Dec. 31, 1957 H. E. SMITH 2,818,242

MINING MACHINE OF THE BORING TYPE HAVING TWO BORING HEADS

Filed Jan. 4, 1956 3 Sheets-Sheet 1

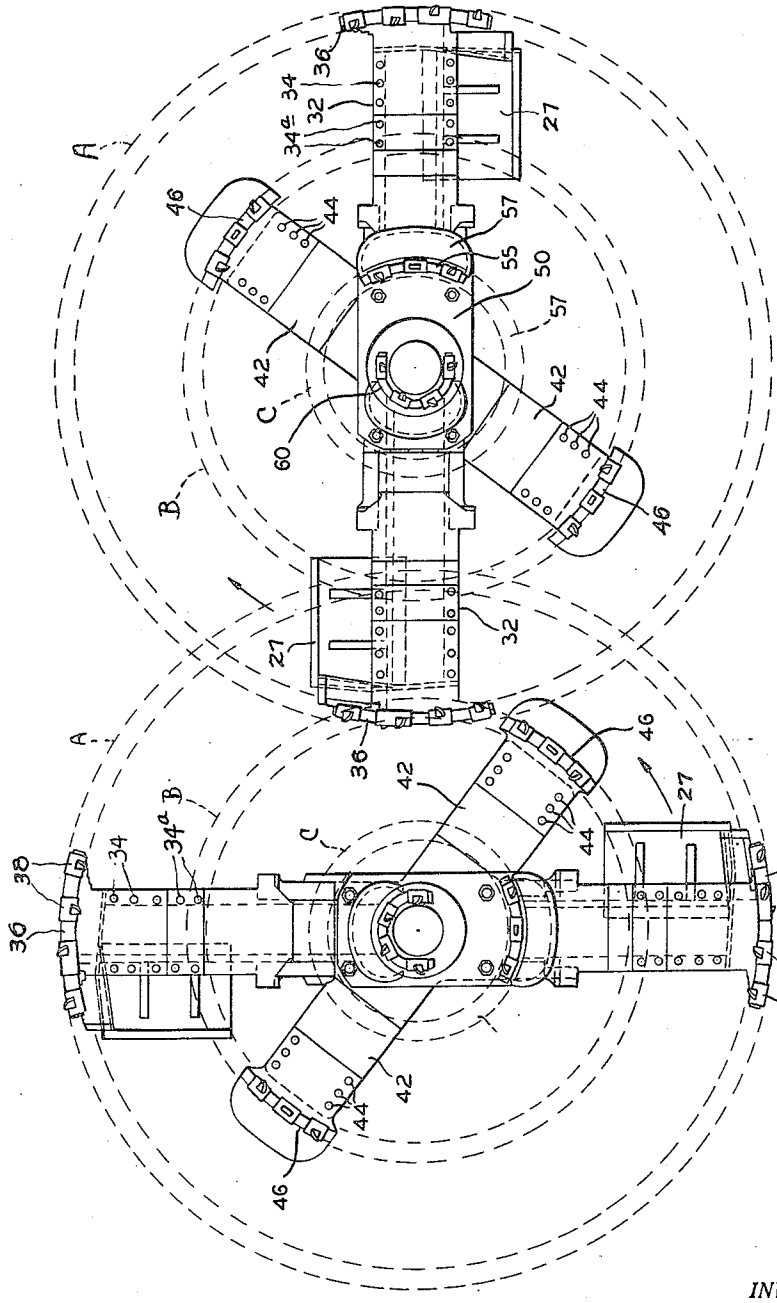


Fig. 1

INVENTOR.
HERMAN E. SMITH

BY
Murray A. Gleeson
ATTORNEY

