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UNDERREAMER

Filed April 19, 1940

3. Sheets-Sheet 1



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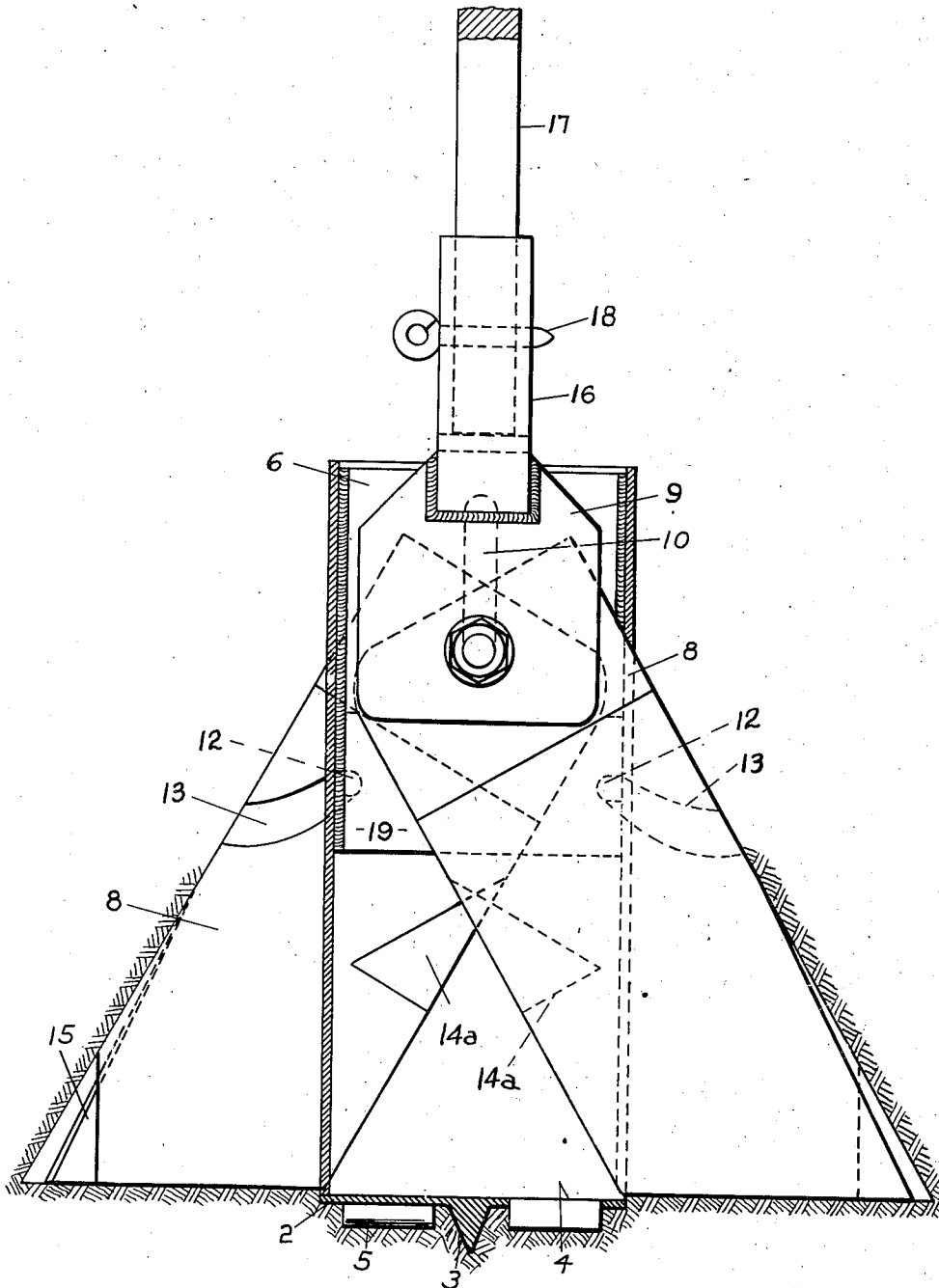


