Jan. 10, 1956 F. CARTLIDGE 2,730,344

COAL MINING MACHINE WITH ROTARY CUTTING AND DISLODGING DRUM

Filed Sept. 20, 1949 4 Sheets-Sheet 1

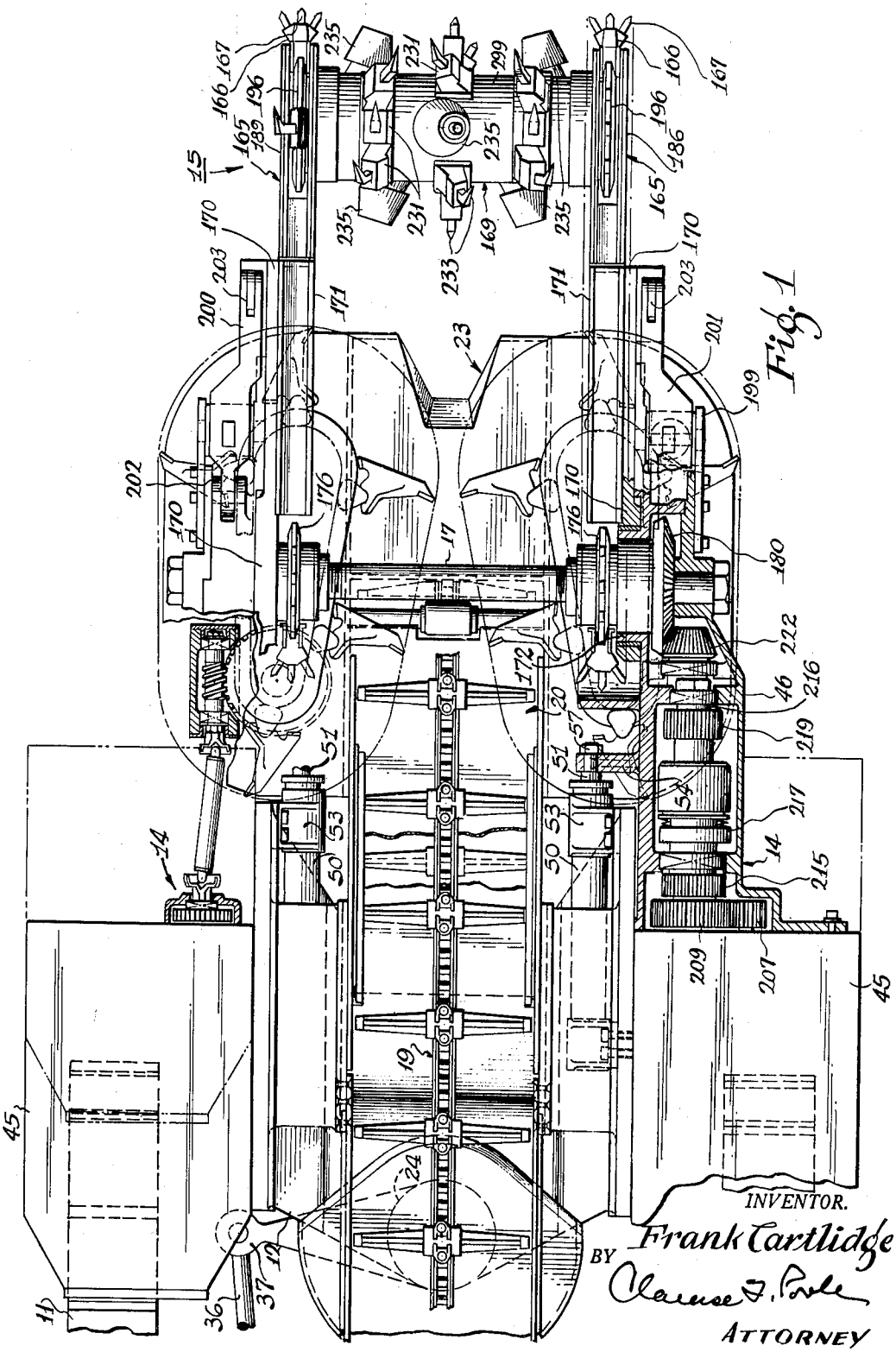


Fig. 1

