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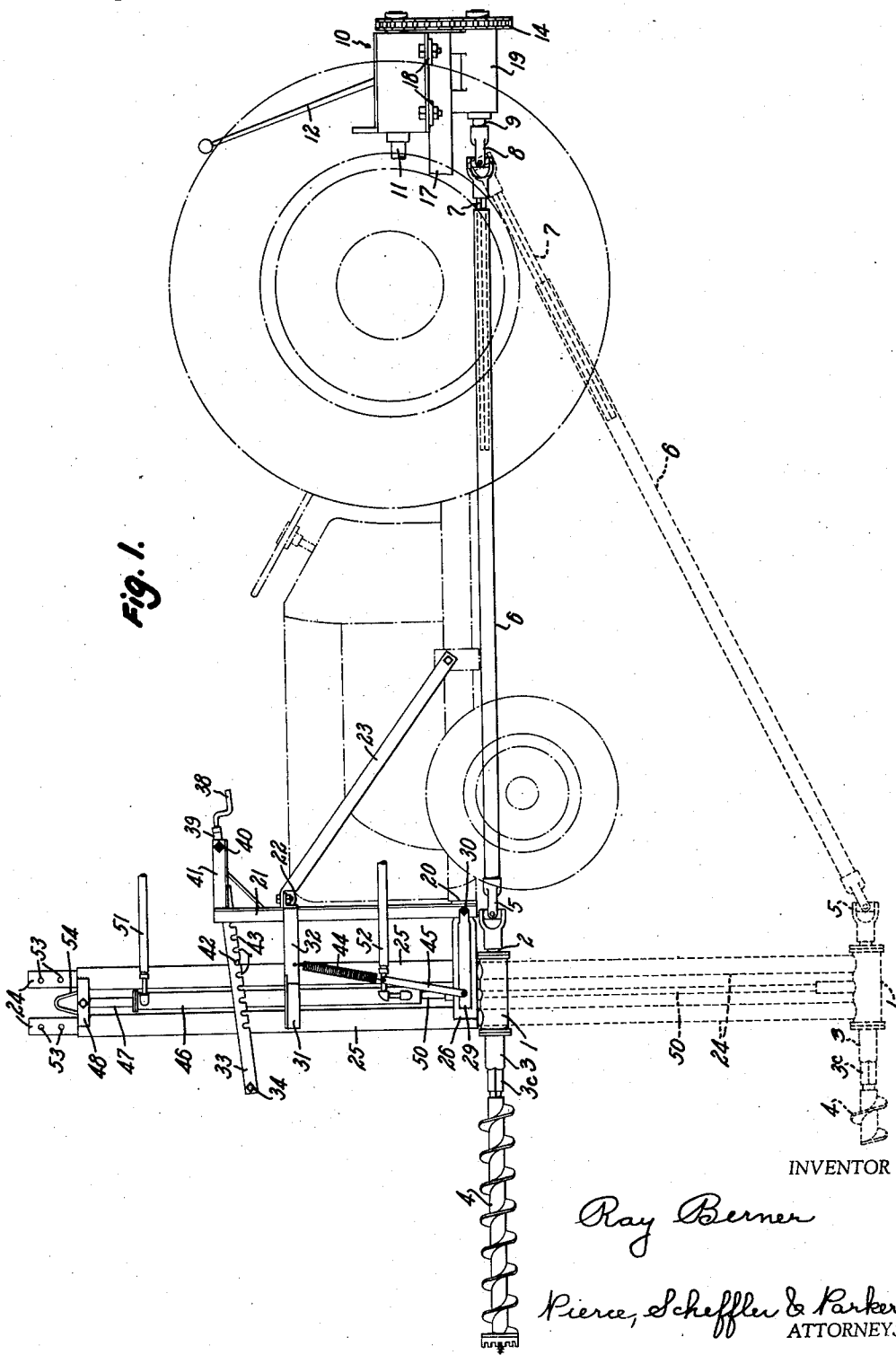
R. BERNER

