July 6, 1943. W. W. SLOANE 2,323,493

KERF-CUTTING MACHINE

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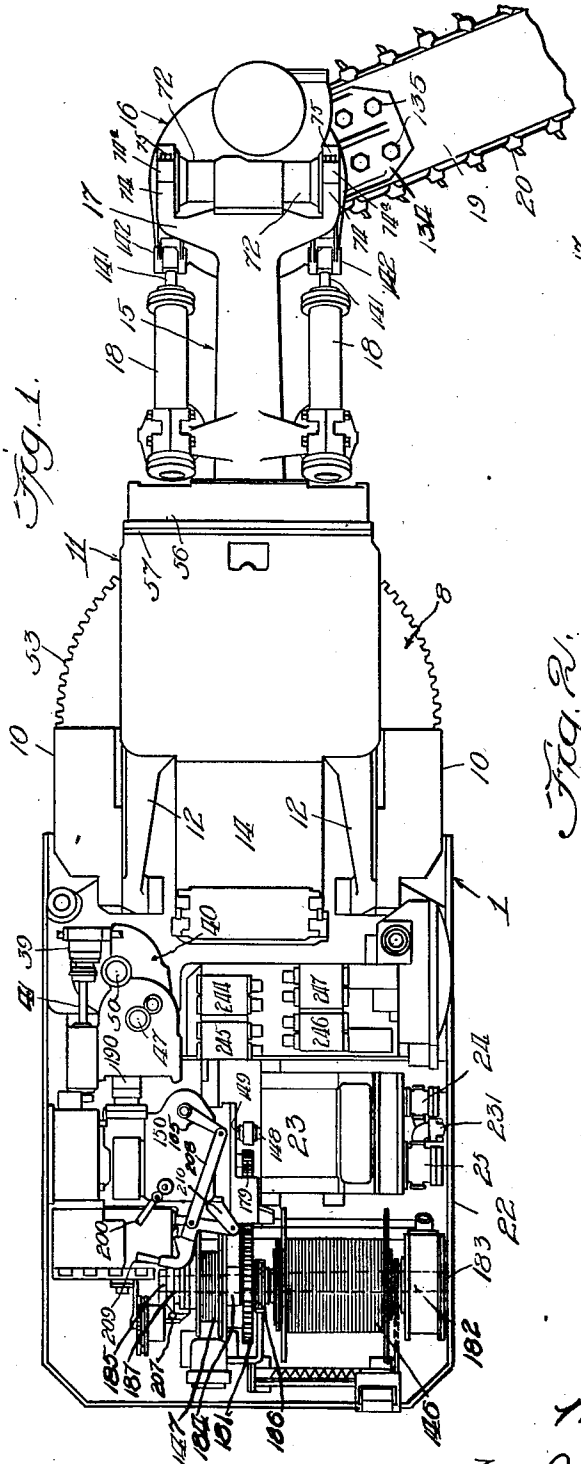


Fig. 1.

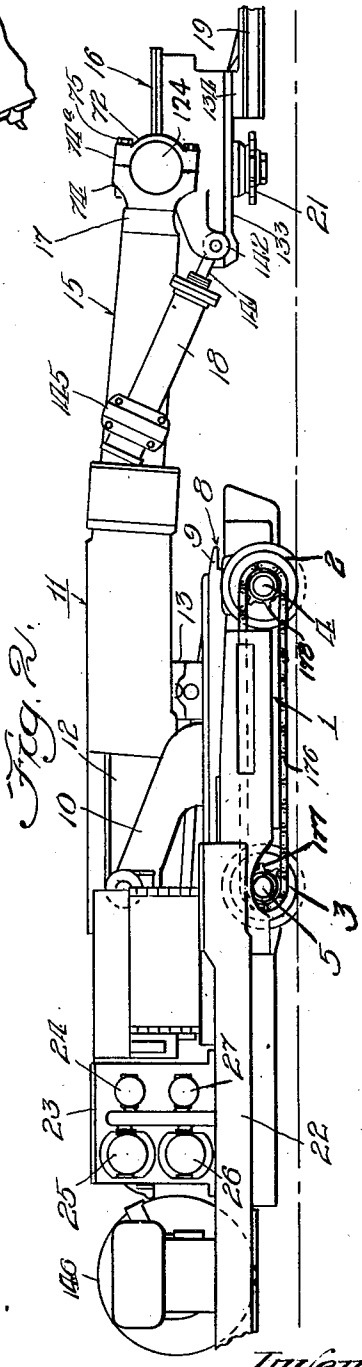


Fig. 2.

Inventor:
William W. Sloane
By Clarence D. Poole Atty.

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KERF-CUTTING MACHINE

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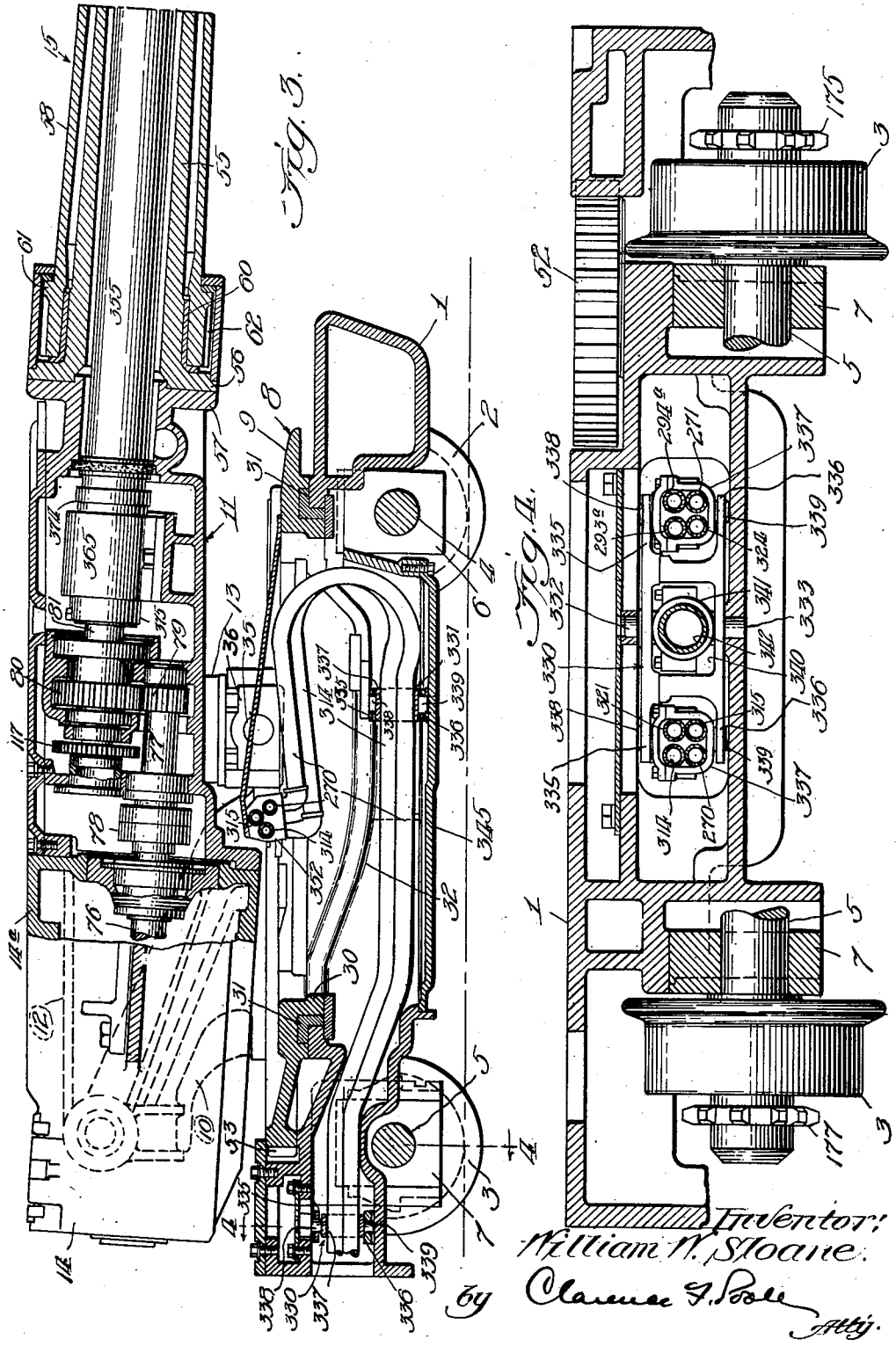


Fig. 3.

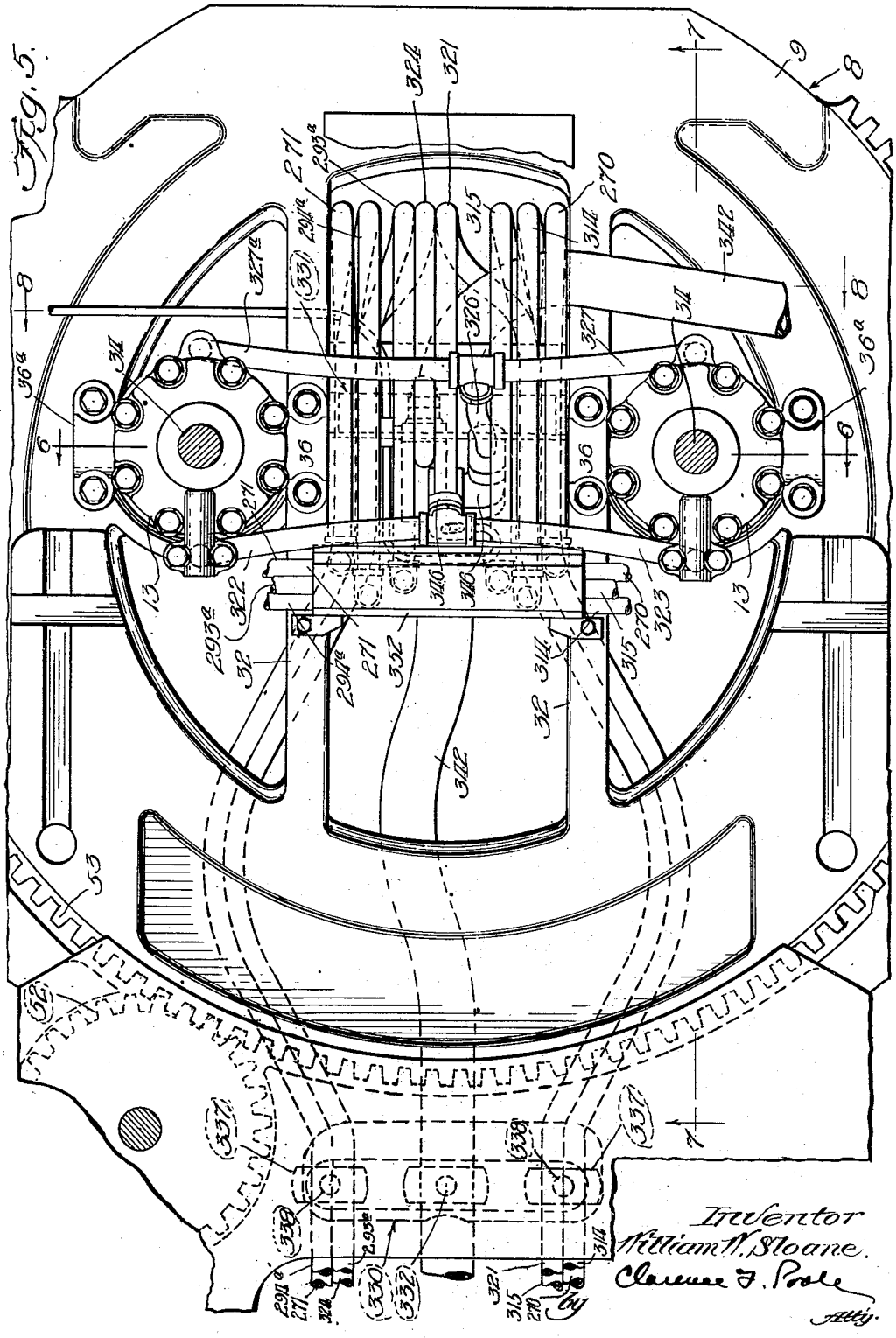
Fig. 4.

Inventor:
William W. Sloane.
By Clarence J. Poole
Atty.

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KERF-CUTTING MACHINE

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KERF-CUTTING MACHINE

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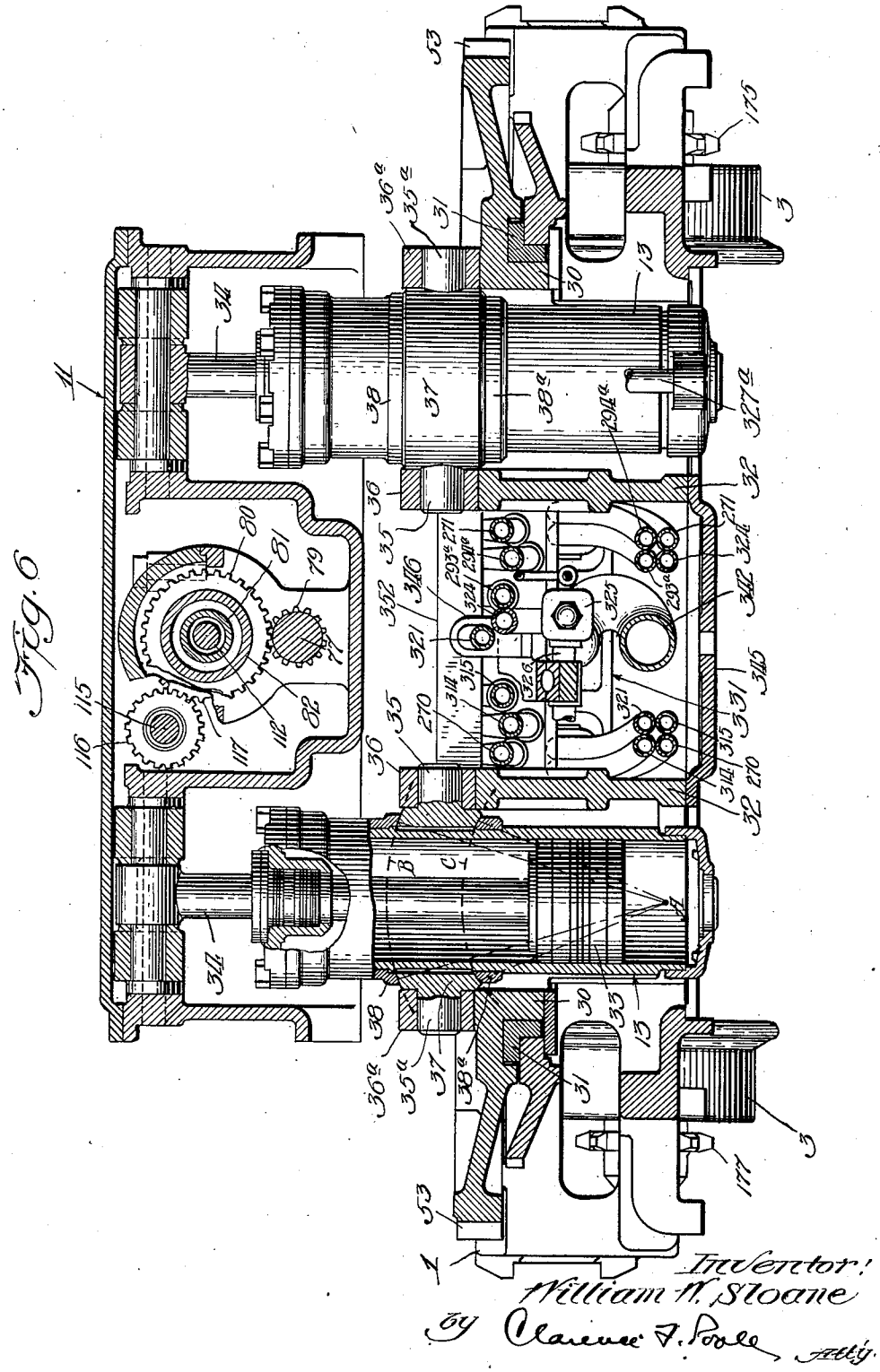


Fig. 6

Inventor:
William W. Sloane
By Clarence A. Poole Atty.

July 6, 1943. W. W. SLOANE 2,323,493

KERF-CUTTING MACHINE

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Fig. 7.

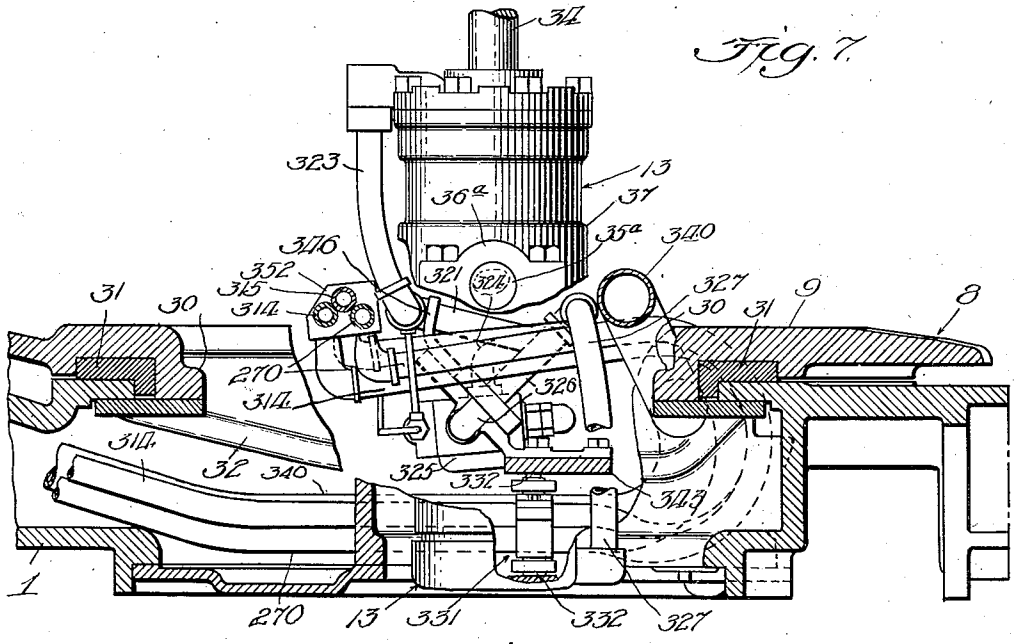
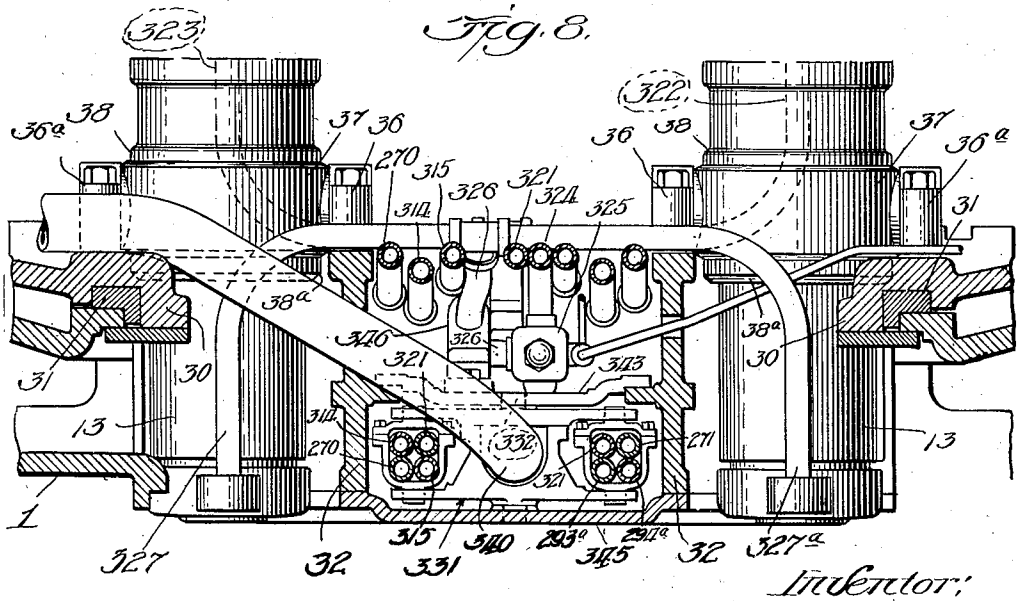


Fig. 8.



