

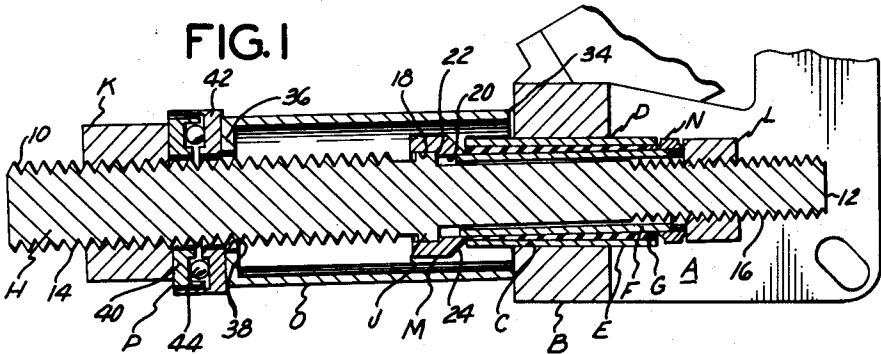
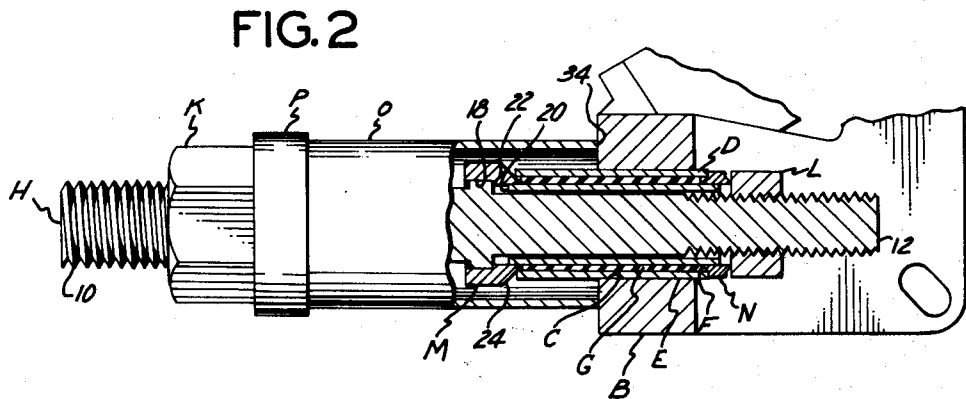
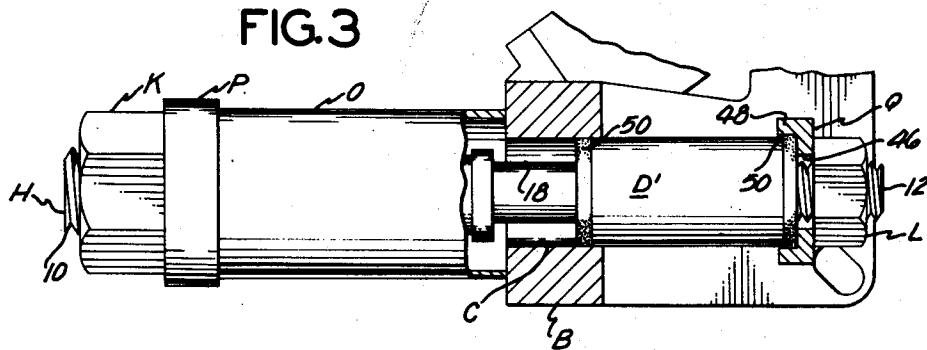
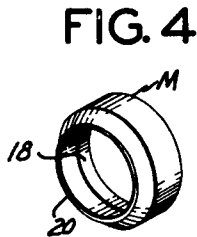
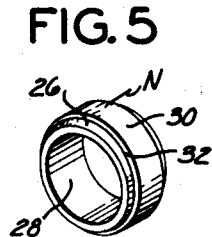
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P. CLOUD

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COMBINATION BUSHING PULLER AND MOUNTING DEVICE

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INVENTOR
PORTER CLOUD

BY
William C. Babcock
ATTORNEY

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Porter Cloud, 12841 S. Harris Ave., Compton, Calif.

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The present invention relates generally to the field of hand tools and more particularly to a combination bushing puller and mounting device.

