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(54) Shank adapter

(57) A shank adapter 12 for rock drilling is provided with an end form 50,58 which can accept either a drill

rod or a rock bolt, making the same adapter usable for drilling and for rock bolting.

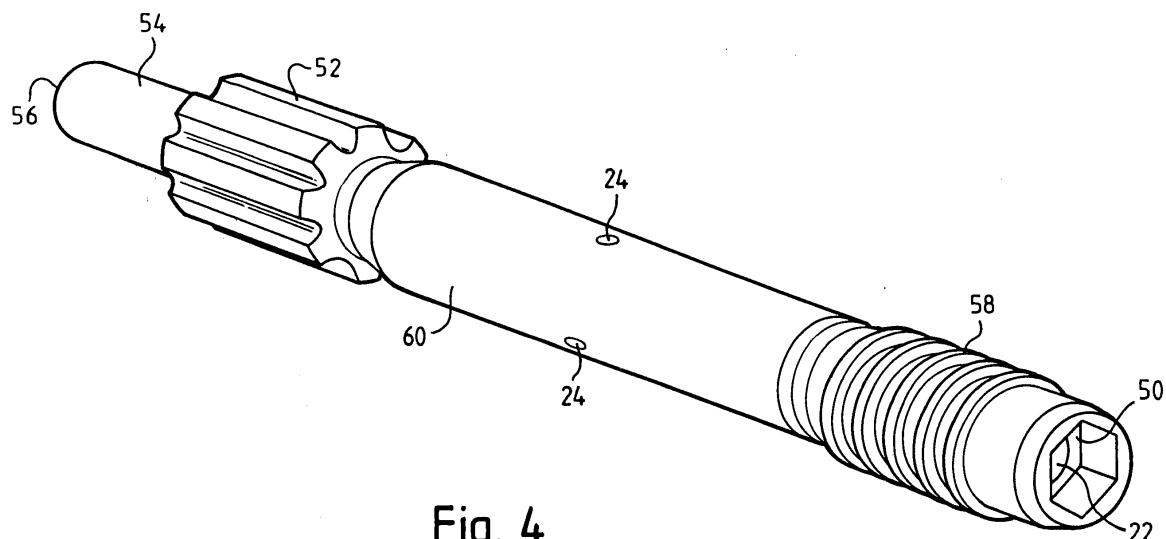


Fig. 4

Description

[0001] This invention relates to a shank adapter for use in rock drilling.

[0002] A shank adapter is conventionally used to connect a drill rod to a rock drill, particularly a rotary percussive rock drill.

[0003] The shank adapter transmits rotation and percussion from the drill to the drill rod. The shank adapter also has a central blind bore at the end for coupling to the drill rod and a radial bore which communicates with the axial bore. The external exit point of the radial bore (or bores) is surrounded by a water box through which flushing fluid is able to enter the radial and then the axial bores before passing along a bore down the axis of the drill rod to the drill bit to flush away debris created by the drilling operation.

[0004] Rock bolting is a technique used to stabilise rock faces, and is used particularly in mining. Rock bolting involves the insertion of a length of steel into a pre-drilled hole. The bolt is anchored in the hole, at least at the inner end of the hole and then a plate mounted at the outer end of the bolt is held against the rock face by tension in the bolt, so that the rock face is held back against the body of the rock.

[0005] Conventional technology for placing these bolts requires the use of a drill (with a shank adapter and a drill rod and a drill bit) to drill a hole. Once the hole has been drilled, a separate machine is lined up with the hole, and this separate machine inserts the rock bolt and sets the bolt in the hole. This process therefore requires two sets of machinery, one to drill the hole and a second to set the bolt.

[0006] By using a specially modified shank adapter, the inventors have now made it possible for both functions to be carried out by a single drill.

[0007] According to the invention therefore there is provided a shank adapter having a chuck end to be received in the chuck of a rock drill and a tool end, wherein the tool end has a coupling for receiving an end of a drill rod to be driven by a drill and an internal non-circular socket for receiving and driving an end of a rock bolt.

