

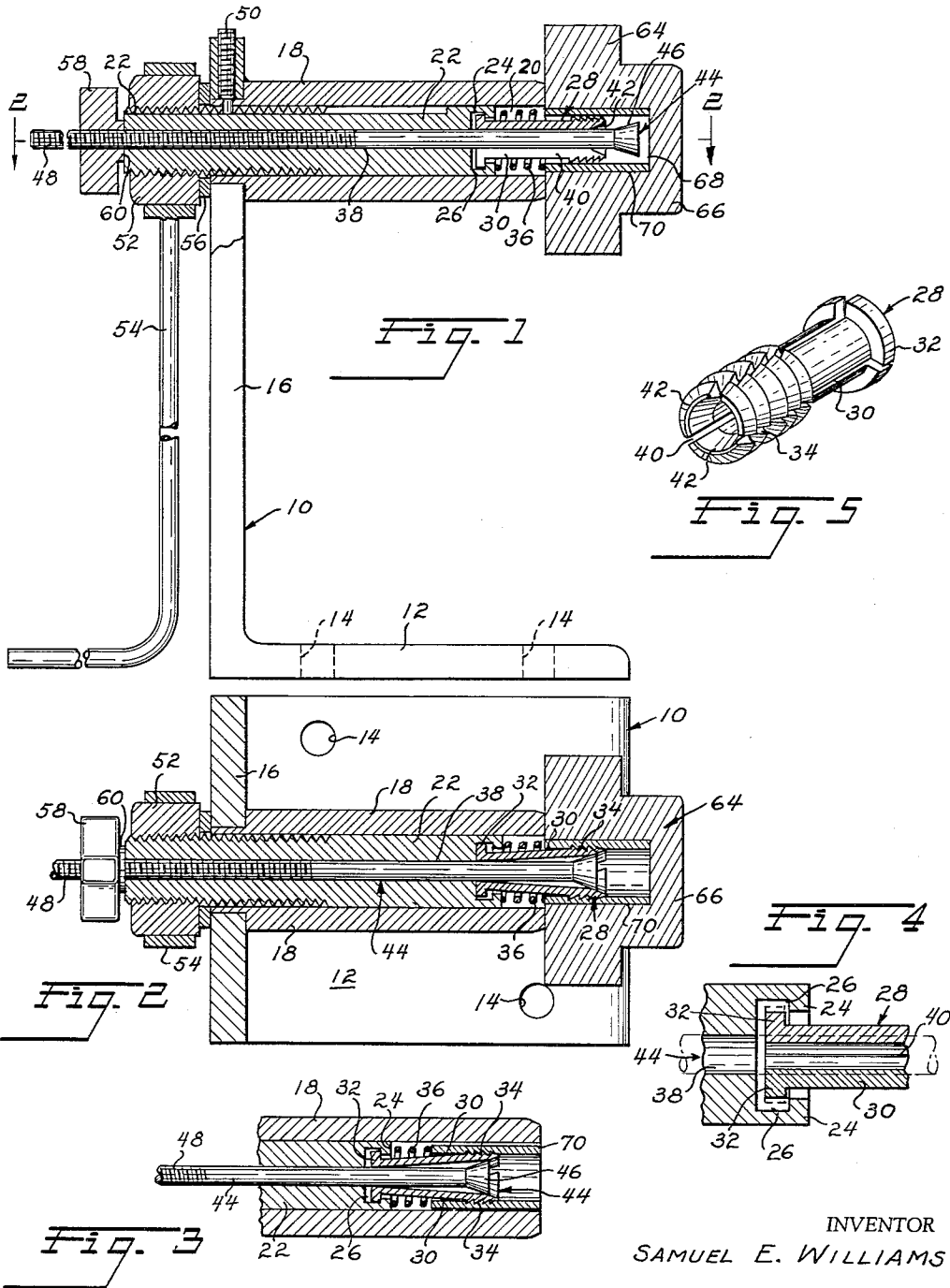
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TOOL FOR REMOVING BUSHINGS

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TOOL FOR REMOVING BUSHINGS
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This invention relates to a tool for removing bushings and especially to such a tool for removing bushings from difficult places such as in blind housings where the bushings are confined so that access can be gained thereto only from one direction as for example is found in the cap housing for the armature shaft of some small electric motors and generators, washing machines, small gas engines, pilot shaft bushings in automobiles, king pin bushings, and many others.

