

Sept. 9, 1952

J. A. BRADLEY  
HYDRAULIC ROTARY DRILL

2,610,031

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3 Sheets-Sheet 1

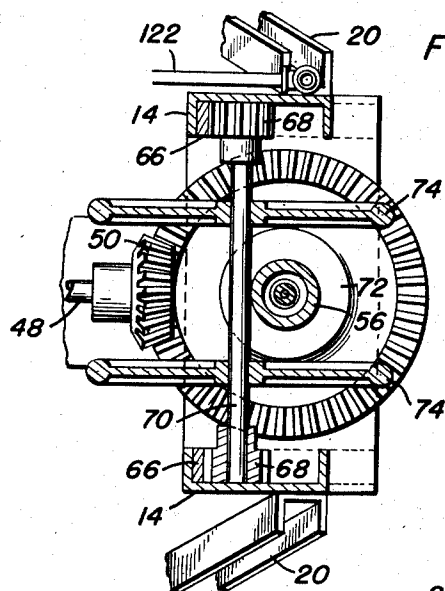


Fig. 5.

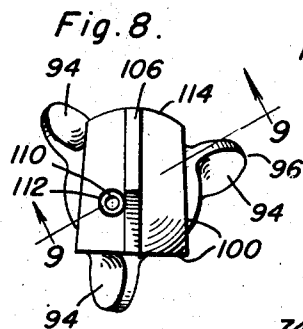


Fig. 8.

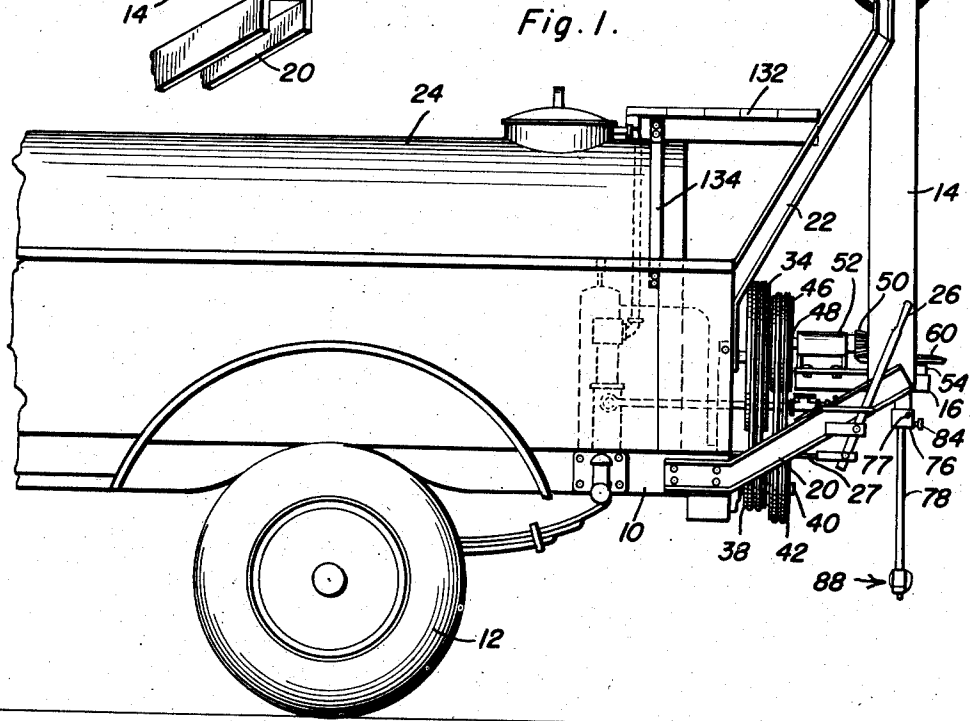


Fig. 1.

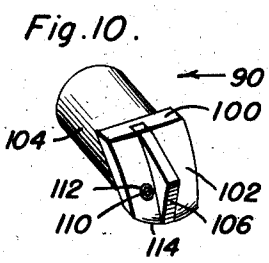


Fig. 10.

