Sept. 29, 1959 J. A. SWANSON ET AL 2,906,515

AUGER TYPE MINING MACHINE

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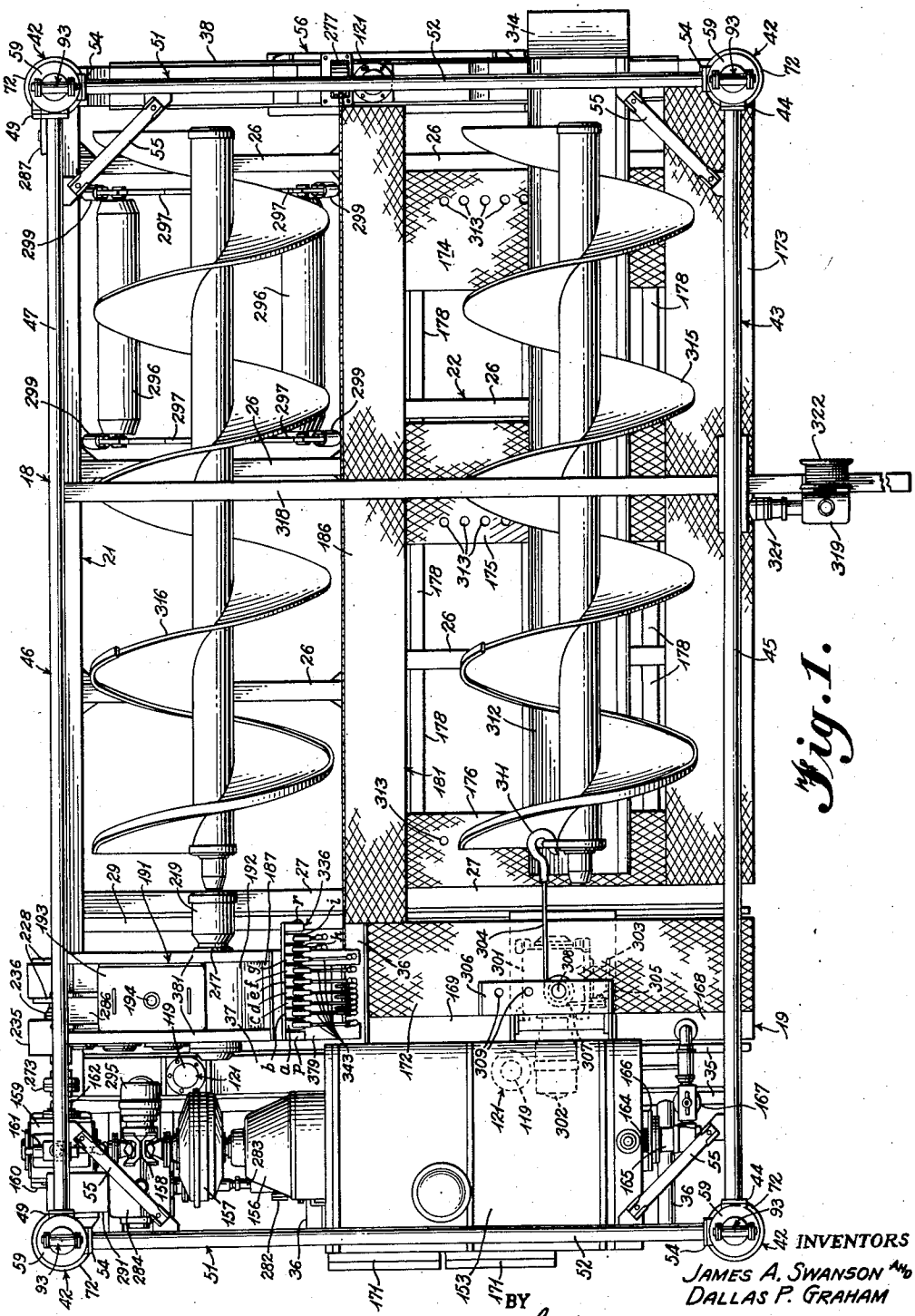


Fig. 1.

INVENTORS
JAMES A. SWANSON AND
DALLAS P. GRAHAM

BY
L. Donald Myers
ATTORNEY

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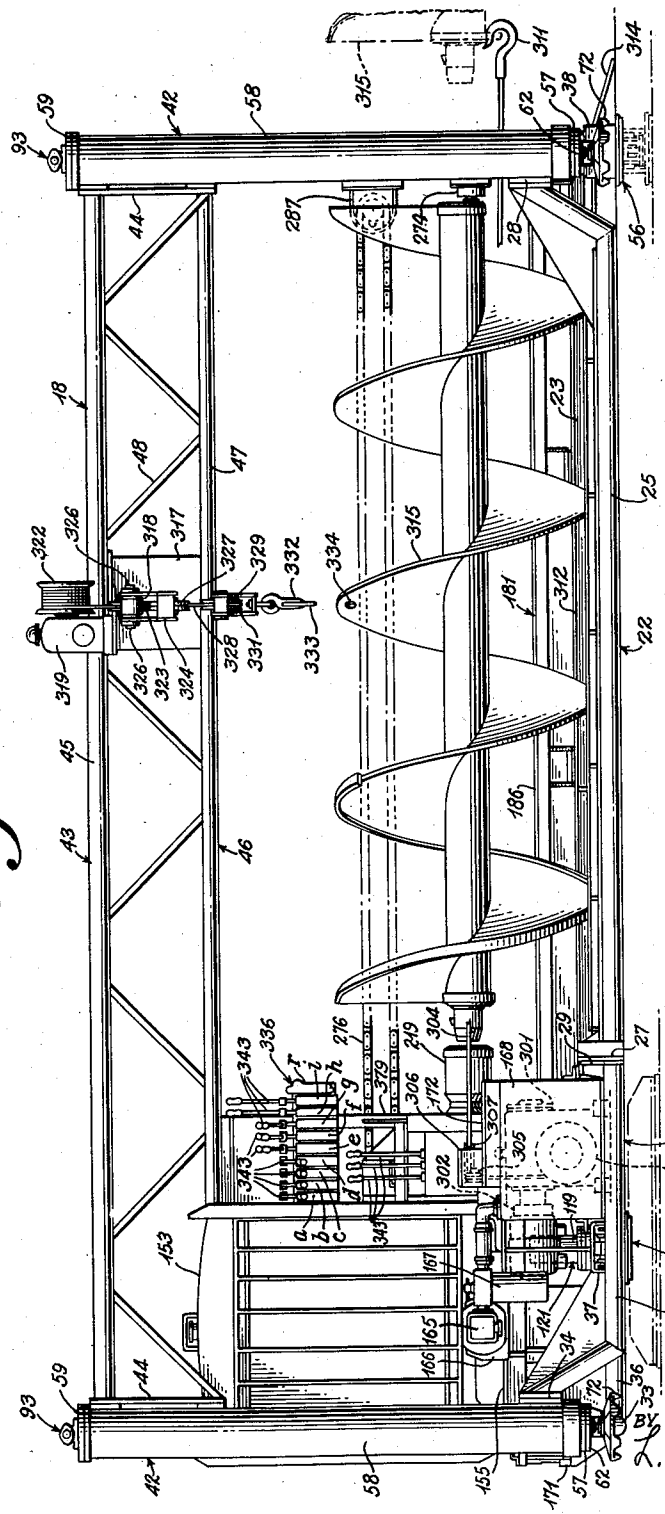


Fig. 2.

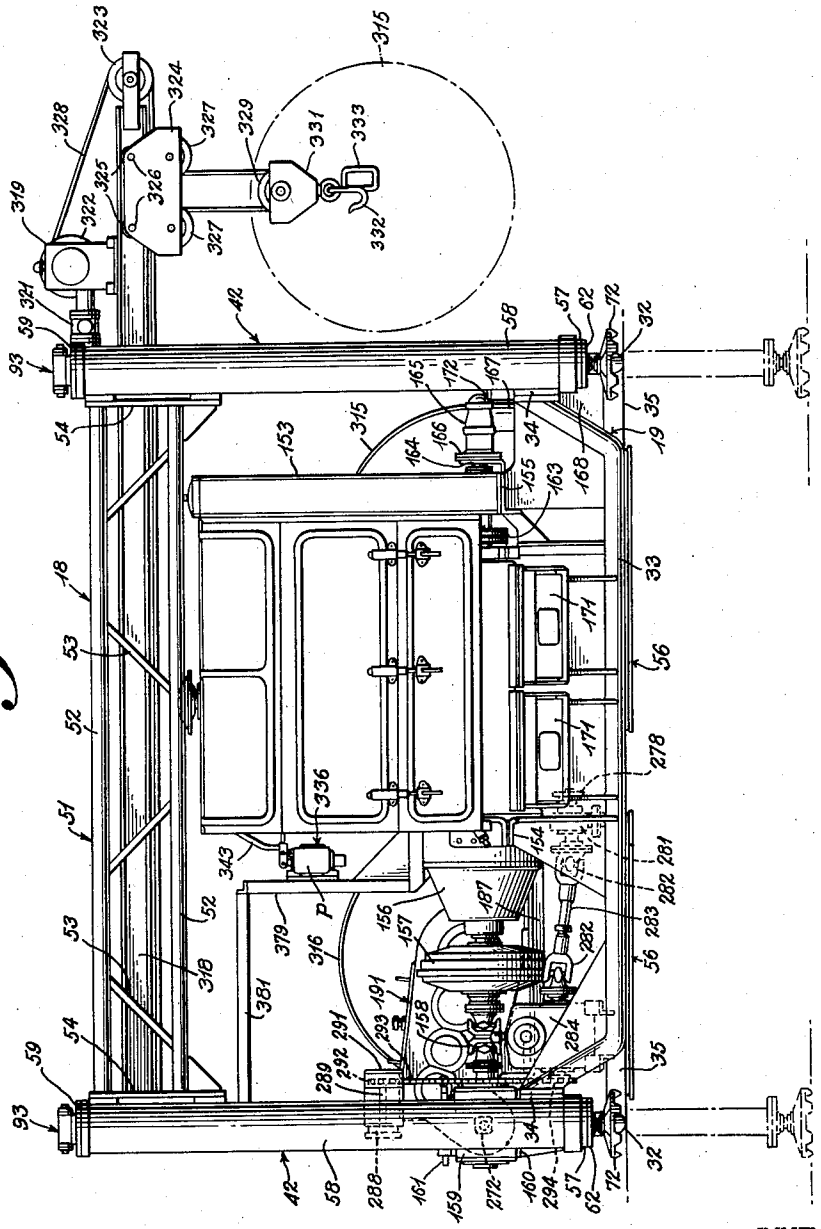
INVENTORS
JAMES A. SWANSON AND
DALLAS P. GRAHAM
BY
L. Donald Myers
ATTORNEY

Sept. 29, 1959 J. A. SWANSON ET AL 2,906,515

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Fig. 3.