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4 Sheets-Sheet 2

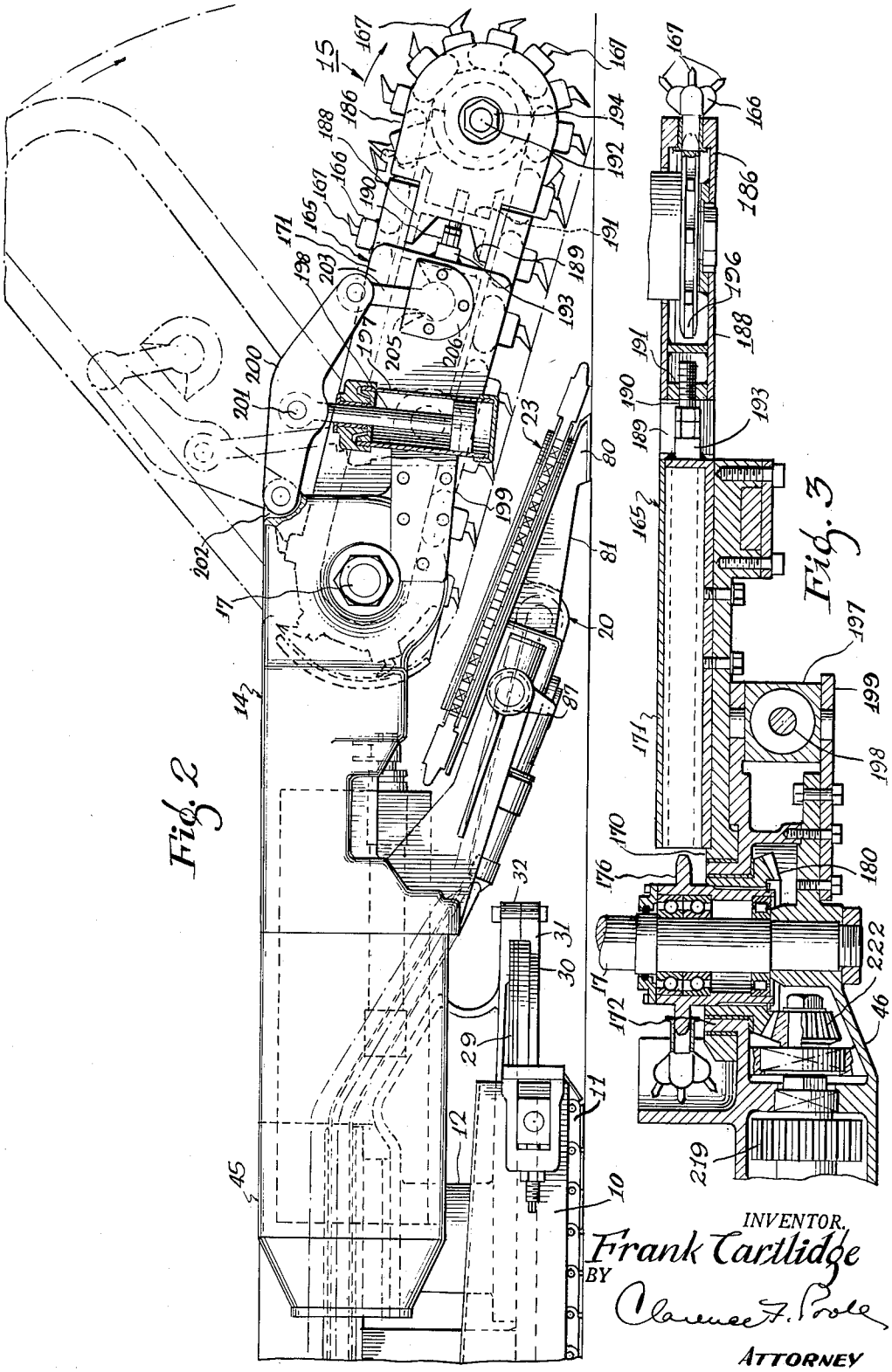


Fig. 2

Fig. 3

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Filed Sept. 20, 1949 4 Sheets-Sheet 3

