

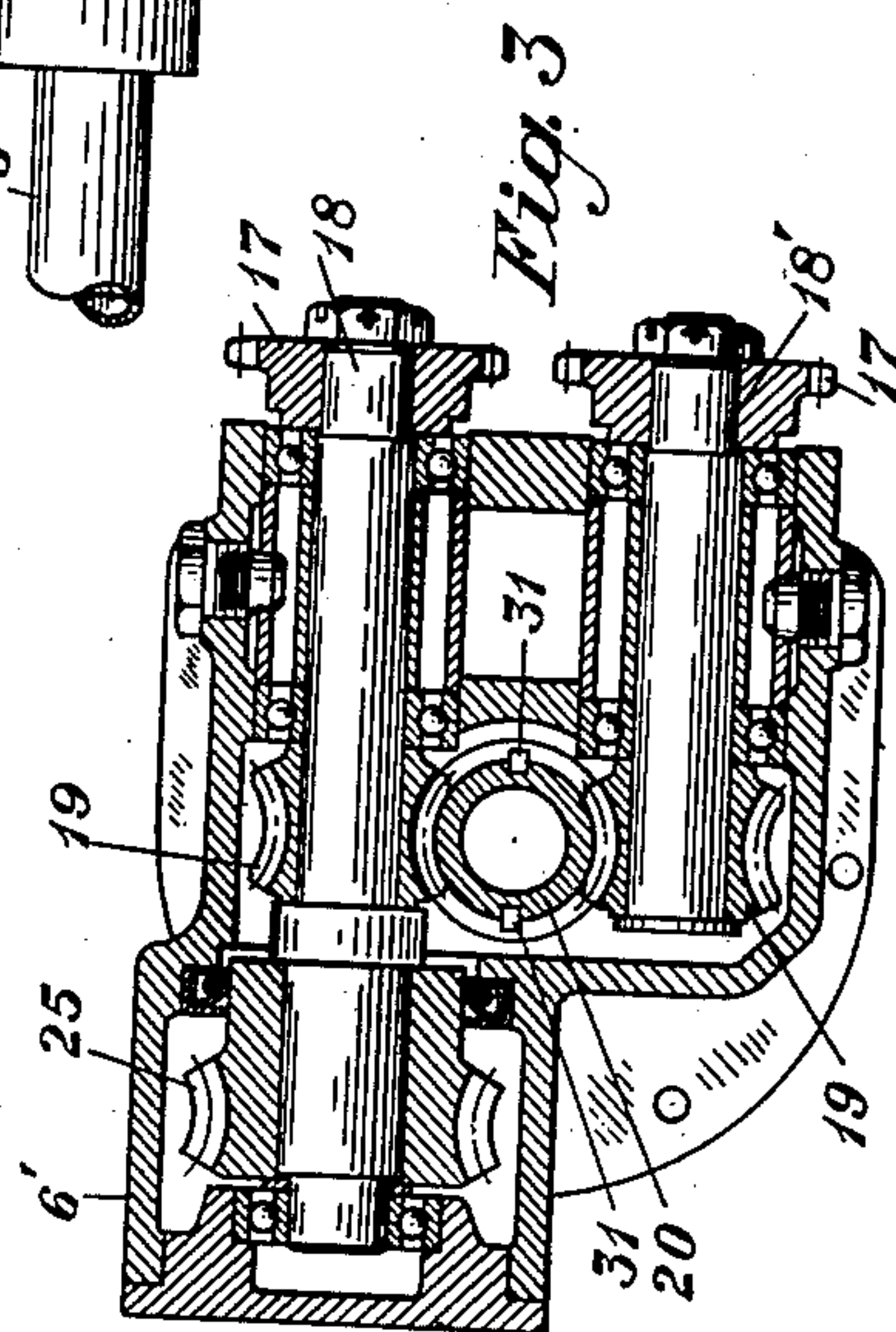
