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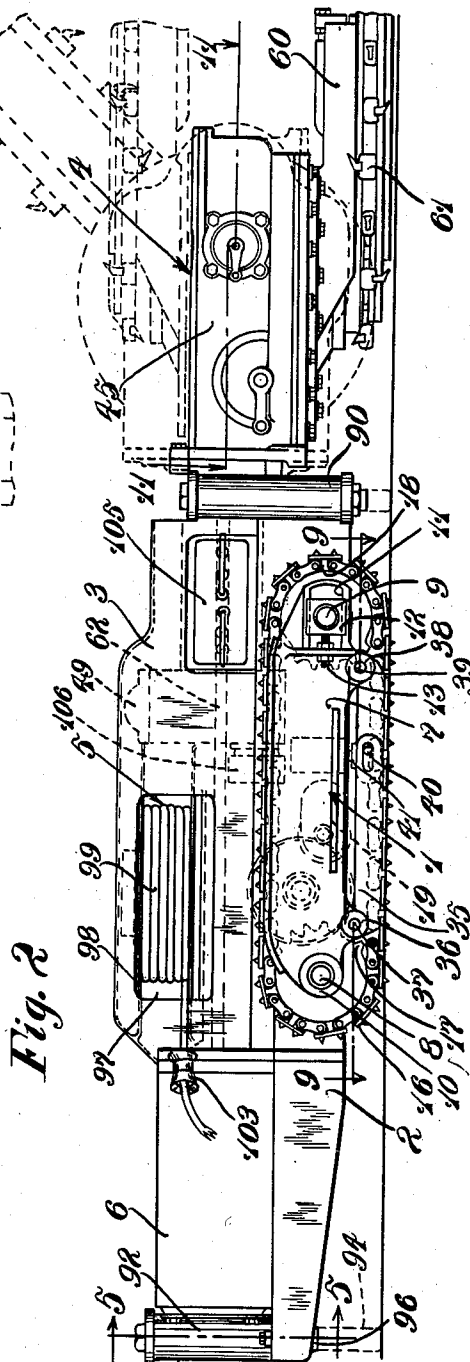
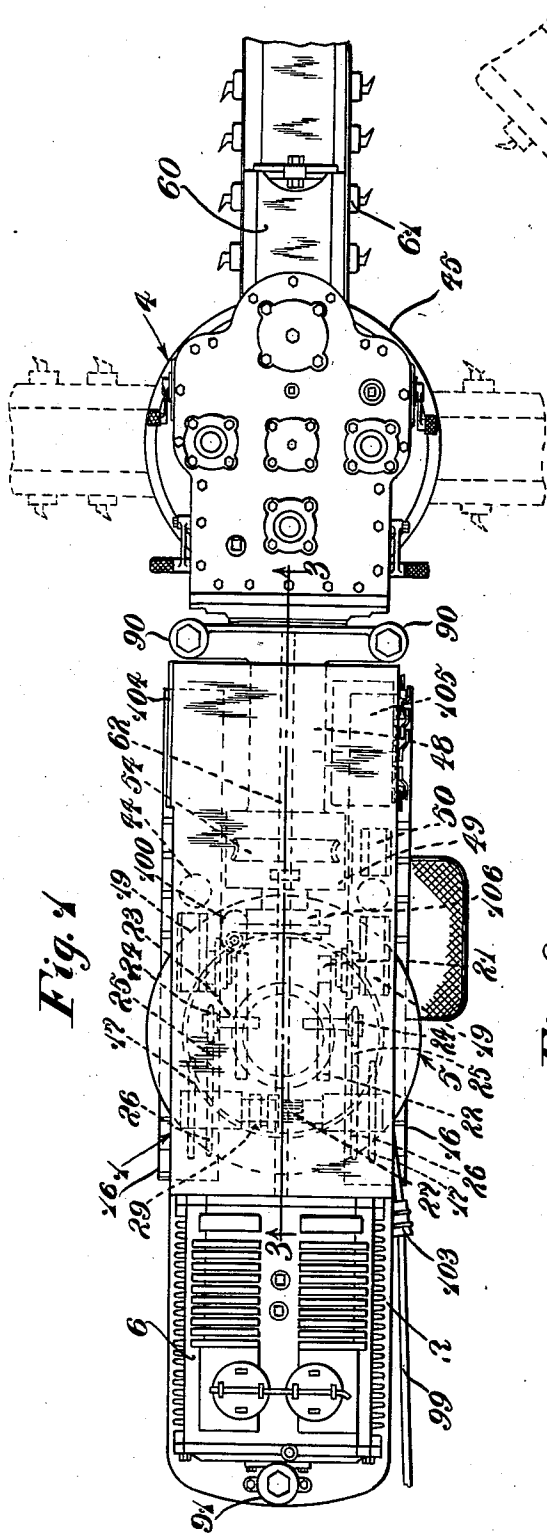
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2,180,359

