United States Patent

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[72] Inventor **Robert L. Dixon**
Whittier, Calif.

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[73] Assignee **Smith International, Inc.**
Newport Beach, Calif.

[54] **ROCK-BORING CUTTER**
8 Claims, 6 Drawing Figs.

[52] **U.S. Cl.** **175/364,** 175/372, 308/8.2
[51] **Int. Cl.** **E21c 13/12,** F16c 19/08
[50] **Field of Search** 175/334, 344, 360, 361, 363, 364, 370–372, 359, 367; 308/8.2

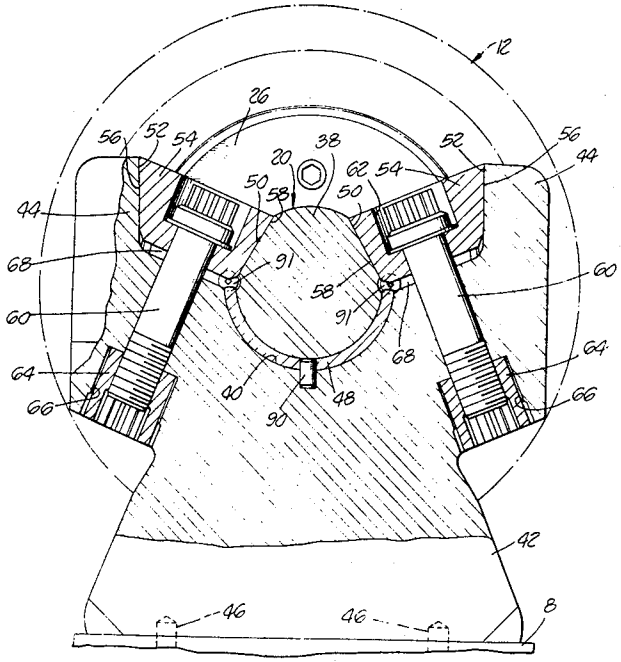
[56] **References Cited**

UNITED STATES PATENTS

2,187,037	1/1940	Kirkpatrick	175/372 X
2,190,350	2/1940	Catland	175/372 X
3,203,492	8/1965	Lichte	175/372 X
3,389,760	6/1968	Morris	308/8.2 X
3,419,093	12/1968	Lichte	308/8.2 X

Primary Examiner—David H. Brown
Attorney—Allan D. Mockabee

ABSTRACT: A cutter assembly particularly adapted for use on headplates of rock-boring tools wherein a plurality of cutters are closely positioned end-to-end, the cutters being supported by journals having restricted endwise movement in their mounts, and the mounts including journal end receiving saddles and clamping means releasably overlying the journal ends to permit removal of the journals and the cutters mounted thereon away from the headplate in a direction transversely of the journals.

