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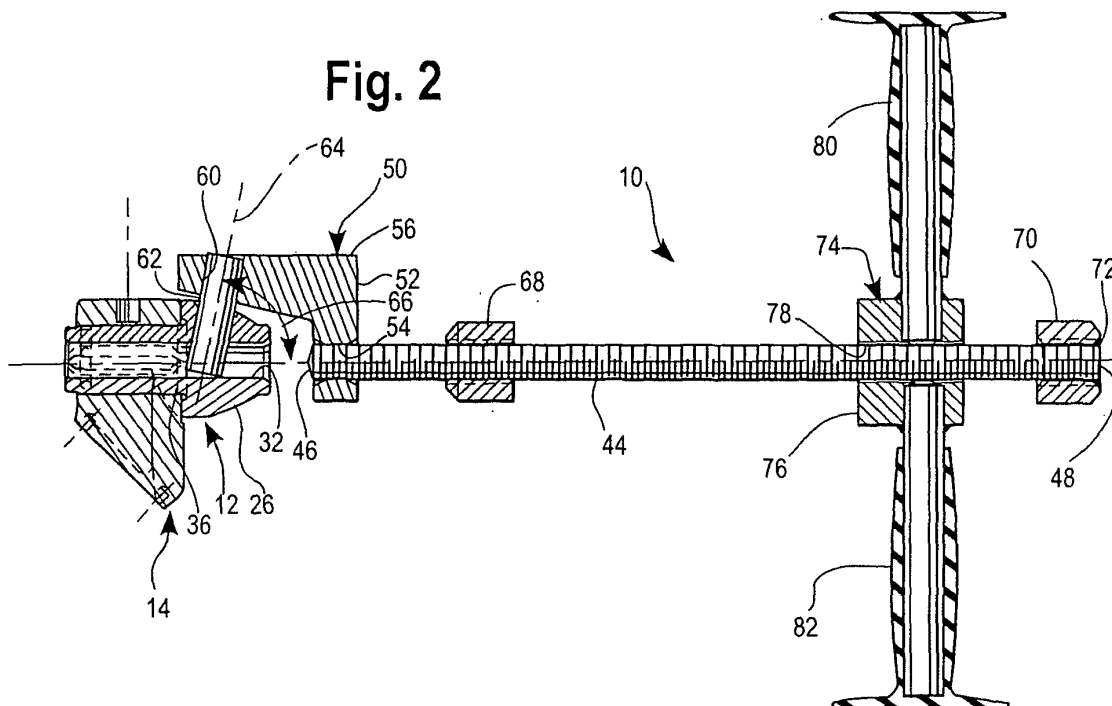
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(54) **Device for extracting a quick-change tool holder**

(57) A retraction tool (10) for removing the shank of a tool holder from a base block mounting (14) includes an elongate threaded member having a hook (50) threaded on one end thereof. The hook has a hook end for attachment to a receptacle in the forward end of a tool holder. A hammer (74) moveable along the length of the elongate member impacts against the stop for pulling

said tool holder from the base block mounting. In the preferred embodiment, the receptacle in the tool holder is a hole having an axis at an angle of 45 to 90 degrees to the axis of the axial bore of the tool holder. When the receptacle hole has a diameter equal to that of the axial bore, a worn tool can be inserted in the receptacle hole and the worn tool can be struck with a hammer as an optional extraction device.



## Description

**[0001]** The present application relates to cutting machines having quick-change tool holders for retaining cutting tools, and to a device for extracting a worn quick-change tool holder from a base block mounting on a machine.

**[0002]** In the course of resurfacing a concrete or asphalt pavement, the upper surface of the worn pavement is removed by a machine having a rotating drum and a plurality of rotatable tools mounted on the drum. Each tool is mounted by first welding to the drum a base block mounting having a bore suitable for receiving the shank of a removable quick-change tool holder. Fitted into the bore of the base block mounting is the shank of a replaceable quick-change tool holder having a retaining bore at the forward end for retaining the shank of a tool.

**[0003]** Where the tools are used to cut hard surfaces such as asphalt or concrete, the tools retained in the quick-change tool holder must rotate to wear evenly around their circumference and thereby maximize their useful life. A hard surface engaged by such tools nonetheless wears the tool rapidly. When the machine is used to cut hard surfaces it is common to replace the tools at least once a day. The hard surface that causes the tool to become rapidly worn also wears the tool holder that receives the rotatable shank of the tools. Although life expectancy of the tool holders may be several times longer than the life of the tools received therein, extended use of the machine will result in the tool holders becoming worn and requiring replacement.

**[0004]** A quick-change tool holder generally has a tapered forward end and extending axially rearwardly of the tapered forward end is a shank that is received in the complementarily shaped bore of the base block mounting on the machine. Preferably, the quick-change tool holder is the type disclosed in my previously issued US 6371567 B1 and US 6585326 B2, which are incorporated herein by reference.

**[0005]** Ideally, worn quick-change tool holders are removed from the base blocks of the machine using a punch and hammer to withdraw the shank from the bore of the base block mounting. The strong forces that are applied to the tools are also applied to the tool holders and the base block mountings as the machine cuts the hard surfaces, and those forces cause the various parts to become deformed such that the shank and quick-change tool holders cannot be easily extracted from the bore of the base block mounting. The problem becomes more complicated for tool holders mounted near the peripheral edges of the drum because several of such end mounted tool holders are oriented at an angle with respect to the drum that allows little or no access to the rearward end of the shank thereof. It is therefore difficult or nearly impossible to remove such quick-change tool holders from the retaining bore, and it is often necessary to use a torch to cut away portions of the worn tool holder in order to replace it.

**[0006]** In my co-pending US patent application filed December 4, 2006 and assigned serial number 11/633,298 I disclosed a retraction device for retracting a quick-change tool holder from the bore of a base block mounting that includes an elongate shaft that extends through the bore of the quick-change tool holder with a nut, or other enlarged object positioned at the distal end of the shaft such that the nut and shank can be used to extract the tool holder from a base block mounting. Where the quick-change tool holder includes a moveable plunger, however, the use of the device of serial number 11/633,298 requires that the plunger be first removed. There is therefore a need for a retraction device for retracting a quick-change tool holder from the bore of a base block mounting without requiring access to the rear end of the shank of the quick-change tool holder. There is also a need for a retraction device that does not require the removal of the plunger from the quick-change tool holder before the tool holder can be removed from the base block mounting.

**[0007]** Yet another problem is that none of the existing tool removal devices remain attached to the quick-change tool holder after it has been removed from the base block mounting and so the removed quick-change tool holder free falls to the ground below. Frequently, the technician can only reach the parts by crawling under the machine and reaching upward to use the removal tool. With his hand so employed, the technician may be defenseless against injury from the falling parts. It would therefore be desirable to provide an extraction device that does not permit the extracted tool holder to free fall.

**[0008]** According to a first aspect, the present invention provides a tool for extracting a shank of a tool holder from a retaining bore of a base block mounting, the tool holder having a forward end and an axial hole for receiving the shank of a tool, and a receptacle at a forward end thereof, said receptacle for receiving a removal device thereto, said tool comprising an elongate member having a first end, a second end and a length, said elongate member having a threading on at least said first end, said first end sized to be received in said axial hole, a hook having a transverse threaded hole for threadedly receiving said threading of said elongate member, said hook having a hook end for grasping said receptacle, a stop on said elongate member spaced from said first end, and a hammer longitudinally moveable along said elongate member between said hook and said stop wherein impact of said hammer against said stop will remove said tool holder shank from said base block mounting bore.

**[0009]** According to a second aspect, the present invention provides a combination comprising :

a tool holder, said tool holder having a forward end and an axial shank, said tool holder also having an axial hole for receiving the shank of a tool, and a receptacle in said forward end for attachment of a removal extraction tool thereto, and an extraction tool, said extraction tool having an elongate member

having a first end, a second end and a length, and a threading on at least said first end, said first end sized to be received in said axial hole of said tool holder, said extraction tool further having a hook having a transverse threaded hole for threadedly receiving said threading of said elongate member and threadedly attaching said hook thereto, said hook having a hook end receivable in said receptacle and attaching said tool holder to said extraction tool, a stop on said elongate member spaced from said first end, and said extraction tool also having a hammer longitudinally moveable along said elongate member between said hook and said stop wherein an impact of said hammer against said stop will remove said tool holder shank from said base block mounting bore.

**[0010]** In a further aspect, the present invention provides a method of removing a shank of a tool holder from a retaining bore of a base block mounting, the tool holder having an enlarged forward end with a receptacle therein for attaching a removal device thereto, said method comprising the steps of: providing an elongate member having a first end, a second end having an enlarged stop, a length, a threading on at least said first end, and a diameter less than a diameter of said axial hole; providing a hook having a transverse threaded hole for threadedly receiving said elongate member and a hook end; providing a hammer that is longitudinally moveable along said elongate member; positioning said hammer on said elongate member and moveable against said stop; positioning said hook end in said receptacle; threading said threads on said first end into said threaded hole of said hook and into said axial hole; and moving said hammer along said length to impact against said stop to apply force to said tool holder shank from said base block mounting bore.

