

April 18, 1961

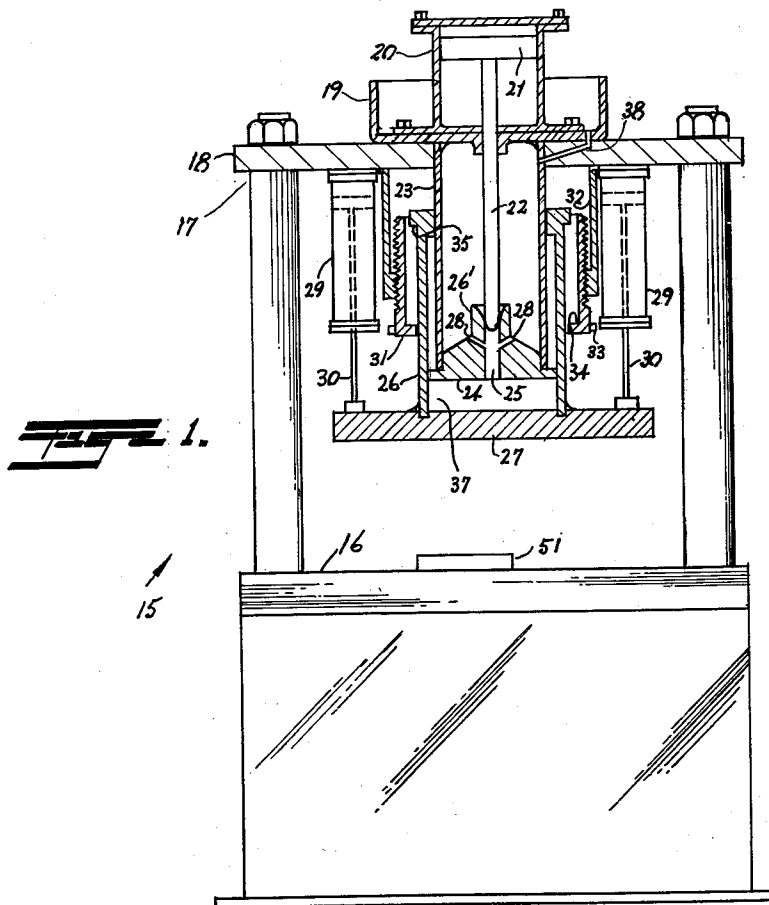
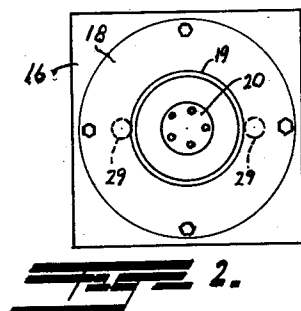
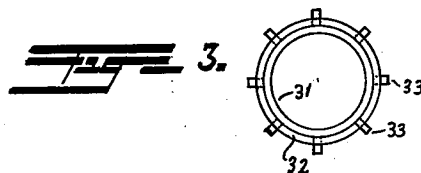
J. S. SWICK ET AL