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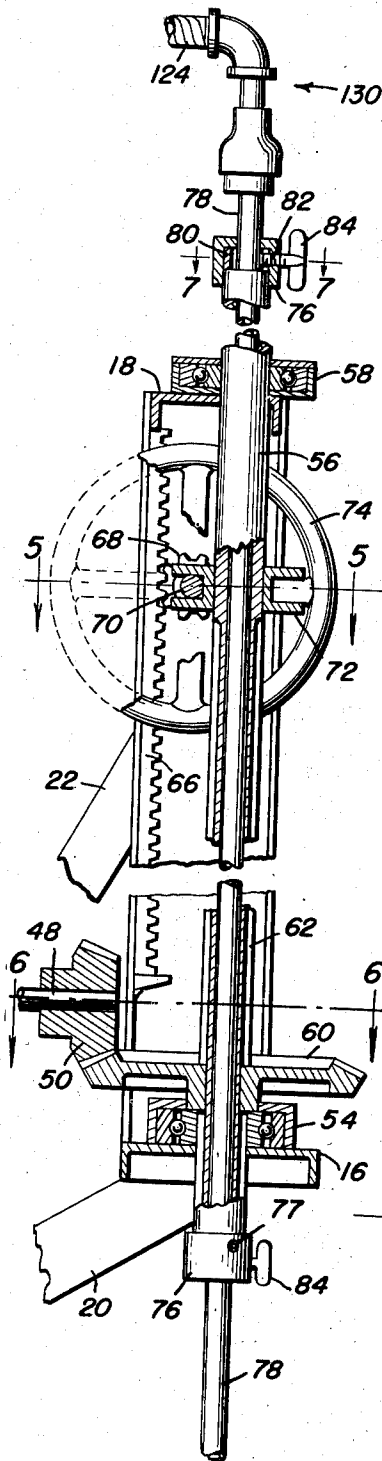


Fig. 4.

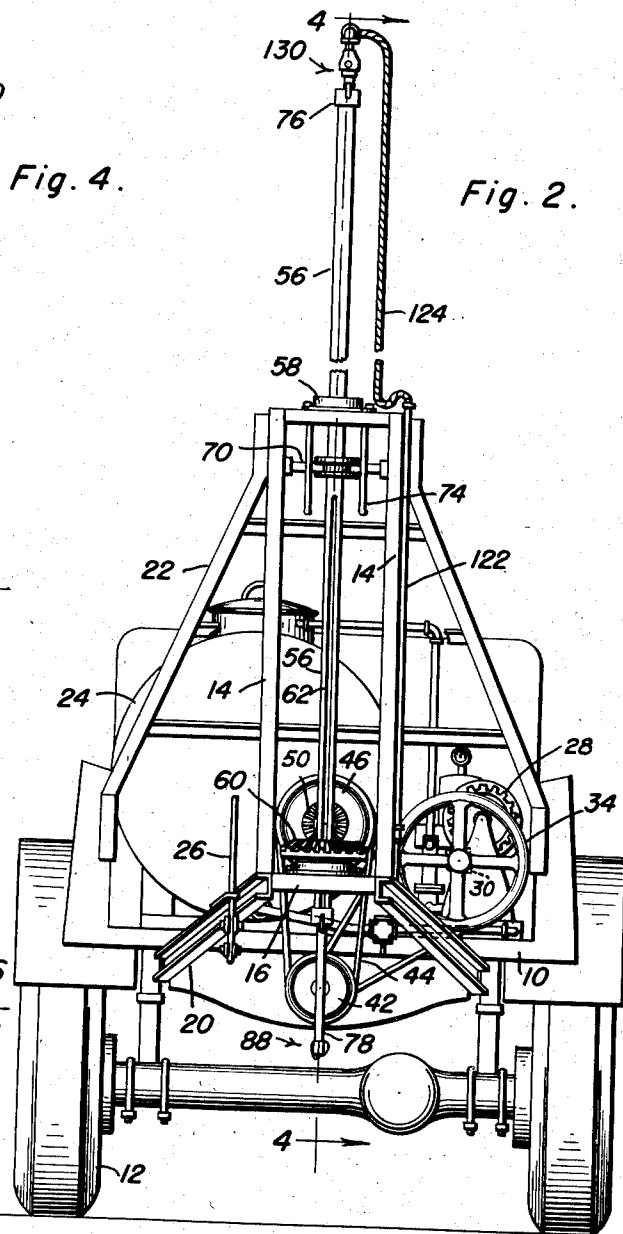


Fig. 2.

