Feb. 18, 1930. E. J. LEACH 1,748,038

PROCESS OF PRODUCING BEARINGS

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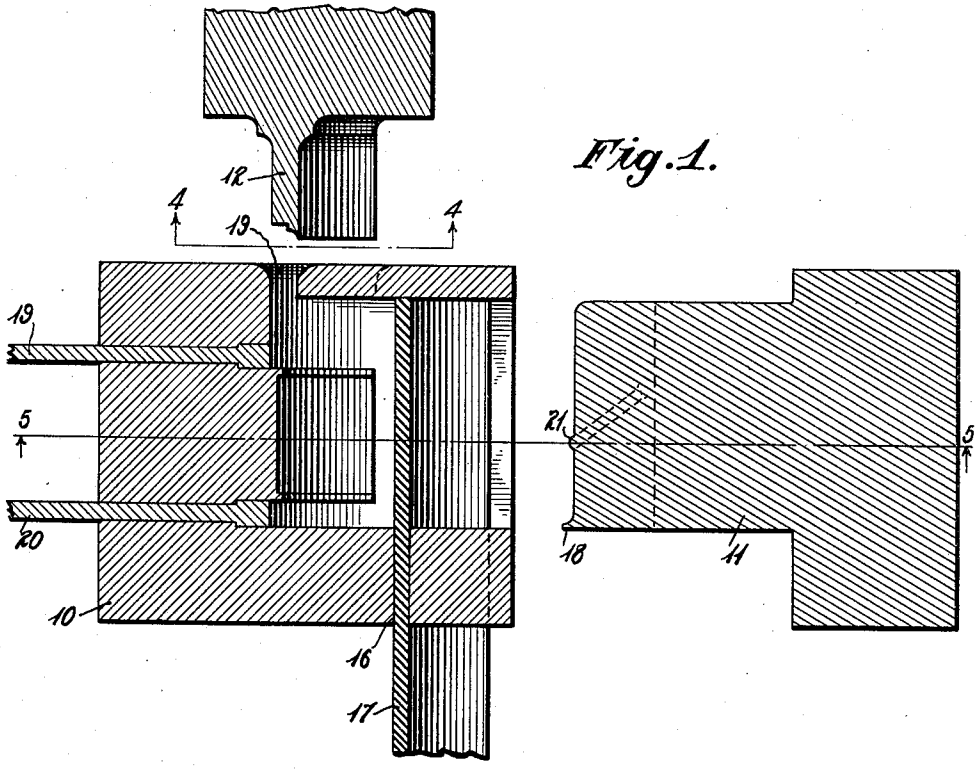


Fig. 1.

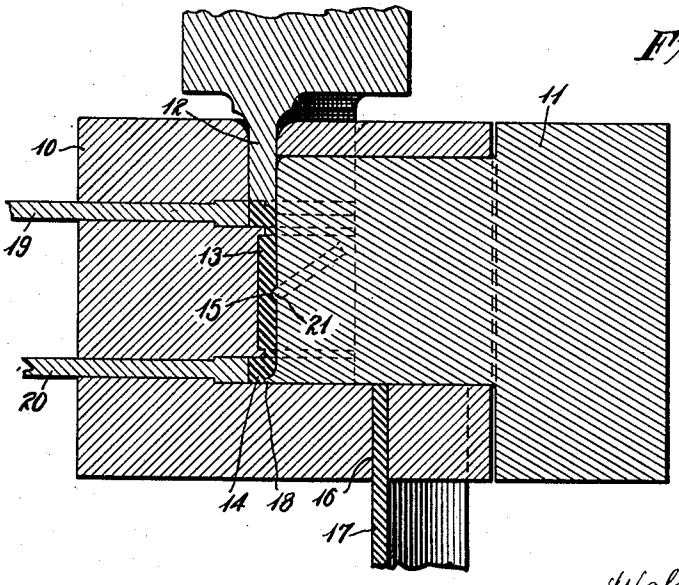


Fig. 2.

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Fig. 3.

