Extrusion methods are known for the manufacture of hollow articles such as cases and sockets, according to which a solid billet, for example, of cylindrical shape, is pressed in a die by means of a punch, so that the material of which the billet is made is forced around this punch, in the opposite direction to that in which the latter moves, to form a hollow part, for example, of cylindrical shape.

In these known methods, the initial billet is placed on the punch before the rising movement of the latter, and it may move at the time of this rising movement, so that the billet is not centered in the die when its distortion commences. Consequently, there is an unequal distribution of the metal around the punch, which gives rise to the formation of a case having a tubular part of unequal height.

On the other hand, the die and punch of known machines are housed by their base, distant from the working part, in the moving and fixed members of the press, and are liable to assume slight transversal displacements with regard to each other, which become accentuated should the billet not be absolutely centered on their common axis.

For these reasons, the cases obtained with known machines possess irregular edges and need to be cut off at some distance from the same, which gives rise to serious metal losses.

The purpose of this invention is to obviate these disadvantages.

It relates to a method of manufacturing a hollow body such as a case, by extrusion, according to which an initial billet is placed on a punch and the punch raised so as to cause it to penetrate into a die, so that the metal of the initial billet is forced downwards around the punch, a method characterized in that the initial billet is fixed on the punch, which enables this billet to be centered on the punch and to avoid any lateral displacement of this billet in relation to this punch, when the latter is displaced, the forcing of the metal of this billet upwards then taking place equally all round the punch.

The invention also relates to a method of manufacturing a hollow body, such as a case, by extrusion, according to which an initial billet is forced into the bottom of a die by means of a punch of a lesser diameter than the internal diameter of the die, so as to force the metal of this billet around the punch, in an opposite direction to that of the displacement of this punch, a method characterized in that the punch is guided in relation to the die before the operation of distorting the metal of the initial billet commences, which enables this punch to be centered in relation to this die during the extrusion operation, and thus obtain a hollow part with regular edges.

The invention also relates to a die which is open downwardly and which has a downwardly projecting edge which slidably engages in a cylindrical wall of an annular member fixed to the lower movable member of a press when the die and plunger cooperating therewith come together thereby preventing any lateral deviation of the plunger with relation to the die during operation.

According to one characteristic of the invention, the punch possesses a collar resting on a stand integral with the lower moveable member of the press, the aforementioned circular part being engaged on the punch and resting on this collar, means such as nuts screwed both on the circular part and the stand ensuring that the punch is secured on the lower moveable member of the press, at the same time that the cylindrical part of this circular part is disengaged, this cylindrical part forming the guide for the assembly.

The invention also relates to the characteristics hereinafter described and to their various possible combinations.

A machine for operating the method of the invention is shown, in its various stages of working, in the attached drawing, in which:

Figure 1 is an axial section of the machine seen with the punch removed from the die.

Figure 2 is a sectional view of the machine before the extrusion stage.

Figure 3 is a sectional view of this machine at the end of the extrusion stage.

Figure 4 is a sectional view of the machine during the ejection stage.

Figure 5 is a section on a larger scale of the end of the punch and the initial billet.

The machine shown in Figures 1 to 4 comprises the following essential components:

A die 1 is fixed in a cylindrical body 2 which is itself fixed by a screw in the upper movable member 3 of a hydraulic press.

The die 1 projects outside the cylindrical body 2 and its edge is provided externally with a part 4 projecting from the external surface of this die.

The die 1 has an internal cylindrical bore 5, a tapering shoulder 6, a second cylindrical bore of smaller diameter 7 and a tapering part 8. Lastly, at the bottom of this die there is a bore 9 in which an ejector 10 can slide.

When in initial position, the lower face of this ejector is slightly recessed from the bottom of the die 1.

A punch or plunger 11 is arranged below the die 1 and its longitudinal axis coincides with the axis of the die 1.

This punch has a general cylindrical shape and comprises a head 12 whose maximum diameter D is slightly greater than the diameter d of the punch below said head 12. The plunger 11 has a flange 13 resting on a base 14 fixed, for example, by screwing into the lower movable member 15 of the press.

The base has two internal bores 16, 17 joined by a shoulder 18 and a threaded external portion 19.