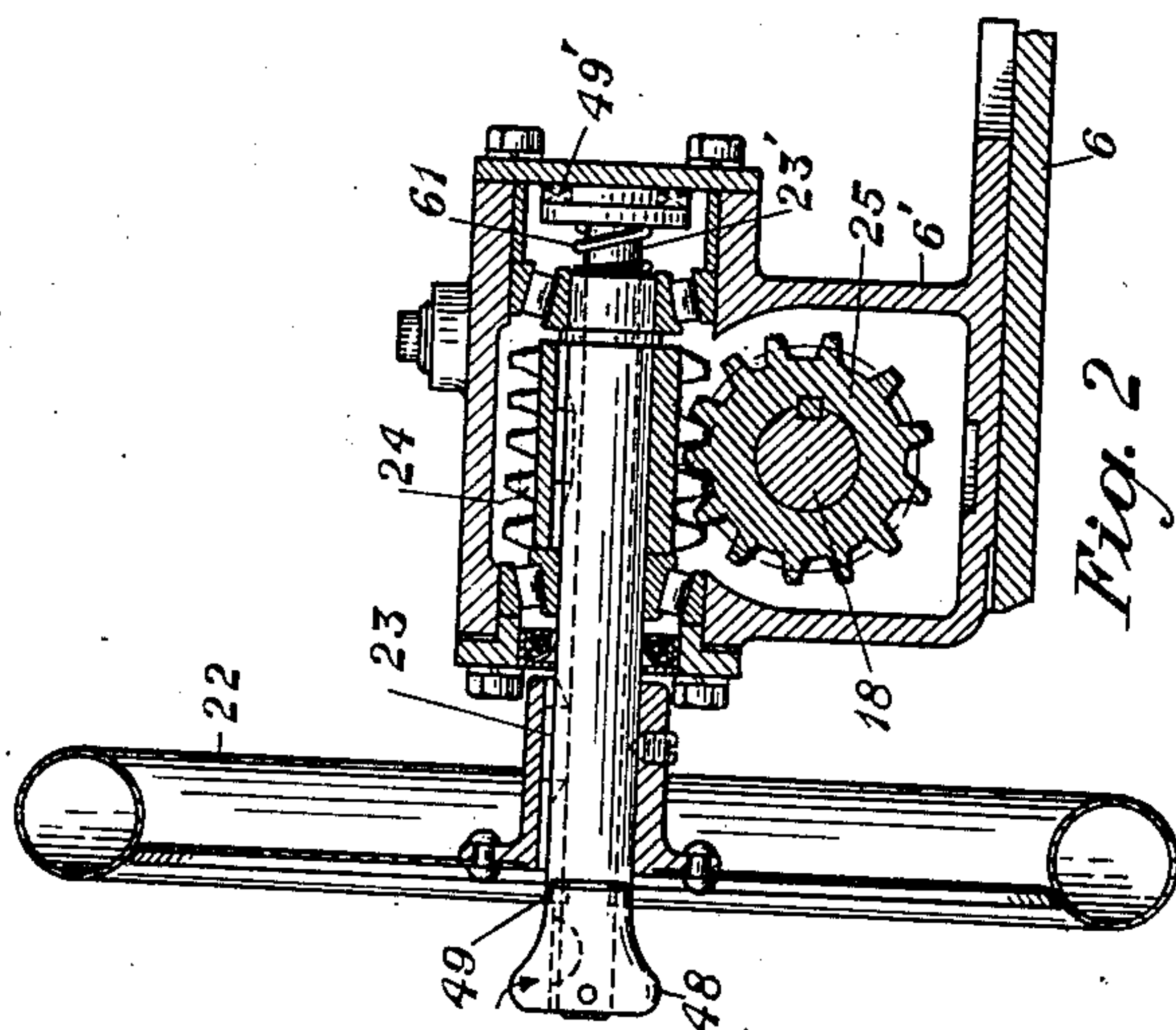
