March 28, 1939. G. J. SOLOMON 2,152,220

DRILLING BUCKET HAMMER

Filed March 6, 1937 2 Sheets-Sheet 1

Fig. 1.

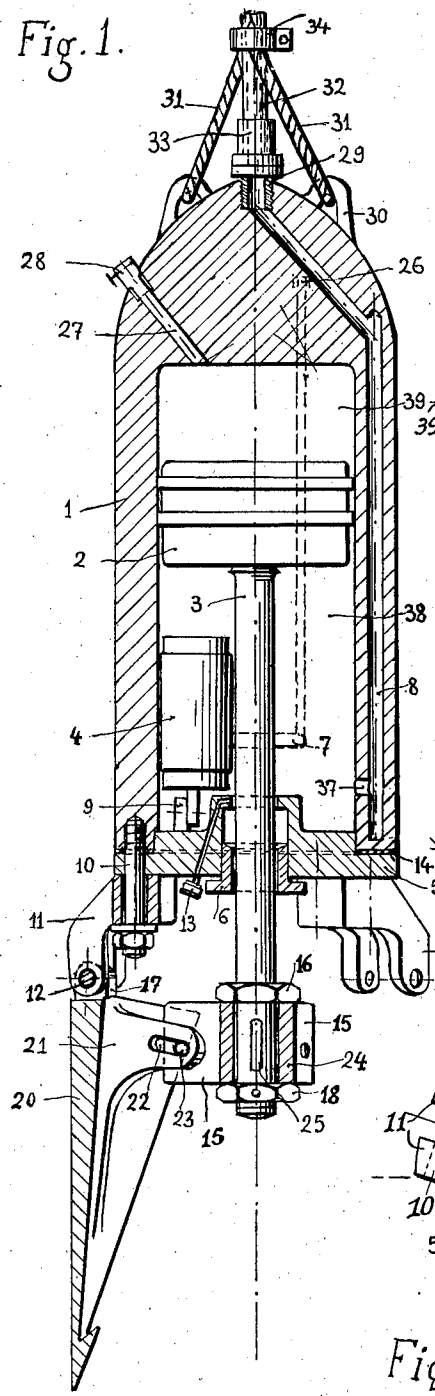
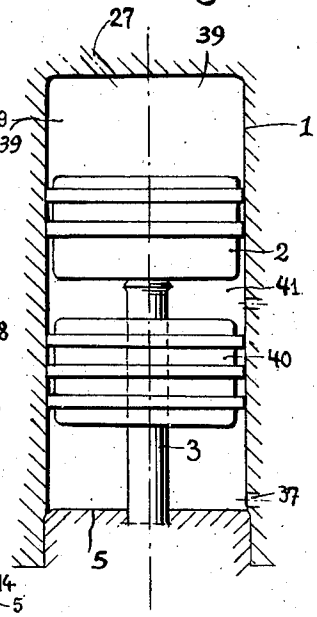


Fig. 3.



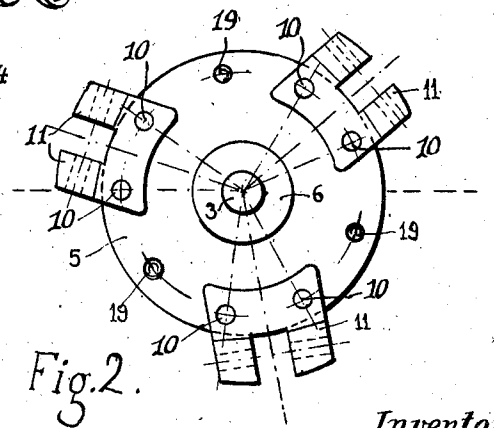


Fig. 2.

Inventor.
Guillaume Jean Solomon,
per Ferdinand Broeter Bonhardt
Attorney.

March 28, 1939. G. J. SOLOMON 2,152,220

DRILLING BUCKET HAMMER

Filed March 6, 1937 2 Sheets-Sheet 2

Fig. 4.

