May 21, 1968 D. B. JUSTMAN 3,383,946

DRILL COLLAR

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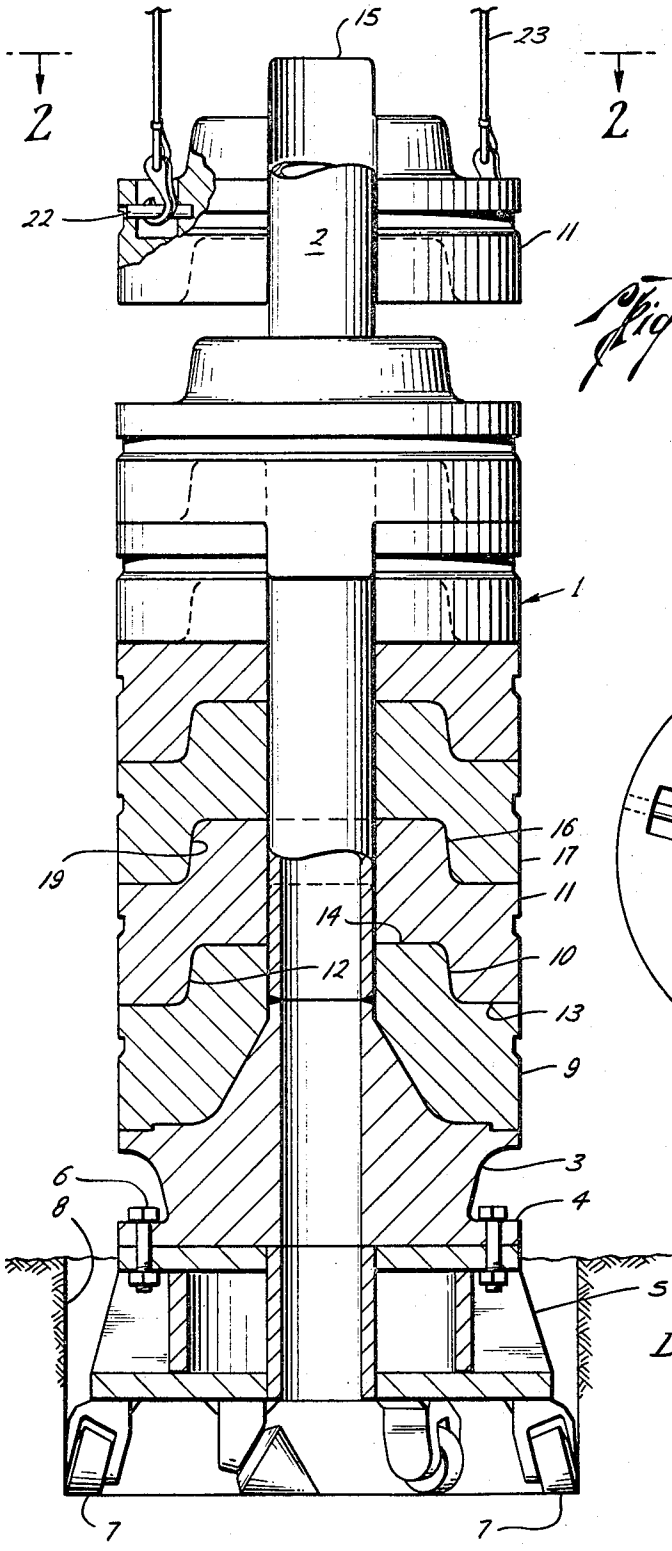
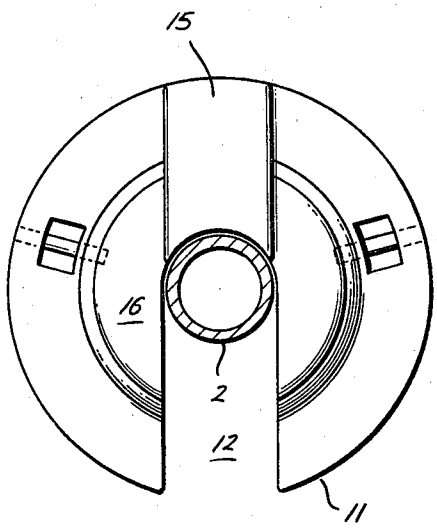


