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[54] **HYDRAULIC PRESS**

[76] Inventors: **Hiroshi Tominaga**, No. 78, Matsugaoka, Kanagawa-ku, Yokohama-shi, Kanagawa-ken; **Kohei Adachi**, No. 6527, Kowada, Chigasaki-shi, Kanagawa-ken, both of Japan

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[52] **U.S. Cl.** ..... **72/55**, 29/159 R, 72/57, 72/58

[51] **Int. Cl.** **B21d 22/00**

[58] **Field of Search** 72/55, 57, 58, 60, 61, 72/62; 83/53, 54, 169; 29/420

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Primary Examiner—Charles W. Lanham
Assistant Examiner—James R. Duzan
Attorney, Agent, or Firm—Blum Moscovitz Friedman & Kaplan

[57] **ABSTRACT**

An improved hydraulic press for sequentially forming and perforating a workpiece including means responsive to hydraulic pressure for selectively forming a workpiece, means for introducing a hydraulic fluid into the workpiece forming means, means for selectively perforating the workpiece and means for actuating the perforating means for perforating the workpiece after formation thereof. The workpiece forming means and hydraulic fluid introducing means are coupled to permit introduction of the hydraulic fluid into the workpiece forming means. The perforating means is responsive to hydraulic pressure and is coupled with the workpiece forming means for perforating the workpiece.

