April 26, 1966 C. HAMMON 3,247,783

HYDRAULIC PRESS

Filed May 21, 1964 2 Sheets-Sheet 1

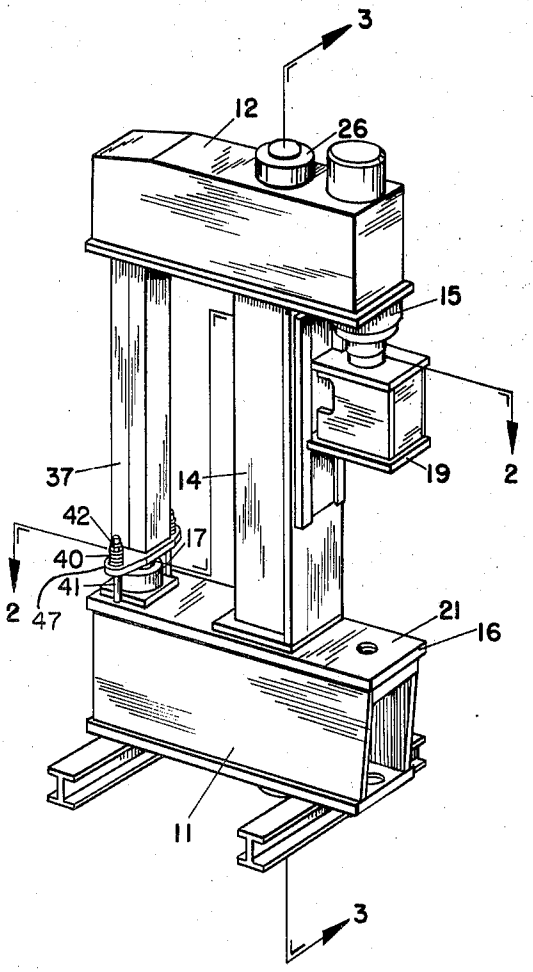


FIG. 1

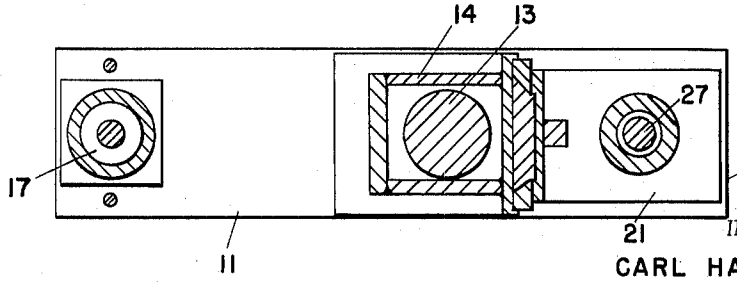


FIG. 2

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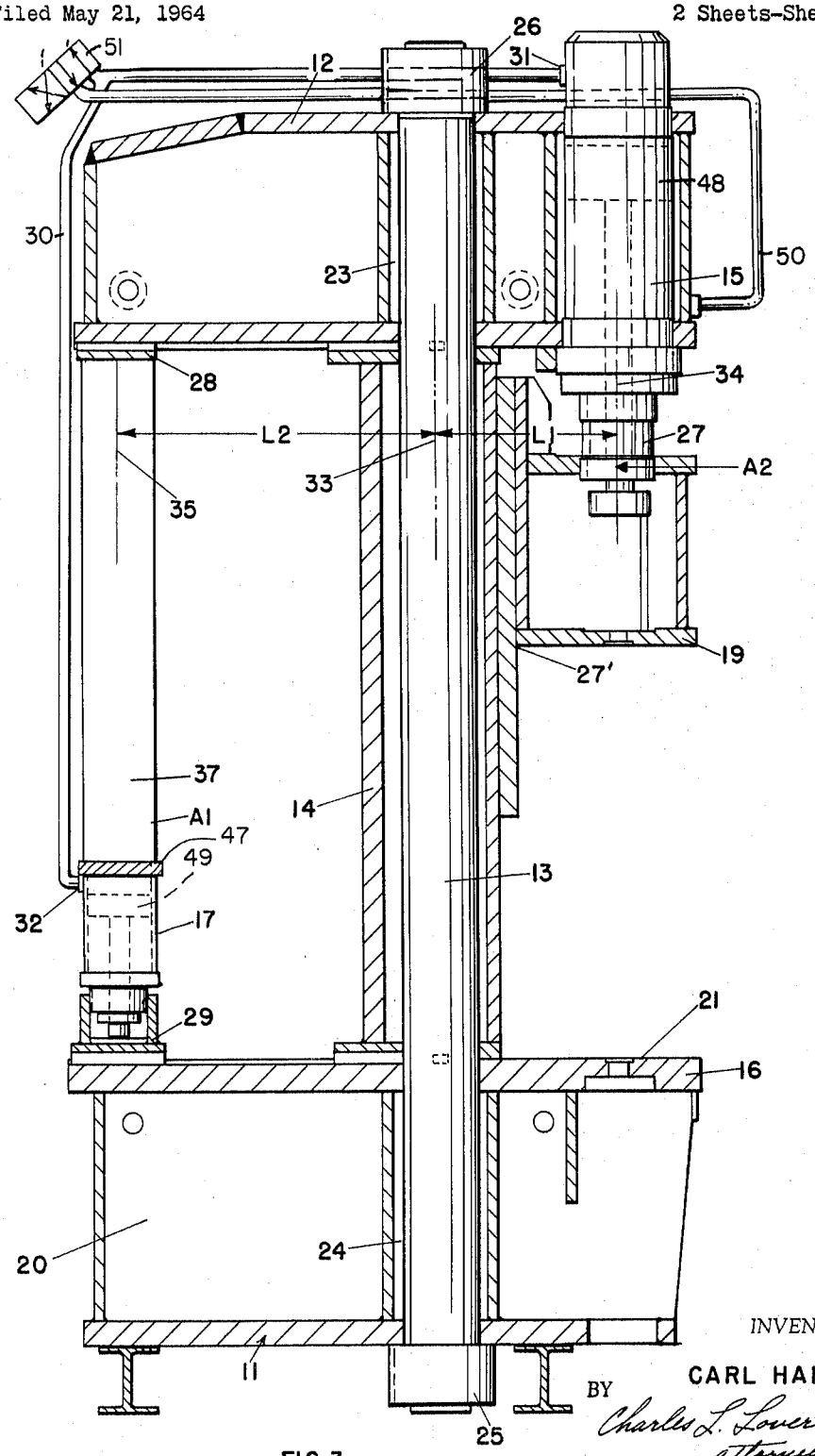


