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(54) **HYDRAULIC PRESS HAVING INTEGRATED COLUMN CLAMPS AND ACTUATORS.**

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Description

The present invention relates to a hydraulic press construction wherein the press is rigid, and the actual pressing cylinders are integrated into clamps which are carried by a movable member that can be opened and closed for charging a mold, and for removing a finished part.

Various hydraulic presses for forming materials have been advanced, including ones that have rigid crossheads that are clamped onto smooth columns, for example, a press a shown in US-A-4,457,684. That specification shows a hydraulic press which has clamps on the crosshead to clamp the crosshead in place, and separate molding cylinders that are positioned below a lower platen, and which provides a wide range of movability during the press operation. The crosshead construction shown in US-A-4,457,684 also shows a rigid, relatively light weight crosshead which distributes the stress substantially uniformly across the supported platen. The ram and bed of the present press accomplishes distribution of stress as well, but in a different manner.

Hydraulically operated sleeve clamps that clamp onto smooth columns, and have to interfitting parts that prevent slip between the two parts are shown in US-A-4,509,910.

US-A-3,449,795 shows a type of a mold closer that has a clamp that is hydraulically operated to clamp to a smooth column, and which has a built-in pressure cylinder. This patent also shows a configuration for latching members into existing grooves in columns, which are hydraulically operated as well.

Further, US-A-4,565,517 illustrates a hydraulic press that has clamps with integrated pressing cylinders, but arranged in a substantially different configuration from the present device and having a requirement for a heavy press frame.

GB-A-402561 disclosed a veneering press in which pressure is applied to one of the press plates through a press beam consisting of at least one girder by means of pressure producing means the line of action of which lies outside the ground plan of the plates. The pressure producing means consist of longitudinal girders which are supported by one or more cross-girders lying within the ground plan of the plates.

This invention provides a hydraulic press having a pair of relatively movable platen members for generating forces therebetween, at least two elongated columns between the platen members at least one of said platen members having a main frame supported relative to the columns at opposite ends of the one platen member and extending between said columns, a flat platen supported against the side of the main frame facing the other of the platen members, and a plurality of spaced load pads mounted on a surface of the main frame at locations facing the other platen member; wherein the load pads are spaced inwardly from the ends of the main frame, wherein the flat platen is supported on the main frame only through the load pads at said locations, wherein said flat platen has gusset means comprising walls fixed to the flat platen with planes perpendicular the plane of the flat platen to distribute loads across the flat platen, and wherein said walls are connected to the main frame only through the load pads supporting the flat platen.

Preferably said main frame includes a pair of rectangularly shaped tube members extending between the columns, said rectangularly shaped tube members having a greater dimension parallel to the length of the columns than transversely to that dimension, and in that draw bolt means is mounted in each of said tube members and threadably engaging said flat platen to clamp the flat platen against the load pads at the locations, each of said tube members of said main frame having a pair of said load pads thereon.

More specifically each of said tube members may have an internal bulkhead welded to at least portions of the walls of said tube members and aligning with the respective load pads on said tube members.

In any of the above arrangements said elongated columns are normally fixed relative to the one platen member to prevent movement of the columns relative to the one platen member in directions parallel to the columns when the columns are loaded to move the one platen member toward the other platen member, slidable guide means being provided for slidably receiving said columns on said other platen member, the one platen being free of guides relative to the other platen member except through said columns, and integrated clamp means and piston force generating means being provided comprising portions of said slidable guide means, whereby when said claimp means are clamped onto a respective column, the piston force generating means can be operated to apply loads on the columns to move the columns and the one platen member relative to the other platen member a desired distance.

Also in any of the above arrangements there are at least two columns at opposite ends of said main frame guidably mounted in a desired location relative to said main frame guidably mounted in a desired location relative to said main frame and each column being capable of transmitting forces for urging said main frame selectively toward and away from the other platen member, said other platen member having means slidably to guide the columns relative thereto, the one platen member

being slidably guided relative to the other platen member only through the columns, first means being provided for moving said one platen member toward and away from said other platen member, second means being mounted relative to said other platen member for clamping said columns at a desired axial location, and piston and cyliner means being operative when said second means have clamped onto said columns for permitting the generation of a force through said columns to said one platen member to urge said one platen member selectively toward or away from the other platen member.

According to a further feature of the invention said columns may be connected to said one platen member adjacent upper ends of the columns, and at a side of said main frame spaced farthest from the other platen member, the connection between the one platen member and the columns comprising means for permitting limited swivel movement of each column relative to said one platen member, and guide means on the one platen member spaced from the swivel connection for slidably receiving said columns to maintain the orientation of the columns relative to the one platen member, said guide means including release means for carrying lateral loads on said column up to a desired level, after which said release means will release and said guide means will permit additional movement of said columns relative to said one platen member.

The following is a description of some specific embodiments of the invention, reference being made to the accompanying drawings, in which:

Figure 1 is a front elevantional view of a hydraulic press made according to the present invention;

Figure 2 is a side elevational view of the device of Figure 1;

Figure 3 is a part sectional, part plan view taken as on line 3 -- 3 in Figure 1;

Figure 4 is an enlarged scale front elevational view of an upper ram shown in Figure 1, with parts in section and parts broken away;

Figure 5 is a sectional view taken as on line 5 -- 5 in Figure 4;

Figure 6 is a sectional view taken as on line 6 -- 6 in Figure 4; and

Figure 7 is a sectional view taken generally along line 7 -- 7 in Figure 2; and

Figure 8 is a typical graphical representation of the deflection of the platens under load.

A press assembly indicated generally at 15 comprises a bed or base indicated generally at 16 that is suitably supported onto a mounting member, such as a concrete base 17, that has a recess for accomodating the movable portions of the frame and which provides an adequate foundation for the press. The bed 16 is made substantially the same as an upper ram or movable crosshead 18.

The bed 16 supports a lower platen 20 mounted thereon and having an upwardly facing support surface, which is used to mount a mold part 21 which is shown only schematically. The movable ram 18 has an upper movable platen 22 that in turn mounts a second mold part 23 that also is shown only schematically. The platens, and the mounting thereof, will be more fully explained.

The ram 18 supports, and carries with it a plurality of smooth columns 26. The columns 26 (there are four as shown, but there could be only 2 laterally spaced apart, if desired) are slidably mounted with respect to the bed 16, and pass through hydraulic press power and guidance modules 30 at each of the four corners of the bed 16. The press power and guidance modules 30 slidably receive the columns 26, and have clamps therein which are operated in response to control signals to releasably clamp onto the columns 26 to hold the ram 18 in a desired position relative to the bed 16.

The pressing force is provided by power cylinders that are integrated in the modules 30, but the large mold opening and closing movements of the ram relative to the bed are controlled through a pair of hydraulic actuators indicated generally at 35, one at each of the opposite ends of the ram and bed. The actuators are fixed to the base 16, and have an extendable and retractable rod 36 that is coupled as shown at 37 to the ram 18, on each end of the ram, as can be seen in Figure 2. The coupling is a spring loaded connection that permits slight upward movement of the ram from the end of the actuator rods 36. The actuators 35 have internal pistons that are controlled through suitable servovalve controls indicated schematically at 40 that can be similar to those shown in U.S. Patent No. 4,457,684. The sequencing of the operations of the actuators 35, and the clamps and power pistons contained in the modules 30 can be carried out with a preset program.

