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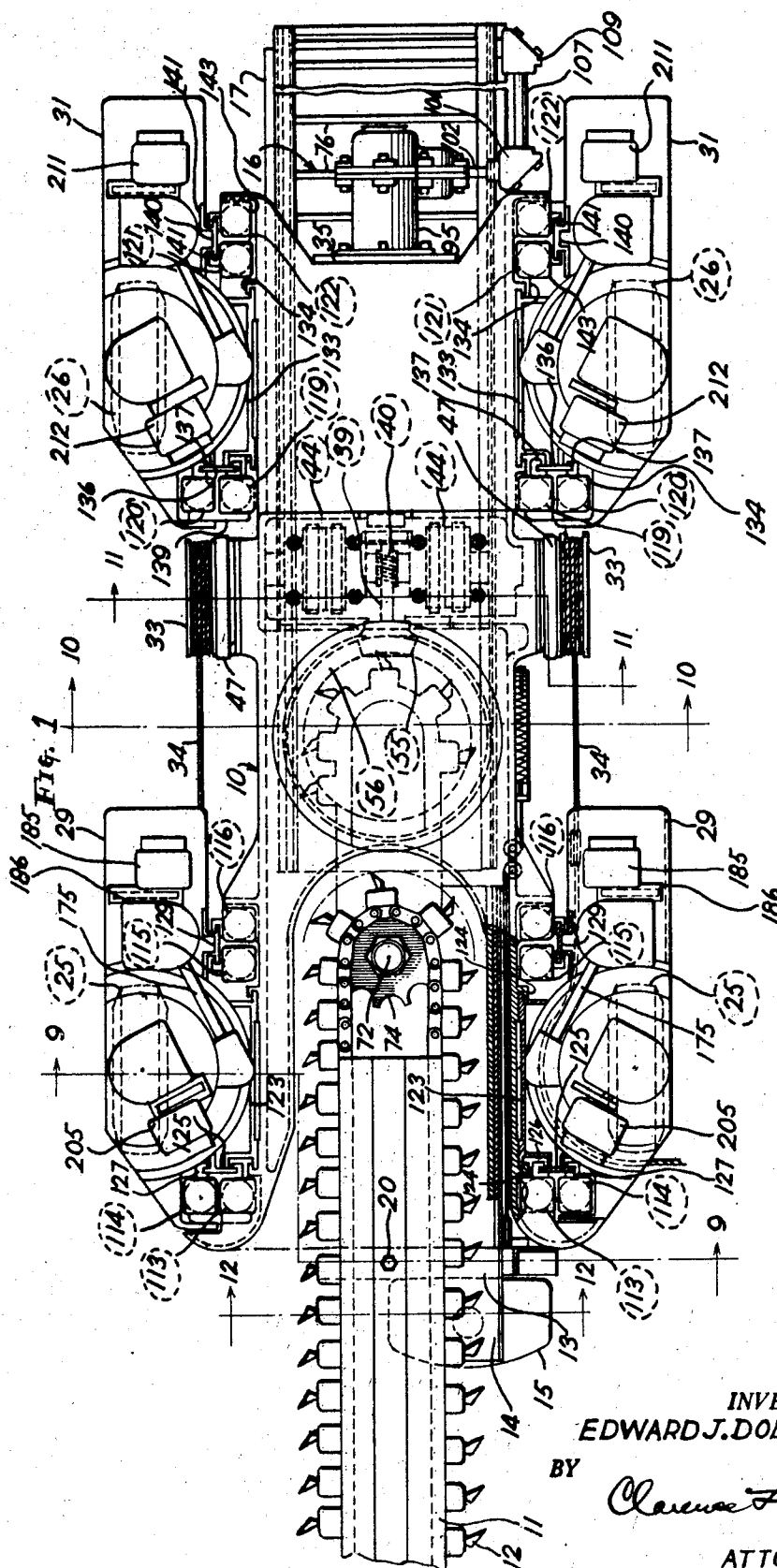
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2,384,083

KERF-CUTTING MACHINE

Filed Oct. 21, 1942

9 Sheets-Sheet 1



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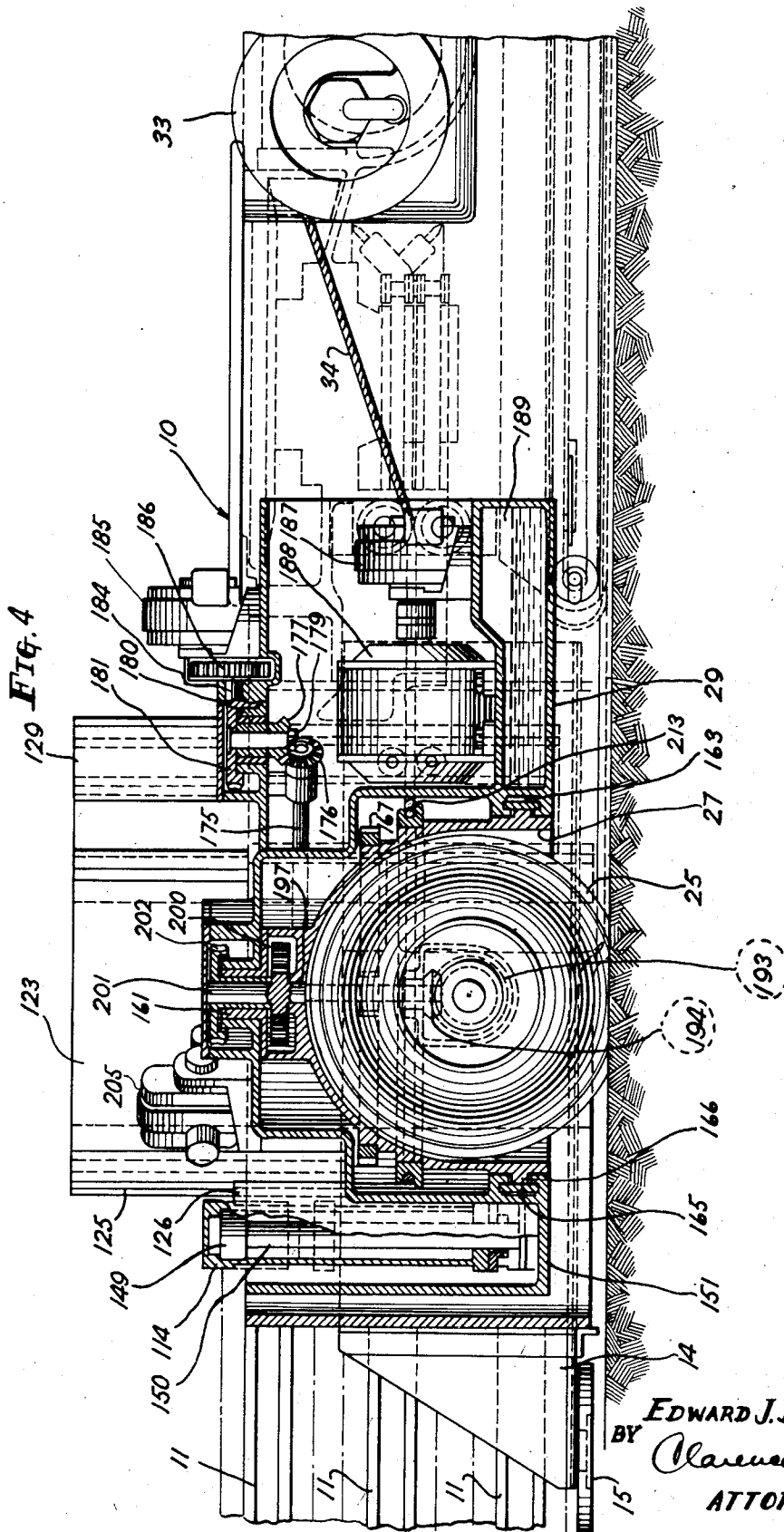
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9 Sheets-Sheet 3



