United States Patent [19]

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[11] **3,749,188**

[45] **July 31, 1973**

[54] **DRILL BIT**

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[73] Assignee: **G. W. Murphy Industries, Inc.**, Houston, Tex.

[22] Filed: **Aug. 20, 1971**

[21] Appl. No.: **173,451**

[52] **U.S. Cl.** **175/364**, 175/372

[51] **Int. Cl.** **E21b 9/08**

[58] **Field of Search** 175/364, 363, 347, 175/360, 361, 346, 367, 368, 369

[56] **References Cited**

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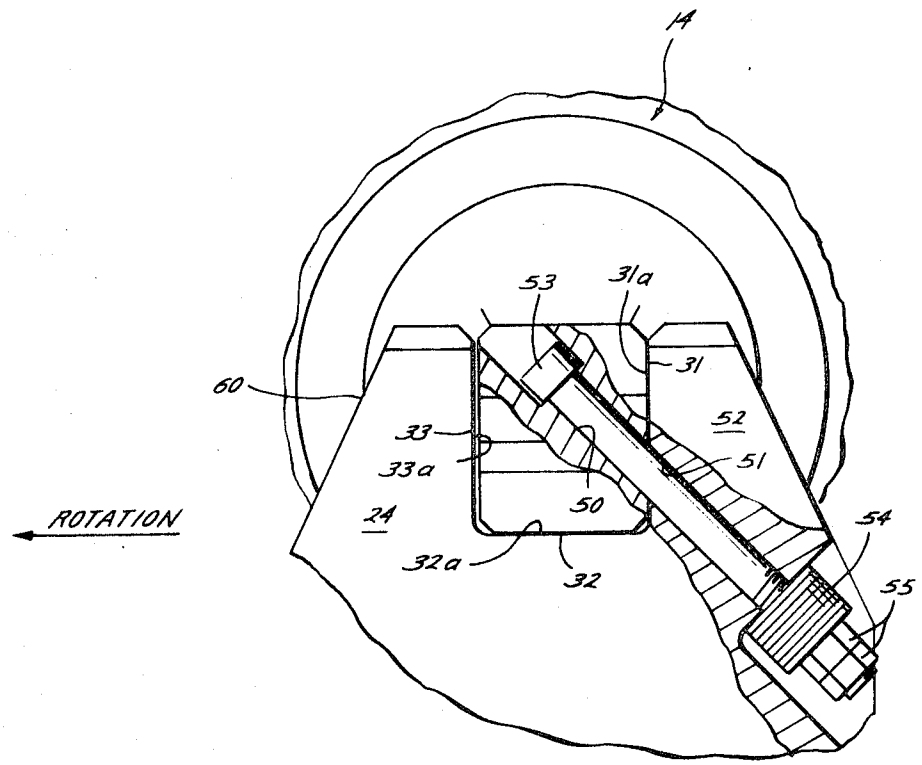
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[57] **ABSTRACT**

A drill bit including at least one roller cutter rotatably mounted on a shaft which is supported between two legs of a saddle wherein the ends of the shaft are non-circular in cross section and fit with non-circular portions on the legs, the shaft being secured to the legs by bolt means passing diagonally through the shaft ends and one side of the mating saddle leg, whereby the shaft may be held against turning with respect to the saddle legs. This abstract is neither intended to define the invention of the application which, of course, is measured by the claims, nor is it intended to be limiting as to the scope of the invention in any way.