[0008] By using a shank adapter with these features, one and the same rock drill/shank adapter combination can first of all be coupled to a drill rod to drill the hole. The drill is then retracted, the drill rod disconnected from the adapter and a rock bolt coupled to the adapter in place of the drill rod.

[0009] Although it is possible for the adapter to have an internal thread for coupling with a drill rod, it is unlikely that sufficient strength could be achieved with such a design. It is therefore preferred for the coupling for the drill rod to comprise an external thread on the shank adapter for coupling to a drill rod with a female threaded end. Alternatively, when the drill rod has a male threaded end, the coupling may comprise an external thread on the shank adapter and a separate connector with internal threads at both ends for coupling the

drill rod to the shank adapter.

[0010] The external thread is preferably a rope thread, in particular an R55 rope thread.

[0011] The socket for receiving a rock bolt preferably comprises an axial bore extending into the adapter and communicating with an axial flushing fluid passage, and a non-round recess at the end of the adapter having a cross-sectional area greater than that of the bore.

[0012] The recess is preferably a hexagon recess, for receiving a conventional hexagonal nut threaded onto a threaded part of a rock bolt.

[0013] The axial bore in the adapter can have a larger diameter than the flushing fluid bore which extends through the adapter, with the bore diameter being such as to allow the threaded end of the rock bolt to travel up inside the bore whilst a nut on the threaded section is held against rotation in the hexagon recess.

[0014] The invention also provides a method of setting rock bolts in a rock face, wherein a hole is drilled in the rock face using a drill rod driven by a rock drill through a shank adapter, the drill rod is removed from the hole and is dismounted from the rock drill, a rock bolt is mounted on the same rock drill using the same shank adapter, and the bolt is run into the hole by the drill.

[0015] This method is preferably used in conjunction with an adapter which has a chuck end to be received in the chuck of a rock drill and a tool end, the tool end having a coupling for receiving an end of a drill rod to be driven by a drill and an internal non-circular socket for receiving and driving an end of a rock bolt. The drill rod is then coupled to the adapter coupling when the drill rod is being driven, and a rock bolt engages with the internal non-circular socket for receiving and driving an end of a rock bolt when the rock bolt is being run into the hole.

[0016] Still further, the invention provides rock bolting apparatus comprising a rock drill having a shank adapter as set forth above, means for alternately mounting a drill rod and a rock bolt to the shank adapter, and a magazine for storing a supply of rock bolts.

[0017] The invention will now be further described, by way of example, with reference to the accompanying drawings, in which:

45 Figure 1 shows a drilling rig arranged to drill a hole in a rock face;

50 Figure 2 shows the same rig as in Figure 1, but arranged to insert a rock bolt in the rock face;

55 Figure 3 is a side view of a shank adapter in accordance with the invention;

Figure 4 is a perspective view of the adapter of Figure 3; and

Figure 5 shows a shank adapter coupling for use with the adapter of Figure 3.

[0018] Figures 1 and 2 show the invention in practice. A drill 10 carries a shank adapter 12 (indicated only schematically in Figures 1 and 2 but shown in detail in Figures 3 and 4). A splined portion 14 of the adapter fits inside a chuck which includes a splined bushing 16 and a guide bush 20. A mechanism (not shown) is provided to rotate the bushing 16. A reciprocating piston 18 provides percussive impacts to the adapter. As the piston reciprocates, it strikes the end of the adapter. Through these two mechanisms, the adapter is simultaneously rotated and hammered in the direction of drilling.

[0019] It is a requirement of rock drilling that a flushing fluid be fed through the drill string to the bit to flush away debris from the cutting face of the bit. This debris is in the form of broken rock, which is to be flushed to the surface of the body of rock in which a hole is being bored. This flushing is necessary both to cool the bit and to remove broken rock to enhance the efficiency of drilling.

