

Aug. 20, 1940.

W. J. HOENECKE

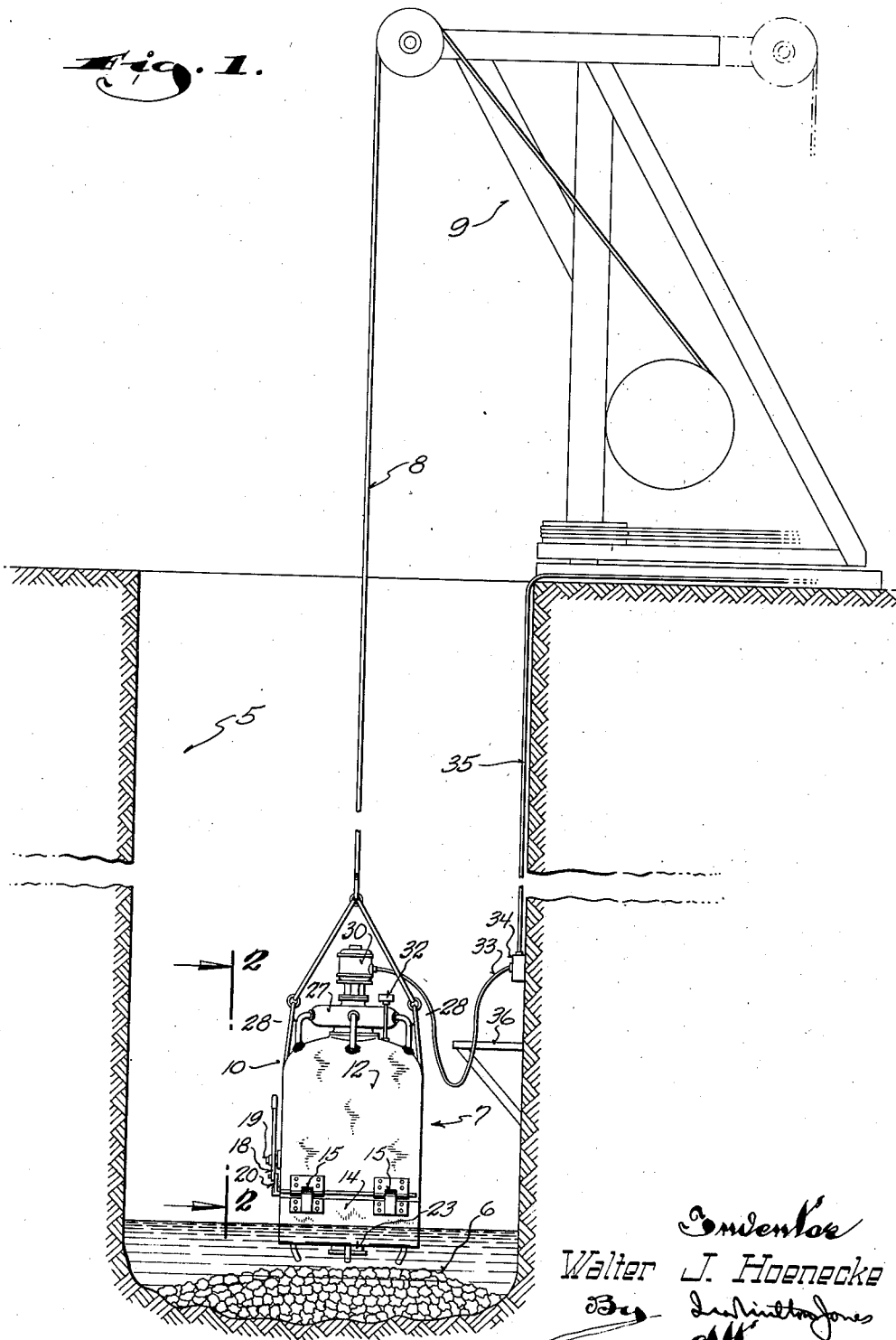
2,212,236

HYDRAULIC EXCAVATING BUCKET

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2 Sheets-Sheet 1

Fig. 1.



