Jan. 10, 1961 G. L. ADAMS 2,967,724

AIR DRILL STEM

Filed May 8, 1957 3 Sheets-Sheet 1

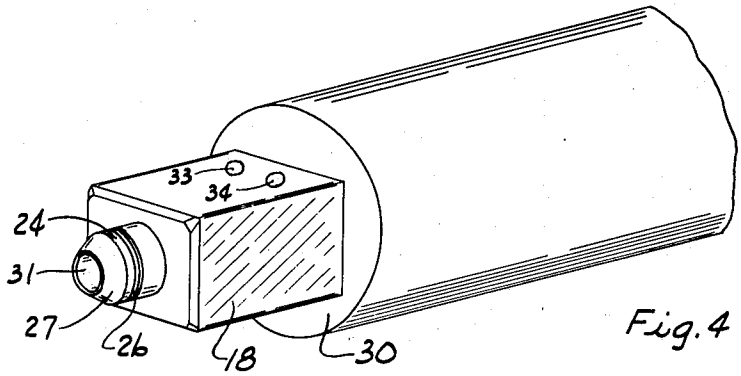


Fig. 4

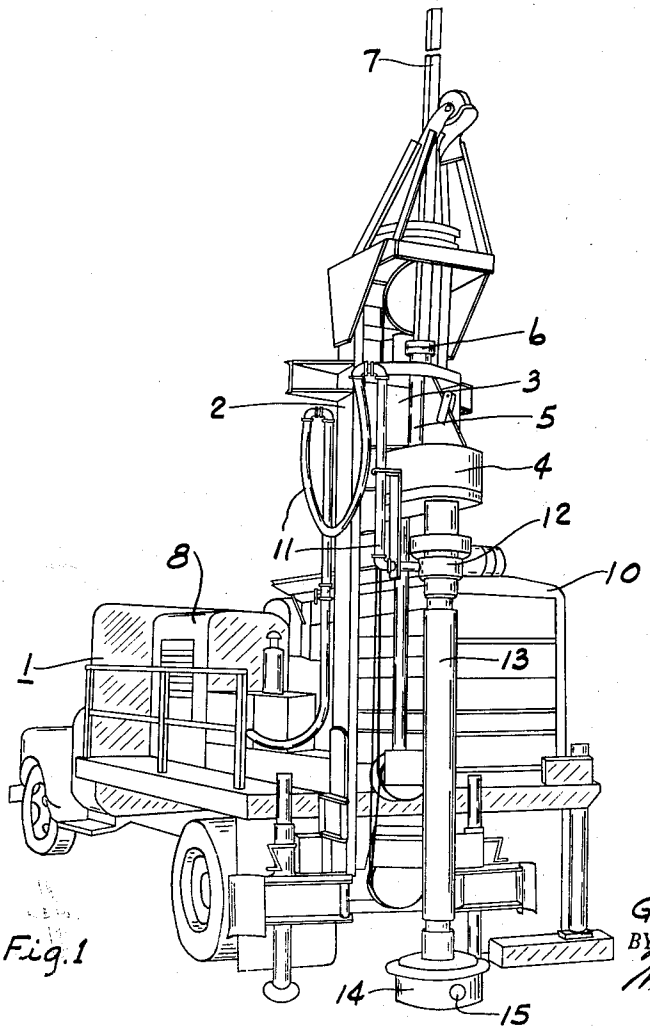


Fig. 1

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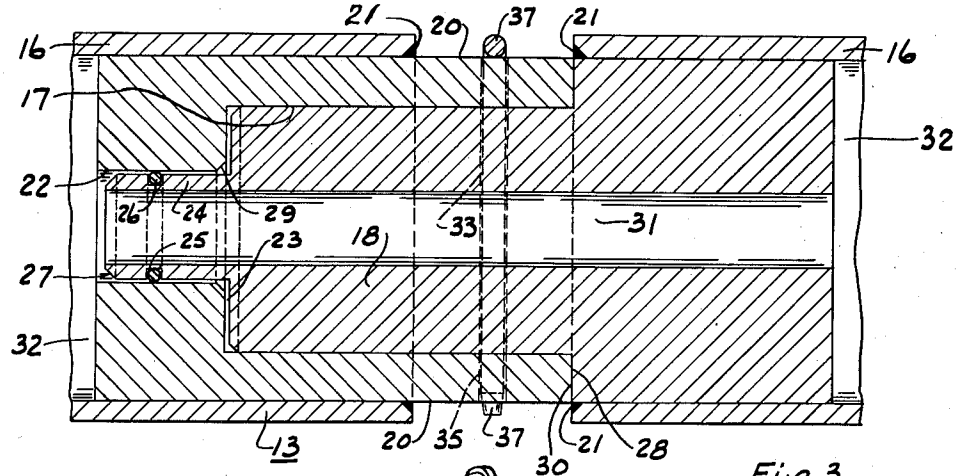


