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PRESS FOR MANUFACTURING TUBES, RODS OR THE LIKE

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Fig. 1.

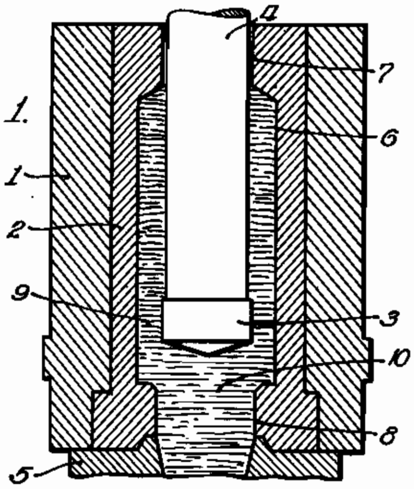


Fig. 2.

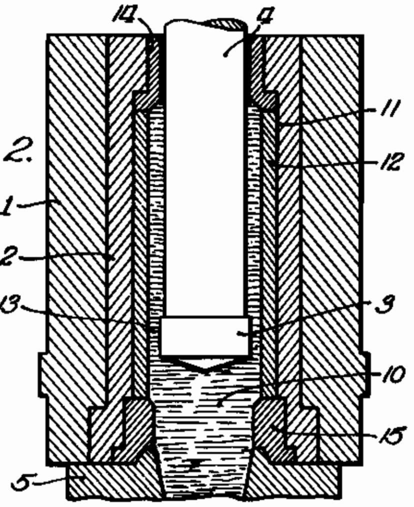


Fig. 3.

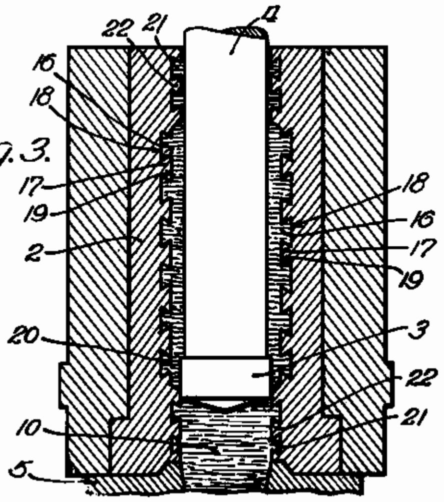


Fig. 4.

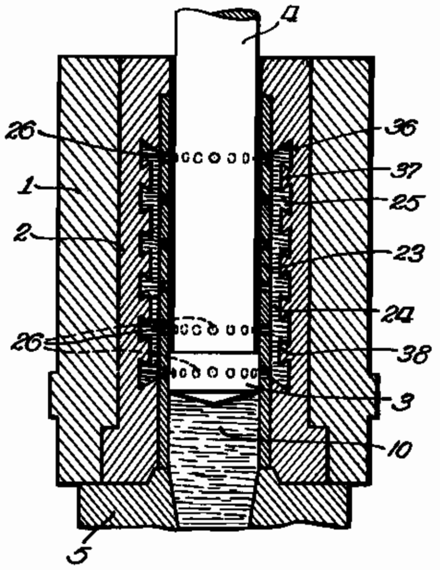
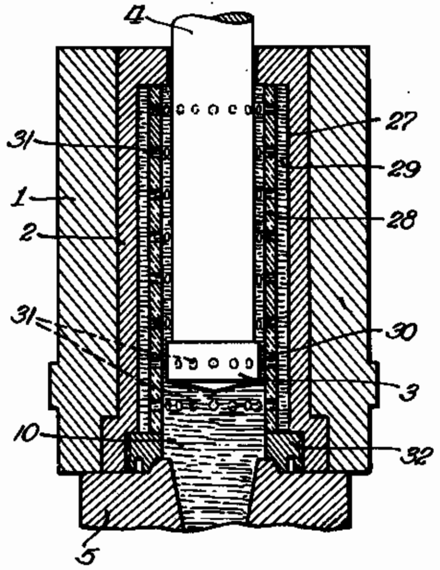


Fig. 5.