Fig. 1

Fig. 2



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DRILL COLLAR

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Fig. 3

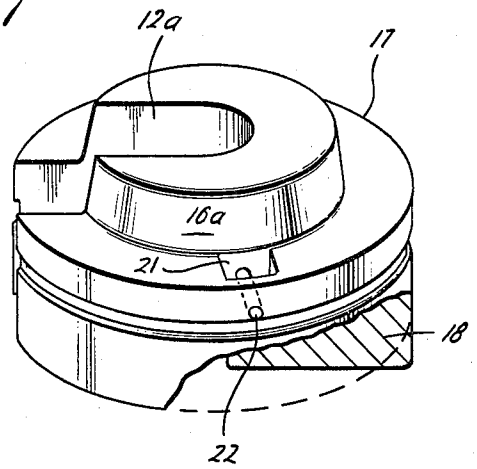


Fig. 4

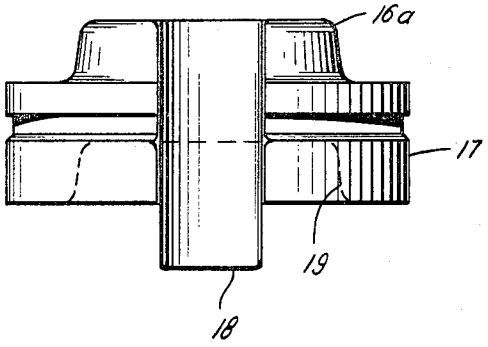


Fig. 5

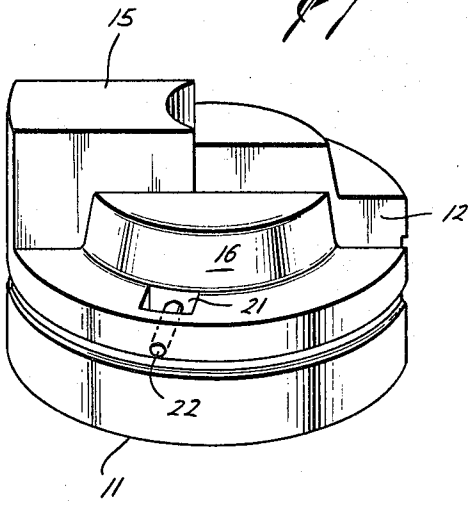
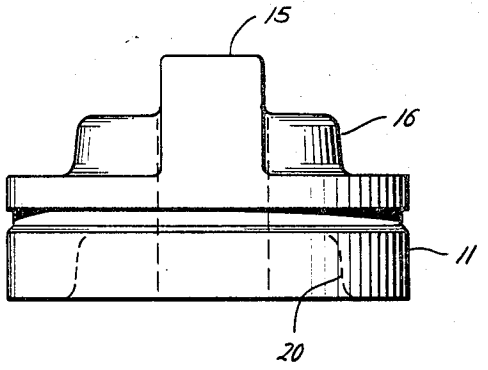


Fig. 6



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DRILL COLLAR

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ABSTRACT OF THE DISCLOSURE

In the making of large bore holes on the order, for example, of 48 inches to 72 inches in diameter for use in atomic bomb tests, vertical mine shafts, access bores and ventilation or excape shafts for mines, it is necessary to employ in the drilling procedure an enormous amount of drilling weight for use with the large drilling bit. The drill collar may weigh between 200,000 to 300,000 pounds and its diameter may be nominally 60 inches when employing a bit 72 inches in diameter. A drilling rig conventionally can accommodate only three drill collars connected end to end for a distance of 90 feet but said conventional collars thus connected would not provide the necessary weight for drilling large bore holes. The drill collar herein disclosed is intended for use under large bore hole conditions.

This invention relates generally to apparatus for drilling wells and more particularly to a drill collar for connection to the lower end of a drill stem.

In the rotary drilling of deep wells, it is customary to employ heavy drill collars connected to the lower end of a lighter drill stem, and to connect a drill bit to the lower end of the lowermost collar. The drill collars provide the necessary weight for drilling and, being on the lower end of a lighter and more flexible drill stem, the drill collars act as a "plumb bob," thus tending to make the drill bit drill straight.