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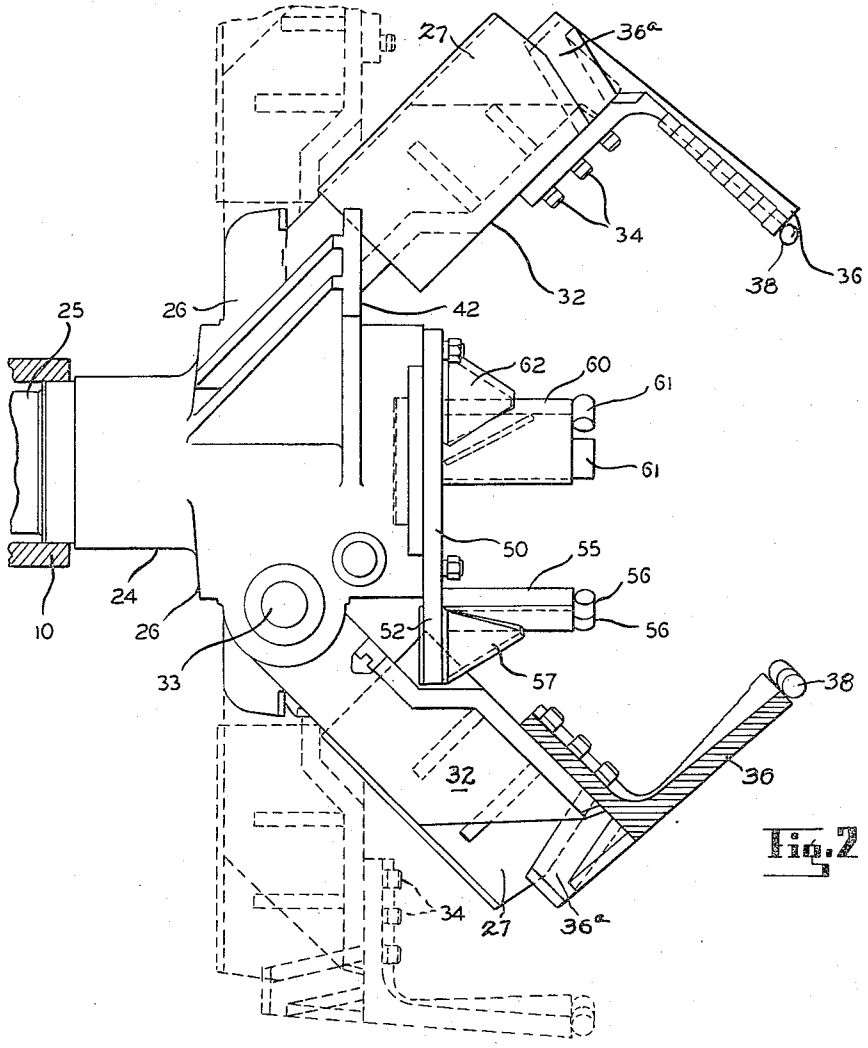


Fig. 2

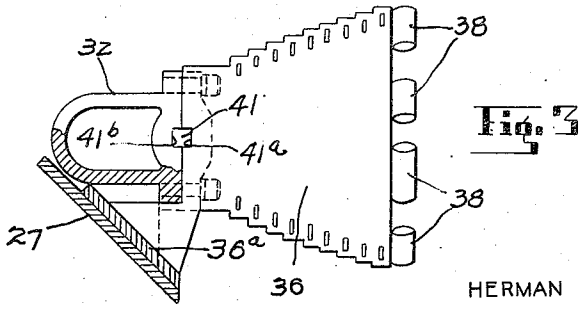


Fig. 3

INVENTOR.
HERMAN E. SMITH

BY
Murray A. Gleeson
ATTORNEY

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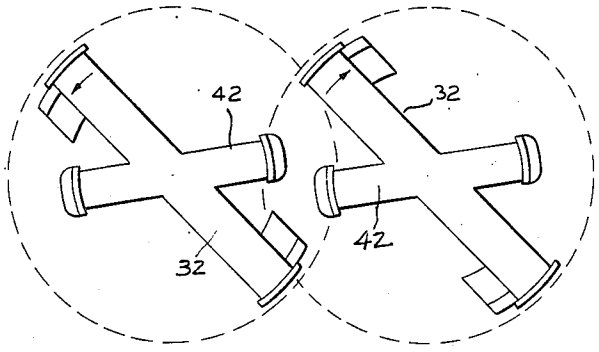