INVENTORS
JAMES A. SWANSON AND
DALLAS P. GRAHAM

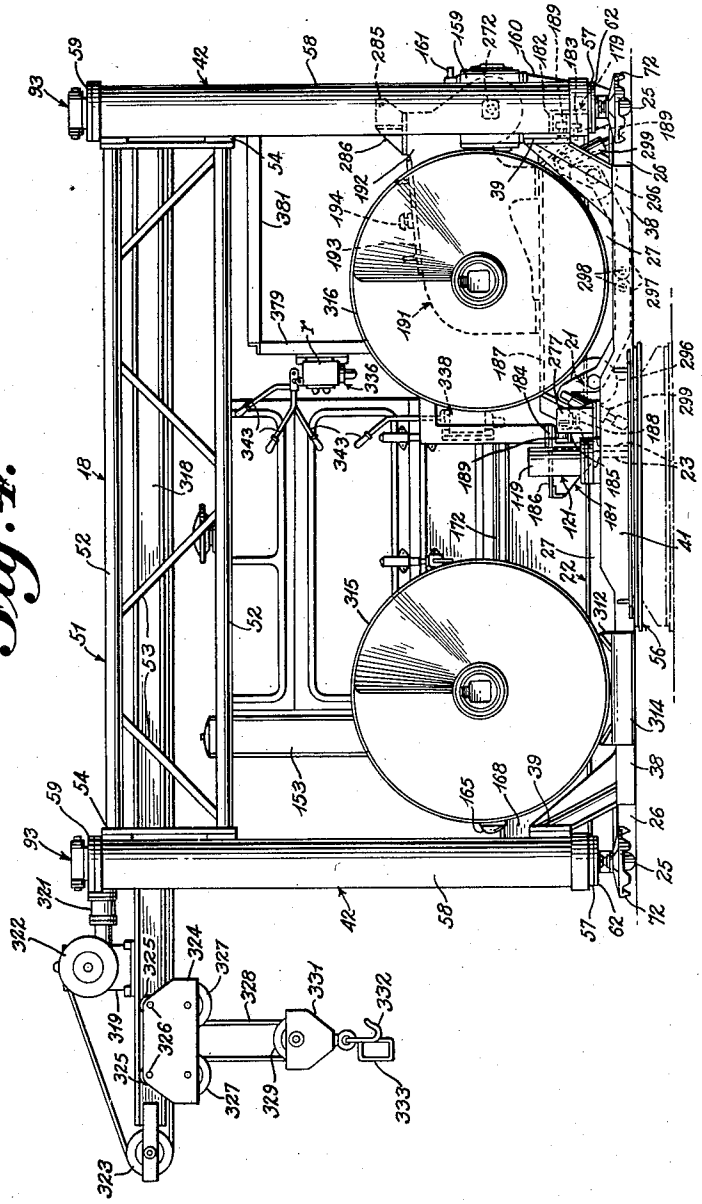
BY L. Donald Myers
ATTORNEY

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Fig. 4.



INVENTORS
JAMES A. SWANSON AND
DALLAS P. GRAHAM

BY L. Donald Myers
ATTORNEY

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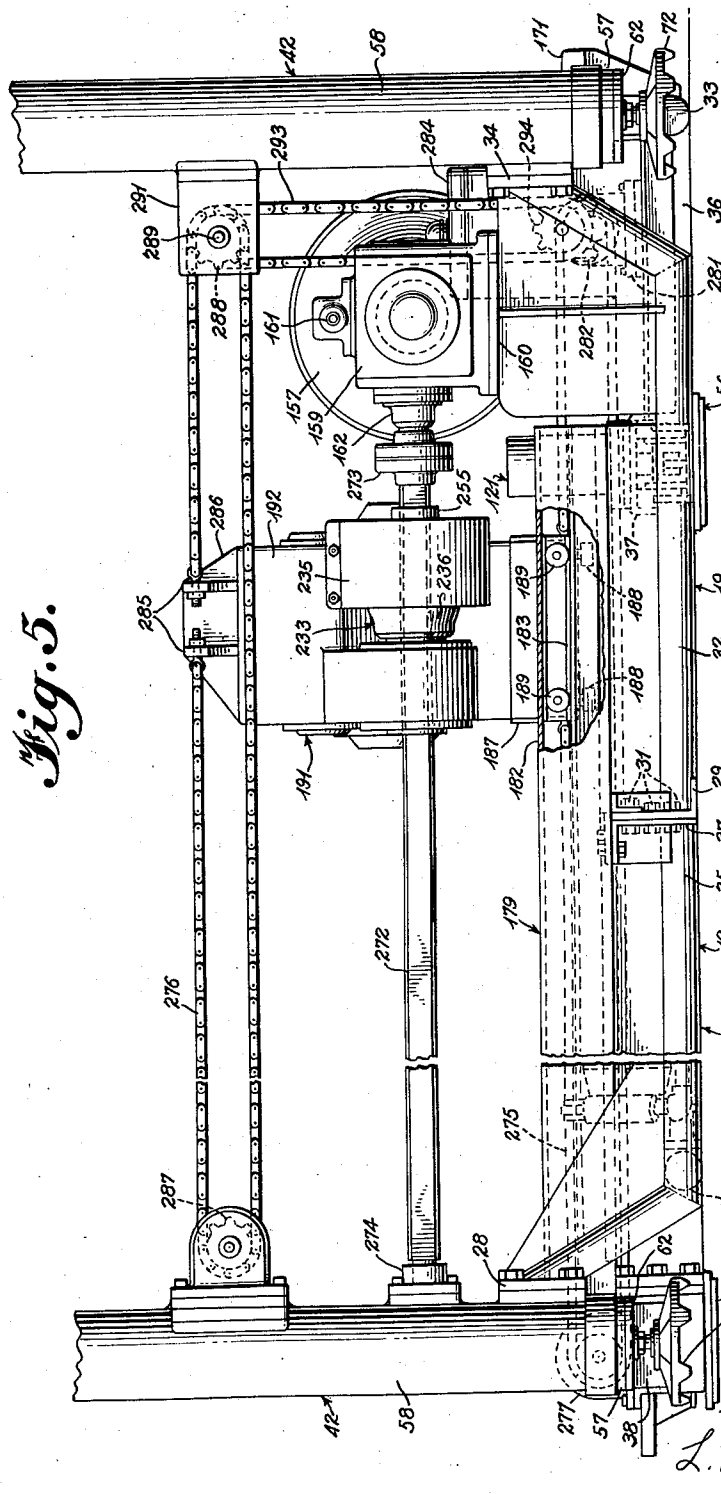


Fig. 5.

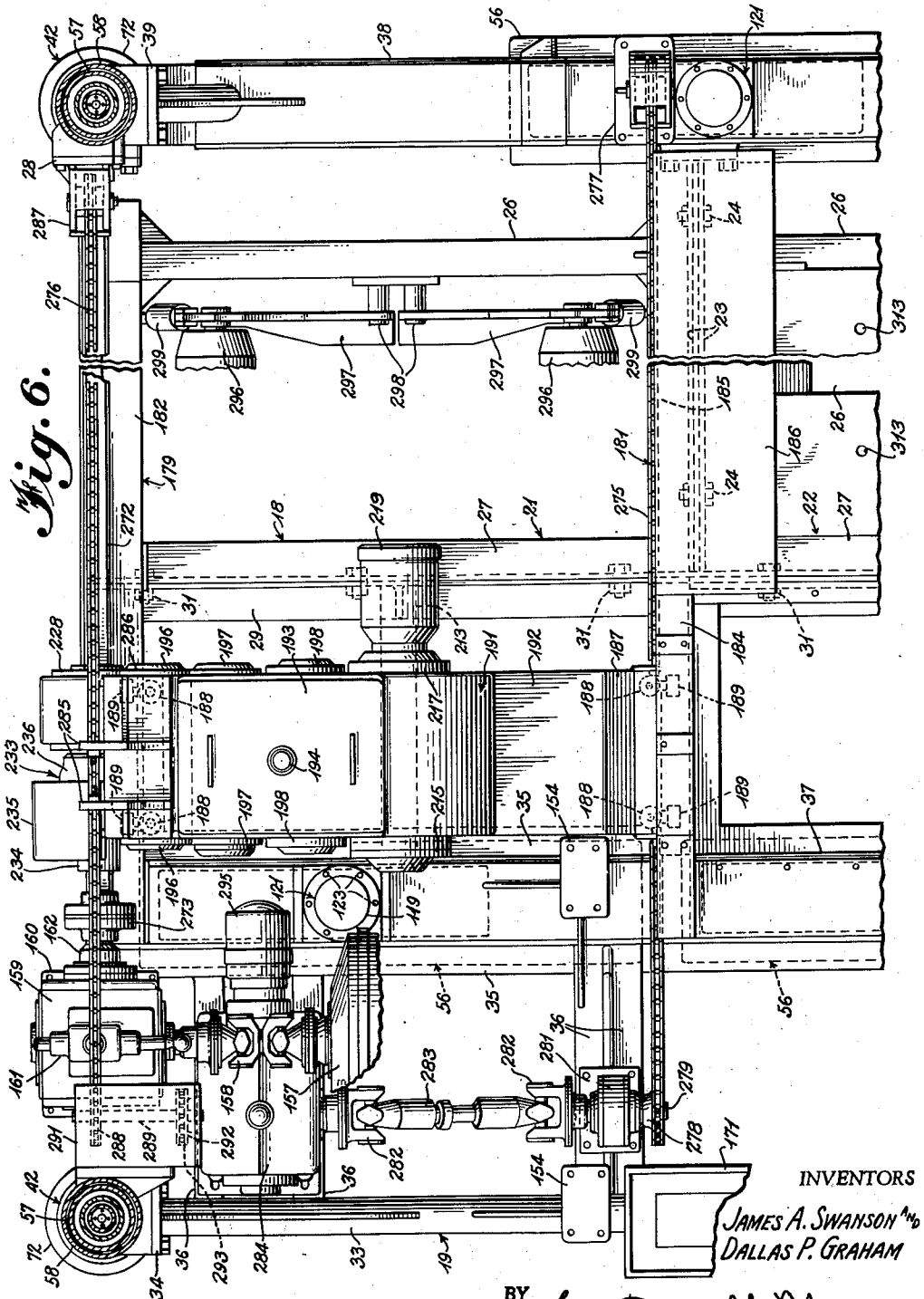
INVENTORS
JAMES A. SWANSON AND
DALLAS P. GRAHAM
BY
L. Donald Myers
ATTORNEY

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Fig. 6.



