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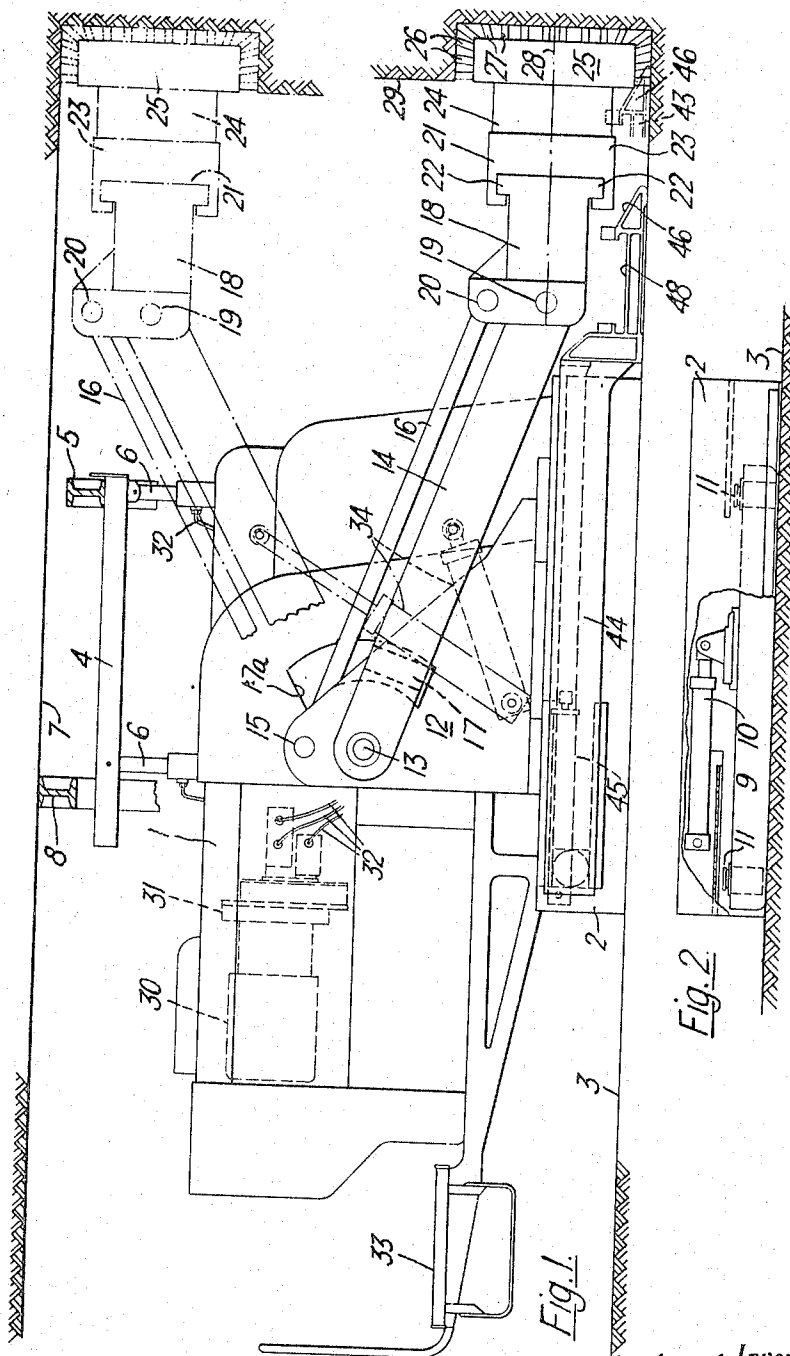
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3,314,722