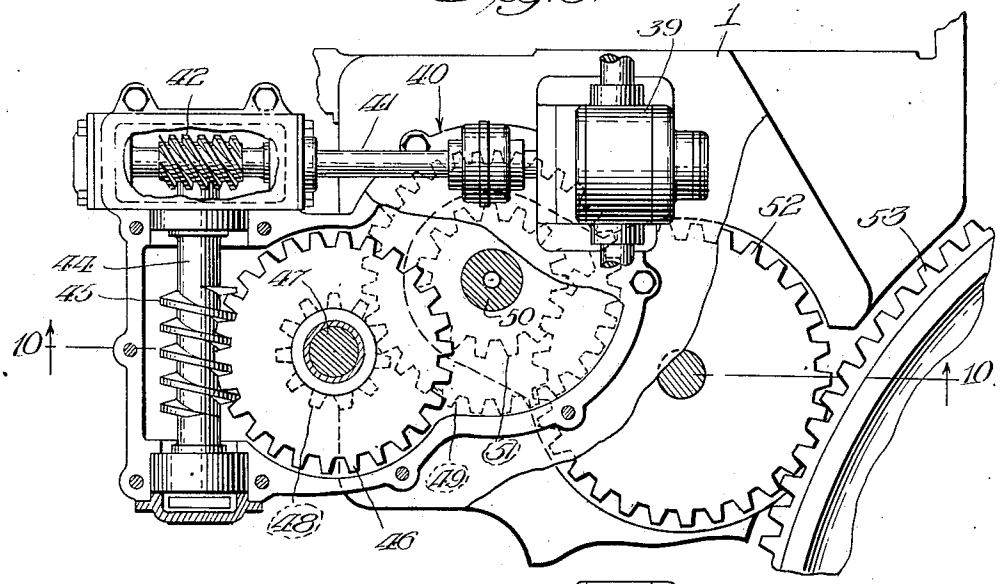
Inventor:
William W. Sloane.
By Clarence J. Poole
Atty

July 6, 1943. W. W. SLOANE 2,323,493

KERF-CUTTING MACHINE

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Fig. 9.



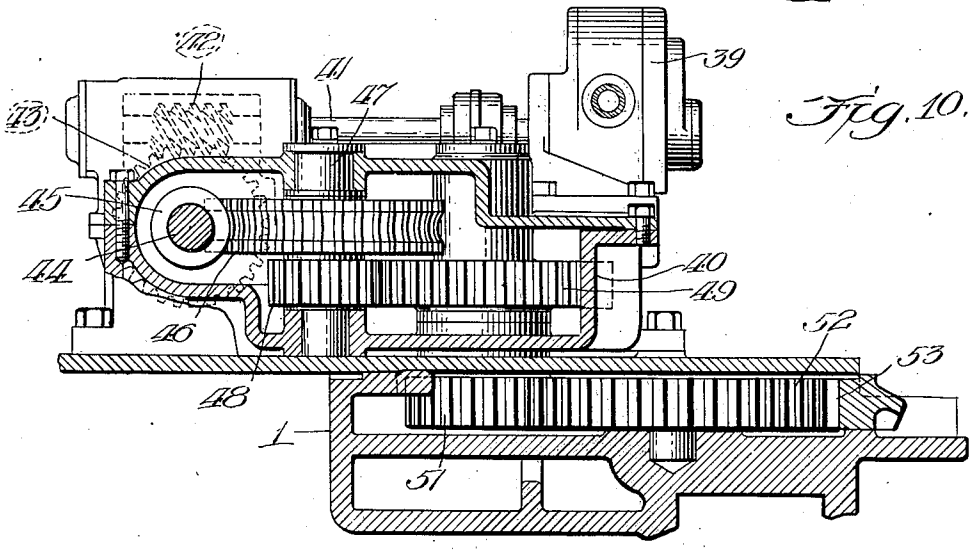


Fig. 10.

Inventor:
William W. Sloane
by Clarence A. Poole
Atty.

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KERF-CUTTING MACHINE

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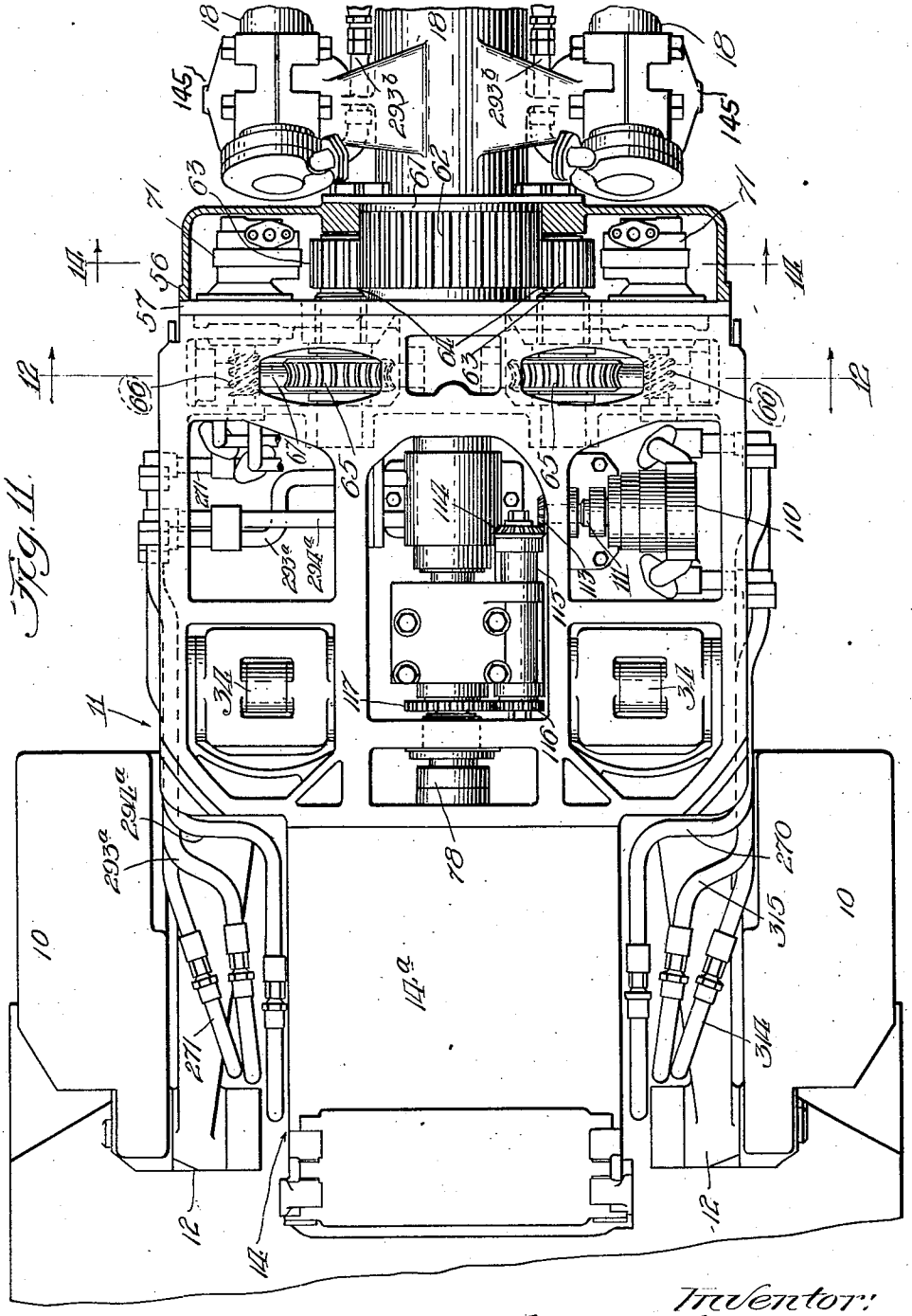


Fig. 11.

Inventor:
William W. Sloane
by Clarence O. Poole
Atty.

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KERF-CUTTING MACHINE

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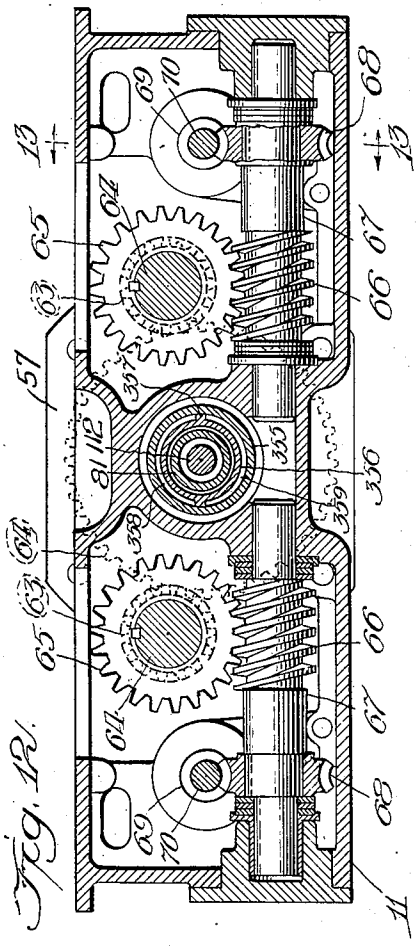


Fig. 12.

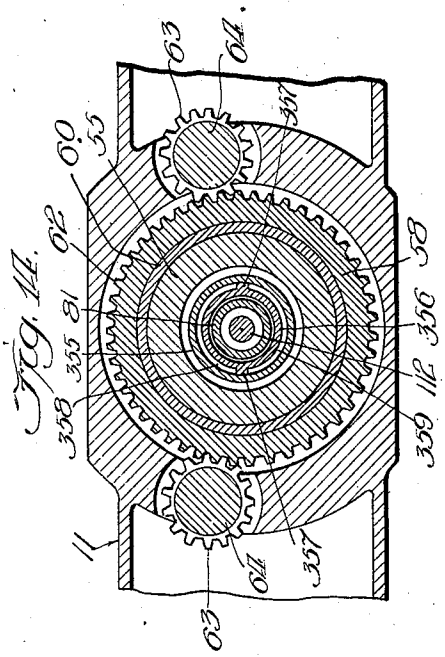


Fig. 14.

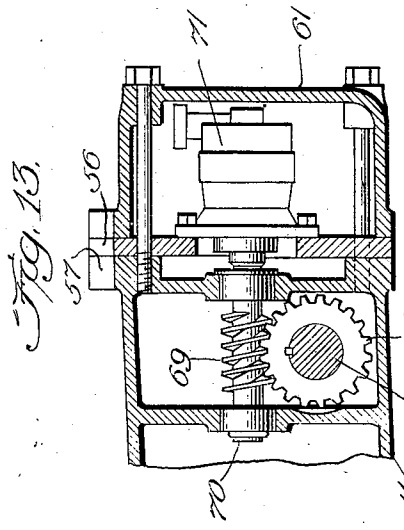


Fig. 13.

Inventor:
William W. Sloane
by Clarence D. Poole
Atty.

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KERF-CUTTING MACHINE

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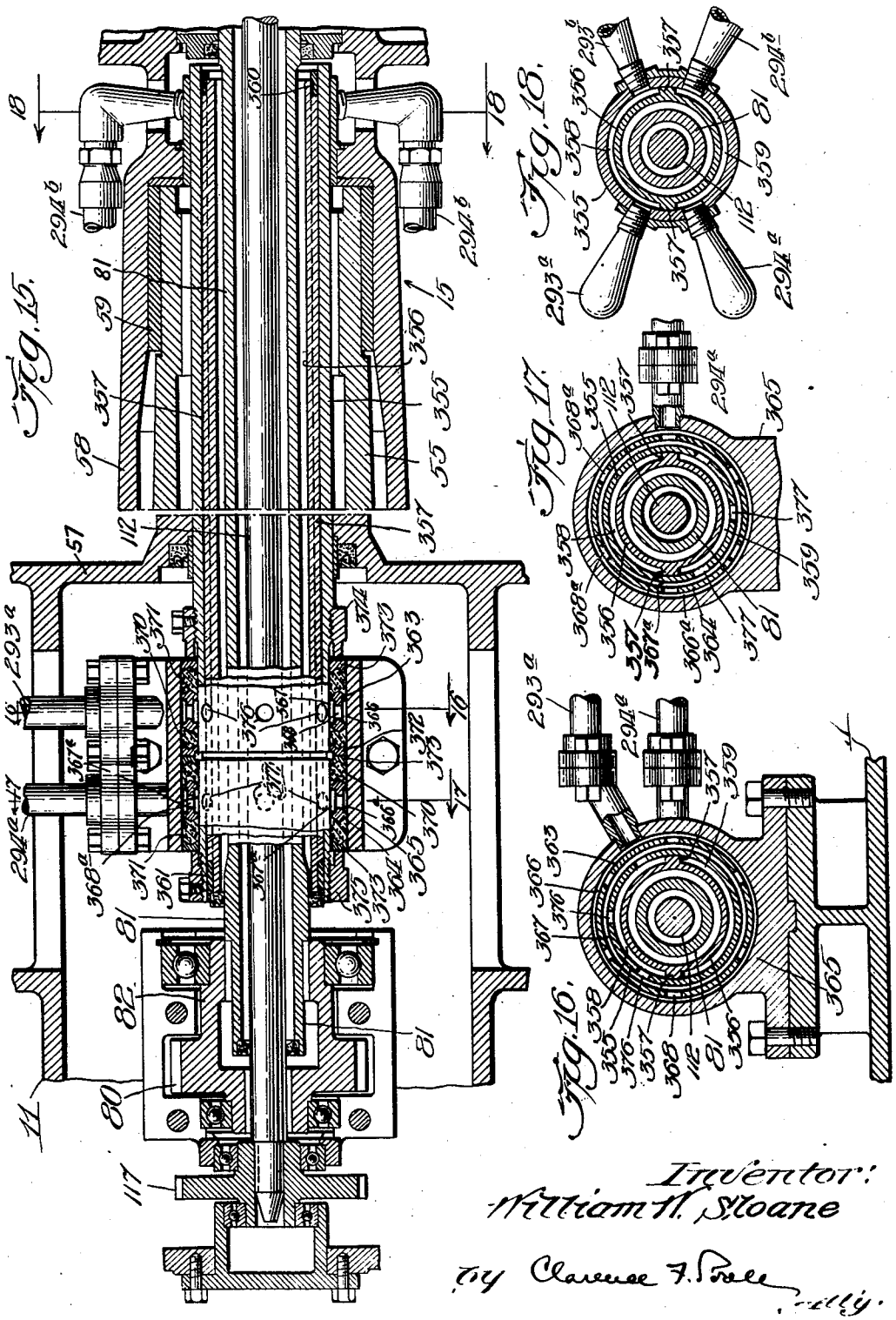


Fig. 15.

Fig. 18.

Fig. 17.

Fig. 16.

Inventor:
William W. Sloane
by Clarence F. Poole
Atty.

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KERF-CUTTING MACHINE

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Fig. 19.

