

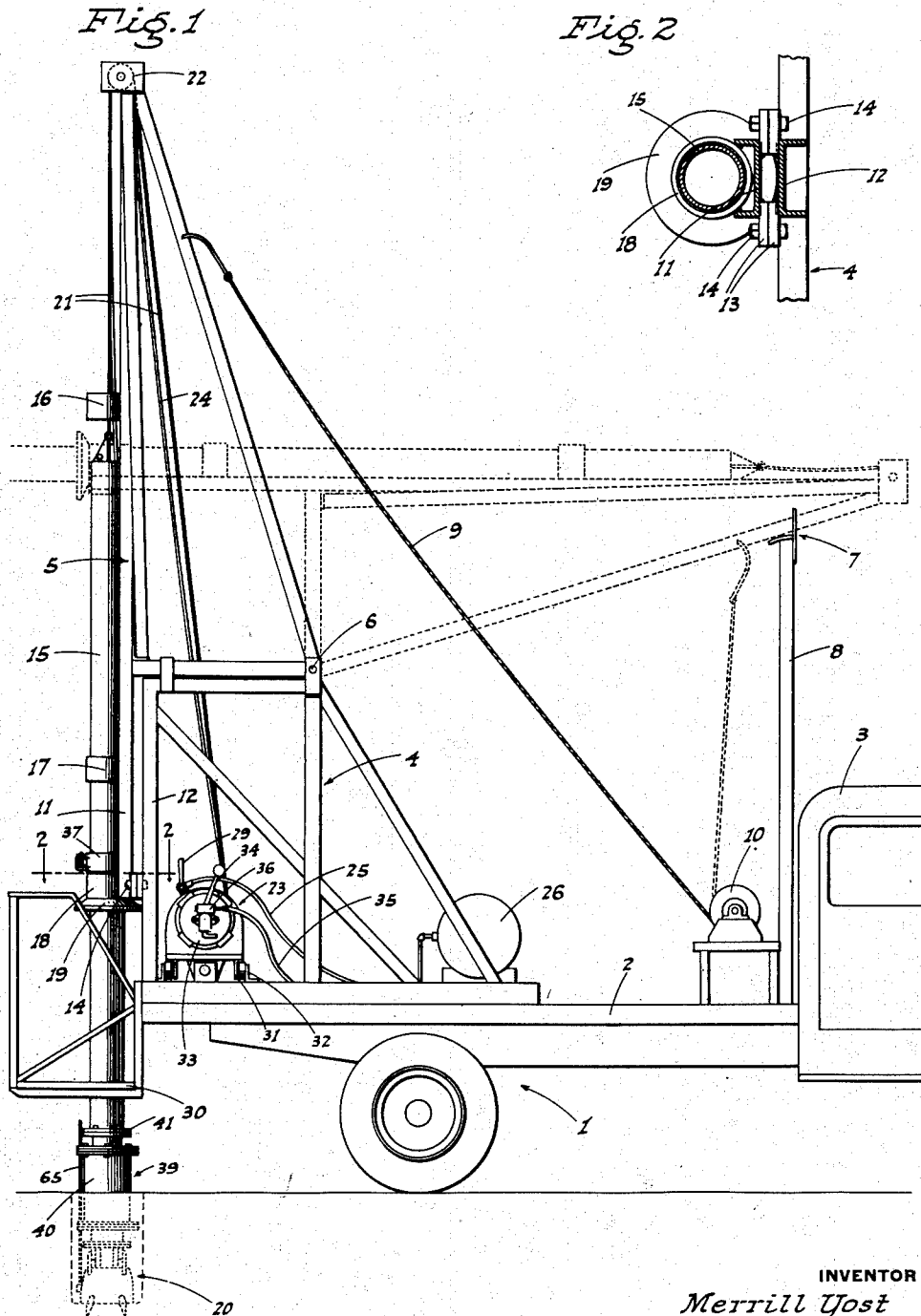
July 14, 1953

M. YOST
HOLE BORING RIG

2,645,458

Filed July 29, 1950

3 Sheets-Sheet 1



