

[54] **DOUBLE ACTING TRAVELING BOLSTER APPARATUS FOR PRESSES**

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[51] Int. Cl. **B30b 15/14**
[58] Field of Search **100/DIG. 18, 53, 229 R, 100/221, 224, 208; 72/446, 448; 83/266, 400, 563**

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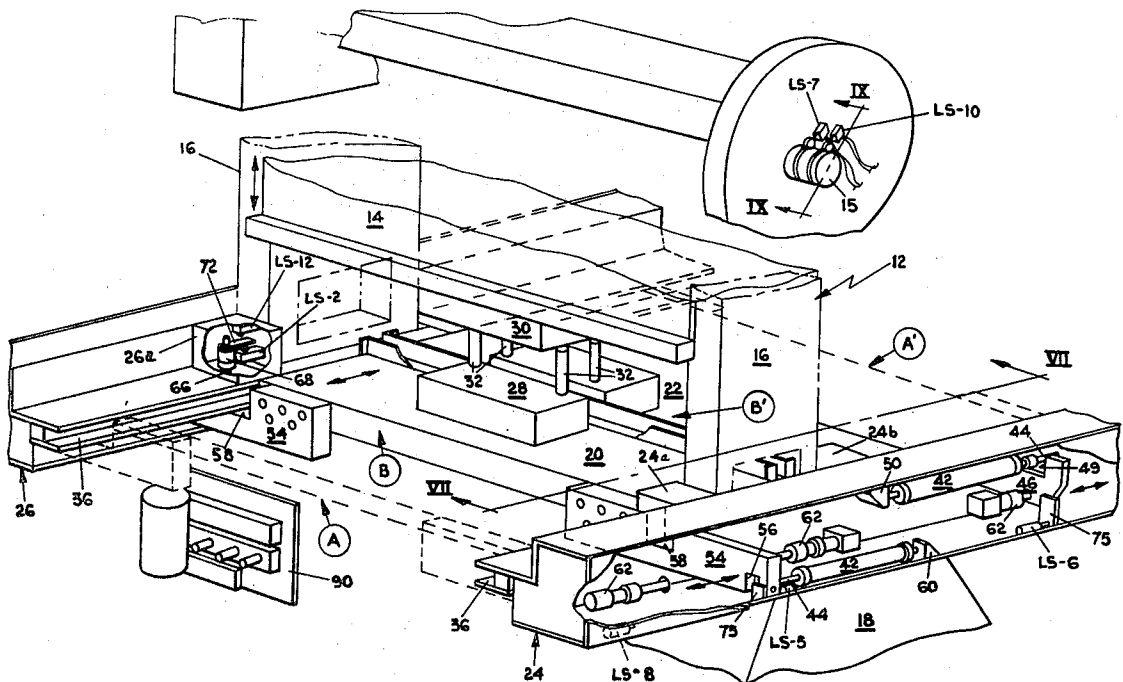
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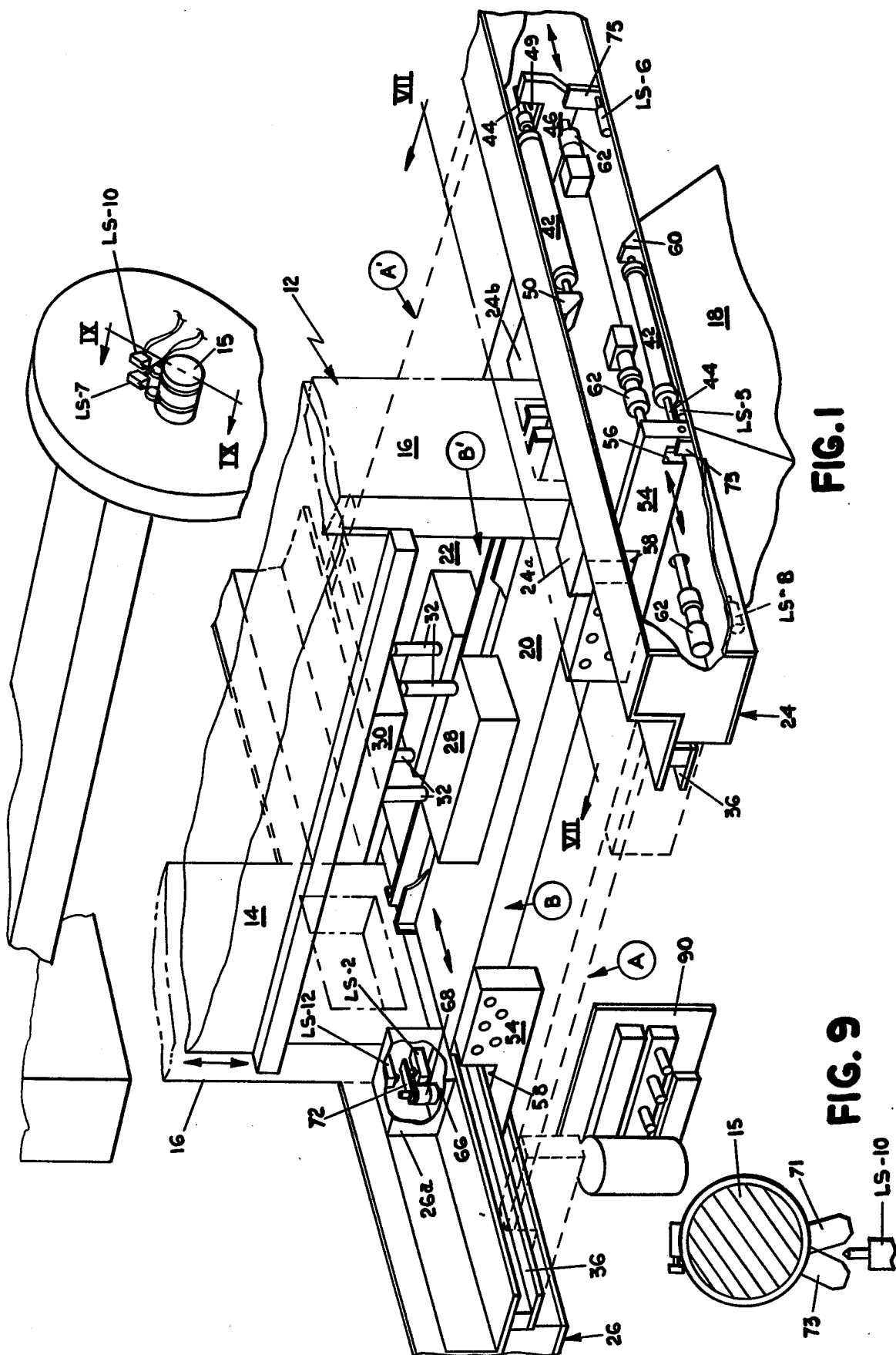
Primary Examiner—Billy J. Wilhite
Attorney, Agent, or Firm—Price, Heneveld, Huizenga & Cooper

[57] **ABSTRACT**

A traveling bolster assembly for power presses including two traveling bolsters which are simultaneously reciprocated toward and away from working positions wherein portions of each are aligned beneath the ram of the press such that the ram simultaneously performs working operations on materials loaded on each bolster. The bolsters are located on opposing sides of the ram and are actuated by control means located adjacent the loading stations for each bolster. The controls and loading stations are spaced a sufficient distance from the ram to prevent the operators from reaching under the ram. The failure in operation or malfunction of either bolster prevents further operation of the entire assembly and any press on which it is incorporated.