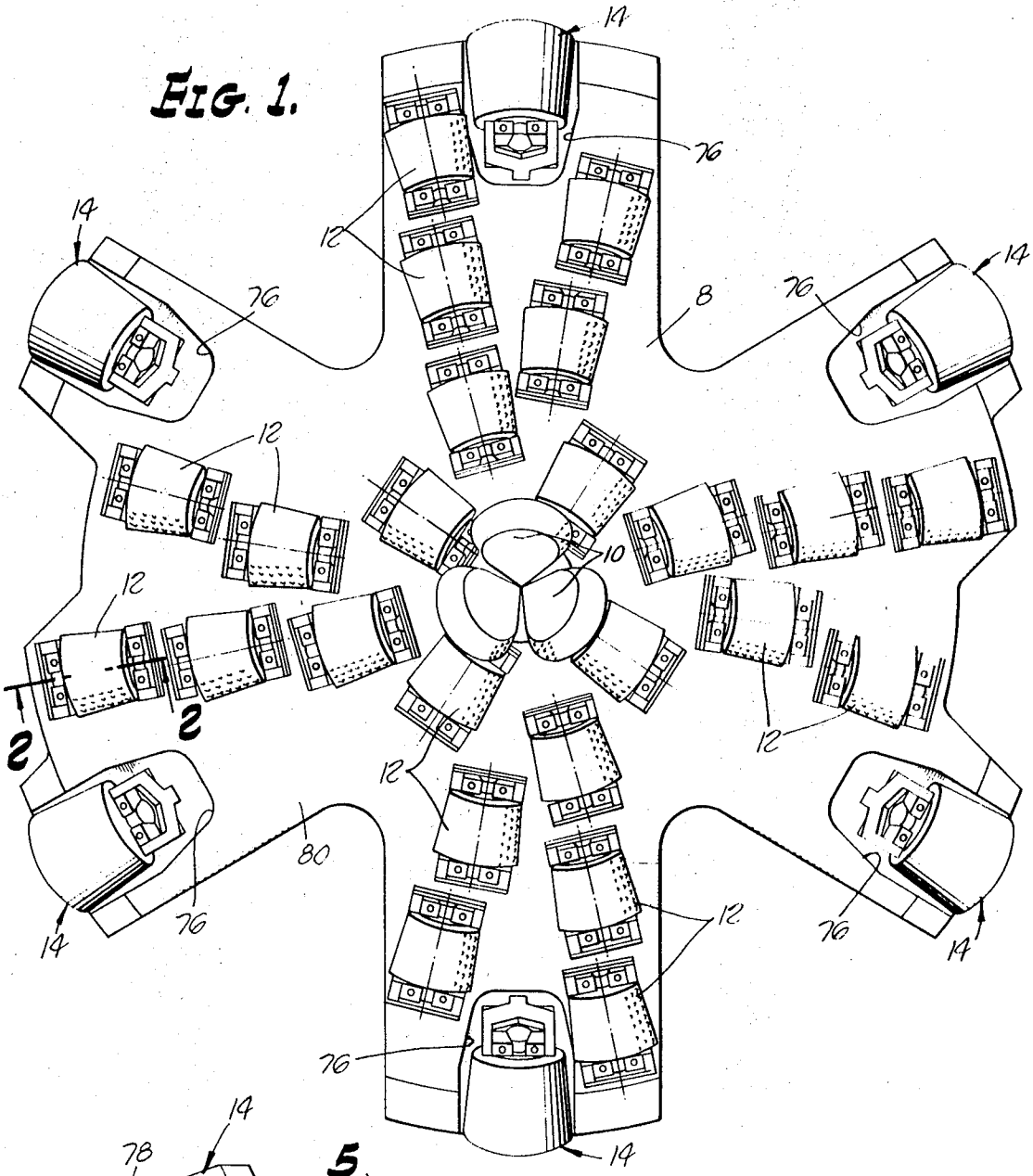


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SHEET 1 OF 3

FIG. 1.



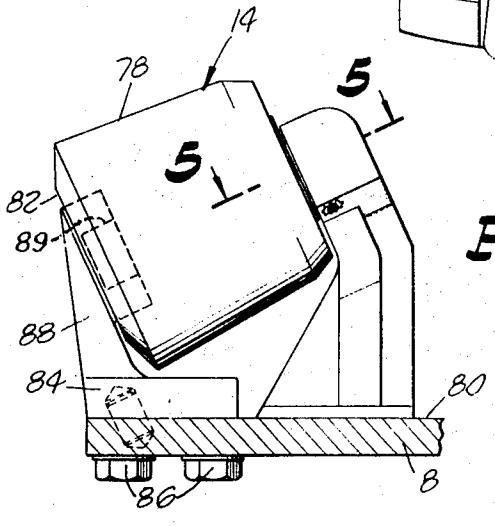


FIG. 6.