**[0011]** In another aspect, the present invention provides a tool for extracting a shank of a tool holder from a retaining bore of a base block mounting, the tool holder having a forward end and an axial hole therein for receiving the shank of a tool, said tool comprising: an elongate member having a first end, a second end, a length, and a threading on at least said first end; said first end sized for extending through said axial hole of said tool holder; a nut for attachment to said first end for retaining said elongate member within said axial hole; a stop on said elongate member spaced from said first end; and a hammer longitudinally moveable along said elongate member between said tool holder and said stop wherein movement of said hammer against said stop will apply force to remove said tool holder shank from said base block mounting bore.

**[0012]** In yet another aspect, the present invention provides a tool holder for retaining a tool having a cylindrical shank with a given diameter wherein said tool holder is removably received in a bore of a base block mounting, said tool holder comprising :

a body having a longitudinal axis; said body having an enlarged forward end with a transverse forward surface; said body also having an axially rearwardly extending shank, sized to fit within said base block mounting bore; said body further having an axial bore extending into said forward surface and through said enlarged forward end and said shank; said axial bore sized to receive said shank of said tool; and said enlarged forward end having a second cylindrical hole at an angle with respect to said axis and said second cylindrical hole having a diameter also sized to receive said shank of said tool.

**[0013]** Briefly, the present invention is embodied in an extraction device for removing a quick-change tool holder from a base block mounting. The quick-change tool holder to be removed is of the type having a generally planar forward surface behind which is an enlarged forward end behind which is a tubular shank that is receivable in the bore of a base block mounting. The quick-change tool holder has an axial hole extending through the enlarged forward end and through the shank with the diameter of the axial bore sized to receive the shank of a tool.

**[0014]** The enlarged forward end of the tool holder also has a receptacle to which a hook of a retraction tool in accordance with the invention is attachable. In the preferred embodiment the receptacle is a second cylindrical hole that extends into the outer surface of the enlarged forward end with the axis of the second hole being at an angle of least forty-five degrees, preferably seventy-eight degrees, with the axial hole and with the axis of the second hole intersecting the longitudinal axis of the axial hole.

**[0015]** The device for removing such a quick-change tool holder from its associated base block mounting includes an elongate member having a first end, a second, and a length with the first end sized to be slideably received in the axial hole of the quick-change tool holder. At least a portion of the first end is threaded and threaded on the first end is a hook that includes an elongate arm and a hook end shaped and oriented so as to extend around a portion of the enlarged forward end of a quick-change tool holder and grasp the receptacle thereon. In the preferred embodiment the hook end includes a dowel pin the free end of which is directed toward the axis of the elongate threaded member and makes an angle between 45 degrees and 90 degrees with the axial hole. The pin has an outer diameter sized to be received within the second hole to thereby grasp and hold the forward end of the tool holder. Positioned at or near the second end of the elongate member is an enlarged stop member, which preferably is a nut that is threadedly engaged to the second end of the elongate member and welded thereto. Positioned along the elongate member between the hook and the stop member is a hammer that is slideable along the length of the elongate member between the hook and the stop member. The hammer is made of metal and has sufficient mass such that quick movement

of the hammer along the elongate member until it impacts against the stop member at the second end will remove the quick-change tool holder from the base block mounting.

**[0016]** To use the device of the present invention, the hook end of the hook is engaged with the receptacle and the elongate member is extended into the axial hole of the quick-change holder. Thereafter, the hammer is pounded against the stop to remove the quick-change holder.

**[0017]** The receptacle is preferably formed as a bore directed into the outer surface of the enlarged forward end and having a diameter sized to receive the shank of one of the worn tools of the type received in the bore of the quick-change tool holder. When a technician is replacing the tools of a machine, he soon has several worn tools scattered on the ground around him. When the receptacle hole of a tool holder is sized to receive the shank of one of those tools, he can grasp one of the worn tools off the floor and insert the shank thereof into the receptacle. He can then use a hammer to pound against the projecting tool body to force the worn tool holder from the base block mounting, thus providing the technician with an optional removal technique.

**[0018]** Preferred embodiments of the invention will now be described by way of example only and with reference to the accompanying drawings, in which :

Fig. 1 is a cross-sectional view of a quick-change holder having a receptacle in the form of a second hole therein, the parts shown greatly enlarged compared to all subsequent figures;

Fig. 2 is a cross-sectional view of the quick-change tool holder and associated base block mounting shown in Fig. 1 with the hook end of the extraction device in accordance with the invention engaged in the receptacle, that is the second hole, of the quick-change tool holder;

Fig. 3 shows the quick-change tool holder, base block mounting, and extraction device of Figs. 1 and 2 after the threaded shaft thereof is engaged into the axial bore of the quick-change tool holder;

Fig. 4 is a cross-sectional view of the extraction device shown in Figs. 1 - 3 locked to the quick-change tool holder immediately prior to extraction from the base block mounting;

Fig. 5 shows the parts shown in Figs. 1 through 4 with the hammer positioned immediately before it is slammed against the stop;

Fig. 6 shows the hammer contacting the stop to thereby apply an impact to pull the quick-change tool holder out of the base block mounting;

Fig. 7 shows the extraction device with the hook removed and the parts assembled in an alternative configuration for removing the quick-change tool holder without a plunger from the base block mounting;

Fig. 8 is a cross-sectional view of a base block

mounting having a quick-change tool holder in accordance with the present invention therein and a tool received in the tool holder;

Fig. 9 is an isometric view of the quick-change tool holder in accordance with the invention showing the shank of a cutting tool being pounded into the receptacle hole thereof;

Fig. 10 is an isometric view of the quick-change tool holder shown in Fig. 9 being removed from the base block mounting;

Fig. 11 is an enlarged fragmentary cross-sectional view of the quick-change tool holder shown in Fig. 8 showing the plug fitted therein prior to being compressed by a compression tool;

Fig. 12 is a side elevational view of another tool holder in accordance with a second embodiment of the invention;

Fig. 13 is a cross-sectional view of the tool shown in Fig. 12 with the tool holder rotated ninety degrees about its longitudinal axis;

Fig. 14 is a fragmentary front elevational view of a quick-change tool holder having a plug ready to be sealed into a receptacle hole in accordance with another embodiment of the invention; and

Fig. 15 is another fragmentary enlarged front elevational view of the parts shown in Fig. 14 after the plug is flattened and sealed in place.

**[0019]** Referring to Figs. 1 through 6, an embodiment of the extraction device 10 of the present invention is employed to remove a quick-change tool holder 12 from a base block mounting 14 which in turn is mounted on a rotating drum, not shown, of a machine. The base block mounting 14 includes a mounting portion 16 suitable for attachment to the drum of a machine and a body 18 having a forward surface 20 and an axial bore 22. Fitted into the axial bore 22 is a shank 24 of the quick-change tool holder 12. The quick-change tool holder 12 further has an enlarged forward end 26 that diverges rearwardly from a transverse planar forward surface 28 and having a planar rearward surface 30 that abuts against the planar surface 20 of the base block mounting 14. Extending longitudinally through the length of the enlarged forward end 26 and the shank 24 is an axial hole 32 having an inner diameter sized to receive the shank of a tool (shown in Fig. 8).

**[0020]** The quick-change holder also includes a receptacle 36 for attachment thereto by means of a hook as is further described below. In the preferred embodiment the receptacle 36 is configured as a second hole 36 extending into the outer surface 34 of the enlarged forward end 26, the second hole having an axis 38 that intersects and is at an angle 42 with the longitudinal axis 40 of the axial hole 32. Preferably, the angle 42 is at least forty-five degrees but no more than ninety degrees (see Fig. 8). I have found that an angle 42 of approximately seventy-eight degrees is most desirable for use with the tool 10. It should be appreciated that the receptacle 36 may have

many other configurations that are suitable for being grasped by a hook as is described below. For example, the receptacle may be an annular groove around the circumference of the enlarged forward end 26, or a pair of diametrically opposed notches, either configuration of which is suitable for receiving a removable attachment device.

**[0021]** I have found that it is most desirable for the receptacle 36 to be a cylindrical hole as depicted in all the drawings and described above, and with the hole having a diameter sized to receive the shank 42 of a cutting tool 45 (depicted in Fig. 8) of the type received in the axial hole 32 of the quick-change tool holder 12.