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KERF-CUTTING MACHINE

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9 Sheets-Sheet 4

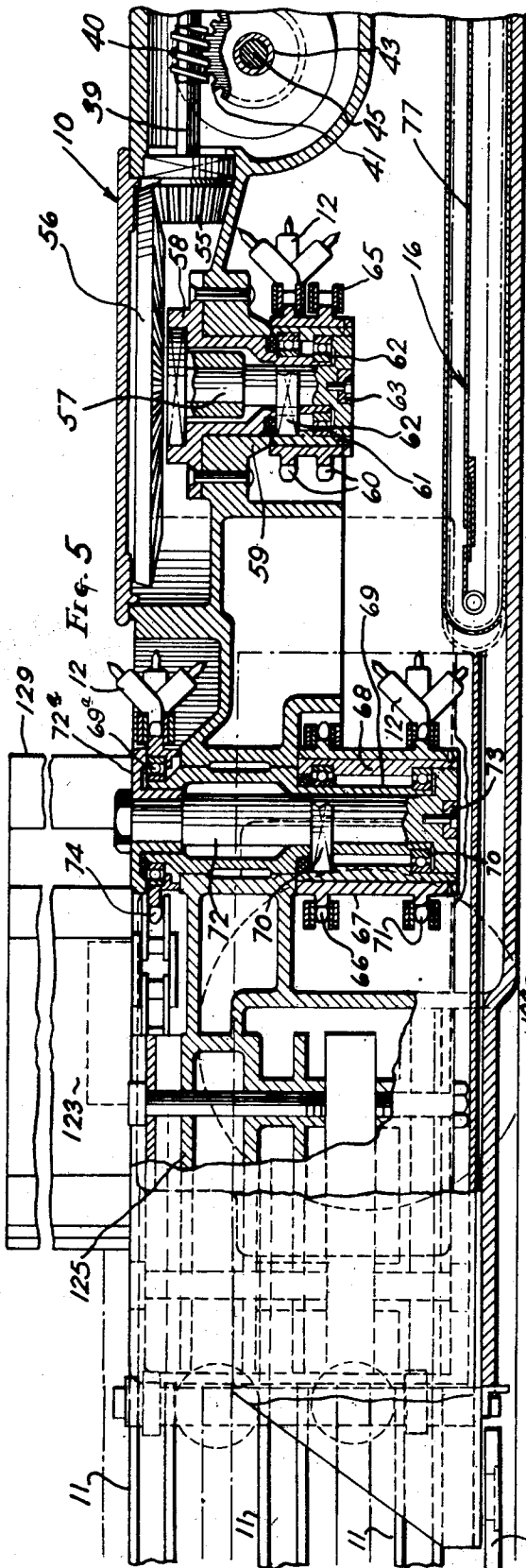
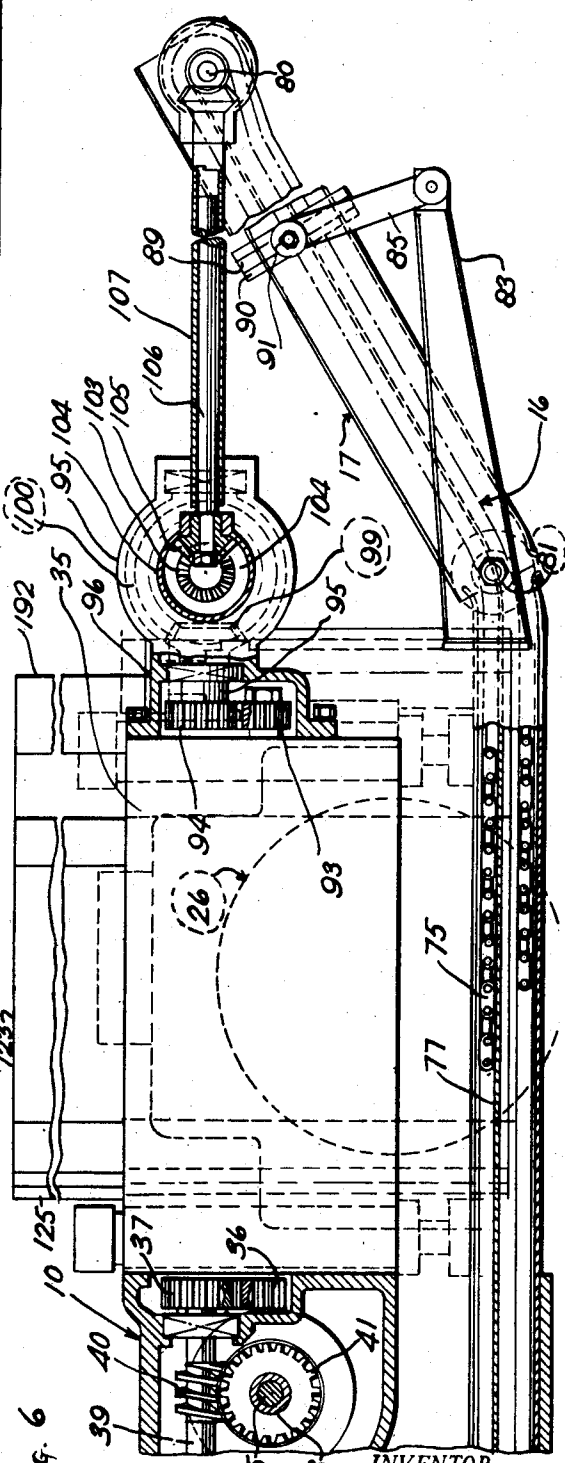


FIG. 6

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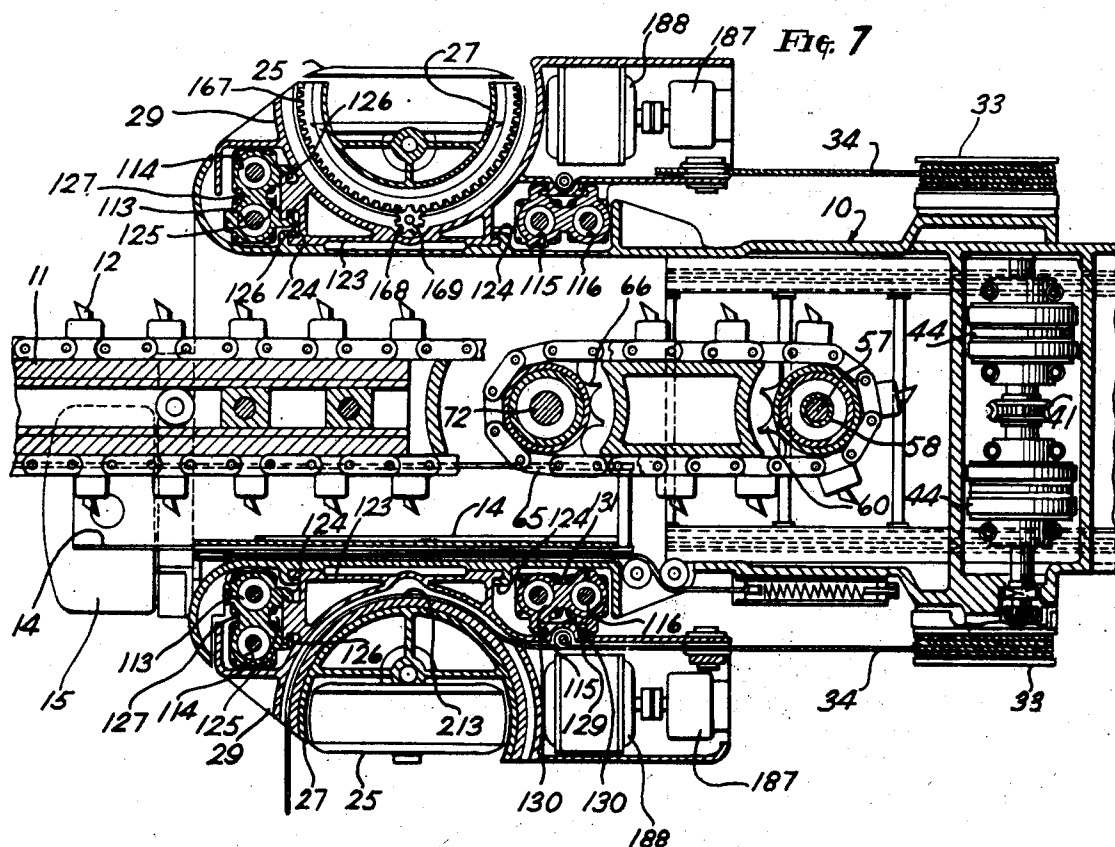
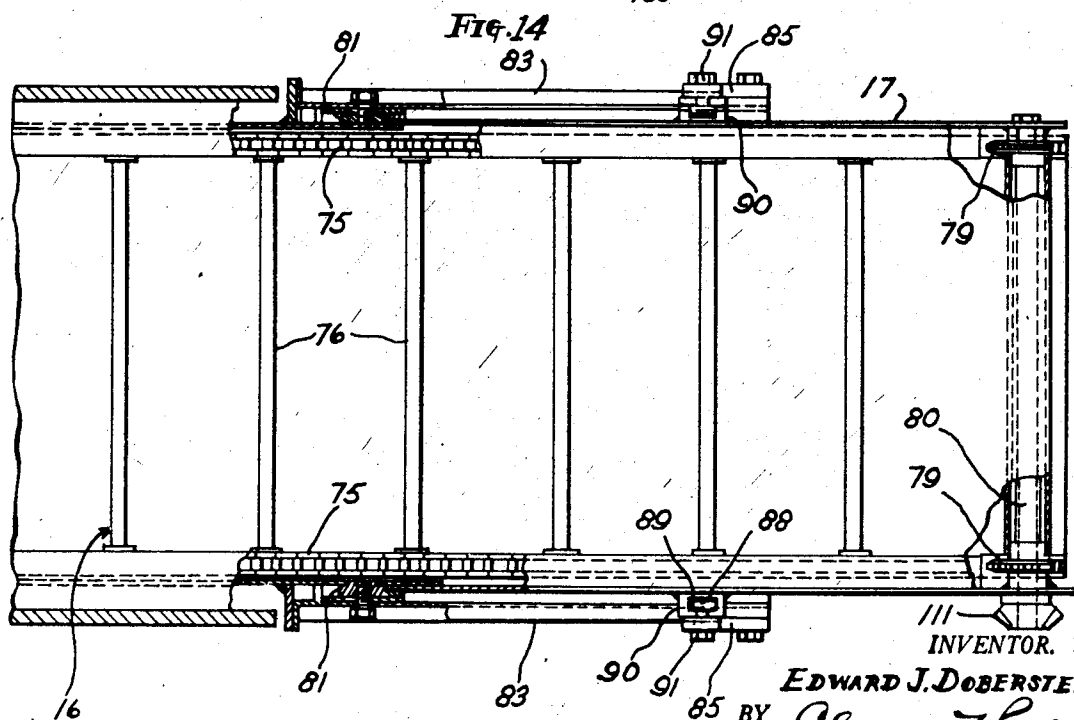
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KERF-CUTTING MACHINE