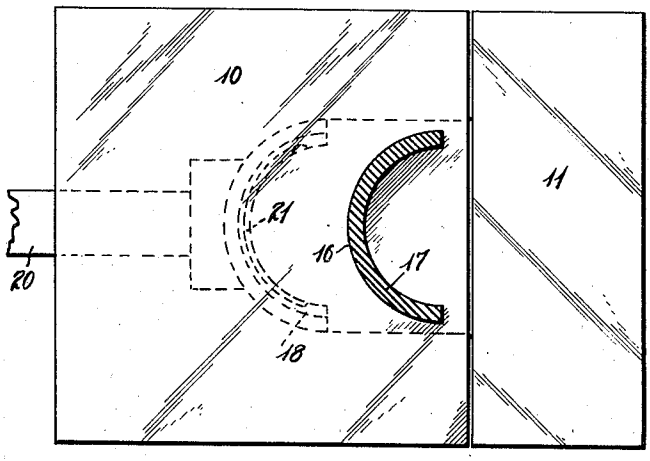


Fig. 4.

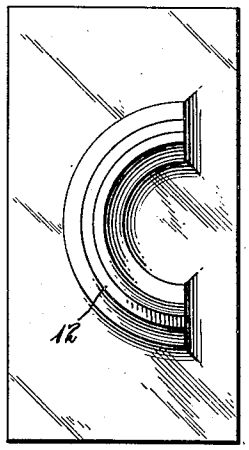


Fig. 5.

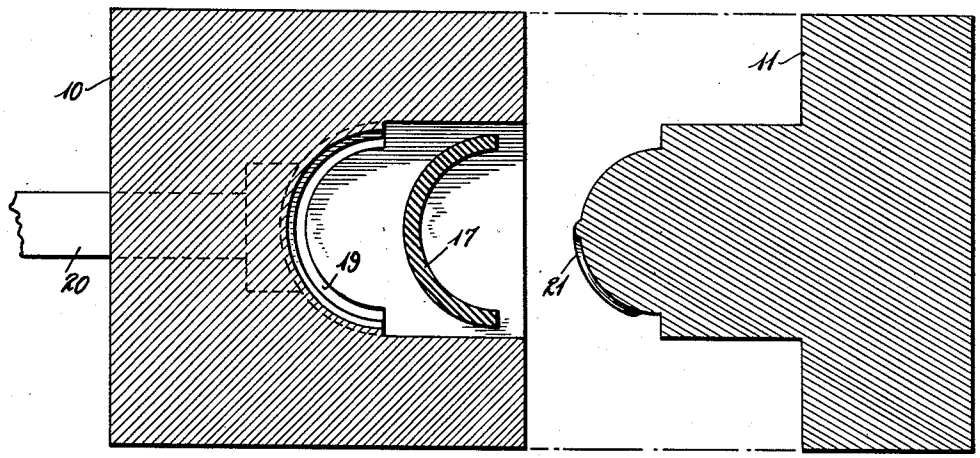
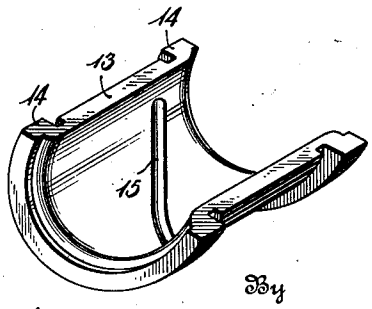


Fig. 6.



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Fig. 7.

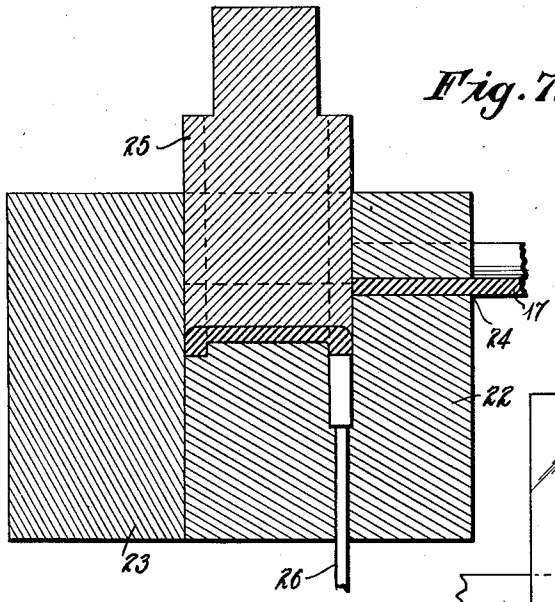


Fig. 8.