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Fig. 3

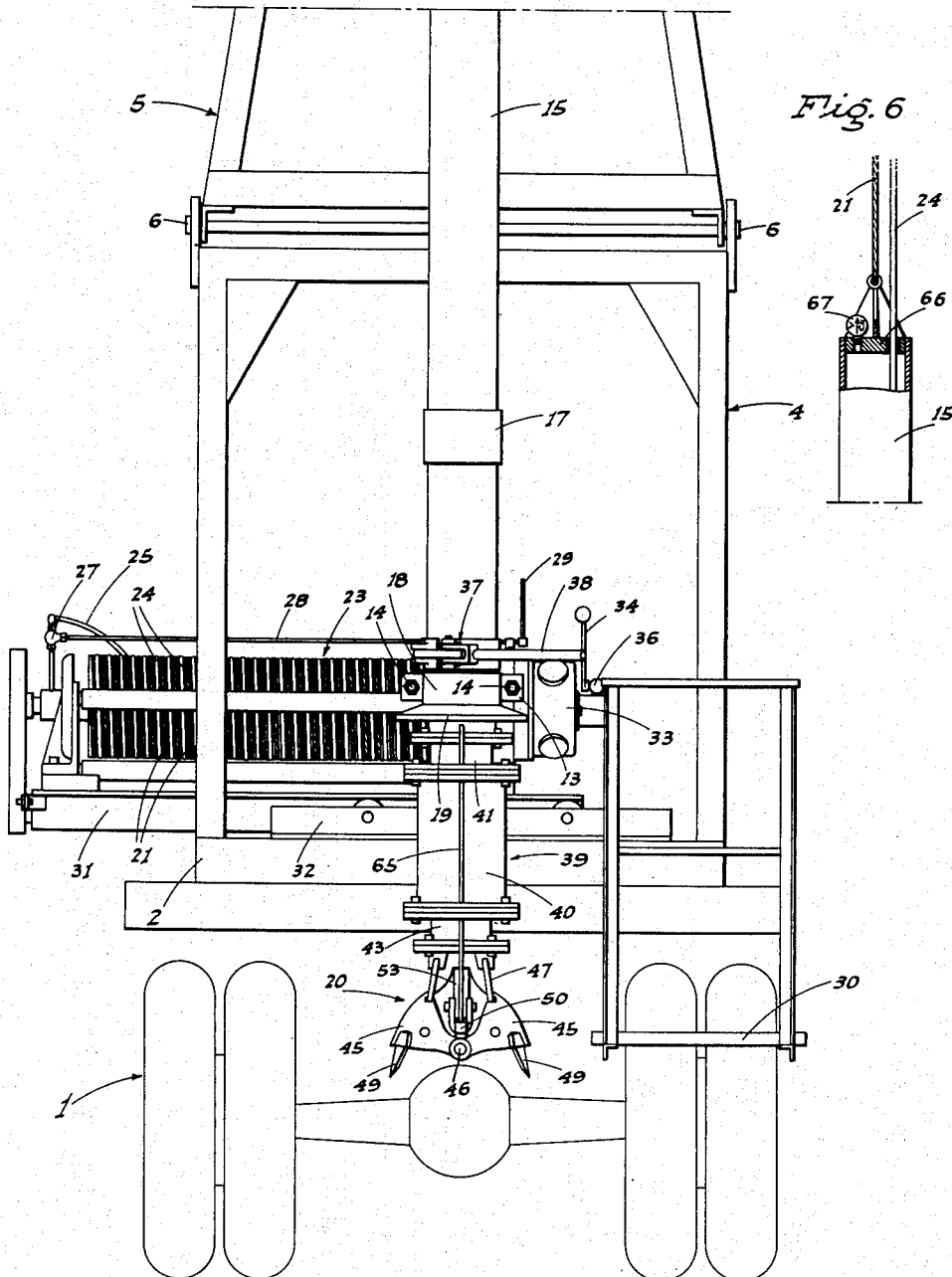
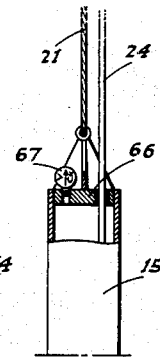


