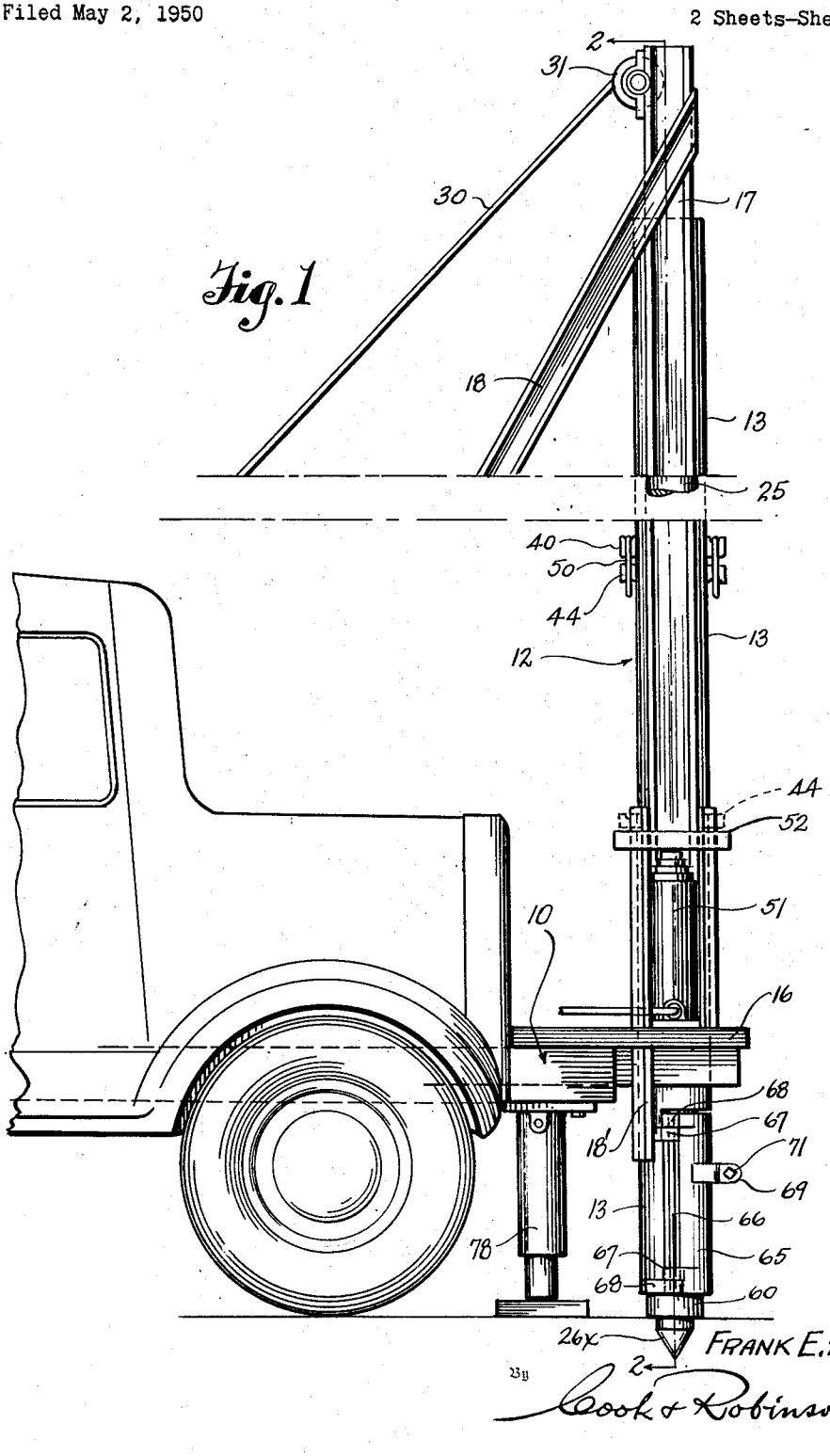
Nov. 24, 1953 F. E. ROLAND 2,660,403

POSTHOLE FORMING MACHINE

Filed May 2, 1950 2 Sheets-Sheet 1

Fig. 1



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Filed May 2, 1950 2 Sheets-Sheet 2