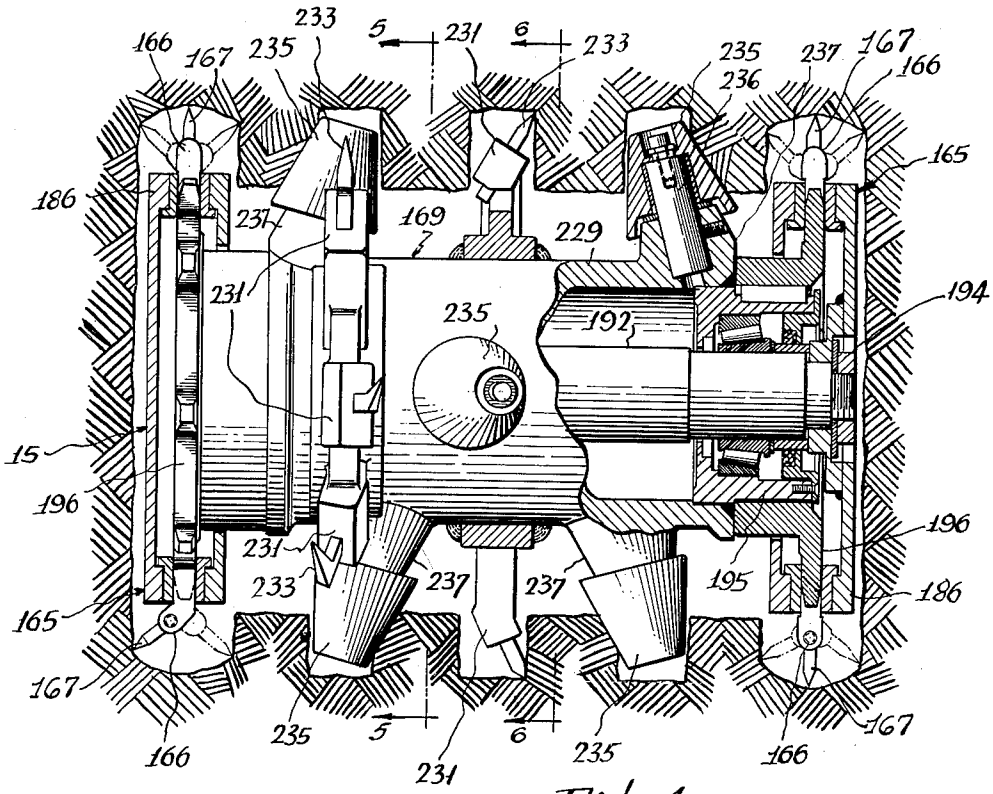


Fig. 4

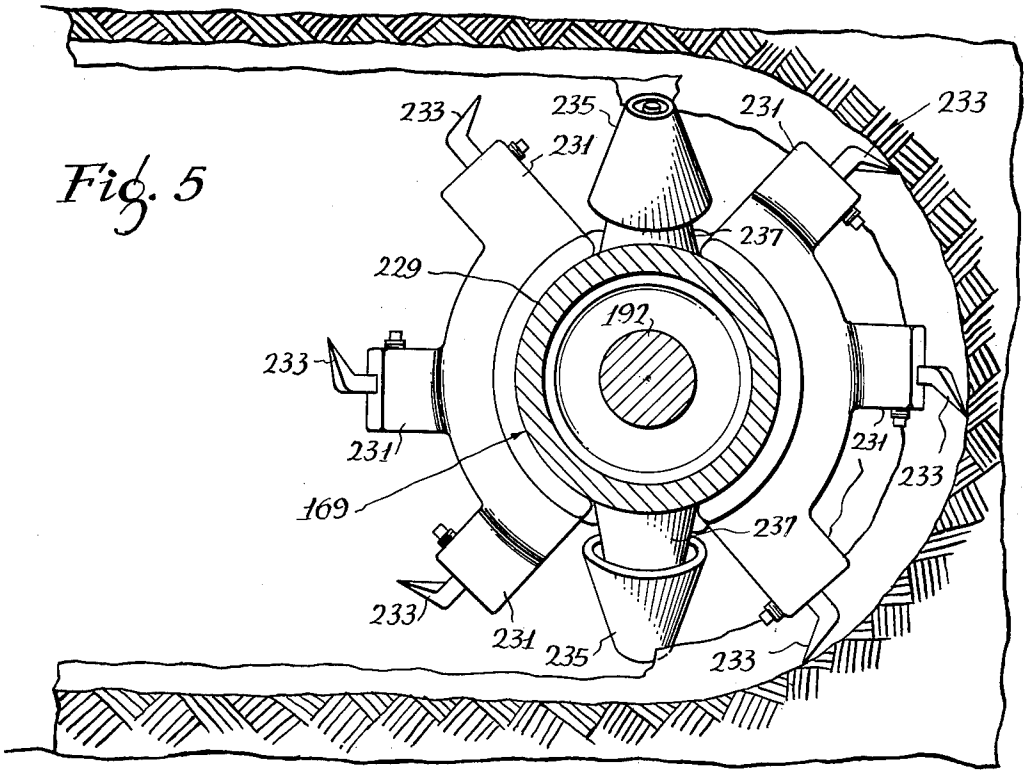
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COAL MINING MACHINE WITH ROTARY CUTTING AND DISLODGING DRUM

