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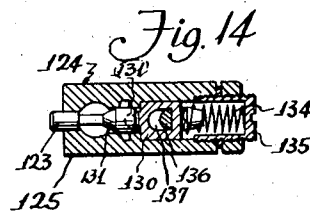
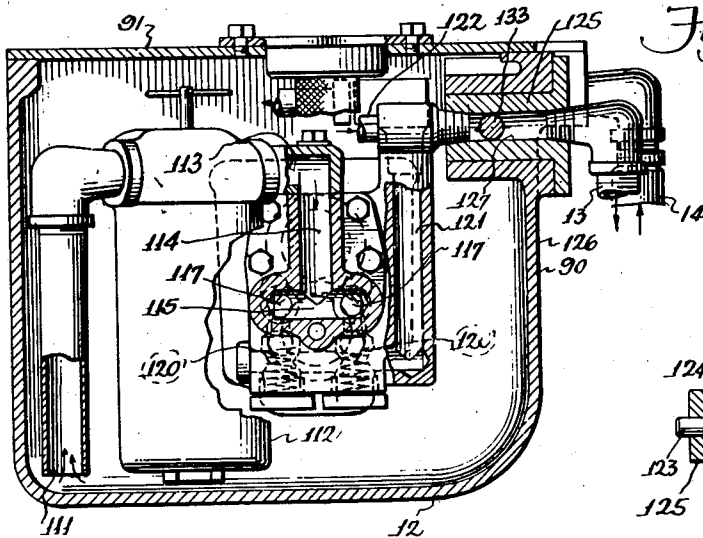
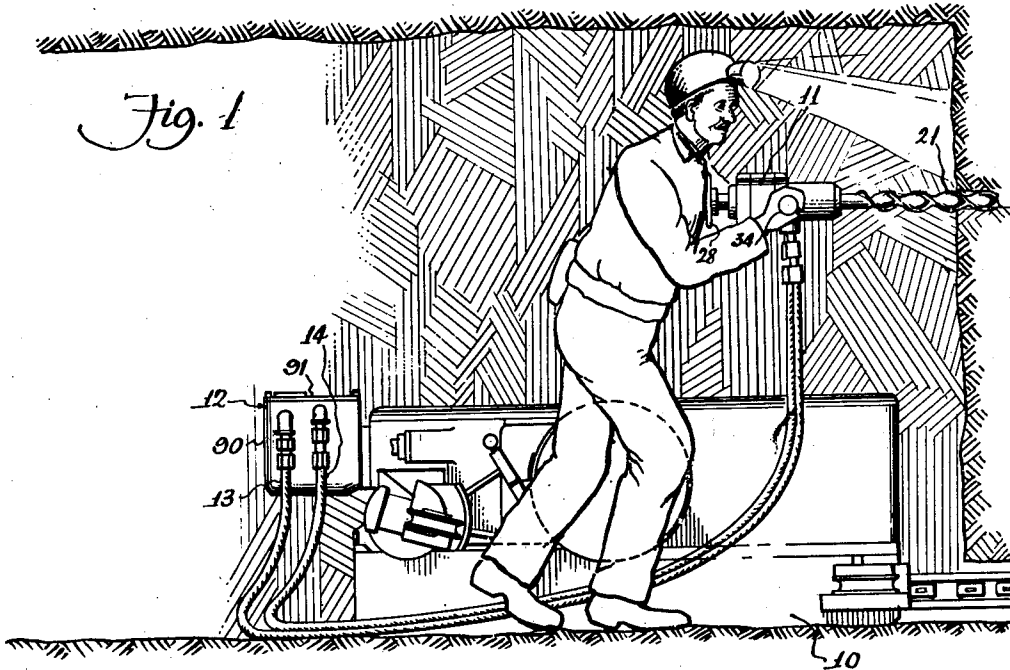
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2,466,972