Fig. 2

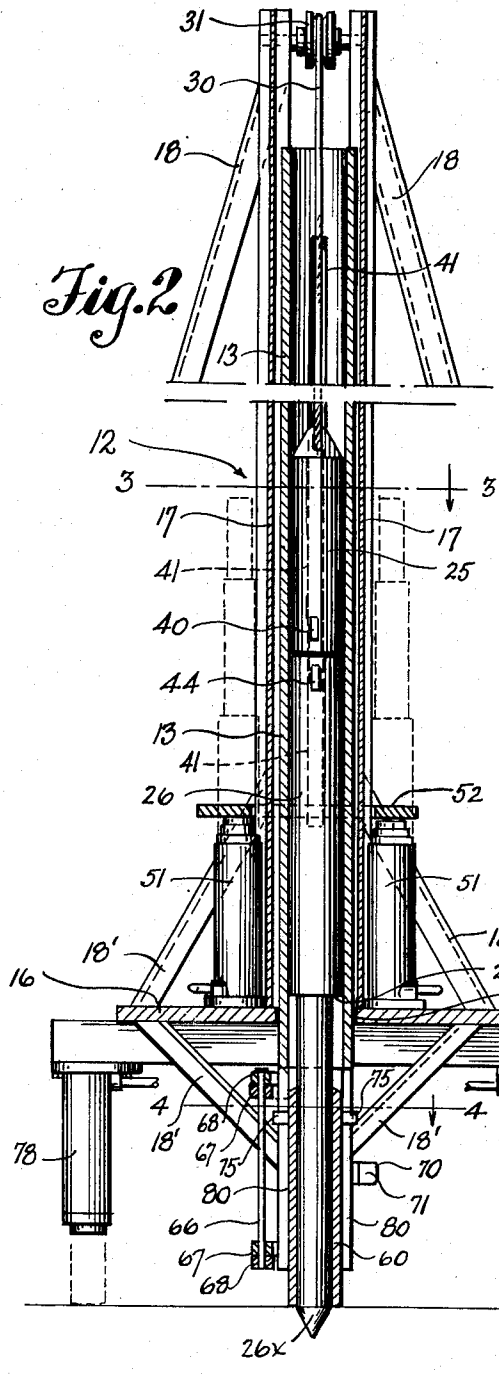


Fig. 3

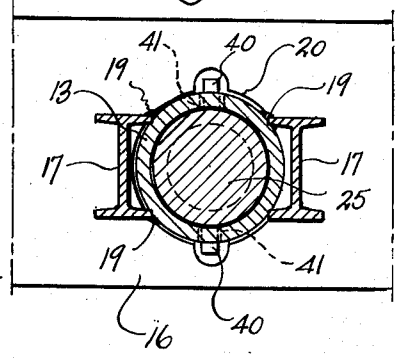


Fig. 4

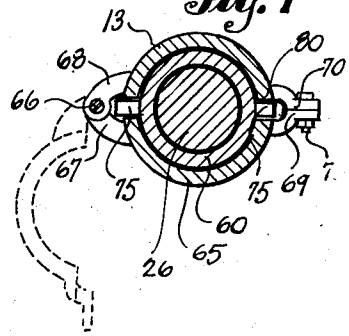
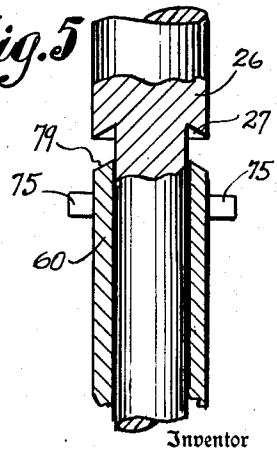


Fig. 5



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POSTHOLE FORMING MACHINE

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Application May 2, 1950, Serial No. 159,401

10 Claims. (Cl. 255—5)

1

This invention relates to post hole forming machines and devices, and it has reference more particularly to machines designed especially for the making of relatively large holes in soil or earth formations where boring or digging is either impossible or impractical.