Fig. 3

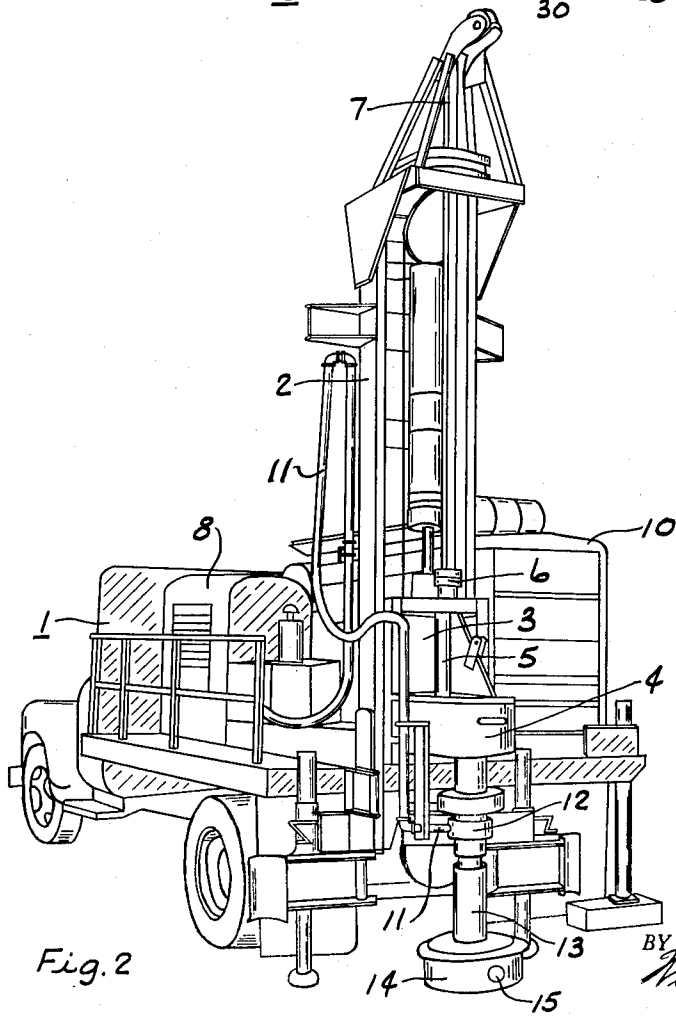


Fig. 2

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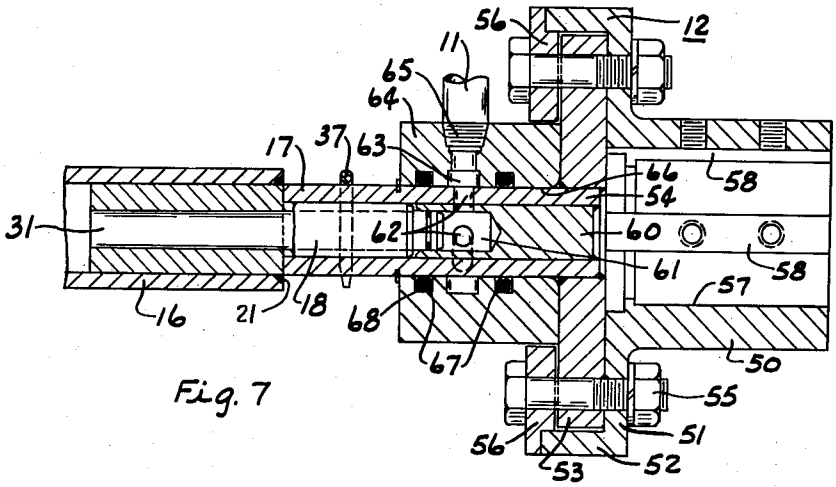


