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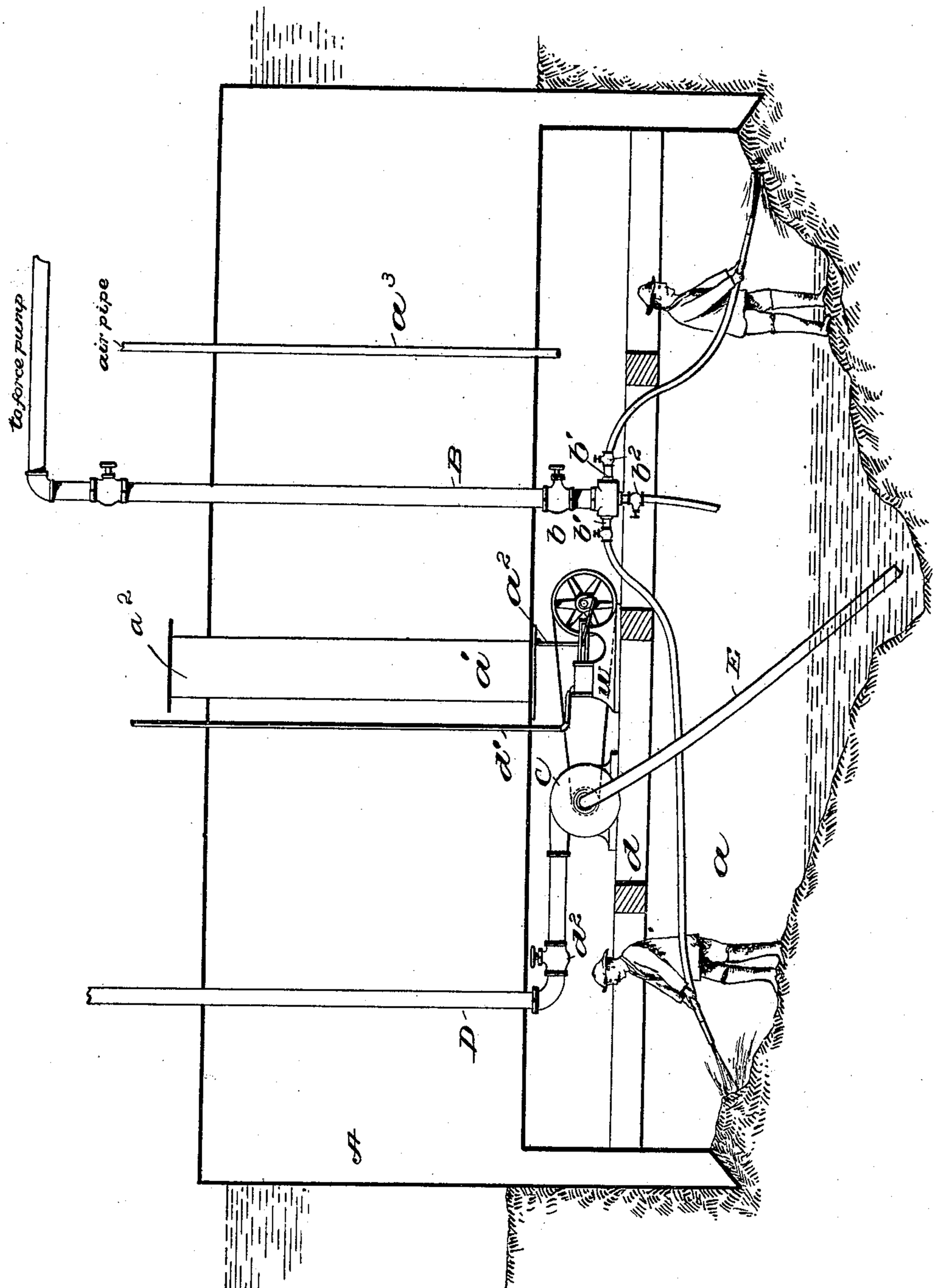
W. H. GAHAGAN.

CAISSON EXCAVATING.

(Application filed Feb. 26, 1898.)

(No Model.)



Witnesses

Jas. L. Wine

Wm. B. Hodges.

Inventor

Walter H. Gahagan,

by Albert G. Davis,

Attorney.

UNITED STATES PATENT OFFICE.

WALTER H. GAHAGAN, OF NEW YORK, N. Y.

CAISSON-EXCAVATING.

SPECIFICATION forming part of Letters Patent No. 618,955, dated February 7, 1899.

Application filed February 26, 1898. Serial No. 671,740. (No model.)

To all whom it may concern:

Be it known that I, WALTER H. GAHAGAN, of New York, in the county of New York and State of New York, have invented certain new and useful Improvements in Caisson-Excavating; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention contemplates certain new and useful improvements in caisson-excavating.

