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H. GRUBER ET AL  
EXTRUDING METALLIC BLANKS

2,207,004

Filed June 28, 1938

FIG. 1.

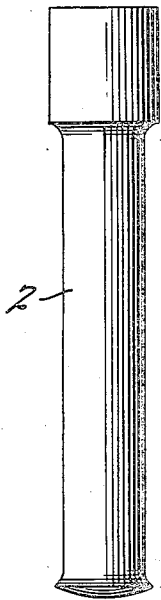


FIG. 2.

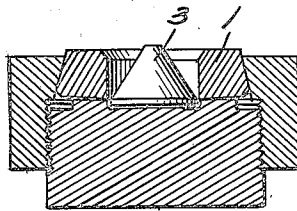


FIG. 3.

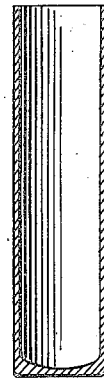


FIG. 4.

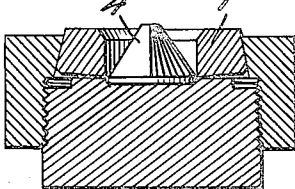


FIG. 5.

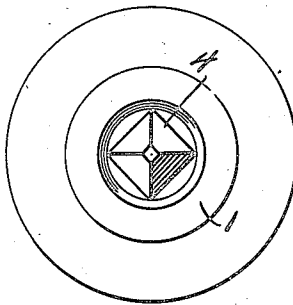
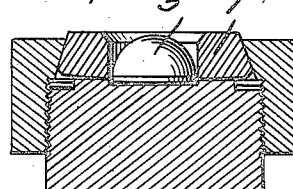


FIG. 6.



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## UNITED STATES PATENT OFFICE

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## EXTRUDING METALLIC BLANKS

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10 Claims. (Cl. 207—10)

A known method of producing tubes and sleeves is the extrusion method which is carried out with the use of an implement consisting of a matrix or female die and a punch or male die by causing the punch to impact against a disc which is adapted to fit in the matrix, and which may if desired be heated. The material is thereby caused to flow, and is cast upwards through the annular gap formed between the inner wall of the matrix and the swelled or beaded edge of the punch.

Although the extrusion method has been in use for decades in the production of tubes made of tin, lead, and aluminium all attempts to form zinc in this way also long proved unsuccessful. The difficulties encountered in the attempts to extrude zinc were only successfully overcome a short time ago, by increasing the impacting velocity to more than 100 mm. per second. An indispensably necessary precondition for the success of the method is at the same time the use of discs of rolled sheet material as blanks. Poured zinc discs of the same size and shape as the rolled tear when formed by die casting. The working up of poured blanks would, however, be very valuable from an economic point of view, since in this case the rolling out of the sheets and the punching out of the round blanks is dispensed with, and no waste is obtained.

The invention has for its object to render possible the extrusion of poured zinc blanks by first causing the material to be improved in quality by heat treatment in the matrix in a manner similar to that in the case of rolling out poured slabs to sheets, and then immediately thereafter extruding the thus improved blank. For this purpose, by using poured blanks which occupy a higher space in the matrix than round blanks of the same volume fitting the matrix, the result is achieved that the blank is deformed by upsetting before the extrusion commences. By the upsetting preceding the extrusion the structure of the material is altered in the same way as in rolling out poured slabs to sheets from which the blanks have hitherto been punched out.

For the production of tubes from tin, lead, and aluminium, that is to say metals which behave differently to zinc when being extruded, it has already been proposed instead of rolled discs and pressed square plates to use castings of the same shape. The significance attributable to preliminary deformation of the workpiece by upsetting has not, however, been recognized, as indeed no preliminary deformation actually takes place when, in accordance with the one mode of prac-

tising the known method, there are used cast round discs the diameter of which is equal to the internal diameter of the matrix socket. If in accordance with the second mode of practising the known method there be employed square blanks for which there is just room in the matrix then the casting is in fact preceded by an upsetting operation, but this operation is carried out under unfavorable conditions inasmuch as not all sections participate to an equal extent in the preliminary deformation. The degree of deformation is also insufficient, and this may be the reason why a relatively large number of rejects are obtained when working by the known method, even when square blanks are used as the starting material.

To obtain with certainty a product of uniformly good quality the extent of the preliminary deformation which the cast blank undergoes in the matrix must also be appropriately determined. Before the extrusion operation is initiated, the workpiece or blank should be deformed in the matrix to approximately the same extent as in the rolling out of cast slabs to the sheets from which the rolled blanks are punched. The degree of deformation may also under certain circumstances be still greater than this, although in many cases it is sufficient to keep the degree of deformation less. This is the case since owing to the fact that the preliminary deformation by upsetting and the extrusion operation follow immediately one upon the other more favorable working conditions are provided than when the preliminary deformation and the die casting operation are separated by a considerable space of time.

The degree of deformation is determined by the shape of the starting blank. In principle, starting blanks of any configuration may be used, provided the height thereof, for the same volume, is greater than that of round blanks having a diameter equal to the internal diameter of the matrix. The height of the blank is preferably also greater than that of the known square blanks which fit in the matrix. By using blanks of this shape the results obtained in extruding tin, lead, aluminium, and similar metals and alloys are also very considerably improved.

In order that all sections of the starting blank may participate in the preliminary deformation the cross-sectional area of the same must, at least at some points, be smaller than the cross-sectional area of the matrix socket, and must be of such shape that contacting with the matrix does not take place. There may be employed for

example cylindrical starting blanks the diameter of which is smaller than the diameter of the matrix, or spherical, hemispherical, pyramidal, and conical blanks. Conical and pyramidal blanks the base of which just fits in the matrix have proved to be particularly suitable, since, like the rolled round blanks, they centre themselves automatically in the matrix.