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EARTH BORING RIG FOR TRACTORS

Filed Aug. 26, 1955

3 Sheets-Sheet 1



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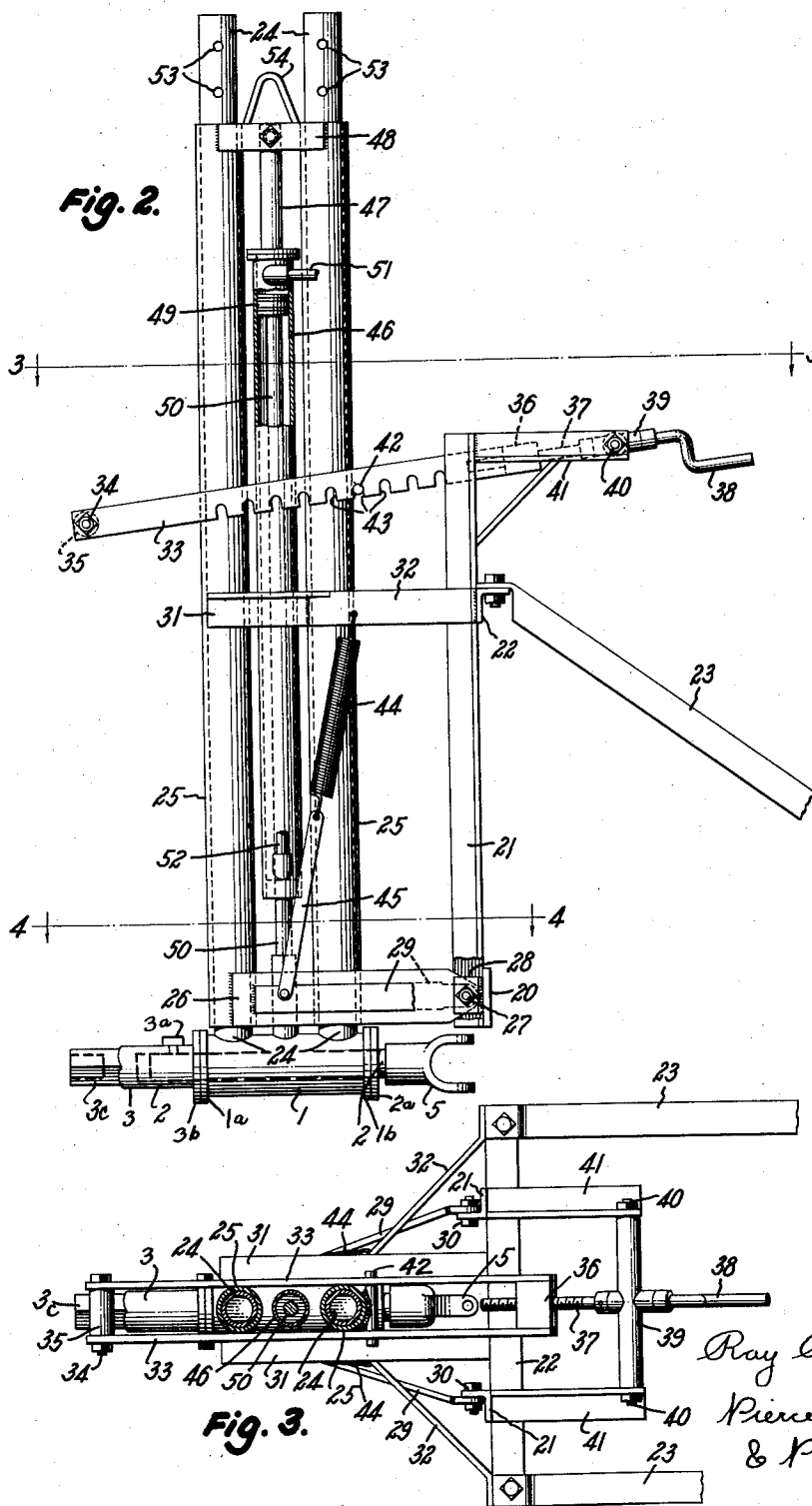
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INVENTOR
Ray Berner
 Pierre, Schiffler
 & Parker
 ATTORNEYS

