

Feb. 11, 1958

E. J. HLINSKY
BORING TYPE MINING MACHINE HAVING HORIZONTALLY
EXTENDING TRIMMER BAR

2,823,023

Filed Nov. 1, 1956

3 Sheets-Sheet 1

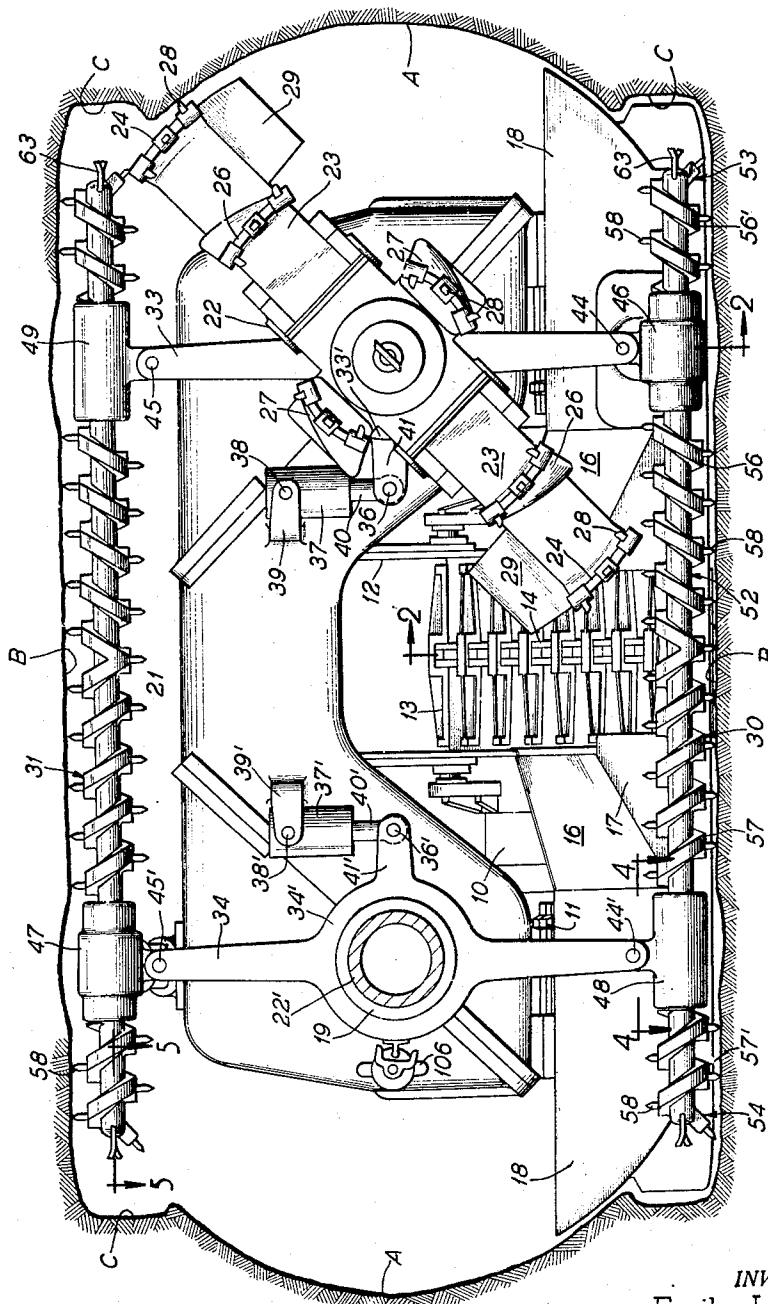


Fig. 1

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3 Sheets-Sheet 2

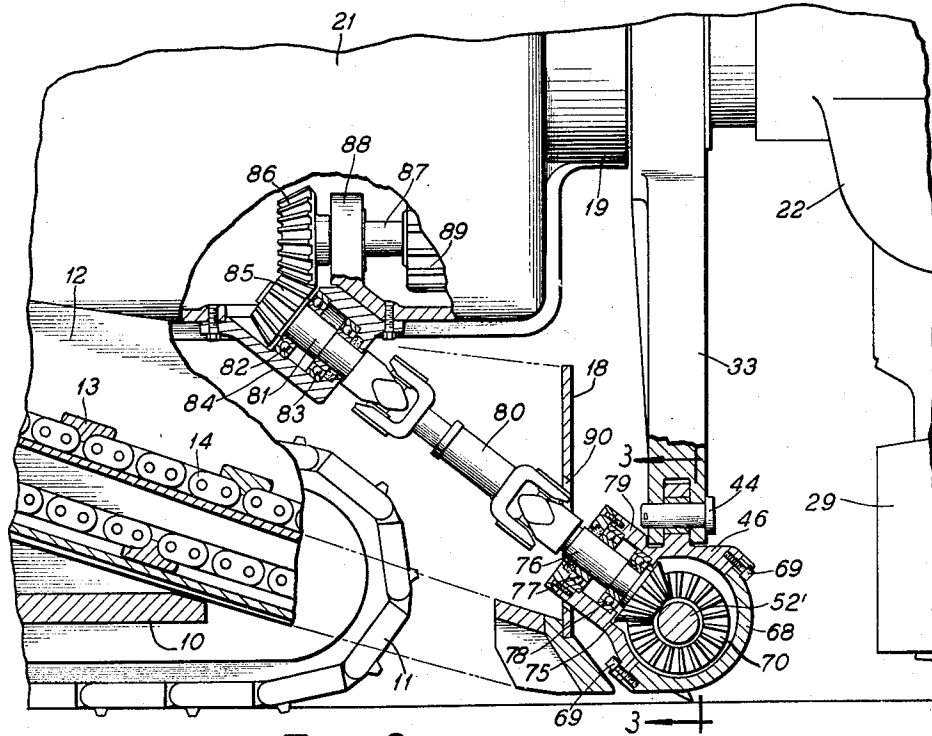


Fig. 2

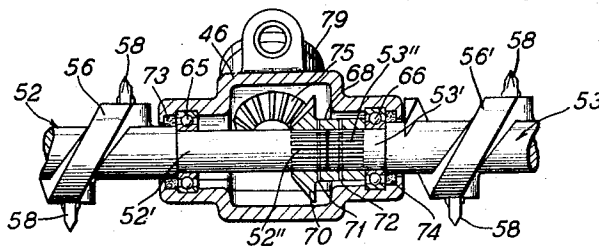


Fig. 3

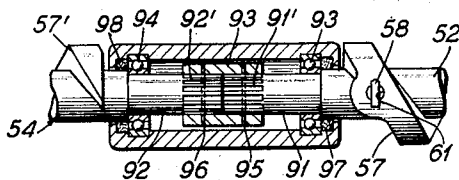


Fig. 4

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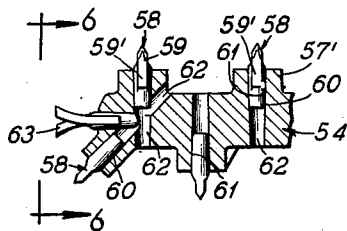