FIG. 3

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3,247,783

HYDRAULIC PRESS

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1 Claim. (Cl. 100—214)

This invention relates to presses and, more particularly, to the type of press ordinarily used for cold forging and the like.

The press disclosed is a simple beam type design tied together with pre-stressed tie rods and spaced with keyed in spacers loaded at each end with a balanced hydraulic force supplied by the fluid supply from the main cylinder which is connected to the fluid supply line of the balance cylinder. This design permits a tie rod to stretch and top and bottom beams to deflect, yet at the same time it holds the working surface between the platen and wear plate parallel under maximum load.

The foregoing is achieved with a small balance cylinder and a spacer or long cylinder located at the back of the press. The balancing cylinder located at the back of the press and the main cylinder located in front of the press are connected in series to a hydraulic source so that the hydraulic pressure will be the same in both cylinders at all times. The ratio of the effective piston area of the balancing cylinder to the effective piston area of the main cylinder is such as to generate a moment equal to the moment generated by the main cylinder about the center line of the tie rod.

This design eliminates multiple accumulated deflections due to tension, compression, and stretch multiplied by a distance from the neutral axis of the press frame and fatigue stresses which are present in ordinary types of C-frame design.

The foregoing design makes it possible to achieve minimum deflection and maximum parallelism, between the wear plate and the platen. To make the ordinary C-frame design of sufficient rugged construction to achieve similar minimum deflections and maximum parallelism would require a press considerably larger and heavier.

The principle employed in this disclosure could also be used in presses for injection molding, die casting, and extrusion work and other similar applications where it is desirable to keep two relatively moving surfaces in parallel relation with each other.

It is accordingly, an object of the invention to provide a press having a compensating means for maintaining the platens of a press in parallel relation with each other.

Another object is to provide an improved press.

Still another object of the invention is to provide a press which is simple in construction and minimum in size and weight for a particular purpose.

With the above and other objects in view, the present invention consists of the combination and arrangement of parts hereinafter more fully described, illustrated in the accompanying drawing and more particularly pointed out in the appended claims, it being understood that changes may be made in the form, size, proportions, and minor details of construction without departing from the spirit or sacrificing any of the advantages of the invention.

In the drawings:

FIG. 1 is an isometric view of a press according to the invention;

FIG. 2 is a cross sectional view taken on line 2—2 of FIG. 1; and

FIG. 3 is a view taken on line 3—3 of FIG. 1.

Now with more particular reference to the drawings, the press is basically made up of a bottom beam **11** and a top beam **12** supported in spaced relation from each other by means of a tie rod **13** and spacer **14**. A main

cylinder **15** is supported above a platen **16** and a balance cylinder **17** is supported between the rearwardly extending portions of the top beam and bottom beam. Thus the top beam **12** acts as a second class lever with its fulcrum at tie rod **13**. The balance cylinder is hydraulically connected to the main cylinder **15**. Balance cylinder **15** is supported on the front of top beam **12**. The press may be so designed that the product of the effective area of the main cylinder times the lever arm measured from the center of the tie rod **13** to the axial center of the main cylinder **15** is equal to the effective area of the balancing cylinder **17** times the distance from the axial center line of the balance cylinder to the axial center of the tie rod **13**. Thus, the design eliminates multiple accumulated deflections due to tension, compression, and strain multiplied by a distance from the neutral axis of the press. It also eliminates fatigue stresses which are present in other types of C-frame press designs. The top beam **12** may be fabricated from steel according to good design practice and it has an opening **23** therethrough which receives the upper end of the tie rod **13**. The lower side of the upper beam is supported on the spacer **14**. The spacer **14** may be of any suitable column construction, either tubular or other suitable shape, and there may be one or more spacers and one or more tie rods. The bottom beam **11** may have the lower end of the spacer **14** resting on it and the tie rod **13** may extend through the opening **24** in the lower beam and have a nut **25** on the lower end thereof. The upper end of the tie rod may have a nut **26** on it. Thus, the tie rod **13** may be prestressed.