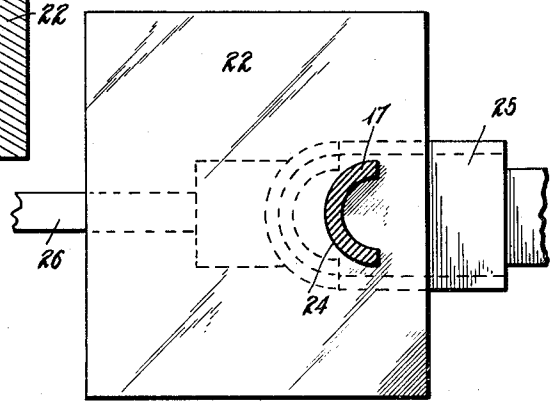


Fig. 9.

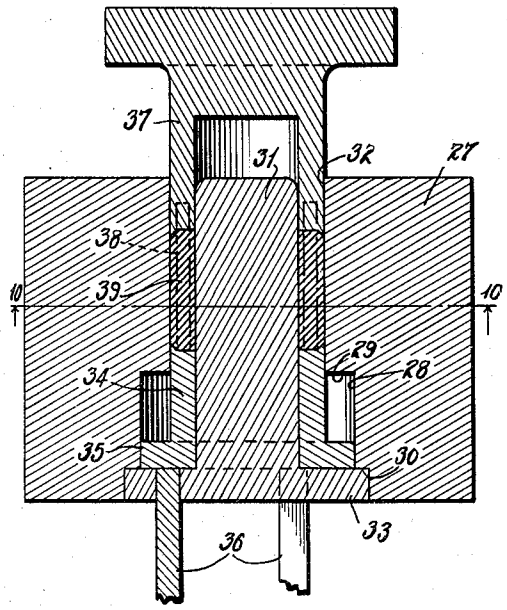
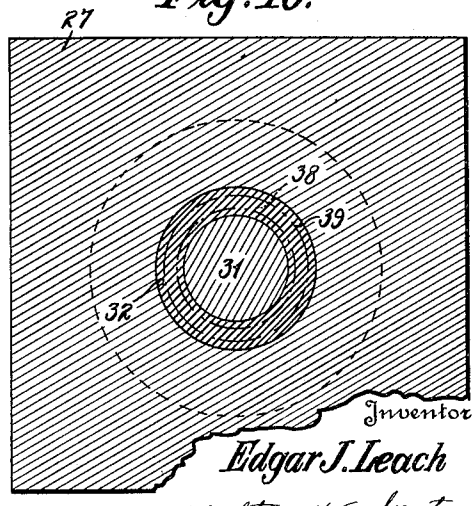


Fig. 10.



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UNITED STATES PATENT OFFICE

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PROCESS OF PRODUCING BEARINGS

Application filed March 6, 1924. Serial No. 697,299.

The invention relates to bearings and has as an object the provision of a process for producing bearings by cold swaging, or rolling. A further object of the invention is the provision of a process of producing bearings of self-lubricating metal which will be exceedingly dense in structure.

A further object of the invention is the provision of a process of producing bearings by pressing the material, without pre-heating, in a die wherein the material is enclosed upon all sides, so that the material can not escape from the great pressure applied thereto.

A further object of the invention is the provision of a process for producing bearings which will be accurate to the desired form and size, so that subsequent machining of the same will be unnecessary, any excess of material existing being present at a portion of the bearing not in contact with the moving parts when in use, so that the same may be readily removed without interfering with the fit of the bearing.

A further object of the invention is the provision of suitable dies for carrying out the process.

Illustrative embodiments of desirable forms of dies for carrying out the process are shown in the accompanying drawings, in which

Fig. 1 is a central horizontal section of the die in the open position, with a piece of stock metal projecting thereinto.

Fig. 2 is a like view of the dies of Fig. 1 shown in a closed position with a completed article enclosed.

Fig. 3 is an end view of the die of Fig. 2 seen from the lower side of said figure.

Fig. 4 is an end view of the plunger viewed in the direction of the arrows of Fig. 1.

Fig. 5 is a vertical section on line 5—5 of Fig. 1.

Fig. 6 is a perspective view of the finished article provided by the dies of Figs. 1 to 5 inclusive.

Fig. 7 is a horizontal section of a modified form of die shown in a closed position, with a knock-out device shown in elevation.

Fig. 8 is a side elevation of the die of Fig. 7 as seen from the right-hand side of said figure, the piece of stock being shown in section.

Fig. 9 is a central horizontal section of a die for producing a bushing.