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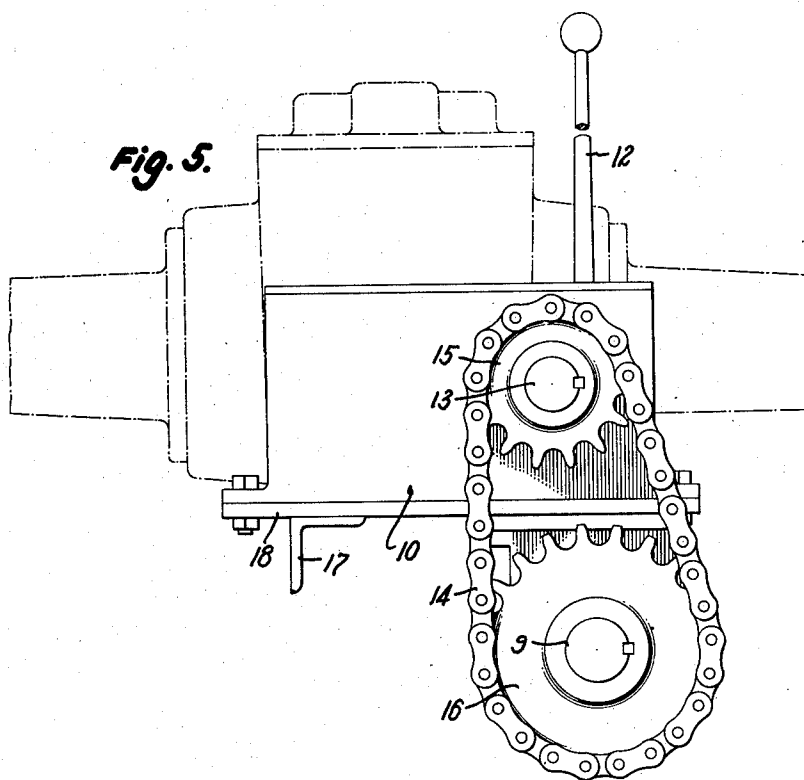
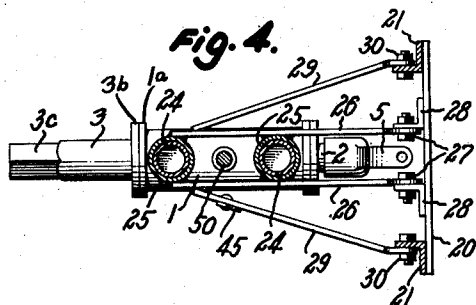
R. BERNER

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INVENTOR

Ray Berner

BY Pierre, Scheffler & Parker
ATTORNEYS

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2,859,014

EARTH BORING RIG FOR TRACTORS

Ray Berner, Rock Valley, Iowa

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8 Claims. (Cl. 255—20)

This invention relates to devices for boring or augering holes in the earth, particularly holes such as are used for the laying of pipe lines or conduits and which may extend substantially horizontally under the pavements of sidewalks, streets and roadways, or under or around other obstructions, and, as distinguished from other devices for a similar purpose, it is embodied in a combination of elements constituting a ring which may be mounted upon, and may receive power for its drive from, any of a variety of known wheeled tractors which are normally provided with power take-off members.

One object of the invention is to provide an earth boring rig which not only has the advantage of being associated with a known type of tractor as an operative assembly therewith but which when not being used for boring, will in no way conflict with, or hamper, the normal use of the tractor and will, furthermore, be transportable by the tractor from job to job with great facility.

A further object is to provide a tractor attached earth boring rig which may be operated to tunnel beneath a roadway, sidewalk or the like without necessitating the digging of a "bell hole" or similar excavation as is now the customary practice, for lowering the entire boring machine to the boring level.