Fig. 6



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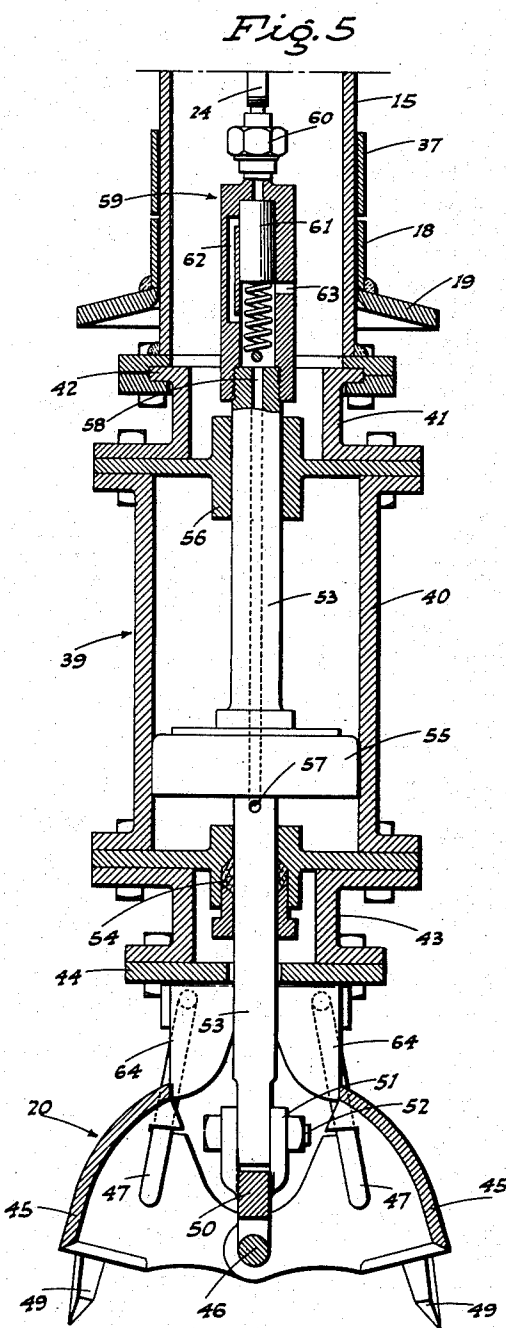
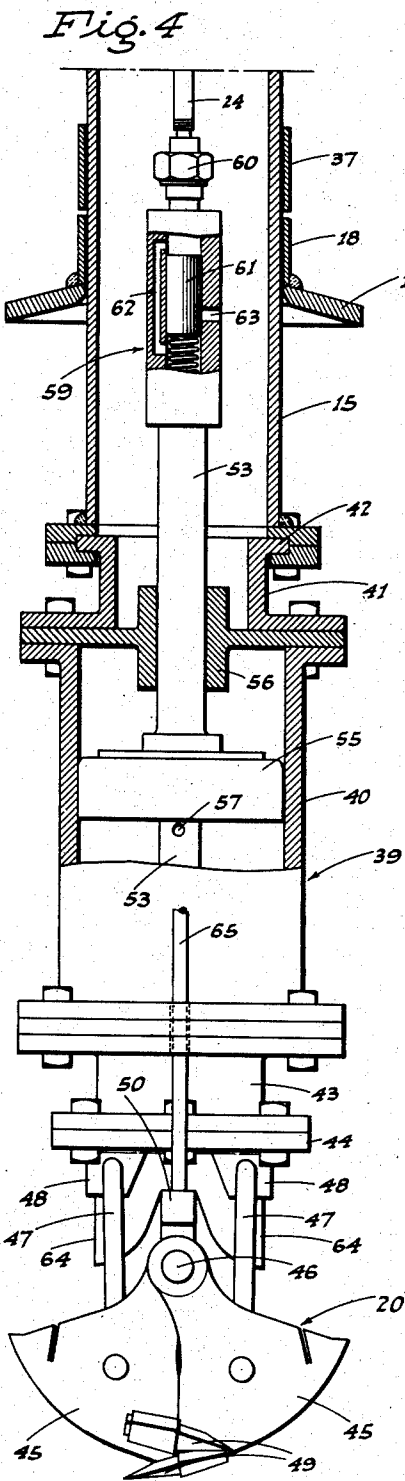
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3 Sheets-Sheet 3



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HOLE BORING RIG

Merrill Yost, Sacramento, Calif.