MINING MACHINE

Filed July 1, 1935

5 Sheets-Sheet 1



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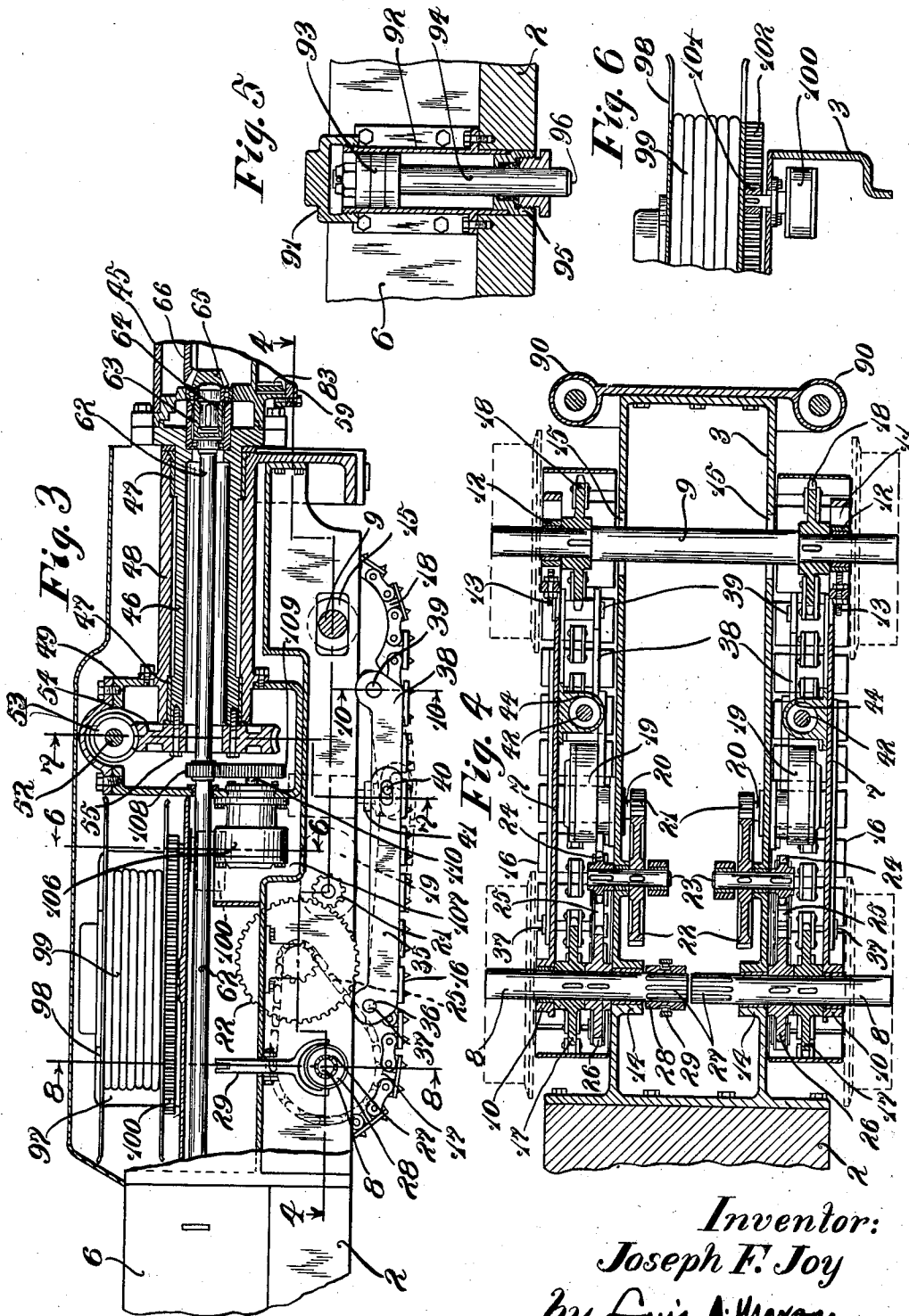
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MINING MACHINE

