United States Patent [19]

Nilsson et al.

[11] **3,751,958**

[45] **Aug. 14, 1973**

[54] **PRESS FOR HYDROSTATIC EXTRUSION OF TUBES**

[75] Inventors: **Jan Nilsson; Hans Larker,** both of Robertsfors, Sweden

[73] Assignee: **Allmanna Svenska Electriska Aktiebolaget,** Vasteras, Sweden

[22] Filed: **May 20, 1971**

[21] Appl. No.: **145,184**

[52] **U.S. Cl.** **72/60,** 72/264

[51] **Int. Cl.** **B21c 25/04**

[58] **Field of Search** 72/60, 264, 272, 72/268, 269

[56] **References Cited**

UNITED STATES PATENTS

3,531,965 10/1971 Nilsson 72/60

OTHER PUBLICATIONS

"Some Considerations of The Mechanics of Hydrostatic Extrusion" by Rozner et al.; page 228; Vol. 277, No. 3; Mar. 1964; J. Franklin Institute.

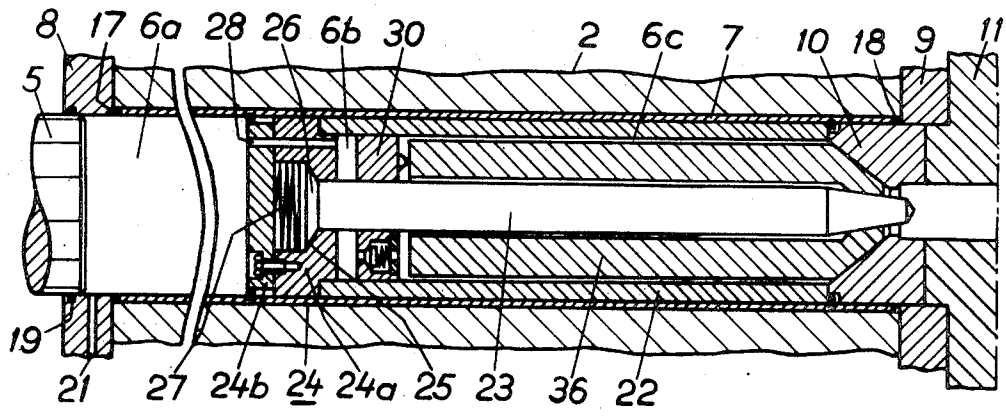
Primary Examiner—Richard J. Herbst

Attorney—Jennings Bailey, Jr.

[57] **ABSTRACT**

A press for hydrostatic extrusion of tubes includes a press stand with a pressure cylinder movable therein to engage over a die supported by the press stand, and a pressure-generating punch movable in the other end of the cylinder. A sleeve slidable in the cylinder supports a mandrel which can engage through an annular billet into the die opening. A billet holder is slidable in the sleeve, the mandrel passing through it. The billet holder is so constructed that pressure fluid can pass from one side of it to the other.

