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METHOD FOR THE HYDROMECHANICAL DRAWING OF WORKPIECES

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Fig.1

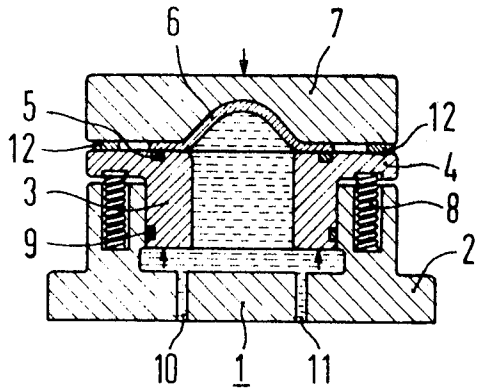


Fig.3

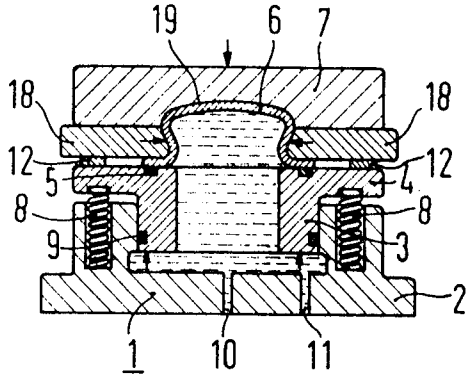
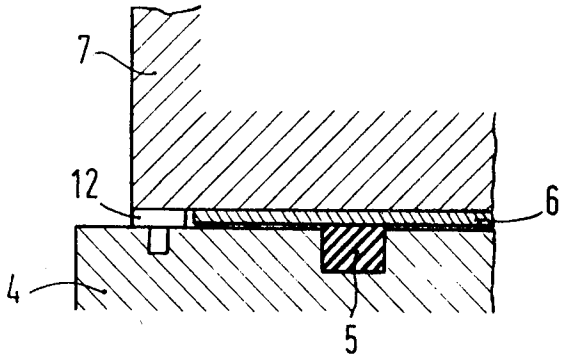


Fig.2



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METHOD FOR THE HYDROMECHANICAL DRAWING OF WORKPIECES

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Int. Cl. B21d 26/04
U.S. Cl. 72—60 7 Claims

ABSTRACT OF THE DISCLOSURE

Circular and other blanks of sheet metal and the like workpieces are shaped by hydromechanical drawing with the aid of a rigid container for liquid, a liquid displacing plunger of tubular shape which is movable relative to the container, and a shaping die having a cavity corresponding to the shape to be imparted to the workpiece. After filling the container with liquid up to its rim, the blank is placed on top of the plunger and the die is placed on top of the blank with the die cavity facing the blank. Then the die and the blank are pressed against the container thus sealing the container and forcing the plunger into the container. This increases the liquid pressure and draws the blank into the die cavity.

My invention relates ot the shaping of circular and other sheet-metal blanks or the like workpieces by hydromechanical drawing with the aid of a pressure container filled with liquid, a displacer structure which holds the workpiece and is movable relative to the pressure container, and a shaping die.

It is known to employ the workpiece blank itself as the cover of a pressure container for performing a hydraulic deep-drawing operation. The shaping of the workpieces is effected by a drawing plunger which directly shapes the blank against the increasing water pressure, the blank then being drawn over a seal or the like inserted into the rim of the pressure container. As a rule, the blank is pressed against the seal by a down-presser member. Such a drawing process requires using a double-acting press or at least a resilient, preferably elastic mounting and bracing of the down presser relative to the drawing plunger. The known process further requires using a tool and a press designed for a die-opening diameter of more than twice the drawing depth. Furthermore, the drawing of undercut workpiece shapes is troublesome because the plunger cannot be readily subdivided or be equipped with slidable components.

It is an object of my invention to improve such hydromechanical drawing processes so as to afford the production or fabrication of undercut workpieces with the aid of single-action presses. Another object of the invention, preferably in conjunction with the one mentioned, is to improve the hydromechanical drawing process so as to afford a drawing operation at a lower drawing depth.

According to the invention, the hydromechanical drawing process is performed by filling the pressure container with drawing liquid up to its rim, then placing a workpiece blank on top of the container and pressure-tightly covering the container by pressing the blank against the container, whereupon the workpiece is drawn into the container by pressing the plunger into the container to displace the liquid and causing the increasing liquid pressure to draw the blank into the cavity of the die.

According to another preferred feature of the invention, the device for performing the method is provided with a cup-shaped, upwardly open pressure container

which constitutes the bottom portion of the equipment and in which the plunger structure is slidably and pressure-tightly mounted, the external portions of this structure forming the recipient for the edge of the blank to be drawn. The equipment further comprises an upper portion which is designed as the shaping die and by means of which the workpiece blank is tightly forced against the plunger and the plunger is pressed into the bottom portion of the equipment.

A particularly simple design is achieved when bracing the plunger structure of the drawing tool relative to the bottom portion by means of springs so that, when the press is opened, the plunger will automatically return to its starting position. If desired, however, hydraulic or pneumatic resetting members may also be employed.

In order to prevent the workpiece to be pressed against the seal by an excessively strong force during the drawing operation, it is further preferable according to another feature of my invention to provide spacers that prevent the workpiece and the plunger from approaching each other more closely than corresponds to the wall thickness of the sheet-metal blank. For the shaping of workpieces to an undercut configuration, the shaping member or die appertaining to the upper portion of the equipment is given a plural-part design or is provided with slidable components.

The invention will be further elucidated with reference to the accompanying drawing in which several embodiments of equipment according to the invention are illustrated by way of example.