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5 Sheets-Sheet 2



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MINING MACHINE

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5 Sheets-Sheet 3

Fig. 7

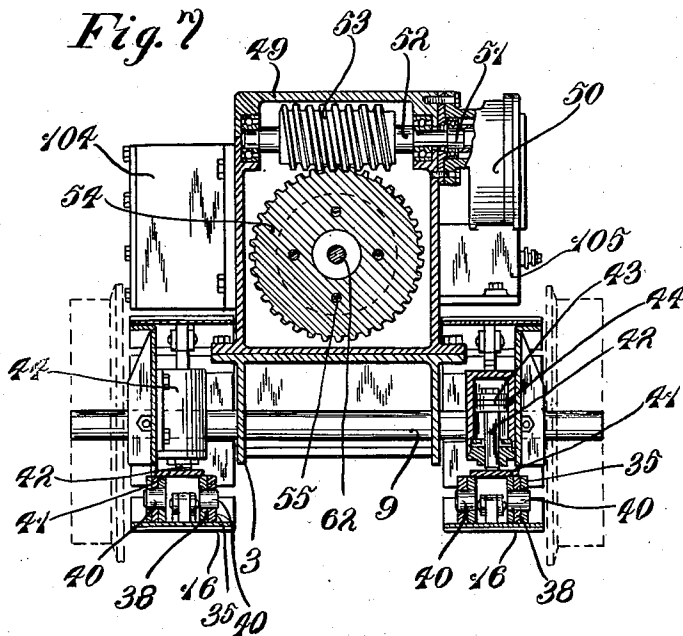


Fig. 8

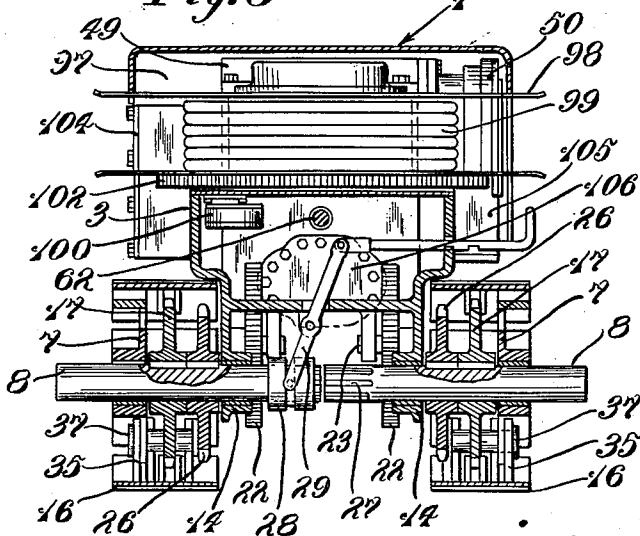


Fig. 10

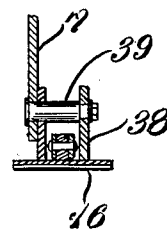
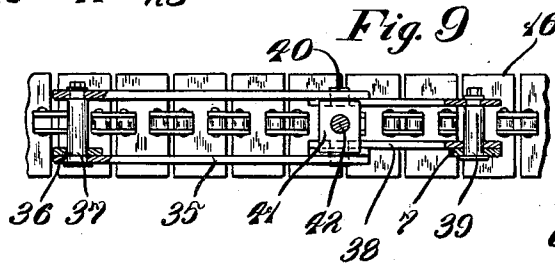


Fig. 9



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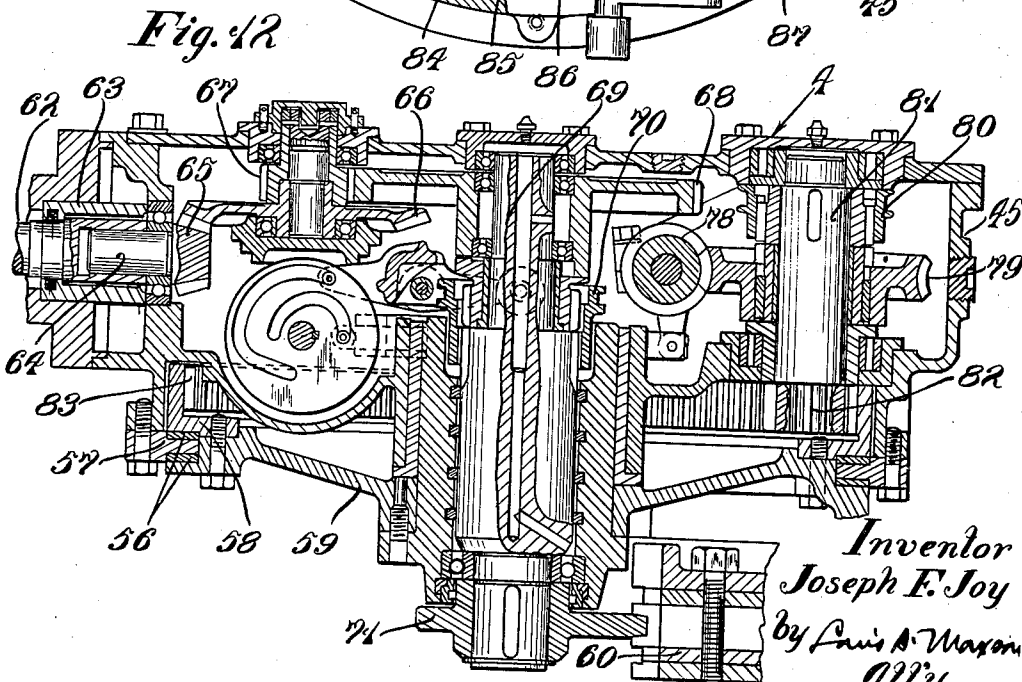
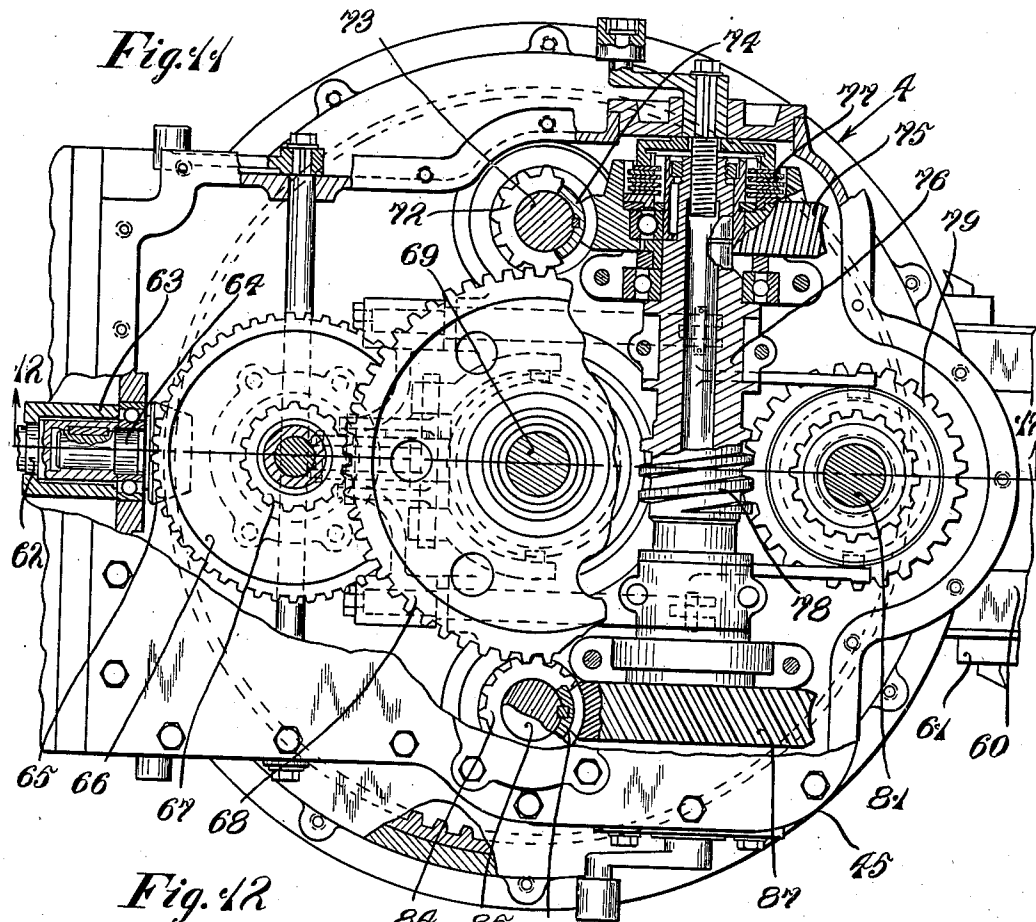
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MINING MACHINE