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KERF-CUTTING MACHINE

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9 Sheets-Sheet 6

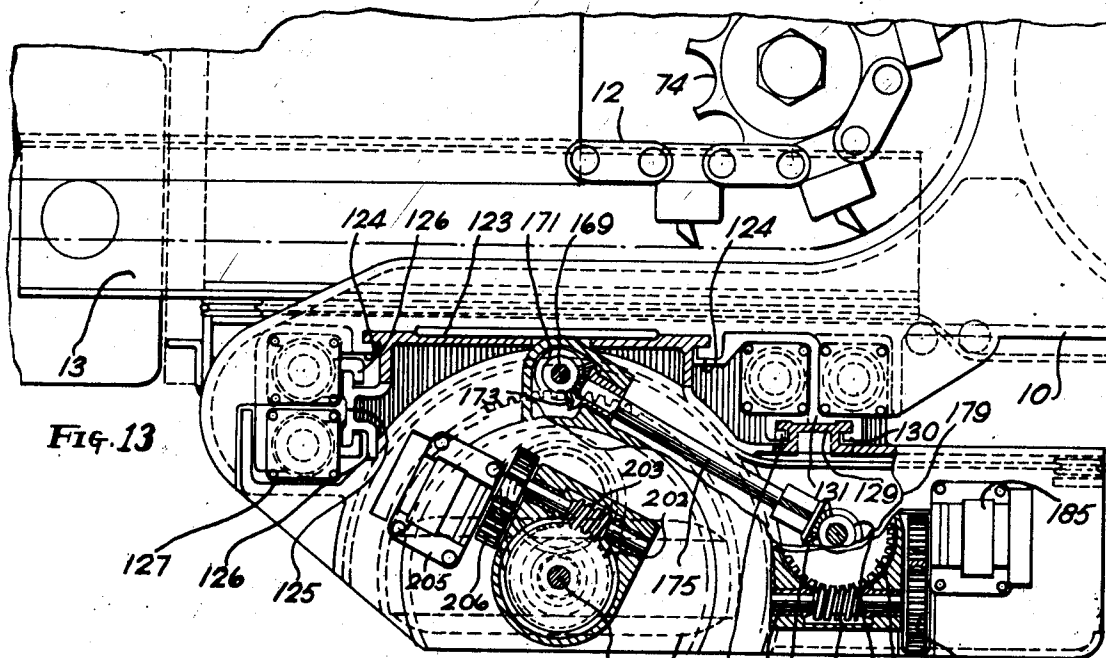


Fig. 13

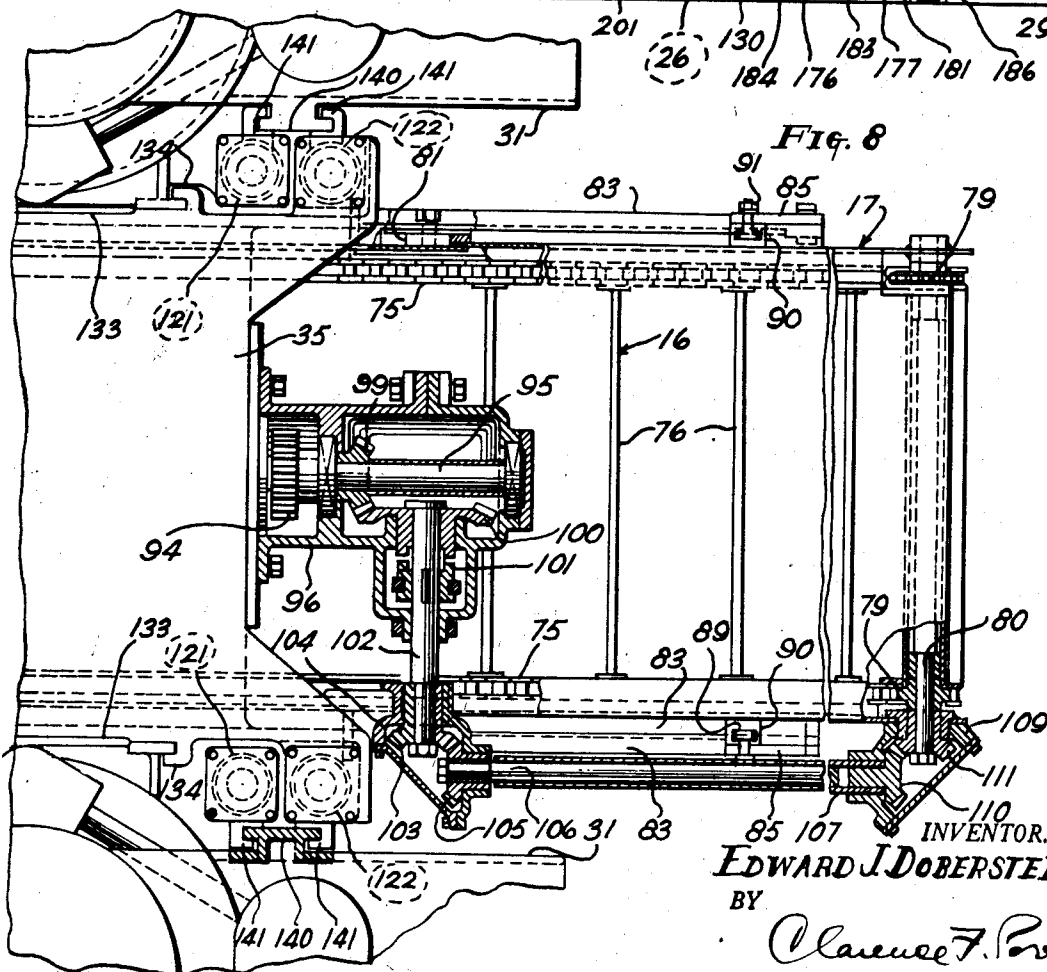


Fig. 8

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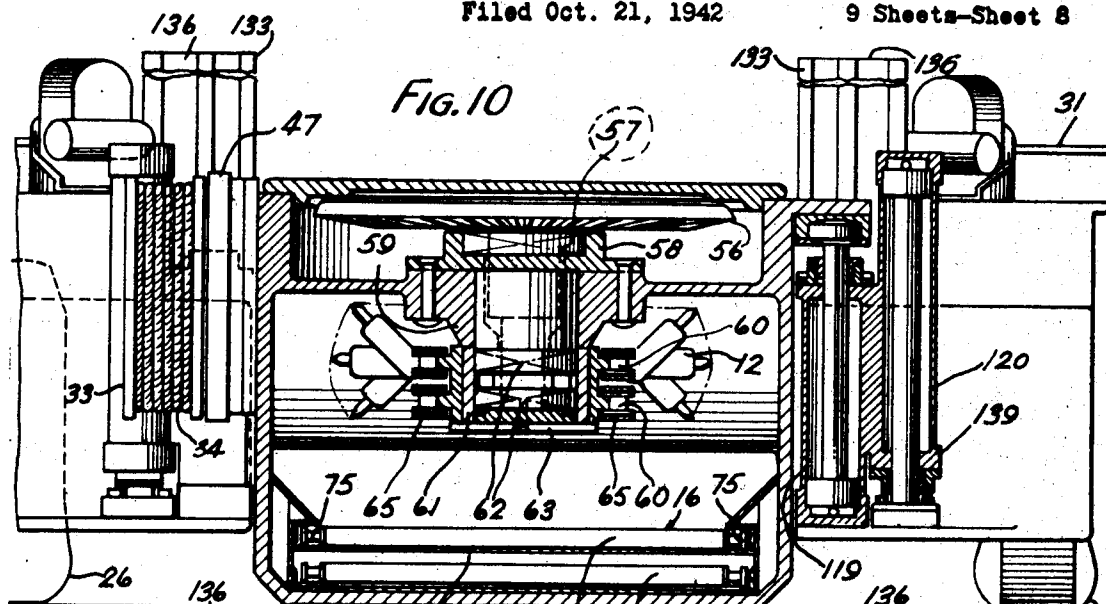
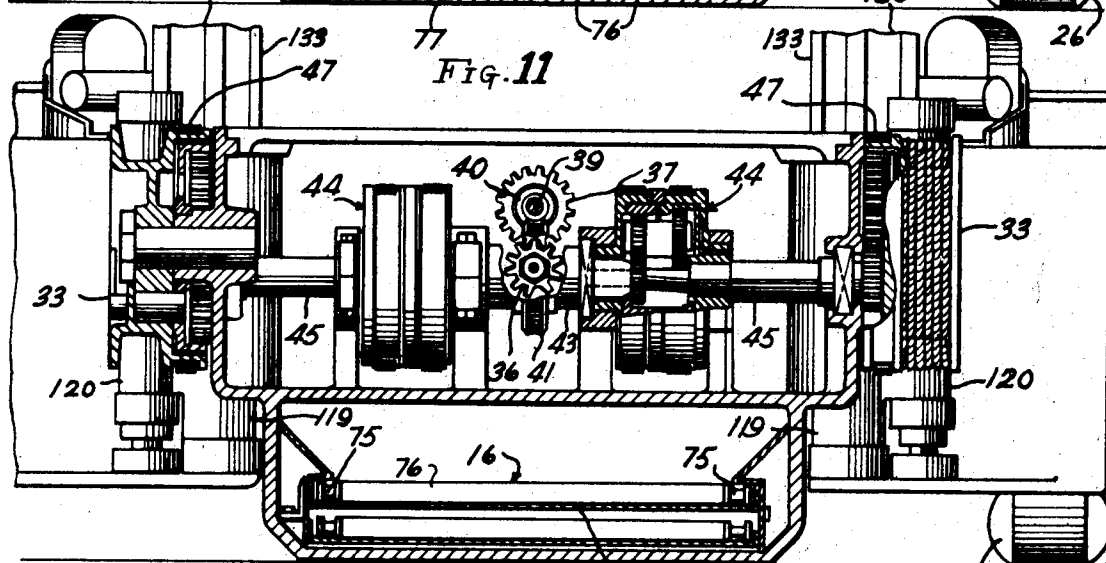
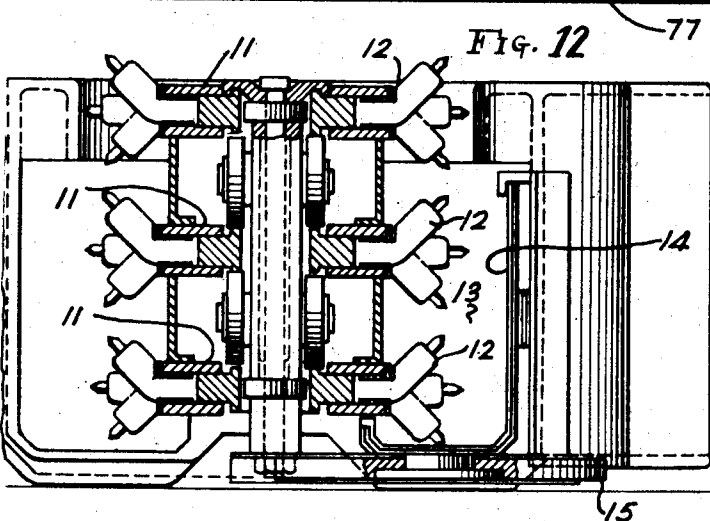
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KERF-CUTTING MACHINE