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5 Claims. (Cl. 255—19)

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This invention is directed to, and it is an object to provide, a hole boring rig of novel construction and function; the rig including a vertically reciprocable column of substantial weight, and a normally open clamshell digging head on the lower end of the column adapted to be driven into the earth upon free fall of the digging column and to then close upon a bite of earth for withdrawal from the hole upon lift of said column.

Another object of the invention is to provide a hole boring rig which is especially designed, but not limited, for use to dig prospect holes, of substantial depth, preparatory to mining or dredging operations.

A further object of the invention is to provide a hole boring rig, of vertically reciprocable, free fall digging type as aforesaid, which includes a novel clamshell digging head designed to withstand the shock of forceful engagement into the earth and to then close under power to pick up a bite or load for withdrawal from said hole.

An additional object of the invention is to provide a hole boring rig which includes novel fluid pressure actuated mechanism to close the clamshell digging head after its impact penetration into the earth at the bottom of the hole; such mechanism comprising a power cylinder and a novel valve unit in association therewith.

A still further object of the invention is to provide a hole boring rig, of the type described, which embodies a novel mast and winch assembly for mounting, guiding, and actuating the digging column and digging head on the lower end of the latter.

It is also an object of the invention to provide a hole boring rig which is fast acting, sturdy and rugged, and relatively simple to operate.

Still another object of the invention is to provide a practical and reliable hole boring rig, and yet one which will be exceedingly effective for the purpose for which it is designed.

These objects are accomplished by means of such structure and relative arrangement of parts as will fully appear by a perusal of the following specification and claims.

In the drawings:

Fig. 1 is a side elevation of the hole boring rig; the mast being shown in its lowered position in dotted lines.

Fig. 2 is an enlarged fragmentary sectional plan on line 2—2 of Fig. 1.

Fig. 3 is an enlarged fragmentary rear end elevation of the hole boring rig.

Fig. 4 is an enlarged elevation, partly in sec-

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tion, of the digging head and its actuating mechanism; the head being closed.

Fig. 5 is a similar view, but in full section and with the digging head open.

Fig. 6 is a fragmentary section of the digging column at its upper end.

Referring now more particularly to the characters of reference on the drawings, the hole boring rig is here shown as mounted on a truck, indicated generally at 1, for transport from place to place; the truck including a flat bed 2 rearwardly of the cab 3.

An upstanding rectangular skeleton frame 4 is mounted in connection with the rear end portion of the truck bed 2 and upstands therefrom; such frame constituting the support for a mast, indicated generally at 5.

The mast 5 is generally triangular in side elevation, and normally seats atop the frame 4, but is hinged at its forward bottom corner, as at 6, for forward and downward tilting to a horizontal transport position; as shown in dotted lines in Fig. 1. When lowered to its horizontal transport position, the mast 5 rests in a cradle 7 on the upper end of a post 8 which upstands from the truck bed immediately rearwardly of the cab 3. The mast 5 is adapted to be tilted forwardly and downwardly to its horizontal transport position by a pull cable 9 which leads from a winch 10.

The mast 5 includes, at the rear thereof, a main channel iron mast beam or pole 11, and said mast beam normally extends downwardly some distance below the upper end of the frame 4 rearwardly of the latter. At its lower end the mast beam 11 is detachably secured to a beam 12 of the frame 4 by matchingly engaged attachment plates 13 fixed on corresponding ones of the beams 11 and 12 and connected by bolts 14.

A vertically elongated, tubular digging column 15 of substantial strength and weight is disposed immediately to the rear of the mast beam 11 for vertical reciprocation, being adapted to run through a plurality of vertically spaced guide collars, indicated at 16, 17, and 18; the guide collar 18 including a downwardly flaring bell 19 for the purpose of guiding the upper end of the column 15 for re-entrance into said guide collar 18 in an instance wherein the column has been working in its entirety below said last named collar.

At its lower end the digging column 15 is fitted with a clamshell digging head, indicated generally at 20, and which is hereinafter described in greater detail.