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5 Sheets-Sheet 4



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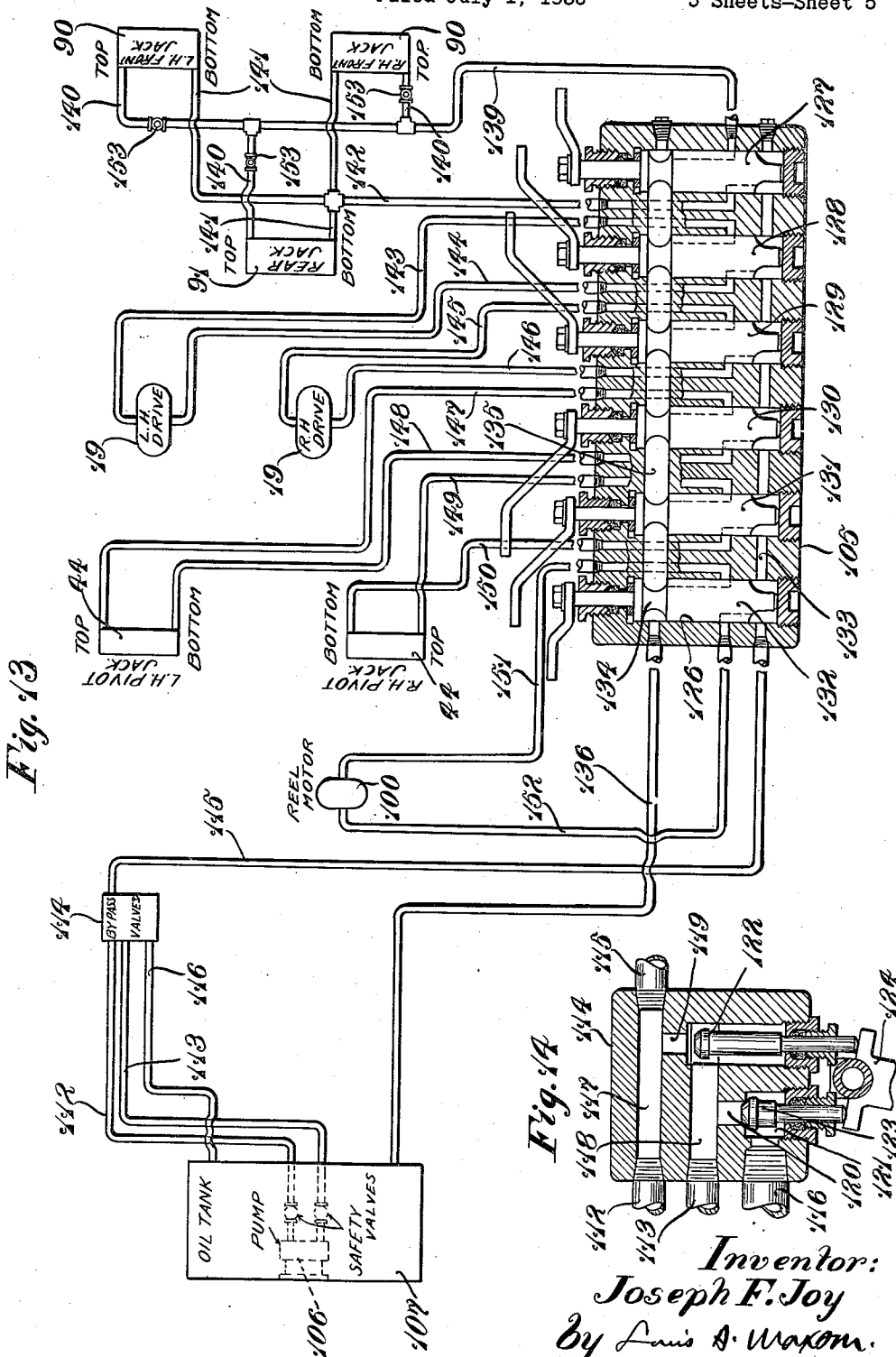
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MINING MACHINE

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5 Sheets-Sheet 5



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UNITED STATES PATENT OFFICE

2,180,359

MINING MACHINE

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Application July 1, 1935, Serial No. 29,310

3 Claims. (Cl. 262—28)

This invention relates to mining machines, and more particularly to coal mining machines of the tractor tread, supported and guided type.