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9 Sheets-Sheet 8



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KERF-CUTTING MACHINE

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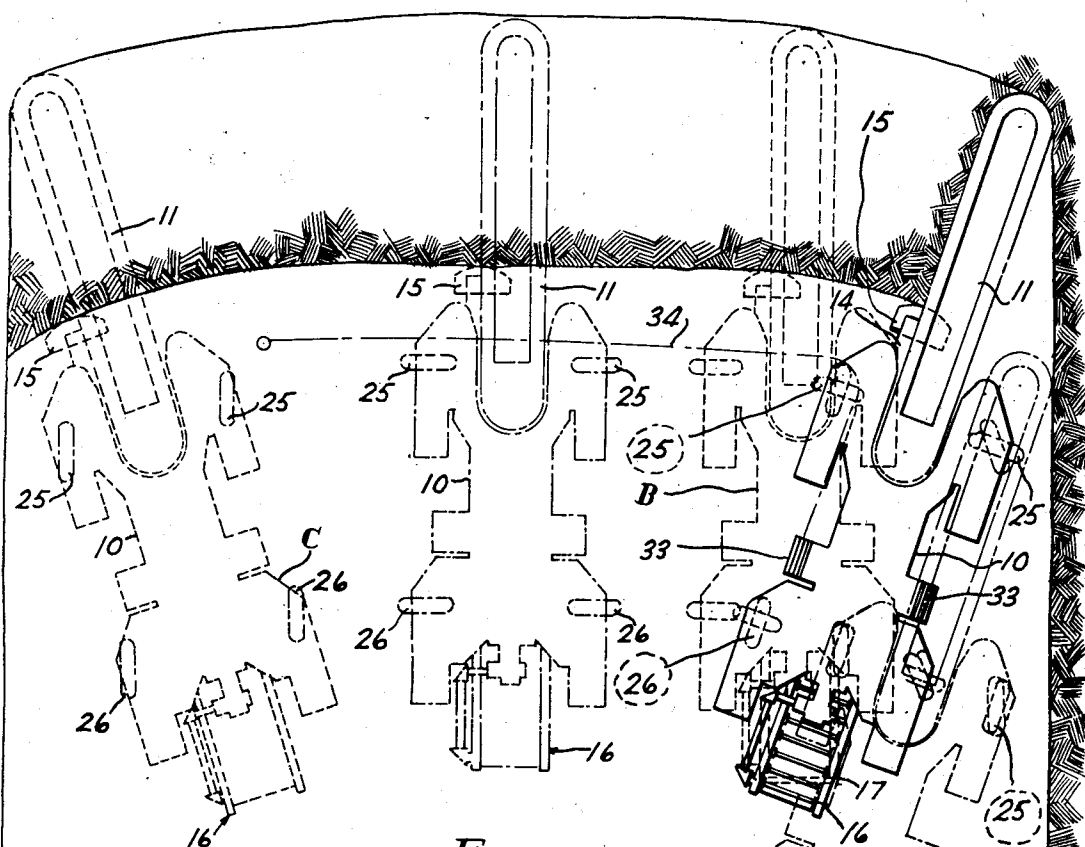


FIG. 15

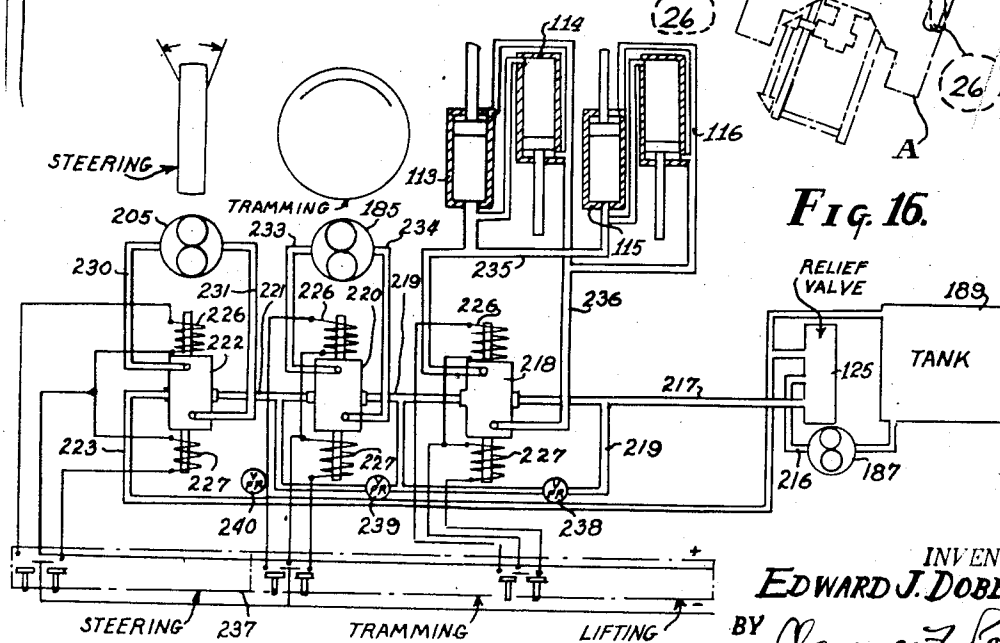


FIG. 16.

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UNITED STATES PATENT OFFICE

2,384,083

KERF-CUTTING MACHINE

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Application October 21, 1942, Serial No. 462,789

21 Claims. (Cl. 262—28)

This invention relates to improvements in kerf-cutting machines and has as its principal objects to provide a new and improved form of kerf-cutting machine of the rubber-tire wheel mounted type.

Heretofore, kerf-cutting machines mounted on rubber-tired wheels have been provided with a cutter bar mounted on a turntable, and the bar has been fed across the coal face by turning movement of the turntable about its axis. Due to the shifting of weight on the supporting truck for the turntable as the cutter bar swings laterally across the forward end of its supporting truck, the tires on one side of the truck will flex as the cutter bar passes thereover and extends laterally therebeyond. This causes tilting of the cutter bar in the coal face which results in binding of the cutter bar, and also causes the kerf cut by the cutter bar to be inclined with respect to the horizontal, making it difficult to withdraw the cutter bar upon completion of the transverse cut without binding.

The kerf-cutting machine of my present invention has as its objects to overcome these difficulties by providing all four supporting wheels of the kerf-cutting machine with mountings so they will turn at right angles to the body of the machine proper and will support the machine for movement in a transverse or a longitudinal direction.

A more specific object of my invention is to provide a rubber-tired mounted machine having a rigid projecting cutter bar and having the supporting wheels mounted to feed the machine and cutter bar longitudinally into the coal face and transversely thereacross, together with independent power operated means for driving the supporting wheels.

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 is a plan view of a kerf-cutting machine constructed in accordance with my invention, with certain parts broken away and certain other parts shown in horizontal section;

Figure 2 is a view in side elevation of the device shown in Figure 1, with certain parts broken away and certain other parts shown in substantially longitudinal section;

Figure 3 is an enlarged view in side elevation of the central part of the machine, with certain other parts broken away and shown in longitudinal section than are shown in Figure 1, in order to

show certain details of the elevating and guide means for the cutting element;

Figure 4 is an enlarged fragmentary view in side elevation of the front part of the machine shown in Figure 1 with certain other parts broken away and shown in longitudinal section than are shown in Figures 2 and 3;

Figure 5 is an enlarged partial fragmentary longitudinal sectional view of the front part of the machine shown in Figure 1, illustrating certain details of the drive to the cutter chains;

Figure 6 is an enlarged fragmentary view in side elevation of the rear part of the machine shown in Figure 1, with certain parts broken away and certain other parts shown in longitudinal section in order to more clearly illustrate the drive to the discharge conveyor;

Figure 7 is an enlarged fragmentary plan view of the front part of the machine shown in Figure 1, with certain parts broken away and certain other parts shown in horizontal section;

Figure 8 is an enlarged fragmentary plan view of the rear part of the machine shown in Figure 1, with certain parts broken away and certain other parts shown in horizontal section in order to illustrate certain details of the drive to the rear conveyor;

Figure 9 is an enlarged fragmentary transverse sectional view taken substantially along line 9—9 of Figure 1, but showing the cutting element in an elevated position;

Figure 10 is an enlarged transverse sectional view taken substantially along line 10—10 of Figure 1, but drawn to a smaller scale than Figure 9;

Figure 11 is an enlarged transverse sectional view drawn to substantially the same scale as Figure 10 and taken substantially along line 11—11 of Figure 1;

Figure 12 is an enlarged fragmentary transverse sectional view drawn substantially to the same scale as Figure 11 and taken substantially along line 12—12 of Figure 1;

Figure 13 is an enlarged partial fragmentary plan view of the forward part of the machine with certain parts broken away and certain other parts shown in horizontal section in order to more clearly illustrate certain details of the drive to one of the front track wheels;

Figure 14 is an enlarged partial fragmentary plan view of the rear part of the machine shown in Figure 1, with certain parts broken away and certain other parts shown in horizontal section in order to show certain details of construction of the discharge conveyor;

Figure 15 is a diagrammatic plan view show-

ing the operation of the machine in a mine room; and

Figure 16 is a diagrammatic view of the fluid circuit for one of the wheel units of the machine.

