June 7, 1949. I. R. MURPHY 2,472,120

EXPLOSIVELY ACTUATED TOOL

Filed Dec. 6, 1944

Fig.1.

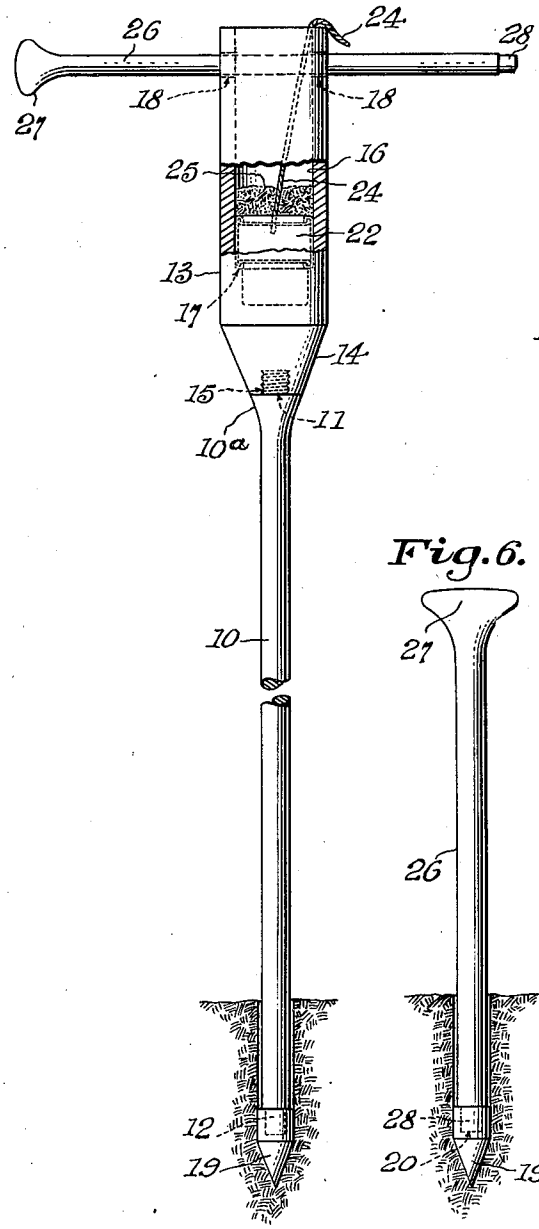


Fig.2.

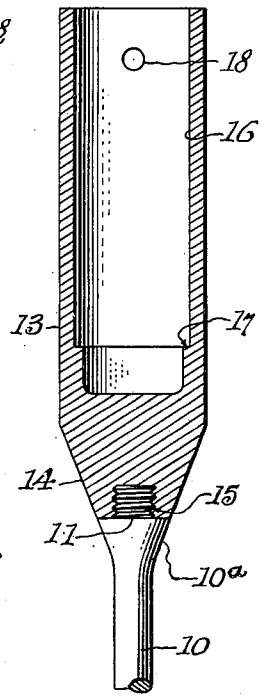


Fig.4.

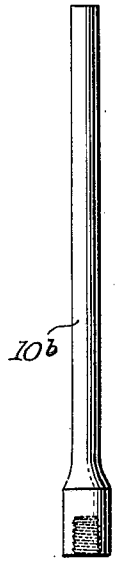


Fig.6.

Fig.3.

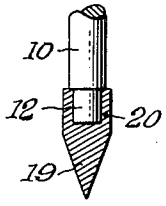
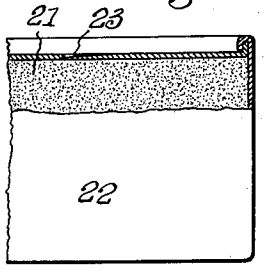


Fig.5.



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EXPLOSIVELY ACTUATED TOOL

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2 Claims. (Cl. 255—1)

(Granted under the act of March 3, 1883, as amended April 30, 1928; 370 O. G. 757)

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The invention described and claimed herein may be manufactured and used by or for the Government for governmental purposes, without payment to me of any royalty thereon.

This invention relates to tools actuated by explosive means and more particularly to apparatus of this character particularly adapted for use in penetrating hard surfaces, as, for example, hard soil or shale.

Equipment used heretofore in working soil preparatory to installing roads or placing poles has been found ineffective when the soil is very hard. For example, earth augers are either ineffective or very slow when employed in hard soil and are not adapted for use by troops in field operations.

It is the general object of this invention to provide an improved explosively actuated tool which is particularly adapted for boring holes in hard soil.