6 Claims, 6 Drawing Figures

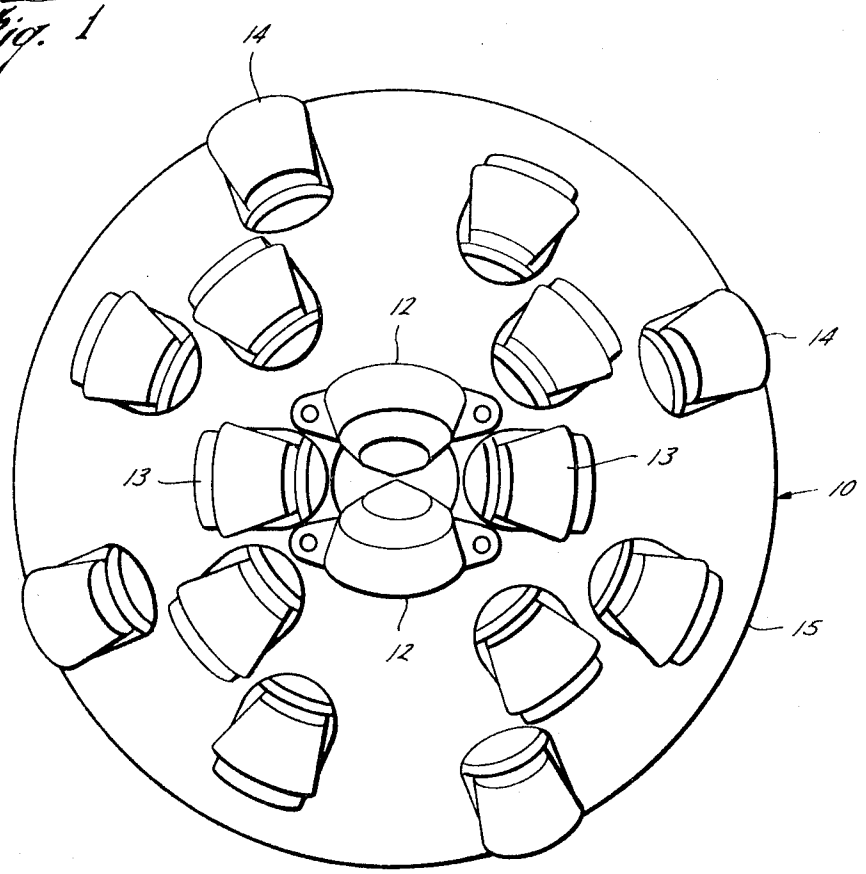


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SHEET 1 OF 3

Fig. 1



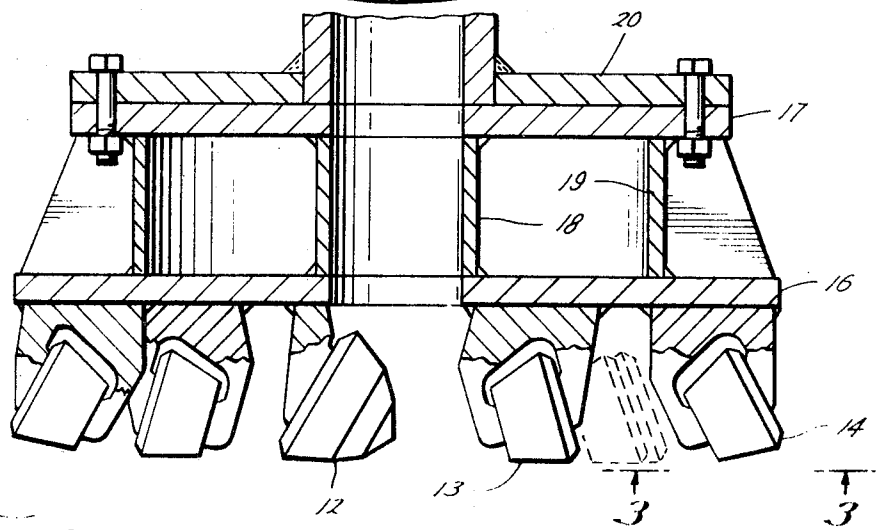


Fig. 2

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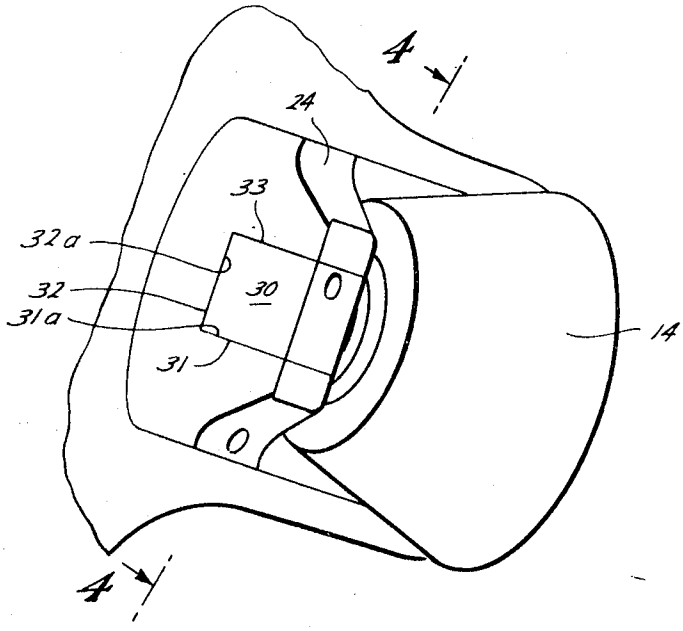