Like reference characters refer to like parts throughout the various figures of the drawings.

Referring now to the details of the embodiment of my invention illustrated in the drawings, the machine generally comprises an elongated cutter frame 10 having a plurality of parallel horizontally spaced cutter bars 11, 11 projecting forwardly therefrom and rigidly mounted thereon. Each of said cutter bars has a cutter bit carrying cutter chain 12 guided for orbital movement thereabout and movable into a cuttings passageway 13 formed in said frame and extending along opposite sides of said cutter bar (see Figures 1 and 9). Said cuttings passageway has an extensible chute 14 telescopically mounted in the advance side thereof, which has a deflector 15 on its forward end, adapted to engage and follow the coal face during cutting across a coal face, to collect the cuttings discharged by said cutter chains. Said cutter chains act as conveyers and move the cuttings rearwardly along said extensible chute and cuttings passageway for discharge into a discharge conveyer 16 at the rear end of said cuttings passageway in a manner similar to that shown and described in a prior application Serial No. 402,052, filed by Thomas E. Pray on July 12, 1941, now Patent No. 2,310,314, and no part of my present invention so not herein shown or described in detail. Said discharge conveyer extends along the bottom of the cutter frame 10 and is provided with an inclined vertically adjustable discharge portion 17, which extends beyond the rear end of said frame, for discharging the cuttings into a suitable receptacle such as a conveyer or a mine car.

As herein shown, three cutter bars 11 are provided. Said cutter bars may be so spaced as to cut out a complete coal seam, if desired, or where the coal seam is too thick to do this practically, said bars may be elevated as a unit to cut out one portion of the coal seam with one lateral cut, and may be lowered to cut out the remainder of the seam with a second lateral cut.

The lower cutter bar 11 is mounted on the lower portion of the cutter frame 10 and is secured thereto by means of a bolt 18 threaded in the lower end of a hollow spacing member 19 (see Figure 9). Said spacing member extends within a central open portion of said cutter bar and also serves as a clamping member to clamp said cutter bar in position. The intermediate and upper cutter bars 11 are secured to said frame by means of a bolt 20 threaded into a clamping member 21 engaging the lower side of the intermediate cutter bar 11 and the inside of the spacing member 19, upon which said intermediate cutter bar is supported. Said bolt extends through a clamping member 22, engaging the upper side of the upper cutter bar 11, and the head of said bolt engages the upper side of said clamping member 22 to hold said clamping member in engagement with said upper cutter bar. Said bolt also extends through a spacing member 23 vertically spacing the intermediate and upper cutter bars.

The cutter frame 10 is mounted on a pair of front rubber-tired wheels 25, 25 and a pair of rear rubber-tired wheels 26, 26, for vertical adjustment with respect to said wheels, to vary the cutting plane of the cutter bars 11, 11. Each

of said front wheels 25, 25 is mounted in a wheel housing 27 on an axle 28, which wheel housing in turn is mounted in a wheel supporting frame 29, for pivotal movement with respect to said frame about a vertical axis extending through the central portion of the wheel. The rear wheels 26, 26 are each mounted in a wheel housing 30 similar to the wheel housings 27, 27, and in the same manner the wheels 25, 25 are mounted in the wheel housings 27, 27. Said wheel housing is mounted in a wheel supporting frame 31 similar to the wheel supporting frame 29, for pivotal movement with respect thereto about a vertical axis extending through the central portion of said wheel. The mountings of said wheels on said wheel housings and of said wheel housings on said wheel supporting frames, as well as the drives to said wheels and wheel housings, for driving said wheels and turning said housings, for steering, will hereinafter be more clearly described as this specification proceeds.

A feeding means auxiliary to the wheels 25, 25 and 26, 26 is provided to aid said wheels in feeding the cutter bars 11, 11 into or across the coal face. Said feeding means includes a pair of winding drums 33, 33 having flexible feeding members 34, 34 thereon, mounted on opposite sides of the cutter frame 10, just forwardly of a drive motor 35, for driving said winding drums by power.

The drive from the motor 35 to the winding drums 33, 33 is somewhat similar to that shown and described in Patent No. 2,075,870, which is issued to William W. Sloane on April 6, 1937, so will not herein be shown or described in detail. Said drive includes an armature pinion 36 driven from the forward end of the shaft for said motor and meshing with and driving a spur gear 37 on the rear end of a longitudinally extending shaft 39 (see Figures 6 and 11). A worm 40 on said shaft meshes with and drives a worm gear 41 on a transversely extending sleeve 43. Said sleeve forms a drive means for a pair of coaxial plural speed planetary gear reduction devices 44, 44 arranged on opposite sides thereof (see Figure 11). Said planetaries form no part of my present invention and are similar to those disclosed in the aforementioned Patent No. 2,075,870, so need not be shown or described in detail herein, excepting to state that said planetaries are arranged to provide an independent plural speed drive to each of the winding drums 33, 33 through separate shafts 45, 45 which have their adjacent ends coaxially but independently mounted within opposite ends of the sleeve 43. Thus either winding drum 33 can be driven from the motor 35 at either a high frictionally controlled positioning speed or a low frictionally controlled feeding speed, or may be disconnected therefrom so as to be rotated under the control of a friction band 47, engageable with said drum in the usual manner, to retard the unwinding thereof.

The drive to the cutter chains 12, 12 includes a bevel pinion 55 on the forward end of the longitudinal shaft 39, which meshes with and drives a bevel gear 56 on the upper end of a vertical shaft 57. Said vertical shaft is mounted on a bearing support member 58, which in turn is mounted on and extends through a boss 59, formed integral with the cutter frame 10. A pair of vertically spaced sprockets 60, 60, herein shown as being integrally formed and keyed on a common sleeve 61, are mounted coaxially of said shaft on the outside of the bearing support member 58, on ball bearings 62, 62 having supporting en-

gagement with the inside of said sleeve. Said sleeve and sprockets are driven from the lower end of the vertical shaft 67, by means of a transversely extending drive member 68, secured to the lower end of said shaft 67 and having driving engagement with the lower end of said sleeve 61.

A cutter chain 12 guided in the intermediate cutter bar 11 meshes with the upper sprocket 66 and is driven therefrom. A drive chain 65 meshes with the lower sprocket 66 and a forwardly spaced sprocket 68, formed integrally with a sleeve 67 adjacent the upper end thereof (see Figure 5) for driving said sprocket and sleeve. Said sleeve is keyed on the outside of a sleeve 69, for rotation therewith. Said last mentioned sleeve 69 is journaled on a depending bearing support member 69 on ball bearings 70, 70. A sprocket 71 is herein shown as being formed integrally with the lower end of said sleeve 67 and meshes with the lower cutter chain 12, for driving said cutter chain about its associated cutter bar.

The sleeve 67 forms a drive means for a coaxial vertical shaft 72, journaled within the depending bearing support member 69. The drive from said sleeve to said shaft includes a drive member 73 secured to the lower end of said shaft and having driving engagement at its ends with the lower ends of said sleeves 67 and 69. A cutter chain drive sprocket 74 is journaled on the outside of the upper end of the bearing support member 69 on a ball bearing 69a and is driven from the upper end of said shaft 72 by means of a drive member 72a, keyed to the upper end of said shaft. Said sprocket 74 meshes with and drives the upper chain 12 about its associated cutter bar 11.

It should here be noted with reference to Figure 5 that the upper and lower cutter chains 12 turn about their drive sprockets at the receiving end of the conveyer 16, but that the intermediate cutter chain extends over the receiving end of said conveyer a substantial distance, thus carrying the cuttings discharged from said upper cutter chain onto said conveyer and aiding in propelling all of the cuttings onto the receiving end of said conveyer, it being understood that when cutting out an entire seam of coal, the entire cuttings passageway 13 is filled with mined coal from its bottom substantially to its top.

The discharge conveyer 16 is herein shown as being of an ordinary form of flight conveyer including a pair of parallel spaced endless chains 75 having spaced flights 76, 76 carried therebetween. Said chains are guided in the lower portion of the cutter frame 10 and form a means for moving material along the upper side of a bottom plate 77 of said conveyer and upwardly along the inclined elevating portion 17 thereof, to and around drive sprockets 79, 79 mounted adjacent opposite ends of a transverse shaft 80, journaled at the rear end of said elevating portion of said conveyer.

The inclined elevating portion 17 of the conveyer 16 is herein shown as being mounted for vertical adjustment about a transverse axis coaxial with a pair of bearing bosses 81, 81 secured to and extending inwardly of a pair of laterally spaced rearwardly projecting parallel supporting arms 82, 82, mounted on and projecting from opposite sides of the casing for the motor 35. Said bearing bosses form a support for said elevating portion of said conveyer (see Figure 14).

The means for holding said elevating portion of said conveyer in various positions of vertical adjustment includes a pair of arms 85, 85, piv-

otally mounted on the rear ends of the supporting arms 82, 82 and herein shown as projecting upwardly therefrom. The free end of each arm 85 has a bolt 86 mounted therein, which bolt has a T-shaped inner end, engaging a gibbed slot 89, formed in a holding member 90, secured to the outside of said elevating frame. Tightening of a nut 91 on the end of said bolt serves to tighten said bolt against said slot and to hold said elevating frame in adjustment.

