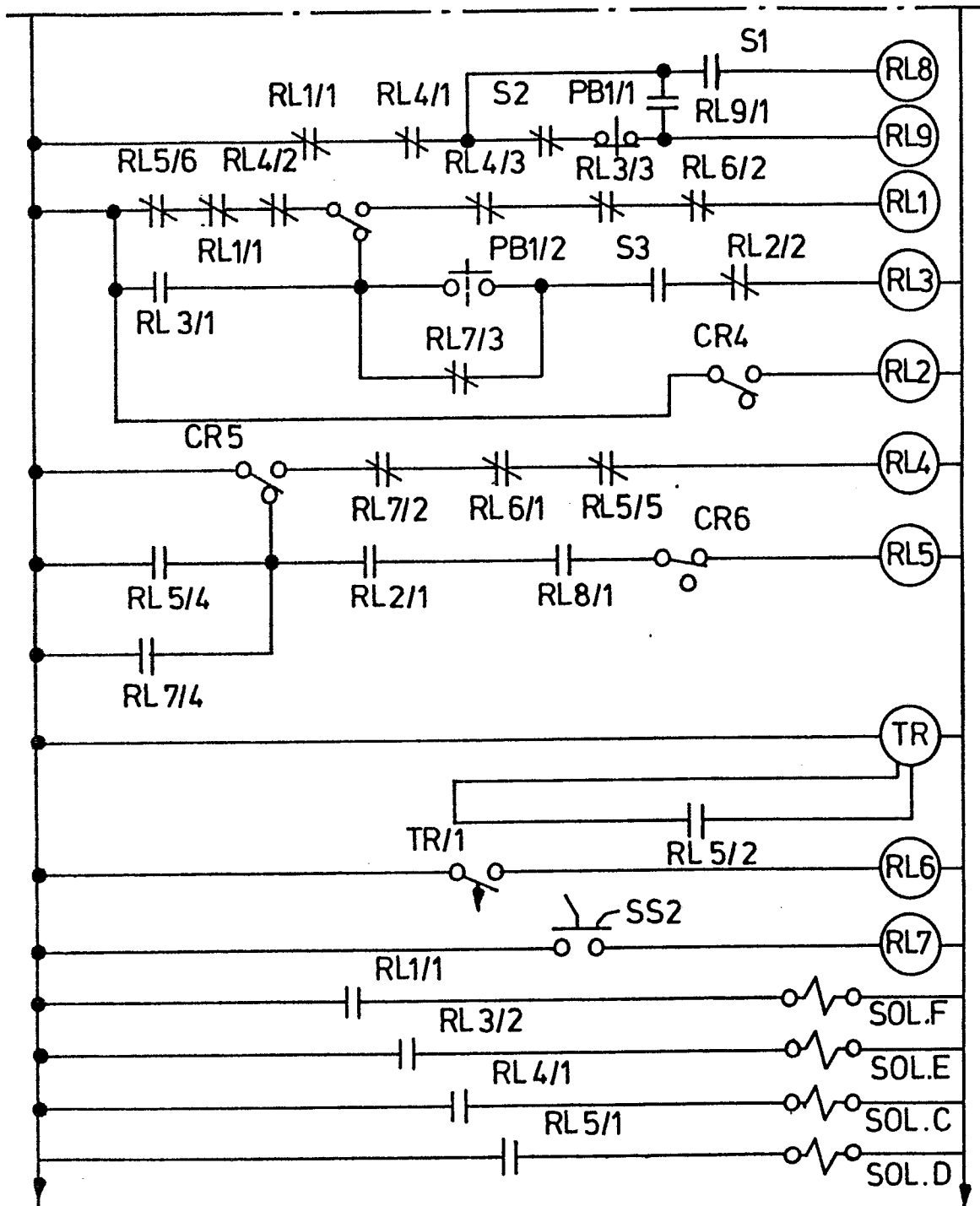


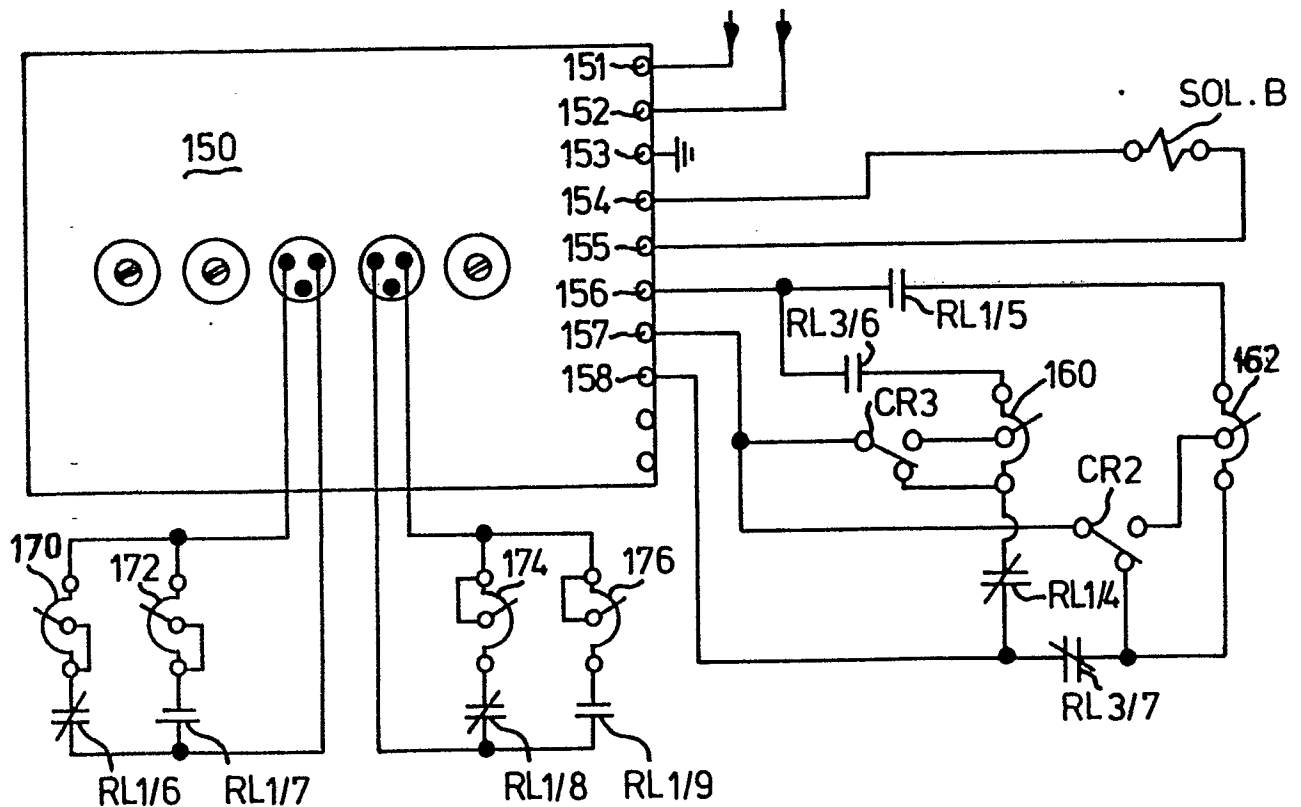