Fig. 10 is a transverse section on line 10, 10 of Fig. 9.

It has heretofore been the practice to forge or swage brass, bronze, or Babbitt material, including bearings, by pre-heating the same to a plastic condition, but it has been thought impossible to treat these materials without such preheating. The present invention depends upon the discovery that materials known as self-lubricating bearing material, and which commonly consists mainly of copper and lead, may be swaged at atmospheric temperature without preheating, and that the bearings produced by this process are much superior to those which are cast and machined. The present invention also rests upon the discovery that bearings formed of this material are very difficult, if not impossible to be swaged hot according to the prior practices.

According to the invention the stock, when a completed article is to be produced by the process, is enclosed in a die which completely surrounds the material on all sides, one element of the die being movable so as to produce a pressure upon the enclosed material very greatly in excess of any pressure which will be encountered by the material during the service for which it is intended. As a result of this pressure and confinement, it is found that the material will flow to accurately fill every corner of any die which has thus far been utilized or which is commonly necessary to produce bearings in ordinary use. It is also found that the material after treatment will be free from seams or cracks, and will be much harder, due to its resulting compactness, than the cast material. As a result bearings thus produced will not elongate when subjected to trying service. Therefore the fit upon the shaft will not be destroyed by elongation and consequent flow of the material of the bearing. At the same time the self-lubricating properties of the material remain.

The material which it is preferred to utilize

in the production of bearings by the process of the present invention is that known to the trade as Ackermite, and comprises copper and lead in a stable combination such that successive melting and solidification will not cause separation of the metals, substantially no materials other than copper and lead being present.

There are shown in the drawings illustrative embodiments of dies suitable for the purpose. In the form shown in Figs. 1 to 5 inclusive there is shown a stationary member at 10, a movable closure therefor at 11, and a pressure providing plunger at 12. The article which the die under consideration is adapted to produce is shown in perspective in Fig. 6, and comprises a half bearing 13 of the type used in connecting rod bearings for gasoline engines. As shown, the bearing is provided with flanges 14 at its ends to interlock with the connecting rod structure, and with an oil groove 15 such as is commonly provided in bearings of this nature.

To introduce material into the die the stationary member 10 is shown as provided with an arcuate slot 16 into which a semi-cylindrical length of bearing metal 17 may be inserted. The movable member 11 of the die when projected to a position to close the die will shear the stock 17 by contact of the portion 18 with the stock and simultaneously will seat the stock in the cavity of the die and firmly press the same to place, leaving exactly the space for the thickness of the material desired in the finished product, the action of the movable member at the same time closing the slot 16. Subsequently the plunger 12 is moved to project into the slot 19, and is formed to fit said slot very accurately, so that no material may flow out around the plunger. Continued movement of the plunger impinging upon the end of the blank in the space will cause the blank to flow to completely fill every corner of the space within the die to produce the article of Fig. 6 in an exceedingly compact form.

Since the material in the die is caused to flow by the great pressure applied thereon, the laws of hydraulics will apply thereto, and the pressure upon every square inch of the material will be equal to the pressure upon each square inch of the face of the plunger 12. Therefore, the form of dies shown in Figs. 1 to 5 will have an advantage over that shown in Fig. 7 in that pressure is applied by means of a plunger of smaller active area. The form of die shown in Figs. 1 to 5 has an added advantage in that excess of material in the finished bearing will be present at an end of the bearing which is not in contact with the working surfaces, and may therefore be removed by a rough machining process without the extreme accuracy which would be necessary in reducing a working face of the bearing. When the article has been formed as described and the closing member 11 retracted the finished article may be ejected from the die by means of the knock-out plungers 19, 20 in a manner well understood. The oil groove 15 may be formed as by means of a pad 21 upon the face of the movable member 11 of the die.

In the form of the invention shown in Figs. 7 and 8, the stationary portion of the die is shown at 22 and the movable member at 23. The stock 17 in this form of invention may be fed into a slot 24, as in the form of Figs. 1 to 5 inclusive. The pressure providing plunger 25 in this form of the invention acts also to shear the material 17 and is shown of substantially the form of the closing member 11 of the form first described. This form of die may be more readily produced but does not offer the hydraulic efficiency of the form first described. A knock-out plunger 26 is shown in this form of the invention.