INVENTOR
ROBERT L. DIXON
BY
ATTORNEY

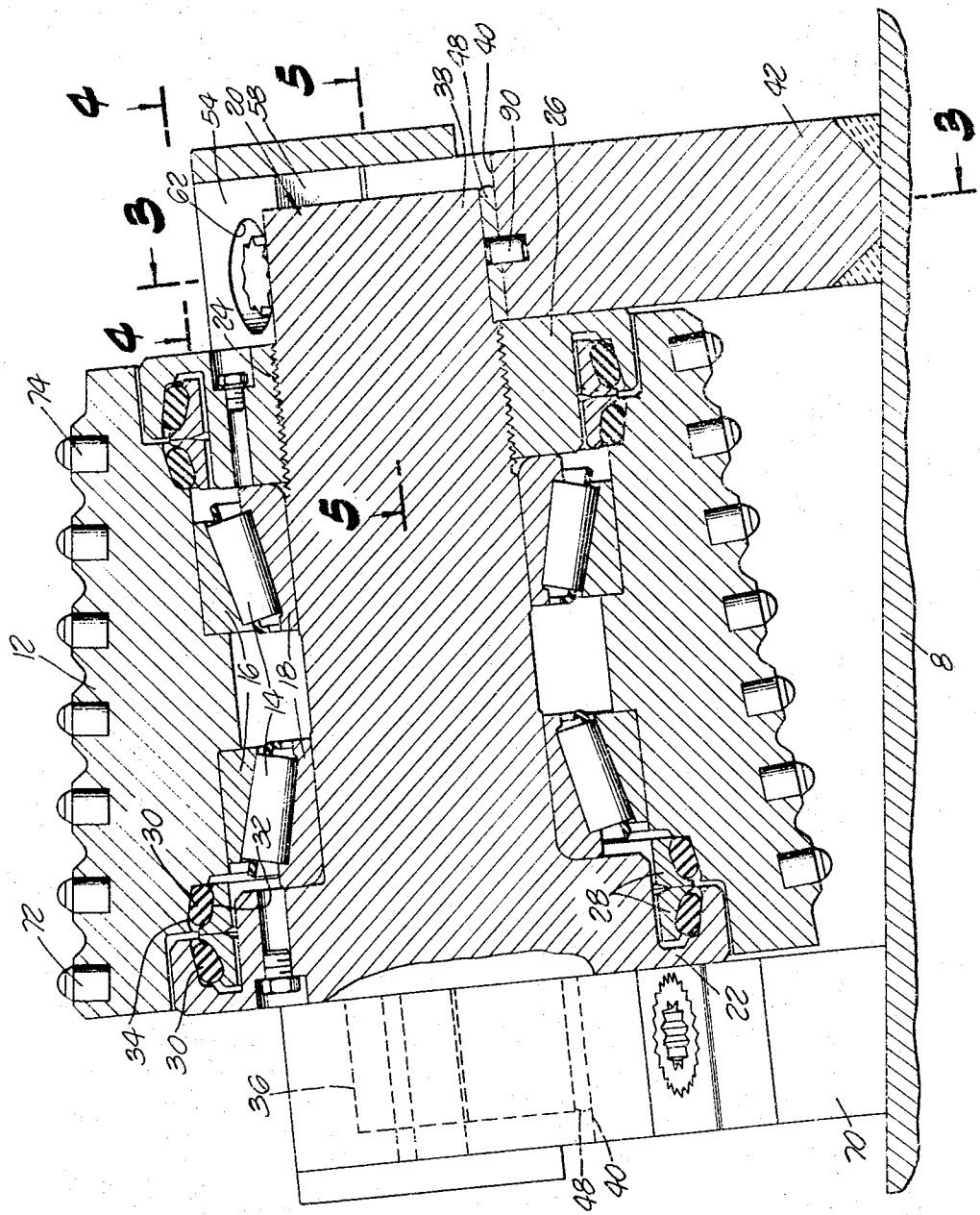


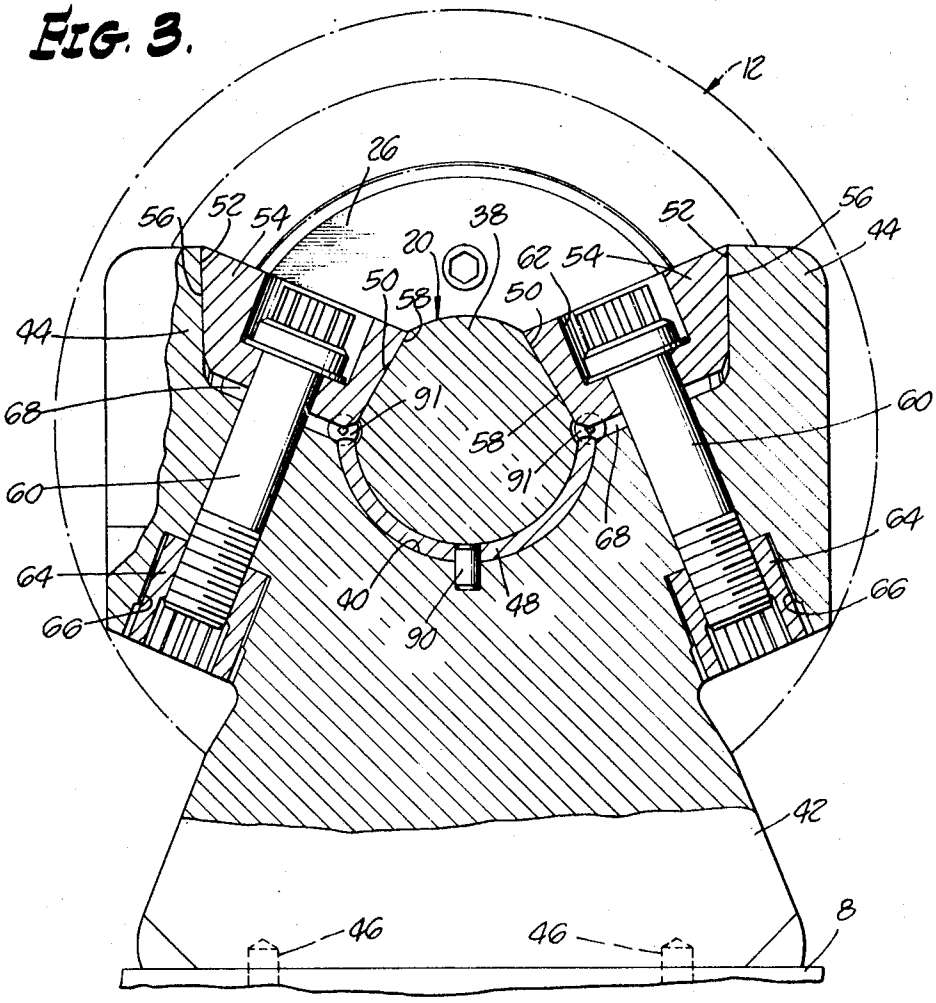
Fig. 2,

INVENTOR
