Sept. 27, 1938. R. A. AMES ET AL 2,131,468

TAPER BORING MACHINE

Filed Aug. 12, 1935 3 Sheets-Sheet 1

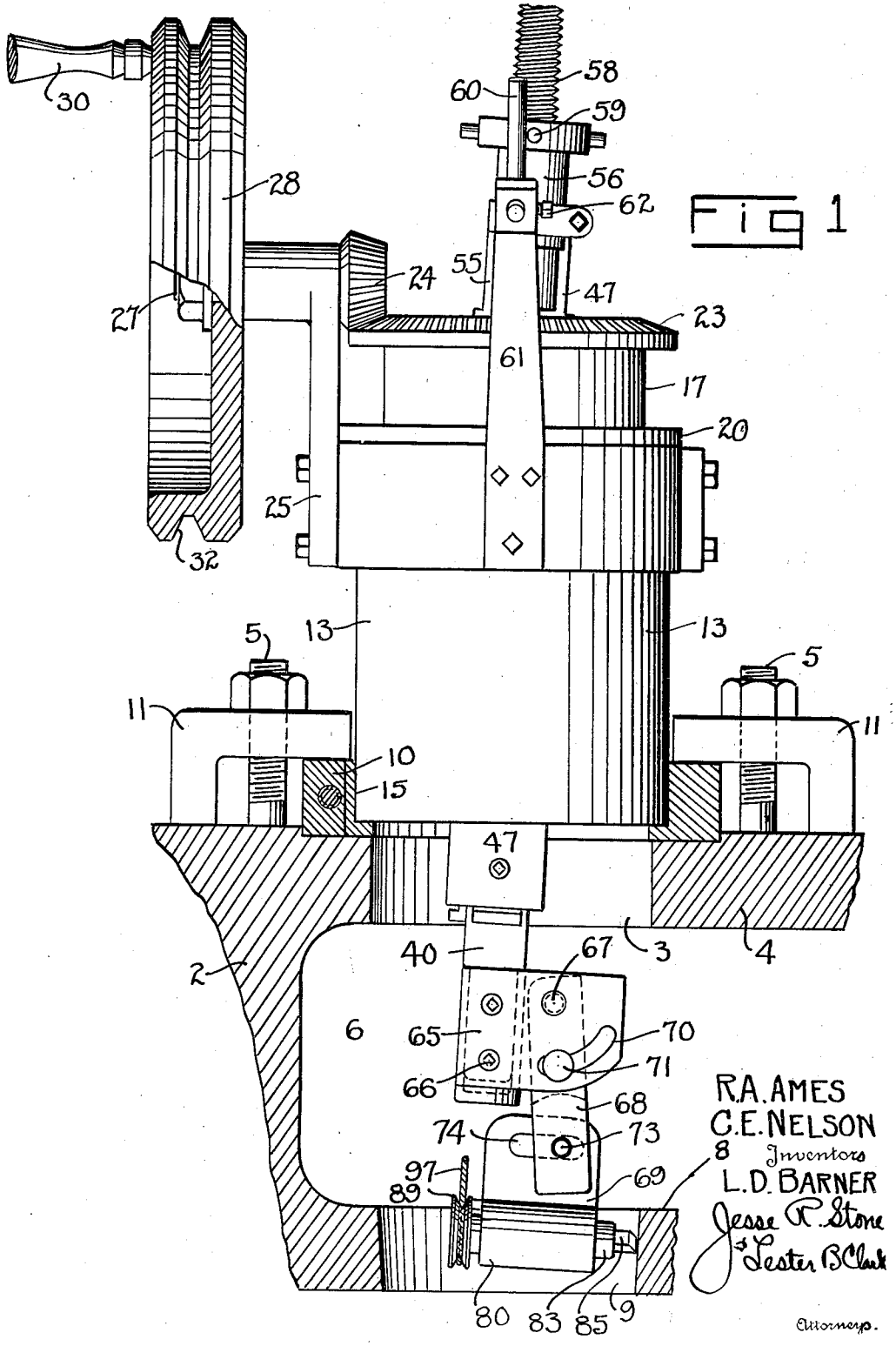


Fig 1

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TAPER