

June 4, 1940.

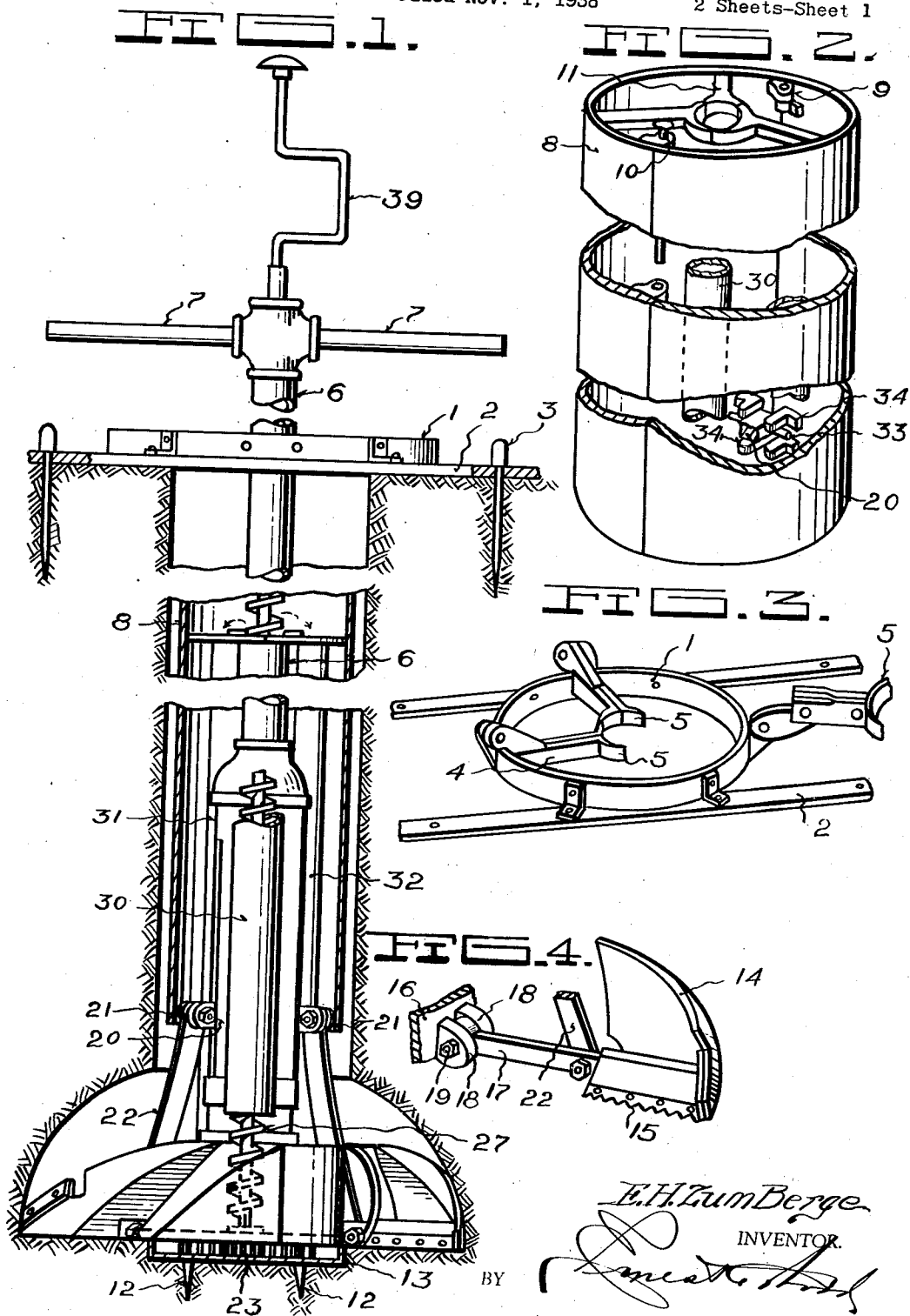
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2,203,246

UNDERREAMER

Filed Nov. 1, 1938

2 Sheets-Sheet 1



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FIG. 5.

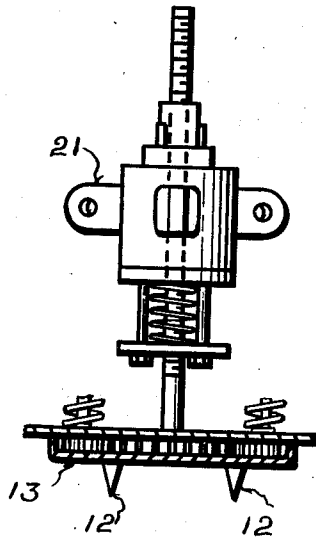


FIG. 6. FIG. 7.