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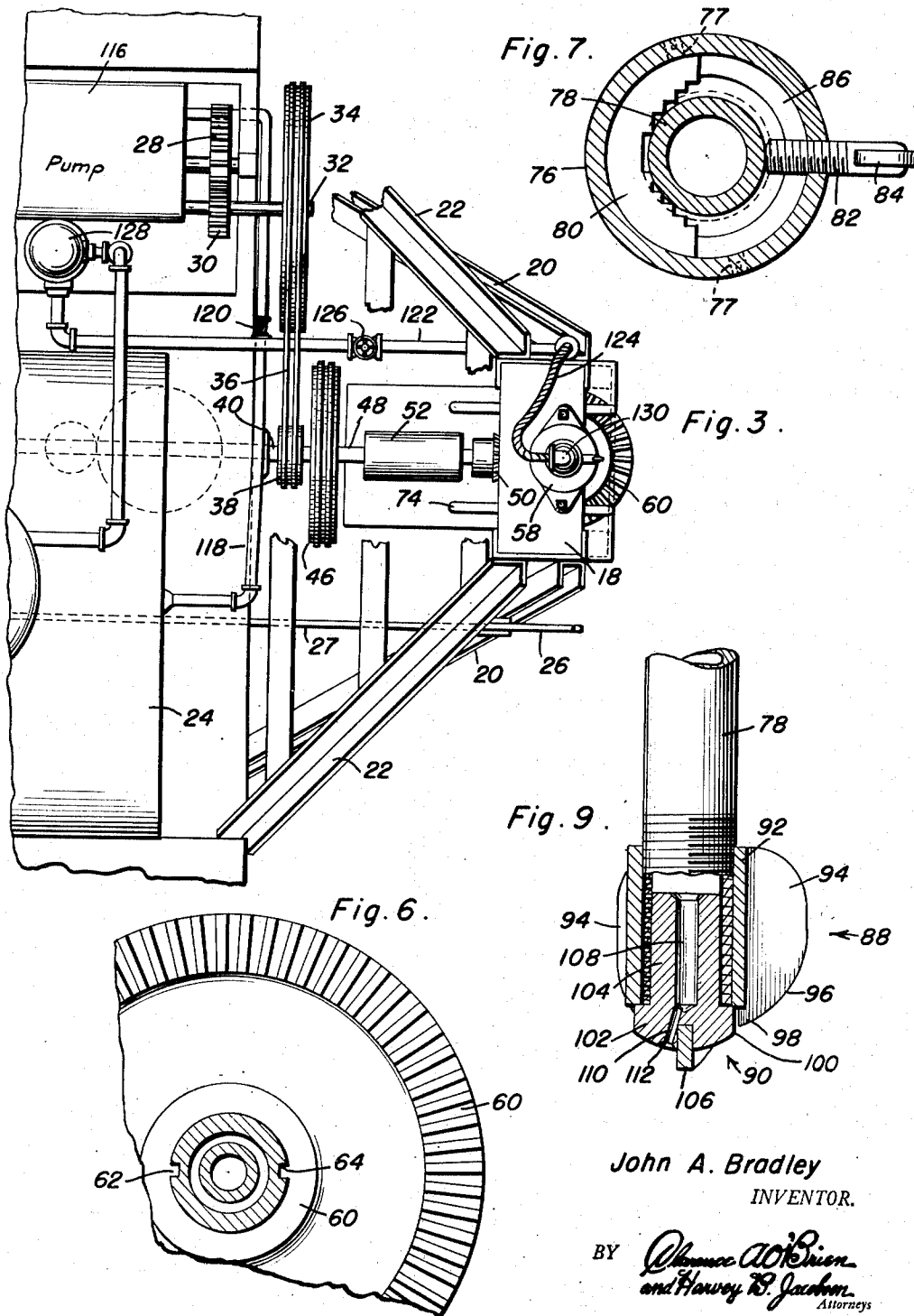
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## UNITED STATES PATENT OFFICE

2,610,031

## HYDRAULIC ROTARY DRILL

John A. Bradley, Santa Ana, Calif.