Protective sleeves indicated generally at 42 and 43 are provided in the recess in base 17. Sleeves 42 and 43 are to protect the lower ends of columns 26 from damage when they protrude downwardly below the press power and guidance modules 30. A safety lock system 39 is provided on the ends of two of the columns to lock the ram against dropping accidentally from its open or raised position. As shown, a ring 39A has an internally keyed recess and is supported below one of the modules 30, and a complemental external key is on a member 39B rotatably mounted on the lower end of one column. The member 39B can be rotated about the axis of the column so the internal key slot in ring 39A and the key member 39B do

not align. Thus, if actuators 35 failed, the ram would be supported through safety member 39.

A suitable position transducer 46 is provided at each of the corners of the press adjacent each column to provide a signal representing the position of the upper platen 22 and provide precise position signals to controls 40 showing the relative positions of the lower platen 20 and the mold part carried thereby and the mold part carried on the upper platen 22. The position transducers thus can be used to control the actuators 35 and also to control the molding force generating actuators, as will be explained. The position of ram 18 will be known and can be controlled through the servocontrols 40.

Both the bed 16 and the ram 18 can he made in a fabricated construction designed to minimize deflection in use, as perhaps is best illustrated in Figures 3, 4 and 6.

As shown in Figure 3, where the upper ram 18 is broken away, platen 20 is shown in partial view. This comprises a T-slot lower platen on which the mold part 21 is mounted. The upper ran 18 comprises a pair of rectangular cross section ram frame tubes (see also Figure 6) 50 and 51, which are side-by-side and parallel, and extend laterally or side-to-side across the press between the columns 26 at opposite ends of the press. The ram frame tubes 50 and 51 can have suitable wall thicknesses, and may be made of suitable material so that they are of adequate strength. End supports 54 are supported on the vertically extending side walls of the tubes 50 and 51 at each end of the ram that extend fore and aft across the ends of the two ram frame tubes. Each end support includes a lower or bottom guide plate 54A, and an upper or top guide Plate 54B on each end support. The guide plates are supported on the vertically extending side walls of tubes 50 and 51. The top and bottom walls of the tubes are notched away to receive the top and bottom plates 54A and 54B and these plates are welded to the vertical walls of the cross tubes to carry vertical loads from the columns 26 directly into the tube side walls. Such a wall portion can be seen at 51B in Figure 4 and in dotted lines at 51B and 50B in Figure 3. The top and bottom guide plates 54A and 54B are also supported on vertically extending end plates 56, respectively, which are welded to the side walls of the tubes 50 and 51 to block the tube openings to make a solid assembly.

The lower guide plates 54A at each end of the ram have openings shown at 58 through which the respective columns 26 can pass. There is one of the openings 58 at the front and one at the rear or each of the plates 54A. Upper plates 54B have openings 59 therein through which the columns 26 also pass, and as can be seen the openings 58 and 59 can be of suitable size to provide for some lateral movement of the columns relative to the plates 54A and 54B.

The columns 26 are each supported with respect to the respective top plate 54B in a limited motion swivel assembly indicated generally at 62. This swivel assembly comprises a housing 63 for each of the columns, which is fixed to the top guide plate 54B. The housing 63 has a generally tapered or conical shaped opening 64 in the bottom thereof aligning with the openings 59 in the plates 54B. The opening 64 increases in size in downward direction. Each housing 63 can be attached to the respective plate 54B with a plurality of capscrews if desired. A cover 65 is held on the housing to enclose an internal chamber 67 in each housing 63. The upper ends of columns 26 each have a cap member 70 fastened thereto with suitable capscrews. Each cap member 70 has a shoulder that overlies an elastomeric swivel pad 66 located in each respective chamber 67. Each cap has a tapered outer peripheral edge surface 72, so that as the attached column 26 tends to move laterally there will be clearance to permit the cap 70 to tilt with respect to its respective chamber 67. The elastomeric pad is contained by the walls of the chamber 67. A suitable Belleville spring 73 is provided below the cover 65 of each chamber 67 and exerts a force between the top of the respective cap 70 and the cover 65 to keep the ram 18 held upwardly with each swivel pad 66 supporting its associated cap member 70 under this spring load.

A containment guide ring assembly 71 is attached to the lower side of the lower plate 54A, surrounding each of the openings 58 to provide a lower sliding guide of the column with respect to the ram until an excessive tilting of the ram. The containment guide ring assembly 77 includes a base ring 80 that is bolted to the underside of the lower guide plate 54A, with a separate one of the base rings 80 surrounding each of the columns 26. In addition, a shear ring 81 is then mounted to the base ring 80, and has an opening of smaller size than the base ring but still provides for an opening that slidably guides the respective column 26.

As shown in Figure 5, the shear ring 81 is held in place with a suitable number of shear bolts of desired size indicated at 82 that are threaded into the ring 80. The shear bolts 82 are selected so that they will shear before misalignment of the columns causes distortion of the platen or bending of the columns, but they are sufficiently strong so they carry normal guiding loads so that there is accurate guiding of the ram as the columns slide in the modules 30. Some shifting from side to side of the ram can be accomodated by the columns and the ram because the swivel pad 66 provides for some

misalignment. The ram base and column can move as a parallelogram slightly (side-to-side or fore and aft) without damage. The construction of the individual power press cylinders will accomodate some such movement as do the swivel assemblies 62.

The upper platen 22 is also shown in Figure 4, along with the supports for supporting it on the ram 18 (supporting lower platen 20 on bed 16 is done in the same way). Ram frame cross tubes 50 and 51 are each provided with interior bulkhead walls indicated at 86 and 87 adjacent opposite ends of each of the tubes 50 and 51. The bulkheads 86 and 87 are welded in place, and access can be obtained from the ends of the tubes 50 and 51 in order to permit welding the bulkheads in place. The bulkheads reinforce the walls of the tubes 50 and 51, and on each side of each of the bulkheads in each of the tubes there are two draw bolts indicated generally at 90 arranged in pairs. There are eight draw bolts on each of the tubes, four of them adjacent each of the bulkheads 86 and 87, respectively.

The draw bolts 90 extend downwardly through the lower wall of the respective tubes 50 and 51 and are threadably mounted in the platen 22, as shown in Figure 4, so that they are secured to the platen. The bolts 90 pass through openings in the upper and lower walls of the tubes 50 and 51, and are provided with nuts 91 at the upper side of the tubes so that the draw bolts 90 can be tightened.

The platen 22 is spaced away from the lower wall 50A and 51A of the respective ram frame tubes with load pads or blocks 93 and 94, respectively, that align with the respective bulk head 86 and 87. The platen is clamped against the load pads with the draw bolts 90. The load pads or blocks support the platen in a spaced relationship to the lower walls 50A and 51A. Platen 22 is provided with a plurality of welded-on upstanding flanges or gussets indicated at 96 and 97 that slide over the outer sides of the two ram frame tubes The gussets or walls 96 and 97 slip up alongside the respective tubes 50 and 51, and the platen 22 is forced against the bottom of the load pads 93 and 94 and clamped tightly in place. Additional bridging plates indicated at 98 are provided between the walls 97 in the space between the tubes 50 and 51 for rigidity. The compression loads that are exerted on the platen are carried to the load pads and are distributed across the platen 22 (and in the same way on platen 20) through the gussets or walls 96 and 97. The ends of the gussets 96 and 97 are trimmed off so that they clear the end guide assemblies of the ram.