2,980,013

HYDRAULIC PRESS APPARATUS

Filed April 29, 1959

3 Sheets-Sheet 1



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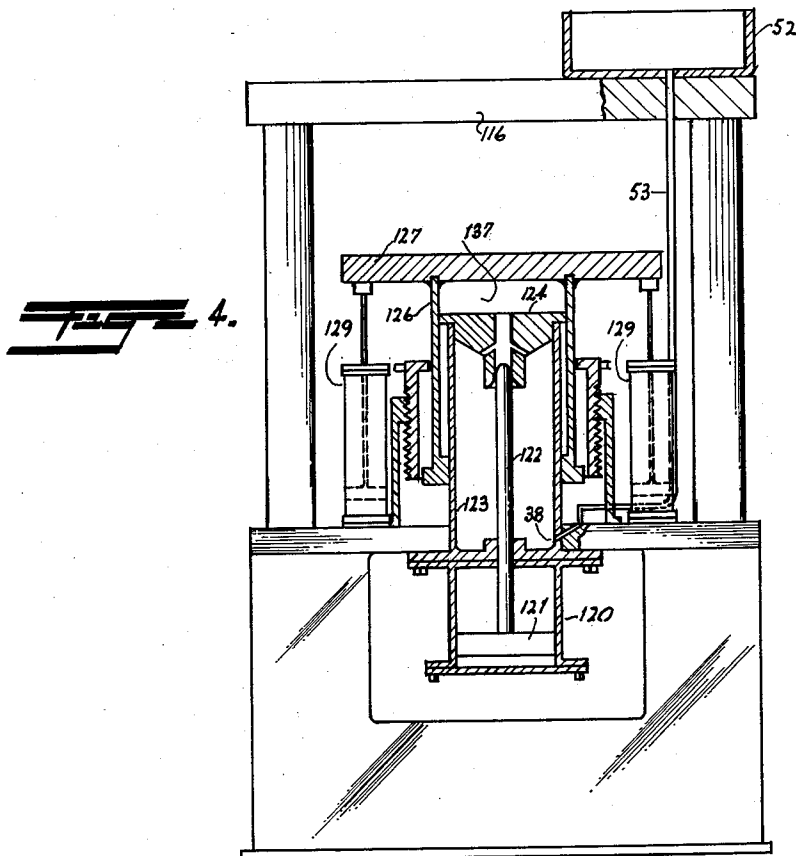
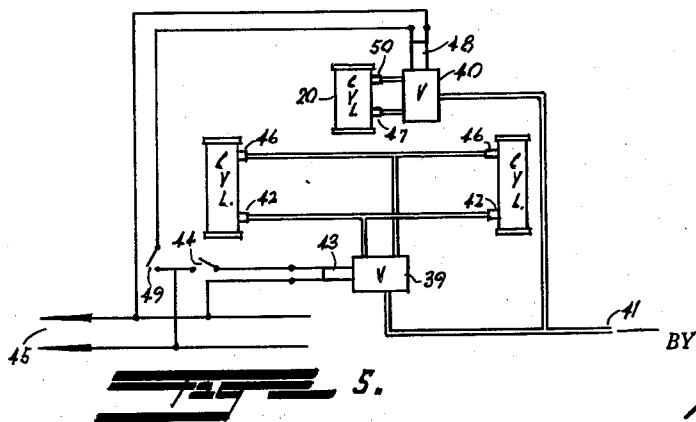
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HYDRAULIC PRESS APPARATUS