The main cylinder **15** is attached to the front end of top beam **12** in a suitable manner in accordance with good design practice and its piston rod **27** fixed to piston **48** may be attached to the wear plate structure **19** which may be in the form of an upper platen. The wear plate may be supported on a guiding mechanism which may be guided up and down on the fixed structure at **27'**.

The bottom beam **11** may be fabricated in accordance with good design practice and has the platen **16** supported on the front portion thereof.

The balance cylinder **17** may be fixed to the plate **47** which is, in turn, fixed to spacer **37** which is, in turn, fixed to the rear end of the top beam at **28** and its piston rod may be connected to the rear end of the bottom beam at **29**. A hydraulic line **30** from a suitable hydraulic pump which may be a part of the machine is connected to the main cylinder **15** at **31** and to the balance cylinder **17** at **32**. The plate **47** is returned by hydraulic fluid from valve **51** and line **50**. The four-way valve **51** controls the fluid. The distance L1 from the axial center line **33** of the tie rod to the axial center line **34** of the main cylinder **15** is of a predetermined value relative to the distance L2 from the center line **33** to the center line **35** of the balance cylinder **17**. The press will be so designed that the product of L2 times the effective area A1 of the balance cylinder **17** is equal to the product of L1 times the effective area A2 of the piston of main cylinder **15**. Thus, the moment of L2 times A2 (the effective area of the balance cylinder) will be equal to the moment L1 times A1 (the effective area of the main cylinder **15**). In this manner, the tendency of the bottom beam to bend on the platen side is compensated for by the balance cylinder. The tendency of the platen to separate from the wear plate **19** is also minimized.

The balance cylinder is held down by springs **40** which are held in place on bolts **41** by nuts **42**. A balance spacer **37** is provided. The upper end of the spacer **37** is fixed to the top beam **12** and the lower end of the spacer **37** is fixed to plate **47** which is, in turn, fixed to cylinder **17**. The bolts **41** pass through plate **47**. When the balance

piston 49 in cylinder 17 extends, springs 40 are compressed. Then, springs 40 expand and urge the piston 17 to its neutral position when the fluid pressure is relieved from line 50.

In the machine which is shown by example, the bottom beam 11 can be considered to be the base indicated at 20, the bottom beam having the working surface thereon.

The foregoing specification sets forth the invention in its preferred practical forms but the structure shown is capable of modification within a range of equivalents without departing from the invention which is to be understood is broadly novel as is commensurate with the appended claims.

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

A press comprising

a bottom beam,

a top beam supported in spaced relation to said bottom beam,

a tubular spacer having a lower end and an upper end,

a platen on said bottom beam,

said tubular spacer having its lower end supported on said bottom beam and its upper end supporting said top beam at an intermediate part of said top beam,

a main cylinder attached to said top beam spaced from said spacer and above said bottom beam,

said main cylinder having a main piston therein,

an upper platen,

means attaching said main piston to said upper platen,

a tie rod extending through said tubular spacer,

said tie rod having a first end and a second end,

said first end terminating above said top beam,

said second end terminating below said bottom beam,

first nut means on said first end of said tie rod overlying and engaging said top beam,

second nut means on said second end of said tie rod,

said second nut means engaging and underlying said bottom beam,

a balance cylinder having a balance piston and a piston rod therein,

an elongated balance spacer attached to said balance cylinder at its lower end,

said balance piston rod engaging said bottom beam at a position spaced from said tubular spacer and on the side thereof remote from said upper platen,

said balance spacer begin fixed to said top beam at a position thereon spaced from said tubular spacer,

fluid pressure means,

said fluid pressure means being connected to said balance cylinder above said balance piston,

said fluid pressure means being connected to said main cylinder above said main piston,

said main cylinder and said balance cylinder being connected in parallel with each other,

said main cylinder and said balance cylinder each having an effective area,

said main piston being disposed from said tie rod a first distance and said balance piston being disposed from said tie rod a second distance,

the ratio of said main cylinder effective area to said first distance being equal to the ratio of said balance cylinder area to said second distance,

said tie rod being disposed between said main cylinder and said balance cylinder,

fluid pressure means connected to said main cylinder below said main piston to return said main piston to a neutral position,

and spring means connected to said spacer and means connecting said spacer to said bottom beam to return said balance cylinder to a neutral position.

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