In the construction shown, the ram is light weight because of the fabricated construction. Having the two load pads or blocks directly under the bulkheads, and using the fabricated cross tube ram main frame assembly, results in a very shallow deflection curve across the width of the platen, as shown in Figure 8.

In Figure 8, representation of a deflection curve for a conventionally supported ram and platen (clamped to the columns at its opposite ends) is shown at 99, and it can be seen that the maximum deflection is thus in the center of the platen and that the amount of deflection diminishes toward the clamps that clamp onto the columns. The deflection curve for the crosshead shown in Figure 4 under pressing loads is illustrated by curve 100 in Figure 8. It can be seen that with relation to the reference line indicated at 100A, at the center of the ram the deflection of the platen 22 or 20 is substantially the same as for a conventional supported ram. The deflection of the platens 20 or 22 reduces at the location of the load pads 93 and 94. At the outer edges of the present platen 20 or 22, deflection from the baseline 100A increases again because the outer edges of the platens 20 or 22 are not supported directly on the ram. The deflection of the platens from the baseline is not substantially diminished from conventional design, but the distortion or deflection from a "best" or average plane is diminished substantially. The distortion of the mold is therefore reduced, which is beneficial in compression molding operation.

The platen deflection from a best fit plane using a ram or crosshead of conventional design, conventionally supported on its outer end and having the same amount of steel or weight as the ram disclosed herein is greater than the present design.

The connection between the actuator rod 36 on each end of the ram 18, which is shown in Figure 2 at 37, provides a direct compression bearing collar 101 fixed to the respective top plate 54B. A plate 102 that is mounted onto the rod 36 bears against its respective collar and a spring 103 is mounted over a bolt 104 that is threaded into the respective rod 36, so that a spring load urges the plate 102 against the sleeve portion of collar 101. The weight of the ram is carried by the compression connection of the plate 102 against the sleeve portion of collar 101. The spring 103 can compress slightly to permit the ram to move away from the plate 102 under forces acting on the ram.

When the actuators 35 move the ram 18 up and down, the columns 26 slide in the press power and guidance modules 30, and as can be seen in Figure 7 in particular, the modules 30 each guide one of the columns independently of an associated power operated piston and clamp assembly.

One corner of the bed 16 is shown in Figure 7. The column 26 is slidably guided in a suitable bearing 110 that is mounted in a top wall 111 of an end support for the bed 16 that is constructed

similarly to the supports 54 for the ram. The construction is modified so that it will accomodate the needs of the power and guidance module. The guide bearing 110 insures that the column 26 is stably supported and guided relative to the bed 16. At the lower end of the module 30, a frame plate 115 is welded to the tubes that support the bed. Webs or wall 112 can be welded into the tubes forming the bed. Such a tube is indicated at 50D in Figure 7 and the bottom wall of tube 50D is shown at 113. Frame plate 115 is securely fastened in place, and is used for reacting molding forces. The frame plate 115 is a type of a ring, and can be square in outer configuration, and is supported by the vertical walls of the cross tube, such as 50D, that the frame is associated with. The frame plate 115 has a central opening 116 therein. A clamp assembly indicated generally at 120 is mounted between wall 112 and an outer end wall 121 that is welded in the end of the associated tube of the bed. The clamp assembly 120 fits within the opening 116 of the frame 115. The clamp assembly 120 is similar to that shown in U.S. Patent No. 4,509,910.

The clamp assembly 120 includes an outer housing 123 and an inner clamping sleeve 124. The clamping sleeve 124 has an interior surface 124A that slidably receives the column 26, until such time as a pressurized fluid is introduced into a chamber indicated at 127 that is defined between the outer housing 123 and the sleeve 124. The chamber is formed between interfitting or interlocking threads or wedges between the housing 123 and clamping sleeve 124. The interfitting members provide for a non-slip arrangement between these two clamp sections, and when fluid under pressure is introduced into the chamber 127, the sleeve 124 will be shrunk down onto the column 26 to positively clamp on the column. The sleeve 124 will contract radially, but cannot move axially relative to the housing 123. Fluid under pressure in the chamber 127 can be controlled through a servovalve 129 that is controlled by the servovalve controls 40.

In this form of the invention, the lower end of the clamp housing 123, which extends down below the level of the frame plate 115, has a piston 131 fixedly mounted thereon with suitable capscrews 132. The piston 131 fits within the interior of a cylinder assembly 133 that in turn is fixedly attached with suitable capscrews 134 to the frame plate 115. The cylinder assembly has an enlarged chamber indicated at 135 in which the head 131A of the piston 131 fits. The piston has a neck 131B that slidably fits within an opening in an annular flange or shoulder 137 on the interior of the cylinder 133.

The upper portion of the cylinder assembly 133, which surrounds the neck 131B has a port 138 leading thereto, and the lower chamber portion 135 has a port 140 leading thereto. The ports 138 and 140 are connected to a servovalve indicated at 142 so fluid under pressure can be provided selectively to the ports. Suitable seals are provided relative to the flange 137 of the cylinder and piston neck 131B, as well as between the outer surface of the piston head 131A and the interior wall of the chamber 135. Additionally, a lower wall 143 is supported on the cylinder 133 with suitable capscrews, and has a bearing 144 mounted thereon, that slidably receives the column 26 to guide the column 26 relative to the bed 16 independently of the piston 131. The bearings 110 and 144 are spaced apart axially along the columns 26 to very stably guide the columns independently of the piston. It can be seen that the central opening of the piston, indicated at 145, is of slightly larger diameter than column 26, so there can be some lateral shifting between the column 26 and the piston 131. The housing portion 123 of the clamp can thus move relative to the column 126 without binding the column against any portion of the bed 16. The piston floats and the bearings 110 and 144 provide independent slidable guides between the bed and the column.

The piston 131 and the cylinder assembly 133 form the power cylinder for molding or pressing forces, and also for stripping the mold. In molding sequence after changing the mold, the actuators 35 are controlled to close the mold, that is, the columns 26 slide through the modules 30 to proper position as controlled by feedback from the sensors 46. The clamp sleeves are clamped by pressure in chamber 127 to secure each housing 123 relative to the respective column 26.

Fluid under pressure is then introduced through the passageway 140, which will tend to move the head of the piston 131A away from the flange 137 formed in the cylinder, and this will then, because clamp sleeve 124 is clamped onto the column, cause the piston, clamp and column, and thus the entire ram 18 to be moved downwardly relative to the frame plate 115 and thus the bed 16. The piston will remain on the column 26 in fixed position and so will the clamp assembly. The force urges the ram downwardly from the mold closed position shown in dotted lines in Figure 1. The servocontrols 40 are provided for adequately loading the power actuators to provide the necessary molding forces, and each of the power actuators on each of the columns 26 will be actuated simultaneously to mold the part. The piston will be moved away from flange 137 toward cover 143 as the molding progresses.

Once the molding is completed, the molded part has to be stripped from the molds by pushing the mold sections apart. Pressure is removed from

port 140 after molding is completed, and pressure is applied to port 138. This creates a force acting against the lower end of the housing 123 relative to the upper surface of the flange 137 to urge the housing and piston back to its position shown in solid lines in Figure 7, and this will provide the stripping force. The entire ram 18 will be moved up (away from bed 16). There is a sliding seal between the outer surface of the housing 123 and the inner surface of the upper portion of the cylinder 133 to carry the pressure that is necessary.