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3 Sheets-Sheet 2



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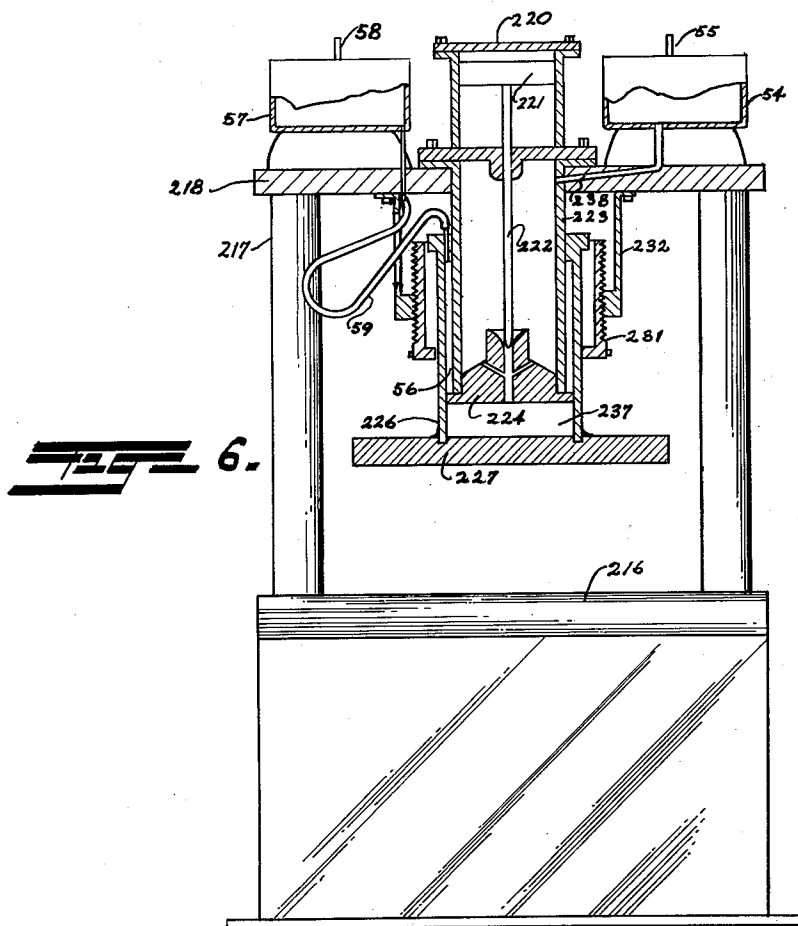
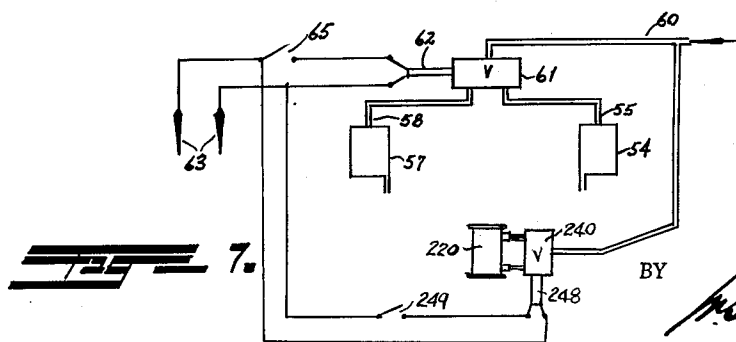
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3 Sheets-Sheet 3



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2,980,013

HYDRAULIC PRESS APPARATUS

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10 Claims. (Cl. 100—257)

The present invention relates to hydraulic presses and more particularly to the type including pressure-multiplying means to act on the part which presses the work against the bed, work-supporting table or other part with which it cooperates.

An object of this invention is to provide a novel and improved press of the character mentioned, whose work-pressing part, usually a platen or tool, is first brought from a fixed rest position, into contact with the supported work and thereupon the pressure-multiplying means is actuated to force the work-pressing part against the work; such means requiring no adjustment whatever, regardless of the distance the work-pressing part need be moved to come to the work.

Another object thereof is to provide a novel and improved press of the kind described, affording means to determine and adjust the extent of movement the work-pressing part is to be permitted when acted on by the pressure-multiplying means. This is to control the extent of compression of the work or the depth the tool reaches into the work, or both, as the case may be. These are merely given as examples of the machine's function, and of course all possible press uses shall be deemed included where a predetermined minimum distance is to be permitted or desired between said machine parts which respectively support and press the work.

A further object of this invention is to provide a novel and improved hydraulic press having the mentioned attributes, requiring a two-section, telescopic, liquid-holding casing, one section of which acts as a storage for the liquid supply in cooperation with the second section whose capacity varies upon relative movement of the sections and yet needs to be constantly filled in order to coact with a pressure-intensifying piston, affording a construction so that said sections are in the relationship of piston and cylinder, one of which serves as the work-pressing member and affording means to relatively move said sections in the nature of piston and cylinder so that the work-pressing member is transported to and from the work, as the respective steps in a cycle of operation before and after the operation of the pressure intensifying means to impose a relatively high pressure of the work-pressing member against the work.

Still another object of this invention is to provide a novel and improved hydraulic press apparatus of the character described, which is simple in construction, reasonable in cost, easy to understand and operate and efficient in carrying out the purposes for which it is designed.