INVENTORS
JAMES A. SWANSON AND
DALLAS P. GRAHAM

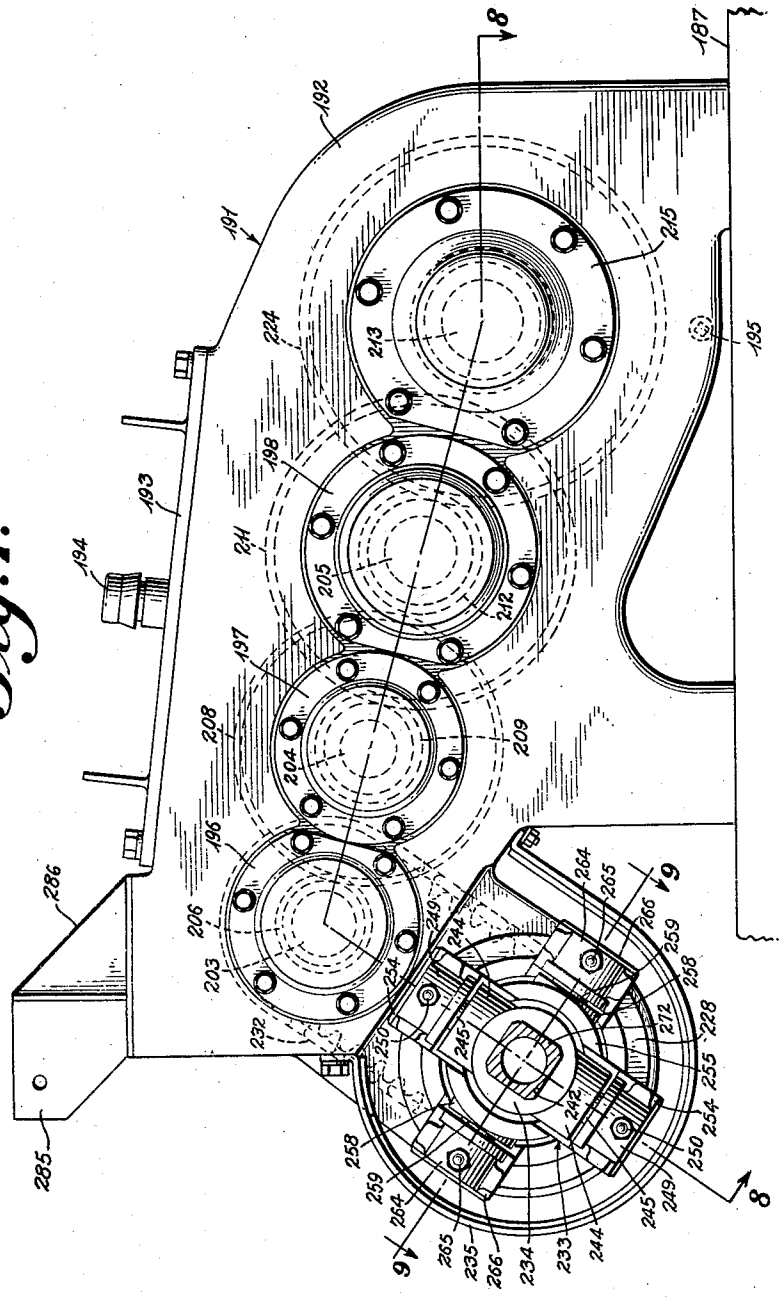
BY L. Donald Myers
ATTORNEY

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Fig. 7.



INVENTORS

JAMES A. SWANSON AND

DALLAS P. GRAHAM

BY L. Donald Myers

ATTORNEY

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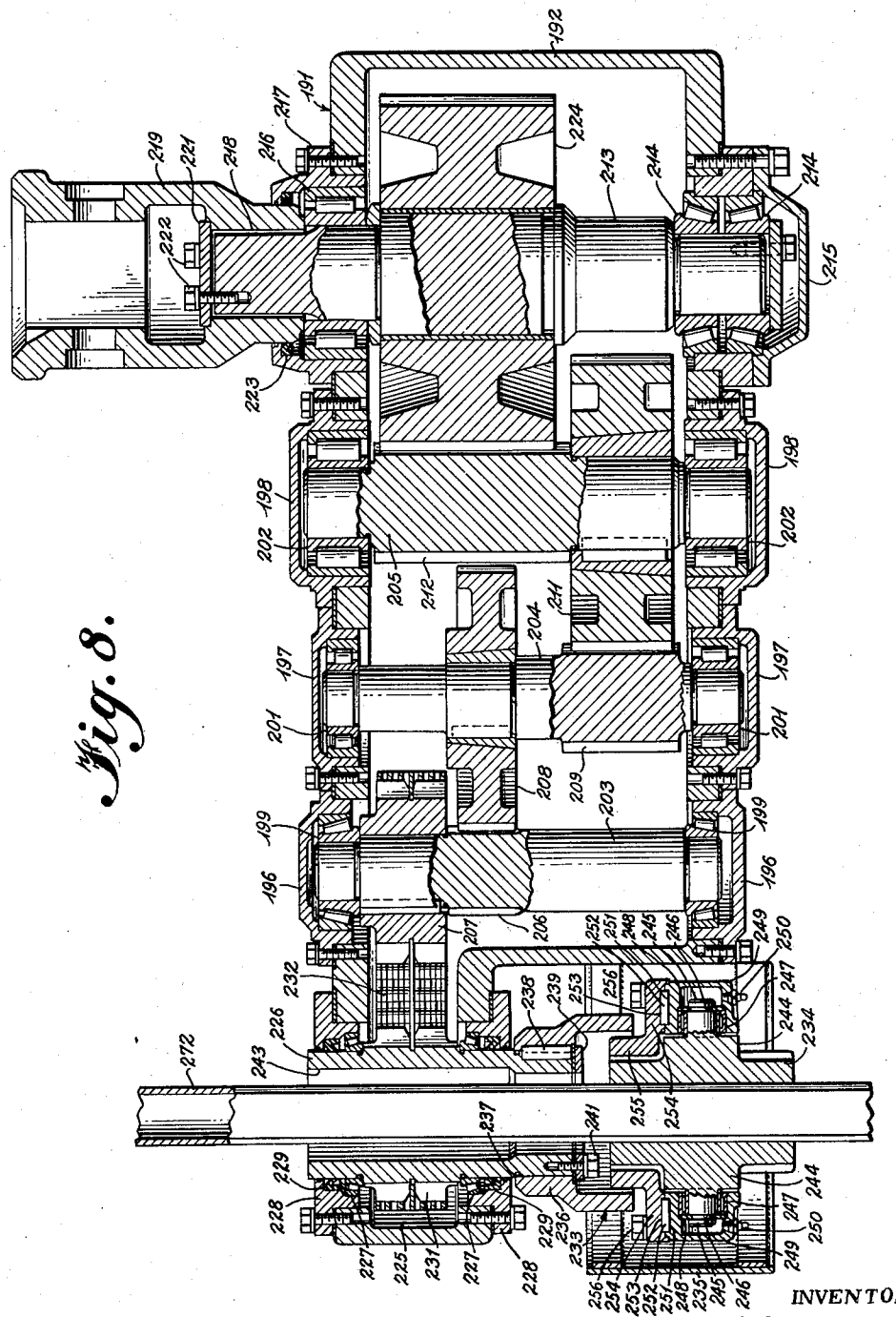


Fig. 8.

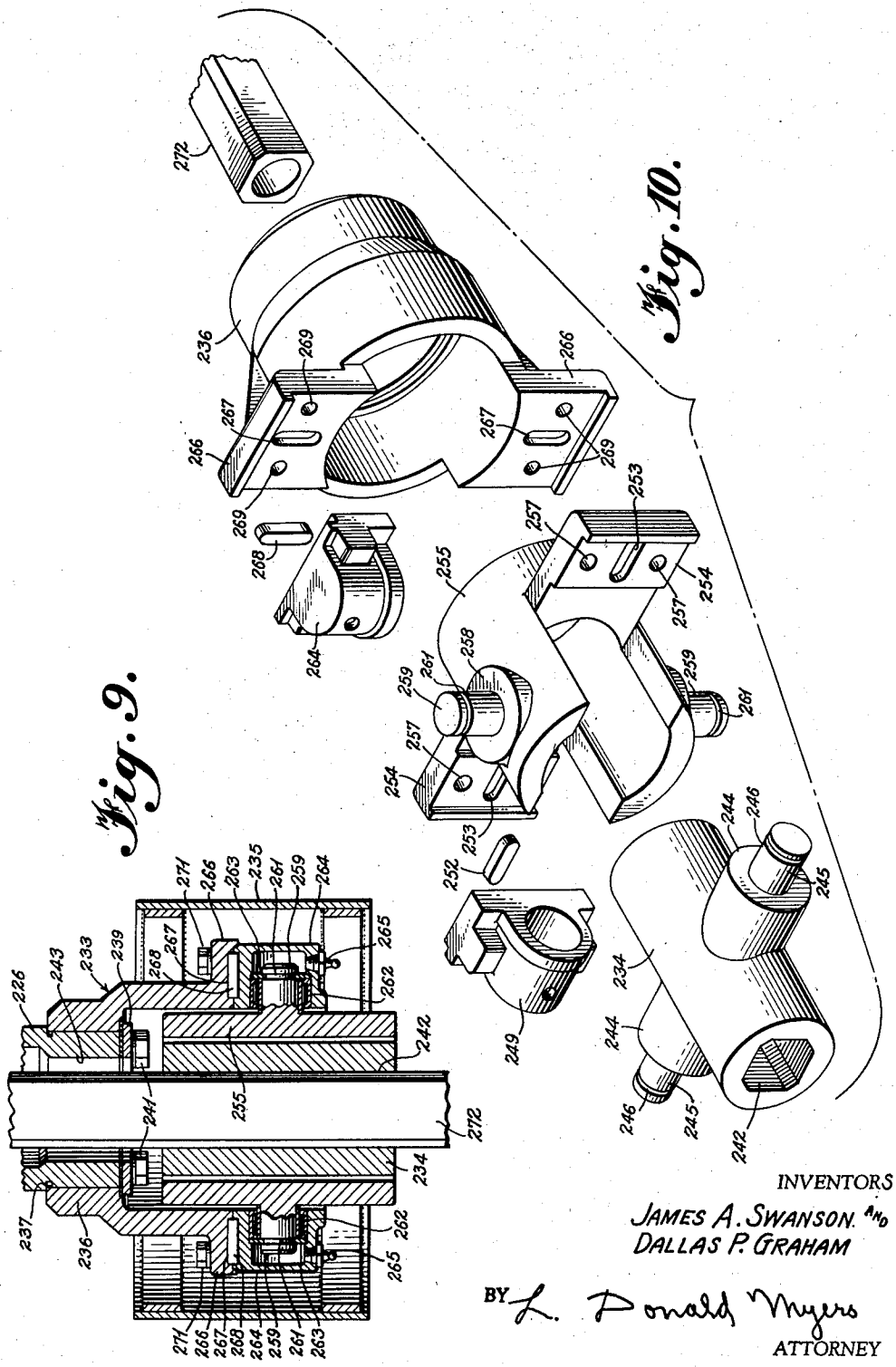
INVENTORS
JAMES A. SWANSON AND
DALLAS P. GRAHAM