Specifically stated, the present invention relates to the provision of a mobile machine, designed for the driving of a bit for the formation of a post hole in extremely hard soil such as rock or lava formations, where blasting has heretofore been required for this purpose. Furthermore, to provide means for extraction of the driven bit.

It is the principal object of this invention to provide an improved, mobile hole forming machine comprising a vertically disposed tubular guide that is fixed rigidly to the vehicle and which contains, in its lower end portion, a hole forming bit or pin and in its upper end portion, contains a hammer that is adapted to be lifted and dropped against the bit to drive it into the earth to form the hole.

It is also an object of the invention to provide a shouldered bit of special design and a sleeve for use in combination therewith and adapted to be forced into the upper end portion of the hole as a means to prevent cave-in or the falling into the hole of gravel, dirt or loose rock as the bit is withdrawn; the sleeve being equipped with means for its withdrawal from the hole after a post has been set therein.

Another object of the invention is to provide a guide tube of special design for the bit and hammer, that is characterized by the provision of a hinged door at its lower end that may be opened for the setting of the sleeve within the tube to receive the bit therethrough in a manner whereby, after being advanced to a certain depth, the bit shoulder engages the sleeve to advance it to its functional position with the continued formation of the hole.

Still another object of the invention is to provide the bit with a beveled shoulder, and to bevel the end of the sleeve accordingly and in a direction that will not tend to expand the sleeve as pushed into the ground.

It is a further object of the invention to provide practical means for the withdrawal of the bit from the ground after a post has been set in the hole.

Still further objects of the invention are to be found in the details of construction and combination of parts embodied in the device, and in their mode of operation as will hereinafter be fully described.

2

In accomplishing these and other objects of the invention, I have provided the improved details of construction, the preferred forms of which are illustrated in the accompanying drawings, wherein—

Fig. 1 is a side view of the front end portion of an automobile truck or similar vehicle, on which a hole forming machine embodied by the present invention, is functionally mounted.

Fig. 2 is a vertical section, taken along the line 2—2 in Fig. 1, showing the relationship of hammer, bit and sleeve as contained in the guide tube and showing the sleeve extracting jacks.

Fig. 3 is an enlarged cross-section taken on line 3—3 in Fig. 2.

Fig. 4 is an enlarged cross-section, taken on line 4—4 in Fig. 2.

Fig. 5 is a sectional detail of the bit and sleeve.

The present invention is primarily intended for the forming of holes in rock or in rocky soil although not limited thereto. Such a machine, at present, is being quite extensively used for the making of holes for guard rail posts as used along automobile highways, and it is designed for the formation of holes to a depth of from four to six feet to receive posts of twelve inches in diameter. However, machines of a like construction, could be adapted to the making of holes of greater depth and also of greater or lesser diameter.

Referring more in detail to the drawings—

In Fig. 1, 10 designates what may be a suitable front end frame structure of a mobile vehicle, such as an automobile truck or tractor, on which a hole forming mechanism embodying the present invention is mounted. Secured to the frame 10, at its forward end, is an elongated, vertically directed frame designated in its entirety by numeral 12, in which there is rigidly fixed a guide tube 13 for the hole forming bit and bit driving hammer.

The frame 12 is rigidly mounted on the frame 10, and in use is plumbed by leveling up the vehicle frame. It is shown as being supported at its lower end upon a heavy, horizontal base plate 16 that is fixed rigidly upon the forward end portions of the opposite side beams of the vehicle chassis or on extensions welded or otherwise joined thereto.

The frame structure 12 comprises two, vertically extending, parallel and laterally spaced I-beams 17—17. These are welded, or otherwise rigidly secured at their lower ends to the plate 16. A pair of brace beams or rods 18—18 extend from the upper end portions of these I-beams, downwardly and rearwardly to the opposite sides

of the vehicle frame, when they are secured to maintain the frame 12 in upright position. Also inclined braces, as at 18' and 18' are applied to the opposite ends of the plate 16 and to the I-beams above and below the plate as seen in Fig. 2.

