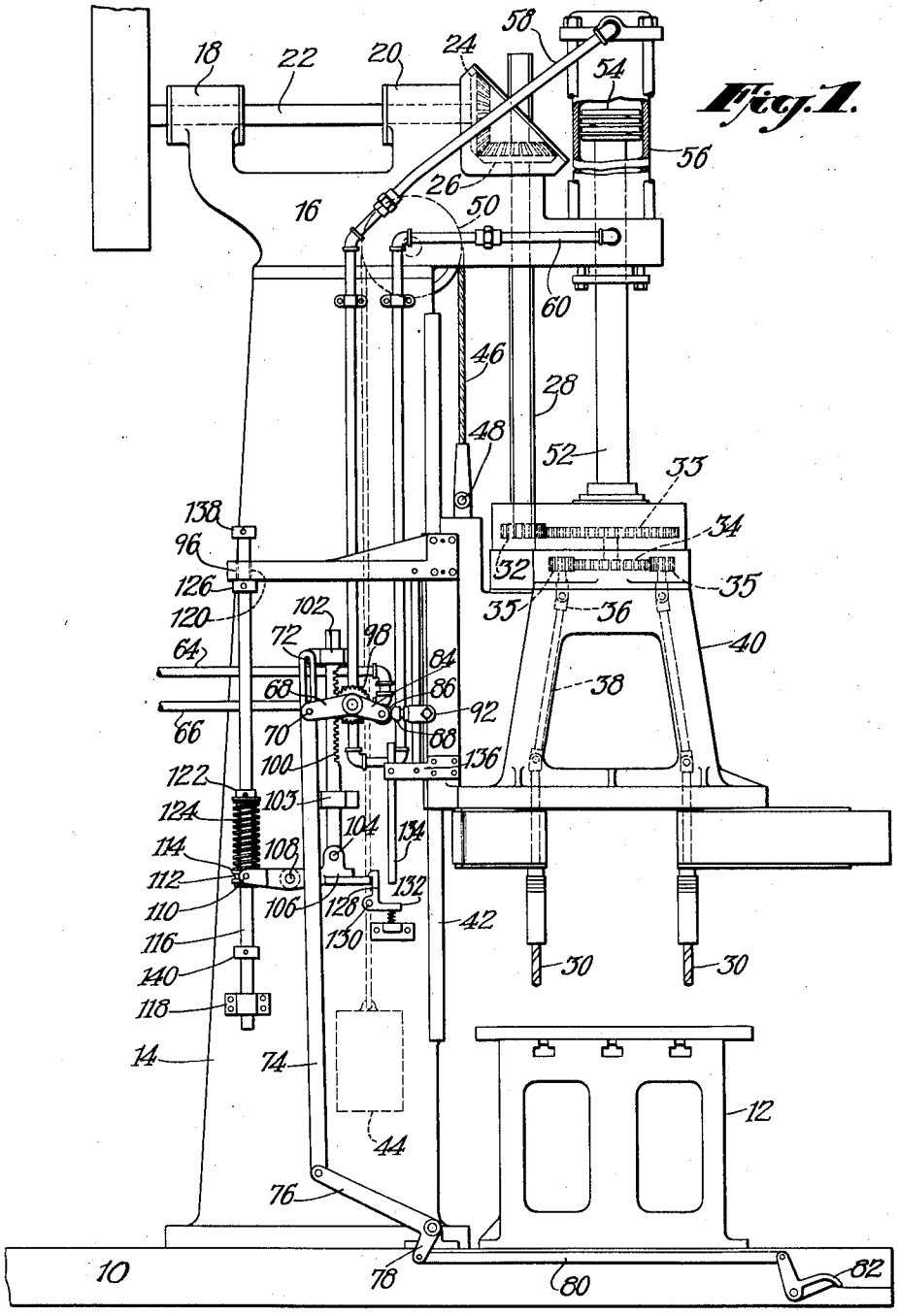
March 18, 1930. J. OAKLEY 1,750,684

HYDRAULIC FEED MECHANISM FOR DRILLING MACHINES

Filed Nov. 16, 1925 3 Sheets-Sheet 1

Fig. 1.




