Aug. 27, 1963 P. W. GRABOW 3,101,799

STEAM NOZZLE BORING DEVICE

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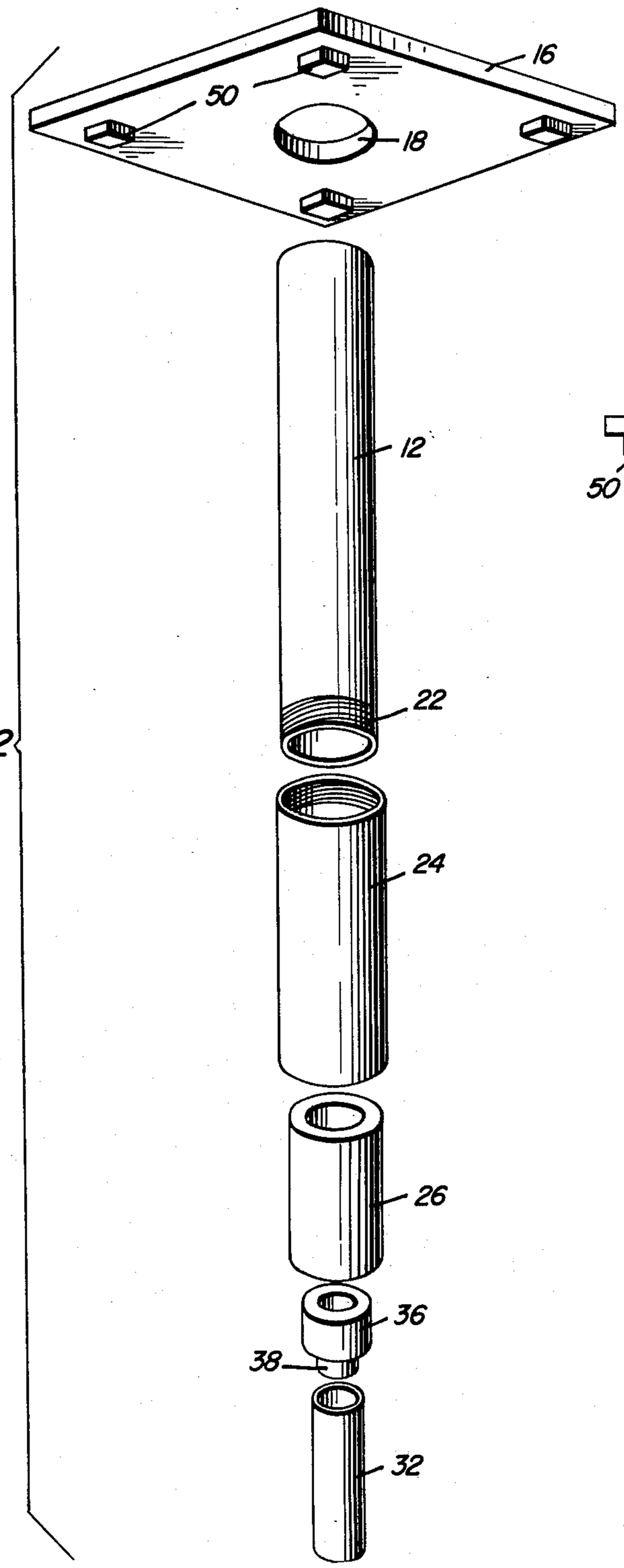