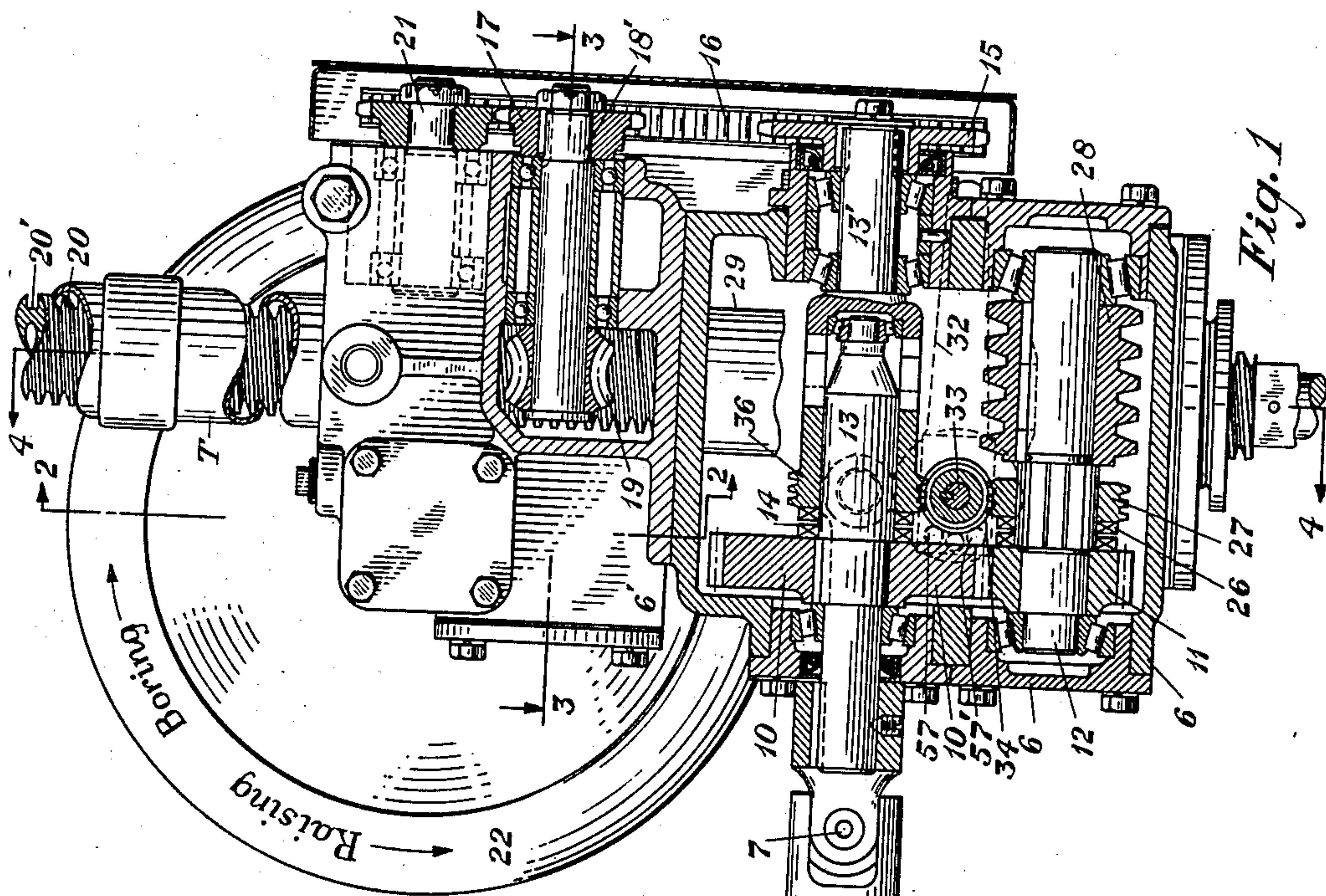
Jan. 18, 1938.