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ALIEN PROPERTY CUSTODIAN

PRESS FOR MANUFACTURING TUBES, RODS OR THE LIKE

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This invention relates to a press for manufacturing tubes, rods or the like, particularly to cable covering presses in which molten metals, for instance, aluminum or aluminum alloys are poured into a container.

In the known presses for the manufacture of hollow articles and cable covering presses as well which serve to extrude solid or molten materials, a container is employed whose bore is, as a rule, slightly, for instance, one millimeter greater than the diameter of the extrustion die head. If a molten material to be extruded, for instance, lead or aluminum is poured into the container a very thin layer corresponding substantially to the difference in diameters between the die head and the bore of the container is generally formed around the die during the extruding stroke. When refilling the container, the above-mentioned layer which remains therein fuses again together with the molten material freshly poured into the container and a very thin layer is again formed during the following extruding stroke. This is repeated during each extruding stroke.

The presses hitherto known present the disadvantage in that the highly heated material to be extruded exerts a detrimental thermal-technological action on the walls of the container or of the liner arranged, as a rule, in the same and consisting of highly tempered steel. The material of the container or the highly tempered steel of the liner is subjected to a premature destruction as a result of heating cracks caused by the high temperature of the material to be extruded which, for instance, amounts in the case of lead to about 400 centigrades and in the case of aluminum to about 450 centigrades. Apart from the formation of heating cracks there is, however, also another thermal-technological drawback, since also the highly tempered steel of which consists the liner is impaired by the fact that the strength of this material is considerably reduced owing to the repeated pouring of the molten material into the container. In this case an annealing of the steel is effected so that the steel can no longer fulfil the desired requirements.

When extruding some materials, for instance, molten aluminum or molten aluminum alloys it has further been found that the steel walls of the container or of the steel liner arranged in the container with which the hot molten material comes into contact are subjected to chemical reactions. In this case parts of the steel are dissolved and mixed with the material to be extruded. They are extruded with the latter and pass into the product, for instance, into the cable sheath. The drawback is thus presented in that on the one hand the walls of the container or of the steel liner are gradually destroyed and that on the other hand the amount of steel absorbed by the aluminum or the like impairs the quality of the product; i. e., the flexibility, the weldability and the resistance to corrosion of the cable sheath are impaired by the undesirable admixture of steel when manufacturing a cable sheath.

The present invention has for its object to avoid the above-mentioned drawbacks which occur when operating the presses hitherto known. The invention consists in the fact that the container of the press or a liner arranged therein has a bore enlarged to an amount which is greater than is, as a rule, usual and which serves for the reception or the formation of a thick protective layer. In this manner, the molten material to be extruded, for instance, lead or aluminum is prevented from coming directly into contact with the steel wall of the container or of the liner. Consequently, the above-mentioned detrimental thermal-technological and chemical actions of the molten material cannot occur on the wall of the container or of the liner.

Different forms of the invention are possible which will hereinafter be dealt with.

Thus, for instance, the bore enlarged according to the invention may be lined with a material which either consists of the same or of approximately the same material as the material to be extruded. For instance, the lining material corresponding to the material to be extruded may consist of the purest aluminum, or pure aluminum or of an aluminum alloy. In this case the the liner of the enlarged bore is formed by itself, insofar as a jacket not extruded by the die is left after each extruding operation.

The above-mentioned enlarged bore may further be lined with a material which has a higher fusing point than that of the material to be extruded and is therefore insensitive to heat with respect to the material to be extruded. The material lining the enlarged bore may also be harder than the material to be extruded. Furthermore, a material having a higher fusing point and/or being harder than the material to be extruded may be provided in an outer zone of two tubular concentric zones within the enlarged bore, whereas a material similar to the material to be extruded may be provided in an inner zone within said bore and facing the extrusion die. Various materials may be therefore employed in combination in lining the container, such as, for instance, an alloy having a high fusing point and a material which consists of the same or of approximately the same material as that to be extruded. Consequently, a hard aluminum alloy may be employed for the outer jacket and purest or pure aluminum for the inner jacket. In the latter case, the liner lying next to the extrusion die is again formed by itself by the fact that a jacket not extruded by the die is left after each extruding operation.