Fig. 7

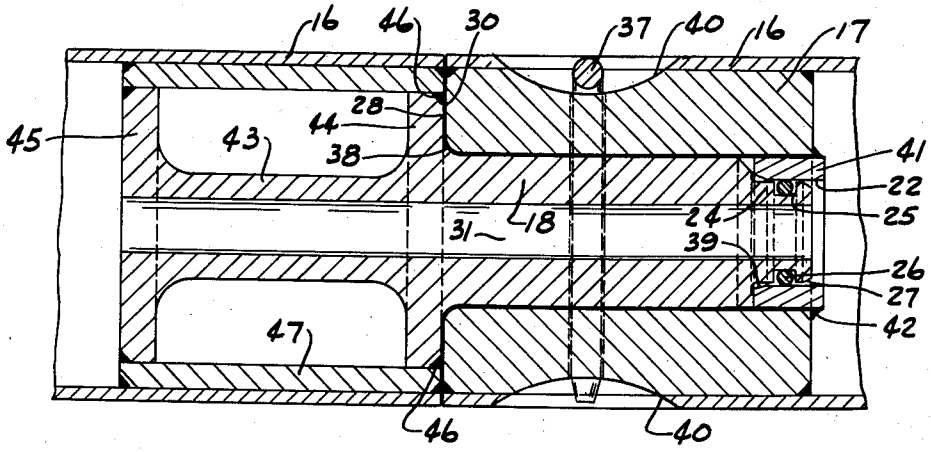


Fig. 5

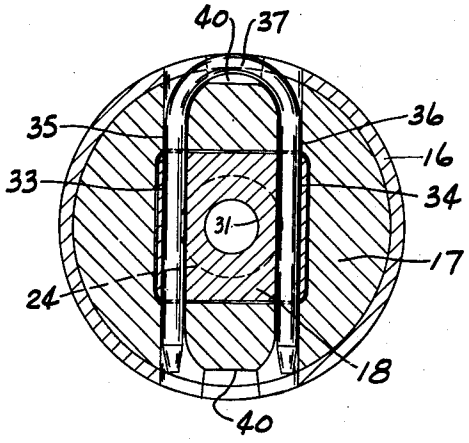


Fig. 6

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2,967,724

AIR DRILL STEM

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6 Claims. (Cl. 285—330)

This invention relates generally to earth boring of shot holes and the like and more particularly to the use of air under pressure while drilling to clean out the shot hole, together with an improved drill stem with a non-round drill stem joint for the transmission of air to the bit to clean out the hole.

Boring shot holes in strip mine overburden with a bit and auger structure presents many problems when it is necessary to drill through certain heavy shale and rock. The small pick-point bits used for auger drilling take a long time to cut or chip through the rock and they frequently break off. A bit having rotary gear type teeth will cut the rock much faster but requires air for cleaning hole and cooling of bit to prevent bit binding. Again threaded joints in the drill string requ.re special tools to make up the same and they are readily injured.

Cuttings are removed from auger drilled holes by the continuous application of compressed air. This presented another problem. The auger sections driving the bit remove the cuttings and allow the compressed air to escape without functioning for this purpose. Again the auger sections did not provide sufficient weight on the bit.

These problems were solved by dispensing with the auger sections and replacing them with a large cylindrical stem section that has more weight than the auger and has only a small amount of clearance in the hole than that permitted by the auger. This restriction for the full length of the stem to the bit increased the velocity of the discharge air and permitted the cutting to be continuously discharged.

The restriction created by the clearance between the hole and the cylindrical stem also reduced the required capacity of the air compressor to flow the cuttings from the hole. This permitted the use of a smaller and less expensive motor and compressor.

