

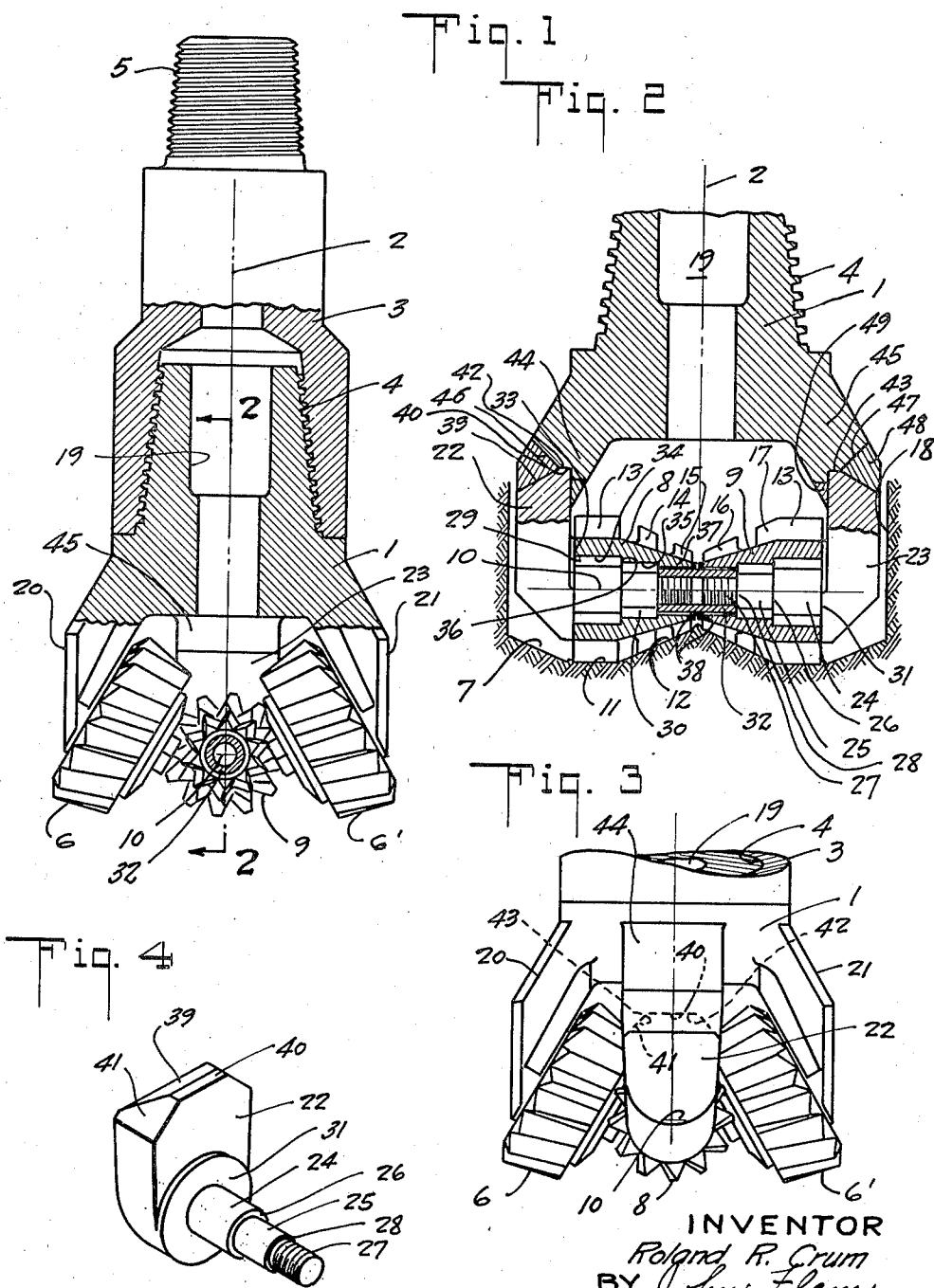
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R. R. CRUM

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ROLLER BIT STRUCTURE

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2,116,561

ROLLER BIT STRUCTURE

Roland R. Crum, Whittier, Calif., assignor of one-fourth to Edwin A. Perkins and three-eighths to Frank W. Brainard, both of Whittier, Calif.

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14 Claims. (Cl. 255—71)

This invention relates to a roller bit structure, and more particularly to a bit structure utilizing a plurality of rollers arranged to rotate about their own axes, transverse to the axis of rotation of the bit structure.

It is one of the objects of this invention to simplify the construction of roller bits of this character.

