

F. BILLINGS.
SINKING DEEP SHAFTS IN WATER IMPREGNATED GROUND.
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989,110.

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Fig. 1.

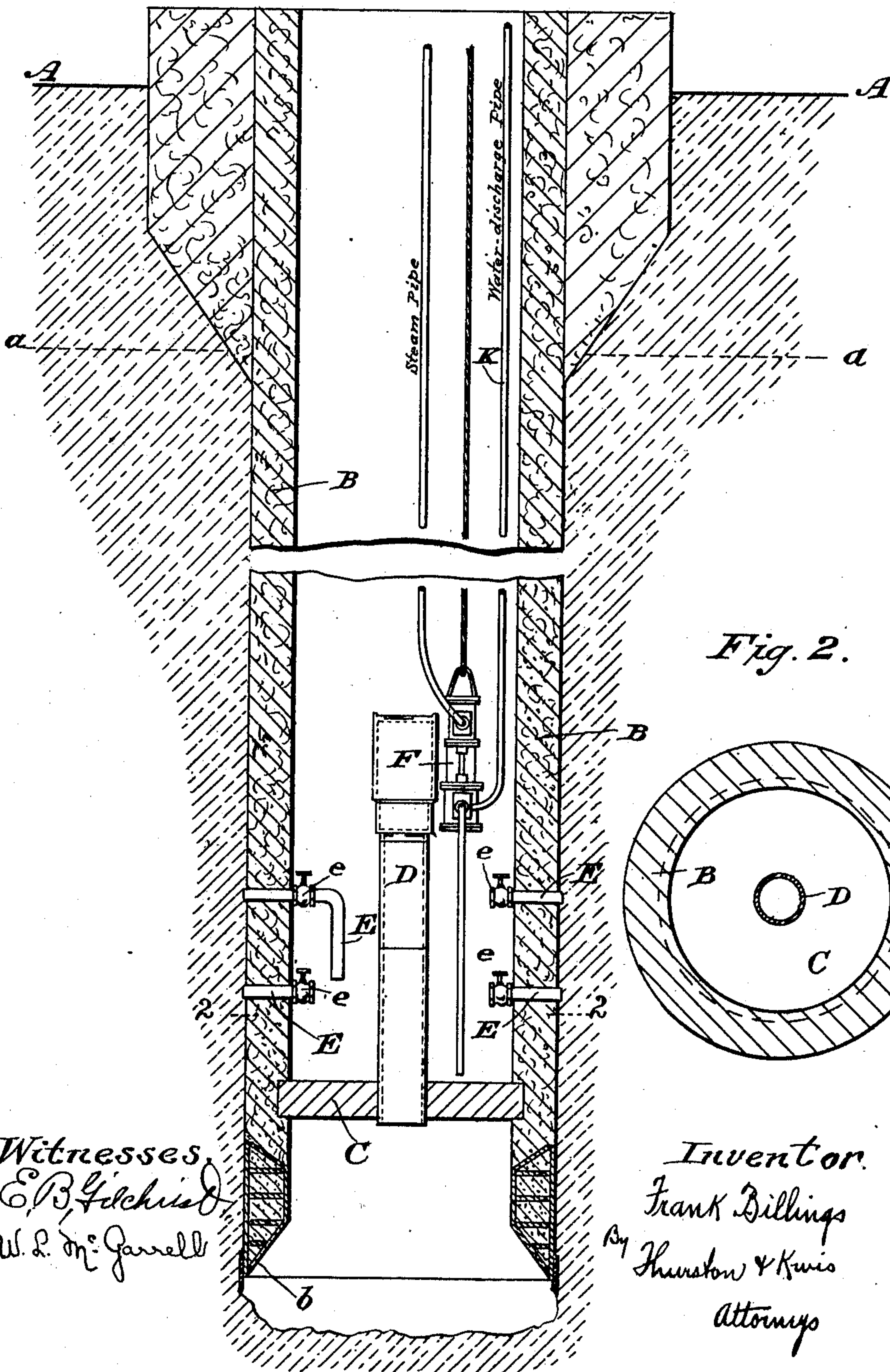
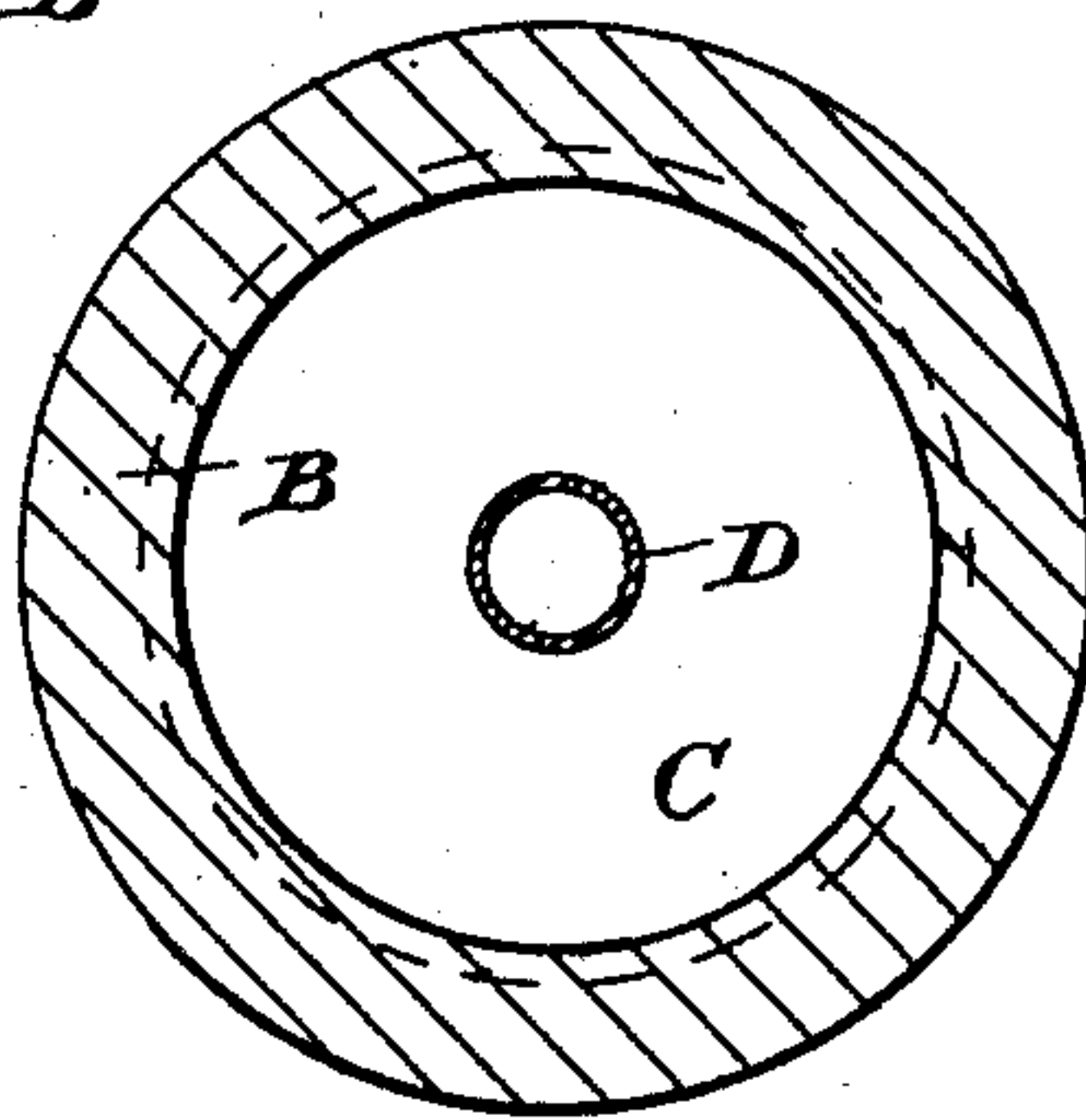