Small shaft bushings are usually press fitted or heat fitted into their housings and after insertion therein, it is virtually impossible to remove them from the housing except by forcing them therefrom with a bushing puller or a bushing pusher. It is simple enough to remove a bushing from an open housing by applying a well-known bushing puller or bushing pusher on one end and exerting longitudinal force against the end of the bushing to push it from the other end. However, in many instances small bushings are confined in closed housings and these are often referred to "blind bushings." Many automotive starters and generator motors have blind bushings, that is, the armature shaft is supported in bushings which are mounted in cap housings and the cap housings are permanently sealed on one end, sometimes with a lifetime seal lubricant, so that it is impossible to reach the bushing through that end of the cap housing. It is simple enough to remove the entire cap housing with the bushing therein, but then the bushing is exposed only on one side, being closed by the cap housing on the other side. It is impossible to use a conventional bushing puller or pusher with any degree of success. There is therefore a great need for a bushing removal tool which will remove a bushing from one side only of a cap housing which has one side totally closed.

Generally described, without use of complex patent terminology as found in claims, and therefore with no restriction on the scope of this invention, this device comprises a stand of generally L-shaped construction, adapted to be bolted by one leg thereof to a work table. Mounted perpendicularly to the normally verticle other leg of the stand at the top thereof is an elongated tool housing or sleeve permanently welded or otherwise fixed to the stand. Mounted in the bore of this housing for longitudinal, sliding movement therein is a draw pull bar or bushing drawbar member having the inward end thereof threaded and with the outward, bushing removal end thereof formed with a keyed, recessed, slotted or notched end in which is fitted three individual arcuate sections forming an expandable bushing engaging tool head; the three members making up the tool head are relatively movable for a limited amount so that when placed inside a bushing in a retracted condition, they may be thereafter expanded to force their outer peripheries into tight engagement with the inner walls of the bushing. Each member of the head is formed at its terminal end and outer periphery with a series of sharp teeth or notches of hardened tool steel for the purpose of digging into or biting into the inner material of the bushing. The drawbar is formed with a longitudinal bore therein in which is mounted for sliding longitudinal movement an expanding plunger rod having the outward end movable inside the expanding head and with a tapered terminal end engageable with the front tapered bore performed by said expanding head to expand said head a limited amount when pulled therein. A mounting

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nut and handle member screws on to the threaded inner end of the drawbar and engages the vertical portion of the stand. A smaller hand locking nut is threaded onto the threaded end of the expanding rod and tightened against the hand locking nut. The handle locking nut is operable manually by hand to draw said drawbar through said bore of said housing after the small hand locking nut has been tightened to expand the expandable head into locked engagement inside said bushing. With said head locked tightly in the bushing, drawing of the drawbar by turning the handle will pull the bushing from its housing. Of course this tears up the inside of the bushing and makes it useless insofar as replacement is concerned; however, this is immaterial since the bushing would not be replaced unless it were already defective.

A primary object of this invention is to provide a hand-operated blind bushing removal tool that locks inside of a bushing and pulls the bushing from its housing from the same side.

An additional object of this invention is to provide a bushing removal tool which has a novel, expandable tool head that will bite into the inside of a bushing and engage the bushing firmly to be drawn from its housing.

A further object of this invention is to provide a blind bushing removal tool consisting of only a few simple mechanical parts requiring virtually no up-keep.

Another object of this invention resides in the particular relationship between the novel drawbar structure and the expanding bushing engagement head mounted thereon, whereby one longitudinal movement will engage said head in said bushing and a second longitudinal movement will remove said bushing from its housing.

Other and further objects and advantages of my invention will become apparent upon reading the following specification taken in conjunction with the accompanying drawings, wherein:

FIG. 1 is a side elevation view of the bushing removal tool of this invention with the upper part thereof in cross-section and having a blind bushing and housing positioned thereon immediately before removal.

FIG. 2 is a cross-sectional view taken substantially along the lines 2—2 in FIG. 1.

