Nov. 17, 1964 J. GONSKI 3,157,437

CONTINUOUS MINING MACHINE OF THE OSCILLATING HEAD TYPE

Filed Sept. 19, 1962 3 Sheets-Sheet 1

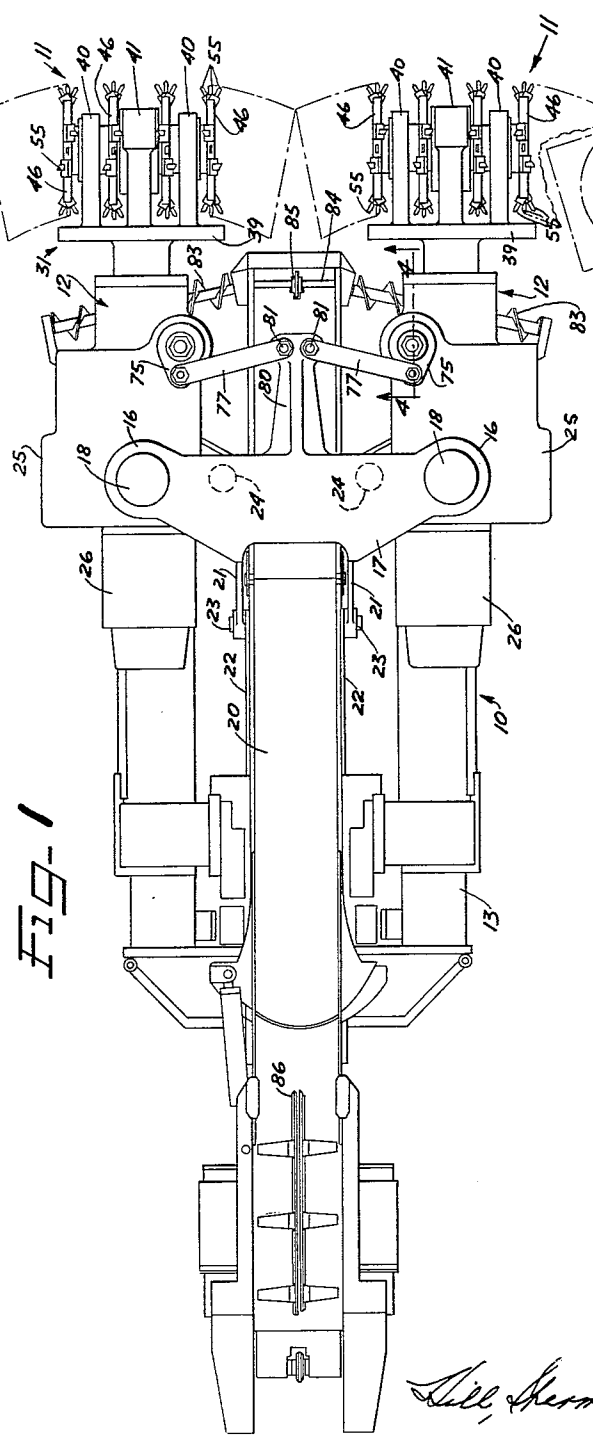