Disposed between the I-beams 17—17 and welded thereto along substantially their full lengths, as indicated at 19 in Fig. 3, is the tubular guide tube 13 in which the hole forming bit is contained. This extends from near the ground to near the upper ends of the I-beams. It passes through an opening 20 in plate 16 and is welded to the plate to add to the rigidity and strength of the structure. In a machine now in use, the upper end of the frame structure 12 is about 23 feet above ground level, and the tube 13 is about 16 feet long, with its lower end about 3 feet above ground. The diameter of tube 13 will be dependent upon the size of hole desired to be formed. At present a tube 12'' in diameter is being used.

Reciprocally contained in the upper end portion of the tube 13 is a heavy steel hammer 25 and slidably contained in the lower end portion is a steel bit 26.

The hammer 25, here shown to be of the gravity drop type, is operatively suspended by a cable 30 that is attached to its upper end. The cable extends upwardly from the tube 13, and over a sheave wheel 31 mounted at the upper end of frame 12. From the sheave the cable extends to a power operated mechanism, not herein shown, whereby the hammer can be lifted and then dropped to strike and drive the pin downwardly. This may be of any suitable kind. In lieu of use of a gravity drop hammer, steam or air powered mechanisms as used for pile drivers or oil drilling rigs, could be used for the operation of the hammer.

It is to be observed in Fig. 2 that the hammer has a diameter just slightly less that that of the tube 13 and that the bit or pin also is of slightly lesser diameter than the tube for easy guided travel therein. However, the lower end portion of the bit is of reduced diameter for the accommodation in the guide tube of the gravel retaining sleeve, as will presently be explained. At its lower end the bit has a tapered point designated at 26x, and at some distance above the point has an annular shulder 27 which defines the upper limit of the reduced end portion of the bit.

In so far as the operation of driving the pin into the ground is concerned, it is effected by repeatedly lifting and dropping the hammer against its upper end after its lower end has been engaged with the ground.

To pull the bit after a hole has been driven thereby in ordinary soil, I have equipped the hammer at near its lower end and at one or both sides, with lugs 40 that extend outwardly through and are operable in longitudinal slots 41 in the guide tube walls. Likewise, the bit is equipped at opposite sides near its upper end with lugs 44 that extend outwardly through the tube slots 41 and are movable therein. After the bit has been driven to the desired depth, and it is desired that it be withdrawn, the hammer is lowered against its upper end and suitable ties 50 are applied, as shown in Fig. 1, about outer portions of the lugs 40 and 44. Then the bit is pulled upwardly through upward pull on the cable 30. This means of connection is employed also in lifting the bit for the application of the sleeve to the lower end of the guide tube

as later explained. Instead of using lugs on the hammer and bit, holes might be formed therein to receive pins about which the cables could be applied.

As an alternative means for extracting the driven bit from the ground, especially when driven in rock, I provide two hydraulic jacks 51—51 which are mounted upon the plate 16 at opposite sides of the lower end portion of tube 13. The jack cylinders are of the telescopic type and are upwardly directed. When a pressure medium is forced into their lower ends, the telescoped parts will be extended upwardly. Extended horizontally between the upper ends of the jacks, is a yoke bar 52 and this is designed to engage with the lugs 44 to extract the bit from the hole as the jacks are extended upwardly. The bit can be held in a lifted position by its securement to the lifted hammer.

In order that sand, dirt or loose rock that usually overlies the surface, may be kept from falling into the hole upon extraction of the driven bit from the ground, I have provided the previously mentioned sleeve and means for pressing it into the ground about the upper end portion of the hole as formed by the pin. This sleeve, designated by numeral 60, prior to being pressed into the ground, is disposed within the lower end portion of the tube 13, with its lower end resting on the ground. The sleeve, in a practical form, would be about two feet long and with an outside diameter equal to that of the upper end portion of the pin, and with an inside diameter to receive the reduced lower end portion of the bit therein. The reduced end portion of the bit is about a foot longer than the sleeve so that it forms a hole in advance of the entry of the sleeve.