PUMP FOR DRILLING APPARATUS

Filed July 17, 1944

4 Sheets-Sheet 1



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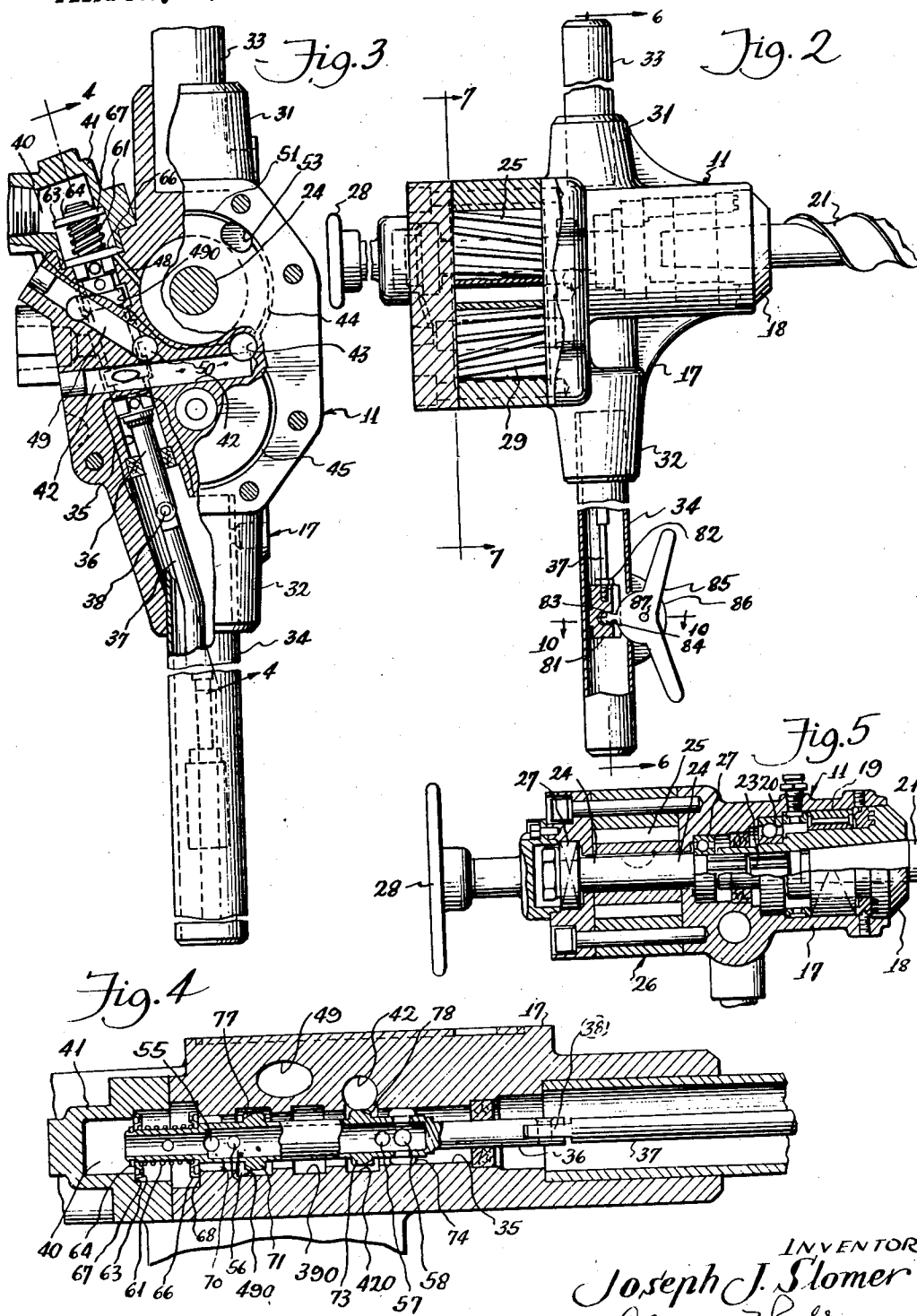
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PUMP FOR DRILLING APPARATUS

