Dec. 17, 1940. W. B. DUNLAP, JR 2,225,165

HOLE UNDERREAMER

Filed Aug. 16, 1939 3 Sheets-Sheet 1

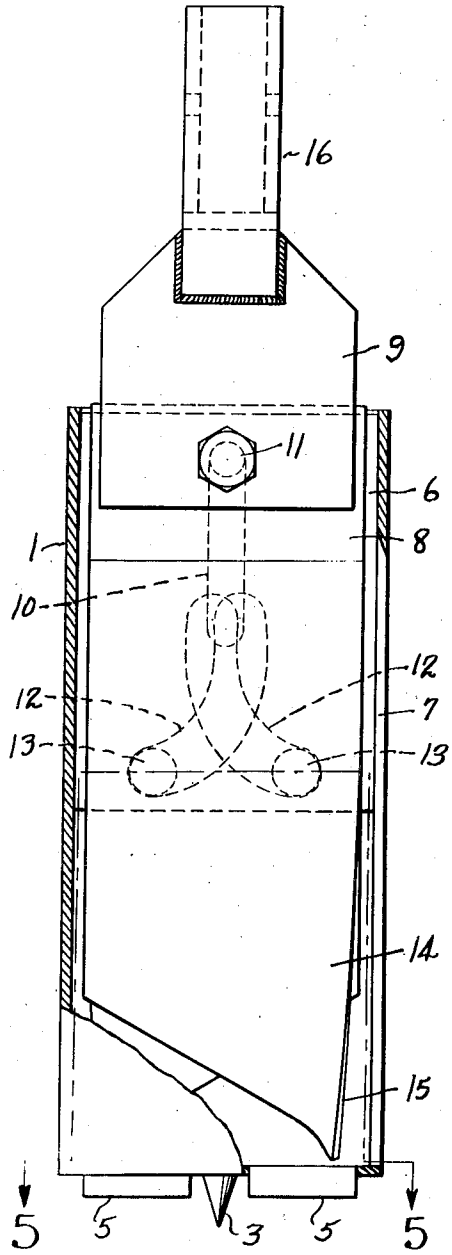


Fig. 1.

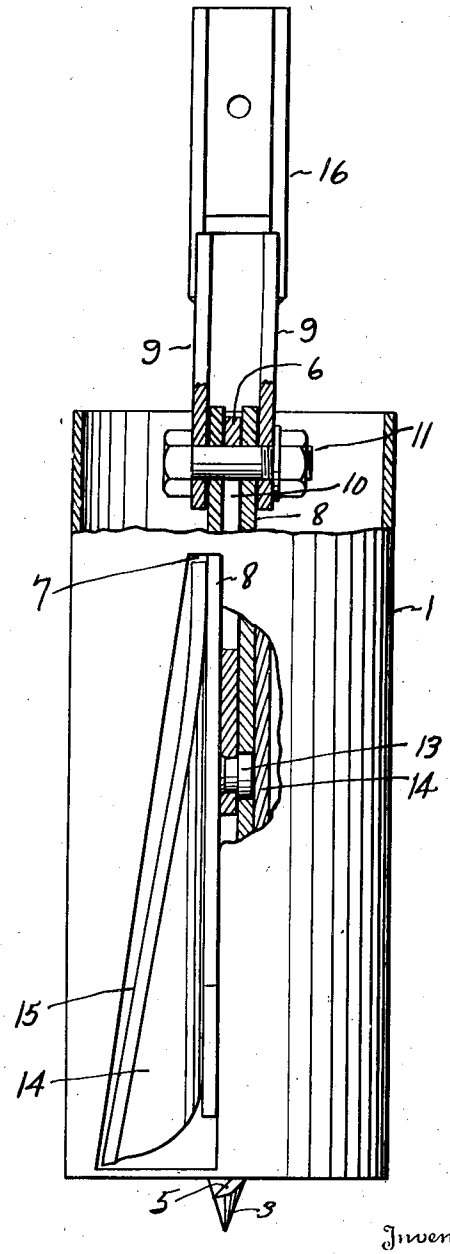


Fig. 2.

Inventor
WEYMAN B. DUNLAP, JR.

