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DIE FOR THE EXTRUSION OF METALS

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Fig. 1

Fig. 2

Fig. 3

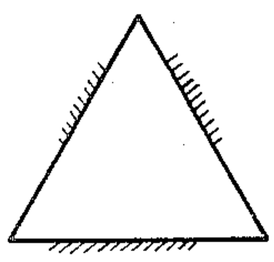


Fig. 4

Fig. 5

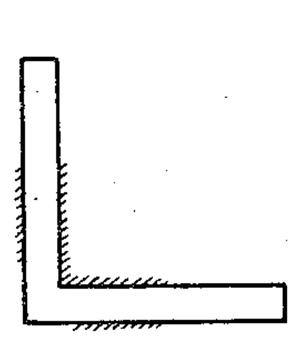


Fig. 6

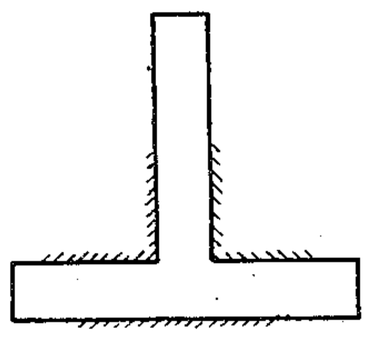


Fig. 7

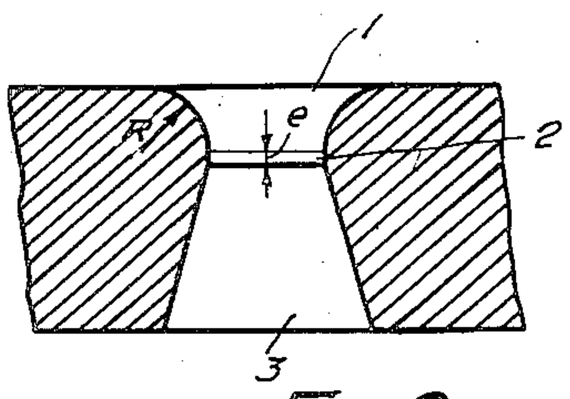


Fig. 9

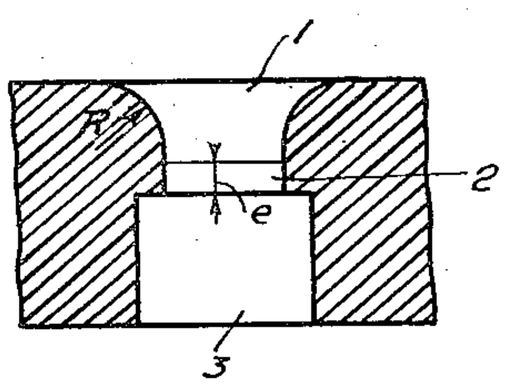
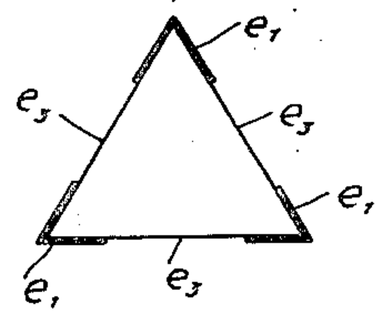