[0020] The adapter (and all components in the drill string) have a central bore 22 for the passage of the flushing fluid. The fluid (which is conventionally a water/air mixture) enters the adapter through a flushing hole 24. When the adapter is in position in the drill, the flushing hole is located within a water box 26, both ends of which are closed by seals 28. The flushing fluid introduced into this box enters the bore 22 through the hole 24, whatever the rotational position of the adapter within the box.

[0021] Figure 1 shows a drill rod 30 which has an internally threaded collar 32 to be screwed onto a threaded end 34 of the adapter. The rod has a drill bit 38 screwed onto the other end of the rod. When the rod is connected to the adapter, the drill is set in operation. The drill simultaneously rotates the rod and the bit, advances it against a rock face 36 and applies percussive blows to the shank adapter which are transferred along the length of the rod to the bit to drill a hole in the rock. As the hole gets deeper, the rod can be extended by inserting other rods into the drill string, in a known manner.

[0022] Figure 2 shows the hole 40 which has been drilled by the drill rod 30. A rock bolt 42 is now to be inserted in that hole.

[0023] The rock bolt 42 consists of a length of rod threaded at one end 44 and with a plate 46 held onto the rod by a nut 48.

[0024] The bolt is connected to the adapter 12 by inserting the threaded end of the bolt into the bore 22 until the nut 48 comes to lie in a correspondingly shaped recess 50 (see Figures 3 and 4) in the end of the adapter. The feed mechanism of the drill 10 then advances the rod 42 in to the hole 40.

[0025] Various mechanisms are known for securing the rod 42 in the hole, and those mechanisms form no part of this invention. One commonly used mechanism involves placing a settable chemical composition in the hole with the entry of the rod into the hole serving to

carry the composition to the bottom of the hole. Movement (including rotation) of the rod in the hole then mixes together the different components of the composition so that the composition sets and anchors the rod in the hole. However other securing mechanisms such as expandable anchors can also be used.

[0026] Once the rod has been anchored in the hole, the nut 48 is run up the thread 44 to press the plate 46 against the rock face and to thereby place the rod in tension. This helps to secure the rock face.

[0027] Figures 3 and 4 show the shank adapter 12 in more detail. The adapter has a splined area 52 from which a tail 54 extends, the tail ending in a struck face 56. In some designs of shank adapters, the tail is very short or non-existent, and the particular shape will depend upon the design of the drill into which the adapter is to fit. The splined area fits into the splined bushing 16 in the rock drill 10, so that the rotation of the drill can be transmitted to the adapter.

[0028] The opposite end of the adapter has a male thread 58, onto which a drill string component can be screwed, using an industry standard thread form. This end of the adapter has a central bore 22a,22b which ends in a hexagonal recess 50. The larger diameter part 22a of the central bore will be sufficiently wide to allow the threaded end 44 of the rod 42 to enter. However the smaller diameter part 22b will be smaller than the rod diameter, so that the rod will only be able to enter the adapter up to the step between the parts 22a and 22b of the bore 22.

[0029] The adapter shown has three flushing holes 24 arranged equidistantly around the adapter periphery. The holes intersect the bore 22 at an angle, as can be seen in Figure 3.

[0030] The drill rod 30 shown in Figure 1 has a female threaded collar 32 which will screw directly onto the male thread 58. However some drill rods have male threads at both ends. Figure 5 shows a coupling joint 62 with a first female threaded socket 64 to be screwed onto the male thread 58 on the adapter, and a second female threaded socket 66 into which the rod end can be screwed.

[0031] It is however possible, and within the scope of the invention, to provide a female thread in the bore 22a of the adapter, although it is envisaged that this would be difficult to manufacture and would reduce the strength of the adapter.

[0032] The adapter design described here allows one and the same adapter to be used for drilling and for rock bolting, thus avoiding the need for two machines or for time consuming tool changes or tool realignment between these two operations (which naturally follow one after the other).

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Claims

1. A shank adapter having a chuck end to be received

in the chuck of a rock drill and a tool end, wherein the tool end has a coupling for receiving an end of a drill rod to be driven by the drill and an internal non-circular socket for receiving and driving an end of a rock bolt.