Fig. 3

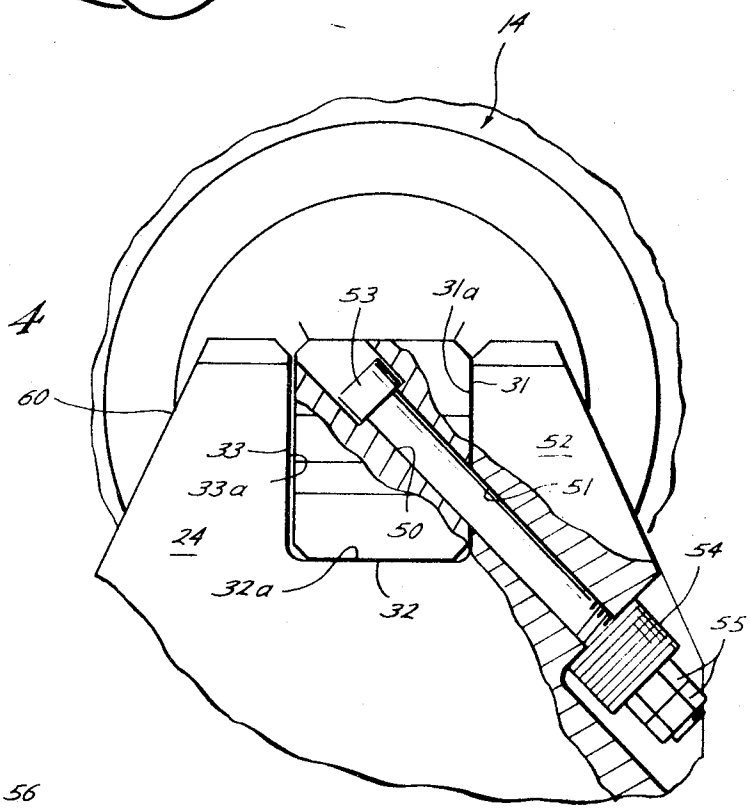


Fig. 4

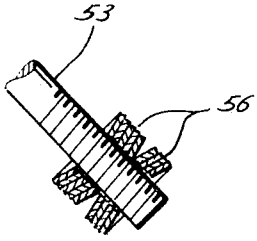
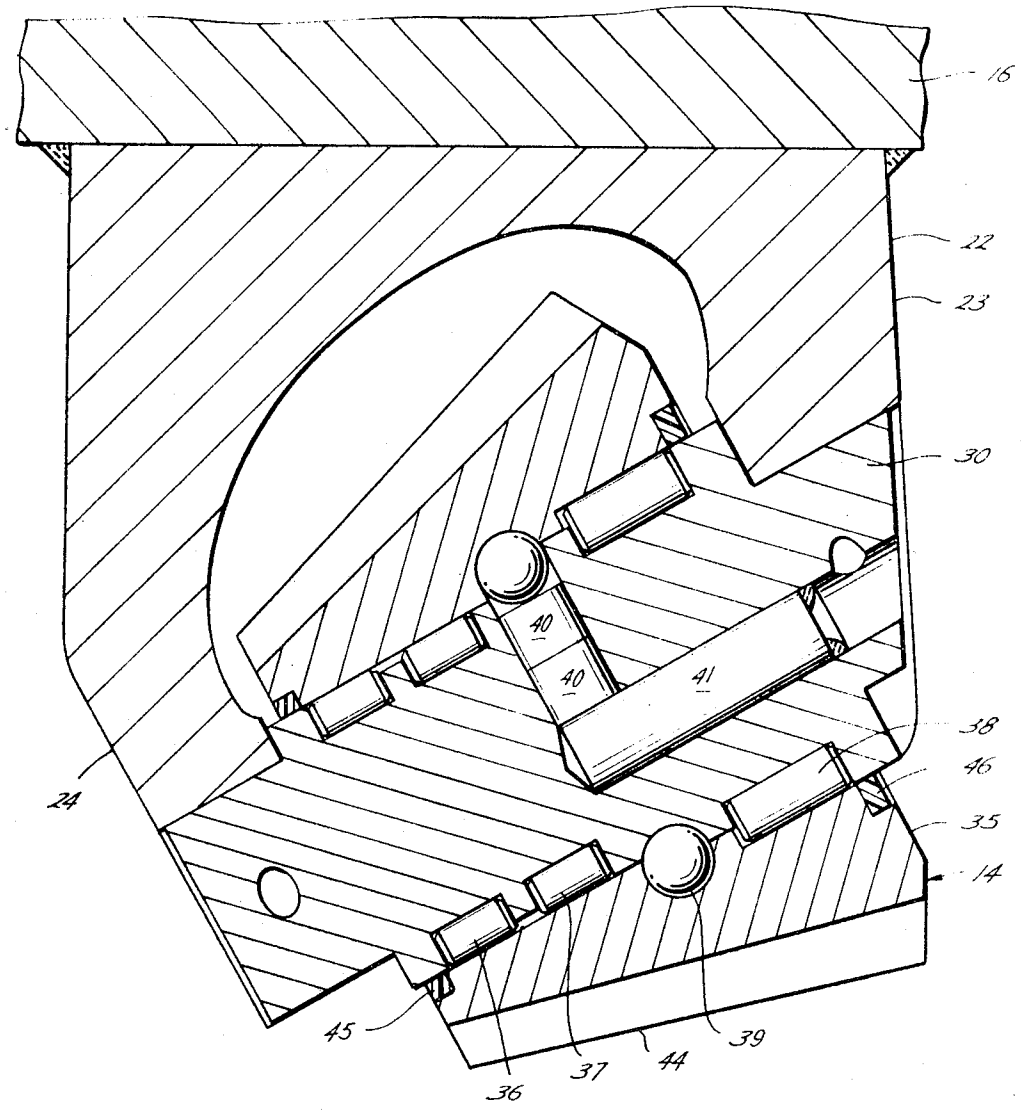