Fig. 7

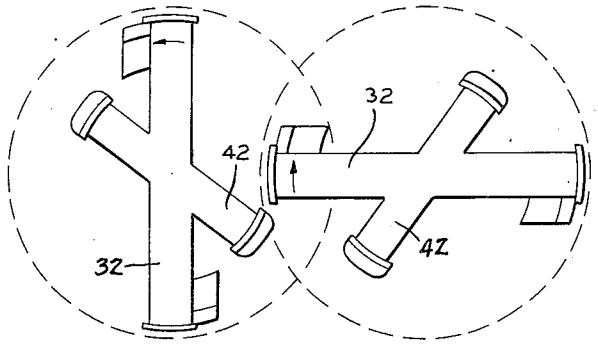


Fig. 6

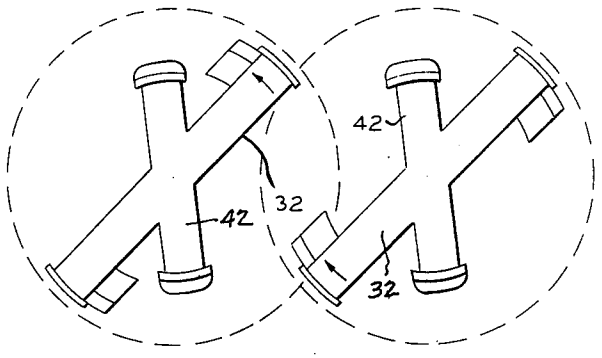


Fig. 5

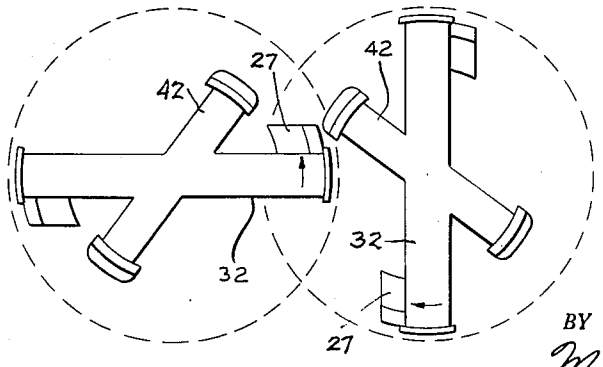


Fig. 4

INVENTOR.
HERMAN E. SMITH

BY
Murray A. Gleeson
ATTORNEY

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2,818,242

MINING MACHINE OF THE BORING TYPE HAVING TWO BORING HEADS

Herman E. Smith, Park Forest, Ill., assignor to Goodman Manufacturing Company, Chicago, Ill., a corporation of Illinois

Application January 4, 1956, Serial No. 557,398

3 Claims. (Cl. 262—7)

This invention relates to improvements in boring heads for mining machines and more particularly to twin bore type mining machines with two, side by side overlapping boring heads, the arms of which clear one another during rotation.

In the past it has been common practice for each head of a twin bore mining machine to cut two or more kerfs concentric with the axis of rotation of each head, the outermost kerf being cut by cutter supports mounted on the extreme ends of long radial arms of equal length in diametrical alignment with each other, and the second kerf being cut by cutter supports mounted on shorter arms projecting radially from the hub and disposed at 90° to the longer arms. The relation of the pairs of arms on the two heads has usually been such that a long arm of one head and the short arm of the other head, when rotated in closest proximity to each other, are in a straight line passing through the axes of the heads so as to avoid interference between the arms. Such an arrangement, however, imposes a definite limitation in the proportion of the height to the width of the bore pattern being cut, because the outermost kerf cut by the long arm of one head cannot intersect the smaller kerf cut by the shorter arm of the other head, without interference between the said short and long arms.

One of the objects of the present invention is to provide a twin bore mining machine in which each of the overlapping boring heads have relatively long and short arms, but the shorter arms are disposed at such an angle to the long arms as to avoid interference between the two sets of arms even though the kerfs cut by the longer arms intersect the kerfs cut by the shorter arms.

A further object of the invention is to provide an improved form and arrangement for the scoops at the ends of the longer arms. Other objects of the invention will appear as the following description proceeds.

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

Figure 1 is a front view of the boring heads of a twin bore mining machine constructed in accordance with the present invention.

Figure 2 is an enlarged side view of one of the boring heads shown in Figure 1.

Figure 3 is an end view of one of the long arms of the boring head shown in Figure 2.

Figures 4, 5, 6 and 7 are diagrammatic views, showing the manner in which the long and short arms of the two boring heads, shown in Figure 1, are rotated without interference with each other, although the kerfs cut by the longer arms partially overlap the kerfs cut by the shorter arms of the two boring heads.