It is another object of this invention to improve the structure of the cutter supports.

It is still another object of the invention to provide a structure that is simple to assemble and that provides great sturdiness.

It is preferred to provide a transverse axial support upon which a plurality of rollers are supported. The contiguous end faces of the rollers are rather closely spaced adjacent the place where the transverse axis intersects the axis of the bit rotation, so that the possibility of a permanent core, axially disposed in the hole, is obviated. Indeed, the strains imposed upon these transverse cutters are such that these contiguous faces may be brought together to touch each other. It is another object of this invention to ensure against undue wear due to this rubbing contact.

This invention possesses many other advantages, and has other objects which may be made more easily apparent from a consideration of one embodiment of the invention. For this purpose there is shown a form in the drawing accompanying and forming part of the present specification. This form will now be described in detail, illustrating the general principles of the invention; but it is to be understood that this detailed description is not to be taken in a limiting sense, since the scope of the invention is best defined by the appended claims.

The process of manufacture referred to herein, is made the subject matter of a divisional application entitled "Roller bit structure", filed January 17, 1938, Serial No. 185,291.

Referring to the drawing:

Figure 1 is an elevation, partly in section of a bit structure embodying the invention;

Fig. 2 is an enlarged sectional view, taken along plane 2—2 of Fig. 1, the frame being shown as disposed in drilling position at the bottom of a hole being drilled;

Fig. 3 is a fragmentary elevation of the lower portion of the bit structure; and

Fig. 4 is a pictorial view of one of the arms utilized for supporting the transverse roller cutters.

The bit structure includes a frame 1 having an axis of rotation 2. This frame 1 is arranged to be disposed at the end of a drill string; and for

this purpose a coupling 3 is provided which joins the bit frame 1 to the drill string. The drill string is adapted, as is well understood, to be rotated at the top of the well by appropriate power mechanism.

The coupling 3 is joined to the frame 1 by the aid of the taper threaded socket 4, and is itself provided at its upper extremity with a tapered threaded extension 5 for coupling it to the bottom of a drill string.

In the present instance, the bit frame 1 is provided with a plurality of roller cutters arranged in general as disclosed in my prior application Serial No. 715,504 filed March 14, 1934. Thus in the present instance there are outside roller cutters 6 and 6', having downwardly directed axes converging toward the axis 2. These rollers are intended to contact with and cut along the sloping annular zone 7 (Fig. 2). Inside of this zone a pair of roller cutters 8 and 9 is disposed. These roller cutters are both adapted to rotate about an axis 10, transverse to the axis 2 and intersecting that axis. These cutters 8 and 9 are adapted to abraid or cut along the flat zone 11, as well as the upwardly projecting conical zone 12 forming the center of the bottom of the hole 18 being drilled.

The outside cutters 6 and 6' can be provided with any appropriately formed teeth or cutting elements, and are shown in this instance as carrying tapered V-shaped teeth. The cutters 8 and 9 can be provided with annular bands of V-shaped teeth, the outer bands 13 serving to cut along the annular surface 11. The other bands of teeth, such as 14, 15, 16 and 17 are closer to the axis 2 and disposed along a taper, and within a conical envelope to cut along the raised central portion 12 of the hole 18. These bands of tapered teeth 14, 15, 16, and 17 can cut along overlapping zones on the surface 12.

The frame 1 as well as the coupling member 3, is provided with a central axial opening or aperture such as 19 providing a water course for the bit.

The outside cutters 6 and 6' can be appropriately supported on their axes by the aid of a pair of side arms 20 and 21 integral with the frame 1. Such details of the bearing support for these outside cutters are described and claimed in an application entitled "Roller bit bearing structure" filed concurrently herewith in the name of Roland R. Crum, and having Serial No. 11,651 now Patent No. 2,061,141, granted November 17, 1936.

The manner in which the inside roller cutters 8 and 9 are supported can be best described in

connection with Figs. 2 and 4. For this purpose a pair of arms 22 and 23 is provided. Each of these arms has an inwardly projecting pin member comprising a large cylindrical portion 24 and a smaller cylindrical portion 25 separated by an abrupt shoulder 26. The end of this pin structure 24—25 is formed as a threaded extension 27 terminating in an abrupt shoulder 28. The cylindrical surfaces 24 and 25 serve as inner races for sets of roller bearings 29 and 30. Furthermore each of the arms 22—23 is provided with a flange or boss 31 providing an abrupt surface at the extremity of the larger cylindrical surface 24. The pair of pin structures 24—25 can be coupled together by a central coupling member or sleeve 32, threaded over both inner threaded portions 27. This coupling member 32 has abrupt end surfaces contacting at its ends with the abrupt surface 28 whereby it is assured that the two arms 22—23 and its associated elements are held in definite spaced relationship. The arms 22 and 23 during the assembly of the roller cutters are separate from the bit frame 1, and are later joined, after assembly of the roller cutters upon these arms, to the frame in a manner to be hereinafter described.