BORING MACHINE

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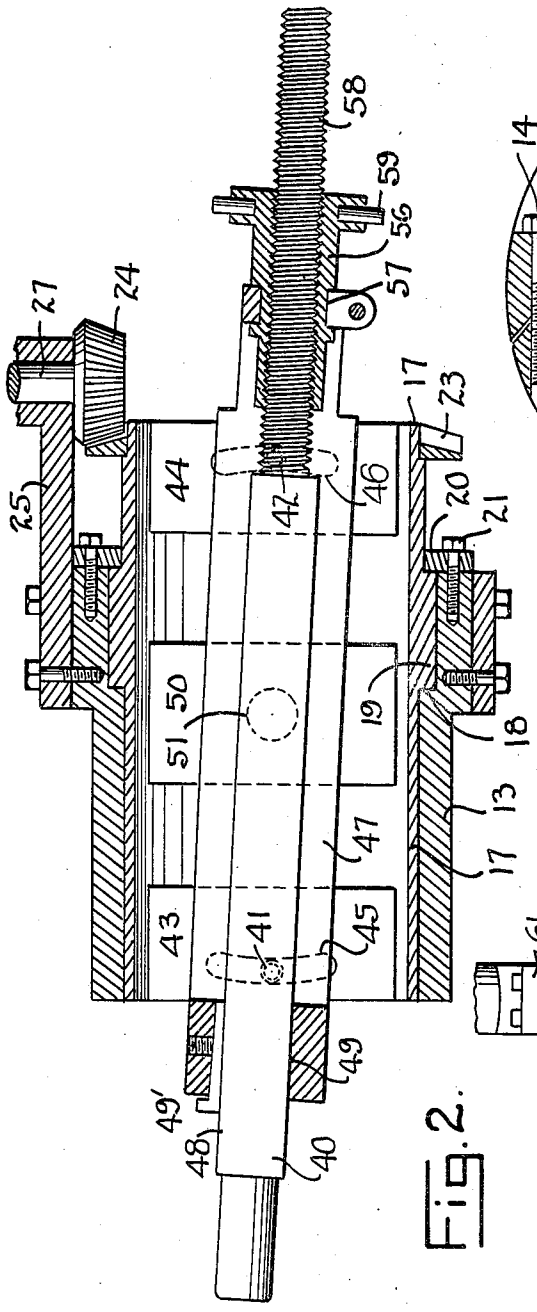


Fig. 2.

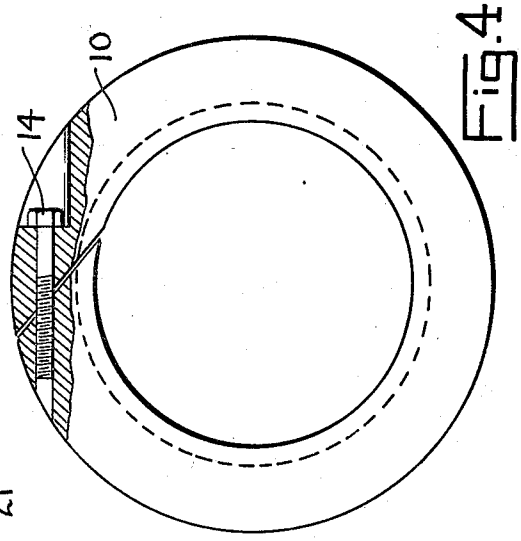


Fig. 4.