Another object of this invention is the provision of improved nonround joints between the stem sections that permit a quick means for coupling and uncoupling the stem sections, and a seal for the air passing through these joints. This seal provides an O-ring on cylindrical concentric projections that are protected by a large shoulder on the nonround joint members when not in use and when inserted in a socket for use. The nonround pin and socket members making up this improved joint may be rotated in either direction and transmit power without becoming disjointed.

Other objects and advantages appear hereinafter in the following description and claims.

The accompanying drawings show for the purpose of exemplification without limiting the claims thereto a practical embodiment illustrating the principles of this invention wherein:

Fig. 1 is a view in vertical section of a vertical drilling rig.

Fig. 2 is a view similar to Fig. 1 with the drilling rig at a different position.

Fig. 3 is an enlarged sectional view of the joint between stem sections.

Fig. 4 is an enlarged perspective view of a seal on the end of a stem section.

Fig. 5 is an enlarged sectional view of a modified form of stem sections.

Fig. 6 is a transverse sectional view through the shank and socket taken along the plane of the locking pin.

Fig. 7 is a sectional view of the air coupling.

Referring to Fig. 1 of the drawings the truck **1** has pivotally mounted thereon the frame **2** which slidably supports the carriage **3** on which is mounted the reduction gear box **4**. The drive shaft **5** extends from the top of the carriage and is connected by the coupling **6** to the bottom of the square Kelly bar **7**. The Kelly bar **7** is slidably mounted in the rotary mating socket driven by a drive shaft that extends upwardly from the engine **8** mounted on the truck bed. The second engine **10** actuates a compressor for supplying air under pressure at 315 cubic feet per minute to the hose and pipe **11** that is connected through the coupling **12** to the drill string **13**, the bottom of which carries a rotary bit to cut a hole seven and three-fourths inches or eight and three-fourths inches when the outside diameter of the stem is seven and one-quarter inches. A head **14** is in the form of a metal can having a flexible rubber collar around the drill stem which is placed over the hole. A discharge hole **15** in one side of the can permits the cutting to be blown from the head.

As shown in Fig. 3 the drillstring **13** is made up of consecutive tubular sections of stems **16** each having a square socket **17** in one end and a mating pin **18** on the other end. The socket may be formed from stock which is cylindrical as indicated at **20** and welded to the tube **16** as shown at **21**. A cylindrical bore **22** is provided at the inner end of the square socket **17**.

The male or mating pin member **18** is square in cross section and is not as long as the socket is deep to provide the clearance **23** between the bottom of the socket and the end of the square section **18**. The end of the pin **18** has a cylindrical nose **24** that fits the bore **22** with a sliding clearance. The nose **24** has an annular groove **25** to receive the O-ring **26** or similar type sealing member that is deformed in the bore **22** and seals therewith. The diameter of the nose **24** is about half the dimension of a square side of the pin **18**. The annular groove **25** on the cylindrical nose **24** is located about halfway along the length of the nose. Thus the O-ring is protected when the pin is in the open. The end of the nose is beveled as indicated at **27** to ward off anything that engages the same so that it will not injure the O-ring. The end of the square pin **18** is likewise beveled as shown at **27** for the same purpose. Thus when the pin **18** is hoisted for stabbing the socket **17** of the last drill stem in the string, these beveled edges cause the section to glance sideways and thus avoid injury to the O-ring and the cylindrical and flat faces of the nose and pin.

The end **28** of the cylindrical portion of the socket **17** has butting engagement with the shoulder **30** of the base of the pin. This is the gauge that forms the clearance **23** at the outer end of the pin. This shoulder is visible and any dirt that may be lodged thereon can easily be seen and brushed off before stabbing the joint.

The bore **31** of the pin provides the compressed air passage from one section **16** to the other. Although the pin and socket sections **18** and **17** are made up and welded in the opposite ends of the shell or casing **16**, the stem could be made from solid tubular stock having the bore **31**. This would eliminate the large chambers **32** between the end of each section.

Each pin **18** has a pair of spaced holes **33** and **34** which pass transversely through the pin and are spaced from the bore **31**. The socket **17** also has the holes **35** and

36 which are aligned with the holes 33 and 34 when the shoulders 28 and 30 abut, for receiving the hair pin lock 37. In the structure of Figs. 1 to 4 the shells or casings 16 of adjacent sections are spaced from each other which exposes the bend of the hair pin on one side and the ends on the other so one can tap the same with a hammer to insert or remove the hair pin.

