Oct. 19, 1965 A. CLEMENTS 3,212,430

SLIDING BOLSTER PRESS

Filed Aug. 30, 1963 6 Sheets-Sheet 1

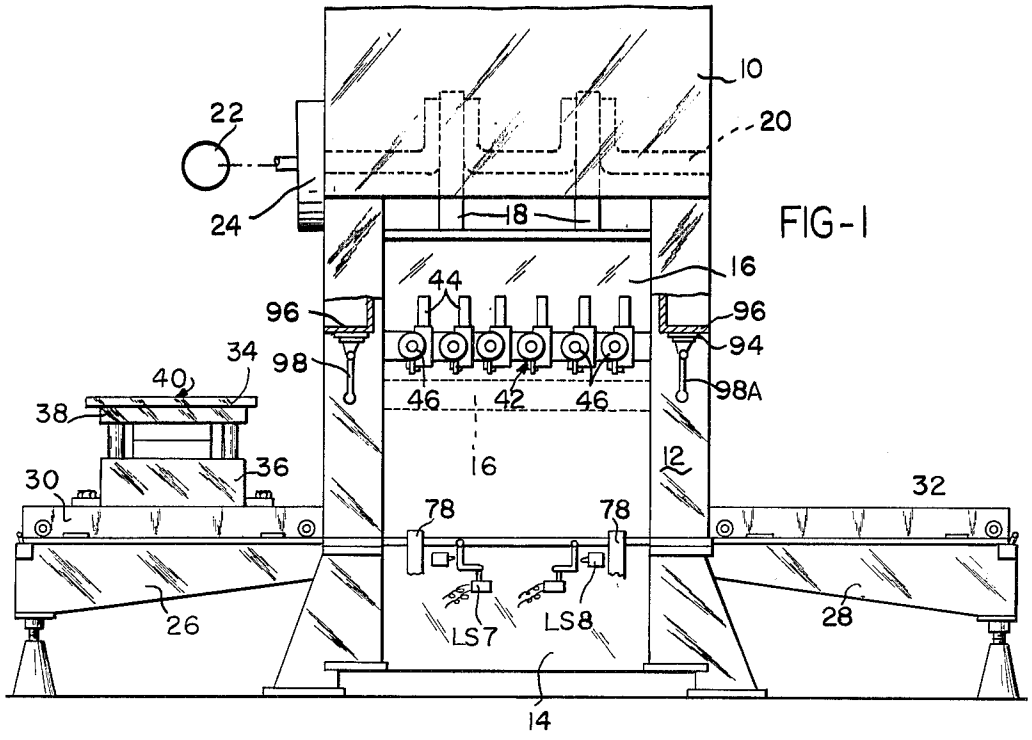

FIG-1

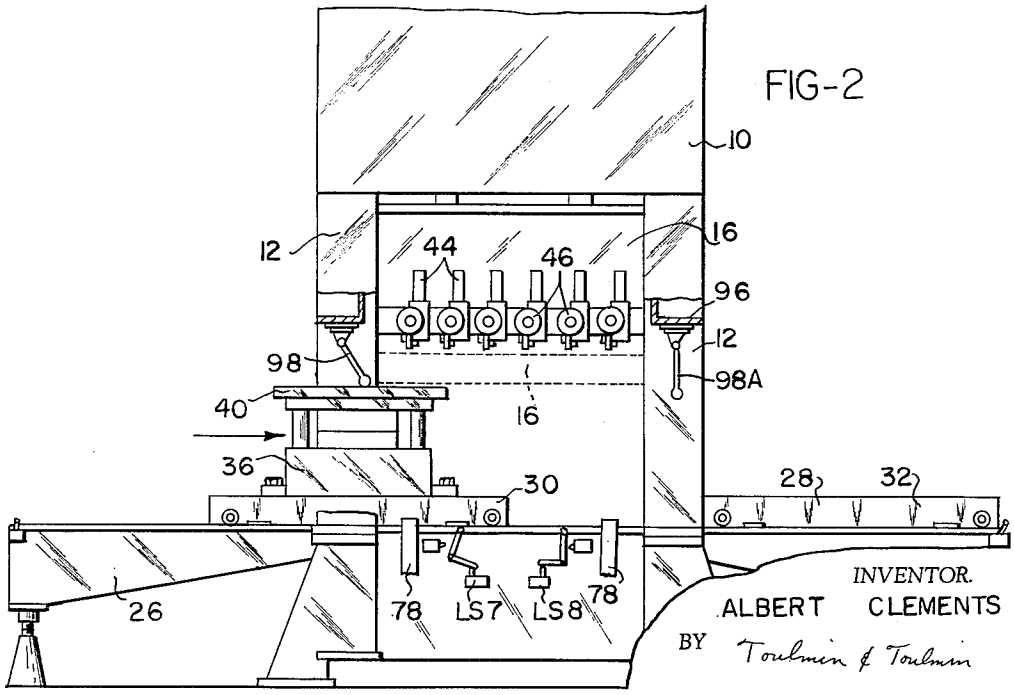

FIG-2

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SLIDING BOLSTER PRESS

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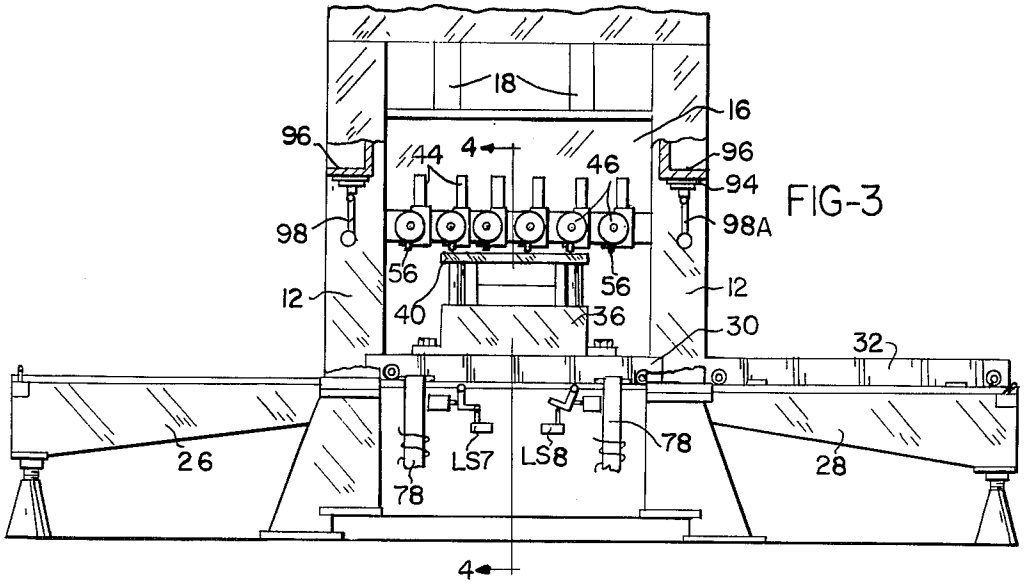