Another object of this invention is to provide a tool operated by the force of a detonating wave generated by an explosive charge to drive the tool into the ground which may thereafter be withdrawn from the soil, placed at another location, and readily reloaded.

Another object of this invention is to provide an explosively actuated tool having a detonating chamber formed with a large upper portion and a reduced lower portion, the large upper portion being provided with an opening adapted to admit a propellent charge and a mass of tamping material to the chamber and release combustion gases therefrom, and the reduced lower portion being adapted to function as an expansion chamber for the combustion gases.

Still another object of this invention is to provide an explosively actuated tool wherein the amount or density of the tamping material may be varied to control the depth of pentration of the tool.

A further object of this invention is to provide an explosively actuated tool including a drill point which is adapted to be detachably connected selectively to either a starting drive rod or a driving rod leaving a chamber at its free end to receive a propellent charge whereby the drilling direction may be controlled.

A still further object of this invention is to provide an explosively actuated tool comprising a

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cup member adapted to receive a propellent charge, a driving rod and a separable drill point wherein the drill point has a larger diameter than the driving rod to permit ready withdrawal of the rod from the body penetrated by the tool.

Other objects will be apparent from the following description of the invention and the accompanying drawings in which:

Figure 1 is an elevational view with parts removed of an explosively actuated tool constructed in accordance with the principles of this invention;

Figure 2 is a longitudinal sectional view showing in enlarged detail the upper portion of the tool which contains the detonating chamber;

Figure 3 is a longitudinal sectional view showing in enlarged detail the lower portion of the tool with the drill point attached thereto;

Figure 4 is an elevational view showing an extension rod;

Figure 5 is an elevational view, partly in section, showing the propellent charge for the tool; and

Figure 6 is an elevational view of a starting rod for setting the drill point in the body to be penetrated.

Referring to Figures 1, 2 and 3, the explosively actuated tool includes a drive rod 10, provided at its uppermost end with a threaded portion 11 and at its lowermost end with a reduced portion 12. The upper end of the rod 10 has a flared portion 10a adjacent the threaded portion 11 which provides a horizontal face or shoulder. A cup member 13 having a tapered lower portion 14 provided with a longitudinal internally threaded recess 15 is adapted to engage the threaded portion 11 of the drive rod 10. The upper portion of the cup member 13 is provided with a longitudinal recess 16 which is restricted near its lowermost portion to form a shoulder 17. A pair of diametrically opposed openings 18—18 are formed in the walls of the cup member 13 which are adapted to receive a detachable handle 26. The handle 26, which may also be used as a starting tool as described below, enables the operator to rotate the cup member 13 and engage or disengage the threaded portion of the recess 15 and the threaded portion 11 of the drive rod 10. The tapered portion 14 of the cup 13 and the flared portion 10a of the rod 10 are comple-

mentary and thus, when the horizontal faces or shoulders of these portions are in contact, the cup 13 and the rod 10 form an uninterrupted substantially conical surface. This arrangement enable the operator to determine by inspection whether the cup member 13 and the drive rod 10 are completely engaged. A separable drill point 19 having a cylindrical upper portion and conical pointed lower portion is provided with a longitudinal recess 20, which is adapted to receive the reduced portion 12 of the lowermost end of the drive rod 10. The cylindrical upper portion of the drill point 19 is larger in cross section than the drive rod 10 and thus drills an opening in the soil or other surface larger than the rod 10 when forced therein by the latter.

The longitudinal recess 16 in the cup member 13 is adapted to receive a propellent charge shown in Figure 5, and thus forms a detonating chamber. The propellent charge may consist of black powder or any other commercially available explosive 21 and is employed in a container 22 formed of light metal or other waterproof material. The container 22 which is preferably cylindrically shaped, is adapted to fit loosely in the recess 16 with the peripheral edge of the bottom thereof resting on the shoulder 17. The top of the container 22 is provided with a frangible disc 23 which may be perforated to permit a fuze 24 to be inserted through the opening and placed in the explosive 21. When the propellent charge container 22 is positioned in the recess 16 of the cup member 13, the restricted portion of the recess 16 below the shoulder 17 forms an expansion chamber for the combustion gases generated by the burning explosive. The charge is exploded by igniting the fuze 24 and the detonating wave generated moves downward in the detonating chamber, striking the bottom of the recess 16 and driving the cup member 13 downwardly. The cup member 13 transmits the explosive impact to the drive rod 10 through the shoulder formed by the flared portion 10*a* and in turn the separable drill point 19 is forced into the soil. Unless the cup member 13 and the drive rod 10 are properly connected with the horizontal face or shoulder of the tapered portion 14 in contact with the horizontal face or shoulder of the flared portion 10*a*, the threads on the portion 11 will be sheared by the impact of the explosion. The operator must therefore observe whether the complementary portions of the cup 13 and the rod 10 are engaged to provide the uninterrupted substantially conical surface described before igniting the fuze 24. The force of the detonating wave generated by the exploding charge exerted on the driving rod 10 may be controlled by covering the propellent charge container 22 in the cup member 13 with a tamping material 25 such as sand, clay or other soil. The tamping material 25 may be dropped into the cup member 13 by gravity and, depending upon the amount and nature of the soil used, the driving rod 10 will penetrate the soil with the drill point 19 to a predetermined depth. If it is desired to force the driving rod 10 further into the ground, the tamping material may be tamped in the cup member 13 thus increasing the density of the tamping.