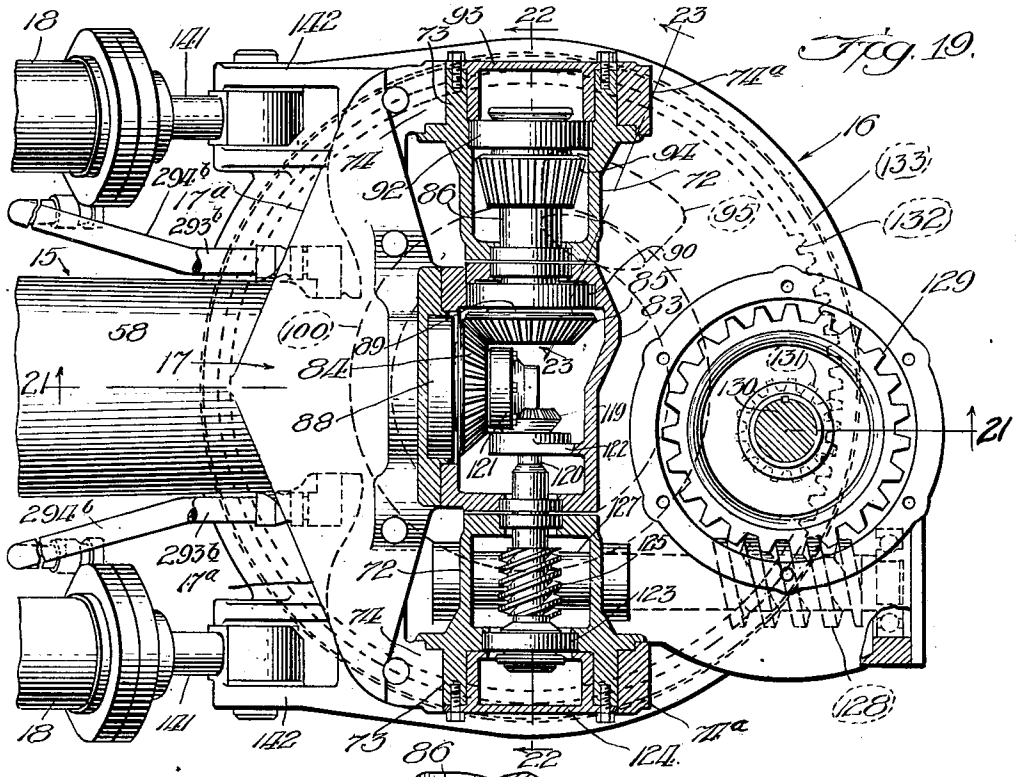
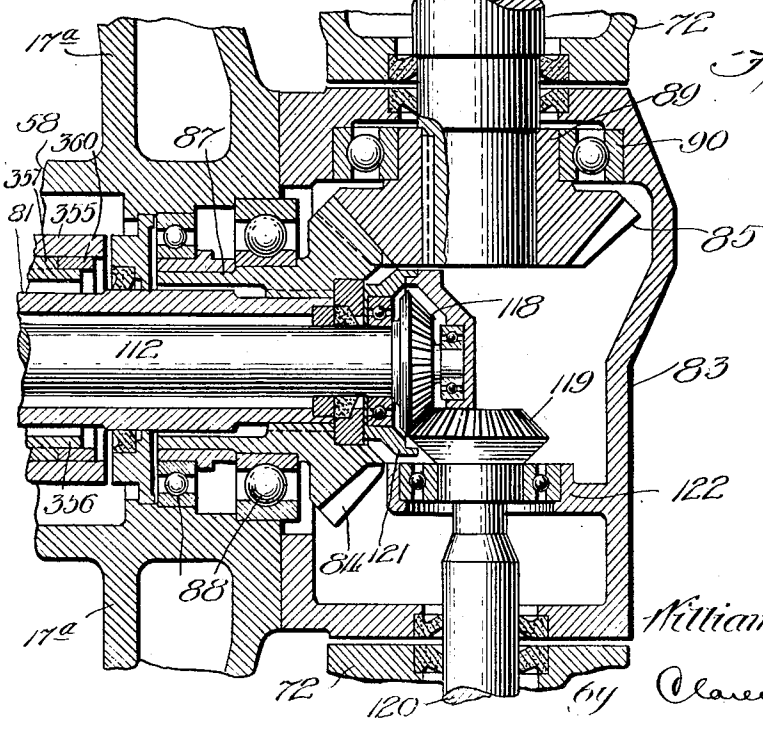


Fig. 20.



Inventor:
William W. Sloane
Clarence F. Poole
Atty.

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KERF-CUTTING MACHINE

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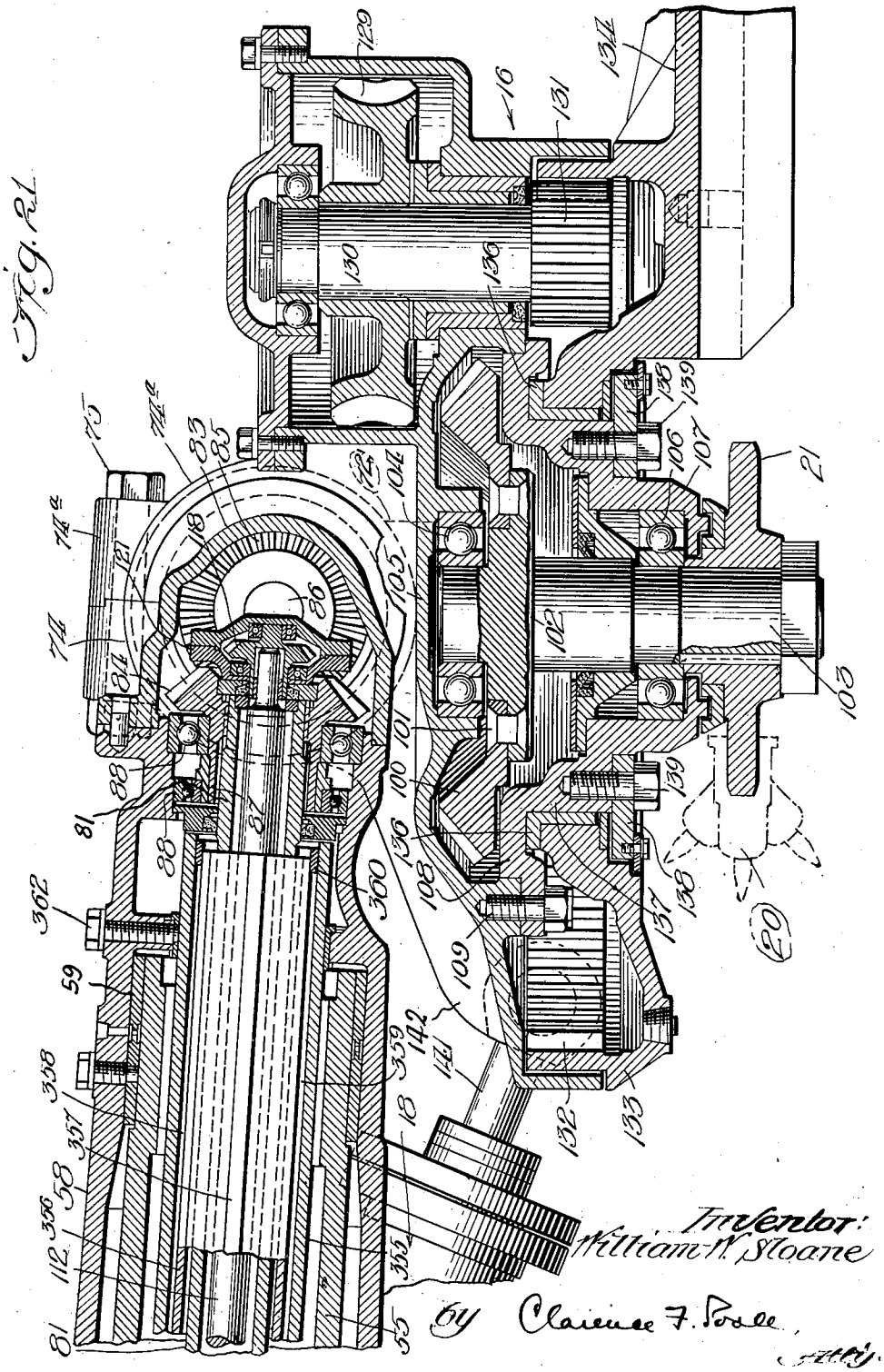


Fig. 21

Inventor:
William W. Sloane
By Clarence F. Poole
Atty.

July 6, 1943. W. W. SLOANE 2,323,493

KERF-CUTTING MACHINF

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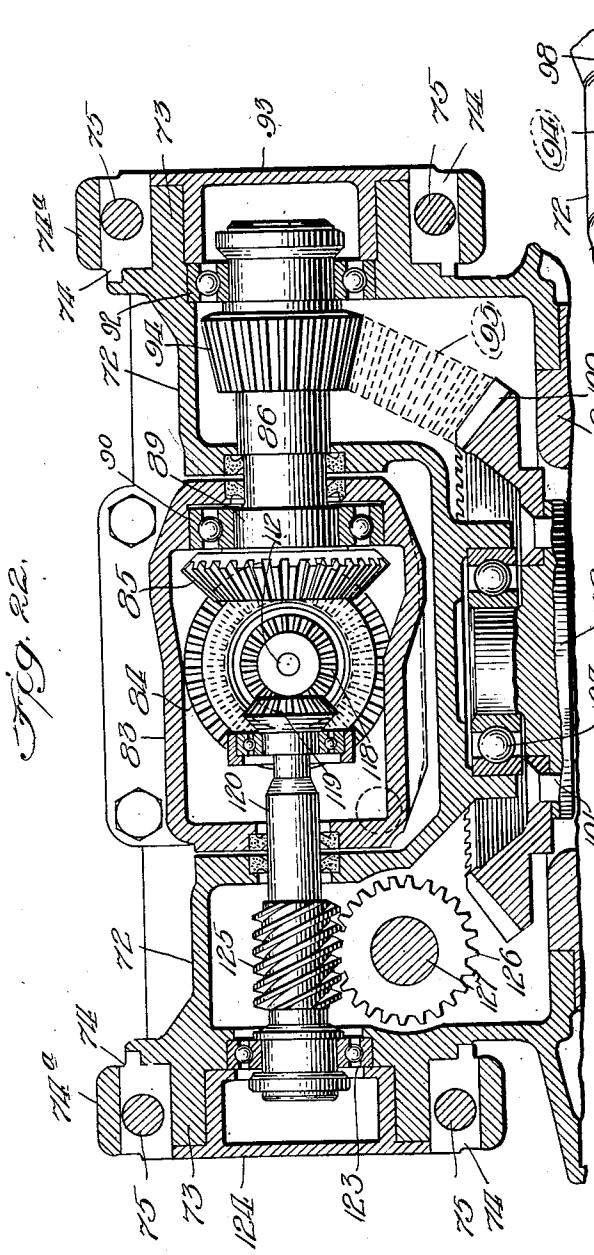


Fig. 22.

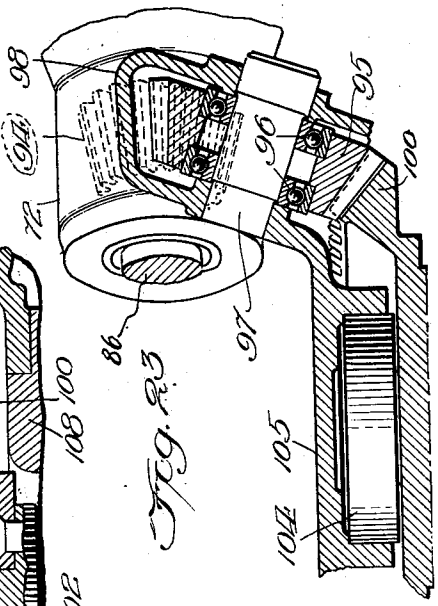


Fig. 23

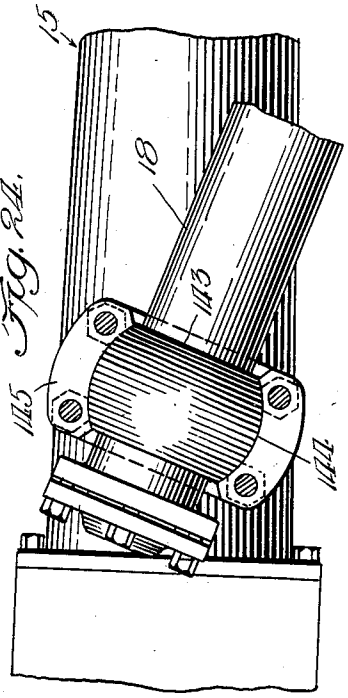


Fig. 24.

Inventor:
William W. Sloane
by Clarence F. Poole
Atty.

July 6, 1943. W. W. SLOANE 2,323,493

KERF-CUTTING MACHINE

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Fig. 25.

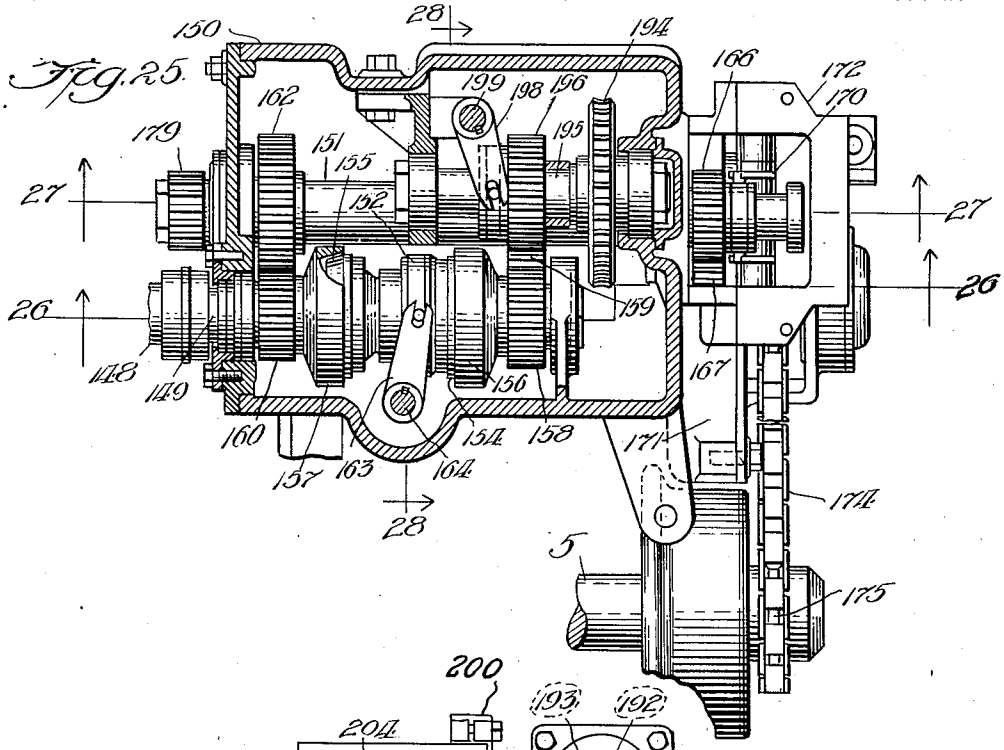
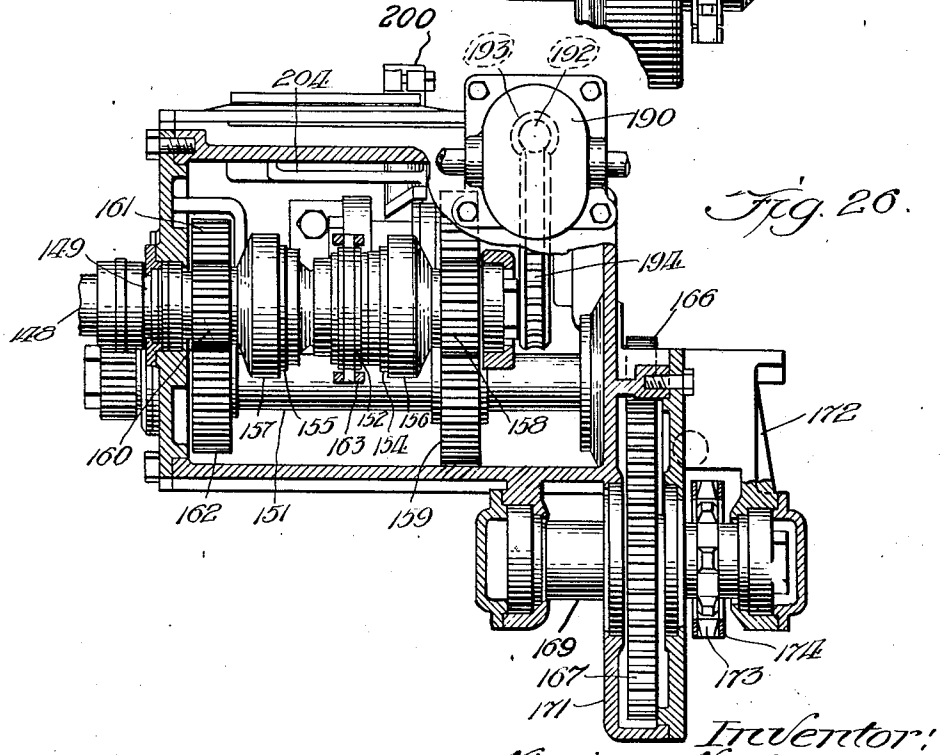


Fig. 26.



Inventor:
William W. Sloane
By Clarence J. Poole
Atty.

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KERF-CUTTING MACHINE

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Fig. 27.

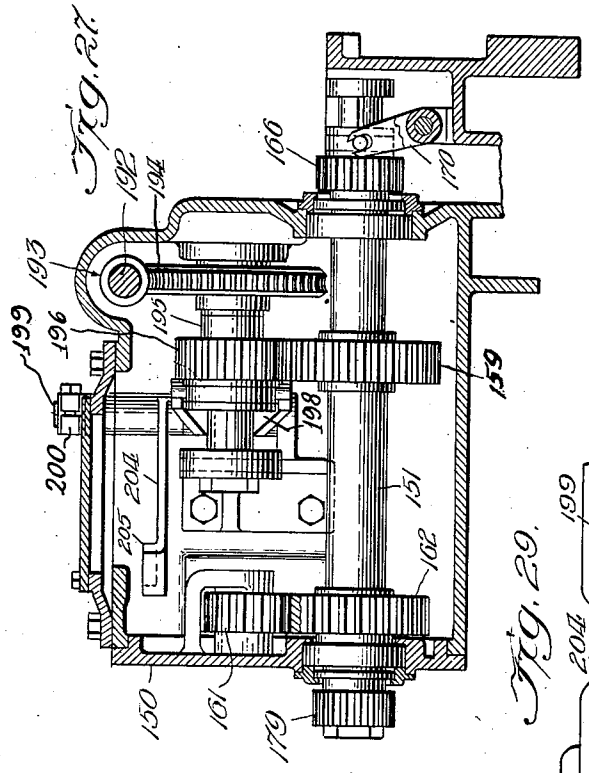


Fig. 29.