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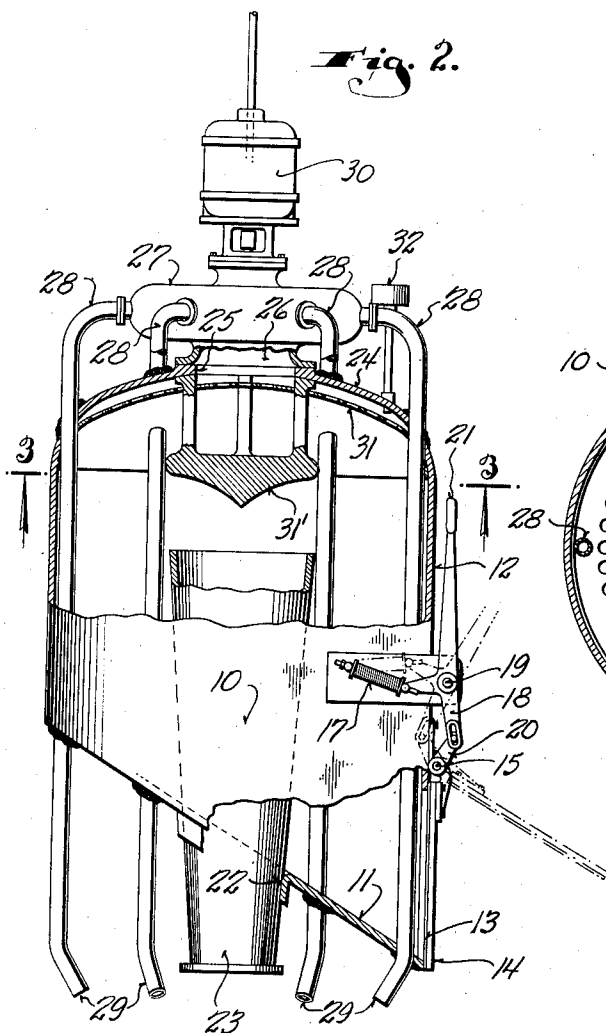
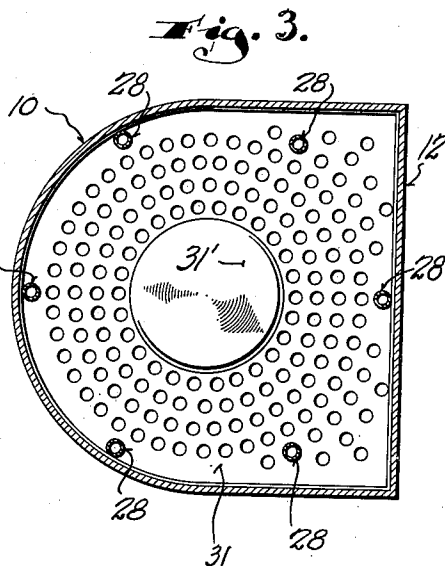
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2 Sheets-Sheet 2



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HYDRAULIC EXCAVATING BUCKET

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11 Claims. (Cl. 37—58)

This invention relates to excavating equipment, and refers particularly to an apparatus for mucking out tunnel and mine shafts, although also admirably suited for use in dredging and in gravel pits.

Heretofore, the digging of such shafts has been a slow, tedious and extremely dangerous undertaking. Most of the digging is done in solid rock which requires blasting. The drilling of the holes and setting off the charge requires very little time in comparison to the time heretofore required for mucking out the accumulated shattered rock and other loose material.

In the past, the mucking (as it is called) was done by a crew of laborers who very carefully loaded a bucket lowered down into the shaft, which was then carefully raised to the surface to preclude the possibility of any small fragment of rock dropping either from the bucket or the side of the shaft during the elevation of the bucket.

The care with which the loading and raising of the bucket had to be done and the nature of the material being dealt with made this operation extremely difficult and slow, and it was not unusual for the mucking to take as long as eight to ten hours while the drilling for the dynamite holes and setting off of the charge took only two or three hours. Needless to say, the mucking was the biggest factor in the cost of sinking a shaft.