Substantially improved performance is achieved with the overall press configuration because of the light weight, rigid fabricated ram that can be moved quickly by the actuator 35 to its mold closed position, and then the ability to provide for independent alignment of the bed relative to the sliding columns 26 through the use of the bushings 144 and 110 that are not connected to the piston that is used, so that the piston can float slightly with respect to the columns to permit radial shifting if necessary during the clamping operation.

Further, the particular clamp with the interfitting inner and outer members insures that there will be no slipping of the two parts of the clamp relative to each other and that the column 26 will be held securely by the clamp sleeve and the clamp housing, so that movement of the ram for molding is with respect to a fixed reference.

The assembly of the end columns (at least two, one at each end), the bed having the power and guidance modules for slidably receiving the columns and the ram held at the ends of the column, provides a press structure that does not require a large crosshead or crown. The columns are guided on the bed precisely and slight parallelograming can be tolerated without adversely affecting operation. There are no intermediate load reacting or guidance members.

Claims

1. A hydraulic press having a pair of relatively movable platen members (16, 18) for generating forces therebetween, at least two elongated columns between the platen members (16, 18) at least one (18) of said platen members having a main frame (50, 51, 54) supported relative to the columns (26) at opposite ends of the one platen member (18) and extending between said columns (26), a flat platen (22) supported against the side of the main frame facing the other of the platen members, and a plurality of spaced load pads (93, 94) mounted on a surface of the main frame (50, 51, 54) at locations facing the other platen member (16); characterised in that the load pads are spaced inwardly from the ends of the main frame (50, 51, 54), in that the flat platen (22) is supported on the main frame (50, 51, 54) only through the load pads (93, 94) at said locations, in that said flat platen has gusset means (96, 97) comprising walls (96, 97) fixed to the flat platen (22) with planes perpendicular the plane of the flat platen (22) to distribute loads across the flat platen (22), and in that said walls (96, 97) are connected to the main frame (50, 51, 54) only through the load pads (93, 94) supporting the flat platen (22).

2. A hydraulic press as claimed in Claim 1, characterised in that said main frame includes a pair of rectangularly shaped tube members (50, 51) extending between the columns (26), said rectangularly shaped tube members (50, 51) having a greater dimension parallel to the length of the columns (26) than transversely to that dimension, and in that draw bolt means (90) is mounted in each of said tube members (50, 51) and threadably engaging said flat platen (22) to clamp the flat platen (22) against the load pads (93, 94) at the locations, each of said tube members (50, 51) of said main frame (50, 51, 54) having a pair of said load pads (93, 94) thereon.

3. A hydraulic press as claimed in Claim 2, characterised in that each of said tube members (50, 51) has an internal bulkhead welded to at least portions of the walls of said tube members (50, 51) and aligning with the respective load pads (93, 94) on said tube members (50, 51).

4. A hydraulic press as claimed in any of Claims 1 to 3, characterised in that said elongated columns (26) are normally fixed relative to the one platen member (18) to prevent movement of the columns (26) relative to the one platen member (18) in directions parallel to the columns (26) when the columns (26) are loaded to move the one platen member (18) toward the other platen member (16), slidable guide means (30, 30) being provided for slidably receiving said columns (26) on said other platen member (16), the one platen member (18) being free of guides relative to the other platen member except through said columns (26), and integrated clamp means (120) and piston force generating means (131) being provided comprising portions of said slidable guide means (30), whereby when said claimp means (120) are clamped onto a respective column (26), the piston force generating means (131) can be operated to apply loads on the columns (26) to move the columns (26) and the one

platen member (18) relative to the other platen member (16) a desired distance.

5. A hydraulic press as claimed in any of Claims 1 to 4, characterised in that there are at least two columns (26) at opposite ends of said main frame (50, 51, 54) guidably mounted in a desired location relative to said main frame (50, 51, 54) and each column (26) being capable of transmitting forces for urging said main frame (50, 51, 54) selectively toward and away from the other platen member (16), said other platen member (16) having means slidably to guide the columns (26) relative thereto, the one platen member (18) being slidably guided relative to the other platen member (16) only through the columns (26), first means (35, 36) being provided for moving said one platen member (18) toward and away from said other platen member (16), second means (120) being mounted relative to said other platen member for clamping said columns at a desired axial location, and piston and cyliner means (131, 133) being operative when said second means (120) have clamped onto said columns for permitting the generation of a force through said columns (26) to said one platen member (18) to urge said one platen member (18) selectively toward or away from the other platen member (16).

6. A hydraulic press as claimed in any of claims 1 to 4, characterised in that said columns (26) are connected to said one platen member (18) adjacent upper ends of the columns (26), and at a side of said main frame (50, 51, 54) spaced farthest from the other platen member (16), the connection between the one platen member (18) and the columns (26) comprising means (62) for permitting limited swivel movement of each column (26) relative to said one platen member (18), and guide means (77) on the one platen member (18) spaced from the swivel connection (62) for slidably receiving said columns (26) to maintain the orientation of the columns (26) relative to the one platen member (18), said guide means (77) including release means (81, 82) for carrying lateral loads on said column (26) up to a desired level, after which said release means (81, 82) will release and said guide means (77) will permit additional movement of said columns (26) relative to said one platen member (18).

Patentansprüche

1. Hydraulische Presse mit einem Paar von relativ zueinander beweglichen Pressentischelementen (16, 18) zur Erzeugung von Kräften zwischen diesen, mindestens zwei langgestreckten Säulen zwischen den Pressentischelementen (16, 18), von denen mindestens eines (18) einen Hauptrahmen (50, 51, 54) aufweist, der relativ zu den Säulen (26) an gegenüberliegenden Enden des einen Pressentischelements (18) abgestützt ist und sich zwischen den Säulen (26) erstreckt, wobei ein flacher Pressentisch (22) gegen die Seite des Hauptrahmens abgestützt ist, die dem anderen Pressentischelement zugewandt ist, und mit einer Mehrzahl voneinander beabstandeten Lastkissen (93, 94), die auf einer Oberfläche des Hauptrahmens (50, 51, 54) an Stellen gelagert sind, die dem anderen Pressentischelement (16) zugewandt sind; dadurch gekennzeichnet, daß die Lastkissen von den Enden des Hauptrahmens (50, 51, 54) nach innen beabstandet sind, daß der flache Pressentisch (22) auf dem Hauptrahmen (50, 51, 54) nur durch die Lastkissen (93, 94) an diesen Stellen abgestützt ist, daß der flache Pressentisch eine Einsatzvorrichtung (96, 97) aufweist, die Wände an dem flachen Pressentisch (22) mit Ebenen senkrecht zur Ebene des flachen Pressentischs (22) befestigt sind, um Lasten über den flachen Pressentisch (22) zu verteilen, und daß die Wände (96, 97) mit dem Hauptrahmen (50, 51, 54) nur durch die Lastkissen (93, 94), die den flachen Pressentisch abstutzen, verbunden sind.

2. Hydraulische Presse nach Anspruch 1, dadurch gekennzeichnet, daß der Hauptrahmen ein Paar von rechteckig geformten Rohrteilen (50, 51) aufweist, die sich zwischen den Säulen (26) erstrecken, wobei die rechteckig geformten Rohrteile (50, 51) eine größere Abmessung parallel zur Länge der Säulen (26) als quer zu dieser Richtung aufweisen, und daß eine Zugstangenvorrichtung (90) in jeder der Rohrteile (50, 51) gelagert ist und im Gewindeeingriff mit dem flachen Pressentisch (22) ist, um den flachen Pressentisch (22) gegen die Lastkissen (93, 94) an diesen Stellen zu klemmen, wobei jedes Rohrteil (50, 51) des Hauptrahmens (50, 51, 54) ein Paar von Lastkissen (93, 94) auf diesem aufweist.