Fig.2

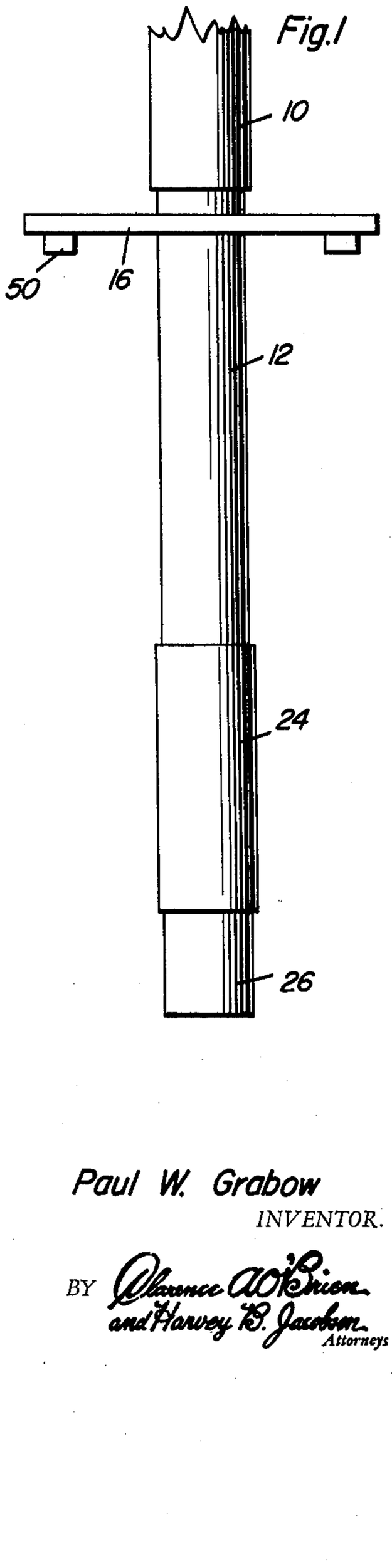

Fig.1

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Fig.3

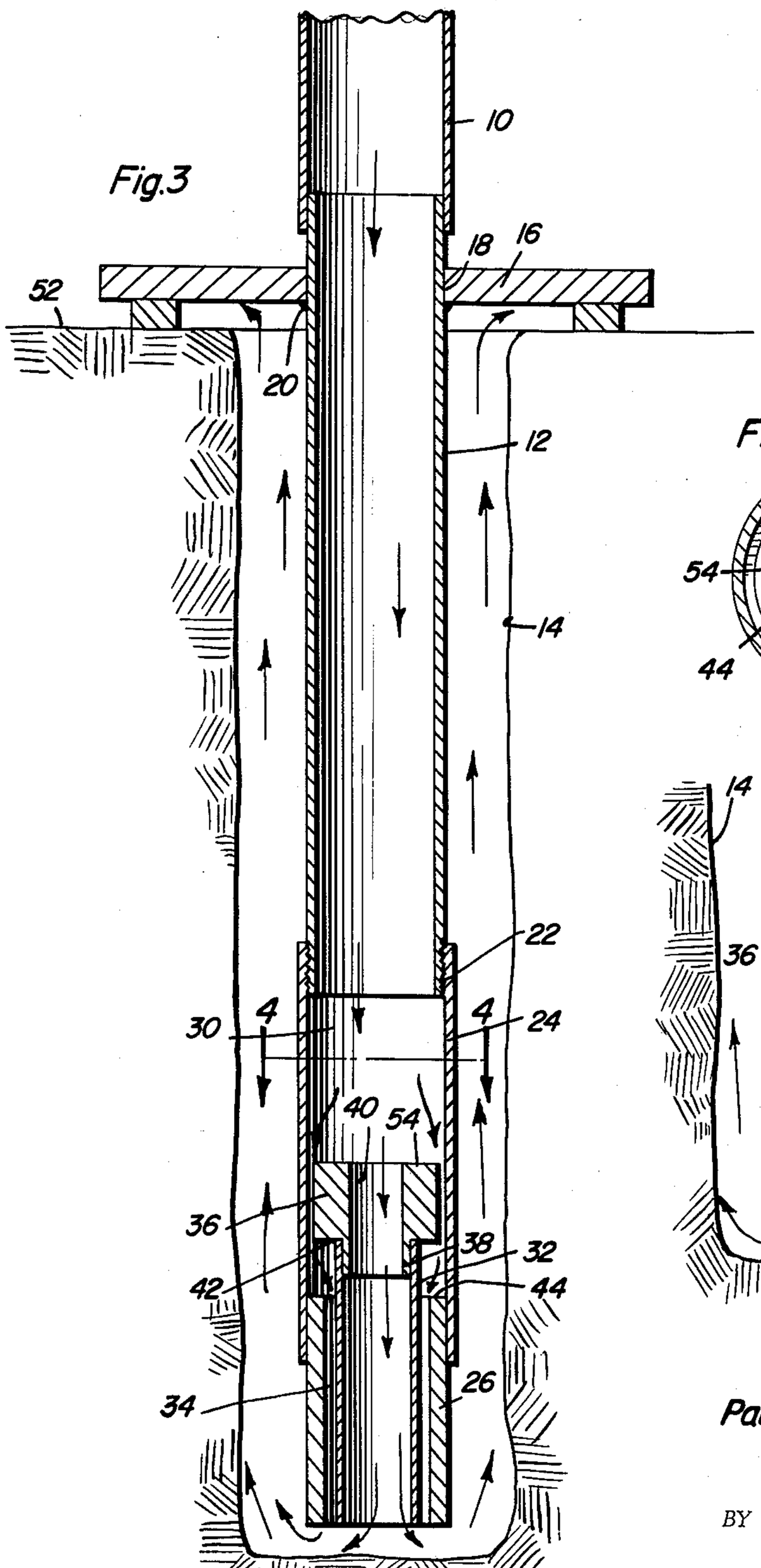


Fig.4

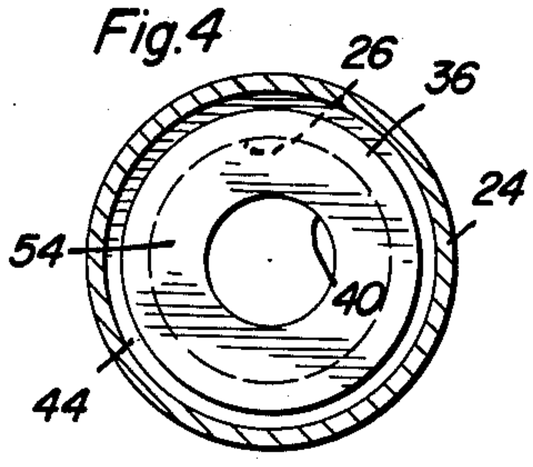
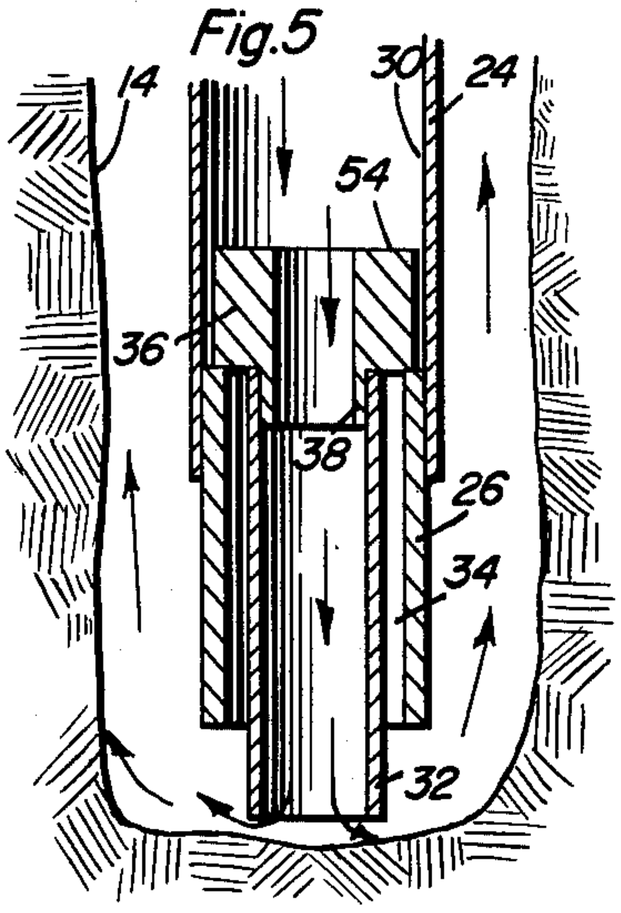


Fig.5



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STEAM NOZZLE BORING DEVICE

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This invention comprises a novel and useful steam nozzle boring device and more particularly relates to an apparatus to effect the drilling or boring of post holes and the like for receiving telephone poles and similar posts and particularly for performing drilling operations in frozen earth as in the winter.