ROBERT L. DIXON

BY

ATTORNEY

FIG. 3.



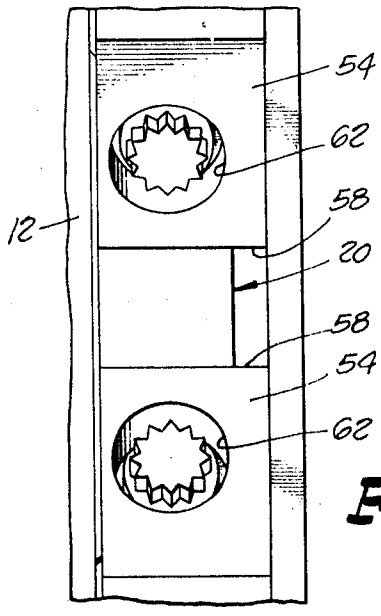
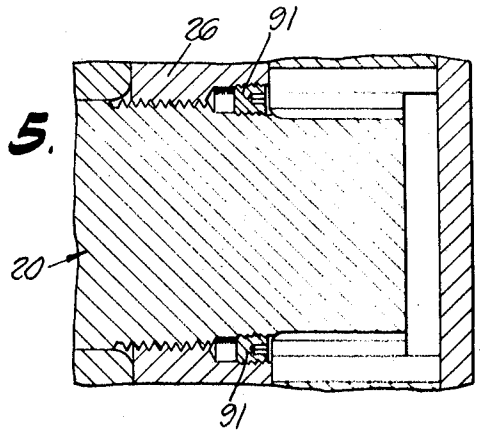


FIG. 4.