Fig. 5

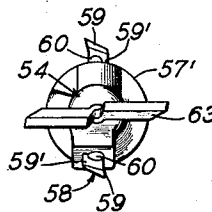


Fig. 6

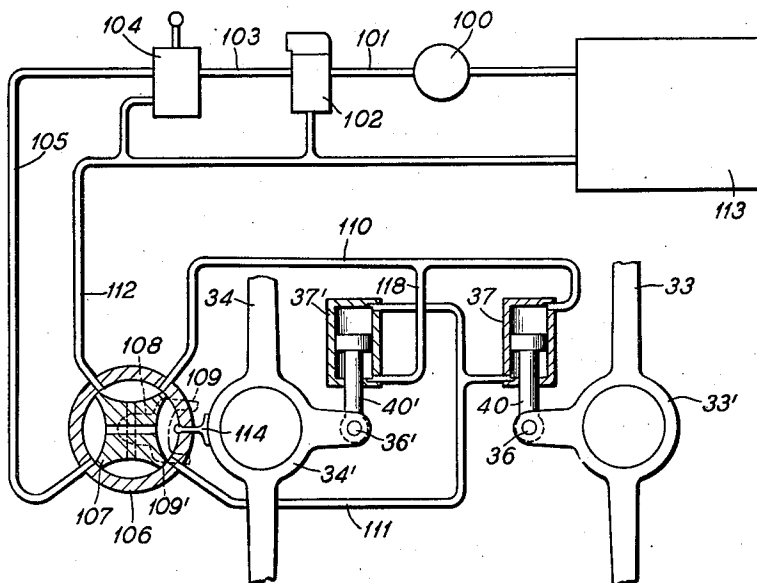


Fig. 7

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BORING TYPE MINING MACHINE HAVING HORIZONTALLY EXTENDING TRIMMER BAR

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6 Claims. (Cl. 262—7)

This invention relates to improvements in mining machines of the boring type, and more particularly to rotary trimmer bar arrangements used on such machines.