The primary object is to provide means for effectively removing the soil from beneath a caisson, lessening the number of men ordinarily employed for such work, and greatly reducing the time and expense heretofore required in the prosecution of caisson-excavating. To this end I place within the air-chamber of a caisson a mechanical-power pump—that is, one the action of which is in no sense siphonic, but in the operation whereof a vacuum or partial vacuum is necessarily created. The inlet or suction pipe of this pump is capable of being shifted from point to point. The discharge-pipe is extended up through and out of the caisson. A suitable valve, preferably located in the discharge-pipe, prevents the escape of air from the air-chamber when the pump is not in operation or the end of the suction-pipe is not submerged. Water is forced down into the air-chamber through a pipe leading from any suitable powerful force-pump and is discharged through a series of jet-hose attached to the inner end of said pipe. The water thus supplied into the air-chamber of the caisson will speedily disintegrate the mud, sand, clay, or hard pan and wash the same into a ditch, so to speak, previously made in the soil, and the end of the suction-pipe being immersed in the water and the pump started to operate all such disintegrated matter, and in addition thereto gravel and small stones, will be forced out through the discharge-pipe. The mechanical-power pump, which is preferably of the centrifugal style, being located within the air-chamber of the caisson or surrounded by air-pressure equal to that of the air-chamber, the vacuum or partial vacuum created in the operation thereof will not be destroyed or broken, (as is the case with a pump positioned outside of the caisson,) since the pump will be constantly primed, because as soon as the pump is stopped the pressure of air in the caisson forces the water or excavated material up into the suction-pipe. Another and most important advantage lies in thus surrounding the pump with the same degree of air-pressure as that to which the suction-pipe is subjected—namely, the air-pressure will tend to force the excavated material, &c., into the suction-pipe and out through the discharge-pipe. It must be borne in mind that in computing the force required to drive the excavated matter through the discharge-pipe allowance must be made for the displacement of water made by the caisson and air-pressure. While I prefer to locate the pump within the air-chamber proper, yet the same results may be attained by positioning it in any supplemental chamber or shaft, it being requisite, however, that the air-pressure in the latter be the same as that within the working chamber in which the end of the suction-pipe is located. While I prefer to operate the engine by which the pump is rotated by means of air or steam, especially the former, yet the motive power is immaterial. Electricity or direct mechanical connection with an engine located outside of the caisson may be employed.

Heretofore attempts have been made to effect the discharge of excavated matter from the air-chamber of a caisson by means of a suction-pump located outside of or above the caisson; but all such attempts have proved utter failures and useless for practical purposes. The primary reason for this is the inability to preserve a vacuum or partial vacuum in the pump so located outside of the caisson, owing to the greater pressure of air in the air-chamber with which its suction-pipe connects, the air forcing its way through the latter, destroying the vacuum, and rendering the pump inoperative. Various arrangements have also been employed to effect the discharge of the excavated material by pumps acting on the siphonic principle, with all of which I am well acquainted. The means now commonly employed for removing the excavated material consists of buckets and hoisting-ropes. Not only does this result in

considerable loss of air-pressure, but I have found in actual practice that with my improvements four times as much material can be excavated with the aid of less than one-tenth as many men and in one-third the time required in the bucket-and-hoisting arrangement. In other words, practice has demonstrated that with a caisson of sixty by seventy-six feet three hundred and sixty cubic yards of material can be excavated in accordance with my improvements in eight hours with the services of eight men, while under the hoisting arrangement with ninety men (three gangs of thirty men each) but ninety cubic yards of material can be removed in twenty-four hours.

The invention will be hereinafter fully set forth, and particularly pointed out in the claims.

In the accompanying drawing the figure is a diagrammatical view of a caisson provided with my improvements.

Referring to the drawing, A designates a caisson, only the general outline of which is indicated; *a*, the air-chamber in which the workmen perform their duties in making an excavation, and *a'* the cylinder through which the men pass to and from the air-chamber, said cylinder having the usual gates a^2 at its ends. The compressed air is supplied to chamber *a* through a pipe a^3.

B is a water-supply pipe which leads from a suitable force-pump (not shown) and opens at its lower end into air-chamber *a*. A suitable valve *b* is located near the inner end of this water-pipe for cutting off or opening up the water-supply, and to the inner end of said pipe are attached a series of jet-hose *b'*, each being provided with a valve b^2. These hose are manipulated by the workmen within the air-chamber, who direct the jets of water against the soil to be excavated, causing the same under the heavy pressure of water to disintegrate and wash into a centrally-located ditch previously dug out at about the center of the confined space. Ordinarily the effect of the air-pressure is to drive all water out of the material beneath the chamber and make it more compact than it is naturally; but by forming the dugout or ditch below the line of seepage or lower horizontal line of the caisson and directing powerful heads of water against the more elevated portions of the soil the latter will readily disintegrate and flow into the ditch or dugout, the line of the water in the latter being usually lower than the line of seepage.

