May 15, 1956 H. E. SMITH 2,745,650

CONTRACTIBLE BORING HEAD FOR MINING MACHINES

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Fig. 1

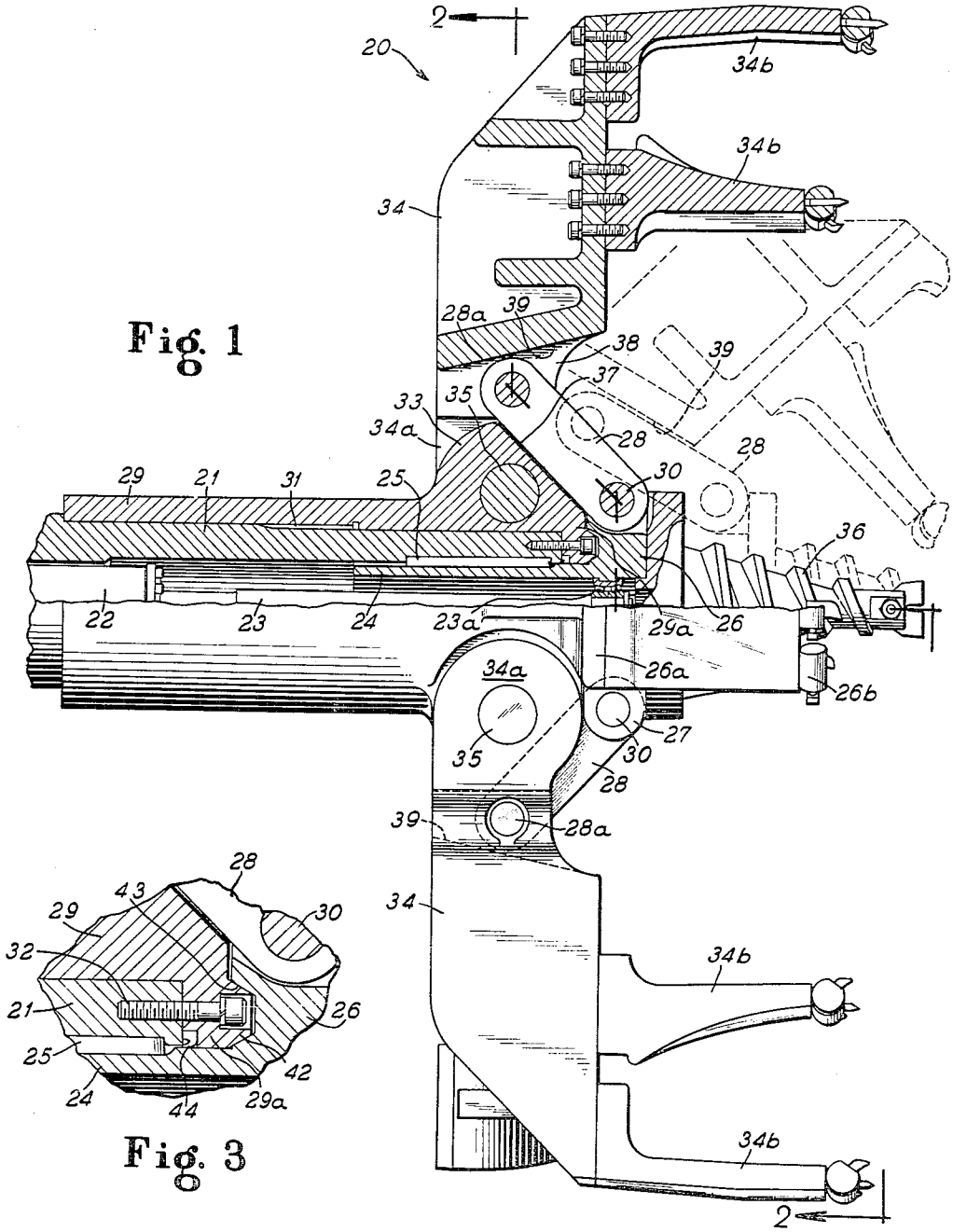


Fig. 3

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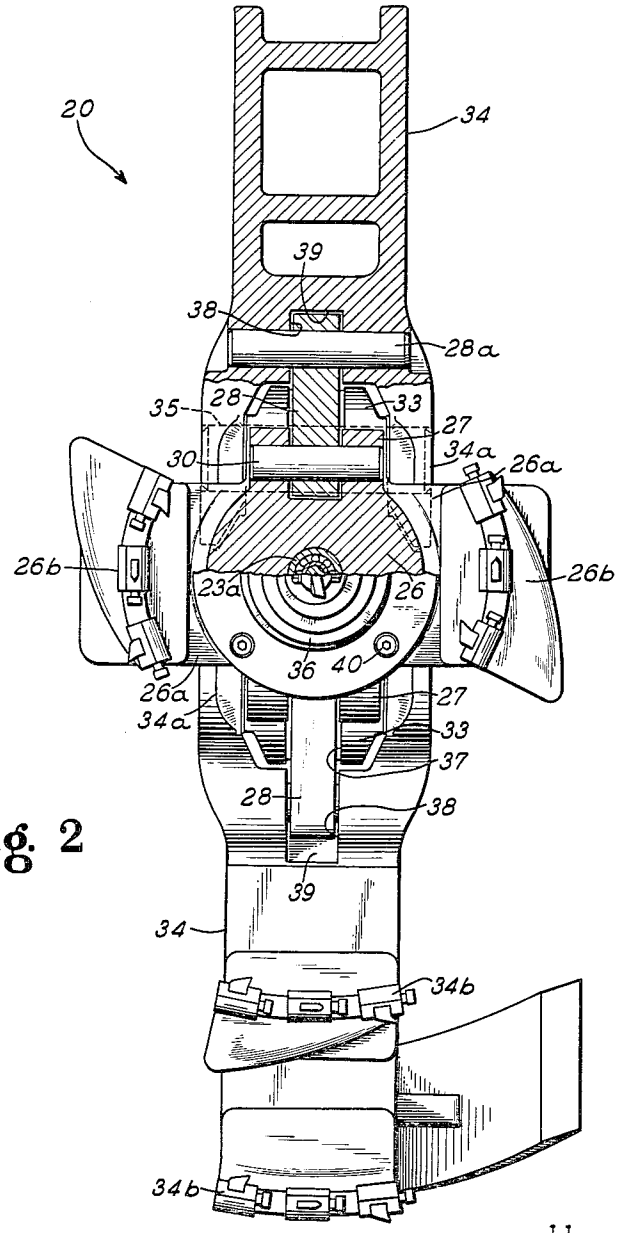


Fig. 2

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United States Patent Office 2,745,650 Patented May 15, 1956

2,745,650

CONTRACTIBLE BORING HEAD FOR MINING MACHINES

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Application December 16, 1954, Serial No. 475,649

3 Claims. (Cl. 262—7)

This invention relates to improvements in mobile mining machines of the boring type wherein one or more rotary boring heads, having a plurality of radial cutter carrying arms, are forced into a face of standing mineral such as coal. Such machines are commonly provided with means for reducing the outer diameter of the boring heads to aid in permitting the machine as a whole to be withdrawn from the bore and transported from place to place in the mine.

Certain means previously devised for collapsing the outer ends of the radial arms of the boring head are disclosed in copending applications Serial Nos. 431,454 and 463,867 filed, respectively, on May 21, 1954, and October 22, 1954, owned by the assignee of the present invention, which means consist broadly in hinging the arms on the boring head hub so that they may be swung toward and away from the axis of the boring head. This type of hinged arm structure presents difficult problems in providing efficient and compact mechanism for swinging the arms simultaneously and at the same time enclosing and sealing the critical bearing surfaces of said mechanism against ingress of dirt, grit or the like, which bearing surfaces otherwise might be exposed to abrasion and corrosion so as to interfere with the efficient operation of the mechanism.