Fig. 10



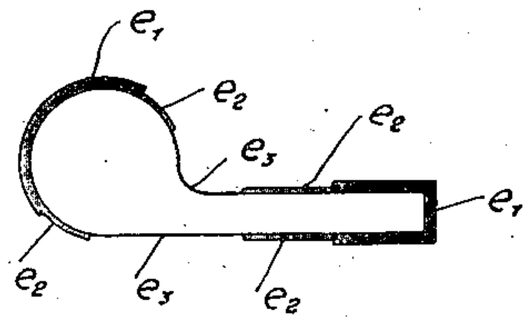


Fig. 11

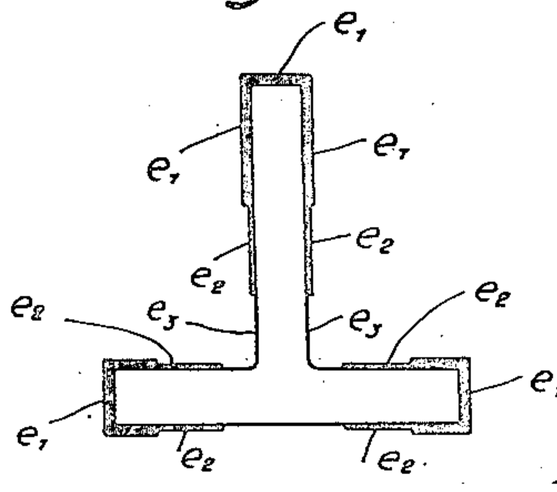


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Fig. 8

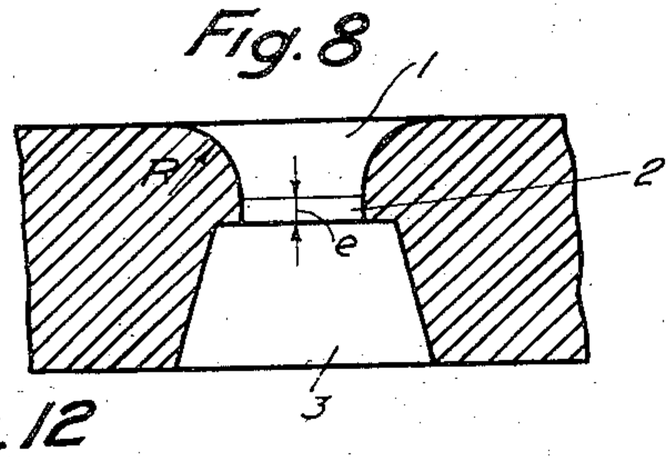


Fig. 12

