United States Patent

Burstrom et al.

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[54] HYDROSTATIC EXTRUSION OF COMPOUND MATERIAL

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[30] **Foreign Application Priority Data**

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[52] **U.S. Cl.**.....**29/421,** 72/60, 72/258

[51] **Int. Cl.**.....**B21c 23/22**

[58] **Field of Search**.....72/60, 253, 258; 29/421, 423, 29/473.5, 475, 480

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[57] **ABSTRACT**

In hydrostatic extrusion of a wire or rod of one metal with a casing of another metal, a billet is extruded through a die from a pressure chamber provided with a conical surface adjacent the die opening. The billet is so constructed that fluid is prevented from entering between the core and the casing and that the axial forces created by the differences in moulding resistance of the different materials are transferred between the casing and the core. This may be done by providing a member which overlies the rear ends of the casing and core. The joint between the casing and core is sealed at the rear ends. The front end of the core is shaped to match the conical surface of the die, and the casing may be brought down over this front end, the front end of the casing tapering in thickness.

6 Claims, 5 Drawing Figures

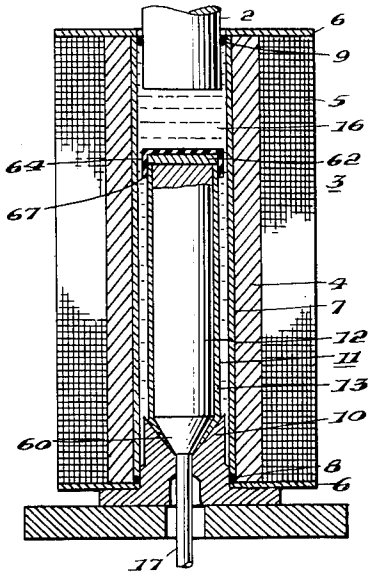


Fig. 1.

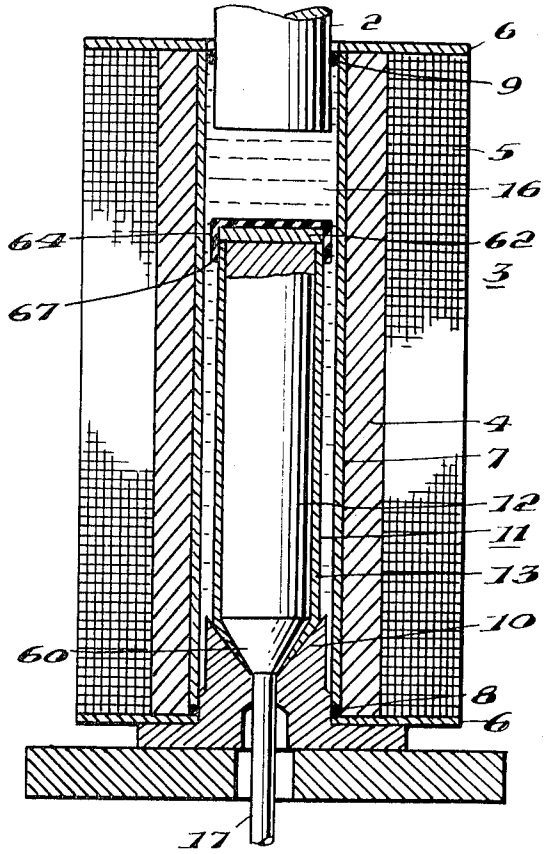


Fig. 5.

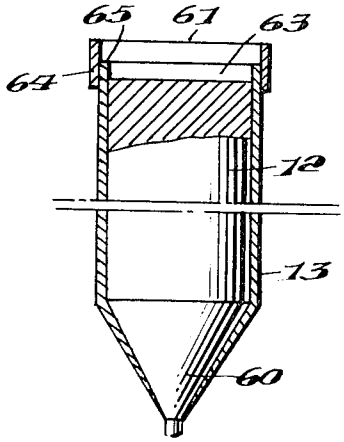


Fig. 2.

