April 23, 1935. C. E. REED 1,999,131

EARTH BORING DRILL

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Fig. 1.

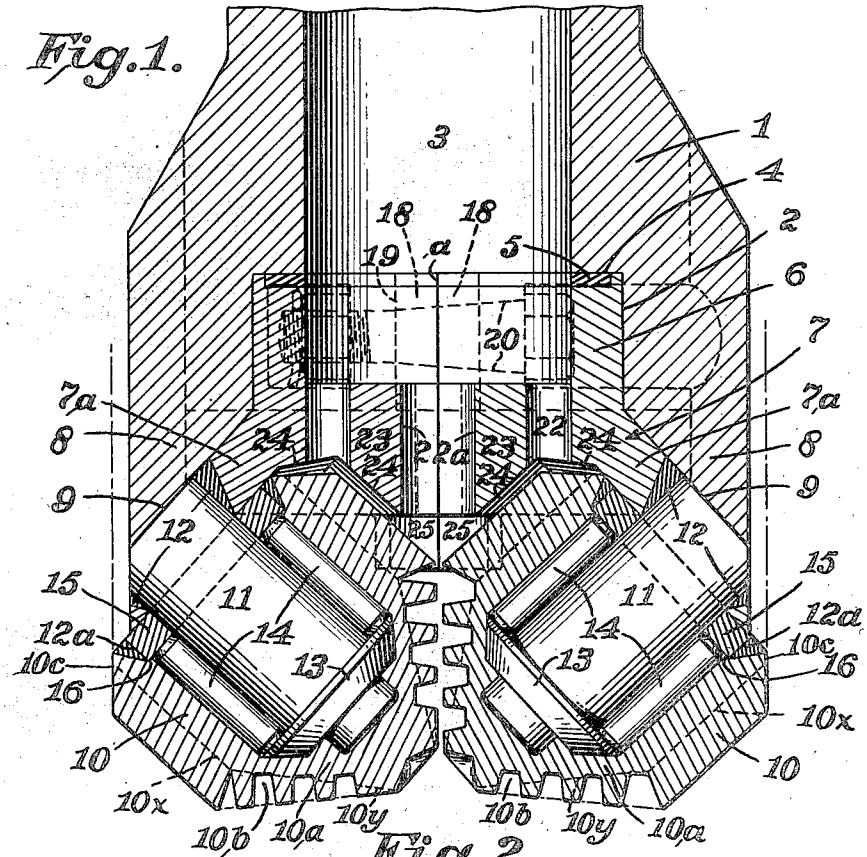
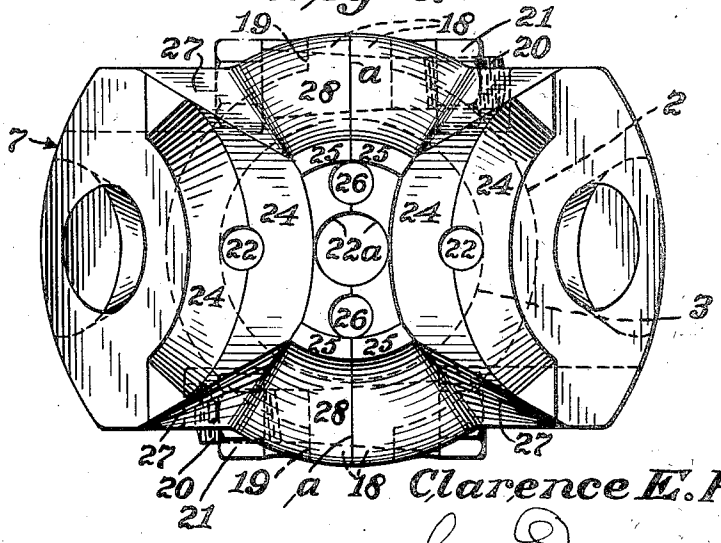


Fig. 2.



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Fig. 3.

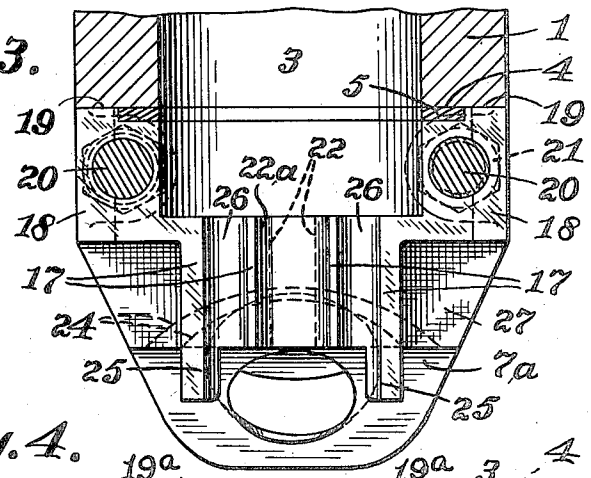


Fig. 4.