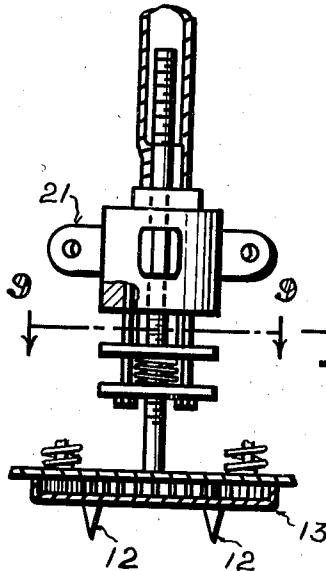


FIG. 9.

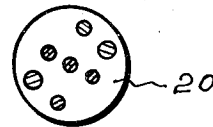


FIG. 2.

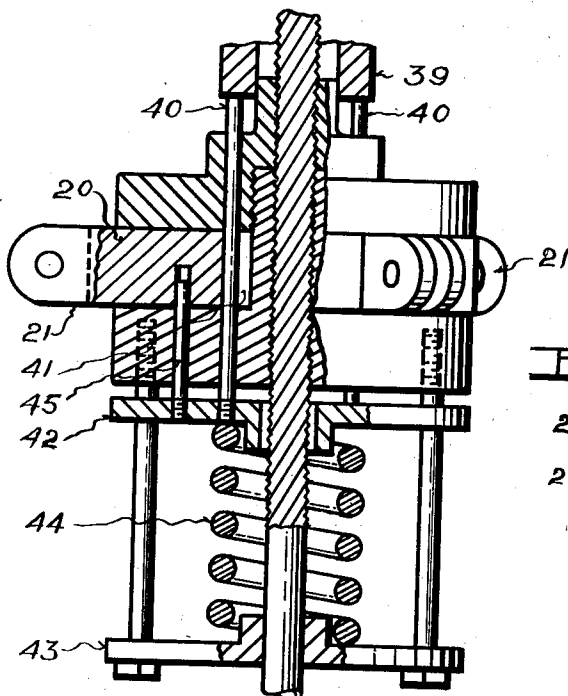


FIG. 10.

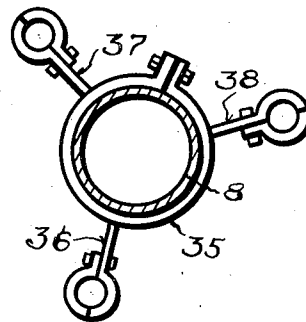
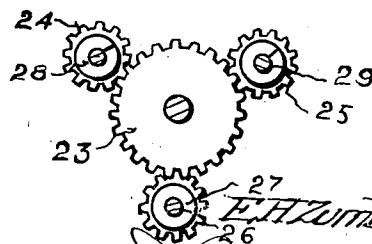


FIG. 11.



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UNITED STATES PATENT OFFICE

2,203,246

UNDERREAMER

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mesne assignments, to Estate of Emil H. Zum-
Berge and George Klein, both of Dallas, Tex.

Application November 1, 1938, Serial No. 238,251

5 Claims. (Cl. 255—76)

This invention relates to underreamers and it has especial reference to expanding and cleaning earth reamers, the action of which may be manually or otherwise suitably controlled.

5 The principal object of the invention is to provide an underreamer for enlarging the region adjacent the bottom of a bore hole, in order to provide an area such that pillars or piers may be provided with a suitable foundation.

10 Another object of the invention is to provide an apparatus whereby earth material underreamed may be conveyed to the surface of the earth with a minimum of effort upon the part of an operator.

15 Still another object of the invention is to provide means by which underreamed strata may be conveyed to a zone, which zone may be later opened and the contents thereof subsequently deposited upon the surface of the earth.

20 Yet another object is to provide gear means and screw conveyers adjacent the lower portion of the underreamer through the medium of which earth cuttings may be transferred into a zone, which latter may be subsequently ele-
25 vated to the surface of the earth.

Yet another object is to provide means by which the underreamer is at all times maintained in concentric relationship relative to the bore hole.

30 With the foregoing objects as paramount, the invention has particular reference to its salient features of construction and arrangement of parts which will become manifest as the description proceeds, taken in connection with the accompanying drawings, wherein:

35 Figure 1 is a view in vertical section of the underreamer shown in fully expanded position and with portions broken away.

40 Figure 2 is a fragmentary view in perspective of the container into which earth cuttings are conveyed.

Figure 3 is a perspective view of the surface means for centering the underreamer.

45 Figure 4 is a fragmentary view of one of the underreaming units, shown fragmentarily in perspective.

Figure 5 is an elevational view of the lower part of the underreamer shown in an inoperative position.

