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FLOATING SLEEVES FOR DIE BUSHINGS

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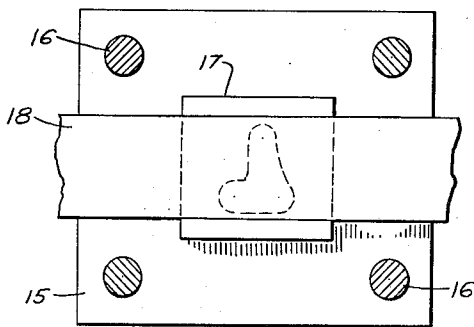


Fig. 2

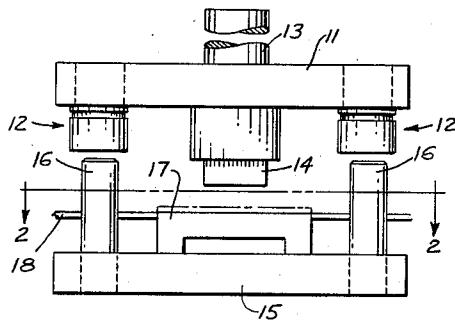


Fig. 1

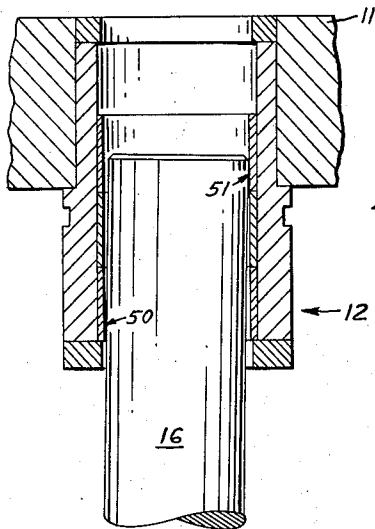


Fig. 3

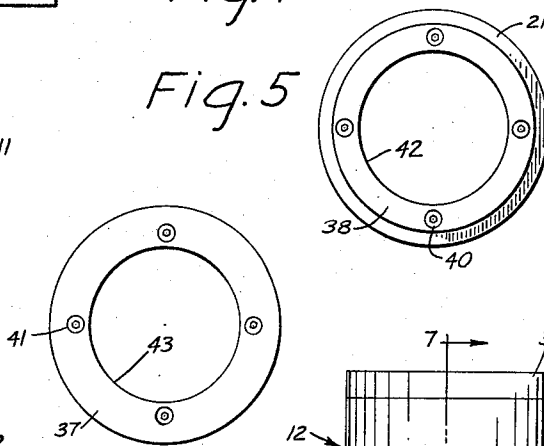


Fig. 5

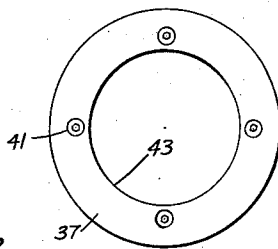


Fig. 6

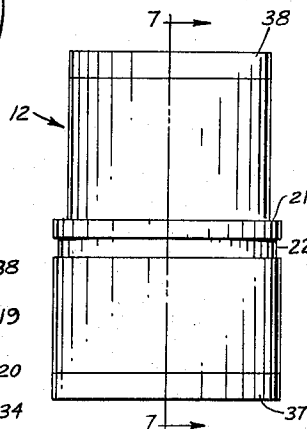
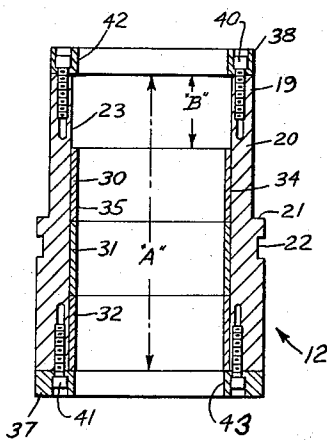


Fig. 4

Fig. 7



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FLOATING SLEEVES FOR DIE BUSHINGS
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This invention relates to floating sleeves for die bushings and more particularly to providing a bushing with a plurality of cylindrical sleeves wherein the aggregate length of the sleeves is less than the length of the bushing so that when the post of a die set enters the bushing it will engage the floating sleeves and thereby prevent the binding of the post with the bushing.

