Sept. 18, 1934. A. E. CARLSON 1,973,975

ROTARY ROCK BIT CONSTRUCTION

Filed July 25, 1933 2 Sheets-Sheet 1

Fig. 1.

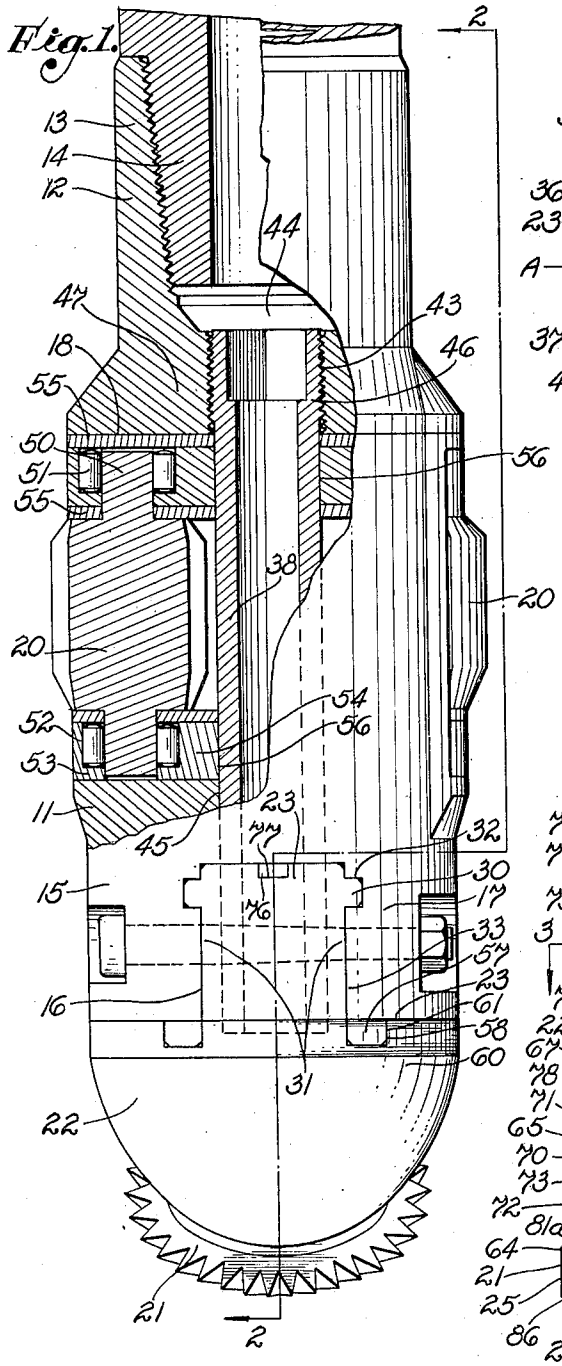


Fig. 3.

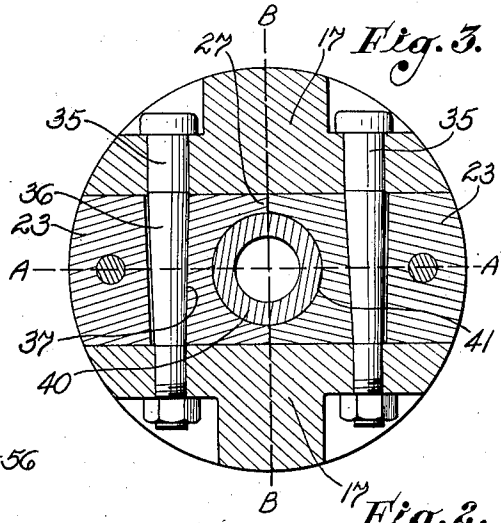
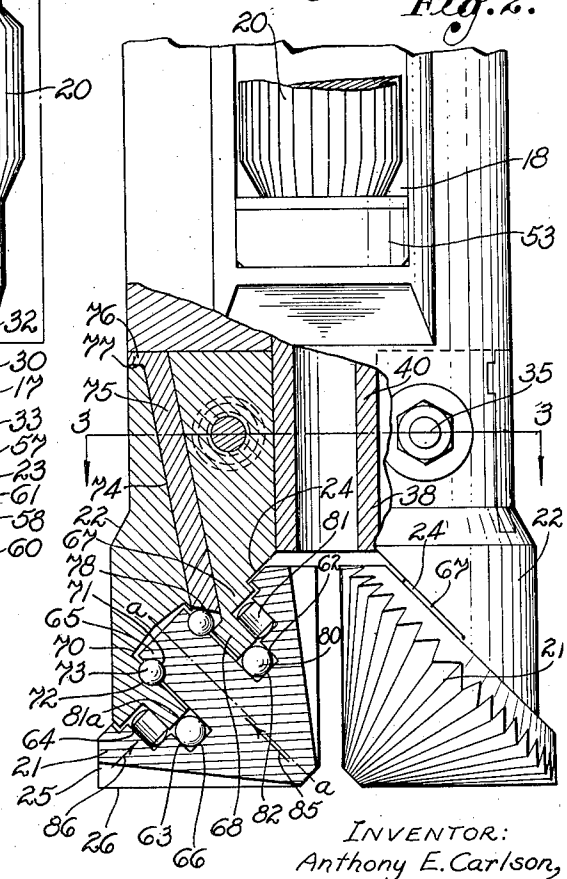