Attempts were made in the past to improve this condition by providing some mechanical device for removing the shattered rock and other material from the bottom of the shaft, but nothing heretofore proposed has been capable of supplanting the hand labor now used.

This invention therefore contemplates as one of its objects to provide a mechanical apparatus for mucking out a shaft in comparatively short time.

With safety to the crew working at the bottom of the shaft in view, the invention has as another one of its objects to provide a mucking device which is so constructed that the shattered rock and other material is picked up by suction and deposited in a container which safely carries the load up to the surface.

Another object of this invention is to utilize a centrifugal pump for creating a strong stream of water upwardly through the inlet of a container so that the loose material to be picked up is carried into the container by the stream of water.

Another object of this invention is to utilize the discharge from the pump for loosening the

material and assisting its passage upwardly through the inlet of the container.

Another object of this invention is to provide a device of the character described which is durable and sufficiently rugged to withstand the hard usage to which equipment of this nature is subjected.

With the above and other objects in view which will appear as the description proceeds, this invention resides in the novel construction, combination and arrangement of parts substantially as hereinafter described and more particularly defined by the appended claims, it being understood that such changes in the precise embodiment of the hereindisclosed invention may be made as come within the scope of the claims.

The accompanying drawings illustrate one complete example of the physical embodiment of the invention constructed in accordance with the best mode so far devised for the practical application of the principles thereof, and in which:

Figure 1 is a view through a shaft illustrating the mucking device of this invention in use;

Figure 2 is an enlarged side view of the mucking device with parts broken away and in section; and

Figure 3 is a horizontal sectional view through Figure 2 on the plane of the line 3—3.

Referring now particularly to the accompanying drawings in which like numerals indicate like parts, the numeral 5 designates a vertical shaft dug into the earth and from the bottom of which shattered rock 6 and other material, generally referred to as muck, is to be removed. The mucking device of this invention, indicated generally by the numeral 7, is lowered down into the shaft by a cable 8 supported in any suitable manner, as by a derrick 9 which is arranged to swing the mucking device around to an unloading or discharging position away from the mouth of the shaft.

The mucking device comprises a metal container 10 of substantially U-shaped horizontal cross section, as shown in Figure 3. The bottom wall 11 of the container is preferably inclined downwardly toward its flat side wall 12, in the bottom of which a discharge opening 13 is provided for discharging the contents of the container. A door 14 hingedly mounted as at 15 from the flat wall 12 serves to tightly close the discharge opening 13, and to insure an air-tight connection between the door and the margin of the opening, a rubber gasket or other suitable packing is preferably provided.

The door may be secured in closed position in

any desired manner, and in the present instance is firmly held closed by a strong spring 17 acting against one arm of a lever 18, which is pivoted as at 19 and has another arm thereof connected to a lever 20 fixed to the door. A handle 21 on the lever 18 permits the same to be manually actuated past dead center to hold the door either in closed position, as shown in full lines in Figure 2, or in open position, as shown in dotted lines.

The center of the inclined bottom wall has an inlet opening 22 in which an upright inlet pipe 23 is secured. The bottom or mouth of the pipe 23 preferably extends down below the lowermost edge of the inclined bottom wall 11 and the upper end of the pipe projects a substantial distance above the bottom wall so that material introduced through the pipe into the interior of the container will not fall out through the inlet.

The top wall 24 of the container has an outlet opening 25 which connects with the inlet 26 of a centrifugal pump 27 mounted on the top wall of the container, as shown. The centrifugal pump 27 is of conventional construction except that in place of the usual single discharge, a plurality of discharge pipes 28 extend downwardly therefrom to terminate in discharge nozzles 29 which are directed downwardly and inwardly toward the central axis of the container.

The pump is driven by an electric motor 30 and when in operation with the device lowered into the shaft and the mouth of its inlet pipe 23 submerged in water, it creates a strong stream of water upwardly through the inlet pipe and projects forceful streams from the discharge nozzles 29 to loosen the rock and assist in conveying it upwardly through the inlet pipe 23 and into the interior of the container.