FIG. 1 shows in cross section a first drawing device;

FIG. 2 shows in section and on larger scale a portion of the same device; and

FIG. 3 illustrates in section a second embodiment for producing a workpiece having an undercut cross-sectional shape.

The device according to FIG. 1 comprises a generally cup-shaped, upwardly open pressure container **1** which forms part of the bottom portion **2** of the drawing equipment. A displacer body **3** in the form of a flanged tubular plunger is guided in the bottom portion **2** so as to be coaxially movable relative thereto. The flange **4** of the plunger **3** forms a supporting face which has a coaxial groove into which a sealing gasket **5** is placed. The upper portion of the drawing device comprises a shaping structure or die **7** with a downwardly open cavtiy whose shape matches that of the shaped work to be produced. The displacer body **3** is braced against the bottom portion **1** by peripherally distributed coil springs **8**. Suitable seals **9** provide for a tight closure of the pressure container **1**. Ducts **10** and **11** permit filling the pressure container with liquid and controlling the drawing pressure. Spacers **12** are placed onto the flange **4**.

FIG. 2 shows a portion of the flange **4** with the inserted ring-shaped gasket seal **5**, the workpiece blank **6** and the inserted spacers **12**. The spacers prevent the blank **6** from being excessively pressed by the die **7**. The height of the spacers **12** is such that the pressure between the die and the seal **5** cannot exceed a predetermined amount in order to secure the desired gliding of the workpiece **6** into the cavity of the die **7** during the drawing operation.

The modified device shown in FIG. 3 is similar to that of FIGS. 1 and 2, except that the die **7** is composed of several parts. That is, the die structure is provided with sliders **18**. This permits drawing the workpiece **19** so that it obtains an undercut configuration as shown.

The described devices afford operating in accordance with the following process.

The device is inserted into, or forms part of a press, the bottom portion **2** being mounted on the lower platen.

The die **7** may be secured to the top platen so as to be lifted by the press machinery.

Normally the springs **8** hold the plunger **3** in lifted position. The process is started each time by supplying liquid through the duct **10** into the pressure container until the container is filled up to the top edge of the flange **4**. Then the blank **6, 19** is placed upon the seal **5** on top of the flange. Thereafter, the press is closed. The lowering of the shaping die **7** forces the blank **6, 19** against the seal **5** so that now the pressure container is pressure-tightly closed. While the die **7** is further lowered, the plunger **3** is forced more deeply into the pressure container **1** and presses the liquid against the blank. As the pressure further increases during lowering of the die **7**, the blank bulges upwardly into the cavity of the die **7**, thus being drawn above the gasket **5** to the shape determined by that of the die cavity.

To those skilled in the art it will be obvious from a study of this disclosure that my invention permits of various modifications and may be given embodiments other than those particularly illustrated and described herein, without departing from the essential features of my invention and within the scope of the claims annexed hereto.

I claim:

1. The method of shaping blanks of sheet metal and the like workpieces by hydromechanical drawing with the aid of a rigid container for liquid, a liquid displacing plunger having a central bore, said plunger being movable relative to the container and adapted for accommodating the workpiece blank, and a shaping die having a cavity corresponding to the shape to be imparted to the workpiece, which method comprises the steps of filling the container and plunger with liquid up to the rim defined by the bore at the top surface of the plunger while the latter is inside the container, placing the blank on top of the plunger and the die on top of the blank with the die cavity facing the blanks, then tightly closing the container by pressing the die and the blank toward the container bottom, and thereby forcing the plunger further inward of the container so as to increase the liquid pressure to draw the blank into the cavity of the shaping die.

2. Device for shaping blanks of sheet metal and the like workpieces by hydromechanical drawing, comprising an upwardly open container for pressure liquid having liquid supply ducts, an axially elongated plunger having a central bore for accommodating at least a portion of said liquid, said plunger having a lower portion permanently disposed and glidably and pressure-tightly displaceable in said container, said plunger having sealable means for receiving the workpiece blank across the central bore so that the blank when pressed against the plunger forms a closure of said

container, and a pressure die removable from said plunger and having a downwardly open cavity corresponding to the shape to be imparted to the workpiece, said die being in pressure-transmitting contact with the peripheral margin of the blank on top of said plunger when in operation, whereby movement of the die under pressure toward the container forces the plunger further inward of the container toward the bottom thereof whereby the increasing liquid pressure causes the blank to be drawn into the die cavity.

3. A device according to claim **2**, wherein said container has a wall surrounding said plunger, said wall having an end face defining the upwardly directed opening of said container, said plunger having a flange extending laterally from the upper portion thereof so as to extend out over said end face, and said device comprising spring means mounted between said flange and said container for urging said plunger in the upward direction.

4. In a device according to claim **3**, said sealable means of said plunger being formed by a seal surrounding said central bore, and spacers disposed on top of said plunger for preventing the blank to be shaped to be excessively pressed by said die, said spacers having a vertical height corresponding to the thickness of the blank.

5. In a device according to claim **2**, said die comprising a plurality of component parts conjointly shaped for providing an undercut configuration of the die cavity.

6. In a device according to claim **2**, said upper portion of said plunger forming a coaxial flange and having a groove coaxially around the top opening of said bore, and a sealing ring seated in said groove and engageable by the blank so as to form said sealable means for receiving the blank.

7. A device according to claim **6**, comprising spacers engaging said flange on the top face thereof and being mutually spaced around said ring, said spacers having a vertical height corresponding to the thickness of the workpiece blank to be shaped.

References Cited

UNITED STATES PATENTS

2,649,067	8/1953	Kranenberg	72—60
3,149,596	9/1964	De Vlieg et al.	29—421

FOREIGN PATENTS

123,867	6/1944	Australia	72—57

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U.S. Cl. X.R.

29—421