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4 Sheets-Sheet 2



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Fig. 6

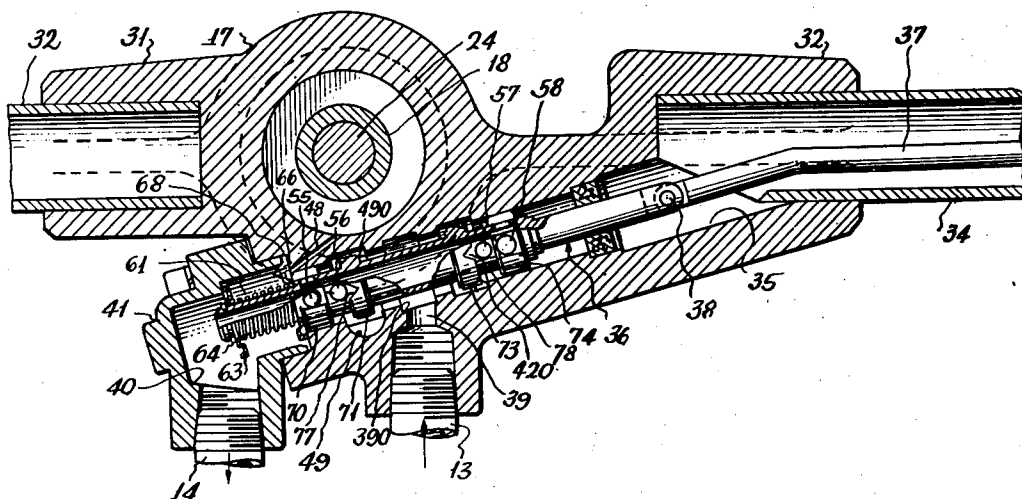


Fig. 7

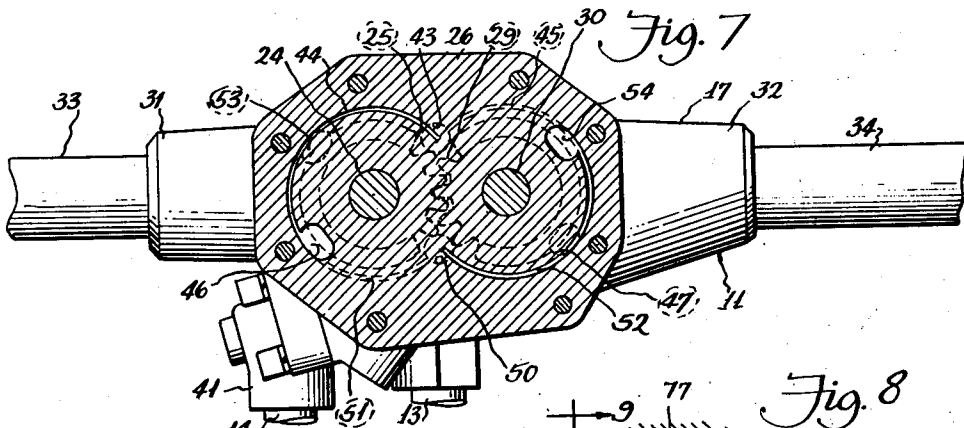


Fig. 8

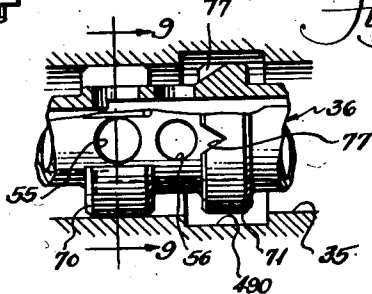


Fig. 10

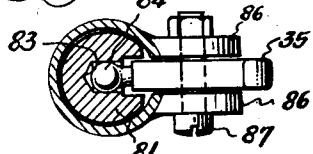
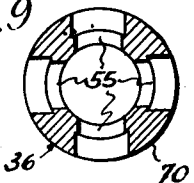