6 Claims, 2 Drawing Figures

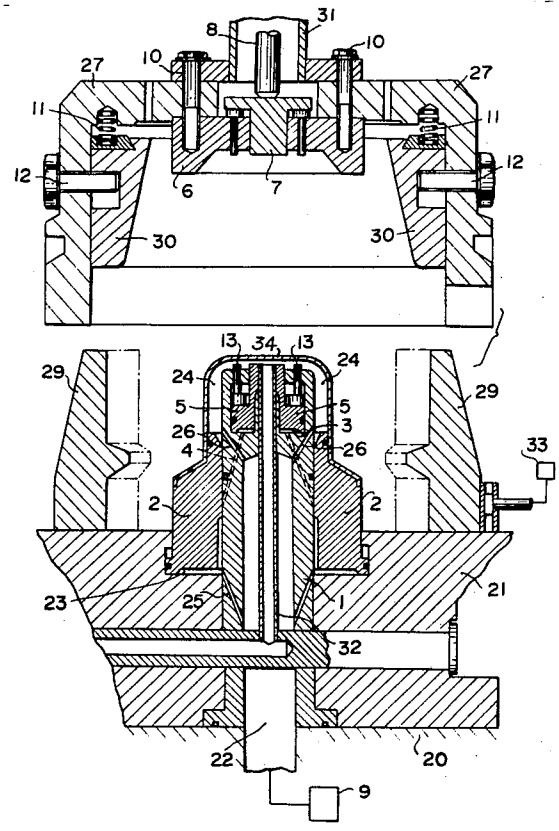


FIG - 1

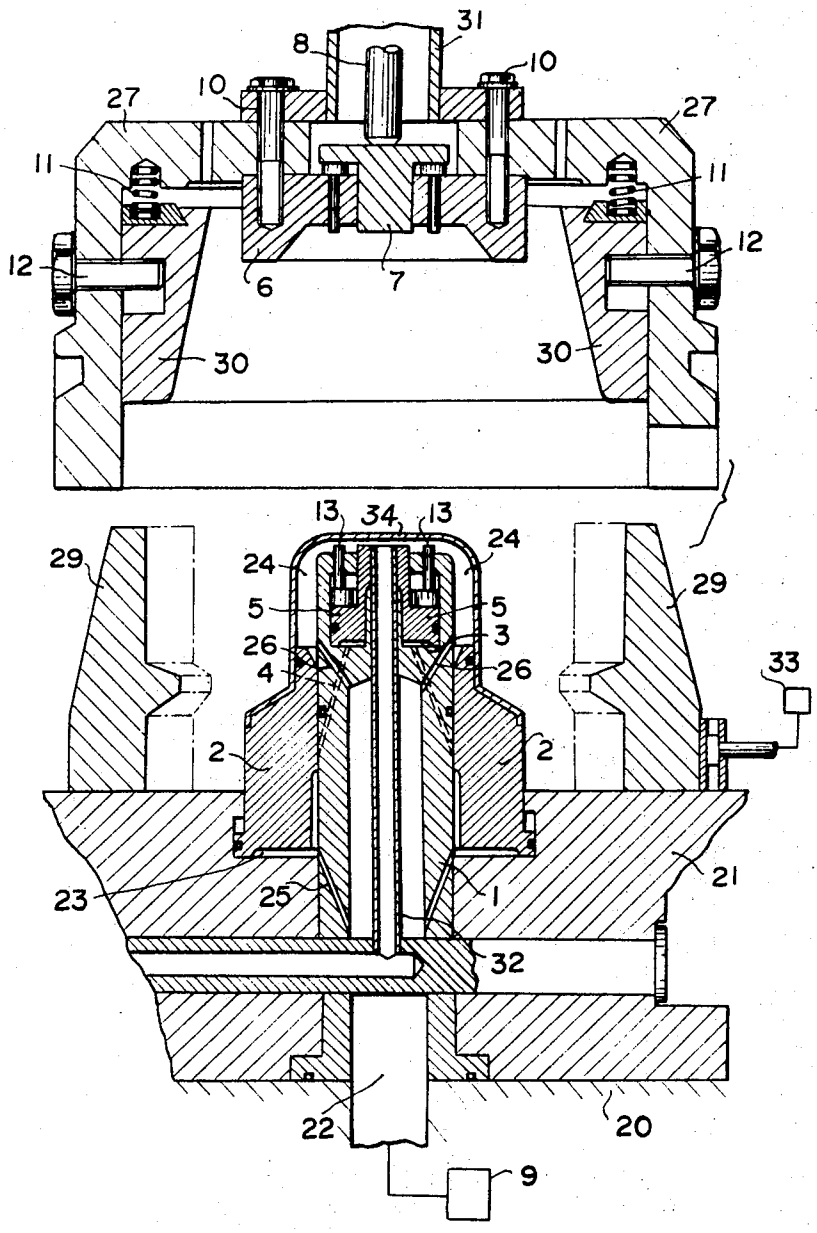
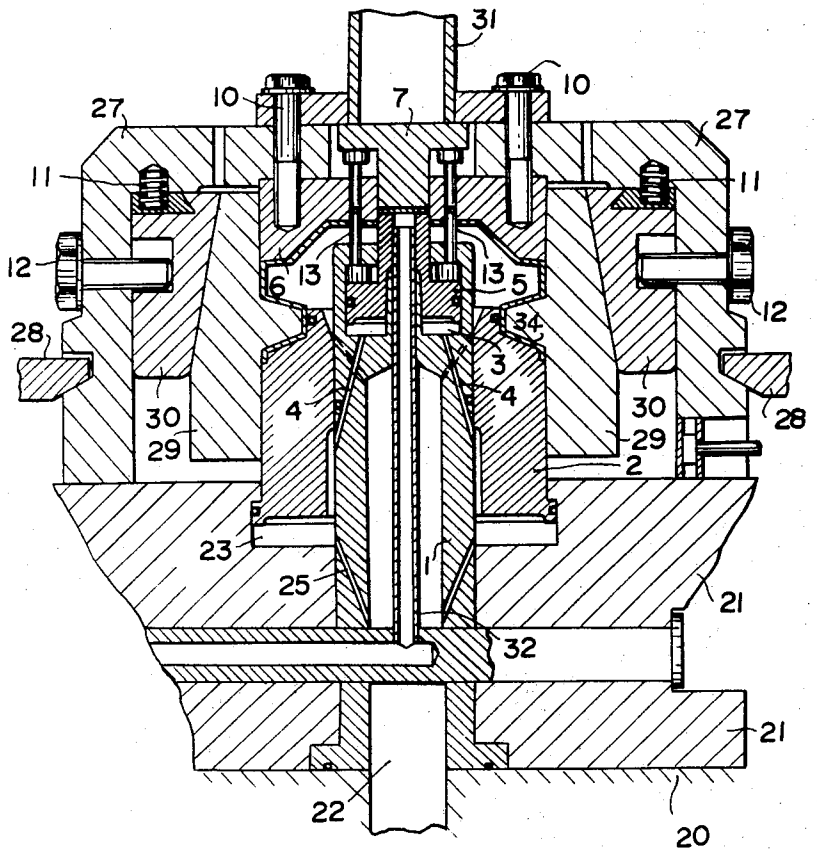