E. DARNELL ET AL
EARTH BORING MACHINE

2,105,587

Filed July 18, 1936

2 Sheets-Sheet 1



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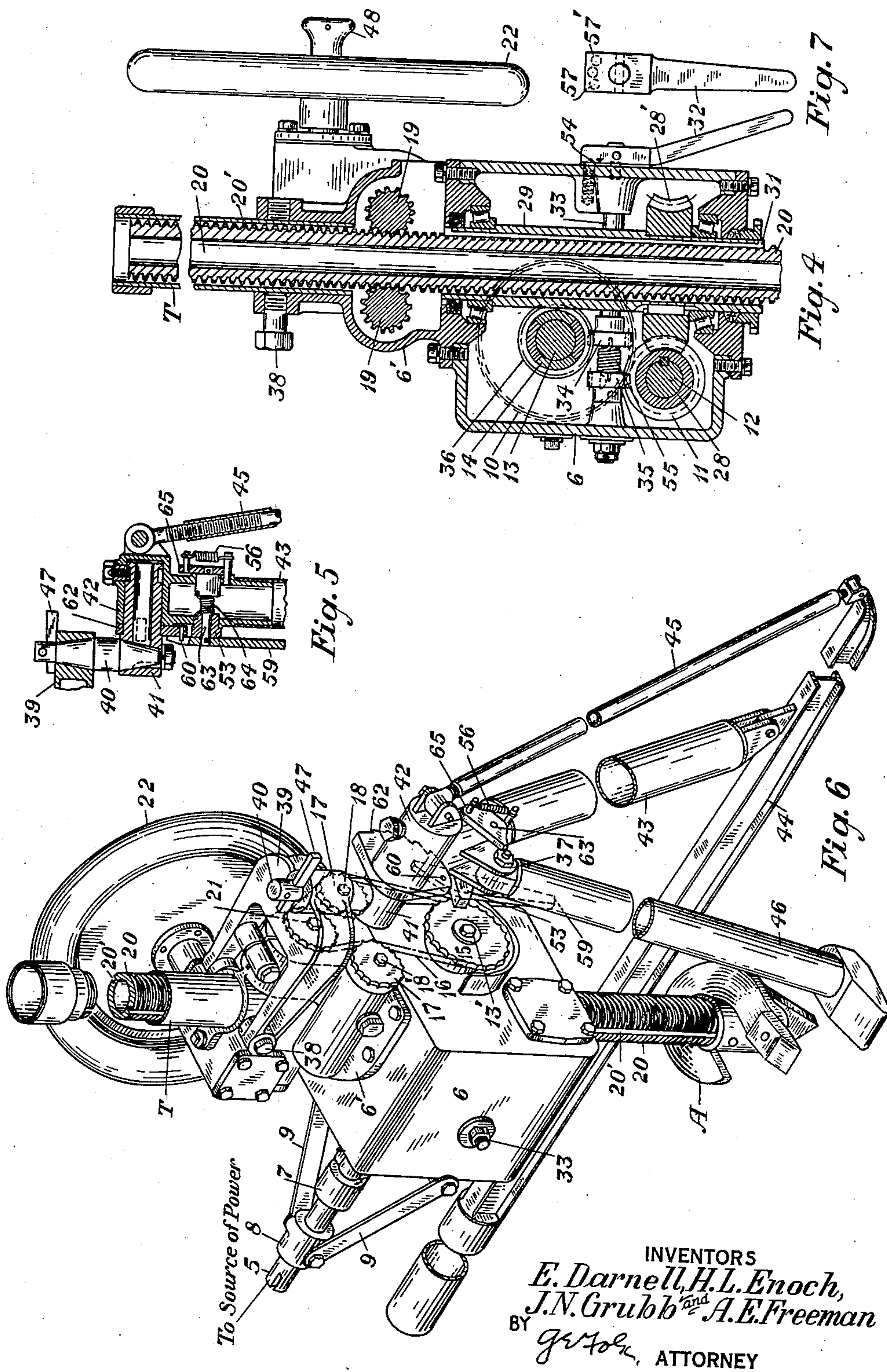
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EARTH BORING MACHINE

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UNITED STATES PATENT OFFICE

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EARTH BORING MACHINE

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4 Claims. (Cl. 255—46)

This invention relates to drilling machines adapted more particularly for boring holes in the earth in which poles or posts may be installed.