To produce a bushing by the process provided by the invention the form of die of Figs. 9 and 10 may be utilized, wherein 27 represents a die in the form of a block of metal having a circular opening therein with a recess 28 shown as provided with two shoulders 29 and 30. A core member 31 projects into the circular opening 32 in the die, and is of such a diameter as to provide an annular space within the opening 32 of the thickness desired in a finished bushing. The core member 31 is shown as provided with a flange head 33 seating against the shoulder 30. A sleeve 34 is shown fitting accurately within the annular space within the bore 32, and carries a flange 35 seated in the recess 28 and reciprocable therein. Motion of the sleeve 34 may be provided by the knock-out plungers 36. A movable plunger 37 having an annular working face is shown. To produce a bushing by the die shown a piece of tubing 38 of the desired material made with walls sufficiently thin to produce loose fit upon the core 31 and within the bore 32 is slipped over the core 31. The plunger 37 is then pressed home, causing the walls of the tubing to swell and shorten to produce the finished bushing shown at 39, and to compact the same after the manner already described in connection with the production of bearings by the dies of Figs. 1 to 8 inclusive. When the plunger 37 is withdrawn the knock-out plunger 36 may be operated to project the finished bushing either completely clear of the die or to a position where it may be removed by an attendant.

The process provided by the invention contemplates the swaging of the metal not only by dies of the nature illustrated but by dies of any other forms, and also by either rolling the material into stock forms or by extrusion. The stock shown at 17 in Figs. 1 to 7 inclusive may be material which

has been produced by such rolling process. The rolled stock shapes may be placed on the market for the purpose of cutting desired lengths therefrom to be used directly as bearings, or to be machined to form.

The process described not only produces bearings much superior in composition and structure to those heretofore produced, but since the material flows accurately to the space enclosed by the dies it becomes possible to produce the finished bearing by the single act of the dies, no subsequent machining being necessary. Therefore the process results in the possibility of producing bearings of a very much superior quality with very greatly decreased expense and in much larger quantities than by processes heretofore known.

The bearing produced by the process described is not only superior to bearings produced by casting and machining to form because of their compactness, but for the reason that under the great pressure used in the treatment the lubricating metal, which flows more readily than the pressure resisting metal, will flow to the surface and form a thin film thereover. When Ackermite is used the resultant bearing will be an exceedingly compact reticulation of copper, the interstices of which are microscopic in size and filled with a complemental reticulation of lead, the surface of the entire bearing being provided with a thin film of the lead, thus providing an ideal bearing surface.

Minor changes may be made in the steps of the process, the material used or the forms of apparatus utilized for carrying out the process, without departing from the spirit of the invention.

I claim:

1. The process of producing a bearing comprising enclosing a body of copper and lead alloy in a die and subjecting the same to pressure in excess of the expected pressure of service and so as to cause the material to flow to the form of the die and to compact the thus formed bearing.

2. The process of producing a bearing which comprises cold pressing a reticulation of pressure resisting metal the interstices of which are filled with a lubricating metal so as to compact the body and cause a film of the lubricating metal to cover the surface of the body.

3. The process of producing a bearing which comprises enclosing material in a die having a plunger opening, pressing said material with a plunger closely fitting said opening, the base of said plunger being equal in area to and bearing upon a portion of the material forming an edge of the completed bearing, said material enclosed metal tight during the pressing thereof to prevent extrusion of the material.

4. The process of producing a bearing which comprises partially enclosing bearing material between die surfaces adapted to form the working surface and to determine the finished effective thickness of the bearing, completing the enclosure of the material by die-means acting against a non-working surface of the bearing and applying pressure upon the material by means of the last named die-means to cause the material to flow to completely fill the space enclosed by the dies, whereby any excess of material will be present in a non-working portion of the die and may be removed by a rough working process.

5. The process of producing a bearing which comprises feeding cold bearing-metal stock to a die through an opening therein, cutting off the stock and closing said opening by a single movement of a die plunger acting to form one surface of the bearing and applying pressure upon the cold stock by a second plunger acting against an edge of the bearing.

6. The process of producing a bearing which comprises, feeding cold copper lead alloy stock to a die through an opening therein, cutting of the stock and closing said opening by a single movement of a die plunger to a position to define the thickness of the finished bearing, and applying pressure upon the cold stock by a second plunger acting against an edge of the bearing, the pressure applied being sufficient to cause the material completely to fill the die and to bring a film of lead to the surface of the finished bearing.

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