In certain present day mechanisms, particularly in the front end of automotive vehicles, bushings are employed that include inner and outer straight-walled cylindrical shells which are arranged in concentric relationship and have a web of resilient material such as rubber extending therebetween, with this resilient material being bonded to the interior surface of the outer shell and to the exterior surface of the inner shell.

The inner shell is usually engaged by a bolt or rod, and the outer shell is press-fit into a bore of an arm or other desired portion of a supporting structure. After prolonged use, it is common to find that due to the pressure and force exerted on the resilient material, it has cold-flowed or permanently deformed to the extent that the longitudinal axis of the inner shell has become angularly disposed relative to the longitudinal axis of the outer shell. After a bushing of this type has deteriorated to the extent that the inner and outer shells thereof are in angular relationship, it must be removed from the opening in the supporting structure in which it has been press-fit. Occasionally considerable difficulty is experienced in removing such a bushing from a supporting structure, for as the tool used in this removal exerts a pulling force on one end of the bushing, this force is also applied to the ends of the shells due to their angular relationship and frequently flange out, thus preventing withdrawal of the bushing.

A major object of the present invention is to provide a combined bushing puller and mounting device for bushings of the character described, and one by means of which bushings can be removed from the openings in which they are press-fit without deforming the end portions thereof, whereby it would be necessary to remove such deformed portions by a chisel or the like before the bushing can be pulled from its supporting structure.

Another object of the present invention is to provide a combined bushing puller and mounting device having an extremely simple mechanical structure which can be fabricated from standard commercially available materials, requires no elaborate plant facilities for the manufacture thereof, and which can be retailed at a sufficiently low price as to encourage its widespread use.

Yet another object of the invention is to supply a combined bushing puller and mounting device that will minimize the time and effort required in removing a bushing from a supporting structure, as well as the time and effort involved in mounting a new bushing in place in such a structure.

These and other objects and advantages of the invention will become apparent from the following description of a preferred form thereof, and from the accompanying drawing illustrating that form, in which:

FIGURE 1 is a longitudinal cross-sectional view of the device shown after it has been mounted in a position to remove a bushing from a structure in which it is press-fit;

FIGURE 2 is a combined longitudinal cross-sectional and side elevational view of the bushing puller after it has partially removed a bushing from a supporting structure;

FIGURE 3 is a combined side elevational and longitudinal cross-sectional view of the bushing puller shown being used to mount a bushing in a supporting structure;

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FIGURE 4 is a perspective view of a first ring utilized in the invention; and

FIGURE 5 is a perspective view of a second ring.

Referring now to FIGURE 1 of the drawing, it will be seen that a portion A of the mechanism, such as the front end of an automobile, has an arm or bracket B through which an opening C extends in which a bushing D is press-fit. The bushing D includes an outer straight-walled cylindrical shell E and an inner shell F that is also of straight-walled cylindrical configuration. A web G of a resilient material is affixed to shells E and F, and extends therebetween. It will be noted in FIGURE 1 that the web G of resilient material associated with the bushing D is illustrated as being deformed due to prolonged application of pressures thereon to the extent that the web supports the inner shell F at an angular position relative to the outer shell E.

The present invention, as may best be seen in FIGURES 1 and 2, comprises an elongate rod H having a collar J located intermediate the ends thereof and projecting outwardly therefrom. Collar J divides the rod H into a first portion 10 situated to the left of the collar and a second portion 12 to the right of the collar. The first portion 10 has first threads 14 formed thereon. The second portion 12 is preferably of smaller transverse cross-sectional area than that of portion 10 and has second threads 16 situated on the outer end thereof. The transverse cross-sectional area of second portion 12 is such as to permit this portion to snugly and slidably engage the interior of the inner shell F. Also, the second portion 12 is sufficiently long that a substantial part thereof extends to the right of the bushing D as shown in FIGURE 1.

A first nut K is provided that threadably engages threads 14. A second nut L is also provided that is adapted to engage threads 16. The transverse cross-sectional area of nut L is such as to permit it to be moved through the opening C, for reasons to be hereinafter explained.

A first rigid ring M is provided that has a bore 18 and counterbore 20 extending therethrough which define an interior body shoulder 22 at the junction thereof. The bore 18 is of a size to permit the collar J to snugly and slidably engage the same, with the right-hand side of the collar as seen in FIGURE 1 abutting against the body shoulder 22. The first ring M also includes an inwardly tapering, circumferentially extending edge surface 24 that is adapted to be inserted between the left-hand ends of the inner shell F and outer shell E, as illustrated in FIGURE 1.