Other objects and advantages will become apparent as this disclosure proceeds.

For the practice of this invention, one form it may assume, is to have two upright containers in liquid-tight, telescopically sliding relation. The inner one depends from the frame and serves as a storage chamber for oil or other suitable liquid. The outer one, serving as the work-pressing member, is movable towards and away from a work-supporting member below it. Said containers are made communicative by an opening in the bottom wall of the inner one, but there is a rod mounted for

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movement from within said inner container, to enter and close said opening and contact the liquid cached in the outer container and apply pressure thereto. This rod, which really acts as the pressure-intensifying piston, may be the piston rod of a double-acting cylinder operated by any desired medium, which may be compressed air. The floor area of the outer container is many times the cross-sectional area of said rod; such relation being of a predetermined ratio. It is evident that the force applied to the work-pressing member for action against the work, would be the force applied by said cylinder, multiplied by such ratio.

The lowering of the work-pressing member to the work, and then upon the completion of a cycle of operation of said cylinder, the raising of said member from the work, may be accomplished by any suitable means and as an example, double-acting air cylinders may be used for such purpose. Adjustable means to define the extent of movement of the work-pressing member after it is brought to contact the work, is provided by having a fixed nut structure threadedly engaging a tubular bolt structure, both of which encircle said containers. There are cooperating stop flanges on the outer container and said tubular bolt which act as stop means.

As a modification, the aforescribed embodiment may be inverted so that the pressing operation is upwardly instead of downwardly. This as will be shown, utilizes a reservoir to accomplish filling the space which needs to be filled for the apparatus to function. In the first described embodiment, gravity performed such required filling.

As a further modification, relative movement of the mentioned containers to bring the work-pressing one to and from the work, can be accomplished by having an annular space between them as will be explained and by employing selectively controlled air-pressure means acting on separate reservoirs connected respectively to said annular space and to the interior of the fixed container.

The simplicity of structure required for the practice of this invention is of special importance because essentially only three principal parts are necessary, namely, a two-section, telescopic, liquid-holding casing having a wall across its inner section which is provided with a hole and a pressure-applying piston to close said opening and impinge the liquid cached in the other section whose available volume varies, depending on the relative movement of said sections.

A detailed description will now be given of several embodiments of this invention and their mode of operation will be fully explained.

In the accompanying drawings forming part of this specification, similar characters of reference indicate corresponding parts in all the views.

Fig. 1 is a front elevational view of a press embodying the teachings of this invention, shown partly in section.

Fig. 2 is a top plan view thereof, drawn to a reduced scale.

Fig. 3 is a top plan view of the tubular screw member of the stop adjustment device which is included in the embodiment illustrated in Fig. 1.

Fig. 4 is a similar to Fig. 1, but shows the press apparatus inverted to operate on the up stroke. In Fig. 1, the press operates on the down stroke.

Fig. 5 is a diagrammatic view showing the electrical control circuit for the valves operating the air cylinders included in the foregoing embodiments and the air-under-pressure supply piping connected to said valves.

Fig. 6 is like Fig. 1, but of a modified embodiment which will be explained.

Fig. 7 is a diagrammatic view like Fig. 5, for the apparatus shown in Fig. 6.