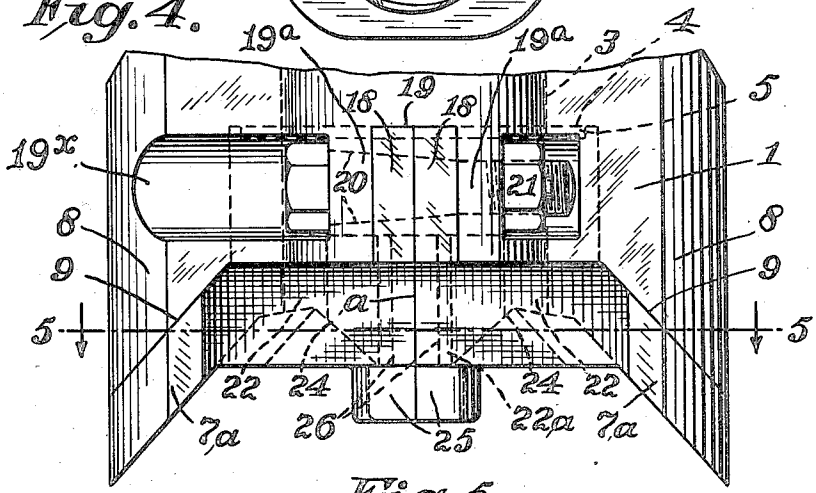
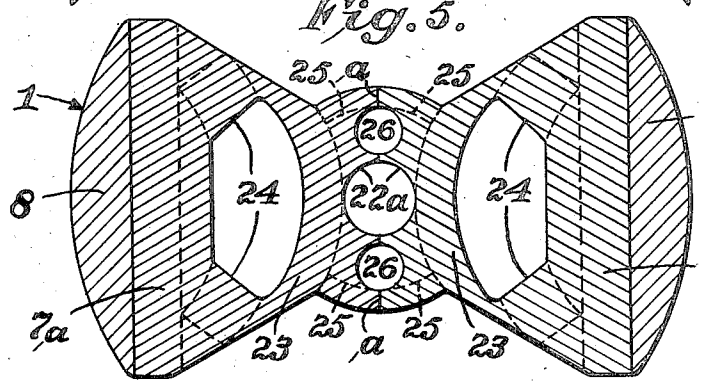


Fig. 5.



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UNITED STATES PATENT OFFICE

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EARTH BORING DRILL

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Application March 17, 1932, Serial No. 599,541

8 Claims. (Cl. 255—71)

The invention relates to earth boring drills of the type employing rotary toothed cutters removably mounted in a drill bit head and it consists in the features and combination and arrangement of parts hereinafter described and particularly pointed in the claims.

In the accompanying drawings:

Figure 1 is a central vertical section through a bit head carrying a roller cutter assembly.

Fig. 2 is a bottom plan view of Fig. 1 with roller cutters and spindles omitted.

Fig. 3 is a vertical section through a part of the bit head of Fig. 1 showing in elevation one of the sections of the cutter carrier members and with the roller cutter and its spindle omitted.

Fig. 4 is a side view of the lower portion of the bit head looking in the direction of Fig. 1 and showing a portion of the roller cutter carrier and the manner in which this sectional carrier is held to the bit head.

Fig. 5 is a sectional plan view on line 5—5 of Fig. 4.

In these drawings 1 indicates a bit head in one piece having a socket 2 centrally disposed therein which socket is of substantially cylindrical form. The bit head has a central bore 3 communicating with this socket and a shoulder 4 is provided upon which a suitable washer 5 bears to seal the joint between said shoulder and the upwardly extending cylindrical shank or upper part 6 of the roller cutter carrier which is indicated generally at 7. The end walls 8 of the bit head are carried down below the central socket 2 and these walls on their inner sides at 9 are flared downwardly and outwardly. The roller cutters comprise cylindrical base portions 10 and frusto-conical portions 10*a* at the inner ends of the cylindrical portions. These cutters are provided with teeth, the depth of which along the cylindrical portion of the roller cutter, is indicated by the dotted line 10*x* and the depth of the teeth on the frusto-conical portion of the cutter is indicated by the dotted line 10*y*. The teeth along the cylindrical portion of the cutter are derived by grooving the cylindrical surface longitudinally and the teeth at the frusto-conical portion of the cutter are derived by circumferential grooves such as 10*b* intersecting the radial grooves indicated by the dotted lines 10*y*.

The cutters are mounted on spindles 11 which incline downwardly and inwardly from the walls of the carrier member 7 so that the axes of these spindles converge at the vertical axial line of the bit head. The walls 7*a* of the cutter carrier are flared downwardly and outwardly and on their outer sides they find a bearing against the flaring walls 9 of the bit head. The axes of the spindles are at substantially right angles to these flaring walls 7*a* and said spindles are welded to these flaring walls integrally at the points 12.