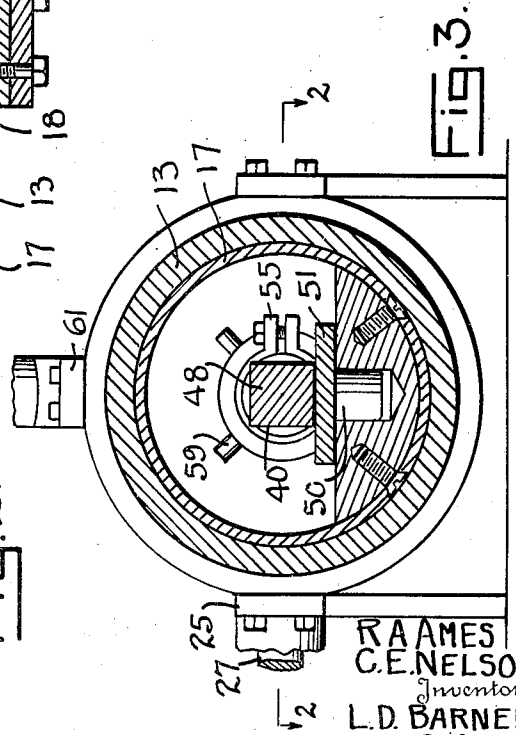


Fig. 3.