Fig. 9



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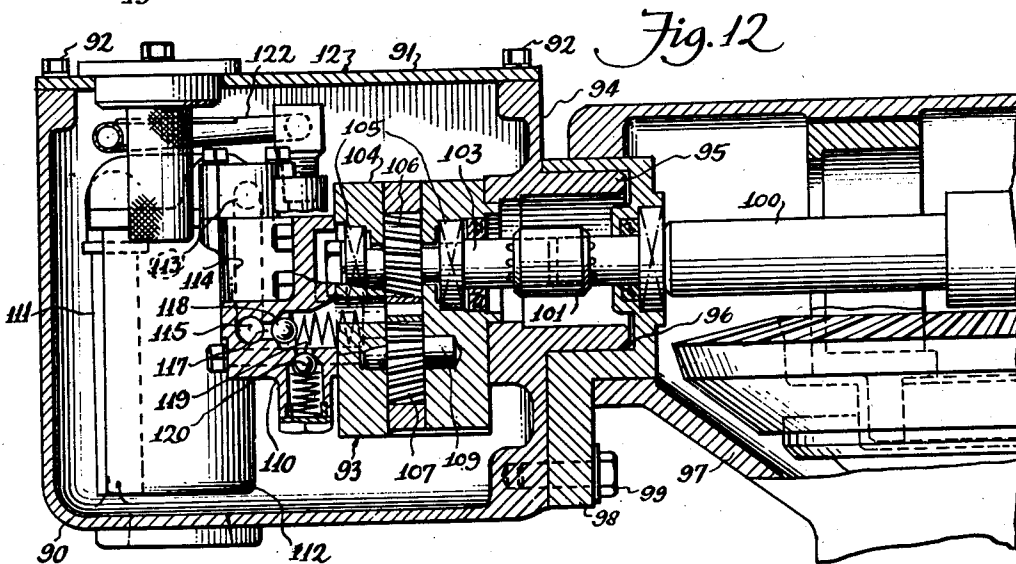
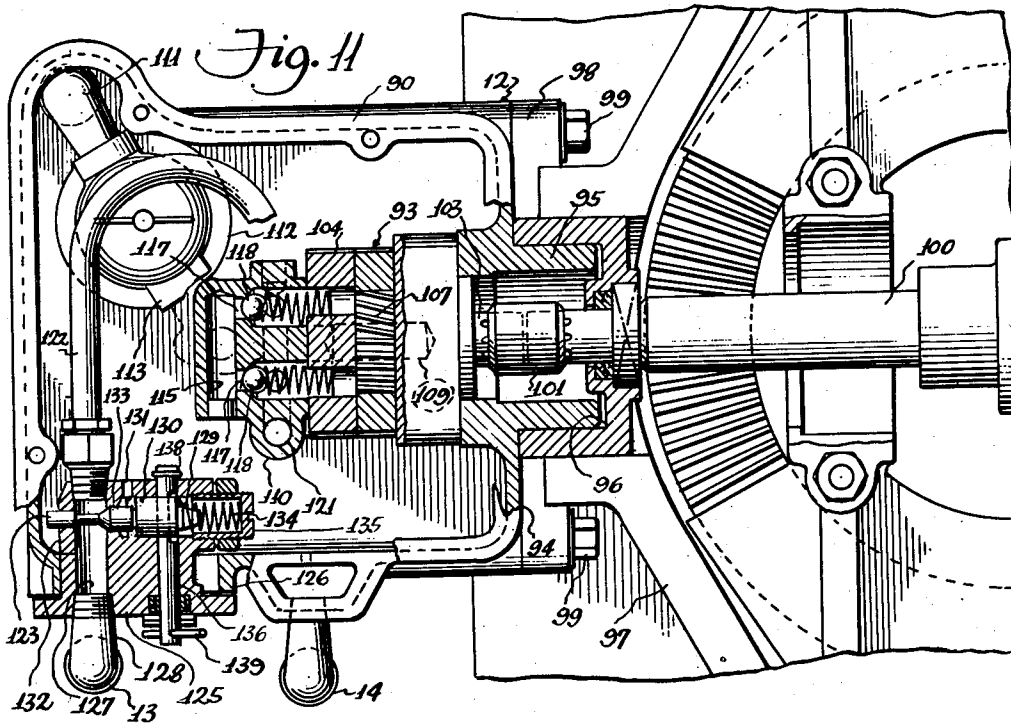
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PUMP FOR DRILLING APPARATUS

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PUMP FOR DRILLING APPARATUS

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3 Claims. (Cl. 103—42)

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This invention relates to improvements in drilling apparatus, and more particularly to a hydraulic drilling apparatus especially adapted for use in drilling coal or similar materials in mines.

Among the objects of my invention are to provide a new and improved hydraulic drilling apparatus particularly adapted for drilling holes in coal or similar materials, together with a portable hydraulic power unit for supplying fluid under pressure to the drilling apparatus, which may be detachably connected with and driven from a kerf-cutting machine.

Other objects of my invention will appear from time to time as the following specification proceeds and with reference to the accompanying drawings wherein:

Figure 1 is a sectional view taken through a mine room, showing a drill constructed in accordance with my invention drilling a hole in the coal face and deriving hydraulic power from a kerf-cutting machine of the room and pillar type;

Figure 2 is an enlarged plan view of the drill shown in Figure 1 with certain parts broken away and certain other parts shown in horizontal section in order to illustrate the fluid motor for driving the drill;

Figure 3 is a rear end view of the drilling apparatus drawn to a slightly larger scale than Figure 2, and showing certain other parts in section than are shown in Figure 2;

Figure 4 is a sectional view taken substantially along line 4—4 of Figure 3;

Figure 5 is a fragmentary longitudinal sectional view taken through the drilling apparatus;

Figure 6 is a fragmentary sectional view taken substantially along line 6—6 of Figure 2;

Figure 7 is a fragmentary sectional view taken substantially along line 7—7 of Figure 2;