Referring now to details of the embodiment of the invention shown in the drawings, the twin boring heads of the mining machine are mounted in side by side relation on bearings **10**, forming a part of the mining machine frame. Each rotatable head includes a hollow hub **24** suitably fixed to the front end of a hollow rotatable drive shaft **25**. The hub **24** includes two hollow radially opening extensions **26**, **26** in which radially extending arms **32** are pivotally mounted, as on pivot pins **33** (see Figure 2) so as to permit hinged movement of said arms toward and away from the axis of rotation of the hub, as indicated by comparison of the forwardly hinged position of said arms shown in full lines in Figure 2, and the fully extended normal cutting position of said arms as shown in dotted lines in the same figure. The hub and its hinged structure just mentioned may be similar to that fully disclosed in the copending application, Serial 463,866, filed October 22, 1954, so further details thereof may not be shown or described herein as they form no essential part of the present invention.

Each of the arms **32** has a forwardly projecting cutter bracket **36** connected to its outer end as by bolts **34**. Each of said cutter brackets have cutter bit clusters **38** along their front edges for cutting a kerf A in the mine face in advance of the machine, as indicated in dotted lines in Figure 1. In the form shown herein the brackets **36** are substantially wider near their front ends than at their rear ends and are arcuate in cross-section to conform generally with the arcuate shape of the kerf A.

Each cutter bracket **36** is mounted for adjustment longitudinally its arm **32** by a key **41**, fitting in opposed longitudinal grooves **41a**, **41b** formed in the adjacent faces of the arm **32** and the bracket **36**, as seen in Figure 3. The arm **32** also has a plurality of sets of bolt holes **34a** to permit selective adjustment of the bracket along the arm.

Each of the arms **32** has a plow member or plate **27** formed integrally therewith along its leading edge and at an intermediate angle thereto, which is employed as usual to direct the cuttings along the mine floor toward the center of the machine for collection by a conventional conveyor (not shown). In the form shown herein each plow member **27** terminates substantially at outer end of its arm **32** and the adjacent adjustable cutter bracket **36** has a short inwardly extending plate **36a** formed integrally therewith, arranged for telescoping engagement with the inner face of the adjacent plow plate **27** (see Figures 2 and 3).

The hub **24** has a second pair of arms **42**, **42** rigidly mounted thereon, slightly in advance of the pivotal mountings of the arms **32**, but shorter than the latter, as shown in Figure 2. These arms **42** (hereinafter referred to as the "shorter arms") are in diametrical alignment with each other, but are disposed at an angle of substantially less than 90° to the adjacent longer arms **32**, as shown in Figure 1. Each of the shorter arms **42** has a forwardly projecting cutter bracket **46** mounted at its outer end as by bolts **44**, on which brackets are mounted cutter bit clusters **48** for cutting a circular kerf B indicated in dotted lines in Figure 1. The cutter brackets **46** are arcuate in cross-section as shown in Figure 1, to correspond generally with the shape of the circular kerf B. These brackets **46** are omitted in Figure 2, for clearer showing of adjacent parts of the head.

At the front end of the hub **24** and projecting forwardly therefrom is an elongated plate **50** in longitudinal alignment with the longer arms **32**. Said plate **50** extends a short distance beyond the hub in one direction so as to form an arm **52**, considerably shorter than the shorter arms **42**. The arm **52** has a forwardly projecting cutter bracket **55** mounted adjacent its outer end, on which are carried cutter bit clusters **56** for cutting a third kerf C, indicated by dotted lines in Figure 1. The bracket **55** also carries an outwardly facing wedge surface **57** around its base for breaking up the adjacent core.

The plate **50** also has a second forwardly projecting cutter bracket **60**, which bracket is substantially semicircular in cross-section, and carries a plurality of bit clusters **61**, **61** along its front edge adapted to cut an

extremely small circular kerf immediately adjacent the axis of rotation of the boring head. The cutter support 60 also has an outwardly facing wedge surface 62 around its base for breaking up the adjacent core.

One of the principal features of the present invention is the arrangement whereby the shorter arms 42 are disposed at less than 90° to the longer arms 32 so as to eliminate interference between the shorter arms of one head and the longer arms of the other head, while the two heads are being rotated in timed relation to each other during operation of the machine. As is customary with twin boring heads in mining machines of the character described, the two heads are rotated simultaneously in opposite directions as indicated by the arrows in Figure 1.