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TAPER BORING MACHINE

Filed Aug. 12, 1935 3 Sheets-Sheet 3

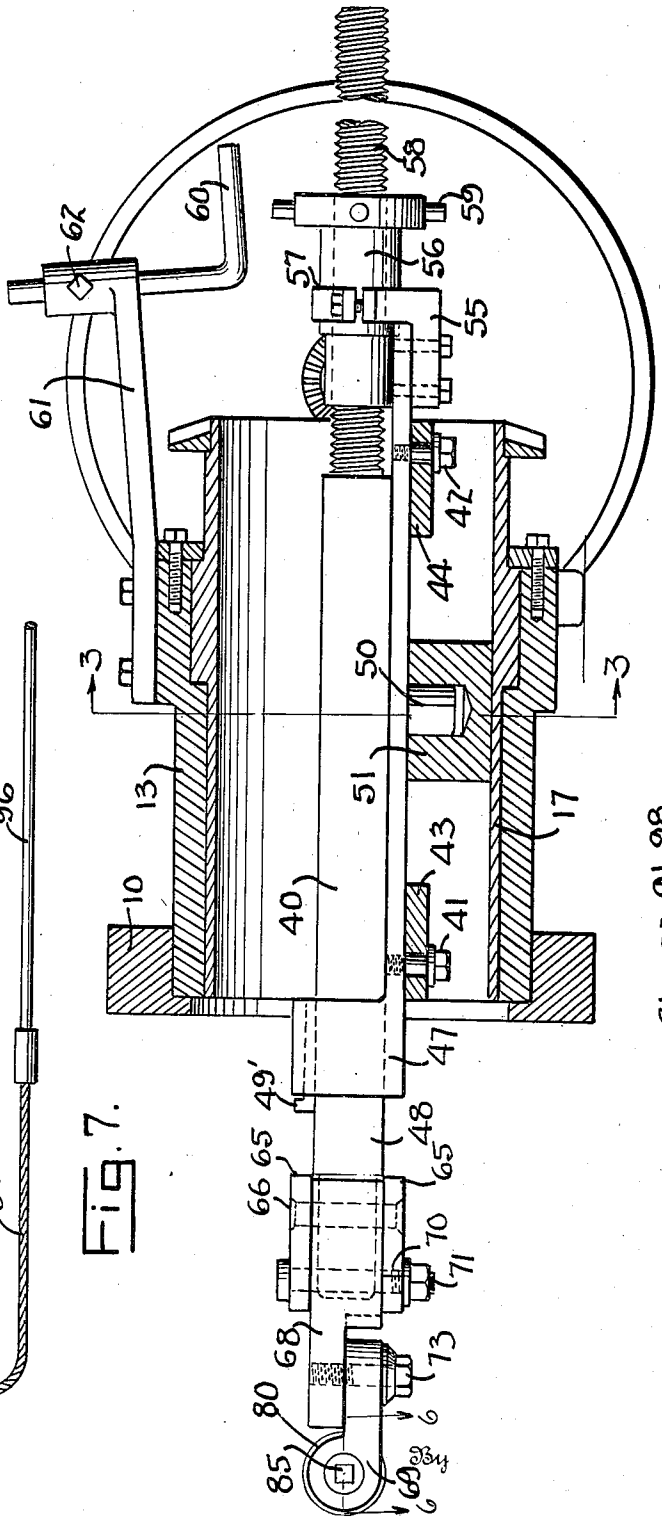


Fig. 5.

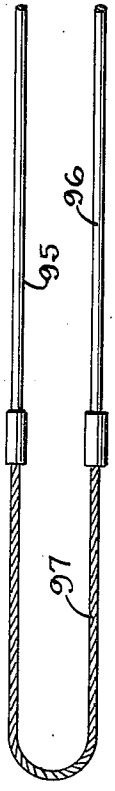


Fig. 7.

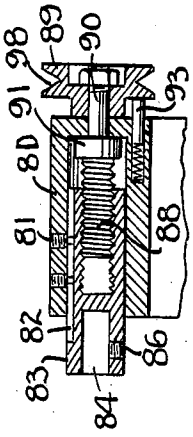


Fig. 6.

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UNITED STATES PATENT OFFICE

2,131,468

TAPER BORING MACHINE

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Application August 12, 1935, Serial No. 35,778

5 Claims. (Cl. 77—2)

The invention relates to an improvement in a portable machine for boring or threading tapered holes, or seats, in machines or structures that cannot be moved to or handled in the usual course of machine shop practice.

The invention is of particular advantage in connection with the boring of valve seats in slush pumps used in maintaining the circulation of mud in the rotary method of drilling wells.

With pumps of the above mentioned type, an opening is provided in the pump body which is tapered in order to receive a seating ring. This ring is usually driven into position in the tapered opening and in turn receives a reciprocating valve which operates by virtue of the force of the pumped liquid and seating due to the back pressure of the same liquid.

In the drilling of wells the liquid used is a slush composed of clay, sand, water, and the cuttings from the drill bits, and is of a very abrasive nature. Pressures as high as 1500 pounds per square inch are maintained with these pumps and it is needless to say, therefore, that there is considerable cutting action on the metal valves and seats and for this reason it is not uncommon for a leak to occur between the valve seat ring and the pump body. When a small leak develops the abrasive nature of the liquid cuts grooves or channels in the metal body of the pump. When this occurs replacing of the valve ring seat is of no avail because a proper seat cannot be made on the pump body. The practice at present is to discard the pump body which, of course, entails an enormous expense.

The present invention has been devised in order that the pump body may be built up by adding welding material and the seat properly bored at a desired taper in order that a new valve seat ring may be positioned in the pump. Pumps of this type weigh from 10,000 to 20,000 pounds and are usually located in remote areas where the wells are being drilled so that a portable boring machine of this type is of particular advantage in that it can be transported quickly to the pump and the seat bored to receive new valve rings in very short periods of time.

It is one of the objects of the invention to provide a boring machine which is adapted for attachment to a pump body in order to bore a tapered valve seat therein.

Another object of the invention is to provide a tapered boring machine wherein a stem is inclined at an angle with respect to the axis of rotation at the inclination at which the taper is to be bored.

Another object of the invention is to provide in a boring machine a stem inclined at the taper which is to be bored in combination with an adjustable head to vary the size of the hole and the depth of the cutting to be executed.

Another object of the invention is to provide an arrangement for advancing the cutter head both longitudinally and radially in order to execute a tapered bore.

Another object of the invention is to provide an arrangement whereby the advancement of the cutter may be adjusted.

Other and further objects of the invention will be readily apparent when the following description is considered in connection with the accompanying drawings wherein:

Fig. 1 is a side elevation of the boring tool shown as attached to a pump body with the parts in cutting position.