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Fig. 5



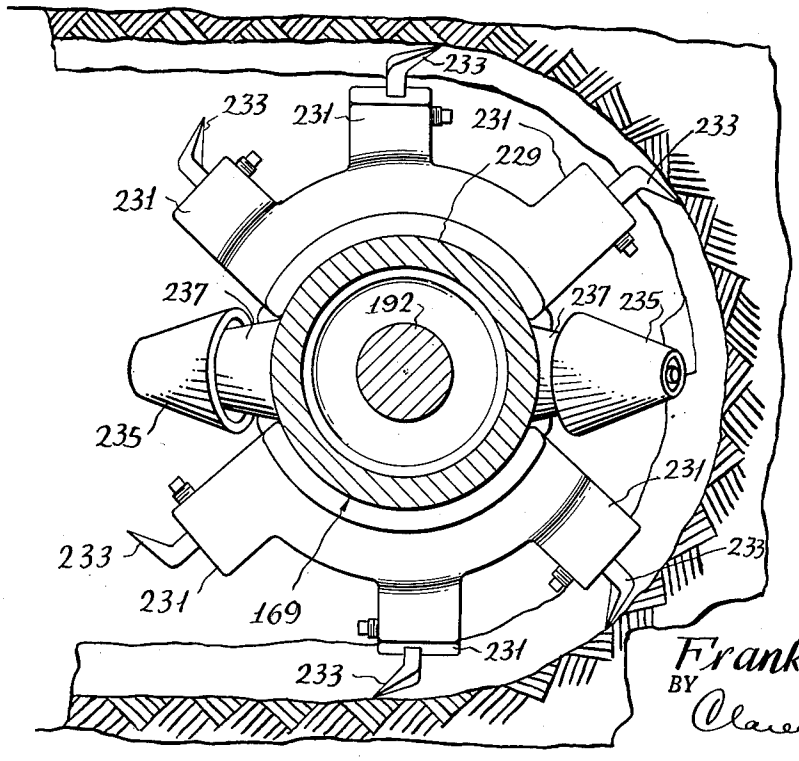


Fig. 6

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2,730,344

COAL MINING MACHINE WITH ROTARY CUTTING AND DISLODGING DRUM

Frank Cartlidge, Chicago, Ill., assignor to Goodman Manufacturing Company, Chicago, Ill., a corporation of Illinois

Application September 20, 1949, Serial No. 116,684

13 Claims. (Cl. 262—9)

This invention relates to an improved apparatus for the continuous cutting and removing of coal from the solid without the usual undercutting, shooting, and loading operations.

A principal object of my invention is to provide a new and improved form of combined mining and loading machine arranged with a view toward providing a machine of the utmost simplicity and ease of operation and maneuverability producing more lump coal and utilizing far less power for the amount of coal mined than with former machines of this type.

A further object of my invention is to provide a novel and improved form of combined cutting and dislodging element arranged to cut and dislodge a far larger percentage of coarse and lump coal from the solid face of a mine than has formerly been done by the cutting and loading elements heretofore known.

A further and more specific object of my invention is to reduce the power consumption and fine coal heretofore produced by continuous cutting and loading machines by providing two kerf cutters spaced rather widely apart and by providing a rotary kerf cutter therebetween and driven thereby and having means mounted thereon to extend into the kerfs cut thereby and engage and roll off the cores between the kerfs in the form of lump and relatively coarse coal.

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

Figure 1 constitutes a plan view of the forward portion of a continuous cutting and loading machine constructed in accordance with my invention, with certain parts thereof broken away and certain other parts shown in substantially horizontal section;

Figure 2 is a view in side elevation of the forward part of the machine with certain parts thereof shown in substantially longitudinal section;

Figure 3 is an enlarged fragmentary horizontal sectional view taken through one of the cutter bars and showing certain details of construction thereof;

Figure 4 is an enlarged end view of the cutting and dislodging element looking toward the front end thereof and showing the element in operation in a coal face, with certain parts thereof broken away and certain other parts shown substantially in vertical section;

Figure 5 is a sectional view taken substantially along line 5—5 of Figure 4; and

Figure 6 is a sectional view taken substantially along line 6—6 of Figure 4.

Referring now to the drawings, the embodiment of my invention illustrated therein includes generally a main frame 10 suitably mounted on and propelled about the mine by a pair of laterally spaced continuous tread devices 11, 11. A laterally movable intermediate frame 12 is mounted on the forward end of said main frame for pivotal movement with respect thereto about a vertical axis and has an extensible frame 14 supported and guided thereon for extensible and retractable movement with respect

thereto and having a cutting and dislodging element 15 projecting forwardly therefrom and transversely pivoted to the forward end thereof for movement about the axis of a transverse shaft 17.

A conveyor 19 is mounted in a downwardly spaced frame structure 20 of the extensible frame 14 at its forward end and extends rearwardly from the forward end of said frame structure in an upwardly inclined direction and along the main frame 10 beyond the rear end thereof, for the discharge of the mined coal into suitable receptacles such as mine cars, rubber tire mounted shuttle cars or any of the well known forms of conveyors of the type used underground in mines. A side-raking gathering mechanism 23 is provided at the front end of the conveyor 19 to pick up the mined coal from the ground and discharge it onto the reeciving end of the conveyor 19.

The intermediate frame 12 extends forwardly from a sleeve 24 about which it pivots, along the top of the main frame 10 and is slidably supported on a segmental bearing 29 mounted on the top surface of the main frame 10 and conforming to the form thereof. An arcuate shouldered-under forward end portion 30 of the main frame 10 is slidably engaged by a segmental retaining gib 31 secured to the bottom of a flange 32, depending from the forward end of the intermediate frame 12, and holding said intermediate frame against vertical displacement during operation of the machine.

The intermediate frame 12 and cutting and dislodging element 15 are positioned laterally about the axis of the sleeve 24 and are held in position by means of a suitable double-acting cylinder (not shown) having a piston rod 36 pivotally connected at its forward end to an arm 37 extending laterally from and herein shown as being formed integrally with the intermediate frame 12 for laterally swinging the same.