MINING MACHINE WITH ROTARY CUTTER HORIZONTALLY
SLIDABLE ON VERTICALLY ADJUSTABLE GUIDE

Filed Jan. 4, 1965

3 Sheets-Sheet 1



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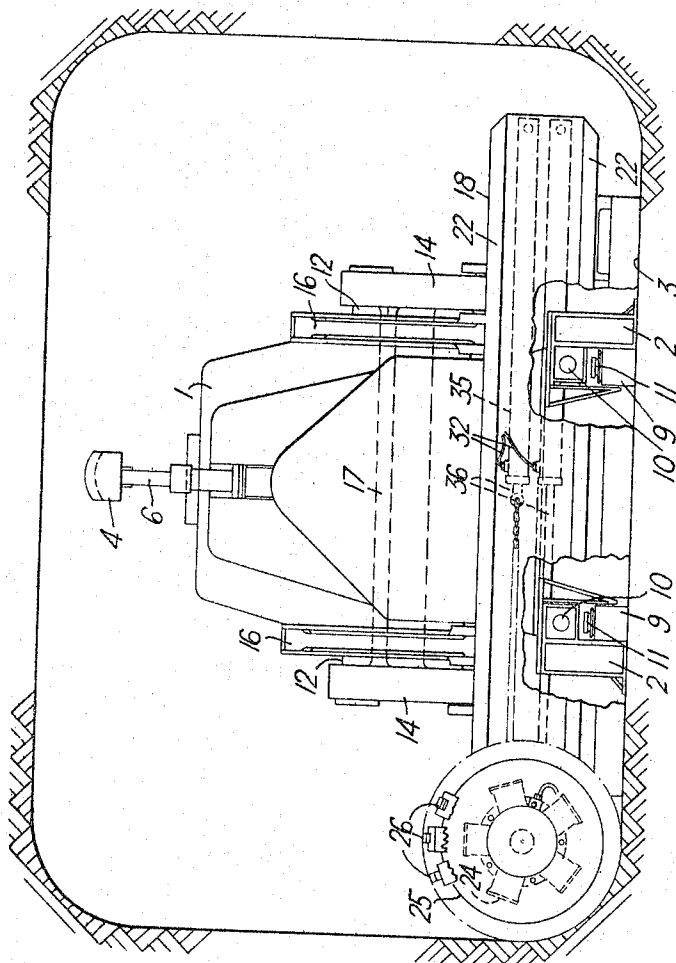


Fig. 3.

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Fig. 4.

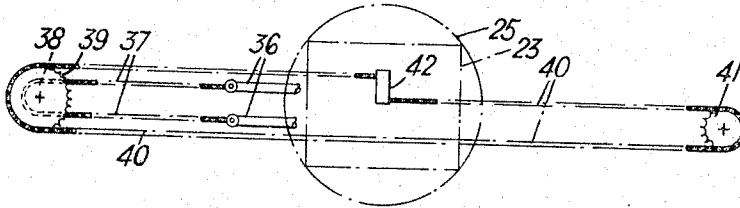
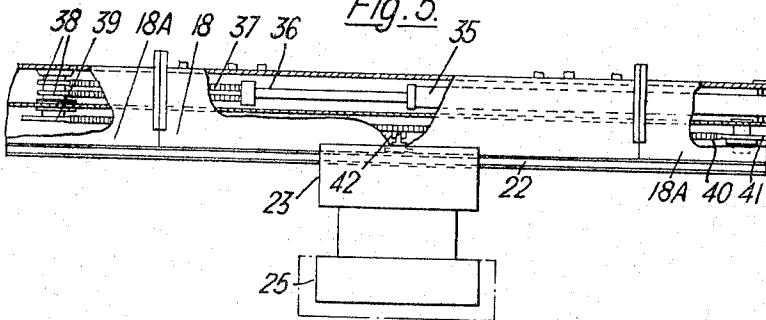


Fig. 5.



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MINING MACHINE WITH ROTARY CUTTER HORIZONTALLY SLIDABLE ON VERTICAL- LY ADJUSTABLE GUIDE

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5 Claims. (Cl. 299—31)

This invention relates to mining machines of the type having a cutting head, rotatable about a horizontal axis, to be advanced axially into the face of the mineral to be mined and also to be moved in any direction transversely to the axis to remove mineral over an area the height and width of which are represented by the respective vertical and horizontal ranges of movement of the drum, plus the diameter of the head in each case.