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By his Attorney

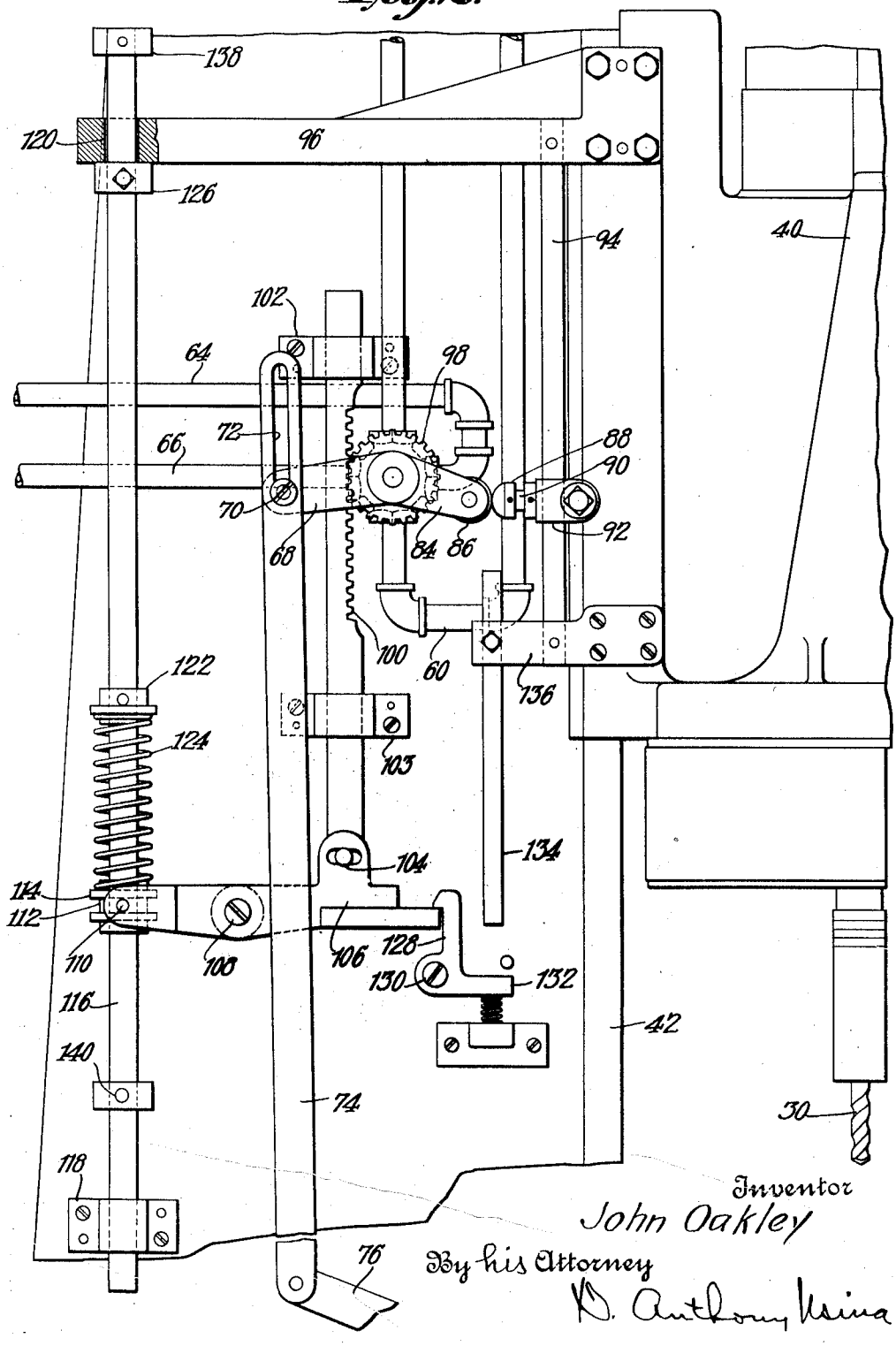
D. Anthony Usina

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HYDRAULIC FEED MECHANISM FOR DRILLING MACHINES

Filed Nov. 16, 1925 3 Sheets-Sheet 2

Fig. 2.




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HYDRAULIC FEED MECHANISM FOR DRILLING MACHINES

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Fig. 7.

