April 22, 1941. C. S. KUNA 2,239,610

JETTING APPARATUS

Filed Oct. 2, 1939

Fig. 1

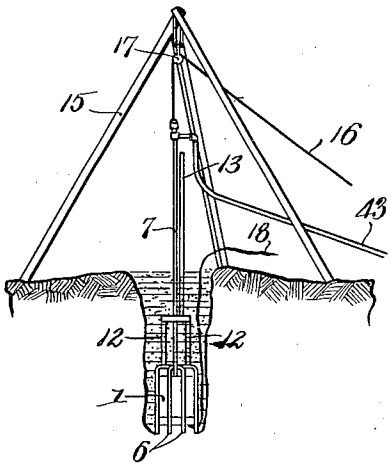


Fig. 2

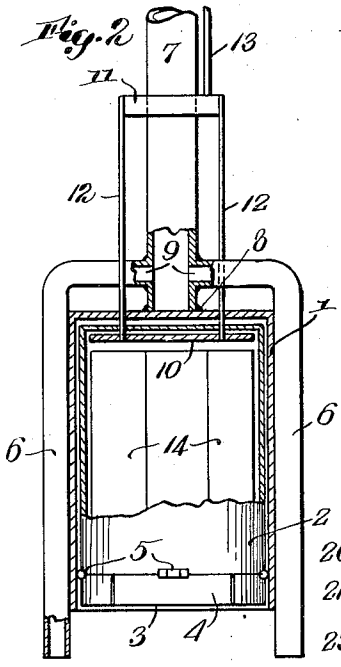


Fig. 3

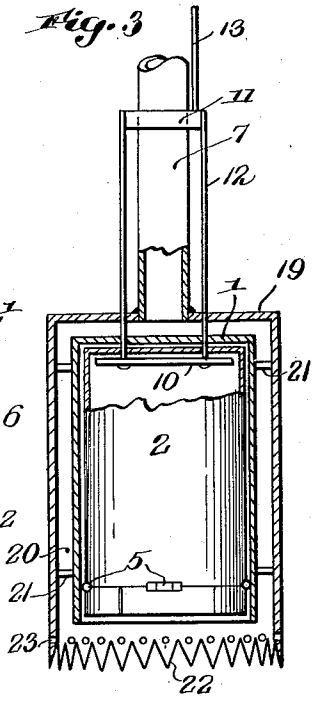


Fig. 4

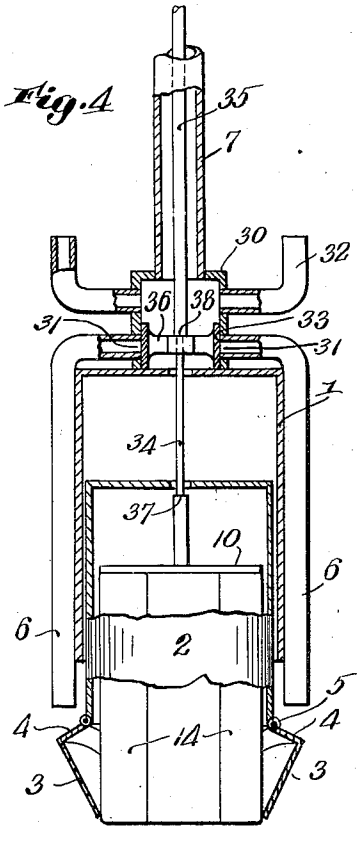


Fig. 5

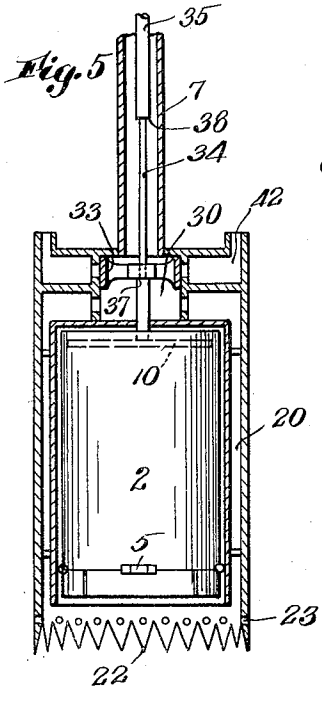


Fig. 6

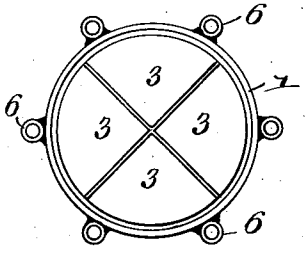
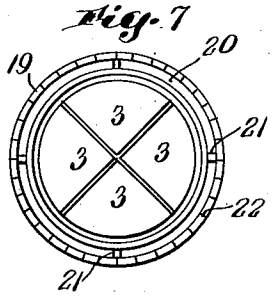


Fig. 7



Inventor:
Charles S. Kuna
By Roluta, Cushman & Woodbury
his Attys.

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UNITED STATES PATENT OFFICE

2,239,610

JETTING APPARATUS

Charles S. Kuna, Floral Park, N. Y., assignor of one-third to Albert K. B. Lyman and one-third to Earl M. Major, both of Newton, Mass.

Application October 2, 1939, Serial No. 297,425

6 Claims. (Cl. 61—63)

This invention relates to apparatus for planting objects, such as explosive charges for example, more or less deeply into sand or other soil. While the apparatus is suitable for many purposes it is particularly useful in compacting soil as disclosed in the pending application of Albert K. B. Lyman, Serial No. 289,358, filed August 10, 1939. According to the method disclosed in said application explosive charges are sunk to depths of ten to twenty feet and upwards at spaced intervals throughout an area of soil which is to be shaken down, after which the charges are fired simultaneously or successively, the size and depth of the charges being such that the soil is shaken down and compacted without craters being formed at the surface.

The objects of the present invention are to provide a method and apparatus which is simple and inexpensive to construct, which is adapted to sink objects such as explosive charges rapidly and economically, which protects the explosive charges from injury while the charges are being sunk, which can be readily withdrawn while leaving the charges in the soil, which is durable in use and which is generally superior to prior apparatus for the same general purpose.

For the purpose of illustration typical embodiments of the invention are shown in the accompanying drawing, in which