The principal object of the present invention is to provide an improved, simplified and more efficient boring head structure of the character above mentioned, wherein the arm-swinging mechanism is of simpler and more compact construction and eliminates the requirement for special enclosing and sealing means for the critical bearing surfaces of the arm-swinging mechanism.

Other objects of the invention will appear as the following description proceeds.

The invention may best be understood by reference to the accompanying drawings, in which:

Figure 1 is a side view of a cutter head constructed in accordance with the present invention, showing the hinged arms in fully extended position and with certain parts shown in section.

Figure 2 is a front view in part section of the cutter head shown in Figure 1.

Figure 3 is an enlarged section showing in greater detail a portion of the mechanism shown in Figure 1.

Referring now to details of the embodiment of the invention shown in the drawings, the cutter head indicated generally at **20** has a hollow drive shaft **21** with a stationary hydraulic cylinder **22** mounted within the hub, having a piston rod **23** extending from its forward end axially of said shaft. A cylindrical slide **24** is keyed as at **25** for longitudinal slidable movement within the front end of the shaft **21**. The slide **24** has an enlarged head **26** at its forward end carrying two pairs of diametrically opposed ears **27, 27** extending radially therefrom, each pair of said ears being pivotally connected to a link **28**.

The front end of the piston rod **23** is coupled to the head **26** of slide **24** by a rotating coupling **23***a* such as broadly disclosed in copending application Serial No. 463,867 above-mentioned, to permit extension or retraction of the slide **24** by hydraulic power while it is rotating with the shaft **21** about the stationary hydraulic cylinder **22**.

The cutter head has an elongated hub **29** fixed on the shaft **21** as by a spline **31**. Said hub may be further held in place by set screws **32** extending rearwardly from an inwardly projecting shoulder portion **29***a* at the front end of the hub, which fits against the front end of the shaft **21**.

The hub **29** has two diametrically opposed bosses **33, 33** extending radially of said hub at its front end to provide pivotal support for the inner ends of the hinged boring arms **34, 34**. In the form shown, each of said arms has a pair of ears **34***a*, **34***a* at its inner end which forms a yoke embracing the adjacent boss **33** on the hub **29**, and hinged to said boss by a pivot pin **35**.

Each of the boring arms **34** has one or more cutter supports **34***b* suitably mounted on its front face and projecting forwardly therefrom. In the form shown herein, the hub **29** also has a pair of integral short arms **26***a* projecting at right angles to the bosses **33** and carrying forwardly projecting cutter supports **26***b* thereon for cutting a relatively small circular kerf.

Each of the arms **34** is pivotally connected to one of the links **28** by a pivot pin **28***a*, disposed intermediate the front and rear longitudinal faces of its respective arm on a transverse axis disposed outwardly of the bosses **33** on hub **29**, as shown in Figures 1 and 2. Each of the bosses **33** has a slot **37** cut away at a forwardly and inwardly inclined angle to provide clearance for the adjacent link **28** when the hinged arms **34** are in their fully extended cutting position, as shown in full lines in Figure 1. The slots **37** are preferably of only slightly greater width than their respective links **28**, so as to provide additional support for the arms **34** against bending or twisting when the boring head is rotated during the boring operation.

As will also be seen from Figures 1 and 2, the outer ends of each of the links **28** fit in a slot **38** extending forwardly and rearwardly of its respective arm to provide working clearance for said link **28**, said slot having a forwardly and outwardly inclined face **39** which forms a stop for engagement with its respective link to limit the forward swinging movement of the arm as will presently be described.

A tapered center breaker or burster cone **36** of conventional form is suitably secured to the front face of the enlarged end **26** of the slide **24** as by bolts **40, 40**.