Fig. 2.



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Fig. 6.

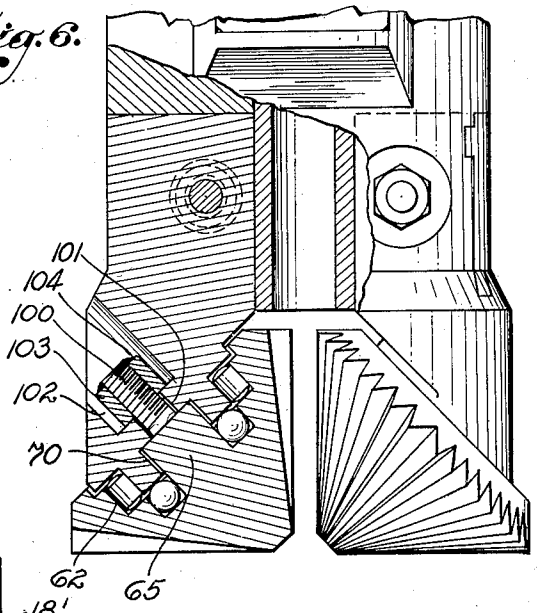


Fig. 4.

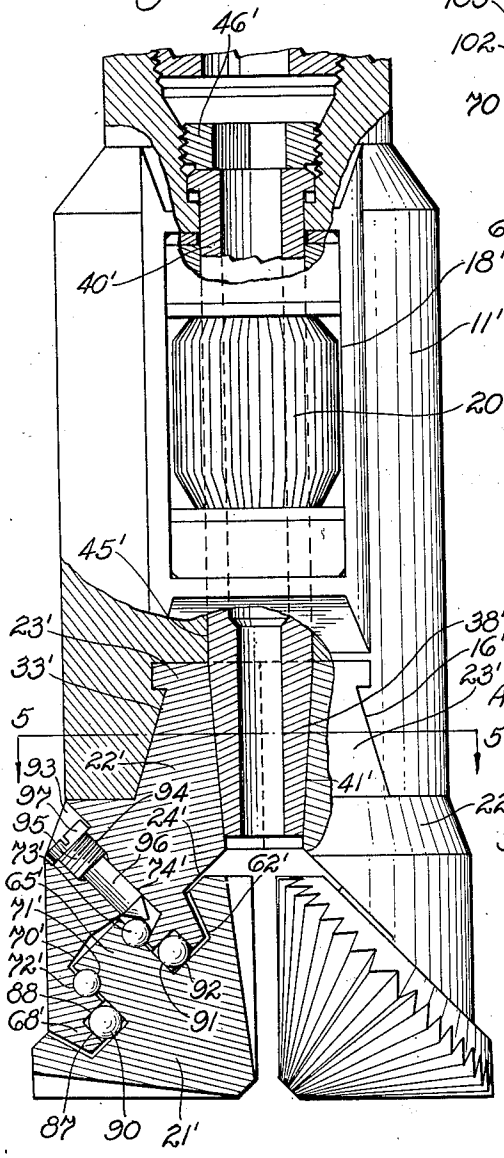
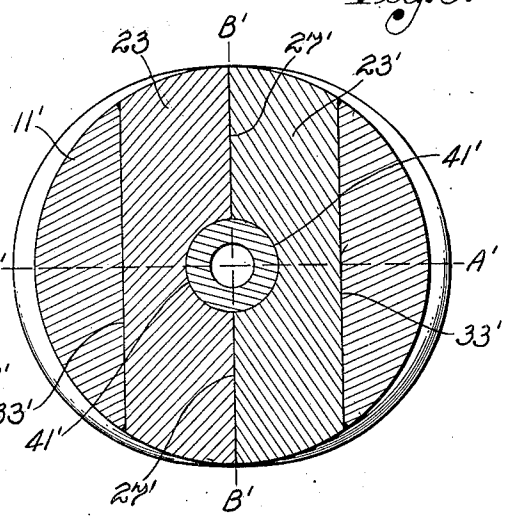


Fig. 5.