By E. V. Hardway,
Attorney

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HOLE UNDERREAMER

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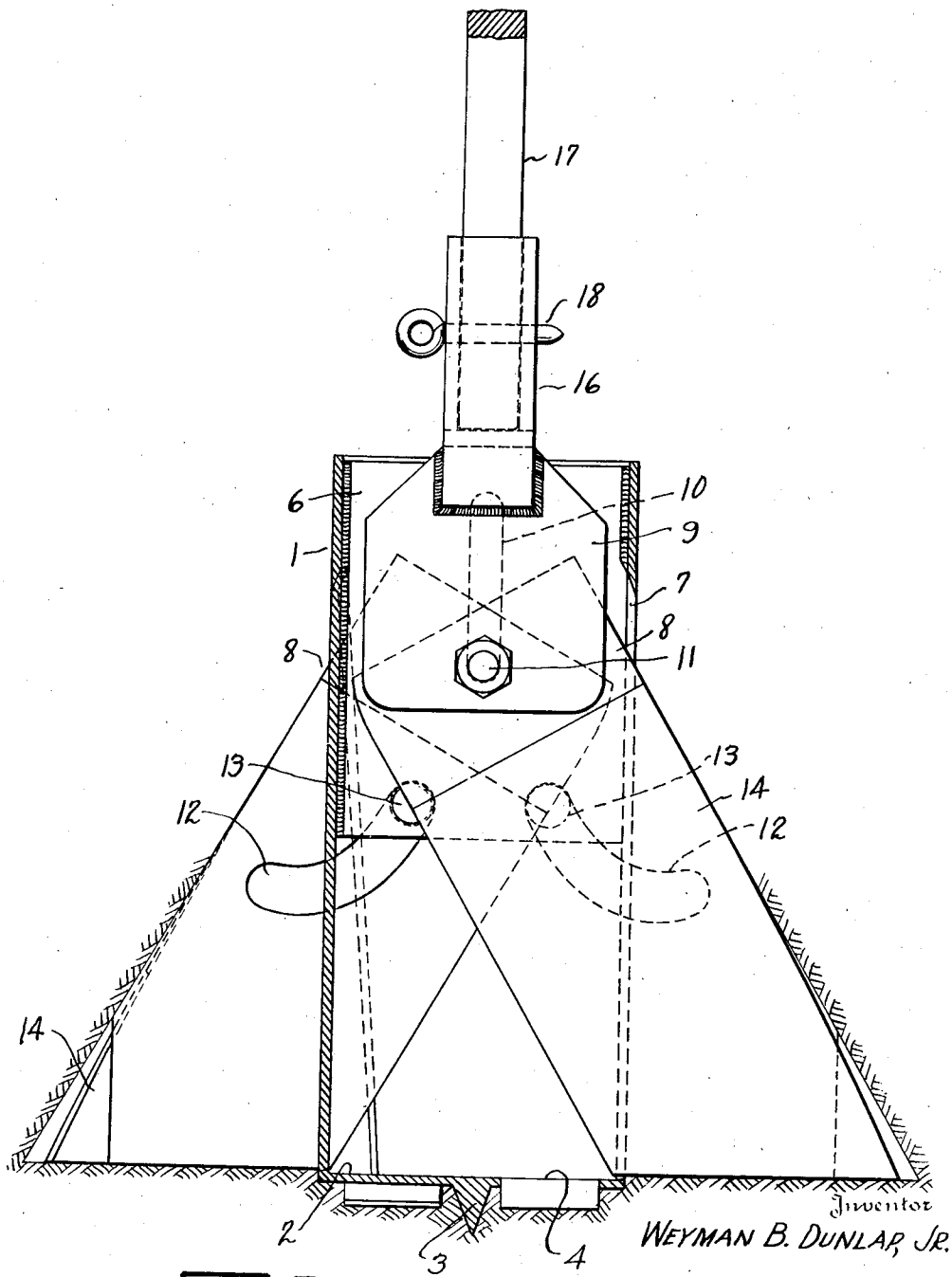


Fig. 3.

Inventor
WEYMAN B. DUNLAP, JR.

By E. V. Hardway
Attorney

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HOLE UNDERREAMER

Filed Aug. 16, 1939 3 Sheets-Sheet 3

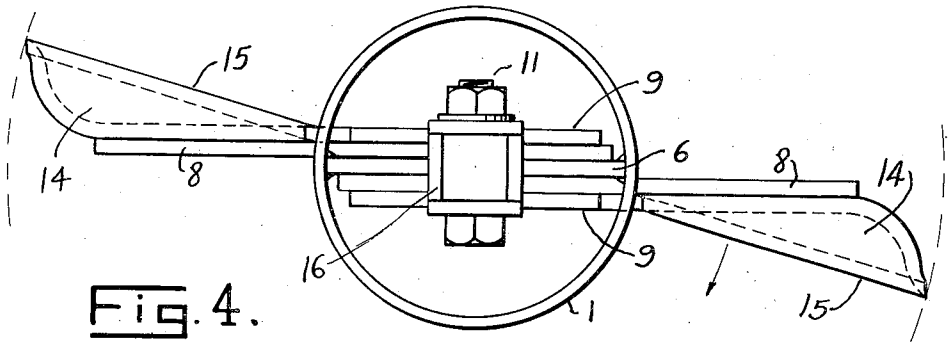


Fig. 4.