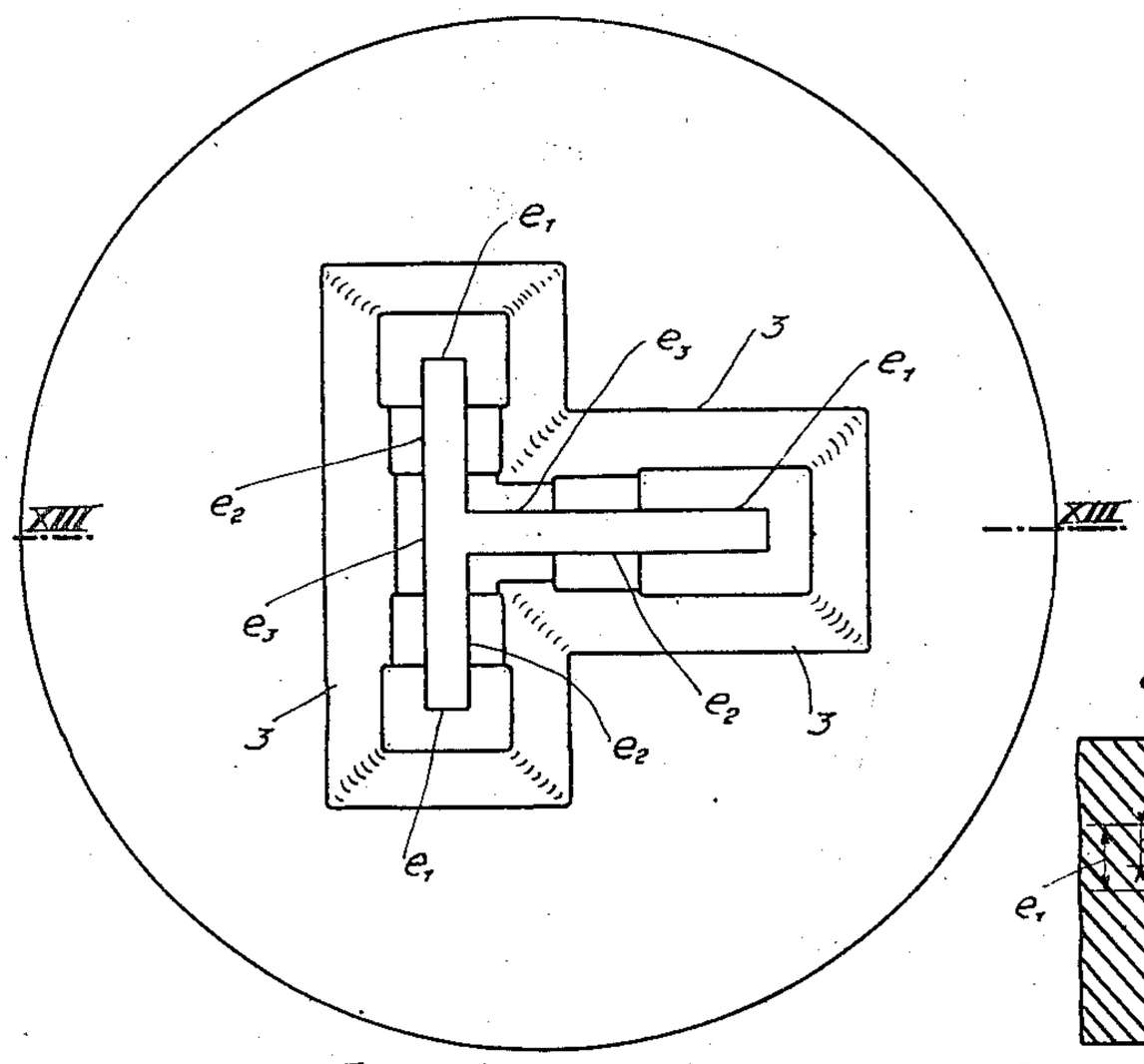


Fig. 16

Fig. 14

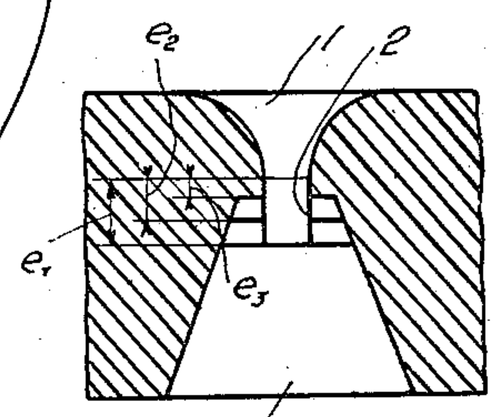


Fig. 15

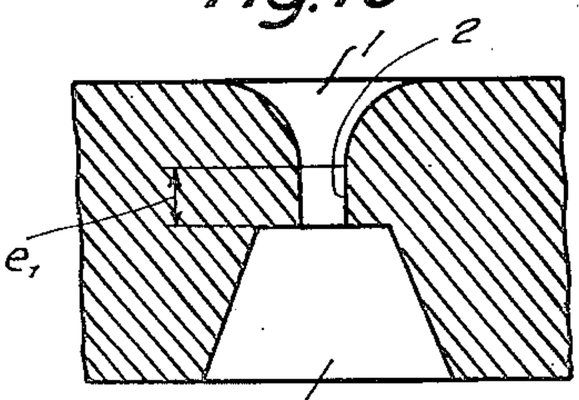
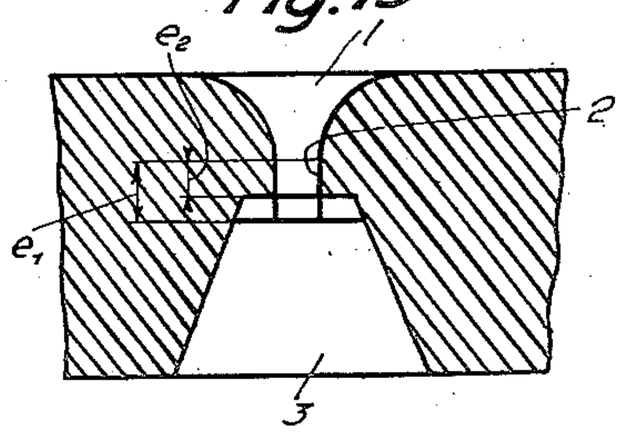
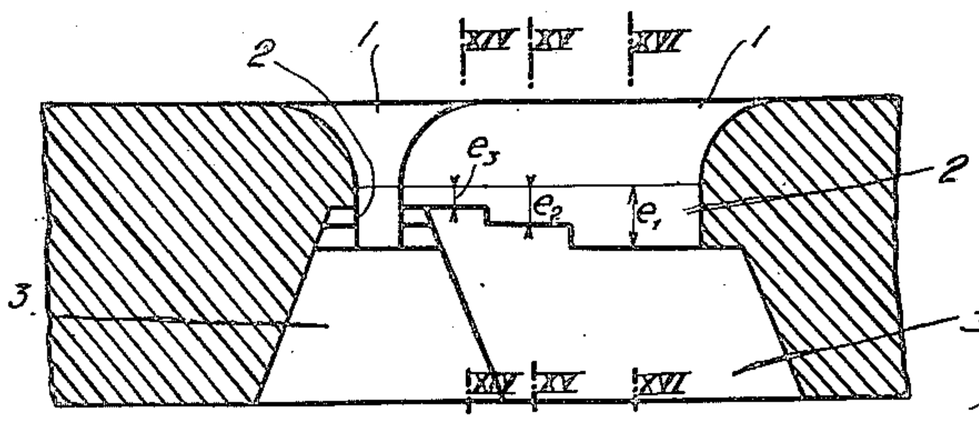