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UNITED STATES PATENT OFFICE

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ROTARY ROCK BIT CONSTRUCTION

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Application July 25, 1933, Serial No. 682,058

17 Claims. (Cl. 255—71)

My invention relates to rotary rock bits of the character having toothed rollers mounted so as to roll against the bottom of the hole to be drilled.

Rock bits of this character ordinarily employ conical rollers, and in order to produce a concentric rolling action of the cutter means it is customary to employ a pair of conical cutter rollers in facing relation. Some difficulty has been encountered in effectively securing the conical rollers in such a manner that they will not be lost in the well. It is an important object of my present invention to provide a simple means for mounting the conical rollers so that they will be securely held in operating condition and so that the rollers may be removed and replaced at a minimum expense.

It is a further object of my invention to provide a cone rock bit of the above character in which breakage of the cutter teeth due to shearing strains placed thereon will be held at a minimum. This effect is accomplished through the provision of centralizing means in the form of reaming rollers placed in close proximity to the digging cutters. In my invention the reaming rollers and the digging cutters are at all times maintained in definite vertical planes.

A further object of the invention is to provide a simple and effective means for securing cutter heads, carrying cutter rollers, to the lower end of a bit body.

Further objects and advantages of the invention will be made evident throughout the following part of the specification.

Referring to the drawings, which are for illustrative purpose only,

Fig. 1 is a partly sectioned side view of a bit embodying a preferred form of my invention.

Fig. 2 is a face view showing the lower portion of Fig. 1, partly sectioned as indicated by the line 2—2 of Fig. 1.

Fig. 3 is a cross section on a plane represented by the line 3—3 of Fig. 2.

Fig. 4 is a partly sectioned side view of an alternative form of my invention.

Fig. 5 is a cross section on a plane represented by the line 5—5 of Fig. 4.

Fig. 6 is a fragmentary sectional view showing an alternative means for securing a cutter roller in place on a cutter head.

In the form of my invention shown in Figs. 1 to 3, I employ a single-piece bit body 11 having means 12 at the upper end thereof for connecting it to the lower end of a drilling member, such as a string of drill pipe, this means 12 being shown in the form of a threaded box 13 adapted to receive a threaded pin 14 which is disposed on the lower end of the drilling member. In the lower end 15 of the body 11 a transverse slot or channel 16 is formed, this channel 16 facing downwardly and being preferably diametrally disposed between a pair of fingers or lugs 17 which are thus formed on the lower end of the body 11 in downwardly projecting positions on opposite sides of the channel 16. In the body 11 a vertically elongated diametral opening 18 is formed in relatively close proximity to the lower end 15 of the body 11. The diametral opening 18 is preferably of rectangular cross section and provides diametrally opened end portions or pockets in which reaming rollers 20 may be secured in a simple manner, as will be hereinafter explained. The vertical plane B—B on which the diametral opening 18 is centralized is preferably disposed at right angles to the plane A—A, Fig. 3, extending centrally through the slot or channel 16. The relative positions of the opening 18 and the channel 16, as defined by the planes B—B and A—A, are definitely fixed so as to definitely determine the relative positions of the reaming rollers 20 and the conical digging cutters 21 which are secured to cutter heads 22 adapted to engage the end portions of the channel 16. The cutter heads 22 are each provided with a block or tongue 23 adapted to slide into the groove or channel 16 in the direction of the plane A—A, and below the blocks 23 the heads 22 are laterally enlarged so as to extend across the lower faces of the downwardly projecting lug portions 17 which lie on opposite sides of the channel 16. The heads 22 each have a cutter receiving face portion 24 disposed in a sloping plane which is perpendicular to the plane A—A and diagonal with relation to the vertical axis of rotation of the bit body 11. As clearly shown in Fig. 2, the cutter receiving face portions 24 face downwardly and inwardly. In accordance with standard practice, the face portions 24 are disposed at angles of 45° relative to the axis of rotation of the bit body, and the cutter rollers 21 have cutting teeth 25 with cutting edges 26 disposed to define a 90° cone.