FIG-3

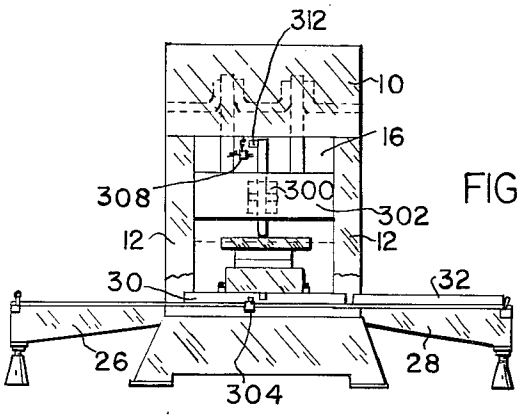

FIG-11

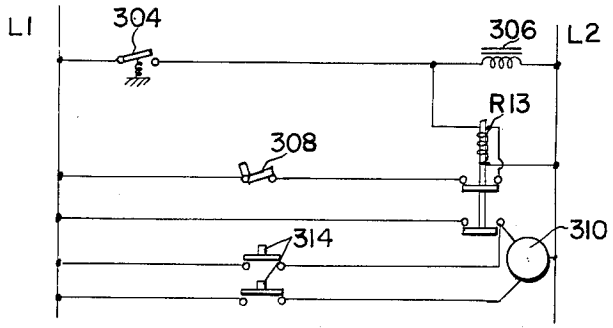

FIG-12

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Filed Aug. 30, 1963 6 Sheets-Sheet 3

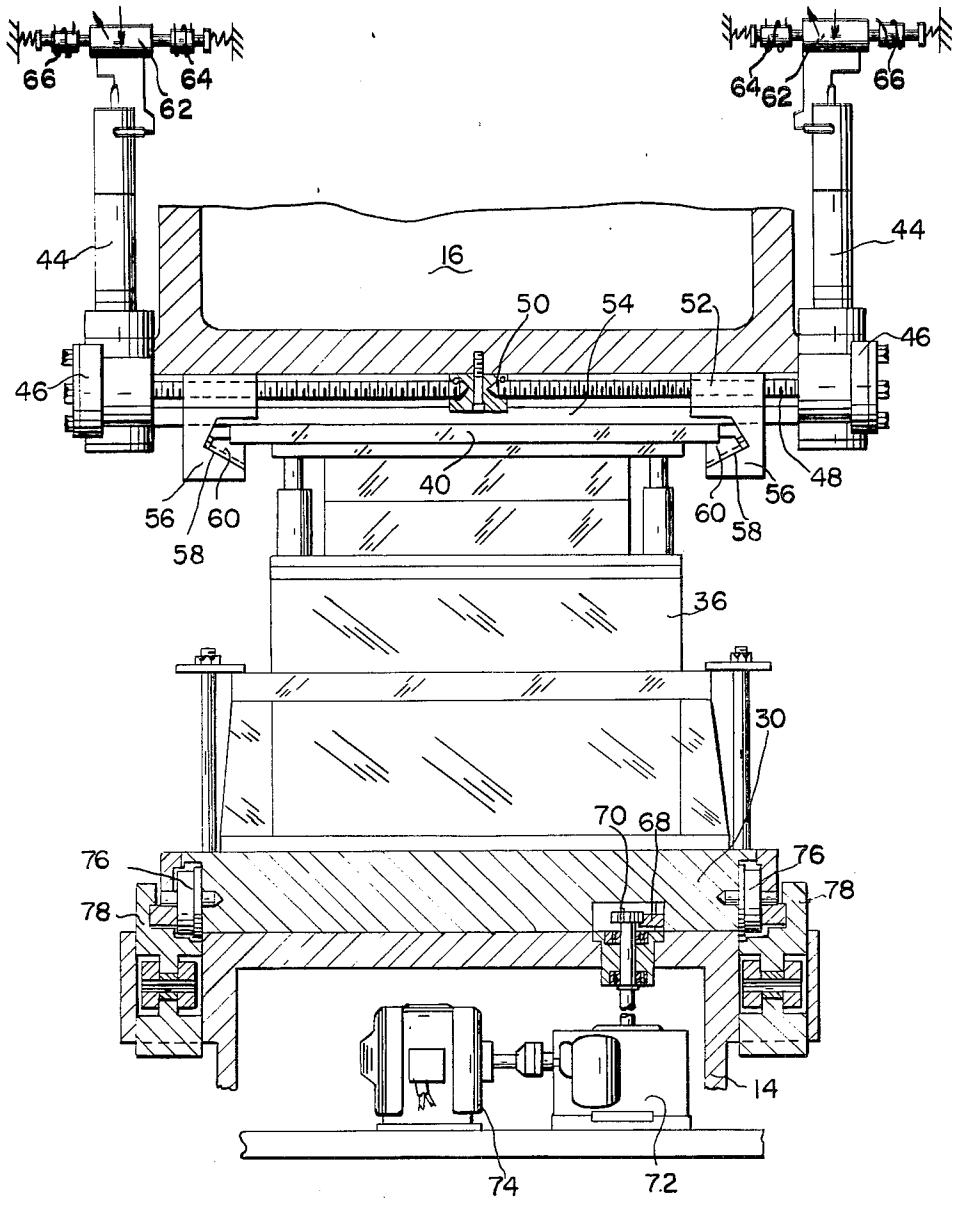

FIG-4

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Filed Aug. 30, 1963 6 Sheets-Sheet 4