50 Figure 6 is a view similar to Figure 5 and showing the means in cross section by which release is effected.

55 Figure 7 is an enlarged view in vertical section shown fragmentarily and with portions broken away, of the apparatus by which units

of the underreamer may be locked together or suitably unlocked at the will of an operator.

Figure 8 is a fragmentary view in perspective of the lower end of the means for locking and unlocking the units of the structure illustrated 5 in Figure 7.

Figure 9 is a view taken on the line 9—9 on Figure 6.

Figure 10 is a plan view of the supporting means for the earth container illustrated in Figure 2, and showing the supporting arms for the earth elevators, and

Figure 11 is a view showing the gearing positioned adjacent the lower portion of the underreamer, and illustrating the plurality of earth 15 elevating screw conveyers.

Referring primarily to Figures 1 and 3, the reference numeral 1 designates a ring fixedly mounted upon supporting members 2 which latter members are fixedly positioned to the earth 20 by means of pins 3. The ring 1 is provided with hingedly connected arms 4. Segmentary and annular sections 5 are affixed to the arms 4, as illustrated in Figure 3. The purpose of the above assembly is to hold the apparatus to be hereinafter described in concentric relationship to 25 the bore hole at all times.

Torque to the underreamer is transmitted through the medium of a pipe 6, which torque 30 may be applied manually by means of the cross bars 7, or through any suitable power means.

The cylindrical unit illustrated in Figure 2 serves as a means for receiving and retaining earth cuttings during operation of the apparatus. This unit is comprised primarily of a longitudinally split housing 8, whose sections are interconnected by hinges 9, and which sections may be manually locked by means of a pin 10. The housing 8 is maintained in concentric relationship with the pipe 6 by means of arms 11 40 which are arranged and formed as shown in Figure 2. The pipe 6 is enlarged as shown in Figure 1 whereby the arms 11 will surround the smaller portion of the pipe 6 and will seat upon the shoulder formed by the enlargement whereby the bucket 8 is suspended to receive the dirt conveyed upwardly through the sleeves 30.

It will be understood that after a bore hole to be underreamed has been drilled to a desired depth, the underreamer is lowered therein and 50 centrally positioned by the pins 3. Prongs 12 serve to engage the earth and prevent rotation of a housing 13, which housing serves to encase a gearing arrangement to be hereinafter described. 55

The cutter blade arrangement is best illustrated in Figure 4. These cutters are each provided with walls 14 which curve inwardly toward the common rotating axis. Earth cutting elements 15, preferably serrated and replaceably arranged, are affixed to the bodies of the underreaming elements. Each of the underreaming units is pivotally attached to a central and tubular member 16 by means of arms 17, which latter arms are hingedly connected to the tubular member 16 through the medium of ears 18 and pin 19. It is to be noted that the tubular member 16 is rigidly connected to the lower end of the pipe 6 whereby rotation of said pipe through the member 7 will cause the ears 18 integral with the member 16, to be rotated. The member 16 forms a jacket around the pipe 6 which pipe extends downwardly in such a manner as to be rotatably connected to the axle of the gear 23 whereby said gear will be rotated when the pipe 6 is revolved.

When the underreamer is lowered into a bore hole and prongs 12 are fixedly positioned in the earth at the bottom of the bore hole, it will be seen that torque applied to the arms 7 will be effective to rotate a collar 20, which collar is provided with ears 21. Arms 22 serve to interconnect the ears 21 with arms 17 as illustrated in Figures 1 and 4, thereby serving to arcuately move the underreaming elements to the position shown in Figure 1 as the arms 7 are rotated, since the ears 21 are longitudinally movable but are constrained to rotate with the central assembly.

The pipe 6 is rigidly attached through its assembly to a central gear 23 which serves to rotate pinion gears 24, 25 and 26 as illustrated in Figure 11. These pinion gears in turn serve to rotate screw conveyers 27, 28, and 29, which latter are encased within tubular members 30, 31, and 32, respectively. As the earth reaming cutters are arcuately moved, the cuttings are continuously deposited within the container, illustrated in Figure 2 by means of the screw conveyers 27, 28 and 29. The container 8 is continuously moved in a downward direction as the cutting units are arcuately moved since the container 8 is constrained to follow the downward movement by reason of the attachment shown in Figure 2. Manifestly the screw conveyers 27, 28 and 29 may be replaced by bucket conveyers or other suitable means for elevating the earth cuttings. One of the arms 20a is elongated to receive a pin 33 which is arranged to be conformably received between ears 34.

Figure 10 illustrates the assembly which serves to centrally position the container 8 relative to the bore hole as well as to the screw conveyor system hereinabove described. This positioning assembly is comprised primarily of a ring 35 to which arms 36, 37, and 38 are rigidly attached, and are formed as shown to receive the tubular members 30, 31, and 32, respectively, thereby insuring central alignment at all times.