3. Hydraulische Presse nach Anspruch 2, dadurch gekennzeichnet, daß das Rohrteil (50, 51) ein innenliegendes Schott aufweist, das mindestens an Bereichen der Wände der Rohrteile (50, 51) angeschweißt ist und zu den betreffenden Lastkissen (93, 94) auf den Rohrteilen (50, 51) ausgerichtet ist.

4. Hydraulische Presse nach einem der Ansprüche 1 bis 3, dadurch gekennzeichnet, daß die langgestreckten Säulen (26) normal relativ zu dem einen Pressentischelement (18) befestigt sind, um die Bewegung der Säulen (26) relativ zu dem einen Pressentischelement (18) in Richtungen parallel zu den Säulen (26) zu verhindern, wenn die Säulen (26) beaufschlagt sind, um ein Pressentischelement (18) auf das andere Pressentischelement (16) zu zu bewegen, wobei Gleitführungsvorrichtungen (30, 30) für die gleitbewegliche Aufnahme der Säulen (26) auf dem anderen Pressentischelement (16) vorgesehen sind und das eine Pressentischelement (18) abgesehen von den Säulen (26) frei von Führungen relativ zu dem anderen Pressentischelement ist, und wobei integrierte Klemmvorrichtungen (120) und Kolbenkraft-Erzeugungsvorrichtungen (131) vorgesehen sind, die Bereiche der Gleitführungsvorrichtungen (30) aufweisen, wodurch, wenn die Klemmvorrichtungen (120) auf einer betreffenden Säule (26) aufgeklemmt sind, die Kolbenkraft-Erzeugungsvorrichtung (131) so betätigt werden kann, daß sie Belastungen an die Säulen (26) anlegt, um die Säulen (26) und das eine Pressentischelement (18) relativ zu dem anderen Pressentischelement (16) um eine gewünschte Entfernung zu bewegen.

5. Hydraulische Presse nach einem der Ansprüche 1 bis 4, dadurch gekennzeichnet, daß mindestens zwei Säulen (26) an gegenüberliegenden Enden des Hauptrahmens (50, 51, 54) gleitbeweglich in einer gewünschten Stelle relativ zu dem Hauptrahmen (50, 51, 54) gelagert sind, und jede Säule (26) dazu in der Lage ist, Kräfte für das gesteuerte Bewegen des Hauptrahmens (50, 51, 54) selektiv zu und weg von dem anderen Pressentischelement (16) zu übertragen, wobei das andere Pressentischelement (16) Mittel aufweist, um die Säulen (26) relativ zu ihm gleitbeweglich zu führen und das eine Pressentischelement (16) gleitbeweglich relativ zu dem anderen Pressentischelement (18) nur durch die Säulen (26) geführt ist, wobei eine erste Vorrichtung (35, 36), um den einen Pressentischelement (18) zu dem anderen Pressentischelement (16) und weg von diesem zu bewegen, zweiten Vorrichtungen (120), die relativ zu dem anderen Pressentischelement für das Festklemmen der Säulen an einer gewünschten axialen Stelle gelagert sind, und eine Kolben- und Zylindervorrichtung (131, 133) vorgesehen ist, die betätigbar ist, wenn die zweiten Vorrichtungen (120) auf den Säulen festgeklemmt sind, um die Erzeugung einer Kraft über die Säulen (26) zu dem ersten Pressentischelement (18) zu ermöglichen, um das eine Pressentischelement (18) selektiv zu dem anderen Pressentischelement (16) oder weg von diesem zu drücken.

6. Hydraulische Presse nach einem der Ansprüche 1 bis 4, dadurch gekennzeichnet, daß die Säulen (26) mit dem einen Pressentischelement (18) angrenzend an die oberen Enden der Säulen (26) und an einer Seite des Hauptrahmens (50, 51, 54) soweit wie möglich von dem anderen Pressentischelement (16) beabstandet verbunden sind, wobei die Verbindung zwischen dem einen Pressentischelement (18) und den Säulen (26) Mittel (62) aufweist, mit welchen eine begrenzte Schwenkbewegung jeder Säule (26) relativ zu dem einen Pressentischelement (18) möglich ist, sowie eine Führungsvorrichtung (77) auf dem einen Pressentischelement (18), die von der Schwenkverbindung (62) zur gleitbeweglichen Aufnahme der Säulen (26) beabstandet ist, um die Ausrichtung der Säulen (26) relativ zu dem einen Pressentischelement (18) aufrechtzuerhalten, wobei die Führungsvorrichtung (77) eine Freigabevorrichtung (81, 82) aufweist, mit welcher seitliche Belastungen auf die Säule (26) bis zu einem gewünschten Wert aufnehmbar sind, nach welchem die Freigabevorrichtung (81, 82) auslöst und die Führungsvorrichtung (77) die zusätzliche Bewegung der Säule (26) relativ zu dem einen Pressentischelement (18) erlaubt.

Revendications

1. Presse hydraulique possédant une paire de plateaux (16,18) mobiles l'un par rapport à l'autre, destinés à développer des forces entre eux, au moins deux colonnes de forme allongée prévues entre les plateaux (16,18), au moins un premier (18) desdits plateaux ayant un châssis principal (50,51,54) qui prend appui sur les colonnes (26) aux extrémités opposées de ce plateau (18) et qui s'étend entre lesdites colonnes (26), un plateau plat (22) qui prend appui sur la face du châssis principal qui regarde vers l'autre desdits plateaux, et une pluralité de tampons de charge espacés (93,94) montés sur une surface du châssis principal (50,51,54) en des endroits qui regardent vers l'autre plateau (16) ; caractérisée en ce que les tampons de charge sont espacés vers l'intérieur par rapport aux extrémités du châssis principal (50,51,54), en ce que le plateau plat (22) ne prend appui sur le châssis principal (50,51,54) que par l'intermédiaire des tampons de charge (93,94) auxdits endroits, en ce que ledit plateau plat possède des moyens (96,97)

formant gousset, qui comprennent des parois (96,97) fixées au plateau plat (22), dans des plans perpendiculaires au plan du plateau plat (22) pour distribuer les charges sur l'étendue du plateau plat (22) et en ce que lesdites parois (96,97) sont reliées au châssis principal (50,51,54) uniquement par l'intermédiaire des tampons de charge (93,94) qui supportent le plateau plat (22).

2. Presse hydraulique selon la revendication 1, caractérisée en ce que ledit châssis principal comprend une paire d'éléments tubulaires (50,51) de forme rectangulaire, qui s'étendent entre les colonnes (26), lesdits éléments tubulaires (50,51) de forme rectangulaire ayant une plus grande dimension dans la direction parallèle à la longueur des colonnes (26) que dans la direction transversale à cette dimension, et en ce que des moyens (90) formant vis tirante sont montés dans chacun desdits éléments tubulaires (50,51) et en prise par vissage avec ledit plateau plat (22) pour serrer le plateau plat (22) contre les tampons de charge (93,94) auxdits endroits, chacun desdits éléments tubulaires (50,51) dudit châssis principal (50,51,54) portant une paire desdits tampons de charge (93,94).