In order that the sleeve 60 can be readily applied within the lower end portion of the guide tube 13, I have provided that portion of the tube with a door 65. This door extends from the lower end of the tube 13 to above the height of the sleeve, and it is secured to the tube by a vertical hinge pin 66 extended through ears 67 and 68, on the door and tube respectively. The door, as noted in Fig. 4, extends through an arc of 180°. Therefore, when opened to the dotted line position of Fig. 4, it provides an opening in the tube through which the tube may be set in coaxial alignment with the bit. The sleeve is then secured in place, coaxial of tube 13, by closing and securing the door.

For the securing of the door in closed position, it is provided with an outwardly extending lug 69 at its swinging edge that registers with a lug 70 extended from the tube, and these lugs are apertured to receive a securing bolt 71 therethrough. After the sleeve has been placed in the tube, as shown in Fig. 2, the bit is lowered from a raised position and its lower end portion of reduced diameter is passed thereinto until its point is rested on the ground. Then by repeatedly lifting and dropping the hammer onto the upper end of the bit, it will be driven into the ground. The shoulder 27 of the bit finally engages the upper end of the sleeve, then the sleeve will be advanced into the ground with the advancement of the bit. Upon extraction of the bit from the driven hole, the sleeve remains in the ground and thus prevents loose material entering the hole. After the bit has been lifted from the sleeve, the door 65 is opened and the machine is advanced, thus providing that a post can then be set in the hole.

After a post has been placed in the hole, the sleeve is extracted for subsequent use. The extraction may be effected by any suitable means, for example, a means corresponding to the bit extracting jacks, or by pull cables or a truck adapted to be applied to lugs 75 that are welded to the sleeve near its upper end.

In view of the fact that it is desirable to plumb the guide tube 15 before driving the bit, the frame 10 is equipped at its under side at opposite sides and at the end adjacent plate 16, with hydraulic lifting jacks 78—78 that may be extended into contact with the ground. The jacks are individually adjustable for the purpose of transversely leveling the frame and also for effecting a vertical adjustment that might be desirable in plumbing the tube.

As a detail of construction, the sleeve 60 has its upper end surface outwardly and downwardly beveled at 79, and the shoulder 27 is under-cut at the same slope, thus there will be no tendency of the pressure as applied by the bit, causing the sleeve to expand, split or spread.

When the sleeve 60 is equipped with extracting lugs 75 at its upper end, the tube 13 is formed with longitudinal slots, as at 80—80, for downwardly travel of the lugs therein as the sleeve is pressed into the ground.

Machines of this kind provide for fast, efficient work in soil where boring or digging is impossible. Machines may be made for the forming of holes of various diameters and to various depths.

It is to be understood that although I have shown the moving vehicle to be of automobile truck type, and the guide frame to be applied to its forward end, it may be found more practical in some instances to use a vehicle of tractor or wagon type, and to apply the frame 12 to its rear end or to a side thereof. Therefore, it is not desired that the showing be considered a limitation of use or place of application of equipment.

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

1. A machine of the character described comprising a mobile supporting vehicle, a vertical guide tube rigidly supported thereby, a hole forming bit contained in said tube to be guided thereby as advanced from the lower end of the tube to form a hole in the earth, a hammer member reciprocally contained in the tube above and independent of the bit, means for lifting and dropping the hammer against the bit to drive it into the earth; said guide tube having a longitudinal slot therein, a lug on the upper end portion of the bit extended outwardly through said slot, and a lifting means for the bit comprising a horizontal cross bar engageable between its ends with the underside of said lug, and a pair of jacks mounted by the vehicle at opposite sides of the guide tube and engageable with the ends of the cross bar to lift it upwardly and against the lug to extract the bit from the earth after being driven thereinto.

2. A machine of the character described comprising a mobile supporting vehicle, a vertical guide tube rigidly supported thereby, a hole forming a bit contained in said tube to be guided thereby as advanced from the lower end of the tube to form a hole in the earth, a hammer member reciprocally contained in the tube above the bit, means for lifting and dropping the hammer against the bit to drive it into the earth; said guide tube having a longitudinal slot therein, a lug on the upper end portion of the bit extended outwardly through said slot, a lug on the

hammer member extending outwardly through said slot, and means applicable about said lugs to effect a connection between hammer and bit through which the bit may be extracted from the earth by the lifting of the hammer.