BY L. Donald Myers
ATTORNEY

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INVENTORS

JAMES A. SWANSON AND
DALLAS P. GRAHAM

BY L. Donald Myers

ATTORNEY

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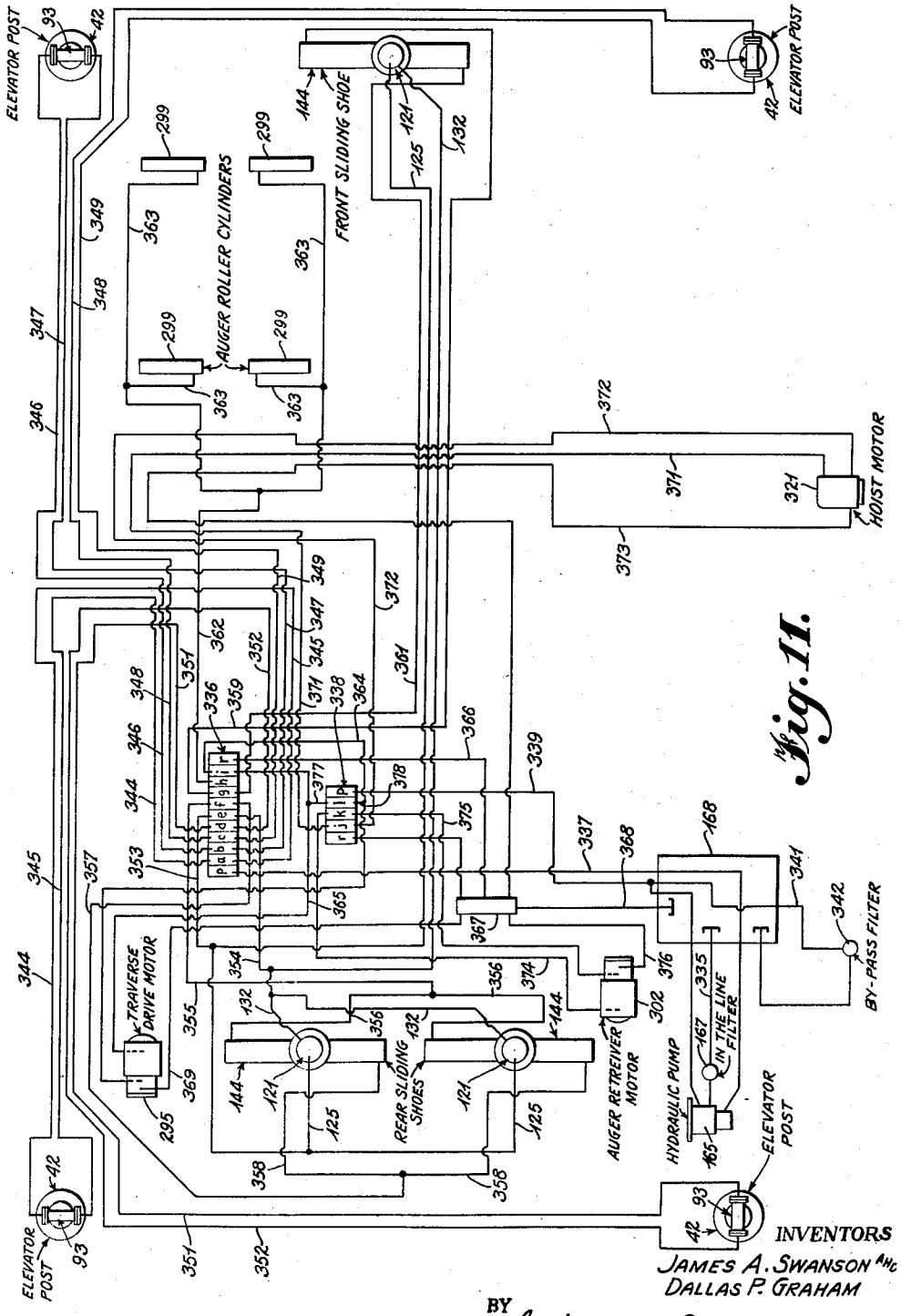


Fig. 11.

INVENTORS
JAMES A. SWANSON AND
DALLAS P. GRAHAM

BY L. Ronald Myers
ATTORNEY

United States Patent Office 2,906,515 Patented Sept. 29, 1959

2,906,515

AUGER TYPE MINING MACHINE

James A. Swanson, Chicago, and Dallas P. Graham, Homewood, Ill., assignors, by mesne assignments, to Chemetron Corporation, Chicago, Ill., a corporation of Delaware

Application July 22, 1955, Serial No. 523,907

9 Claims. (Cl. 262—26)

This invention relates to new and useful improvements in mining machines and deals more particularly with machines for recovering coal, or the like, by auger drilling operations.

One of the recently developed methods of mining coal, and the like, involves the use of augers which are driven into the exposed face of a seam or vein of the material being mined. One of the more common applications of this method arises in those mining operations where a pit is dug to a depth that will at least include the thickness of the vein of material to be mined. The drilling operation is then carried out from the floor of the pit or from one or more benches left standing adjacent the walls of the pit. This method is also utilized in some instances where an outcropping of the material to be mined occurs on the side of a slope or hill. In such instances, a relatively level bench is formed along the side of the hill to expose the face of the vein of material to be mined.

It will be readily apparent that whether the auger drilling machine used in the above described method is positioned on a bench or on the floor of a pit, a substantial amount of unproductive earth moving is necessary to prepare a site for the drilling operation. Further, the amount of earth moving necessary to prepare the site will depend upon the width of the pit or bench required to accommodate the drilling machine.

Since the augers used in the drilling operation may have a diameter of 48 inches, or more, and may be driven to a depth of two hundred, or more, feet, it will also be apparent that the auger drilling machine must be of such a size that any instability in the support therefor, or any possibility of failure of the support, would be extremely dangerous to the personnel operating the machine and would create a serious risk of damage to the machine itself.

Another serious problem encountered with prior types of auger drilling machines for use in mining operations has been the difficulty in providing a driving connection between the auger feeding portion of the machine and a stationary drive for rotating the auger. In other words, the advantages of providing a stationary drive for rotating the auger while it is being advanced have been offset by the difficulty in providing and maintaining a critical alignment between the drive and the direction of movement of the auger.

It is the primary object of the invention to provide an auger type mining machine which will operate from a narrow bench or pit floor.

A further important object of the invention is to provide an auger type mining machine the operation of which requires no storage space for the augers forming the drill train after the first hole is drilled.

Another important object of the invention is to provide a mining machine which is so supported as to substantially completely eliminate any possibility of the machine tipping or falling.

A further object of the invention is to provide an auger type mining machine designed to permit a limited amount of misalignment in the connection between a stationary drive for rotating the auger and the axis of the auger without undue stress on the auger train or drive.

A further object of the invention is to provide a mining machine which will rotate and advance an auger into a vein of the material to be mined and which will simultaneously and independently withdraw the auger from an adjacent completed hole into the frame of the machine for transfer of successive sections from the withdrawn auger to positions for attachment to the feed end of the advancing auger.

Additional objects of the invention are to provide a mining machine having a main frame which is of sectional construction for ease in transportation and maintenance; which is provided with independently driven mechanisms for rotating an auger, for advancing the auger, for withdrawing the auger from a completed hole, for transferring sections of the withdrawn auger to the feed end of the drilling auger, and which is provided with a retractable auger guide assembly for use in starting the drilling operation and for facilitating the connection of successive auger sections into the drill train.

Other objects and advantages of the invention will be apparent during the course of the following description.

In the accompanying drawings forming a part of this specification and in which like reference characters are employed to designate like parts throughout the same,

Figure 1 is a top plan view of a mining machine embodying the invention,

Figure 2 is a side elevational view of the machine illustrated in Fig. 1,

Figure 3 is a rear end elevational view of the machine of Fig. 1,

Figure 4 is a front end elevational view of the machine of Fig. 1,

Figure 5 is a fragmentary elevational view, partly broken away, taken from the side of the machine opposite that illustrated in Fig. 2,

Figure 6 is a fragmentary top plan view, partly broken away, of the drive end portion of the machine,

Figure 7 is a rear elevational view of the traversing drive drive mechanism employed in the machine of Fig. 1,

Figure 8 is a sectional view taken on line 8—8 of Fig. 7,

Figure 9 is a sectional view taken on line 9—9 of Fig. 7,

Figure 10 is an exploded view showing the different elements of the universal joint employed in the drive mechanism of Fig. 7, and

Figure 11 is a diagrammatic view of the hydraulic system of the machine.

In the drawings, wherein, for the purpose of illustration is shown the preferred embodiment of this invention, and first particularly referring to Figs. 1 to 6, inclusive, there is shown a mining machine, the various component parts of which are mounted on a frame designated in its entirety by the reference character 18. This frame com-

prises a plurality of subassemblies which are separately fabricated to facilitate movement from one location to another and which are so constructed that the entire frame can be easily and quickly assembled at any location at which the machine is to be used.

Considering first the rectangular base or bottom portion of the frame **18**, it is assembled from an outer or drive end section **19** extending transversely across the outer end of the frame, as viewed in Fig. 1, and from left-hand and right-hand sections **21** and **22**, respectively, which extend longitudinally of the frame, as illustrated at the top and bottom, respectively, of Fig. 1. The adjacent sides of the left-hand and right-hand sections **21** and **22** are formed of channels **23**, as illustrated in Fig. 4, which are rigidly connected to each other by belts **24**, as is best illustrated in Fig. 6. The outer sides of the two sections **21** and **22** are formed of tubular members **25** which are rigidly connected to the channels **23** by a plurality of transversely extending tubular members **26**. The inner ends of the left-hand and right-hand sections **21** and **22**, which are adjacent the drive section **19**, are formed of angle members **27** which extend between and are rigidly connected to the channels **23** and the tubular members **25** at opposite sides of each section. The opposite ends of the tubular members **25** at the outer sides of the sections **21** and **22** are inclined angularly upwardly and are each provided with a mounting pad **28** for a purpose that will be later described.

The drive section **19** is formed with an angle member **29** at its inner side for connection to the angle members **27** by bolts **31**, as illustrated in Fig. 6. The ends and outer side of the drive section **19** are formed of tubular members **32** and **33**, respectively, which are inclined upwardly at the corners of the frame and are provided with mounting pads **34** for a purpose that will be later described. Extending longitudinally of the drive end section **19** and transversely of the frame **18** are two spaced tubular members **35** which are rigidly connected at their ends to the tubular members **32** and to the adjacent angle member **29** or tubular member **33** by a plurality of laterally extending tubular members **36**. An inverted channel member **37** overlies the space between and is rigidly connected to the tubular members **35**.

At the opposite end of the frame **18** from the drive end section **19**, the channel members **23** of the left-hand and right-hand sections **21** and **22** are rigidly connected to an end piece or sill **38** which is formed of an inverted channel member having its opposite end portions inclined angularly upwardly and provided with mounting pads **39**. As best illustrated in Fig. 4, the depth of the channel member from which the sill **38** is formed is increased at the middle portion **41** of the sill for a purpose that will be later described.