Figure 8 is an enlarged detail view showing certain details of the valve for controlling operation of the drilling apparatus;

Figure 9 is a sectional view taken substantially along line 9—9 of Figure 8;

Figure 10 is a sectional view taken substantially along line 10—10 of Figure 2;

Figure 11 is an enlarged plan view of the rear end of the kerf-cutting machine shown in Figure 1, having a power unit constructed in accordance with my invention attached thereto for supplying fluid under pressure to the drilling apparatus, with certain parts broken away and certain other parts shown in horizontal section;

Figure 12 is a longitudinal sectional view taken through the power unit, showing certain details

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of the connection between the rear end of the kerf-cutting machine and the power unit, which are not shown in Figure 11;

Figure 13 is a fragmentary transverse sectional view taken through the power unit; and

Figure 14 is a fragmentary sectional view showing certain details of the relief valve of the power unit, which are not shown in Figure 11.

In Figure 1 of the drawings a kerf-cutting machine 10, herein shown as being of the room and pillar type, is shown making an undercut across the coal face and as providing motive power for supplying fluid under pressure, such as oil, to a drilling apparatus 11 through a detachable power unit 12. Said power unit is detachably connectible with the rear end of said kerf-cutting machine and is driven from the motor of said kerf-cutting machine in a manner which will hereinafter more clearly appear as this specification proceeds. Flexible hoses 13 and 14 are provided to connect said power unit to the pressure and return sides of said drilling apparatus. The hose 13 serves to supply fluid under pressure to said drilling apparatus, and the hose 14 serves to return fluid to said power unit.

The drilling apparatus 11 includes a casing 17 having a drill chuck 18 journaled therein for rotation about a longitudinal axis on a roller bearing 19 and on a ball bearing 20 spaced rearwardly from said roller bearing. Said chuck is adapted to receive the rear end of and to rotatably drive a drill 21, which may be a well known form of spiral drill having a drill bit (not shown) on its forward end. Said chuck is hollow and is provided with a splined inner rear portion 23, adapted to be engaged by a splined drive shaft 24, having a rotor 25 of the drill motor keyed thereon (see Figure 5). Said drive shaft 24 is journaled in the casing 17 adjacent opposite sides of the rotor 25 on ball bearings 27, 27. Said rotor is herein shown as being a gear type rotor having teeth cut on a helix and meshing with the helical teeth of a rotor 29, which is mounted on a shaft 30, journaled in the casing 17 on suitable ball bearings (not shown).

The casing 17 is provided with two laterally projecting parts 31, 32 projecting from opposite sides thereof, which are adapted to have handles 33 and 34 mounted in said projecting portions, which form a means for holding the drilling apparatus in position by the hands, so pressure can be exerted against a breast plate 28 at the rear end of said drilling apparatus while held by the hands, for feeding the drill 21 into the material it is desired to drill. The handle

34, mounted in the laterally projecting part 32, is hollow and has communication with a valve chamber 35, having a piston valve 36 slidably mounted therein, for controlling the admission and release of fluid under pressure to opposite sides of the drill motor, to permit reverse operation of said motor. A valve operating rod 37 is slidably mounted within said handle and is connected to the left-hand end of said piston by means of a pivotal pin 38.

The hose 13 is connected with a pressure passageway 39 formed in the casing 17 for the drilling apparatus, which leads to an annular groove 390 formed in the valve chamber 35. The return hose 14 has connection with a passageway 40 formed in a fitting 41, secured to the left-hand end of the valve chamber 35, to return fluid discharged from the left-hand end of the piston valve 36, to the power unit 12.

The valve chamber 35 is provided with an annular groove 420 spaced to the right of the annular groove 390, which is connected with a pressure passageway 42, for supplying fluid under pressure to one side of the rotors 25 and 29 through a passageway 43, to cause the drill motor to rotate in one direction (see Figures 3 and 4). Balancing passageways 44 and 45 are connected with balancing chambers 46 and 47 respectively, to supply fluid under pressure to the rotors 25 and 29 at points spaced diametrically opposite from the passageway 43, to balance the pressure supplied to said rotors through said passageway 43 (see Figures 6 and 7).

In a like manner, a passageway 49 is connected with an annular groove 490 formed in the valve chamber 35. Said passageway connects the valve chamber 35 with a pressure passageway 50, to supply fluid under pressure to the opposite sides of the rotors 25 and 29, from the passageway 43, to reverse the direction of rotation of the fluid motor. Balancing passageways 51 and 52 connect said pressure passageway 50 with balancing chambers 53 and 54, to balance said rotors when the direction of rotation thereof is reversed. A drain passageway 48 for oil seepage, connects the motor chamber with the return passageway 40.