Still another object is to provide an earth boring rig which will be inexpensive to acquire and maintain and which, being provided as an attachment for various types of tractors, many of which are always owned by or available to contractors and municipalities, may expeditiously be put into use.

A still further object is to provide an earth boring rig which is especially adaptable to the performance of small jobs which would ordinarily not warrant the transportation and use of specialized boring equipment and would therefore be done wholly manually.

With these and other objects in view, and the many advantages obtained, as will hereinafter be apparent, the invention may be defined as comprising, broadly, an earth boring rig for tractors of the type having a power take-off, including a boring head having a rotatable spindle normally disposed with its axis substantially horizontal and adapted to be fitted with a boring tool such as an auger bit, means for so mounting this boring head upon a tractor, preferably at the front end thereof, that it may be raised and lowered with relation to ground level and may be adjusted angularly to the horizontal, transmission-means coupled to the power take-off and fixed on the tractor, usually remote from the front end thereof, and provided with an arbor to which rotation is imparted through the transmission means from the power take-off of the tractor, and a shaft connecting the arbor and spindle as by universal joint means and preferably having telescoping parts which will accommodate its length to the varying distance between the arbor and spindle occasioned by vertical and angular adjustment of the boring head, all as will be explained hereinafter more fully and finally claimed.

In the accompanying drawings illustrating the inven-

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tion, in the several figures of which like parts are similarly designated:

Fig. 1 is a side elevation of the elements constituting the earth boring rig of the invention shown in their assembly in relation to a conventional tractor illustrated in dot-and-dash lines, and indicating raised and lowered positions of the boring head and associated parts in full and broken lines, respectively.

Fig. 2 is an enlarged side elevation, with parts broken away, of the boring head and its mounting means.

Fig. 3 is a sectional elevation taken on the line 3—3 of Fig. 2.

Fig. 4 is a sectional elevation taken on the line 4—4 of Fig. 2 and

Fig. 5 is a greatly enlarged rear elevation of the transmission means showing its association with the rear axle of the tractor which is indicated in dot-and-dash lines.

Having reference particularly to Fig. 1, it will be seen that the boring head 1 has end flanges 1a, 1b which are provided with central openings sized to receive, and support for rotation in suitable bearings, a spindle 2 which extends through the head 1. A flange 2a on spindle 2 abuts flange 1b and serves as one stop for spindle 2. A coupling sleeve 3 is secured upon the other end of spindle 2 by means of a set screw 3a. This coupling sleeve also includes flange 3b which bears against flange 1a and a socket 3c to receive and drive the tank or shank of an auger bit 4. The rear end of the spindle 2 is connected through a universal joint 5, the complementary telescoping members 6 and 7 of a drive shaft, and a universal joint 8 with the arbor 9 of the transmission means 10 (Figs. 1 and 5).

The transmission-means include a reduction gearing (not shown), coupled with the power take-off shaft 11 of the tractor, a reversing gear (not shown) responsive to shifting of the lever 12, and a back shaft 13 which, through the chain 14 and speed-reducing sprockets 15 and 16, the latter of which is keyed to the arbor 9, will drive the arbor 9, and through it the shaft 6—7 and spindle 2 either clockwise or counter-clockwise. In the particular embodiment illustrated there is a four-to-one reduction in speed from the power take-off shaft 11 to the arbor 9, this having been found in practice most suitable.

It will be noted that the transmission means are rigidly mounted in fixed relation to the rear axle of the tractor by bolting the gear casing to tractor frame elements 17 and 18. Normally, the chain and sprocket gearing 14, 15, 16 will be encased, but a showing of such a casing has been omitted in the interest of clearness.

The head 1 which houses the spindle 2 and the housing 19 of the arbor 9 are both preferably provided with antifriction bearings, are packed with grease and are provided with grease and dirt seals for their respective rotary elements, but these structural refinements being of known form have not been illustrated.