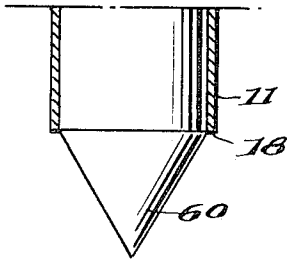


Fig. 3.

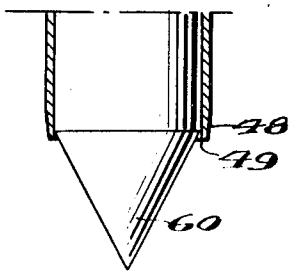
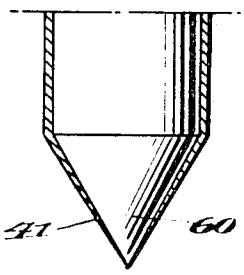


Fig. 4.



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HYDROSTATIC EXTRUSION OF COMPOUND MATERIAL

PRIOR APPLICATIONS

This application is a division of application Ser. No. 758,308 filed Sept. 9, 1968, in the name of Martin Burstrom and Jan Nilsson.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The invention relates to the production of a wire or rod of a hard material with a casing of one material and a core of another, usually a softer material by hydrostatic extrusion.

2. The Prior Art

It is known by means of hydrostatic extrusion to surround a wire or rod of a hard material with a casing or softer material. In the known method a wire or core is used which has a smaller diameter than the finished compound product and only the casing is reduced during the extrusion. The material for the casing is obtained from a substantially tubular casing through which the wire or rod forming the core in the finished product is threaded, after which the tubular casing is pressed along its front part tightly around the wire or rod while along the greater part of its length there will be an annular gap between the wire rod and the casing. The pressure medium will thus be in contact with the surfaces which in the finished product should, if possible, be tightly joined. This means that layers may be formed on the surface which jeopardize the adhesion.

Attempts have also been made to manufacture wire or rod-shaped compound material with simultaneous reduction in area of both core and casing in the billet used. The results have not been satisfactory. The reduction in core and casing has been different from billet to billet. Sometimes only the core or the casing has been extruded through the die.

SUMMARY OF THE INVENTION

The method according to the the invention has made it possible to manufacture rods, wire, and tubes of compound material by means of hydrostatic extrusion of a billet through an outlet opening in a die which is arranged in a pressure chamber. The method is essentially characterized in that the core and the casing in a billet consisting of a core of one or more materials and a casing of another material are combined so that the axial forces arising from the differences in moulding resistance of the different materials are transferred between the casing and the core and sliding between casing and core is thus prevented. This joining can be carried out in many different ways. In order to obtain an effective cohesion between core and casing it is essential that sealing means are applied to the billet to prevent the pressure medium from penetrating between the casing and core of the billet. Thus the pressure medium will press the casing with considerable force against the core so that solely through the friction between the core and the casing considerable axial forces can be transferred between the casing and the core. Sealing plates of elastomeric material or metal provided with flanges may also be placed over the end of the billet so that the flange projects in over the outer side of the casing and is sealingly joined to this.

When a plate of metal is used the sealing can be effected by joining the flange of the plate and the casing of the billet by means of welding or soldering. The core can be placed in the casing in such a position that its rear end surface is at a distance from and completely inside the rear end surface of the casing so that a recess is formed. Into this a plate provided with a flange can be inserted which seals against both the inner surface of the casing and the end surface of the core. Even when the end surface of the billet is shaped in this way a sealing plate of metal provided with a flange may be used and the sealing between the flange and the casing of the billet is effected by means of welding or soldering.

Since the pressure medium is prevented from penetrating between the core and casing of the billet it will press the casing against the core with considerable force, in the order of magnitude of 10–20 kbar.

A method to ensure simultaneous and uniform movement of the core and the casing is to place a rigid plate over the rear part of the billet, covering the end surfaces of both the core and the casing, and to apply one or more seals to prevent pressure medium from penetrating between the end surfaces of the plate and the billet. If the end surfaces of the core and the casing are applied at different levels and one side of the plate is shaped to fit the end surface of the billet thus formed, a control is obtained which prevents the plate from being displaced axially. The sealing member may consist of a ring or a lid having a flange which is placed over the billet and fixed so that it covers the joint between the plate and the casing. If the friction forces between casing and core are too small to join the casing and core when their end surfaces, either directly or through slightly deformable sealing means, are influenced by the pressure medium, this rigid pressure plate can distribute the forces operating on the rear surface of the plate between the core and the casing so that in this way these will be joined.