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FIG - 2


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HYDRAULIC PRESS

BACKGROUND OF THE INVENTION

This invention relates generally to an improved hydraulic press and more particularly to a hydraulic press which sequentially forms and perforates a workpiece.

Hydraulic presses, for instance of the impact type, are in common use for mass producing configured articles from workpieces of varied configurations. It has been considered desirable to provide a hydraulic press which sequentially forms and punches or apertures the formed article. Such a device serves to expedite and reduce production costs by integrating two conventionally separate production steps. For example, a pulley may be fabricated by press forming an essentially cylindrically configured workpiece and immediately after the pulley is pressed formed, the formed article may be apertured, as desired, while still in the press.

The instant invention provides means for efficiently and satisfactorily accomplishing both tasks in one operation. The instant improved hydraulic press may be modified to aperture or punch the formed article according to any desired manner, as will become apparent from the detailed description of the invention which follows.

SUMMARY OF THE INVENTION

Generally speaking, in accordance with the invention, an improved hydraulic press for sequentially forming and perforating a workpiece is provided which includes means responsive to hydraulic pressure for selectively forming the workpiece, means for introducing a hydraulic fluid into the workpiece forming means, means for selectively perforating the workpiece and means for actuating the perforating means for perforating the workpiece after formation thereof into the desired article. The means for introducing a hydraulic fluid into the workpiece forming means is coupled with the workpiece forming means to faciliate introduction of hydraulic fluid therein. Also, the workpiece perforating means is coupled with the workpiece forming means and the perforating means is responsive to hydraulic pressure and in response to a hydraulic pressure build-up therein perforates the workpiece.

Accordingly, it is an advantage of this invention that it provides an improved hydraulic press which sequentially forms and punches or apertures the formed article in substantially one operation. The apertures may be of any desired configuration and may be placed or spaced on the formed article as desired.

Still other advantages of the invention will in part be obvious and will in part be apparent from the specification.

The invention accordingly comprises the features of construction, combinations of elements, and arrangement of parts which will be exemplified in the constructions hereinafter set forth, and the scope of the invention will be indicated in the claims.

BRIEF DESCRIPTION OF THE DRAWINGS

For a fuller understanding of the invention, reference is had to the following description taken in connection with the accompanying drawings in which:

FIG. 1 is a side elevational view, in section, of a preferred embodiment of the instant invention; and

FIG. 2 is another side elevational view, in section, of the embodiment of the invention shown in FIG. 1 at a different stage of operation.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to the drawings, centrally mounted in a base plate **21** is a hydraulic pressure distributing cylinder **1** provided with a central main duct **22** through which hydraulic fluid is introduced into hydraulic pressure distributing cylinder **1** by, for instance, an impact type hydraulic pressure generator **9** (not shown) through a coupler **20.** Central main duct **22** extends approximately three-quarters of the way through hydraulic pressure distributing cylinder **1** and communicates with angularly disposed hydraulic fluid distributing ducts **25, 26** defined therein. Above central main duct **22** and in the upper portion of hydraulic pressure distributing cylinder **1** are defined hydraulic pressure chambers **3** which communicate with hydraulic fluid intake ducts **4** defined and angularly disposed in hydraulic pressure distributing cylinder **1.** Hydraulic fluid introduced into hydraulic pressure distributing cylinder **1** through central main duct **22** is distributed therefrom through exhaust ducts **25, 26** and distributed hydraulic fluid inlets into hydraulic pressure chambers **3** through hydraulic fluid intake ducts **4.**