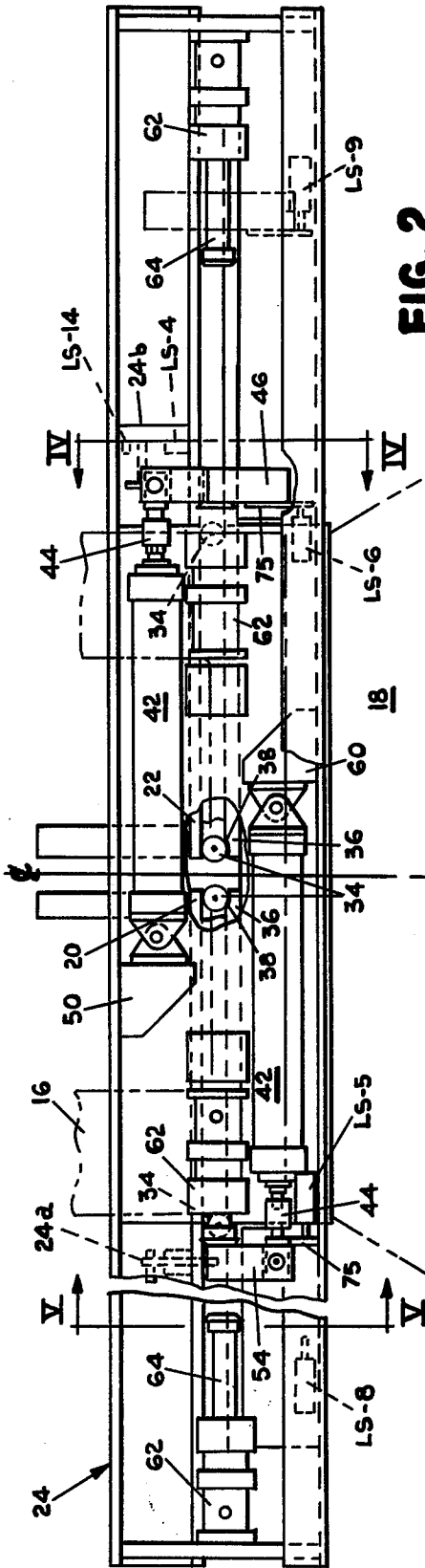
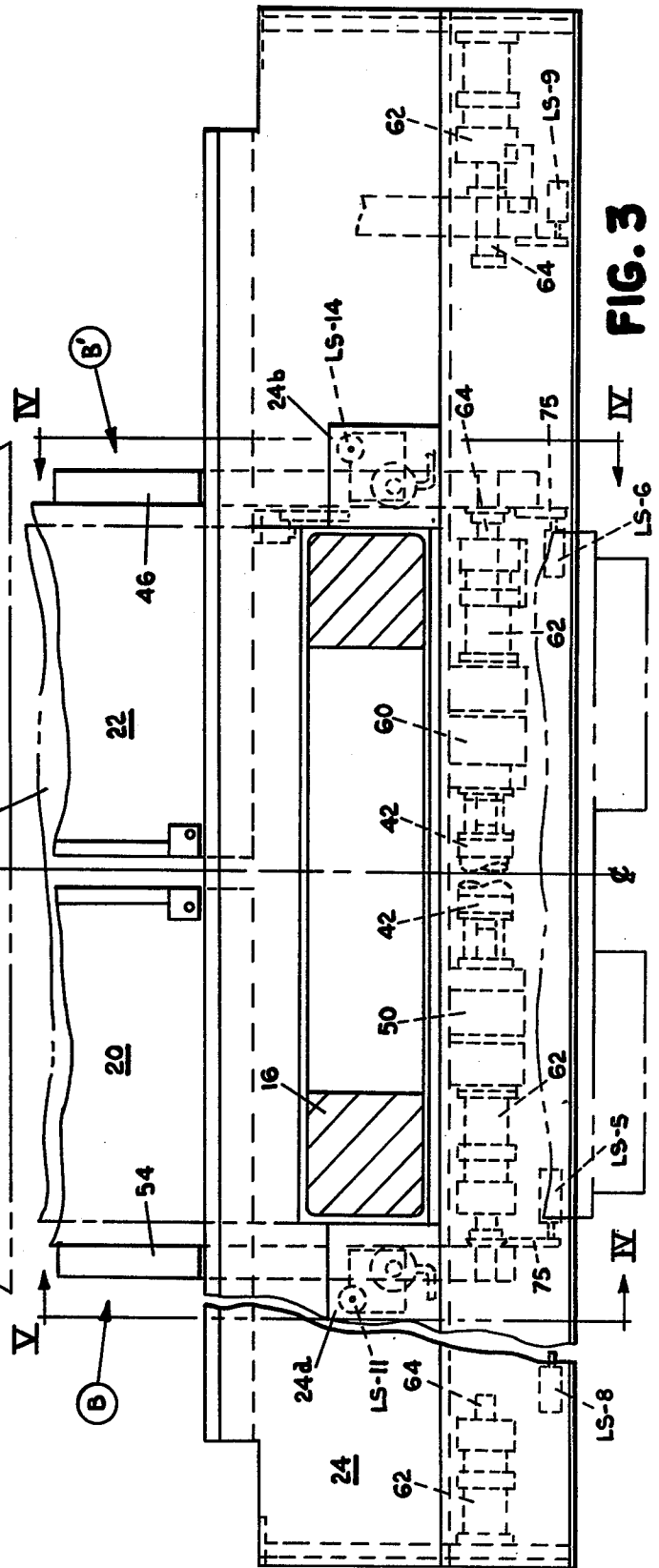
18 Claims, 10 Drawing Figures

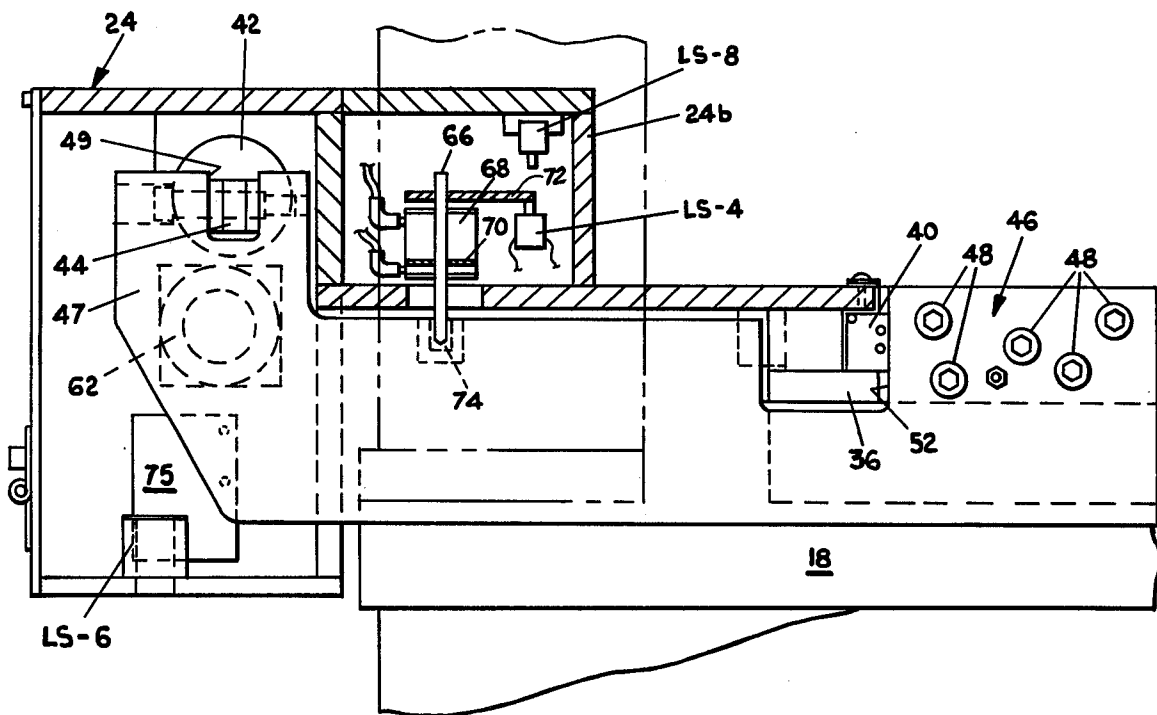
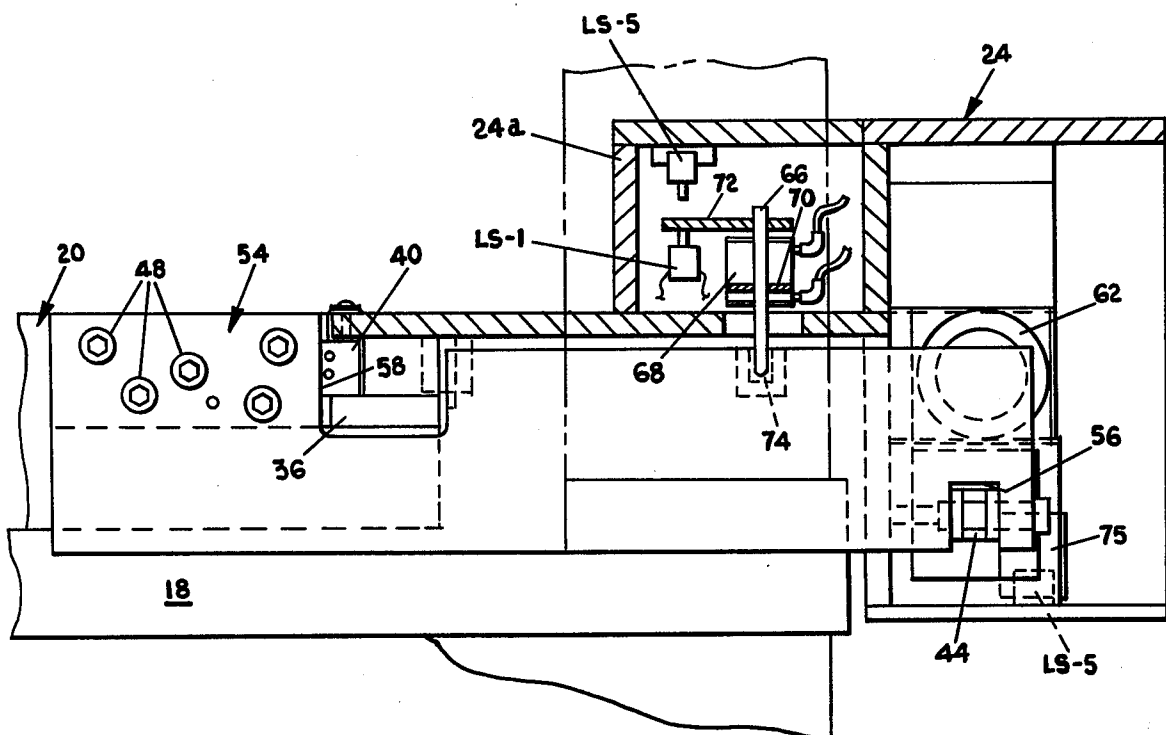