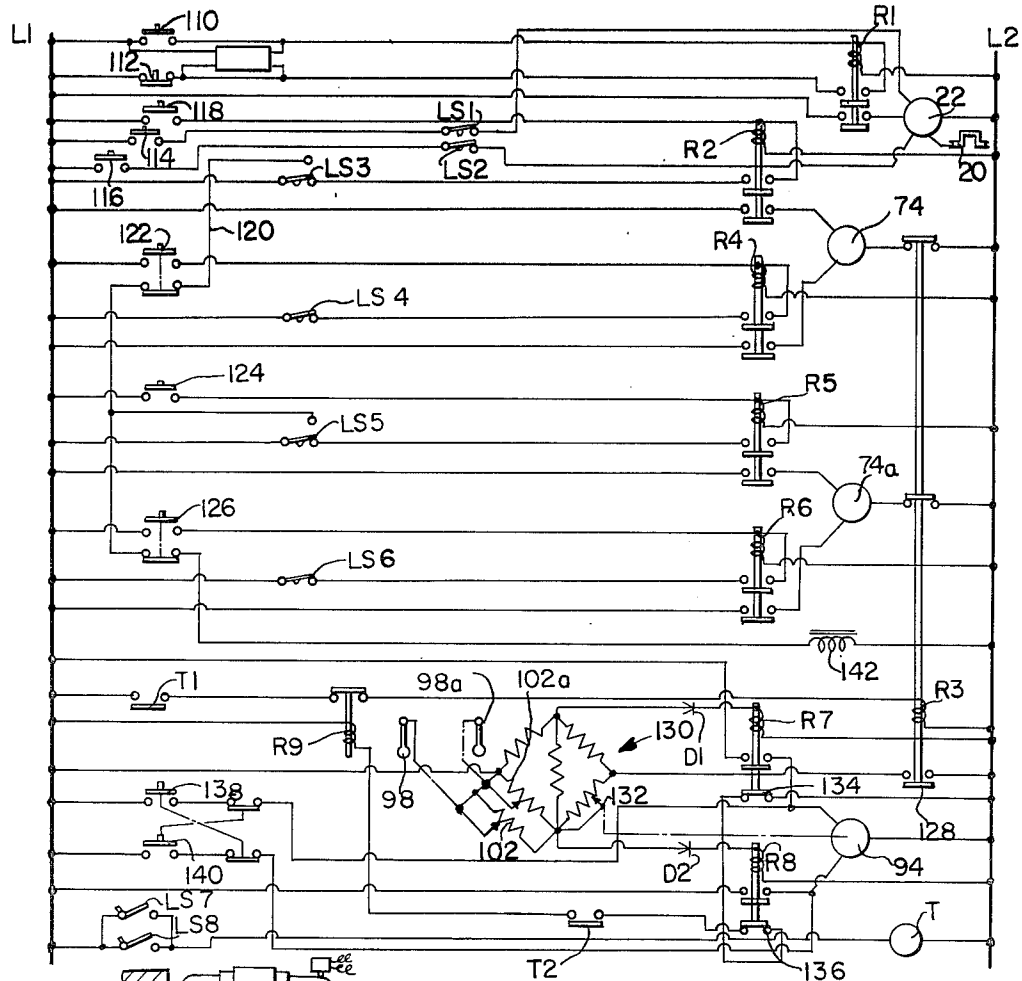

FIG-7

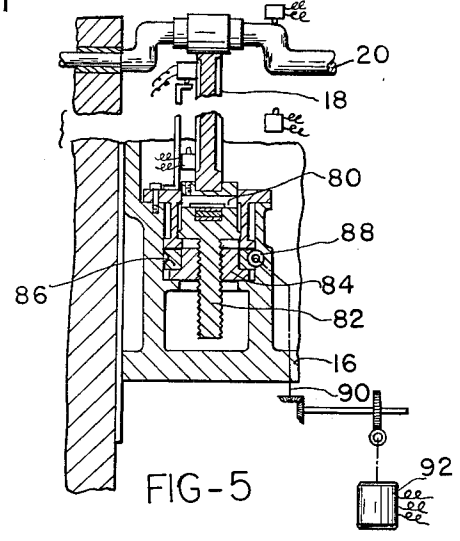

FIG-5

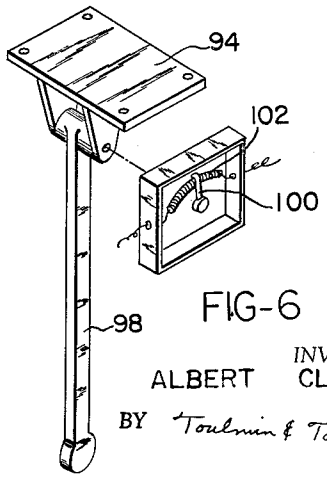

FIG-6

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Filed Aug. 30, 1963 6 Sheets-Sheet 5