FIG. 1

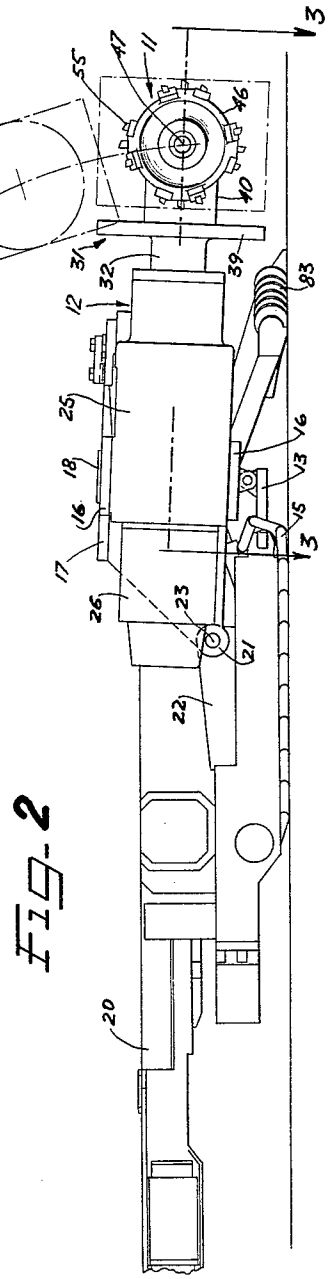


FIG. 2

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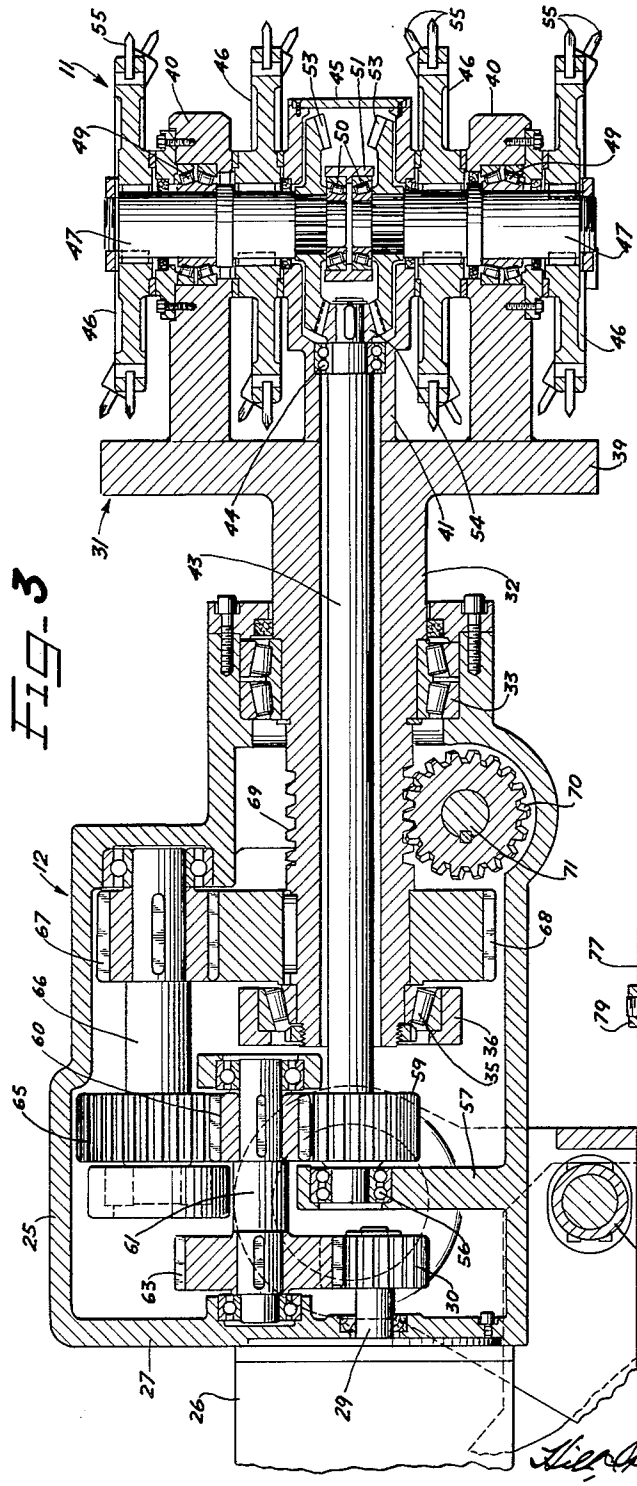