**[0022]** To remove the quick-change tool holder 12 from the bore 22 of the base block mounting 14, the device 10 includes an elongate shaft 44 having a first end 46 and a second end 48. At least a portion of the first end 46 is threaded. Since long lengths of threaded shafts are readily available the invention is most easily constructed using a shaft threaded along its entire length as shown in the drawings. Threaded onto the first end 46 is a hooked arm 50 having a first arm portion 52 with a transverse threaded hole 54 therein for threadedly receiving the threads of the elongate member 44. The hooked arm 50 also includes an angled second portion 56 having a surface 58 shaped to extend around the outer surface of the enlarged forward end 26 of the quick-change tool holder 12. Near the distal end of the angled second portion 56 is a hook end 62 suitable for grasping the receptacle 36 on the quick-change holder 12. In the preferred embodiment the hook end 62 is an elongate pin having one end welded into a second transverse hole 60 in the second arm portion 56. The pin 62 has an outer diameter that is a slightly smaller than the inner diameter of the second cylindrical hole (the receptacle 36) of the quick-change tool holder 12. The axis 64 of the cylindrical pin 62 is oriented at an angle 66 that is equal to the angle 42 between the axis of the second hole 36 and the longitudinal axis 40 of the quick-change tool holder 12 so as to be attachable to the receptacle 36 as is further described below. It should be appreciated that the hook end 62 may have any of a number of configurations depending on the configuration of the receptacle 36. For example, if the receptacle 36 is an annular groove around the forward end 26 of the quick-change tool holder 12, or is a pair of diametrically spaced apart notches, the hook end 62 may be configured as a yoke having spaced apart opposing ends sized and shaped to fit within the annular groove, or fit within the notches to thereby hold the hook end 62 to the quick-change tool holder 12.

**[0023]** Fitted on the elongate member 44 behind the hooked arm 50 is a first threaded nut 68. Attached to the second end 48 of the elongate member 44 is a stop 70. Where the elongate member 44 is threaded along its entire length as shown the stop 70 may be a second threaded nut as shown. If the stop is a nut a weldment 72 firmly attaches the stop 70 to the second end 48 locking it to the elongate member such that a wrench, not shown,

can engage the hex head of the second nut to rotate the elongate member 44.

**[0024]** Fitted around the elongate member 44 between the first nut 68 and the stop 70 is a slideable hammer 74 having a body 76 with a transverse hole 78 therein having a diameter large enough to slideably receive the elongate member 44. Extending from opposite sides of the body 76 are handles 80, 82 with the longitudinal axis of the handles 80, 82 oriented perpendicular to the longitudinal axis of the elongate member 44. Preferably the elongate member has an overall length of about 0.45m (18 inches) and the hammer 74 has a slideable range of movement of about 0.3m (twelve inches).

**[0025]** Referring to Fig. 2, to employ the device 10 the hook end 62, in this embodiment the hook end is the end of the cylindrical pin 62, is engaged into the receptacle 36, which in this embodiment is the second cylindrical hole of the quick-change tool holder 12. As shown in Fig. 3, thereafter the stop 70, or second threaded nut, attached to the elongate member 44 is rotated to thread the elongate member 44 through the threaded hole 54 on the hook 50 and into the axial hole 32 of the quick-change tool holder 12. The elongate member 44 is extended into the axial hole 32 until the end 46 of the elongate member 44 contacts the distal end of the pin 62. As shown in Fig. 4, the parts are then locked into position by hand tightening the first threaded nut 68 against the rearward surface of the hook arm 50. As shown in Figs. 5 and 6, one operates the device by grasping the handles 80, 82 with his hands and longitudinally moving the hammer 74 from a position against the first nut 68 (as shown in Fig. 5) along the length thereof and causing it to impact against the stop 70 (as shown in Fig. 6) to thereby disengage the shank 24 of the quick-change holder 12 from the axial bore 22 of the base block mounting 14. After removal from the base block mounting 14 the quick-change tool holder 12 will remain connected to the end 46 of the elongate member 44 and will not drop so as to cause personal injury or property damage.

**[0026]** Referring to Fig. 7, portions of the device 10 may be used to extract a quick-change tool holder 84 from a base block mounting 86 which does not have a plunger therein, or the plunger has been removed. In this embodiment the hook arm 50 is unnecessary and is unthreaded from the first end 46 of the elongate member 44. The first end of the elongate member 44 is then extended through the axial hole 88 of the quick-change tool holder 84 until a portion thereof extends outward of the rearward end 90 thereof. A third threaded nut 92 is fitted on the first end 46 and the quick-change tool holder 84 is then snugly retained between the first and third threaded nuts 68, 92. Thereafter, the hammer 74 is moved along the elongate member 44 as described above to strike the stop 76 to force the shank 94 of the quick-change tool holder 84 out of the bore of the base block mounting 86.

**[0027]** Where the elongate member 44 has threads along its entire length, it is desirable that the threads of the elongate member 44 have a flat and wide outer sur-

face so as not to become worn as a result of the movement of the hammer 74. Preferably, the threads are  $\frac{3}{4}$  - 5 ACME threads. Accordingly, the threads in the threaded hole 54 of the hook arm 50 and in the various nuts 68, 70, 92 are female  $\frac{3}{4}$  - 5 ACME threads.

**[0028]** Referring to Figs. 8, 9 and 10, a machine used for cutting hard surfaces retains a cutting tool 45 having a cutting portion 96 and extending axially rearward of the cutting portion 96 is a generally cylindrical shank 43. The generally cylindrical shank 43 is received within the axial bore 32 of the quick-change tool holder 12 substantially as described above.

**[0029]** Positioned between the forward surface 28 of the quick-change tool holder 12 and a rearwardly facing annular flange of the cutting portion 96 of the cutting tool 45 is a wear ring 98 that protects the forward surface 28 from becoming worn away as a result of rotation of the cutting tool 45 in the axial bore 32. The cylindrical shank 43 of the cutting tool 45 is retained within the axial bore 32 by a generally tubular retaining sleeve 100 that engages an annular shoulder (unnumbered) on the shank 43 thereby preventing forward movement of the cutting tool 45 and also applies a radially outward pressure against the inner surface of the cylindrical axial bore 32 of the quick-change tool holder 12 to retain the cutting tool 45 within the quick-change tool holder 12.

**[0030]** I have found that where the receptacle bore 36 of the quick-change tool holder 12 has a diameter that is equal to or a little greater than the axial bore 32, the receptacle bore 36 will receive the shank 43 of a typical cutting tool 45 used by the machine. It should be appreciated that while the quick-change tool holders 12 are infrequently replaced, perhaps twice each working season, the cutting tools 45 are replaced on a more frequent basis, perhaps more than once during each work day. As a result, an operating technician will have access to many worn tools that have fallen to the ground after removal or have been collected in boxes. The operator can readily obtain one of the worn tools and, as shown in Fig. 9, use a conventional hammer 102 to pound the shank 43 of the worn cutting tool 45 into the receptacle hole 36 such that the cutting portion 96 of a worn tool 45 extends radially outward of the outer surface of the quick-change tool holder 12. Thereafter, the hammer 102 is pounded against the outer surface of the cutting portion 96 of the worn tool 45, as shown in Fig. 10, to remove the shank 24 of the quick-change tool holder 12 from the bore 22 of the base block mounting 14.

**[0031]** It is preferable that a worn tool be used for this purpose because a new tool may become damaged during the extraction process. If for some reason a worn tool is not available, a drive pin of the type used to insert a tool holder into a base block mounting has a shank the outer diameter of which is sized to fit within the bore of the tool holder and can also fit into the transverse hole. One advantage of this embodiment of the invention over prior art extraction devices is that an operator can remove a worn tool holder using only one hand.

**[0032]** Referring further to Figs. 8 and 11, to prevent debris from entering into the receptacle hole 36, a disc shaped metal plug 104 is inserted into the hole 36 near the outer surface of the tool holder 12. To receive the metal plug 104, a cylindrical counterbore 58 is provided around the mouth of the hole 54 adjacent the outer surface 50 with the counterbore 105 having a diameter a little larger than the diameter of the receptacle hole 36 so as to form an annular shoulder 106 that is recessed a short distance from the outer surface. It should be appreciated that the counterbore 105 is preferably angled so that the outer surface of the plug 104 will conform as nearly as possible to the adjacent portions of the outer surface of the tool holder 12. The outer circumference of the disc shaped plug 104 rests against the annular shoulder 106.

**[0033]** As best shown in Fig. 11, the plug 104 is manufactured with concave and convex surfaces 107, 108 respectively opposite each other such that the surfaces of the plug 104 are partially spherical. The outer circumference of the plug 104 is made a little smaller than the inner circumference of the counterbore 105 but larger than the inner circumference of the receptacle hole 36 such that the outer edge of the plug 104 will rest upon the shoulder 106 formed by the counterbore 105. Thereafter, a tool 110 having a circular substantially planar end surface 112 having a diameter approximately equal to the diameter of the metal plug 104 is pounded against the radially outwardly bowed outer surface 108 of the plug 104 causing the plug 104 to deform and causing the cylindrical outer surface thereof to be compressed against the cylindrical inner surface of the counterbore 105 as shown in Fig. 8, thereby locking the plug in place. Preferably, the plug 104 has a thickness of about 0.2 cm (0.080 inches) and is carburized about 0.05 cm (0.020 inches) deep and hardened to a hardness of between Rc 55 and Rc 67 on the Rockwell "C" scale of hardness. The outer circumference of the plug 104 will then be harder than the metal forming the wall of the counterbore. When a hardened plug 104 is subsequently deformed by tool 110 the lower circumference of the plug 104 will be more radially extended and will bite into the wall of the counterbore 105 to retain the plug 104.