The drill collar of the invention is particularly useful in the drilling of large bore holes since a large amount of drilling weight is desired for drilling with a large bit, but the limited axial room available in a drilling rig may not afford the necessary length required to supply the desired weight by connecting conventional drill collars end to end. In other words, a drill rig may, for example, accommodate only three collars connected end to end, which collars extend for a distance of approximately 90 feet. Three conventional collars thus connected would not provide the necessary or desired weight for drilling from the surface of the earth large bore holes on the order for example of 48 inches to 72 inches in diameter. Such large bore holes are commonly drilled for atomic bomb test devices, vertical mine shafts, access bores and ventilation or escape shafts for mines.

It is an object of this invention to provide a new and improved drill collar particularly useful in large bore holes.

Another object is to provide a new and improved drill collar to provide a large amount of weight concentrated close to the drill bit and to the bottom of the hole being drilled.

Another object of the invention is to provide a new and improved drill collar, having a central member or mandrel upon which is placed a number of separate weights.

Another object is to provide a new and improved drill collar, having a central member upon which separate weights may be placed and wherein some of the weights are keyed together.

Another object is to provide a new and improved drill collar having a central stem to which weights may be added to or removed from laterally thereof without the necessity of raising the weights over the top of the central member.

Another object to provide a new and improved drill collar for large bore holes which collar is efficient to operate and economical to manufacture.

Another object is to provide a new and improved drill collar for large bore holes which collar may be disassembled and transported to another drilling site and assembled at the new drilling site.

Another object is to provide a new and improved drill collar which may be disassembled so that the parts thereof may be shipped or transported separately on a number of trucks or the like.

Other objects will become apparent from the following description and the accompanying drawings in which:

FIGURE 1 is a side elevational view of the drill collar of the invention, partly in section, showing it in operating position with a drill bit attached to the bottom thereof.

FIGURE 2 is a view taken along line 2—2 in FIGURE 1.

FIGURE 3 is a pictorial view of one of the drill collar weights of the invention having a downwardly projecting boss.

FIGURE 4 is a side elevational view of the drill collar weight shown in FIGURE 3.

FIGURE 5 is a pictorial view of one of the drill collar weights of the invention having an upwardly extending boss.

FIGURE 6 is a side elevational view of the drill collar weight shown in FIGURE 5.

The drill collar of the invention as shown generally at 1, comprising a central tubular member 2, the top of which is adapted to be threadedly engaged into the lower end of a hollow drill stem (not shown).

A lower drill collar member 3 is shown welded or otherwise secured to the lower end of the tubular member 2. The member 3 is provided with a bolting flange 4. A drill bit 5 is attached to the bolting flange 4 by means of bolts 6. The drill bit 5 may have a number of roller cutter assemblies 7 attached to the lower end thereof to drill the formation being encountered during the drilling operation.

Drilling fluid such as air or water may be circulated downwardly on the drill stem (not shown) and through the tubular member 2 and through the bit 5 and thence upwardly to the surface of the earth in the annulus between the drill bit 5 and the drill collar 1 and the wall 8 of the bore hole being drilled.

Adapter 9 is shown installed upon the lower member 3. The upper portion of the adapter 9 has an upwardly extending conical projection 10. A first weight 11 is installed upon the adapter 9 and it has a conical recess 12 which is adapted to register with and fit over the conical projection 10 of the adapter 9.

As may be seen in FIGURE 5, the weight 11 has a side opening 12 which is of sufficient width to fit around the exterior of the tubular member 2. The weight 11 will have to be raised sufficiently so that the lower portion 13 thereof clears the upper portion 14 of the adapter 9. Then the weight is positioned so that the side opening 12 is aligned with the tubular member 2 and the weight is moved sideways until it is properly placed, whereupon the weight is then lowered to fit over the projection 10, as shown in FIGURE 1.

The weight 11 has an upwardly extending boss 14 thereon and has an upwardly extending conical portion 16 near the upper central portion thereof.