Mining machines of the boring type are usually characterized by a mobile frame having a plurality of boring heads rotatable on parallel axes for cutting a plurality of contiguous bores in advance of the machine, together with horizontally extending trimmer bars disposed rearwardly of and generally tangential to adjacent pairs of boring heads so as to trim or cut off the depending and up-standing cusps left between said boring heads as the machine is advanced.

The present invention relates particularly to bit-carrying trimmer bars rotatable on horizontal axes of the kind broadly disclosed in Patent No. 2,734,731, issued February 14, 1956.

Among the objects of the present invention is to provide an improved form and arrangement of rotary trimmer bars and supporting means therefor wherein the bars are oscillated in endwise direction while the machine is in operation, so as to enhance the effectiveness of the cutting action with a relatively small number of cutter bits.

A further object is to provide a form of rotary cutter bar having spiral bit carrying formations thereon which constitute an improved means for clearing the material dislodged from the working face by the machine, and leading such material toward the center of the machine into position for removal by the conveyor on the machine.

Other objects and advantages of the invention will appear from time to time as the following description proceeds:

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

Figure 1 is a front view of a mining machine constructed in accordance with the invention, with one of the boring heads removed;

Figure 2 is an enlarged detailed section taken generally along line 2—2 of Figure 1;

Figure 3 is a detailed section taken on line 3—3 of Figure 2;

Figure 4 is a detailed section taken along line 4—4 of Figure 1;

Figure 5 is a section taken on line 5—5 of Figure 1;

Figure 6 is an end view taken on line 6—6 of Figure 5; and

Figure 7 is a diagram of the hydraulic circuit and associated parts employed for oscillating the rotary cutter bars generally along their axes.

Referring now more particularly to details of the embodiment of the invention shown on the drawings, the numeral 10 generally indicates the main frame of a mobile mining machine which in the form shown is mounted for movement along a mine floor on endless crawlers 11. Mounted on the main frame 10 is a conveyor frame 12 carrying conveyor flights 13 on a center chain 14 mounted for movement upwardly and rearwardly from adjacent the front end of an auxiliary frame 21 so as to remove

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the loose material dislodged during the operation of the machine. The front end of the conveyor frame is extended with forwardly flaring side plates 16 and a downwardly flaring bottom plate 17 which form an open throat for receiving the loose material adjacent the mine floor at the center of the machine. A pair of upright deflector plates 18 extend outwardly from opposite sides of the throat so as to aid in directing dislodged material into the conveyor throat.

The auxiliary frame 21 is mounted as usual by suitable jacks (not shown) at the front end of the main frame 10 so as to provide vertical, forward and rearward, and a lateral tilting adjustments of said auxiliary frame relative to the main frame. The arrangement affording the tilting adjustments just mentioned is well known in the art so need not be shown or described in greater detail herein.

A pair of boring heads 22, 22 have drive shafts 22', 22' journaled in bearings 19 projecting forwardly from the auxiliary frame 21 so that said boring heads rotate on laterally spaced axes for cutting contiguous bores in advance of the machine. Each of the boring heads 22, one of which is shown in full in Figure 1, has a pair of radially extending arms 23, 23. Each of the arms has a forwardly projecting cutter support 24 at its outer end and a second cutter support 26 spaced inwardly thereof. The cutter supports 24 and 26 have a plurality of cutter bits 28 mounted as usual there along. The two pairs of cutter supports 24 and 26 are arranged to cut two concentric kerfs in the mine face. A third pair of cutter supports 27 may be mounted at opposite sides of the arms 23 in position to cut a third smaller concentric kerf.

In addition, a pair of plows 29 are mounted near the outer ends of each of the arms 23 for sweeping dislodged material toward the center of the machine into position for removal by the conveyor flights 13.

The general structure and arrangement of the main frame 10, auxiliary frame 21, and the boring heads 22, as previously described, is more or less conventional in boring machines and is merely illustrative of the environment of the trimmer bars, which form the principal subject matter of the present invention, as will now be described.

A lower trimmer bar indicated generally at 30 is rotatable on a horizontal axis and journaled near opposite ends in supports 46 and 48. Said trimmer bar is located in front of the auxiliary frame 21 and the upright baffle plate 18 and rearwardly of the paths of movement of the two boring heads 22, 22 (see Figures 1 and 2). It will also be observed that the two cutter supports 46 and 48 are disposed respectively in vertical alignment below the axes of the two boring heads 22, 22 so that said boring heads will cut paths for said supports while the machine is being advanced into the mine face.