The drive from the rear end of the motor 35 to the chains 75, 75 of the conveyer 16 includes an armature pinion 93 on the rear end of the shaft of said motor (see Figure 6). Said armature pinion meshes with a spur gear 94 on the rear end of a longitudinally extending shaft 95, which is journaled in a housing 96 secured to and projecting rearwardly from the rear end of the casing for said motor (see Figures 6 and 8). A bevel pinion 98 is keyed on said longitudinal shaft and meshes with and drives a bevel gear 100, journaled on its hub in said housing 96. A suitable clutch, such as a jaw clutch 101, is provided to selectively connect said bevel gear with a transversely extending shaft 102. Said shaft extends through the hub of said bevel gear and laterally therefrom beyond one side of said housing 96, and has a bevel pinion 103 keyed to its outer end, which is journaled on its hub in a housing 104. A bevel pinion 105 journaled on its hub in said housing meshes with and is driven from said bevel pinion 103. A splined shaft 106 is keyed to the hub of said bevel gear and projects rearwardly therefrom. A sleeve 107 is splined on said shaft and is journaled at its forward end in a frame and housing member 109 which is pivotally mounted in one side of the rear elevating portion 17 of the conveyer, for movement about an axis coaxial with the transverse shaft 80 (see Figure 8). Said sleeve extends within the hub of a bevel pinion 110 which is keyed to and driven from said sleeve. Said last mentioned bevel pinion meshes with and drives a bevel pinion 111, keyed to an outer end of the transverse shaft 80, for driving said shaft and the discharge conveyer.

The means for elevating the cutter frame 10 and cutter bars 11, 11 with respect to the front wheels 25, 25 and the rear wheels 26, 26 operates on principles similar to the elevating mechanism shown and disclosed in Patent No. 2,220,274, which issued to T. E. Pray on November 11, 1940, so will not herein be shown or described in detail. As herein shown, each wheel supporting frame 29, 29 and 31, 31 has an independently operable elevating mechanism, which forms the means for supporting the cutter frame 10 on said wheel supporting frames. Said elevating mechanisms on each wheel supporting frame are substantially the same and include a pair of longitudinally spaced fluid pressure cylinders 113, 114 connected between the forward end of each front wheel supporting frame 29 and the cutter frame 10 and a pair of rearwardly spaced fluid pressure cylinders 115 and 116 connected between the rear end of each wheel supporting frame 29 and the cutter frame 10. They also include a similar pair of fluid cylinders 119, 120 connected between the forward end of each rear wheel supporting frame 31 and the cutter frame 10 and a pair of fluid cylinders 121, 122 connected between the rear end of each rear wheel supporting frame 31 and the cutter frame 10.

Each forward wheel supporting frame 29 is provided with an upright guide portion 123 extend-

ing along the cutter frame 10, just outside of the cuttings passageway 13 and engaging vertically extending gibbed guides 124, 124 at its opposite ends. A forward guide member 125 engages facing gibbed guides 126, 126, herein shown as being formed integrally with a block 127 for the cylinders 113 and 114. A rear guide member 129 extends upwardly from the wheel supporting frame 29 and is shown as having slidable engagement with facing guides 130, 130, herein shown as being formed integrally with a block 131 for the cylinders 115, 116.

The guiding connection between the rear wheel supporting frame 31 and the cutter frame 10 is similar to the guiding connection between the front wheel supporting frame 29 and said cutter frame and includes an upright guide 133 extending upwardly from the top of said rear wheel housing and along the inside thereof and engaging facing gibbed guides 134, 134, herein shown as extending outwardly from the casing for the motor 35 (see Figures 1, 2 and 8). A guide member 136 is provided adjacent the forward portion of said wheel supporting frame and extends vertically therealong and upwardly beyond the upper end thereof and is adapted to be engaged by facing gibbed guides 137, 137, herein shown as being formed integrally with a block 139 of the forward cylinders 119, 120. In a similar manner an upright guide member 140 is provided adjacent the rear end of said wheel supporting frame and is slidably engaged by facing gibbed guides 141, 141, herein shown as being formed integrally with a block 143 for the cylinders 121, 122.

The cylinder 113 has a piston 144 therein having a piston rod 145 extensible therefrom. Said piston rod has an enlarged upper end as indicated by reference character 146, which has an engaging member 147 mounted thereon. Said engaging member engages the underside of a foot 148, projecting outwardly from the cutter frame 10. The other cylinder 114 has a piston 149 slidably mounted therein with a piston rod 150 depending therefrom and secured at its lower end to a bracket 151, projecting inwardly from the wheel housing 29. Fluid under pressure enters the cylinder 113 adjacent its lower end, to move the piston 144 upwardly therealong, and at the same time enters the upper end of the cylinder 114 through a passageway 152. When said piston 144 reaches the extreme end of its travel, fluid engaging the upper end of the piston 149 will cause the cylinder 114 and cylinder block 127 to move vertically along the piston rod 150, to elevate said cutter frame to its extreme vertical position.

The rear cylinders 115, 116 in the block 131 have suitable pistons (not shown), mounted therein, which are constructed and arranged in the same manner as the pistons 144 and 149, and the principle of operation of said rear cylinders and pistons is the same as said forward cylinders and pistons, so will not herein be shown or described in detail, it being understood that fluid is admitted to or released from the cylinders 115 and 116 simultaneously with the admission to, or the release of fluid from the cylinders 113 and 114.

The cylinders 119, 120 and 121, 122 and the piston rods extensible therefrom supporting the rear end of the cutter frame on the rear wheel supporting frames 31, are of the same construction as the cylinders 113, 114 and 115, 116 and their associated piston rods, and serve to elevate or lower the rear end of the cutter frame simultaneously with the elevation or lowering of the forward end of said cutter frame in the same man-

ner as said forward cylinders 113, 114 and 115, 116 and their associated pistons and piston rods. Said rear cylinders and their operative supporting connection between their associated frames 31, 31 and the cutter frame 10, thus need not herein be shown or described in detail.

The valves for controlling the admission of fluid under pressure to the cylinders 113, 114, 115 and 116 and for holding pressure therein, to hold the cutter bars at any desired cutting height, may be so arranged as to permit the simultaneous admission of fluid to all of the elevating cylinders, to elevate said cutter bars in a plurality of parallel planes, or to admit fluid to or release it from the cylinders associated with either the front or rear wheel supporting frames to tilt the cutter bars about either the front or rear wheels. Said fluid control valves may also be so arranged as to admit fluid to or release it from the cylinders associated with the wheel supporting frames 29 and 31 on one side or the other of the machine to tilt the cutter bars about the supporting wheels 25, 26 on either side of the machine.

Referring now in particular to certain novel details of the drive to the front and rear rubber-tired supporting wheels and the mounting of the wheel supporting frames in their respective housings, together with the means for turning said wheel supporting frames and wheels by power, for steering the machine, the wheel housing 27 is provided with a hollow boss 161 projecting upwardly from its upper end, which is journaled in a bearing member 162, formed integral with the upper side of the wheel supporting frame 29 (see Figure 9). The axis of pivotal connection of said wheel housing to said wheel supporting frame is herein shown as being coaxial with the vertical center of the wheel 25. The lower portion of said wheel supporting frame is of an enlarged arcuate formation and extends within a horizontal arcuately formed gibbed guide 163, formed integrally with the lower portion of the wheel supporting frame 29. The arc of said gibbed guide is cast from the turning center of said front wheel 25, and said guide is engaged by a guide strip 165, secured to an inwardly projecting arcuately formed portion of said wheel housing 27.

The means for turning said wheel housing by power includes an arcuate rack 167 secured to the outer periphery of the inner side of said wheel housing, above the axle 28 of the wheel 25. Said rack is meshed with a pinion 168 on the lower end of a vertical shaft 169, which shaft is journaled adjacent the upper end of said pinion in a bearing boss 170, formed integral with said wheel supporting frame. A bevel pinion 171 is keyed to the upper end of said shaft and journaled on its hub in said bearing boss. Said bevel pinion is meshed with and driven from a bevel gear 173, journaled on its hub in said wheel supporting frame and keyed on the forward end of a horizontal shaft 175, journaled in said wheel supporting frame. Said horizontal shaft extends rearwardly from said bevel pinion 171 in an angularly outward direction and has a bevel pinion 176 keyed to its rear end. Said last named pinion meshes with and is driven from a bevel pinion 177 on the lower end of a vertical shaft 179 (see Figure 4). Said bevel pinion 177 is journaled on its hub in a bearing boss 180 formed integral with said wheel supporting frame and is driven from a worm gear 181 keyed to the upper end of said vertical shaft 179. Said worm gear in turn is driven from a worm 183 on a longitudinally extending worm shaft 184, which worm shaft is driven from a

motor 185 through a spur gear reduction train 186.

The motor 185 may be of any well known form, but is herein shown as being a reversible fluid motor of a well known geared type. Fluid is supplied to said motor under pressure by means of a fluid pump 187 disposed beneath said fluid motor and driven from an electric motor 188. A fluid storage tank 189 is herein shown as being formed in said wheel supporting frame beneath said fluid pump and electric motor (see Figure 4).