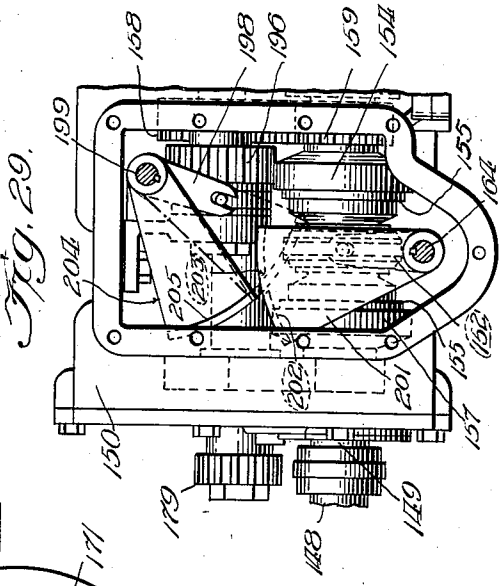
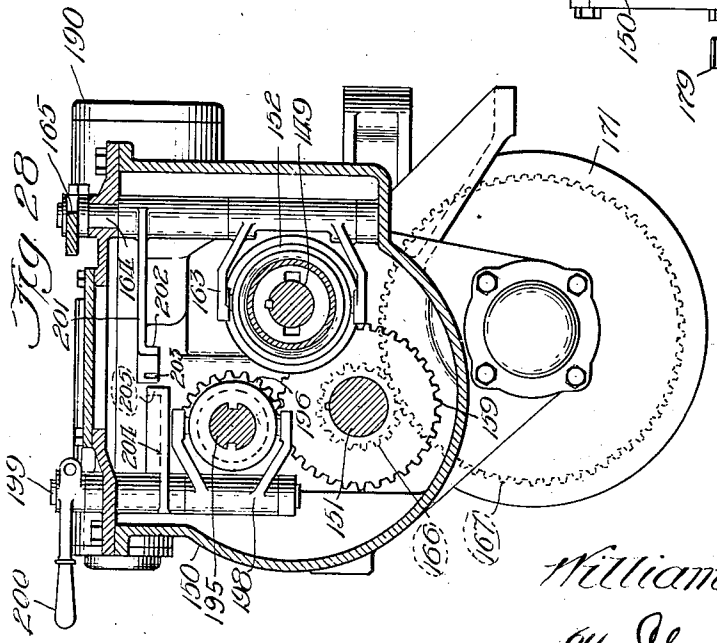


Fig. 28



Inventor:
William W. Sloane
by Clarence F. Poole Atty.

July 6, 1943. W. W. SLOANE 2,323,493

KERF-CUTTING MACHINE

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Fig. 30.

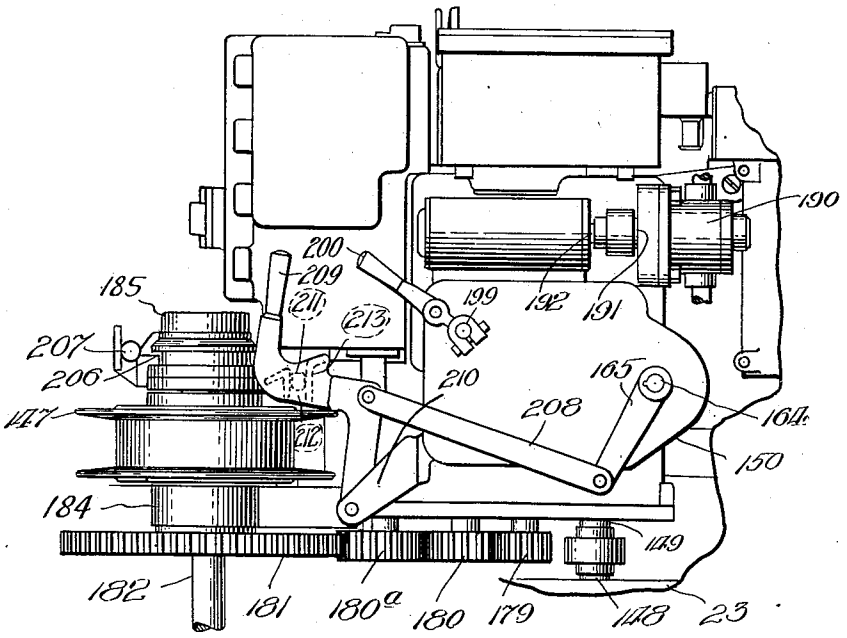
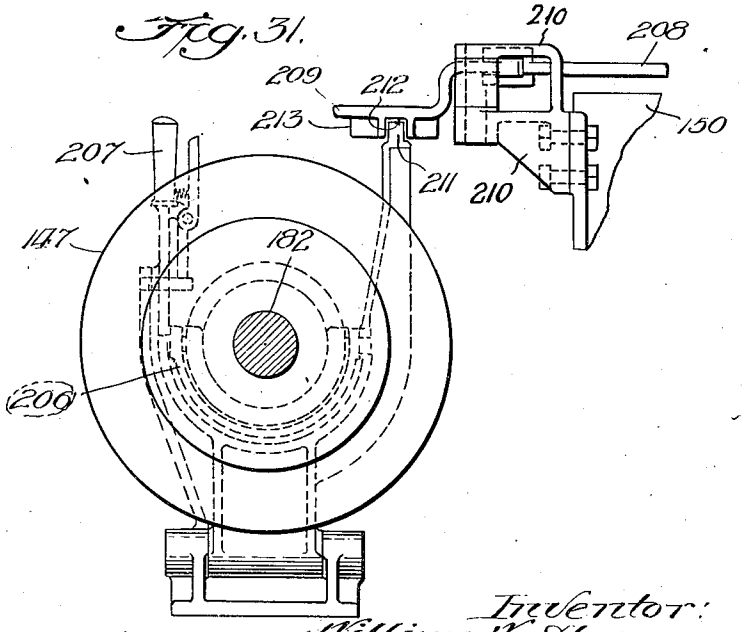


Fig. 31.



Inventor:
William W. Sloane
by Clarence F. Poole
Atty.

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KERF-CUTTING MACHINE

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Fig. 33.

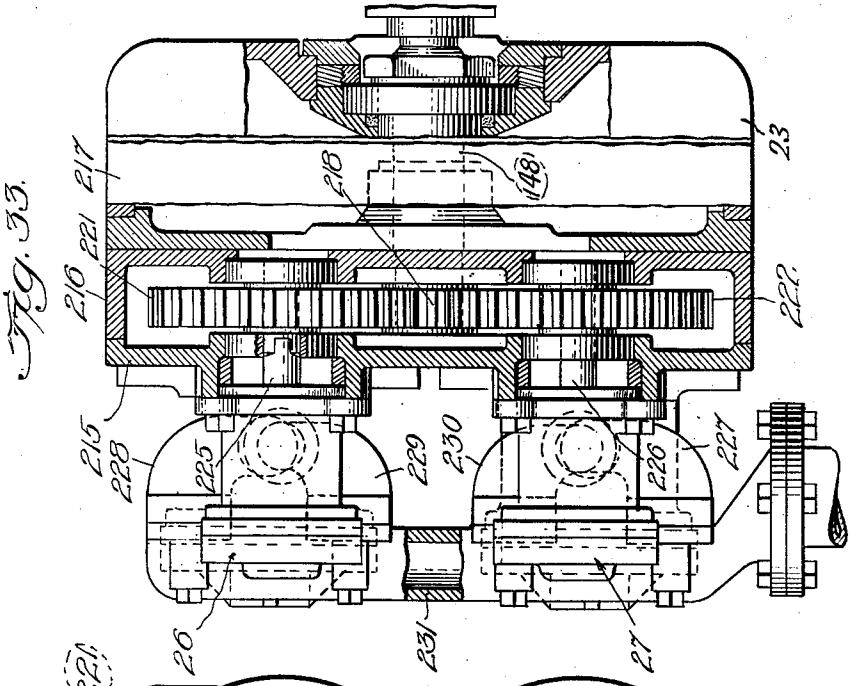
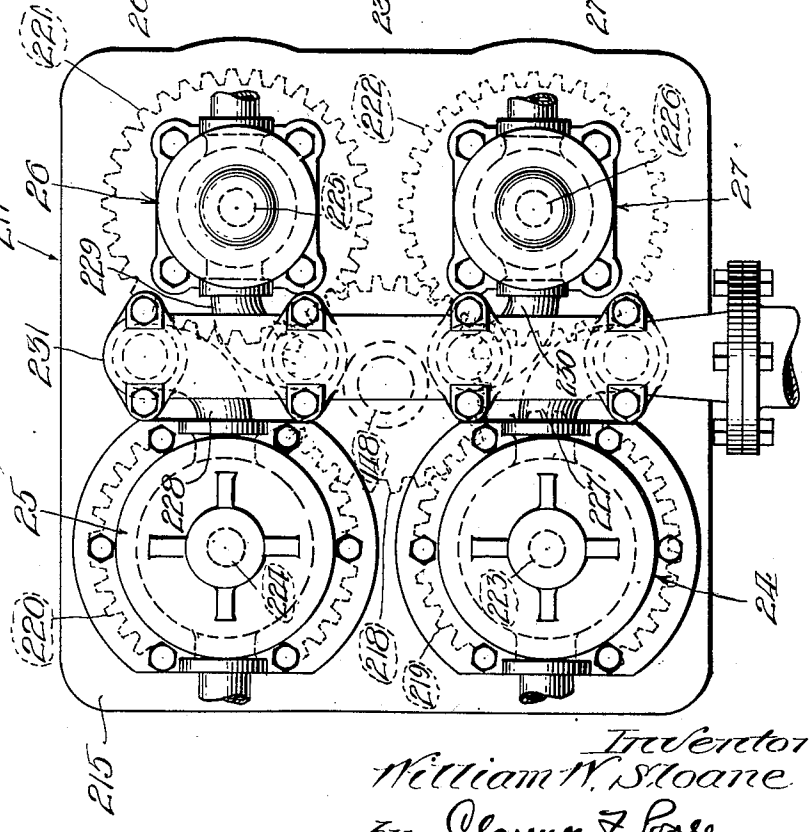


Fig. 32.



Inventor:
William W. Sloane
by Clarence F. Poole
Atty.

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KERF-CUTTING MACHINE

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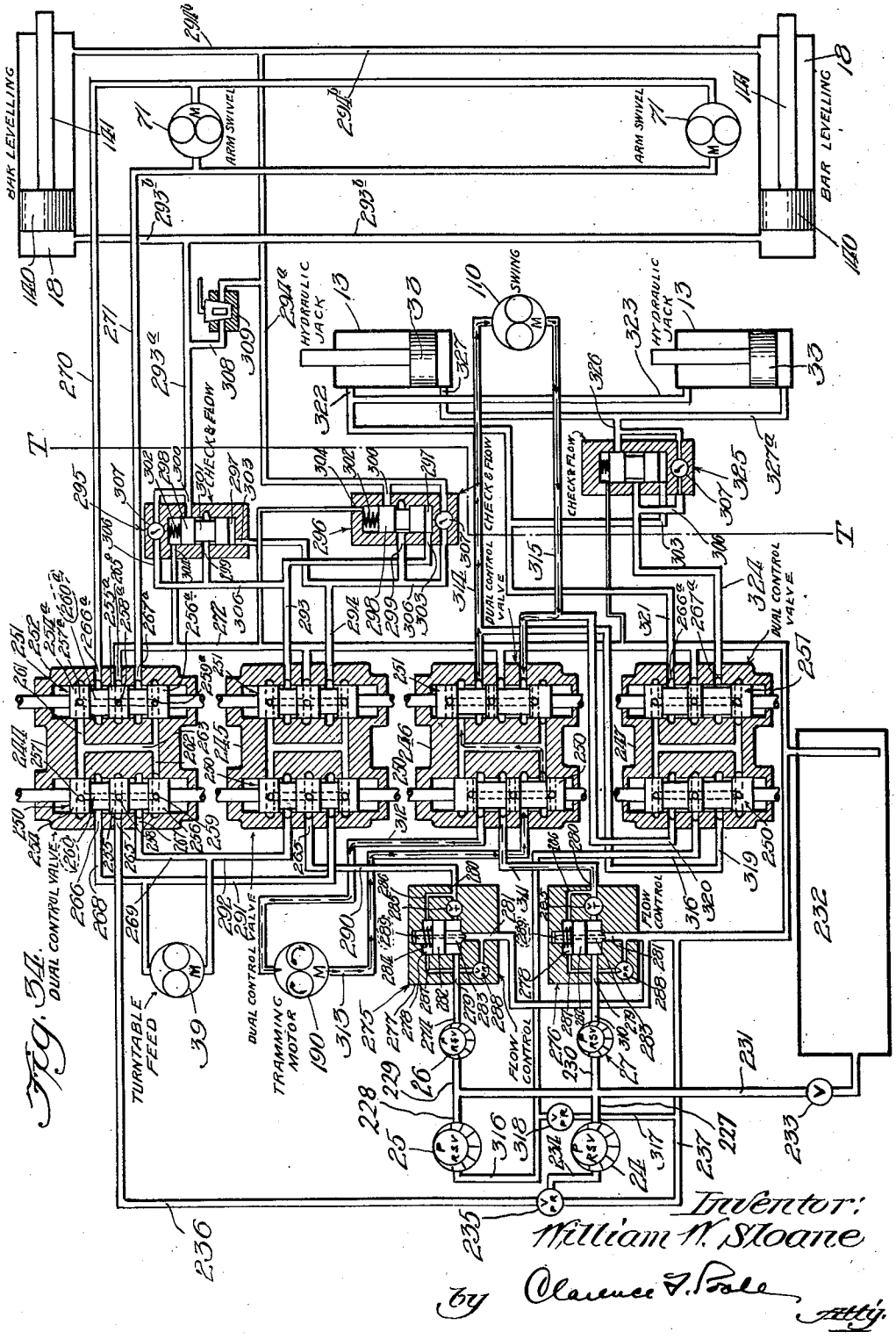


FIG. 34.

Inventor:
William W. Sloane
by Clarence A. Poole
Atty.

Patented July 6, 1943 2,323,493

UNITED STATES PATENT OFFICE

2,323,493

KERF-CUTTING MACHINE

William W. Sloane, Chicago, Ill., assignor to Goodman Manufacturing Company, Chicago, Ill., a corporation of Illinois

Application December 9, 1940, Serial No. 369,194

41 Claims. (Cl. 262—28)

This invention relates to improvements in kerf-cutting machines especially adapted for use in confined spaces such as coal mines, and more particularly to machines of the universal type in which a chain-carrying cutter bar is supported for adjustment in a wide variety and range of angular positions relative to the machine base, so as to be capable of cutting in a plurality of horizontal planes between the floor and roof of the mine, or of making shearing cuts in a plurality of vertical or inclined planes at the front or sides of the machine.

Among the principal objects of the present invention are to provide a machine of compact design affording quick and efficient adjustment of the cutter bar by power in its numerous cutting positions, to provide improved feeding and transporting mechanism to facilitate rapid movement of the machine both in transportation and during cutting operations, and to assure greater ease and safety in manipulation and control of the machine in all of its various functions.

A further object of the invention is to provide an improved hydraulic system for effecting and controlling the principal adjusting movements of the cutter bar supporting means, and for propelling the machine truck itself during certain feeding operations, by fluid pressure means.

Another object of the invention is to provide an improved swiveling connection for the several hydraulic conduits leading from the main frame to certain hydraulic motor devices mounted on a turntable at the front end of the main frame, and to provide other improved swiveling connections for certain hydraulic conduits leading to hydraulic motor devices on a rotatable portion of the cutter bar support.

Other objects of the invention will appear from time to time as the following description proceeds.

The invention may best be understood by reference to the embodiment thereof illustrated in the accompanying drawings, in which

Figure 1 is a plan view of a machine constructed in accordance with my invention, but with a part of the cutter bar broken away;

Figure 2 is a side view of the machine shown in Figure 1;

Figure 3 is a fragmentary longitudinal section drawn to a larger scale than the preceding figures, showing details of the base frame, turntable mounting, and tilting frame;

Figure 4 is an enlarged detail transverse section taken on line 4—4 of Figure 3;

Figure 5 is a plan view drawn to the same scale as Figure 4, showing details of the turntable, with the tilting frame removed therefrom;

Figure 6 is a transverse detail section taken generally on line 6—6 of Figure 5;

Figure 7 is a longitudinal detail section taken generally on line 7—7 of Figure 5;

Figure 8 is a transverse detail section taken generally on line 8—8 of Figure 5;

Figure 9 is an enlarged fragmentary plan view showing details of the drive connections from the hydraulic motor for rotating the turntable;

Figure 10 is a section taken on line 10—10 of Figure 9;

Figure 11 is an enlarged fragmentary plan view of the tilting frame, with its cover plate removed, and parts broken away to show certain details;

Figure 12 is an enlarged detail section taken on line 12—12 of Figure 11;

Figure 13 is a detail section taken on line 13—13 of Figure 12;

Figure 14 is a detail section taken on line 14—14 of Figure 11;

Figure 15 is an enlarged horizontal section taken generally along the axis of rotation of the extension arm relative to the tilting frame, and showing details of the drive shafts and hydraulic control ducts which extend coaxially through the extension arm;

Figure 16 is a section taken on line 16—16 of Figure 15;

Figure 17 is a detail section taken on line 17—17 of Figure 15;

Figure 18 is a detail section taken on line 18—18 of Figure 15,

Figure 19 is an enlarged plan view showing details of the cutter head and the extension arm, with certain parts shown in section;

Figure 20 is an enlarged view in horizontal section showing details of the drive gearing at the junction of the extension arm and the cutter head;

Figure 21 is a longitudinal section taken on line 21—21 of Figure 19;

Figure 22 is a transverse section taken on line 22—22 of Figure 19;

Figure 23 is a fragmentary detail of the idler gear and its mounting, taken on line 23—23 of Figure 19;

Figure 24 is a detail side view of the extension arm, showing the mounting of one of the bar leveling cylinders with the cover plate of said mounting removed;

Figure 25 is a horizontal detail section of the transmission casing providing dual-powered drive to the track wheels;

Figure 26 is a vertical section of the transmission casing taken generally on line 26—26 of Figure 25;

Figure 27 is a vertical section of the transmission casing, taken on line 27—27 of Figure 25;

Figure 28 is a transverse section taken generally on line 28—28 of Figure 25;

Figure 29 is a plan view of a part of the transmission casing with the cover removed to show

the dual power interlocking mechanism therein;

Figure 30 is a fragmentary plan view of the dual power transmission casing and the drive connections to the winding drum at the rear of the machine;

Figure 31 is an enlarged detail view of the winding drum and the interlocking mechanism between the drive clutch and the transmission control handle;

Figure 32 is an enlarged end view of the hydraulic pumps and their driving connections with the electric motor;

Figure 33 is a detail side view of the driving connections shown in Figure 32, with parts broken away to show details of the drive gearing;

Figure 34 is a diagram showing the hydraulic system for effecting drive and control of the several hydraulically driven motive devices on the machine.

Referring now to the embodiment illustrated in the drawings, a general understanding of the machine may best be obtained by pointing out, in a preliminary way, the main structural elements of the machine, and their principal cooperative relations.

A base frame 1 is supported by front and rear track wheels 2, 2 and 3, 3 on axles 4 and 5, respectively, journaled as usual in journal boxes 6, 6 and 7, 7.

A turntable 8 is mounted on the front end of the main frame 1, generally above the supporting wheels 2 and 3. Said turntable includes an annular base 9 having a pair of upwardly and rearwardly extending trunnions 10, 10 at opposite sides thereof.