Figures 5, 6, 7, 8 and 9 illustrate the means by which the underreaming cutters may be locked to or unlocked from the rotatable underreaming assembly from the surface of the earth. Figure 5 illustrates in elevation the assembly in locked and operative position. Figure 6 is a view similar to Figure 5 and showing the assembly in a position such that the cutting elements are in released position.

After the underreaming operation has been completed, and withdrawal of the tool from the

bore hole is required an elongated member 39, formed at its lower extremity as shown in Figure 8, is inserted within the pipe assembly 6, which member serves to contact and move downwardly a plurality of pins 40. The collar 20 is provided with an annular groove 41 within which the pins 40 are positioned. Thus it will be seen that the collar 20 which, hereinabove described, carries the ears 21, is free to rotate about the pins 40. The pins 40 are affixed to a plate 42 which is positioned above a plate 43, a spring 44 being interposed therebetween. Longitudinally arranged pins 45 are fixedly arranged to the plate 42 and slidably mounted within the collar 20. It is to be noted that the elongated member 39 is screw threaded intermediate the ends thereof, which threads in cooperation with threads in the collar 20 serve to raise or lower said collar. As has been stated the arms 22 are pivotally connected to ears 21 of the collar 20 at one end and at the other end to the arms 17. Thus, rotation of the member 39 will impart a vertical movement to the collar 20 whereby as the collar moves downwardly the arms 17 will be forced toward the center of the device to permit the insertion or withdrawal of the device in the bore hole, while upward movement of the collar will tend to expand the arms 17 and their accompanying earth cutting means to perform the underreaming operation. Thus when pressure is exerted upon the member 39 the pins 40 are depressed thereby lowering the plate 42 against the action of the spring 44 and causing pins 45 to be disengaged from their respective recesses. Hence ring 20 and its attendant parts including the cutting elements are freed from rotation with other elements of the structure. The above described operation is accomplished prior to withdrawal of the tool from the bore hole.

In operation the member 39 is rotated to force the collar 20 downwardly to retract the members 14. The device is then lowered into the bore hole to be underreamed and rotation of the member 39 reversed to expand the members 14. The pins 3 are then set in the earth after the device has been "centered" within the bore hole. The member 7 is then rotated to actuate the earth cutting blades 15 as has hereinbefore been explained. Upon rotation of the member 6 the conveyers will serve to raise the cuttings upwardly into the bucket 8 to remove the same from the underreamed portion. Obviously, the collar 20 could not be raised to the fullest extent until portions of the earth were cut away. Thus, the member 39 would be rotated to expand the blades in accordance with the amount of dirt removed. After the underreamed portion has been completely bored the blades are retracted through the medium of the member 39 and the device withdrawn from the bore hole.

Manifestly, the construction as shown and described is capable of some modification and such modification as may be construed within the scope and meaning of the appended claims is also considered to be within the spirit and intent of the invention.

What is claimed is:

1. An underreamer for bore holes including a tubular body, pivoted earth cutting means, means within said body to move said earth cutting means arcuately as said body is rotated, means for receiving the earth cuttings from said blades, means for continuously transferring said earth cuttings to said earth receiving means, and

means for releasing said earth cutting means from rotation relative to said tubular body.

2. Apparatus for underreaming bore holes including a cylindrical body, earth cutting means pivoted to said body, means to move said earth cutting means arcuately and in a helical path as said body is rotated, screw conveyer means for elevating the earth cuttings for disposal within an earth container and means whereby said earth cutting blades may be released from rotation when said apparatus is withdrawn from the bore hole.

3. Apparatus for underreaming bore holes including a cylindrical body, earth cutting means pivoted to said body, means to move said earth cutting means arcuately and in a helical path as said body is rotated, gear driven conveyer continuously elevating the earth cuttings for disposal within a cylindrical container and means whereby said earth cutting blades may be released from rotation when said apparatus is withdrawn from the bore hole.

4. Apparatus for underreaming bore holes in-

cluding a cylindrical body, earth cutting means pivoted to said body, means to move said earth cutting means in a helical path as said body is rotated, gear driven screw conveyer means for elevating the earth container, means whereby said earth cutting blades may be released from rotation when said apparatus is withdrawn from the bore hole, and spring pressed means for releasing rotation of the blades when the apparatus is withdrawn from the bore hole.

5. Apparatus for underreaming bore holes including a cylindrical body, earth cutting means pivoted to said body, means to move said earth cutting means arcuately and in a helical path as said body is rotated, gear driven screw conveyer means for elevating the earth cuttings for disposal within an earth container, means to hold said earth container in central position, and means whereby said earth cutting blades may be manually released from rotation from the attendant parts.

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