**[0034]** Another advantage of a quick-change tool holder 12 having a sealed receptacle hole 36 is that the cavity adjacent the axial bore 32 and underneath the plug 104 becomes a collection box for debris that enters the space between the cutting tool shank 43 and the axial bore 32 allowing better rotation of the cutting tool 45 and thereby increasing tool life.

**[0035]** Referring to Figs. 12 and 13, a second embodiment of a quick-change tool holder 120 has an enlarged forward end 122, a rearwardly directed generally cylindrical shank 128 and an axial bore 118 extending from a forward surface 124 to a planar rearward end 130. In this embodiment, a receptacle hole 154 has a longitudinal axis 153 that intersects the longitudinal axis 126 of the tool holder 120. Near the outer surface 150 of the tool

holder 120 and surrounding the receptacle hole 154 is a cylindrical counterbore 158 into which a plug 156 is fitted. The described parts are all similar to that described above with respect to tool holder 12.

**[0036]** In this embodiment, however, extending along one wall of the receptacle hole 154 and parallel to the axis of the counterbore 158 is an elongate notch 170 that extends into the wall of the counterbore 158 and the wall of the receptacle hole 154. When the plug 156 is inserted into the counterbore 158 and locked into place with a tool, such as tool 110 previously described, the outer surface of the plug 156 will not entirely fill the notch 170, however, any remaining opening will be small and will be easily filled with debris once the machine is placed in use.

**[0037]** Referring to Figs. 14 and 15, instead of using a tool 110 to deform the outer circumference of the plug 104, the plug 256 can be retained against the annular surface 259 of a counterbore 258 around a receptacle hole 244 by deforming the rim 272 of the counterbore 258 and causing portions of the metal of the tool holder 220 to fold over the outer surface 262 of the plug 256. To deform the rim 272 a tool 280 having a generally cylindrical body 282 with a diameter approximately equal to that of the plug 256 is provided. The tool 280 has a plurality of parallel ribs extending along the outer surface of the body 282, two of which bearing indicia numbers 284, 285 are visible. The lower end of ribs 284, 285 extend at least to the lower end of the tool body 282. To lock the plug 256 in the counterbore 258 the lower end of the ribs 284, 285 are positioned against the surface 250 of the tool holder 220 forming the rim 272. The opposite end of the tool body 282 is then struck with a hammer, not shown, causing the ribs 284, 285 to deform portions 286, 287, 288, 289 of the rim 272 to lock the plug 256 in place.

**[0038]** While the present invention has been described with respect to several embodiments, it will be appreciated that many modifications and variations may be made without departing from the scope of the invention. It is therefore the intent of the following claims to cover all such variations and modifications that fall within the true scope of the invention.

**Claims**

1. A tool for extracting a shank of a tool holder from a retaining bore of a base block mounting, the tool holder having a forward end and an axial hole for receiving the shank of a tool, and a receptacle at a forward end thereof, said receptacle for receiving a removal device thereto, said tool comprising:

an elongate member having a first end, a second end and a length,  
said elongate member having a threading on at least said first end,  
said first end sized to be received in said axial

hole,  
a hook having a transverse threaded hole for threadedly receiving said threading of said elongate member,  
said hook having a hook end for grasping said receptacle,  
a stop on said elongate member spaced from said first end, and  
a hammer longitudinally moveable along said elongate member between said hook and said stop wherein impact of said hammer against said stop will remove said tool holder shank from said base block mounting bore.

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2. A tool as claimed in claim 1 wherein said receptacle on said quick-change tool holder is a second cylindrical hole in an outer surface thereof and said hook end is a cylindrical peg receivable in said second cylindrical hole.

3. A tool as claimed in claim 2 wherein said second hole is at an angle of between 45 degrees and 90 degrees with said axial hole.

4. A tool as claimed in any preceding claim, further comprising a nut on said threads of said elongate member between said hook and said hammer wherein said nut is tightenable against said hook for locking said hook with respect to said elongate member.

5. A tool as claimed in claim 4 wherein said hammer includes a handle for striking said hammer against said stop for applying a force to remove said tool holder shank from said base block mounting bore.

6. A combination comprising:  
a tool holder,  
said tool holder having a forward end and an axial shank,  
said tool holder also having an axial hole for receiving the shank of a tool, and a receptacle in said forward end for attachment of a removal extraction tool thereto, and  
an extraction tool,  
said extraction tool having an elongate member having a first end, a second end and a length, and a threading on at least said first end, said first end sized to be received in said axial hole of said tool holder,  
said extraction tool further having a hook having a transverse threaded hole for threadedly receiving said threading of said elongate member and threadedly attaching said hook thereto, said hook having a hook end receivable in said receptacle and attaching said tool holder to said extraction tool,  
a stop on said elongate member spaced from

said first end, and  
 said extraction tool also having a hammer lon-  
 gitudinally moveable along said elongate mem-  
 ber between said hook and said stop wherein  
 an impact of said hammer against said stop will  
 remove said tool holder shank from said base  
 block mounting bore.

7. A combination as claimed in claim 6 wherein said  
 receptacle is a second hole in said forward end, said  
 second hole at an angle between forty five and ninety  
 degrees with said axial hole.

8. A combination as claimed in claim 6 or 7 wherein  
 said second hole has a diameter at least equal to a  
 diameter of said axial hole.

9. A combination as claimed in claim 6, 7, or 8 and  
 further comprising a nut on a threading on said elon-  
 gate member between said hook on said hammer  
 wherein said nut is tightenable against said hook for  
 locking said hook with respect to said elongate mem-  
 ber.

10. A combination as claimed in claim 9 wherein said  
 hammer includes a handle for manually striking said  
 slide against said stop for applying a force to remove  
 said tool holder shank from said base block mounting  
 bore.

11. A method of removing a shank of a tool holder from  
 a retaining bore of a base block mounting, the tool  
 holder having an enlarged forward end with a recep-  
 tacle therein for attaching a removal device thereto,  
 said method comprising the steps of:

providing an elongate member having a first  
 end, a second end having an enlarged stop, a  
 length, a threading on at least said first end, and  
 a diameter less than a diameter of said axial  
 hole;

providing a hook having a transverse threaded  
 hole for threadedly receiving said elongate  
 member and a hook end;

providing a hammer that is longitudinally move-  
 able along said elongate member;

positioning said hammer on said elongate mem-  
 ber and moveable against said stop;

positioning said hook end in said receptacle;

threading said threads on said first end into said  
 threaded hole of said hook and into said axial  
 hole; and

moving said hammer along said length to impact  
 against said stop to apply force to said tool hold-  
 er shank from said base block mounting bore.

12. A method as claimed in claim 11 comprising the fur-  
 ther steps of providing a nut for threading on said

threads of said elongate member, threading said nut  
 between said hook and said hammer, and tightening  
 said nut against said hook to lock said hook with  
 respect to said threaded member.

13. A tool for extracting a shank of a tool holder from a  
 retaining bore of a base block mounting, the tool  
 holder having a forward end and an axial hole therein  
 for receiving the shank of a tool, said tool comprising:

an elongate member having a first end, a second  
 end, a length, and a threading on at least said  
 first end;

said first end sized for extending through said  
 axial hole of said tool holder,

a nut for attachment to said first end for retaining  
 said elongate member within said axial hole;

a stop on said elongate member spaced from  
 said first end; and

a hammer longitudinally moveable along said  
 elongate member between said tool holder and  
 said stop wherein movement of said hammer  
 against said stop will apply force to remove said  
 tool holder shank from said base block mounting  
 bore.

14. A tool holder for retaining a tool having a cylindrical  
 shank with a given diameter wherein said tool holder  
 is removably received in a bore of a base block  
 mounting, said tool holder comprising :

a body having a longitudinal axis;

said body having an enlarged forward end with  
 a transverse forward surface;

said body also having an axially rearwardly ex-  
 tending shank, sized to fit within said base block  
 mounting bore;

said body further having an axial bore extending  
 into said forward surface and through said en-  
 larged forward end and said shank;

said axial bore sized to receive said shank of  
 said tool; and

said enlarged forward end having a second cy-  
 lindrical hole at an angle with respect to said axis  
 and said second cylindrical hole having a diam-  
 eter also sized to receive said shank of said tool.

15. A tool holder as claimed in claim 14, further  
 comprising :

said enlarged forward end having a side surface,  
 said cylindrical hole opening into said side sur-  
 face,

said enlarged forward end having a counterbore  
 around said opening of said cylindrical hole in  
 said side surface,

a removable plug in said cylindrical hole,  
 said removable plug having an outer perimeter

that rests against said counterbore.