One of the objects of the invention consists in the provision of a portable device of the above character which may be operated from a power unit such, for instance, as a motor of automotive apparatus or the like.

Another object consists in the provision of apparatus whereby holes may be bored in any desired direction.

Another object is to provide an earth boring machine whereby the boring operations may be easily, quickly and accurately performed.

A further object is to provide an improved control system for feeding or raising the auger.

These and further objects will be apparent from the following description, when considered in connection with the accompanying drawings, in which one embodiment of the invention is illustrated.

Referring to the drawings, Figure 1 is an elevation, partly in section, of the auger rack and drive shaft and associated gearing;

Fig. 2 is a section taken on the line 2—2 of Fig. 1 showing the hand-wheel and associated apparatus in clutched position;

Fig. 3 is a section taken on the line 3—3 of Fig. 1 showing the drive sprockets and associated shafts of the device;

Fig. 4 is a section of the auger rack and associated elements taken on the line 4—4 of Fig. 1 looking in the directions of the arrows;

Fig. 5 is a fragmentary sectional view showing the adjustable supports from which the improved device is adapted to be suspended;

Fig. 6 is a perspective view of the exterior of the improved boring machine assembly in mounted position upon its supports; and

Fig. 7 is an elevation of the control lever by which the auger shaft may be operated to boring and raising positions; the lever being turned 90° from its true position for the sake of clearness. The true position of the lever is indicated by dotted lines in Fig. 1.

The earth boring machine of this invention comprises in general a standard or support on which mechanism is carried for controlling the raising and lowering of the auger shaft. This shaft consists of a cylindrical rack bar or auger shaft which has a continuous worm cut in its surface. An auger is carried on the end of the shaft. Meshing with the continuous worm on the auger shaft are two worm wheels located on diametrically opposite sides of said shaft. A

hand-wheel may be used to control the rate of speed for raising or lowering the auger. By holding the hand-wheel while the auger shaft is rotating, the auger will feed automatically. By exerting a greater turning movement on the hand-wheel, additional thrust on the auger and linear speed of the auger shaft is increased. If the auger shaft is not rotated, the hand-wheel may be used to boost the raising power when an obstruction is met, or the hand-wheel may be used as a sole means for raising the auger.

More specifically, the earth boring apparatus of this invention is connected to a power unit which may be assumed, for the purpose of description, as being an automobile motor, power take-off or winch shaft associated with the said motor. The earth boring apparatus may be positioned some distance away from the power unit by which it is operated. For instance, in the case of power being derived from the motor of an automobile truck, the truck may be positioned at the side of a road, while the boring apparatus may be located a distance therefrom, as in an adjacent field. The power connection may be made by means of a drive shaft 5, one end of which is adapted to be attached to a shaft from which power is transmitted, and the other end of which enters a casing 6 to operate the boring machine which will be presently described. The drive shaft 5 is provided with a universal joint at each end, and one of these joints is shown (Figs. 1 and 6) adjacent the casing at 7. The shaft 5 extends through a collar 8 (Fig. 6), which is pivotally connected to the casing 6 by a pair of hinged straps 9. By this arrangement the shaft 5 is pivoted to permit leveling of the auger, as will presently appear.