In the enlarged bore also a bush may be provided which fills up only in part in the radial direction the zone limited on the one hand by the jacket surface of the die head and on the other hand by the enlarged bore. The above-mentioned bush may be provided with perforations for equalizing the difference in pressure. By the arrangement of these perforations the material to be extruded may pass through these perforations when pouring the molten material into the container or as a result of the pressure caused by the extrusion die so that the pressure internally and externally of the brush is equalized and therefore the material of the bush is not subjected to excessive stresses which might impair the life of the bush.

Furthermore, the bush may consist of a pressure-tight metal which is as far as possible not subjected to corrosion and is resistant to wear, such as, for instance, steel bronze. In this case, it is preferable to employ a bush having relatively thin walls and to embed under pressure at least its outer jacket end, if necessary, also the inner jacket into a molten metal. By the use of a relatively thin bush a saving in material is effected. The bush may also be made of a non-metallic, for instance, ceramic material. The heat resistant but under certain conditions very fragile ceramic jacket is preferably embedded in molten metal.

In the cases mentioned above the advantage is attained according to the invention in that the molten lining material in the enlarged bore comes into contact only once during the first charge with the steel walls of the container or of the steel liner arranged therein and then solidifies. By the next following charges the lining material cannot be fused, if this material has a higher fusing point than the material to be extruded. But even if the liner consists of the same or approximately the same material as the material to be extruded only a small portion of the lining material can be molten during the subsequent charge of the container provided that the wall of the liner is chosen according to the invention sufficiently thick, since the jacket remaining in the enlarged bore at the end of the extruding stroke solidifies and the molten material supplied during the subsequent extruding stroke can fuse only a small portion of the inner surface of the jacket left back in the enlarged bore. The molten material to be extruded is therefore prevented with certainty from coming regularly into direct contact with the steel walls of the container or of the liner arranged therein. The danger of a premature destruction of the container walls or of the walls of the steel liner owing to the formation of heating cracks or to an annealing of the steel is therefore avoided with certainty. Also a pitting of said walls owing to the chemical action of the molten material to be extruded and also a contamination of the same is prevented.

The enlarged bore according to the invention may at best take up only a portion of the length of the container, whereas at both ends of the container the bore is restricted to the necessary amount. In this manner, the advantage is presented in that a flow of the lining material in the longitudinal direction of the container is prevented. In order to prevent to a further extent a flow of the lining material in the longitudinal and the transverse direction of the container under the action of the pressure, the enlarged bore is further provided with comb-like depressions which are filled up with the lining material. These comb-like depressions may be given the shape of annular grooves, whose cross-section may have any suitable form. The annular grooves are preferably given a dove-tail shape in order that they firmly retain the lining material. In this manner a wandering of the lining material in the axial direction as well as an escape of this material inwardly in the radial direction to the axis of the container is prevented.

These comb-like depressions are preferably arranged in the outer jacket surface of a tubular zone filled up with the lining material and which is adjacent to the extrusion die. Consequently, the comb-like depressions do not extend to the extrusion die but are separated from the die by a tubular layer of the lining material. This layer is preferably chosen so thick that the comb-like depressions or the amounts of the lining material arranged therein are not uncovered when recharging the container with molten material to be extruded.

Furthermore, the parts which are easily subjected to wear and arranged at the end of the container may preferably be provided with easily interchangeable pressure-tight bushes. In this manner a saving of material is effected.

In the accompanying drawings are shown several embodiments of the invention in diagrammatic form in which

Figs. 1 to 6 are vertical sectional views of different forms of a cable covering press according to the invention.

The container of the cable covering press in Fig. 1 is provided with a vertical pressure jacket 1 consisting of forged steel and in which is arranged a liner 2 made of highly tempered steel. In the liner 2 the extrusion die 4 provided with a head 3 may move in the upward and downward direction. At the lower end of the container is arranged in the known manner the extrusion head 5 carrying the extrusion tools. The jacket 1 and the liner 2 serve to take up the pressure exerted in the interior of the liner and employed to drive the extrusion die.