In view of the abrupt space expansion at the upper end of the inlet pipe 23 which results from the fact that the inlet pipe is considerably smaller in area than the container, the material falls down into the bottom of the container while the water continues upwardly through the outlet 25 and into the pump. To guard against the passage of solid material into the pump, a screen 31 extends across the upper portion of the container.

A deflector 31' suitably supported from the top wall 24 directly above the discharge end of the inlet pipe 23 deflects the rising material laterally and facilitates its disposition in the bottom of the container.

To guard against the possibility of having rocks or large pieces of material jam in the inlet pipe, the pipe increases in diameter toward its discharge end, as shown in Figure 2.

It is of course understood that in operation, the entire interior of the container is filled with water and that the pump is suitably primed before the actual mucking operation begins.

The device is substantially entirely mechanical and requires little or no attention outside of being moved around over the bottom of the shaft to dispose the same above the loose rock. One or two men at the bottom of the shaft can do all the work necessary to insure efficient operation of the device, which greatly minimizes the danger connected with this work, especially when compared with the old hand method of mucking in which a crew of twelve men usually were employed for the average sized shaft twelve or fourteen feet in diameter.

If by chance, a particularly large piece of rock becomes jammed against the mouth of the inlet

pipe 23, the resultant rise in vacuum inside the container, indicated on a gauge 32 visible from above, indicates this fact to the operator so that he may slightly lift the container and allow the workmen to clear the obstructing rock from the mouth of the inlet pipe.

Upon being filled with muck, the container is elevated out of the shaft and its load discharged by merely opening the door 14.

To obviate the need for a flexible power line leading entirely down to the bottom of the shaft, the electrical connection for supplying current to the motor is preferably provided by means of a flexible line 33 adapted to be plugged into an outlet box 34 fixed to the side of the shaft and having a power line 35 leading thereto from the mouth of the shaft. The outlet box is preferably mounted above a shelf or platform 36 upon which a workman may stand to plug in the electric connection and also guide or push the unit over the floor of the shaft.

From the foregoing description taken in connection with the accompanying drawings, it will be readily apparent to those skilled in the art, that this invention provides a practical mechanical device for mucking out deep vertical shafts and that considerable time and money can be saved in the mucking operation by its use.

What I claim as my invention is:

1. A device for mucking out the bottom of a shaft comprising: a container adapted to be lowered down into the shaft, said container having an outlet opening, and having a restricted inlet opening through the bottom thereof; a water pump having its inlet connected with the outlet of the container and arranged to discharge the water from the container outside the container so that operation of the pump with the container inlet submerged in water creates a strong stream of water and muck into the container toward the pump; means extending upwardly from the inlet toward the pump for preventing muck carried into the container from passing outwardly through its inlet; and means for preventing the passage of muck into the pump.

2. A mucking device comprising: a water pump; a passage connected with the inlet of the pump and having a restricted inlet at its end opposite the pump and an abruptly enlarged intermediate chamber so that solid material entering the inlet of the passage along with the stream of water to the pump is deposited in the chamber; and means for directing the discharge of the pump towards the inlet of said passage to facilitate the carrying of solid material into the passage.

3. A mucking device comprising: a container adapted to be lowered down into a shaft and having a restricted inlet at its bottom and an outlet at its top; means for projecting a strong flow of water at the bottom of the shaft toward the restricted inlet of the container and for producing a flow of water up through the inlet for discharge through the outlet at the top of the container so that muck is carried upwardly into the container; and means for preventing the passage of muck out through the outlet of the container.

4. A device for mucking out the bottom of a shaft comprising: a container adapted to be lowered down into the shaft and having a restricted inlet at its bottom and an outlet at its top; a pump having its inlet connected with the outlet of the container and having its discharge arranged to project a stream of water against the

bottom of the shaft and toward the restricted inlet of the container so that operation of the pump with the inlet of the container submerged in water induces a strong flow of water upwardly through said inlet to carry muck into the container; and means for preventing the passage of muck out through the outlet of the container.