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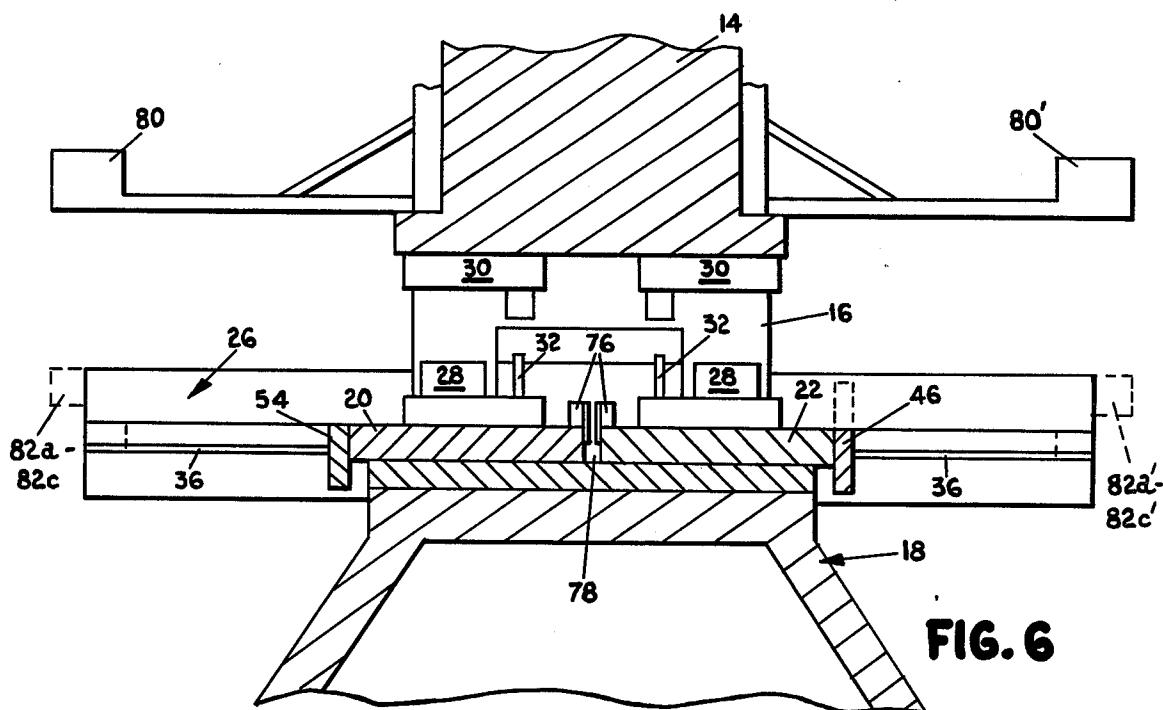