A tilting frame 11 has a pair of rearwardly extending arms 12, 12 pivotally connected to the trunnions 10, 10. Said tilting frame is disposed generally in a horizontal plane above the turntable and forwardly of said trunnions, and is arranged to be swung upwardly or downwardly relative to the latter by a pair of upright hydraulic cylinder jacks 13, 13 carried on the turntable, as will hereinafter more fully appear. The tilting frame has an electric motor 14 at its rear end between the rearwardly extending arms 12, 12, which motor provides power for driving the cutting mechanism.

An extension arm 15 is rotatably mounted at the front end of the tilting frame 11. As indicated in Figure 3, said arm is rotatable on a longitudinal axis disposed at a slightly depressed angle to the general plane of said tilting frame. The arm 15 is rotated by hydraulic power, as will presently appear.

A cutter head 16 is trunnioned for tilting movement on a transverse axis in a yoke 17 at the front end of the extension arm. Tilting of the cutter head relative to the extension arm is controlled by a pair of hydraulic cylinder devices 18, 18 mounted at opposite sides of said extension arm.

The cutter bar 19 having the usual cutter chain 20 driven by sprocket 21 is pivotally mounted in the cutter head 16 on an axis perpendicular to the transverse axis about which said head tilts relative to the extension arm 15. The cutter chain sprocket 21 is concentric with the pivotal axis of the cutter bar.

The driving connections to the cutter chain sprocket 21 from the motor 14 on tilting frame 11 are such as to permit the cutter chain to be driven in any permissible positions of adjustment of the cutter bar. As will presently appear, other driving connections are also provided for swinging the cutter bar by power relative to the cutter head.

The rear end of the main frame consists of a platform-like extension 22 on which is mounted an electric motor 23 for driving a plurality of hydraulic pumps 24, 25, 26 and 27, and also for propelling the truck through mechanism to be later described in detail.

From the above general description of the main structural elements of the machine it will now be understood that the cutter bar 19 can be fed into the coal by holding the machine stationary on the mine track and swinging the cutter bar in any one of the many cutting planes into which it is capable of adjustment, with its edge presented to the coal face. The cutter bar can also be fed into the coal by moving the machine bodily along the mine track with said bar adjusted in one of its numerous cutting positions.

The several cutter bar adjustments may be effected by movement about any one of the several axial centers hereinabove set forth, or by various combinations of such axial movements. For instance, swinging the turntable 8 about its vertical axis with the cutter bar held rigidly in extended position at the end of its supporting means will produce a long sweeping horizontal cut about the turntable axis. By holding the turntable stationary and swinging the cutter bar about its axis on the cutter head, a more limited horizontal arcuate cut about the latter axis will be produced. By tilting the frame 11, the cutter bar can be moved into a wide variety of horizontal cutting positions, and complete rotation of the extension arm 15 to inverted position permits the cutter bar to be positioned in any horizontal cutting plane between the floor and roof of an ordinary mine room. Vertical shearing cuts or cuts at intermediate inclined angles relative to the floor may be effected by partial rotation of the extension arm 15 on the tilting frame 11. Endwise tilting of the cutter bar relative to the extension arm is also possible when the cutter bar is disposed either for horizontal or shearing cuts.

Referring now in greater detail to features of construction of the machine disclosed in the drawings, the base 9 of turntable 8 is generally ring-shaped, having a depending annular flange 30 engaging a bearing ring 31 supported at the front end of the base frame 1. The front end of said base frame below said turntable and rearwardly thereof is in the form of a generally hollow circular casting. Said turntable has two longitudinally extending partitions 32, 32 depending into the base frame, and spaced apart so as to provide a passage therebetween for certain of the hydraulic pipes or conduits, as will hereinafter more fully appear.

The hydraulic cylinder jacks 13, 13 which effect the elevation of tilting frame 11 are disposed at the outer sides of partitions 32, 32. Said cylinders have pistons 33, 33 therein, with piston rods 34, 34 pivotally connected at their upper ends to the tilting frame 11, as shown in Figure 6. In the form shown, the cylinder jacks 13, 13 are each supported on the turntable base 9 by trunnions 35, 35a having bearing in brackets 36, 36a, respectively, mounted on the adjacent partition 32 and the side flange 30 of said turntable. Each pair of trunnions 35, 35a is integral with a sleeve 37 which loosely surrounds one of the cylinders 13. As shown in Figure 6, the upper and lower bearing surfaces of the sleeve 37 are concave and convex, being formed on arcs of

radii A—B and A—C, respectively, having a common center at A disposed substantially below the horizontal axis of the trunnion members 35, 35a. Said bearing surfaces have bearing between an upper retaining collar 38 and a lower retaining collar 38a, fixed on their cylinders 13, 13. With this arrangement, each of said hydraulic cylinders is afforded limited lateral rocking movement in any direction relative to their trunnions 35, 35a, in addition to their normal rocking movement on said trunnions, thereby permitting said cylinders to accommodate themselves to any lateral tilting movements of the tilting frame relative to the turntable.

The turntable 8 is rotated by a hydraulic motor 39 herein shown as mounted on a gear casing 40 at one side of the main frame 1. Said motor is connected by a horizontal shaft 41 and worm 42 to worm gear 43 on shaft 44 at right angles thereto. The last named shaft has a worm 45 meshed with worm gear 46 on upright shaft 47. A pinion 48 on said upright shaft meshes with gear 49 on another upright shaft 50. All of the shafts just mentioned have suitable bearing in the casing 40. The last named shaft 50 extends downwardly through the bottom wall of said casing and has a pinion 51 at its lower end meshing with a reach gear 52 journaled on the main frame. Said reach gear meshes with the toothed portion 53 of the turntable 8 which extends around the rear and sides of the latter, so as to permit the turntable to turn through an arc of approximately 270°. The hydraulic motor 39 is of the reversible type so that the turntable can be driven in either direction. One or more of the worms and worm gear connections described are of the self-locking type so the turntable will remain stationary in any position to which it has been turned.

The extension arm 15 is mounted for rotation on a generally longitudinal axis at the front end of the tilting frame 11 in the following manner: A hollow bearing support 55 is integral with an end plate 56 rigidly secured to the front wall 57 of the tilting frame, and extends forwardly within a tubular outer shell 58 of said extension arm, as shown in Figures 3 and 15. Said outer shell 58 has bearing at the front and rear of the hollow bearing support 55, on suitable bearing sleeves 59 and 60.

It will be observed that the bearing support 55 is arranged at a downwardly inclined angle relative to the tilting frame 11, so that the extension arm 15 rotates on an axis disposed at a slight angle to the general plane of said tilting frame.

The outer shell 58 of the extension arm 15 has a flanged rear portion 61 with a drive gear 62 formed thereon, which is engaged by a pair of pinions 63, 63 on shafts 64, 64 at opposite sides thereof (see Figures 11 to 14). Each shaft 64 has a worm gear 65 thereon meshed with a worm 66 on a transverse shaft 67. Each of the latter shafts has a worm gear 68 thereon meshed with a worm 69 on a longitudinal shaft 70. The shafts 70, 70 are driven by hydraulic motors 71, 71, which form part of the hydraulic control system, as will hereinafter be more fully described. The motors 71, 71 are of the usual reversible type so as to rotate the extension arm 15 in either direction through the gearing just described.

Referring now to other details of the extension arm 15 and the cutter head 16 supported thereby, it will be seen that the yoke 17 at the front end of said extension arm is preferably formed integral with the outer shell 58 of the latter. The cutter head 16 has two upright hollow trunnion members 72, 72 at opposite sides thereof, each having an outwardly projecting sleeve 73 journaled in a bearing 74 in the front end of its adjacent yoke arm 17a. In the preferred form shown, each of said bearings 74 includes a cap member 74a split in a generally vertical plane and secured to the end of its yoke arm 17a, as by bolts 75, 75, so as to permit bodily detachment of the cutter head from the end of the extension arm, when desired.

The mechanism for driving the cutter chain from the electric motor 14 on tilting frame 11 may now be described as follows: Said motor is enclosed in a casing 14a which is suitably attached to the rear end of said tilting frame between the rearwardly extending arms 12, 12 of the latter. The armature shaft 76 of said motor is connected to a stub shaft 77 suitably mounted on anti-friction bearings near the bottom of said tilting frame, as shown in Figure 3. For convenience in assembly, the armature shaft 76 and stub shaft 77 may be connected by a suitable flexible coupling indicated at 78. The stub shaft 77 has a pinion 79 thereon which drives a gear 80 keyed on a tubular drive shaft 81. In the preferred form shown, the gear 80 has a hollow hub 82 supported at both ends by suitable anti-friction bearing members. The tubular drive shaft 81 extends forwardly through the extension arm 15 coaxially with the latter. (See Figure 15.)

It will be observed that the drive gearing just described is supported in its bearings on axes tilted to correspond with the axis of rotation of the extension arm 15, and that the armature shaft 76 of the motor 14 is also tilted at the same angle, as clearly shown in Figure 3.

The tubular drive shaft 81 extends forwardly into a housing 83 connected to the front end of the outer shell 58 of extension arm 15 and has a bevel gear 84 feathered thereon. Said bevel gear is meshed with a bevel gear 85 on a stub shaft 86 disposed at right angles thereto. Bevel gear 84 has a hub 87 mounted in suitable anti-friction bearings 88 supported in the front end of the outer shell beyond the end of bearing support 55. The bevel gear 85 has a hub 89 mounted in anti-friction bearings 90 mounted in the housing 83.

The stub shaft 86 extends laterally into the adjacent trunnion member 72, concentrically therewith, and the outer end of said stub shaft is mounted in an anti-friction bearing 92 carried in said trunnion member. In the form shown, the last named anti-friction bearing is held in place by an end plate 93 detachably secured to the outer end of the trunnion member so as to permit ready access to and removal of the bearing 92 and stub shaft 86, when desired.

The stub shaft 86 has a bevel gear 94 adjacent its outer end meshed with a beveled reach gear 95 on anti-friction bearings 96 on shaft 97. Said shaft is supported on an upwardly extending bracket 98 formed integrally with the cutter head 16 so that the reach gear 95 is disposed to one side of and below the stub shaft 86. Said reach gear is meshed with a large bevel gear 100 fixed by bolts 101 to a flange 102 on the upper end of the cutter chain sprocket shaft 103. As shown in detail in Figure 23, the reach gear 95 is rotatable on an axis inclined at an intermediate angle to the stub shaft 86 and the sprocket

shaft 103, and at an acute angle to the plane including the axes of said shafts. This arrangement provides a driving connection between said shafts without requiring a bevel gear of excessive diameter on the stub shaft 86, thereby affording a considerable reduction in the vertical height of the cutter head.

The cutter chain sprocket 21 is keyed on the lower end of sprocket shaft 103. In the form shown, an anti-friction bearing 104 for the top end of said shaft is recessed in the top wall 105 of the cutter head between the trunnion members 72, 72. A second anti-friction bearing 106 is mounted in a depending bearing support 107 forming part of a detachable bottom plate 108 connected by bolts 109 to the top wall 105 of said cutter head.

The mechanism for pivotally swinging the cutter bar 19 relative to the cutter head 16 consists of a hydraulic motor 110 mounted at one side of the tilting frame 11 with its rotor shaft 111 connected by suitable gearing to a solid shaft 112 which extends through the tubular drive shaft 81. As herein shown, such gearing comprises bevel gears 113 and 114, stub shaft 115, and pinion 116 meshed with gear 117 keyed on the rear end of the solid shaft 112. The front end of the latter shaft projects beyond the end of the tubular drive shaft 81, and has a bevel gear 118 suitably fixed thereon, meshed with a bevel gear 119 on stub shaft 120, disposed at right angles thereto, as shown in Figures 19 and 20. The two bevel gears 118 and 119 are journaled respectively in brackets 121 and 122 supported within the cutter head 16. The stub shaft 120 extends into the right hand trunnion member 72 coaxially with the pivotal axis of the cutter head, and has anti-friction bearings 123 in the latter. As in the case of the bearing 92 for the stub shaft 86 in the opposite trunnion member 72, the bearings 123 for stub shaft 120 are held in place by an end plate 124 detachably engaged to the end of its trunnion member 72 so as to permit ready access to and removal of the bearing and its stub shaft, when desired, without dismounting the cutter head from the extension arm.

A worm 125 is fixed on the stub shaft 120 and is meshed with a worm gear 126 on a longitudinal shaft 127. The latter shaft extends forwardly in the cutter head and has a worm 128 thereon meshing with a worm gear 129 on an upright shaft 130 journaled in the front portion of the cutter head. Said upright shaft has a pinion 131 keyed on its lower end and meshed with an internal gear 132 of relatively large diameter, integral with cutter support 133. Said cutter support is generally of ring-like shape, with a downwardly and forwardly extending foot 134 to which the cutter bar 19 is rigidly connected in the usual manner, as by bolts 135, 135. As shown in Figure 21, the cutter support 133 is journaled on a bearing ring 136 fitted on an annular shouldered portion 137 of the detachable bottom plate 108. A retaining ring 138 is secured by bolts 139, 139 to the bottom of said shouldered portion, to secure said cutter support to the cutter head.

The hydraulic cylinders 18, 18 on opposite sides of extension arm 15 have pistons 140 therein, with piston rods 141 pivotally connected to brackets 142 at opposite sides of the cutter head 16, so as to effect rocking movement of said cutter head and the cutter bar relative to said extension arm. It will be noted that the piston rods 141 are connected with brackets 142 at relatively widely spaced points closely adjacent the plane of swinging movement of the cutter bar 19. In the preferred form shown in detail in Figure 24, the cylinders 18 are each mounted in a sleeve 143 having a spherical outer bearing surface 144 fitting in a split bearing support 145 extending from the side of the extension arm 15, so as to form, in effect, a ball and socket mounting to permit limited swiveling movement of each of said cylinders relative to said extension arm.

The means for propelling the machine truck by traction of its supporting wheels includes a novel form of dual power transmission mounted on the rear extension 22 of main frame 1, whereby the machine can be selectively propelled in either direction at a relatively high transporting speed by power from the electric motor 23, or can be propelled in either direction at relatively low feeding speeds by power from a hydraulic tramming motor 190. This dual power transmission also includes geared connection to a cable reel 146 and a winding drum 147. The transmission mechanism also includes interlocking clutch controls so as to insure certain driving connection with only one source of power at a time, as will presently appear.

The dual power transmission is shown in detail in Figures 25 to 29. Referring first to the gearing connections from the electric motor 23, the armature shaft 148 of said motor is coupled to shaft 149 rotatably mounted in transmission casing 150. This shaft has suitable reversible drive connections with a jack shaft 151, herein comprising a sliding clutch member 152 feathered on shaft 149 and having two opposed cone surfaces 154, 155 adapted to be selectively engaged with clutch members 156, 157, respectively, loosely mounted on said shaft. Clutch member 156 has a gear 158 rotatable therewith, meshed directly with a gear 159 on the jack shaft 151 to drive the latter in one direction, and the other clutch member 157 has a gear 160 meshed with an idler gear 161 which in turn is meshed with a second gear 162 on jack shaft 151, to drive the latter in a reverse direction.

A shifter yoke 163 of the usual type engages the sliding clutch member 152 and is keyed on rock shaft 164 which extends through the cover of the transmission casing 150 and has a control lever 165 keyed on its upper end. Said control lever forms part of a control interlock device, as will hereinafter be fully described.

The jack shaft 151 has bearing in and extends through both side walls of the transmission casing 150 and has a pinion 166 feathered on its outer end, shiftable into and out of driving engagement with a gear 167 on a stub shaft 169 by a shifter yoke 170 of the usual form. The stub shaft 169 is rotatably mounted in brackets 171, 172 extending below the main frame extension 22 at one side thereof, as shown in Figures 25 and 26. Said stub shaft has a chain sprocket 173 fixed thereon, with a drive chain 174 trained thereabout and connected to a sprocket 175 on the rear supporting axle 5. Said axle may also be connected, as usual, to the front axle 4, by a second drive chain 176 and sprockets 177 and 178 (see Figure 2).

The jack shaft 151 also has a pinion 179 on its inner end, which is operatively connected by intermediate gears 180 and 180a to gear 181 on a transverse shaft 182 mounted on suitable supporting brackets 183, 184 and 185 at the rear of the extension platform 22. The cable reel 146 and winding drum 147 are loosely mounted on the shaft 182 and are respectively connectible

thereto by sliding clutch members of any well known form, indicated at 186 and 187. As usual, the cable reel is adapted to carry a length of conductor cable thereon to provide electric connections from a remote source of power to the electric motors on the machine. The geared driving connection between the jack shaft 151 and the transverse shaft 182 on which said reel is mounted affords an automatic pick-up or release for the free end of the conductor cable as the machine is propelled forwardly or rearwardly along the mine track, at the same speed and in a direction corresponding with that of the machine at any given time.

The winding drum 147 carries a draft cable or rope, the free end of which is adapted to be anchored either forwardly or rearwardly of the machine to assist in propelling the machine when desired, as for instance, when feeding the machine up steep grades, or under other unusually hard cutting conditions, when traction of the wheels alone may not be sufficient to feed the machine.

Referring now to the connections for tramming the machine at feeding speed by hydraulic power, the hydraulic motor 190 has its rotor shaft 191 coupled to a shaft 192, rotatably mounted in the upper part of the transmission casing 150 and having a worm 193 fixed thereon. Said worm is meshed with a worm gear 194 on a stub shaft 195 rotatably mounted in said casing parallel with the shafts 149 and 151, previously mentioned. The stub shaft 195 has a gear 196 feathered thereon, so as to be shiftable into and out of meshed engagement with gear 159 on the jack shaft 151 by means of a shifter yoke 198 on rock shaft 199. Said rock shaft extends through the cover of the transmission casing and has an operating lever 200 on its upper end.

