A mining and loading apparatus and more particularly a continuous mining apparatus having improved means for supporting and driving the cutter drum assembly from a floating axle shaft at the forward end thereof.
MINING MACHINE DRUM CUTTER

In a continuous mining apparatus of the type employed in this invention, a disintegrating head mechanism is used to dislodge mineral from a mine face and is operable to provide mine passageway or room into which the apparatus advances and mining progresses. The disintegrating head mechanism is pivotally mounted on a mobile base to swing in a vertical plane between the mine roof and floor and includes a rotary drum cutting head assembly arranged on a horizontal transverse axis and having teeth or teeth, which tear away and dislodge the mineral. The rotary drum cutting assembly has the cutting drum portions thereof driven from a central headshaft.

The present invention contemplates improvements over known mining apparatus of the type described hereinabove for example, an improved structure for driving and supporting the drum cutting head assembly which results in the head shaft being primarily a torque transmitting member only and additionally allows for varying the cutting width of a head assembly without revising the head shaft or length.

These and other objects and advantages of the present invention will become more readily apparent from a reading of the following description and drawings in which:

FIG. 1 is a partial plan view of the mining machine embodying the principles of the present invention;

FIG. 2 is an enlarged view, partly in section and showing the mounting casing and a portion of the cutter head assembly of the mining machine shown in FIG. 1; and

FIG. 3 is an enlarged view, partly in section and showing half of the cutter head assembly of the mining machine shown in FIG. 1.

A continuous mining machine generally designated at 10, which embodies the principles of this invention, may assume various forms but, for illustrative purposes, herein comprises a crawler base 14 carrying a frame 16 on which a forwardly extending mining boom 18 is pivotally mounted at the forward end of the frame 16 to swing up and down between a mine roof and a mine floor. A cutting head assembly 24 extends transversely of boom 18 and is rotatably secured thereto at the forward end thereof. Pivotally mounted at the forward end of frame 16 and extending forwardly therefrom beneath the boom 18 is a conventional loading head 26 having oscillatory gathering arms 28 for engaging mined mineral and moving such mineral rearwardly and inwardly toward well known conveying means 30 of the mining machine 10. Conventional fluid jacks (not shown) serve to swing the boom 18 in a vertical plane about the pivot axis thereof and to tilt the loading head 26 about the horizontal axis.

The cutting head assembly 24 is driven from a pair of motors 34. As shown motors 34 are in spaced axial alignment and extend generally parallel to assembly 24. Motors 34 are suitably carried by boom 18 at opposite side portions thereof.

The drive from motors 34 rotatably drives a cutting head assembly head shaft 36. Head shaft 36 extends transversely of the longitudinal axis of mining machine 10 and is captively and rotatably supported by tubular gear casing extensions 38 which extend outwardly (i.e., transversely from the centerline of machine 10) from a forward portion 40 of a main gear and support casing.
Spacer sleeves 60 are positioned along shaft 36 intermediate sprocket 54 and gears 46 so as to maintain a spaced relationship between sprocket 54 and gears 46. Outwardly adjacent (outward being away from sprocket 54 along the centerline of shaft 36) of gears 46, annular roller bearing 62 are disposed radially intermediate shaft 36 and the inner periphery of casing extensions 38 outwardly adjacent the respective axially innermost end of extensions 38. Roller bearings 62 provide a rotational relationship between the casing 42 and shaft 36. It is to be noted that, inasmuch as gear casing extensions 38 are of a comparatively rigid structure, extensions 38 do not deflect laterally a substantial amount under normal operating conditions and hence bearings 62 merely provide a rotational and supporting relationship between shaft 36 and the casing 42 and do not transmit any loads from casing 42 to the shaft 36. Substantially all normal loads acting on casing 42 are dissipated thereby or by the boom 18.

Casing extensions 38 extend axially outward from respective bearings 62 and have the axially outermost ends thereof inwardly spaced from respective axial ends of shaft 36. The inner diameter of casing extensions 38 are shown as being greater than the outer diameter of shaft 36. A respective spacer sleeve 64 is disposed radially intermediate casing extension 38 and shaft 36 at an axially outer portion of extension 38. Sleeve 64 is suitably splined to shaft 36 and is rotatable therewith. The outer diameter of sleeve 64 is less than the inner diameter of the portion of extension 38 radially adjacent thereto. A suitable anti-friction sleeve 66 such as bronze or the like, is disposed radially intermediate sleeve 64 and extension 38 and is fixedly secured to extension 38 in any suitable manner, for example having a radially outwardly extending flange portion 68 outwardly adjacent the outer end of extension 38 with bolt means 70 threadably extending between flange portion 68 and the respective extension 38. With such arrangement of sleeves 64 and 66 as described hereinabove the outer ends of casing extensions 38 are in rotational communication with shaft 36 by means of the rotational engagement between the outer periphery of sleeve 64 and the inner periphery of sleeve 66. As mentioned hereinbefore the gear casing extensions are of a comparatively rigid structure and as such will not deflect laterally a substantial amount under normal operating conditions and hence the rotational communication between the shaft 36 and the outer ends of casing extensions 38 merely provides a rotational and supporting relationship therebetween and will not act to transmit any loads from the casing 42 to the shaft 36.