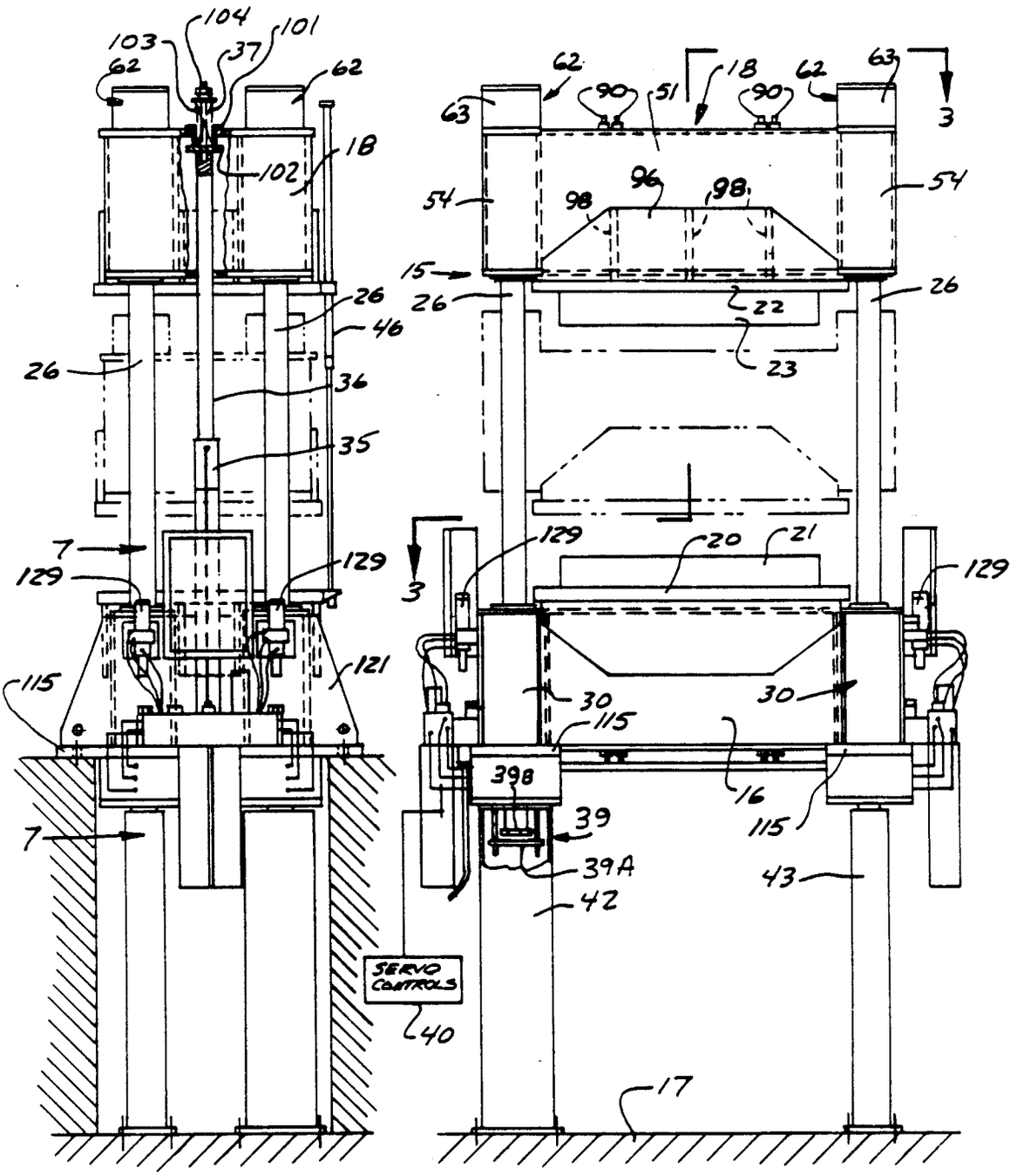
3. Presse hydraulique selon la revendication 2, caractérisée en ce que chacun desdits éléments tubulaires (50, 51) possède une cloison intérieure soudée au moins à des parties des parois desdits éléments tubulaires (50,51) et alignée sur les tampons de charge respectifs (93,94) desdits éléments tubulaires (50,51).

4. Presse hydraulique selon une quelconque des revendications 1 à 3, caractérisée en ce que lesdites colonnes (26) sont normalement fixes par rapport au premier plateau (18) pour empêcher les colonnes (26) de se déplacer par rapport au premier plateau (18) dans des directions parallèles aux colonnes (26) lorsque les colonnes sont chargées pour déplacer le premier plateau (18) vers l'autre plateau (16), des moyens de guidage coulissants (30), étant prévus sur ledit autre plateau (16) pour recevoir lesdites colonnes (26) à coulissement, ledit premier plateau (18) n'étant pas guidé par rapport à l'autre plateau, sauf par lesdites colonnes (26) et il est prévu des moyens de blocage intégrés (120), et des moyens générateurs de force à piston (131) qui comprennent des parties desdits moyens de guidage coulissants (30), de sorte que, lorsque lesdits moyens de blocage (120) sont bloqués sur une colonne (26) respective, les moyens générateurs de force à piston (131) peuvent être mis en action pour appliquer des charges aux colonnes (26) pour mettre les colonnes (26) et le premier plateau (18) en mouvement par rapport à l'autre plateau (16) sur une distance désirée.

5. Presse hydraulique selon une quelconque des revendications 1 à 4, caractérisée en ce qu'il y a au moins deux colonnes (26) à des extrémités opposées dudit châssis principal (50,51,54), qui sont montées de façon guidée en un endroit désiré par rapport audit châssis principal (50,51,54) et chaque colonne (26) étant capable de transmettre des forces pour tendre à rapprocher ou éloigner sélectivement ledit châssis principal (50,51,54) dudit autre plateau (16), ledit autre plateau (16) comportant des moyens servant à guider les colonnes (26) en mouvement coulissant par rapport à lui, le premier plateau (18) étant guidé en mouvement coulissant par rapport audit autre plateau (16) uniquement par l'intermédiaire des colonnes (26), des premiers moyens (35,36) étant prévus pour rapprocher ou éloigner ledit premier plateau (18) dudit autre plateau (16), des seconds moyens (120) étant montés par rapport audit autre plateau pour bloquer lesdites colonnes dans une position axiale désirée, et des moyens a piston et cylindre (131,133) entrant en action lorsque lesdits seconds moyens (120) se sont bloqués sur lesdites colonnes pour permettre d'appliquer une force audit premier plateau (18) par l'intermédiaire desdites colonnes (26) pour tendre sélectivement à rapprocher ou à éloigner ledit plateau (18) dudit autre plateau (16).