Fig. 1 is a side elevation of one embodiment of the invention in use;

Fig. 2 is a central vertical section of the lower part of the apparatus, parts being shown in elevation;

Figs. 3, 4 and 5 are similar views of three other embodiments of the invention;

Fig. 6 is a bottom plan of the apparatus shown in Fig. 2; and

Fig. 7 is a bottom plan of the apparatus shown in Fig. 3.

The particular embodiment of the invention shown in Figs. 1, 2 and 6 comprises an outer cylindrical container 1 having its upper end closed and its lower end open. Inside the outer container is an inner container 2 which is also closed at the top and open at the bottom. Mounted over the bottom opening of the inner container is a closure in the form of four segments 3 each having a vertical circular portion 4 concentric and flush with the container 2, the segmental closures being hinged to the container 2 by means of the hinges 5. Extending lengthwise of the outer periphery of the container 1 are jet pipes 6 which may be secured to the outer periphery of the container in any suitable manner as by welding, these pipes being open at the bottom as shown in Figs. 2 and 6. Extending upwardly from the top of the container 1 is a pipe 7 which may be welded to the center of the container as indicated at 8. As shown in Fig. 2 the upper ends of the pipes 6 extend inwardly over the top of the container and join the pipe 7 through openings 9. Water may be supplied to the upper end of the pipe 7 through a hose 43. Disposed within the inner container 2 is a disk 10 for use in pushing the contents of the container outwardly through the bottom opening. Slidably mounted on the pipe 7 is a collar 11 which is connected to the disk 10 by means of three or more rods 12 which extend through snug-fitting openings in the top of the containers 1 and 2. Extending upwardly from the collar 11 along the pipe 7 to the upper end of the apparatus is a rod 13 with which the collar 11, and therefore the disk 10, may be moved up and down. In the drawing the contents of the containers are illustrated as comprising bundles of dynamite sticks 14.