FIG. 6

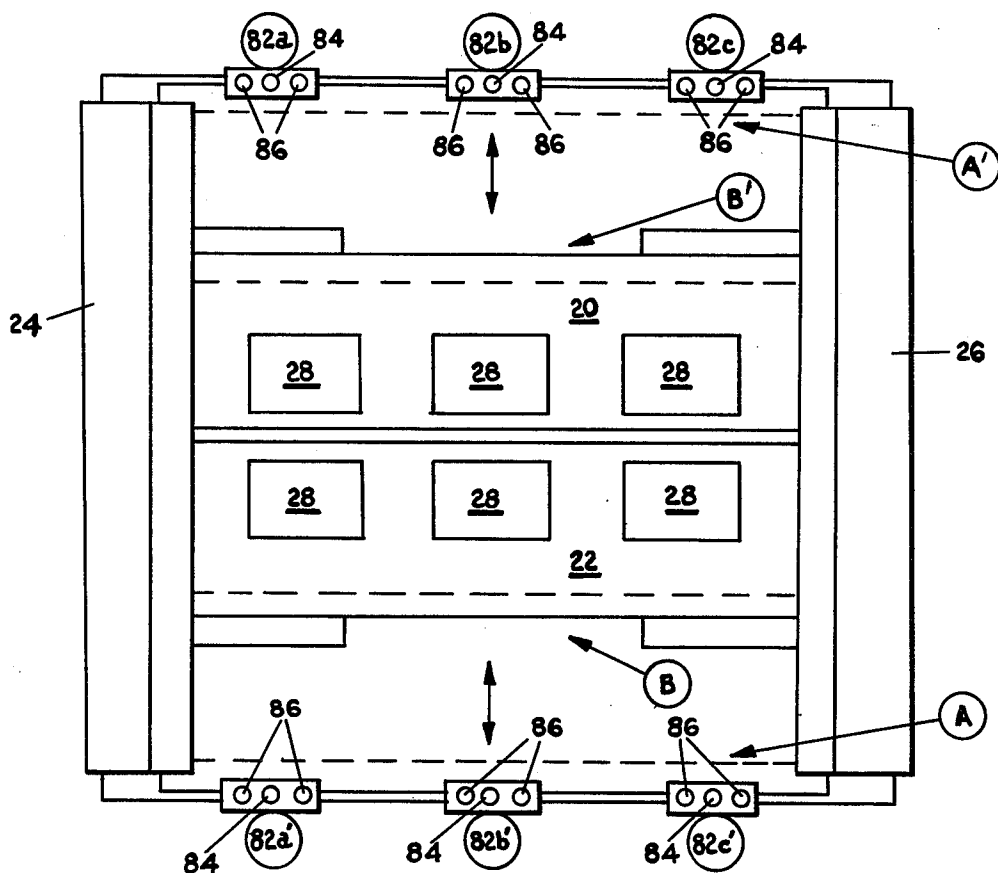


FIG. 7

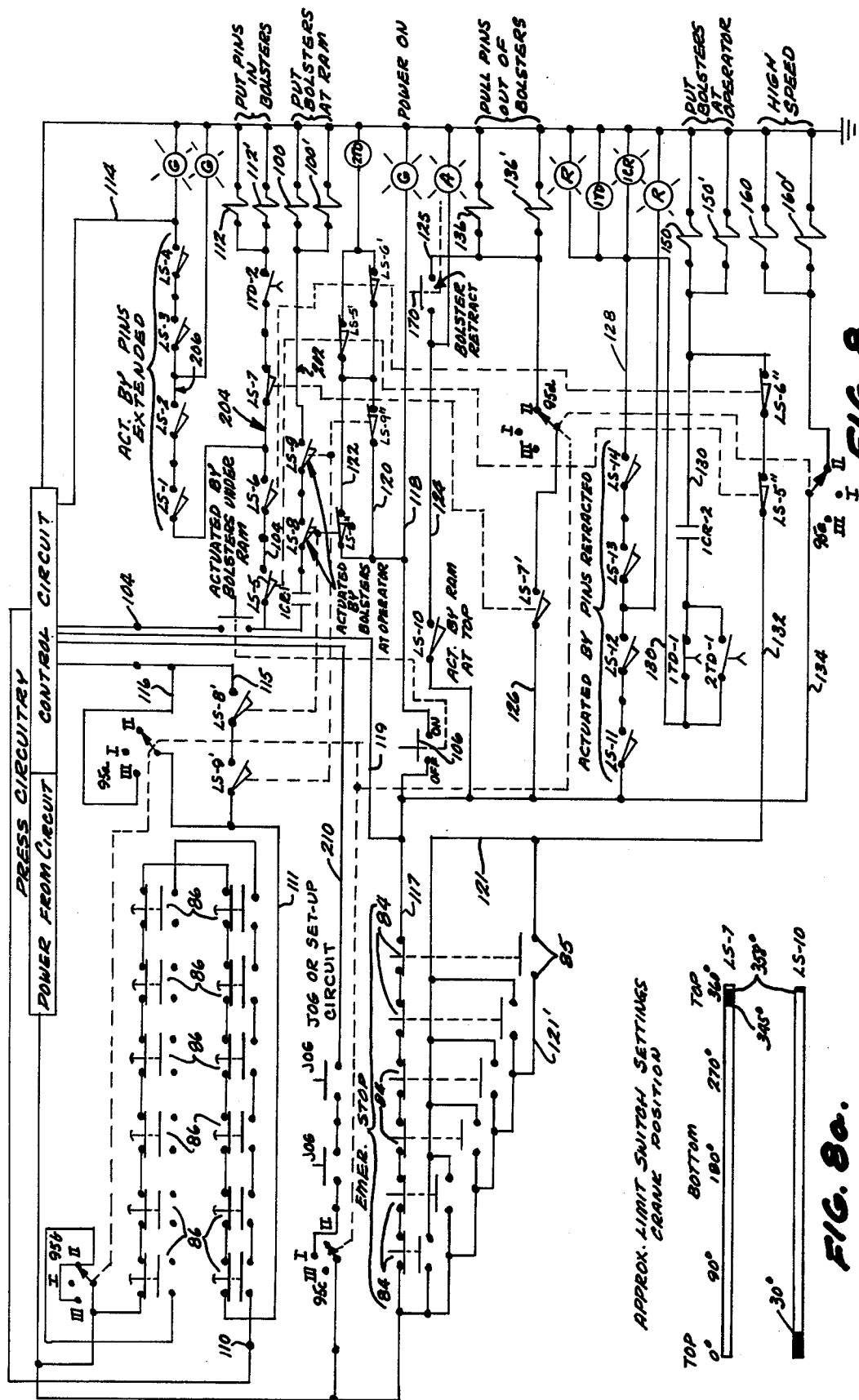


FIG. 8.

DOUBLE ACTING TRAVELING BOLSTER APPARATUS FOR PRESSES

This invention relates to traveling bolster assemblies for power presses and, more particularly, to a double traveling bolster assembly wherein materials to be worked can be loaded on each of the bolsters from opposite sides of a press, moved simultaneously beneath a single ram of the press, and simultaneously worked by the single ram.

BACKGROUND OF THE INVENTION

The maintenance of high-production capacities in stamping and other press operations has been difficult and expensive in the past. Typically, a power press is utilized to stamp or work but a single piece of material for every single stroke of the press ram or punch. Thus, a single press will have a maximum capacity based on the time period in which the stroke of the ram or punch occurs. In order to increase production, multiple presses have been used, each having single dies and turning out single work pieces for each stroke of a ram or punch on each press.

The introduction of traveling bolsters on which parts are loaded on the moving bolsters at a position remote from the ram and moved under the ram to a location at which the ram performs a working operation on the part, although advantageous in many aspects, did not rectify the production capacity limitations of a single press apparatus. Thus, although traveling bolster systems have helped reduce die change-over times for large stamping operations, helped reduce operation fatigue, and greatly increased operator safety as well as reduce operator fear of the machines, prior apparatuses were adapted to move only one traveling bolster under the ram at a single time. Accordingly, the apparatus still could produce but one part for each single stroke of the ram.

Some attempts were made to overcome the production capacity problem by joining two bolsters together and reciprocating them beneath the ram such that when one was under the ram, the other could be loaded and vice versa. Such an apparatus is shown in German Pat. No. 678,935 of JULY 25, 1939. Another apparatus of this type is shown in U.S. Pat. No. 3,273,490 issued SEPT. 20, 1966, to J.H. Beard and entitled PRESS ANVILS, wherein a single traveling bolster is reciprocated from side to side beneath the press ram also to allow one portion to be loaded while the other is in position to be worked. Even with these systems the press ram could work material from only one side of the press at any one time while the other side was being loaded.

Additionally, the prior known apparatuses gave little attention to safety aspects whereby operator injury and fear of the machine could be reduced.

SUMMARY OF THE INVENTION

Accordingly, it is the purpose of the present invention to provide a double traveling bolster assembly for power presses which enables the press ram to work several parts on the same stroke. The parts are loaded simultaneously on two traveling bolsters from opposite sides of the press at loading and control stations adjacent each bolster. These loading stations are spaced from the ram a sufficient distance to prevent operator injury. The two bolsters are moved simultaneously to transport the loaded parts into alignment beneath the

press ram which performs a working operation on all of the loaded parts simultaneously. Production efficiency is effectively double since twice as many parts can be loaded and worked by the same number of cycles of the press apparatus. Further, the production efficiency is aided by a reduction in operator fatigue, fear of injury, and actual injury to the persons who operate the apparatus.

In the preferred embodiment, two traveling bolsters are mounted over the lower press bed of a power press such that they may be reciprocated toward and away from each other simultaneously from loading positions remote from the ram. Parts are loaded thereon in the loading positions and the bolsters are moved to working positions wherein a portion of each bolster, including the loaded parts, is brought into registry simultaneously beneath the single press ram. Movement of the bolsters is controlled by fluid cylinders mounted in housing adjacent either lateral side of the bolsters. Shock absorbers are included to help decelerate the bolsters in both the loading and working positions such that high production speeds may be maintained. Control means for the fluid cylinders are included and are actuated by manual control means positioned adjacent each operator's loading station at a sufficient distance from the press ram such that none of the operators in any of the loading stations can reach under the press ram.

In addition to the positioning of the operators at distances whereby they cannot reach under the ram and still actuate the apparatus, other safety features are included. Timing means are included to time the movement of each bolster from its loading to its working position. If either of the bolsters is blocked, obstructed, or otherwise prevented from reaching its aligned position beneath the ram within the predetermined time, both bolsters are automatically returned to their loading positions and further operation of the press apparatus is halted. Further, the control means are designed to prevent operation of the apparatus until the operators at each loading station actuate their manual control means.

Means are also included for proving the proper alignment of the bolsters beneath the press ram before operation thereof as well as means for allowing the bolsters to be supported directly by the lower press bed during the working operations of the ram.

These and other objects, advantages, purposes, and features of the invention will become more apparent from a study of the following description taken in conjunction with the drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a fragmentary, perspective view, with portions broken away, showing the double traveling bolster apparatus of the present invention mounted on a typical power press;

FIG. 2 is a fragmentary, broken, side view of the power means controlling movement of the double bolsters;

FIG. 3 is a fragmentary, broken, plan view showing the power means of FIG. 2 and approximately one-half of the present double bolster apparatus;

FIG. 4 is a fragmentary, sectional, right end view of the present apparatus taken along planes IV—IV of FIGS. 2 and 3;

FIG. 5 is a fragmentary, sectional, left end view of the apparatus taken along planes V-V of FIGS. 2 and 3;

FIG. 6 is a fragmentary, sectional view of the apparatus shown in FIG. 1 illustrating the manual control means located above the operator's loading position;

FIG. 7 is a plan view of an apparatus similar to that shown in FIG. 1 but including the manual control means positioned in front of the individual operator's loading stations;

FIG. 8 is a schematic diagram of the electrical control circuit for the double bolster assembly;

FIG. 8a is a limit switch setting diagram for indicating the closing and opening of limit switches which are responsive to the position of the crankshaft which reciprocates the press ram; and

FIG. 9 is a sectional, end view of the crankshaft and limit switches taken along plane IX-IX of FIG. 1.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the drawings in greater detail, FIG. 1 illustrates a straight-sided press 12 incorporating the double traveling bolster apparatus 10 of the present invention. The bolster apparatus 10 may be incorporated generally on all types of power presses other than the type shown in FIG. 1, including open back inclinable presses, presses utilizing air or partial revolution clutches, and presses utilizing dog-type or full-cycle or revolution-type clutches.

The straight-sided press 12 includes a generally vertically reciprocable upper ram or punch 14 which is supported by side members 16 forming the upper framework of the press. A lower press bed 18 supports the press above a floor or other supporting surface and forms a platform on which the double traveling bolster apparatus 10 is mounted. The upper ram or punch 14 is typically reciprocated by a revolving crankshaft 15 which is engaged and disengaged by a suitable clutch (not shown) in response to control through the press-operating circuitry. The clutch enables a suitable power means such as an electric or fluid-operated motor to cause revolution of the shaft thereby causing reciprocation of the ram.

