May 19, 1942. P. L. CLARK 2,283,791

EXTRUSION MACHINE CYLINDER OR CONTAINER

Filed July 20, 1940 2 Sheets-Sheet 1

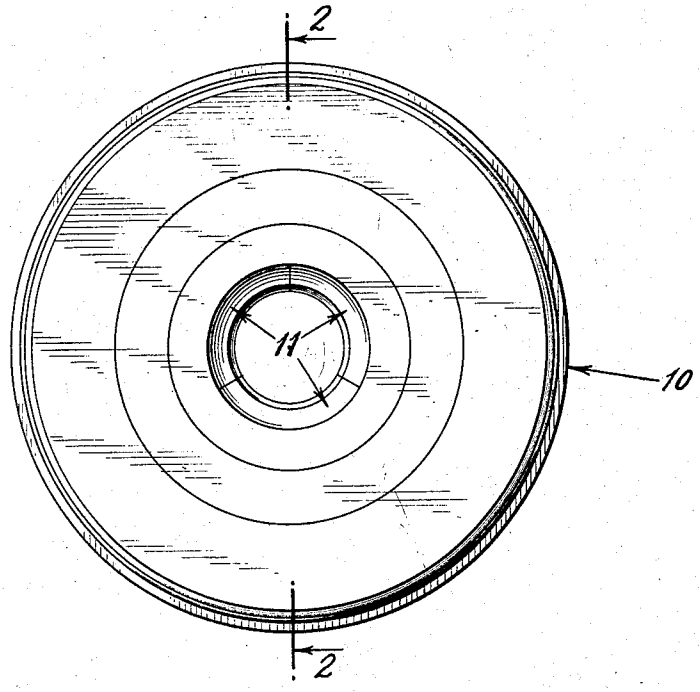


Fig. 1.

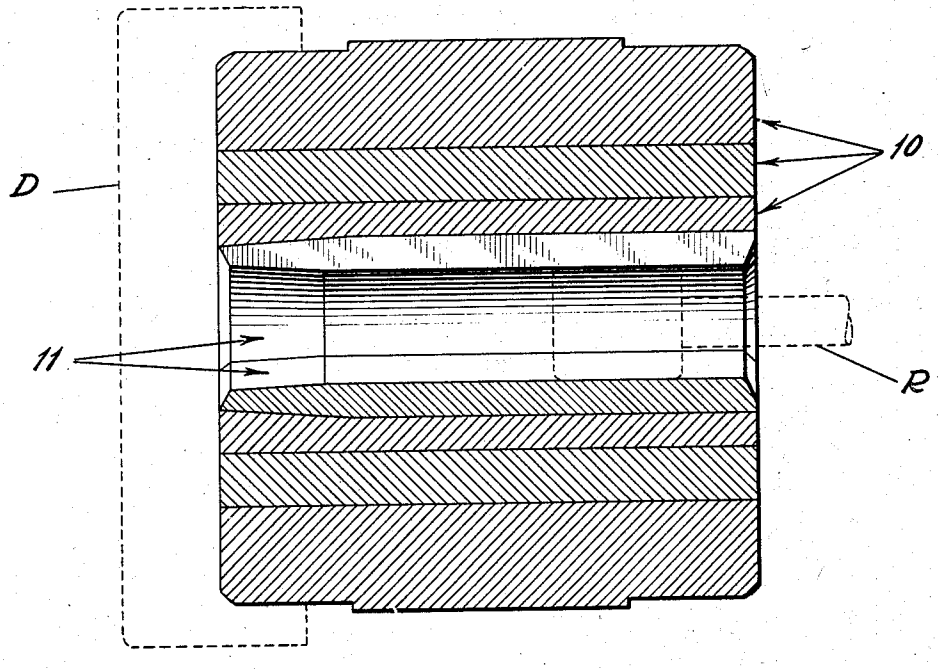


Fig. 2.

