Sept. 22, 1964 R. F. MOYER 3,149,887

DIE BUSHING WITH REMOVABLE LINER

Filed Jan. 3, 1961

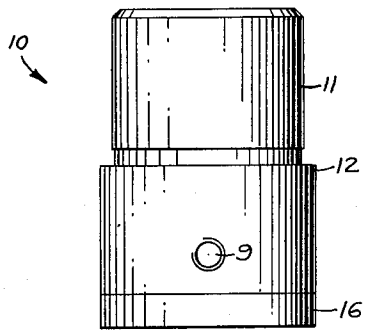



Fig 1

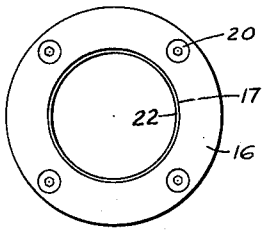



Fig 3

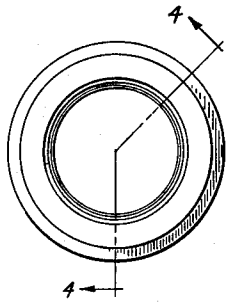



Fig 2

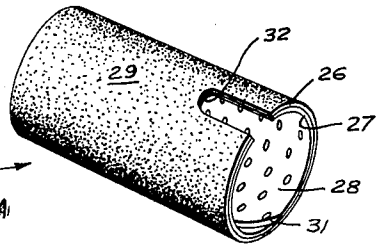



Fig 5

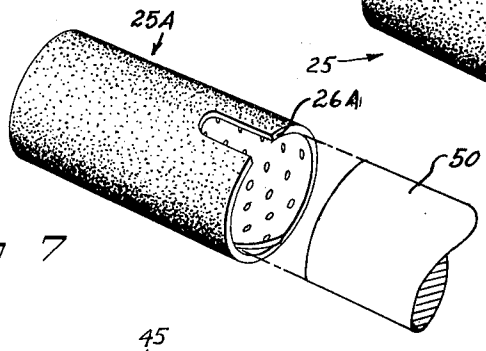



Fig 7

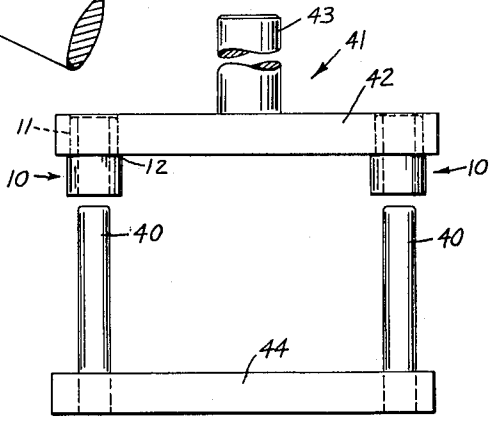



Fig 6

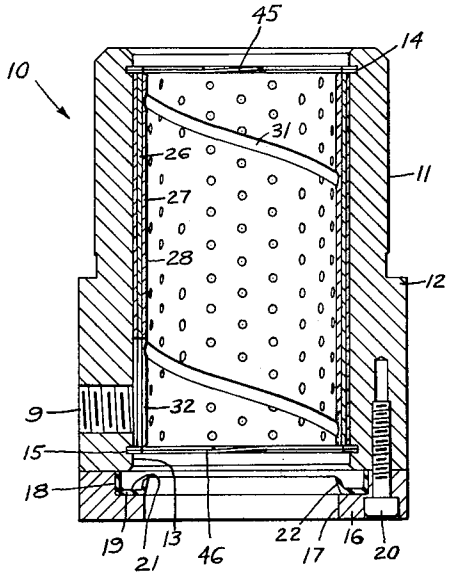



Fig 4

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United States Patent Office 3,149,887 Patented Sept. 22, 1964



3,149,887

# DIE BUSHING WITH REMOVABLE LINER

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Filed Jan. 3, 1961, Ser. No. 80,057
3 Claims. (Cl. 308—3.5)

This invention relates to die bushing liners and more particularly to die bushing liners which may be removed and replaced in die bushings.

One of the objects of the present invention is to provide a die bushing with a replaceable liner.

In the conventional die set the upper or punch carrying plate is provided with either two or four bushings located in the corner areas of the upper plate. The lower or die carrying plate is provided with either two or four posts located in the corner areas of the lower plate.

The posts cooperatively mate with the bushings in the normal function of the die set as a punch press reciprocates the upper plate toward and away from the lower plate. The sliding movement of the bushing upon the mating post wears the bushing. The accuracy of the mating relationship is thereby destroyed. The accuracy of the mating relationship between the post and mating bushing determines the accuracy between the punch and die and therefore of the article produced by the punch and die.

As the bushings wear "play" develops between the post and mating bushing. Thus, accurately and uniformly sized and shaped articles are no longer produced by the die set. In addition the "play" causes misalignment of the punch carrying plate with the die carrying plate. Thereby, causing the punch to be misaligned with the die. As the punch press forces the punch against the die in misaligned relationship, the punch is broken or damaged and the die is damaged. The cost of producing punches and dies runs into many thousands of dollars.