Fig. 2.



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SINKING DEEP SHAFTS IN WATER-IMPREGNATED GROUND.

989,110.

Specification of Letters Patent.

Patented Apr. 11, 1911.

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To all whom it may concern:

Be it known that I, FRANK BILLINGS, a citizen of the United States, residing at Cleveland, in the county of Cuyahoga and State of Ohio, have invented a certain new and useful Improvement in Sinking Deep Shafts in Water-Impregnated Ground, of which the following is a full, clear, and exact description.

10 In order to reach mineral deposits, where there is water bearing material of considerable depth above the stratified rock or ledge material, the usual practice is to dig an excavation and put into the excavation
15 a shaft of such character as to prevent the sides of the excavation from caving in. When the excavation is being made in the water bearing ground it is usually done by men who work in an atmosphere of com-
20 pressed air in a pneumatic caisson in or near the bottom of the shaft,—the compressed air being for the purpose of counteracting the pressure of the water and the ground, so that the ground beneath the
25 lower end or bottom of the shaft can be excavated to a considerable extent. The air pressure prevents the ground from caving in, and also keeps the excavation free from water, or nearly so, in accordance with the
30 number of pounds pressure. The shaft is usually made of sufficient weight so that, as the ground is excavated beneath the bottom or lower end of the caisson, the weight of the shaft and caisson will cause them to
35 sink as the excavation is deepened. In that event the shaft is added to or built up on the top as it sinks into the ground.

When the excavation reaches a depth of a little over a hundred feet below the level
40 of the water in the water bearing ground, the air pressure required to resist the pressure of the water and the ground, when the ground is excavated below the bottom of the shaft, will be about fifty pounds to the
45 square inch. It is practically impossible for men to work under greater pressure than this.

In order to sink or excavate to a greater depth below the normal water level in the
50 ground it is necessary to lower the water level in the ground at, or in the vicinity, of the point at which the excavation is made, and in the accomplishment of this result engineering operations of various
55 sorts, but generally of very expensive sorts, have to be employed.

The object of this invention is to economically and expeditiously lower the water level in the ground, or water bearing material, so that excavation can be made with not to
60 exceed fifty pounds air pressure per square inch, preferably at a much lower pressure, the operation at all times being under control.

In carrying out my invention a tubular
65 shaft, preferably made of concrete, is put or built into the excavation when it has reached a suitable depth. The lower end of this concrete shaft is provided with a sharp steel shoe to facilitate its downward
70 movement into the deepening excavation. An air tight deck is formed across the shaft near the lower end thereof, thereby forming an air caisson in the lower end. The usual
75 air locks are, of course, provided for communicating with the caisson. As the excavation is deepened and the shaft caused to descend, the upper end of the shaft is added to as may be required.

As the shaft is constructed, or when the
80 excavation has become deep enough to make it desirable to drain the territory, holes are made through the walls of the shaft, and pipes are sealed into these holes,—said pipes having valves, operable from within the
85 shaft, whereby the water from the surrounding territory may be allowed to drain at the proper rate into the shaft and onto said deck. A pump is then employed to pump
90 the water from the shaft, and this water is to be led by suitable pipes or flumes to such discharge point that it will not again sink into the ground near the excavation.

The drawing shows, somewhat conventionally in some respects, an apparatus with
95 which said invention may be practiced.

Figure 1 is a vertical section through said apparatus; and Fig. 2 is a horizontal section on line 2—2 of Fig. 1.

Referring to the parts by letters, A represents the ground in which a vertical hole is being excavated,—the line *a* indicating the
100 normal level of the water in said ground.

B represents a shaft which, in the form shown, is made of concrete. It is provided
105 with a steel shoe *b* at its lower end, which shoe has a sharp lower edge to facilitate the downward movement of said shaft.

C represents a transverse air tight deck which is formed across said shaft near the
110 lower end thereof, whereby the lower end of the shaft B becomes an air caisson. D rep-

resents the air lock tube going through said deck. It has not been thought necessary to show the air locks in detail, because the construction and arrangement of such parts are
5 familiar to those having any acquaintance with this art.

Through the wall of shaft B one or more pipes E are passed at any required distance above the deck. The inner ends of said
10 pipes are provided with valves e, whereby to regulate the in-flow of water into the shaft B. These valves are desirable practically because, without them, the water might, especially if the pump is temporarily put out
15 of service, rise in the shaft B above the air-locked tube D.

F represents a swing pump of any suitable construction, by means of which water may be pumped from the shaft E, through
20 pipe K.

Having described my invention, I claim:

1. The herein described process of sinking shafts through water-impregnated ground which consists in lowering into the excavation as it is deepened a shaft having an air
25 caisson at its lower end, in draining water

from the surrounding ground into said shaft through ports in the walls thereof above said caisson, and in pumping said water from the shaft.

2. In apparatus for sinking shafts in water-impregnated ground, the combination of a shaft formed with an air caisson in its lower end, and having in its wall, above the caisson, a port through which water may
35 flow into the shaft, and means for drawing the water from said shaft.

3. In apparatus for sinking shafts in water-impregnated ground, the combination of a concrete shaft, having a sharp steel shoe
40 on its lower end, and having an air tight transverse deck near the lower end valve controlled pipes through the wall of said shaft above the deck, and a pump for drawing water from said shaft.

In testimony whereof, I hereunto affix my signature in the presence of two witnesses.

FRANK BILLINGS.

Witnesses:

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