In some cases the invention may also be of advantage in connection with the extrusion of rolled blanks. Owing to the thermal refining of the material immediately preceding the extrusion it becomes possible to extrude even in the case of alloys which could not hitherto be subjected to this preliminary deforming method. At all events the preliminary deformation of rolled blanks in the matrix makes it possible to simplify the method, inasmuch as the castings need no longer be so thoroughly rolled out as hitherto if the blank be subjected, in accordance with the invention, to a thermal refining process in the matrix.

The accompanying drawing illustrates embodiments of the invention. Fig. 1 shows the punch, Fig. 2 a section through the female die or matrix, Fig. 3 a beaker in section, Fig. 4 a section through the matrix with a blank having the form of a truncated pyramid, Fig. 5 a plan view to Fig. 4, Fig. 6 a section through the matrix with a blank of hemispherical shape.

1 denotes the multi-part matrix, 2 the punch, and 3 a starting blank which, according to the constructional example shown in Fig. 2, is in the shape of a truncated cone. When, after the insertion of the blank in the matrix, the punch descends with suitable velocity the cone is first deformed to a short cylinder completely filling out the matrix, whereupon the metal, which is caused to flow, is squeezed out through the annular gap formed between the inner wall of the matrix and the swelled or beaded edge of the end of the punch, the result being to produce the beaker shown in Fig. 3.

According to the embodiments shown in Figs. 4 and 5 the blank 4 is in the form of a truncated pyramid, and according to Fig. 6 the blank 5 is hemispherical.

It may under certain circumstances be advantageous to heat the workpiece before inserting the same in the matrix, as in the case of extruding rolled blanks.

The starting blanks may if desired be poured in coherent series in the form of rods which are divided up by appropriate cuts.

What I claim is:

1. The method of producing a zinc shell by extrusion through a gap between a female and a male die, which consists in placing within the said female die a poured blank having a greater height than a cylindrical blank of equal volume and of a size to fit said female die, and causing the male die to descend upon said blank thereby first deforming the blank by upsetting and then extruding the same through the annular gap formed between the said dies, whereby preliminary working of the blank prior to the actual extrusion is attained.

2. The method of producing a shell by extrusion through a marginal gap between a female die and a male die, from a metal selected from the group comprising zinc, tin, lead, and aluminum, which consists in placing in the said female die a poured blank square in cross section and having a greater height than a square prismatic blank of equal volume and of a size

to fit in said female die, and causing the male die to descend upon said blank thereby first deforming the blank by upsetting and then extruding the same through the annular gap formed between the said dies, whereby preliminary working of the blank prior to the actual extrusion is attained.

3. A poured zinc blank of circular cross-section for the extrusion of a shell, the blank being substantially circular in cross-section, and the height of the said blank being greater than that of a cylindrical blank of the same volume and of a size to fit the female die for casting a similar sized shell.

4. A shell extruding blank poured from a metal selected from the group comprising zinc, tin, lead, and aluminum, the blank being square in cross-section, and the height of the said blank being greater than that of a square prismatic blank of the same volume and of a size to fit the female die for casting a similar sized shell.

5. The method of producing a metallic shell by extrusion through the marginal clearance space between male and female dies, which comprises placing in the female die a cast blank the side walls of which converge, and causing the male die to descend upon said blank, thereby effecting a preliminary working of the blank by upsetting and then extruding the same through the annular clearance space between the dies.

6. The method of producing a metallic shell by extrusion through the marginal clearance space between substantially cylindrical male and female dies, which comprises placing in the female die a cast blank of substantially pyramidal configuration, a circle described about the base of the pyramid being substantially identical with the margin of the bottom of said female die, and causing the male die to descend upon said blank, thereby effecting a preliminary working of the blank by upsetting and then extruding the same through the annular clearance space between the dies.

7. The method of producing a metallic shell by extrusion through the marginal clearance space between substantially cylindrical male and female dies, which comprises placing in the female die a cast blank of substantially conical configuration, the base of the blank being of substantially the same shape and diameter as that of the bottom of the female die, and thus of the base of the shell to be formed, and causing the male die to descend upon said blank, thereby effecting a preliminary working of the blank by upsetting and then extruding the same through the annular clearance space between the dies.

8. The method of producing a metallic shell by extrusion through the marginal clearance space between substantially cylindrical male and female dies, which comprises placing in the female die a cast blank of substantially hemispherical configuration, the base of the blank being of substantially the same shape and diameter as that of the bottom of the female die, and thus of the base of the shell to be formed, and causing the male die to descend upon said blank, thereby effecting a preliminary working of the blank by upsetting and then extruding the same through the annular clearance space between the dies.

9. The method of producing a zinc shell by extrusion through the marginal clearance space between substantially cylindrical male and female dies, which comprises placing in the fe-

male die a cast blank the side walls of which converge so that the cross-sectional area of the blank varies with the height, and causing the male die to descend upon said blank, thereby effecting a preliminary deformation of the blank through transverse flow to fill the die and then extruding the same through the annular clearance space between the dies, said preliminary deformation serving to effect a working of the cast zinc blank which is the substantial equivalent of that effected by the rolling of a zinc plate from which conventional round blanks are stamped.

10. A blank for use in the extrusion of a shell through the annular marginal clearance space between male and female dies, said blank being made of cast zinc and of a configuration such that at least portions of the opposite side walls converge, whereby the cross-sectional area of the blank varies with the height thereof.

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