Fig. 3

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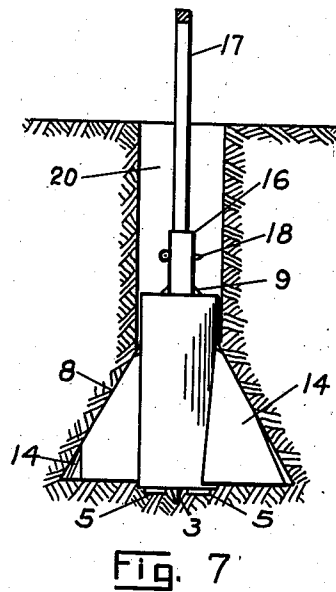
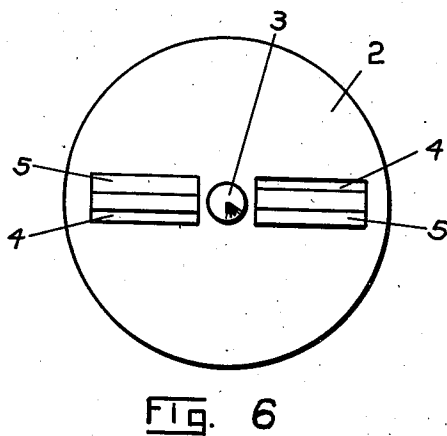
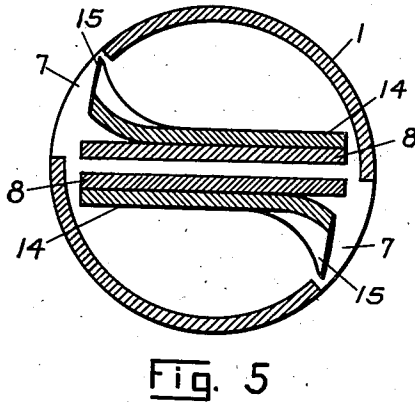
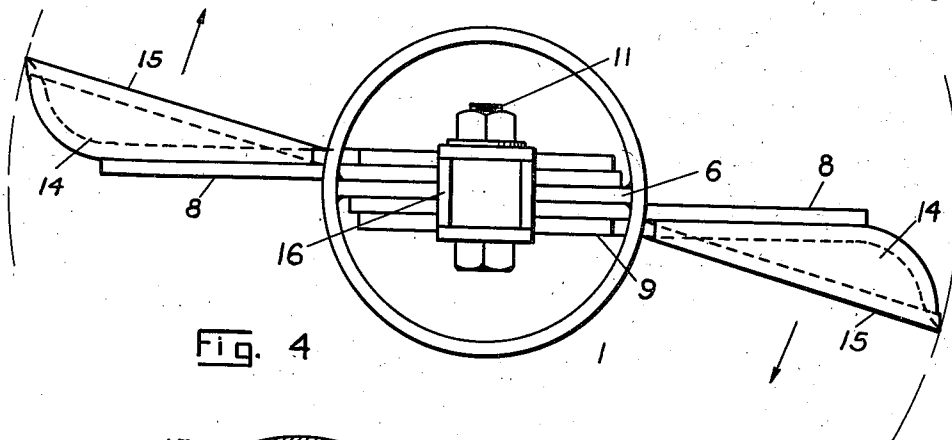
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3 Sheets-Sheet 3



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UNDERREAMER

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

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5 Claims. (Cl. 255—74)

This invention relates to an underreamer.

The invention embodies certain improvements over that type of underreamer disclosed in my co-pending application, Serial No. 290,405, filed August 16, 1939.

An object of the invention is to provide an underreamer, or foundation auger, having under-reaming blades for underreaming, or enlarging, the lower ends of holes or bores for receiving foundation piers, piling and the like with novel means for actuating the underreaming blades.

It is another object of the invention to provide an underreamer shaped to be readily lowered into a 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 hole.