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In the drawings which show preferred embodiments of this invention, the numeral 15 designates generally an hydraulic press whose horizontal bed or work-supporting member is designated by the numeral 16 and whose frame is denoted generally by the numeral 17, includes the horizontal plate 18 spaced over the bed 16. Atop this plate 18, is a reservoir 19 which is an open-top receptacle holding the removably secured, vertically positioned, double-acting air cylinder 20 whose piston 21, has its piston rod 22 extending downwardly into the fixed container 23 which depends from the plate 18 directly over the bed 16 of the machine 15. The bottom wall 24 of this fixed container 23, has a central hole 25 there-through whereby said container 23 is communicative with the interior of the outer slidable container indicated generally by the numeral 26. These containers 23 and 26 are in liquid-tight, telescopic relation; the bottom wall 27 of the outer container 26, being the platen of the press. In order that the piston rod 22 shall have a slide bearing 26', there need be the slant holes 28 to make said containers 23, 26 communicative via the hole 25. The piston rod 22 slidably fits said hole 25 and when said rod is moved downwardly past the holes 28, it acts as a valve cutting off the flow of oil or other suitable liquid housed in the container 23 from entering into the movable container 23. To move such container 26 down and up so that the platen 27 is brought to any work positioned on the bed 16 and away therefrom, there are the identically operating, vertically positioned, double acting air cylinders 29, fixed to and extending downwardly from the plate 18. The rods 30 of the pistons of these cylinders 29, are connected to the platen 27. Fixed to the frame 17, there is a nut structure 32 which is in threaded engagement with a hollow screw 31; both said nut and screw being concentrically about the containers 23 and 26. To be able to turn said screw, it has the outwardly extending knobs 33 at its lower end where it also has an inward flange 34 which cooperates with an outward flange 35 on the open end of the movable container 26, to stop the downward movement of such container which carries the platen 27.

The container 23 serves as a storage for oil so that the chamber 37 which is of varying capacity, is constantly fully filled with such oil, and since it is best that some of the oil shall also always be within the container 23, regardless of how large the chamber 37 may be, an overflow reservoir need be provided in many instances, to receive oil from the storage container 23 when the said chamber 37 is a minimum. This is provided for by the receptacle 19 which is communicatively connected to the upper end of the storage container 23 by the duct 38. It is evident that while the holes 28 are unobstructed by the rod 22, the oil supply is free to flow between the storage container 23 and the chamber 37, in either direction.

One system for controlling the operation of the air cylinders 20 and 29, is shown in Fig. 5. Here, the numerals 39 and 40 denote four-way valves, each connected to a compressed air supply entering the piping system at 41. The valve 39 is normally set to deliver to the lower ports 42 of the cylinders 29 so that the platen 27 is in raised position. This valve 39 is operated by an electrical solenoid 43, which when actuated upon closing the switch 44 in its circuit with the power lines 45, will direct the air flow to the upper ports 46 of the cylinders 29, so that the platen 27 is lowered. Upon opening the switch 44, the said valve 39 will again be automatically set to direct the the air flow to the lower ports 42, whereupon the platen 27 will be raised. When these valves deliver compressed air to one end of a cylinder, they connect the other end to atmosphere. This type of valve is well known and hence needs no further description.

The valve 40 is normally set to deliver the compressed air supply to the lower port 47 of the cylinder 20 so that the rod 22 is in its raised position as shown in Fig. 1, where the holes 28 are unobstructed. This valve 40 is

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operated by the electrical solenoid 48, which when actuated upon closing the switch 49 in its circuit with the power lines 45, will direct the air flow to the upper port 50 of the cylinder 20, so that the rod 22 is lowered to obstruct the holes 28 and press the oil in the completely filled chamber 37. Upon opening the switch 49, said valve 40 will again be automatically set to direct the air flow to the lower port 47, whereupon said rod 22 will be raised to clear the holes 28.

To place the machine of Fig. 1 in condition for operation, at which time, the switches 44 and 49 are open and a compressed air supply is entered at 41, a piece of work 51 to be acted on by the platen 27, is set on the bed 16 and the screw 31 is lowered so as not to interfere with the downward movement of the platen. Now, the switch 44 is closed, whereupon the platen 27 will be lowered until it rests on the work 51. The screw 31 is then adjusted to determine the permitted extent of further downward movement of the platen 27 upon the application of a substantially large pressure in a downward direction on the said platen, caused by the downward movement of the rod 22. After such adjustment of the screw 31 is made, the switch 49 is closed, causing the downward movement of the platen 27 to operate on the work 51 until it is stopped when the flanges 34 and 35 meet. Now, both of the switches 44 and 49 are opened, whereby both the platen 27 and the rod 22 again are raised to their initial rest position as shown in Fig. 1.