The spindles at their inner ends are provided with flanges or abutments 13 extending circumferentially about the spindles and integral therewith. Between the spindles and the roller cutters, roller bearings 14 are interposed, which roller bearings at their inner ends contact with the abutments or flanges 13. At the bases of the roller cutters a ring 15 is mounted within the open end of the cutter which ring bears on a shoulder 16. The ring is welded in place as at 12*a* and the outer ends of the roller bearings contact with the inner faces of these rings. The frusto-conical portions of the roller cutters cover the inner ends of the spindles. The cutter carrier member is formed in sections divided from each other on a transverse plane cutting the vertical axis of the bit head, the line of separation being indicated at *a* in Figs. 1, 2, 4 and 5. The sections present flat contacting faces some of which are indicated at 17 in Fig. 3. In making the assembly, the roller cutters are slipped onto the spindles. The roller bearings are then inserted between the spindles and the roller cutters. The rings 15 are then placed in position and the welding is done at 12*a* to integrally unite the rings with the roller cutters and to retain the roller bearings in place. After these parts have been assembled the spindle is inserted in the opening in the wall of the carrier section and welded integrally in place at 12. From this assembly it will be noted that each section of the cutter carrier together with its integrally mounted spindle and roller cutter can be handled as one body for insertion into the bit head. Each section of the carrier is provided with a lug 18 and these lugs are received face to face within a lateral notch or opening 19 in the side walls of the bit head. The sections having been placed within the bit head with the lugs 18 assembled in the recess 19, a bolt 20 is inserted through a portion of the bit head and through the lugs or ears 18 and by turning a nut 21 the bolt will be drawn into position and being of wedge shape at the point where it passes through the lug 18, said lug will be drawn tightly into the recess 19. The tapered bolt finds bearings in the wall portions 19*a* defining the recess 19 at each side thereof. At the sides of these wall portions 19*a* are recesses 19*x* in the body of the

head. One of these side recesses receives the head of the bolt and the other of these recesses receives the nut 21 of said bolt which draws the parts into place by the action of the taper bolt thereon. This structure is best shown in Fig. 4.

The passageway or bore 3 of the bit head is adapted to conduct flushing fluid to the cutters and for this purpose the cutter carrier is provided with openings 22, one of which, as shown in Fig. 1, lies over the upper corner of the adjacent cylindrical base portion of the roller cutter so as to direct the flushing fluid to the upper ends of the teeth extending longitudinally of the cylindrical portions of the cutter. Each of the sections of the carrier has a semi-circular recess at the base portion which when the sections are brought together match each other and provide a centrally disposed conduit or nozzle member 22*a* which will direct the flushing fluid from the bore of the bit head centrally downward therefrom so as to impinge upon the teeth of the frusto-conical portions of the roller cutters adjacent the vertical axis of the drill and this centrally discharged flushing fluid will also impinge upon the bottom of the hole after scouring the teeth of the conical portions of the cutters. Each of the sections of the cutter carrier has a portion at 23 overhanging the adjacent toothed cutter and these overhanging parts of the carrier are formed with flaring walls indicated at 24 extending from the fluid flushing ports 22 so as to direct the flushing fluid along the teeth of the cutter. The central flushing fluid port 22*a*, besides directing the flushing fluid upon the teeth of the conical ends of the cutters also directs the flushing fluid upon the inner end portions of the teeth extending longitudinally of the cylindrical portions of the cutters.

There is also provided a depending skirt member 25 of segmental form upon each section of the roller cutter carrier so that when these sections are brought together the skirt sections 25 will match each other and as they lie with their inner walls substantially at the outer margins of the ports 26 leading down from the bore 3 of the bit head and through the upper portion of the sectional carrier, the flushing fluid passing down through these ports 26 will be directed by the depending skirt sections 25 so as to act upon the conical portions of the cutter to clear them of the material cut from the bottom of the hole. The portions of the cutter carrier which lie out beyond the depending skirt portions 25, flare laterally and upwardly at the points 27, 28.

The flaring walls 24 above mentioned define recesses which are indicated in Fig. 2 and conform in curvature substantially to the upper corners of the cylindrical tooth portions of the cutters.

Reverting to the roller bearing feature of the roller cutters it will be noted that these bearings are inserted into place between the spindles and the inner walls of the bore of the cutters without the employment of any ports or apertures in the wall of the cuter which, after the insertion of the anti-friction bearings into place, must be closed and thereby leave a more or less rough surface against which the roller bearings must contact.

In the present construction the roller bearings are inserted through the open end or base of the roller cutter and thereafter the ring 15 is placed in position and secured by welding.