Referring to FIGURES 3 and 4, a second weight 17 is shown which is generally similar to the construction just described for the first weight 11 except that the weight 17 has a downwardly extending boss 18 which is adapted to fit within the side opening 12 of the first weight 11.

The second weight **17** has a side opening **12***a* and a conical portion **16***a* comprises the upper central portion of the weight **17**. The weight **17** has a conical recess **19** in the lower portion thereof which recess is adapted to engage and fit over the conical portion **16** of the weight **11**. The weight **11** has a conical recess **20** which is adapted to fit over the conical portion **16***a*.

Thus it will be apparent in the embodiment shown, the first weight **11** and the second weight **17** are keyed together by means of the extension **15** registering within the side opening **12***a* and the extension **18** of the weight **17** registering within the side opening **12** of the weight **11**. Also, as just described, the central conical portion of the weight **11** fits within the conical recess **19** of the weight **17** and as the weights are stacked, the conical portion **16***a* of the weight **17** will fit within the recess **20** of the weight **11**.

It will be apparent that the weights installed about the central member **2**, as just described, are also prevented from being dislodged laterally from the member **2** because of the registering of the portion **16** within the recess **19** and the portion **16***a* within the recess **20**.

The extensions **15** and **18** registering within the side openings **12***a* and **12** respectively also provide a structure where the space is substantially filled so that in the structure shown very little desired weight is lost.

If desired, the extensions **18** and **15** may be omitted and the weights simply may be stacked on one another about the central member **2**. With this arrangement, the drill collar will weigh less because the voids are not filled with the material of the weights.

Each of the weights **11** and **17** may have recesses **21** therein, and a lifting pin **22** extends across such recess to provide means whereby the weights may be lifted such as by the sling **23**, which is shown in FIGURE 1.

By way of example, the drill collar of the invention may weigh between 200,000–300,000 pounds, and the diameter of the collar may be nominally 60 inches when drilling with a bit, for example, 72 inches in diameter. The central member **2** may be on the order of 16 inches in diameter and having walls approximately 1½ inches thick. The metal of the weights may be cast steel, cast iron, lead or other suitable material so that sufficient and concentrated weight is provided for the bit in order that it may drill properly and straight. By way of illustration, each of the weights may weigh approximately 8,000–12,000 pounds, and the mandrel or central member **2** may weigh from 7,500–15,000 pounds.

A drill collar in accordance with the invention has the further advantage that it may be supported in a normal fashion from the top of the central member when installing or removing the weights therefrom since each of the weights is provided with a side opening. Thus the weight does not have to be lifted to the top of the central member **2**, which is about 30 feet long, in order to install or remove such weight from the central member.

The design of the invention has a further advantage of providing pairs of weights keyed together and does not require the use of separate locking devices. Further, since the drill collar as illustrated has pairs of weights keyed together, such pairs may move rotationally independently of the other pairs of weights on the drill collars.

The invention is not limited to the embodiment shown. Various changes within the scope of the following claims will become apparent to those skilled in the art.

I claim:

1. A drill collar comprising a central tubular member, retainer means on the lower end of said member, a plurality of circular weights each having a slot extending from its periphery inwardly thereof, and an axially extending upper portion, the lower central portion of each of said weights having a recess adapted to engage and register with the said axially extending portion of an adjacent weight when stacked thereon and adapted to prevent the weights from being disloged laterally from said central member.

2. A drill collar comprising a central tubular member, retainer means on the lower end of said member, a plurality of weights each having a slot extending from its periphery inwardly thereof, and an axially extending upper portion, the lower central portion of each of said weights having a recess adapted to engage and register with the said axially extending portion of an adjacent weight when stacked thereon.

3. A drill collar according to claim **2** wherein the said weights comprise cast metal.

4. A drill collar comprising a central tubular member, retainer means on lower end of said member, a plurality of weights stacked on said retainer and one another, each of said weights having a slot extending from its periphery inwardly thereof, the lower of adjacent weights having an upwardly extending boss fitting into the slot of the upper adjacent weight to substantially fill said slot, and the upper weight having a downwardly extending boss fitting into the slot of the lower weight to substantially fill said slot.

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