2. A shank adapter as claimed in Claim 1, wherein the coupling for a drill rod comprises an external thread on the shank adapter for coupling to a drill rod with a female threaded end. 10

3. A shank adapter as claimed in Claim 1, wherein the coupling for a drill rod comprises an external thread on the shank adapter and a separate connector with internal threads at both ends for coupling a drill rod with a male threaded end to the shank adapter. 15

4. A shank adapter as claimed in Claim 2 or Claim 3, wherein the external thread is a rope thread. 20

5. A shank adapter as claimed in Claim 4, wherein the external thread is an R55 rope thread.

6. A shank adapter as claimed in any preceding claim, wherein the socket for receiving a rock bolt comprises an axial bore extending into the adapter and communicating with an axial flushing fluid passage, and a non-round recess at the end of the adapter having a cross-sectional area greater than that of the bore. 25 30

7. A shank adapter as claimed in Claim 6, wherein the recess is a hexagon recess.

8. A shank adapter as claimed in Claim 6 or Claim 7, wherein the axial bore has a larger diameter than the flushing fluid bore which extends through the adapter. 35

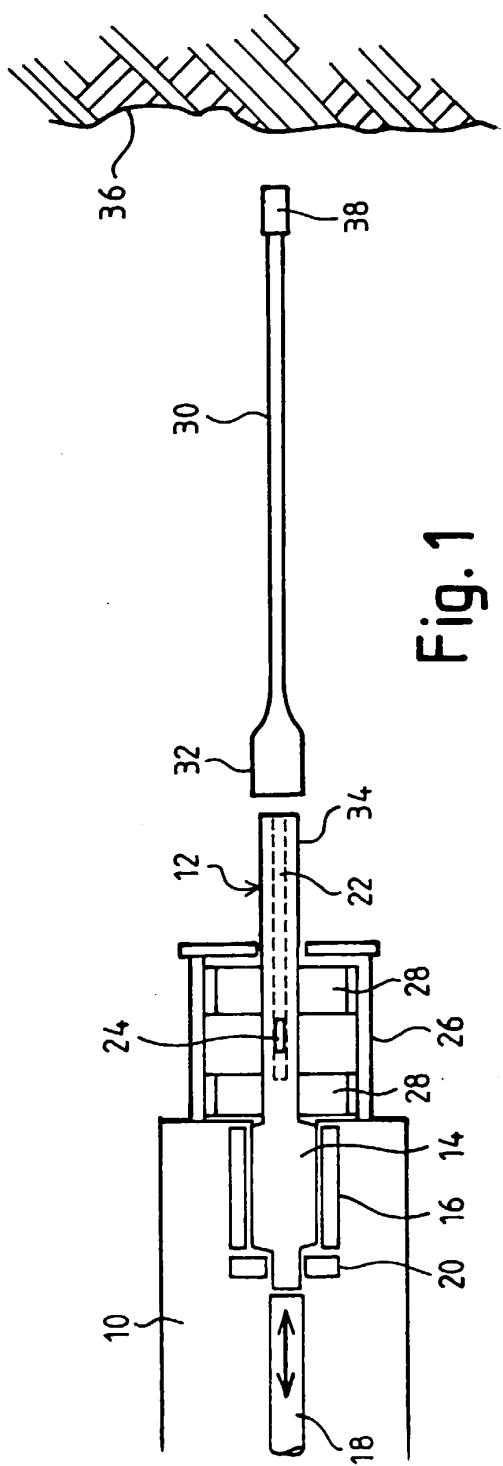
9. A method of setting rock bolts in a rock face, wherein in a hole is drilled in the rock face using a drill rod driven by a rock drill through a shank adapter, the drill rod is removed from the hole and is dismounted from the rock drill, a rock bolt is mounted on the same rock drill using the same shank adapter, and the bolt is run into the hole by the drill. 40 45

10. A method as claimed in Claim 9, wherein the shank adapter is as claimed in any one of Claims 1 to 8, and wherein the drill rod is coupled to the adapter coupling when the drill rod is being driven, and a rock bolt engages with the internal non-circular socket for receiving and driving an end of a rock bolt when the rock bolt is being run into the hole. 50 55

11. Rock bolting apparatus comprising a rock drill having a shank adapter as claimed in any one of Claims 1 to 8, means for alternately mounting a drill rod and

a rock bolt to the shank adapter, and a magazine for storing a supply of rock bolts.

