

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

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Fig. 1.

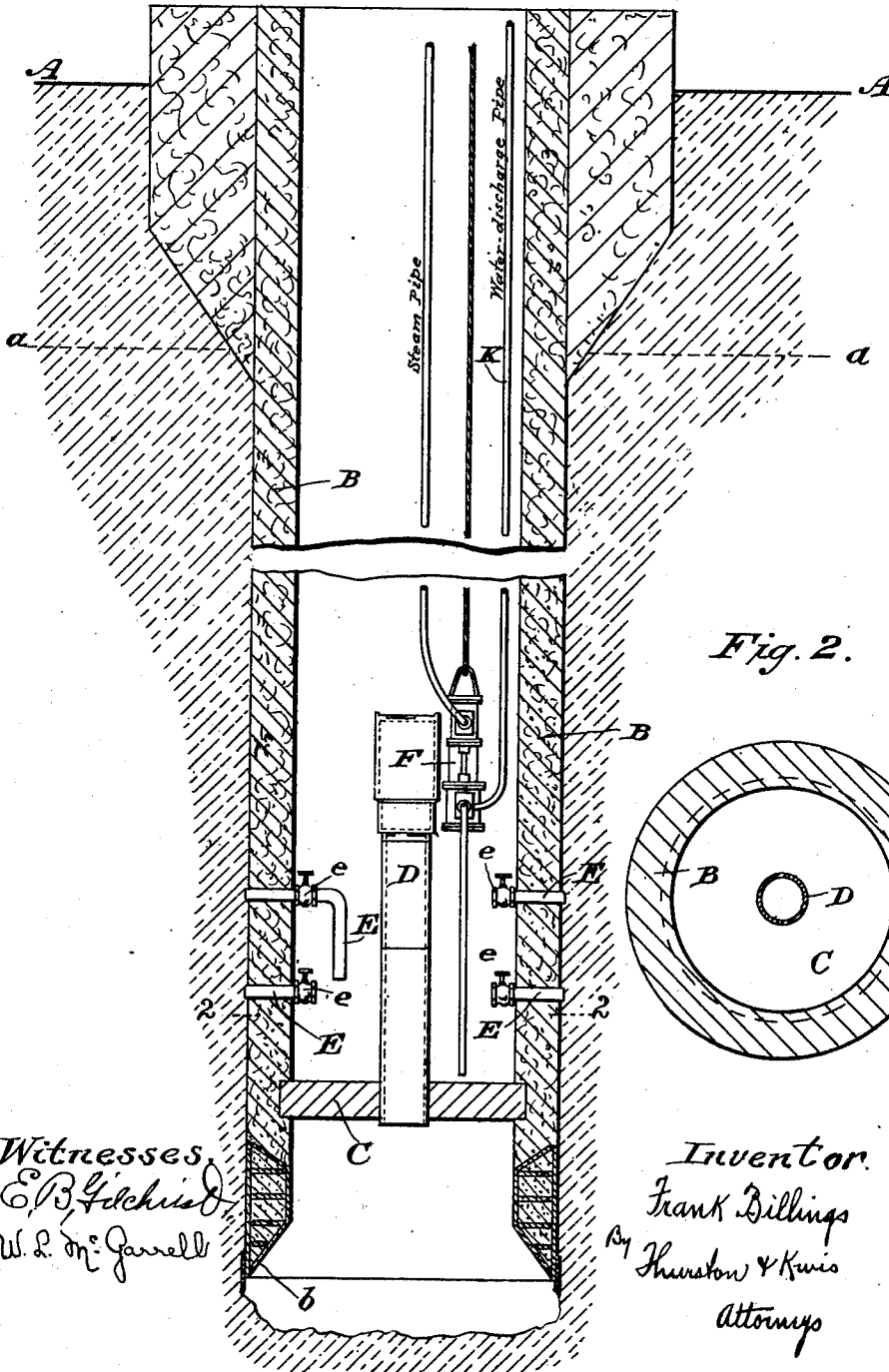
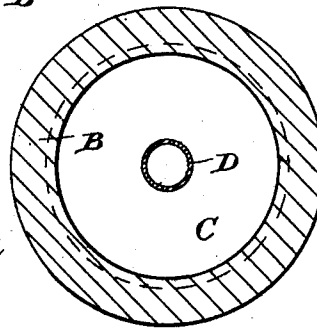


Fig. 2.



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UNITED STATES PATENT OFFICE.

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SINKING DEEP SHAFTS IN WATER-IMPREGNATED GROUND.

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Specification of Letters Patent.

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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 compressed air in a pneumatic caisson in or 20 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 lower end or bottom of the shaft can be excavated to a considerable extent. The air 25 pressure prevents the ground from caving in, and also keeps the excavation free from water, or nearly so, in accordance with the number of pounds pressure. The shaft is 30 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 sink as the excavation is deepened. In that 35 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 exceed fifty pounds air pressure per square 60 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 85 having valves, operable from within the 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 100 is being excavated,—the line *a* indicating the 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 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 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 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 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 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 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 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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