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ADJUSTABLE BIT BORING BAR

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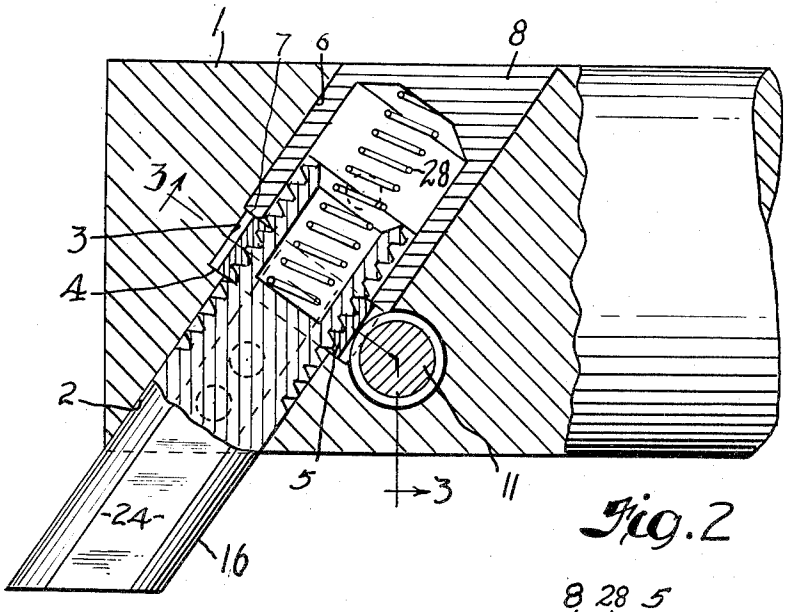


Fig. 2

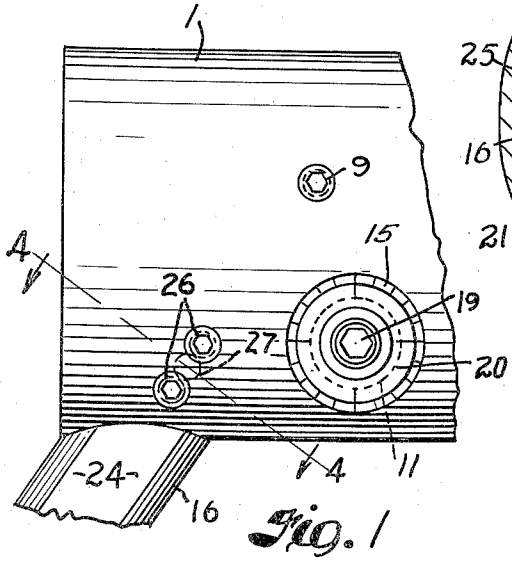


Fig. 1

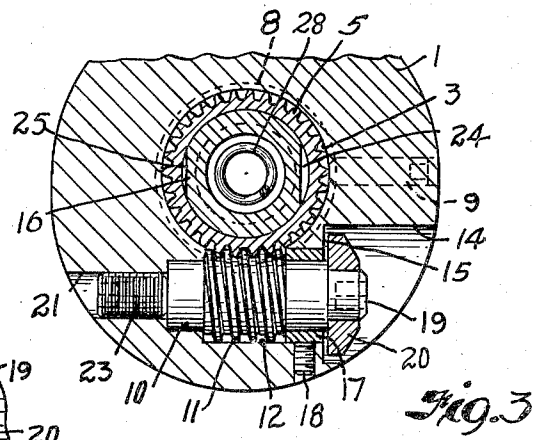


Fig. 3

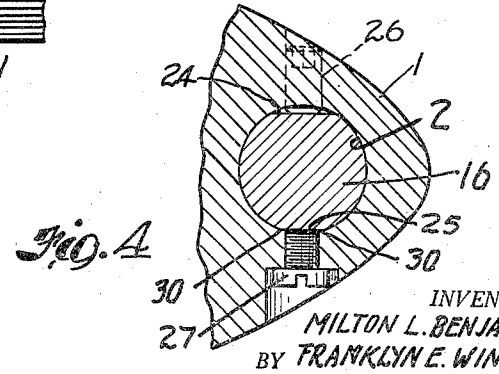


Fig. 4

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ADJUSTABLE BIT BORING BAR

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3 Claims. (Cl. 77—58)

The present invention relates generally as indicated to an adjustable bit boring bar.

Adjustable bit boring bars are, of course, currently available in a number of different styles or types, some of which have extremely limited ranges of adjustment, some of which lose accurate adjustment in locking, and some of which employ special high cost, complex bits.