At each corner of the frame **18** there is provided a vertically arranged elevator post **42**. It will be noted, however, that the lower end portions of the elevator posts **42** are connected to the mounting pads **34** of the drive end section **19** and to the mounting pads **28** and **39** of the left-hand and right-hand sections **21** and **22** and the sill **38**, respectively, in such a manner that the lower end of each elevator post is retractable to a position above the bottom level of the frame **18**.

The upper end portions of the elevator posts **42** at the right-hand side of the frame **18** are rigidly connected to each other by a truss **43** which extends longitudinally between the two elevator posts and is provided with structurally reinforced mounting brackets **44** for connection to the elevator posts. The middle portion of the truss **43** consists of a single tubular member **45** so that the right side of the frame **18** is substantially open and unobstructed.

The elevator posts **42** at the left-hand side of the frame **18** have their upper end portions connected by a truss **46** formed of vertically spaced tubular members **47** which are connected by angularly arranged struts **48** and are provided with mounting pads **49** at their end portions for connection to the posts **42**.

A truss **51** extends laterally between and is rigidly connected to the elevator posts **42** at each end of the frame **18**, each truss **51** being formed of a pair of vertically spaced tubular members **52** connected by angularly arranged struts **53** and provided with mounting pads **54** at their opposite end portions for connection to the posts **42**. The trusses **51** at opposite ends of the frame **18** are connected to the side trusses **43** and **46** at each corner of the frame by corner braces **55** which extend angularly between the trusses.

The above described structure of the frame **18** provides a strong and rigid support for the operating components of the machine. Further, mobility is provided for the machine by the elevator posts **42** at the corners of the frame **18**, which are employed to raise and lower the frame, and by sliding shoes **56** mounted at laterally spaced points on the bottom of the drive portion **19** and at the middle portion **41** of the sill **38**. The sliding shoes **56** are employed for moving the frame **18** in any desired direction along the surface on which the machine is to be operated.

Referring now to Figs. 1 to 6 for a description of the four identical elevator posts **42**, it will be noted that an inner housing member **57** is telescopically arranged within the outer housing member **58**, the latter being rigidly connected to the frame **18** as previously described. A cap **59** is mounted on the upper end of the outer housing member **58** and a cap **62** is mounted on the lower end of the inner housing member **57**.

Mounted on the bottom surface of the cap **62** at the lower end of the elevator post **42** is a cleated foot **72**.

The sliding shoe **56** mounted on the middle portion **41** of the sill **38** and the two sliding shoes **56** mounted at spaced points along the channel **37** of the drive section **19** are of identical construction and are best illustrated in Figs. 1 to 6.

Referring once again to Figs. 1 to 6, inclusive, for a detail description of the power plant employed for operating the machine, an internal combustion engine **153** is mounted on the drive end section **19** of the frame, the engine being supported on pedestals **154**, as best illustrated in Fig. 6, and a pedestal **155**, as best illustrated in Figs. 2 and 3. At the power output end of the engine **153** its drive shaft is connected to a power take off assembly, including a clutch, within the housing **156**, a twin hydraulic coupling **157** of traction design, a universal joint **158**, and a bevel gear transmission unit **159**. The bevel gear transmission unit **159** is mounted on a pedestal **160** that is rigidly connected to the frame **18** and is provided with a gear shifting mechanism **161** by means of which the direction of rotation of the power output shaft **162** may be reversed or stopped while the engine **153** continues to operate.

At the fan end of the engine **153**, its drive shaft is extended past the fan pulley **163** and is drivingly connected to the driven shaft **164** of a "Vickers" double pump **165** which is of conventional vane type construction and is mounted on a bracket **166** carried by the pedestal **155**. The inlet port of the double pump **165** is connected through a filter **167** to a hydraulic tank **168** which is supported on the angle **29** and channel **37** of the drive end section **19** adjacent the right-hand side of the frame **18**. The two outlet ports of the double pump **165** supply the pressure fluid for operating all of the fluid motors of the machine and are connected into the hydraulic circuit of the machine in a manner which will be later described.

Mounted on the drive end section **19** of the frame **18** between the angle **29** and channel **37** and inwardly of the hydraulic tank **168** is a fuel tank **169** for the engine **153**. The batteries for the engine **153** are carried on brackets **171** that are rigidly mounted on the tubular member **33** at the outer side of the drive end section

19. As is best illustrated in Figs. 1 and 2, a catwalk 172 is mounted on the frame 18 in overlying relationship with the tanks 168 and 169. Another catwalk 173 is suitably mounted to extend longitudinally along the outer side of the right-hand section 22 of the frame 18 and additional catwalks 174, 175 and 176 extend transversely across the right-hand section and are supported on angles 178 which extend longitudinally between the transverse tubular members 26.

Mounted on and extending longitudinally along the inner and outer sides of the left-hand section 21 of the frame 18 and into overlying relationship with the adjacent portions of the drive end section 19 are two track assemblies 179 and 181 respectively.

As best illustrated in Figs. 4 to 6, inclusive, the track assembly 179 is formed with an inwardly projecting top flange 182 and with an angle member 183 rigidly mounted in spaced relationship below the top flange to provide a horizontal surface spaced downwardly from the top flange and a vertical surface extending downwardly from the inner edge of the horizontal surface. As illustrated in Fig. 4, the track 181 at the inner side of the left-hand section 21 is also formed with an inwardly projecting top flange 184 and with an angle member 185 rigidly mounted in spaced relationship below the top flange to provide a horizontal surface spaced downwardly from the bottom surface of the top flange and a vertical surface projecting downwardly from the inner edge of the horizontal surface. The inner track assembly 181 is also provided with a catwalk 186 which is suitably mounted on the top of the track assembly and extends longitudinally along the inner side of the left-hand section 21.

Mounted for longitudinal movement along the track assemblies 179 and 181 is a carriage 187 having pairs of right angularly arranged rollers 188 and 189 at each corner thereof for engaging the vertical and horizontal surfaces, respectively, of the angle members 183 and 185 to facilitate and guide the movement of the carriage. Mounted on the carriage 187 is a power transmission unit 191 which is best illustrated in Figs. 7 to 10, inclusive, and will be described in detail as follows:

The transmission unit 191 is encased within a housing 192 which is suitably mounted on the carriage 187 and is provided with a removable cover plate 193 having a filler plug 194 thereon. A drain plug 195 is provided adjacent the bottom of the housing 192. Mounted on the front and rear walls of the housing 192 are three axially aligned pairs of bearing caps 196, 197 and 198 having mounted therein aligned pairs of antifriction bearings 199, 201 and 202, respectively, for supporting the countershafts 203, 204 and 205. The countershaft 203 is formed with a toothed gear portion 206 and a drive chain sprocket 207 is keyed to the shaft adjacent the toothed gear portion. Keyed to the countershaft 204 in meshing engagement with the toothed gear portion 206 of the countershaft 203 is a pinion gear 208 and the shaft 204 is also provided with a toothed gear portion 209. A pinion 211 is keyed to the countershaft 205 and meshes with the toothed gear portion 209 of the countershaft 204. The countershaft 205 is also provided with a toothed gear portion 212. The driven shaft 213 of the transmission unit 191 is rotatably supported at the rear wall of the housing 192 by antifriction thrust bearings 214 which are mounted in a bearing cap 215. The driven shaft 213 extends longitudinally through the housing 192 and projects forwardly from the front wall thereof where it is supported by an antifriction bearing unit 216 which is mounted in a support ring 217. The forwardly projecting end portion of the driven shaft 213 is splined at 218 for receiving a chuck 219 which is clamped onto the shaft by a clamping plate 221 and screws 222. A seal member 223 is carried by the mounting ring 217 in sealing engagement with the outer surface of the chuck 219 adjacent the bearing unit 216.

That portion of the driven shaft 213 adjacent the bearing unit 216 and within the housing 192 is splined to receive a pinion gear 224 which meshes with the toothed gear portion 212 of the countershaft 205.

A portion of the housing 192 adjacent the countershaft 203 is reduced in longitudinal dimension to provide a chamber 225 in radial alignment with the drive chain sprocket 207. Extending longitudinally through the chamber 225 is a drive sleeve 226 which is rotatably supported by thrust bearing units 227 carried by mounting rings 228 on the front and rear walls of the housing.

Seal members 229 are carried by both of the mounting rings 228 in sealing engagement with the outer surface of the sleeve 226. Formed on the outer surface of the sleeve 226 within the chamber 225 is a drive chain sprocket 231 which is radially aligned with the drive chain sprocket 207 for receiving the drive chain 232 by means of which rotation of the sleeve will effect rotation of the countershaft 203. One end portion of the sleeve 226 projects rearwardly from the housing 192 and has rigidly mounted thereon a universal joint, designated in its entirety by the reference character 233, which supports a sleeve 234 for limited universal movement relative to the sleeve 226. A guard 235 is mounted on the housing 192 and extends circumferentially around the universal joint 233 in spaced relationship therewith.

Referring now to Figs. 8 and 9, it will be noted that the outer member 236 of the universal joint 233 is fitted over the rearwardly projecting end portion of the sleeve 226 into abutting relationship with the shoulder 237 on the sleeve. A key 238 prevents relative rotation between the outer member 236 and the sleeve 226 and the outer member is clamped against the shoulder 237 by a clamping plate 239 which is mounted on the end of the sleeve by screws 241.

Referring now to Figs. 8, 9 and 10 for a detail description of the structure and assembly of the various parts of the universal joint 233, it will be noted that the sleeve 234 is cylindrically shaped and that the bore 242 of the sleeve is formed with flat, opposed surfaces. The radial dimensions of the bore 242 are smaller than those of the bore 243 of the sleeve 226, for a purpose that will be later described. Extending radially outwardly in opposite directions from lugs 244 on opposite sides of the sleeve 234 are a pair of pivot pins 245 each having a circumferentially extending groove 246 in the outer end portion thereof. An antifriction bearing unit 247 is fitted onto each of the pins 245 and is retained thereon by a snap ring 248 which is positioned in groove 246. Fitted over each bearing unit 247 and pin 245 is a bearing cap 249 which is provided with a tapped opening for receiving a lubrication fitting 250. Each of the bearing caps 249 is also provided with a flat mounting face on one side thereof into which are formed a key slot 251 and two tapped holes, not shown.

After the bearing caps 249 have been assembled on the sleeve 234, as described above, keys 252 are fitted into the key slots 251 and into corresponding key slots 253 in the mounting pads 254 of the bifurcated cylindrical joint member 255. The bearing caps 249 are thereafter secured to the mounting pads 254 by means of screws 256 which pass through openings 257 in the mounting pads and are threaded into the tapped openings in the bearing caps. The bore of the joint member 255 is slightly larger than the outer surface of the sleeve 234 so that the sleeve may partake of limited pivotal movement about the axis of the pins 245.