The drive shaft 5 is connected through the universal joint 7 to an aligned shaft 13 journaled in the casing 6. The shaft 13 carries a keyed gear 10, which gear constantly meshes with gear 11 loosely carried by shaft 12. Shaft 13 can be also connected to an aligned shaft 13' through the medium of a jaw clutch 14 when it is desired to raise the auger A. A sprocket 15 is attached to the outer end of the shaft 13', as shown in Fig. 1, and a roller chain 16 connects the sprocket 15 with a pair of sprockets 17, 17 which are mounted, respectively, on parallel shafts 18 and 18' as more clearly indicated in Fig. 3. The roller chain and sprockets may be suitably enclosed by a removable cover. The shafts 18 and 18' carry keyed worm wheels 19, 19 which are diametrically positioned on and mesh with and drive the cylindrical rack bar or auger rack 20 having spiral threads. A tube T is affixed to the casing and encircles the

upper portion of the auger rack. An auger A is attached to the lower end of the auger rack bar. The attached auger may be of any well-known or suitable design. A shaft 21 provided with a sprocket is eccentrically mounted in the casing 6' which casing is bolted to the lower casing 6. The shaft 21 is positioned above the parallel shafts 18 and 18' and is used to take up slack which may be present in the chain 16.

A hand-wheel 22 is carried by the casing 6' and serves to raise or lower the auger A and its rack 20 by hand power when desired. The wheel may be turned by hand while the auger and its rack are being raised by power, so that manual effort can be used to boost the power drive in case an obstruction is met in the raising operation. The hand-wheel is also used to force the auger into the ground by applying manual effort in the opposite direction to that required for raising, as will later appear. This hand-wheel 22 is mounted on shaft 23 which shaft also carries a worm 24, and the worm 24 meshes with a driving worm wheel 25 which is keyed to the end of shaft 18 (Figs. 2 and 3). A concentric shaft 23' is rotatably and slidably mounted within the shaft 23 and a knob 43 is carried at its outer end. By pulling this knob outwardly, against the pressure exerted by a spring 61, to a position in which it may be rotated 90°, the outer and inner clutches 49 and 49', respectively, may be disengaged. When the clutches are thus disengaged, the wheel 22 may be used to manually control the raising or lowering of the rack shaft 20. When clutch 49' is engaged, it prevents lowering or raising of the auger shaft when it is not rotating, as when the apparatus is being transported.

To rotate the auger rack shaft 20 and auger A, the drive continues from drive shaft 5 through shaft 13, gear 10 and gear 11 through engaged jaw clutch 26 on shaft 12. A circular rack 27 is splined to the shaft 12, which drives worm 28 which is rigidly keyed to shaft 12. The worm 28 drives worm wheel 28', which is keyed to the auger rack bar sleeve 29 which in turn drives the auger rack 20 by means of parallel keys 31 (Fig. 4). The keys 31 engage in the longitudinal keyways 20' of the auger rack, whereby the latter element is rotated, and said keys also permit the auger rack to slide up and down thereon.

The engagement and disengagement of the jaw clutches 14 and 26 are accomplished by rotating lever 32 so that the spring actuated detent 54 engages in detent positions in the lever, whereby the auger is connected to a "raising" or to a "boring" position, respectively. The lever 32 is attached to the outer or extended end of shaft 33 and is provided with three detent positions near one pivoted end. The detent 54 selectively engages with the detent positions which maintain the lever in the position desired. For instance, in the "raising" operation the lever will be rotated so that the detent 54 engages in detent position 57. In the "boring" operation the detent 54 engages in detent position 57'. The detent engages the central detent position when the lever is moved to a neutral position. The shaft 33 which carries the lever is journaled in the casing 6 at right angles to the auger rack 20 and to the shafts 12 and 13'. Small gears 34 and 35 are carried by the shaft 33 and mesh with circular racks 36 and 27 which are carried on shafts 13' and 12, respectively. The racks 36 and 27 form parts of the clutches 14 and 26, respectively, associated with these latter shafts. The gear 35 is keyed on the shaft 33 and the gear 34 is loosely carried by said

shaft. A spring 55 is also carried on the shaft 33 between the gears 34 and 35 and is attached to these gears. When the lever 32 is rotated to the "raising" position or in a counter-clockwise direction it causes the rotation of gear 34 which slides circular rack 36 to the left (Fig. 1) and forces the jaw clutch 14 into engagement. If the jaws of clutch 14 are not in position to engage with each other, the spring 55 winds up and stores torque so that when the jaws of said clutch are in a position to engage, pressure is exerted by the spring to cause this engagement. When power is applied under this condition the shaft 5 causes the rotation of shafts 13 and 13' and the sprocket 15 is driven, which in turn drives chain 16 and the sprockets 17, 17, thereby driving shafts 18 and 18'. The worm wheels 19, 19, which are carried on the shafts 18 and 18', respectively, are rotated to drive the auger shaft 20 to raise the auger to a desired height.