In Figure 1 it would be seen that the left hand boring head is rotated in a counter-clockwise direction, while the right hand head is rotated in a clockwise direction with the longer arms 32 in phases of 180° to each other, so that when one of the longer arms 32 is in a vertical position, the longer arms of the other head is in a horizontal position. In practice this 180° phase relationship between the longer arms is especially desirable to maintain an even but alternately timed scraping movement of the plows 27 toward the center of the machine. If the shorter arms 42 were, as usual, substantially at a right angle to their adjacent longer arms, a shorter arm on the left hand head would interfere with the adjacent longer arm on the right hand when the two heads are in the relative positions shown in this figure. Accordingly, it would be impossible to make a second kerf B of as large diameter as that shown, when the axes of the two heads are brought as close together as in this figure. This difficulty is overcome in the present invention by disposing the shorter arms 42 at an angle intermediate a full right angled, or 90° relation to the adjacent longer arms. In the illustrative arrangement shown in Figure 1, the shorter arms 42 are disposed at an approximate angle of 37° to their adjacent longer arms.

The manner in which the two sets of longer and shorter arms of the heads cooperate with each other without interference, is more clearly illustrated in Figures 4, 5, 6 and 7, which show the two cutter heads in four successive positions of rotation. In these diagrams the shorter arms 42 are disposed at an angle of 45° instead of 37° to their adjacent longer arms 32, but the principal of operation is manifestly the same in each case.

Referring to these diagrammatic figures 4–7, it is assumed that the two heads are rotated as usual in opposite directions at the same speed, the left hand head in counter-clockwise, and the right hand head in a clockwise direction. In Figure 4, the two pairs of long arms 42 are disposed at right angles to each other, but the innermost longer arm 32 has ample clearance with respect to the innermost shorter arms 42 of the other head.

In Figure 5, the two pairs of longer arms have rotated through 45°. In this position, both the long and short arms have ample clearance with respect to each other.

In Figure 6 the heads have rotated through 90° from the position shown at Figure 4. In this case the shorter arm 42 of the left hand head moves into close proximity to the adjacent longer arm 32 of the right hand head, but without interference therewith, since the longer arm 32 is moving upwardly in advance of the adjacent shorter arm 42 in this position.

In Figure 7 the heads have rotated through angles of 135° from that shown in Figure 4, in which position the ends of the two shorter arms pass each other without interference.

The relative positions of the nearest long and short arms of the two heads will be the same as above described during the second 180° rotation of the two heads.

Although I have shown and described certain embodiments of the invention, it will be understood that various changes and modifications may be made without departing from the spirit and scope of the invention as defined in the appended claims.

I claim:

1. In a mining machine of the multi-boring type, a frame, a pair of cutter heads rotatably mounted in side-by-side relation in advance of said frame, each of said boring heads including a hub, a pair of relatively long arms on said hub substantially in diametrical alignment with each other, each having forwardly projecting cutter supports and material-moving plows on their outer ends, a pair of shorter arms on said hub, each of said shorter arms having forwardly projecting cutter supports on their outer ends and being disposed at an angle of substantially less than 90° to its adjacent longer arm, the axes of said heads being so arranged with respect to each other that the paths of movement of the longer arms on one head intersect the paths of movement of the shorter arms on the other head without interference between said arms when the two heads are rotated at equal speeds in opposite directions.

2. The structure of claim 1 wherein each pair of shorter arms of each head are disposed substantially in diametrical alignment with each other, at about 45° to the adjacent longer arms.

3. In a mining machine of the multi-boring type, a frame, a pair of cutter heads rotatably mounted in side-by-side relation in advance of said frame, each of said boring heads including a hub, a pair of relatively long arms on said hub substantially in diametrical alignment with each other, each having material-moving plows and forwardly projecting cutter supports on their outer ends, a pair of shorter arms on said hub, each of said shorter arms having forwardly projecting cutter supports on its outer ends and being disposed at an angle of substantially less than 90° to its adjacent longer arm, and the axes of said heads being so arranged with respect to each other that the paths of rotation of the cutter supports on the ends of the longer arms are approximately tangential to the paths of rotation of the cutter supports on the ends of the shorter arms, without interference between said arms when the two heads are rotated at equal speeds in opposite directions.

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