The piston valve 36 is drilled from the left-hand end thereof and opens from its left-hand end, for the release of fluid through the return passageway 40, through cross-drilled passageways 55, 56, 57 and 58, drilled transversely of said piston valve from the left to the right-hand end thereof, respectively.

A compression spring 61 encircles the left-hand or discharge end of the piston valve 36, to hold said piston valve in a neutral position, so that fluid will pass from the pressure passageway 39 through the cross-drilled passageways 55, 56, 57 and 58, to and through the hollow inside of said piston valve to the return passageway 40, except when said piston valve is manually moved against said spring to a position to admit fluid through the passageways 42 or 49. Said compression spring abuts a retaining collar 63 at its outer or left-hand end, which in turn abuts a shouldered portion 67 of the fitting 41. A snap type locking ring 64 abuts the outer side of said collar and is secured to the end of said piston valve, to hold said collar to the end of said piston valve. The opposite end of said compression spring abuts a retaining collar 66. Said retaining collar abuts the left-hand end of a land 70 of said piston valve, and also abuts a shouldered portion 68 of the discharge end of the valve chamber 35. Said retaining collars thus cause

compression of said spring when said piston valve is moved either to the right or the left. Said spring 61 thus serves to return said piston valve to a neutral position from an operative position either to the right or to the left of a neutral position, when the hand is removed from the means for operating said valve.

The land 70 of the piston valve 36 serves as a guide for said piston and is slotted. The slotted portions of said land have the cross-drilled holes 55, 55 extending therethrough (see Figure 9). A land 71 is spaced to the right of the land 70 and is midway between the walls of the annular groove 490, when the valve is in a neutral position. Said land controls the admission of fluid under pressure to the passageway 49 and the release of fluid from said passageway to the return upon reversal in the direction of rotation of the drill motor. A land 73 is spaced to the right of the inlet port 39 and is midway between the walls of the annular groove 420 when the valve piston is in a neutral position. Said land serves to control the admission and release of fluid under pressure to and from the passageway 42.

When the piston valve 36 is moved against the compression spring 61 to the right, the land 71 will close the passage of fluid from the pressure port 39 to the annular groove 490 and the passageway 49. The land 73 will be moved to a position to close the release of fluid from the pressure port 39 through the cross drills 57 and 58. Fluid under pressure will thus be supplied to the drill motor through the pressure passageways 42 and 43. Fluid will also be released from said motor and returned to the power unit 12 through the passageways 50 and 49, through the cross drills 55 and 56, and out the hollow inside of said piston to the return. This will cause the drill to rotate in one direction.

When the piston valve is moved to the left against the spring 61, the land 71 will be moved to a position to permit fluid under pressure to enter the passageway 49 to the fluid motor, through said passageway and the passageway 50. The land 73 will be moved to close the passage of fluid through the passageway 40 and to permit the release of fluid through said passageway and through the cross drills 57 and 58, leading to the hollow inside of the piston valve, to reverse the direction of travel of said motor.

It should here be noted that the land 71 is provided with a plurality of V-shaped notches 77, 77 which are cut in its left-hand face, and that the land 73 is provided with a plurality of V-shaped notches 78, 78 cut in its right-hand face. The purpose of these notches is to permit the passage of fluid by either of said lands when initially moving the valve in one direction or another, to throttle the fluid pressure supplied to the drill motor, so that said motor will be gradually started when initially starting the drilling apparatus.

The rod 37 slidably mounted in the handle 34, for operating the piston valve 36, is bent at the junction between said handle and the chamber 35, to extend at the angle of said chamber and piston valve, and its end opposite said piston valve has a guide member 81 threaded thereon and locked in position on said rod by means of a lock nut 82. Said guide member is slidably guided in said handle and is provided with a notch 83 adapted to receive a substantially ball-shaped inner end 84 of a hand lever 85. Said hand lever is pivotally connected intermediate its ends, between two parallel spaced projecting portions 86,

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86 extending from said handle 34, by means of a pivotal pin 87. Thus when one side of said hand lever is depressed towards said handle, the piston valve 36 will be moved in one direction, to cause the motor and drill to be driven in one direction, and when the opposite side of said hand lever is depressed towards said handle, said piston valve will be moved in an opposite direction, to reverse the direction of rotation of said motor and drill.