The steel liner 2 which in the known cable covering presses has a bore only about 1 mm greater than the diameter of the die head 3 is provided according to the invention with a bore 6 which is, for instance, 12 mm or more greater than the bore of the hitherto known cable covering presses and which serves for the reception or the formation of the protective layer to be hereinafter described. The bore of the liner 2 is restricted at the upper and lower end as indicated at 7 and 8 to the desired diameter.

The enlarged bore 6 is filled up in the embodiment according to Fig. 1 with a material consisting of the same metal to be extruded, for instance, purest aluminum or pure aluminum or with an aluminum alloy. If the press is, for instance, to be employed to extrude molten purest aluminum the entire inner space of the liner 2 is at first filled up with the molten material to be extruded which comes into engagement only the first time with the material of the liner 2 at the surface formed by the enlarged bore 6. At the end of the first downward stroke of the extrusion die 4 a layer 9 of the material to be extruded remains in the tubular zone which extends from the upper to the lower end of the bore and which is limited on the one hand by the bore 6 and on the other hand by the jacket surface of the extrusion die head 3, which layer solidifies together with the residual amount 10 of the molten material under the die head 3. The solidified layer 9 forms for the further operation of the press a protective layer which prevents with certainty the above-described destruction of the inner walls of the liner 2.

By the restricted portions 7 and 8 of the liner 2 a flow of the lining material 9 is prevented in the longitudinal direction of the container.

In some cases it may be preferable to fill up the inner space of the liner 2 during the first extruding stroke with a molten material which has a higher fusing point or is harder than the material to be later regularly extruded; i. e., for instance, a molten phosphor bronze may be poured for the first time into said space, whereas, for instance, molten purest aluminum is filled later into said space regularly. There then remains in the tubular zone for the reception of the above-mentioned layer 9 a protective layer consisting of phosphorus bronze.

The zone according to Fig. 1 for the reception of the protective layer 9 may also be subdivided into various, for instance, into two tubular zones arranged concentrically with respect to one another, one of which is filled up with a material having a higher fusion point than the material to be extruded and the other is filled with a material consisting of the material to be extruded. A corresponding form of the invention is shown in Fig. 2.

Within the enlarged bore 11 (Fig. 2) of the steel liner 2 is provided an outer tubular zone which is filled up with a molten material 12 having a relatively high fusing point, such as, for instance, gun-bronze. Furthermore, a lining 13 which consists of the same material as the material to be extruded, for instance, purest aluminum is provided in an inner tubular zone facing the extrusion die 4. In this case the two tubular protective layers 12 and 13 serve to protect the material of the liner 2 from being destroyed by the molten material to be extruded.

In the embodiment shown in Fig. 2 the enlarged bore 11 of the liner 2 is provided at the upper and lower end of the container 1 with two pressure-tight bushes 14 and 15 whose diameters are, for instance, only 1 mm. greater than the diameter of the extrusion die head 3.

In the container shown in Fig. 3 circular dove-tailed grooves 16 are turned in the steel lines 2 so that also dove-tailed projections are formed. The above-mentioned enlarged bore is formed by the front faces 18 and 19 of the grooves 16 and of the projections 17 respectively and by the undercut surfaces of these depressions and projections. The projections 17 are shaped in such a manner that the front faces 19 of these projections are spaced a certain distance from the path in which moves the jacket surface of the die head 3. In this manner a tubular space is obtained between said path and the front faces 19 which space may serve to form the protective layer to be hereinafter described and which has a similar function as the zone for the exception of the protective layer 9 according to Fig. 1.

The restricted portions of the bore of the liner 2 shown in Fig. 3 are provided at the upper and lower end of the container with small depressions 21 having also a dove-tail shape. Dove-tail shaped projections 22 are formed by the depressions 21.