Outwardly adjacent to sleeves 64 and 66 internally splined rotary drum cutting head driving rings 72 are in driving engagement with shaft 36. When rotary drum cutting heads 50 are in assembled position the inner periphery thereof is spaced radially outwardly from the outer periphery of casing extension portions 38 along substantially the entire axial extent thereof and the axial outermost end of cutting heads 50 are spaced axially outwardly from respective axial ends of shaft 36. Driving rings 72 are in driving engagement with the internal periphery of respective cutting heads 50 in any suitable manner which leaves a gap between the outermost extent of driving rings 72 and the adjacent internal periphery of cutting heads 50. An acceptable arrangement is shown in FIG. 3 wherein driving rings 72 engage a plurality of circumferentially spaced keys 74 which have the outermost extent thereof fixedly secured to respective portions of cutting heads 50 and extend radially inwardly therefrom. With the cutting drum driving arrangement shown in FIG. 3 a suitable gap, for example thirty thousandths of an inch, exists between the outermost extent of driving rings 72 and the respective periphery of cutting heads 50 adjacent thereto.

Each cutting head 50 is rotatably supported by a plurality of roller bearings disposed between the inner periphery thereof and the outer periphery of a respective casing extension 38. As shown in FIG. 3 cutting head 50 is rotatably supported by inner and outer roller bearings 76 and 78, respectively. Bearings 76 are suitably captively disposed intermediate heads 50 and extensions 38 adjacent the axially innermost ends thereof. Bearings 78 are suitably captively disposed intermediate heads 50 and extensions 38 adjacent the axially outermost end of extensions 38.

With the driving and supporting arrangement of cutting heads 50 as described hereinabove reactive forces on cutting heads 50 due to cutting resistance and the like will react on casing extensions 38 and will not react directly on shaft 36 nor will such forces be transferred through extensions 38 to shaft 36. In other words, inasmuch as the cutting heads 50 are rigid members supported to bear on respective portions of casing 42 all external forces thereon will be transferred to casing 42 and such forces shall never be reactive on shaft 36. Accordingly, inasmuch as shaft 36 is isolated from such external reactive forces, shaft 36 will be primarily in torque only. It is to be noted that should the portion of casing heads 50 adjacent driving ring 72 deflect an amount greater than the clearance between such portion and ring 52, a portion of the above described reactive forces will be transferred directly to and cause bending stress in shaft 36, however, under normal operating conditions of a cutting head assembly 24 of this invention designed according to the preferred standards the above mentioned deflection will not occur under normal operating conditions.

The hollow cylindrical rotary drum cutting head extensions 52 have an inner diameter thereof larger than the outer diameter of cutting heads 50 and are rotatably driven by respective cutting heads 50. As shown in FIG. 3, a plurality of circumferentially spaced keys 82 have the inner ends thereof fixedly secured to an outer peripheral portion of cutting heads 50 adjacent the axial outermost ends thereof. Heads 50 drive respective heads 52 by means of keys 82 drivingly engaging respective ones of a plurality of cooperating keyways 84 which are circumferentially spaced about the inner periphery of cutting head extensions 84. Keyways 84 extend axially outwardly from the axially innermost end of cutting heads 52. The above described key and keyway driving arrangement additionally allows for the reciprocable axial movement of cutting head extensions 52 with respect to cutting heads 50 by the axially sliding relationship which exists between keys and keyways 82 and 84, respectively.

Cutting head extensions 52 include transversely extending end cap portions 86 at the respective outer
ends thereof. Hollow cylindrical guiding and supporting members 88 have the outer ends thereof fixedly secured to respective cap portions 86 and extend axially inward therefrom. Supporting members are coaxial with respect to the central axis of cutting head assembly 24. The outer diameter of supporting members 88 is less than the inner diameter of cutting heads 50. Spacer and retaining sleeve 90 are disposed intermediate the inner periphery of cutting heads 50 and the outer periphery of supporting members 88. The outer periphery of sleeves 90 are in captive engagement with a respective axial end portion of cutting heads 50. Antifriction sleeves 92, such as bronze or the like, are disposed radially intermediate respective sleeves 90 and supporting members 88. With the arrangement of supporting members 88 and sleeves 90 and 92 as described hereinabove, cutting head extensions 52 are supported by an outer end portion of respective cutting heads 50 for reciprocable movement with respect to cutting heads 50.