Extending radially outwardly from lugs 258 on opposite sides of the joint member 255 are a pair of axially aligned pivot pins 259 the axes of which lie in the plane of and in normal relationship with the axes of the pins 245. Each of the pins 259 is provided with a circumferentially extending groove 261 adjacent its outer end portion so that antifriction bearing units 262 may be fitted onto the pins and retained thereon by snap rings 263 in

the same manner as was employed in connection with the pins 245. After the bearings 262 have been assembled on the pins 259, a pair of bearing caps 264, which are identical to the bearing caps 249, are fitted onto the bearings for relative pivotal movement between the caps and the pins. Each of the caps 264 has mounted thereon a fitting 265 through which lubricants may be introduced to the associated bearing 262.

After the bearing caps 264 have been assembled on the bearings 262 and pins 259, as described above, the bearing caps are rigidly connected to mounting pads 266 which extend radially outwardly from the joint member 236 and are provided with key slots 267 for receiving keys 268 and openings 269 for receiving the cap screws 271 by means of which the bearing caps are connected to the mounting pads. The bore of the outer joint member 236 is of larger diameter than the outer surface of the joint member 255 so that the joint member 255 is permitted to partake of limited pivotal movement about the axis of the pins 259.

Fitted into the bore 242 of the sleeve 234 and extending longitudinally through the bore 243 of the sleeve 226 is an elongated drive bar 272. The clearance between the outer surface of the drive bar 272 and the bore 243 permits limited universal movement of the bar relative to the sleeve. The fitted relationship between the bar 272 and the bore 242 of the sleeve 234, however, will cause rotation of the sleeve 234 when the bar is rotated and, acting through the universal joint 233, will effect corresponding rotation of the sleeve 226 and the drive sprocket 231 which is formed on the outer surface of the sleeve. Rotation of the bar 272, therefor, will act successively through the drive chain 232, the drive chain sprocket 207, the gear portion 206, the pinion 208, the gear portion 209, the pinion 211, the gear portion 212, and the pinion 224 to effect rotation of the driven shaft 213 and its attached chuck 219.

As is best illustrated in Fig. 5, the transmission unit 191 is so positioned on the carriage 187 that the drive bar 272 is axially aligned with the output shaft 162 of the bevel gear transmission unit 159. One end of the drive bar 272 is connected to the output shaft 162 by a flexible coupling 273 and the opposite end of the drive bar is connected to the longitudinally aligned elevator post 42 by means of a bearing support 274 which permits free rotation of the bar.

As is best illustrated in Figs. 5 and 6, the carriage 187 and the transmission unit 191 mounted thereon are moved longitudinally of the frame 18 by a drive chain 275, positioned adjacent the track 181, and a drive chain 276, positioned at the left side of the frame. The ends of the chain 275 are connected to opposite sides of the carriage 187 and the chain is trained around an idler sprocket 277 mounted on the sill 38 and a drive sprocket 278 mounted on the tubular members 36 of the drive end section 19 of the frame. The shaft 279 of the drive sprocket 278 is supported for rotation by a bearing 281 and is connected through universal joints 282 and a torque tube 283 to a conventional worm gear drive 284.

The ends of the chain 276 are connected to ears 285 of a bracket 286 which is mounted on the top of the transmission unit 191 in longitudinal alignment with the elevator posts 42 at the left side of the frame 18 and the chain is trained around an idler sprocket 287, mounted on the elevator post 42 at the forward end of the frame, and a drive sprocket 288, mounted on a shaft 289 carried by a bracket 291 on the elevator post 42 at the drive end of the frame. Mounted in axially spaced relation with the drive sprocket 288 on the shaft 289 is a second sprocket 292 which is connected by a drive chain 293 to a drive sprocket 294 on the output shaft of the worm gear drive 284. Th worm gear drive 284 is powered by a conventional, vane type rotary fluid motor 295 which is mounted directly on the housing of the worm gear drive.

It will be readily apparent that actuation of the fluid motor 295 to effect rotation of the worm gear drive 284 will effect synchronized rotation of the two drive sprockets 278 and 288 for the chains 275 and 276, respectively. The chains 275 and 276 are thereby moved to effect movement of the carriage 187 along its supporting tracks 181 and 182. The fluid motor 295 is, of course, reversable so that the direction of movement of the carriage 187 may be reversed when the carriage has been moved to either end of its path of travel. The manner in which the fluid motor 295 is supplied with pressure fluid to control the periods and direction of operation of the motor will be fully described in connection with the complete hydraulic system of the machine.

Referring now to Figs. 1, 4 and 6 for a detail description of the support rollers 296 mounted on the outer end portion of the left-hand section 21 of the frame 18, it will be noted that each roller extends longitudinally between and is rotatably mounted on the free end portions of a pair of pivot arms 297. The arms 297 of each pair are pivotally supported at the middle portion of the transverse tubular members 26 of the left-hand section 21 of the frame 18 by pins 298 so that pivotal movement of the arms will cause the rollers 296 to move toward and away from the projected axis of the chuck 219. Connected between the free end of each pivot arm 297 and the adjacent side member 23 or 25 of the left-hand section 21 of the frame 18 is a conventional reciprocating type fluid motor 299. All of the motors 299 are connected to a common source of pressure fluid so that actuation of the motors will effect simultaneous movement of the rollers 296 upwardly and inwardly toward the projected axis of the chuck 219. The release of pressure fluid from the motors 299, on the other hand, will permit the weight of the rollers 296 to return the pivot arms 297 to their retracted positions, as illustrated in Fig. 4. It will be noted, that when the pivot arms 297 and rollers 296 are in their retracted positions, sufficient clearance is provided for movement of the carriage 187 into overlying relationship with the arms and rollers. The manner in which the supply of pressure fluid to the motors 299 is controlled will be fully described at a later point in connection with the complete hydraulic system of the machine.

As is best illustrated in Figs. 1 and 2, a worm gear drive 301 is mounted on the drive end portion 19 of the frame 18 between the hydraulic tank 168 and the fuel tank 169 and beneath the catwalk 172. The worm gear drive 301 is powered by a conventional vane type rotary fluid motor 302 the operation of which will be later described in connection with the hydraulic system for the complete machine. Mounted on the output shaft of the worm gear drive 301 is a drum 303 for receiving a cable 304 which extends upwardly from the drum and is trained laterally over a pulley 305 carried by the bracket 306 above the top surface of the catwalk 172. From the pulley 305, the cable 304 extends laterally to a pulley 307 which is rotatable about a vertically arranged pin 308 to guide the movement of the cable longitudinally of the frame 18. The pin 308 is selectively positioned in laterally spaced holes 309 in the bracket 306 to permit lateral adjustment of the point of support for the cable 304 provided by the pulley 307. A hook 311 is mounted on the end of the cable 304 for a purpose that will be later described.

Extending longitudinally of the right-hand section 22 of the frame 18 from the drive end section 19 to the sill 38 is a shallow pan 312 which rests upon and is supported by the transverse catwalks 174, 175 and 176. The pan 312 is mounted on catwalks 174, 175 and 176 by parts, not shown, which cooperate with laterally spaced holes 313 in the catwalks so that the position of the pan can be laterally adjusted into substantial alignment with the support provided by the pulley 307 for the cable 304. At the end portion of the pan 312 adjacent the sill 38, a ramp 314 extends downwardly and outwardly from the sill.

It will be readily apparent, that when the fluid motor 302 is operated in a direction to pay out the cable 304, the hook 311 may be drawn longitudinally of the frame above the pan 312 for connection to a drilling implement such as the auger section 315 as illustrated by broken lines in Fig. 2. Operation of the motor 302 in the opposite direction will thereafter cause the auger section 315 to be drawn longitudinally onto the pan 312 to the position illustrated in full lines in Figs. 1 and 2. The ramp 314 facilitates this movement of the auger section 315 onto the pan 312.

Referring now to Figs. 1 to 4, inclusive, for a detail description of the mechanism for transferring the auger sections from the position occupied by the auger section 315 laterally across the frame 18 to the position occupied by the auger section 316 of Fig. 1 or from a position adjacent the right-hand side of the frame to either of the positions occupied by auger sections 315 and 316, there is suspended from the tubular member 45 of the truss 43 and from a plate 317 extending vertically between the members 47 of the truss 46 an I-beam 318 which extends laterally across the frame and projects outwardly from the right-hand side of the frame. Mounted on the top of the outwardly projecting end portion of the beam 318 is a worm gear drive 319 which is powered by a conventional vane type rotary fluid motor 321 and has mounted on its output shaft a drum 322. The periods and directions of operation of the fluid motor 321 will be fully described in connection with the complete hydraulic system of the machine.

Mounted on the projecting end of the beam 318 is a pulley 323 and a hoist carriage 324 is suspended for longitudinal movement along the beam by wheels 325 which are mounted on stub axles 326 projecting inwardly from the sides of the carriage. A pair of pulleys 327 are mounted on the hoist carriage 324 in longitudinally spaced relationship below the beam 318. Wound onto the drum 322 is a cable 328 which is trained around the pulley 323 at the end of the beam 318 and is anchored to the truss 46 at the opposite side of the frame 18. Between the pulleys 327, the cable 328 is formed into a depending loop which passes around a pulley 329 of a block 331 to support the latter for vertical movement in accordance with the length of the depending loop. In other words, as the cable 328 is wound onto and off of the drum 322, the length of the depending loop between the pulleys 327 will be decreased and increased, respectively, to vary the height of the block 331. On the other hand, the drum 322 may be held in a fixed position while the hoist carriage 324 is moved laterally across the frame and the block 331 will remain at a given elevation during this lateral movement of the carriage. Mounted on the block 331 is a hook 332 having a handle 333 formed thereon to facilitate insertion of the hook into holes 334 near the longitudinal midpoint of an auger section, as illustrated in Fig. 2.

It will be readily apparent that the hoist carriage 324 may be moved longitudinally along the beam 318 to a position above an auger section on the pan 312, or adjacent the side of the frame 18, and the block 331 thereafter lowered by actuation of the motor 321 to a position at which the hook 332 may be inserted into the hole 334 of the auger section. The direction of operation of the motor 321 is thereafter reversed to shorten the cable 328 and raise the auger section to a level at which the hoist carriage 324 may be moved laterally across the frame 18 without interference between the auger section and the track assembly 181. The block 331 is then lowered to position the auger section in axial alignment with the chunk 219 and the carriage 187 is advanced to a position at which the auger section may be coupled to the chuck. The supporting rollers 226 are thereafter elevated to positions of engagement with the auger section, at which time the hook 332 may be disengaged from the auger section and the hoist carriage 324 moved to the right-hand side of the frame 18.

Referring now to Fig. 11 for a detail description of the hydraulic system incorporated in the machine, it will first be noted that the vane type double pump 165 includes two vane carrying rotors mounted in a single housing on a common drive shaft and receiving their supply of fluid through a common inlet port. Separate pressure fluid outlet ports are provided for the two rotors of the pump. The inlet port of the pump 165 is connected to the hydraulic tank 168 by a supply line 335 having the filter 167 mounted therein.