FIG. 5.



INVENTOR
ROBERT L. DIXON
BY
ATTORNEY

ROCK-BORING CUTTER

DISCLOSURE

This invention relates to a cutter assembly which is particularly adapted for use in structures such as rock-boring machinery wherein a plurality of cutter units are mounted for rotation upon journals which are closely spaced end-to-end, and wherein the close spacing and alignment prevents the journals from being removed endwise.

Another object of the invention is to provide means for clamping the cutter journal ends to the receiving saddles by which assembly clearance will be totally removed allowing variations in radial and thrust loading to be transmitted smoothly from the cutting elements through the bearings to the saddles, ultimately resulting in optimum bearing life.

Another object of the invention is the provision of a cutter assembly wherein the journal is supported by mount means which may be permanently secured to the rotary headplate of the machine by welding to provide rigid anchoring means which will not be loosened by vibration and shock, and wherein the rotary cutters are supported on journals which in turn are so supported that the journals can be removed in a direction transversely to their axes, thus permitting close end-to-end positioning of cutter units while still permitting the ready removal of the cutters from their mounts when required.

Another object of the invention is to provide removable cutter assemblies for use on boring machines wherein the peripheral or gage cutters have journals whose outboard ends lie approximately at the periphery of the rotary headplate of the machine, and wherein the journal supports for the outboard ends of said gage cutters comprise shirttail structures of relatively thin tapered shape with journal sockets having their outer ends closed, and wherein the inboard ends of the journals for said gage cutters are supported by upwardly open saddles and retained in the saddles by removable clamping means.

The above and other objects of the invention will more fully appear from the following description in connection with the accompanying drawings:

FIG. 1 is a front elevation of the rotary cutting plate of a rock-boring machine with a plurality of embodiments of my invention mounted thereon;

FIG. 2 is an enlarged sectional view taken approximately on the line 2—2 of FIG. 1;

FIG. 3 is a sectional view taken approximately on the line 3—3 of FIG. 2 with the rotary cutter indicated in broken lines;

FIG. 4 is a detail taken approximately on the line 4—4 of FIG. 2;

FIG. 5 is an enlarged sectional detail approximately on line 5—5 of FIG. 6.

FIG. 6 is a side elevational view on a scale intermediate that of FIGS. 1 and 2 of a gage cutter and its mounting means.

In FIG. 1 there is illustrated a rotary headplate 8 for a rock-boring machine, such as is used in cutting tunnels through rock formations. Conventionally the headplate 8 would be mounted in a vertical plane on the forward end of a rotary mechanism on a horizontal axis. The headplate 8 may if desired, be provided at its central portion with a plurality of rotary cone cutters 10. The remainder of the headplate in a number of locations is provided with a plurality of rotary frustoconical sleeve cutters 12 which are mounted on suitable journals to be described below. At spaced points about the periphery of the headplate 8 are frustoconical rotary cutters 14 which comprise gage cutters because they, at their peripheral locations, determine the gage of the tunnel or hole to be cut.

The cutters 12 are shown disposed on rotational axes which preferably lie on radii of the rotary headplate 8 and they are shown in groups in closely spaced end-to-end relationship, and while they can be aligned in groups, it is preferred that the rotational axes of adjacent end-to-end cutters be slightly offset, as indicated.

Because of the close end-to-end positioning and the slight offset of the adjacent cutters 12 in a group, it has previously been impossible to remove cutters from their saddles without first extracting an axially removable load pin. This invention eliminates the use of the axially removable load pin and provides load-carrying journal extensions 36 and 38 which are clamped to the saddles 40 in such manner as to allow removal of the journal and the cutter mounted thereon away form the headplate 8 in a direction transversely of the journal.