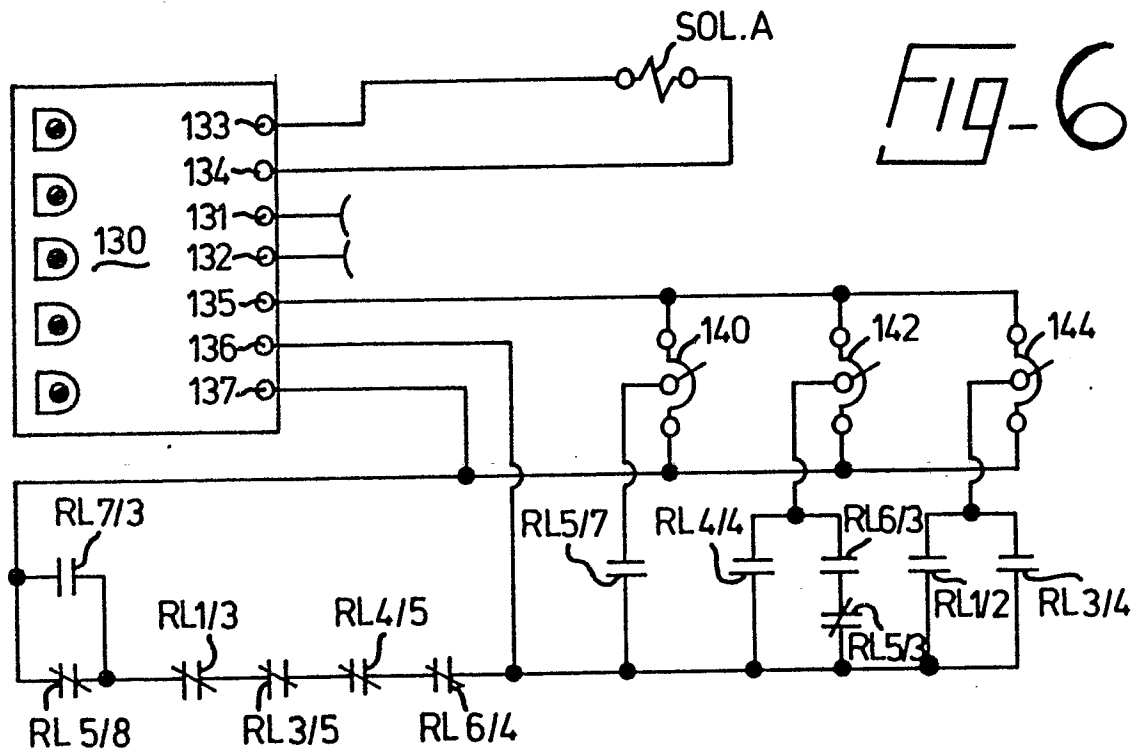
FIG. 4