The digging column 15 is suspended, for vertical reciprocation, by a cable 21 which turns over a top sheave 22 on the mast, and thence leads downwardly to a winch 23 of a standard axially traveling drum type; such winch being set so that the drum travels axially in a direction transversely of the truck bed 2. The purpose of this arrangement is to assure that the cable 21 maintains proper alignment at all times with the top sheave 22. In addition to the cable 21, the winch 23 carries a hose 24 wound with the turns side by side with the cable 21; said hose likewise extending to the top of the mast, turning about a top sheave, and thence depending into the digging column 15 to supply air under pressure to the hereinafter described power mechanism which actuates the digging head 20.

Air under pressure is supplied to the hose 24, through the winch 23 and suitable connections, by a hose 25 leading from an air supply tank 26. The air supply tank 26 is connected to a suitable source of air pressure (not shown), which may be a separate compressor unit disposed alongside the truck 1.

Air pressure delivery from the hose 25 through the winch fittings to the hose 24 is controlled by a two-way valve 27 actuated by a rod 28 connected to an operating lever 29 at the opposite end of the winch 23, and which is adjacent the operator's platform 30; the latter being mounted at the rear end of the truck in a laterally offset position.

The winch 23 includes a carriage 31 carried on roller ways 32 for axial travel transversely of the truck bed, and which travel of the winch is caused by an air motor 33 built into the winch and having suitable driving connections; said air motor 33 being controlled by an operating lever 34 accessible from the platform 30. Air under pressure to actuate the motor 33 is delivered through a hose 35 which leads to the valve 36 which the lever 34 controls.

Operation of the lever 34 one way or the other causes the winch 23 to pay out or to wind in both the cable 21 and hose 24, with simultaneous axial travel of the winch drum in a direction to maintain the desired alignment with the top sheaves.

Under certain operating conditions it is desired to lock the digging column 15 to the mast beam 11, and this is accomplished by a band-type brake 37 fixed to the mast beam 11 and encircling the digging column 15, such brake being adapted to be set or released by a brake lever 38 accessible from the operator's platform 30. This brake may be of any conventional type, such as is shown, for instance, in Patent No. 2,337,133 to H. G. Strain.

The brake lever 38 has a beyond-dead-center position whereby the digging column 15 may be locked to the mast beam 11; this being essential under certain working conditions, and when the mast and the digging column 15 are in their horizontal transport position, as in dotted lines in Fig. 1.

The clamshell digging head 20 is actuated by a power cylinder unit, indicated generally at 39, interposed between said digging head and the lower end of the digging column 15; said digging head and power cylinder unit being constructed in detail as follows:

The power cylinder unit 39 includes a cylinder 40 secured in dependent relation to the lower end of the digging column 15 by means of a flanged attachment collar 41; the uppermost flange 42 being turnably connected to said column whereby

the power cylinder unit 39 and the digging head 20 may be manually rotated from time to time, to the end that a round hole be bored. It will be understood that with a clamshell digging head 20 the hole would not be round if said head were not turned from time to time during the digging or boring operation.

At its lower end the cylinder 40 is connected by a flanged attachment collar 43 to a mounting plate 44 from which the clamshell digging head 20 is suspended; said head comprising a pair of cooperating clamshell bucket halves 45 pivoted together at their inner end by a cross shaft 46. On opposite sides each clamshell bucket half 45 is pivotally suspended by swing arms 47 from ears 48 on the under side of the mounting plate 44; each clamshell bucket half including digging teeth 49.

A cross head 50 is fixed in connection with the cross shaft 46 above the latter, and said cross head includes a centrally disposed, upstanding clevis 51 pivoted, as at 52, to the lower end of a piston rod 53 which extends upwardly through a packing gland 54 axially into the cylinder 40.

Within the cylinder 40 the piston rod 53 is fitted with a piston 55, and thence the piston rod continues upwardly through a guide 56 through the attachment collar 41.

A port 57 opens from the piston rod 53 below the piston 55, and such port is in communication with an axial bore 58 which leads upwardly in the piston rod 53 opening to its upper end.

An automatic valve, indicated generally at 59, is affixed at its lower end to the upper end of the piston rod 53, and at its upper end the valve 59 is connected by a rotary fitting 60 to the hose 24 which depends into the digging column 15 from the upper end of the mast.