FIG. 3 is a view similar to the bushing end portion in FIG. 2 but with the bushing partially removed from its housing.

FIG. 4 is a cross-sectional view enlarged to show a detail of the drawbar and bushing engaging head portion.

FIG. 5 is a perspective view of the expandable bushing engagement head shown removed from the remainder of the tool of FIG. 1.

Referring initially to FIG. 1, the over-all bushing removal tool 10 comprises a generally L-shaped stand member or tool base having a bottom support ledge or plate 12 with attachment bolt holes 14 therein, and having an upstanding substantially vertically disposed support member 16 constituting the other leg of the L. Mounted on top of the support 16 and protruding outwardly substantially perpendicularly therefrom is a bushing removal arrangement comprising a substantially cylindrical housing 18 having a bore 20 therethrough and being permanently welded or otherwise fixed on the support 16.

Bore 20 is open at both ends and throughout its length. Mounted for substantially longitudinal movement in bore 20 is an elongated drawbar member 22 having its inward end which is adjacent support 16 threaded along a length thereof and having its outward end 24 which is confined within bore 20 formed with a T-shaped slot or keyed end 24 therein which provides a recessed slot or circumferential groove or socket 26.

An expandable bushing engagement head 28 consists of three individual independent expandable members 30

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each formed with a flange 32 on one end and with a plurality of teeth 34 on the other end, is mounted loosely for removal from but for normal movement with drawbar 22 in the slot 26 thereof. The toothed end 34 of each of the members 30 is formed from hardened durable tool steel, capable of being sharpened to a keen edge and to maintain said edge after repeated use. The entire head 28 is mounted in or circumferential groove or socket slot 26 by sliding one flange 28 of one member 30 slightly forward of the others, hooking it into the recessed slot 26 and then likewise engaging the other of the two members 30 by their flanges 32 in the recessed end 24. When in position on drawbar 22, the members 30 have limited relative movement with respect to each other through movement of their respective flanges 32 retained within the slot 26. The flanges 28 of the assembled expandable members 30 define a ring of greater diameter than the adjacent diameter of the slot or circumferential groove or socket 26 whereby the expandable members 30 when in said position may be removed one at a time when the assembly of said expandable members 30 is eccentrically positioned in the slot or groove or socket 26 in the manner previously described by sliding one flange 28 of member 30 slightly forward of the others. A coil spring 36 is positioned on and normally surrounds the body portions of the members 30 making up the composite head 28. Coil spring 36 is engaged by the expandable members 30 upon expansion thereof and prevents members 30 from complete disengagement from each other and urges them to normal retracted position upon release.

Drawbar member 22 has a longitudinal open bore 38 formed therein normally in alignment with the open space or bore 40 defined by the combined members making up the head 28. The inner inside end 42 of each of the head members 30 is canted, slanted or tapered at 42 to provide a frusto-conical surface inside bore 40 at the front leading end thereof.

An elongated drawrod or drawbar rod member 44 has a solid frusto-conical or tapered terminal end 46 adjacent said bore 40 and tapered front 42 of head 28 and the rod 44 extends longitudinally through the head 28 and through the bore 38 of drawbar member 22. The end 48 of rod 44 opposite from end 46 is threaded along a portion of the end thereof and lies substantially co-extensive and coaxially with the threaded end of drawbar member 22. It is pointed out that the housing 18 extends on one side of support 16 while the drawbar member 22 and rod 44 extend through the support 16 and beyond the other side thereof. This is important to note because support 16 and housing 18 provide a bearing surface against which force will be exerted to cause longitudinal motion. A set screw 50 screwed into the top of support 16 bears against a portion of drawbar 22 and locks the drawbar in position to prevent rotational displacement of drawbar 22 while at the same time permitting said drawbar 22 to be withdrawn longitudinally as said set screw 50 travels in a longitudinal slot provided on the top of said drawbar 22. A large drawbar actuating nut 52 with handle 54 formed integrally and rigidly thereon and therewith is threaded on the end of drawbar member 22 and presses against a steel washer 56 surrounding said drawbar member 22 and which in turn pushes against the back side of support 16. Accordingly, turning said nut 52 by handle 54 will draw said drawbar through said bore 20.