In the drawings the cutters 12 are shown rotatably supported by tapered roller bearings 13 which are mounted between outer races 16 and inner races 18. Extending through each tubular cutter 12 is a journal 20, one end of which is enlarged as at 22, and a portion near the opposite end is threaded at 24 to threadedly receive a collar 26, which in turn is locked in position by set screws 91 as viewed in FIG. 5. The enlarged end 22 lies at one side of the bearing units and the threaded collar 26 lies at the other side axially of the journal. Thus, when the collar 26 is removed, the cutter 12 can be slipped from the right end of the journal as viewed in FIG. 2.

It is customary to seal the rotary cutters 12. This may be done by metal sealing rings 28 which are held in sealing frictional engagement by resilient rings 30 working against cam surfaces 32 and 34, this type of seal being known in the art.

As will be seen in FIG. 2, the journal 20 has a left end portion 36 which is preferably of the same diameter as the right end portion 38. Referring to FIG. 3 each of said end portions lies in an upwardly open approximately semicircular saddle 40 in the upper portion of a journal mount block 42 having posts 44 lying laterally and extending above the saddle 40. The base of the block 42 is secured to the rotary headplate 8 in a permanent manner as by welding, positioning and anchoring pins 46 also being utilized.

In the saddle 40 is a pin 90 which positions a semicircular bushing 48 and said bushing supports the end 38 of the journal 20. The other end of the journal is supported in a similar post and saddle in a like manner. The journal end 38 is provided with flats 50 which are downwardly divergent and terminate above the saddles 40. The mount posts 44 are cut away vertically to provide cam surfaces 52 and said surfaces are spaced from the journal end 38 to receive mounting or clamping blocks 54. Each block 54 has a surface 56 which lies flat against the surface 52 of the mount posts 44 and an oppositely facing angularly disposed face 58 in flat sliding engagement with one of the flats 50 on the journal end 38. A bolt 60 preferably has its head countersunk in a cavity 62 in the mounting or clamping block 54 and said bolt is provided with a threaded nut 64 countersunk in a cavity 66 at the base of the mount post 44. Said nut 64 preferably is of the Allen type. When each of the bolts 60 or nuts 64 at one end of the journal is tightened to securely clamp the mounting or clamping blocks 54 against the journal end, all endwise, radial or torsional movement is restricted, there is provided an assembly relief space 68 between the bottom of the clamping block 54 and the mount post 44.

As viewed in FIG. 2, the mount block 42 is at an angle to the rotary headplate 8. The mount block 70 which supports the end 36 of journal 20 is on a similar angle but is of less length so that the frustoconical rotary cutter 12 is supported in such a way that its outer portion lies in a plane parallel to the face of the headplate 8. This gives the circular row of inserts 72 a greater surface speed than the circular row 74 and also of course those rows in between 72 and 74 in decreasing proportion from row 72. This is in accordance with established practice for most efficient cutting.

Since the majority of the rotary cutters, i.e., those designated by reference numeral 12, lie in groups which are slightly offset but generally in axial alignment, and since adjacent ends of cutters of a group are closely spaced, it is not possible, as stated previously, to remove their journals in an axial direction, and as a result, the mount blocks for said journals have previously been detachably connected to the rotary headplate 8. However, with my construction, the clamping

blocks 54 can be removed and the journals 20 lifted from the saddles 40 without interference with adjacent cutter units, and the mount blocks 42 can be permanently welded to the rotary headplate. The mount blocks 42 are not required to be replaced because of wear due to the features of their construction. For example, the bushings 48, which lie in the saddles 40, can be replaced, and should it happen that the clamping blocks 54 or their nutted bolts 60 should wear, due to vibration, etc., they can readily be replaced without disturbing the positional location or attachment of the permanent mounting blocks 42, which blocks comprise the major structural portions of the journal-supporting elements.