6. Presse hydraulique selon une quelconque des revendications 1 à 4, caractérisée en ce que lesdites colonnes (26) sont reliées audit premier plateau (18) dans la région adjacente aux extrémités supérieures des colonnes (26) et sur la face dudit châssis principal (50,51,54) qui est la plus éloignée de l'autre plateau (16), la liaison entre le premier plateau (18) et les colonnes (26) comprenant des moyens (62) servant à permettre un mouvement de pivotement limité de chaque colonne (26) par rapport audit premier plateau (18), et des moyens de guidage (77) prévus sur ledit premier plateau (18) qui sont espacés de ladite liaison pivotante (62) pour recevoir lesdites colonnes (26) à coulissement pour maintenir l'orientation des colonnes (26) par rapport audit premier plateau (18), lesdits moyens de guidage (77) comprenant des moyens à déclenchement (81,82) destinés à transmettre des charges latérales à

ladite colonne (26) jusqu'à un niveau désiré, après quoi lesdits moyens à déclenchement (81,82) se déclenchent et lesdits moyens de guidage (77) permettent un mouvement additionnel desdites colonnes (26) par rapport audit premier plateau (18).


104
103
101
37
62
62
62
102
18
26
46
26
36
35
7
129
129
121
115
7
SERVO CONTROLS
40
62
90
51
18
90
62
63
63
3
54
98
96
98
54
15
26
22
26
23
129
20
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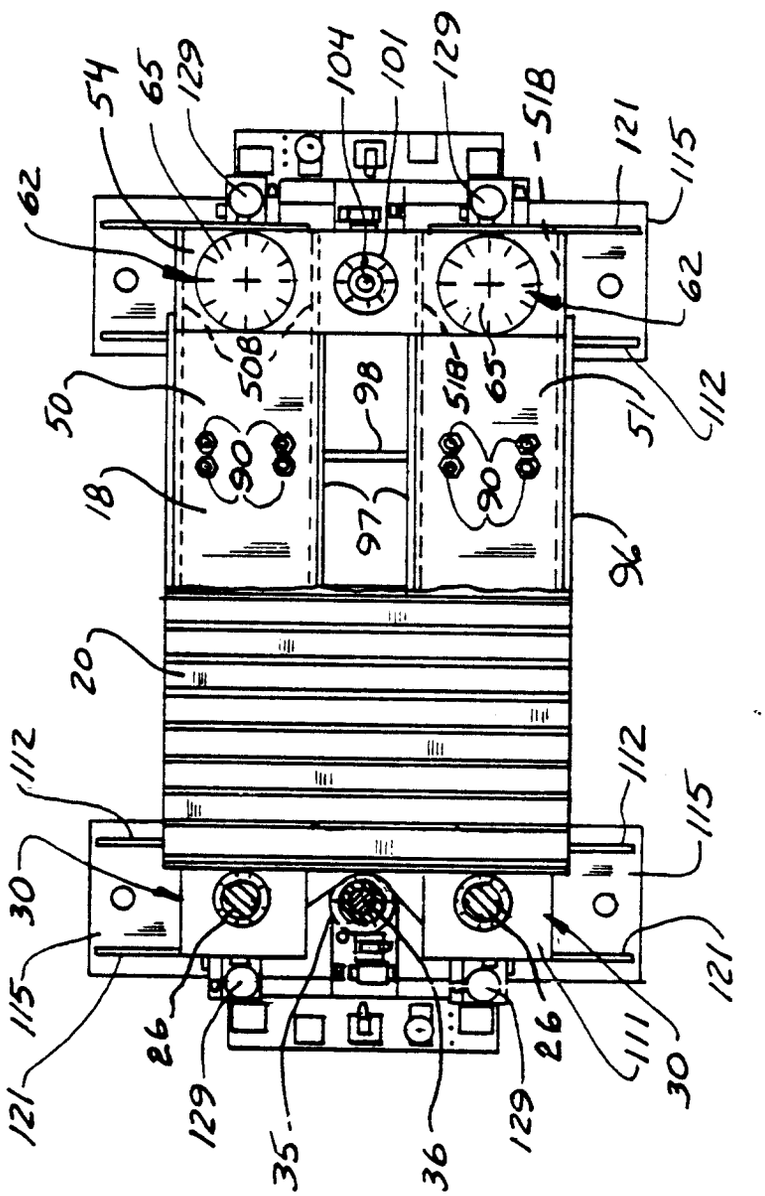
115
398
39
39A
42
16
115
43
17

FIG.2 FIG.1

FIG. 3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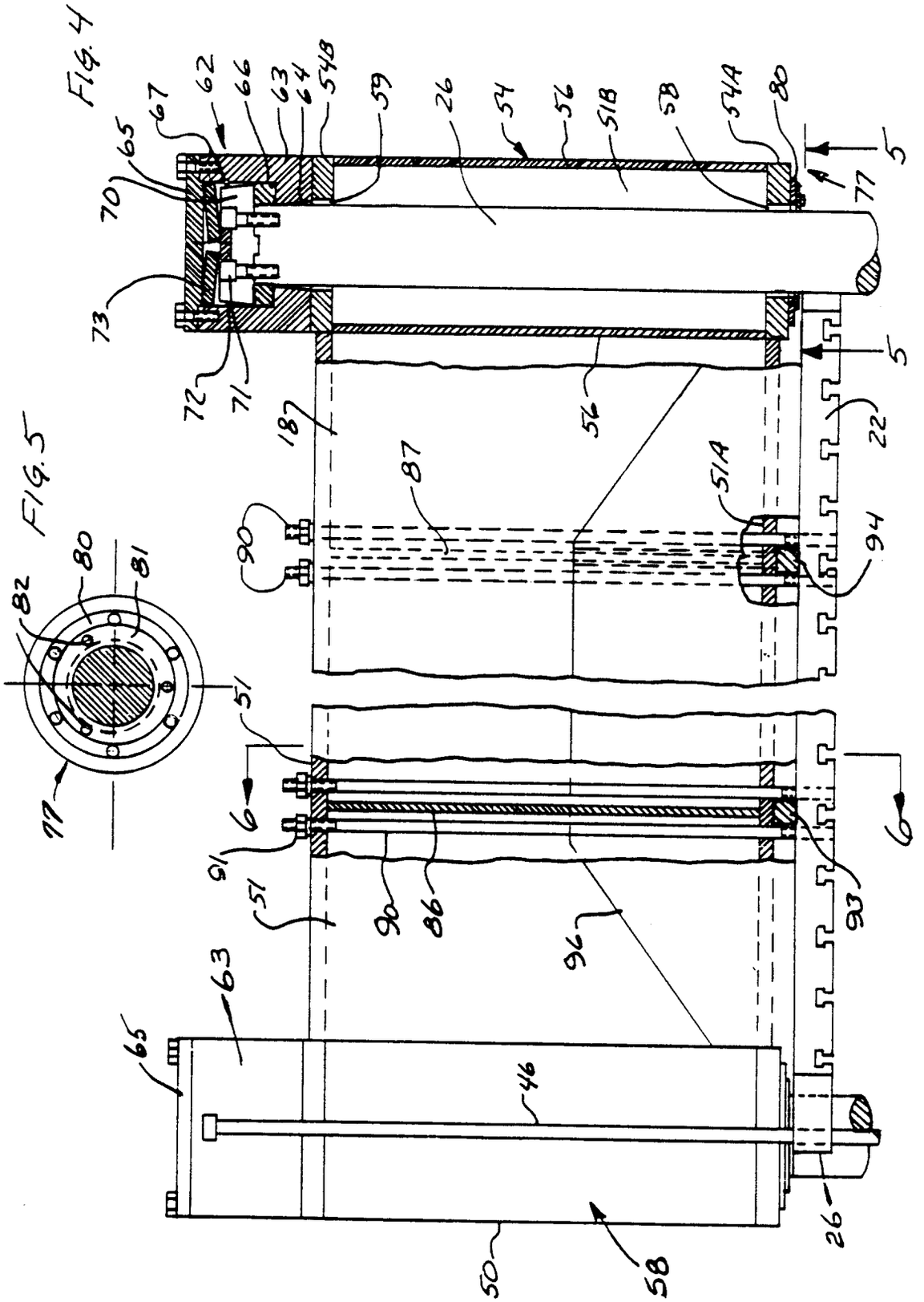
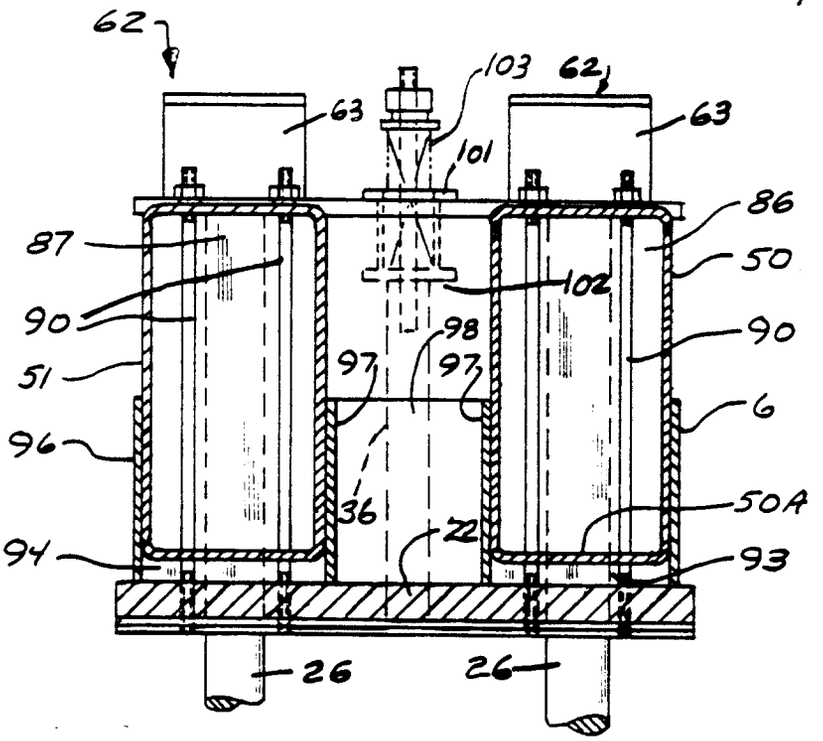