16. A tool holder as claimed in claim 15, further comprising :

said cylindrical shank of one of said tools inserted into a cylindrical hole wherein a cutting end of said tool can be hit with a hammer to remove said tool holder from a base block mounting.

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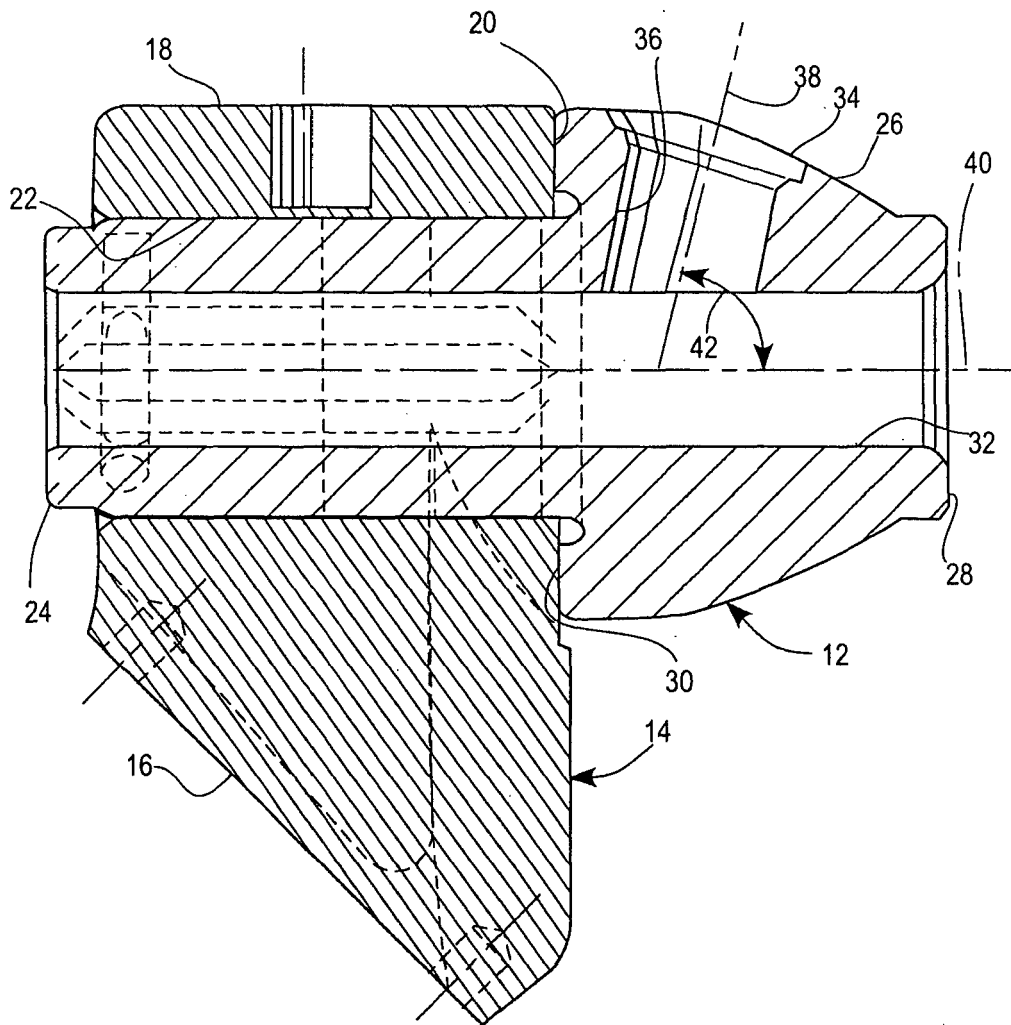
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Fig. 1



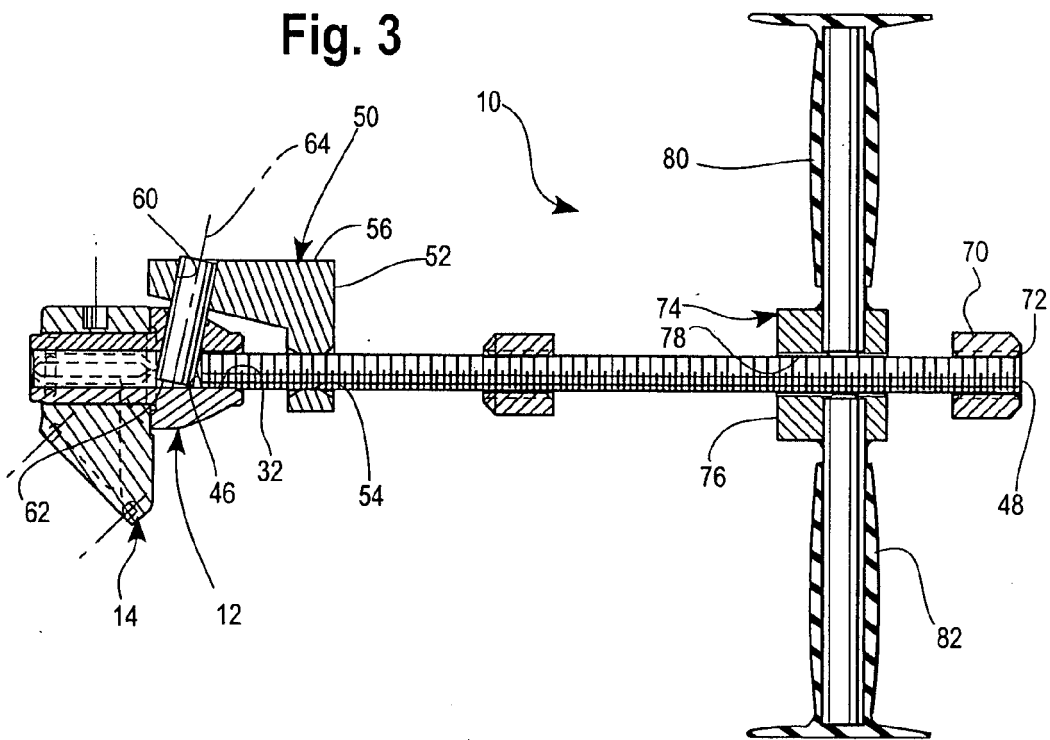
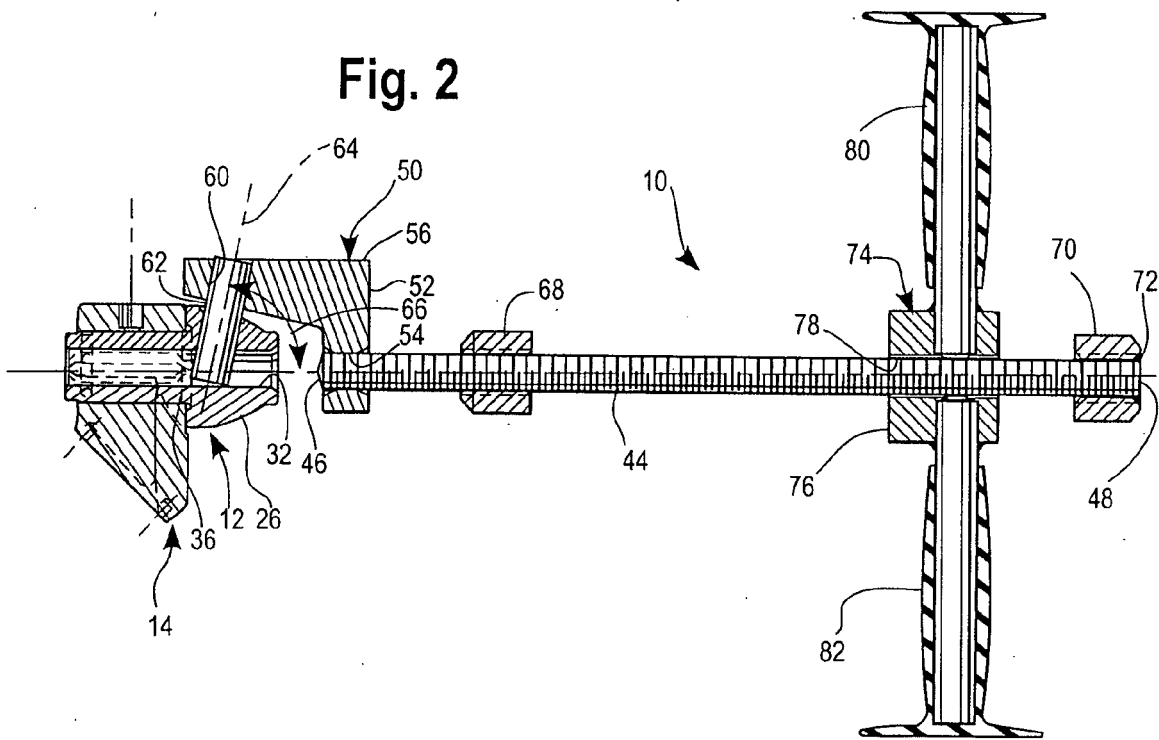