As shown in FIG. 1, the double traveling bolster apparatus 10 is incorporated on the press 12 such that the two traveling bolsters 20 and 22 are mounted for generally horizontal movement of reciprocation toward and away from the center line of the press (see FIGS. 2 and 3). Mounted along either side of the press 12 generally parallel to the direction of movement of the bolsters 20 and 22 are housing 24 and 26 which include the fluid cylinders 42, locating or registry pins 66, shock absorbers 62 and other control means for the operation of the traveling bolsters. Suitable solenoid controlled fluid valving 90 for cylinders 42 and pins 66 is located generally below each bolster (FIG. 1).

Each traveling bolster 20 and 22 is designed to support and transport the lower portion of a punch-die combination, i.e., the die and die shoe 28 in FIG. 1, while the upper movable ram or head portion of the press 12 carries the mating punch 30 which cooperates with the lower die. Locating pins 32 may be included in the punch-die combination such that when the ram is reciprocated vertically downwardly, the pins 32 will enter mating apertures in the ram to ensure correct alignment of the punch and die.

As will be more fully explained below, each traveling bolster 20 and 22 is movable between a loading position (phantom lines in FIG. 1), wherein the bolster is positioned away from the ram area of the press a sufficient distance to prevent the operator from reaching under the ram, and a working position (solid lines in FIG. 1) wherein the die-supporting portions of each bolster are simultaneously located in alignment with the ram of the press. For reference purposes, the loading positions are designated A and A' for bolsters 20 and 22, respectively, while the working positions are designated B and B' for the bolsters 20 and 22, respectively. During operation, the operators load materials on the bolsters at positions A and A' and actuate the manual controls located adjacent each of the loading positions which in turn causes the bolsters to move to the working positions B and B'. When the bolsters are in the working positions, the ram carries out working operations such as stamping, punching, die cutting or drawing materials to be worked which have been previously loaded on the dies 28. Typically, the material to be worked is a sheet material such as steel, aluminum, or other metals. Accordingly, operation and loading of the press including the double traveling bolster apparatus 10 is accomplished completely from positions A and A' which are remote from the working area of the press thereby preventing aligned injury.

Referring to FIGS. 2-5, the construction of the double bolster apparatus will be more apparent. FIG. 3 illustrates approximately one-half of the press 12 incorporating the double traveling bolster apparatus, the remaining half being but a mirror image thereof. Each of the bolsters 20 and 22 comprises a generally rectangular plate of hardened steel or another similar durable material supported at its four corners on bearings or wheels 34 (see FIG. 2). The wheels 34 in turn are supported on rails 36 under either lateral edge of bolsters 20 and 22 (see FIGS. 1 and 2). Rails 36 are parallel to one another and include detents or recesses 38 at the position of each wheel in the working positions such that when the bolsters are moved to their working positions B and B', each of the four wheels 34 on each bolster is received in a recess. The entry of the wheels into the recesses lowers the bolster plates into direct supporting contact with the press bed 18 of press 12. Accordingly, the press bed and not rails 36 supports the full force of the punching operation when the bolsters are in the working position. Each of the recesses 38 is sloped toward its deepest point such that the wheels will roll gradually downwardly thereby gradually lowering the bolster plate. Wiper members 40 may be secured in front of the wheels on each bolster (see FIGS. 4 and 5) in order to clear the rail of any foreign matter prior to the passage of the bolster wheels 34 thereover.

Movement of the bolsters 20 and 22 between their respective loading and working positions is accomplished via fluid-motor cylinders 42 mounted in the housing 24 and 26 located adjacent the lateral edges of the bolsters (see FIGS. 1-3). In the preferred embodiment, cylinders 42 are pneumatic cylinders having internally mounted pistons and extendable connecting rods or shafts 44. The end of each piston rod 44 from each fluid cylinder 42 is in turn connected to one of the bolsters via a bolster-connecting arm 46 or 54 secured to the front edge of one of the bolster plates.

As will be understood from a comparison of FIGS. 4 and 5, the bolster connecting arms are of two types

since the fluid cylinders for each bolster are located in vertically different positions within housings 24 and 26. The first is the type designated 46 (FIG. 4). Each of the two bolster arms 46 is secured via suitable bolts or securing means 48 to the front edge of bolster 22 and extends generally laterally of the bolster into one of the housings 24 and 26. At the housing end of the arm, a portion 47 extends generally vertically upward into alignment with the extendable rod 44 of one of the fluid cylinders 42. A recess 49 is provided for connection of rod 44. Both of the fluid cylinders for bolster 22 are secured via mounting blocks 50 from the top of housings 24 and 26 (see FIGS. 1 and 4). Arms 46 also include recesses 52 through which the rails 36 extend as the bolster 22 and associated arms are reciprocated between the loading and working positions.

The second type of bolster-connecting arm 54 is illustrated in FIGS. 1 and 5. Arms 54 also include portions which are secured by bolts 48 or other suitable securing means to the front edge of bolster 20. Each of the two arms 54 extend laterally of bolster 20 into one of the housings 24 and 26 and includes a recess 56 along its lower edge in alignment with the extendable rod 44 of one of the lower fluid cylinders 42 (FIG. 5). A recess 58 is included along its upper edge through which the rail 36 may pass during movement of the bolster. Lower cylinders 42 are secured between mounting blocks 60 on the bottom of housings 24 and 26 and recesses 56.

Each of the cylinders is pivotally mounted to its mounting block 50 or 60 and to arms 46 or 54 as shown in FIG. 2. As will also be understood from FIG. 2, the end of each cylinder 42 secured to mounting blocks 50 or 60 extends past the center line of the press. Thus, the cylinders 42 overlap one another and the center line in each housing. Accordingly, in order to incorporate both bolsters in the press, the cylinders have been vertically offset from one another in the aforementioned manner in order to include them both in the same housing and yet retain the full horizontal stroke for each bolster.

Also included in housings 24 and 26 are energy-absorbing shock absorbers 62 mounted at each end of the path of travel of each bolster 20 and 22. Thus, as shown in FIGS. 1-3, shock absorbers 62 are mounted at either end of each of housing 24 and 26 as well as at the loading position for each bolster. The shock absorbers are mounted within the housings in alignment with the portions of the bolster arms 46 and 54 immediately adjacent recess 49 or 56. Accordingly, as each bolster 20 or 22 reaches either its loading or working position, each of its two bolster arms 46 or 54, respectively, engage a shock absorber 62 which helps decelerate and stop the bolster at its correct position. The shock absorbers 62 are of the type including compressible spring arms 64 which are contacted and compressed inwardly by the opposing sides of the respective bolster arms as the bolsters move into positions. Other conventionally known fluid-filled shock absorbers may also be used. The shock absorbers thus provide a means for quickly decelerating the movable bolsters from their controlled production speed to a complete stop within a predetermined distance as determined by the resistance of the compressible spring arm included therein.

If desired, the shock absorbers may be adjustable in order to accommodate various weights and sizes of dies

28 to be supported and transported by the bolsters 20 and 22. Accordingly, if the size of the die supported by the bolsters is increased, the shock absorbers are adjusted in order to increase the amount of force needed to compress the spring arms. The increased mass of the larger combined die and movable bolster plate will then be brought to a complete stop within the same distance as with the lighter and smaller dies as described above.

Apparatus is also included in the traveling bolster assembly 10 for indicating the proper location of the bolsters 20 and 22 in the working positions prior to the actuation of the press ram in its working stroke. The locating or registry apparatus is mounted in four positions in housing extensions 24a and 24b and 26a and 26b such that it is in alignment with each of the bolster arms 46 and 54 for each bolster 20 or 22 (FIGS. 1-5). The apparatus in each of the housing extensions includes an extensible pin 66 which is reciprocated generally vertically via a pneumatic fluid cylinder 68 between an inserted and retracted position. The fluid cylinder includes a piston 70 which moves the pin 66 between the two positions, while the pin 66 also includes a plate 72 on the upper extremity thereof. In the extended position, when pins 66 are inserted in receiving apertures 74 in each of the bolster arms 46 or 54, plates 72 engage the lower of two limit switches in each housing. These limit switches, LS-1-LS-4 (FIGS. 1, 2, 4, and 5), enable the operation of the remainder of the press circuit. Correspondingly, when the pins 66 are retracted or withdrawn, they engage the upper of the two limit switches in each housing extension (switches LS-11-LS-14) thereby indicating that the bolsters are not in the working positions B and B'. If for some reason the bolsters are not properly aligned in the work position, the pins do not enter apertures 74 thereby preventing further operation of the press assembly.

Other limit switches actuated by plates 75 secured to the respective bolster arms 46 and 54 are included within housing 24 and 26. Thus, limit switches LS-8 and LS-9 indicate that the bolsters are in the loading position while limit switches LS-5 and LS-6 indicate that the bolsters are in the working positions beneath the ram. Limit switches LS-7 and LS-10, which indicate the position of the press ram, are mounted by suitable clamps adjacent actuating cam members 71 and 73 which revolve with crankshaft 15 on the press (see FIGS. 1 and 9).