Other objects and purposes of the invention will be more particularly hereinafter pointed out in this specification and are illustrated in the accompanying drawings, wherein:

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

Figure 2 shows an 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 position.

Figure 4 shows a top plan view showing the reaming blades expanded.

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 a central depending 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 guide the loose earth on the bottom of the bore and direct it through the slots 4 into the bucket 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 side 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.

At opposite margins of the fixed plate 6, near its lower end, are the guide studs 12, 12 which are arranged on opposite sides of said fixed plate 6 and the plates 8 have the downwardly and outwardly curved arcuate slots 13 cut therethrough to receive the guide studs 12 and which extend to the side margins of said plates 8. These slots 13 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 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 bucket 1.

The upper ends of the plate-like jaws 9, 9 are secured, preferably by welding, to the lower end of the upstanding socket member 16 which is preferably square in horizontal cross-section. It is provided to receive the correspondingly shaped lower end of a drive 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 Figure 7.

The rear margin of each blade 14 has an approximately diagonal notch as 14a, shown more clearly in Figure 3 and on opposite sides of the fixed plate 6 at its opposite margins are correspondingly shaped triangular deflectors 19, 19 which are symmetrical with said notches and adapted to be received by the notches when the blades are in inactive, or retracted, position as shown in Figure 1. As is clearly illustrated in Figures 1 and 3 the inner margins of the deflectors 19, 19 are pitched, or converge downwardly and inwardly so that upon downward movement of the blades said blades are also expanded.

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 20. When the underreamer lands on the bottom of the hole the pilot 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 a suitable mechanism provided for the purpose. The downward thrust of the driving stem will then move the plates 8 and the blades 14 downwardly, the clamp bolt 11 moving downwardly in the slot 10. During this downward movement of the blades the blades will also be gradually expanded by the co-action of the upper margins of the notches 14a against the downwardly converging margins of the guides 19, that is, their lower ends will be moved radially outwardly. The co-action of the studs 12 and the upper margins of the slots 13 will also contribute to the expansion of the blades as they are moved downwardly. As the blades move downwardly they will also move outwardly through the slots 7 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 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 to 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 13 engage the studs 12 the blades will be fully expanded and the underreaming of the bore will be fully accomplished. 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 by the co-action of the studs 12 with the lower margins of the slots 13 and when the clamp bolt 11 reaches the upper end of the slot 10 the blades will be fully retracted and the deflectors 19 will be seated in the slots 14a and the entire tool may then be moved upwardly and be completely withdrawn from the bore. When the tool reaches the ground surface the driving stem may be again 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 underreamer comprising a cylindrical bucket having side slots, a transverse supporting plate anchored in the top of the bucket and having a vertical slot, plate-like reamers aligned with said side slots and having arcuate grooves, guide studs on the plate in the grooves, the outer margins of the reamers being curved away from the supporting plate, deflectors on the plate arranged to cooperate with the reamers, driving means for rotating the bucket, a bolt working through said vertical slot and forming a pivoted

connection between the driving means and reamers whereby downward movement of the reamers relative to the supporting plate will cause co-action between the reamers and deflectors to cause the outward movement of the lower end 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 the side slots and having a vertical slot, reamers on opposite sides of the plate in alignment with the side slots and whose outer, 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 downwardly converging wedge-like deflectors on the plate and cooperating tapering bearing surfaces on the respective margins of the reamers whereby upon downward movement of the reamers in the bucket the lower ends of the reamers will be moved outwardly.

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 reamer assembly having wedge shaped deflectors and guides arranged to co-act upon downward movement of the reamers to effect movement of the lower ends of the reamers outwardly.

4. 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 downwardly converging deflectors arranged to co-act with the other respective margins 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 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 downwardly converging deflectors arranged to co-act with the other whereby upon downward movement of the reamers in the bucket the lower ends of the reamers will be moved outwardly, studs on said supporting element and the reamers being provided with channels in the rear faces thereof to receive the studs to assist such outward movement of the reamers upon their downward movement.