12. A shank adapter substantially as herein described 5 with reference to the accompanying drawings.



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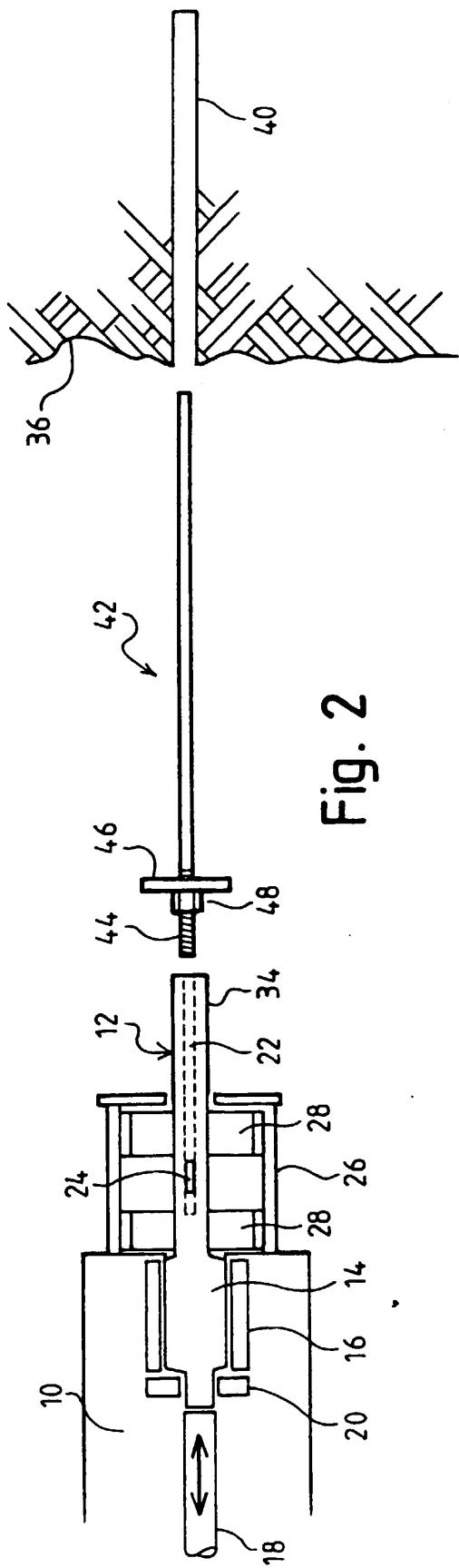