Fig. 3

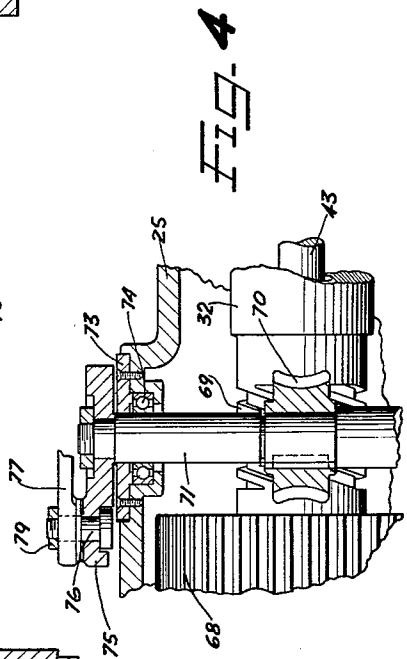


Fig. 4

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Fig. 5

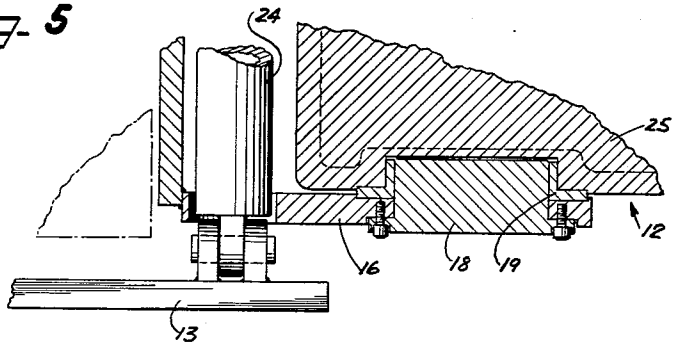
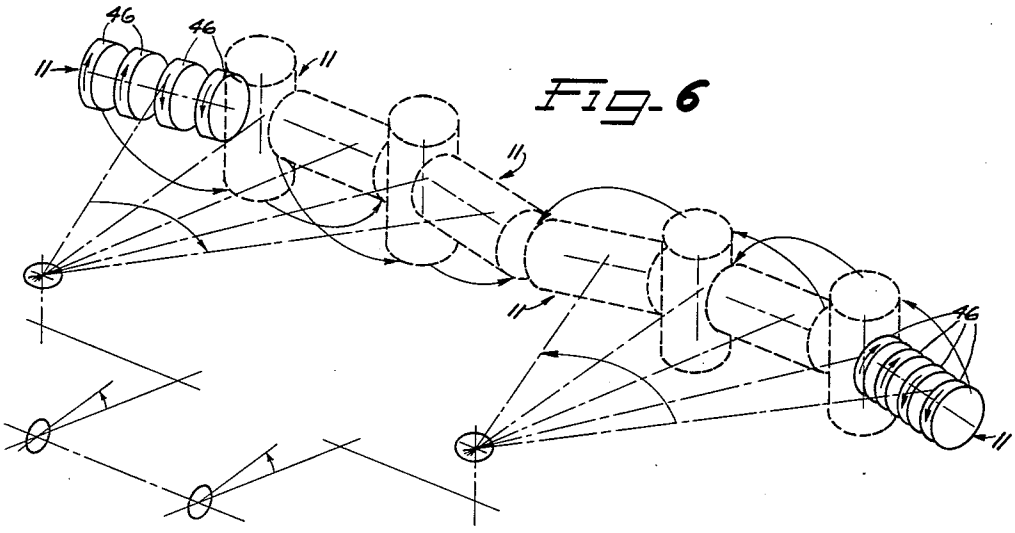


Fig. 6



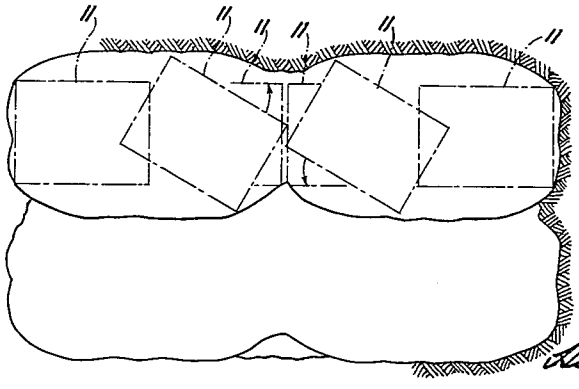


Fig. 7

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3,157,437

CONTINUOUS MINING MACHINE OF THE OSCILLATING HEAD TYPE

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Filed Sept. 19, 1962, Ser. No. 224,675
12 Claims. (Cl. 299—71)

This invention relates to improvements in mining machines and more particularly relates to an improved form of continuous mining machine in which the mining heads are oscillatably driven to mine out a complete area of a working place in a mine.