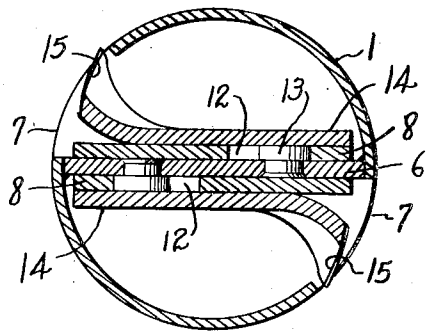


Fig. 5.

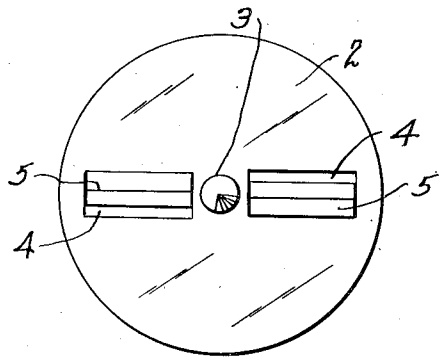


Fig. 6.

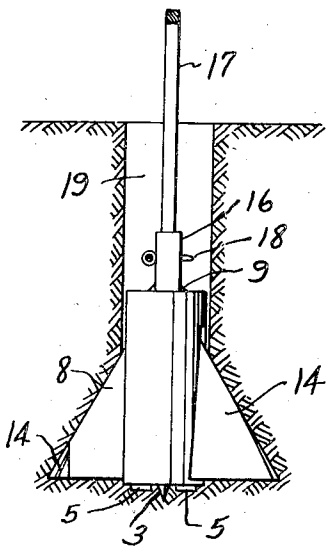


Fig. 7.

Inventor
WEYMAN B. DUNLAP, JR.

By E. V. Hardway
Attorney

Patented Dec. 17, 1940 2,225,165

UNITED STATES PATENT OFFICE

2,225,165

HOLE UNDERREAMER

Weyman B. Dunlap, Jr., Houston, Tex.

Application August 16, 1939, Serial No. 290,405

9 Claims. (Cl. 255—66)

This invention relates to an underreamer.

An object of the invention is to provide an underreamer specially designed for underreaming, or enlarging, the lower ends of holes, or bores, for receiving foundation piers, piling and the like.

It is another object of the invention to provide an underreamer shaped to be readily lowered into a hole or bore previously formed and having outwardly movable blades, or cutters, whereby the lower end of the bore may be gradually enlarged to the desired extent, said blades being retractable to permit the ready withdrawal of the underreamer from the bore, or hole. The underreamed bore may then be filled with plastic, concretious material which, when set, will have a relatively large supporting base.

The invention also embodies novel means for expanding, or retracting, the reaming blades, or cutters.

Another object of the invention is to provide an underreamer having a substantially cylindrical retainer, or bucket, permanently closed at its lower end and having side slots through which the reaming blades work, said blades being shaped to gradually move the cuttings inwardly, as the underreamer is rotated, to collect the cuttings within the container or bucket, and, upon retraction of the reaming blades to close said side slots and retain the cuttings within the container upon withdrawal of the underreamer. The invention also embodies novel means for centering the underreamer in the bore during the rotation or operation thereof as well as means for collecting, into the bucket, the loose earth that may be at the bottom of the bore.

The invention also embodies novel guide means for accurately guiding the reaming blades.

With the above and other objects in view the invention has particular relation to certain novel features of construction, operation and arrangement of parts, an example of which is given in this specification and illustrated in the accompanying drawings, wherein:

Figure 1 shows a side elevation of the underreamer, partly in section, showing the reamer blades retracted.

Figure 2 shows a side elevational view, partly in section, taken at right angles to the view shown in Figure 1.

Figure 3 shows a vertical, sectional view showing the reaming blades in expanded, or active, position.