Fig. 2

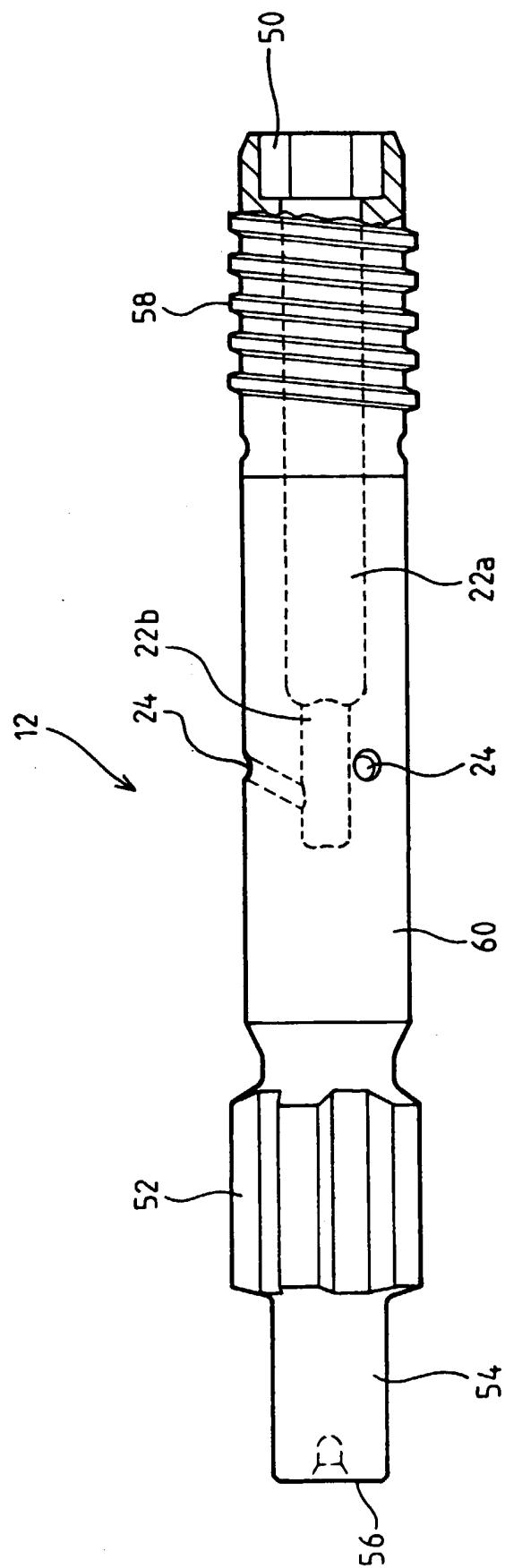


Fig. 3

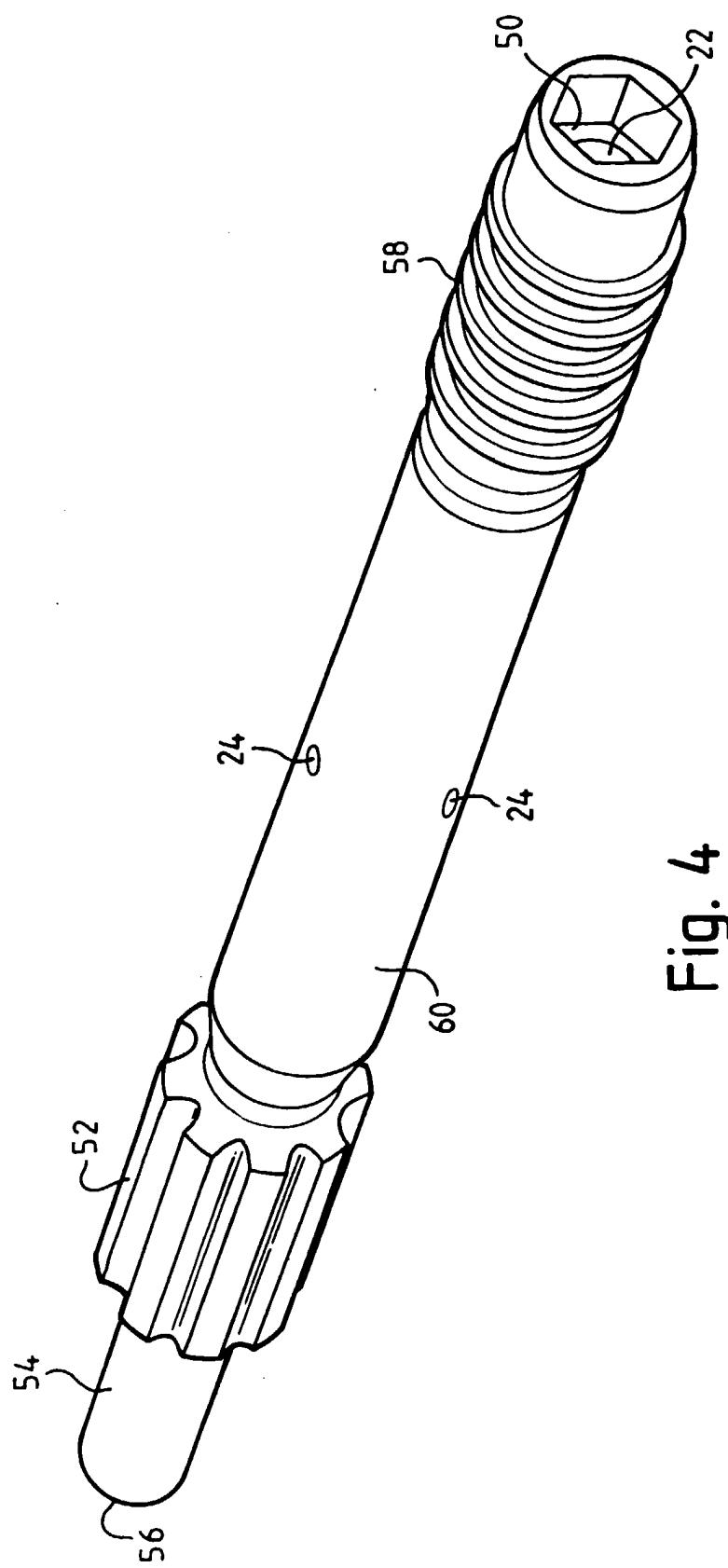


Fig. 4

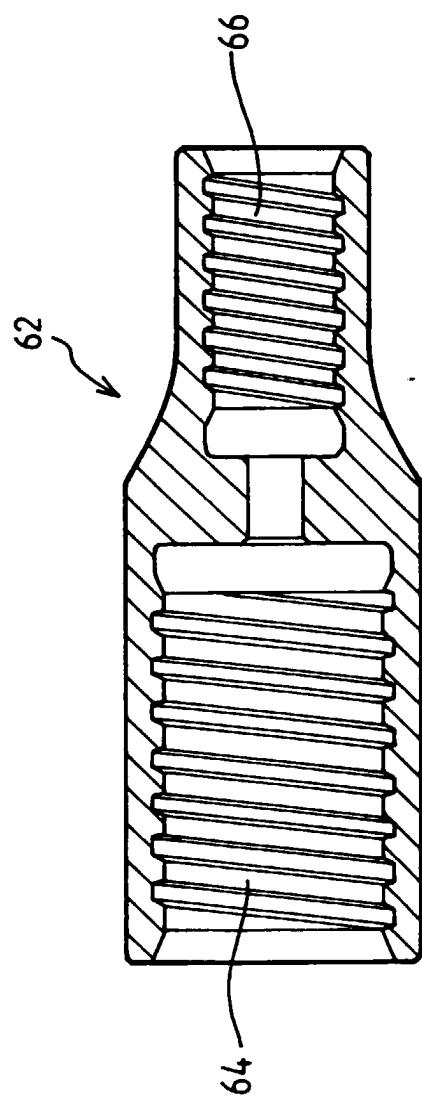


Fig. 5



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EUROPEAN SEARCH REPORT

Application Number
EP 00 30 6588

DOCUMENTS CONSIDERED TO BE RELEVANT			CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	
A	EP 0 883 733 A (BOART LONGYEAR LTD) 16 December 1998 (1998-12-16) * paragraph '0016! - paragraph '0017! *	1-12	E21B6/00 E21B19/08 B25D17/00
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			TECHNICAL FIELDS SEARCHED (Int.Cl.7)
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<p>The present search report has been drawn up for all claims</p>			
Place of search	Date of completion of the search		Examiner
THE HAGUE	12 October 2000		Garrido Garcia, M
CATEGORY OF CITED DOCUMENTS			
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document			
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**ANNEX TO THE EUROPEAN SEARCH REPORT
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EP 00 30 6588

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12-10-2000

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