Also secured on the rear edges of each of the bolsters 20 and 22 are shields 76 extending above the supporting surfaces of the respective bolsters. As is seen in FIGS. 1 and 6, the shields extend along the complete rear edges of the bolsters and forwardly a short distance along the lateral sides of the bolsters. Shields 76 prevent foreign objects from falling over the rear edges of the bolsters and filling the space 78 between the two bolsters when they are both in the aligned positions beneath the press ram as is seen in FIG. 6. Without the shields, foreign objects could enter that space and prevent the bolsters from coming into complete alignment.

As seen in FIGS. 6 and 7, one of two types of manual control means 80 or 82 are provided for actuating the control circuitry to operate the double traveling bolster apparatus and the associated press. Regardless of the width of the bolsters, each operator's position along that width is provided with a manual control panel including three palm buttons or actuators in the preferred embodiments. As shown in the embodiment in FIG. 7,

three operator loading and control positions are provided on each bolster such that materials may be loaded on each of six dies included on the bolsters. These loading and control positions are designated 829-82c for bolster 20 and 829'-82c' for bolster 22. The central palm button in each grouping at each operator location is an emergency button 84 while the two lateral outside buttons 86 at each location must be pushed by each of the six operators in order to actuate the circuitry and allow the bolster assembly and press to operate.

The cluster of three buttons may be located above the bolster at each operator position as shown in FIG. 6 at 80 and 80'. The remainder of the controls, such as the main on-off switch 106, selector switch 95, etc. described below, are also generally located in this position above the bolsters. In this case, the operator must reach up with both hands after loading the bolster to actuate buttons 86, whereas in the embodiment shown in FIG. 7, wherein the manual controls are located beyond the front edges of the bolsters when the bolsters are in the loading position, the operator merely places his hands adjacent the bolster on the controls. However, in either case, the horizontal distance from the position at which the manual controls are located to the press ram area is greater than the length of an operator's arm such that he cannot reach under the ram from the position adjacent the manual controls. Thus, complete operator safety is maintained especially since both of his hands must be on the palm buttons 86 in order to operate the apparatus.

OPERATION

Referring now to FIGS. 8 and 8a, the control means for controlling the operation of the double bolster assembly 10 and its coordination with the operation of the power press 12 will be described in greater detail. The control means basically comprises solenoid operated, fluid flow control valve systems 90 (FIG. 1) and an electrical circuit for controlling the operation of the control valve system (FIG. 8). The control valve systems are of the type which are well known in the art and include solenoid-responsive, pneumatic valving for actuating the pneumatic fluid cylinders 42 described above. Fluid valving is also included to operate the locating or registry pins 66 and associated fluid cylinders 68.

As shown in FIG. 8, the electrical control circuit includes means for operating the bolster assembly 10 in either an automatic or semi-automatic sequence of operation as desired. The electrical circuit includes bolster advance control solenoids 100 and 100', one for each of the two bolsters 20 and 22, as well as bolster return control solenoids 150 and 150', one for each bolster. These solenoids control the operation of the pneumatic cylinders 42 for advancing the bolster under the ram of the press and for returning them back to their loading position.

The press incorporating the present invention may be operated in one of these three operational modes, e.g., the set-up mode I, the bolster traveling-press run mode II, and a bolster-stationary-press run mode III. These modes are determined by the setting of the selector switch 95 (FIG. 8) which is a wafer-type switch having a plurality of switch parts or contact groupings, namely, 95a, 95b, 95c, 95d, and 95e all as disclosed in FIG. 8. It will be noted that in various positions I, II, and III, the

parts or groupings 95a, 95b, etc., of the switch 95 are generally connected or disconnected to the electrical control circuit so as to control the energization and the de-energization of the advance solenoids 100 and 100' and the return solenoids 150 and 150' as well as other portions of the circuit. The various parts of switch 95 are shown in mode II in FIG. 8.

In order to understand the circuit and its operation, the mode II operation, in which the bolsters are automatically advanced under the ram, the ram is actuated, and then the bolsters are returned to their loading positions, will be explained first.

Referring to the advanced control solenoids 100 and 100', it will be noted that they are part of circuit 202 which is also comprised of the limit switches LS-8 and LS-9 and the relay contacts 1CR-1, the entire circuit 202 being connected to the line 104 in which is located the main power switch 106. Line 104 continues into the press control circuit.

As is illustrated in FIG. 8, the only time power can be fed to line 104 through line 110 and the press control circuit in mode II is when each pair of palm buttons 86 at each operator location along each side of each of the bolsters 20 and 22 is depressed, thereby connecting the power in line 110 from the press power supply through portion 95b of the selector switch and through each of the then-connected contacts of the palm buttons 86 in line 110. Accordingly, it will be appreciated that if any one operator does not depress both buttons, the bolsters will not move to their working positions and the ram 14 will not reciprocate.

When all of the palm switches 86 are depressed, power from line 110 is fed through the press control circuit, line 104 and the closed switches 1CR-1, LS-8 and LS-9 to the bolster advance control solenoids 100 and 100'. Contacts 1CR-1 are closed whenever the pins 66 are retracted and limit switches LS-11 to LS-14 are closed. When solenoids 100 and 100' are energized, they immediately set fluid control valves in apparatus 90 in position to cause fluid cylinders 42 to advance the bolsters 20 and 22 toward the ram. It will be understood that switches LS-8 and LS-9 open as the bolsters advance toward their working positions but without affecting the position of the fluid control valves. When the bolsters reach the proper position under the ram, limit switches LS-5 and LS-6 are actuated by plates 75 mounted on the bolster arms thereby closing the circuit 204 and energizing the registry pin extension control solenoids 112 and 112'. It will be understood that switch LS-7 on the ram crankshaft is closed when the ram is at the top thereby allowing movement of the pins 66. The pins 66 (FIGS. 1-5) are immediately extended into openings 74 in the bolster arms by the pneumatic fluid cylinders 68 described above. Extension of the pins closes limit switches LS-1, LS-2, LS-3, and LS-4 by means of plates 72 mounted on the pins. Switches LS-1, LS-2, LS-3 and LS-4 are located in circuit 206 including line 114 which is connected to circuit 204 between limit switches LS-6 and LS-7 and to the press ram clutch control included in the press control circuit.

The press ram clutch control is operated by closing circuit 206 only after the press control circuit is reset by the closing of portions LS-8' and LS-9' of switches LS-8 and LS-9, LS-8' and LS-9' being located in line 115 which extends from the location of the normally closed side of the palm buttons 86 to the press control circuit. This resetting is accomplished in modes I and

II by the closing of limit switches LS-8' and LS-9' each time the bolsters return to their loading positions. In mode III, as will be explained below, switches LS-8' and LS-9' are bypassed and a direct connection is made through portion 95a of the selector switch such that the ram will run continuously without the bolsters having to complete a cycle for each cycle of the ram. Thus, in mode II, the closing of LS-1 through LS-4 causes the press ram to reciprocate downwardly through one cycle. As the ram returns to the top or up position, the bolster return circuits are actuated as explained below.

As shown in FIGS. 1 and 9, switches LS-7 and LS-10 are physically located on the ram crankshaft 15 at the top of the press. The settings for these crank limit switches are shown in FIG. 8a. Immediately before the crank and the ram reach the top position, that is, between approximately 345° and 358°, limit switch LS-7 is actuated thereby opening circuit 204 of the pin extension control solenoids 112 and 112' and at the same time closing switch LS-7' located in line 126. This closes the circuit of line 126 since the switch part 95d is set in mode II and immediately energizes the pin retraction control solenoids 136 and 136' causing retraction of the locating pins out of the bolster arms. Retraction of the locating pins causes plates 72 to contact and close limit switches LS-11, LS-12, LS-13, and LS-14 (FIGS. 1-5) located in line 128 which in turn causes the energization of relay coils 1CR, 1TD, and line 130. Energization of 1TD closes switch 1TD-1 in line 130. Energization of 1CR closes relay contacts 1CR-2 in line 130 which energizes the return control solenoids 150 and 150'. This immediately changes the position of the control valve for the cylinders 42 causing the cylinders to return the bolsters to the loading positions B and B'. After a short time delay controlled by the timer relay coil 1TD, the switch 1TD-1 times open leaving both bolsters and the entire circuit in its original position ready to be actuated again via the palm switches 86. Indicating lights are positioned at various positions in the circuit as illustrated in FIG. 9 to show when various switches and circuits are energized.