For example, in one known form of adjustable bit boring bar, the bit itself is threaded and has specially formed radially projecting lugs at its inner end which fit into corresponding longitudinal keyways which are broached in the bit receiving bore of the boring bar, and in this form of boring bar the bit is locked in the adjusted position by means of a screw which draws a conical collar or dial member adjacent the outer end thereof into engagement with a conical seat formed in the boring bar; and, therefore, a loss of accurate adjustment is encountered when re-tightening such screw.

Moreover, the backlash in the threads makes it necessary to perform the axial adjustment of the bit only while it is actuated outwardly, and thus, when the bit is adjusted too far outwardly, the adjusting collar must be rotated in the opposite direction to draw the bit inwardly to a point less than the desired adjustment from which it is then cautiously advanced outwardly to the point of desired adjustment.

In another known form of adjustable bit boring bar, the latter is formed with a broached square cross-section hole in which a corresponding cross-section shape bit is inserted for longitudinal adjustment therein as by means of oblique serrations on one side thereof meshing with corresponding oblique serrations on a crosswise adjusting block, and with this form of boring bar the range of adjustment is relatively short; and, therefore, in order to make a substantial adjustment, said adjusting block must be disengaged from the bit, whereupon the bit can be shifted longitudinally in its square bore and then the adjusting block re-engaged therewith.

This latter type of boring bar has another deficiency which bears special comment, and that is that, when a square cross-section bit is fitted into a square hole, there must be a certain amount of clearance, and thus the bit may wobble and induce chatter and loss of adjustment when one flat side thereof is clamped against a flat side of the bore.

With the foregoing in mind, it is an object of our invention to provide an adjustable bit boring bar which has the following and other features as enumerated below without regard to relative importance thereof:

1. The employment of a simple form of boring bar bit which can be duplicated by the customer or user from round section bit stock without special jigs and fixtures, since it requires only the threading of one end and the formation of parallel flats extending from the other end toward such threaded end;

2. The provision of a circular cross-section bit mounting hole in the boring bar itself to eliminate necessity of special broaching or like operations for providing a non-rotary mounting for the bit;

3. Extreme fineness of adjustment with automatic take-up of backlash irrespective of whether the bit is being advanced or retracted;

4. The provision of a quick rough adjustment and easy removal and replacement of the bit and other parts of the adjusting mechanism;

5. The provision of a long range of adjustment, including rapid rough adjustment and extremely fine slow adjustment, wherein the indicia, for example, include only four radial marks around the periphery of a dial and wherein, for example, one full revolution of the dial only advances the bit .004" in a radial direction; and

6. The provision of a unique, stable, and secure locking of the bit in its accurately adjusted position.

Other objects and advantages of the present invention will become apparent as the following description proceeds.

To the accomplishment of the foregoing and related ends, the invention, then, comprises the features hereinafter fully described and particularly pointed out in the claims, the following description and the annexed drawings setting forth in detail a certain illustrative embodiment of the invention, this being indicative, however, of but one of few of the various ways in which the principle of the invention may be employed.

In said annexed drawing:

Fig. 1 is a top plan view of the end portion of an adjustable bit boring bar according to this invention;

Fig. 2 is a cross-section view diametrically through the boring bar of Fig. 1, such section having been taken in a plane which passes through the longitudinal axis of the bit and through the axis of the boring bar itself;

Fig. 3 is a fragmentary cross-section view taken substantially along the line 3—3, Fig. 2; and

Fig. 4 is a fragmentary cross-section view taken substantially along the line 4—4, Fig. 1.

Referring now in detail to the drawing, the boring bar 1 herein shown is of circular cross-section and will be provided at its rear end with a shank or equivalent mounting means which forms no part of this invention and which, therefore, has not been illustrated herein. The front end of said bar 1 includes the bit mounting and adjusting mechanism which will now be described in detail.

The boring bar 1 is formed with a bore 2 which is angularly or obliquely related to the longitudinal axis of said bar, said bore 2 being counterbored as at 3 to form a stop shoulder 4 and guide for a worm wheel 5 which is internally threaded. A second counterbore 6 provides a stop shoulder 7 for a plug 8, and said plug in turn has its end surface juxtaposed to the opposite side of the worm wheel 5 so that the latter is restrained between the shoulder 4 and the end surface of said plug 8 against axial movement. The plug 8 is held in place as by means of the set screw 9 which is threaded into the boring bar 1 and has its point or other end formation engaged in a recess in the side of said plug.

Disposed perpendicularly to the aforesaid bore 2 and counterbores 3 and 6 and radially offset from counterbore 3 is a bore 10 which forms a bearing for one end of a worm 11, a counterbore 12 for receiving said worm proper and providing a stop shoulder therefor, and a further counterbore 14, the bottom plane face 15 of which has suitable indicia therearound which, in this particular instance, from one radial mark to the next denotes .0002" radial movement of the bit 16 which is described in detail later. Inserted into the counterbore 12 is a bearing sleeve 17 held in place by the set screw 18 and providing a shoulder juxtaposed to the end of the worm 17 so that said worm is rotatable in opposite directions but is restrained from axial movement by the stop shoulder

between bore **10** and counterbore **12** and by the inner end face of the bearing sleeve **17**.