A small hand nut 58 is threaded onto the end 48 of bar 44 and has a shoulder 60 which bears against the outside of nut 52.

With this arrangement, the tightening of nut 58 against nut 52 will draw rod 44 through the bore 38 pulling tapered end 46 into engagement with complementary tapered bore 42, thereby expanding the members 30 radially outwardly from the center of bore 38 and rod 44. Thereafter, if the hand crank 54 is cranked to turn the nut 52, it will, by bearing against support 16 through

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washer 56, draw the entire drawbar 22 complete with rod 44 and head 28 through the bore 20 from one side of support 16 to the other side of support 16. For example in FIG. 1 there is shown a conventional closed cap housing 64 having a permanently closed and sealed end 66 and having a journal shaft end bore 68 in which had been previously tightly forced a permanent bushing member 70. With both nut 52 and nut 58 loosely mounted on their respective members, head 28 is in retracted condition and the bushing housing 64 may be loosely positioned thereon with bushing 70 loosely mounted over the teeth 34 of head 28. To remove the bushing from the blind cap housing 64 from this position, nut 58 is tightened down on threaded end 48 to draw end 44 into head 28 thereby expanding the head members 30 and causing the sharp teeth 34 to dig into the inside periphery of bushing 70. The head 28 and teeth 34 will remain in this position until the nut 58 is affirmatively released by hand. Then the rotation of handle 54 with nut 52 pulls the entire drawbar 22, and head 28 complete with bushing 70 thereon, from the cap housing 64 into the front end of bore 20, (that is, from the position shown in FIGS. 1 and 2 to the retracted position shown in FIG. 3). After the bushing has been pulled from the cap housing 64, it is a simple matter to loosen nuts 58 and 52 to remove the ruined bushing 70 from head 28. With a little practice, an unskilled operator can remove a bushing in a matter of a minute or two.

As pointed out previously, it is a simple matter to slip the individual members 30 into the recessed end 24 and it is likewise a simple matter of reversal to remove these members from the end 24 if they should become worn or broken. However, with spring 36 in place, there is virtually no likelihood that these members will accidentally become displaced during use. If the tapered end 46 of rod 44 is made from durable material such as good tool steel and likewise the end portion 42 of head 28 is made from good durable tool material, the entire device should give long and reliable service, without breakdown or difficulty.

While I have shown and described a particular embodiment of my bushing removal tool, this is by way of illustration only, and represents only one form thereof, since various alterations, changes, eliminations, substitutions, variations, and other modifications may be made in the embodiment shown and described, without departing from the scope of my invention as shown in the appended claim.

I claim:

In a bushing removal tool for removing bushings from their housings entirely from one side thereof, and where the bushing is exposed on one side thereof within the housing in which the bushing is mounted and from which the bushing is to be removed, said bushing removal tool having a drawbar member mounted for longitudinal movement relative to the longitudinal axis of said bushing to withdraw said bushing from its housing; a plurality of independent but mutually associated expandable bushing engagement members mounted for expansion relative to and radially outwardly from the longitudinal axis of said bushing, each of said expandable members being formed with a respective flange on one end and which flange extends radially outwardly therefrom, said flanged ends being mounted for limited movement on and retained in a groove leading from an opening in the forward end of said drawbar member for removal therefrom and each having the other end thereof opposite from said flanged end formed with a respective bushing engagement element adapted to frictionally engage the interior surface of said bushing, the flanges on the assembled expandable members in retracted position defining a ring of greater diameter than the adjacent diameter opening in said drawbar member whereby said expandable members when in said position may be removed one at a time when said assembly of expandable members is eccentrically positioned

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in said opening, an elongated drawrod member mounted within and for longitudinal movement inside of said drawbar member and for movement within said expandable members, an inclined surface formed on said drawrod member for gradually engaging said expandable members and for expanding same into the interior surface of said bushing, means on said tool for drawing said drawrod member relative to said drawbar member, other means on said tool for drawing said drawbar member to pull said bushing from its housing after said drawrod member has caused said expandable members to engage the interior of said bushing, a flexible and resilient means normally resisting the radial movement of said expandable members and being biased normally to urge the

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return of said expandable members to retracted condition, whereby said expandable members will return to retracted condition after said drawrod member is released.

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