A second ring N is also provided which is of such external diameter as to be movable through the opening C formed in the arm B. The second ring N has two oppositely disposed, inwardly tapering circumferential edge surfaces 26. The interior diameter of bore 28 in ring N is such that the left-hand extremity of the inner shell F may be inserted therein. The central portion 30 of ring N, together with the edge surfaces 26 cooperatively define a circumferentially extending body shoulder 32 at the junction thereof.

Normally, the inner shell F is longer than the outer shell E, and when the bushing is new the web G projects outwardly at both ends of the outer shell. However, after a bushing has become worn in the manner shown in FIGURE 1, usually almost all of the projecting portions of the web are broken away or worn off. As a result, there is usually a projecting portion of the inner shell F that is available to engage the bore 28. When an end portion of the inner shell F engages a portion of the bore 28, the tapering edge surface 26 is oriented to enter between shell F and the outer shell E, and due to its taper, enter the space therebetween.

It will be obvious that for this tapering edge surface

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26 to enter the space between the shells F and E, a longitudinally directed force must be applied to the second ring N. As ring N is forced toward the right-hand ends of shells F and E as shown in FIGURE 1, the surface 26 together with the bore 28, cooperatively cause the outer shell E to assume a position relative to the inner shell F where the two shells are aligned along the same longitudinal axis.

When the second nut L is caused to engage the second threads 16 and rotated thereon in an appropriate direction, it abuts against the right-hand side of ring N, and as the nut L is rotated, the ring N is moved to the left to concentrically space the outer and inner shells E and F equally from one another. After shells E and F have been oriented as to a common axis as shown in FIGURE 2, the bushing D is in condition to be forcibly removed from the opening C without danger that the right-hand ends of the shells will flare outwardly to prevent movement of the bushing through the opening.

A cylindrical cup O is provided (FIGURE 1), a first end 34 of which abuts against the left-hand surface of the arm B. Cup O also has a second end 36 which is closed and in which an aperture 38 is formed of such cross section as to permit the first portion 10 to be extended therethrough. The bushing puller also preferably includes a ball bearing assembly P that has a first race 40 and a second race 42 which abuts against the second end 36 of cup O. A plurality of hardened balls 44 are disposed between the first and second races 40 and 42 as is conventional in ball bearing assemblies.

When the first nut K is caused to engage the first threads 14 and the nut is tightened on these threads in an appropriate direction, it moves to the right thereon to abut against the first race 40. As further rotational force is exerted on the nut by a wrench or other means, the first race 40 rotates relative to the second race 42, with the first nut K rotating relative to the first threads 14. As this rotation of nut K relative to the first threads 14 takes place, the cup O tends to be forced to the right as illustrated in FIGURE 1, but movement in that direction cannot occur, for the first end 34 of the cup contacts the surface of arm B. Accordingly, rotation of the first nut K relative to the first threads 14 results in movement of rod H to the left, which rod movement is only possible when the first ring M, second ring N, second nut L and bushing D gripped therebetween are moved to the left. Rotation of nut K is continued until the bushing D is completely removed from the confines of the opening C. After removal of bushing D, the second nut L is rotated to free it from the second threads 16, with the second ring N and the bushing D then being removed from the bushing puller.

After the invention has been used to remove a worn or deformed bushing from the opening C, the bushing puller can then be used to dispose a new bushing D', as shown in FIGURE 3, within the confines of the opening. When used for this purpose, the first ring M of the invention can be removed from engagement with collar J if desired. The new bushing D' is mounted on the second portion 12, and a washer Q is caused to engage the right-hand end of this bushing. Washer Q has a bore 46 formed therein through which the second portion 12 extends. Washer Q also has a circumferentially extending lip 48 that projects to the left therefrom, as shown in FIGURE 3. The dimensions of lip 48 are such that the interior surface thereof snugly and slidably engages a projecting portion 50 of the web G, as is common in the structure of new bushings D'. The second nut L is then caused to engage the second threads 16 to hold the washer Q in abutting contact with the right-hand end of the bushing D'. By rotating the first nut K, the rod H can be caused to move to the left as previously described, and this movement of the rod pulls the new bushing D' into a press-fit within the confines of the opening C.