Fig. 2 is a vertical, sectional view taken through the boring tool on the plane parallel with the parts as seen in Fig. 1.

Fig. 3 is a transverse sectional view taken on the line 3—3 of Fig. 5.

Fig. 4 is a plan view of the adapter ring whereby the body of the tool is clamped in aligned position over the opening to be bored.

Fig. 5 is a vertical, sectional view taken at right angles to the section shown at Fig. 2 and illustrating the mechanism for adjusting the advancement of the cutter head.

Fig. 6 is a section taken on the line 6—6 of Fig. 5.

Fig. 7 is a view of a tool to be used in adjusting the depth of cut to be taken while the boring machine is attached to the pump structure.

What is known as the mud end of the slush pump is shown at 2 in broken, sectional form in Fig. 1. In pumps of this type the opening 3 is provided in the outer jacket 4 of the pump and is normally covered with a cap which is held in position by nuts positioned on the bolts 5. This opening 3 is provided in order that access may be had to the valve member which is positioned in the bottom of the discharge manifold 6 of the pump and is deposited upon a partition 8 of the pump body.

This partition 8 has an opening 9 therein which is the tapered seat which is to be bored by this machine and it is this seat which is subject to cutting when a leak occurs between the valve seat ring not shown and the seat 9 in the pump body. The valve seat ring is an annular ring tapered on its outside to fit the taper of the opening 9 and is usually driven into position

by a suitable tool inserted through the opening 3. When a leak occurs between the valve seat ring and the pump body seat the surface of the opening 9 becomes irregular and the pump is no longer serviceable unless this opening 9 can be restored to a proper seat to receive the valve seat ring.

As stated above, the present practice is either to discard the entire mud end of the pump or to attempt to rebuild the seat by welding and to grind it out to the proper depth by the use of a portable hand grinder. This procedure has proven entirely unsatisfactory in practice and a majority of the users of pumps of this type merely discard the mud end of the pump and purchase a new piece of equipment.

The present boring machine is arranged for attachment to the pump and takes advantage of the fact that the bolts 5 are present. An adapter ring 10 is positioned on the jacket 4 and is clamped in position by the arms 11 which pass over the bolts 5 and are arranged to engage the adapter ring 10 and clamp it in proper alignment with the openings 3 and 9. This ring 10 is adjustable in order to clamp the machine body 13 therein. The set screw 14 as seen in Fig. 4 accomplishes this adjustment by contracting the inside circumference of the ring.

The machine body 13 is of a cylindrical nature and fits into the opening 15 of the ring 10 so that when the bolt 14 is adjusted the machine body will be securely clamped in position in proper alignment over the holes 3 and 9.

The machine body 13 is seen in elevation in Fig. 1 and in section in Fig. 2. This body carries a rotatable sleeve 17 which is held against axial movement because of the enlarged band 19 thereon, one end of which is arranged to engage the shoulder 18 on the body 13, and the other end of which is arranged to engage a stop ring 20 which is held on the body 13 by the bolts 21. This sleeve 17 carries a ring gear 23 on its upper end which is arranged to mesh with a pinion gear 24 carried by the bracket 25 on the body 13. The pinion 24 is mounted on a shaft 27 which is rotated by the wheel 28 which is fixed thereon. This wheel is provided with a handle 30 so that the device can be manually rotated if desired, but is also provided with a groove 32 to receive a V-belt so that the device may be power operated if desired.

It seems obvious that as the wheel 28 is rotated the sleeve 17 will be rotated on an axis which is concentric with the body 13 and the sleeve 17.

The sleeve 17 carries the stem 40 which is adjustable to different angles with respect to the axis of the sleeve 17 in accordance with the taper which is to be bored.