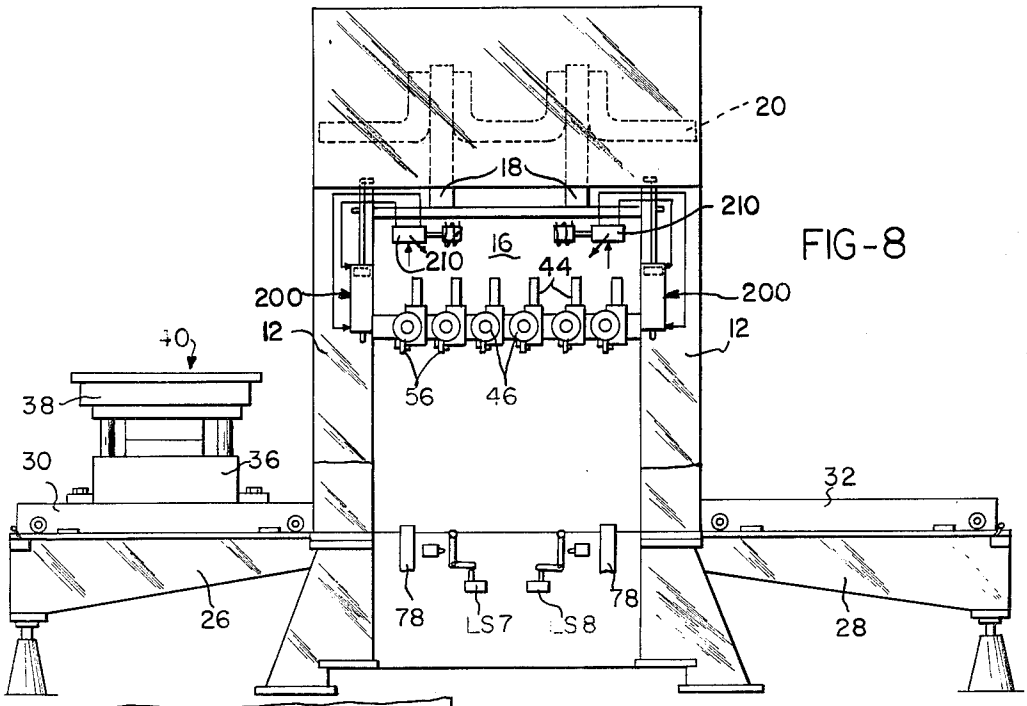

FIG-8

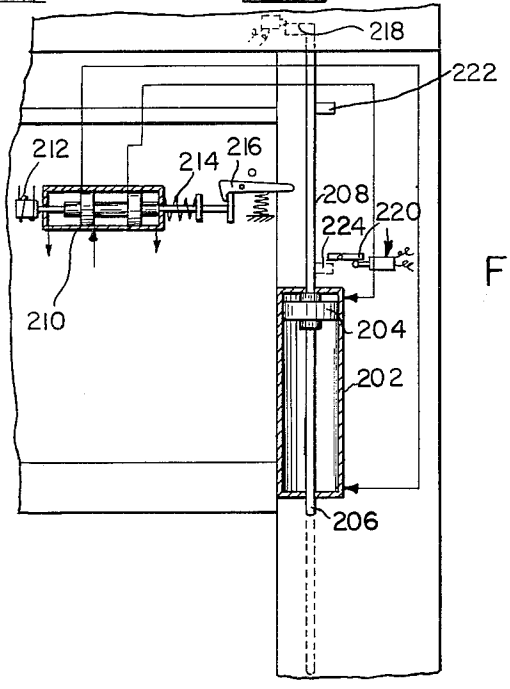

FIG-9

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FIG-10

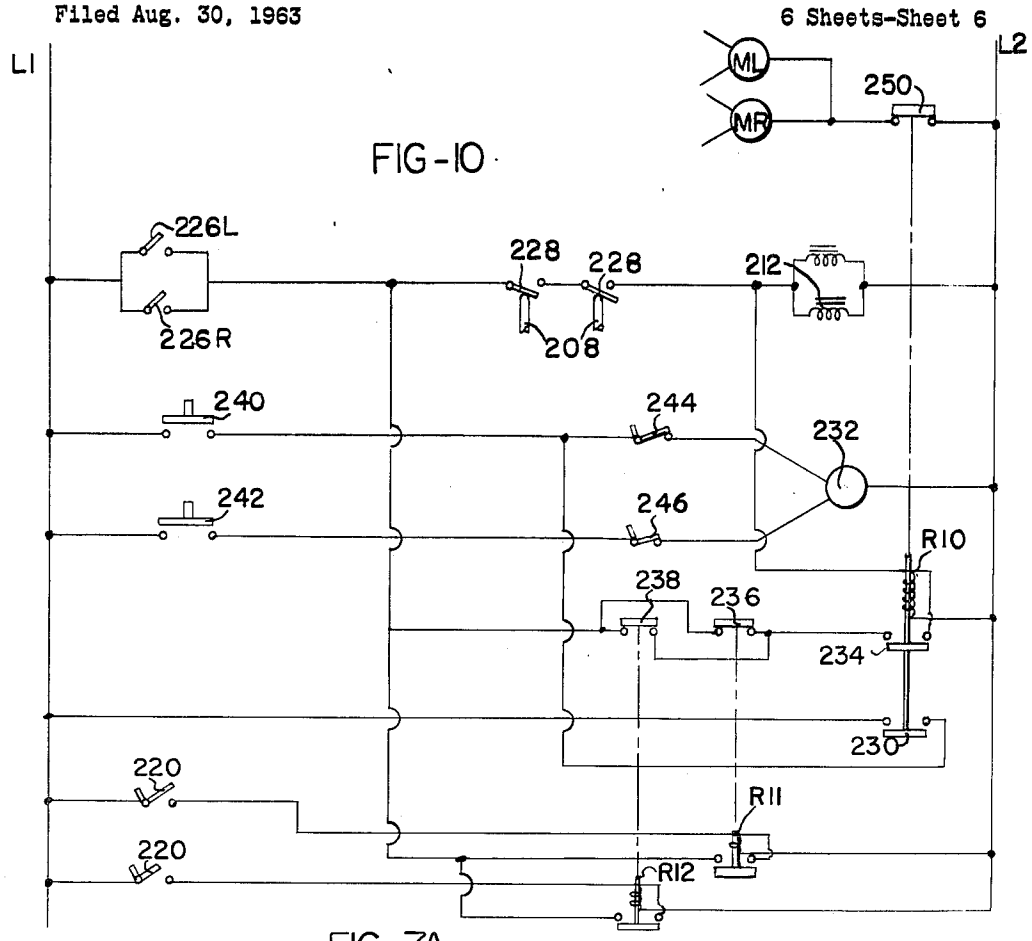
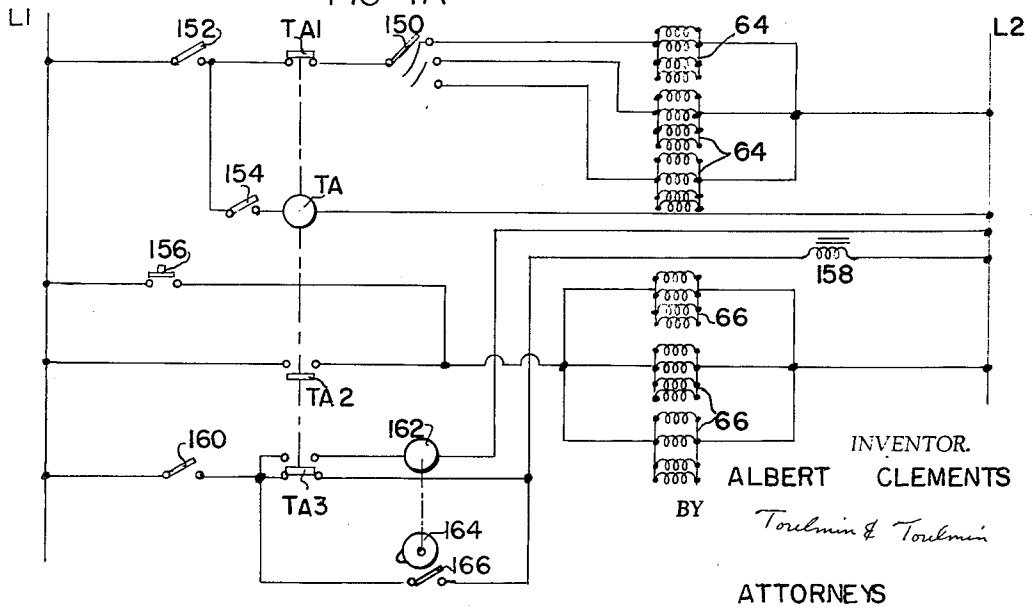


FIG-7A



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United States Patent Office 3,212,430 Patented Oct. 19, 1965

3,212,430

SLIDING BOLSTER PRESS

Albert Clements, Hamilton, Ohio, assignor to Minster Machine Company, Minster, Ohio, a corporation of Ohio

Filed Aug. 30, 1963, Ser. No. 305,625
7 Claims. (Cl. 100—35)

This invention relates to presses and in particular to mechanical presses and is related to my co-pending application, Serial No. 305,693, filed August 30, 1963.

In my companion application above referred to, there is shown a mechanical press having automatically operable clamping means for clamping the upper part of a die set to the press slide, thereby saving time and labor. The present application relates to an arrangement for automatically adjusting a press slide to the proper height for clamping to the upper part of a die set and may employ in the combination the die clamping means forming the principal subject matter of the co-pending application above referred to.

The particular type of press for which the invention is employed is a sliding bolster press in which die sets are placed on a bolster plate outside the press frame and are then moved into the press frame when the die set is to be put to work. This type of press structure enables die sets to be changed rapidly and cuts to a minimum the press down time for effecting die changes and also makes for more simple, efficient and less laborious press setups.