When the power cylinder unit and digging head are manually rotated, as previously stated, piston rod 53 and valve 59 are rotated therewith; the rotary fitting 60 allowing such rotation without twisting of the hose 24.

The valve 59 functions as follows:

When air pressure is fed to the hose 24 by manipulation of the operating lever 29, a normally spring elevated plunger 61 is depressed, establishing communication about said plunger through a bypassing duct 62, the air pressure then feeding downwardly in the bore 58 and delivering through the port 57 into the cylinder 40 below the piston 55.

The piston 55 and the clamshell bucket halves 45 are normally lowered and opened, respectively, by gravity, but when air pressure delivers from the port 57 the piston 55 is forced upwardly, and corresponding motion of the piston rod 53 closes the clamshell bucket halves with a digging or biting action. The clamshell bucket halves 45 will thus remain closed as long as air pressure remains in the hose 24, and the spring elevated plunger 61 is depressed, in the manner shown in Fig. 4, to open the bypassing duct 62. However, immediately upon the air pressure being relieved from the hose 24, the plunger 61 is spring-elevated, closing the bypassing duct 62 and opening a vent port 63, venting the cylinder 41 through the port 57 and axial bore 58, with the result that the piston 55 and clamshell bucket halves 45 fall to their normally lowered and open positions, respectively.

It will thus be evident that by the simple manipulation of the lever 29 the operator has full and positive control of the bucket halves 45 of the clamshell digging head 20.

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In order to prevent the clamshell bucket halves 45 from opening beyond a predetermined point, and to the end that said bucket halves may have great impact resistance, the same abut at their upper edges against heavy-duty stops 64 which are fixed to, and depend from, the mounting plate 44 centrally between the corresponding swing arms 47.

In operation of the described hole boring rig the digging column 15 is recurringly elevated by the cable 21 to a substantial height and then released for free fall; the clamshell digging head 20 being open with each such free fall and thus striking the bottom of the hole with the clamshell bucket halves apart.

By reason of the heavy-duty construction embodied in the clamshell digging head, including the stops 64, the clamshell bucket halves are capable of withstanding the impact shock, and they are driven forcefully into the earth at the bottom of the hole.

Thereafter, with the digging column 15 remaining lowered and stationary, the clamshell digging head 20 is actuated, in the manner previously described, to close upon a bite of earth, whereupon the digging column 15 is elevated until the digging head 20 is above ground. At this time a suitable scoop (not shown) is placed over the top of the hole directly below the digging head 20, and the latter is then opened to discharge said bite of earth onto the scoop for removal.

The above described cycle of operation may be repeated relatively rapidly, and as a consequence the rig is capable of boring a hole in the earth at a substantial number of feet per hour.

Under conditions where the hole is relatively deep, the digging column 15 will run out of the lowermost guide collar 18, but—as aforesaid—the bell 19 assures that upon each upward travel of said digging column it re-enters the said guide collar 18 through the bell 19. The rig is thus capable of digging relatively deep holes, such as prospect holes for mining or dredging, or wells, with the depth limited only by the length of the cable 21, and hose 24. It may be here noted that cable 21 is of a neutral or rotating type so as to prevent rotation of column 15 while being raised or lowered.

In working in certain types of earth which may be gummy or sticky, the clamshell bucket halves 45 which normally fall apart by gravity when the digging head 20 is opened, are positively forced apart by a push rod 65 which leads upwardly from the crosshead 50 and abuts against the bell 19 when the digging column 15 reaches its uppermost limit of travel. The push rod 65 thus assures of positive mechanical opening of the clamshell bucket halves 45 as each digging cycle is completed.

In order to prevent dirt or water from entering column 15, said column is closed at the top by a head 66, the hose 24 passing through the head in sealed relation.

In order that air trapped within the column from the cylinder exhaust may escape to atmosphere, the head is provided with an upwardly opening check valve 67.

The described hole boring rig is very practical and reliable; providing a mechanism capable of digging or boring holes in the earth in a relatively fast and expeditious manner.

From the foregoing description it will be readily seen that there has been produced such a device as substantially fulfills the objects of the invention, as set forth herein.