A continuous mining machine 10 having a forward cutting structure constructed according to the principles of this invention has a capability of adjusting to a plurality of cutting widths, for example from 10 feet 10 inches to 15 feet 6 inches, and/or cutting shapes such as square or arch contours, without a necessity of providing new head shafts for such varying cutting widths or shapes. Minor changes in cutting widths can be accomplished by merely extending or retracting the cutting head extensions 52, however, major changes necessitates substitution of new main cutting heads for the existing main cutting heads of a particular cutting head assembly. Inasmuch as the invention herein contemplates the head shaft 36 being primarily a torque transmitting member only, the substitution of new cutting heads of a larger axial length will not result in any additional bending moment being imparted to head shaft 36 and hence head shaft 36 need only be designed to carry the maximum torque load applied thereto. Additionally, inasmuch as the cutting head extensions 52 are driven by the main drum cutting heads and not by the head shaft 36 it naturally follows that a longer length head shaft is not required to drive the cutting head extensions 52 when longer main cutting heads are required.

Cutting head extensions 52 are selectively extended and retracted in any suitable manner for example by hydraulically extensible piston assemblies 96 which have at least the major portion thereof coaxially received within head shaft 36 and have the rod ends thereof in communication with respective end cap portions 86. For a detailed description of hydraulically extensible piston assemblies such as assemblies 96 reference is hereby made to the above mentioned copending application Ser. No. 786,650. Hydraulic pressure fluid is selectively supplied to assemblies 96 by any suitable means for example such means as fully illustrated and described in copending U.S. patent application Ser. No. 786,648, filed Dec. 24, 1968.

Inasmuch as the invention herein is directed to a means for supporting and driving main cutter drums in a manner such that the driving head shaft is primarily a torque transmitting member only and the invention is additionally directed to driving and supporting the cutter drum extensions directly from respective main cutter casings, various modifications can be made to the preferred embodiment described hereinbefore, for example: a cutting head assembly can be constructed without any cutting head extensions 52 or a cutting head extension on one end thereof only; a cutting head assembly can be constructed which does not incorporate the feature of supporting and driving the main cutter drums by means of this invention but which does include the feature of driving the cutter drum extensions directly from the main cutter drums; a cutting head assembly can be constructed which does not include the feature of driving the cutter drum extensions directly from the main cutter drums but which does include the feature of supporting and driving the main cutter drums in a manner of this invention; and the like.

The scope of this invention is to be defined by the scope of the claims appended hereto.

What is claimed is:

1. A mining machine cutting structure comprising: a unitary support member; an elongated cutting head assembly mounted at the forward end of said support member for powered rotation about a longitudinal axis of said head assembly; said longitudinal axis extending transversely of said support member; said cutting head assembly having a longitudinally extending rotatably driven head shaft, said support member having portions thereof extending in opposite directions along said longitudinal axis for rotatably supporting said head shaft at axially spaced portions thereof; said cutting head assembly having axially spaced main cutter casings coaxially extending from opposite sides of said support member and supported solely by said support member; drive means having cooperative portions carried by said head shaft and respective ones of said main cutter casings for transmitting power from said head shaft to said main cutter casings for powered rotation of said main cutter casings; said cooperative portions of said drive means being cooperative for driving only and having a radial clearance between adjacent surfaces thereof.

2. A mining machine cutting structure as specified in claim 1 additionally including bearing means disposed intermediate said portions of said support member and respective main cutter casings.

3. A mining machine cutting structure as specified in claim 1 including axially extensible and retractable end cutter casings.

4. A mining machine cutting structure as specified in claim 3 including drive means having cooperative portions carried by said end cutter casings and respective ones of said main cutter casings for transmitting power from said main cutter casings to said end cutter casings for powered rotation thereof.

5. A mining machine cutting structure as specified in claim 4 wherein said cooperative portions include cooperating key and keyway portions.

6. A mining machine cutting structure as specified in claim 1 including bearing means disposed intermediate said portions of said support member and said head shaft at said axially spaced portions.

7. A mining machine as specified in claim 1 including hydraulically operable extensible means cooperate with said end portions for the selective extension and retraction thereof.

8. A mining machine cutting structure comprising: a unitary support member; an elongated cutting head as-
3,695,725

embly mounted at the forward end of said support member for powered rotation about a longitudinal axis of said head assembly; said cutting head assembly having a longitudinally extending rotatably driven head shaft, said support member rotatably supporting said head shaft; said cutting head assembly having axially spaced and axially extending main cutter casings and axially extensible and retractable end cutter casings; drive means having cooperable portions carried by said head shaft and respective ones of said main cutter casings for transmitting power from said head shaft to said main cutter casings for powered rotation thereof; and other drive means having cooperable portions carried by said end cutter casings and respective ones of said main cutter casings for transmitting power from said main cutter casings to said end cutter casings for powered rotation thereof.

9. A mining machine cutting structure as specified in claim 8 with said support member having portions thereof extending in opposite directions along said longitudinal axis and including bearing means disposed intermediate said portions of said support member and respective main cutter casings for supporting said main cutter casings.

10. A mining machine cutting structure as specified in claim 8 wherein said cooperable portions of said other drive means include cooperating key and keyway portions.

* * * * *