To sink the apparatus in soft sandy soil it is necessary merely to stand the apparatus on the soil and jet water downwardly through the main pipe 7 and thence through the jet pipes 6, the apparatus gradually settling into the ground as the water and soil flows upwardly around the container. However to penetrate harder soil it may be necessary to loosen the soil mechanically, in which case the apparatus may be recurrently raised and lowered by means of a tripod 15 and a cable 16 extending over a pulley 17 on the tripod. As the apparatus is repeatedly raised and lowered the downwardly projecting pins of the pipe 6 dig into the soil with a loosening action. This action may be greatly augmented by rotating the apparatus back and forth as it is raised and lowered, as for example by means of two pipe wrenches applied to the upper end of the pipe 7 and facing in opposite directions circumferentially of the pipe.

After the apparatus has been sunk to the desired depth the contents 14 of the container may be ejected by moving the disk 10 downwardly. Owing to the fact that the segmental doors 3 are hinged to the container 2 somewhat above the lower edges of the doors they can not swing outwardly until the inner container 2 has been moved downwardly sufficiently to bring the hinges 5 approximately to the level of the lower ends of the pipes 6. Thus downward thrust of the disk 10 on the contents 14 of the container first causes the inner container 2 to move down-

wardly in the outer container until the hinges 5 reach the aforesaid level, whereupon the continued thrust of the disk 10 causes the segmental doors to swing outwardly and the contents 14 to be ejected.

After the contents are ejected the apparatus may be lifted out of the soil by means of the cable 16, leaving the explosive charge buried in the soil. Ordinarily the loose soil settles back into the opening after the apparatus is withdrawn but if the opening does not fill by gravity the filling operation may be completed in any suitable way. After the apparatus is withdrawn a new charge is inserted, the doors 3 are closed and the inner container is pushed back into the outer container to the position shown in Fig. 2, whereupon the apparatus is ready for further use.

In planting explosive charges it is of course necessary to have a detonating cable leading from the charge upwardly to the surface of the ground as indicated at 18 in Fig. 1. While this cable may be connected to the charge in any suitable manner it preferably extends along the outside of the outer container and thence through one of the cracks between the doors 3.

The modification shown in Figs. 3 and 7 is similar to that shown in Figs. 1, 2 and 6 and corresponding parts are correspondingly designated. However instead of the pipes 6 the apparatus of Figs. 3 and 7 comprises a third casing 19 which surrounds the casing 1 with a space 20 therebetween for the passage of water from the pipe 7 through the lower end of the apparatus, the casing 19 being joined to the casing 1 by means of spacers 21. As shown in Fig. 3 the pipe 7 is joined to the casing 19 instead of the casing 1 and its lower end communicates with the space 20 between the two casings. The lower end of the casing 19 is serrated as indicated at 22 for the purpose of loosening the soil as previously described in connection with the downwardly projecting ends of the pipes 6. The lower end of the casing 19 may if desired also be provided with lateral openings 23 to produce radial jets, thereby to enlarge the opening produced by the jetting action.

The modification shown in Fig. 4 is like the embodiment shown in Figs. 1, 2 and 6 except in the following respects. Instead of the pipe 7 joining directly to the casing 1 it is joined to the casing through the medium of a valve chamber 30 to which the pipes 6 are connected through radial openings 31. Also connected to the valve chamber 30 through similar radial openings are other pipes 32 which turn upwardly instead of downwardly and whose upper ends are open. Slidable up and down in the casing 30, between a lower position in which the openings 31 are closed and an upper position in which the openings to pipe 32 are closed, is a ring valve 33 slidably mounted on the reduced portion 34 of the rod 35 (corresponding to the rod 13 of Fig. 2) for actuating the disk 10, the ring 33 being mounted on the rod 34 through ribs 36 which permit the free passage of water therebetween to the opening 31 when the valve is in the upper position. By virtue of the reduction in diameter of the portion 34 the rod 35 is provided with shoulders 37 and 38 which limit the upward and downward movement of the rod. The modification shown in Fig. 5 is like that of Fig. 3 except for the addition of upwardly directed ducts 42 corresponding to the ducts 32 of Fig. 4 and the valve mechanism shown in Fig. 4, corresponding parts being correspondingly numbered.