The primary object of this invention is to provide a means which will enable boring or drilling of post holes into the frozen ground in a convenient and efficacious manner.

A further object of the invention is to provide an apparatus in accordance with the foregoing object which shall be of a relatively simple construction, shall be capable of being readily assembled or disassembled as desired as for servicing and the like and shall be capable of ready replacement as to any parts which may become worn during operation.

Still another object of the invention is to provide a device in accordance with the preceding objects in which a heated fluid such as steam is employed to perform the joint operations of thawing the ground when the boring operation is to be performed in frozen soil and for removing the excavated material from the bore hole as the drilling operation progresses.

Yet another important object of the invention is to provide a device in accordance with the preceding objects which shall be particularly well adapted for preventing the clogging of the steam nozzle and for maintaining the steam nozzle of the drilling device in an open condition in use.

A still further important object of the invention is to provide a device in which a single conduit member shall be employed for conveying steam to a drilling nozzle on the end of the conduit member and whereby the conduit member shall both deliver steam to the nozzle for thawing the ground and for performing the drilling operation, and shall further support and position the nozzle during the drilling operation, with the waste steam and the excavated material removed thereby being conveyed to the surface of the ground in the annular space between the conduit and the bore hole.

These together with other objects and advantages which will become subsequently apparent reside in the details of construction and operation as more fully hereinafter described and claimed, reference being had to the accompanying drawing forming a part hereof, wherein like numerals refer to like parts throughout, and in which:

FIGURE 1 is a side elevational view showing a preferred embodiment of the drilling apparatus embodying therein the principles of this invention;

FIGURE 2 is an exploded perspective view of the components of the apparatus of FIGURE 1.

FIGURE 3 is a view in vertical central section through the apparatus of FIGURE 1 and showing upon an enlarged scale the internal construction of the device, the position of the movable nozzle member being shown therein and with arrows indicating the direction of the flow of fluid during the drilling operation;

FIGURE 4 is a horizontal sectional detail view taken substantially upon the plane indicated by section line 4—4 of FIGURE 3; and

FIGURE 5 is a fragmentary view of the lower portion of FIGURE 3 but showing the position of the movable nozzle member under a different drilling condition.

It is often desirable to drill or bore post holes in the ground, as for example, to receive telephone poles, posts

or the like under conditions in which the soil is frozen to at least a considerable depth. In order to overcome this difficulty, and to permit the drilling of such holes with equal facility when the ground is thawed or frozen there is provided a drilling or boring apparatus of the jet type in accordance with this invention.

Indicated by the numeral 10 is a pipe or conduit which may be flexible or rigid in character and by means of which a heating fluid such as hot water or steam is supplied from a boiler or other suitable source, not shown in a continuous manner under suitable controls, not shown, in order to effect a drilling operation by jet action. Secured to the lower end of the supply conduit 10 in any suitable manner as by means of a threaded connection therein, by welding or by other connections, is a pipe 12 of steel or other rigid material which is of any desired length in accordance with the depth to which the bore hole, shown at 14, is to be drilled. A shield or guard in the form of a support plate 16 is provided with an aperture 18 therethrough for the reception of the upper end of the body 12 and is perferably fixedly secured to and embraces this pipe in any suitable manner as by the use of welding as at 20. The support plate serves both as a means to limit the downward travel of the device in the soil during the forming of the hole 14 and also serves as a means to apply pressure or force to facilitate downward travel of the device during the boring and drilling operation, and further serves as a shield to cover the opening of the hole and to permit the flow of the jetting or drilling fluid therefrom as set forth hereinafter.