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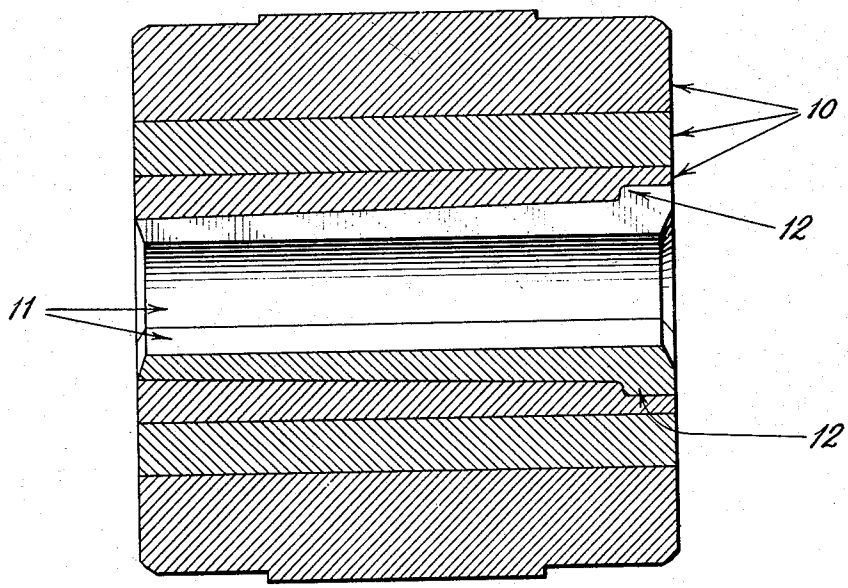


Fig. 3.

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EXTRUSION MACHINE CYLINDER OR CONTAINER

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3 Claims. (Cl. 207—15)

This invention relates to extrusion machine cylinders or containers. An extrusion machine consists essentially of a container, a ram and a die. A hot billet of suitable metal is placed in the container and the ram exerts pressure thereon to extrude the metal through the die.

Heretofore, extrusion machine containers have consisted of a tubular body containing a continuous tubular steel liner. Such liner is subject to complex stresses and must be made of material sufficiently hard and tough to withstand the abrasive wear and tensile stresses brought about by frictional contact of the hot billet with the interior of the liner and still must not be of sufficient brittleness to permit longitudinal or circumferential breakage of the liner. Also, it must be composed of metal which will withstand sudden variations in temperature and pressure and still maintain the required physical strength at the temperatures under which the extrusion takes place.

As extrusion has been applied to alloys of increasingly higher elastic limits, many of which require the use of higher temperatures than formerly used, it has become necessary to find steel which combined to a greater extent some or all of the above-mentioned qualities. The addition of elements such as tungsten, cobalt, molybdenum, chromium or alloys having similar heat resisting characteristics to steel melts for the purpose of resisting the stresses at higher temperature, increases the difficulty of maintaining ductility and preventing breakage when heat treated, distortion and excessive abrasive wear. A steel satisfying all the above requirements can be obtained only at considerable difficulty and expense.

An object of this invention is an extrusion container structure provided with a liner in which circumferential tensile stresses are substantially eliminated and the stresses are substantially confined to those brought about by heat and to compressive and abrasive stresses, thereby making practical the use of a liner composed of a material not otherwise practical.

In accordance with this invention, the liner is constructed in segmental sections which are shrunk into a tubular container under circumferential compression in the usual manner. When a billet is introduced into the liner and pressure from an extrusion ram is exerted upon it, the plastic material being extruded translates the longitudinal pressure of the extrusion ram into stresses tending to expand the liner as a whole. These stresses are carried through the segments of the liner to the container into which the liner is shrunk and are resisted by the container. The container is shielded by the liner from contact with the heated billet and does not attain the temperature that the liner experiences. Therefore, it can be made of a tougher and more elastic material. As an illustration of a suitable steel for this purpose, one containing .45 carbon; 2.60 nickel; .75 chrome; .40 molybdenum with traces of vanadium, has proven satisfactory when heat treated for maximum strength and ductility at 395 Brinell hardness (3000 kg. load on 10 mm. ball). The liner is substantially free from circumferential tensile stresses and the major stresses in the liner during the extrusion operation are confined to heat stresses and compressive and abrasive stresses, thus permitting the use of a liner material with high compressive and abrasive stress resistance under heat. A steel suitable for this purpose would be one having the characteristics of the following alloy: 18.0 tungsten; 4.0 chrome; 1.0 vanadium; .50 carbon; heat treated to give maximum strength and ductility at 490 Brinell hardness (3000 kg. load on 10 mm. ball). A further advantage of the segmental construction is that the segments are more readily heat-treated than single piece liners and give increased service life.