As herein shown, the extensible frame 14 has two laterally spaced motors 45, 45 secured to and projecting rearwardly from parallel spaced housing structures 46, 46 of said extensible frame (Figure 1). The motors 45, 45 are herein shown as being well known forms of electric motors and serve to drive the cutting and dislodging element 15 and the gathering mechanism 23. Their weight also tends to offset the tendency for the front end of the machine to lift due to reactive forces of the mine face on the cutting element 15 when the latter is sumped thereagainst.

Cylinders 50, 50 of the double-acting type and having piston rods 51, 51 extensible therefrom are provided to extensibly or retractably move the extensible frame 14 with respect to the intermediate frame 12 to feed the cutting and dislodging element 15 into the solid mine face and withdraw it therefrom. The cylinders 50, 50 are clamped to the intermediate frame 12 by longitudinally spaced clamps 53, 53 and extend longitudinally along said guide plates beyond the forward ends thereof. The piston rods 51, 51 extend through and are secured to ears 54, 54 extending inwardly from housing structures 46, 46 for the drive gearing for driving the cutting and dislodging element 15 from the motor 45, as by nuts 57, 57.

The cutting and dislodging element 15 is herein shown as including two connected laterally spaced cutter bars 165, 165 mounted for vertical feeding movement about the transverse shaft 17, supported in the housing structures 46, 46 of the extensible frame 14. A cutter chain 166 having cutter bits 167, 167 projecting therefrom is guided for orbital movement about each cutter bar 165 in a well known manner. The cutter bars 165, 165 are connected adjacent their forward ends by a rotary kerf cutter and breaker 169.

Each cutter bar 165 has a laterally spaced and longitudinally extending bracket 170 secured to the outer side of a rear guide portion 171 thereof and extending rearwardly

therefrom. The bracket **170** is pivotally mounted for movement about an axis coaxial with the axis of the shaft **17** on an inwardly extending annular boss **172** of the housing structure **46** (Figure 3). The rear guide **171** is provided with the usual gibbed guides opening toward the top and bottom thereof and in alignment with a cutter chain drive sprocket **176** journaled on the transverse shaft **17**. A bevel gear **180** is splined on the hub of the sprocket **176** and is journaled within the annular boss **172**. A cutter head **186** is mounted for adjustable movement with respect to the rear guide **171**. The cutter head **186** has a tongue **188** projecting rearwardly therefrom and slidably mounted in a guide slot **189** formed in the rear guide **171** and opening toward the forward end thereof. An adjusting screw **190** threaded within a cross bar **191** of the tongue **188** and abutting a lug **193** on the rear guide **171** is provided to adjust the tension of the cutter chain **166**.

A transverse shaft **192** is mounted at its opposite ends in the cutter heads **186, 186** and is secured thereto as by nuts **194, 194** threaded on opposite ends thereof. Hubs **195, 195** of the rotary kerf cutting and breaking element are journaled on said shaft adjacent opposite ends thereof and have sprockets **196, 196** keyed thereto and meshing with and driven from the cutter chains **166, 166**.

The cutting and dislodging element **15** is elevated and lowered by means of two laterally spaced double-acting fluid pressure cylinders **197, 197** having piston rods **198, 198** extensible therefrom. Each of the cylinders **197** is trunnioned intermediate its ends to a trunnion support **199** extending forwardly from the lower portion of the housing structure **46**. Each piston rod **198** is pivotally connected at its upper end to a lever **200**, intermediate the ends thereof, on a transverse pin **201**. The lever **200** is pivoted adjacent its rear end to an ear **202** extending forwardly from the upper forward portion of the housing structure **46**. The opposite end of the lever **200** has a depending link **203** pivotally connected thereto and herein shown as having a substantially ball-shaped lower end portion engageable within a segmental spherical socket **205** formed in a boss **206** extending outwardly from the rear guide **171** of the cutter bar **165** (Figure 2).

The drive from each motor **45** to its associated cutter chain drive sprocket **176** includes a motor pinion **207** which drives a longitudinal shaft **216** spaced from the axis of the motor pinion **207** and parallel thereto, through a spur gear train indicated generally by the reference character **215**. The shaft **216** has a friction slip clutch **217** thereon and drives the same. The friction slip clutch **217** has driving connection with a bevel pinion **222** spaced in advance and beneath the shaft **216**, through a spur gear train indicated generally by reference character **219**. The bevel pinion **222** meshes with and has driving engagement with the bevel gear **180** for driving the cutter chain drive sprocket **176**.

It should here be noted that the cutter chains **166, 166** travel in a forward direction along the upper guides of the cutter bars **165, 165** and downwardly along the sprockets **196, 196** and that the bits **167, 167** are set to cut when the cutting element **15** is sumped into the coal face along the mine roof and is vertically fed from the mine roof to the mine floor.

The endless chains **67, 67** of the gathering mechanism **24** are driven from the motors **45, 45** through spur gears **223, 223** meshing with and driven from the spur gears **209, 209** and suitably connected with the universal and extensible couplings **77, 77** to drive said couplings.