At its lower end, the pipe 12 is preferably externally threaded as at 22 for the reception of the upper end of an internally threaded connecting sleeve 24. The lower end of the connecting sleeve receives therein the upper end of a nozzle assembly, the nozzle assembly including an outer sleeve 26 which is fixedly but detachably secured in the lower end of the connecting sleeve 24 in any suitable manner, not shown, as by the use of screw threads, by welding or by various types of detachable connections. Preferably the outer sleeve 26 is of a good heat conducting material such as copper and constitutes a part of the nozzle assembly.

The connecting sleeve 24 thus serves to establish communication between the interior of the pipe 12 and the interior of the outer sleeve 26 for the passage of fluid therethrough, the connecting sleeve thus constituting a chamber 30. Received within the outer sleeve 26 and within the chamber 30 is a movable or inner sleeve 32 which likewise may be of copper or other material having good heat conductivity and which is of such a size as to be loosely received within the outer sleeve and to thus provide an annular channel or space 34 therebetween. The inner sleeve is considerably longer than the outer sleeve so that as shown in FIGURES 3 and 5, the inner sleeve may be caused to selectively extend into the chamber 30 of the connecting sleeve 24 or to project downwardly below the outer end of the outer sleeve as shown in FIGURE 5. Fixedly secured in the upper end of the inner sleeve 32 is a tubular member 36 having a diametrically enlarged cylindrical upper end constituting a rib on the inner sleeve and a diametrically reduced depending stem portion 38 which is received within the upper end of the inner sleeve. The member 36 is hollow having an axial bore 40 therethrough which thus serves to establish continuous communication between the pipe 12, the chamber 30, and the interior of the inner sleeve 32 and from thence to the interior of the bore hole 14 being drilled by the device. In some instances, the member 36 may be integral with the inner sleeve, while in other instances it may be rigidly secured thereto.

The member 36 thus whether integrally connected to or mechanically attached to the upper end of the sleeve

32 comprises an enlarged collar on the same. This collar has an annular bottom surface as at 42 which cooperates with a corresponding annular surface 44 on the upper end of the outer sleeve 26 to limit downward travel of the movable inner sleeve assembly with respect to the outer sleeve as shown in FIGURE 5. However, there is enough clearance between the external diameter of the enlarged portion of the member 36 and the wall of the chamber 30 to provide for a continuous passage of fluid therebetween as indicated by the arrows in FIGURE 3 as long as the surfaces 42 and 44 are out of engagement with each other as shown in FIGURE 3. Thus, when the inner sleeve is in a relatively raised position as shown in FIGURE 3, the heating and drilling fluid supplied by the pipe 12 may continuously and simultaneously pass through the interior of the inner sleeve and through the annular passage 34 between the inner sleeve and the outer sleeve to effect a jetting drilling action as suggested by the arrows in FIGURE 3. Owing to the application of weight applied in any suitable manner to the support plate 16, which thus urges the nozzle assembly downwardly, the flow of fluid for the hot water or steam will by its jetting action effect a heating and thawing of the frozen ground and an erosion or excavation of the same to form the bore hole 14, the exhaust fluid accompanied by the excavating material passing upwardly through the annular space between the pipe 12 and the wall of the bore 14 to escape at the surface as shown in FIGURE 3.

In order to facilitate this escape of the waste fluid and of the excavated material, the support plate 16 is provided upon its under surface with a plurality of spacer lugs 50 which is shown in FIGURE 3 serve to provide a clearance between the bottom surface of the support plate 16 and the adjacent surface 52 of the ground by means of which the waste fluid and the excavating material can escape.