The wheel 25 is mounted on the wheel housing on the axle 28 on bearings 190 and 191. Said axle is herein shown as being mounted in and projecting from an outwardly extending axle portion 192, herein shown as being formed integral with said wheel housing (see Figure 9). A bevel gear 193 is secured to said wheel and is meshed with a bevel pinion 194 journaled in a bearing bracket 195, formed integral with the wheel supporting frame 27. Said bevel pinion is keyed to the lower end of a vertical shaft 197, journaled in said wheel housing and having a spur gear 199 keyed to its upper end. Said spur gear meshes with and is driven from a spur gear 200, keyed to a vertical shaft 201, which shaft is mounted coaxial with the vertical center of the boss 181, and is keyed to a depending hub of a worm gear 202, journaled on its hub in said boss. A worm 203 meshes with said worm gear and is driven from a motor 205 through a spur gear reduction train 206. Said motor 205 may be of any well known form, but is herein shown as being a fluid motor of a well known reversible type.

The rear wheels 26, 26 are mounted in the wheel housings 30, 30 in the same manner the front wheels are mounted in their wheel housings 27, 27. Said rear wheel housings are also mounted in the wheel supporting frames 31, 31 in the same manner the front wheel housings 27, 27 are mounted in the wheel supporting frames 29, 29, so the detailed construction of said wheel mountings will not herein be shown or described in detail. Each rear wheel supporting frame 31 is provided with a fluid pump 208 driven by an electric motor 210. Said pump supplies fluid under pressure to the cylinders 118, 120 and 121, 122 for elevating the rear end of the cutting element and also supplies fluid under pressure to a fluid motor 211, which reversely turns said wheel housing about a vertical axis for steering the rear wheel. Said pump also supplies fluid under pressure to a fluid motor 212, which drives the rear wheels in the same manner the fluid motor 205 drives the front wheels. The geared reduction drives from said fluid motors, for driving and steering the rear wheels, are the same as the drives for driving and steering the front wheels, so will not herein be shown or described in detail.

The fluid control valves and piping to the fluid motors 185, 205, 211 and 212 may be so arranged that each wheel may be driven independently of the other in either a forward or a reverse direction and may be turned independently of each other in one direction or the other, and so that all the wheels may be driven or turned simultaneously, if desired, so that the machine may be driven in a forward or rearward direction and may also be driven laterally across the coal face and withdrawn therefrom, in a simplified manner.

The fluid control system shown in Figure 16 for supplying fluid under pressure to the steering motor 205 and the associated traction motor 185 of one wheel supporting frame, and to the ele-

vating cylinders 113, 114, 115 and 116 of the same wheel supporting frame, includes the pump 187 which takes fluid from the fluid storage tank 189. From said pump fluid passes to an overload pressure relief valve 215 through a pipe 216, and out from said relief valve through a pressure pipe 217 leading to a valve 218, for supplying fluid under pressure thereto. A pipe 219 connects the discharge side of said valve with the pressure side of a similar valve 220, and a pipe 221 connects said last mentioned valve with a valve 222.

When the valves 218, 220 and 222 are in a neutral position, fluid will pass from the pipe 217 through said valves, to and through a return pipe 223, to the fluid storage tank 189. Said valves may be balanced four-way piston valves connected in series so that the return fluid from one valve will supply pressure to the next valve, as disclosed in the Sloane Patent No. 2,354,336, and are no part of my present invention, so will not herein be shown or described in detail. Each of said valves is herein shown as being operated by means of two opposed solenoids 226 and 227.

The valve 222 has connection with the steering motor 205 through pipes 230 and 231. When said valve is moved to one extreme position by means of its solenoid 226, fluid will flow from the pressure pipes 217 and 219 through the pipe 230, to drive said motor in one direction, and will be exhausted through the pipe 231, and through the pipe 223 to the tank 189. When said valve is moved to an opposite open position by means of its solenoid 227, fluid under pressure will pass through the pipe 231 to drive the motor 205 in a reverse direction, and will be exhausted through the pipe 230 and the pipe 223.

In a like manner, the valve 220 is connected with the motor 185, to drive said motor in reverse directions through pipes 233 and 234.

The valve 218 is connected with the cylinders 113, 114, 115 and 116, to elevate the cutting element through a pipe 235, and is also connected with the opposite ends of said cylinders, to positively lower said cutting element, through a pipe 236. Pressure is held in said cylinders, to hold the cutter bars at the desired cutting height, when said valve is in a neutral position.

A relief valve 238 is connected from the pressure to the exhaust sides of the valve 218 so that when overload conditions are reached in the cylinders 113, 114, 115 and 116, fluid will pass by said relief valve to the valve 220. In a like manner the motor 185 is protected by a relief valve 239 connected between the pressure and exhaust sides of the valve 220, and the motor 205 is protected by a relief valve 240 connected between the pressure and exhaust sides of the valve 222.

The solenoids 226 and 227 for each valve may be controlled by electric switches on a central control panel indicated generally by reference character 237. It should here be understood that each wheel unit is provided with a hydraulic circuit as described, and that the switches for controlling the energizing of the solenoids for the valves for each hydraulic circuit may be on one central control panel. These electric control switches may be so arranged as to be operated individually, or certain of said switches may be connected to be operated simultaneously or independently, to permit independent or simultaneous operation of the wheels, and independent or simultaneous operation of the elevating means on each wheel supporting frame, so the cutter bar may be elevated in a plurality of parallel

planes, or may be tilted in one direction or another.

Referring now in particular to Figure 15, illustrating one manner in which the machine of my invention may cut across a coal face, the machine may first be moved up to the coal face on its supporting rubber-tired wheels, driven by the motors 205, 205 and 212, 212, until the end of the cutter bars are adjacent the coal face and the right-hand rib, designated as position A in this figure. The front and rear wheels may then be turned by the fluid motors 185, 185 and 211, 211 until they are substantially parallel to the coal face. If the cutting is soft, the cutter bars may be sumped into the coal face solely by operation of the fluid motors 205, 205 and 212, 212. Where, however, the cutting is relatively hard, one flexible feeding member 34, usually the left-hand feeding member, may be trained forwardly from its feed drum and its free end may be anchored adjacent the coal face. Power may then be applied to said feed drum, to feed the cutter bars into the coal face independently of or simultaneously with said fluid motors 205, 205 and 212, 212.

When the cutter bars 11, 11 have been sumped into the coal face for substantially the full cutting depth of said cutter bars, the front and rear wheels may be turned to bring the cutter bars at substantially right angles to the coal face for cutting thereacross, as in position B in Figure 15. Here again, when the cutting is soft, the machine may be fed to a position perpendicular to the coal face and across the coal face by the motors 205, 205 and 212, 212. Where, however, the cutting is relatively hard, the left-hand flexible feeding member 34 may be trained forwardly from its winding drum 33 around a guide 213 formed in the wheel housing 29 and illustrated in Figures 4 and 7. From thence it may be trained laterally from the left-hand side of the machine and may be anchored at its free end in a suitable manner. Power may then be applied to said cable to feed the machine across the coal face, the wheels 25, 25 and 26, 26 being substantially parallel to the coal face during this operation. When the machine has traveled entirely across the coal face, the wheels may be turned so as to be parallel to the coal rib to position the machine for withdrawal, as in position C in Figure 15. The machine may then be withdrawn from the face by the fluid motors 205, 205 and 212, 212, the flexible cables usually not being necessary for withdrawing the machine from the face as it is cutting, even where the cutting is relatively hard.

Where it is desired to cut out and load the entire seam, and three cutter bars are used and the coal seam is thicker than the distance from the lower cutter bits on the lower cutter chain 12 to the upper cutter bits of the upper cutter chain 12, the cutter bars are first elevated and the top portion of the seam is first cut out and loaded. They are then lowered and another cut is made across the coal face to cut and load out the remainder of the seam, it being understood that the conveyer 16 is in operation during the entire cutting operation.

While I have herein shown and described one form in which my invention may be embodied, it will be understood that the construction thereof and the arrangement of the various parts may be altered without departing from the spirit and scope thereof. Furthermore, I do not wish to be construed as limiting my invention to the spe-

cific embodiment illustrated, excepting as it may be limited in the appended claims.

I claim as my invention:

1. In a kerf-cutting machine, an elongated frame, a cutter bar projecting from the forward end thereof, a pair of front rubber-tired wheels and a pair of rear rubber tired wheels for supporting said frame, all of said wheels being pivoted for movement about vertical axes for supporting said frame and cutter bar for movement longitudinally of or across a coal face, and power drive connections for driving said wheels in all positions of adjustment thereof about said vertical axes.

2. In a kerf-cutting machine, an elongated frame, a cutter bar projecting from the forward end thereof, a pair of front rubber-tired wheels and a pair of rear rubber-tired wheels, for supporting said frame, all of said wheels being pivoted for movement about vertical axes, for supporting said frame and cutter bar for movement across a coal face, power drive connections for driving said wheels in all positions of adjustment thereof about said vertical axes, and flexible feeding means auxiliary to said wheels, for feeding said kerf-cutting machine on said wheels transversely across a coal face.

3. In a kerf-cutting machine, an elongated frame having a cutter bar projecting from the forward end thereof, a plurality of wheels for supporting said frame for movement along the ground, power means for driving said wheels, a vertical pivotal support mounting for each of said wheels, permitting said wheels to be turned for supporting and moving said frame longitudinally with respect to a coal face or transversely thereacross.

4. In a kerf-cutting machine, an elongated frame having a cutter bar projecting from the forward end thereof, a plurality of wheels for supporting said frame for movement along the ground, power means for driving said wheels, a vertical pivotal support mounting for each of said wheels, permitting said wheels to be turned for supporting and moving said frame longitudinally with respect to a coal face or transversely thereacross, and flexible feeding means auxiliary to said power means, for feeding said cutter bar on said wheels longitudinally into and transversely across a coal face.