The rotary kerf cutting and breaking member **169** includes a rotary drum **229** secured at its opposite ends to the hubs **195, 195**, as by welding. The drum **229** has a plurality of cutter blocks **231, 231** projecting from the face thereof and having cutter bits **233, 233** detachably mounted therein and projecting therefrom. The blocks **231, 231** are herein shown as being aligned around the periphery of the drum **229** and as spaced laterally along the face thereof. The blocks **231, 231** likewise are so

arranged that alternate of said blocks extend in different angular directions to position the cutter bits **233, 233** to cut in the center of said blocks and to opposite sides thereof. As shown in Figures 4, 5 and 6, three blocks **231, 231** are integrally formed, and two sets of three blocks extend around the face of the drum **229**. It should be understood, however, that separate blocks may be mounted on the drum and that the number and positions thereof may vary to take care of various mining conditions.

Intermediate each series of three blocks **231** is positioned a rolling breaking member **235** adapted to engage one side wall of the kerf and roll off the core between two kerfs with a rolling wedging action. As shown in Figure 4, each rolling breaking member **235** is rotatably mounted on a pivotal pin **236** which is mounted in and projects from a boss **237** extending angularly outwardly from the face of the drum **229**. Said pins and bosses are herein shown as being inclined at angles inclined transversely to radial lines extending through the center of the drum **229**. One of said bosses **237** is herein shown as being positioned between each set of three blocks and said bosses between each set of blocks are shown as being spaced on opposite sides of a center line extending through said blocks to position the rollers journaled thereon so that one roller will engage one side wall of the kerf and the other roller will engage the opposite side wall of the kerf. The number and arrangement of the rolling breaking members of course may vary, and the size of the drum **229** may vary to accommodate more or less cutters and breaking members to take care of varying mining conditions.

The rolling breaking members **235, 235** are herein shown as being of a frusto-conical form so arranged as to extend into the kerf and engage only one side wall thereof to assure free rotation of said rollers during the rolling wedging operation, although they may be of other forms as long as they are freely rotatable within the kerf when wedging the cores between adjacent kerfs.

It may be seen with reference to Figures 4, 5 and 6 that the cutter bits **233, 233** are arranged to cut a plurality of parallel relatively widely spaced vertical kerfs spaced inwardly of the kerfs cut by the bits **167, 167** during horizontal feeding movement of the cutting and dislodging element **15** during the sumping and withdrawing operations and during vertical feeding movement thereof from the mine roof to the mine bottom. It may further be seen that the rolling breaking members are shown as being arranged to alternately come into engagement with opposite side walls of the kerfs and present inclined rolling surfaces so formed as to laterally roll off the cores between the kerfs with a wedging action along the cleavage planes of the coal as the rotary kerf cutting and breaking element advances into and along the coal face and thus roll and wedge off coarse and lump coal in place of the fine coal cut by the usual cutter bars spaced closely together. It may also be seen that the rotary cutter and breaker will require far less power to drive it than the closely spaced cutter chains in frictional engagement with their chain guides, heretofore used to continuously cut and load coal.

It will be understood that the term "cleavage planes of the coal" as used herein refers to those randomly oriented planes (as indicated by the cross-hatching in Fig. 4) along which cleavage under pressure takes place, and is not in any way limited to the planes called bedding planes which generally lie horizontal or parallel to the coal seam.

While I have herein shown and described one form in which my present invention may be embodied, it will be understood that various modifications and variations thereof may be effected without departing from the spirit and scope of the novel concepts thereof.

I claim as my invention:

1. In a continuous cutting and dislodging element, a rotary drum mounted for rotatable movement about an axis extending parallel to a working face, a plurality of rows of cutter bits mounted around the periphery of said

drum and spaced laterally along the surface thereof and projecting therefrom to cut a plurality of parallel kerfs in a mine face, and roller means mounted on said drum to extend into the kerfs cut by said bits, said roller means being rotatable about axes inclined with respect to the face of said drum and extending from the face of said drum from points outside of said rows into the path of said cutter bits and each having an inclined engaging face engageable with one wall of the kerf and presenting continuously rotating wedging faces inclined with respect to one wall of the kerf and shearing off the cores between the kerfs along the cleavage planes of the coal.

2. In a continuous cutting and dislodging element, a rotary drum mounted for rotatable movement about an axis extending parallel to a working face, a plurality of rows of cutter bits mounted around the periphery of said drum and spaced laterally along the face thereof, and projecting therefrom to cut a plurality of parallel kerfs in a solid mine face, and a plurality of rollers mounted on said drum extending into alignment with the path of travel of said bits for rotation about axes extending at angles to the face of said drum, alternate of said rollers extending from opposite sides of the center lines of said bits and presenting rolling wedging faces movable into the kerfs cut by said bits upon the advance of said drum and bits into the coal face and into angular engagement with the walls thereof, the face of one of said rollers engaging one wall of the kerf and the face of the next roller engaging the opposite wall of the kerf, to shear off the cores between the kerfs cut by said bits along the cleavage planes of the coal upon rotatable movement of said drum.