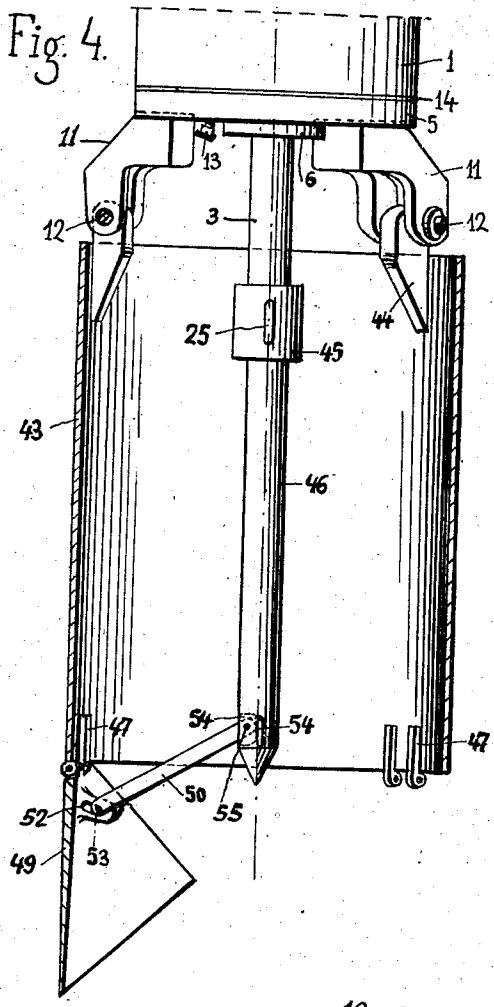


Fig. 5.

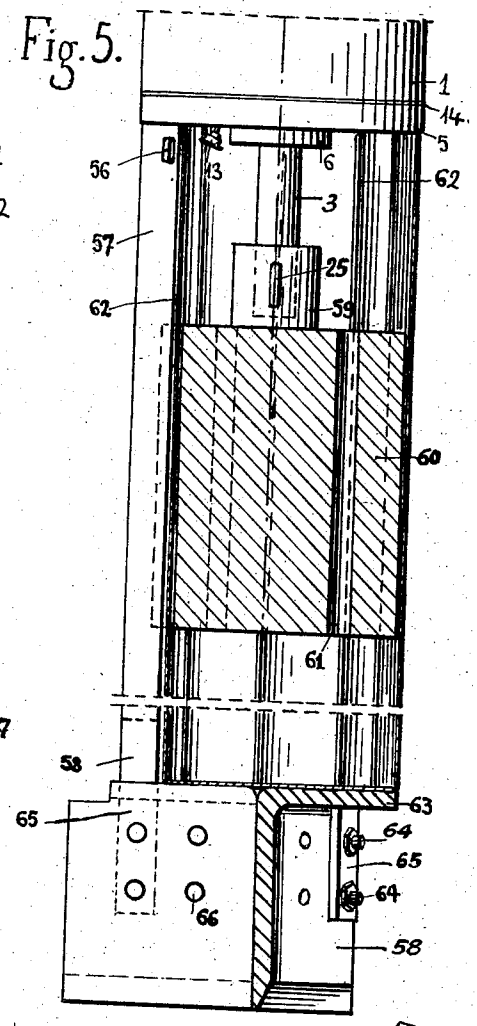


Fig. 6.

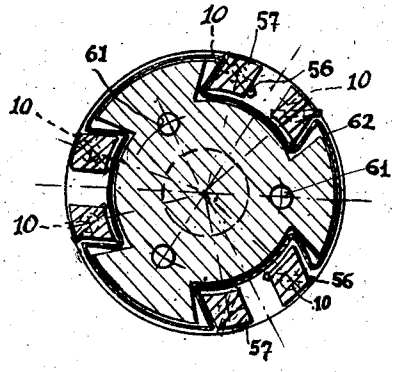
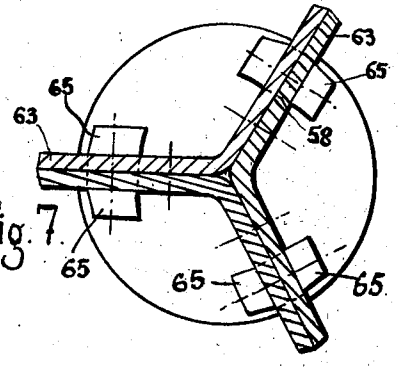


Fig. 7.



Inventor:
Guillaume Jean Solomon
by Ferdinand Broster Bosshardt
Attorney.

Patented Mar. 28, 1939 2,152,220

UNITED STATES PATENT OFFICE

2,152,220

DRILLING BUCKET HAMMER

Guillaume Jean Solomon, Paris, France

Application March 6, 1937, Serial No. 129,294
In France May 12, 1936

2 Claims. (Cl. 255—1)

The present invention concerns a machine specially built for the sinking of wells, (either vertical or little inclined) of any diameter and in all grounds, by drawing out the earth and for any work of the same kind (boring, mining, etc.).

The present machine constitutes a hammer operated by a compressed fluid, such as compressed air. The lower part of the hammer comprises jaws closed by a piston. The earth which has been acted on by the hammer and has consequently entered the machine is thus gripped between the jaws and then raised to the surface.