A piston **2** is slidably mounted on hydraulic pressure distributing cylinder **1** for slidable engagement on the outer peripheral wall thereof along its interior peripheral wall. Piston **2** is provided with interiorally contoured sidewalls relative to the exterior surface of hydraulic pressure distributing cylinder **1** thereby defining therebetween at least one pressure chamber. Base plate **21** is provided with a cavity contiguous with hydraulic pressure distributing cylinder **1** for housing piston **2,** the cavity terminating in an elbow for co-acting with an annular peripheral flange extension on the lower periphery of piston **2** for limiting the slidable movement of piston **2** along the exterior surface of hydraulic pressure distributing cylinder **1.** Piston **2** is provided with a contoured bottom surface defining a pressure chamber between piston **2** and the continuous end wall of base plate **21** defining the annular cavity for limiting the slidable movement of piston **2.** The defined pressure chamber is substantially continuous with the plurality of pressure chambers defined by the interiorally contoured side walls of piston **2** and hydraulic fluid exhaust ducts **25** communicate therewith and distribute hydraulic fluid under pressure thereto.

As shown in FIG. **1** piston **2** is shown in a lower set position within its annular restraining cavity in base member **21** and piston **2** is shown in an upper set position within its annular restraining cavity in FIG. **2.** Piston **2** in a lower set position maintains hydraulic fluid intake ducts **4** in a normally closed position, hydraulic fluid intake ducts **4** being in an open position when piston **2** is in an upper set position. Piston **2** is accelerated from lower to upper set positions by hydraulic pressure build-up in pressure chamber **23** through hydraulic fluid exhaust thereto from hydraulic fluid exhaust ducts **25** of hydraulic pressure distributing cylinder **1.** Piston **2** is provided with configured top and exterior side walls to provide a seating surface for at least the rim portion of workpiece **34,** which, as shown, is substantially cylindrical in shape having a closed top portion which houses the top portion of hydraulic pressure dis-

tributing cylinder 1 and an open bottom portion sitting on the contoured seating surface of piston 2. A plurality of dies 29, releasably mounted on base member 21 and annularly disposed on the top surface thereof may slidably engaged to the exterior surface of piston 2 forming an outer mold for workpiece 34. Dies 29 are demountably connected on the perimeter of piston 2 for forming an outer mold for workpiece 34 by pneumatic cylinder 33. The outer mold is moved upwardly by piston 2 during the forming operation of workpiece 34 and is restrained by annular ring 30 when piston 2 reaches its upper set position. In an upper set position of piston 2 hydraulic fluid intake ducts 4 are in an open position and hydraulic fluid under pressure enters pressure chambers 3 at the back of a punch 5. Hydraulic pressure chamber 3 accelerates punch 5 for perforating holes in workpiece 34. When piston 2 is in an upper set position the workpiece forming process is complete and the perforating operation is initiated.

Punch 5 is integrally formed with a piston at the back thereof accelerated by dynamic pressure to perforate, for instance, circular holes in the bottom of formed workpiece 34. Punches 13 are mounted on the piston portion of punches 5 and are actuated thereby to perforate the formed workpiece around the main perforation defined by punches 5. Mounted on bottom mold 6 is conduit 31 secured thereto by bolts 10 and lid 27. The interior face of bottom mold 6 is contoured to the shape of the bottom of the product which is formed and also provides a punching die surface for perforating workpiece 34 oppositely disposed from punches 5.

Spring biased ejector 7 is demountably connected to bottom mold 6 for expelling punched waste out of bottom mold 6 which coacts with counter punches aligned with punches 5 and 13. During the forming operation ejector 7 is maintained in an inoperative position by a biasing spring (not shown) and at the conclusion of the sequentially oriented forming and perforating operations ejector 7 may be actuated by driving member 8 to expel punched out waste adhering to bottom mold 6. Driving member 8 is mounted within conduit 31 and is positioned to depress ejector 7 after completion of the perforating operation for expelling downwardly punched out waste material adhering to the surface of bottom mold 6. In an inoperative position the T-bar and counter punches of ejector 7 correspond to the contour of bottom mold 6 and as shown in the drawings the configuration of ejector 7 mirrors the configuration of punches 5 and 13.