An object of this invention is to provide an improved coal mining machine. Another object is to provide an improved propelling, supporting and adjusting mechanism for a coal mining machine. A further object is to provide an improved elevating and adjusting means for the cutting mechanism of a coal mining machine of the above character. These and other objects and advantages of the invention will, however, hereinafter more fully appear.

In the accompanying drawings there is shown for purposes of illustration one form which the invention may assume in practice.

In these drawings—

Fig. 1 is a plan view of the illustrative form of the improved mining machine.

Fig. 2 is a side elevational view of the mining machine shown in Fig. 1.

Fig. 3 is an enlarged view in longitudinal vertical section taken substantially on line 3—3 of Fig. 1.

Fig. 4 is a horizontal sectional view taken substantially on line 4—4 of Fig. 3.

Fig. 5 is a detail sectional view taken on line 5—5 of Fig. 2.

Fig. 6 is a detail sectional view showing the cable reel and its associated driving motor.

Fig. 7 is a cross sectional view taken substantially on line 7—7 of Fig. 3.

Fig. 8 is a cross sectional view taken substantially on line 8—8 of Fig. 3.

Fig. 9 is a horizontal sectional view taken substantially on line 9—9 of Fig. 2.

Fig. 10 is a detail sectional view taken on line 10—10 of Fig. 3.

Fig. 11 is an enlarged horizontal sectional view taken substantially on line 11—11 of Fig. 2.

Fig. 12 is a view in longitudinal section taken substantially on line 12—12 of Fig. 11.

Fig. 13 is a diagrammatic view showing a hydraulic fluid system and the associated control means.

Fig. 14 is a detail sectional view of the by-pass valve.

In this illustrated embodiment of the invention there is shown a coal mining machine of the tractor tread, supported and guided type generally comprising a tractor base, generally designated 1, supporting a base frame 2 in turn supporting a frame 3 on the forward end of which is mounted a kerf cutting mechanism generally designated 4. Mounted on the frame 3 is a cable

reel device generally designated 5, while supported on the rearward portion of the base frame is a motor 6, herein preferably an electric motor, which is adapted to drive, through connections to be later described, the kerf cutting mechanism 4.

The tractor base 1 comprises tread frames 7 supporting alined rear axles 8, 8 and a front axle 9, the tread frames 7 having cylindrical bearing portions 10 supporting bearing sleeves in which the rear axles 8, 8 are journaled. Mounted in longitudinal guideways 11 formed in the forward portions of the tread frames 7 are adjustable bearing blocks 12 having suitable adjusting screws 13 and supporting bearings in which is journaled the front axle 9 in the manner shown in Fig. 4. The base frame 2 is supported between the tractor treads and has cylindrical bearing portions 14 supporting bearing sleeves alined with the cylindrical bearing sleeve supporting portions 10 of the tread side frames and in which the alined rear axles 8, 8 are journaled, the forward portion of the base frame having longitudinal slot-like openings 15 in the side walls thereof through which the front axle 9 extends, these openings permitting movement of the front axle with respect to the frame. Guided on the tread frames 7 are endless track laying treads 16, 16 each in the form of an endless tread-plate-supporting block chain engaging drive sprockets 17 respectively keyed to the alined rear axles 8, 8 and front guide sprockets 18 keyed to the front axle 9. The bearing blocks on the tread frames may be adjusted to move the front axle in a longitudinal direction relative to the tread frames to take up undue slack in the endless tread chains. The tractor tread chains are driven each by a hydraulic motor 19, of a conventional design, secured to the opposite sides of the base frame 2 and projecting within the tractor treads between the top and bottom runs of the tread chains in the manner shown in Fig. 4. The power shaft 20 of each of these motors has keyed thereto a spur pinion 21 meshing with a spur gear 22 keyed to a horizontal transversely extending shaft 23. The shafts 23 are arranged in axial alinement, as shown in Fig. 4, and are suitably journaled within the base frame 2. These alined shafts 23 project outwardly through the sides of the base frame and have keyed thereto chain sprockets 24 engaging endless drive chains 25 in turn engaging chain sprockets 26 keyed to the alined rear axles 8, 8 respectively. The adjacent ends of the rear axles 8, 8 are splined at 27, and interlocked with the spline-

ways of one axle is a sliding clutch element 28 operated by a pivoted clutch shipper 29, and this clutch member is slidable axially from the motion in ly of the gear housing 49 and suitably journaled therein. Operating fluid may be supplied to said



Obscured by a pivoted clutch shipper 29, and therein. Operating fluid may be supplied to said ways of one axle is a sliding clutch element 28 ly of the gear housing 49 and suitably journaled

84 meshing with and driven by the gear 68 and keyed to a shaft 85 herein arranged parallel with the shaft 73 and likewise suitably journaled within the cutter head frame. Keyed to and driven by the shaft 85 is a worm 86 meshing with a high speed worm wheel 87 journaled on the shaft 76 in a manner similar to the worm wheel 75 and similarly connectible to the shaft by a multiple disc clutch. It will thus be seen that when the high speed clutch connecting the worm wheel 87 to the shaft 76 is applied, and the gear 68 is driven, the cutter bar may be swung about its pivot, in a direction opposite from the slow speed bar swing, at a high bar positioning speed through the fast speed worm gearing 86, 87, worm gearing 78, 79, shaft 81 and spur pinion 82 meshing with the internal gear 83. The worm gearing 78, 79 is of the self-locking type, and when the disc clutches controlling the fast and slow speed worm gearings are released, locks automatically the cutter bar against swinging movement about its pivot relative to the cutter head.