One of the outlet ports of the pump 165 is connected to the inlet manifold *p* of a "Vickers" multiple valve unit 336 by a hydraulic line 337. The multiple valve unit 336 includes the inlet manifold *p*, valve sections *a* to *i*, inclusive, and an outlet manifold *r* all of which are of the type illustrated in United States Patent No. 2,489,435, issued to James Robinson on November 29, 1949. The second fluid outlet port of the pump 165 is connected to the inlet manifold *p* of a multiple valve unit 338 by a hydraulic line 339. In addition to the inlet manifold *p*, the valve unit 338 includes three valve sections *j* to *l*, inclusive, and an outlet manifold *r*.

The general construction of the various portions of the valve 338 is the same as those of the valve unit 336. The hydraulic line 339 has connected thereto a bypass line 341 having a filter 342 of limited capacity mounted therein. A limited quantity of fluid from the line 339, therefore, is permitted to flow from the line 339 through the bypass line 341 and filter 342 for return to the tank 168.

Considering first the multiple valve unit 336, each of the valve sections *a* to *g*, inclusive, and *i* is provided with two ports which are alternatively connected to the inlet manifold *p* and the outlet manifold *r* by movement of a valve plunger in opposite directions from its neutral position. The valve plunger of each section is spring biased into its neutral position and is provided with an operating handle 343, as illustrated in Figs. 1 to 4, inclusive, for movement of the plunger in either direction from its neutral position. At the neutral position of the valve plunger, both ports of each valve section are closed and the fluid entering the inlet manifold *p* flows directly through the valve section to the outlet manifold *r*. When one of the valve sections is actuated by movement of its plunger out of its neutral position, the full flow of fluid into the inlet manifold *p* is diverted to the selected port of the valve section, and when more than one of the valve sections have their valve plungers displaced from their neutral positions, the flow of fluid into the inlet manifold is divided between the various actuated valve sections. The inlet manifold *p* is provided with an integral relief valve to prevent the application of excessive pressures to the various valve sections and with a check valve which prevents back flow from the ports of the valves to the pump.

The valve section *h* is identical to the other valve sections of the unit 336 except that one of the ports of this section is plugged so that movement of its valve plunger in one direction connects the open port to the inlet manifold *p* and movement in the opposite direction from its neutral position connects the open port to the outlet manifold *r*. In its neutral position, the plunger of the valve section *h* closes the open port and permits the flow of fluid through the valve section to the outlet manifold *r*.

The ports of the valve sections, *a* to *d*, are connected by pairs of hydraulic lines 344 and 345, 346 and 347, 348 and 349, and 351 and 352, respectively, to the ports of the check valves 93 associated with the elevator posts 42 at the four corners of the frame 18. The ports of the valve section *e* are connected by line 353 and branch lines 125 to one port of each fluid motor 121 of the sliding shoes 56 and by line 354 and branch lines 132

to the other port of each fluid motor **121**. The two ports of the valve section *f* are connected respectively by line **355** and branch lines **356** to one port of each fluid motor **144** associated with the sliding shoes **56** carried by the drive end portion **19** of the frame **18**, and by line **357** and branch lines **358** to the other port of each of these fluid motors. Valve section *g* is connected by lines **359** and **361** to the two ports of the fluid motor **144** associated with the sliding shoe **56** carried by the sill **38**. The single open port of valve section *h* is connected by line **362** and branch lines **363** to the four fluid motors **299** associated with the support rollers **296**. Valve section *i* has its two ports connected by hydraulic lines **364** and **365** to the two pressure fluid inlet ports of the rotary type fluid motor **295**. The outlet manifold *r* of the multiple valve unit **336** is connected by a hydraulic line **366** to a return manifold **367** from which fluid flows directly back to the tank **168** through the line **368**.

The vane type rotary fluid motor **295** has two pressure fluid inlet ports through which fluid may be alternately admitted to effect rotation of the motor in opposite directions and a single outlet port through which fluid is released to the hydraulic line **369** for return to the manifold **367**.

Considering now the multiple valve unit **338**, this unit includes three valve sections which are of the same construction as the sections *a* to *g*, inclusive, and *i* of the valve unit **336**. Valve section *j* has its two ports connected to the two inlet ports of the vane type rotary fluid motor **321** by hydraulic lines **371** and **372** through which pressure fluid is alternately admitted to effect rotation of the fluid motor in opposite directions. The outlet port of the fluid motor **321** is connected by a hydraulic line **373** to the return manifold **367**. The two ports of the valve section *k* are connected by lines **374** and **375**, respectively, to the two inlet ports of the vane type rotary fluid motor **302** for alternately supplying pressure fluid to rotate the motor in opposite directions. The outlet port of the motor **302** is connected by a line **376** to the return manifold **367**. The two ports of the valve section *l* are connected, respectively, by the line **377** to the line **365** and by the line **378** to the line **364**. Since the fluid motor **295** is of the positive displacement vane type, it will be readily apparent that the common connections between the outlet ports of the valve sections *i* and *l* and the ports of the motor will permit operation of the valve sections jointly or independently to vary the speed of operation of the motor.

Referring now to Figs. 1 to 4, inclusive, for a detail description of the manner in which the multiple valve units **336** and **338** are mounted on the frame **18**, the control station for the machine is located at the inner end of the catwalk **172** on the drive end section **19** of the frame **18**. Extending upwardly from the inner end of the catwalk **172** is a stepped control bracket **379** the upper end portion of which is connected by laterally extending members **381** to the bottom tubular member **47** of the truss **46**. The multiple valve unit **336** is mounted on the upper portion of the bracket **379** and the multiple valve unit **338** is mounted on the lower portion of the bracket. The operating handles **343** of the various valve sections of the two multiple valve units **336** and **338** are arranged for operation from the catwalk **172** and suitable instruction plates, not shown, are provided for indicating the function controlled by each handle. The hydraulic lines for connecting the various valve sections to the fluid motors controlled thereby are omitted from Figs. 1 to 4, inclusive, for purposes of clarity. It will be noted, however, that metallic tubing has been used for all the hydraulic lines of the system which are not subject to movement or to vibration and that all of the hydraulic lines have been mounted, when possible, on the various appropriate portions of the frame **18** to provide a strong and rigid support for the lines.

The operation of the machine will be described as follows, and will start with the assumption that a drilling operation has just been completed and the frame **18** is supported in an elevated position on the elevator posts **42** as illustrated in broken lines in Fig. 3. The fluid motors **121** of all of the sliding shoes **56** are actuated by movement of the operating handle **343** of the valve section *e* in a direction to cause fluid to flow through the line **353** and the branch lines **125**. The sliding shoes **56** will thereupon be lowered to the positions illustrated by broken lines in Figs. 2 and 4 at which positions the shoes are freely rotatable about vertical axes to permit the axes of their associated fluid motors **144** to be aligned with the desired direction of movement of the frame **18**.

When the shoes **56** have been so aligned, the operating handles **343** of valve sections *a* to *d*, inclusive, are moved in a direction to permit pressure fluid to flow from the inlet manifold *p* through the hydraulic lines **344**, **346**, **348** and **351** and to permit fluid to flow through the valve sections from the hydraulic lines **345**, **347**, **349** and **352** for return to the tank **168**. This flow of pressure fluid through the hydraulic lines **344**, **346**, **348** and **351** will actuate the check valves **93** in the cap **59** of each elevator post to shorten the elevator posts **42** and lower the frame **18** to a position at which the sliding shoes **56** rest upon the surface along which the machine is to be moved.

As was previously discussed in connection with the description of the sliding shoes **56**, the fluid motors **144** associated with the shoes carried by the drive end section **19** and the fluid motor **144** associated with the sliding shoe carried by the sill **38** will have been actuated by operation of the valve sections *f* and *g* to extend the sliding shoes in the direction of intended movement of the frame before the shoes engage the surface along which the machine is to be moved. After the shoes **56** have engaged the surface, the valve sections *f* and *g* are again operated by their handles **353** to effect relative movement between the shoes and frame in an opposite direction so that the frame is moved on the shoes in the direction in which the axes of the fluid motors **144** have been arranged.

The fluid motors of the various elevator posts **42** are then actuated by operation of the valve sections *a* to *d*, inclusive, to cause pressure fluid to flow into the hydraulic lines **345**, **347**, **349** and **352** and from the lines **344**, **346**, **348** and **351**. The fluid motors will thereupon extend the elevator posts **42** to lift the frame **18** to a position at which the sliding shoes **56** no longer engage the surface below the frame.

The frame **18** may thereafter be moved along the shoes **56** until the machine has been properly positioned for drilling a hole in laterally spaced parallel relationship with the previously drilled hole. The frame **18**, of course, may be moved to an entirely new location bearing no fixed relationship to the previously drilled hole or may be pivoted about the vertical axis of the fluid motor **121** associated with the shoe **56** carried by the sill **38** by operation of the valve section *f* while the valve section *g* remains in its neutral condition. Normally, however, the frame **18** will be moved laterally along a bench adjacent the wall into which successive parallel holes are to be drilled so that the fluid motors **144** of all of the sliding shoes **56** will be operated concurrently as described above.

It will be appreciated that the frame **18** may be leveled on its supporting surface by independent actuation of the valve sections *a* to *d*, inclusive, to individually adjust the lengths of the various elevator posts **42** in accordance with any irregularity in the level of the supporting surface.

After the machine has been relocated subsequent to a drilling operation, as described above, the pan **312** is positioned in substantial alignment with the bore of the previously drilled hole and is connected to the catwalks **174**, **175** and **176** through the selected holes **313** therein. The chuck **219** having been disconnected from the previously employed auger train, it will be returned to its retracted position at the drive end section **19** of the frame

18 by operation of one or both of the valve sections *i* and *l* to energize the fluid motor 295. The valve section *k* is thereafter operated to effect actuation of the fluid motor 302 in a direction to cause rotation of the drum 303 to pay out the cable 304. When a sufficient length of the cable 304 has been unwound from the drum 303 to permit the hook 311 to be connected to the end of the previously employed auger string, the operation of the valve section *k* is reversed to effect actuation of the motor 302 in an opposite direction so that the cable 304 will be again wound onto the drum 303. The previously employed auger string will thereupon be withdrawn from the bore of the previously drilled hole, through the end of the frame 18, and onto the pan 312. When a sufficient length of the auger string has been withdrawn from the previously drilled hole the end auger section is disconnected from the remainder of the string to clear the end auger section for lateral movement within the frame 18. After one auger section has been drawn onto the pan 312 and is fully within the frame 18, the operation of the valve section *k* is again reversed to effect rotation of the motor 302 in an opposite direction so that the hook 311 may be disconnected from the thus positioned auger section.