Ordinarily, the adjustment of the press slide to a predetermined height to receive a particular die set is done manually and this, of course, is time consuming and is not particularly accurate.

The present invention is particularly concerned with an arrangement where the height of a die set to be moved into the press is detected and the press slide is adjusted in conformity with the height of the die set so that the set can be moved into the press and thereafter immediately clamped in place. Any minor adjustments that may be necessary can then be made manually quite quickly and the press placed in operation without any further delay.

A primary object of the present invention is the provision of a safety arrangement for a press so that a die will not be moved into the press die space unless the closed height of the slide is no greater than the die height. If this were not the case a die could be moved into the press with the press slide stroke up with the slide improperly adjusted. Then, with the die in the press, if the press drive were actuated and the slide were brought to its bottom position, there would be interference between the slide and the die and possible press or die breakage.

Where a sliding bolster is not used and a die is placed in the press die space by other means, a probe located in the center of the slide will act as a safety preventing the press slide from being brought down unless there is clearance between the slide and the die with the slide in the down stroke position.

With the foregoing in mind, it will be evident that an object of this invention is the provision of an automatic slide adjusting mechanism for a press and particularly one useful in connection with sliding bolster presses.

A still further object of this invention is the provision of an arrangement for automatically detecting height of a die set to be moved into a press and for adjusting the press slide to the proper height for receiving the die set.

A still further object of this invention is the provision of a press including automatic means for adjusting the slide to the proper height for receiving various die sets and with the automatic mechanism for effecting the adjustment of the slide constituting a relatively simple and reliable structure that can easily be incorporated in a press structure.

These and other objects and advantages of this invention will become more apparent upon reference to the following specification taken in connection with the accompanying drawings, in which:

FIGURE 1 is a more or less diagrammatic front view of a press having two sliding bolsters with both of the bolsters of the press and one thereof having a die set clamped thereto.

FIGURE 2 is a view showing the bolster carrying the die set moved into detecting position in the press frame.

FIGURE 3 is a view showing the bolster moved completely into working position in the press frame and with the slide lowered in the press frame and the upper portion of the die set clamped thereto.

FIGURE 4 is a somewhat schematic view in the form of a vertical section indicated by line 4—4 in FIGURE 3 showing clamps carried by the slide and also showing a bolster actuating motor arrangement for moving the bolster into and out of the press frame.

FIGURE 5 is a sectional view showing the connection of the press crankshaft with the slide and illustrating the motor arrangement for adjusting the effective length of the connecting rod to adjust the position of the slide in the press frame relative to the crankshaft.

FIGURE 6 is a schematic perspective view showing a probe arrangement that detects the height of the die set being moved into the press and which controls the slide adjusting motor of FIGURE 5.

FIGURES 7 and 7*a* are schematic electric control circuits for controlling the operation of the press and the movement of the bolsters into and out of the press frame, and for controlling the slide adjusting motor and the operation of the motors pertaining to the clamp devices carried by the slide.

FIGURE 8 is a schematic view similar to FIGURE 1 but shows the press provided with pneumatically operated probes at each side for detecting the height of the die set to be moved into the press.

FIGURE 9 is a schematic view partly in section and drawn at enlarged scale showing the pneumatically operated probes and control elements associated therewith.

FIGURE 10 is a diagrammatic representation of an electric control circuit for use with the penumatic probe devices of FIGURES 8 and 9.

FIGURE 11 is a diagrammatic view showing the manner in which a pneumatic probe device could be mounted in the middle of the press slide for detecting the height of a die set directly therebeneath.

FIGURE 12 is a diagrammatic representation of an electric control circuit for use in connection with the probe of FIGURE 11.

Referring to the drawings somewhat more in detail, the press illustrated in FIGURES 1 through 4 comprises a press frame having a head **10**, uprights **12** and a base **14**. A slide is reciprocably guided along the uprights and is connected by connecting rods **18** connected with crankshaft **20** journalled in the press head. Crankshaft **20** is drivingly connected with a drive motor **22** as by way of a pneumatically operable clutch brake device **24**.

Extending laterally from the press bed **14** are platforms **26** and **28** which carry the left hand bolster plate **30** and right hand bolster plate **32** respectively.

These plates are individually moveable into the working space in the press frame for carrying die sets clamped thereto into working position. Such a die set is indicated at **34** mounted on the left hand bolster plate and this die set comprises a roller part **36** clamped to the bolster plate and an upper part **38** to be clamped to the slide **16** and which comprises a top plate **40** which is directly engaged

by clamping devices on the slide. The clamping devices in the slide are generally designated at **42** and are disclosed somewhat more in detail in FIGURE 4. Each clamping device, of which there are six on each side of the lateral center line of the slide, includes a pneumatically operable actuating motor **44**.

As will be seen in FIGURE 4, each motor **44** is connected through gearing **46** with a screw **48** extending across the slide to the region of the center thereof and with the inner end of the screw journalled in a support block **50** fixed to the slide.

Each screw **48** has a clamp block **52** threaded thereto having a foot part slidable in a pertaining T-slot **54**.

Each block **52** comprises a dependent part **56** having an inclined surface **58** on which a clamp element **60** is slidable. The clamp elements **60** are the elements which directly engage top plate **40** of the upper part of the die set and these elements are pushed up their respective inclines to clamp top plate **40** tightly against the bottom of the press slide.

The arrangement is substantially self-locking on account of the threaded engagement of a screw **48** with block **52** and because of the worm gearing between each motor **44** and its screw **48**, so that once the plate **40** is clamped to the slide it will remain in place.

Each motor **44** is controlled by way of a reversing valve **62** having associated therewith solenoids **64** and **66**. Energization of solenoid **64** will cause motor **44** to run in a direction to advance its clamping block toward the center of the press, whereas energization of solenoid **66** will reverse the motor to retract the pertaining clamping block from the center of the press. With both solenoids de-energized, the supply of air to motor **44** is interrupted and the clamping block pertaining thereto will remain in its adjusted position.

FIGURE 4 will also show that each bolster plate, bolster plate **30** being illustrated, has an actuating rack **68** engaged by a pinion **70** on the slow speed output shaft of a reducer **72** driven by a motor **74**, preferably a reversible motor. By operation of motor **74** the pertaining bolster can be driven into and out of working position in the press frame.

The bolsters are preferably supported on rollers **76** so that they are freely moveable, but when in working position in the press frame, the bolsters are set down on the press bed **14** so as to have a firm foundation and at that time, the bolster is clamped in place by clamp **78** which may be pneumatically operated and controlled by way of a solenoid valve.

The aforementioned connecting rods **18** are adjustable in effective length as diagrammatically illustrated in FIGURE 5 which shows one of the connecting rods and its connection to slide **16** and to crankshaft **20**.