The casing 6 and its associated upper casing 6' are suspended from trunnions 38 formed on the ends of U-shaped arm 39. This arm is adapted to be quickly attached to or detached from a tapered support 40 (Figs. 5 and 6). The tapered key 47 locks the arm in the attached position. The support 40 is attached to pivot 41 which swivels in a casting 42, carried on the main support 43. This main support is attached to a casting 44, which rests on the ground. The leveling of the auger in one direction is accomplished by turning a threaded pipe 45 which also acts as a tension or compression member during the boring operations. A small hand-wheel (not shown) may be added to the pipe 45, if desired, to facilitate its rotation. The leveling in the other direction is accomplished by properly positioning the brace 46, the top of which is pivoted between parallel lugs 37 extending from casting 42.

In the operation of the improved device, the standard or support is set up at the desired location, and the boring case is then attached to the standard as just described. As previously mentioned, the machine can be operated at any desired distance from the source of power within the range or length of the shaft to which the shaft 5 is coupled. This range may be relatively large.

After the machine is set up and leveled, as outlined above, knob 43 is pulled out from the hand-wheel 22 as previously described to disengage jaw clutches 49 and 49' (Fig. 2) and turned 90°, as indicated by the arrow, to hold the jaw clutches 49 and 49' in a disengaged position. During this operation the wheel 22 can be turned to relieve the pressure on jaw clutches 49 and 49'. By releasing the hand-wheel 22 the auger shaft 20 and its associated auger A will then drop to the ground. Lever 32 is now rotated clockwise from a neutral position, where the detent 54 was engaged in the middle detent position to a "boring" position, where the detent engages detent position 57'. When the lever 32 is rotated to this position, it causes the shaft 33 to rotate also. As gear 35 is also on this shaft it also rotates at this time in a direction to cause circular rack 27 which is meshed therewith to move to the left along the splined portion of shaft 12 and thus cause the engagement of jaw clutch 26 (Figs. 1 and 4). Power is now applied to shaft 5 to cause its rotation, which power is transmitted through gears 10 and 11 through jaw clutch 26 to shaft 12, worm 28 and worm wheel 28', sleeve 29 through keys 31, thus rotating the auger shaft 20 as outlined above. By applying

a turning force to the hand-wheel 22 in the direction indicated by the arrow for "boring," the auger is forced into the ground as it rotates. After boring to sufficient depth, the power is shut off and lever 32 is rotated counter-clockwise to its neutral position and back to a raising position where the detent 54 engages in detent position 57. The shaft 13' is now engaged through jaw clutch 14, and power is again applied to raise the auger with its load of dirt. If an obstruction is met during the raising operation, or in case a heavy pull is encountered at the start, the hand-wheel 22 can be rotated in the direction shown by the arrow marked "raising," thereby boosting the power application for raising the auger.

When the auger is raised slightly above the ground, the knob 48 of wheel 22 is rotated 90° from the position mentioned above and released, thus engaging the clutches 49 and 49' to prevent the auger from dropping to the ground when the power is shut off. The power being shut off, the auger is swung away from the operator by pulling the tube T encircling the upper part of the auger rack 20, thereby rotating the boring machine on pivot 41 (Figs. 5 and 6). This tube is pulled toward the operator until the auger rack 20 and its associated auger A lie at an angle of about 45 degrees. In this position the cam 53 will engage the ratchet 62 which is keyed on pivot 41 and thus hold the auger at said angle. The hands of the operator are now released for the next operation. At this time dirt may be removed from the auger. The operator rotates the handle 32 in a clockwise direction until detent 54 engages in the middle or neutral position in the handle, thus disengaging the jaws of the clutch 14, in case there is no pressure on these jaws. If pressure is present in the jaws, the spring 55 stores up the turning motion which disengages said jaws when the pressure is relieved by turning wheel 22.