According to the present invention, a mining machine of the type referred to comprises a base, a forwardly extending arm pivoted transversely to the base at its rear end, means for positioning the arm in any desired location between limits of maximum elevation and depression of its forward end with respect to its pivoted end, a transverse guide bar transversely pivoted to and disposed beyond the forward end of the arm, the guide bar being constituted as a transverse slideway, a carrier movable along the slideway, a cutting head on the carrier and rotatable at the front of the carrier about a horizontal axis, a parallel linkage, including the arm itself, connecting the guide bar to the machine base so as to maintain the axis of the cutting head horizontal at all positions to which the arm is brought, and means for propelling the carrier along the guide bar in either direction, and means for rotating the cutting head.

The pivoted arm is preferably duplex, two side members providing for pivot connections widely spaced with respect to the width of the machine, to the base and the guide bar respectively, and the side members being connected by one or more stiff braces. Thus, with a single transverse brace, the arm may be of H-form.

Since the guide bar is movable vertically to any position between those reached by it at the maximum elevation and depression of the arm by which it is carried, and since the carrier is movable to any position along the arm, the axis of the cutting head may be brought anywhere in a rectangle having a horizontal and vertical side approximately equal to the length of the arm and its vertical travel respectively, and the head itself can operate over an area greater than that of the rectangle by that of a strip external to the rectangle and of a width equal to the cutting radius of the head.

Consequently, the single cutting head, receiving the whole of the cutting power available in the machine, can remove at one setting of the machine a volume of material equal to the product of this extended area and the depth of penetration of the head into the material. The use of a single cutting head minimises recirculation of the cut mineral by the head, thus avoiding the formation of excessive dust, as well as utilising the major part of the power for actual cutting.

The machine advantageously includes a transverse conveyor mounted across its front at floor level, with means for advancing and retracting the conveyor. The conveyor may be retracted to permit the cutting head to cut a strip starting at floor level, with the guide bar dropped by the pivoted frame to its lowest position, then, with the cutting head raised (whether clear of the material by retraction of the machine base, or into the overlying material), the conveyor may be advanced into a position to receive directly the overlying material then to be cut.

Moreover, by the further provision of an inclined

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pusher plate along the forward side of the conveyor, the initial advance of the conveyor can be used to force on to itself most of the material first cut from the strip starting at floor level.

The invention will now be further described with reference to an embodiment shown in the accompanying drawings, in which:

FIGURE 1 is a side elevation of the machine, showing the transverse guide bar and the cutting head in both lowered and raised positions;

FIGURE 2 is a fragmentary side elevation of walking means for advancing and retracting the machine;

FIGURE 3 is an end elevation of the machine of FIGURE 1 as viewed from the right;

FIGURE 4 is a diagrammatic elevation of chain and sprocket mechanism seen also partly in FIGURE 3 and more fully in FIGURE 5; and

FIGURE 5 is a part-sectional plan of part of FIGURE 4, with the chain and sprocket mechanism exposed.

In FIGURES 1 and 3, a machine frame 1 is supported by two spaced longitudinal base members 2 to sit on the floor 3 of the working and to provide lateral stability. When the machine is in position, an upper longitudinal beam 4, used to carry a support arch 5 about to be fixed, can be raised by hydraulic rams 6 to clamp the machine to the roof 7 by pressing against the lifted arch 5 and a previously positioned arch 8, so that the machine is solidly located in the working. The machine can be progressively advanced by pushing forwardly of each base 2 a walking pad 9 (FIGURE 2) by means of a hydraulic cylinder 10, raising the bases 2 (and therefore the whole machine) by jacks 11 on the pads, drawing the machine forward by the cylinders 10, and lowering the jacks 11. Retraction of the machine is effected by reversing this procedure. The machine may also be "steered" by the same mechanism.

Substantial side brackets 12 provide horizontal pivots 13 for the rear end of two forwardly extending arms 14, and also pivots 15 for the rear ends of links 16 parallel to the arms 14. The arms 14 are integrally connected by a transverse brace 17 (FIGURES 1 and 3) that may extend through an open arcuate passageway 17a formed in the machine frame 1 (see FIGURE 1), the purpose of said transverse brace 17 being to provide a stiff H-structure for the supporting of a transverse guide bar 18, to which the front ends of the arms and links 14, 16 are pivoted at 19, 20, respectively. The links 16 maintain the front face 21 of the bar 18 vertical in all positions of the bar, as is shown by FIGURE 1.