Each connecting rod has its upper end engaging a throw of crankshaft **20** and its lower end connected by a pin **80** with the upper end of a screw **82**. Screw **82** threadedly engages a nut **84** rotatable in the press slide **16** but non axially moveable therein. Rotation of nut **84** is accomplished by a worm wheel **86** fixed thereto which is engaged by a worm **88** mounted on a shaft **90** which drivingly engaged with a drive motor **92**. Motor **92** is reversible and it will be evident that by energizing motor **92**, screw **82** can be moved up or down in the slide and thus adjust the position of slide **16** with respect to crankshaft **20** and thereby change the effective length of connecting rod **18**. This adjustment will not change the total stroke of slide **16**, which is determined by the eccentricity of the throw on the crankshaft, but it will shift the operating range in the slide in the press frame to conform it to the operating range required to run a particular die set in the press.

The adjustment of the slide motor **92** for each connecting rod is under the control of a detector system which includes a detector probe such as is diagrammatically illustrated in FIGURE 6. This probe comprises a base member **94** for connection with the press frame as indicated at **96** in FIGURE 1, and which base member pivotally carries the probe arm **98**. This probe arm is connected to finger **100** which sweeps across a resistor **102** which is connected into a resistance bridge in the detector and control circuit as will be explained hereinafter.

An electric control circuit for operating the press is diagrammatically illustrated in FIGURE 7. In this figure the press drive motor **22** is arranged for being energized to run in a forward direction upon energization of a relay **R1** which is energized by closing a switch **110**, and which can be de-energized by operating a normally closed switch **112**.

Motor **22** is also adapted for being manually operated in the forward direction by a switch **114** and a limit switch **LS1** is operable for halting the motor with the press slide at either its uppermost or lowermost position. The motor can be operated in the reverse direction by another manual switch **116** in circuit with a limit switch **LS2**, and this will stop the motor with the press slide in its other extreme position.

The left hand bolster motor **74** is adapted for being operated in a forward direction by energization of a relay **R2** which is under the control of a switch **118**. The holding circuit for relay **R2** includes a double throw limit switch **LS3** which is normally closed in the holding circuit, but which, at the time that the left hand bolster reaches its full in position, moves to a second position to connect power line **L1** with wire **120**. The circuit through motor **74** is completed through a blade of a relay **R3** which can be opened to stop the motor and re-closed to again start the motor, as will be developed hereinafter.

Motor **74** is adapted for being energized to run in a direction to move left hand bolster **30** out of the press frame by energization of a relay **R4**, which is under the control of a manual switch **122** and which relay has in its holding circuit a normally closed limit switch **LS4** that is opened by the left hand bolster in its full out position.

Right hand bolster motor **74*a*** is under the control of identical circuitry consisting of a forward relay **R5** that can be energized by closing a push button **124**. This relay has in its holding circuit double throw limit switch **LS5** which is operated by the right hand bolster in its full in position so as to connect power line **L1** with wire **120** the same as described for limit switch **LS3**. Motor **74*a*** has in its energizing circuit another normally closed blade of relay **R3**.

Motor **74*a*** is controlled in a direction to move the right hand bolster out of the press by relay **R6** which can be energized by push button **126**. The holding circuit of relay **R6** has a normally closed limit switch **LS6** therein that is opened by the bolster when in its full out position. In the operation of the press, after a die is mounted on a bolster plate, the pertaining bolster plate is moved toward working position in the press. Before the bolster reaches this position however, it comes to a halt in an intermediate position as indicated in FIGURE 2. This comes about, with respect to bolster **30**, by the actuation thereof of a limit switch **LS7**. In the case of right hand bolster **32**, a corresponding limit switch **LS8** is operated by the bolster in its intermediate position.

These switches are connected in parallel, as will be seen in FIGURE 7, and closing of either one thereof will energize a timer **T**. Energization of timer **T** will close its blade **T1** which is in circuit with the coil of relay **R3**, and this relay therefore is energized. Energization of this relay will open the blades thereof that are in circuit with the bolster motors and the motor pertaining to the bolster which is moving into the press will thus be de-energized and the bolster will come to a halt, as indicated by bolster **30** in FIGURE 2.

Energization of relay **R3** closes its blade **128**, and this completes a circuit to the resistance bridge generally in-

dicated at **130**, which contains in one leg thereof the resistances **102** and **102***a* pertaining to the left hand probe arm **98** and the right hand probe arm **98***a*, respectively. An unbalance in the bridge circuit as determined by the deflection of the probe arm engaged by a die set being moved into the press is effective to energize one or the other of relays R7 or R8, as determined by the direction of said unbalance. The selective energization of relays R7 and R8 can be controlled by the diodes D1 and D2 in circuit therewith.

These relays are in circuit with the reversible slide adjusting motor **94** which is drivingly connected with the nuts **84** associated with the slide adjusting screws **82**. The motor **94** is connected to an adjustable contact **132** in another leg of bridge **130** to feed back positional information so that the motor will come to a halt when it has been adjusted in conformity with the deflected position of the probe arm engaging the die being moved into the press.

Each of relays R7 and R8 have a normally closed blade thereof, **134** for relay R7 and **136** for relay R8, which are connected in series with each other, and through a timer blade T2 with the coil of a relay R9 having a normally closed blade in series with the coil of relay R3. It will be apparent that upon the bridge **130** reaching a condition of balance, both of relays R7 and R8 will drop out and this will energize relay R9 thereby de-energizing relay R3 whereupon relay R3 will drop out and the bolster motor pertaining to the bolster in intermediate position will again be energized and the said bolster will continue into the press into working position therein, and will come to a halt when the pertaining limit switch LS3 or LS5 is opened.

The timer T at this time is also de-energized because both of limit switches LS7 and LS8 will be open. Opening of relay R3 also opens its blade **128**, and thus de-energizes the bridge circuit.

In order to prevent premature energization of relay R9, timer blade T2 is arranged to close a predetermined time after the close of timer blade T1, thereby to allow the detector system to commence operation.

Adjustment of the slide is possible by manually controlling the energization of motor **94** by way of push buttons **138** and **140**.

Upon the bolster moving into the press reaching its full in position, its pertaining limit switch LS3 or LS5 connects power line L1 with wire **120** which leads to a solenoid **142** associated with the clamping device **78** that clamps the bolster to the press bed. This clamp remains energized until one or the other of the bolster out switches **122** and **126** are operated to move the pertaining bolster out of working position.

With the bolster in working position and the press slide adjusted in conformity with the height of the die set on the bolster, the die set can now be clamped to the bolster. This is accomplished by lowering the press slide by turning the crankshaft to its bottom dead center position, and by then running the clamp members inwardly into engagement with the top plate **40** of the upper part of the die set.