The shape of the point of the billet is of considerable importance for the start of the compression and for the replacement of material. If the core is shaped with a conical point and with a casing having the same length as the cylindrical part of the billet and with even thickness, an unfavorable start is obtained with considerable waste. At the start a rod or wire of the core material is obtained and then a product of bad quality before a product having the correct thickness and quality of the casing is obtained. The starting process is improved and waste decreased if the casing is beveled towards the point.

Furthermore a better seal between casing and die is obtained if the contact surface is narrow. The best starting action and also reduced waste, and thus increased production, are obtained if the point of the billet is also surrounded by the casing and the thickness of the casing decreases evenly from the periphery to the point. The extrusion must be discontinued before a billet is completely extruded.

The invention also relates to a billet for manufacturing rods or wire by means of the method described. In billets consisting of a core of one or more materials and a casing of another material, the core and casing are joined so that axial forces can be transferred between the core and the casing. The joint is effected by providing the billet at its rear end, that is the end projecting furthest into the pressure chamber, with sealing means to prevent the surrounding pressure medium from penetrating between casing and core. The pressure prevailing during the extrusion process produces a considerable contact pressure between the casing and the core so that an effective cohesion is obtained. The sealing means may be of different types and placed in different positions.

In one embodiment the sealing means consists of a plate provided with a flange which is placed over the rear end of the billet with its flange projecting over the casing. This plate may be made of metal, sealing between flange and casing being effected by joining the flange to the casing by means of welding or soldering. In still another embodiment of the billet the rear end surface of the core is at a certain distance from the rear end surface of the casing and inside this so that a recess is formed with the casing as a wall around the casing. In this embodiment the sealing means may consist of a plate of steel provided with a flange which is applied with one side against the core and with its flange in contact with the inner surface of the casing, the seal between the flange of the plate and the casing consisting of a soldered or welded joint which sealingly connects flange and casing.

In one embodiment of the billet the core is pointed at the front end, its shape closely following that of the inlet part of the die, and the casing is the same length as the cylindrical part of the core. The casing may be beveled at its front part and has at its point a wall thickness which is only a fraction of the original. In another embodiment the casing is drawn for-

wards and shaped so that it also covers the point of the core. In this embodiment it should suitably have a wall thickness decreasing towards the point.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will be described in conjunction with the accompanying drawings, in which:

FIG. 1 shows partly in cross-section a billet according to the invention in the process of extrusion;

FIGS. 2, 3, and 4 show the front ends of modified forms of billet;

FIG. 5 shows a further form of billet.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

In FIG. 1, 1 designates a press platen and 2 a pressure-generating piston which is arranged in an hydraulic press, not otherwise shown, in which there is a cylinder to operate the piston 2. As pressure chamber a high pressure cylinder 3 is used which is constructed of a steel cylinder 4, a strip sheath 5 of rectangular tapes of great strength wound on under prestressing, and end walls 6. Between the end walls 6 and a spacing sleeve 7 in the cylinder are arranged seals 8 and 9 which provide sealing between the pressure cylinder 4 and the pressure die 10 and the piston 2, respectively. In the pressure chamber is a billet 11 consisting of a core 12 of one metal and a surrounding tubular casing 13, of another metal.

The billet is provided with a rigid end plate 62 which takes up the pressure from the pressure medium and transfers the axially operating forces. The plate is so rigid that it can, without noticeable deformation, transfer most of the axial forces to a casing of one metal surrounding a core of another metal so that the core and casing are joined and move simultaneously and with the same speed towards the die during the extrusion process.