Annular ring 30 is spring biased to a lower set position by torsion spings 11 and stopper bolts 12 laterally mounted in press lid 27 and extending into an annular cavity defined around the periphery of annular ring 30 to thereby confine annular ring 30 between upper and lower set positions.

In practice, a cylindrical workpiece 34 is demountably positioned over hydraulic pressure distributing cylinder 1 with at least its rim portion seated on the contoured seating surface of piston 2 while piston 2 is in a lower set position. Dies 29 are slidably engaged to the piston and workpiece exterior surfaces and as assembled comprise an outer mold therefore. Dies 29 are assembled under the action of, for instance, a pneumatic or hydraulic cylinder 33. Press lid 27 is lowered for example by a pneumatic or hydraulic cylinder to a position for which annular ring 30 restrains dies 29 and maintains the outer mold assembly. Press lid 27 is rigidly urged against base plate 21 by a wedge 28 which coacts with the pneumatic or hydraulic cylinder to rigidly juxtapose lid 29 against base plate 21.

A purge conduit 32 centrally disposed within hydraulic pressure cylinder 1 is opened and water is supplied thereto from a suitable source (not shown) and a hydraulic fluid, for instance water, is introduced into hydraulic pressure cylinder 1 through main duct 22 thereby filling the press interior with fluid. After the press interior is fluid filled the water and/or hydraulic fluid supply sources are closed. Piston 2 being in a lower set position during the fluid fill operation, no hydraulic fluid is supplied to hydraulic pressure chambers 3 through hydraulic fluid intake ducts 4, as best shown in FIG. 1.

Hydraulic pressure, generated for instance by impact type hydraulic pressure generator 9, is applied to hydraulic pressure distributing cylinder 1 through duct 22 and hydraulic fluid under pressure exhausts from hydraulic pressure distributing cylinder 1 through ducts 25, 26 thereby precipitating pressure build-up in hydraulic pressure chambers 23, 24, whereby cylindrical workpiece 34 is bulged and formed to the shape defined by outer mold 29 and bottom mold 6 by the joint effect of the pressure build-up in hydraulic chamber 24 and accelerated upward movement of piston 2, which is accelerated upwardly by the impact type hydraulic pressure build-up in hydraulic pressure chamber 23. As best seen in FIG. 2, the forming operation is complete when piston 2 is accelerated to and reaches its upper set position. As piston 2 reaches its upper set position, at the conclusion of the forming operation, ducts 4 open and hydraulic fluid under pressure inlets therethrough into hydraulic pressure chambers and actuates piston type punch 5. Punch 5 is thereby driven upwardly into the formed workpiece and punches and perforates the workpiece surface. Perforating means 13 actuated by punch 5 are similarly driven upwardly and perforate the workpiece surface around the punched out areas thereof.

Upon completion of the punching operation, the press may be brought to its initial released state, as shown in FIG. 1, by reversing the sequence of operation above-described. For instance, wedge 28 is released outwardly from the body of the press, lid 27 is urged upwardly and the outer mold is disassembled into component dies 29. As press lid 27 is upwardly urged to its upper set position, rod 8 actuates ejector 7 and waste material adhering to bottom mold is expelled therefrom.

A hydraulic press constructed as described sequentially forms and instantly perforates the processed article at high speed thereby providing finished articles with clear punch configurations. The punching operation occurs after the article is formed thereby effecting satisfactory article formation. Through utilization of energy derived from impact type hydraulic pressure, it is possible to quickly and efficiently effect bulge forming and perforating successively in the same operation, in sequence.

It will thus be seen that the advantages set forth above, among those made apparent from the preceding description, are efficiently attained and, since certain changes may be made in the above constructions without departing from the spirit and scope of the invention, it is intended that all matter contained in the above description or shown in the accompanying draw-

ings shall be interpreted as illustrative and not in a limiting sense.

It is also to be understood that the following claims are intended to cover all of the generic and specific features of the invention herein described, and all statements of the scope of the invention which, as a matter of language, might be said to fall therebetween.