These clamp blocks are driven inwardly by energizing the in solenoids **64** pertaining to the motors **44**. The solenoids are arranged in groups of four with each group containing two solenoids on each side of the press so that the clamp blocks can be driven inwardly in groups and thus only the number of clamp blocks necessary to engage the top plate are actuated.

This energization of the in solenoids is under the control of a selector switch **150** which can be adjusted so that one, two or all three of the groups of solenoids can be selectively energized. Energization of these solenoids is under the further control of manual switch **152** in series with selector switch **150**, and also in series with a timer blade TA1.

The timer T8 itself is under the control of a manual switch **154** which can be closed to energize the timer and opened to de-energize the timer.

The out solenoids **66** are arranged in corresponding groups of four and are under the control of a push button **156** so that the clamps can be opened when desired. A second blade of timer TA, namely, TA2, is in parallel with switch **156**.

Means are provided for a supply of air under pressure to motors **44** only when necessary in the form of a main supply valve having an actuating solenoid **158** that is energized by closing of a switch **160**. The circuit to valve solenoid **158** includes a normally closed blade TA3 of timer TA.

The timer TA is provided so that after a die set is clamped to the press slide the motor can be periodically energized to make certain that the clamp blocks remain in their clamping position. This is accomplished, following the closing of the clamps, which is carried out by closing switch **152**, by closing switch **154**, which will energize timed TA. With timer TA energized it first opens blade TA1 and closes blade TA2. This will reverse motors **44**, and immediately thereafter blade TA1 will again close and blade TA2 will open, and motors **44** will again drive the clamp blocks in against the die set top plate.

Thereafter, blades TA1 and TA2 remain in closed and open position respectively, but thereafter timer blade TA3 will open from its lower contacts and close on its upper contacts, thereby energizing a motor **162**. This comes about because switch **160** has been closed. Motor **162** drives a cam **164** that periodically closes switch **166** in circuit with valve solenoid **158**. Periodic energization of valve solenoid **158** in this manner will periodically supply air under pressure to motors **44**, and this will make certain that the clamp blocks remain in clamping position at all times.

FIGURES 8 through 10 show an air probe arrangement for checking die height and an electric control system operated by the air probes for adjusting the slide position.

In FIGURE 8 the same press structure is illustrated that was previously illustrated, and the same reference numerals, where applicable, are applied thereto. In the arrangement of FIGURE 8 however, there are air probe arrangements generally indicated at **200** mounted on opposite sides of the slide and these are employed for detecting the die height. This is done by adjusting the slide to its lowermost position with the crankshaft at its top dead center position, and then moving the bolster with the die to be placed in the press toward the center of the press to its intermediate position, as was done in connection with the first modification. The slide will then adjust upwardly until the probe arrangement indicates that it is in the proper position.

The manner of operating the probe is better seen in FIGURE 9 wherein it will be observed that each probe comprises a cylinder **202** with a piston **204** therein having a rod portion **206** extending out the bottom of the cylinder and a rod portion **208** extending out the top of the cylinder. A reversing valve **210** is connected to the cylinder, and when the valve is moved rightwardly by energization of its solenoid **212**, piston **204** will move downwardly, whereas when the valve is moved leftwardly by spring **214**, the piston will move upwardly in the cylinder.

Upon energization of solenoid **212**, which is a momentary energization, a latch **216** engages the valve member and holds it in its shifted position. This latch **216** is arranged for being released by a dog **218** on rod **208** when piston **204** reaches its lowermost position.

Also associated with each probe arrangement is a limit switch **220** adapted for actuation by another dog **222** on rod **208** through the intervention of a lever **224**. The lever is provided so that dog **222** will pass idly by lever **224** in the downward direction, but will operate through

the lever to actuate limit switch LS **220** when lever **224** is moved upwardly in cylinder **202** following unlatching of the valve member.

The described arrangement is employed in the control circuit shown in FIGURE 10. In this figure, the motor pertaining to the left hand bolster is indicated at ML and the one pertaining to the right hand bolster is indicated at MR. The energization of these motors is controlled as before explained in connection with the first modification.

The switches operated by the bolster in their intermediate position are indicated at **226L** for the left hand bolster and **226R** for the right hand bolster. These switches are connected in parallel so that the closing of either one as the pertaining bolster is moving inwardly and reaches its midpoint position will supply energy to the valve solenoids **212** for shifting the valves **210**. The circuit to the valves is completed through the limit switches **228**, one pertaining to each probe, and which limit switches are held closed by rods **208** in their upper position.

Closing of either of switches **226L** or **226R** will also energize relay **R10** which has a blade **230** connected with slide adjusting motor **232** to run the slide adjusting motor in a direction to move the slide upwardly.

Relay **R10** has a holding circuit passing through its blade **234** and through the parallel arranged relay blades **236** and **238** and to the slide of limit switches **226L** and **226R** opposite line **L1**.

The slide adjusting motor **232** can be manually controlled by the up switch **240** and the down switch **242** and they are provided with the up limit switch **244** and the down limit switch **246**, at the limits of travel of the slide.

Each of the limit switches **220**, which are operated when the pertaining prove reverses in the bottom of its stroke and starts upwardly, controls one of relays **R11** and **R12** and each thereof controls one of the normally closed blades **236** and **238**. Each said relay furthermore, has a holding circuit connected to the side of limit switches **226L** and **226R** opposite line **L1**.

In operating the pneumatic probe system, the slide is first adjusted downwardly by using switch **242** and thereafter the bolster when the die to be put in the press is moved anwardly to its intermediate position. When the bolster reaches its intermediate position, one of the switches **226L** and **226R** closes, and this will energize valve solenoid **212** and relay **R10**. Both probes move downwardly while simultaneously the slide motor is energized to adjust the slide upwardly. One probe will move to its lowermost position and reverse by unlatching its valve member, and will energize its pertaining relay **R12**, **R11**, as the piston of the probe moves upwardly. The relay **R10** however, will continue to be energized and the slide will continue to adjust upwardly until the probe rod engaging the die set reaches its lowermost position, whereupon it will reverse and the other of relays **R11**, **R12** will be energized, thus de-energizing relay **R10**. De-energization of relay **R10** will close its blade **250** in circuit with the bolster motor and the bolster in intermediate position will resume its travel into the press and further operation of the press will be as described in conjunction with the first modification.

In the arrangement of FIGURES 11 and 12, a single pneumatic probe **300** is mounted in about the center of the slide **302**. In this case, the slide is adjusted to its lowermost position and after the bolster is completely in the press, the probe is operated and the slide adjusts upwardly to a predetermined point. The crankshaft is again at top dead center.