One of the principal characteristics of the invention is that either several pneumatic or electric vibrators, or a second piston, according to the different sorts of grounds, may cause the hammer which has arrived at the bottom of the well after a free fall, to continue to sink into the ground until the whole cavity of the machine is filled with earth. This results in a high increase in capacity of the machine and a material reduction in the weight thereof being rendered possible.

Another advantage of the invention is that the pressure of the air is very easily changed, so that the power needed for each sort of earth, can be very easily obtained.

The bucket-hammer may be used to determine the dynamic resistance of the ground at the bottom of the well, to sink tubes used to restrain earth, and owing to the different tools provided, for all sinking operations.

The objects of my invention are attained by the apparatus shown in the accompanying drawings, wherein—

Figure 1 is a vertical section of a bucket hammer provided with several vibrators and three jaws (in Figure 1 one vibrator only may be seen).

Figure 2 is a plan view of the machine regarded from below and with the jaws removed.

Figure 3 is a vertical section of the hammer with a second piston instead of the vibrators.

Figure 4 is a vertical section of a cylindrical element provided with jaws and used for oozy grounds.

Figure 5 is a vertical section of the three knives of the bore-bit which is used for hard and compact grounds.

Figure 6 is a horizontal section of the ram shown in Figure 5, regarded from below.

Figure 7 is a horizontal section of the boring-bit, regarded from below.

Referring to the drawings, the machine shown in Figure 1 comprises a cylinder 1 inside of which works a piston 2 which is connected to the jaws 20 by a piston rod 3. The jaws 20 are pivotally mounted in forked blocks 11.

The cylinder 1 is closed at its lower end by an end cover 5. Bolts 19 (Figure 2) and a packing gasket 14 between the cylinder and the end cover make the cylinder absolutely air-tight. Other bolts 10 (Figure 1) secure the blocks 11 to the cylinder and end cover. These blocks may be connected differently. For instance they may each be keyed to the end cover by a key 56, as shown in Figure 5.

There is a jaw 20 for each block 11. The jaws are shaped to produce when closed a substantially conical bucket. It is advantageous to provide the jaws with claws. The jaw pivot 12 engages a lug 17 on the jaw so that the jaw may turn on its pivot. A lug 21 is provided on the jaw 20 and has a slot 22 engaged by a pivot stud 23 which is carried by a lug 15 formed on a collar 24. The collar 24 is secured to the piston rod 3 by nuts 16 and 17 and a key 25.

Figure 1 shows the wide-open position of the jaw 20 in which the stud 23 is at one end of the slot 22. A split collar may be secured to the piston rod 3 to reduce the length of piston stroke by impingement against the end cover 5.

To produce a perfectly air-tight joint between the piston rod 3 and the end cover 5, the end cover 5 is provided with a packing gland 6 to act on a packing of oakum. Lubrication is effected by means of a lubricator 13.

It is obvious that the means for transmission of motion from the piston 2 to the jaws may be of various forms. Another form of the said means is shown in Figure 4.

In Figure 1, 9 is a block secured to the end cover 5 and used to secure a vibrator 4 in position inside the cylinder 4. The drawings show only one vibrator, but there are preferably three vibrators. The arrangement and means for securing the vibrators may vary. For instance, they may alternatively be secured to the piston 2.

The tube required for feeding compressed air, electric current, or liquid pressure waves to the vibrator 4 is connected to the vibrator by means of a passage 7 drilled into the wall of the cylinder 1 and communicating with the vibrator, a union 26 being provided on the cylinder for connection of the said tube thereto.

The space 38 beneath the piston 2 is connected to a compressed fluid supply by an opening 37 leading to a passage 8 which is provided in the wall of the cylinder and has a union 29 whereby

it is connected to a compressed air tube 32 forming the hauling cable.

The machine is suspended from the tube 32 the eyes 30 and the cables 31. The space 39 above the piston 2 may be connected to the open air by the oblique passage 27 which is closed by the valve 28.

Figure 3 shows the same machine, but with a piston 40 employed instead of vibrators to vibrate the machine. The piston slides on the piston rod 3.