Preferably, in mode II, it is desirable that the bolster be moved at high speed. Therefore, high speed control solenoids 160 and 160' are located in line 134 in series with selector switch portion 95e. These high speed control solenoids, by appropriate valving, cause the rate at which air is fed to the cylinders 42 to be increased, thus increasing the speed at which the cylinders 42 actuate the bolsters. If the high speed solenoids 160 and 160' burn out or in any way become non-functional and de-energized, the bolster is accordingly controlled to move at low speeds since the solenoids will not be energized to control the appropriate valving.

Having described the operation of mode II, the operation of mode I is easily understood. In accordance with mode I, both bolsters can be advanced manually by the operation of push buttons 89 and then, only when the bolsters are properly in their working positions, can the press ram be actuated intermittently via push buttons 89 in the press control jog circuit 210 without causing the bolster to retract. Accordingly, using mode I allows the proper positioning of dies and work pieces when changes or used for the first time since the apparatus may be controlled to move intermittently and slowly.

In operating in mode I, the selector switch 95 is adjusted to mode I position. (Note that FIG. 8 shows the

selector switches 95 in the mode II position.) In the mode I position, the only part of the selector switch 95 that provides an electrical connection is part 95c located in line 210 which in turn is connected from the power supply circuit of the press. However, in order to move the bolsters under the ram when mode I is selected, line 210 is closed by depression of push buttons 89 allowing power to pass through the press control circuit line 104 and switches LS-9 and LS-8, which are closed because the bolsters are in their loading positions, to the bolster advance control solenoids 100 and 100' as described above. When both bolsters reach their working positions under the ram, switches LS-5 and LS-6 are closed permitting pin extension control solenoids 112 and 112' to be energized. The pins thereafter remain extended and the bolsters remain under the ram no power can reach the automatic ram clutch control circuit through line 114 since LS-8' and LS-9' are open when the bolsters are under the ram in mode I. Circuit 210 is selected on the selector switch 95c thereby allowing the ram to be moved vertically downwardly by the depression of palm switches 89 either intermittently or continuously. Once the ram returns to its top position passing through 345° as shown in FIG. 8a, limit switch LS-7 opens and LS-7' is closed, as described above in relation to mode II. However, switch part 95d prohibits energization of the pin retraction control solenoids 136 and 136'. As a result, there is no automatic return of the bolster as previously described in mode II and the entire apparatus comes to a standstill with the ram at the top and the bolster beneath the ram.

With the ram at the top, limit switch LS-10 located adjacent crankshaft 15 and in line 124 is closed thereby closing the circuit through indicator light A showing the ram is at the top position. Connected to line 24 is line 125 having a manual bolster retract switch 170 which, if manually closed, energizes the pin retraction control solenoids 136 and 136' causing the pins to be retracted and limit switches LS-11, LS-12, LS-13 and LS-14 to be closed. As previously described, the closing of limit switches LS-11, LS-12, LS-13 and LS-14 energizes coils 1TD and 1CR and thus causes the closing of circuit of line 130. The closing of this circuit energizes the return control solenoids 150 and 150' causing the cylinders 42 to be actuated for returning the bolsters to their loading positions. Manual retract switch 170 may be used any time when LS-10 is closed, i.e., until approximately 10° after the crank of press 12 passes its top position as shown in FIG. 8a.

A third operational mode available on the preferred embodiment is with the bolster stationary-press run mode III selected on switch 95. In mode III, the traveling bolsters 20 and 22 remain stationary in their working positions beneath the ram while the movable ram is automatically actuated for continuous and repeated work cycles by means of the press control circuit. Normally, mode III is selected after the bolsters have been advanced to their working positions using mode I. Thus, the continuous operation of the press ram is generally selected only after the die location has been verified using the set-up mode I. However, the sequential operation of advancing the bolsters under the ram in mode III is also the same as in mode I. That is, after the bolsters reach the proper positions and the registry pins are extended into the bolster, the pins and bolster cannot be retracted because the switch 95d in line 126 is

open thus preventing the limit switch LS-7' from closing the circuit to energize the pin retraction control solenoids. However, in mode III, as opposed to mode I, the closing of the switch part 95a permits the circuit through lines 111 and 116 to be closed for continuous actuation of the press ram in the manner described above.

It should be understood that in order for the press ram to be actuated in successive cycles, the press control circuit must be reset by closing the circuit through line 116. This is accomplished in one of two ways. As previously described, one way is as the bolsters return to their loading positions, LS-8' and LS-9' close thereby resetting the press control circuit. In mode III, line 116 is always closed by switch part 95a and therefore the press control circuit is reset after each operation of the ram. As a result, in mode III, the press ram is continuously actuated without returning the bolster to the operator. It is possible also to provide a means in the press control circuit which will cause the ram to operate in single cycles without the bolster returning by means of the repeated actuation of the palm switches 86.

One safety feature which is present in all modes I-III involves the bolster delay circuit which is found in lines 120 and 122. This circuit includes limit switches LS-5', LS-6', LS-8'', and LS-9'' as well as time delay relay coil 2TD. Thus, as the bolsters are advanced toward the ram of the press and their working positions, if either of the bolsters does not reach its operative position with a predetermined time as set on coil 2TD, the circuit through line 130 will be closed by the closing of switch 2TD to energize the return control solenoids 150 and 150' thereby automatically returning the bolsters to their respective loading positions. The failure to reach the working positions within the predetermined time may be caused by obstructions in the way of either bolster, a malfunction in the bolster wheels 34 or any other like causes which prevent the bolsters from properly moving. However, if the bolsters reach their working positions within the said time limit, limit switches LS-5' and LS-6' open thereby preventing the energization of coil 6TD.

An additional safety aspect of the invention is the provision of emergency buttons 84, one emergency button being included at each operator's position as shown in FIG. 7. In FIG. 9, emergency buttons 84 are located in line 117. If any of the six emergency stop buttons is depressed by any one of the operators of the press of the type shown in FIG. 7, power through line 117 will be interrupted thereby preventing operation of the circuit and lines 118-130 and 134 which prevents the bolsters from being moved further in either direction. Simultaneously, power is interrupted through line 119 by the depression of any one of the emergency stop buttons 84, line 119 being connected to the press control circuit to prevent further movement of the press ram.

When any of the emergency stop buttons 84 are depressed, contact is automatically made between contacts 85 on the depressed switch thereby completing the circuit either through line 121 or 121' to line 132. Portions LS-5'' and LS-6'', comprising portions of limit switches LS-5 and LS-6 which are actuated by the positioning of the bolsters beneath the press ram, are located in line 132. LS-5'' and LS-6'' are normally closed whereas LS-5 and LS-6 are normally open. Accordingly,

when the bolsters are positioned in their working positions beneath the ram, LS-5'' and LS-6'' are opened such that even if a connection is made across contacts 85 by the depression of an emergency stop button, circuit 130 will not be energized and the bolster will not be returned to the operators. Accordingly, depression of an emergency stop button brings a complete halt to all movement in the entire press apparatus and the double traveling bolster assembly.

It will be now understood that the present invention accomplishes a great increase in productivity utilizing a single press since at least twice the normal work pieces may be worked simultaneously on the two bolsters by a single stroke of the ram. Further, the increased productivity is accomplished while maintaining complete operator safety because the operator or operators on either side of the ram along either of the bolsters are prevented from being injured during operation of the press apparatus.

While several forms of the invention have been shown and described, other forms will now be apparent to those skilled in the art. Therefore, it will be understood that the embodiments shown in the drawings and described above are merely for illustrative purposes, and are not intended to limit the scope of the invention which is defined by the claims which follow.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows.

1. In a traveling bolster assembly for incorporation on power presses, said presses of the type having an upper movable ram, a lower press bed, and means for reciprocating said ram toward and away from said bed, the improvement comprising: two traveling bolsters adapted to be mounted on opposing sides of the center of the ram of such a press, each bolster extending substantially the full width of said ram on its respective side, means for mounting each of said bolsters on such a press for reciprocal movement only on its respective side of the center of said ram, each bolster moving between a loading position spaced generally horizontally from said ram wherein materials are loaded on the bolster and a working position in alignment with and beneath the ram wherein a working operation is performed on the supported material by the ram, said bolsters when simultaneously in their working positions being located on their respective sides of and adjacent to said center of said ram with no portions of said bolsters being in said loading positions; power means for simultaneously reciprocating each of said bolsters between said loading and working positions whereby at least a portion of both of said bolsters are simultaneously brought into registry and alignment with such a ram such that the ram may operate on the material loaded on both of said bolsters at the same time.

2. The bolster assembly of claim 1 further including manual control means for actuating said power means, said control means including separate manual control actuators mounted adjacent each of said loading positions of each of said bolsters a distance from the ram which prevents the operator of each manual control means from reaching under the ram.