Figure 4 shows a top plan view showing the reaming blades in active position.

Figure 5 shows a cross-sectional view taken on the line 5—5 of Figure 1.

Figure 6 shows a lower end view, and

Figure 7 shows a side elevation showing the reamer in action.

Referring now more particularly to the drawings wherein like numerals of reference designate the same parts in each of the figures, the numeral 1 designates a container, or bucket, preferably cylindrical in shape and whose lower end is permanently closed by the lower end plate, or bottom, 2, having the central pilot 3 which is of an inverted, conical shape. On opposite sides of the pilot the lower end of the bucket has approximately radial slots 4, 4 and behind them the scrapers 5, 5, which are forwardly pitched so as to gather the loose earth on the bottom of the bore and direct it through the slots 4 into the bucket, or container, 1.

At the upper end of the bucket there is a transverse plate 6 which extends a selected distance down into the bucket and whose margins may be secured to the walls of the bucket in any preferred manner as by welding.

On opposite sides of the plate 6 there are the diametrically opposed side slots 7, 7, which extend from adjacent the upper end of the bucket downwardly to the lower end thereof.

On opposite sides of the fixed plate 6 are the reinforcing plates 8, 8, whose upper ends are embraced by the plate-like jaws 9, 9. The fixed plate 6 has a vertical bearing slot 10, at its upper end and a clamp bolt 11 is fitted through aligned bearings in the overlapping ends of the plates 8 and jaws 9 and is fitted also through the slot 10 as more clearly shown in Figure 2. The plates 8 have the downwardly and outwardly curved arcuate slots 12, 12 cut therethrough to receive the guides studs 13, 13 which are anchored to the fixed plate 6. These slots are covered by the plate-like blades 14, 14 which are fastened, in any preferred manner, as by welding, to the forward sides of the corresponding reinforcing plates 8, 8. The outer margins of the blades 14 are forwardly curved, as more accurately shown in Figures 4 and 5 and terminate in the scraping or reaming edges 15, 15. The curvature of said blades at their lower ends is such that when the blades are in retracted position they will substantially close the slots 7 as indicated in Figure 5 so as to retain the cuttings in the container, or bucket, 1.

The upper ends of the plate-like jaws 9, 9 are secured, preferably by welding, to the lower end of the upstanding driving socket member 16

which is preferably square in horizontal, cross-section. It is provided to receive the correspondingly shaped lower end of a driving stem 17 which may be retained therein by means of the cross-pin 18 fitted through the socket member and the driving stem as shown in Figures 1 and 7.

In operation the blades will be in retracted position within the bucket 1 as shown in Figures 1 and 2 when lowered into the hole 19. When the underreamer lands on the bottom of the hole the pilot 3 will penetrate into the formation and will hold the bucket centered during rotation. The driving stem 17 may then be rotated in an appropriate direction and by any suitable mechanism provided for the purpose. The downward thrust of the driving stem will tend to move the plates 8 and blades 14 downwardly, the clamp bolt 11 moving downwardly in the slot 10. During this downward movement of the plates, the blades will also be gradually expanded, that is, their lower ends will be moved radially outwardly due to the pins, or studs, 13 engaging in the outwardly curved cam shaped grooves 12, 12, said blades moving outwardly through the slots 7 and finally reaching their extreme outer position as shown in Figures 3 and 7.

As the blades move outwardly they will also gradually move downwardly so that their lower ends move, or thrust, outwardly in a horizontal direction to the end that the lower end of the bore, when underreamed, will lie in a horizontal plane as shown in Figure 7. To accomplish this the lower ends of the blades 14 are cut on the diagonal, as shown in Figures 1 and 2, and terminate in sharp cutting edges. As the underreamer is rotated the blades will come into cutting contact with the sides of the hole and the formation will be gradually reamed away from the side walls at the bottom as the blades are progressively expanded. The forward curvature of the blades will gradually force the cuttings inwardly through the side slots 7 and when the upper ends of the slots 12 engage the pins or studs 13 the blades will be fully expanded and the underreaming of the bore will be fully accomplished. The range of outward movement of the blades and the consequent enlargement of the bore may be determined by the length of the slots 10, 12 and the size of the blades.

Thereupon the underreamer may be lifted out of the bore by an upward pull on the driving stem 17. This will operate first to retract the blades inwardly and when the clamp bolt 11 reaches the upper end of the slot 10, the entire tool will then be moved upwardly and may be completely withdrawn from the bore. When the tool reaches the ground surface the driving stem may again be lowered thus moving the blades outwardly and rendering the interior of the bucket accessible so that the contents thereof may be discharged.