The hereinbefore described machine operates as follows:

In soft grounds the machine is lowered in free fall by a capstan, the tube 32 being unwound from the drum of the capstan. The jaws are kept wide open by keeping the pressure in 39 higher than atmospheric pressure which exists in 38. When the machine arrives at the bottom of the well, the jaws sink into the ground. At this moment, the vibrators are operated through the tube connected to the union 26 and their action causes the machine to descend further until the ground is completely penetrated by the jaws. The vibrators are stopped and compressed air is injected through the tube 32, and thereby raises the piston 2, whereby the jaws are closed. The amount of power which can be employed to close the jaws is quite independent of the weight of the machine. When the machine has been hauled up, the pressure in 38 is released by permitting the compressed air to escape from the tube 32. The weight of the piston and the pressure existing in 39 thereupon make the jaws open to deposit the charge of earth held by them. These operations are repeated until the well is finished.

In oozy grounds, to increase the capacity of the machine it is desirable to insert a cylinder 43 (Figure 4) between the blocks 11 and the jaws. The piston rod 3 is lengthened by an extension rod 46. The jaws 49 are pivotally mounted on the lower end of the cylinder 43 and formed to tightly close up the said lower end. Each jaw 49 is closed by the connecting bar 50 articulated at 53 by means of a slot 52 in the jaw and at 55 by means of a slot 54 in the rod 46. Exactly as in Figure 1, the translation of the linear motion of the piston into the circular motion of the jaw can be effected by other means.

If the ground is very hard (with rocks or gravel) a boring-bit (Figures 5, 6 and 7) is substituted for the jaws. Bars 57 are connected by keys 56 to the bolts 10 shown in Figures 1 and 2 and 6 after removal of the brackets 11 from the said bolts. At the lower part 65 of the said bars steel blades 63 which constitute the boring-bit are secured by bolts 64. The part 58 which is connected to the two bars 65 of each of the three branches of the boring-bit supports its three blades. A striker 60 having perforations 61 is secured to the piston rod 3, in place of the collar 24 of Figure 1, by a cross key 25 and works in a space enclosed by a shell or casing 62.

In operation, the machine provided with the boring-bit and striker 60 instead of the jaws 20 arrives after a free fall at the bottom of the well. The compressed fluid lifts the piston 2 of Figure 1 and the striker 60 on the end of the rod 3 until the moment arrives when the pressure in 39 equals the sum of the pressure in 38 and the weight of the moving parts. The compressed fluid is then allowed to escape from 38 by releasing the compressed air in the tube 32, with the result that the piston 2 and striker 60 fall and the striker 60 hits the boring-bit and drives it further into the ground.

In very hard grounds the machine shown in Figure 1 is used but a second piston as shown on Figure 3 should be used in the cylinder 1 of the said machine.

The machine then operates as follows:

The machine arrives at the bottom of the well with its jaws 20, Figure 1, open. The compressed air passes through 37 into the space below the piston 40 which rests on the end cover 5 and the piston 40 is thereby raised from the end cover until the pressure beneath it becomes equal to the sum of the pressure in the intermediate space 41 and the weight of the piston 40 and may be equal at the same time to the initial pressure in 39 and even greater. During the raising of the piston 40, the piston 2 remains stationary. The compressed fluid from the space beneath the piston 40 is then released by allowing the compressed air to escape from the tube 32. The piston 40 then falls and hits the end cover. The jaws are thereby caused to sink further into the ground. Such operations are continued until the jaws are full. The air under pressure is then again delivered through 37 until the pressure beneath the piston 40 is greater than the pressure in 39. This causes the piston 40 to raise the piston 2 and close the jaws. The machine is then hauled up and emptied. The operations may then be repeated.

Naturally, the boring-bit may be directly connected so the cylinder and the piston 40 may act as the striker instead of the striker 60.

The hauling cable may alternatively be an ordinary cable instead of the tube 32, and in that case, the tube 8 and the tube 32 need not take any of the strain. Furthermore the admission and release of the compressed fluid from the cylinder may be effected by means other than those described. If cooling is required it should be effected in the same manner as for steam-engine cylinders.

Naturally the invention is not limited to the present examples.

I claim:

1. A machine for sinking vertical and slightly inclined holes in the ground comprising in combination a cylinder, a piston reciprocatable therein, jaws articulated thereto, connecting means operatively connecting the said jaws to the piston, vibratory means in the said cylinder for driving the said jaws into the ground, and duct means in the said cylinder for supplying motivating power both to the said piston and to the vibratory means.

2. A machine for sinking vertical and slightly inclined holes in the ground comprising in combination, a fluid tight cylinder, pivotal jaws connected to the cylinder, a piston within the cylinder for closing and opening the said jaws, means for introducing compressed air into the cylinder for actuating the piston in jaw-closing direction, and a second and separately movable piston within the cylinder for operation by the said compressed air for producing inside the cylinder impacts which drive the said jaws into the ground.

GUILLAUME JEAN SOLOMON.