The mounting means for attaching the boring head 1 to the front end of the tractor includes a base plate 20 attached horizontally by suitable means such as bolts, not shown, to the front frame member of the tractor and to this base plate are welded two laterally spaced uprights 21 to which are welded a cross member 22 provided at its ends with angle braces 23 bolted to it and to elements on the side frame members of the tractor.

For accommodating the boring head 1 to vertical adjustment, as is desired, relatively slidable mounting members are provided, including preferably, a pair of tubular elements 24 affixed to the boring head as by welding and spaced axially of said head in order to impart to it the desired axial directional stability, and these elements are telescopically received within complementary tubular elements or sleeves 25 secured at their lower ends, as by

welding, to lever arms 26 pivotally connected at 27 to pivot brackets 28 secured to the base plate 20. For imparting lateral rigidity to these lever arms they are provided with angle braces 29 secured to them and pivoted at 30 to the uprights 21 concentric with the pivots 27 of the lever arms (Figs. 2 and 4). By this arrangement it will be apparent that by tilting the telescoping members backward or forward in line with the axis of the boring head 1 the horizontal angle of the boring head, and hence of the boring tool or auger 4 carried by its spindle 2 may be varied.

Substantially midway of the height of the sleeves 25, and preferably in tangential contact with them there are provided side guides 31 fixedly attached to the cross member 22 and given lateral rigidity by angle braces 32 secured to them and to the cross member 22 (Figs. 1, 2, and 3).

Adjustment of the horizontal angle of the boring head 1 is effected and maintained through adjustment of the vertical angle of the telescoping members 24 and 25 by means of a pair of bars 33 which embrace the sleeve members 25 and are joined at their forward ends by a bolt 34 and spacing sleeve 35 and at their rear ends by a block 36 having a screw-threaded bore engaged by an adjusting screw 37 having a crank handle 38 and carried by a bearing member 39 pivoted at 40 in brackets 41 projecting rearwardly from the upper ends of the uprights 21 (see Figs. 2 and 3). Secured to one of the sleeve members 25 as by welding (Fig. 3) is a cross pin 42 the ends of which may be engaged with any of a plurality of notches 43 arranged in laterally aligned pairs in the two bars 33 and thus an approximate adjustment of the horizontal angle of the boring head 1 may be arrived at, and the exact desired adjustment may be obtained by proper actuation of the adjusting screw 37.

In order to support the weight of the boring head 1, and those parts which are movable with it, during transport and when it is not in operation, and to maintain and facilitate adjustment of its horizontal angle as determined by the cooperative action of the pin 42 and the notches 43 of the bars 33, resilient counterbalance means are provided including a pair of tension springs 44 having one end attached to the fixed angle braces 32 and their other ends joined to links 45 pivotally connected to the pivoted angle braces 29.

Pressure-fluid actuated means are provided for imparting vertical movement to the boring head, including a hydraulic or air cylinder 46 suspended by a link 47 from oppositely disposed spacing and strut members 48 secured at the upper ends of the sleeve members 25, and a piston 49 (Fig. 2) having its piston rod 50 attached to the boring head 1. Pressure-fluid may be introduced into and exhausted from the two ends of the cylinder 46, above and below the piston 49, by way of conduits 51 and 52, respectively, controlled by suitable manually actuated valve means, not shown.

When the boring head 1 is in its elevated position, as when inoperative or during transport, it may be thus maintained by stop pins, not shown passed through properly located holes 53, formed in the upper ends of the tubes 24 so as to rest upon the upper ends of the sleeve members 25.

From the foregoing it will be apparent that the three main elements of the boring rig of the invention, namely the boring head 1 with its mounting means, the drive shaft 6-7, and the transmission member 10 may be applied to and removed from a tractor of appropriate type without modification of such tractor but merely by bolting the mounting means of the boring head to the front and side frame members of the tractor, and bolting the transmission member to rear frame members of the tractor in appropriate operative assembly with the power take-off shaft 11. The shaft 6-7 being thereafter coupled to the arbor 9 and spindle 2 by means of the universal joints 5 and 8, respectively.