An upper cutter bar indicated generally at 31 is mounted in a similar manner on supports 47 and 49 at the upper limits of movement of the boring heads 22, 22. In the form shown, the lower and upper cutter bars 30 and 31 are of similar construction so that a detailed description of the lower cutter bar 30 will also apply to similar parts of the upper cutter bar.

The lower cutter bar 30 consists of a rotary shaft-like center section 52 extending between the supports 46 and 48, a stub end section 53 connected to the center section and extending laterally beyond the support 46, and a stub end section 54 connected to the opposite end of the center section and extending laterally beyond the support 48. The center section 52 has a projecting rib 56 formed spirally thereabout and extending from the support 46 inwardly to the center line of the machine, where said rib joins a reversed spiral rib 57 extending from the center line of the machine to the opposite support 48. This reversing spiral rib construction is so designed that when

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the center section 52 is rotated in the proper direction, the cuttings, as well as larger lumps of coal, which are engaged by the center section 52 will be urged inwardly toward the center of the conveyor flights 13 for loading on the latter.

The stub end sections 53 and 54 have spiral ribs 56' and 57' which are, in effect, continuations of the spiral ribs 56 and 57, respectively, on the center section 52.

A plurality of cutter bits 58 are mounted in spaced relation along the spiral ribs 56, 56' and 57, 57' on the center and end sections. In the form shown in detail in Figures 5 and 6, all of said cutter bits are disposed in the same diametrical plane at opposite sides of the trimmer bar. Each bit 58 has a bit blade 59 with the shank 60 generally circular in cross-section and tapered toward its inner end but with a portion 59' of the blade off-set toward the rear of said shank. Each shank is adapted to have wedge-fitting engagement in bit receiving apertures 61 along the spiral ribs. Said apertures also have through-holes 62 extended therethrough to the opposite side of the trimmer shaft to aid in ejecting the bits when desired.

The stub end sections 53 and 54 may also have wing-shaped cutter bits 63 projecting at the outer ends thereof.

The arrangement for journalling the lower trimmer bar in the supports 46 and 48 is shown in detail in Figures 2, 3 and 4. The support 46 includes a drive connection for the trimmer bar, whereas the support 48 affords a bearing support for adjacent ends of the center shaft section 52 and the stub end section 54.

Referring first to the support 46, said support consists of a generally cylindrical housing which is split longitudinally with a removable outer cap 68 fastened to the support 46 by screws 69. The shaft of the center section 52 has a reduced end portion 52' journaled in bearing 65 in one end of the support 46. The shaft of end section 53 has a reduced end portion 53' journaled on bearings 66 in the opposite end of support 46. The reduced end portion 53' is considerably shorter than the reduced end portion 52' and the abutting ends of these two shafts have splines 52'' and 53'', thereon, both seated in an elongated splined hub 68 of a bevel gear 70. The hub 68 of said bevel gear may be fixed to the adjacent splined ends of shaft portions 52' and 53' as by pins 71 and 72. The shafts 52' and 53' have end seals 73 and 74 in the support 46 outside of the bearings 65 and 66, respectively.

The bevel gear 70 is meshed with a bevel pinion 75 on a shaft 76 which is rotatably mounted in bearings 77 and 78 in a tubular extension 79 on support 46. This tubular extension and the shaft carried thereby extends at an upwardly and rearwardly angle from the support 46 and the shaft is connected by a conventional extensible universal coupling 80 to a shaft 81 which is journaled in bearings 82 and 83 in a tubular housing 84 mounted on the auxiliary frame 21. The shaft 81 has a bevel pinion 85 at its upper end meshed with a beveled pinion 86 on a horizontal shaft 87 journaled on a support 88 fixed in the auxiliary frame 21. The shaft 87 has a spur gear 89 fixed thereon which may be driven from the main drive gear (not shown) for one of the boring heads 22.

As will be seen from Figure 2, the shaft 76 and the front end of the universal coupling 80 pass through an aperture 90 in the adjacent upright plate 18 at the front end of the machine with ample clearance to permit lateral oscillation of the support 46 and the trimmer bar carried thereby, as well as to permit the several tilting adjustments of the auxiliary frame 21 relative to the main frame 10.

The trimmer bar support 48 is split longitudinally in the same manner as described in connection with the support 46. The center section 52 and the end section 54 have reduced shaft sections 91 and 92, respectively, which extend into opposite ends of the support 48 and are journaled respectively in bearings 93 and 94 in the latter.