Referring now in particular to Figures 11, 12 and 13 illustrating certain details of the portable power unit adapted to be detachably connected to the kerf-cutting machine, for supplying fluid under pressure to the drilling apparatus, a casing 90 forms an enclosure for a pump 93 for supplying fluid under pressure to the drilling apparatus, and also forms a reservoir for fluid for operating the drilling apparatus through said pump. Said casing is closed by a top cover 91 secured thereto by cap screws 92, and is adapted to be detachably connected to the rear end of the kerf-cutting machine in such a manner that the fluid pump 93 may be driven from the rear end of the kerf-cutting machine. A forward wall 94 of said casing has a hollow boss 95 projecting outwardly therefrom, which is adapted to extend within a socket 96 mounted in the rear end portion of a frame 97 for the kerf-cutting machine. Said socket is provided with a downwardly and laterally extending portion 98, adapted to abut the outside of said inner wall, and to be detachably secured thereto by cap screws 99, 99, to detachably hold said casing to the frame of said kerf-cutting machine.

The kerf-cutting machine 10 is provided with a longitudinal shaft 100 driven from the motor of said kerf-cutting machine in a well known manner, and having a splined socket 101 formed at its rear end. Said shaft serves as the drive member for the feed operating and cutter chain drive mechanism of said kerf-cutting machine, and said socket is provided to serve as a means to drive the truck for propelling the kerf-cutting machine from working place to working place, as is well known to those skilled in the art. The splined socket 101 is adapted to be engaged by the splined forward end of a drive shaft 103 for the pump 93, for driving said pump. Said drive shaft is journaled in a pump casing 104 on ball bearings 105, 105, and has a rotor 106 keyed thereon (see Figure 12). Said pump casing is suitably mounted within said casing 90 and said rotor may be of a well known form having helical teeth cut on the surface thereof and meshing with a rotor 107 suitably journaled in said casing 104 on a shaft 109. A manifold 110 is secured to the rear end of said pump casing 104, for supplying fluid to the suction side of said pump and for releasing fluid from the pressure side thereof.

Fluid is supplied to the suction side of the pump 93 through a pipe 111 leading from a point adjacent the bottom of said casing, and connected with a filter 112 (see Figure 13). Said filter may be of any well known form, to filter dirt from the oil taken in by said pump, and is not herein shown or described in detail since it is not part of my present invention. Said filter is herein shown as being suitably secured to and supported by the manifold 110 and is connected with said manifold to supply fluid thereto, through a passageway 113. Said passageway leads to a vertically extending passageway 114 formed in said manifold and leading downwardly to a branch horizontal passageway 115, extending in opposite directions from said vertical passageway. Said branch passageway is connected at its ends with passage-

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ways 117, 117 leading to opposite sides of the fluid pump 93 and having check valves 118, 118 therein. Said check valves are of a well known form of ball type check valve, and said valves and passageways are so arranged that the pump may be reversible, to supply fluid under pressure to the drill when the shaft 100 is rotating in reverse directions, so as to insure that power be supplied to the drill when the kerf-cutting machine is cutting along the face in one direction or another. The passageways 117, 117 have vertically extending passageways 119, 119 communicating therewith, on the suction sides of the check valves 118, 118. Each of said last mentioned passageways 119 has a check valve 120 therein. Said last mentioned passageways lead to a vertically extending pressure passageway 121 formed in said manifold, which is connected to a pressure pipe 122. The check valves 120, 120 are of a well known type and are so arranged as to permit fluid under pressure to pass through either one of said valves, depending upon the direction of rotation of said pump, but to prevent the flow of fluid therethrough in the wrong direction.

The pressure pipe 122 is connected with an overload relief valve 124, mounted in a valve block 125, which is mounted in a side wall 126 of the casing 90. Said valve block has a passageway 127 extending therethrough, which has a fitting 128 threaded in its outer end, adapted to have the pressure hose 13 connected thereto. A valve chamber 129 extends transversely of the passageway 127 and has a piston valve 130 slidably mounted therein. A relief passageway 131 is connected from said chamber to the inside of the casing 90 to permit fluid to by-pass from the passageway 127 into said casing, when pressure in said passageway 127 exceeds a predetermined amount.