As best shown in Fig. 3, the worm **11** is in engagement with the worm wheel **5** so that the latter is rotated upon rotation of the worm. The outer end of the worm **11** which extends into the counterbore **14** is provided with a hollow hex or like wrench-engaging portion **19**. Press-fitted or otherwise secured on this end of the worm **11** is a dial **20** provided with four equally spaced radial marks which cooperate with the indicia around the bottom of said counterbore. In this particular case, one full revolution of the worm **11** will rotate the worm wheel **5** only a part turn, and the threads in the latter will cause a .004" radial movement of said bit **16**.

To facilitate disassembly of the worm **11** from the boring bar **1**, there is provided a threaded hole **21** in which a screw **23** is adapted to be threaded to abut the inner end of the worm, and thus force the worm **11** out of the boring bar when the set screw **18** is loose.

Coming now to the bit **16** per se, the same is formed of circular cross-section stock and is threaded at its inner end for threaded engagement in the threads of the worm wheel **5**. The bit **16** is also formed with parallel flats **24** and **25** against one of which (flat **24**) a pair of lock screws **26** threaded in said boring bar **1** are adapted to bear perpendicularly; and against the other one of which (flat **25**) the plane, squared end of a key screw **27** is adapted to be in juxtaposed relation, preferably with about .002" clearance so as to form, in effect, a keyway to hold the bit **16** against rotation in the bore **2** of the boring bar. The head of the key screw **27** provides a stop shoulder thereon which engages the boring bar to thus predeterminedly position the end face of said key screw as aforesaid.

In the normal, small range adjustment of the bit **16**, the two lock screws **26** are first loosened, and then the worm **11** is turned a desired amount to advance or retract the bit **16** radially with respect to the axis of the boring bar **1**.

In order to automatically take up the backlash and thus permit accurate adjustment both inwardly and outwardly, there is compressed between the bit **16** and the plug **8**, a coil spring **28** which constantly maintains the forward helical face of the threads on the bit **16** in engagement with the forward helical face of the threads in the worm wheel **5** and also holds the worm against stop shoulder **4**.

Accordingly, whether the worm **11** is rotated in one direction or the other, the backlash of the threads is not a factor in the accuracy of the adjustment; and, therefore, it is not required to stop the adjustment as the bit **16** is being moved outwardly, as is the case in some known prior art devices.

In other words, as already mentioned, in some prior art devices, retraction of the bit first results in a taking up of the backlash before any actual retraction movement commences; and, therefore, the adjustment will be that much in error if the adjustment is stopped while the bit is being retracted. This backlash may also work the other way in that, if the adjustment direction compensates for the backlash, an axial tightening of the bit results in that much loss of adjustment.

With the bit construction as thus described, the adjustment is so fine that, if it were desired to advance or retract the bit **16** say ¼", it would be necessary to make 62½ revolutions of the worm **11**.

In order to avoid the necessity of having to make so many revolutions of the worm, the key screw **27** is loosened a part turn; and, with the lock screws **26** in retracted position, the bit **16** can be grasped at its outer end and rotated about its own longitudinal axis to rapidly advance or retract the bit in direct relation to the pitch of the threads which, in the case of say 13 threads to the inch, would require only three or four turns of the bit **16** for making the rough ¼" adjustment, whereupon the flat **25** is aligned with the key screw **27**, and when the latter has been tightened, the fine, accurate adjustment is made by rotating the worm **11** only a few turns or only a part turn if the rough adjustment is fairly close to the final desired adjustment.

A notable feature of this invention is that the flat **25**, which is herein on the bottom surface diametrically opposite the flat **24** on which the lock screws **26** bear, engages the boring bar bore **2** along two parallel lines **30, 30** which makes possible the stable supporting of the bit **16**, even though the bore **2** may be slightly larger than the bit diameter as it would have to be in order for the bit **16** to be a slide fit in such bore **2**. If it were attempted to clamp a cylindrical surface of the bit **16** against the bore **2**, there would only be a single line contact opposite the lock screw or screws **26**, whereby, due to the clearance between the bit **16** and the bore **2**, the former will wobble and result in chatter and otherwise unsatisfactory operation.