Fig. 4

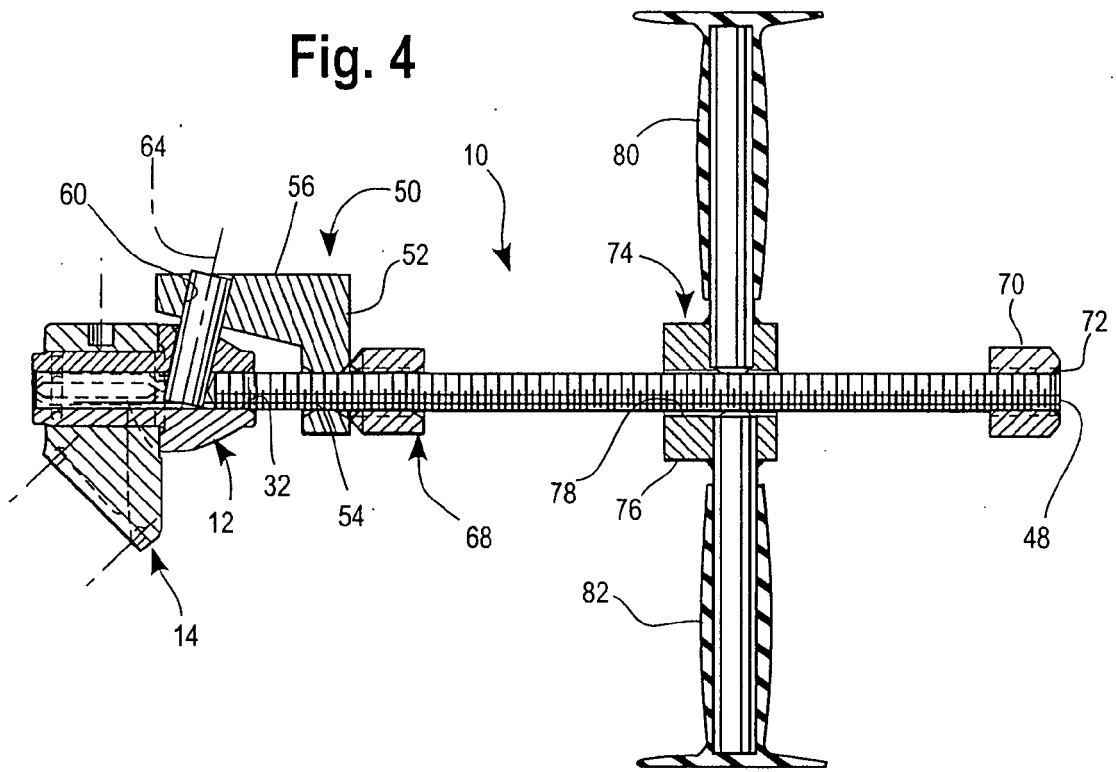
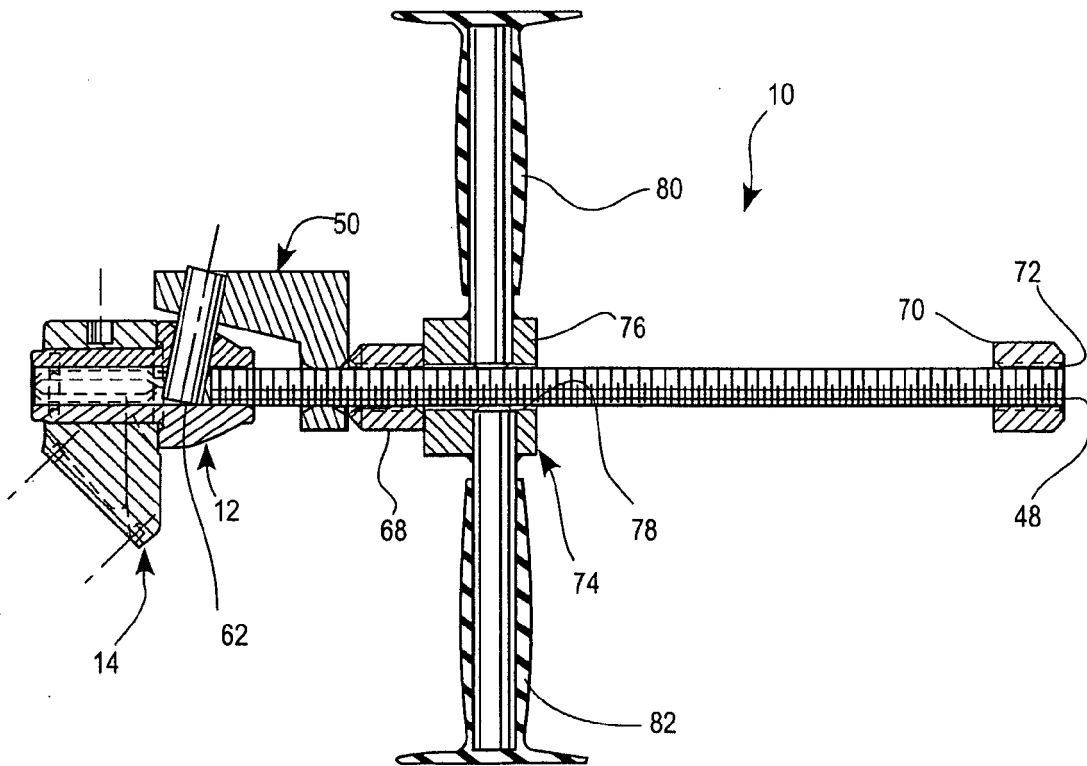


Fig. 5



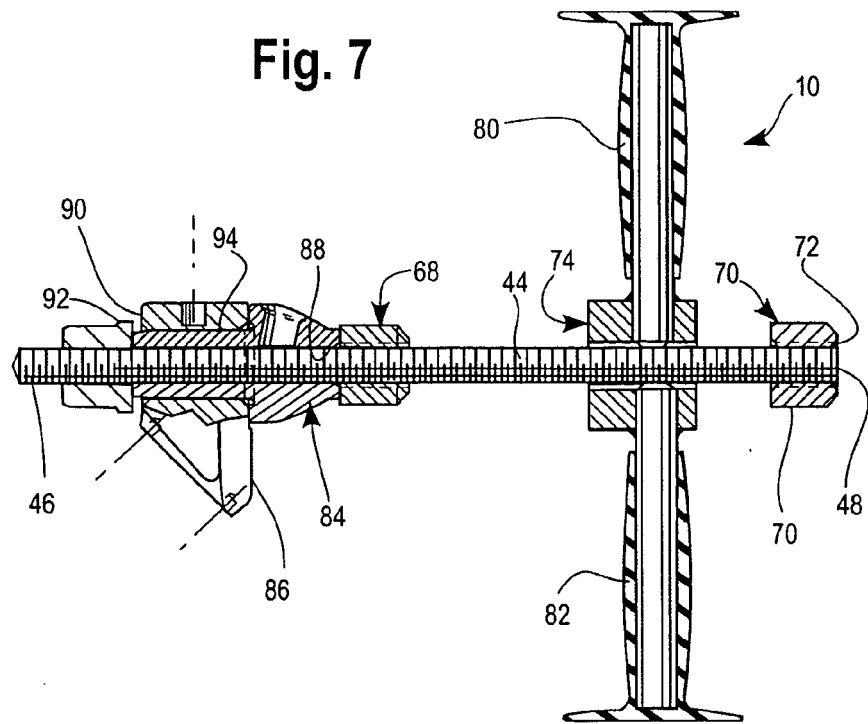
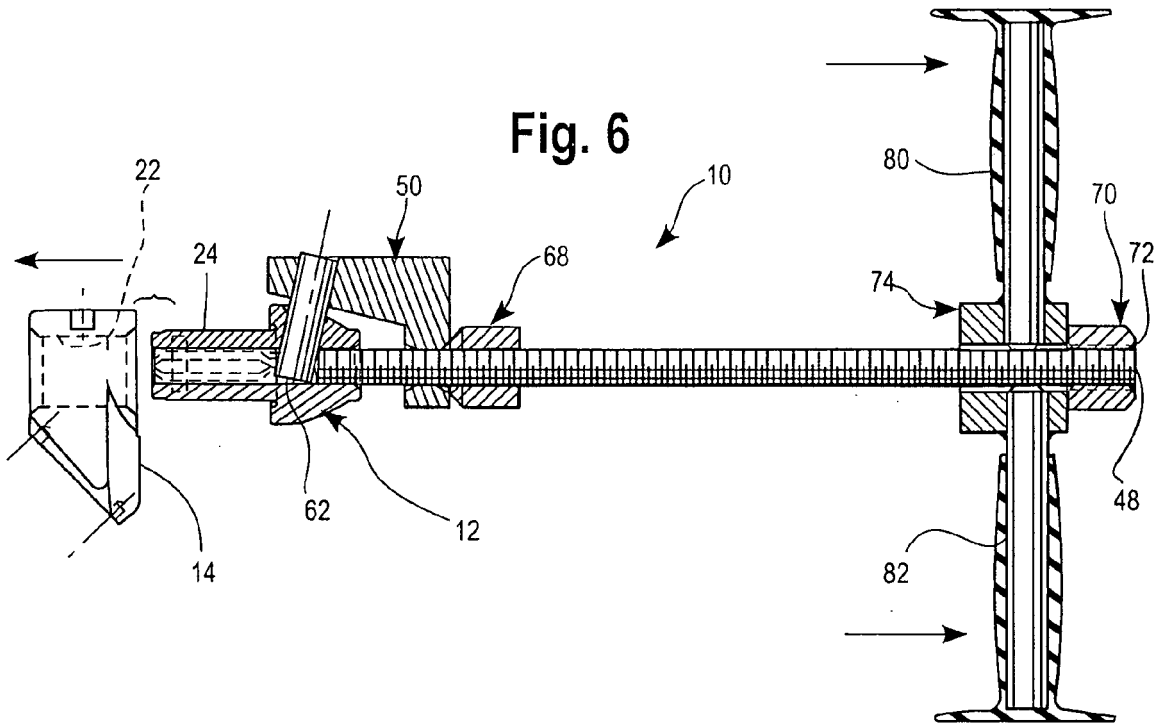