The hoist carriage 324 is thereafter moved along the beam 318 to a position overlying the withdrawn auger section, and the fluid motor 321 is actuated by operation of the valve section *j* to cause the cable 328 to be unwound from the drum 322 so that the block 331 with its attached hook 332 is lowered to a position for connection with the hole 334 in the middle portion of the auger section. The direction of operation of the motor 321 is then reversed by operation of the valve *j* to cause the block 331 to be raised to a position at which the attached auger section is supported above the level of the catwalk 186. With the auger section supported, in this elevated position, the hoist carriage 324 is moved laterally along the beam 318 and the direction of operation of the motor 321 again reversed to lower the auger section to a position in axial alignment with the chuck 219. The supporting rollers 296 are then moved into engagement with thet periphery of the flight of the auger section by operation of the valve section *h* to actuate the fluid motors 299. This engagement between the rollers 296 and the flight of the auger section supports the outer end portion of the latter in axial alignment with the chuck 219 while the carriage 187 is moved forwardly by actuation of the fluid motor 295 to a position at which the chuck 219 may be coupled with the auger section.

With the chuck 219 coupled to the inner end of the auger section and the outer end portion of the latter supported by the rollers 296, a suitable cutter head, not shown, is mounted on the outer end of the auger section after which the drilling operation is initiated by movement of the shifting device 161 of the bevel gear drive 159 to a position to effect rotation of the drive bar 272 in a direction at which power will be transmitted through the transmission unit 191 to rotate the chuck 219 in a clockwise direction. The fluid motor 295 is then energized by operation of the valve section *i* in a direction to cause the carriage 187 to move the transmission unit 191 along the drive bar 272 toward the open end of the frame 18.

As soon as the drilling operation has been initiated, valve section *k* may again be operated to cause the fluid motor 302 to unwind the cable 304 from the drum 303 so that the hook 311 may be connected to the next section of the previously employed auger string. The direction of rotation of the motor 302 is thereafter reversed to further withdraw the auger string from the previously drilled hole for a sufficient distance to release the end auger section therefrom as described above. While this second auger section is being positioned on the pan 312 within the frame 18, the previously withdrawn section will have been advanced by movement of the carriage 187 and will have entered the seam of material to be mined. When the carriage 187 has advanced to the outer ends of the tracks 179 and 181, the valve section *i* and the shifting device 161 of the bevel gear drive 159 are moved to their neutral positions to stop the forward movement and rotation, respectively, of the chuck 219. The chuck 219 may thereupon be disconnected from the auger section and the fluid motor 295 energized by operation of the valve sections *i* and *l* to quickly return the carriage 187 to its position at the drive end section 19 of the frame 18. The second auger section is then transferred laterally across the frame 18 in the same manner as was previously described, and is supported by the rollers 296 for connection with the chuck 219 and with the outer end of the preceding auger section. The rollers 296 are thereafter lowered out of engagement with the second auger section by operation of the valve section *h* to release the pressure fluid from the fluid motors 299. Rotation and forward movement of the chuck 219 is thereafter resumed in the same manner as was employed for the first auger section. The above described operation for removing the successive auger sections from the previously drilled hole and for advancing the successive auger sections into the hole which is currently being drilled is repeated until the hole is drilled to the proper depth.

The entire drilling operation is repeated for forming each successive, laterally spaced hole along a wall. It will be appreciated, however, that the first and last holes of a series of laterally spaced holes will require a slightly different procedure. For example, the first hole to be drilled along a wall will employ a drill train that is formed of successive auger sections which are positioned adjacent the right side of the frame 18 as illustrated by broken lines in Fig. 3. These auger sections are positioned alongside the frame 18 in any suitable manner and the cable 304 may be employed for this purpose if desired. The auger sections are then transferred into and across the frame 18 in a manner similar to that described above except that the hoist carriage 324 is moved onto the projecting end portion of the beam 318 so that the hook 332 may be lowered for connection with the hole 334 in the auger section. When the last hole to be drilled in a wall has been completed, drilling operations are suspended while successive auger sections are withdrawn from the completed hole in the manner described above and transferred to positions adjacent the right side of the frame 18 by movement of the hoist carriage 324 to the projecting end portion of the beam 318. The auger sections removed from the completed hole and positioned beside the frame 18 are rolled away to provide room for the successive sections as they are removed from the completed hole and transferred out of the frame.

It is to be understood that the form of this invention herewith shown and described is to be taken as a preferred example of the same, and that various changes in the shape, size, and arrangement of parts may be resorted to without departing from the spirit of the invention or the scope of the subjoined claims.

Having thus described the invention, we claim:

1. A mining machine, comprising a frame having one open end, means mounted on said frame for supporting it in a selected operating position, a carriage movable within and along one side of said frame, means mounted on said carriage for engaging and rotating an auger string about an axis extending in the direction of movement of said carriage, a prime mover mounted in a fixed position adjacent the end of said frame opposite said open end, means drivingly connecting said prime mover and said auger string rotating means for actuating the latter while said carriage is moved to axially advance said string through said open end of said frame, means mounted on said frame for moving an auger section through the open end and along the opposite side thereof into a position within said frame in laterally spaced parallel relationship

with the path of movement of said carriage, and means for transferring the auger section from said laterally spaced relationship into a position in axial alignment with said auger string rotating means.

2. A mining machine, comprising a frame having one open end, means mounted on said frame for supporting it in a selected operating position, a carriage movable within and along one side of said frame, means mounted on said carriage for engaging and rotating an auger string about an axis extending in the direction of movement of said carriage, a prime mover mounted in a fixed position adjacent the end of said frame opposite said open end, means drivingly connecting said prime mover and said auger string rotating means for actuating the latter while said carriage is moved to axially advance said auger string through said open end of said frame, means mounted on said frame for supporting an auger section in laterally spaced parallel relationship with the path of movement of said carriage, draft means mounted on said frame for pulling an auger section longitudinally through the open end and along the opposite side thereof onto said auger section supporting means, means for transferring an auger section from said supporting means to a position in axial alignment with said auger string rotating means, and means movable into a position for engaging an auger section in said axially aligned position to support the latter for connection with said auger string rotating means.

3. A mining machine, comprising an elongated frame having an open end and of sufficient width to accommodate two auger sections disposed side by side within said frame in parallel relationship with the sides thereof, means mounted at spaced points on said frame for supporting the frame at a fixed elevation, a carriage movable within and along one side of said frame toward and away from the open end thereof, a chuck mounted on said carriage and adapted to be connected to an auger string for rotating the latter about an axis in laterally spaced parallel relationship with said one side of the frame, independently actuated means for rotating said chuck and moving said carriage to rotate and axially advance the auger string through the open end of the frame, draft means mounted on said frame and adapted to be connected to an auger section for pulling the latter longitudinally along the other side of said frame and through the open end thereof into a position spaced laterally from the path of movement of the carriage, and means for transferring an auger section within said frame from said laterally spaced position to a position in axial alignment with said chuck.

4. A mining machine, comprising a frame having an open end, means for supporting said frame at a fixed elevation, a carriage mounted for longitudinal movement within and along one side of said frame, means for moving said carriage longitudinally of said frame, a chuck mounted on said carriage for engaging an auger string and rotating the same about an axis in laterally spaced parallel relationship with said one side of the frame, a drive bar of non-circular cross-section supported at its opposite end portions for rotation about a longitudinal axis in substantially parallel relationship with the axis of said chuck, a sleeve having an opening for receiving said bar in fitted relationship to permit longitudinal movement of the sleeve on the bar and rotation of the sleeve by the bar, a sprocket having an opening therethrough for receiving said bar with clearance therebetween and connected to said sleeve for rotation thereby and for limited universal movement relative thereto, a gear train having an input shaft and an output shaft connected to said chuck for rotating the latter, means drivingly connecting said input shaft to said sprocket, means for rotating said drive bar to actuate said gear train and rotate said chuck, draft means mounted on said frame in laterally spaced relationship with the axis of rotation of said chuck, means for connecting said draft means to an auger section for pulling said auger section longitudinally into said frame along the other side thereof to a position spaced laterally from the path of movement of the carriage, and means for transferring said auger section within said frame from said laterally spaced position to a position in axial alignment with said chuck.

5. A mining machine as defined in claim 4 further characterized by the means for moving said carriage comprising a pair of chains trained over sprockets spaced longitudinally of said frame and having their ends connected to opposite sides of said carriage, and a drive for simultaneously rotating one of the sprockets of each of the chains to move the carriage in opposite directions along the frame.

6. A mining machine, comprising a rectangular frame having an open end and of sufficient width to accommodate two auger sections disposed side by side within said frame in parallel relationship with the sides thereof, means mounted at each corner of said frame for supporting the frame at a fixed elevation, a carriage movable within and along one side of said frame toward and away from the open end thereof, a chuck mounted on said carriage for engaging an auger string and rotating the same about an axis in laterally spaced parallel relationship with said one side of the frame, independently actuated means for simultaneously rotating said chuck and moving said carriage to rotate and axially advance the auger string through the open end of the frame, a winch mounted on said frame, a cable connected to said winch, means for connecting said cable to an auger section for pulling said auger section longitudinally along the other side of said frame and through the open end thereof into a position spaced laterally from the path of movement of said carriage, and a hoist mounted for lateral movement on said frame for lifting and transferring an auger section within said frame from said laterally spaced position to a position in axial alignment with said chuck.

7. A mining machine as defined in claim 6 further characterized by a pair of guide rolls mounted on said frame for rotation about axes which lie on opposite sides of and below the axis of rotation of said chuck for supporting an auger section during connection of the latter to said chuck, and means for varying the spacing between said guide rolls and the distance at which said rolls lie below the axis of rotation of said chuck to support auger sections of different diameters in axial alignment with the chuck during connection of the latter thereto.

8. A mining machine, comprising a rectangular frame having an open end, means mounted at each corner of said frame for supporting the frame at a fixed elevation, a carriage movable within and along one side of said frame toward and away from the open end thereof, a chuck mounted on said carriage and adapted to be connected to an auger string for rotating the latter about an axis in laterally spaced parallel relationship with said one side of the frame, independently actuated means for simultaneously rotating said chuck and moving said carriage to rotate and axially advance the auger string through the open end of the frame, a winch mounted on said frame, a cable connected to said winch and adapted to be connected to an auger string for pulling the latter longitudinally through the open end of the frame into a position spaced laterally from the path of movement of the carriage, a pan for receiving an auger section pulled onto said frame, means for detachably mounting said pan on said frame in a preselected one of a plurality of positions extending longitudinally of the frame and spaced at various lateral distances from the path of movement of said carriage, movable guide means supporting said cable for movement through a path overlying said pan to pull an auger section longitudinally onto said pan, and a hoist mounted for lateral movement on said frame for lifting

and transferring an auger section within said frame from said laterally spaced position to a position in axial alignment with said chuck.

9. A mining machine as defined in claim 8 further characterized by independent drive means for operating said winch to pull an auger section onto said pan while an auger string is being rotated by said chuck and advanced through the open end of said frame, and said hoist having a lateral path of movement extending outwardly of the side of the frame adjacent said pan for transferring auger sections from positions adjacent said latter side of the frame onto said pan.

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