10 Claims, 5 Drawing Figures



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SHEET 1 OF 2

Fig. 1

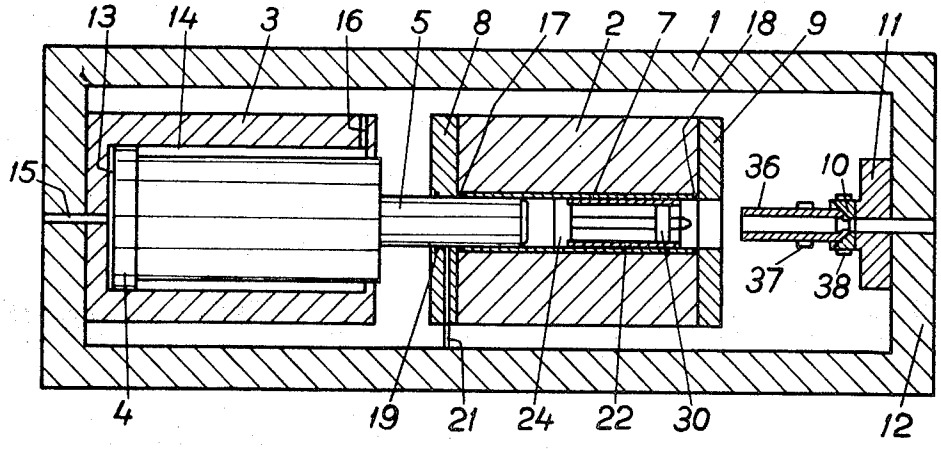


Fig. 2

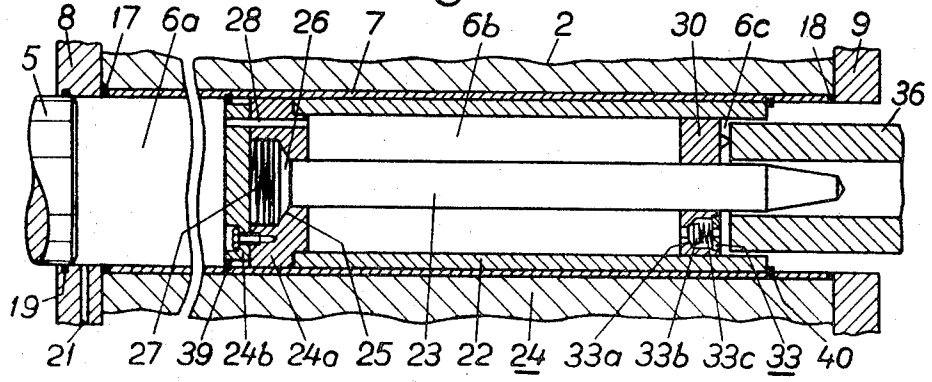
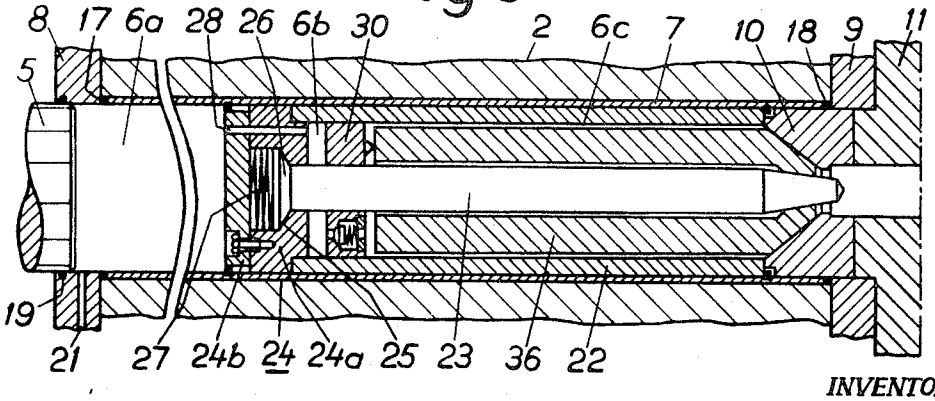


Fig. 3



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Fig. 4

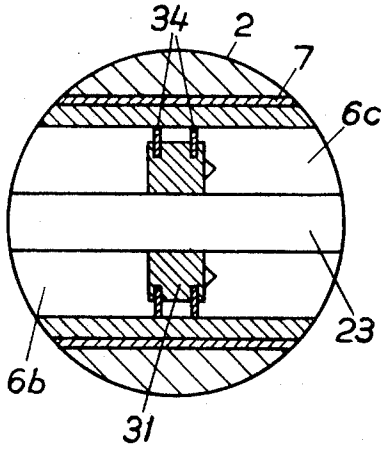
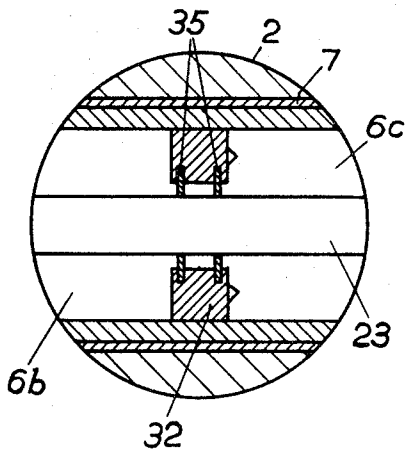


Fig. 5



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PRESS FOR HYDROSTATIC EXTRUSION OF TUBES

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a press, preferably a horizontal press, for hydrostatic extrusion of tubes. It can be used both for cold and hot hydrostatic extrusion.