It is to be noted that upon forcing the piston rod 22 downward to close the holes 28 and apply pressure on the oil filling the chamber 37, that said rod acts as a pressure intensifier, because the downward pressure then acting on the platen 27 is as many times the downward thrust of said rod 22, as the area of the floor of the outer receptacle 26 is compared to the cross-sectional area of such rod 22. It is therefore advisable that the cylinder 20 and its associated piston and rod 22, be exchangeable for others operating with greater or lesser operating thrust, so that a suitable pressure be attained for operation of the platen 27 as the requirements of the work to be done, demands.

The machine of Fig. 1 may be so constructed that the platen shall operate on the work by movement upwardly thereto. Such modified embodiment is shown in Fig. 4, which is essentially the machine of Fig. 1 inverted, except that the reservoir 19 is retained in its place in Fig. 1. Hence, in Fig. 4, such reservoir which is designated by the numeral 52 is connected by pipe 53 to the duct 38. All other components of Fig. 4 which correspond to the components of Fig. 1, are numbered with the same numerals as in Fig. 1 increased by 100. The same control system as shown in Fig. 5 is used for this modified embodiment, and the mode of operation is identical as described for Fig. 1, except that all reference to movements and positions are reversed, but the container relation as to which is inside and which is outside, remains the same.

In the modified embodiment shown in Fig. 6, the structure of Fig. 1 is retained, except that the cylinders 29 are omitted because other provision is made for moving the platen to and from the work on the bed of the machine. Also, in place of the reservoir 19 of Fig. 1, there is a casing 54 having an inlet 55 for compressed air to play on the oil contained in such casing, and the annular space 56 is communicatively connected by the flexible hose 59 to another raised casing 57 having the inlet 58 for compressed air to act on the oil therein contained. All components of Fig. 6 which correspond to the components of Fig. 1, have the same numerals as in Fig. 1, increased by 200. It is evident that upon application of air under pressure at 55 when the platen 227 is in raised position, will force oil from the casing 54 into the chamber 237 and lower the platen to the bed, and that upon application of pressured air at 58 when the platen 227 is at its lowered position, will force oil from the casing 57 into the annular space 56 and thereby raise the platen.

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The control system for this, shown in Fig. 7, will now be explained.

The system illustrated employs the four-way valves 61 and 240, each of which is connected to control a compressed air supply furnished at 60. The valve 61 is normally set to deliver to the port 58 so that the platen 227 is in its raised position as shown in Fig. 6. Said valve 61 is operated by an electrical solenoid 62, when actuated by closing the switch 65 in its circuit with the power lines 63, will direct the air flow to the port 55 so that the platen is lowered. Upon opening the switch 65, said valve 61 will again be automatically set to direct the air flow to the port 58, whereupon the platen will be raised. The connections of the valve 240 to the cylinder 220 and its operation by the electrical solenoid 248 controlled by the switch 249, is the same as set forth for the circuit they correspond to in the system shown in Fig. 5. When the valve 61 delivers compressed air to the port 58, it connects the port 55 to atmosphere and when it delivers to the port 55, it connects the port 58 at atmosphere. All the valves 39, 40, 61 and 240 are of identical construction.

It is to be noted that where the stroke of travel of the platen 27 to the work 51 in the embodiment shown in Fig. 1, is not too great, that all the liquid necessary for the operation of the machine is confined within the containers 23 and 26, and hence in such instance, the reservoir 19 can be dispensed with. The same condition is true for the embodiment shown in Fig. 6, where the reservoir 54 may be dispensed with, in which event, the compressed air supply would be entered directly into the container 223 through the passage 238. It is also to be noted that the extensive pressure produced by action of the intensifying piston, the rod 22, exists only within the movable container. This simplifies the design for strength of the fixed container, which serves principally as storage for the operating liquid supply, and as a track for the movable container to move along. Except for the compressed air supply needed to operate in the specific embodiments illustrated, the apparatus taught by this invention is self-contained.