Fig. 8

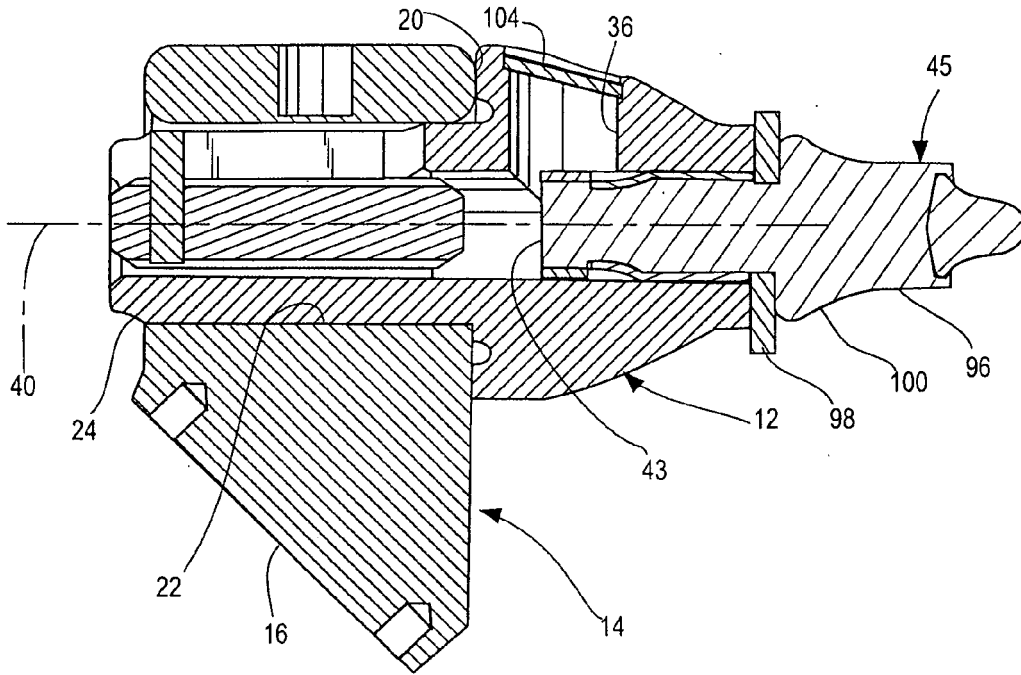


Fig. 9

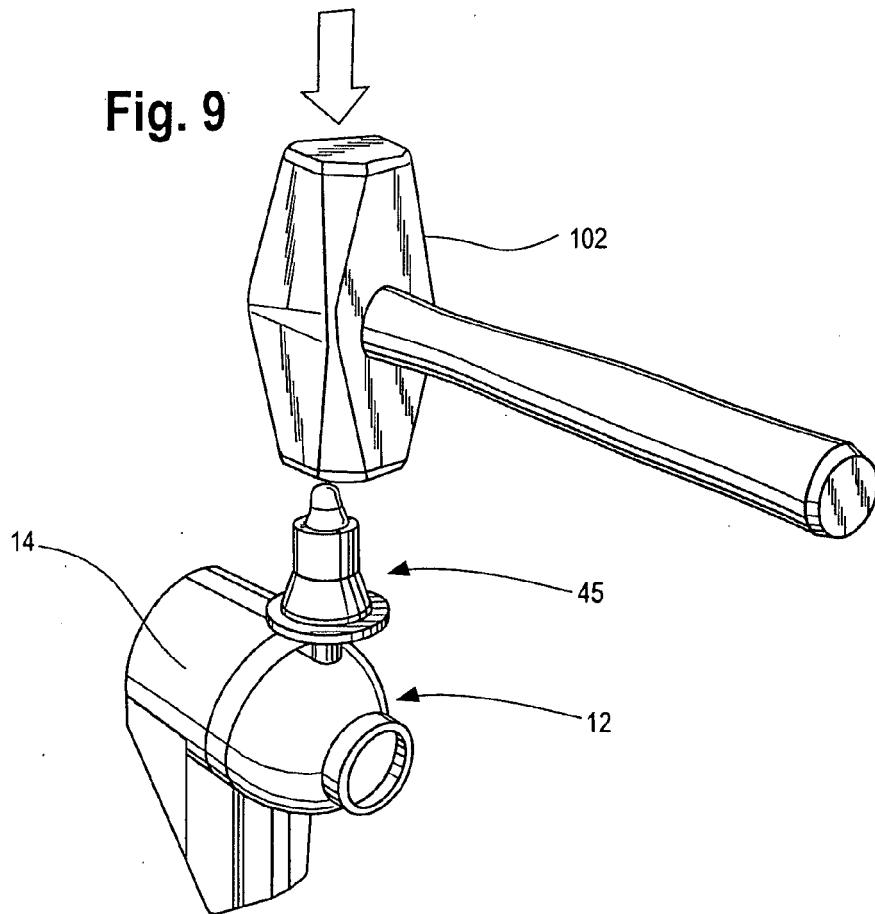


Fig. 10

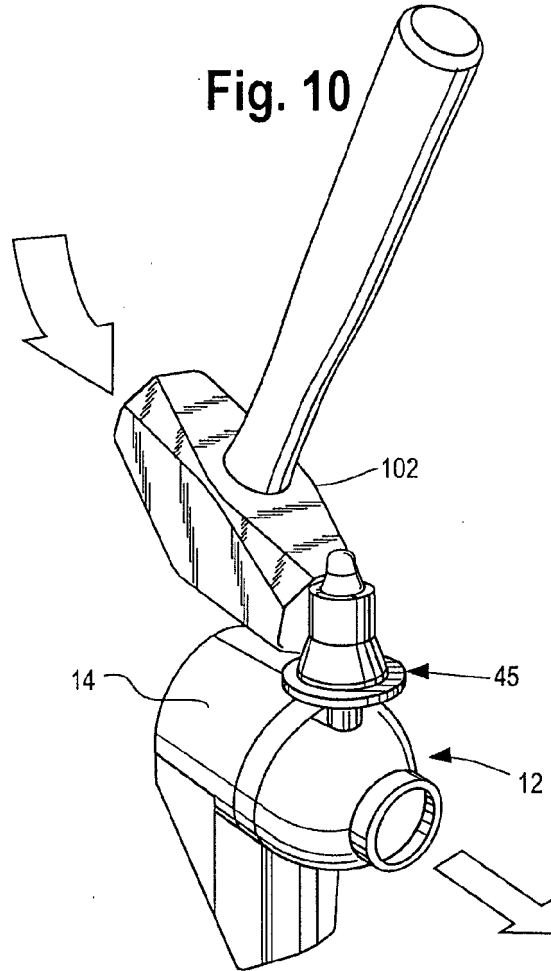


Fig. 11

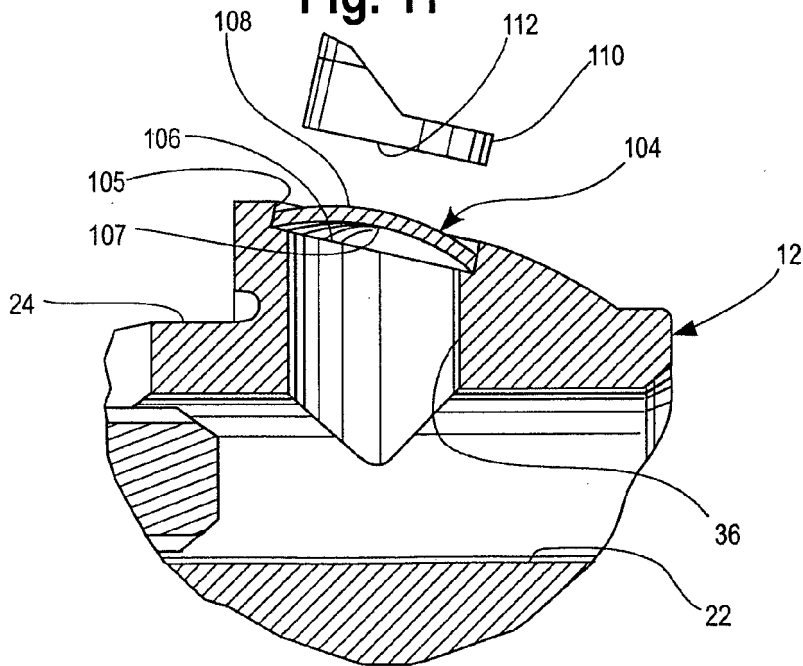


Fig. 12

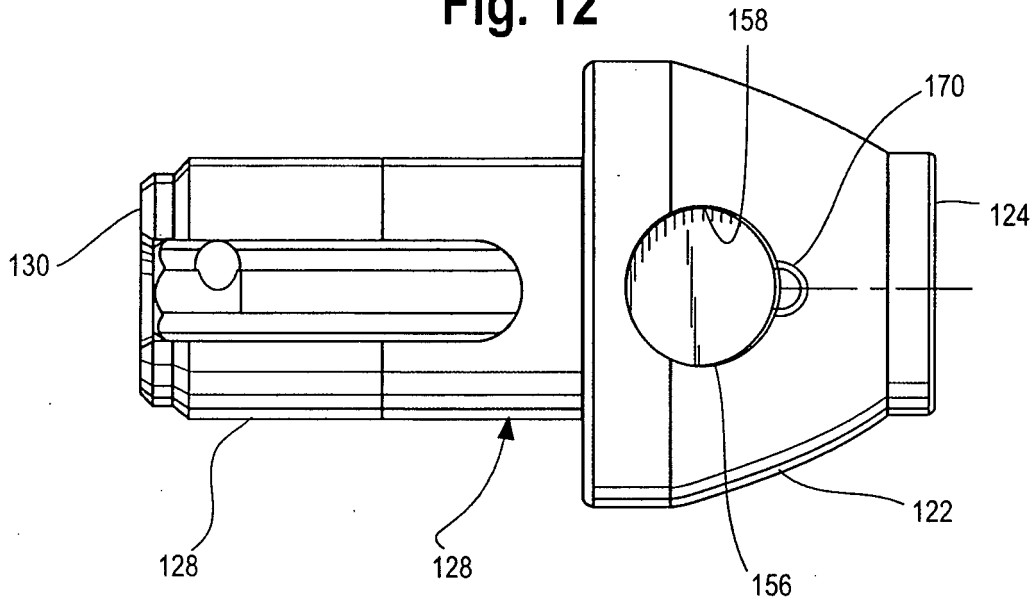