The end surfaces of the core 12 and the casing 13 are at the same level and the plate 62 is entirely flat. Over the end of the billet is placed a lid-shaped sealing member 66 of elastomeric material, the axially projecting part 67 of which projects over the rear part of the casing 13, covers the joint 68 between plate and casing and sealingly abuts the casing.

The sealing member 67 prevents the pressure medium from penetrating between the casing and the core so that the pressure medium about the billet 11 will press the casing with considerable pressure against the core and effectively joins core and casing so that axial forces can be transferred between core and casing.

FIG. 2 shows the billet 11 before insertion into the pressure chamber. The core is here pointed and its point 60 has approximately the same acute angle as the conical inlet opening of the die 10. The casing 13 is positioned so that its edge 18 sealingly abuts the die at the start of the extrusion.

The front part of the casing in FIG. 3 is provided with bevelling 48 so that the thickness at the front end surface 49 is only a fraction of the thickness of the rest of the casing.

When the billets according to FIGS. 2 and 3 are used in a product is obtained at the start of the extrusion which consists only of core material and only later a product with a casing of the desired thickness. The waste is therefore considerable as both the product first obtained and the remaining material will be waste. The disadvantages of waste are of great economical importance when a mixed waste material of the two metals has very low value in comparison with pure waste material of either metal. The waste can be considerably reduced, substantially to only the remaining material, if the point is shaped in the manner shown in FIG. 4 with a casing forming a conical point 41 which covers the point 17 of the core. If the point 41 is shaped so that its thickness decreases from the connection to the cylindrical part of the casing to the point, usable products can be obtained right from the start of the extrusion.

In the billet according to FIG. 5, the end surface of the core 12 is inside the end surface of the casing 13. One side of the plate 61 is shaped with a central projecting part 63 which projects into the recess at the end of the billet. The plate 61 is thus firmly fixed in relation to the billet. The rear part of the billet is surrounded by an annular elastomeric sealing member 64 which covers the joint 65 between the plate 61 and the casing 13.

The invention is not limited to the methods described or the embodiments shown. Many modifications and variations are feasible within the scope of the following claims.

We claim:

1. Method of manufacturing by hydrostatic extrusion in a pressure chamber elongated bodies of compound material having a tubular casing which comprises forming a billet by inserting a core of at least one solid metallic material into a casing of another solid metallic material, applying to the rear end of the billet a plate of rigid material which overlies the ends of both the casing and the core, sealing the joint between the casing and the plate to prevent the pressure medium in the chamber from penetrating between the casing and the core, whereby upon exposure to a pressure medium a connecting force is produced between the core and the casing and sliding between the casing and the core is substantially prevented, and furnishing to the pressure chamber pressure medium around the billet for hydrostatically extruding the billet through an outlet opening in a die which is arranged in the pressure chamber.

2. Method of manufacturing by hydrostatic extrusion in a pressure chamber elongated bodies of compound material having a tubular casing which comprises forming a billet by inserting a core of at least one solid metallic material into a casing of another solid metallic material, applying to the rear end of the billet a plate of rigid material which overlies the ends of both the casing and the core, applying an elastomeric sealing means to seal the joint between said plate and the casing to prevent the pressure medium in the chamber from penetrating between the casing and the core whereby upon exposure to a pressure medium a connecting force is produced between the core and the casing and sliding between the casing and the core is substantially prevented, and furnishing to the chamber pressure medium around the billet for hydrostatically extruding the billet through an outlet opening in a die which is arranged in the pressure chamber.

3. A method according to claim 2, which comprises positioning the rear end surface of the core at a distance from and inside the rear end surface of the casing, thereby leaving a recess in the end of the billet, and in which the plate has a portion projecting into such recess.

4. Method according to claim 2, in which the step of applying a sealing means comprises applying a sealing plate of elastomeric material provided with a flange over the rear end of the billet and the plate and bringing the flange in contact with the outer side of the casing.

5. Method according to claim 2, in which the die has a conical inlet and which includes bevelling the casing so that its outermost part forms a narrow contact surface for abutment with the inlet of the die.

6. Method according to claim 2, which comprises forming the front end of the billet with a point which is in close contact with the inlet surface of the die in which the casing covers this point.

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