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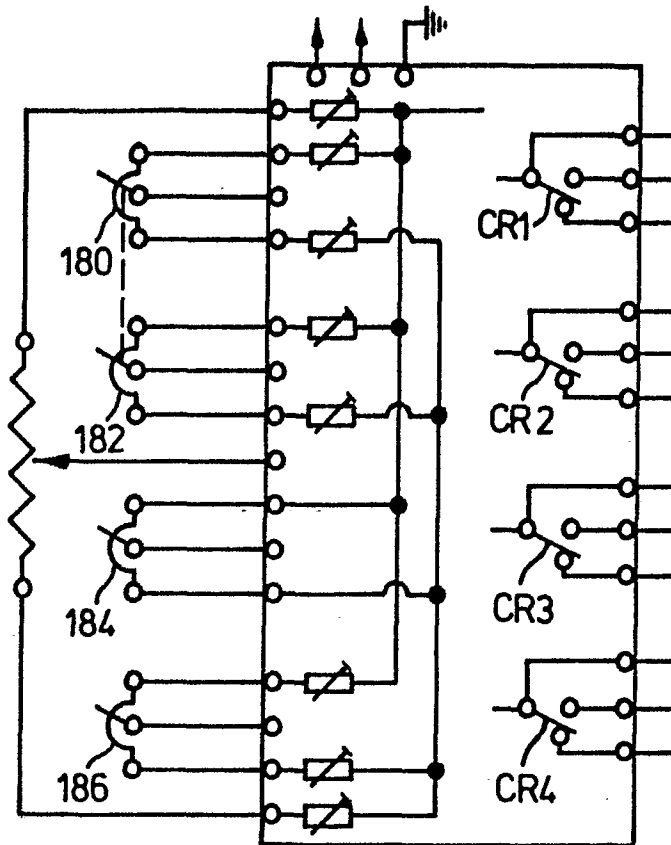