3. In a continuous cutting and dislodging element, a rotary drum mounted for rotatable movement about an axis extending parallel to a working face, a plurality of rows of cutter bits mounted around the periphery of said drum and spaced laterally along the surface thereof and projecting therefrom to cut a plurality of parallel kerfs in a solid mine face, and a plurality of conical rollers mounted on and extending from said drum and having reduced ends extending into substantial alignment with the paths traversed by said bits, and said rollers being mounted for rotation about axes inclined transversely with respect to the face of said drum and said rollers presenting rolling wedging faces movable into the kerfs cut by said bits upon the advance of said drum and bits into the coal face each roller engaging one wall only of the kerf and rolling therealong to shear off the cores between said kerfs along the cleavage planes of the coal.

4. In a continuous cutting and dislodging element, a rotary drum mounted for rotation about an axis extending parallel to a working face, a plurality of rows of cutter bits mounted around the periphery of said drum and spaced laterally along the surface thereof and projecting therefrom to cut a plurality of parallel kerfs in a mine face, and a plurality of conical rollers mounted on said drum outside of said rows of cutter bits and inclined to extend into the space between adjacent said cutter bits in said rows and having reduced ends in substantial alignment with the circular paths traversed by said bits, each of said rollers being mounted for rotation about an axis extending at an angle to the face of said drum, and alternate of said rollers extending from opposite sides of the center line of said bits and presenting rolling wedging faces extending into the kerfs cut by said bits and alternately engaging opposite walls of the kerf, and rolling along and shearing off the cores between the kerfs cut by said bits along the cleavage planes of the coal.

5. In a continuous cutting and dislodging element for coal and the like, a rotary drum, a plurality of cutter bit carrying cutter blocks mounted around the periphery of said drum in laterally spaced aligned rows, to cut a plurality of parallel kerfs in the mine face, a plurality of rollers mounted on said drum for rotation about axes extending from said drum outside of the margins of said blocks in the space between adjacent blocks at angles to the periphery of said drum and intersecting the paths of travel of said blocks, said rollers extending outwardly from the surface of said drum at least as far as the outer margins of said blocks and presenting inclined rolling wedging faces engageable with the walls of the kerfs and shearing the cores between the kerfs from the face along the cleavage planes of the coal.

6. In a continuous cutting and dislodging element for coal and the like, a rotary drum, a plurality of cutter bit carrying cutter blocks mounted around the periphery of said drum in laterally spaced aligned rows, to cut a plurality of parallel kerfs in a mine face, and a plurality of alternately arranged wedging rollers spaced between said blocks and rotatably mounted on and extending from the face of said drum for rotation about axes inclined with respect to the face of said drum, one of said rollers extending from a point spaced laterally from an associated block angularly towards said block and outwardly from said drum a distance sufficient to extend for substantially the full depth of the kerf, and a next adjacent one said rollers extending angularly from said drum from an opposite side of an associated block in the same row as said first roller and angularly toward said associated block, said rollers presenting alternately arranged inclined rolling wedging faces alternately engaging opposite walls of the kerf and rolling therealong and shearing the coal from the solid laterally along its cleavage planes.

7. In a continuous cutting and dislodging element for coal and the like, a rotary drum, a plurality of cutter bit carrying cutter blocks mounted around the periphery of said drum in aligned rows spaced laterally along the surface thereof and projecting therefrom to cut a plurality of parallel kerfs, and a plurality of angularly disposed allochiral rollers associated with each row of cutter blocks and rotatably mounted on said drum for rotation with respect thereto, and the axes of rotation of said rollers extending from points spaced laterally from said blocks angularly towards said blocks, and said rollers extending in the region of the outer margins of said blocks and presenting rolling engaging faces angularly disposed with respect to one wall of the kerf and generally parallel to the other wall of the kerf and alternately engageable with opposite side walls of the kerf and forming rolling wedges shearing off the cores between adjacent kerfs.

8. In a continuous cutting and dislodging element for coal and the like, a rotary drum, a plurality of cutter bit carrying cutter blocks mounted around the periphery of said drum in laterally spaced aligned rows, a plurality of angularly disposed allochiral rollers associated with each row of cutter blocks and rotatably mounted on said drum for rotation about angularly disposed axes, the axes of rotation of said rollers extending alternately from points spaced laterally from said rows of blocks into the space between adjacent blocks, and said rollers having generally conical faces extending from the outside of said rows into the space between adjacent blocks, the face of each of said rollers on one side of said rows of blocks presenting an angular shearing face engaging the core between the kerfs cut by said bits and shearing the same from the coal face as said rollers are progressed thereinto, by advancing movement of said dislodging drum into and along the coal face, and the face of each roller on the opposite sides of said rows of blocks extending generally along said blocks within the kerfs cut by said bits generally parallel to the kerf wall free from the core, to accommodate the rollers for free rotation by engagement with the inclined faces thereof with the cores between the kerfs.