Hydraulically operated means is provided for bodily elevating the machine with respect to the mine floor comprising a pair of hydraulic jacks 90 mounted at the opposite sides of the base frame 2 at the forward end of the latter and at the opposite sides of the head axis, and a third hydraulic jack 91 mounted on the rear end of the base frame 2 midway between the sides of the latter. These hydraulic jacks each comprise, as shown in Fig. 5, a vertically arranged hydraulic cylinder 92 containing a reciprocable piston 93 having a piston rod 94 extending downwardly through a packed lower head 95 of the cylinder, the lower end of the piston rod having a bottom abutment surface 96 engageable with the mine floor. When hydraulic pressure is supplied to the upper ends of the cylinders 92, the pistons 93 are moved downwardly to bring the abutment surfaces 96 on the piston rods into engagement with the mine floor, and upon continued flow of hydraulic pressure to these cylinders, the machine is raised bodily from the mine floor. It will thus be seen that these hydraulic jacks may be employed for moving the cutter bar into different horizontal cutting positions and by individually controlling the flow of liquid pressure to the hydraulic jacks, the cutter bar may be tilted to change its angle in altitude, thereby enabling the cutting of kerfs in planes inclined with respect to the horizontal. These hydraulic jacks may be also employed to raise the machine to enable rotation of the cutter head during swinging of the cutter bar from the full line position shown in Fig. 2 into its vertical shearing position.

In this illustrative construction, arranged in a horizontal, open-sided chamber 97 formed in the upper portion of the upper frame 3 is an electric cable reel 98 journaled for rotation about a vertical axis and having wound thereon an electric conductor cable 99 for supplying motive power to the motor 6. As shown in Fig. 6, a hydraulic motor 100 of a conventional design is arranged within the upper frame 3 beneath the reel, and keyed to the vertical drive shaft of this motor is a spur gear 101 meshing with a large spur gear 102 secured to the reel. The electric conductor cable 99 is guided with respect to the cable reel 98 by means of a spool-like guide element 103 suitably mounted on the side of the motor casing. Supported on the upper frame 3 at one side thereof is a conventional electric control box 104 for

controlling the electrical circuits of the motor 6. Mounted on the opposite side of the upper frame 3 is a control valve box 105 for controlling the supply of liquid pressure from a hydraulic pump 106 to the various hydraulic cylinders above referred to. As shown in Fig. 3, the pump 106 is arranged within a liquid containing reservoir 107 formed in the upper frame 3 and is driven from the transmission shaft 62 by a spur gear 108 fixed to the transmission shaft and meshing with a spur gear 109 fixed to the horizontal drive shaft 110 of the pump. In this instance, the pump casing is secured to the rear wall of the gear housing 49.

Now referring to the improved hydraulic fluid system and the associated control means shown in Figs. 13 and 14, it will be noted that the intake of the pump 106 communicates with the reservoir 107, and the discharge side of the pump is connected through supply conduits 112 and 113 to a by-pass valve 114 for varying the pressure in the hydraulic system, while leading from the by-pass valve is a main supply conduit 115 through which hydraulic pressure is supplied to the various hydraulic devices. A return conduit 116 connects the by-pass valve 114 with the reservoir 107. As shown in Fig. 14, the supply conduit 112 is connected to the main supply conduit 115 by a passage 117 in the valve casing, while the conduit 113 communicates with a passage 118 communicable through a passage 119 with the passage 117 and through a passage 120 with a chamber 121 with which the return conduit 116 communicates. The passages 119 and 120 are controlled by end seating valves 122 and 123 respectively, having a suitable operating lever 124. When the lever 124 is swung into the position shown, both of the pressure supply conduits 112 and 113 communicate with the main supply conduit 115, while the passage 120 is closed by the valve 123. When the lever 124 is swung into its opposite position, the passage 119 is closed by the valve 122, while the passage 120 is open so that the supply conduit 112 communicates with the main supply conduit 115 and the supply conduit 113 is connected through the passage 120 and chamber 121 with the return conduit 116. The main supply conduit 115 leads from the by-pass valve 114 to the control valve box 105. The casing of the valve box 105 is formed with a plurality of vertical bores 126 having arranged therein control valves 127, 128, 129, 130, 131 and 132, respectively, each provided with a manual control handle. Formed in the valve box casing and extending substantially thereacross and communicating with the lower ends of the valve bores is a liquid pressure supply passage 133 with which the main supply conduit 115 communicates. The valves are provided with upper annular channels 134, and communicating with these channels and connecting the upper ends of the valve bores together is a discharge passage 135 connected by a return conduit 136 to the reservoir 107. The bore for the valve 127, which is herein the control valve for the hydraulic jacks, is connected by a conduit 139 and branched conduits 140 to the upper ends of the jack cylinders 92, the lower ends of these jack cylinders being connected by branched conduits 141 to a conduit 142 leading to the bore for the valve 127. The bore for the valve 128, which is herein the control valve for the left hand tractor tread driving motor 19, is connected by conduits 143, 144 to the left hand motor 19. The bore for the valve 129, which is the control valve for the right hand tractor tread