Fig. 5

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Fig. 6



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DRILL BIT

SUMMARY

The present invention relates to earth boring drill bits of the rotating cutter type and more particularly to replaceable cutter assemblies and the mounting thereof on cutter supports.

In the drilling of earth bores for raises, wells, shafts tunnels or the like, it is desirable to have a drill which is suitable for any of these purposes and which can readily be repaired without replacement of the complete drill bit.

It is an object of this invention to provide a new and improved drill bit having replaceable cutter assemblies which are adapted to fit on cutter supports mounted on a bit head.

Another object is to provide a new and improved cutter assembly wherein the bearing shaft or journal thereof may be disposed between cutter support legs and which shaft end has a non-circular surface secured to a corresponding non-circular surface on the cutter support leg to prevent the shaft from turning about its own axis.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a bottom plan view of the drill bit of the invention.

FIG. 2 is a radial section through the drill bit with portions of the cutting structure and cutter traces moved into the plane of the paper to illustrate the manner of cutting the entire working face of the formation being drilled.

FIG. 3 is a view taken along line 3—3 in FIG. 2.

FIG. 4 is a view taken along line 4—4 in FIG. 3.

FIG. 5 is a detail view of a portion of the screw securing means having Belleville springs arranged thereon.

FIG. 6 is an enlarged sectional view of the cutter assembly of the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to FIGS. 1 and 2, a drill bit 10 includes a plurality of cutter assemblies 12, 13 and 14 secured to a steel bit head 15. The cutter assemblies 12 cut closest to the rotating axis of the drill bit and are here shown as cone-type cantilever cutter assemblies. The cutter assemblies 13 and 14 are substantially identical except that the mounting angle of the cutter assembly 14 with respect to the bit head 15 may be somewhat different from the cutter assembly 13 so as to cut the gage of the bore hole being drilled.

The bit head 15 includes a lower steel plate 16 and an upper steel plate 17. Extending between and secured to said plates are circular steel members 18 and 19. Bolted to plate 17 is a flange 20 which serves to rotatably drive the drill bit.

Referring to FIGS. 3, 4 and 6, an enlarged view of the cutter assembly 14 is shown comprising a steel cutter support or saddle 22 having an outer leg 23 and an inner leg 24. A bearing shaft or journal 30 extends between the legs 23 and 24 and has flat surfaces 31, 32 and 33 cooperating with corresponding flat surfaces 31*a*, 32*a* and 33*a* of the legs 23 and 24 to hold the shaft 30 against turning.