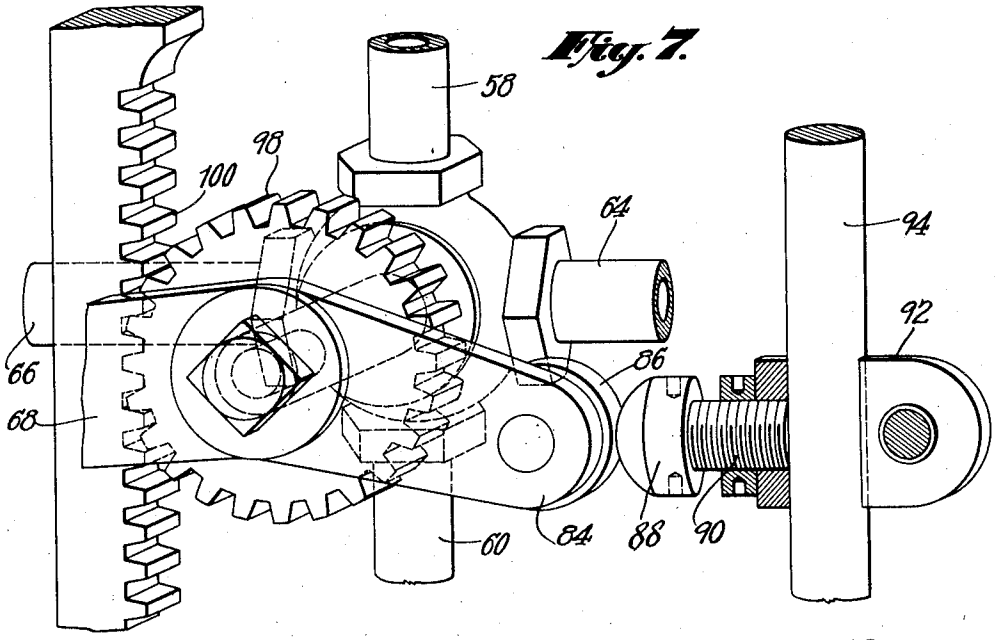



Fig. 3.

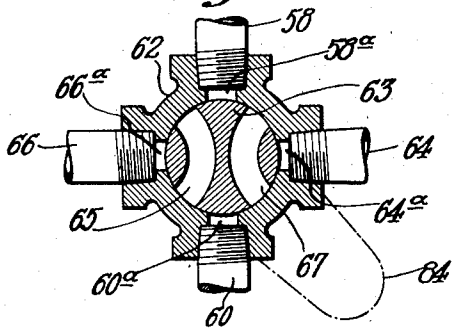



Fig. 5.

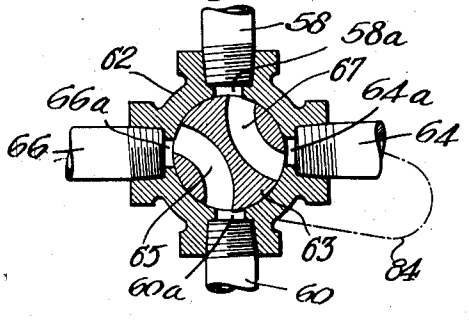



Fig. 4.

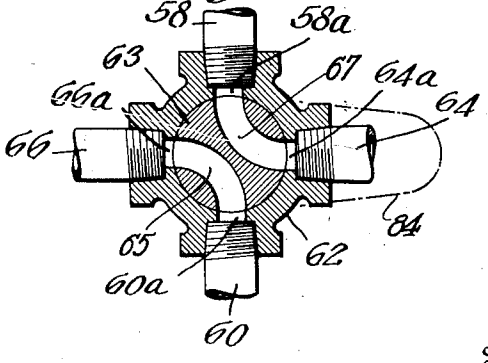
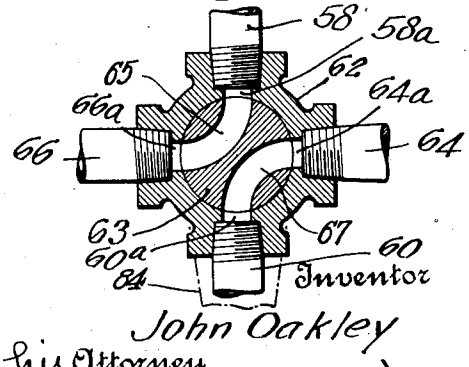



Fig. 6.




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# UNITED STATES PATENT OFFICE

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## HYDRAULIC FEED MECHANISM FOR DRILLING MACHINES

Application filed November 16, 1925. Serial No. 69,232.