Application January 12, 1948, Serial No. 1,730

1 Claim. (Cl. 255—61)

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This invention relates generally to drills, and more particularly to a combination hydraulic and rotary drill.

A primary object of this invention is to provide a drill which is particularly well suited for drilling through alluvial soil, a specially designed drill head being used in combination with means to produce a cutting jet of water operating in front of the rotary drill head, so that very rapid drilling may be accomplished.

Another object of this invention is to provide a combined hydraulic and rotary drill which is very easily portable, being suitable for mounting on a relatively light vehicle such as a power wagon of conventional design.

This invention comprehends provision of a drill which may be used to sink drill rod and either to withdraw the drill rod at the completion of the operation or to leave the drill rod to comprise a well. Being rapid in action and easily portable the drill is particularly well adapted for use in the process of forcing fluids such as asphaltic emulsion and sodium silicate into understrata to seal this understrata into a curtain wall or submerged dam, or in improving quicksand and other soft foundations. The instant invention may be used to pump such material into the soil at a predetermined depth and at a large number of locations, all at a minimum cost, the drill rod being withdrawn after the drilling and pumping operations.

Still another object of this invention is to provide a drill in which the drill rod when not withdrawn will become the well when the drill rod is cut off just above the surface of the ground after a sufficient number of lengths of drill rod have been used to reach the desired depth, and in this connection it should be noted that the drill head is screwed to the lower end of the first drill rod, while a specially designed plug is used to close the lower end of the drill rod and drill head excepting a jet opening wherethrough a cutting jet of pressurized water is forced during the operation of the drill rod, and it should also be noted that the invention includes means for removing this plug from the lower end of the drill rod as a sub-surface operation.

Still another object of this invention is to provide a drill according to a form required to carry out the preceding objects, while entailing only a very moderate cost of manufacture, as regards the specially designed drill head and plug, so that these members may be abandoned in the wellpoint without greatly increasing the cost of the operation.

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An object ancillary to the preceding objects is to provide means of this character which is particularly well adapted for use in proving and testing an area, as by sinking a comparatively large number of wellpoints in order that permeability and pressure tests may be made.

Other objects of this invention include provision of means in which a very simple yet completely satisfactory indication of the material through which the drill head is passing is given to the operator, the type of material being indicated by the action of the handwheels used to lower the drill rod, that is, the operator can distinguish between sand, clay, gravel and harder materials by reference to a pressure gauge in the water line and the feel of the handwheels, since this relatively light drilling rig is particularly responsive to changes in types of material drilled.

And a last object to be specifically mentioned is to provide a drill which is relatively inexpensive and completely practicable to manufacture, which is very economical in its use of water, which is extremely simple and convenient to mount upon a truck or other automotive vehicle, and which will give generally efficient and durable service.

With these objects definitely in view, this invention resides in certain novel features of construction, combination and arrangement of elements and portions which will be hereinafter described in the specification, particularly pointed out in the appended claim, and illustrated in the accompanying drawings which form a material part of this application, and in which:

Figure 1 is a side elevational view of this invention operatively applied on the rear end of a light weight automotive vehicle;

Figure 2 is an elevational view of the same structure, the view being taken as from the rear of said vehicle and what will be considered the rear of the assembled drill;

Figure 3 is a top plan view of the same structure, portions thereof being broken away to show underlying structure;

Figure 4 is a vertical transverse sectional view, taken substantially upon the line 4—4 in Figure 2;

Figure 5 is an enlarged fragmentary horizontal sectional view, taken on the line 5—5 in Figure 4;

Figure 6 is a horizontal sectional view taken on the line 6—6 in Figure 4 and showing a portion of the ring gear along with the means used to secure this ring gear to the drill rod quill for

rotation thereof while allowing the vertical movement of the quill;

Figure 7 is an enlarged horizontal sectional view on the line 7—7 in Figure 4, the view being included in the drawings primarily to illustrate the vise jaws used in the means employed for clamping drill rod to the quill;

Figure 8 is an enlarged end elevational view, or this figure may be considered a lower plan view, of the drill head with the specially designed plug operatively associated therewith;

Figure 9 is a cross sectional view of the same structure, taken on the line 9—9 in Figure 8; and

Figure 10 is a perspective view of the specially designed plug removed from what is herein referred to as the drill head, the term drill head being retained for description of that part of the complete drill head which is screwed to the end of the drill rod.