The inclination of the stem 40 is accomplished by adjusting the set screws 41 and 42 with respect to the transverse plates 43 and 44 respectively, as seen in Figs. 2 and 5. These plates 43 and 44 are fixed transversely on the inside of the sleeve 17 adjacent the upper and lower ends thereof and the set screws 41 and 42 pass through arcuate slots 45 and 46 in the plates 43 and 44 respectively. The stem is supported in a frame 47 in a slidable but nonrotatable position by virtue of the fact that the portion 48 of the spindle is squared and is arranged to pass through a similar squared portion 49 in the lower end of the frame 47. A key 49' prevents any play of the stem in the opening 49.

This frame carries a stud 50 which is arranged for turning movement in the bearing 51 which is also fixed in the sleeve 17. This stud 50 keeps the frame 47 in proper alignment in the center of the sleeve so that any opening being bored will be properly centered with respect to the boring tool. The plates 43 and 44 can be suitably graduated so that when the taper to be bored is known it can be easily set by adjustment of the stem. The upper end of the frame 47 has attached thereto an arm 55 which receives a threaded bushing 56. This bushing is clamped in position in the arm 55 so that it is rotatable but not longitudinally movable by virtue of the fact that the arm engages the bushing in the groove 57. The bushing 56 receives the threaded end 58 of the stem 40 so that rotation of the bushing 56 causes longitudinal movement of the stem with respect to the boring machine. This bushing 56 is of special construction and has a plurality of radially projecting pins 59 thereon. Any desired number of these pins may be provided and they are arranged to contact an upstanding finger 60 which is carried on a bracket 61 which is fixed to the housing or body 13 of the machine.

This finger 60 is adjustable radially by means of the set screw 62. As the sleeve 17 rotates the upper end 58 of the stem, of course, executes an eccentric movement which brings at least one of the pins 59 into contact with the finger 60 as seen in Fig. 1. As the stem 40 rotates past the finger 60 there will be a step by step rotation imparted to the bushing 56 and each step causes a slight advancement of the stem 40 along its axis. This advancement is used to cause the cutter to advance in the hole being bored. By radial adjustment of the finger 60 any desired amount of advancement may be obtained by the amount of contact which occurs between the pin 49 and the finger 60.

The cutter head is best seen in Figs. 1, 5, and 6 and constitutes the opposite plates 65 which are bolted to the lower end 48 of the stem 40 by means of the bolts 66. These plates extend to one side of the stem as seen in Fig. 1 and have a pivot bolt 67 passing therethrough to receive the bar 68 which in turn carries the cutter assembly 69. This bar 68 is adjustable with respect to the plates 65 by means of the arcuate slot 70 which receives the bolt 71 carried by the bar 68. It seems obvious that adjustment of the angularity of this bar 68 in the slot 70 determines the radial position of the cutter assembly 69 with respect to the stem.

In order that the cutter assembly will be perpendicular to the surface being bored, a setting bolt 73 is carried by the lower end of the bar 68 and is received in the slot 74 of the cutter assembly. This slot 74 also permits radial adjustment of the cutter assembly with respect to the stem and bore so that different sized holes may be bored and a variation in size is limited by the adjustment of the bar 68 in the slot 70 and the head 69 in the slot 74. With these two adjustments a great many different sized openings may be bored.

The cutter assembly is shown in section in Fig. 6 and comprises the body 80 which carries the guide pins 81 which work in a slot 82 of the cutter mandrel 83. This mandrel has an opening 84 therein which receives the cutter 85 as seen in Fig. 1. The cutter is held in position by a set screw passing into the opening 86. In order to obtain longitudinal adjustment of the cutter 85 to control the depth of the cut to be

made, a screw **88** is threaded into the rear end of the mandrel **83** so that rotation of the screw **88** causes longitudinal movement of the mandrel and the cutter **85**. An adjustment of this screw is obtained by having the wheel **89** fixed thereon. This wheel is connected to the reduced portion **90** of the screw which passes through an opening in the end of the body **80**. An enlarged portion **91** on the screw prevents outward movement thereof, and, of course, the wheel prevents inward movement so that the screw is fixed against longitudinal movement but is permitted to rotate. A spring pressed pin **93** engages the inner side of the wheel **89** to hold it in any set position.