Each tongue 23 of a cutter head 22 has a length in the direction of the plane A—A equal to the radius of the lower end 15 of the bit body 11 so that the inner end faces 27 of the tongues 23 will come together on the plane B—B when the tongues 23 are moved radially into the channel 16, as shown in Fig. 3. Interengagement preventing downward movement of the tongues 23 in the channel 16, but permitting radial move-

ment in the direction of the axis *a*—*a*, is provided, such interengagement comprising horizontal ribs or tongues 30 projecting from the upper portions of the side walls 31 of the tongues 23 so as to engage grooves 32 formed horizontally in the upper portions of the side walls or faces 33 defining the channel 16. Accordingly, the cutter heads 22 may be moved radially in and out of the channel 16 but cannot move downwardly. To lock the tongues 23 of the cutter heads 22 operatively in the channel 16 after they have been placed therein as shown in the drawings, I provide transverse bolts 35 extending perpendicularly relative to the plane A—A so as to pass through end portions of the lugs 17 and through the central portions of the respective tongues 23, as shown in Fig. 3. The central portions 36 of the bolts 35 may be tapered, and the openings 37 through the tongues 23 may be likewise tapered so that the effect of the bolts 35 will be to force the tongues radially inwardly into face-to-face engagement and into engagement with the lower end 38 of a mud tube 40 which projects axially through the body 11 in such a manner that the lower end 38 will rest in semi-circular channels 41 formed in abutting faces 27 of the tongues 23. To support the mud tube 40, the body 11 has a threaded opening 43 connecting the upper part of the diametral opening 18 with the lower interior space 44 of the box 13, and an axial bore or opening 45 connecting the lower portion of the diametral opening 18 with the upper end of the channel 16. The mud tube 40 is essentially cylindrical throughout its length with the exception of an externally threaded head 46 at its upper end adapted for engagement with the threaded opening 43. Descriptively speaking, it may be stated that the mud tube 40 projects downwardly from the upper wall 47 in which the opening 43 is formed, through the opening 18 and the bore 45, and into the cylindrical space formed by the semi-circular depressions 41 in the inner faces 27 of the tongues 23.

In the form of the invention shown in Figs. 1 to 3, the mud tube 40 has the function of carrying drilling mud downwardly through the diametral opening 18 and of locking the reaming rollers 20 in the diametral opening 18. The reaming rollers 20 have trunnions 50 extending from the ends thereof into roller bearing means 51 mounted in openings 52 formed in the end portions 53 of flat plates 54 which extend across the top and bottom ends of the diametral opening 18. The plates 54 are shown with thinner plates 55 mounted thereon and with openings 56 through the plates 54 and 55 through which the mud tube 40 extends when the bit structure is assembled. The mud tube 40, passing as it does through the openings 56 in the plates 54, prevents movement of the plates 54 from the diametral opening 18, thereby holding the reaming rollers 20 in such positions that they will project equally from the opposite ends of the diametral opening 18 to engage the side wall of a hole being bored.

Although the fingers or lugs 17 which project downwardly from the lower end 15 of the body 11 are of rugged form, it may be desirable to prevent any spreading thereof in a direction perpendicular to the plane A—A by use of ribs or tongues 57 on the lower ends of the lugs 17 to engage cooperating grooves or channels 58 formed in the cutter heads 22 along the lower ends of the tongues 23, thereby forming in the laterally extending portions 60 of the heads 22 shoulders 61 which will engage the ribs 57 in a manner to prevent outward movement of the lower ends of the tongues 17.

The invention embodies a novel and effective means for securing the cutter 21 rotatably to the cutter head 22 in such a manner that the load carrying bearings will be disposed within the body of the cutter, but the locking means will be disposed outside the body of the cutter and in such position that working strains will not be placed thereon so that there will be a liability of breaking of the locking means. In the form of cutter mounting shown in Fig. 2, the cutter 21 is provided with an annular recess or pocket 62 concentric with the axis *a*—*a* of rotation of the cutter 21. This recess or pocket 62 has a stepped outer wall so formed as to produce an inner cylindrical wall 63 of relatively small diameter and a cylindrical wall 64 of larger diameter adjacent thereto. Extending upwardly or outwardly from the recess 62, the cutter 21 is provided with an axial pin 65 of such diameter that between it and the cylindrical wall 63 a ball race or groove 66 is formed.