Similar characters of reference designate similar or identical elements and portions throughout the specification and throughout the several views of the drawings.

Referring now to the drawings in detail, it will be noted that this invention is designed for use with an environment including a truck or other automotive vehicle of suitable design having a bed frame 10 and a complement of other parts including ground-contacting wheels 12, so that the drill hereinafter described may be made readily portable by securement to said bed frame 10. It is preferred that the framework of this improved drill shall be constructed with a view to limiting the number of portions thereof necessarily securable to the truck frame, so that the drill may be mounted upon and removed from the automotive vehicle without unnecessary damage thereto. With this in view, the framework of this drill is comprised chiefly of upright members 14, which are spaced apart and welded to a lower plate member 16, an upper plate member 18, lower inclined brace members 20, and upper inclined brace members 22, these frame elements being preferably of an angle iron or channel and the brace members being bolted to any suitable portions of the automotive vehicle such as the bed frame 10. In this connection, it may be noted that the said automotive vehicle will be equipped with a suitable tank 24 and power take-off means including the shaft 40 extending to the rear of the vehicle. In the interest of safety a remote control for the power take-off is provided including the hand lever 26 at the rear of the vehicle and the extension control rod 27. The lever 26 is illustrated as pivoted on one of the lower inclined brace members 20 and the control rod 27 extends forwardly for connection to a clutch pedal at the side of the truck's gear box, not illustrated in the drawings.

Power transmission means may be of any suitable character and is represented in the drawings as including a gear wheel 28 driving the pump 116 and driven by another gear wheel 30 on a shaft 32 carrying a double pulley 34 connected by belts 36 to a pulley 38. The pulley 38 is mounted upon the shaft 40 which drives another pulley 42 connected by belts 44 with a pulley 46 carried on the drive shaft 48 for the pinion 50, the necessary complement of bearing members for the said shafts being provided in any suitable manner; it being thought sufficient to note that the drive shaft 48 must be particu-

larly well journalled in thrust bearing means indicated at 52.

Another thrust bearing assembly 54 is supported on the lower plate member 16 to provide support for the lower end of the quill 56, and another bearing 58 is mounted upon the upper plate member 18 for support of the upper portion of the said quill, it being noted that the thrust bearing 54 actually supports the ring gear 60 rather than the quill 56 directly and that this quill is provided with a pair of diametrically oppositely disposed longitudinal keyways 62 within which slide keys 64 in the hub portion of the ring gear 60. Means must be provided for raising and lowering the quill 56, and when uprights 14 of channel form are employed, this means may conveniently include vertical racks 66 in these channel uprights, pinions 68 in engagement with these racks 66 and rigidly secured on a jack shaft 70, and a collar or thimble 72 having an annular groove to receive an intermediate portion of this jack shaft, this thimble 72 being rigidly secured to the quill 56 and, finally, a pair of handwheels 74 rigidly mounted on the jack shaft.

It will be understood that lengths of pipe rod, usually termed drill rod, will be used to drill the well and that a plurality of such rods terminally joined together, all according to a conventional practice, will comprise the well in instances when not to be withdrawn, and means is therefore required for releasably securing the drill rod to said quill. It is proposed by this invention to provide a hood 76 screwed by screws 77 over each end of the quill, as best illustrated in Figures 4 and 7. The lowermost or first of the drill rods is represented at 78 and the hoods 76 are axially apertured to receive the drill rod. Interiorly thereof and on one side of each hood a multiple driving dog of pipe vise character 80 is welded, the other side of the hood being bored and threaded to receive a set stud 82 which may be provided with wings 84 whereby the stud may be manually set to force the drill rod 78 against the dog 80. If preferred, each of the hoods 76 may be provided with a substantially semi-circular liner 86 opposite to the dog 80.