A principal object of the invention is to provide an improved form of continuous mining machine arranged with a view toward mining out an area of a working place in a mine with a reduction in power consumption.

Another object of the invention is to improve upon the continuous mining machines having oscillating drum type mining heads heretofore in use, by bodily rotating the mining heads about axes extending longitudinally of the machine as they are rotatably and oscillatably driven.

A further object of the invention is to provide an improved form of continuous mining machine in which the mining heads are supported on boom arms for rotation about axes extending longitudinally and transversely of the boom arms and are oscillatably driven during rotation about longitudinal and transverse axes, to mine out an area substantially equal in height to the length of the mining heads, and of a width determined by the phase of oscillatable movement of the mining heads.

A further object of the invention is to provide an improved form of oscillating head type of continuous mining machine in which the heads comprise a series of rotatable cutter disks rotatable about axes extending transversely of their supports and are supported on the ends of the boom arms and rotated about axes extending longitudinally of the boom arms, in which the cutter disks on one side of the longitudinal axis of the associated boom arm are rotated in one direction and the cutter disks on the opposite side of the longitudinal axis of the boom arm are rotated in an opposite direction, and in which the directions of rotation of the cutter disks are such as to rotate said cutter disks in the direction of turning movement of the cutter heads about their longitudinal axes, to engage the cutter bits on the disks on each side of said longitudinal axis with the mine face in the direction of cutting movement of the mining heads.

These and other objects of the invention will appear from time to time as the following specification proceeds and with reference to the accompanying drawings wherein:

FIGURE 1 is a top plan view of a continuous mining machine constructed in accordance with the principles of the present invention;

FIGURE 2 is a view in side elevation of the continuous mining machine shown in FIGURE 1;

FIGURE 3 is an enlarged partial fragmentary longitudinal sectional view taken through one of the boom arms and mining heads substantially along line 3—3 of FIGURE 2;

FIGURE 4 is a partial fragmentary sectional view taken substantially along line 4—4 of FIGURE 1 and showing certain details of the drive means for oscillatably driving the mining heads;

FIGURE 5 is a fragmentary detail transverse sectional view illustrating certain details of the vertical pivotal mounting of one of the boom arms, and the mounting of the lifting jacks on the main frame of the machine;

FIGURE 6 is an extended diagrammatic view with the paths of the mining heads stretched out in order to show

the paths of the mining heads during a complete cycle of bodily rotation thereof about their boom arms to effect travel of the mining head from the ribs to the center of a working face; and

FIGURE 7 is a diagrammatic view diagrammatically showing the cutting paths of the mining heads and the pattern of mining a working face of a mine.

In FIGURES 1 and 2 of the drawings, I have shown a continuous mining machine 10 of the oscillating head type having two mining heads 11, 11 mounted on the outer ends of individual boom arms 12, 12 extending in advance of a main frame 13 of the machine, and mounted on said main frame for vertical adjustable movement about an axis extending transversely of said main frame adjacent the forward end thereof, and for oscillatable movement in opposite directions about axes extending perpendicular to said transverse axis.

The main frame 13 is mounted on laterally spaced continuous traction tread devices 15, for propelling the machine along the ground from working place to working place at a high traveling speed, and advancing the machine toward a working face at a relatively low feeding speed, to feed or sump the mining heads 11, 11 into the working face of a mine.

The boom arms 12, 12 extend between the furcations 16 of a bifurcated tilting frame structure 17 and are mounted thereon on individual stub shafts 18, 18 projecting inwardly of said furcations on bearings 19, 19, as shown in FIGURES 1 and 5.