This invention relates in general to drills and more particularly to improved means for causing the drills to rapidly approach the work and to feed into the work at a slower speed and then return automatically to a suitable starting position clear of the work. The invention will be understood from the following specification when read in connection with the accompanying drawings which illustrate one embodiment thereof. Referring in detail to the drawings—

Fig. 1 is a side elevation of a multiple spindle drill showing fluid pressure actuated means for moving the drills relatively to the work;

Fig. 2 is an enlarged detail of valve actuated mechanism which controls the operation of the fluid motor;

Figs. 3, 4, 5 and 6 are sectional views illustrating different positions assumed by the valve, Fig. 3 showing the position of the valve with the drill head at rest, Fig. 4 showing the quick approach position, Fig. 5 the comparatively slow feed position and Fig. 6 the quick return position;

Fig. 7 is a detail view illustrating certain operating members for the control valve.

Referring in detail to the drawings, the drill illustrated comprises a suitable base 10 having a work supporting bed 12 thereon and a pedestal 14, the upper end of which carries a bracket 16 provided with bearings 18 and 20 in which is journalled a suitable drive shaft 22 to the outer end of which is secured a bevel gear 24 meshing with the pinion 26 carried on a vertical shaft 28. The shaft 28 and gearing above described may be of any standard type and is adapted to drive a multiplicity of drills indicated at 30 through suitable gears 32, 33, 34, 35 and universal joints 36 and inclined connections 38 of known type, the gearing 34, drills 30 and intermediate connections all being supported by the multiple spindle drill head indicated generally by numeral 40. This drill head is guided on suitable ways 42 formed on the pedestal and its weight is counterbalanced by a suitable counterweight 44 connected to the free end of a cable 46 one end of which is anchored at 48 to the drill head, the cable passing over a suitable sheave 50.

Drill head 40 is connected by means of a rod 52 with a piston 54 located in the cylinder 56 of a fluid pressure motor. Pipes 58 and 60 connected to the opposite ends of the cylinder 56, connect with ports $58^a$ and $60^a$ of a valve casing 62, which houses a rotary valve 63 having passages 65 and 67 therein.

A pipe 64 connects a pump (not shown) with the port $64^a$ of said valve and another pipe 66 connects the port $66^a$ of the valve to a suitable storage tank not shown.

Valve 63 carries on the exterior of the valve-casing an arm 68 connected by screw and slot connection 70, 72 with a link 74, the lower end of which is connected with a bell crank 76 having an arm 78 connected with link 80 to a foot treadle 82.

The valve 63 also has an oppositely extending arm 84 which carries a roller 86 adapted to coact with an adjustable cam member 88 having a threaded shank 90 screwed into a block 92 which is adjustably secured to a vertical rod 94 depending from a bracket 96 which is movable with the drill head 40.

Valve 63 has secured at one end a pinion 98 arranged to mesh with a rack 100, the upper end of which is guided in fixed brackets 102 and 103. The lower end of the rack is connected by a pin 104 with a lever 106 pivoted at 108 to the drill pedestal. The lever 106 carries at one end a pin 110 adapted to engage an annular groove 112 in a collar 114 loosely mounted on a rod 116, the lower end of which is guided in a fixed bracket 118 and the upper end of which slides freely through an opening 120 formed in the extremity of the aforesaid bracket 96. The rod 116 carries a fixed collar 122 and between this collar and the collar 114 is located a spring 124 which is adapted to store up energy as the drill head moves downward as will hereinafter more fully appear, the rod 116 being provided with an adjustable collar 126 arranged to bear on the underside of the bracket 96.

A spring pressed latch 128 pivoted at 130 to the pedestal tends to normally hold the lever 106 in the position shown. This latch

has a tail 132 which is in the path of a stop rod 134 which is adjustably secured by means of a suitable screw to a bracket 136 carried by the drill head.

The rod 116 above referred to carries at its upper end a collar 138 and near its lower end an adjustable stop collar 140.

In operation, assuming the drill head 40 to be at its highest position with the drills 30 clear of the work, the valve 63 will be in the position shown in Fig. 3 so that communication between the fluid pressure motor and source of fluid pressure is cut off.