In order to readily handle the boring head and its

mounting means which, of necessity are rather heavy, the upper ends of the sleeve members 25 joined by the spacing and strut members 48 are provided with an eye 54 to receive the lead of any suitable hoisting mechanism.

A major application for the improved boring rig of the present invention lies in tunneling beneath a paved roadway, sidewalk or the like for the purpose of carrying a pipe line beneath the same. In usual practice a trench to receive the pipe line is dug to the side of the pavement by conventional trench digging machinery. The tractor with the boring rig is then positioned in straddling relation over the ditch and the boring head with auger attached is then lowered to the proper depth. Power is then applied to arbor 9 and shafting 6-7 through the transmission means to rotate the boring head spindle 2 and auger 4 and start the boring and the tractor is gradually advanced in the boring direction as the auger cuts into the earth. Most tunnels to be driven are generally horizontal but deviations in the tunnel axis from true horizontal are made possible by means of the pivotal adjusting assembly comprising the pivotally connected lever 26 and the notched bars 33 previously described.

If the boring is to be done in the side wall of a cut or other excavation large enough to receive and admit of maneuvering of the tractor, a complete string of auger bits may be attached to the boring head spindle 2 and fed to the work by the tractor.

It will thus be seen that the boring rig of the invention has practical advantages over any apparatus for a similar purpose now known, not only because of its relatively inexpensive nature, its adaptability for application to tractors of known types, its ease of transportation from job to job, and on the job, but also because of its maneuverability and versatility in the performance of boring operations of numerous types and the saving in costs of such operations.

Various changes and modifications are considered to be within the principle of the invention and the scope of the following claims.

I claim:

1. In an earth boring rig for mounting upon a tractor having a power take-off, a boring head provided with a rotatable spindle for carrying a boring tool upon a substantially horizontal axis, means for mounting said boring head upon said tractor in spaced relation to its power take-off, said mounting means including relatively vertically slidable stationary and movable members, said movable member being connected to said boring head and said stationary member being secured to a mounting structure adapted to be attached to the tractor, means for imparting sliding movement to said movable member thereby to effect a vertical adjustment of said boring head with respect to the ground in order that the boring tool may enter the ground at a predetermined distance below the surface thereof, power transmission means mounted on said tractor adjacent to said power take-off and including an arbor rotatively driven thereby, and shaft means coupled to said spindle and the arbor of said power transmission means and serving to impart rotation to said spindle, said shaft means being extensible to accommodate it to vertical adjustment of said boring head.

2. An earth boring rig as claimed in claim 1, in which the relatively vertically slidable members comprise telescoping tubular elements.

3. An earth boring rig as claimed in claim 1, in which the means for imparting relative sliding movement to said relatively vertically slidable members include pressure fluid actuated cylinder and piston elements mounted for reaction between said members.

4. An earth boring rig as claimed in claim 1, in which the connection between said stationary member and said mounting structure includes pivot means whereby the horizontal angle of said spindle and boring tool may be adjusted and means for maintaining such adjustment.

5. An earth boring rig as claimed in claim 4, in which

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resilient means are interposed between said stationary member and said mounting structure, said resilient means serving to counterbalance the weight of said boring head and the means for its vertical adjustment.

6. An earth boring rig as claimed in claim 4, in which the means for maintaining angular adjustment of said boring head include means carried by said stationary member and said mounting structure respectively.

7. An earth boring rig as claimed in claim 4, in which the means for maintaining angular adjustment of said boring head include bar means connected with said mounting structure, and provided with longitudinally spaced notches, and means carried by said stationary member engageable with notches of said bar means appropriate to the angle desired.

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8. An earth boring rig as claimed in claim 7, in which the connection of said bar means with said mounting structure includes a screw and nut connection through which a fine adjustment of the desired angle may be obtained.

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