In the structure of Figs. 5 and 6, the shells 16 of adjacent sections abut each other at the shoulders 28 and 30 and the corner is filleted at 38. The socket 17 is provided with an arcuate slot 40 to permit the tine of a hammer to pry under the hair pin 37. This structure thus provides a wider shoulder bearing at 28 and 30 and eliminates the external annular space that clogs with dirt. The cylindrical bore 22 is formed in the externally squared sleeve 41 that is slid into the socket 17 and is welded as indicated at 42. The edge of the bore 22 is beveled as shown at 39. The inner end of the pin 18 is made in the shape of a spool 43, the flange 44 forming the shoulder 30 and the flange 45 providing the other end of the spool. Both spool flanges are welded as indicated at 46 to the bore of the sleeve 47 which in turn is welded to the cylindrical casing 16.

The swiveled seal coupling 12 shown in Fig. 7 comprises the flange socket 50 having a flange member 51 with an annular rim 52 to enclose the driving flange 53 welded to the nonround driving socket 54. The flange 53 is bolted in place by the bolts 55 which pass through the retaining plate 56. Thus the flange has some wobbling play in the chamber formed by the rim 52. This may take care of small misalignments in the drill string when boring. The flange socket 50 is provided with bore 57 having the key ways 58 to receive the drive shaft.

The socket 54 has the nonround plug 60 welded therein to provide the cylindrical bore 61 to receive the mating nose 24 and its O-ring seal 26. The bore 61 has at least three lateral holes 62 that also pass through the walls of the socket 54 and connects with the annular chamber 63 in the stationary block 64. A threaded passage 65 connects with the pipe 11 to supply compressed air to the bore 31 of the pin on the first section of the drill stem. The outer surface of the socket 54 is cylindrical and has a rotary fit in the bore 66 of the block 64. Two annular sealing grooves 67 are provided in the bore 66 on opposite sides of the chamber 63 and are provided with O-ring seals 68 which may be of the quadraform, to seal the compressed air from escaping as the socket 54 rotates in the block 64.

I claim:

1. A stabbing joint between sections of an earth boring drill string the sections of which comprise an outer cylindrical tube, an exposed concentric nonround pin on one end of said tubes, an exposed nonround socket on the other end of said tubes to receive said pin in driving mating engagement, an annular radial abutment between the end of said socket and said pin to hold the end of said pin in spaced relation from the bottom of said socket, a cylindrical projection on the end of said pin and smaller in diameter than said pin and concentric therewith, a small complementary cylindrical socket coaxially and inwardly of said nonround socket to receive said projection with clearance therebetween, an annular groove in the cylindrical portion of said projection, an annular elastomer ring in said groove and engaging said cylindrical socket, said pin and projection and said socket having a passage therethrough sealed by said elastomer, and a beveled end on said cylindrical projection.

2. The stabbing joint of claim 1 characterized in that said sockets and pins have aligned transverse holes spaced from the passage therethrough, and locking key means in said holes to prevent disengagement between said drill string sections.

3. The structure of claim 2 characterized in that said locking key means has a curved head and said socket is undercut under the curved head of said locking key means.

4. A stabbing joint between sections of an earth boring drill string having couplings of complementary nonround pin and socket members held from parting by transverse locking means, characterized in that the drill string and coupling have an axial passage therethrough, and each complementary nonround pin and socket has consecutively engaging mating radial annular shoulders, mating nonround portions, second radial annular shoulders held from engagement by said first radial shoulders, and cylindrical portions with clearance therebetween, an annular groove in the cylindrical portion of the pin member spaced from said second shoulder, an elastomer ring in said groove and engaging the cylindrical socket to form a seal, and a beveled end on the end of said cylindrical portion of the pin.

5. The stabbing joint of claim 4 characterized in that said transverse locking means is a key passing through aligned transverse holes in the nonround portions independent of said axial passage and outwardly of said seal.

6. The stabbing joint of claim 5 characterized in that said key has a head and said socket is undercut to pry on said head.

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