An object of the present invention is to provide a die bushing with a plurality of longitudinally positioned sleeves wherein the aggregate length of the sleeves is less than the length of the bushing so that the die post, in the downward stroke of the punch carrying plate which causes the post to misalign, will engage a floating sleeve with a pressure point which rides out of binding position.

Another object of the present invention is to provide a die bushing with easily replaceable and inexpensive sleeves whereby the bushing life is increased while maintaining the needed tolerance accuracy between post and bushing.

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

The accuracy of the mating relationship between the post and cooperating bushing determines the accuracy available between the punch and die and therefore of the article produced by the punch and die.

As the bushings wear a "sloppy" relationship develops between the post and mating bushing. Thus, accurately and uniformly sized articles are no longer produced by the die set. In addition misalignment of the punch with the die causes breakage to the punch and damage to the die. Punch and die sets, depending upon the size and shape of article produced, may be extremely costly to produce.

In the normal operation of a die set, the punch and punch carrying or upper plate are subjected to torsion or wrenching due to the exertion of the lateral force created when the punch engages the strip material from which the desired article is produced.

This torsion takes the form of mis-axial-alignment of the post with the bushing. The post is therefore cantered as it enters the bushing. The points at which the post engages the bushing are termed "pressure points." It is at these pressure points that undue wear is created on the bushing. Thus the life of the bushing is shortened. The die is withheld from production. Expensive punches and dies are damaged or destroyed before the undue wear is discovered. The accuracy of the article produced is destroyed before the useful life of the punch and die is realized. This undue wear is costly to manufacturers and is an economic waste.

The present invention was created to overcome undue wear and to increase the economic life of both the die set and the punch and die. The manner in which this result is accomplished will presently appear.

Other objects of the present invention will be pointed out in part and become apparent 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 a die set incorporating the present invention.

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FIGURE 2 is a horizontal view partly in cross section taken on line 2—2 of FIGURE 1.

FIGURE 3 is a vertical cross sectional view through the new and improved floating sleeves and die bushing, illustrating the post at the moment of entry of the punch into the material, whereby pressure points are created.

FIGURE 4 is a side elevational view of the new and improved die bushing provided with floating sleeves.

FIGURE 5 is a top plan view of FIGURE 4.

FIGURE 6 is a bottom plan view of FIGURE 4.

FIGURE 7 is a vertical cross sectional view taken on line 7—7 of FIGURE 4.

Reference is now made to FIGURE 1 wherein the conventional die set is illustrated as consisting of a punch carrying plate 11 provided with removable bushings, generally indicated by reference numeral 12, a stem 13, adapted to be held in a punch press, and a punch 14.

The lower or die carrying plate 15 is normally secured to the bed of a punch press (not shown). Plate 15 is provided with posts 16 equal in number and matingly engaging bushings 12. The die 17 is fixed to plate 15 in cooperative relationship with punch 14. A strip of material which could be brass, steel or any other material is indicated at 18 in position on die 17 awaiting the reception of punch 14.

The removable bushing 12 consists of a cylindrical housing 20 provided externally with a small diameter 19 terminating in a shoulder 21, and a groove 22. Internally, housing 20 is provided with an axial bore 23. Bushing 12 is fabricated from tool steel and is hardened and ground to precise dimensions. This is especially true of axial bore 23 and small diameter 19.

A floating or slidably mounted sleeve or liner is provided which is circumferentially divided into a plurality of sections illustrated as three in number 30, 31, 32 and proportioned to provide for a space equal to the width of one of said bushings in the distance between the ends of said axial bore 23. Said sleeves or liners by detaching retaining means on opposite ends of said cylindrical housing are freely removable and replaceable in an endwise direction in said axial bore 23.