The bar 18 has upper and lower slide rails 22 for a carrier 23 movable from one end of the bar to the other. The length of the bar 18 is adjustable to the desired width of the working by means of extensions 18A (FIGURE 5) replaceable by extensions of any other appropriate length. The slide rails 22 extend continuously along the bar 18 and its extensions 18A. A motor 24 (shown in FIGURE 3 as hydraulic) mounted on the carrier 23 has its axis horizontal and directed at right-angles to the front face 21 of the guide bar 18. The motor drives a cylindrical cutting head 25 having peripheral picks 26 and also picks 27 on its front face. The axis 28 of the head 25 always remains horizontal, so that when the head is "sumped-in," i.e., forced endwise into the end face 29 of the working, the picks 27 cut into the material to be mined and the picks 26 cut the material to the overall diameter of the head.

The machine frame 1 carries a motor 30 (FIGURE 1), which drives one or more pumps 31 from which oil is transmitted by lines 32 to the various hydraulic devices of the machine, including the motor 24, all under the control of an operator on a rear platform 33. The hydraulic cylinders 10 for advancing and retracting the

machine and the cylinders 6 for the clamping beam 4 have already been mentioned. At each side of the machine there is a pivoted hydraulic cylinder 34 for raising and lowering the arms 14.

Lengthwise in the bar 18 are two parallel hydraulic cylinders 35, the piston rods 36 of which have a stroke substantially equal to one-half of the length of the bar. The free ends of the rods 36 are connected by duplex chains 37 looped around sprockets 38 (FIGURES 4 and 5) at one end of the bar 18, so that the sprockets can be rotated, in one direction or the other, by a pull on the appropriate rod 36. The sprockets 36 drive a co-axial sprocket 39 of twice their diameter, so that a chain 40 is moved by the sprocket at twice the speed of the chains 37. The chain 40 is looped round a sprocket 41 at the other end of the bar 18 and its ends are connected to a rear projection 42 on the carrier 23, so that the latter, with the cutting head 25, may be positioned at any point along the bar or power-driven along the bar. FIGURE 3 shows the head 25 at the left-hand end of the bar 18; FIGURES 4 and 5 show it in an intermediate position.

FIGURE 1 shows a transverse conveyor 43 at floor level across the front of the base members 2. It is carried by side bars 44 (not shown in FIGURE 3) each operated by a hydraulic cylinder 45, so that the conveyor can be advanced towards the end face 29 of the working. Across the front of the conveyor 43 is an inclined pusher plate 46.

The cutting head 25 may be sumped into the end face 29 by advancing the whole machine by the use of the walking pads 9, with the bar 18 lowered and the head 25 at one end of the bar. After sumping-in, the head 28 may then be traversed along the bar 18 by the chain 40 to cut a horizontal strip of a width (height) equal to its cutting diameter; then, by raising of the bar by the cylinders 34 connected to the H-frame 14, 17, the head cuts into the material above the space from which the first strip has been cut, and a further traverse in the reverse direction removes a second strip; and so on until cutting has taken place over the desired maximum height, as at the top right-hand side of FIGURE 1.

Sumping-in may be by any amount up to the axial cutting length of the head 25, depending on the nature of the material to be cut. If desired, each or any horizontal strip may be removed by successive traverses between which the head is advanced deeper into the material, until the full axial length of the head has entered the material.

When the lowermost horizontal strip has been cut and the bar 18 and the head 25 raised for the next strip, the side bars 44 are propelled forward by the cylinders 45 to bring the conveyor 43 into position to receive material removed in the cutting of all subsequent strips. At the same time, the pusher plate 46 lifts on to the conveyor 43 material lying on the floor 3. The conveyor 43 thus removes all material to the side of the machine, where, as will be readily understood, it can discharge the material as may be desired, e.g., on to a conveyor mounted along one side of the machine, to lead it to a stage loader or other disposal device.

When the whole end face 29 has been cut to the rectangular form shown by FIGURE 3, the machine is again advanced, and the cutting cycle is repeated. Instead of the walking pads 9, the machine could be mounted on crawler tracks; and, in either case, instead of advancing the bar 18 and the cutting head 25 by use of the advancing mechanism for the machine, the whole frame 1 could be advanced on the base members (or on a crawler base) by the use of hydraulic cylinders.