In order that the cutter **85** may be adjusted to effect one cut after another to obtain the proper sized opening while the tool is in operating position as seen in Fig. 1, there has been provided an adjusting tool which is seen in Fig. 7. It seems obvious that the cutter will be down inside of the pump at a location which is relatively inaccessible and for this reason the two handles **95** and **96** of the adjusting tool are connected to the opposite ends of a flexible cord or cable **97**. This tool is lowered through the center of the machine through the sleeve **17** so that the cord **97** is passed over the wheel **89** as seen in Fig. 1. A pull on one handle or the other in this manner imparts rotation to the wheel **89** because the cable **97** passes into the groove **98** in the wheel **89**. The desired amount of rotation can be imparted to the wheel **89** and in this manner the cutter **85** is readily adjustable to take the desired depth of cut in order that the machine may operate properly or that the proper sized hole may be obtained.

When the seat is to be threaded the operator may readily insert a threading tool in lieu of the cutter **85** and when the bushing **56** is prevented from turning the tool will execute a thread on the seat of the same pitch as the thread on the stem so that it seems obvious that a threaded seat of any type may be obtained.

The invention contemplates broadly a portable machine which can be carried about and attached to pumps or other pieces of equipment where a tapered object is to be bored, turned, or threaded.

What is claimed is:

1. A boring machine for slush pump valve seats comprising, an adapter ring, means to attach said ring over the valve opening on the pump, a body portion carried by said ring, a sleeve rotatable in said body, means on the body to rotate said sleeve, a stem in said sleeve, said stem extending beyond the ends of said sleeve, means for adjustably positioning said stem at an inclination to the axis of said sleeve, means cooperating with one end of said stem to move the stem longitudinally during rotation, and a cutter head on the opposite end of said stem to be rotated and moved longitudinally thereby whereby a tapered seat may be bored.

2. A boring machine for cutting tapered seats comprising a body, a sleeve rotatable in said body, means on said body to rotate said sleeve, a frame mounted in said sleeve for simultaneous rotation, means for adjusting said frame angularly with respect to said sleeve, a stem slidably and non-rotatably mounted in said frame and projecting from the ends of said sleeve, a cutter fixed on one end of said spindle, and means for moving said stem longitudinally with respect to said frame during rotation thereof, said last named means comprising a part threaded on the projecting end of said stem and rotatably secured to said frame and a member fixed on said body arranged to engage with said part to turn the same during rotation of said spindle.

3. A boring machine for cutting tapered holes comprising a body, a rotatable sleeve therein, means for rotating said sleeve, a frame mounted in said sleeve for simultaneous rotation therewith, a stem slidably and non-rotatably mounted in said frame and extending outwardly from the ends of said body, a tool on one end of said stem and means on the opposite end of said stem for advancing the stem and tool during rotation of said sleeve.

4. In a boring machine a rotatable sleeve, means for mounting said sleeve to rotate about its axis, a stem slidably and non-rotatably mounted in said sleeve, said stem having its ends projecting from said sleeve, one of said ends being threaded, a cutter fixed on one end of said stem, means for adjustably inclining said stem to the axis of said sleeve, and means cooperating with the threaded portion of said stem for advancing said stem and tool during rotation of said sleeve.

5. A boring machine for cutting tapered seats comprising a sleeve, means for mounting said sleeve to rotate about its axis, means for rotating the sleeve, a stem adjustably mounted within said sleeve to be set at the angle of taper with respect to the axis of rotation and having its ends extending beyond the ends of the sleeve, a radial extension on one end of said stem, a part connected to said extension and angularly adjustable with respect to the extension, a cutter head supported by said part, means for adjusting said cutter head angularly and laterally with respect to said part, and means for feeding the stem axially of the sleeve.

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