From this construction it will be observed that all contacting surfaces of the roller bearings find an opposed contacting surface which is smooth throughout and in free from any roughness which would ensue if the roller cutter were inserted through an aperture, and some means used for closing this aperture after the anti-friction bearing member had been placed in position. It will be observed from Fig. 1 that the upper portion of the sectional carrier depends between the V-shaped opening formed by the upper edges of the cylindrical portions of the roller cutters and therefore this downwardly projecting central portion of the top or cross piece of the cutter carrier provides a nozzle formation through which the opening 22*a* extends so that the discharge point of the flushing fluid is brought low down in respect to the tooth parts of the roller cutters upon which the flushing fluid is intended to impinge.

The ports 26 deliver the flushing fluid at opposite sides of the cutters.

Certain features disclosed, but not claimed herein are claimed in a divisional application Ser. No. 707,977, filed on Jan. 23, 1934.

I claim:

1. In a roller boring drill having a plurality of cutters that cut the entire area of the bottom of bore hole, a carrier member having a bore at its upper end to receive flushing fluid, an axial fluid passage, extending down from said bore, other fluid passages located off center relative to the axis of the bore and delivering fluid into roller containing recesses in the lower face of the carrier member, said carrier having flaring walls for confining and directing the fluid to wash the cutter teeth and the bottom of bore hole, said carrier being adapted for mounting at the lower end of the drill stem.

2. A roller cutter carrier for earth boring drills formed in sections divided from each other in the plane of the axis of the drill, each of said sections having a roller cutter non-removably mounted thereon and each cutter comprising a toothed base portion and a frusto-conical portion, each section having a flushing fluid conduit and having a recess to receive the upper toothed portion of the base part of the cutter, said recess being defined by flaring walls between which the flushing fluid conduit discharges to be directed by said flaring wall onto the cutter teeth of the base section and another flushing fluid conduit at the axis of the carrier to direct the flushing fluid down along the teeth of the frusto-conical portions and upon the bottom of the hole, said sections fitting together to get a bearing one upon the other and means for holding the sections together in operation, substantially as described.

3. In a roller cutter earth boring apparatus, a bit head, a plurality of roller cutters having toothed surfaces, a carrier for said cutters having spindles upon which spindles said cutters are mounted inclining downwardly and inwardly towards the vertical axis of the apparatus, the said carrier having a downwardly flaring recess covering the top portion of the roller cutters, and flushing fluid ports in the carrier at the upper corners of the cutters to direct flushing fluid upon the upper ends of the cutter teeth to flow downwardly and inwardly along said teeth and an axial fluid port in the carrier to direct flushing fluid to the cutters between the same to the bottom of the hole, substantially as described.

4. In apparatus of the class described a rotary

bit head having a downwardly flaring recess, a cutter carrier in said recess having end walls, roller cutters mounted on the end walls, said carrier having laterally extending lugs from the sides of the carrier in a plane about midway between the cutters to fit up into notches in the sides of the bit head above the horizontal plane in which the cutters lie and conical bolts extending through said lugs and through portions of the bit head and having a wedging action to draw the said lugs up into said notches.

5. In a roller bit head having two cutters disposed to cut the entire area of the hole on bottom, a carrier member having a plurality of recesses in its lower face one above each cutter and individual thereto, a fluid outlet in each recess, and an axial fluid outlet, the carrier having lugs extending above the cutters and fitting notches in said head, and means securing the carrier in said head.

6. In a rotary earth boring apparatus, a body having a recess opening through the side, a roller cutter carrier having a lug positioned in said recess, said lug having a tapered bore therein, other recesses in the side of said body adjacent the first mentioned recess, a tapered bolt positioned in a plane transverse of the axis of the apparatus across said first mentioned recess within the tapered bore of said lug, and means within said other recesses securing said tapered bolt, said bolt having a wedging action drawing and rigidly securing said carrier to said body.

7. A rotary earth boring drill having a rotary toothed cutter, a bit head having a recess in its side, means in which the rotary cutter is mounted, having a lug fitting in said recess and a tapered bolt lying in a plane transverse to the drill axis and extending through the said lug and bearing in the walls of the bit head defining said recess, said bit head having recesses at the sides of said bearing walls, the head of the tapered bolt lying in one of said side recesses and the nut for drawing said bolt up into place lying in the other of said side recesses, substantially as described.

8. In a roller bit having a plurality of cutters disposed to cut the entire area of the bottom of the hole by acting on the bottom only and not partly on the side of the hole, a carrier member having a plurality of recesses in its lower face off center from the carrier axis, one for each cutter, a fluid outlet in each recess located immediately above the cutter teeth, and an axial fluid outlet, a depending wall between said recesses and the axial outlet, and downwardly projecting outer skirt walls confining the fluid under pressure to wash the cutter teeth and impinge on bottom of hole.

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