The direct driving of the cutting head 25 by a hydraulic motor 24 is generally advantageous, since it enables the whole of the machine to be hydraulically controlled, with power derived from the single motor 30. However, the head 25 could be operated by an electric

motor or other drive, with any necessary reduction gearing.

The machine is particularly adapted for mining by the room-and-pillar system, notably where there is a considerable depth of mineral to be mined, e.g., as frequently the case in iron ore mines. Thus, the width of the machine and the length of the guide bar 18 may be suited (by appropriate extensions 18A on the bar) to the actual width of the room to be worked under that system, so that the machine merely has to be advanced after each succession of transverse cuts made at each setting of the machine with respect to the face immediately to be worked. The machine may likewise be used to advantage in thick coal seams; and in such case the guide bar can be accurately positioned for height so that only coal is cut. Since the bulk of the desired material can be immediately removed by the conveyor 43, any cutting of rock that may be found necessary can take place by a traverse particularly for the purpose, with the cut rock conveyed away separately from coal subsequently cut.

What I claim is:

1. A mining machine for working against an earth face comprising a frame, an arm assembly transversely pivoted at its rear end to opposite sides of the frame and extending forwardly with respect to the frame, said assembly being formed by two separate arms connected by a transverse brace thereby forming a stiff H-shaped structure, means for raising and lowering said assembly, a transverse elongated guide bar transversely pivoted at spaced points to the forward end of said assembly, a carrier slidably mounted for lengthwise movement along said bar, means for moving said carrier in either direction along said bar, a cutting head mounted on said carrier for rotation about a forwardly directed axis, means for rotating the cutting head, two separate links parallel to the respective arms of said arm assembly, said links connecting said guide bar to said frame to maintain said cutting head axis horizontal in all adjusted positions, and means on said frame for bodily advancing said guide bar horizontally in the forward direction of the machine whereby said cutting head may be moved straight into said earth face to mine the material in the same by movement of said carrier along said bar and raising and lowering of said arm assembly.

2. A mining machine as in claim 1 wherein said means for moving said carrier comprises two hydraulic cylinders mounted lengthwise of the guide bar, a chain-and-sprocket assembly in operative connection with the cylinders for traversing the carrier along the guide arm, said assembly including at least one chain forming a loop, a sprocket mounted for rotation at one end of the guide bar to engage the looped end of the chain, another sprocket of twice the diameter of the first sprocket in co-axial driving connection with the first sprocket, a third sprocket pivoted at the other end of the guide bar, and a second chain looped around the second and third sprockets and having its ends connected to the carrier to provide said movement along said bar.

3. A mining machine for positioning on a floor to work against a substantially perpendicular earth face comprising a frame, an arm assembly transversely pivoted at its rear end to opposite sides of the frame and extending forwardly of the frame, means for raising and lowering said assembly, a transverse elongated guide bar transversely pivoted at spaced points to the forward end of said assembly, a carrier slidably mounted for lengthwise movement along said bar, means for moving said carrier in either direction along the bar, a cutting head mounted on said carrier for rotation about a forwardly directed axis, means for rotating the cutting head, linkage means parallel to the arm assembly connecting the guide bar to the machine frame to maintain said cutting head axis horizontal in all adjusted positions, means on said frame for bodily advancing said guide bar horizontally in the forward direction of the machine whereby said cutting head may be moved straight into said earth face to mine

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the material in the same by movement of said carrier along said bar and raising and lowering of said arm assembly, a transverse conveyor mounted across the front of the machine at floor level to remove the mined material, and means for advancing and retracting the conveyor to and from working position. 5

4. A mining machine as in claim 3, comprising an inclined pusher plate along the forward side of the transverse conveyor to collect the mined material on the floor during the advancing movement of said conveyor.

5. A mining machine as in claim 1, wherein said advancing means for said guide bar comprises spaced base members extending longitudinally of said frame, each base member being provided with a walking pad and with 10

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hydraulic means for advancing and retracting the pad in the direction of movement of the machine and for lifting and lowering the machine with respect to said pad.

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ERNEST R. PURSER, *Primary Examiner.*