While this specification sets forth in detail the

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present and preferred construction of the device, still in practice such deviations from such detail may be resorted to as do not form a departure from the spirit of the invention, as defined by the appended claims.

Having thus described the invention, the following is claimed as new and useful, and upon which Letters Patent are desired:

1. A hole boring rig comprising a mast, a digging column disposed adjacent the mast for vertical reciprocating motion, guide collars on the mast in vertically spaced relation, the column running through said collars, a power actuated cable suspending the column from the mast for reciprocating motion, a digging head on the lower end of the column, and a downwardly flaring bell fixed on the mast below the lowermost collar to guide the column for re-entry into said lowermost collar from a position below the same.

2. A hole boring rig comprising a mast, a digging column disposed adjacent the mast for vertical reciprocating motion, guide collars on the mast in vertically spaced relation, the column running through said collars, a power actuated cable suspending the column from the mast for reciprocating motion, a digging head on the lower end of the column, and a normally released, friction brake mounted in connection with the mast and cooperating with the column to clamp the same against movement relative to the mast.

3. In a hole boring rig which includes a digging column arranged for power lift and free fall relative to a mast; a digging head on the lower end of the column comprising a horizontal mounting plate, a pair of cooperating clamshell bucket halves below said plate, swing arms suspending the bucket halves from the plate, adjacent ends of the bucket halves being pivoted for opening and closing motion of said halves, power means operative to impart such motion to the bucket halves, an upstanding push rod connected to the assembly of bucket halves to open the same upon relative downward movement of the rod, and a fixed member against which said rod abuts upon said column being lifted to its uppermost limit of travel.

4. A hole boring rig comprising a mast, a digging column disposed adjacent the mast for vertical reciprocating motion, power means operative to impart such motion to the column, a fluid pressure actuated power cylinder mounted axially on the lower end of the column, a digging head mounted on the lower end of the power cylinder and connected for actuation by the latter, a valve controlled fluid pressure supply conduit leading to the power cylinder to cause actuation of the latter, and an automatic valve interposed between the conduit and power cylinder arranged to cause fluid pressure to feed in actuating relation to the power cylinder upon fluid pressure being present in said conduit, and to vent the power cylinder upon cessation of said fluid pressure in the conduit; said automatic valve comprising a cylindrical member which at its upper end is connected to the supply conduit and at its lower end to the power cylinder, a piston slidable in the cylinder and a spring urging the piston up, the cylinder having an exhaust port in one side uncovered below the piston when the latter is fully raised by the spring and the cylinder having a piston-bypassing passage in its wall open at both ends to the cylinder when the piston is lowered by pressure against the resistance of the spring, and the exhaust port is covered by said piston.

5. A hole boring rig comprising a mast, a dig-

ging column disposed adjacent the mast for vertical reciprocating motion, power means operative to impart such motion to the column, a fluid pressure actuated power cylinder mounted axially on the lower end of the column, a digging head 5 mounted on the lower end of the power cylinder and connected for actuation by the latter, a valve controlled fluid pressure supply conduit leading to the power cylinder to cause actuation of the latter, an automatic valve interposed between the conduit and power cylinder and arranged to cause fluid pressure to feed in actuating relation to the power cylinder upon pressure being present in the conduit and to vent the power cylinder upon cessation of pressure in the conduit, means 10 mounting the head and cylinder on the column for rotation as a unit relative thereto, means mounting the valve in fixed connection with the top of the cylinder, the supply conduit being within the column, and a rotary coupling con- 20

necting the valve and conduit and axially aligned with the axis of rotation of the power cylinder.

MERRILL YOST.

References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
1,245,274	Riley -----	Nov. 6, 1917
1,645,989	Hansen -----	Oct. 18, 1927
1,674,392	Flansburg -----	June 19, 1928
1,928,485	Gilbert -----	Sept. 26, 1933
15 1,985,710	Allard -----	Dec. 25, 1934
1,999,115	Shinn -----	Apr. 23, 1935
2,013,070	Sheridan -----	Sept. 3, 1935
2,223,645	Solomon -----	Dec. 3, 1940
2,337,133	Strain -----	Dec. 21, 1943