The cutter receiving face portion 24 of each cutter head 22 has a flat annular metal body 67 projecting therefrom concentric with the axis *a*—*a*, and from the face of the annular metal body 67 an annular metal body 68 of smaller diameter projects outwardly and downwardly concentric with the axis *a*—*a*, the annular metal bodies 67 and 68 both being disposed around a pin receiving opening 70 disposed on the axis *a*—*a* and being of a diameter greater than the pin 65 of the cutter 21. Cooperating ball receiving grooves 71 and 72 are formed in the pin 65 and the wall of the opening 70 in a plane near the outer end of the pin 65 and the bottom of the opening 70. To lock the cutter in operative position, steel balls 73 are placed in the grooves or races 71 and 72 through an opening 74 which extends upwardly from the upper part of the groove 72 through the head 22 to the upper face of the tongue 23. After the balls 73 are placed as shown in Fig. 2, the opening 74 is filled with a metal bar 75 having a laterally projecting lug 76 at its upper end resting in a short groove 77 in the upper face of the tongue 23, this metal bar being of such length that the lower end face 78 thereof will prevent the balls 73 from moving out of the groove 72 into the lower part of the opening 74. It will be perceived that when the cutter head 22 is mounted on the lower end of the bit body 11, the upper end of the ball holding bar 75 will be within the channel 16 and is accordingly locked in place without the use of individual locking means such as bolts and screws.

For taking the upward thrust of the cutter 21, roller type bearing members, preferably in the form of balls 80, are placed in the groove 66, and for carrying the radial loads produced in the rotation of the cutter 21, roller type bearings, preferably in the form of short cylindrical rollers 81, are placed around the annular wall or metal body 68 of the cutter head 22 and within the cylindrical wall 64 formed within the cutter 21 in such position that it surrounds the annular metal body 68. When the bit is rotating on the bottom of the hole being drilled, the roller type bearing members 80 roll between the end face 81*a* of the annular metal body 68 and the bottom face 82 of the annular channel 66 in the cutter 21 and in this manner provide a thrust bearing. At the same time the upward reaction of the

cutter 21 against the downward force exerted through the cutter head 22 produces a pair of resultant forces as indicated by arrows 85 and 86. The force in the direction of the arrow 85 is carried by the thrust bearing members 80, and the force in the direction of the arrow 86 is absorbed by the roller bearing members 81.

The working loads imposed on the mounting means for the cutter 21 are carried by the thrust and radial bearing means 80 and 81, and the balls 73 serve only as a means for locking the cutter 21 operatively on the lower end of its cooperating cutter head 22. The grooves 71 and 72 are of such size that the balls 73 rest relatively loosely therein so that working loads are not imposed on the balls 73 as the result of the operation of the cutter 21 on the bottom of the hole.

In Fig. 4 I show a cutter 21' connected to a cutter head 22' by a mounting means embodying the principles involved in the mounting means shown in Fig. 2 but employing a single set of roller bearing members for carrying both the thrust and radial loads, instead of separate sets of roller type bearings for carrying the thrust and radial loads, as shown in Fig. 2. The cutter 21' is provided with an axial annular recess 62' having a pin 65' extending axially outwardly therefrom into an opening 70' formed in the head 22'. Projecting from the diagonal face portion 24' of the head 22' is an annular wall 68' of a size to substantially fill the annular recess 62', this annular wall 68' having a counterbore formed around the lower end of the opening 70' so as to provide a cylindrical face 87 and a radial face 88. In the counterbore formed by the faces 87 and 88, balls 90 are placed so as to engage the faces 87 and 88, the cylindrical surface 91 of the lower end of the pin 65', and an essentially radial wall or face 92 forming a part of the bottom of the recess 62'. The outer or upper end of the pin 65' is provided with a ball receiving groove 71', and in the wall of the opening 70' a cooperating groove 72' is formed. For placing balls 73' in the cooperating grooves 71' and 72', an opening 74' is drilled diagonally so as to connect the outer face of the head 22' and the upper part of the groove 72'. The outer end of the opening 74' is counterbored at 93 and adjacent the counterbore 93 is provided with a threaded section 94 to receive the threaded section 95 of a filler pin 96 adapted to be placed in the opening 74' so as to prevent the balls 73' from moving outwardly from the groove 72' into the lower end of the opening 74', there being a head 97 on the upper end of the pin 96 which is received in the counterbore 93 formed at the outer end of the opening 74'.