A special feature of this invention is the drill head, generally indicated by the numeral 88 and the plug generally indicated at 90. These elements are best illustrated in Figures 8, 9 and 10. If reference is now had to these figures, it will be seen that the drill head includes a hollow cylindrical member 92 which may be an ordinary pipe coupling and a plurality, preferably three, small blades 94 which are welded externally and radially on the cylindrical member 92, the blades being similarly tilted or inclined, as best illustrated in Figure 8. The blades may have curved outer edges 96 and it will be noted that these blades do not extend across either end of the tubular cylindrical member 92, thus allowing the lower end of the drill rod 78 to be threadedly connected to the drill head as indicated in Figure 9. The blades extend below the lower end of the member 92 when the device is in use, as indicated at 98 to comprise driving dogs engaging flat sides 100 of the head portion 102 of the plug 90. If reference be had to Figure 10, it will be seen that this plug 90 includes a shank portion 104 which will be integral with the head 102 and that the shank 104 is adapted to fit tightly within the cylindrical member 92 on the lower end of the drill rod 78 with the inner surface of the enlarged head 102 preferably abutting

both the said lower end of the drill rod 78 and the lower end of the tubular member 92. If desired, the tubular member 92 may be fixed in any suitable manner to the lower end of the drill rod 78 to assure that this relationship may be accomplished, the important feature being, however, that the flat faces 100 shall be engaged by the driving dog portions 98 of the blades 94. A cutting fin 106 of triangular form is secured to the lower face of the head 102, being preferably mortised therein and welded in position. The shank portion 104 is axially bored, as at 108 and a communicating inclined or non-axially disposed channel 110 extends through the head 102, the extreme outer end of this channel being preferably bevelled as indicated at 112.

It is preferred that the blades and fin 106 be constructed from mild steel and that these parts, after being fabricated and welded in position, should be faced with relatively hard tool facing material, and it may not be inappropriate in this specification to note that a convenient source of material for the plug 90 may be found in conventional structural steel rivets, the three flat faces 100 being ground on the head of the rivet, leaving one curved edge 114 intact.

In order to force water under pressure through the rod at the same time as it is rotating, a pump 116 of any suitable character is connected as described with the power means 40 for operation, with the tank 24 as a source of water supply, by means of a pipe 118 controlled by a valve 120, and with the drill rod 78 by means of a pipe 122 and a flexible hose 124. A complement of structure usually associated with hydraulic drills and including a control valve 126 and a pressure gauge 128 will be provided, the detail of construction of this portion of the apparatus being immaterial in this application. Since the quill 56 and the drill rod 78 must move vertically during the operation of the machine, a swivel connection, generally indicated by the numeral 130 is used to connect the upper end of the flexible hose 124 to the upper end of the drill rod 78, and of course, to the upper ends of other drill rods added as the depth of the well is increased. A platform 132 will preferably be provided for a tower man to stand upon while connecting new drill rods, this platform being represented in Figure 1 as supported on braces 22 and 134.

The method of operation of this invention will be clearly understood from the foregoing description of the mechanical details thereof, and taken in connection with the above recitation of the objects sought to be achieved by this invention. In recapitulation, it may be added that the drill head 88 with its blades 94 and the coacting fin 106 on the plug 90, operate as a mechanical drill means simultaneously with the action of a cutting jet of water ejected from the channel 110

in the plug 90. The combination of a hydraulic and mechanical cutting means is reflected in a very high speed drilling operation. It should be understood that when the wellpoint has reached a predetermined depth, the drill rods are retracted a distance in the order of two feet and the plug 90 is removed, either by increasing the water pressure in the drill rod well beyond normal operating pressure or by dropping a cord suspended weight into the drill rod, thus driving the plug out of the drill head. The drill head and plug are not salvaged. The lower end of the wellpoint is thereby properly conditioned for permeability and water pressure tests, as well as for other purposes.

Obviously many minor variations may be made in the exact construction and the proportionment of the various elements of this invention all within the spirit and scope thereof and the drawings especially should be considered as illustrative rather than limiting. Accordingly this invention should be limited only as determined by a proper interpretation of the subjoined claim.

Having described the invention, what is claimed as new is:

In a combination hydraulic jet and rotary drill, a hollow drill head rigidly secured to a drill rod, cutting blades on said head, and a plug removably secured in said head, said plug having a non-axially disposed channel extending therethrough and communicating with the interior of said drill rod, said blades being inclined to the axis of the drill head, and said plug having a portion thereof with flat faces engageable by said blades so that said plug is rotated, and a cutting fin on the lower end of said plug.

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