Each of the roller cutters 8 and 9 is provided with an abrupt end surface 33 abutting the flange 31. Each of the cutters is furthermore provided with a pair of internal cylindrical surfaces 34 and 35, the internal cylindrical surface 34 being separated from the smaller cylindrical surface 35 by an abrupt shoulder 36. These internal cylindrical surfaces form respectively the outer races for the roller bearings 29 and 30. The inner ends of each of the roller cutters 8 and 9 is provided with a projection 37 having a clearance aperture with respect to the coupling member 32.

The rollers 29 and 30 are confined against axial movement, as shown most clearly in Fig. 2, by a plurality of abrupt shoulders. Thus for example, the rollers 29 are confined between the surfaces 31 and 36; and rollers 30 are confined between the abrupt surface 26 and the corresponding abrupt extremity of coupling member 32, as well as the overhanging edge 37 of the inner end of the cutters. These roller bearings are of sufficient length and number to sustain adequately the radial forces imposed upon the cutters during the process of drilling.

Furthermore, since these forces may tend to bring the inner adjacent faces of the cutters 8 and 9 together in frictional or rubbing engagement, it is preferred to deposit hard wearing surfaces or layers such as 38 on these inner faces as by welding. Such hard wearing surfaces can be formed for example of tungsten carbide composition, now commonly used to impart wear resisting qualities to surfaces of this character.

The manner in which the roller structure can be assembled can now be set forth. First of all, each of the cutters 8 and 9 can be assembled with the rollers 29 and 30 and then the pin structure 24—25 can be passed into the cutters. When this is accomplished, the coupling member 32 can be turned in tightly on one of the threaded extremities 27. Then the threaded extremity 27 of the other arm can be inserted into the free end of the coupling member 32, and the entire arm 22 or 23 can be rotated to provide engagement of the threads between the coupling member and the threaded extremity.

After the transverse supported structure and cutters are so assembled, the arms 22 and 23 can be joined to the frame 1. It is preferred to ac-

complish this connection by welding. For this purpose each of the arms 22—23 can be provided with a sloping surface 39 connecting the outside surface of the arm with a narrow flat surface 40. The ends of this flat surface 40 are joined by slanting surfaces 41 to the sides of the arms 22—23. The surfaces 40 and 41 are arranged to contact respectively with corresponding surfaces 42 and 43 provided in the ends of the stubs 44 and 45 joined integrally to the frame 1. These surfaces 42 and 43 serve to define a socket for the upper end of the arm. It is of course understood that the contacting surfaces are machined in order to provide accuracy and definiteness to the spacing of the arms.

Furthermore each of the stubs 44 and 45 can be provided with upwardly slanting surfaces 46 and 47 defining with the surfaces 39 a tapered groove in which welded metal 48 can be built up to weld the parts together. The weld can be further strengthened by the welded in fillet 49 joining the inside surfaces of the arms 22—23 to the lower extremity of the stubs 44 and 45.

I claim:

1. In a roller bit structure, a bit frame, a pair of arms attached thereto, a transverse pin support secured to the arms, and roller cutters rotatably supported on the pin support, said pin support including a pair of radially inwardly extending members, secured respectively to the arms, and a central coupling member secured to the inner ends of the radially extending members to prevent relative movement of said members.

2. In a roller bit structure having a pair of supporting arms, a radial pin member secured to each of the arms, each pin member having an inwardly projecting portion, a central coupling member secured to both of the projecting portions, to prevent relative movement of the pin members and a roller cutter rotatably supported on each pin member.

3. In a roller bit structure having a pair of supporting arms, a radial pin member secured to each of the arms, each pin member having an inwardly projecting portion, as well as a cylindrical surface forming an inner roller race, a central coupling member secured to both of the projecting portions to prevent relative movement of the pin members, a roller cutter placed over each pin member, and having an internal cylindrical surface forming an outer roller race, and roller elements disposed between the races.

4. In a roller bit structure having a pair of supporting arms, a radial pin member attached to each of the arms, each pin member having an inwardly projecting portion, as well as a pair of cylindrical surfaces, of different diameters, the larger diameter surface being adjacent the arm, said surfaces forming inner roller races, a central coupling member connected to both of the projecting portions, a roller cutter placed over each pin member, and having internal cylindrical surfaces forming outer roller races corresponding respectively to the inner races on the pin members, and roller elements disposed between the races.