Fig-8

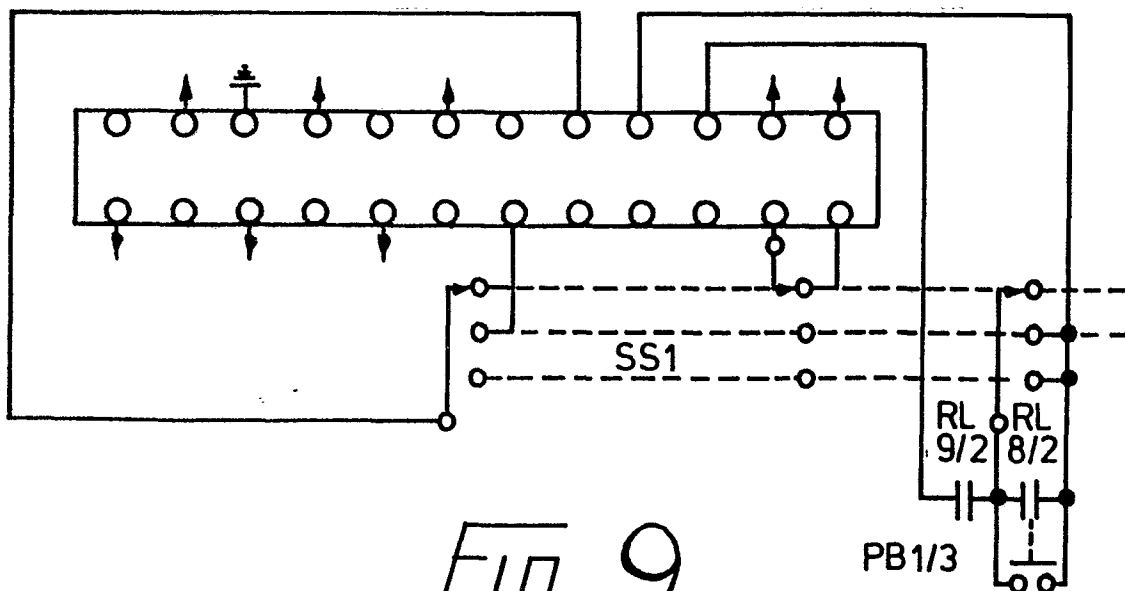


Fig-9



European Patent
Office

EUROPEAN SEARCH REPORT

0205302

Application number

DOCUMENTS CONSIDERED TO BE RELEVANT			EP 86304207.3
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl. 4)
A	<p>US - A - 3 152 499 (MOELBERT)</p> <p>* Column 3, lines 10-17 *</p> <p>--</p> <p>A GB - A - 467 599 (MACKLOW-SMITH)</p> <p>* Fig. *</p> <p>--</p> <p>A A. KOPECKY und R. SCHAMSCHULA "Mechanische Technologie", 3rd edition, 1961 Springer-Verlag, Vienna</p> <p>* Pages 166-167; fig. 96 *</p> <p>----</p>	1	<p>B 30 B 1/34</p> <p>B 26 F 1/40</p>
			<p>TECHNICAL FIELDS SEARCHED (Int. Cl. 4)</p>
			<p>B 21 D</p> <p>B 21 J</p> <p>B 23 D</p> <p>B 26 F</p> <p>B 30 B</p>
The present search report has been drawn up for all claims			
Place of search VIENNA		Date of completion of the search 15-09-1986	Examiner GLAUNACH
<p>CATEGORY OF CITED DOCUMENTS</p> <p>X : particularly relevant if taken alone</p> <p>Y : particularly relevant if combined with another document of the same category</p> <p>A : technological background</p> <p>O : non-written disclosure</p> <p>P : intermediate document</p> <p>T : theory or principle underlying the invention</p> <p>E : earlier patent document, but published on, or after the filing date</p> <p>D : document cited in the application</p> <p>L : document cited for other reasons</p> <p>& : member of the same patent family, corresponding document</p>			