Other objects, novel features and advantages of this invention will become apparent from the following specification and accompanying drawings, wherein:

Fig. 1 is an end view of an extrusion cylinder constructed in accordance with the invention;

Fig. 2 is a section on the line 2—2 of Fig. 1; and

Fig. 3 is a section similar to Fig. 2 of a modified form.

The extrusion cylinder illustrated in Figs. 1 and 2 consists of a tubular body 10 formed of three concentric cylinders and a liner 11 shrunk into the inner cylinder. The liner is shown as consisting of three segmental sections, but it is contemplated the liner may be constructed of two or more sections. Each section is tapered over a portion of its length to co-operate with a corresponding surface in the inner cylinder to prevent longitudinal creeping of the segments with respect to each other and to maintain them in proper position in the body. Each segment of the liner is composed of high strength heat resisting alloy and is properly heat-treated to condition it to withstand the stresses to which it is to be subjected. The cylinders forming the body 10 are composed of a heat-treated alloy of great

toughness and high elasticity to resist circumferential strains, but not necessarily highly heat-resistant as the body is subjected only to comparatively low temperatures. The liner, however, is composed of a material having high compressive stress resistance under heat and capable of withstanding the abrasive wear and tensile stresses resulting from frictional contact of a hot billet.

As indicated in Fig. 2, the extrusion cylinder is associated with a die D and a ram R, both shown in dotted lines. After a billet has been introduced into the container, it is forced through the liner and into the die D by operation of the ram R. The right-hand end of the liner is slightly countersunk to facilitate insertion of the billet and the left-hand end is also slightly countersunk as well as being diverging over a short distance to facilitate removal of the butt.

The modification illustrated in Fig. 3 differs essentially from the modification illustrated in Fig. 2 by the provision of a shoulder 12 on the liner segments and provision of a coacting annular recess in the inner body cylinder. In this modification, the shoulder 12 maintains the segments in fixed longitudinal position, thereby preventing longitudinal creeping of any segment relative to the remainder and also relative movement of the liner with respect to the body. Also in this modification, the liner may be straight instead of tapered, as the shoulder is sufficient to maintain the liner or the segments in fixed position.

I claim:

1. An extrusion machine container comprising, a tubular body formed of a plurality of concentric cylinders and a liner composed of material having high wear and compressive stress resistance under heat, said liner being formed from several longitudinally arranged segmental sections each tapering externally in its entire length and shrunk within the inner of said concentric cylinders, the said inner of said concentric cylinders having an inner surface complemental to the external surface shape of said tapering segments whereby substantially all circumferential tensile stresses in said liner during extrusion are eleminated, the said stress being taken up by said tubular body, and the tapering form of said liner and said inner of said concentric cylinders tending during extrusion to increase the tightening pressure between said segments and said inner cylinder and between the segments themselves, and the inner surface of said inner cylinder and the outer surface of said segments having engaging shoulders to prevent creeping of said segments with respect to each other and to maintain them in proper position in said body.

2. An extrusion machine container comprising, a tubular body formed of a plurality of concentric cylinders and a liner composed of material having high wear and compressive stress resistance under heat, said liner being formed from three longitudinally arranged segmental sections each tapering externally and shrunk within the inner of said concentric cylinders, the said inner of said concentric cylinders having an inner surface complemental to the external surface shape of said tapering segments, whereby substantially all circumferential tensile stresses in said liner during extrusion are eliminated, the said stresses being taken up by said tubular body, and the tapering form of said liner and said inner surface of said inner of said concentric cylinders tending during extrusion to increase the tightening pressure between said segments and said inner cylinder and between the segments themselves, and the inner surface of said inner cylinder and the outer surfaces of said segments having annular shouldered portions adapted to engage each other to prevent creeping of said segments with respect to each other and to maintain them in proper position in said body.

3. An extrusion machine container comprising, a tubular body, and a liner therefor composed of material having high wear and compressive stress resistance under heat, said liner being formed of several longitudinally arranged segmental sections each tapering externally in its entire length and shrunk within the said body, the said body having an inner surface complemental to the external surface shape of said tapering segments whereby substantially all circumferential tensile stresses in said liner during extrusion are eliminated, the said stresses being taken up by said tubular body, and the tapering form of said liner and said inner surface of said body tending, during extrusion, to increase the tightening pressure between said segments and said body and between the segments themselves, and the inner surface of said body and the outer surface of said segments having engaging shoulders to prevent creeping of said segments with respect to each other and to maintain them in proper position in said body.

PERCY L. CLARK.