A roller cutter 35 is rotatably mounted on shaft 30 on roller bearings 36, 37 and 38 and ball bearings 39 in suitable races. After the ball bearings 39 have been inserted into place, plugs 40 and retaining pin 41 serve to keep them in place. The roller cutter 35 may be made of alloy steel and may have teeth 44 which are milled into the cutter, or other suitable cutting elements. Grease seals 45 and 46 are provided at either end of the cutter.

Referring to FIG. 4, one end of shaft 30 is shown as having a rectangular cross section fitted within the surfaces 31*a*, 32*a*, and 33*a* of the leg 24 which mate closely with the rectangular cross section of shaft 30. The shaft 30 has a bore 50 diagonally therethrough which in this case extends toward the bit head and rearwardly with respect to the direction of rotation of the drill bit 10. A corresponding bore 51 extends through the arm 52 of the leg 24. A cap screw 53 extends through bores 50 and 51, and on its threaded end has a plurality of resilient metal washers 54 and nuts 55 to secure the shaft 30 to the leg 24.

It will be appreciated that the cap screw 53 is somewhat resilient and when tightened serves to keep shaft 30 in place even through the bit and cutter assemblies are subjected to severe vibrations and stresses during the drilling operation. Since the cap screw 53 does have some resiliency, the resilient washers 54 may be dispensed with, if desired.

FIG. 5 shows an arrangement of Belleville spring washers 56 which may be used in place of the resilient washers 54.

The cap screw 53 passing diagonally through the shaft 30 serves to keep it tightly against the surface 31a which is rearward of the shaft with respect to the direction of bit rotation and tightly against the upper surface 32*a* of the leg 24. Since the shaft 30 is held snugly in the corner of the leg opening as just described, no extremely close fits are required between the shaft and the opening in the bit leg and the likelihood that the shaft 30 would become loose and batter the mating surfaces of the leg is remote as it is held resiliently by the screw means against the leg surfaces. Thus it can be seen that with the present invention, a close fit is not required initially between the screw 53 and the bores 50 and 51 or between the non-circular end of shaft 30 and the mating surfaces of leg 24. Thus this type of cutter assembly mounting is less expensive and greatly improved over that which has been used in the past.

If desired, the forward portion 60 of the leg 24 could be completely removed and it is believed that the cutter assembly mounting of the present invention would still serve its intended purpose. Also, alternatively, it is believed that the cap screw could extend through the shaft and leg diagonally toward the bit head and forwardly with respect to the direction of bit rotation and still serve the purpose of the invention.

The structure of the preferred embodiment has been successfully proved in actual drilling operations in the field.

The foregoing disclosure and description of the invention are illustrative and explanatory thereof, and various changes in the size, shape and materials, as well as in the details of the illustrated construction, may be made within the scope of the appended claims without departing from the spirit of the invention.

What is claimed is:

1. In a drill bit comprising a head and a plurality of cutter assemblies supported on said head, at least one of said assemblies including:

a saddle having spaced-apart legs,

a bearing shaft extending between said legs;
a roller cutter;
bearing means rotatably supporting said cutter on the shaft between said legs;
at least one of said legs having non-circular and non-parallel surfaces on the lower portion thereof;
at least one end of said shaft being shaped to mate with said non-circular and non-parallel surfaces whereby the shaft is held against rotatable movement relative to said saddle leg;
at least said one end of said shaft having a bore therein extending substantially diagonally;
at least one leg of said saddle having a bore aligned with said shaft bore;
and screw means in said bores adapted to secure said shaft to said leg.

2. A drill bit cutter assembly according to claim **1** wherein the bores in the end of the shaft and in the leg

extend toward the head and rearwardly with respect to the direction of rotation of said head during the drilling operation.

3. A drill bit cutter assembly according to claim **1** wherein the bores in the end of the shaft and in the leg extend toward the head and forwardly with respect to the direction of rotation of said head during the drilling operation.

4. A drill bit cutter assembly according to claim **1** wherein the screw means includes a nut and bolt.

5. A drill bit cutter assembly according to claim **4** wherein a resilient member is positioned between the nut and said leg.

6. A drill bit cutter assembly according to claim **5** wherein the resilient member includes at least one Belleville spring.

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