An annular forwardly tapered rib **42** may be formed on the front face of the shouldered portion **29***a* at the front end of the hub adapted to fit in a mating groove **43** in the enlarged head **26** of slide **24**, when the slide is in fully retracted position, as shown in full lines in Figure 1, so as to provide additional stability for the burster cone **36** in a centered relation relative to the hub. A sealing ring **44** may be disposed around the inner periphery of the shouldered portion **29***a* in juxtaposition to the front end of the shaft **21** in position to engage the outer surface of the slide **24** as the latter is reciprocated in the shaft **21**.

The use and operation is as follows:

During normal boring operations the radial boring arms **34** will be swung to their fully extended positions substantially perpendicular to the axis of the head, as shown in Figure 1. In this position the slide **24** is in its rearwardmost or fully retracted position in the hub **21**, with its enlarged head **26** in abutting engagement with the front face of the hub **21**. When the head is thrust forwardly during the boring operation, reaction on the burster cone **36** will tend to urge the slide toward its rearwardmost position, aided, if necessary, by hy-

draulic pressure maintained in the cylinder 22. In this operating position it will be observed that the longitudinal bearing surfaces of the slide will be fully retracted in the hub and enclosed by the head 26, so as to be fully sealed and protected against abrasion or erosion. It will further be noted from Figure 3 that with the arms in the extended boring position just mentioned, the annular tapered rib 42 on the hub will engage in the corresponding groove 43 in the head 26 to afford increased sealing effect for the bearing surfaces of the slide, as well as to provide greater stability for the burster cone 36.

The hinged arms may be collapsed forwardly into a position so as to reduce the overall diameter of the boring head when the entire boring head is retracted or withdrawn from the working face, as, for instance, if the machine is to be moved from place to place in the mine. This collapsing movement is effected by exerting hydraulic pressure on the piston rod 23 to thrust the slide 24 with its head 26 forwardly. This movement carries the two links 28 forwardly to an advanced position so as to swing the cutter arms 34 simultaneously on their hinged pins 35 into the forwardly inclined collapsed positions as indicated in dotted lines at the upper portion of Figure 1. Such forward hinged movement of the arms may be limited by suitable stop means, herein provided by the upper walls of the slots 39 against which the links 28 will be engaged at the forward limit of hinged movement of said arms, as will also be seen in Figure 1.

It will be observed that by reason of the improved and simplified arrangement of control linkage and slide of the present invention, it is possible to encompass all of this mechanism in an especially compact relation at the hub, particularly when the boring arms are in fully extended position for boring operations. Moreover, the links 28 are disposed at forwardly inclined angles to their respective cutter arms when the latter are in fully extended positions, so as to be placed under tension to aid in supporting said arms when the head 26, to which said links are connected, is engaged with the front end of the hub.

Although I have shown and described certain embodiments of my invention, it will be understood that I do not wish to be limited to the exact construction shown and described but that various changes and modifications may be made without departing from the spirit and scope of the invention as defined by the appended claims.

I claim:

1. In a boring head for mining machines, a rotatable hollow hub having a plurality of cutter arms hinged at its forward end for limited swinging movement in radially extending planes including the axis of said hub, a slide reciprocably mounted in the front end of said hollow hub having an enlarged head projecting beyond the front end of said hub, a link connecting the said enlarged head with each of said cutter arms for swinging the latter simultaneously in response to reciprocable movement of said slide in said hub, said head being movable rearwardly to engage the front end of said hub and enclose the longitudinal bearing surfaces of said slide in said hub when the cutter arms are in fully extending boring position.

2. The structure of claim 1, wherein each of the links is inclined rearwardly and outwardly so that each link is placed under tension to support its respective arm against rearward swinging movement in its fully extended boring position.

3. The structure of claim 2, wherein the hub has rearwardly and outwardly inclined slots for receiving the intermediate portions of the links in close-fitting relation therein when the arms are in fully extended boring position.

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