This invention is capable of numerous forms and various applications without departing from the essential features herein disclosed. It is therefore intended and desired that the embodiments thereof herein be deemed merely illustrative and not restrictive and that the patent shall cover all patentable novelty herein set forth; reference being had to the following claims rather than to the specific description herein to indicate the scope of this invention.

We claim:

1. In an hydraulic press apparatus of the character described, a frame having a work-supporting member, two containers, one within the other in liquid-tight sliding relation forming a telescopic structure; one of said containers being fixed to the frame; said telescopic structure being so positioned that upon extension thereof by movement of the movable container, said movable container moves towards the work-supporting member; the movable container being movable towards said work-supporting member a distance more than sufficient to contact work on said work-supporting member and then in the opposite direction to leave such work respectively; the inner container having an opening connecting the interiors of said containers, a rod positioned in the inner container, mounted for movement to close said opening and continue such movement whereby said rod slides in said opening in liquid-tight relation therewith and means to move said rod to close said opening and slide therein after it has closed said opening and to move said rod back to open said opening; the cross-sectional area of the interior of the outer container being comparatively large and the cross-sectional area of the portion of said rod which operates in said opening being comparatively small whereby the movable container serves as the press-

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ing piston to act on work set on the work-supporting member and said rod serves as the intensifying piston of the press; the inner container being a storage for liquid which is the working fluid.

2. An hydraulic press apparatus as defined in claim 1, wherein the telescopic structure is above the work-supporting member and including a reservoir for liquid communicatively connected with the inner container whereby liquid from within said reservoir will flow into the inner container by the action of gravity.

3. An hydraulic press apparatus as defined in claim 1, wherein the telescopic structure is below the work-supporting member and including a reservoir for liquid communicatively connected with the inner container whereby liquid from within the reservoir will flow into the inner container by the action of gravity.

4. A hydraulic press apparatus as defined in claim 1, including adjustable stop means to limit the extension of the telescopic structure.

5. An hydraulic press apparatus as defined in claim 1, including a nut threadedly engaging a tubular screw; the telescopic structure being inward of said tubular screw; said nut being fixed to the frame; said tubular screw having an inward flange and the outer container having an outer flange which comes into contact with said inward flange when the telescopic structure is extended; the distance between said flanges being adjustable by turning said tubular screw to permit a predetermined extent of extension of the telescopic structure.

6. An hydraulic press apparatus as defined in claim 1, wherein the mentioned rod constantly extends part way into said opening; said opening serving as a slide bearing for said rod and at least one other opening in the inner container, communicatively connecting the first mentioned opening with the interior of the inner container; said other opening being closed by said rod when said rod is moved towards the work-supporting member.

7. An hydraulic press apparatus as defined in claim 1, wherein the liquid-tight sliding relation of the containers is afforded by having an outward flange on the inner container, slidably fitted and in liquid-tight relation with the interior of the outer container and by having an inward flange on the outer container, slidably fitted and in liquid-tight relation with the exterior of the inner container whereby an annular chamber is formed between said containers; said flanges being near those ends of the containers respectively, which are nearest one another when the telescopic structure is extended and including a reservoir for liquid communicatively connected with said annular chamber and means for selectively applying pressure to the fluid contents of the inner container and said reservoir respectively.

8. An hydraulic press apparatus as defined in claim 7, including a second reservoir communicatively connected with the inner container; the application of pressure to the fluid contents of the inner container being effected by having said pressure-applying means to apply pressure to the contents of the second reservoir.

9. An hydraulic press apparatus defined in claim 1, wherein said containers are substantially upright and including means for moving the movable container towards and away from the work-supporting member and adjustable means to limit the extension of the telescopic structure.

10. An hydraulic press apparatus as defined in claim 1, wherein the inner container is the one which is fixed to the frame.

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