The operation of the modifications shown in Figs. 4 and 5 is similar to that above described in sinking and discharging the contents 14, the valve 33 being in the upper position shown in Fig. 5 while the charge is being sunk. However, when the rod 35 is pushed downwardly to discharge the contents 14 the shoulder 38 of the rod engages the upper side of the valve 33, forcing the valve from the position shown in Fig. 5 to the position shown in Fig. 4. Thus the flow of water through the pipes 6 is diverted to the upwardly directed pipes 32 so that the jetting action may also be utilized in withdrawing the apparatus from the ground, these upwardly directed jets being particularly useful in withdrawing the apparatus from great depths and/or through soil which tends to fill in over the apparatus as it sinks into the ground. After the apparatus has been withdrawn from the ground and a new charge has been inserted, the rod 35 is retracted from the position shown in Fig. 4 to that shown in Fig. 5, thereby closing the container and causing the shoulders 37 to return the valve 33 to the position shown in Fig. 5.

It should be understood that the present disclosure is for the purpose of illustration only and that this invention includes all modifications and equivalents which fall within the scope of the appended claims.

I claim:

1. Apparatus for planting an object in soil or the like comprising a container having an opening in the bottom through which the object may be discharged, means for jetting fluid downwardly around the periphery of the container to assist in sinking the container to the desired depth in the soil, said means including a pipe joined to the container through which the fluid may be supplied and with which the container may be withdrawn, and a plunger having a head inside the container for discharging the object through said opening after the container has been sunk to the desired depth, said container having a horizontal dimension greater than that of the pipe and said plunger extending upwardly from the container outside the pipe.

2. Apparatus for planting an object in soil or the like comprising a container having an opening in the bottom through which the object may be discharged, downward projections on the container around said opening for loosening the soil in response to rotary movement of the container, means for jetting fluid downwardly around the periphery of the container to remove the loosened soil, said means including a pipe fast to the top of the container through which the fluid may be supplied and with which the container may be rotated as aforesaid, said container having a horizontal dimension greater than that of the pipe, and means extending upwardly from the container outside the pipe for ejecting the object from the container.

3. Apparatus for planting an object in soil or the like comprising a container having an opening in the bottom through which the object may be discharged, means for jetting fluid both downwardly and upwardly from the region of the container, downwardly to assist in sinking the container to the desired depth in the soil and upwardly to assist in withdrawing the container, and means for changing the direction of jetting after the container has been sunk to the desired depth.

4. Apparatus for planting an object in soil or the like comprising a container having an opening in the bottom through which the object may be discharged, jetting means including outlets directed upwardly and downwardly respectively from the region of the container, and a valve for selectively controlling the flow of water to the respective outlets.

5. Apparatus for planting an object in soil or the like comprising a container having an opening in the bottom through which the object may be discharged, jetting means including outlets directed upwardly and downwardly respectively from the region of the container, a pipe extending upwardly from the container through which fluid may be supplied to said jetting means, a valve in said jetting means for selectively controlling the flow of water to the respective outlets, and means extending upwardly along said pipe for controlling said valve.

6. Apparatus for planting an object in soil or the like comprising a container having an opening in the bottom through which the object may be discharged, jetting means including outlets directed upwardly and downwardly respectively from the region of the container, a pipe extending upwardly from the container through which fluid may be supplied to said jetting means, a valve in said jetting means for selectively controlling the flow of water to the respective outlets, ejecting means for discharging the object through said opening, and means extending upwardly along said pipe for controlling said valve and ejecting means.

CHARLES S. KUNA.