9. In a continuous cutting and dislodging element for coal and the like, two parallel spaced vertically extending cutter bars having cutter chains guided for orbital movement thereabout and power means for driving said cutter chains about said cutter bars and direction changing sprockets at the forward ends of said cutter bars meshed with said cutter chains, a rotary dislodging drum mounted between said cutter bars and rotatably driven by said

sprockets, said drum having a plurality of laterally spaced rows of cutter blocks projecting from the periphery thereof and having cutter bits projecting therefrom to cut a plurality of relatively widely spaced parallel kerfs in a mine face between the kerfs cut by said cutter chains, and a plurality of alternately arranged angularly disposed wedging rollers extending from the periphery of said drum into said rows between said blocks, and rotatably mounted on said drum for rotation about axes inclined with respect to the face of said drum, said rollers presenting alternately arranged inclined rolling faces in registery with the cores between the kerfs cut by said chains and cutter bits and extending into the kerfs cut thereby and alternately advancing into engagement with the cores on opposite sides of the kerfs, and rolling therealong and shearing the coal from the solid laterally along its cleavage planes upon rotation of said drum by said cutter chains and feeding movement thereof.

10. In a continuous mining machine, a mobile main frame, an extensible frame mounted thereon for extensible movement with respect thereto, a cutting and dislodging element mounted on said extensible frame and advanced into the coal face by extensible movement thereof, said cutting and dislodging element including two laterally spaced cutter bars pivotally mounted on said extensible frame for vertical movement with respect thereto and having cutter bit carrying chains orbitally guided thereabout, a dislodging drum rotatably mounted between said cutter bars and driven from said cutter chains, said drum having a plurality of rows of cutter bits projecting from the periphery thereof for cutting a plurality of parallel spaced kerfs between the kerfs cut by said cutter chains and also having a plurality of angularly disposed rollers associated with each row of cutter bits and rotatably mounted on said drum for rotation with respect thereto, the axes of rotation of said rollers alternately extending angularly from the periphery of said drum from opposite sides of said cutter bits into the spaces between adjacent bits, and the faces of said rollers presenting wedging faces on one side of said bits engageable with the core upon the movement of said cutter bars and drum along the coal face, and free from the core left by said bits on the opposite sides of said bits, to accommodate free rotation of said rollers by engagement with the core and rotatable movement of said drum during the operation of shearing the cores between the kerfs.

11. In a continuous mining machine for coal and the like, a mobile main frame, an extensible frame mounted thereon for extensible movement with respect thereto and having two parallel spaced vertically extending cutter bars transversely pivoted thereon having cutter chains orbitally guided thereabout and also having power means for extending said frame and cutter bars horizontally into a coal face, and for moving said cutter bars vertically therealong and other power means for driving said cutter chains about said cutter bars, the improvements comprising a rotary dislodging drum mounted between said cutter bars and rotatably driven by said cutter chains, said drum having a plurality of rows of cutter bit carrying cutter blocks mounted around the periphery thereof and a plurality of alternately arranged wedging rollers extending into the spaces between said blocks and rotatable about axes alternately inclined in opposite directions laterally with respect to said drum, said wedging rollers being of a generally conical form having a face

inclined with respect to the kerf wall on one side of said rows of cutter bits and generally parallel to the kerf wall on the opposite sides of said rows of cutter bits, and each being engageable with a core on one side of the kerf and shearing off the cores by advancing movement of said cutter bits into the coal face.

12. In a continuous cutting and dislodging element for coal and the like, two parallel spaced vertically extending cutter bars having cutter chains guided for orbital movement thereabout, power means for driving said cutter chains about said cutter bars, and direction-changing sprockets at the forward ends of said cutter bars meshed with said cutter chains, a rotary dislodging drum rotatably mounted between said cutter bars and driven by said sprockets, said drum having a plurality of laterally spaced rows of cutter blocks projecting from the periphery thereof and having cutter bits projecting therefrom, to cut a plurality of relatively widely spaced parallel kerfs in a mine face between the kerfs cut by said cutter chains, and a plurality of alternately arranged angularly disposed breaker members extending from the periphery of said drum into said rows of cutter blocks, between said blocks and presenting shearing faces engaging one wall only of the core, and shearing off the cores between the kerfs along the cleavage planes of the coal.

13. In a continuous mining machine for coal and the like, a mobile main frame, an extensible frame mounted thereon for extensible movement with respect thereto and having two parallel spaced vertically extending cutter bars transversely pivoted thereon having cutter chains orbitally guided thereabout, and also having power means for extending said frame and cutter bars horizontally into a coal face, and for moving said cutter bars vertically therealong, and having other power means for driving said cutter chains, about said cutter bars, the improvements comprising a rotary dislodging drum mounted between said cutter bars and rotatably driven by said cutter chains, said drum having a plurality of rows of cutter bit-carrying cutter blocks mounted around the periphery thereof and a pluraility of alternately arranged core-breaking members extending into the spaces between said blocks in said rows of cutter blocks, and alternately inclined in opposite directions laterally with respect to the face of said drum, said core breaker members being positioned to alternately engage the cores on opposite sides of the kerf and shear off the cores by advancing movement of said rows of cutter bits into the coal face.

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