2. The Prior Art

For hydrostatic extrusion a billet is inserted in a pressure chamber formed by a cylinder, a die having an opening with a cross-section the same shape as the product to be manufactured, and a pressure-generating punch which can be inserted into the cylinder and thus generates the high pressure necessary for the extrusion process, and enclosed in a pressure medium which surrounds the billet and exerts an all-sided pressure on it. When tubes are to be extruded, a hollow billet is used and a mandrel to shape the hollow in the tube. Particularly when tubes having a small inner diameter are being extruded, the stress on the mandrel is considerable and it has been advisable to have the mandrel axially fixed in relation to the die opening so that its outer end is only a short distance outside the point in the die where the opening has its smallest cross-section. In many cases it is suitable to have a somewhat conical mandrel and then axial fixation of the mandrel is absolutely necessary. According to one extrusion process the mandrel is attached in a part which transfers the tensile stress acting on the mandrel to a support tube which rests against the die. A billet, a mandrel, the attachment part of the mandrel the support tube and the die are put together outside the press to form a unit or packet, which is inserted in a high pressure cylinder forming part of the pressure chamber. This is uneconomical from the production point of view and impedes the commercial exploitation of the extrusion process. Furthermore, the process can hardly be used at all for hot extrusion.

SUMMARY OF THE INVENTION

The invention relates to a press which permits economical exploitation of the basic idea of the known process.

According to the present invention, a press for hydrostatic extrusion of tubes includes a press stand with a pressure cylinder movable therein to engage over a die supported by the press stand, and a pressure-generating punch movable in the other end of the cylinder. A sleeve slidable in the cylinder supports a mandrel which can engage through an annular billet into the die opening. A billet holder is slidable in the sleeve, the mandrel passing through it. The billet holder is so constructed that pressure fluid can pass from one side of it to the other.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention is further described with reference to the accompanying drawings.

FIG. 1 shows the main parts of a press according to the invention,

FIGS. 2 and 3 the essential parts of the pressure chamber during the insertion of a billet and with a billet inserted just when the pressure chamber has been sealed, respectively.

FIGS. 4 and 5 show variants of a billet holder used in the press.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

In the drawings 1 designates a press stand. A high pressure cylinder 2 is arranged axially in this stand. The necessary operating cylinders for cylinder 2 are not shown. At one end of the stand is an operating cylinder 3 with an operating piston 4 shaped as a differential piston and connected to a pressure-generating punch 5 which projects into the high pressure cylinder 2 and generates the pressure necessary for the extrusion process in the pressure chamber 6*a*, 6*b*, 6*c*, formed by the cylinder 2, the tube or ring 7, end members 8 and 9, punch 5 and a die 10 inserted at the opposite end of the cylinder, said die being supported by a die support 11 resting against one yoke 12 of the press. The chambers 13 and 14 on each side of the piston 4 in the cylinder 3 are supplied with operating medium through the conduits 15 and 16. Between the ends of the tube 7 and the end members 8 and 9 are high pressure seals 17 and 18. In the end members 8 is a seal 19 which seals between the end member 8 and the pressure generating punch 5. Between the seals 17 and 19 a channel 21 opens out for the supply of pressure medium. Inside the tube 7 in the cylinder 2 is a support tube or sleeve 22 which, during the extrusion process, transfers the force acting on the mandrel 23 to the die 10. The mandrel 23 is attached in a holder 24 consisting of a main part 24*a* having a conical seat 25 for a head 26 on the mandrel and a lid 24*b*. A spring 27 keeps the head 26 pressed against the seat 24. In the holder 24 are channels 28 through which the spaces 6*a* and 6*b* communicate. In the sleeve 22 is a billet holder 30 having valve members which, depending on the pressure between the two sides, permits pressure medium to flow from the space 6*b* to the space 6c and which supports and centers the mandrel 23. The billet holder 30, shown in FIGS. 2 and 3, is provided with an overflow valve 33 having a valve seat 33*a*, a valve body 33*b* and a spring 33*c*, which determines at which pressure the valve opens and allows pressure medium through. Holders of the type shown are further described in U.S. Pat. No. 3,531,965 to Jan Nilsson. A billet to be extruded is designated 36 and two gripping members to insert the billet and the die 10 between the die support 11 and the cylinder 2 are designated 37 and 38. The unit consisting of the mandrel 23, attachment piece 24 and support tube 22 is permanently inserted in the cylinder 2 and its movement is limited by stop rings 39 and 40.