In the forms of cutter mounting means shown in Figs. 2 and 4, the conical cutter is provided with a recess having a pin or trunnion extending outwardly from the bottom of the recess, and the cutter supporting head is provided with an annular wall extending into the recess, there being bearing means operative in the recess of the cutter and between the cutter and the annular body extending from the cutter supporting head. The working loads are carried by the bearing means situated within the conical roller in a position centralized with respect to the upward application of forces to the cutter when the bit structure is resting on the botton of the hole. The balls 73', which serve as a means for locking the cutter on the head, are placed outside the recess and in a position isolated from the roller members constituting the thrust and radial bearing means for the cutter.

In Fig. 6 I show a form of cutter mounting means which is essentially the same as disclosed in Fig. 2 and accordingly may have the same numerals applied to the parts thereof which are in duplicate of parts shown in Fig. 2. This form of cutter mounting means differs from the previous forms in that it does not employ balls for locking the cutter in place but provides a pin 100 extending outwardly from the pin 65 which projects from the bottom of the cutter recess 62. This small diameter pin 100 is preferably threaded, as shown, and passes through an opening 101 which connects the pin receiving opening 70 with an external opening 102 of sufficient diameter to receive a head portion 103 which is replaceably mounted on the outer end of the pin or screw 100. The head portion 103 may be in the form of a collar or other enlargement and may be threaded upon the outer portion of the pin 100, where it may be then locked against removal by some suitable means such as welding 104.

In the form of the invention shown in Figs. 1 to 3, the cutter heads 22 are slidable into engagement with the bit body 11 in a radial direction coinciding with the plane A—A, which plane is parallel to or passes through the axes a—a of rotation of the cutters 21. In other words, the cutter heads 22 move into engagement with the bit body 11 on planes defined by the axes of the cutters 21. In Figs. 4 and 5 I show a form of my invention in which the cutter heads 22' slide into engagement with a bit body 11' along a plane B'—B' which is transverse to and essentially perpendicular to the plane A'—A' coinciding with the axes of rotation of the cutters 21'. In this alternative form of the invention the bit body 11' is provided with a transverse channel 16' at its lower end centralized on the plane B'—B' defined by a diametral opening 18' in which reaming rollers 20' are mounted. The cutter heads 22' are each provided with a tongue 23' which is the full length of the channel 16' and is of a shape and size to fill a half of the channel 16' lying to one side of the plane B'—B'. The tongues 23' have abutting faces 27' which are parallel to the side walls 33' of the channel 16'.

In this alternative form of the invention a mud tube 40' is provided which serves also as a locking means for preventing removal of the tongues 23' from the channel 16', and for this purpose the lower end 38' of the mud tube 40' is tapered to fit cooperating tapered depressions 41' formed in the abutting faces 27' of the tongues 23'. After the cutter heads 22' are conected with the bit body 11' by sliding the tongues 23' radially into the channel 16', the mud tube 40' is lowered into the position in which it is shown in Fig. 4, and a threaded ring 46' is screwed tightly down against the upper end thereof so as to force the lower end portion 38' tightly into the tapered channels 41' of the cutter heads 22', thereby clamping the tongues 23' tightly in the channel 16'. When thus placed, the lower end 38' of the mud tube 40' operates in shear to prevent lateral movement of the tongues 23', and accordingly the cutter heads 22' cannot be removed from the channel 16' until the mud tube 40' is raised from the position in which it is shown in Fig. 4. The bit body 11' and the detachable cutter supporting means are slidable into interengagement along a transverse line of movement. In the body 11' an opening 45' for a mud tube 40' is

formed so as to intersect the path on which said detachable cutter supporting means moves into engagement with the bit body 11' so that when the mud tube is lowered through the opening 45' in the bit body 11', it will engage the cutter supporting means and prevent its movement laterally from engagement with the body 11'.

Although I have herein shown and described my invention in simple and practical form, it is recognized that certain parts or elements thereof are representative of other parts, elements, or mechanisms which may be used in substantially the same manner to accomplish substantially the same results; therefore, it is to be understood that the invention is not to be limited to the details disclosed herein but is to be accorded the full scope of the following claims.