The angularly movable elevator frame 17 extends across the forward end of the conveyor 20 and has parallel spaced arms 21, 21 extending rearwardly therefrom along opposite sides of the conveyor 20 and transversely pivoted at the lower rear ends of said arms on parallel spaced wall members 22, 22, extending along the outer sides of the side walls of the conveyor 20, and transversely pivoted to said wall members on pivot pins 23, 23. Hydraulic jacks 24, 24 transversely pivotally connected between the front of the main frame 13 and the elevator frame 17, at opposite sides of the conveyor 20, are provided to move said elevator frame about the axes of the pivot pins 23, 23 and elevate or lower the mining heads 11 and hold said mining heads in cutting positions.

The conveyor 20 is shown as being a conventional laterally flexible single strand chain and flight conveyor and extends from a position adjacent the ground in advance of the forward end of the main frame 13, in an upwardly inclined direction over the top of the main frame 13 beyond the rear end thereof, to discharge the mined material onto shuttle cars or other material transporting means.

Each boom arm 12 is shown as being in the form of a housing and has a housing portion 25 containing drive gearing for driving the mining heads about their axes of rotation, rotating the mining heads about axes extending longitudinally of said boom arms and oscillating said mining heads in opposite directions. A motor 26 is mounted on and projects rearwardly of a rear wall 27 of the housing 25 and has a motor shaft 29 extending within the housing portion 25 and having a pinion 30 on its outer end, serving as a drive pinion for oscillatably and rotatably driving the associated mining head 11.

A mounting member 31 forms a mounting for the associated mining head 11 and has a hollow shaft portion 32 extending rearwardly of the mining head within the housing 25 and journalled at the forward end portion of said housing on bearings 33, and journalled in its rear end within said housing on bearings 35 carried in a bearing support 36, suitably mounted within the housing 25.

The mounting member 31 for the mining head includes a plate 39 at the front of the hollow shaft portion 32, which plate may be circular and has two parallel spaced

support arms 40 extending forwardly therefrom adjacent the outer ends thereof and an inner arm 41 in the form of a housing, and opening along a drive shaft 43 and forming a support for a bearing 44 for the forward end of said drive shaft. A cover 45 closes the outer end of the housing 41.

The mining head 11, as shown in FIGURE 3, comprises two spaced disks 46 on opposite sides of each arm 40. Each pair of disks 46 is keyed or otherwise secured to a shaft 47 journalled intermediate its ends in the arms 40 on bearings 49. The inner ends of the shafts 47 are journalled on bearings 50, mounted in a bearing support member 51 suitably mounted within the housing 41. Facing bevel gears 53 are shown as being splined on the inner end portions of the shafts 47 and as meshing with and being driven from a bevel pinion 54, keyed or otherwise secured to the forward end of the shaft 43. The shafts 47 are thus driven from the shaft 43 in opposite directions to drive the cutter disks 46 on opposite sides of the shaft 43 in the general direction of rotation of the mining head about the axis of the hollow shaft 32. The cutter disks 46 have the usual cutter bits 55 mounted thereon and projecting from the periphery thereof and pitched in various angles with respect to said disks to cut clearance for the respective disk. It will be noted from FIGURE 3 that the cutter bits 55 on the cutter disks 46 on the side of the shaft 43, shown in FIGURE 3 as being the left hand side of said shaft, face in a direction to cut when the disks 46 rotate in clockwise directions, while the cutter bits 50 on the opposite side of the shaft 43 face oppositely from the cutter bits 55 previously mentioned, to cut when the cutter disks 46 rotate in counterclockwise directions.

The shaft 43 extends along the hollow interior portion of the hollow shaft 32 beyond the rear end thereof and is journalled at its rear or inner end in an anti-friction bearing 56, mounted in a bearing support 57. A spur gear 59 is keyed or otherwise secured to the shaft 43 and is meshed with and driven from a spur pinion 60 on a shaft 61 suitably journalled within the gear housing 25 and extending parallel to the shaft 43. A spur gear 63 on the inner end of the shaft 61 meshes with and is driven from the motor pinion 30 and drives the shaft 61.