The interlocking control means for the transmission mechanism may now be described as follows: The rock shaft 164 for the reversing clutch shifter yoke 163 has a segment 201 keyed thereon so as to swing in a horizontal plane near the top of the transmission casing 150. Said segment has a depending arcuate flange 202 along its edge, having a notch 203 adjacent the center thereof. The rock shaft 198 for the hydraulic drive shifter yoke 196 has a segment 204 keyed thereon with an upturned arcuate flange 205 which intersects the normal plane of movement of the depending flange 202 of segment 201, as shown in Figures 27, 28 and 29. The arrangement is such, that when the shifter yoke 196 for connecting the hydraulic motor to the jack shaft 151 is thrown to disengaged position, as shown in full lines in Figure 28, its segment 204 is swung out of the path of movement of the segment 201 on the reversing clutch rock shaft 164. In this position, the reversing clutch member 152 can then be shifted in either direction, to connect the electric motor for propelling the machine in either direction, as desired. When so engaged, however, the rock shaft 199 is locked in disengaged position, because its flange 202 cannot pass the flange 205 on segment 204 when the latter is swung either into forward or reverse position. However, when the latter segment is in neutral, disengaged position, as shown in Figure 29, so as to disconnect the electric motor, the flange 205 will register with the notch 203 in flange 202 and the segment 204 can then be swung as indicated in dotted lines in Figure 29, so as to connect the hydraulic motor 190 with the jack shaft 151. At all times that the latter driving engagement is in effect, it will be observed that the flange 205 will be engaged in the notch 203 on segment 201, so as to lock the latter in neutral, disengaged position. As a result of the interlocking mechanism just described, it is impossible to connect both the electric motor 23 and the hydraulic motor 190 with the jack shaft 151 at the same time.

As an additional protective feature, interlocking control means are also provided to prevent driving connection of the electric motor whenever the winding drum 147 is clutched to its transverse drive shaft 182. It will be understood that the winding drum is designed for use only at low feeding speeds. This interlock control therefore prevents accidental shifting of the winding drum into high speed when the rope or cable on the latter may still be anchored at a remote point. The interlocking mechanism includes a shifter yoke 206 on the lever 207 which is used to shift the clutch member 187 of the winding drum into and out of engagement with the transverse shaft 182. The control lever 165 connected to the upper end of the reversing rock shaft 164, as previously described, is connected by link 208 to a hand lever 209 pivotally mounted on a bracket 210 at the rear end of the transmission casing 150. Said hand lever is arranged for swinging movement in a limited arc generally transverse to the arc of movement of the clutch control lever 207 of the winding drum. The latter lever has an upright extension 211 which is adapted to engage in a restricted transverse slot 212 in a depending flange 213 underneath the hand lever 209. The arrangement is such, that the winding drum clutch lever 207 can only be moved into engaging position when the hand lever 209 is disposed in an intermediate, neutral position. When said drum clutch is moved into engaged position, the extension 211 is confined in the slot 212 of hand lever 209 so the latter lever is locked against movement in either direction. On the other hand, the depending flange 213 on the hand lever 209 will not permit the drum clutch lever 207 to be moved into clutching position excepting when said hand lever is in neutral position, and the extension 211 can be moved into the slot 212.

Hydraulic power for the various hydraulic motors and cylinder devices previously described is supplied from the four pumps 24, 25, 26, and 27. For greater efficiency in operation and control, the four pumps shown herein are of varying sizes and capacities, depending upon the different requirements of the various motors or cylinders they serve, as will presently appear.

As shown in detail in Figures 32 and 33, all four of the hydraulic pumps 24, 25, 26, and 27 are detachably mounted on the outer wall 215 of a gear casing 216 at the outer end of the motor casing 217 which encloses the electric motor 23. One end of the armature shaft 148 of said motor extends into the gear casing 216 and has a pinion 218 thereon which drives all four of said pumps simultaneously, through gears 219, 220, 221 and 222, respectively. Said gears are all disposed in the gear casing 216 and are coupled directly to rotor shafts 223, 224, 225, and 226, respectively, of said pumps.

All of the pumps herein shown are of the rotary vane, constant speed, constant pressure type commonly used in hydraulic systems, so their interior construction need not be described in detail. Said pumps have intakes 227, 228, 229,

and 230, all connected directly to a common intake manifold 231.

The hydraulic system with its various connections from pumps 24, 25, 26, and 27, for effecting operation and control of the various hydraulic adjusting and feeding mechanisms hereinbefore described, may now be best described by reference to the diagram, Figure 34 of the drawings.

Referring first to pump 24 and its operative connections, said pump is preferably of relatively high capacity and effects driving of the turntable feed motor 39 at high speed, and driving of the two motors 71, 71 which effect swiveling or rotation of the extension arm 15 in relation to the tilting frame 11.

The intake manifold 231 connected to the intake 227 of pump 24 is connected with and leads from tank or sump 232. The manifold 231 has a check valve 233 therein. The outlet 234 of said pump is connected to a pressure relief valve 235 having a pressure supply pipe 236 leading to a dual direction control valve indicated generally at 244, and a relief pipe 237 leading to the tank 232.

The dual control valve 244 is of the balanced piston type heretofore commonly used in hydraulic systems. As shown herein, the output of the other pumps 25, 26 and 27 is also controlled by dual control valves 245, 246, and 247, respectively, all similar to the dual control valve 244, so a detailed description of the latter valve will also apply to all of said dual control valves.

Valve 244 has a pair of piston valve members 250 and 251 slidably mounted in block 252 in parallel relation with each other. Said valve members have upper pistons 254 and 254*a*, intermediate pistons 255 and 255*a*, and lower pistons 256 and 256*a*, respectively. The peripheries of the three pistons on valve member 250 have radial openings 257, 258 and 259, respectively, intermediate their ends, all communicating with a passageway 260 extending axially of said valve member 250. Similarly, the three pistons on valve member 251 have radial openings 257*a*, 258*a*, and 259*a*, respectively, communicating with a passageway 260*a* extending axially of said valve member.

The valve members 250 and 251 are connected at opposite ends by cross passages 261 and 262 extending transversely of the block 252. Said cross passages are also connected by passage 263 so as to afford communication between the upper and lower openings in the end pistons when the valve members are in neutral position. In the diagram, both valve members 250 and 251 of valve 244 are shown in such neutral position.

Pressure from pipe 236 enters the valve block 252 of valve 244 through a central port 265, communicating with valve member 250. Upper and lower ports 266 and 267 in the valve block lead from valve member 250 through pipes 268 and 269, respectively, to the opposite sides of the turntable feed motor indicated at 39.

When both valve members 250 and 251 of control valve 244 are in neutral position, as shown in the diagram, oil entering the central port 265 will pass through openings 258 in the intermediate piston 255 into passage 260, through openings 257 and 259 into passages 261 and 262. From thence the oil will pass through openings 257*a* and 259*a* in valve member 251, through passage 260*a* and openings 258*a* in the intermediate piston 255*a*, and be discharged through central port 265*a* and pipe 272 to the tank 232.

The valve member 250 may be operated to control the direction of flow through the turntable feed motor 39 in the following manner: When said valve member is shifted downwardly (as for instance, in the position in which the corresponding valve member 250 of dual control valve 246 is shown), the oil under pressure entering port 265 will be cut off from the central openings 258, and instead will pass upwardly into the port 266 and thence through pipe 268 to one side of the motor 39. From the other side of said motor, the oil will be returned through pipe 269 into port 267 and thence downwardly into the lower cross-passage 262. From this cross passage the oil will be discharged through valve member 251 to the tank 232, so long as said valve member 251 is in neutral position, as previously described.

By shifting the valve member 250 in the opposite direction, that is to say, upwardly (see the corresponding valve member 251 of valve 246), the direction of flow through the turntable feed motor 39 will be reversed, as follows: The oil entering the port 265 will pass downwardly through port 267 into the pipe 269 to the motor 39, and will be returned through pipe 268 and port 266 into the upper cross passageway 261.

The two extension arm swiveling motors 71, 71 are connected in parallel to valve member 251 by pipes 270 and 271. The valve member 251 controls the direction of flow through said motors in the same manner as valve member 250, excepting that in this instance pressure is supplied through cross passages 261 and 262, and is unloaded through central port 265*a*. In other words, the oil flows through valve member 251 in a direction reverse to that previously described in connection with valve member 250. For instance, movement of valve member 251 upwardly from its neutral position will cause the oil to flow from upper port 266*a* into pipe 270 connected to one side of the swiveling motors 71, 71 and return the oil through pipe 271 and lower port 267*a* to be finally returned through central port 265*a* and pipe 272 to tank 232. Movement of the valve member 251 downwardly from its neutral position reverses the flow through the swiveling motors, thereby reversing their direction of rotation.

Referring next to pump 26 and its operative connections, said pump is preferably of relatively low capacity and is connected to effect driving of the turntable feed motor 39 at relatively low speed under the control of the valve member 250 of the second dual control valve generally indicated at 245, and to effect operation of the bar leveling cylinders 18, 18 under control of the valve member 251 of said dual control valve 245. In this case, however, means are provided for controlling the rate of flow to the two motive devices named, so as to vary the speed of movement thereof. Accordingly, as shown in the diagram, the high pressure outlet 274 leads from pump 26 to the dual control valve 245 through a flow control valve indicated generally at 275.

A similar flow control valve 276 is employed to vary the output of pump 27 so that a detailed description of one of said valves will apply to both.

Flow control valves 275 and 276 each comprise a block 277 having a cylinder 278 therein communicating at its lower end with an inlet 279, a supply outlet 280, and a by-pass outlet 281. A piston 282 is mounted in said cylinder and has a valve stem 283 projecting from its bottom so as to form a valve member for the by-pass outlet 281. An adjustable compression

spring 284 normally urges the valve stem 283 into position to close said by-pass outlet. The supply outlet 280 is controlled by a throttle valve 285.

The cylinder 278 is connected at its upper end by a restricted passage 286 leading to the low pressure side of the throttle valve 285 and by a passage 287 leading to the by-pass outlet 281. The last named passage has a pressure relief valve 288 therein. The valve stem 283 has a bleed passage 289 extending therethrough to its upper end.

The operation of the flow control valves 275 and 276 is as follows: When the throttle valve 285 is fully open, the oil entering the lower end of cylinder 278 flows through said throttle valve into the supply outlet 280 without substantial drop in pressure, so that the pressure effective on the top of piston 282 through passage 287 tends to equalize the pressure on the bottom of said piston. This equalizing pressure, supplementing the compression of spring 284, keeps the valve stem 283 closed so that the desired pressure will be transmitted to the motive devices served by the flow control valve. This effective pressure however, is governed by the small relief valve 288 in the passage 287, which is adjustable so as to relieve the pressure on the upper end of the piston after it reaches a predetermined value, and thereby permit the piston 282 to be raised against the spring 284 under excessive pressures, and cause the by-pass outlet 281 to be opened.

When the throttle valve 285 is only partially open, the flow of oil through said throttle valve will be reduced in amount so that there is a substantial drop in pressure across said throttle valve. The pressure effective on the upper end of the piston 282 through passage 287 will therefore be correspondingly reduced. Accordingly, said piston will be raised by the pressure on its under surface so as to by-pass the oil through outlet 281 at a lower pressure than is the case when the throttle valve 285 is fully open.

When the throttle valve 285 is fully closed, there will be no back pressure through passage 286 acting on the top of the piston 282 to counteract the pressure on the bottom of said piston. Thus the by-pass outlet 281 will be opened to by-pass the oil at a relatively low pressure. Movement of the piston 282 in opening the by-pass outlet 281 is facilitated by the bleed passage 289, which affords restricted communication between said by-pass outlet and the upper end of the cylinder to relieve any oil, or air, that might otherwise accumulate above the piston 282 to retard its movement.

From the above it will now be understood that the flow control valve 275 provides an automatic control to limit the maximum pressure applicable to the dual control valve 245, and also provides a by-pass which is automatically opened at different pressures which vary inversely with the rate of flow of oil through the manually operated throttle valve 285.

The supply outlet 280 of flow control valve 275 is connected by pipe 290 to the inlet port 265 of dual control valve 245.

The valve member 250 of said dual control valve 245 is connected by pipes 291 and 292 to the pipes 268 and 269, respectively, which lead to opposite sides of the turntable feed motor 39. Accordingly, the turntable feed motor 39 can be driven either at relatively high speed, by pump 24 through dual control valve 244, or at relatively low speeds, by pump 26 through flow control valve 275 and dual control valve 245.

Pipes 293 and 294 lead from valve member 251 of control valve 245 to a pair of check and flow valves indicated generally at 295 and 296. These check and flow valves automatically control the movement of the pistons 140, 140 in the bar leveling cylinders 18, 18 so that they cannot move faster than oil is positively supplied thereto under pressure from the pump 26.

The two check and flow valves 295 and 296 are of similar construction, so a description of one will apply equally to both. Each includes a cylinder 297 with a piston 298 therein. Each cylinder has two laterally opening supply ports 299 and 300 offset axially of each other. Each piston 298 has an annular groove 301 of sufficient width to afford communication between said supply ports when the piston is moved toward the upper end of the cylinder. A spring 302 normally urges the piston in the opposite direction, to cut off such communication. Each cylinder 297 also has a pressure control inlet 303 at its lower end nearest the supply port 299, and a relatively small bleeder or drain outlet 304 leading from its opposite end to a tank return pipe 272. A by-pass pipe 306 having a check valve 307 therein connects the supply ports 299 and 300 of each valve structure.

The two check and flow valve structures above described are cross connected to the pipes 293 and 294 leading from direction control valve 245 as follows: The pipe 293 is connected to the supply port 299 and by-pass pipe 306 of valve 295, and also to the pressure control inlet 303 of the second valve 296, while pipe 294 is connected to the supply port 299 and by-pass pipe 306 of the second valve 296, and also to the pressure control inlet 303 of the first valve 295. The pipe 293*a* is connected to the by-pass pipe 306 and supply port 300 of the first valve 295 and leads through branch pipes 293*b*, 293*b* to the inner ends of both cylinders 18, 18; while the pipe 294*a* is connected to the by-pass pipe 306 and supply outlet 300 of the second valve 296, and leads through branch pipes 294*b*, 294*b* to the outer ends of said cylinders.

The operation of the check and flow valves just described is as follows: Assuming that oil is directed from control valve 245 under pressure through pipe 293 and is to return through pipe 294, said oil is free to pass through check valve 307 in by-pass pipe 306 of the first valve direct to pipe 293*a*, and thence through branch pipes 293*b* to the inner ends of cylinders 18, 18 so as to tend to move the pistons 140, 140 outwardly. Such movement will be restrained, however, so long as the second valve 296 is in closed position as shown, in which the oil cannot return through its check valve 307 nor through its cylinder because supply port 300 is closed by the piston 298. Before the latter port can be opened, sufficient pressure must be built up in the lower end of the cylinder through the pressure inlet 303 to move the piston 298 upwardly and establish communication between ports 299 and 300 of the second valve 296. Since sufficient pressure to open said ports can only be supplied from the pressure pipe 293, the bar leveling pistons 140, 140 can only be moved toward the right by pressure supplied positively thereto from the high pressure side of check and flow valve 295. Moreover, movement of said pistons will cease as soon as such pressure is cut off by the flow control valve 245.

When pressure is applied through pipe 294 to move the pistons 140, 140 in the opposite direction, the operation of the two check and flow valves 295 and 296 is the reverse of that just described, whereby the return of oil through pipe 293 is dependent upon a positive operating pressure being applied from the pump through pipe 294. It will also be noted that neither valve ports 300 in the two valves 295 and 296 can be opened by back-pressures that may be built up in the pipes 293*a* or 294*a*, as for instance, due to the suspended weight of the cutter bar, because such pressures cannot be transmitted through either check valves 307 to the pressure inlet 303 of the other valve.

The use of two check and flow valves cross connected as described, is particularly advantageous where, as here, the cutter bar is capable of being inverted by rotation of the extension arm. Thus, any tendency of the cutter bar to drop due to its own weight is effectively controlled whether said bar is in normal or inverted positions. Accordingly, it will now be understood that the bar leveling pistons 140, 140 will normally be hydraulically locked against movement in either direction, excepting when under direct operating pressure from the pump 26.

Under some conditions, however, it is desirable to release the bar leveling pistons 140, 140 from their locked position so as to permit the cutter head and cutter bar 19 to swing freely relative to the extension arm 15. For this purpose, a pipe 308 is connected across pipes 293*a* and 294*a* and is provided with a manually controlled valve 309. When said valve is opened, direct communication is established between the front and rear ends of the bar leveling cylinders 18, 18 so that the cutter bar can be swung freely relative to the extension arm. This feature is particularly advantageous when the machine is being transported from place to place and it is desired to swing the cutter arm in order to clear lateral obstructions, or to assist the machine in turning sharp curves in the mine.

Referring next to pump 27 and its operative connections, said pump is preferably of a capacity intermediate that of pumps 24 and 26, and is connected to effect driving of the tramming motor 190 under control of the valve member 250 of dual control valve 246 and to effect driving of the bar swinging motor 110 under control of valve member 251 of said dual control valve 246. In this instance, the rate of flow from the pump 27 is controlled by the second flow control valve 276 previously referred to. Thus, pressure from the pump 27 is led through pipe 310 to flow control valve 276 and thence by pipe 311 to the dual control valve 246. The valve member 250 of said control valve is connected by pipes 312 and 313 to the tramming motor 190. The valve member 251 of said control valve is connected by pipes 314 and 315 to the bar swing motor 110. As indicated for illustrative purposes in the diagram, it will be observed that the valve member 250 of control valve 246 is shifted downwardly in position to operate the tramming motor 190 while the compression valve member 251 is shifted upwardly in position to operate the bar swinging motor 110. By shifting either of said valve members in the opposite direction, their respective motors will be driven in the reverse direction.

The fourth pump 25 is preferably of relatively high capacity substantially equal to pump 24 and is connected to effect driving of the bar swinging motor 110 at relatively high speed under the control of the valve member 250 of the fourth dual control valve generally indicated at 247, and to effect operation of the cylinder jacks 13, 13 which elevate the tilting frame 11, under control of the valve member 251 of said valve 247. In this instance no flow control valve is used on the high pressure side of said pump, but the pressure pipe 316 leading to the control valve 247 has a by-pass pipe 317 connected thereto, with a pressure relief valve 318 therein, leading to the tank 232. Pipes 319 and 320 connect the valve member 251 of valve 247 to pipes 314 and 315 leading to opposite sides of the bar swinging motor 110 so that the latter motor can be selectively driven at high or low speeds, depending upon whether pressure is supplied thereto from pump 25 or pump 27.

Pipe 321 leads from the upper port 266*a* of dual control valve 247 to branch pipes 322 and 323 connected respectively with the upper ends of the cylinder jacks 13, 13. Pipe 324 leads from the lower port 267*a* of said dual control valve to a check and flow control valve indicated generally at 325, and from thence pipe 326 leads to branch pipes 327 and 327*a* connected respectively with the bottom ends of the cylinder jacks 13, 13. Said check and flow valve is similar in construction to the check and flow valves 295 and 296, previously described, so that it need not be described again in detail, excepting to point out that in the present instance, only one such valve is used, connected to pipe 324 to control the return flow from the lower end of the lifting cylinders 13, 13. Since these cylinders are always in upright position, instead of being capable of inversion, as in the case of the bar leveling cylinders 18, 18, only one such check and flow valve is required to restrain any tendency of their respective pistons to drop due to the weight of the tilting frame supported thereby.