Fig. 13





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Patented Jan. 23, 1951

2,538,918

UNITED STATES PATENT OFFICE

2,538,918

DIE FOR THE EXTRUSION OF METALS

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Application June 5, 1945, Serial No. 597,650
In France September 15, 1944

1 Claim. (Cl. 207—17)

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In the U. S. patent application Ser. No. 597.266, of June 2, 1945, and now abandoned, improvements in the extrusion, thru an extruding press, of metals in a heated state have been described, which consist in inserting between the metal ingot, brought to a high temperature, and the tool implement, an incombustible material melting partially or totally under the action of the heat of the ingot and of the implement, but showing and retaining, when so melted, a viscosity which is sufficiently high for this material to form, between the ingot and the implement, a lubricating layer which flows with the metal in the course of the extruding operation. Glass, oxides, salts and natural or synthetic slags, answering the above mentioned conditions, can be chosen to this effect, said materials being advantageously used in the form of plates set in between the ingot and the die.

In said application, attention has been drawn to the fact that, in certain cases, the breaking of such plates between ingot and die in the beginning of the extruding process may lead to an irregular lubrication, an important fraction of the incombustible material being ejected thru the die in front of the extruded metal. In order to avoid such irregularities, it has been recommended to provide the surface of the die which comes into contact with the ingot, with cavities or recesses in which reserves of melted lubricating material can be formed.

However, in certain cases, such a measure may not be sufficient to insure a perfect lubrication of the die. This occurs particularly when the extruded bars show a polygonal cross section with a low number of sides, i. e. three or four sides for instance, or when the angles of the cross section of the die are close to the edges of the die block, or, further, if the profile shows re-entering angles. The lubricating material is then irregularly distributed, lubrication being insufficient in the middle region of the longer sides of the cross section of the extruded bar, and in the re-entering angles, by the fact that the lubricating film diminishes in said parts. Such irregularities entail "sticking" of the extruded metal on the die, gripping, carrying away of the metal of the die by the extruded metal, said die being in any case rapidly worn and put out of use.

The dies generally used up to now for the extrusion of metals comprise a converging entrance zone, the generating lines of which are usually formed by an arc of 0 to about 10 mm. radius, this entrance zone being followed by a

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cylindrical or prismatical part known as the "bearing" of the die, of constant height and the cross section of which corresponds to that of the bar which is to be extruded. The bearing is followed, on the exit side of the die, by an open zone which may show different forms, for instance that of a cylinder or of a cone.

Instead of such dies, and to avoid irregular lubrication in the above mentioned conditions, one may use, according to the present invention, a die the bearing of which shows a variable height in the different parts of the profile, this height being the smaller, in a determined zone, the more difficult the latter is to lubricate, the radius of the entrance zone being practically the same in all the points of the profile.