The spur gear 60 also drives a spur gear 65 on a shaft 66 journalled within the housing 25 parallel to the shaft 61. The shaft 66 has a spur pinion 67 keyed or otherwise secured thereto, meshing with a spur gear 68 keyed or otherwise secured to the rear end portion of the hollow shaft 32, outwardly of the bearing 35, for driving said hollow shaft and rotating the associated cutter head 11 about the axis of said hollow shaft during the operation of mining.

The hollow shaft 32 is shown as having a worm 69 cut integrally therewith meshing with and driving a worm gear 70 keyed or otherwise secured to a vertical shaft 71 suitably journalled within the housing 25 and projecting upwardly of said housing through a cap 73 maintaining a bearing 74 for said shaft in its bearing support. A crank 75 is suitably secured to the upper end of the shaft 71 and is rotatably driven therefrom. The crank 75 has a pin 76 mounted on its outer end and projecting upwardly therefrom. A link 77 is pivotally mounted on the pin 76 and is secured thereto as by a nut 79 threaded on said pin. The link 77 extends inwardly of the crank 75 and is pivotally connected at its inner end to a rigid arm 80, extending forwardly of the elevating frame 17, on vertical pin 81. The rigid arm 80 thus forms a rigid reaction member for the two links 77 to effect oscillatable movement of the two mining heads 11 in opposite directions upon rotation of the cranks 75, as the mining heads are rotated about the longitudinal axis of the hollow shaft 32 and about the axes of the transversely extending shafts 47.

Thus when the two motors 26 are turned on, the cutter disks 46 on opposite sides of the shaft 43 will be driven

in opposite directions, the hollow shafts 32 and mounting members 31 will be rotatably driven in opposite directions about axes extending longitudinally of the boom arms to bodily rotate the mining heads 11, and the cranks 75 will oscillatably move the boom arms and mining heads 11 as they are rotated about axes extending longitudinally and transversely of the boom arms 12. The lengths of the cranks 75 are preferably such as to move each mining head from the rib to the center of the working place during each half revolution of the cranks, it being understood that cranks of varying lengths may be interchanged with the cranks 75 to mine wider or narrower working faces than shown herein.

In mining, where the seam to be mined is of greater thickness than the length of the mining heads 11, the jacks 24 may elevate the boom arms 12 about the axes of the pivot pins 23, with the mining heads positioned vertically to position the ends of the mining heads adjacent the top of the seam. The mining heads 11 may then be rotated into their transverse positions with the cranks 75 positioning said mining heads with their ends adjacent opposite ribs of the working place. The mining heads 11 may then be rotatably driven to oppositely rotate the cutter disks 46 and bodily rotate the mining heads in opposite directions about the axes of the hollow shafts 32, and at the same time oscillatably move the mining heads across the working face from the rib to the center of the working face. During operation of the mining heads the traction tread devices 15 advance the mining heads into the face so that relatively shallow kerfs are cut across the working face during each cycle of oscillation of the mining heads.

It may be seen from FIGURE 6, that the mining head adjacent the left hand rib is bodily rotated about the axis of the hollow shaft 32 in a downward or counterclockwise direction, while the cutter disks 46, 46 on opposite sides of the drive shaft 43 rotate in opposite directions, the outer cutter disks 46 rotating in clockwise directions and the inner cutter disks 46 rotating in counterclockwise directions to cut in the direction of bodily rotation of the mining head. The opposite mining head 11 is bodily rotated to move upwardly from the rib into an upright position in a counterclockwise direction, as the two pairs of cutter disks on opposite sides of the axis of the hollow shaft 32 are rotated in opposite directions so the cutter disks on each side of the axis of the shaft 32 will be driven in cutting directions, as the mining head bodily rotates about the axis of said shaft.

The geared reduction drives to the hollow shaft 32 and the crank 75 are so proportioned with respect to each other that upon the completion of angular travel of the mining heads from the rib to the center of the working place, each mining head will have completed one cycle of bodily rotation about the axis of its hollow shaft 32 and will thereby have completed a shallow cut in the working face from the rib to the center of the working face.