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The abutting ends of the reduced shaft portions 91 and 92 are splined at 91' and 92' and fit in a connecting collar 93 which is fastened on said spline shaft ends as by pins 95 and 96. The shafts 52 and 54 have end seals 97 and 98 in the support 48 outside of the bearings 93 and 94 respectively.

Referring again to Figure 1, it will be seen that the upper and lower trimmer bars 30 and 31 form respectively the upper and lower cross-members of a parallelogram linkage, the upright portions of which linkage consists of a pair of connecting members 33 and 34 which are pivotally mounted respectively by central hubs 33' and 34' surrounding the bearing supports 19, 19 of the cutter heads 22 and 22.

In the form and arrangement shown in Figure 1, the upper trimmer bar 31 has a support 47 near its left end which is similar in construction to the support 46 near the right end of the lower trimmer bar 30 as seen in this figure. Said upper trimmer bar also has a support 49 adjacent its right end which is similar in construction to the support 48 near the left end of the lower trimmer bar 30. The lower end of the upright connecting member 33 is pivotally connected by pin 44 to the support 46 of the lower trimmer bar and the similar lower end of the connecting member 34 is pivotally connected by pin 44' to the support 48. In the same manner the upper end of the connecting member 33 is pivoted by pin 45 to the support 49 of the upper trimmer bar and the upper end of the similar connecting member 34 is pivotally connected by pin 45' to the support 47. It will be manifest that with this parallelogram type of construction, the two connecting members 33 and 34 may be rocked about their respective axes so as to oscillate the upper and lower trimmer bars equally in opposite directions, generally longitudinally of their axes.

The means for oscillating the connecting members 33 and 34 consist of a pair of hydraulic jacks or cylinders 37, 37' pivotally connected on pivot pins 38, 38' to supports 39, 39' mounted on the front face of the auxiliary frame 21. The jacks 37, 37' have piston rods 40 and 40' respectively pivotally connected at 36, 36' to levers 41 and 41' projecting inwardly from the hubs 33' and 34' of the upright connecting members 33 and 34.

The hydraulic power connections for actuating the jacks 37 and 37' is shown in detail of the diagram of Figure 7. As will be seen from this figure, said hydraulic cylinders are actuated by pressure supplied thereto from a pump 100 having a high pressure line 101 leading to a conventional relief valve 102 and through line 103 through control valve 104 and high pressure line 105 to an automatic reversing valve 106. This reversing valve is of a conventional type well known in the art, having a rotating valve element 107 adapted to be thrown in one direction or the other by a forked shifting lever 108 having a pair of spaced contact members 109 and 109' at its outer end, so as to direct the flow of fluid from the pressure line 105 either through a line 110 leading to the upper and lower ends respectively of the hydraulic cylinders 37 and 37' or through a second line 111 leading to the lower and upper ends respectively of said cylinders. The reversing valve 106 is also arranged so as to simultaneously relieve pressure from hydraulic cylinders 37 and 37' through lines 110 and 111 to a relief line 112 leading to a sump or tank 113.

As will be further seen from Figures 1 and 7, the hub 34' of the upright connecting member 34 has a projecting finger 114 which projects between the contact members 109 and 109' on the forked shifting lever 108. The arrangement of such that when pressure is applied through the reversing valve 106 with the valve element 107 in one of its two operating positions, the two upright connecting bars 33 and 34 will be rocked in the same direction, until the finger 114 engages one of the contact members 109 or 109' on the shifting lever 108 so as to rotate valve element 107 into its second re-

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versed position so as to reverse the flow of fluid leading to and from said cylinders. This produces an automatic reversal of the rocking or oscillating movement of the connecting members 33 and 34, and the trimmer bars carried thereby.

The use and operation of the machine is as follows:

The machine as a whole is advanced toward the working face on its crawlers 11 with the two boring heads 22 and 22 rotating in synchronized opposite directions so as to tend to sweep the material dislodged from the working face inwardly along the mine floor toward the center conveyor. Simultaneously, the upper and lower trimmer bars 30 and 31, which follow immediately behind the path of rotation of the two cutter heads, are rotated through their respective driving connections. While the trimmer bars are being rotated, they are also oscillated transversely of the machine by rocking movement of the connecting members 33 and 34. The center sections 52 of the trimmer bars between the outer-most vertical limits of the bores A, A cut by the two cutter heads, will trim off cusps left at the floor and roof respectively between said cutter heads as indicated at B, B. The outer stub ends 53 and 54 of the trimmer bars will also extend the bore pattern at the floor and roof levels, beyond the bores A, A as indicated at C, C in Figure 1.