I claim as my invention:

1. A rotary bit of the character described, including: a roller cutter having an axially aligned recess in one face thereof and a pin extending axially from the bottom of said recess; a cutter supporting head having an opening therein receiving said pin of said cutter and an annular body projecting into said recess around said pin; radial and thrust bearing means operative between said cutter and said head in said recess; and means engaging the outer end portion of said pin to hold said cutter in operative position on said head.

2. A rotary bit of the character described, including: a roller cutter having an axially aligned recess in one face thereof and a pin extending axially from the bottom of said recess; a cutter supporting head having an opening therein receiving said pin of said cutter and an annular body projecting into said recess around said pin; bearing means operative between said cutter and said head in said recess; and means engaging said pin and the side walls of said opening in said head to hold said cutter in operative position on said head.

3. A rotary bit of the character described, including: a roller cutter having an axially aligned recess in one face thereof and a pin extending axially from the bottom of said recess; a cutter supporting head having an opening therein receiving said pin of said cutter and an annular body projecting into said recess around said pin; bearing means operative between said cutter and said head in said recess; and means engaging the outer end portion of said pin to hold said cutter in operative position on said head.

4. A rotary bit of the character described, including: a cutter supporting head having means for connecting it to a drilling string and having a cutter receiving portion with a face inclined to the axis of the bit, an opening in said cutter receiving portion perpendicular to said face, there being an annular body around said opening projecting from the face of said cutter receiving portion; a cone roller cutter member having an annular recess in the base thereof receiving said annular body of said cutter supporting head, there being a pin projecting from the bottom of said recess into said opening of said head; bearing means in said recess and operative between said cutter and said head; and means in said opening of said head engaging said pin and head to hold said cutter operatively on said head.

5. A rotary bit of the character described, including: a cutter supporting head having means for connecting it to a drilling string and having a cutter receiving portion with a face inclined to the axis of the bit, an opening in said cutter receiving portion perpendicular to said face, there being an annular body around said opening projecting from the face of said cutter receiving portion; a cone roller cutter member having an annular recess in the base thereof receiving said annular body of said cutter supporting head, there being a pin projecting from the bottom of said recess into said opening of said head; radial bearing means in said recess and operative between said cutter and said head; thrust bearing means in said recess operative between said cutter and said head; and means in said opening of said head engaging said pin and head to hold said cutter operatively on said head.

6. A rotary bit of the character described, including: a cutter supporting head having means for connecting it to a drilling string and having a cutter receiving portion with a face inclined to the axis of the bit, an opening in said cutter receiving portion perpendicular to said face, there being an annular body around said opening projecting from the face of said cutter receiving portion; a cone roller cutter member having an annular recess in the base thereof receiving said annular body of said cutter supporting head, there being a pin projecting from the bottom of said recess into said opening of said head; roller type radial and thrust bearing means in said recess and operative between said cutter and said head; and means in said opening of said head engaging said pin and head to hold said cutter operatively on said head.

7. A rotary bit of the character described, including: a cutter supporting head having means for connecting it to a drilling string and having a cutter receiving portion with a face inclined to the axis of the bit, an opening in said cutter receiving portion perpendicular to said face, there being an annular body around said opening projecting from the face of said cutter receiving portion; a cone roller cutter member having an annular recess in the base thereof receiving said annular body of said cutter supporting head, there being a pin projecting from the bottom of said recess into said opening of said head; bearing means in said recess and operative between said cutter and said head; and balls engaging the outer portion of said pin and the side walls of said opening to hold said pin in said opening.

8. A rotary bit of the character described, including: a cutter supporting head having means for connecting it to a drilling string and having a cutter receiving portion with a face inclined to the axis of the bit, an opening in said cutter receiving portion perpendicular to said face, there being an annular body around said opening projecting from the face of said cutter receiving portion; a cone roller cutter member having an annular recess in the base thereof receiving said annular body of said cutter supporting head, there being a pin projecting from the bottom of said recess into said opening of said head; roller type radial and thrust bearing means in said recess and operative between said cutter and said head; and balls engaging the outer portion of said pin and the side walls of said opening to hold said pin in said opening.

9. A rotary bit of the character described, including: a roller cutter having an axially aligned recess defined by a bottom wall and a side wall there being a pin extending axially from the bottom of said recess; a cutter supporting head having an opening therein receiving said pin of said cutter and having an annular wall projecting into said recess; roller bearing means disposed be-

tween the end of said annular wall and the bottom of said recess; roller type bearing means disposed between said side wall of said recess and the side portion of said annular wall; and means in said opening engaging said wall and the outer portion of said pin to hold said pin in said opening.