In the present case, when the edges **30, 30** of the bottom flat **25** engage the bore **2**, there is an automatic alignment of the bit **16** with the bore axis by reason of the parallel line engagements between the bit and the bore through the pressure applied by the lock screws **26** bearing on the top flat **24**. It has been discovered that a pair of lock screws **26** of relatively small size are preferred to a single larger size lock screw so as to provide spaced apart points of frictional contact which also contribute to the rigidification of the mounting of the bit **16** in its adjusted position.

In cross-section, we have provided a three-point contact which has great stability and which permits the use of bits **16** which are not of exactly the same diameter as the bore **2**. In other words, the fit between the bit **16** and the bore **2** may be somewhat looser than the ordinary tight slip fit.

The reason for maintaining a slight clearance between the end face of the key screw **27** and the bottom flat **25** is to assure that the action of the bit **16** will be smooth and uniform axially thereof while yet the bit **16** is kept from rotating except the negligible amount as would be permitted by the .002" clearance between the flat **25** and the end of the lock screw **27**.

As is now evident, the customers or users of our adjustable bit boring bar may, in case of emergency, make their own bits without having to keep a stock of specially formed bits which require complicated jigs or fixtures for their proper duplication. Thus, all that such customers or users would have to do is to take from their stock standard diameter pieces of bit stock, form threads on one end thereof, and counterbore the same end to receive the spring therein, and grind parallel flats. The top flat **24** is, of course, not at all critical in its location and may be radially spaced from the axis of the bit varied amounts. The bottom flat **25** should desirably be accurately located, but even some variation may be tolerated here, and the only thing lost is the automatic .002" clearance between the end of the key screw and the bottom flat.

Similarly, other patrs of the boring bar herein may be readily duplicated in case of emergency.

In summary, it can be seen that the adjustable bit boring bar herein admirably fullfills the above-recited objects and features of the invention.

Although we show a bit **16** which is essentially cylindrical except for the relief or flat **25** which provides for axially slidable keying of the bit in bore **2**, it is to be understood that the bit **16** may be made from square, hexagonal, or other comparable cross-section stock dimensioned so as to have a close sliding fit in bore **2**; to provide parallel line contacts **30, 30**; and to provide a threaded rear end engaged with the threads in worm wheel **5** or equivalent nut means which, when rotated with respect to said bit **16**, effects fine adjustment of the latter. In the case of square or hexagonal bits, the key screw **27** would extend inwardly to nearly abut one of

the plane faces of the bit and the lock screws 26 would bear on an opposite face of the bit.

Essentially, the worm wheel 5 is a nut which, except for the distinct advantage of the worm drive, could be rotated by equivalent means. However, the worm drive is ideally suited for the extremely fine adjustment feature of this invention, since it is small and compact even when the desired ratio is 30:1, or more.

Other modes of applying the principle of the invention may be employed, change being made as regards the details described, provided the features stated in any of the following claims, or the equivalent of such, be employed.

We therefore particularly point out and distinctly claim as our invention:

1. An adjustable bit boring bar comprising a bar formed with a circular cross-section bore, a bit axially slidable in such bore, said bit being of circular cross-section except for a longitudinally extending relief along one side which provides two relatively widely spaced apart and parallel lines of contact along such bore, bit locking means in said bar releasably bearing transversely on said bit at a point diametrically opposite such relief, means in said bar effective to longitudinally adjust said bit in such bore, and a key screw threaded into said bar with its end in juxtaposition to such relief whereby said bit is nonrotatable in such bore except upon withdrawal of said key screw.

2. An adjustable bit boring bar comprising a bar formed with a counterbored opening, a nut rotatable, but axially fixed, in said bar and having internal threads coaxial with such opening and having one end in juxtaposition to the shoulder of such opening, a bit axially slidably keyed in such opening and having threaded engagement with said nut, means for rotating said nut in opposite directions to thus axially move said bit in opposite directions in such opening, and spring means constantly bearing axially on said bit to take up backlash in the nut and bit threads and to hold said nut against such shoulder whereby accurate axial adjustment of said bit may be accomplished in either direction.

3. An adjustable bit boring bar comprising a bar formed with a bore angularly related to the longitudinal axis of said bar and providing a shoulder, a bit movable longitudinally in such bore to position its tip at different radial distances from the bar axis, an axially fixed, rotatable nut in said bar in juxtaposition to such shoulder and having threaded engagement with said bit whereby the latter is moved longitudinally in such bore upon relative rotation of said nut and said bit, key means selectively movable to permit and to prevent rotation of said bit in such bore, and nut-rotating means effective to rotate said nut, and thus longitudinally move said bit, when said key means is in the second-mentioned position and to prevent rotation of said nut when said bit is longitudinally adjusted by rotation thereof while said key means is in the first-mentioned position, and spring means bearing on said bit to take up axial looseness in the nut and bit threads and to hold said nut against such shoulder whereby accurate adjustment of said bit may be accomplished in either direction.

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