The check and flow valve 325 has its pressure control inlet 303 connected to the pipe 321 leading to the upper end of cylinder jacks 13, 13, so that return communication will not be established through said valve from the lower end of said cylinders unless positive pressure from the pump is applied through said pipe 321, acting on the upper end of said cylinders. When flow is directed in the opposite direction by control valve 247, to raise the pistons 33, 33, the oil under pressure in pipe 324 will pass freely through the check valve 307 into the lower end of said cylinders, and be returned through pipe 321.

The principal parts of the hydraulic system illustrated in the diagram Figure 34 are disposed on the main frame 1 of the machine, and for convenience in operation, the principal manual controlling devices, and particularly the four dual control valves 244, 245, 246 and 247, are grouped together at a single station on the main frame, as shown in Figure 1 of the drawings.

The several connecting pipes leading to the motive devices carried on the turntable 8 have flexible conduit sections which are provided with novel swiveling support means to permit the maximum range of turning movement of said turntable without undue bending or kinking of said flexible conduit sections. As indicated in the diagram, Figure 34, the parts of the hydraulic system which are mounted on and carried by the main frame 1 are disposed generally to the left side of the upright dotted line T—T on said diagram, while the parts of said hydraulic system mounted on and rotatable with the turntable 8

are disposed to the right side of said line T—T. It will be understood, therefore, that the eight main control pipes which are intersected by line T—T are the pipes which have flexible conduit sections leading to the turntable as above mentioned, namely, pipes 270 and 271, 293a and 294a, 314 and 315, and 321 and 324.

Referring to Figures 3 to 8, both inclusive, which show details of the turntable mounting, it will be observed that eight flexible conduit sections of the pipes above named lead from the rear of the base frame 1 and forwardly below said turntable through two similar intermediate swiveling supports indicated generally at 330 and 331.

The rearmost swiveling support 330 is disposed transversely in the open part of the main frame, to the rear of the turntable bearing ring 31, and is mounted for horizontal swinging movement on trunnions 332 and 333 having suitable bearing in said main frame above and below said swiveling support. Said swiveling support includes a pair of vertically spaced arms 335, 336 extending at each end thereof, between which an open supporting frame 337 is mounted on vertically disposed trunnions 338, 339. With this arrangement, the open supporting frames have independent rocking movement on vertical axes at opposite ends of said swiveling support 330.

Each of said open supporting frames 337 has four flexible conduits loosely supported therein, as is best shown in Figures 4 and 8. While the specific arrangement of said conduits in the two supporting frames 337, 337 is more or less optional, for illustrative purposes herein, the supporting frame at the near side of the machine, as seen in Figure 3, carries conduits 270, 314, 315 and 321, while the other supporting frame carries conduits 271, 293a, 294a and 324.

The swiveling support 330 also has a centrally disposed opening 340 in which a third supporting frame 341 is swiveled on a vertical axis. This third supporting frame carries a relatively large flexible tube 342 therein which contains the usual electrical conducting and control cables leading to the electric motor 14 on the tilting frame 11.

The second swiveling support 331 is similar in construction to the swiveling support 330 just described, and is disposed between the upright partitions 32, 32 near the bottom of the hollow casing of the main frame 1 and below the front of turntable 8. The upper trunnion 332 of the front swiveling support 331 is pivoted in a cross bar 343 extending between the upright partitions 32, 32 and the lower trunnion 332 is pivoted in a bottom plate 345 of the turntable, which bridges the bottom edges of the upright partitions 32, 32, as clearly seen in Figures 7 and 8.

The two groups of flexible conduits mentioned pass freely through both front and rear swiveling supports in the same order and arrangement. Between said swiveling supports, each group of conduits is normally bowed or bent outwardly within the hollow portion of the base frame 1, as clearly shown in Figure 5, so as to provide sufficient take-up for said conduits when the turntable is swung to one side or the other.

After the several flexible conduit sections pass through the front swiveling support, they are bent upwardly and rearwardly on relatively wide radii as shown in Figures 3 and 7, and their extremities are connected to certain terminals mounted on and carried by the turntable so as to rotate with the latter, as will now be described in some detail with reference to Figures 5 to 8, inclusive. The conduit 321 is supported in the upper end of an inclined bracket 346 mounted on cross bar 343 and leads directly to branch pipes 322 and 323, the outer ends of which curve upwardly and lead to the upper ends of hydraulic cylinder jacks 13, 13. The companion conduit 324, however, is first connected to the check and flow valve 325 and from said check and flow valve a short connecting pipe 326 leads to branch pipes 327 and 327a, the outer ends of which curve downwardly and lead to the lower ends of hydraulic cylinder jacks 13, 13.

The conduits 271, 293a and 294a are led through separate passages opening into the under side of a manifold 352 mounted on partitions 32, 32 across the open central portion of the turntable 8 and disposed to the rear of the axis of turning movement of the latter. From the adjacent end of said manifold, the three conduits referred to are continued respectively as conduits bearing the same reference numerals leading upwardly to their respective motive devices mounted on and carried by the tilting frame 11. Similarly, the conduits 270, 314 and 315 lead through separate passages in the opposite end of manifold 352 and are continued upwardly from the latter as conduits bearing the same reference numerals to the tilting frame 11, where they are also connected to their respective motive devices, as shown in Figure 11.

It will be especially noted that the pipes 293a and 294a which eventually lead to the bar leveling cylinders 18, 18, mounted on the sides of the extension arm 15, have hydraulic connections through the body of said arm in a novel manner so as to permit complete freedom of rotation of said arm in either direction without interruption of said hydraulic connections.

As shown in Figures 15 to 19, the connections to the bar leveling cylinders 18, 18 are provided by means of two tubes 355 and 356 which extend axially through the extension arm 15, with their rear ends projecting into the tilting frame 11. The walls of said tubes are spaced apart, and the inner tube 356 has a pair of fins 357, 357 along opposite sides thereof which engage the bore of said outer tube 355, so as to form two separate oil ducts or passages 358 and 359, semi-circular in cross section, extending to the front end of the extension arm 15. The front and rear ends of said oil ducts are closed by sealing rings 360 and 361, respectively, inserted between said tubes, as shown in Figure 15. The two tubes are thus permanently connected together for rotation as a unit within the hollow bearing support 55. The front end of the outer tube projects beyond the end of said bearing support, as shown in Figure 20, where it has supporting engagement in the outer shell 58 of the extension arm and is connected for rotation with the latter, as by set screw 362. It will also be understood that the tubular drive shaft 81 previously described is freely rotatable within the inner tube 356.

The pressure pipes 293a and 294a communicate respectively with the two ducts 358 and 359 through two continuous inlet rings 363 and 364 housed side by side in a cylindrical casing 365 surrounding the rear end of the tubes 355 and 356. The inlet ring has external and internal annular grooves 366 and 367 thereabout, connected by a plurality of spaced openings 368, 368, while the second inlet ring 364 has similar external and internal annular grooves 366a and 367a, connected by a plurality of spaced openings 368a, 368a. Each of said inlet rings has suitable packing 370 and 371 at opposite sides

thereof, enclosed between inner and outer packing rings 372 and 373 respectively, so as to form leak-proof joints. In the form shown, the two inner packing rings 372, 372 abut each other, and the two outer packing rings 373, 373 are held in place at opposite ends of the cylindrical casing 365 by retaining sleeves 374 and 375 which are threaded on adjacent parts of the outer tube 355 so as to provide a take-up for the packing, in the usual manner.

The outer tube 355 has a series of ports 376, 376 formed through one side thereof in circumferential alignment with the inlet ring 363, so as to afford communication from said inlet ring to the duct 358, at one side of said tube, as shown in Figure 16. A second series of ports 377, 377 are provided around the opposite side of the outer tube 355 in circumferential alignment with the second inlet ring 364 so as to provide communication from the latter ring to the second duct 359 at the opposite side of said tube, as shown in Figure 17.

One of the ducts 358 formed between the tubes 355 and 356 as aforesaid is connected with branch pipes 293b and 293b leading from said duct at the front end of the extension arm 15 to the inner ends of the bar leveling cylinders 18, 18, while the other duct 359 is similarly connected with branch pipes 294b, 294b leading to the outer ends of said bar leveling cylinders.

The arrangement just described is such that the conduits 293a and 294a entering the casing 365 are always in communication, respectively, through the two ducts 358 and 359, with the upper and lower ends of the bar leveling cylinders in all positions of rotation of the extension arm 15 relative to the tilting frame 11.

From the foregoing description it will now be understood that a machine constructed in accordance with my invention affords all of the cutter bar positioning and feeding movements requisite in so-called "universal type kerf-cutting machines," and that such machine is of especially compact design adapted for use in mines having narrow working spaces and extremely limited head room. It will be observed that the vertical height of the machine is made up of the truck wheels, the turntable base surmounting said wheels, and the tilting frame. In the present instance the vertical dimensions of these three elements are reduced to a minimum consistent with practical requirements. For instance, the truck wheels must be of suitable diameter to provide proper support and traction. The tilting frame 11 requires some clearance over the turntable for tilting adjustment. In the present instance the height of the tilting frame is largely determined by the electric motor 14 at its rear end, but the forward end of the tilting frame is of reduced vertical height so as to increase its range of tilting movement toward and away from the turntable and base frame.

The extension arm 15 and its mode of connection with the turnover cutter head 16 also provides an especially compact and efficient construction. The bar leveling cylinders 18, 18 are disposed on the same side of the extension arm as the main body of the cutter head; that is to say, in the position shown in Figure 1, the bar leveling cylinders do not project above the top of said extension arm, and their pistons are pivotally connected to the cutter head below the axis of tilting movement of the latter, closely adjacent the cutting plane of the cutter bar 19. With this arrangement the bar leveling devices require no additional vertical height either in the upright or inverted position of said cutter head. Moreover, said bar leveling devices are in especially effective position to provide lateral stabilization and support for the cutter bar while the latter is being fed edgewise to the coal. The cylinder devices 18, 18 thus relieve the extension arm of substantial lateral cutting stresses, so that said extension arm can be made considerably lighter than would otherwise be possible.

The arrangement of the two hydraulic motors 71, 71, with separate gearing connections at opposite sides of the gear 62 which rotates the extension arm 15 also aids in reducing the vertical height of the tilting frame, and therefore, of the whole machine.

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

I claim as my invention:

1. In a kerf-cutting machine, a base frame, a tilting frame pivotally supported on said base frame and projecting forwardly thereover for tilting adjustment on a transverse axis, an extension arm supported on the front end of said tilting frame for rotation on a generally horizontal axis, a cutter head pivotally supported on said extension arm in advance of said base frame for tilting adjustment on a transverse axis, a cutter bar pivotally supported on said cutter head for swinging movement in planes parallel to said last named transverse axis, and means for tilting said cutter head on its last named axis, including a pair of telescopic power devices pivotally connected between opposite sides of said extension arm and said cutter head at laterally spaced points on the same side of the axis of tilting adjustment of the latter as said cutter bar.

2. In a kerf-cutting machine, a base frame, a tilting frame pivotally supported on said base frame and projecting forwardly thereover for tilting adjustment on a transverse axis, an extension arm supported on the front end of said tilting frame for rotation on a generally horizontal axis, a cutter head pivotally supported on said extension arm in advance of said base frame for tilting adjustment on a transverse axis, and a cutter bar pivotally supported on said cutter head for swinging movement in a plane parallel to said last named transverse axis, and means for adjusting said cutter head on its last named axis including a telescopic power device extending between said extension arm and said cutter head and pivotally connected to the latter on the same side of the transverse axis of the latter as said cutter bar.

3. In a kerf-cutting machine, a base frame, a tilting frame pivotally supported near said base frame and projecting forwardly thereover for tilting adjustment on a transverse axis, an extension arm supported on the front end of said tilting frame for rotation on a generally horizontal axis, a cutter head pivotally supported on said extension arm in advance of said base frame for tilting adjustment on a transverse axis, and a cutter bar pivotally supported on said cutter head for swinging movement in a plane parallel to said last named transverse axis, and means

for adjusting said cutter head on its last named axis including a pair of telescopic power devices extending between said extension arm and said cutter head and pivotally connected at opposite sides of the latter adjacent the plane of swinging movement of said cutter arm relative to said cutter head.

4. In a kerf-cutting machine, a base frame, a turntable mounted on the front end of said base frame, a tilting frame pivotally supported on said turntable adjacent its rear end and projecting forwardly over the latter for tilting movement on a transverse axis, an extension arm rotatably supported on the front end of said tilting frame on an axis extending forwardly thereof at an obtuse angle to the general plane of said tilting frame, a cutter head pivotally supported on the front end of said extension arm for tilting movement on a transverse axis, and a cutter bar pivotally supported on said cutter head for swinging movement in a plane parallel to said last named transverse axis, and fluid pressure means for adjusting said cutter head on its last named axis including a pair of cylinder and piston devices each having one movable element pivotally connected at one side of said extension arm, and the other movable element pivotally connected to said cutter head in vertically and laterally offset relation to said extension arm.

5. In a kerf-cutting machine, a base frame, a turntable mounted on the front end of said base frame, a tilting frame pivotally supported on said turntable adjacent its rear end and projecting forwardly over the latter for tilting movement on a transverse axis, an extension arm rotatably supported on the front end of said tilting frame on an axis extending forwardly thereof at an obtuse angle to the general plane of said tilting frame, a cutter head pivotally supported on the front end of said extension arm for tilting movement on a transverse axis, and a cutter bar pivotally supported on said cutter head for swinging movement in a plane parallel to said last named transverse axis, and fluid pressure means for adjusting said cutter head on its last named axis including a pair of cylinder and piston devices each having one movable element pivotally connected at one side of said extension arm, and the other movable element pivotally connected to said cutter head in vertically and laterally offset relation to said extension arm and adjacent the plane of swinging movement of said cutter bar.

6. In a kerf-cutting machine, a base frame, a generally elongated tilting frame pivotally supported near its rear end on said base frame for tilting adjustment on a transverse axis, an extension arm rotatably supported at the front of said tilting frame on a generally horizontal axis, and having a turnover head in advance of said base frame, a pair of motors having independent operative connection with said extension arm for rotating the latter, said motors and their operative connections being disposed at opposite sides of said extension arm within the vertical limits of said tilting frame.

7. In a kerf-cutting machine, a base frame, a generally elongated tilting frame pivotally supported near its rear end on said base frame for tilting adjustment on a transverse axis, an extension arm rotatably supported at the front of said tilting frame on a generally horizontal axis, and having a turnover head in advance of said base frame, said extension arm having a coaxial gear member thereon, a pair of motors having independent operative connection with the coaxial gear member on said extension arm for rotating the latter, said motors and their operative connections being disposed at opposite sides of said extension arm within the vertical limits of said coaxial gear member.

8. In a kerf-cutting machine, a base frame, a generally elongated tilting frame pivotally supported near its rear end on said base frame for tilting adjustment on a transverse axis, an extension arm rotatably supported at the front of said tilting frame on a generally horizontal axis, and having a turnover head in advance of said base frame, and a pair of motors on said tilting frame having independent geared connections with opposite sides of said extension arm so as to balance the driving reaction during rotation of the latter.

9. In a kerf-cutting machine, a base frame, a generally elongated tilting frame pivotally supported near its rear end on said base frame for tilting adjustment on a transverse axis, an extension arm rotatably supported at the front of said tilting frame on a generally horizontal axis, and having a turnover head in advance of said base frame, said extension arm having a coaxial gear member thereon, and a pair of motors on said tilting frame each having similar independent geared connections with said coaxial gear member at opposite sides of said tilting frame, so as to balance the driving reaction during rotation of the latter.

10. In a kerf-cutting machine, a base frame, an elongated supporting frame disposed generally in a horizontal plane above said base frame and pivotally mounted thereon for tilting adjustment on a transverse axis, an extension arm supported on the front end of said supporting frame for rotatable adjustment on a generally longitudinal axis, a cutter head including a cutter chain driving sprocket pivotally supported on said extension arm in advance of said base frame for tilting adjustment on a transverse axis, and a cutter bar pivotally supported on said cutter head for swinging movement on an axis coaxial with said cutter chain driving sprocket, a motor on said supporting frame having operative connections with said cutter chain driving sprocket, said connections including a drive shaft extending along said extension arm coaxially with the axis of rotation thereof, and a second motor on said supporting frame having independent driving connections for swinging said cutter bar relative to said cutter head including a second drive shaft extending along said extension arm coaxial with said first named drive shaft.

11. In a kerf-cutting machine, a base frame, an elongated supporting frame disposed generally in a horizontal plane above said base frame and pivotally mounted thereon for tilting adjustment on a transverse axis, an extension arm on the front end of said supporting frame for rotatable adjustment on a generally longitudinal axis and having trunnions at the front end thereof, a cutter head including a cutter chain driving sprocket pivotally supported between said trunnion supports for tilting adjustment on a transverse axis, a cutter bar pivotally supported on said cutter head for swinging movement on an axis coaxial with said cutter chain driving sprocket, a motor on said supporting frame having operative connections with said cutter chain driving sprocket, said connections including a drive shaft extending along said extension arm coaxially with the axis of rotation thereof and a connecting shaft

coaxial with one of said trunnion supports, and a second motor on said supporting frame having independent driving connections for swinging said cutter bar relative to said cutter head, said last named connections including a second drive shaft extending along said extension arm coaxial with said first named drive shaft and a second connecting shaft coaxial with the other of said trunnion supports.

12. In a kerf-cutting machine, a supporting member having a yoke forming spaced trunnion supports, a cutter head having spaced trunnion members each having outer end portions rotatably mounted in said trunnion supports for tilting adjustment of said cutter head relative to said supporting member, a driving element on said supporting member, a driven element on said cutter head, and operative connections between said elements including a gear rotatably mounted centrally of said supporting member between said trunnion members, and a gear mounted on a shaft extending coaxially through one of said trunnion members and meshed with said first named gear.

13. In a kerf-cutting machine, a supporting member having a yoke forming spaced trunnion supports, a cutter head having spaced trunnion members each having outer end portions rotatably mounted in said trunnion supports for tilting adjustment of said cutter head relative to said supporting member, a driving element on said supporting member and a driven element on said cutter head, operative connections between said elements including a gear rotatably mounted centrally of said supporting member between said trunnion members, and a gear meshed with said first named gear and mounted on a shaft extending coaxially through one of said trunnion members, said shaft having rotatable bearing support at one end on said supporting member and at the other end in said trunnion member.