10. A rotary bit of the character described, including: a bit body having means at the upper end thereof for connecting it to a drilling string; a cutter head adapted to be secured to the lower part of said bit body, said head having a face portion against which a cutter may be received and an opening substantially perpendicular to said face portion, there being a hole extending from a side wall of said opening in such position that the outer end of said hole will be obstructed by a part of said body when said head is secured to said bit body; a cutter adapted to operate adjacent said face portion of said head, said cutter having an axially aligned recess and a pin extending from the bottom of said recess into said opening of said head; bearing means in said recess, said bearing means being operative between said cutter and said head; means adapted to be passed through said hole in said head into engagement with the portion of said pin in said opening to hold said pin in said opening; and means for securing said head to said bit body.

11. A rotary bit of the character described, including: a bit body having means at the upper end thereof for connecting it to a drilling string; a cutter head adapted to be secured to the lower part of said bit body, said head having a face portion against which a cutter may be received and an opening substantially perpendicular to said face portion, there being a hole extending from a side wall of said opening in such position that the outer end of said hole will be obstructed by a part of said body when said head is secured to said bit body; a cutter adapted to operate adjacent said face portion of said head, said cutter having an axially aligned recess and a pin extending from the bottom of said recess into said opening of said head; bearing means in said recess, said bearing means being operative between said cutter and said head, there being an annular groove in the outer portion of said pin; means adapted to be passed through said hole in said head into engagement with said groove in said pin; a bar for filling said hole so as to hold said engagement means in engagement with said groove in said pin; and means for securing said head to said bit body.

12. A rotary bit of the character described, including: a roller cutter having an axially aligned recess in one face thereof and a pin extending axially from the bottom of said recess; a cutter supporting head having an opening therein receiving said pin of said cutter and an annular body projecting into said recess around said pin; bearing means operative in said recess and between said cutter and said head to maintain said cutter for rotation on the axis of said pin; and means engaging between said head and said pin to hold said cutter in operative position on said head.

13. A rotary bit of the character described, including: a roller cutter having an axially aligned recess in one face thereof and a pin extending axially from the bottom of said recess; a cutter supporting head having an opening therein receiving said pin of said cutter and an annular body projecting into said recess around said pin; bearing means operative in said recess and between said cutter and said annular body to maintain said cutter for rotation on the axis of said pin; and means engaging between said head and said pin to hold said cutter in operative position on said head.

14. A rotary bit of the character described, including: a roller cutter having an axially aligned recess in one face thereof and a pin extending axially from the bottom of said recess; a cutter supporting head having an opening therein receiving said pin of said cutter and an annular body projecting into said recess around said pin; bearing means operative in said recess and between said cutter and said head to maintain said cutter for rotation on the axis of said pin; and means holding said cutter in operative position on said head.

15. A rotary bit of the character described, including: a cutter supporting head having means for connecting it to a drilling string and having a cutter receiving portion with a face inclined to the axis of the bit, an opening in said cutter receiving portion perpendicular to said face, there being an annular body around said opening projecting from the face of said cutter receiving portion; a cone roller cutter member having an annular recess in the base thereof receiving said annular body of said cutter supporting head, there being a pin projecting from the bottom of said recess into said opening of said head; roller type radial and thrust bearing means in said recess and operative between said cutter and said annular body; and means holding said cutter operatively on said head.

16. A rotary bit of the character described, including: a cutter supporting head having means for connecting it to a drilling string and having a cutter receiving portion with a face inclined to the axis of the bit, an opening in said cutter receiving portion perpendicular to said face, there being an annular body around said opening projecting from the face of said cutter receiving portion; a cone roller cutter member having an annular recess in the base thereof receiving said annular body of said cutter supporting head, there being a pin projecting from the bottom of said recess into said opening of said head; bearing means in said recess and operative between said cutter and said annular body; and means holding said cutter operatively on said head.

17. A rotary bit of the character described, including: a roller cutter having an axially aligned recess in one face thereof and a pin extending axially from the bottom of said recess; a cutter supporting head having an opening therein receiving said pin of said cutter and an annular body projecting into said recess around said pin; roller type thrust bearing means operative between the end face of said annular body and the bottom of said recess; roller type radial bearing means operative between the circumferential wall of said annular body and the side wall of said recess; and means holding said cutter in operative position on said head.

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