3. The bolster assembly of claim 2 wherein said manual control actuators are mounted above each of said loading positions.

4. The bolster assembly of claim 2 wherein each of said bolsters includes a front edge which is the farthest

edge from the ram when the assembly is mounted on a press; said manual control means being mounted a distance beyond said front edge away from said ram.

5. The bolster assembly of claim 2 including control means which cause operation of said bolsters and ram only when said manual control actuators adjacent each of said loading positions are actuated.

6. The bolster assembly of claim 1 wherein each of said bolsters has a size sufficient to include a plurality of loading stations therealong and manual control actuators adjacent each of said loading stations for actuating said power means.

7. The bolster assembly of claim 6 including control means for causing operation of said bolsters and ram only when said manual control actuators adjacent each of said loading positions are actuated.

8. The bolster assembly of claim 1 wherein said power means comprise fluid cylinders mounted adjacent and on either side of each of said bolsters; said assembly includes housings extending along both sides of said bolsters; fluid cylinders for one side of each of said bolsters being located in one of said housings; said fluid cylinders in each of said housings being offset vertically and overlapped with respect to one another within said housing.

9. In a traveling bolster assembly for incorporation on power presses, said presses of the type having an upper movable ram, a lower press bed, and means for reciprocating said ram toward and away from said bed, the improvement comprising: two traveling bolsters adapted to be mounted on opposing sides of the center of the ram of such a press, means for mounting each of said bolsters on such a press for movement between a loading position spaced generally horizontally from said ram wherein materials are loaded on the bolster and a working position in alignment with and beneath the ram wherein a working operation is performed on the supported material by the ram; power means for simultaneously reciprocating each of said bolsters between said loading and working positions whereby at least a portion of both of said bolsters are simultaneously brought into registry and alignment with such a ram such that the ram may operate on the material loaded on both of said bolsters at the same time; said power means including fluid cylinders mounted adjacent and on either side of each of said bolsters; said assembly including housings extending along both sides of said bolsters; fluid cylinders for one side of each of said bolsters being located in one of said housings; said fluid cylinders in each of said housings being offset vertically and overlapped with respect to one another within said housing; said housings also including shock absorbers for each of said bolsters in both said loading and working positions of each bolster.

10. In a traveling bolster assembly for incorporation on power presses, said presses of the type having an upper movable ram, a lower press bed, and means for reciprocating said ram toward and away from said bed, the improvement comprising: two traveling bolsters adapted to be mounted on opposing sides of the center of the ram of such a press, means for mounting each of said bolsters on such a press for movement between a loading position spaced generally horizontally from said ram wherein materials are loaded on the bolster and a working position in alignment with and beneath the ram wherein a working operation is performed on the supported material by the ram; power means for si-

multaneously reciprocating each of said bolsters between said loading and working positions whereby at least a portion of both of said bolsters are simultaneously brought into registry and alignment with such a ram such that the ram may operate on the material loaded on both of said bolsters at the same time; said bolsters including rear edges which are adjacent one another and define an area therebetween when said bolsters are in said working positions; each of said bolsters including shielding means for preventing foreign materials from being deposited in said area between said rear edges.

11. In a traveling bolster assembly for incorporation on power presses, said presses of the type having an upper movable ram, a lower press bed, and means for reciprocating said ram toward and away from said bed, the improvement comprising: two traveling bolsters adapted to be mounted on opposing sides of the center of the ram of such a press, means for mounting each of said bolsters on such a press for movement between a loading position spaced generally horizontally from said ram wherein materials are loaded on the bolster and a working position in alignment with and beneath the ram wherein a working operation is performed on the supported material by the ram; power means for simultaneously reciprocating each of said bolsters between said loading and working positions whereby at least a portion of both of said bolsters are simultaneously brought into registry and alignment with such a ram such that the ram may operate on the material loaded on both of said bolsters at the same time; said power means including fluid cylinders on either side of each of said bolsters; each fluid cylinder having an extendable piston and piston rod; said piston rods each being connected to said respective bolster by connecting arms; and registry means for indicating the correct positioning of said bolsters in said working positions and means for actuating reciprocation of the ram on a press in response to the indication of said correct positions; said registry means being mounted for engagement with said connecting arms.

12. The bolster assembly of claim 11 wherein said registry means comprise extensible pins; said reciprocation actuating means comprising limit switches engaged by abutments secured to said pins.

13. In a traveling bolster assembly for incorporation on power presses, said presses of the type having an upper movable ram, a lower press bed, and means for reciprocating said ram toward and away from said bed, the improvement comprising: two traveling bolsters adapted to be mounted on opposing sides of the center of the ram of such a press, means for mounting each of said bolsters on such a press for movement between a loading position spaced generally horizontally from said ram wherein materials are loaded on the bolster and a working position in alignment with and beneath the ram wherein a working operation is performed on the supported material by the ram; power means for simultaneously reciprocating each of said bolsters between said loading and working positions whereby at least a portion of both of said bolsters are simultaneously brought into registry and alignment with such a ram such that the ram may operate on the material loaded on both of said bolsters at the same time; control means for causing operation of said power means; said control means comprising circuit means having timing means for causing said power means to move

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each of said bolsters from said loading positions to said working positions within a predetermined time period; said control means adapted to return both of said bolsters to said loading positions if either one or the other or both of said bolsters fails to reach said respective working positions within said predetermined time period.

14. The bolster assembly of claim 1 including control means for operating said power means; said control means comprising circuit means and selection means for selective operation of said circuit means; said selection means including first means for selecting coordinated low speed operation of both of said bolsters and the ram; second means for selecting coordinated high speed operation of both of said bolsters and the ram; and third means for selecting operation of the ram alone when said bolsters are both in said working positions; said circuit means including means for preventing further operation of said bolster and ram if movement of either bolster to said working position is obstructed.

15. A traveling bolster assembly for presses including a ram or punch having a centerline which moves in a general plane; said assembly comprising two bolsters, each bolster extending substantially the entire width of said ram on its respective side thereof; means for mounting said bolsters for opposing movement generally transverse to both the general plane of movement and said centerline of the ram on opposing sides of the ram; means for reciprocating each of said bolsters on only its respective side of said centerline between a loading position wherein material to be worked is loaded on said bolster at a position spaced horizontally from the ram from which the operator cannot reach under the ram and a working position wherein said bolster is in alignment beneath the ram and a work operation is performed by the ram on the material loaded on said bolster; said loading positions of each of said bolsters being on opposite sides of the ram; said working positions of each of said bolsters being adjacent but on opposing sides of the ram with no portions of said bolsters being in said loading positions whereby each bol-

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ster is simultaneously in alignment with the ram along its entire side of the ram and material loaded on each bolster may be simultaneously worked by the ram; power means for moving said bolsters between said loading and working positions; and control means for controlling the operation of the bolsters and ram; said control means including manual control actuators and means for mounting said manual control actuators at positions adjacent each of said loading positions whereby operators standing in position to load each of said bolsters can actuate said manual control actuators at their respective positions but cannot reach under said ram.

16. The traveling bolster assembly of claim 15 wherein said manual control actuators are mounted above each of said loading positions.

17. The traveling bolster assembly of claim 15 wherein each of said bolsters includes a front edge which is the farthest edge from the ram when the assembly is mounted on a press; said manual control means being mounted a distance beyond said front edge away from said ram.

18. A traveling bolster assembly for power presses having a movable ram or punch having a centerline including at least two traveling bolsters mounted for reciprocal movement in opposing directions on opposite sides of and generally transverse to said centerline of a press ram, each of said bolsters extending generally the entire width of said ram on its respective side thereof; and means for simultaneously moving said two bolsters from their respective loading positions remote from such a press ram, wherein they are both located at the same time and parts are loaded on each, and from where an operator cannot reach under the ram, to working positions, wherein a portion of each bolster is in alignment beneath the press ram at the same time whereby parts on both bolsters may be simultaneously worked by the ram, said bolsters when in said working positions being located on their respective sides of and adjacent to said ram centerline with no portions of said bolsters being in said loading positions.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

PATENT NO. : 3,878,773
DATED : April 22, 1975
INVENTOR(S) : Henry Smit

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 4, line 27;
 "aligned" should be --operator--;
Column 7, line 5;
 "829-82c" should be --82a-82c--;
Column 9, line 40;
 "shown" should be --show--;
Column 10, line 17;
 "rama" should be --ram--;
Column 10, line 17;
 "ram" should be --since--;
Column 10, line 36;
 "24" should be --124--;
Column 15, line 41;
 After "the", insert --center of the--.

Signed and Sealed this

ninth Day of September 1975

[SEAL]

Attest:

RUTH C. MASON
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents and Trademarks