The tubular zone between the front faces 19 (Fig. 3) of the projections 17 and the path of the jacket surface of the die head 3 is filled up with a material 20, for instance, with a hard aluminum alloy serving as protective layer. This material also fills up the comb-like depressions 16. The projections 17 are therefore completely surrounded by said protective layer. Also the depressions 21 at the upper and lower end of the container are filled up with the above-mentioned hard aluminum alloy.

The protective layer which consists of the material 20 contained in the above-mentioned tubular zone and of the material in the depressions 18 protects the material of the steel liner 2 against destructions which might be caused by the molten material to be extruded. By the passage of the material forming the protective layer into the depressions 16, 21 the wandering of the protective layer in the axial direction of the container is prevented to a greater extent than is the case with the forms shown in Figs. 1 and 2. Owing to the dove-tail shape of the depressions 16, 21 also a squeezing out of the lining material in the radial direction to the axis of the container is prevented.

The container shown in Fig. 4 is designed in part similar to that shown in Fig. 3. However, in the form of the invention according to Fig. 4 a relatively thin walled, pressure-tight and corrosion-proof metal bush, for instance a bush 23 made of steel bronze is arranged in the immediate neighborhood of the path in which the jacket surface of the die-head 3 moves in the steel liner 2. A portion of the length of the outer surface of the bush 23 is surrounded by a tubular recess serving for the reception of a protective layer 24 and which has the same function as the tubular zone for the reception of the protective layer 20 in Fig. 3. Adjacent to the tubular space for the reception of the protective layer 24 (Fig. 4) are disposed comb-like depressions 25 which have the same function as the depressions 16 shown in Fig. 3 and which are formed in the same manner as these depressions by annular dove-tailed grooves. The above-mentioned enlarged bore of the liner 2 is formed in the embodiment shown in Fig. 4 in the same manner as in the embodiment shown in Fig. 3 by front faces 38 and 37 and by the undercut surfaces of the depressions 25 and of the projections 38 placed therebetween.

The bush 23 (Fig. 4) is provided with perforations 26 through which passes the molten material to be extruded, for instance, purest aluminum when pouring this material into the container and when exerting a pressure by means of the extrusion die 3, 4. Owing to the arrangement of the perforations 26 the pressures exerted on the material to be extruded interiorly and exteriorly of the bush 23 are equalized so that a non-uniform stressing of this bush is prevented. The thin-walled bush 23 may be exchanged, because of the tearing of metal of the bush without there occurring a considerable loss of material.

If necessary, the bush 23 (Fig. 4) may have such a large inner and outer diameter that the outer jacket surface of the bush is not only in engagement with a protective layer 24 but that also a similar protective layer is arranged between the bush 23 and the path formed by the jacket surface of the die head 3. A bush arranged between two protective layers is shown in Fig. 5.

In the form of the invention shown in Fig. 5 a bush 28 which consists of a ceramic material containing, for instance, steatite which cannot be corroded by the material to be extruded such as, for instance, purest aluminum or of a corundum mixture is arranged in the enlarged bore 27 of the steel liner 2. The bush 28 has such an outer and inner diameter that it is spaced a given distance both from the enlarged bore 27 and from the path in which moves the jacket surface of the die head 3. In this manner tubular zones are formed exteriorly and interiorly of the ceramic bush 28 serving for the reception of the protective layers 29 and 30 respectively. A material similar to the material to be extruded, such as, for instance, purest aluminum may be employed also in these zones as a protective layer. The bush 28 is provided with perforations 31 which have the same function as the perforations 26 shown in Fig. 4. An equalization of the difference in pressure between the outer layer 29 and the inner layer 30 may be brought about with the aid of the perforations 31. Consequently, the outer and inner jacket surfaces of the ceramic bush 28 are embedded in a molten material such as, for instance, purest aluminum which is under a uniform pressure and cannot therefore be destroyed by the pressure brought about during the extruding stroke although it is in itself fragile.

At the lower end of the container is provided as shown in Fig. 5 an annular closure 32 designed in the form of a nut which is threadedly associated with the steel liner 2 and by means of which the ceramic bush 28 and the metallic lining 20 which is solidified after the first charging and which is arranged exteriorly of the bush are protected in the liner 2.

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