Fig. 13

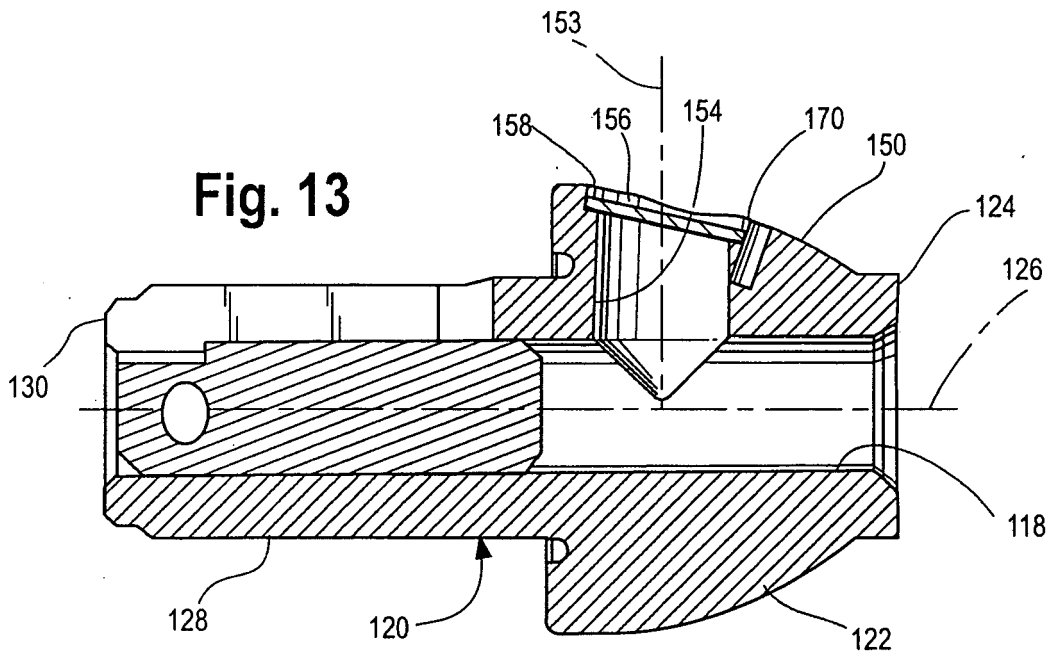


Fig. 14

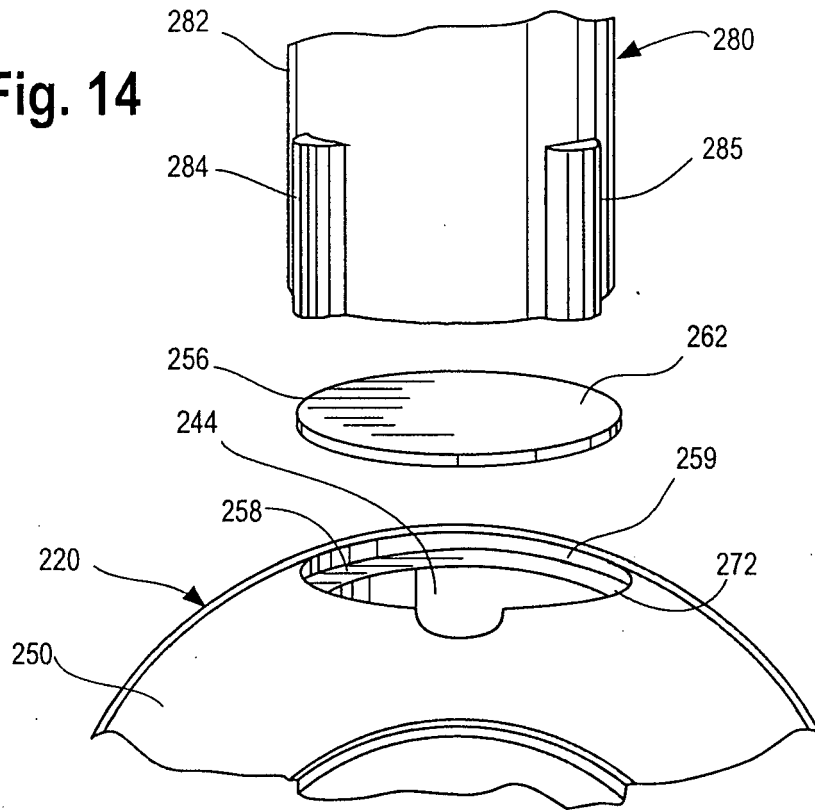
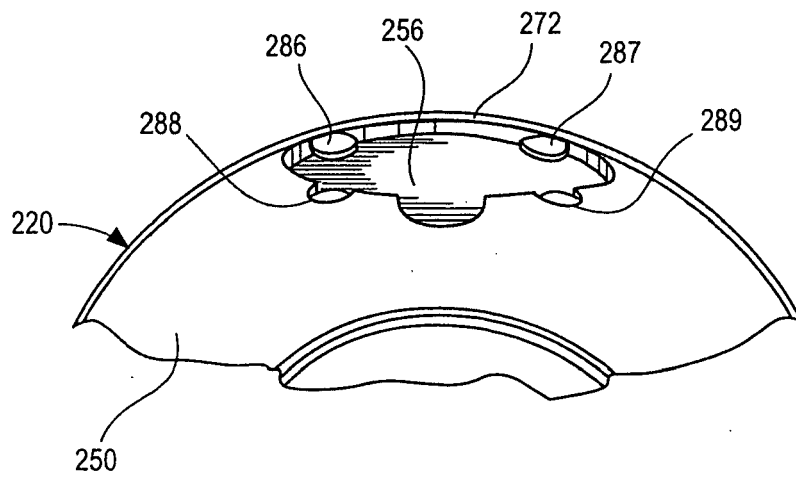


Fig. 15



**REFERENCES CITED IN THE DESCRIPTION**

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