3. A machine of the character described comprising a mobile supporting vehicle, a vertical guide tube rigidly supported thereby, a hole forming bit contained in said tube to be guided thereby as advanced from the lower end of the tube to form a hole in the earth, a hammer member reciprocally contained in the tube above the bit, means for lifting and dropping the hammer against the bit to drive it into the earth; said guide tube having a longitudinal slot therein, a lug on the upper end portion of the bit extended outwardly through said slot, a lifting jack mounted on the supporting vehicle and adapted to act upwardly against said lug for the extraction of the bit from the earth.

4. A machine of the character described comprising a mobile ground vehicle, a guide tube supported rigidly in vertical position thereby with its lower end adjacent the ground surface, a hole forming bit contained in said tube to be guided thereby in its advancement from the tube into the earth, a hammer contained in the tube above the bit, means for lifting and dropping the hammer against the bit to advance it into the earth; said bit having a lower end portion of substantial length uniformly diametrically reduced and providing at the upper end of the reduced portion an annular downwardly facing shoulder spaced from its lower end, and a sleeve slidably contained in the lower end portion of the tube to receive the reduced lower end portion of the bit therethrough and to be engaged by the bit shoulder for the advancement of the sleeve into the earth with the advancement of the bit thereinto and from which sleeve the bit may be lifted without lifting it or causing its withdrawal from the earth.

5. A machine as recited in claim 4 wherein said bit has a pointed lower end and the said sleeve is of lesser length than that portion of the bit that is below said annular shoulder and above the pointed lower end.

6. A machine as recited in claim 4 wherein that portion of the bit that is above the said annular shoulder is substantially of the full inside diameter of the guide tube, and that portion below the shoulder is of a uniformly reduced diameter and fits closely within the sleeve and said sleeve being of the same diameter as the upper end portion of the bit and is equipped at its upper end with means for the attachment of extraction means.

7. A hole forming machine of the character described comprising a mobile ground vehicle, a vertical guide tube of uniform diameter supported rigidly by said vehicle, with its lower end close to the earth, and having a lateral opening in the lower end portion thereof, and a door attached to the tube and adapted to be closed into said opening, and conforming to the cylindrical form of the guide tube, a sleeve adapted to be set within the lower end portion of said tube through said opening and to be held thereby in axial alignment with the tube, a hole forming bit reciprocally fitted in the tube and having a lower end portion adapted to be projected downwardly through and below the said sleeve, a shoulder on the bit to engage the upper end of the sleeve, a hammer reciprocally contained in the tube above the bit, means for lifting and

dropping the hammer against the bit to drive it and the sleeve into the earh, and means for extracting the bit from the sleeve and earth.

8. A device as in claim 7 wherein the lower end portion of the guide tube is formed with longitudinal slots opening to the lower end of the tube and said sleeve is equipped adjacent its upper end with extracting lugs adapted to be contained in the slots and to move downwardly therein and from the tube with the advancing of the sleeve into the earth by the bit.

9. In a hole forming device; a vertical guide tube, a sleeve slidably contained within the lower end portion of said tube coaxial thereof, a hole forming bit fitted for guided travel in the tube above the sleeve and having a lower end portion adapted to pass downwardly through and beyond the sleeve, and means in the tube for engaging and advancing the bit downwardly in the guide tube; said bit terminating at its advancing end in a piercing point and having a shoulder spaced from that end to engage the upper end of the sleeve for its advancement from the tube and into the earth with the advancement of the bit and said bit being freely liftable from the sleeve and said sleeve having means at its upper end for the attachment of an extraction device.

10. A machine of the character described comprising a mobile vehicle, a guide vertically supported thereby, a hole forming bit contained in said guide, to be guided thereby as advanced from the lower end thereof to form a hole in the earth, a hammer member reciprocally contained in the guide, means for lifting and dropping the hammer against the bit to drive it into the ground, said guide having a longitudinal slot therein and said bit having a lug on its upper end portion extended outwardly and through said slot, and an extracting means on the said vehicle, in association with and adapted to exert force upwardly against said lug for the extraction of the bit from the earth.

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