It will be particularly noted from the above descrip-

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tion that the second portion 12, the second threads 16, and the second nut L cooperatively serve a dual purpose. First, the second nut L in cooperation with the second ring N, serves to position the outer shell E and inner shell F in true longitudinal concentric alignment to permit withdrawal of the shells from opening C. Secondly, the same elements in cooperation with the washer Q press-fit a new bushing D' into the confines of opening C.

Although the present invention is fully capable of achieving the objects and providing the advantages hereinbefore mentioned, it is to be understood that it is merely illustrative of the presently preferred embodiment thereof and I do not mean to be limited to the details of construction herein shown and described, other than as defined in the appended claims.

I claim:

1. A device for use in removing a bushing of a type including concentric inner and outer straight-walled cylindrical shells joined by an inner web of a resilient material from an opening in a solid body in which said bushing is press-fit, comprising:

- (a) a rod having a collar that is intermediately disposed between the ends thereof to divide said rod into first and second portions, said second portion having threads formed on at least that part thereof adjacent the end thereof, with said second portion being adapted to extend through said inner shell;
- (b) a rigid cup having a first open end that bears against said body, and a second end in which an aperture is formed through which said first portion of said rod projects;
- (c) a first rigid ring having an interior circumferentially extending body shoulder at the junction of a bore and counterbore, which bores extend longitudinally through said ring, with said collar being slidably disposed in said bore in said first ring and in abutting contact with said shoulder, which first ring has an inwardly tapering first end surface that is partially insertable between first ends of said inner and outer shells;
- (d) a second rigid ring mounted on said second rod portion, which second ring has an inwardly tapering second end surface that is partially insertable between second ends of said inner and outer shells;
- (e) a nut that engages said threads on said second portion of said rod, which second nut when rotated in a direction to move it towards said collar forces said second ring towards said shells to center said inner shell relative to said outer shell, with the transverse cross section of said second nut and second ring being of such dimensions as to permit the same to be moved through said opening; and
- (f) means for moving said first portion of said rod relative to said cup to force said first end thereof against said body and move said second portion of said rod, bushing, second ring and nut through the opening in said body to separate said bushing therefrom.

2. A device as defined in claim 1 wherein said first means comprise:

- (a) threads formed on said first end portion of said rod;
- (b) a ball bearing assembly that includes first and second races, said assembly having said first portion of said rod extending therethrough, with said second race being in abutting contact with said second end of said cup; and
- (c) a nut that engages said threads on said first portion of said rod and is in abutting contact with said first race.

3. A device for use in removing a bushing of a type including concentric inner and outer straight-walled cylindrical shells joined by an inner web of a resilient material from an opening in a solid body in which said bushing is press-fit, comprising:

- (a) a rod having a collar that is intermediately dis-

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- posed between the ends thereof to divide said rod into first and second portions, said first portion having first threads formed thereon, with said second portion having second threads formed on at least that part adjacent the end thereof, which second portion has a transverse diameter such as to permit slidable insertion thereof in said inner shell; 5
- (b) a rigid cup having a first end that bears against said body and a second closed end in which an aperture is formed through which said first portion of said rod projects; 10
- (c) a first nut that engages said first threads;
- (d) a ball bearing assembly that encircles said first portion of said rod, which assembly includes a first race in contact with said first nut and a second race in contact with said second end of said cup; 15
- (e) a first rigid ring having an interior circumferentially extending body shoulder at the junction of a bore and counterbore which extend longitudinally therethrough, with said collar being slidably disposed in said bore in said first ring and in abutting contact with said shoulder, which first ring has an inwardly tapering first end surface that is partially insertable between first ends of said inner and outer shells; 20
- (f) a second rigid ring mounted on said second portion of said rod, which second ring has an inwardly 25

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- tapering second end surface that is partially insertable between second ends of said first and second shells; and
- (g) a second nut that engages said second threads on said second rod portion of said rod, which second nut when rotated in a direction to move it towards said collar forces said second ring towards said shells to center said inner shell relative to said outer shell, with the transverse cross section of said second nut and second ring being of such dimensions as to permit said second nut and ring to be moved through said opening in said cup, said first nut when rotated relative to said first threads in an appropriate direction forcing said cup against said body and pulling said bushing, second ring and second nut through said opening to free said bushing therefrom.

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