The cup member 13 and the driving rod 10 secured thereto may be withdrawn from the earth after penetration has been accomplished by detonating the explosive material 21. Ordinarily this operation may be carried out easily since the drill point 19 is slightly larger than the driving rod 10 and the hole drilled by the point will not engage

the rod 10 tightly. If the force of the explosion causes the drive rod 10 to penetrate the soil to too great a depth, the cup member 13 is disengaged from the threaded portion 11, a tapped extension rod 10*b*, which is shown in Figure 4, secured to the threaded portion 11 and the drive rod then withdrawn from the soil. The drill point 19 is separated from drive rod 10 when the latter is withdrawn and remains in the soil. The opening formed in the soil may be enlarged by inserting a prima cord charge therein and exploding the charge.

In Figure 6, there is shown a combined starting drive rod and handle 26 provided at its uppermost end with an enlarged head 27 and at its lowermost end with a reduced portion 28. The reduced portion 28 is adapted to fit into the recess 20 of the drill point 19. As described above, the rod 26 may be inserted in the openings 18—18 to provide a handle for attaching the cup member 13 to the drive rod 10. In operation, as a starting tool, the reduced portion 28 is inserted in the recess 20 of the drill point 19 and force applied by striking the head 27 to drive the drill point into the soil, usually a depth of about one foot. In this manner the drilling direction of the drill point 19 may be controlled. Thus started, the tool 26 is withdrawn and the reduced portion 12 of the drive rod 10 is inserted in the recess 20 of the drill point 19. The cup member 13 is attached to the drive rod 10, the propellent charge with the fuze 24 attached thereto inserted in the recess 16 and tamping placed therein. The fuze 24 is ignited and the explosive material 21 detonated forcing the tool into the soil. The tool may then be withdrawn and inserted in another drill point at another location. If any difficulty is encountered in withdrawing the tool from the soil, a rod extractor or any other commercially available apparatus similar to casing extractors employed in the oil industry may be used to withdraw the tool. The tool may thus be used to drill holes in extremely hard soil rapidly, efficiently and economically.

Having thus described my invention, what I claim as new and wish to secure by Letters Patent is:

1. An explosively actuated earth boring tool comprising, in combination, a driving rod, the driving rod having opposite ends, one of which is a reduced end, and a threaded portion on its opposite end, a drill point removably mounted on the reduced end of the driving rod, a cup member threadedly mounted on the threaded end portion of the driving rod, the cup member being of substantially larger diameter than the driving rod and being adapted to receive a propellent charge and a mass of tamping material, the cup member being provided with oppositely disposed holes adapted to receive a handle bar for attaching the cup member to the driving rod, a handle bar in the holes, the said handle bar having a reduced end portion adapted to fit into the drill point and an enlarged end portion adapted to form a driving head, whereby the said handle bar may be used interchangeably as a starting rod and as a handle bar, a propellant charge in the cup member, and means for igniting the propellant charge.

2. An explosively actuated earth boring tool comprising, in combination, a driving rod, a drill point removably mounted on one end of the driving rod, a cup member mounted on an opposite end of the driving rod, means for detachably mounting the cup member on the driving rod, a handle removably mounted in the cup member for

attaching the cup member to the driving rod, the handle comprising a bar having an end adapted to be received in the drill point and an enlarged driving end, whereby the handle may be used interchangeably as a handle and as a starting rod, the cup member being adapted to receive an explosive charge, the cup member having an open end through which the explosive charge is received and a closed end attached to the driving rod, and a shoulder on the inner wall of the cup member for retaining the explosive charge and for providing an expansion chamber for products of combustion of the explosive charge.

IVESTER R. MURPHY.

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