driving motor 19, is connected to the motor through conduits 145 and 146. The bore for the valve 130, which is the control valve for the left hand tread jack 44, is connected through a conduit 147 to the upper end of the jack cylinder and through a conduit 148 to the lower end of the jack cylinder. The bore for the valve 131, which is the control valve for the right hand tractor tread jack 44, is connected by a conduit 149 to the upper end of the jack cylinder and by a conduit 150 to the lower end of the jack cylinder. The bore for the valve 132, which is the control valve for the reel driving motor 100, is connected by conduits 151 and 152 to the reel motor. When the hydraulic jack control valve 127 is in the position shown in Fig. 13, liquid under pressure may flow from the supply passage 133 through a passage on the valve, conduit 142 and branched conduits 141 to the lower ends of the jack cylinders 92 while the upper ends of the jack cylinders are connected to the exhaust passage 135 through the branched conduits 140, conduit 139 and a passage on the valve 127, thereby effecting upward movement of the jack pistons. When the position of the valve 127 is reversed, liquid under pressure may flow from the supply passage 133 through a passage on the valve, conduit 139 and branched conduits 140 to the upper ends of the jack cylinders, while the lower ends of the jack cylinders are connected to the exhaust passage 135 through the branched conduits 141, conduit 142 and a passage on the valve, and as a result, the jack pistons are moved downwardly within their cylinders to effect elevation of the machine. The branched passages 140 leading to the upper ends of the jack cylinders are provided with individual control valves 153 whereby the flow of liquid pressure to the upper ends of the jack cylinders 92 may be individually controlled, thereby to enable the jacks to be operated to effect tilting of the machine to change its angle in altitude. When the control valve 128 for the left hand tractor tread driving motor 19 is in the position shown in Fig. 13, liquid under pressure may flow from the supply passage 133 through a passage on the valve, conduit 144 to the left hand tractor tread driving motor 19, while the exhaust of this motor is connected through conduit 143 and a passage on the valve to the discharge passage 135. When the position of the valve 128 is reversed, liquid under pressure may flow from the supply passage 133 through conduit 143 to the motor to effect drive of the latter in the reverse direction, while the motor exhaust is connected through conduit 144 and a passage on the valve to the discharge passage 135. When the control valve 129 for the right hand tractor tread driving motor 19 is in the position shown in Fig. 13, liquid under pressure may flow from the supply passage 133 through a passage on the valve and conduit 146 to the motor, while the motor exhaust is connected through conduit 145 and a passage on the valve to the discharge passage 135. When the position of the valve 129 is reversed, liquid under pressure may flow from the supply passage 133 through a passage on the valve and conduit 145 to the motor 19 to effect drive thereof in the reverse direction, while the motor exhaust is connected to the discharge passage 135 through conduit 146 and a passage on the valve. When the valve 130, which controls the left hand tractor tread jack 44, is in the position shown in Fig. 13, liquid under pressure may flow from the supply passage 133 through a passage on the valve and conduit 148 to the lower end of the jack cyl-

inder, while the upper end of the jack cylinder is connected through conduit 147 and a passage on the valve with the discharge passage 135. When the right hand tractor tread jack control valve 131 is in the position shown in Fig. 13, liquid under pressure may flow from the supply passage 133 through a passage on the valve and conduit 150 to the lower end of the jack cylinder, while the upper end of the jack cylinder is connected to the exhaust passage 135 through conduit 149 and a passage on the valve. When the positions of the valves 130, 131 are reversed, liquid pressure may flow through conduits 147 and 149 to the upper ends of the jack cylinders, while the lower ends of the jack cylinders are connected to exhaust through the conduits 148 and 150. When the reel motor control valve 132 is in the position shown in Fig. 13, liquid under pressure may flow from the supply passage 133 through a passage on the valve and through conduit 152 to the motor, while the motor exhaust is connected through conduit 151 and a passage on the valve to the discharge passage 135. When the position of the valve 132 is reversed, the conduit 151 is connected to the supply passage 133, while the conduit 152 is connected to the exhaust passage 135, and as a result, the direction of drive of the reel motor is reversed. In any position of the valves above described, when it is desired to supply more pressure to the various hydraulic devices, the by-pass valves 122, 123 may be positioned to supply pressure from both the supply conduits 112 and 113 to the main supply conduit 115.

The general mode of operation of the improved mining machine is as follows: The mining machine is propelled about the mine from one working place to another by the track-laying treads 16 driven by the hydraulic motors 19, 19. When it is desired to effect propulsion of the machine in a straight path, the rear drive axles 8, 8 are connected together by the sliding clutch 28 so that the track-laying treads are driven in unison. When it is desired to turn the machine in one direction or the other, the clutch 28 is moved into its released position to disconnect the rear axles 8, 8, thereby enabling independent drive and control of the track-laying treads by their individual driving motors 19, 19. To facilitate turning movement of the machine, hydraulic pressure may be supplied to the hydraulic jacks 44 for the tractor treads so that the pivoted tread guide frames 35 and 38 may be swung downwardly about their pivots with respect to the tread frames from the full line position shown in Fig. 3 to the dotted line position in that figure, thereby decreasing the contact area of the treads with the ground surface. When the working place is reached, and it is desired to effect a horizontal cut in the coal seam, the hydraulic jacks 90, 91 are operated to elevate the machine bodily with respect to the mine floor, and hydraulic pressure is then supplied to the head rotating motor 50 to effect movement of the cutter bar about the head axis to its horizontal cutting position. The hydraulic pressure is then released from the hydraulic jacks so that the machine is lowered into the full line position shown in Fig. 2. The hydraulic pressure is also released from the tractor tread jacks 44 to move the pivoted frames 35, 38 into the position shown in Fig. 2 so that the relatively large surfaces of the tractor treads engage the mine floor to stabilize the machine. The hydraulic jacks 90, 91 may also be operated to jack the machine firmly in posi-