The press operates in the following manner. At the start of a working cycle, the cylinder 2 assumes the position shown in FIG. 1. A billet 36 and a die are inserted from the side between the die support 11 and the cylinder 2 so that the billet is located opposite the opening of the cylinder 2. The cylinder 2 is moved to the right over the billet 36 and, at the position shown in FIG. 2, the space 6*a* is supplied with pressure medium from a pressure medium source, not shown, through the channel 21 in the end member 8. It then passes from this space through the channel 28 to the space 6*b*. The pressure medium actuates the billet holder 23 shaped as a piston and moves this to the right until it comes into contact with the end surface of the billet 36 and presses the billet 36 and the die 10 against the die support 11. The pressure is dependent on the pressure difference

between the spaces 6*b* and 6*c* on each side of the billet holder and is limited upwardly by the opening pressure of the valve **33** or by the pressure of the pressure medium source if this is less than the opening pressure of the valve **33**. The billet **36** and die **10** are held by the pressure in a certain position and the gripping members **37** and **38** of the manipulator can be removed so that the cylinder **2** can be pushed unimpeded completely over the billet **36** and the die **10** so that the pressure chamber becomes completely sealed as shown in FIG. **3**. In normal cold extrusion it is usually suitable to feed the space **6**a with pressure medium from a pressure medium source having an operating pressure lying somewhat above the opening pressure of the valve **33**, so that a pressure medium flows into the space 6*c* during the entire closing process. It is thus possible during the closing process to fill the space **6**c completely with pressure medium. For hot hydrostatic extrusion, however, it is suitable to keep the pressure in the spaces 6*a* and 6*b* lower than the opening pressure of the valve **33** during the entire closing process to avoid cooling the billet during the actual insertion, and, only after closing, increase the pressure so that the space 6*c* is also filled and any remaining air is compressed to an acceptably small volume. The pressure is now increased to the level required for the extrusion process by inserting the pressure generating punch in the cylinder **2**.

In the billet holders according to FIGS. **4** and **5**, the members having valve action consist of annular flanges **34** and **35**, respectively, of elastomeric, yielding material bridging a gap between the billet holder itself and the support tube **22** and mandrel **23**, respectively.

The invention is of course not limited to the embodiment shown. Many variations are feasible within the scope of the following claims.

We claim:

1. Press for hydrostatic extrusion of tubes comprising a press stand, a horizontal high pressure cylinder displaceably mounted in the press stand forming a pressure chamber, a die engageable in one end of the cylinder between the cylinder and the press stand, a pressure-generating punch mounted for movement in the other end of the cylinder to generate a pressure necessary for extrusion in a pressure medium enclosed in the chamber and surrounding a billet to be extruded, a mandrel in the cylinder engageable within the die, a sleeve, means mounting the sleeve in the cylinder for longitudinal movement with respect thereto, stop means carried by the cylinder for limiting such movement in both directions, the length of the sleeve being less than distance between said stop means, said sleeve surrounding the mandrel, means operable when the die is fully engaged in the cylinder to prevent movement of the sleeve in the direction of extrusion through the die, and means operatively connecting the sleeve to the mandrel to prevent movement of the mandrel with respect to the sleeve in the direction of extrusion during such extrusion.

2. Press according to claim **1**, in which said sleeve is axially movable in the cylinder between a position in which the mandrel is outside of the die and a position in which it is partially within the die.

3. Press according to claim **1**, in which the movement preventing means for the sleeve comprises a part of the die against which the sleeve engages.

4. Press according to claim **1** including a billet holder slidable in the sleeve between the movement preventing means for the mandrel and the die, the mandrel passing through the billet holder.

5. Press according to claim **4**, in which the billet holder has a passage therethrough and valve means in said passage to allow the flow of pressure medium therethrough in the direction of extrusion.

6. Press according to claim **5**, in which said valve means is responsive to a pressure of predetermined difference in the parts of the pressure chamber on opposite sides of the billet holder from the die to permit flow through said passage.

7. Press according to claim **4** having means associated with the billet holder for permitting passage of pressure medium from one side to the other thereof in response to a predetermined difference of pressure on opposite sides of the billet holder.

8. Press according to claim **7**, in which said associated means includes at least one yielding annular flange carried by the billet holder.

9. Press according to claim **8**, in which the flange engages the sleeve.

10. Press according to claim **8**, in which the flange engages the mandrel.

* * * * *

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,751,958 Dated August 14, 1973

Inventor(s) Jan Nilsson and Hans Larker

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

After the heading, insert:

Claims priority, Application Sweden,
May 27, 1970, 7252/70

Signed and sealed this 27th day of November 1973.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

RENE D. TEGTMEYER
Acting Commissioner of Patents

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