5. A device for mucking out the bottom of a shaft comprising: a container adapted to be lowered down into the shaft and having an outlet at its top; an inlet pipe passing through the bottom wall of the container and extending upwardly above the bottom wall a substantial distance; a centrifugal pump having its inlet connected to the outlet of the container; and a plurality of discharge tubes leading from the pump and extending downwardly to have their lower ends arranged to project streams of water against the bottom of the shaft and toward the mouth of the inlet pipe so that operation of the pump with the mouth of the inlet pipe submerged in water produces a strong stream upwardly through the inlet pipe to carry muck into the container; and means for preventing the passage of muck outwardly through the outlet of the container.

6. A device for mucking out the bottom of a shaft comprising: a container adapted to be lowered down into the shaft and having an outlet at its top; an inlet pipe passing through the bottom wall of the container and extending upwardly above the bottom wall a substantial distance; a centrifugal pump having its inlet connected to the outlet of the container; a plurality of discharge tubes leading from the pump and extending downwardly to have their lower ends arranged to project streams of water against the bottom of the shaft and toward the mouth of the inlet pipe so that operation of the pump with the mouth of the inlet pipe submerged in water produces a strong stream upwardly through the inlet pipe to carry muck into the container; and means for preventing the passage of muck outwardly through the outlet of the container; and a discharge door on the container adapted to be opened to permit the discharge of accumulated muck therefrom.

7. A mucking device of the character described comprising: an upright container having an inclined bottom wall with a discharge opening in its side wall adjacent to the lower end of the inclined bottom wall; a door for closing said discharge opening; an inlet pipe extending through an opening in the bottom wall with its upper end disposed substantially above the bottom wall of the container; the top of the container having an outlet; a centrifugal pump having its inlet connected to the outlet of the container; a screen across the outlet of the container to prevent the passage of solid material into the pump; and a plurality of discharge pipes leading from the pump downwardly to the bottom of the container to have their lower ends arranged as nozzles to

direct streams of water against material to be carried through the inlet pipe into the container.

8. An apparatus for mucking out the bottom of a shaft comprising: a container adapted to be lowered down into the shaft and having an inlet opening at its bottom and an outlet opening at its top axially aligned with the inlet opening; a pump connected with the container in alignment with said openings and adapted to cause a stream of water to rush upwardly through the inlet into the container and to be discharged by the pump to the outside of the container so as to carry muck upwardly into the container toward the pump; means for lowering the container and pump down into the shaft; an electric motor to drive the pump; a power line extending down into the shaft to a point near the bottom; and a detachable connection between the motor and said power line.

9. A device for mucking shattered rock and similar material from the bottom of a shaft comprising: a container having an inlet at its bottom; a pump connected with the container so as to be spaced from said inlet with said space providing a reservoir for rock and similar material, said pump being adapted to cause a stream of water to rush upwardly through the inlet into the container so as to carry shattered rock and similar material upwardly into the container toward the pump and into said reservoir; and means extending from said inlet toward the pump for preventing rock and similar material from passing outwardly through the inlet of the container.

10. A mucking device comprising: a water pump; a passage connected at one end with the inlet of the pump and having a restricted inlet for muck at its opposite end; an abruptly enlarged intermediate chamber so that solid material or muck entering the inlet of the passage along with the stream of water to the pump is deposited in the chamber; and a deflector for the muck positioned intermediate the pump and the inlet for the passage to deflect the muck passing through the inlet of said passage radially outwardly into said enlarged chamber.

11. A mucking device comprising: a water pump; a passage connected with the inlet of the pump and having a restricted inlet at its end opposite the pump; an abruptly enlarged intermediate chamber so that solid material entering the inlet of the passage along with the stream of water to the pump is deposited in the chamber; means for directing the discharge of the pump towards the inlet of said passage to facilitate the carrying of solid material into the passage; and a deflector positioned between the pump and the inlet of the passage for deflecting muck passing through the inlet of said passage into said enlarged chamber.

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