FIG. 4
FIG. 5
62
66
63
64
54B
59
26
54
56
51B
58
54A
80
67
65
70
73
72
71
187
56
87
90
51A
94
22
77
5
5
82
80
81
77
51
6
6
91
51
90
86
96
93
63
65
46
26
50
58

FIG. 6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63
63
101
86
87
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96
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50A
22
94
93
26
26

FIG. 8

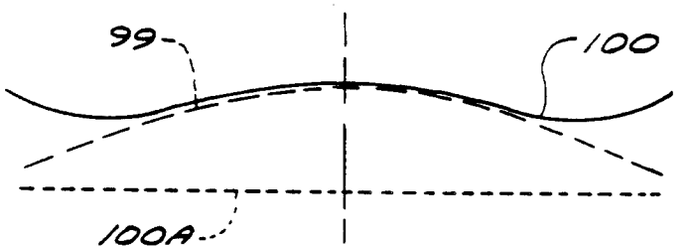
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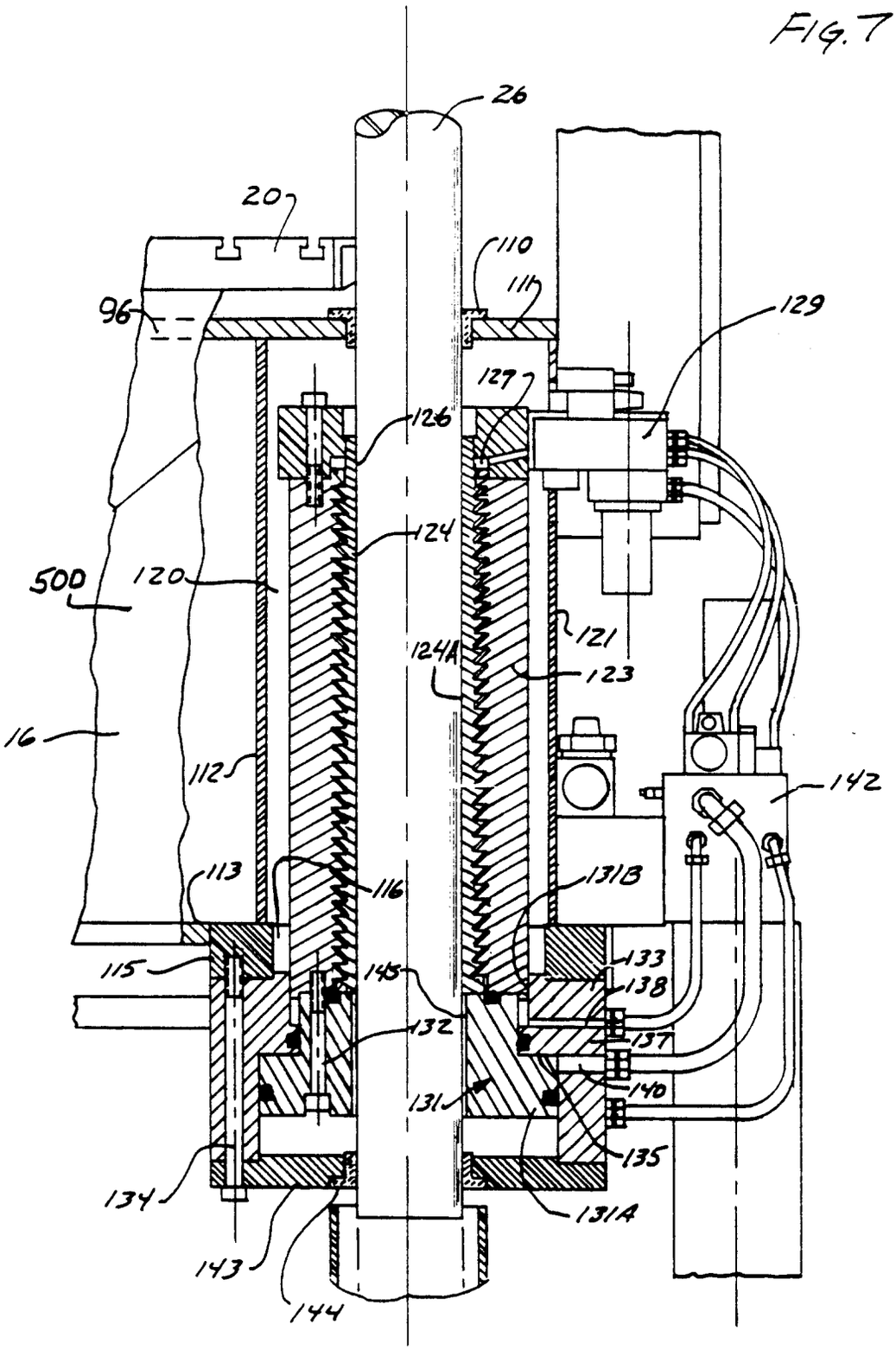
FIG. 7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124A
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131B
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145
133
138
132
137
140
131
135
134
131A
143
144