Sleeves or liners 30, 31, 32 are identical in construction. Therefore, only one will be described in detail. The outside diameter 34 of line 30 is five ten thousandths of an inch smaller than the diameter of axial bore 23 to provide a "slipfit" or gravitational sliding fit between sleeve 30 and axial bore 23. The inside diameter 35 of sleeve or liner 30 is between three and five ten thousandths of an inch larger than the standard diameter of a post 16. A post 16 provided with a standard one inch diameter is manufactured with a tolerance from minus zero to plus two ten thousandths of an inch larger than the standard diameter. In this way the clearance between the outside diameter of post 16 and the inside diameter 32 of the sleeve is never less than one ten thousandth of an inch and never greater than five ten thousandths of an inch.

This example of dimensions is cited to illustrate the precision existing between the cooperating elements of post 16, sleeve 30 and bushing 12. A very high degree of manufacturing accuracy is necessary to the proper function of these cooperating elements.

The length of axial bore 23, dimension "A," FIGURE 7, is divided into a multiple number of smaller dimensions, illustrated as four in number. The number four becomes evident when sleeves 30, 31, 32 are counted and the space "B" is considered equal to the length of one of the sleeves 30, 31, 32. It thus becomes evident that sleeves or liners 30, 31, 32 are slidably mounted in axial bore 23. Through the force of gravity sleeves 30, 31, 32 will gravitate to one end as illustrated in FIGURE 7.

To prevent sleeves or liners 30, 31, 32 from sliding

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beyond the ends of axial bore 23, two collars 37, 38 are provided on opposite ends of cylindrical housing 20. Screws 40 secure collar 38 to housing 20. Screws 41 secure collar 37 to the opposite end of housing 20. The inside diameters 42 of collar 38 and 43 of collar 37 are slightly larger in size over the size or dimensions of the inside diameters of sleeves 30, 31, 32. Said inside diameters 42, 43 are smaller in diameter than the diameter of axial bore 23. Collars 37, 38 retain sleeves 30, 31, 32 between them.

In operation, as punch 14 engages strip material 18 held in die 17, punch 14 and punch carrying plate 11 and therefore bushings 12 are subject to torsion and wrenching and therefore misalignment from a parallel relationship with lower plate 15 and posts 16. This misalignment, illustrated in FIGURE 3, creates pressure points 50 and 51.

Prior to the present invention these pressure points would be provided between post 16 and axial bore 23 with the consequent wear on bore 23. With the advent of sleeves 30, 31, 32 the sleeves slide along axial bore 23 and thereby realign posts 16 with bushings 12 by sliding the liners or sleeves 30, 31, 32 along axial bore 23. The thrust of post 16 against sleeves 30, 31, 32 is greatly minimized due to the sliding movement of the sleeves 30, 31, 32.

Thus the axial bore 23 is provided with an extended life; the sleeves or liners 30, 31, 32 are easily replaced and inexpensive to manufacture; and the necessary accurate relation between the posts and bushings is maintained. When a sleeve 30, 31, 32 wears, it is more readily apparent; thereby, preventing a clash of punch 14 with die 17 which results in costly damage to the punch 14 and/or die 17.

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 a die set having in combination a punch carrying plate provided with a plurality of removably secured bushings and a cooperating die carrying plate provided with a plurality of mating posts for aligning the die carrying plate with the punch carrying plate, that improvement in said bushings which consists of a bushing comprising a cylindrical housing having externally a small diameter terminating in a shoulder, and provided internally with an axial bore, said small diameter removably secured in said punch carrying plate with said shoulder abutting the underside of said punch carrying plate, a liner slidably mounted in said axial bore and circumferentially divided into a plurality of sections, proportioned to provide a space equal to the width of one of said sections in the distance between the ends of said axial bore, a first collar having an inside diameter smaller in diameter than the diameter of said axial bore, a second collar having an inside diameter smaller in diameter than the diameter of said axial bore and means to secure said first collar and said second collar to opposite ends of said cylindrical housing to removably secure said plurality of sections, slidably mounted, in said axial bore, whereby the mating post moves said sections in one direction and gravity returns said sections to initial position.

2. In a die set having in combination a punch carrying plate provided with a plurality of removably secured bushings and a cooperating die carrying plate provided with a plurality of mating posts for aligning the die carrying plate with the punch carrying plate, that improvement in said bushings which consists of a bushing comprising an axial bore, a liner slidably mounted in said axial bore and circumferentially divided into a plurality of sections proportioned to provide for longitudinal movement of said sections in said axial bore, collar means secured to opposite ends of said bushing to retain said sections in said axial bore and to permit misalignment of a post

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with a mating bushing whereby mating movement of said bushing with a post causes said sections to engage said post and through longitudinal sliding movement of said sections in said axial bore to realign said post with its mating bushing.