To restore the auger and shaft to a vertical position at this time, the handle 59 is rotated and the spring 64 is wound tightly about the shaft 63. The plate 65 at the end of the shaft 63 also rotates, and spring 56 is thrown over center, holding lever 59 in this position. The operator now pulls on tube T, thus relieving the pressure of cam 53 on ratchet 62. Spring 64 unwinds and throws cam 53 out of its engaged position with ratchet 62. The operator then lowers the auger and shaft to a vertical position over the hole. As the auger shaft approaches the vertical position, ratchet 62, which carries the pin 60, engages and trips handle 59 and resets the mechanism so that cam 53 will again automatically engage the ratchet 62 when the auger shaft is swung off the vertical position. The spring 55 is thus restored to its normal position. When in this position the boring operation may be repeated as described above.

After the hole is dug, the auger is raised to a carrying position, and knob 48 of hand-wheel 22 is rotated 90°, permitting spring 61 to force the jaw clutches 49 and 49' into engagement, thereby preventing the auger from dropping while being carried.

In dismantling the machine the procedure just outlined is, of course, the reverse of that above described in connection with the operation of setting it up.

What is claimed is:

1. In an earth boring machine, a shaft carrying an auger, said shaft having a spiral thread on its external surface, a worm wheel engaging said spiral thread, means to impart rotation to said shaft whereby said worm wheel acts as a nut engaging the external thread of said shaft to feed the shaft longitudinally as it is rotated, means whereby power may be applied to said worm wheel when the shaft is not rotated to move said shaft longitudinally by a rack and pinion action, and a hand-wheel for rotating said worm wheel to supplement the action of the driving power applied to the worm wheel.

2. In an earth boring machine, a pivotally mounted casing, an auger shaft having a spiral thread on its exterior surface and being longitudinally movable in said casing in boring and in raising positions, oppositely positioned worm wheels engaging said spiral thread to raise the auger shaft by a rack and pinion action, means to impart rotation to said shaft so that with said worm wheels engaging the threads of the shaft it will be fed in a boring direction as it is rotated, a power shaft, driving connections for the worm wheels, and driving connections for said last mentioned means, and a clutch to engage either of said driving connections with the power shaft.

3. In an earth boring machine, a pivotally mounted casing thereon, an auger shaft having a spiral thread on its exterior surface and being longitudinally movable in said casing in boring and in raising directions, oppositely positioned worm wheels engaging said spiral thread to raise the auger shaft by a rack and pinion action, means to impart rotation to said shaft so that with said worm wheels engaging the threads of the shaft it will be fed in a boring direction as it is rotated, a power shaft, driving connections for the worm wheels and driving connections for said last mentioned means, a clutch to engage either of said driving connections with the power shaft, a control handle to move said clutches into their respective engagements, and a hand-wheel for operating said auger shaft in each direction when the clutches are disengaged from said power shaft, said hand-wheel also serving to supplement the operation of said auger shaft in each direction when the power shaft is engaged with respective driving connections.

4. In an earth boring machine, a casing, an auger shaft having a spiral thread on its exterior surface and being longitudinally movable in said casing in boring and in raising positions, oppositely positioned worm wheels engaging said spiral thread to raise the auger shaft by a rack and pinion action, means to impart rotation to said shaft so that with said worm wheels engaging the threads of the shaft it will be fed in a boring direction as it is rotated, a power shaft, driving connections for the worm wheels and driving connections for said last mentioned means, a clutch to engage either of said driving connections with the power shaft, and means for pivotally mounting said casing whereby said auger may be adjusted to desired angular positions.

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