5. In a kerf-cutting machine, an elongated frame having a cutter bar projecting from the forward end thereof in relatively rigid relation with respect thereto, a plurality of rubber-tired wheels for supporting said frame for movement along the ground, a vertical pivotal support mounting for each of said wheels, means for turning said wheels about said vertical axes for supporting said frame for movement longitudinally with respect to a coal face or transversely thereacross, and power drive connections to said wheels, for driving said wheels in all positions of adjustment thereof about said vertical axes.

6. In a kerf-cutting machine, an elongated frame having a cutter bar projecting from the forward end thereof, in relatively rigid relation with respect thereto, a plurality of rubber-tired wheels for supporting said frame for movement along the ground, a vertical pivotal support mounting for each of said wheels, permitting said wheels to be turned for supporting said frame for movement longitudinally with respect to a coal face or transversely thereacross, power drive connections to said wheels, for driving said wheels in all positions of adjustment thereof

about said vertical axes, and flexible feeding means auxiliary to said wheels for feeding said cutter bar into and transversely across a coal face.

7. In a kerf-cutting machine, an elongated frame having a cutter bar projecting from the forward end thereof, in relatively rigid relation with respect thereto, a plurality of rubber-tired wheels for supporting said frame for movement along the ground, a vertical pivotal mounting for each of said wheels, permitting said wheels to be turned for supporting said frame for movement longitudinally with respect to a coal face or transversely thereacross, and independent drive connections to each of said wheels for independently driving each of said wheels in all positions of adjustment thereof, about said vertical axes.

8. In a kerf-cutting machine, an elongated frame having a cutter bar projecting from the forward end thereof, in relatively rigid relation with respect thereto, a plurality of rubber-tired wheels for supporting said frame for movement along the ground, a vertical pivotal mounting for each of said wheels, permitting said wheels to be turned for supporting said frame for movement longitudinally with respect to a coal face or transversely thereacross, and independent drive means for each of said wheels for independently driving each of said wheels in all positions of adjustment thereof about said vertical axes, comprising a separate drive motor for each of said wheels.

9. In a kerf-cutting machine, an elongated frame having a cutter bar projecting from the forward end thereof, in relatively rigid relation with respect thereto, a plurality of rubber-tired wheels for supporting said frame for movement along the ground, a vertical pivotal support mounting for each of said wheels, permitting said wheels to be turned for supporting said frame for movement longitudinally with respect to a coal face or transversely thereacross, independent drive means for each of said wheels for independently driving each of said wheels in all positions of adjustment thereof about said vertical axes comprising a separate drive motor for driving each of said wheels, and flexible feeding means auxiliary to said drive motors, for feeding said cutter bar longitudinally into and transversely across a coal face.

10. In a kerf-cutting machine, an elongated frame, a cutter bar projecting from the forward end thereof, a pair of front rubber-tired wheels and a pair of rear rubber-tired wheels for supporting said frame, and a support mounting for each of said wheels including a separate wheel housing forming an axle support for each of said wheels and mounted on said frame for pivotal movement about a vertical axis intersecting said wheel, a motor, a geared drive connection from said motor to said wheel for driving said wheel in all positions of adjustment thereof about said vertical axis, and means for turning said wheel housing about its axis of pivotal connection to said frame for steering said associated wheel.

11. In a kerf-cutting machine, an elongated frame, a cutter bar projecting from the forward end thereof, a pair of front rubber-tired wheels and a pair of rear rubber-tired wheels for supporting said frame, and a support mounting for each of said wheels including a separate wheel housing forming an axle support for each of said wheels and mounted on said frame for pivotal movement about a vertical axis intersecting said

wheel, said wheel housing forming an axle support for said wheel, a motor, a geared drive connection from said motor to said wheel for driving said wheel in all positions of adjustment thereof about said vertical axis, and means for turning said wheel housing about its axis of pivotal connection to said frame for steering said associated wheel including a motor and power drive connections from said motor to said wheel housing.

12. In a kerf-cutting machine, an elongated frame, a cutter bar projecting from the forward end thereof, a pair of front rubber-tired wheels and a pair of rear rubber-tired wheels for supporting said frame, and a support mounting for each of said wheels including a separate wheel housing for each of said wheels and forming an axle support therefor, said wheel housing having a portion journaled in said frame for pivotal movement about a vertical axis and having an enlarged arcuate portion slidably guided in said frame and forming a guide and support means therefor, and means for turning said wheel and wheel housing about said vertical axis including a motor and power drive connections from said motor to said wheel housing.

13. In a kerf-cutting machine, an elongated frame, a cutter bar projecting from the forward end thereof, a pair of front rubber-tired wheels and a pair of rear rubber-tired wheels for supporting said frame, and a support mounting for each of said wheels including a separate wheel housing for each of said wheels and forming an axle support therefor, said wheel housing having an upright boss journaled in said frame for mounting said wheel housing in said frame for pivotal movement about a vertical axis and having a downwardly spaced enlarged arcuate portion slidably guided in said frame and forming a guide and support means therefor, and means for driving said wheel including a motor, and a geared drive connection from said motor to said wheel including a vertical shaft extending through and journaled in said boss.

14. In a kerf-cutting machine, an elongated frame, a cutter bar projecting from the forward end thereof, a pair of front rubber-tired wheels and a pair of rear rubber-tired wheels for supporting said frame, and a support mounting for each of said wheels including a separate wheel housing for each of said wheels and forming an axle support therefor, said wheel housing having an upright boss journaled in said frame for mounting said wheel housing in said frame for pivotal movement about a vertical axis and having a downwardly spaced enlarged arcuate portion slidably guided in said frame, means for driving said wheel including a motor and a geared drive connection from said motor to said wheel including a vertical shaft extending through and journaled in said boss, and a power drive connection to said wheel housing for turning said wheel and wheel housing about said vertical axis.

15. In a kerf-cutting machine, a frame, a cutter bar projecting from the forward end thereof, and means for supporting said frame for first summing said cutter bar and then moving said cutter bar across the coal face without stopping the cutting operation including two front supporting wheels and two rear supporting wheels, supporting connections between said wheels and said frame, mounting all of said wheels for pivotal movement about vertical axes, means for turning said wheels about said vertical axes to cause said wheels to support and guide said frame

for movement perpendicularly of and longitudinally across a coal face in a continuous operation, and means for driving at least two of said wheels by power, for feeding said frame longitudinally of or transversely across a coal face.

16. In a kerf-cutting machine, a frame, a cutter bar projecting from the forward end thereof, and means for supporting said frame for first sumping said cutter bar and then moving said cutter bar across the coal face without stopping the cutting operation including two front supporting wheels and two rear supporting wheels, supporting connections between said wheels and said frame, mounting all of said wheels for pivotal movement about vertical axes, means for turning said wheels about said vertical axes, and power drive connections for driving said wheels in all positions of adjustment thereof about said vertical axes, to cause said wheels to feed said cutter bar perpendicularly into a coal face and then longitudinally thereacross in a continuous cutting operation.

17. In a kerf-cutting machine, a frame, a cutter bar projecting from the forward end thereof, and means for supporting said frame for first sumping the cutter bar and then moving the cutter bar across the coal face without stopping the cutting operation including two front supporting wheels and two rear supporting wheels, and supporting connections between said wheels and said frame mounting all of said wheels for pivotal movement about vertical axes, means for turning said wheels about said vertical axes, power drive connections for driving said wheels in all positions of adjustment thereof about said vertical axes, and flexible feeding means auxiliary to said wheels for feeding said kerf-cutting machine on said wheels into and transversely across a coal face at the speed of travel of said wheels.

18. In a kerf-cutting machine, an elongated frame having a cutter bar projecting from the forward end thereof, a plurality of wheels for supporting said frame for movement along the ground, power means for driving said wheels, and a vertical pivotal support mounting for each of said wheels, for mounting each of said wheels on said frame for pivotal movement about a vertical axis intersecting said wheel, permitting said wheels to be turned for supporting and moving said frame perpendicularly with respect to a coal face and transversely thereacross in a continuous operation.

19. In a self-propelled vehicle, a frame, means

for supporting said frame for movement along the ground in longitudinal and transverse directions including a pair of front rubber-tired wheels and a pair of rear rubber-tired wheels, and a support mounting for each of said wheels including a separate wheel supporting frame for each

5 wheel, a wheel housing forming an axle support for each of said wheels and mounted on said wheel supporting frame for pivotal movement about a vertical axis, a motor mounted on said wheel supporting frame, a geared drive connection from said motor to said wheel for driving said wheel in all positions of adjustment thereof about said vertical axis, and means self-contained on each wheel supporting frame for turning said associated wheel housing about its axis of pivotal connection to said wheel supporting frame, for steering said associated wheel.

20. In a self-propelled vehicle, a frame, means for supporting said frame for movement along the ground in longitudinal and transverse directions including two front rubber-tired wheels and two rear rubber-tired wheels, and a support mounting for each of said wheels including a separate wheel supporting frame for each wheel, a wheel housing forming an axle support for each of said wheels and mounted on said wheel supporting frame for pivotal movement about a vertical axis, and means self-contained on each wheel supporting frame for turning said associated wheel and wheel housing about said vertical axis including a motor and power drive connections from said motor to said wheel housing.

21. In a self-propelled vehicle, a frame, means for supporting said frame for movement along the ground in longitudinal and transverse directions including two front rubber-tired wheels and two rear rubber-tired wheels for supporting said frame, and a support mounting for each of said wheels including a separate wheel supporting frame for each wheel, a wheel housing forming an axle support for each of said wheels and mounted on said wheel supporting frame for pivotal movement about a vertical axis, a motor mounted on said wheel supporting frame, a geared drive connection from said motor to said wheel for driving said wheel in all positions of adjustment thereof about said vertical axis, and means self-contained on each wheel supporting frame for turning said associated wheel and wheel housing about said vertical axis including a motor and power drive connections from said motor to said wheel housing.

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