The circuit for this arrangement is shown in FIGURE 12 wherein there is a limit switch **304** operated by the bolster as it approaches its full in position. This switch is normally open and effects energization of the valve solenoid **306** corresponding to valve **212** of the previous modification. Relay **R13** is also closed and holds through normally closed limit switch **308**. Closing of relay **R13** energizes slide adjusting motor **310** to adjust the slide upwardly, and this continues until dog **312** on the rod of the probe opens limit switch **308** thereby releasing its control valve, whereupon the probe will retract upwardly and the slide adjustment is complete.

As before, the slide can be controlled in its up and down directions manually by switches **314**. The operating of the press from this point on is the same as described with the other modifications.

From the foregoing it will be apparent that the present invention provides a relatively simple and reliable arrangement for automatically adjusting a press slide to the proper height for receiving a die set, thereby eliminating manual adjustment of the slide and greatly increasing the productivity of the press by reducing its down time for changing of die sets to a minimum.

It will be understood that this invention is susceptible to modification in order to adapt it to different usages and conditions; and accordingly, it is desired to comprehend such modifications within this invention as may fall within the scope of the appended claims.

I claim:

1. An automatic slide adjusting mechanism for a press comprising; a press frame, a slide reciprocably mounted in said frame, slide actuating means, an adjustable connecting rod means connecting said slide with said actuating means, means for varying the length of said connecting rod means, pneumatic detector means for detecting the height of a die set in said frame, and actuating means responsive to the said pneumatic detector means for adjusting the length of the connecting rod means while said slide actuating means are in the uppermost position so the slide in the downstroke position will be in conformity with the height of said die set.

2. In a sliding bolster press comprising; a press frame, a bed, a head, uprights, a slide guided on said uprights, slide actuating means in the head, an adjustable connecting rod means connecting said slide and said slide actuating means, a bolster and means supporting the bolster for movement into and out of the press to and from a working position on the bed; the improvement consisting of an automatic slide adjusting mechanism comprising; means operable during the movement of the bolster into the press for interrupting the movement of the bolster, pneumatic detector means movable to engage a die set on said bolster and operable during the interruption of said bolster for detecting the height of a die set on said bolster when said slide actuating means is in its topmost position, actuating means responsive to the said detector means for adjusting the length of the connecting rod so the slide in the downstroke position will be in conformity with the height of said die set, and means operable to move said bolster into working position upon completion of the slide adjustment.

3. In a sliding bolster press comprising; a press frame, a bed, a head, uprights, a slide guided on said uprights, slide actuating means in the head, an adjustable connecting rod means connecting said slide and said slide actuating means, a bolster and means supporting the bolster for movement into and out of the press to and from a working position on the bed; the improvement consisting of an automatic slide adjusting mechanism comprising; means operable during the movement of the bolster into the press for interrupting the movement of the bolster, pneumatic detector means operable during the interruption of the movement of said bolster for detecting the height of a die set on said bolster, said detector means comprising; a pneumatic probe positioned on each side of the slide over the path of the bolster travel, air supply means for said probes to drive said probes when operable, each said pneumatic probe comprising a cylinder and a piston having a rod portion including a part extending below the cylinder for engagement with a die set, a reversible

motor connected to the said connecting rod means to adjust the length thereof, an energizing circuit for said motor, and control means responsive to movements of the said rod portions as the rod portions move downwardly to contact said die set with one of said rod portions remaining in contact with said die set until the slide is raised to a position in conformity with the height of said die set, said control means energizing the circuit to said reversible motor for adjusting the length of the connecting rod means so the slide in its downstroke position will be in conformity with the height of the die set, said connecting rod means including a connecting rod having the upper end rotatably mounted on said slide actuating means, screw means pivotally joined to the lower end of said connecting rod, a nut rotatably mounted in the said slide and engaging said screw means, a worm wheel fixedly attached to said nut, said nut being restrained in an axial direction in said slide, and gear driving means connecting said worm wheel with said reversible motor.

4. An automatic slide adjusting mechanism for a press comprising; a press frame, a slide reciprocably mounted in said frame, slide actuating crankshaft means in the frame, adjustable connecting rod means connecting said slide with said actuating crankshaft means, means for varying the length of said connecting rod means, detector means carried by the slide for detecting the height of a die set in said frame, said detector means comprising an air cylinder and a piston therein having a rod portion including a part extending below the cylinder so as to be movable into contact with said die set in the press, a reversible motor connected to the connecting rod means to adjust the length thereof, control means operable to energize said reversible motor to shorten said connecting rod means so as to raise said slide upwardly while keeping said rod portion in contact with said die set until said slide is raised sufficiently so the slide in its downstroke position will be in conformity with the height of the die set and thereafter to retract said rod portion.

5. The method of automatically adjusting the position of a reciprocating slide in a sliding bolster press relative to the slide actuating means of the press to which the slide is connected to bring the range of reciprocation of the slide into conformity with the height of a die set on the press bolster comprising the steps of: placing a die set on the bolster and anchoring the portion of the die set adjacent the bolster to the bolster, adjusting said slide actuating means to maximize the distance between the slide and the surface of the bolster, advancing the bolster towards working position, momentarily stopping the bolster before it reaches working position, detecting the distance between the surface of the said die set which is remote from the bolster and a fixed point on the press, adjusting the slide relative to the slide actuating means in conformity with the detected information, advancing and locking the bolster in working position, and anchoring the other portion of the die set which is adjacent the slide to the slide.

6. The method of automatically adjusting the position of a reciprocating slide in a sliding bolster press relative to the slide actuating means of the press to which the slide is connected to bring the range of reciprocation of the slide into conformity with the height of a die set on the press bolster comprising the steps of: placing a die set on the bolster and anchoring the portion of the die set adjacent the bolster to the bolster, adjusting said slide actuating means to maximize the distance between the slide and the surface of the bolster, lowering the slide relative to the slide actuating means to a position which is closer to the bolster than that finally needed for the die set on the bolster, advancing the bolster towards working position, momentarily stopping the bolster before it reaches working position, detecting the distance between the surface of the said die set which is remote from the bolster and the slide, adjusting the slide relative to the slide actuating means in a direction away from the bolster and in conformity with the detected information, advancing the bolster to working position, and anchoring the other portion of the die set which is adjacent the slide to the slide.

7. The method of automatically adjusting the position of a reciprocating slide in a sliding bolster press relative to the slide actuating means of the press to which the slide is connected to bring the range of reciprocation of the slide into conformity with the height of a die set on the press bolster comprising the steps of: placing a die set on the bolster and anchoring the portion of the die set adjacent the bolster to the bolster, adjusting said slide actuating means to maximize the distance between the slide and the surface of the bolster, supporting the slide on said slide actuating means at a position spaced farther from the bolster than that finally needed for the die set on the bolster, advancing the bolster to working position, detecting the distance between the surface of the die set remote from the bolster and the slide, adjusting the slide relative to said slide actuating means in a direction toward the bolster and in conformity with the detected information, and anchoring the other portion of the die set which is adjacent the slide to the slide.

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