It would appear to be a simple matter to provide a die bushing with a replaceable sleeve or liner when the bushing becomes worn and the accurate mating relationship between the post and bushing is destroyed. However, such is not the case because the reciprocating movement of the punch press causes heat to develop due to friction, in both the post and mating bushing. The heat generated in the bushing causes a liner to "freeze" or bind to the bushing, thereby, destroying the purpose for which the liner was placed in the bushing. Namely, to be removed and replaced when the inside diameter of the liner becomes worn.

As the punch and die mate during the work cycle, fine metallic dust and splinters are created. The dust and splinters are created from the action of the punch piercing the metal strip.

The dust and splinters find their way between the post and mating bushing. The heat generated by friction, the pressure of the punch press, and the dust and splinters combine to reduce the space or tolerance between the outside diameter of the post and the inside diameter of the bushing. Eventually the dust and splinter accumulation cause "galling" and/or welding of the post to the bushing. The post becomes frozen or jammed into the bushing. The punch press having a positive action, thereby causes an accident to the operator and destruction to the very valuable punch and die.

The present invention was created to obviate all of these undesirable and costly conditions in a die set by providing a liner which may be removed from the bushing, regardless of the adverse conditions under which the die set functions.



Other objects of the present invention will become apparent in part and be pointed out in part in the following specification and claims.

Referring to the drawings in which similar characters of reference indicate corresponding parts in all the figures:

FIGURE 1 is a side elevational view of the new and improved die bushing provided with a removable liner.

FIGURE 2 is a top plan view of FIGURE 1.

FIGURE 3 is a bottom plan view of FIGURE 1.

FIGURE 4 is a vertical cross sectional view taken on line 4—4 of FIGURE 2.

FIGURE 5 is a perspective view of the liner fabricated from bimetallic material.

FIGURE 6 is a side elevational view of a die set provided with the new and improved die bushing liners.

FIGURE 7 is a perspective view of a liner fabricated from a single material.

In proceeding with this invention reference is made to all figures in the drawing. A die bushing fabricated of steel, generally indicated by reference numeral 10, consists of a cylindrical body, externally provided with a reduced diameter 11 terminating in a flange 12. Internally, die bushing 10 is provided with an axial bore 13 and two grooves 14, 15 adjacent opposite ends of said die bushing 10. Die bushing 10 may be provided with a tapped hole 9. Said cylindrical body constituting a supporting shell.

A liner, cylindrical in form, generally indicated by reference numeral 25, may be fabricated from steel, bearing metal or from bimetallic elements. FIGURE 5 illustrates bimetallic elements. FIGURE 7 illustrates steel or bearing metal such as bronze. Bearing metal or bimetallic element material provides a lower coefficient of friction over other metals such as steel. Referring to FIGURE 5, a layer of bearing metal 27 is laminated to a sheet of steel 26. The bimetallic laminated sheet is cut into strips which are formed into a round or cylindrical shape and brazed to provide a permanent cylinder. The steel outside diameter 26 of liner 25 is ground to a precision size. The internal diameter 28 of bearing metal is reamed to a precision size.

The outside diameter 26 of the liner 25 in FIGURE 5 and the outside diameter 26A of liner 25A in FIGURE 7 is then subjected to an electrolytical coating of a nonferrous metal such as copper 29. Said coating 29 preferably does not add more than one thousandth of an inch to outside diameter 26. Said coating 29 is approximately five ten thousandths of an inch in thickness. A steam pressure application or coating of cadmium of the same thickness as copper may also be used.

The internal diameter 28 may be provided with an oil groove 31. Liner 25 may be provided with a slot 32 for purposes which will presently appear.

The difference between the diameter of the axial bore 13 and the outside diameter 26 is approximately one thousandth of an inch after the coating 29 is applied. Liner 25 is forced or driven into axial bore 13. The copper or cadmium coating 29 serves two functions. The first function is as an insulating medium between the steel of the die bushing 10 and the steel 26 of the liner 25. Should the die bushing 10 steel and the liner 25 steel 26 engage, they could rust into position and be jammed or frozen permanently or they could gall together due to frictional heat.

The second and most important function served by the copper or cadmium coating 29 is its cooperative function as a "backing up filler." The coating 29 compensates for irregularities in either axial bore 13 or outside diameter 26 when they unite. Thus preserving the vital inside diameter 28 size and concentric shape so vital to the proper function of the post 40 and the die set.

The liner 25 prior to being pressed into axial bore 13, is placed upon a gage or aligning post 50. The gage or aligning post 50 is provided with an exacting outside diameter. The highest skill of the tool making art plus precision machinery is needed to provide the exacting outside diameter.