The punch is securely maintained on the base 14 by an annular part 20 having an axial bore in which the plunger 11 engages without clearance. This annular part 20 has a shoulder 22 corresponding to the shoulder 18 of the base and a washer 21 is inserted between these two shoulders 18, 22. The annular part 20 has a cylindrical wall 23 at its upper part, pierced with holes 24 and a threaded part 25 in its middle part.

A nut 26 is screwed both on the external threaded part 19 of the base and on the threading 25 of the annular part. This screwing gives the washer 21 a firm grip, thus ensuring a perfectly tight fit.

The punch 11 has an axial duct 28 opening into the space provided between the lower face of the flange 13 and the inside bottom face of the base 14 provided with ribs radiating from this face.

A cooling fluid is conveyed through a pipe 50 into an axial tube 27 engaged in the bore 28 of the punch 11, escaping through the upper part of the tube, then passing between the tube 27 and the bore 28 to escape through
the ribs to the interior of the base and from there to the outside through the pipe 30.

According to this invention, the head 12 of the punch 11 has a nipple 31 centered on the axis XY.

The billet 32 has a small axial hole 33 in the center of its lower face, which enables the billet 32 to rest on the upper face of the head 12 of the punch 11 before the working stage (Fig. 1) with the nipple 31 of the head 12 penetrating with minimum clearance in the axial hole 33 of the billet 32 to hold the latter centered on the punch 11 (Fig. 5).

The machine described above operates as follows:

The movable members 3 and 15 of the press are separated from each other in the initial position (Figure 1). The billet 32 is placed on the upper face of the punch 11, the nipple 31 penetrating into the hole 33.

The press is then operated, which brings the movable members 3 and 15 together. In this closing movement, the projecting part of the die 1 penetrates within the cylindrical wall 23, with the external cylindrical part 4 sliding with a slight frictional contact against the internal cylindrical surface 25.

At the end of this first stage, the billet 32 is forced by the punch into the bottom of the die and assumes the shape of this bottom, more particularly the tapering part 8.

The movable members 3, 15 continuing to approach each other, the metal of the billet 32 is driven into the annular space between the bore 7 of the die and the head 12 of the punch 11. This is the extrusion stage (Fig. 3). The thrust of the metal is facilitated by the shape of the head 12 of the punch, whose diameter D is greater than the diameter d of the plunger 11 and by the internal shape of the die whose bore 5 is of greater diameter than the bore 7. These particular shapes enable the cylindrical wall formed by the passage of the material in the annular space described above, to move, without rubbing against the walls, thus diminishing the force required for this extrusion.

During this downward extrusion, the ejector 10 withdraws slightly, thus allowing a slight penetration of the material into the bore 9 of the die.

Extrusion being terminated, the movable members 3, 15 separate from each other (Fig. 4) while the ejector 10 projects through the die and drives the case 35 obtained out of this die.

While the metal is being shaped, the punch 11 is cooled by the circulation of a cold fluid arriving through the pipe 50, rising through the axial pipe 27 then passing between pipe 27 and the bore 28 to escape through the pipe 30.

The method of the machine described above affords more particularly the following advantages:

The billet 32 is in the initial position perfectly centered on the head 12 of the punch, by the nipple 31 of this head, penetrating into the hole 33 of this billet. Owing to this, this billet cannot move sideways during the upstroke of the punch.

When the punch 11 carrying the billet 32 comes towards the bottom of the die, and before the work of shaping the billet commences, the external part 4 penetrates into the cylindrical wall 23, which ensures an absolute centering of the punch in the die.

For these reasons, the billet 32, perfectly centered on the axis XY is shaped in a regular manner, without any possible deviation of the punch 11 in relation to the die 1 and the case obtained has regular edges.

What I claim is:

In a press with movable upper and lower elements, a matrix open towards the bottom fixed to the upper movable element of the press having an edge projecting from the bottom, a base fixed to the lower movable element, a plunger having a flange at the bottom of the same, said flange resting upon said base, an annular piece seated on said lower movable element receiving said plunger and resting upon said flange, said annular element having a cylindrical portion in which engages slidingly said edge projecting at the bottom of said matrix, a nut screwed to both said annular piece and said base assuring the locking of said plunger upon the movable lower element of the press as well as the fixing of the cylindrical portion of said annular piece.

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