14. In a kerf-cutting machine, a supporting member having a yoke forming spaced trunnion supports, a cutter head having spaced trunnion members each having outer end portions rotatably mounted in said trunnion supports for tilting adjustment of said cutter head relative to said supporting member, two driving elements on said supporting member, and two driven elements on said cutter head, and independent operative connections between said driving and driven elements respectively, including two bevel gears rotatably mounted in concentric relation on said supporting member between said trunnion members, a bevel gear meshed with one of said drive gears rotatably mounted on a shaft extending coaxially through one of said trunnion members, and a second bevel gear meshed with the other drive gear mounted on a shaft extending coaxially through the other trunnion member.

15. In a kerf-cutting machine, a supporting member having a yoke forming spaced trunnion supports, a cutter head having spaced trunnion members each having outer end portions rotatably mounted in said trunnion supports for tilting adjustment of said cutter head relative to said supporting member, a driving element on said supporting member, a driven element on said cutter head, and operative connections between said elements including a gear rotatably mounted centrally of said supporting member between said trunnion members, and a gear mounted on a shaft extending coaxially through one of said trunnion members and meshed with said first named gear, and a casing mounted on the end of said supporting member to enclose said gear between said trunnion members and affording a bearing support for said shaft.

16. In a kerf-cutting machine, a supporting member having a yoke forming spaced trunnion supports, a cutter head having spaced trunnion members each having outer end portions rotatably mounted in said trunnion supports for tilting adjustment of said cutter head relative to said supporting member, two driving elements on said supporting member, and two driven elements on said cutter head, and independent operative connections between said driving and driven elements respectively, including two bevel gears rotatably mounted in concentric relation on said supporting member between said trunnion members, a bevel gear meshed with one of said drive gears rotatably mounted on a shaft extending coaxially through one of said trunnion members, and a second bevel gear meshed with the other drive gear mounted on a shaft extending coaxially through the other trunnion member, and a casing mounted on the end of said supporting member to enclose said bevel gears between said trunnion members and affording bearing supports for both of said shafts.

17. In a kerf-cutting machine, an extension arm, a cutter head including a casing having a pair of upstanding hollow trunnion members connected to said extension arm for adjustment on a transverse axis, cutter chain supporting means on said frame including a chain sprocket, drive means from said arm to said sprocket including a shaft mounted coaxially with one of said trunnion members, and a gear on said shaft disposed within said last named trunnion member.

18. In a kerf-cutting machine, an extension arm, a cutter head including a casing having a closed top plate with a pair of upstanding hollow trunnion members connected to said extension arm for adjustment on a transverse axis, cutter chain supporting means on said frame including a chain sprocket, a shaft having its upper end rotatably supported in said top plate, and drive connections from said extension arm to said sprocket shaft including a shaft mounted coaxially with one of said trunnion members and a gear on said shaft disposed within said last named trunnion member.

19. In a kerf-cutting machine, a wheel-supported base frame having an open horizontally disposed annular bearing, a turntable rotatably mounted on said bearing, a supporting frame pivotally mounted adjacent its rear end on said turntable, said supporting frame projecting forwardly for vertical tilting adjustment relative to said turntable and having cutting mechanism carried thereby in advance of said base frame, and fluid pressure means for tilting said supporting frame relative to said turntable, comprising a pair of cylinder and piston devices supported in widely spaced relation at opposite sides of said turntable with their lower ends extending below the open annular bearing of said base frame.

20. In a kerf-cutting machine, a wheel supported base frame having an open horizontally disposed annular bearing, a turntable rotatably mounted on said bearing, a supporting frame pivotally mounted adjacent its rear end on said turntable, said supporting frame projecting forwardly for vertical tilting adjustment relative to said turntable and having cutting mechanism

carried thereby in advance of said base frame, and fluid pressure means for tilting said supporting frame relative to said turntable, comprising a pair of cylinders trunnioned on opposite sides of said turntable for rocking movement on transverse axes, with their lower ends extending through the open annular bearing support of said base frame, and with pistons therein pivotally connected to said supporting frame.

21. In a kerf-cutting machine, a wheel supported base frame having a hollow open portion surrounded by an annular bearing, a turntable rotatably mounted on said bearing having depending frame members bridging the central portion thereof within said bearing, a supporting frame pivotally mounted at its rear end on said turntable and having cutting mechanism carried thereby in advance of said base frame, and fluid pressure means for elevating said supporting frame relative to said base frame comprising a pair of cylinder and piston devices pivotally mounted on said turntable with their inner sides supported by said depending frame members, and with their lower ends extending downwardly into the hollow open portion of said base frame.

22. A flexible mounting for a hydraulic cylinder, comprising a sleeve having trunnion supports at opposite sides thereof, said sleeve being loosely mounted on said cylinder and having concentric concave and convex bearing surfaces at opposite ends thereof respectively engaging abutments on said cylinder to permit limited universal rocking movement of said cylinder relative to said sleeve.

23. A flexible mounting for a hydraulic cylinder comprising an annular sleeve member having trunnion supports at opposite sides thereof and loosely mounted on said cylinder, and abutment means fixed on said cylinder having opposed concentric concave and convex bearing surfaces respectively engaging corresponding surfaces on said sleeve member to permit limited universal rocking movement of said cylinder relative to said sleeve.

24. In a kerf-cutting machine, a base frame having a hollow open portion at the front end thereof surmounting by an annular bearing member, a turntable having an open central portion mounted for horizontal swinging movement on said bearing, fluid pressure pump means on said base frame rearwardly of said turntable, cutting mechanism mounted on said turntable, a plurality of adjusting devices for said cutting mechanism having fluid motor operating devices mounted on and rotatable with said turntable, and means connecting said pump means and said fluid motor operating devices comprising a plurality of flexible conduits extending forwardly from said pump means into said hollow open portion of said base frame beneath said turntable, and thence curving upwardly through the front of said open central portion of said turntable and thence rearwardly to connections on said turntable in communication with their respective motor devices, said flexible conduits being free to bend laterally within the hollow open portion of said base frame so as to accommodate themselves to the swinging movements of said turntable.

25. In a kerf-cutting machine, a base frame having a hollow open portion at the front end thereof surmounted by an annular bearing member, a turntable having an open annular bearing ring mounted for horizontal swinging adjustment on said bearing member, cutting mechanism mounted on said turntable, a plurality of adjusting devices for said cutting mechanism having fluid motor operating devices also mounted on and swingable with said turntable, fluid pressure pump means mounted on said base frame, and means connecting said pump means with said motor operating devices comprising a plurality of flexible conduits leading forwardly into said hollow open portion of said base frame and thence curving upwardly and rearwardly therein to connections on said turntable in communication with their respective motor devices.

26. In a kerf-cutting machine, a base frame having a hollow open portion at the front end thereof surmounted by an annular bearing member, a turntable having an open annular bearing ring mounted for horizontal swinging adjustment on said bearing member, cutting mechanism mounted on said turntable, a plurality of adjusting devices for said cutting mechanism having fluid motor operating devices also mounted on and swingable with said turntable, fluid pressure pump means mounted on said base frame, and means connecting said pump means with said motor operating devices comprising a plurality of flexible conduits leading forwardly into said hollow open portion of said base frame and thence curving upwardly and rearwardly therein through the bearing ring of said turntable to connections on said turntable in communication with their respective motor devices.

27. In a kerf-cutting machine, a base frame having a hollow open portion at the front end thereof surmounted by an annular bearing member, a turntable having an open annular bearing ring mounted for horizontal swinging adjustment on said bearing member, cutting mechanism mounted on said turntable, a plurality of adjusting devices for said cutting mechanism having fluid motor operating devices also mounted on and swingable with said turntable, fluid pressure pump means mounted on said base frame, and means connecting said pump means with said motor operating devices comprising a plurality of flexible conduits leading forwardly into said hollow open portion of said base frame and thence upwardly to connections on said turntable in communication with their respective motor devices, and two longitudinally spaced supporting members for said conduits swiveled for independent horizontal swinging movement, one being mounted on and movable with said turntable within said hollow open portion, and the other being mounted in said base frame to the rear of said first named supporting member.

28. In a kerf-cutting machine, a base frame having a hollow open portion at the front end thereof surmounted by an annular bearing member, a turntable having an open annular bearing ring mounted for horizontal swinging adjustment on said bearing member, cutting mechanism mounted on said turntable, a plurality of adjusting devices for said cutting mechanism having fluid motor operating devices also mounted on and swingable with said turntable, fluid pressure pump means mounted on said base frame, and means connecting said pump means with said motor operating devices comprising a plurality of flexible conduits leading forwardly into said hollow open portion of said base frame and thence upwardly to connections on said turntable in communication with their respective motor devices, and two longitudinally spaced supporting members for said conduits swiveled for independent horizontal swinging movement, one

being mounted on and movable with said turntable within said hollow open portion, and the other being mounted in said base frame to the rear of said first named supporting member, said conduits being normally bowed within said hollow open portion to accommodate themselves to swinging movements of said turntable.

29. In a kerf-cutting machine, a base frame having a hollow open portion at the front end thereof surmounted by an annular bearing member, a turntable having an open annular bearing ring mounted for horizontal swinging adjustment on said bearing member, cutting mechanism mounted on said turntable, a plurality of adjusting devices for said cutting mechanism having fluid motor operating devices also mounted on and swingable with said turntable, fluid pressure pump means mounted on said base frame, and means connecting said pump means with said motor operating devices comprising a plurality of flexible conduits leading forwardly into said hollow open portion of said base frame and thence upwardly to connections on said turntable in communication with their respective motor devices, and two longitudinally spaced supporting members for said conduits swiveled for independent horizontal swinging movement, one being mounted on and movable with said turntable within said hollow open portion, and the other being mounted in said base frame to the rear of said first named supporting member, said conduits being normally bowed both horizontally and vertically within said hollow open portions to accommodate themselves to swinging movements of said turntable.

30. In a mining machine, a base frame and a turntable mounted thereon for lateral swinging adjustment, fluid pressure means on said base frame, cutting mechanism adjusting devices having motor operating devices mounted on and swingable with said turntable, and flexible conduit means connecting said fluid pressure means with said motor operating devices, including a laterally swiveled supporting arm mounted in said base frame beneath said turntable, and having independently swiveled supporting frames at opposite ends thereof for carrying the flexible conduits extending therethrough in laterally spaced relation.

31. In a kerf-cutting machine having a support and a cutter bar pivotally mounted thereon, a hydraulic motor for swinging said cutter bar, power supply means for said motor comprising a single prime mover, two constant speed, constant pressure hydraulic pumps of different capacities, both driven simultaneously by said prime mover, and hydraulic control connections between each of said pumps and said motor to drive the latter selectively at different speeds, the connections from the larger pump including manually operable direction control valve means for directing the flow in reverse directions through said motor, to swing said cutter bar reversely at a relatively high bar positioning speed, or to unload said pump, and the connections from the smaller pump including similar manually operable direction control valve means, and in addition, a manually operable throttle valve for controlling the volume of flow to its direction control valve means to vary the swinging speed of said cutter bar at relatively low bar feeding speeds effected reversely by said smaller motor.

32. In a kerf-cutting machine having a support and a cutter bar pivotally mounted thereon, a hydraulic motor for swinging said cutter bar, power supply means for said motor comprising a single prime mover, two constant speed, constant pressure hydraulic pumps of different capacities, both driven simultaneously by said prime mover, and hydraulic control connections between each of said pumps and said motor to drive the latter selectively at different speeds, the connections from the larger pump including manually operable direction control valve means for directing the flow in reverse directions through said motor, to swing said cutter bar reversely at a relatively high bar positioning speed, or to unload said pump, and the connections from the smaller pump including similar manually operable direction control valve means, and in addition, a manually operable throttle valve for controlling the volume of flow to its direction control valve means to vary the swinging speed of said cutter bar at relatively low bar feeding speeds effected reversely by said smaller motor, and means responsive to the drop in pressure across said throttle valve for automatically unloading said smaller pump at different pressures varying substantially inversely to the amount of flow through said throttle valve.

33. In a kerf-cutting machine, a base, a support mounted thereon for rotation on a generally horizontal axis, and cutting mechanism mounted on said support for tilting adjustment on a transverse axis, hydraulic power means for tilting said cutting mechanism relative to said support including reversible hydraulic motive means, hydraulic pressure means, supply lines connected to opposite sides of said motive means, and direction control valve means for reversing the direction of flow in said supply lines, each of said supply lines having control valve means therein comprising a return cut-off valve connected so as to be opened only under a predetermined pressure effected thereon from the other of said supply lines, and a by-pass line around said cut-off valve having a check valve therein, permitting flow only toward said motive means, whereby said cutting mechanism will be hydraulically locked against self-tilting movements in either upright or inverted positions thereof.

34. In a kerf-cutting machine, a base, a support mounted thereon for rotation on a generally horizontal axis, and cutting mechanism mounted on said support for tilting adjustments on a transverse axis, hydraulic power means for tilting said cutting mechanism relative to said support including reversible hydraulic motive means, hydraulic pressure means, supply lines connected to opposite sides of said motive means, and direction control valve means for reversing the direction of flow in said supply lines, each of said supply lines having control valve means therein comprising a return cut-off valve connected so as to be opened only under a predetermined pressure effected thereon from the other of said supply lines, and a by-pass line around said cut-off valve having a check valve therein, permitting flow only toward said motive means, whereby said cutting mechanism will be hydraulically locked against self-tilting movements in either upright or inverted positions thereof, and means between said control valve means and said motive device affording direct communication at will between opposite sides of said motive means, so as to render said hydraulic locking means temporarily ineffective.

35. In a kerf-cutting machine, a main frame member including a bearing support, an extension frame mounted on said bearing support for

rotation on a generally horizontal axis, cutting mechanism supported for pivotal adjustment on said extension frame, fluid pressure motor devices on said extension frame for effecting pivotal adjustment of said cutting mechanism, fluid pressure supply means on said main frame, two-way conduit means connecting said fluid pressure supply means with said motor devices, including a tubular member extending coaxially through said bearing support and rotatable with one of said frames, said tubular member having two independent fluid ducts therelong and separate openings for said ducts adjacent one end thereof, and fluid-tight bearing means for said tubular member mounted on the other of said frames having separate openings on the inner surface thereof registering with the openings on said tubular member to afford independent communication with the ducts therein in all positions of rotation of said extension frame relative to said main rfame.

36. In a kerf-cutting machine, a main frame member including a bearing support, an extension frame mounted on said bearing support for rotation on a generally horizontal axis, cutting mechanism supported for pivotal adjustment on said extension frame, fluid pressure motor devices on said extension frame for effecting pivotal adjustment of said cutting mechanism, fluid pressure supply means on said main frame, two-way conduit means connecting said fluid pressure supply means with said motor devices, including two tubes extending coaxially through said bearing support and rotatable as a unit with one of said frames, said tubes having longitudinal partitions therebetween to form two independent fluid ducts therealong, and the outer tube having separate, spaced openings for each of said ducts adjacent one end thereof, and fluid-tight bearing means for said outer tube mounted on the other of said frames having separate, fluid-conduit openings on the inner surface thereof registering with the openings in said outer tube to afford independent communication with the ducts therein in all positions of rotation of said extension frame relative to said main frame.

37. In a kerf-cutting machine, a main frame member including a bearing support, an extension frame mounted on said bearing support for rotation on a generally horizontal axis, cutting mechanism supported for pivotal adjustment on said extension frame, fluid pressure motor devices on said extension frame for effecting pivotal adjustment of said cutting mechanism, fluid pressure supply means on said main frame, two-way conduit means connecting said fluid pressure supply means with said motor devices, including two tubes extending coaxially through said bearing support and rotatable as a unit with said extension frame, said tubes having longitudinal partitions therebetween to form independent ducts along opposite sides thereof, and the outer tube having separate openings for each of said ducts spaced longtudinally and at opposite sides thereof, and fluid-tight bearing means for said outer tube mounted on said base frame and having separate fluid conduit openings on the inner surface thereof registering respectively with the openings in said outer tube to afford independent communication with the ducts therein in all positions of rotation of the extension frame relative to said main frame.

38. In a kerf-cutting machine, a main frame member having an elongated bearing support, a tubular extension frame mounted on said bearing support for rotation on a generally horizontal axis, a cutter head supported for pivotal adjustment on said extension frame, a cutter-chain-carrying cutter bar supported on said cutter head, a motor on said main frame and driving connections between said motor and said cutter chain including a drive shaft extending coaxially through said bearing support and said tubular extension, fluid pressure motor devices on said extension frame for effecting pivotal adjustment of said cutter head relative to said extension frame, fluid pressure supply means on said main frame, and two-way conduit means connecting said fluid pressure supply means with said motor devices including a tubular member concentric with and surrounding said drive shaft, said tubular member being rotatable with said extension frame and having two independent fluid ducts therealong, and fluid-tight bearing means for said tubular member mounted on said main frame, having separate communication with said ducts through lateral openings in said tubular member, so as to afford independent communication with said ducts therein in all positions of rotation of said extension frame relative to said main frame.

39. In a kerf-cutting machine, a support, an extension arm in advance of said support and rotatable on a generally horizontal axis, a cutter head pivotally supported on said extension arm in advance of said support for tilting adjustment on a transverse axis, and a cutter bar pivotally supported on said cutter head for swinging movement in a plane parallel to said last named transverse axis, and means for adjusting said cutter head on its last named axis including a telescopic power device extending between said extension arm and said cutter head and pivotally connected to the latter on the same side of the transverse axis of the latter as said cutter bar.

40. In a kerf-cutting machine, a support, an extension arm in advance of said support and rotatable on a generally horizontal axis, a cutter head pivotally supported on said extension arm for tilting adjustment on a transverse axis, a cutter bar mounted on said cutter head for swinging in a plane parallel to and offset from said last named transverse axis, and means for adjusting said cutter head on said last named transverse axis including a telescopic power device between said extension arm and said cutter head and connected to the latter on the same side of the latter transverse axis as said cutter bar.

41. In a kerf-cutting machine, a support, an extension arm in advance of said support and rotatable on a generally horizontal axis, a cutter head pivotally supported on said extension arm for tilting adjustment on a transverse axis, a cutter bar mounted on said cutter head for swinging in a plane parallel to and offset from said last named transverse axis, and means for adjusting said cutter head on said last named transverse axis including a telescopic power device between said extension arm and said cutter head and pivotally connected to the latter on the same side of the latter transverse axis as said cutter bar.

WILLIAM W. SLOANE.