The gage or aligning post 50 is placed within internal diameter 28 with an exactness of fit. The aligning post 50 then forces liner 25 into die bushing 10 with the coating 29 engaging the steel surface of axial bore 13. The cylindrical body serving as a supporting shell for liner 25.

It is well known in the art, that it is impossible for all practical and commercial and manufacturing purposes, to fabricate the inside diameter of one member and the outside diameter of a mating member to absolute zero variation. The variation is called tolerance. The tolerance between a one inch diameter gage post and the inside diameter 28 of a mating bushing liner is between three ten thousandths of an inch and four ten thousandths of an inch. In a two inch diameter gage post the tolerance between a mating bushing liner 28 would be between five ten thousandths and eight ten thousandths of an inch.

The aligning post 50, as it forces liner 25 into position in die bushing 10, causes the coating 29, which is softer than the steel of either bushing 10 or liner 25, to accommodate itself to tolerance variation, so that, the tolerance variation between axial bore 13 and outside diameter 26 of liner 25 is not reflected in the dimension of the inside diameter 28 of liner 25. If the coating 29 is not applied such tolerance variation is present in inside diameter 28 to the detriment of the proper functioning of the mating die set post 40.

A collar 16 provided with an axial passageway 17 and a shelf consisting of a cylindrical wall 18 and a wall 19 at right angles to said cylindrical wall 18 is removably secured to one end of die bushing 10 by means of screws 20. Said axial passageway 17 having a diameter larger than internal diameter 28. A wiping ring 21 is fixed in position between the shelf and the end of die bushing 10. Wiping ring 21 is shaped to lie against cylindrical wall 18 and wall 19 with a flexible tongue 22 overlying axial passageway 17.

A die set generally indicated by reference numeral 41, (see FIGURE 6) consists of an upper or punch carrying plate 42 provided with a punch press attaching stem 43 and a die carrying plate 44 normally secured to the bed of a punch press. The punch carrying plate 42 is provided (as illustrated) with two bushing receiving orifices into which the reduced diameters 11 of the die bushings 10 are forced with a "drive fit." The die carrying plate 44 is adapted to have die posts 40 secured therein.

In normal punch press operation die posts 40 slidingly engage the inside diameters 28 of liners 25 secured in die bushings 10, for example, by means of snap rings 45, 45 located in grooves 14, 15, respectively. Lubricating oil may be passed through tapped hole 9, through slot 32 into oil groove 31. The film of oil coating inside diameter 28 will be approximately one ten thousandth of an inch thick. Thus, the precision and magnitude of the very slight tolerances or variations of the parts constituting the present invention can be understood and appreciated.

Having shown and described a preferred embodiment of the present invention by way of example, it should be realized that structural changes could be made and other examples given without departing from either the spirit or scope of this invention.



What I claim is:

1. In combination a die bushing with a removable liner comprising a die bushing consisting of a cylindrical body and an axial bore provided with two oppositely located circumferential grooves, a cylindrical liner, fabricated from bimetallic elements of bearing metal laminated to steel, said bearing metal forming the inside surface of said liner, said steel forming the outside surface of said liner, a coating of copper applied to said outside surface, said liner being forced into said die bushing with said coating of copper separating said outside surface from said axial bore, and two snap rings, located in said two oppositely located circumferential grooves, respectively, whereby said liner is removably secured in said die bushing.

2. In combination a die bushing with a removable liner comprising a steel die bushing consisting of a cylindrical body and an axial bore having a steel surface provided with two oppositely located circumferential grooves, a cylindrical liner, fabricated from bimetallic elements of bearing metal laminated to steel, said bearing metal forming the inside surface of said cylindrical liner, said steel forming the outside surface of said cylindrical liner, a coating of non-ferrous metal applied to said outside surface, said cylindrical liner removably secured in said axial bore with said non-ferrous metal coating separating the steel surface of said axial bore from the steel surface of said liner, two snap rings, one for each circumferential groove, removably secured in the respective circumferential groove to removably secure said liner in said axial bore, a collar provided with an axial passageway and a shelf comprising a cylindrical wall, and a wiping ring provided with a flexible tongue housed on said shelf with said flexible tongue overlying said axial passageway and means to removably secure said collar to said die bushing with said axial passageway axially aligned with said axial bore.

3. In combination a die bushing with a removable liner comprising a steel die bushing consisting of a cylindrical body defining an axial bore having a steel surface, a cylindrical liner fabricated from bimetallic elements of bearing metal laminated to steel, said bearing metal being softer than said steel and forming the inside surface of said cylindrical liner, said steel forming the outside surface of said cylindrical liner, a coating of non-ferrous metal applied to said outside surface, said coating approximating a thickness of five ten thousandths of an inch, said cylindrical liner being forced into said axial bore with said non-ferrous metal coating separating the steel surface of said axial bore from the steel surface of said cylindrical liner and said non-ferrous metal coating adapting itself to the variations of axial bore and the steel cylindrical body of the die bushing reinforcing and supporting the steel outside and bearing metal inside of said cylindrical liner and means for removably retaining said liner in said die bushing.


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