The piston valve 130 has a balancing land 123, which is slidably mounted in an outer side wall 132 of the valve block 125, on the opposite side of the passageway 127 from a land 133, which controls the passage of fluid through the relief passageway 131. Said land 133 is of a slightly larger diameter than the land 123 so that pressure against said land 123 in one direction and against said land 133 in an opposite direction, will cause said valve to close. A spring 134, which may be relatively light, is provided to hold said valve in a closed position. Said spring engages the right-hand end of said piston valve at one of its ends, and extends within a cap piece 135 at its opposite end. Said cap piece is threaded within the valve chamber 129, to provide a means for adjusting the tension of said spring.

A manual control means is provided to selectively open the piston valve 130, to relieve pressure from the passageway 127, when desired. Said manual control means, as herein shown, includes a valve operating rod 136 pivotally mounted in the valve block 125 and extending through an opening 137 of the piston valve 130. Said operating rod has a flattened portion 138 adapted to be engaged with a flat surface of said opening by the spring 134. A pin 139 extends through the outer end of said rod and serves as a hand grip, to permit operation of said valve by the hand. Thus upon turning movement of said rod, the curved portion thereof will be moved into engagement with the flattened portion of said opening in said piston valve, which will slidably move said piston valve in a direction to open the passageway 127 to the relief passageway 131, to by-pass fluid from the pressure line 13.

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 fluid pressure system, a closed reservoir casing, a pump operating within said closed reservoir casing, a valve block mounted in a wall of said reservoir casing, a pressure line from the output side of said pump connected to said valve block, a pressure passageway in said valve block, a piston valve extending across said pressure passageway and having a piston on each side of said passageway, each of said pistons having a surface subject to the pressure within said closed reservoir casing, a return passageway on one side of said pressure passageway, said piston valve being adapted to control opening and closing of said return passageway, a spring for moving said piston valve in a direction to close said return passageway, and said piston controlling the opening and closing of said return passageway having a larger effective area than said other piston so that the pressure within said reservoir casing will create a differential force to maintain said valve in closed position and close said return passageway and pressure in excess of a predetermined amount in said pressure line will move said valve to a position to open said return passageway until pressure in said pressure passageway is reduced to said predetermined value, and manually operable means for moving said piston valve to a position to by-pass fluid in said pressure passageway to said closed reservoir casing.

2. In a fluid pressure system, a closed reservoir casing, a pump operating within said closed reservoir casing, a valve block mounted in a wall of said reservoir casing, a pressure line from the output side of said pump connected to said valve block, a pressure passageway in said valve block, a piston valve extending across said pressure passageway and having a piston on each side of said passageway, each of said pistons having a surface subject to the pressure within said closed reservoir casing, a return passageway on one side of said pressure passageway, said piston valve being adapted to control opening and closing of said return passageway, a spring for moving said piston valve in a direction to close said return passageway, and said piston controlling the opening and closing of said return passageway having a larger effective area than said other piston so that pressure within said reservoir casing will create a differential force to maintain said valve in closed position and close said return passageway and pressure in excess of a predetermined amount in said pressure line will move said valve to a position to open said return passageway until pressure in said pressure passageway is reduced to said predetermined value, and a manually operable control member having slidable engagement with said piston valve when in one position to permit said valve to operate as a relief valve, and having positive engagement with said piston valve when in another position and adapted to move said valve against said spring to by-pass fluid from said pump to said closed reservoir casing.

3. In a fluid pressure system, a closed reservoir casing, a pump operating within said closed reservoir casing, a valve block mounted in a wall of said reservoir casing, a pressure line from the output side of said pump connected to said valve block, a pressure passageway in said valve block, a piston valve extending across said pressure passageway and having a piston on each side of said passageway, each of said pistons having a surface subject to the pressure within said closed reservoir casing, a return passageway on one side of said pressure passageway, said piston valve being adapted to control opening and closing of said return passageway, a spring for moving said piston valve in a direction to close said return passageway, and said piston controlling the opening and closing of said return passageway having a larger effective area than said other piston so that pressure within said reservoir casing will create a differential force to maintain said valve in closed position and close said return passageway and pressure in excess of a predetermined amount in said pressure line will move said valve to a position to open said return passageway until pressure in said pressure passageway is reduced to said predetermined value, and a manually operable control member adapted to positively move said piston valve to a by-pass position, to by-pass fluid from said pump to the closed reservoir casing, said control member extending through said piston valve and having a flat side which when in one position permits free movement of said piston valve so said piston valve may operate as a relief valve, and having an opposite curved side adapted to engage said piston upon turning movement of said control member to positively move said piston against said spring into position to by-pass fluid from said pump to said closed reservoir casing.

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