During the mining operation, screw conveyors 83 suitably supported on the main frame 13 in advance thereof, progress the mined material inwardly toward the conveyor 20 to be loaded onto said conveyor as the machine advances into the working place. The screw conveyors 83 may be of a conventional form and may be driven from a transverse shaft 84 having a direction changing idler 85 mounted thereon and driven from a chain 86 of the conveyor as it turns about said direction changing idler 85. Said screw conveyors and the drive thereto are no part of the present invention, so need not herein be shown or described further.

Upon the completion of the mining of the upper bench, the machine may be withdrawn by the traction tread devices 15 and the mining heads may then be positioned to mine the lower bench of the working place along the floor.

It should be understood, however, that while I have shown the first mining operation as being downwardly

from the roof that the first mining operation may also be upwardly from the floor.

It should also be understood that FIGURE 6 shows the paths of travel of the mining heads as stretched out in order to clearly show how mining is effected, while FIGURE 7 shows the true cutting paths of the mining heads during each cycle of operation thereof, and shows how the mining heads clear themselves at the center of the working place, and also shows that the cusps left between the mining heads are negligible.

While I have herein shown and described one form in which my invention may be embodied, it may readily be understood that various variations and modifications in the invention may be attained without departing from the spirit and scope of the novel concepts thereof as defined by the claims appended hereto.

I claim as my invention:

1. In a continuous mining machine,
a frame,
a rotary mining head spaced in advance of said frame,
mounting means for said mining head mounting said mining head for rotation about an axis extending transversely of said frame,
support means for said mounting means mounting said mounting means for rotation about an axis extending longitudinally of said frame and for sidewise oscillation,
means for rotatably driving said mining head and simultaneously rotating said mounting means about said longitudinal axis,
and other means for oscillatably moving said support means to effect sidewise oscillatable movement of said mining head during rotation thereof about said longitudinal and transverse axes.

2. A continuous mining machine in accordance with claim 1 wherein each mining head comprises,
two aligned transverse shafts rotatably mounted on said mounting means on opposite sides of the longitudinal axis of said mounting means,
at least one cutter bit carrying cutter disk on each shaft, and drive means for said shafts driving said shafts and cutter disks in opposite directions during bodily movement of said cutter disks about said longitudinal axis.

3. A continuous mining machine comprising,
a frame,
two rotary mining heads spaced in advance of said frame,
mounting means for said mining heads mounting said mining heads for rotation about axes extending transversely of said frame,
support means for said mounting means mounting said mounting means for rotation about axes extending longitudinally of said frame and for sidewise oscillation,
means for rotatably driving said mining heads and simultaneously rotating said mounting means about said longitudinal axes,
and other means for oscillatably moving said support means to effect sidewise movement of said mining heads in opposite directions.

4. A continuous mining machine comprising, a frame,
two rotatable mining heads spaced in advance of said frame,
mounting means for said mining heads mounting said mining heads for rotation about axes extending transversely of said frame,
support means for said mounting means, mounting said mounting means for rotation about axes extending longitudinally of said frame and for sidewise oscillation,
a separate motor for each mining head, means driven by each motor for rotatably driving an associated mining head,
other means rotatably driven by each motor for rotating an associated mounting means and bodily rotating said mining heads about axes extending longitudinally of the machine,
and oscillatable drive means driven by said motor for oscillatably driving said mining heads in opposite directions.

5. A continuous mining machine comprising a frame,
two rotatable mining heads supported in advance of said frame, each mining head comprising a plurality of aligned spaced rotary cutter disks, mounting means for said cutter disks mounting said cutter disks for rotation about axes extending perpendicular to the longitudinal axis of said frame,
support means for said mounting means, supporting said mounting means for rotation about axes extending longitudinally of said frame and for sidewise oscillation,
means for rotatably driving the cutter disks of each mining head in opposite directions,
and for simultaneously rotating said mounting means about said longitudinal axis,
and other means for oscillatably moving said support means to effect sidewise oscillatable movement of said mining heads in opposite directions during rotation thereof.