The drawings and description are illustrative merely, while the broad principle of the invention will be defined by the appended claims.

What I claim is:

1. An under reamer comprising a cylindrical bucket having side slots, a transverse supporting plate anchored in the top of the bucket and having a vertical slot, lateral studs on the plate, plate-like reamers aligned with said side slots and having cam grooves which receive said studs, driving means, a bolt working through said vertical slot and forming a pivoted connection between the driving means and reamers whereby the downward movement of the driving means relative to said supporting plate will cause the outward movement of the lower ends of the reamers.

2. A tool for underreaming holes comprising a bucket shaped to enter the hole and having side slots, a supporting plate anchored in the bucket between said side slots and having a vertical slot, reamers on opposite sides of the plate in alignment with the side slots whose outer and lower margins terminate in cutting edges, driving means embracing the upper ends of the reamers, means forming a pivotal connection between the driving means and reamers and passing through the slot of said plate, operative connections between the plate and reamers comprising cooperating studs and cam shaped bearings whereby upon downward movement of the reamers in the bucket will cause the outward movement of the lower ends of the reamers.

3. A tool for underreaming earth holes comprising a bucket shaped to enter the hole and having side slots, a transverse plate in, and anchored to, the bucket between the side slots and having a vertically elongated bearing, reamers arranged to work through the side slots, driving means for rotating the tool, means pivotally connecting the reamers to the driving means and working in the bearing, said plate and reamers being provided, one with studs and the other with cam grooves to receive the studs whereby upon downward movement of the reamers in the bucket the lower ends of the reamers will be moved outwardly.

4. A tool for underreaming holes comprising a bucket shaped to enter the hole and having side slots, a transverse supporting element in, and anchored to, the bucket and having a vertically elongated bearing, reamers arranged to work through the side slots, driving means for rotating the tool, means pivotally connecting the reamers to the driving means and working through said bearing, said reamers having cam shaped grooves whose lower ends are outwardly turned, reamer guides on said fixed element projecting into said grooves whereby upon downward movement of the reamers in the bucket the lower ends of the reamers will be moved outwardly.

5. A tool for underreaming holes in the earth comprising a bucket shaped to enter the hole and having side slots, a supporting element in, and anchored to, the bucket and having a vertically elongated bearing, plate-like reamers arranged to work through said side slots, driving means for rotating the tool and including plate-like jaws embracing the upper ends of the reamers and means pivotally connecting said reamers to said jaws and working through said bearing, said supporting element and reamers being provided one with cam grooves and the other with means projecting into said grooves whereby upon downward movement of the reamers relative to the bucket the lower end of the reamers will be moved outwardly.

6. A reamer formed with a blade and a reinforcing plate behind the blade, means for slidably supporting the reamer, said plate having a downwardly and outwardly curved cam groove therein, the lower and outer margins of the blade terminating in forwardly directed edges.

7. A tool for underreaming holes in the earth comprising a bucket shaped to enter the hole and having a side slot, a reamer in the bucket aligned with said side slot, said reamer being formed of a blade and a reinforcing plate behind and se-

cured to the blade, means for slidably supporting the reamer, a downwardly and outwardly curved cam on the reamer and means fixed relative to the bucket and arranged to cooperate with the cam to move the lower end of the blade outwardly upon downward movement of the blade relative to the bucket.

8. A tool for underreaming earth holes comprising a bucket shaped to enter the hole and having side slots, a supporting element in, and anchored to, the bucket between the side slots and having a vertically elongated bearing, reamers arranged to work through the side slots, driving means for rotating the tool, means pivotally connecting the reamers to the driving means and working in the bearing, said supporting element and reamers being provided, one with studs and the other with cam grooves to receive the studs whereby upon downward movement of the reamers in the bucket the lower ends of the reamers will be moved outwardly.

9. A tool for underreaming holes in the earth comprising a bucket shaped to enter the hole and having a side slot, a reamer in the bucket aligned with the side slot, said reamer being formed of a blade and a reinforcing plate behind and secured to the blade, means for slidably supporting the reamer, said reamer and bucket being provided one with an outwardly curved cam and the other with means fixed thereon and arranged to cooperate with the cam to move the lower end of the blade outwardly upon downward movement of the blade relative to the bucket.

WEYMAN B. DUNLAP, JR.