It will be observed that during the operation of the device FIGURE 3 is considered to be the normal position of the same and heating and jetting fluid will pass both through the interior of the inner sleeve and through the annular space between the inner and outer sleeves to effect an excavating action. However, if this annular space should become clogged for some reason, the inner sleeve will move downwardly under the build-up of pressure on the horizontal annular top surface 54 thereon and thus force the inner sleeve downwardly as shown in FIGURE 5 thus cutting off the passage 34. At this time all of the fluid will then pass through the inner sleeve and through the relatively reduced orifice of the inner sleeve to thereby readily clear away the obstructions and upon further downward travel of the nozzle assembly to permit the inner sleeve to resume its original position.

The foregoing is considered as illustrative only of the principles of the invention. Further, since numerous modifications and changes will readily occur to those skilled in the art, it is not desired to limit the invention to the exact construction and operation shown and described, and accordingly all suitable modifications and equivalents may be resorted to, falling within the scope of the invention as claimed.

What is claimed as new is as follows:

1. A drilling device for post holes comprising a vertically elongated hollow cylindrical body for receiving steam under pressure in its upper end and a nozzle assembly at its lower end for discharging steam from said body, said nozzle assembly including an outer sleeve fixed secured to, projecting downwardly from and communicating with said body and an inner sleeve continuously communicating with said body and slidably

received in said outer sleeve and in spaced relation thereto for providing an annular steam discharge passage therebetween, cooperating generally horizontally extending surfaces on said outer and inner sleeves movable into engagement with each other for closing flow through said annular passage while limiting downward movement of and retaining said inner sleeve within said outer sleeve, said inner sleeve being of sufficient length to enable its lower end to be selectively retracted into the outer sleeve and to be projected below the outer sleeve in the lowered position of the inner sleeve.

2. The combination of claim 1 wherein said inner sleeve has a radially enlarged collar overlying said outer sleeve, said cooperating surfaces comprising annular flat and parallel faces on said collar and on said outer sleeve.

3. The combination of claim 1 wherein said body and outer sleeve have adjacent ends, a connector sleeve secured to the exteriors of the adjacent ends of said body and outer sleeve and establishing communication therebetween.

4. The combination of claim 3 wherein said inner sleeve has a radially enlarged collar overlying said outer sleeve, said cooperating surfaces comprising annular flat and parallel faces on said collar and on said outer sleeve, said collar being freely slidable in said connecting sleeve.

5. The combination of claim 1 including a support plate embracing and fixedly secured to the upper portion of said body for supporting the latter upon the ground while stopping further penetration of said nozzle assembly into the ground, said support plate including spacers on its underside engaging the ground and providing a clearance between said plate and ground.

6. A device for drilling post holes in frozen ground comprising a hollow, vertically elongated and vertically movable cylindrical body for receiving steam under pressure in its upper end and a jetting nozzle assembly at its lower end for discharging steam from said body and thereby drilling a post hole, said nozzle assembly comprising generally concentric cylindrical relatively reciprocable and laterally movable inner and outer sleeves each open at both ends and with the inner sleeve being of greater length than said outer sleeve and being extensible therebeneath, a connecting sleeve supporting said outer sleeve upon said body in spaced relation thereto and containing a chamber having continuous unobstructed communication with the interior of said body and sleeves, a diametrically enlarged cylindrical member fixedly secured to the upper end of said inner sleeve and having an open bore continuously connecting with said chamber and said inner sleeve, said cylindrical member being slidably and loosely received in said connecting sleeve and having a continuously open annular space therebetween, said inner and outer sleeves having complementary engageable relatively movable surfaces for limiting relative downward movement of said inner sleeve in said outer sleeve while simultaneously closing the space between said sleeves from the interior of said chamber.

References Cited in the file of this patent

UNITED STATES PATENTS

1,688,356	Romney	Oct. 23, 1928
2,169,223	Christian	Aug. 15, 1939
2,258,001	Chamberlain	Oct. 7, 1941
2,540,464	Stokes	Feb. 6, 1951
2,754,086	Summers	July 10, 1956
2,873,092	Dwyer	Feb. 10, 1959
2,963,102	Smith	Dec. 6, 1960