6. A continuous mining machine in accordance with claim 5 wherein each mining head comprises,
two aligned transverse shafts rotatably mounted on said mounting means on opposite sides of the longitudinal rotational axis of said mounting means,
wherein each shaft has at least two rotary cutter disks mounted thereon,
wherein the drive means for said shafts includes an individual bevel gear for driving each shaft,
driving said shafts in opposite directions to drive said cutter disks on opposite sides of said longitudinal rotational axis in cutting directions during rotation thereof about said longitudinal axis.

7. A continuous mining machine in accordance with claim 6 wherein jack means are provided for raising and lowering said support means for said mining heads and for holding said support means and mining heads in position to mine out a working place in benches.

8. A continuous mining machine comprising, a main frame,
two rotary mining heads mounted in advance of said main frame for bodily rotation about axes extending longitudinally of said main frame and for oscillatable movement toward and from each other in opposite directions,
each mining head including a shaft extending perpendicular to said longitudinal axis,
at least one cutter bit carrying cutter disk mounted on said shaft and having cutter bits projecting from the periphery thereof,
means for rotating said mining heads about said longitudinal axes and rotatably driving said shaft and for oscillatably moving said mining heads toward and from each other in opposite directions.

9. In a continuous mining machine,
a main frame,
a boom arm mounted on said frame for sidewise oscillatable movement,
a mounting member extending in advance of said boom arm and mounted thereon for rotation about an axis extending longitudinally thereof,
a mining head rotatably mounted on said mounting member,
said mining head including a pair of aligned shafts mounted for rotation about coaxial axes extending transversely of said longitudinal axis of said boom arm,
each shaft having at least one cutter disk thereon having cutter bits projecting from the periphery thereof,

a motor on said boom arm,
a longitudinal shaft driven from said motor,
drive connections from said longitudinal shaft for driving said transverse shafts in opposite directions,
other drive connections from said motor for bodily rotating said mounting member and mining head about an axis extending longitudinally of said boom arm,
and means driven from said last-mentioned drive connections for oscillatably moving said boom arm and mining head sideways.

10. In a continuous mining machine,
a mobile main frame,
an elevator frame at the forward end of said main frame and transversely pivoted thereto,
a boom arm,
means pivotally mounting said boom arm on said elevator frame for oscillatable movement about an axis extending generally perpendicular to the axis of pivotal mounting of said elevator frame on said main frame,
a mounting member rotatably mounted on said boom arm for rotation about an axis extending longitudinally thereof,
a rotary mining head rotatably mounted on said mounting member for rotation about an axis extending transversely of said longitudinal axis,
a motor on said boom arm,
a drive connection from said motor, for driving said mining head, including a shaft coaxial with the axis of rotation of said mounting member,
another drive connection from said motor for rotatably driving said mounting member about said longitudinal axis and bodily rotating said mining head,
and oscillatable driving means driven from said motor for oscillatably driving said mining head during rotation thereof about the axis of pivotal connection of said boom arm to said elevator frame.

11. A continuous mining machine in accordance with claim 10 wherein said mining head comprises two aligned shafts extending transversely of said longitudinal axis on opposite sides of said longitudinal axis,
wherein each shaft has at least one cutter disk mounted thereon having cutter bits projecting from the periphery thereof,
and wherein the drive connection from said longitudinal shaft to said cutter disks comprises facing beveled gears and a bevel pinion on said longitudinal shaft driving said bevel gears in opposite direction and driving said cutter disks on each side of said longitudinal shaft in the general directions of bodily rotation of said mining head.

12. In a continuous mining machine,
a mobile main frame,
an elevator frame extending across the forward end of said main frame and transversely pivoted thereto,
a pair of mining heads,
means for mounting said mining heads on said elevator frame for sidewise oscillatable movement with respect thereto and for rotational movement with respect thereto about axes extending longitudinally and transversely of said main frame,
said mining heads each including a rotary cutter disk on each side of the longitudinal rotational axis thereof and rotatable about an axis extending transversely of said longitudinal rotational axis,
means driving said mining head about said longitudinal axis,
means driving said cutter disks on each mining head in opposite directions in the general direction of rotation of said mining heads about said longitudinal axis,
and means for oscillatably moving said mining heads in opposite sidewise directions.

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