tion during horizontal swinging of the cutter bar. The cutter bar is then swung horizontally at a high bar positioning speed to bring its tip end adjacent the right hand rib, and upon application of the slow speed bar swing controlling clutch 77, the cutter bar is swung horizontally about its pivot at a low cutting speed to effect an arcuate cut beneath the coal face. If desired, the hydraulic jacks may be raised during the cutting operation so that the cutter bar may be sumped beneath the coal and withdrawn from the coal by means of the endless track-laying treads, the tread driving motors driving the treads to effect a relatively low speed feeding movement of the machine forwardly and rearwardly. During this operation, the cutter bar is first sumped in, thereafter swung laterally across the face and lastly moved rearwardly from beneath the coal. When it is desired to insert a horizontal kerf in the coal face in an elevated position with respect to the mine floor, the hydraulic jacks may be operated bodily to elevate the machine, and the cutter head rotated to move the cutter bar about the head axis from the full line horizontal cutting position shown in Fig. 2 to the upper dotted line horizontal cutting position shown in that figure. The cutter bar may also be rotated about the head axis to bring the kerf cutter into a vertical shearing position, as indicated in dotted lines in Fig. 2. When the cutter bar is in a vertical shearing position, it is swung upwardly about its pivot at a fast bar positioning speed to bring its tip end adjacent the mine roof. The machine is then propelled forwardly over the mine floor by means of the track-laying treads to effect sumping of the cutter bar within the coal. The low speed bar swing controlling clutch 77 is then applied to effect swinging movement of the cutter bar downwardly about its pivot at a low cutting speed until the tip end of the cutter bar reaches the mine floor. The tractor tread driving motors are then reversed and the machine is propelled rearwardly at a low cutting speed to effect withdrawal of the cutter bar from the coal. As the machine moves over the mine floor, the cable reel 98 may be operated to wind in or pay out the conductor cable 99 as desired. Under certain conditions, the track-laying tread driving motors may be independently operated to effect independent drive of the track-laying treads in opposite directions, thereby to swing the machine about a vertical axis to move the cutter bar about said axis in a horizontal plane across the coal face while the cutter bar remains stationary as regards swinging movement about its own pivot with respect to the cutter head. The cutter bar may be swung into right angled positions, as indicated in dotted lines in Fig. 1, so that it extends laterally from either side of the machine, and the tractor treads may be operated to propel the machine longitudinally to effect feeding movement of the cutter bar in a direction to insert a long-wall cut in the coal seam at either rib. If desired the machine may be elevated by the hydraulic jacks, and track rail engaging wheels placed on the projecting ends of the tread axles, as indicated in dotted lines in Figs. 4 and 7, thereby to enable the machine to operate as a

wheel mounted track cutter, in a well known manner. Further uses and advantages of the improved mining machine will be clearly apparent to those skilled in the art.

While I have in this application specifically described one form which my invention may assume in practice, it will be understood that this form of the same is shown for purposes of illustration, and that the invention may be modified and embodied in various other forms without departing from its spirit or the scope of the appended claims.

What I claim as new and desire to secure by Letters Patent is:

1. The combination with a mining machine having traction means for supporting and propelling the machine, and kerf cutting mechanism supported by said traction means and including a horizontal kerf cutter, of elevating devices on the machine and engageable with the mine floor for bodily elevating the machine together with said traction means out of engagement with the surface over which the traction means moves, thereby to elevate said kerf cutter into different horizontal cutting planes, said machine when so elevated being solely supported by said elevating devices.

2. The combination with a mining machine having traction means for supporting and propelling the machine, kerf cutting mechanism supported by said traction means and including a horizontal kerf cutter, of elevating devices on the machine and engageable with the mine floor for bodily elevating the machine together with said traction means out of engagement with the surface over which the traction means moves, thereby to elevate said kerf cutter into different horizontal cutting planes, said machine when so elevated being solely supported by said elevating devices, and means for independently controlling said elevating devices to effect independent operation thereof, thereby to tilt the kerf cutter with respect to the horizontal.

3. The combination with a mining machine having traction means for supporting and propelling the machine, and kerf cutting mechanism supported by said traction means and including a horizontal kerf cutter, of elevating devices on the machine and engageable with the mine floor for bodily elevating the machine together with said traction means out of engagement with the surface over which the traction means moves, thereby to elevate said kerf cutter into different horizontal cutting planes, said machine when so elevated being solely supported by said elevating devices, said elevating devices including elevating devices differently disposed both laterally and longitudinally with respect to said mining machine and another elevating device so disposed that it is at the opposite side of the center line of said mining machine from one of said other elevating devices, and means for independently controlling said elevating devices to effect independent operation thereof, thereby to tilt the kerf cutter longitudinally with respect to the horizontal or laterally with respect to the horizontal at will.

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