C designates a mechanical-power pump, preferably of the centrifugal pattern. It is necessary that it be of a style not siphonic in its action, but depending for its operation on the creation therein of a vacuum or partial vacuum. I have shown this pump located on some cross-timbers *d* directly within the air-chamber *a;* but it may be located at any other point of the caisson, provided the air-pressure in its confining-chamber be coequal to that in the air-chamber *a*. This pump may be operated by any preferred means. I have indicated an engine at *w* for this purpose. The engine is preferably operated by air introduced through a pipe *d'*. It is not essential that the motive power be located within the caisson, since it may be outside thereof and connected in any suitable way to the pump. The discharge-pipe D is extended from the pump up through and out of the caisson and may lead to any desired point. In this pipe is located a valve d^2, designed to be closed when the pump is not in operation or the free end of the suction-pipe is not immersed, thereby preventing the escape of air from the air-chamber. The inlet or suction pipe E of the pump consists, preferably, of flexible hosing, which may be readily moved from point to point by the workmen. When the valve d^2 is opened and the pump is in operation, it is necessary that the end of the suction-pipe be submerged within the pool of water within the ditch or dugout, or said end must be closed by other means to prevent the escape of the confined air.

In practice the water forced through pipe B by a powerful force-pump is directed by the workmen against the banks of the soil to be excavated, and the latter will be rapidly disintegrated and caused to wash into the dugout. As this begins to fill, the end of the suction-pipe is submerged therein, and after valve d^2 is opened the engine is caused to operate the pump. The action of the latter, aided by the effect of the air-pressure within the chamber *a*, will result in the rapid discharge of all disintegrated matter, gravel, and small stones. In fact everything save rock can thus be excavated from the air-chamber of the caisson. The work or labor of the pump in lifting the disintegrated materials from the bottom of the air-chamber to the highest point of the discharge is diminished by the head of water displaced by the air-pressure in the air-chamber.

I am aware that heretofore it has been sought to make excavations by forcing water through and out of a cylinder beneath a gravitating disk, the disintegrated matter being drawn out by a suction-pump located above the excavation, and I am also aware that excavations have been carried on by means of siphonic pumps located within a caisson; but so far as I am aware I am the first to employ a mechanical-power pump located within the air-chamber of a caisson (or within a chamber having coequal pressure) for discharging from the air-chamber disintegrated matter and water forced down into said chamber.

It will be observed that by my invention the pump is under the direct control and supervision of the pressure-men. The advantages of thus locating a mechanical-power pump within the air-chamber of a caisson are apparent. The volume of material that can be thus excavated in a given period is many times that of any other known means or

method. I do not confine myself to the use of any special form of pump, and although I prefer the centrifugal pattern yet a vacuum or pulsometer pump may be employed.

I claim as my invention—

1. The combination with a caisson having an air-chamber, of a mechanical-power pump carried by the caisson and surrounded by the same air-pressure as exists in said chamber, a discharge-pipe leading from said pump outward through the caisson, a suction-pipe opening at its free end in said chamber and a water-pipe opening at its lower end into said chamber, as set forth.

2. The combination with a caisson having an air-chamber, of a mechanical-power pump located in said air-chamber, and a suction-pipe connected to said pump, a discharge-pipe leading from said pump outward from said chamber and caisson, and means for supplying water to said air-chamber, as set forth.

3. The combination with a caisson having an air-chamber, of a mechanical-power pump located in said air-chamber, a suction-pipe connected to said pump, a discharge-pipe leading from said pump outward from said chamber and caisson, means for preventing the escape of air from said chamber when the pump is not working, and a water-supply pipe leading down into said air-chamber and having a valve located within said chamber, substantially as set forth.

4. The combination with a caisson having an air-chamber, of a mechanical-power pump located in said air-chamber, a flexible suction-pipe connected to said pump, a discharge-pipe leading from said pump outward from said chamber and caisson, a valve in said discharge-pipe, a water-supply pipe leading down into said air-chamber, a series of jet-hose extending from the inner end of said water-pipe, and valves for controlling the outflow of the water, substantially as set forth.

In testimony whereof I have signed this specification in the presence of two subscribing witnesses.

WALTER H. GAHAGAN.

Witnesses:

MICHAEL J. KENNEDY,

NICHOLAS CONNOLLY.