The height of the bearing can vary stepwise, three different heights being generally enough in most practical cases. It is also possible to confer to the bearing regularly increasing or decreasing heights, but the industrial realization of such dies is much more difficult and experience has proved that they do not show any marked advantage.

To determine precisely the zones of the bearing where the lubrication is insufficient or more difficult to realize, one may proceed to a preliminary test excuted in the conditions in which the extrusion shall take place, but with a normal die the bearing of which shows a constant height; such a test shows immediately the insufficiently lubricated regions, for which a small height of bearing must be chosen, and the regions where lubricating is fair or good and in which the bearing can be chosen higher.

In a general manner, according to what has been set forth above, the height of the bearing must be minimum in the region of re-entering angles of the profile and in the middle region of the sides of polygonal profiles with few sides, and maximum in the protruding angles of the profile, the regions of maximum and minimum height being contingently linked by regions of intermediary height or heights.

In the appended drawings:

Figs. 1 to 5 represent different examples of cross sections of extruded bars.

Figs. 6 to 8 are sectional views of three dies of known type.

Figs. 9 to 11 represent diagrammatically the repartition of regions of various bearing heights for dies corresponding to the cross sections respectively represented at Figs. 1, 3 and 5.

Fig. 12 is a view on the exit side of a die with

a bearing of variable height according to the invention.

Fig. 13 is a sectional view thru line XIII—XIII of Fig. 12.

Figs. 14 to 16 are sectional views respectively thru XIV—XIV, XV—XV and XVI—XVI of Fig. 13.

On the cross sections of bars represented at Figs. 1 to 5, the shadings indicate the regions in which the corresponding dies are particularly subject to wear following an insufficient thickness of the lubricating film. Thus, when extruding a triangular bar (Fig. 1), the middle region of the sides of the triangle can be insufficiently lubricated. For a pentagonal bar, such as that of Fig. 2, the insufficiently lubricated regions correspond to the middle part of the longer sides. For a bar showing a cross-section such as that of Fig. 3, the region neighbouring the re-entering angle and the opposite region are the most difficult to lubricate. The same occurs in right angle and T-shaped bars (Figs. 4 and 5).

In known type dies represented at Figs. 6 to 8, comprising an entrance zone 1 the lateral surface of which shows a radius of curve R, a bearing 2 the cross section of which corresponds to that of the bar to be extruded, and an exit zone 3, the height e of bearing 2 is constant all around for a same die.

On the opposite, in the dies according to the invention, the height of the bearing varies from one region of the profile to another, said height, in a determined zone, being the smaller, the more difficult said zone is to lubricate.

At Figs. 9 to 11, the bearing zones of maximum height have been indicated diagrammatically by heavy lines, the zones of minimum height by fine lines and the zones of intermediary height by medium lines. In a decreasing order, the bearing heights can, for instance, be the following:

e_1=6 mm.
e_2=4 mm.
e_3=2 mm.

In case of a triangular die (Fig. 9), two different heights are used, e_1 and e_3, respectively of 6 mm. and 2 mm. for instance, height e_1 corresponding to the three angles and e_3 to the middle regions of the sides.

For the cross section represented at Fig. 10, one adopts preferably three different heights. The smaller, e_3, corresponds to the re-entering angle and to the straight part opposite this angle. The greater, e_1, must be adopted for the external circular region and for the extremity of the rectangular part, the higher and lower zones being joined by intermediary steps e_2.

In the case of a T-shaped profile, the bearing zones of smaller height e_3 are those of the re-entering angles and of the part of the wings opposite the latter, the zones of greater height e_1, those of the wing and web extremities, the different zones being joined by steps of medium height e_2.

The die represented at Figs. 12 to 16 corresponds to the latter type.

What we claim is:

In a device for extruding a heated metal ingot through a die by means of an extruding press in which an incombustible material melting at least partially when in contact with the ingot is inserted between the latter and working parts of the extruding press, a die the height of the bearing wall of the die varying in the different parts of the profile, said height being a maximum at the protruding angles and a minimum at the re-entering angles and middle regions of the sides of said profile.

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The following references are of record in the file of this patent:

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