To cause the drill head 40 to rapidly approach the work the operator steps on the starting treadle 82 and through the link connections shown in Fig. 1, the arm 68 secured to the valve 63 is pulled downward so as to turn the valve counterclockwise to the position shown in Fig. 4 so that the passage 65 of the valve opens communication between the ports $66^a$ and $60^a$. At the same time passage 67 is positioned to open communication between the ports $58^a$ and $64^a$. With the valve in this position the pump supplies oil or other fluid through the pipe 58 to the top of the cylinder 56 at a rapid rate, and thus causes the drill head 40 to quickly approach the work. When the drills 30 contact with the work or if desired at an instant before they actually contact therewith the adjustable feed cam 88 strikes the roller 86 carried on the free end of the valve arm 84 thus turning the valve 63 to the feed position shown in Fig. 5. With the valve in this position, it is noted that the passages 67 and 65 of the valve are moved slightly out of alignment with the ports formed in the valve casing so that the rate of flow of fluid from the pump through the pipe 64 to the top of the cylinder 56 through pipe 58 is materially diminished. This results in moving the drill head 40 at a much slower rate. The rate at which the drills are fed into the work can be varied to suit the material being drilled and also the cutting speed at which the drills can efficiently work on the particular material being drilled. By adjusting the block 92 at different points along the rod 94 it will be understood that the time at which the change in rate of feeding movement of head takes place can be varied. It is also apparent that by screwing the member 88 in or out the effective area of valve port opening can be varied at will so as to cause the head to travel at any desired rate so as to suit requirements of different drilling operations.

As the drill head moves down the bracket 96 impinging in the collar 126 of the rod 116 causes the spring 124 to be compressed against the collar 114, it being remembered that this collar is slidable on the rod 116 and is held in position by the pivoted lever 106 which in turn is held by the latch 128.

After the drills 30 have drilled into the work for the required distance, that is to say, after they have reached a predetermined point, the adjustable feed stop rod 134 will strike the tail 132 of the latch and thus permit the energy stored up in the spring 24 on the downward movement of the drill head to be released so as to transmit upward motion to the rack 100. This will cause the pinion 98 to turn in clockwise direction so as to turn the passages 65 and 67 of the valve 63 to the quick-return position shown in Fig. 6, thus permitting fluid to flow rapidly from the pipe 64 through the passage 67 to the pipe 60 leading to the bottom of the cylinder 56 so as to quickly retract the drill head 40 from the work. Upon the upward movement of the head 40, the bracket 96 will strike the collar 138 and thus lift the rod 116 and after an interval determined by the setting of the adjustable stop collar 140, the latter will strike the collar 112 and thus rock lever 106 which will result in pulling the rack 100 down so as to turn the valve 63 in a counterclockwise direction so as to move the passages 65 and 67 therein from the position shown in Fig. 6 to the starting position shown in Fig. 3. The latch 128 will snap in the position shown in Figs. 1 and 2, thus resetting all of the mechanism in position for a repetition of the above described cycle.

The above described arrangement it will be understood provides means whereby feeding pressure on the drill head is exerted substantially or approximately in the center of the drilling area, it being understood that the piston rod 52 is secured to the drill head in the center of that portion of the head which carries the multiplicity of drills 30. These drills, however, are capable of a wide range of adjustment as to position with respect to the center line of the head. It is, nevertheless, clear that the feeding pressure exerted is much more centrally applied by the provision of a fluid motor located above the head than is the case in mechanically fed drill heads employing rack and pinion or equivalent expedients which are frequently placed to one side of the drill head.

While I have described quite specifically the four-way valve illustrated and certain mechanism for actuating the same, it is apparent that various equivalents may be substituted therefor without departing from the invention as defined in the appended claims.

What I claim is:—

1. The combination with a drill head, of a fluid motor for moving the latter, a valve controlling the rate at which fluid pressure is supplied to said motor and means for shifting the valve to admit fluid at a fast rate to cause the head to rapidly approach the work and means for automatically shifting the valve to cause the head to feed the drills into the work at a slower rate, a member arranged to store energy as the drill head

moves, and devices coacting with said member and said valve arranged to release the stored energy and transmit movement to said valve after the drills have travelled a predetermined distance into the work so as to cause the fluid motor to rapidly retract the drill head from the work.

2. A drilling machine including in combination a drill head supporting a multiplicity of drills, a hydraulic cylinder having therein a piston for exerting a pressure substantially or approximately in the center of the drilling area, a valve controlling the supply of fluid to the ends of said cylinder, means for moving the valve to admit fluid at a rapid rate to one end of the cylinder, means for automatically actuating said valve to reduce the rate at which fluid is admitted to said cylinder, a spring which is compressed by the movement of the drill head, latch restrained means operatively connecting said spring with said valve and means for automatically releasing said latch retained means after the drills have travelled a predetermined distance so as to set the valve to quickly retract the drill head from the work.

In witness whereof, I have hereunto signed my name.

JOHN OAKLEY.