What is claimed is:

1. An improved hydraulic press for sequentially forming and perforating a workpiece comprising means responsive to hydraulic pressure for selectively forming a workpiece, means for introducing a hydraulic fluid into said workpiece forming means, said means being coupled with said workpiece forming means for introduction of said hydraulic fluid therein, means for selectively perforating said workpiece coupled with said workpiece forming means, said perforating means being responsive to hydraulic pressure for perforating said workpiece, means for actuating said perforating means for perforating said workpiece after formation of said workpiece, said hydraulic pressure responsive workpiece forming means including a hydraulic pressure distributing cylinder having an open end for receiving a hydraulic fluid under pressure and a substantially closed end for providing selective distribution through said hydraulic pressure distributing cylinder of said hydraulic fluid, said hydraulic pressure distributing cylinder being provided with at least one hydraulic fluid exhaust duct for exhausting hydraulic fluid therefrom under pressure for distributing said hydraulic fluid for forming said workpiece, said hydraulic pressure distributing cylinder being provided with at least one hydraulic fluid intake duct for inletting thereto hydraulic fluid under pressure for perforating a formed workpiece, respective outlets and inlets of said at least one hydraulic fluid exhaust and intake ducts being in spaced relation, one to another, in said hydraulic pressure distributing cylinder, said at least one hydraulic fluid exhaust duct being continuously open for continuous exhaust of pressurized hydraulic fluid therethrough, said at least one hydraulic fluid intake duct being normally closed for permitting workpiece forming before perforating said workpiece.

2. The improved hydraulic press of claim **1,** including a piston slidably mounted on said hydraulic pressure distributing cylinder for slidable movement there along, said piston having interiorly contoured side walls relative to said hydraulic pressure distributing cylinder exterior surface thereby defining therebetween at least one pressure chamber, and means for limiting slidable movement of said piston along said hydraulic pressure distributing cylinder exterior surface between upper and lower set positions, said piston having a contoured bottom surface defining a pressure chamber between said piston and said means for limiting slidable movement thereof along said hydraulic pressure distributing cylinder exterior surface, said at least one hydraulic fluid exhaust duct of said hydraulic pressure distributing cylinder communicating with said pressure chamber, said pressure chamber being substantially continuous with said at least one pressure chamber defined between said hydraulic pressure distributing cylinder exterior surface and said contoured interior piston side wall, said piston in a lower set position maintaining said at least one hydraulic fluid intake duct of said hydraulic pressure distributing cylinder in a normally closed position, said at least one hydraulic fluid intake duct being in open position when said piston is in an upper set position, said piston being accelerated from lower to upper set positions by hydraulic pressure build-up in said pressure chamber through hydraulic fluid exhaust thereto from said at least one hydraulic fluid exhaust duct of said hydraulic pressure distributing cylinder.

3. The improved hydraulic press of claim **2,** including a bottom mold having an interior face contoured to the shape of the bottom of the formed workpiece and providing a punching die surface for perforating said workpiece.

4. The improved hydraulic press of claim **2** said hydraulic pressure distributing cylinder having at least one chamber communicating with said at least one hydraulic fluid intake duct through which hydraulic fluid inlets into said at least one chamber in an upper set position of said piston, at least one piston housed in said at least one chamber of said hydraulic pressure distributing cylinder, and at least one punch member for perforating said workpiece, said at least one punch member being mounted on said at least one piston and being actuated thereby perforating said workpiece, said at least one piston being actuated by hydraulic pressure build-up in said at least one chamber through hydraulic fluid inlet therein from said at least one hydraulic fluid intake duct of said hydraulic pressure distributing cylinder.

5. The improved hydraulic press of claim **2** including means for ejecting areas of said workpiece defined by perforations therein thereby providing said formed workpiece with configured apertures and means for actuating said ejector means.

6. The improved hydraulic press of claim **4** said piston having configured top and exterior side walls to provide a seating surface for at least the rim portion of said workpiece and means for biasing said at least the rim portion of said workpiece on said piston seating surface during forming and perforating of said workpiece, said biasing means being configured to impart a particular design to a formed workpiece.

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