3. In a die set having in combination a punch carrying plate provided with a plurality of removably secured bushings and a cooperating die carrying plate provided with a plurality of mating posts for aligning the die carrying plate with the punch carrying plate, that improvement in said bushings which consists of a bushing comprising an axial bore, a liner slidably mounted in said axial bore and circumferentially divided into a plurality of sections proportioned to provide for longitudinal movement of said sections, a distance equal to the width of one of said sections, in said axial bore, collar means removably secured to opposite ends of said bushing whereby said sections are freely removable and replaceable in a longitudinal direction along said axial bore, the difference between the diameter of said axial bore and the outside diameter of said liner being five ten thousandths of an inch to provide a slip fit between the outside diameter of said liner and said axial bore, longitudinal sliding movement of said liners in said axial bores realigning the die carrying plate with the punch carrying plate through the mating posts.

4. In a die set having in combination a punch carrying plate provided with a plurality of removably secured bushings and a cooperating die carrying plate provided with a plurality of mating posts for aligning the die carrying plate with the punch carrying plate, that improvement in said bushings which consists of a bushing comprising an axial bore, a liner slidably mounted in said axial bore and circumferentially divided into a plurality of sections proportioned to equal a length less than the full length of said axial bore, to provide for longitudinal sliding movement of said sections in said axial bore, collar means removably secured to opposite ends of said bushing, said collar means freely slidable over a mating post, whereby said sections are retained in said axial bore and are removable and replaceable in said axial bore, said liner having an inside diameter, the difference in diameters between the mating post and the inside diameter of the cooperating liner approximating the difference between one ten thousandth of an inch and five ten thousandths of an inch, whereby misalignment of the mating post with the cooperating liner causes said post to engage said sections to slide said sections in said axial bore to realign said mating post with the cooperating liner and bushing and thereby align said punch carrying plate with said die carrying plate.

5. In a die set having in combination a punch carrying plate provided with a plurality of removably secured bushings and a cooperating die carrying plate provided with a plurality of mating posts for aligning the die carrying plate with the punch carrying plate, that improvement in said bushings which consists of a bushing comprising an axial bore, a liner slidably mounted in said axial bore and circumferentially divided into a plurality of sections proportioned to equal a length less than the full length of said axial bore, to provide for longitudinal sliding movement of said sections in said axial bore, collar means removably secured to opposite ends of said bushing, said collar means freely slidable over a mating post, whereby said sections are retained in said axial bore and are removable and replaceable in said axial bore, said sections having an inside diameter, whereby misalignment of the mating post with the cooperating liner causes said post to engage the inside diameter of said sections to slide said sections in said axial bore to realign said mating post with the cooperating liner and bushing and thereby align said punch carrying plate with said die carrying plate.

6. In a die set having in combination a punch carrying plate provided with a plurality of removably secured bushings and a cooperating die carrying plate provided with a plurality of mating posts for aligning the die carrying plate with

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the punch carrying plate, that improvement in said bushings which consists of a bushing comprising an axial bore, a liner slidably mounted in said axial bore and circumferentially divided into a plurality of sections proportioned to equal a length less than the full length of said axial bore, collar means removably secured to opposite ends of said bushing, said collar means freely slidable over a mating post, whereby said sections are retained in said axial bore and are removable and replaceable in said axial bore, the difference between the diameter of said axial bore and the outside diameter of said liner being approximately five ten thousandths of an inch to provide a gravitational sliding fit for said liner in cooperation with said axial bore, said liner having an inside diameter, the difference in diameter between the mating post and the in-

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side diameter of said liner approximating two ten thousandths of an inch, whereby misalignment of the mating post with the inside diameter of said liner causes said post to engage the inside diameters of said sections to slide said sections in said axial bore to realign said mating post with said inside diameter and therefore said bushings and said punch carrying plate with said die carrying plate.

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