5. In a roller bit structure, a bit frame, a pair of arms welded to said bit frame, said arms having surfaces contacting with surfaces provided on the frame, one set of surfaces forming a socket for the other set of surfaces, a bearing support extending between the arms, and including a detachable central coupling member, and roller cutters rotatably supported on said bearing support.

6. In a roller bit structure, a bit frame, a pair

of arms welded to said bit frame, said arms having surfaces contacting with surfaces provided on the frame, one set of surfaces forming a socket for the other set of surfaces, a bearing support extending between the arms, and including a detachable central coupling member, as well as a pair of pin supports coaxial with the coupling member, and connected at their inner ends to the coupling member, and at their outer ends respectively to the arms, said coupling member having abrupt end shoulders cooperating with corresponding shoulders of the pin members, to maintain said arms in definite spaced relationship.

7. In a bit structure, a bit frame, means forming a transverse bearing support and supported on the frame, a pair of roller cutters relatively rotatably supported on the bearing support, and having inner adjacent faces adapted to be, at least at times, in rubbing contact with each other, and a wear resisting layer disposed over each of the adjacent faces.

8. In a roller bit structure, means forming a cylindrical bearing support, said support having a pair of different diameter cylindrical surfaces forming inner roller races, there being an abrupt shoulder between the two surfaces, a roller bit having a pair of different diameter internal cylindrical surfaces, forming outer roller races corresponding respectively with the inner races, said internal cylindrical surfaces being separated by an abrupt shoulder, said roller cutter having an overhanging edge defining an abrupt shoulder at the end of the internal cylindrical surface of smaller diameter, a set of rollers between the smaller diameter inner and outer races, said rollers being confined between overhanging edge and the abrupt shoulder formed on the cylindrical bearing support, a set of rollers between the larger diameter inner and outer races, said rollers being confined at one end of the rollers in one direction by the abrupt shoulder between the internal cylindrical surfaces of the roller cutter, and means forming a confining surface for the other end of said rollers.

9. In a roller bit structure, a bit frame, a pair of arms attached to said bit frame, a bearing support extending between the arms, and including a detachable central coupling member, as well as a pair of pin supports coaxial with the coupling member, and connected at their inner ends to the coupling member to prevent relative movement between the pin supports, and at their outer ends respectively to the arms, said coupling member having abrupt end shoulders cooperating with corresponding shoulders of the pin supports,

to maintain said arms in definite spaced relationship.

10. In a roller bit structure, a bit frame, a pair of arms attached to said bit frame, a bearing support extending between the arms, and including a detachable central coupling member, as well as a pair of pin supports coaxial with the coupling member, said coupling member having a threaded engagement with the contiguous ends of the pin supports.

11. In a roller bit structure, a bit frame, a pair of arms attached thereto, a transverse pin support secured to the arms, roller cutters on said support, each of said cutters having a plurality of internal cylindrical surfaces forming roller races of different diameters, and roller bearings contacting said surfaces and located between the cutters and the pin support.

12. In a roller bit structure, a bit frame, a pair of arms attached to said bit frame, a bearing support extending between the arms, and including a detachable central coupling member, as well as a pair of pin supports coaxial with the coupling member, and connected at their inner ends to the coupling member, to prevent relative movement between the pin supports, and at their outer ends respectively to the arms, said coupling member having abrupt end shoulders cooperating with corresponding shoulders of the pin supports, to maintain said arms in definite spaced relationship and roller bearing members between the cutters and the bearing support.

13. In a roller bit structure, a bit frame, a pair of arms attached to the frame, means forming a bearing support extending between the arms, a pair of cutters rotatably supported on the bearing support, each of said cutters having opposite ends of different diameters, the small end of each cutter being adjacent the axis of the bit, said bearing support being stepped to provide portions of different diameters, the portions of the greatest diameter being adjacent the arms.

14. In a roller bit structure, having a pair of supporting arms, a radial pin member secured to each of the arms, each pin member having an inwardly projecting portion, as well as a cylindrical bearing surface, a central coupling secured to both of said projecting portions, a roller cutter disposed over each pin member and having an internal cylindrical surface cooperating with the cylindrical surface of the pin to form a supporting bearing, each of said cutters also having a part extending in telescopic relation over the coupling member, and spaced radially therefrom.

ROLAND R. CRUM.