The gage cutters 14, one of which is shown in side elevation in FIG. 6, have slightly different mounting means at one end of the outboard end of the journal. These gage cutters are in countersunk recesses 76 in the rotary headplate 8 and are so positioned that their cutting surfaces indicated generally at 78, will cut at an angle to the face 80 of said headplate. Cutters 14 work at the edge of the hole in the formation and determine the diameter of the cut. Since they lie at the periphery of the headplate 8 and actually extend slightly outwardly thereof, as shown in FIGS. 1 and 6, the outboard end 82 of the gage cutters cannot be supported by mounting and clamping structures, such as shown in FIGS. 2 and 3. Therefore, said outboard end is provided with a base 84 detachably secured to the headplate structure 8 by suitable bolts 86. The base 84 has a shirttail 88 extending outwardly therefrom with diminishing thickness to provide a support for the gage cutter journal. The outboard end of the gage cutter journal and its support in the shirttail 88 is conventional and therefore well known in the art and not shown herein.

However, a circular journal-mounting socket 89 is indicated in the shirttail 88 in FIG. 6.

While the gage cutters are provided at one end with means detachably securing them to the rotary headplate, it will be seen that their inner ends and both ends of all the other frustoconical cutters, such as cutters 12, are supported at both ends by the structure of FIGS. 2 and 3. This structure provides strong and rigid support for the cutter journals and permits them to be removed and reinserted or replaced with a minimum of time and expense.

It should of course be understood that various changes can be made in the form, details, arrangement and proportions of the parts without departing from the spirit of the invention.

I claim:

1. A cutter assembly including a rotary headplate having a rotational axis and a cutter mounting face normal to said rotational axis, and a plurality of rotary cutters having axes of rotation on lines extending inwardly from peripheral portions of said rotary headplate, journals supporting said cutters, certain of said cutters being in groups in closely spaced end-to-end relationship restricting axial movement of said journals, wherein the improvement comprises: said cutters comprising sleevelike members, said journals extending through and beyond the ends of and rotationally supporting said sleevelike cutter members, journal-mounting means comprising mounting posts secured to said cutter-mounting face and having upwardly open saddles, said journal ends being supported in said saddles, and clamping means removably secured to said mount posts and releasably securing said journals in said saddles, whereby said journals can be removed from said mount means in a direction normal to their longitudinal axes and without interference from adjacent cutter assemblies.

2. The structure in claim 1, and said mount posts being permanently secured to said cutter-mounting face by welding.

3. The structure in claim 1, and said journals having noncircular end portions positioned above said saddles, and said clamping means engaging said noncircular end portions.

4. The structure in claim 1, and each journal having on at least one end portion noncircular portions located above its saddle, and said clamping means engaging said noncircular portions at opposite sides of the longitudinal axis of the journal and above said saddle with a wedging clamping action.

5. The structure in claim 1, and said clamping means comprising means engaging said journals at opposite sides of the longitudinal axes of the journals above said saddles and exerting diagonally downward and inward pressure at each side of the journal end.

6. The structure in claim 1, and said journal mount posts having cam surfaces at opposite sides of said journal ends in spaced relation thereto above said saddles, mount blocks having wedge surfaces engaging said cam surfaces, and means for drawing the mount blocks inwardly along said cam surfaces and into wedging engagement with said journal ends.

7. The structure in claim 1, and said journal mount posts having cam surfaces at opposite sides of said saddles, said journal ends in said saddles having downwardly divergent surfaces, mount blocks engageable with said cam surfaces and said divergent surfaces, and means connected between said mount posts and mount blocks for drawing the mount blocks securely against and between said cam surfaces and said divergent surfaces to clamp said journal ends in saddles.

8. The structure in claim 1, and gage cutters located about the peripheral portion of said rotary head, said gage cutters having journals one end of each of which has an outboard end located approximately at the periphery of said rotary head, the journal mount for said outboard end comprising a base detachably secured to said rotary headplate and having a portion extending outwardly from said cutter mounting face with diminishing thickness in the form of a shirttail, a journal mount in said shirttail comprising a circular socket, the journal mount for the other end of said journal comprising a semicircular saddle, and clamping means for releasably securing said journal in said semicircular saddle.