This transverse oscillating movement of the trimmer bars extends the cutting effect of the opposite ends of the two trimmer bars. It also aids the cutting action of the cutter bits 58 on the trimmer bars because they are constantly being shifted laterally in one direction or the other to attack the coal face at different points instead of rotating in the same paths longitudinally of the machine. Due to this oscillating motion, therefore, it is possible to obtain more effective cutting action of the bits 58 with a relatively small number of such bits. Moreover, if one or more of the bits should be lost or broken, the operation of the machine may be continued without materially effecting the cutting action of the trimmer bars.

It will be further understood that due to the spiral formation of the ribs 56, 57 on the center section 52 and the similarly spiralled ribs 56', 57' on the end sections 53 and 54 of the trimmer bars, the loose material dislodged by the machine and engaged by said ribs, and particularly by the lower trimmer bar 30, will tend to be moved inwardly from opposite sides of the machine into loading position in front of the open throat of the conveyor.

One of the special advantages of rotating trimmer bars of the kind disclosed herein is the fact that the trimmer bars are capable of cutting either at roof and floor levels either when the machine is being advanced into the working face or when it is being retracted from the working face or when the auxiliary frame 21 is being tilted so as to change the angle of advance of the machine into the working face. It will be seen that the trimmer bars are capable of cutting their own clearance either when the machine as a whole is being advanced or retracted or when the auxiliary frame is tilted in any direction with respect to the main frame.

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

I claim:

1. In a mining machine of the boring type having a mobile frame with a plurality of boring heads journaled on parallel axes for cutting a plurality of contiguous

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bores in advance of the frame, a horizontally extending trimmer bar disposed generally tangential to but rearwardly of an adjacent pair of boring heads to cut off the cusp left between said adjacent boring heads, said trimmer bar including a cutter-bit-carrying bar rotatable on a horizontal axis, means including a pair of laterally spaced parallel arms rockably mounted on said frame for oscillating said trimmer bar generally longitudinally of its axis and in a substantially fixed vertical plane, and power connections from said frame for rotating said bar on its axis.

2. The structure of claim 1, wherein the frame has a loading conveyor with a receiving throat adjacent the bottom of the frame rearwardly of the trimmer bar, and the trimmer bar has reversely extending spiral rib formations along its opposite ends for guiding loose material from opposite ends of said bar toward a loading position in front of said conveyor throat upon rotation of said trimmer bar in a normal cutting direction.

3. The structure of claim 1, wherein the trimmer bar is journaled in two laterally spaced supports, the pair of rocking arms are pivoted on said frame on axes disposed vertically of the bar, said trimmer supports are pivoted to the ends of said rocking arms, and the means for oscillating the trimmer bar includes reversible power means connected to the rocking arms.

4. The structure of claim 3, wherein the pair of rocking arms are pivoted on the frame in substantially vertical alignment with the axes of the adjacent pair of boring heads, and the trimmer bar supports are oscillated within the bore patterns cut by said boring heads.

5. In a mining machine of the boring type having a mobile frame with a plurality of boring heads journaled on parallel axes for cutting a plurality of contiguous bores in advance of the frame, said frame having a loading conveyor with a receiving throat adjacent the floor level between an adjacent pair of boring heads, a pair of horizontally disposed rotary trimmer bars disposed rearwardly of said adjacent pair of boring heads, and generally tangential to the upper and lower limits of said boring heads for cutting off the depending and upstanding cusps left between said boring heads at roof and floor levels respectively, said trimmer bars each consisting of a cutter-bit-carrying bar, rotatable upon a horizontal axis in a pair of longitudinally spaced journal supports, means for oscillating said upper and lower trimmer bars transversely of the machine in mutually reversed directions including a pair of upright rocking members pivotally connected to said frame intermediate their ends on laterally spaced axes, and pivotally connected at their upper and lower ends to said journal supports, power means for oscillating said rocking members, and power connections on said frame for rotating said trimmer bars.

6. The structure of claim 5, wherein the rocking members are pivotally mounted on said frame concentrically with the axes of the adjacent boring heads, the journal supports for the trimmer bars are oscillable in arcs within the bore patterns cut by said boring heads, and the power connections from the frame to said trimmer bars are effected through one of the journal supports of each of said trimmer bars.

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