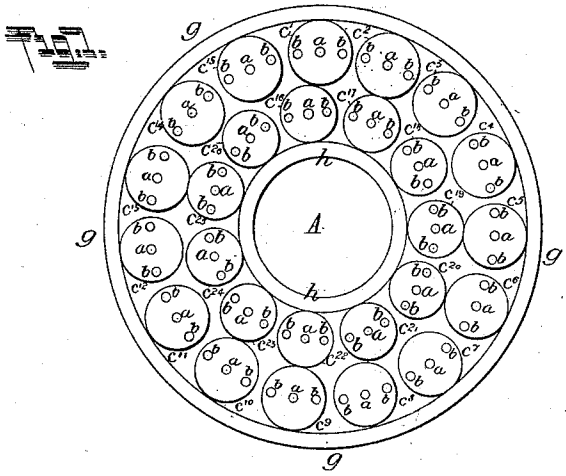
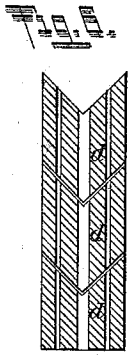
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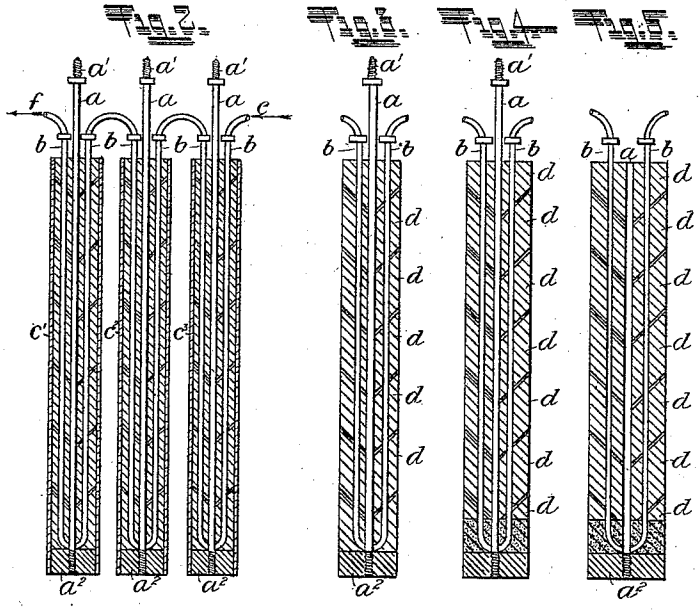
F. H. POETSCH.

METHOD OF SINKING SHAFTS, BUILDING FOUNDATIONS, &c., IN AQUEOUS STRATA.

No. 363,419. Patented May 24, 1887.







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UNITED STATES PATENT OFFICE.

FRIEDRICH HERMANN POETSCH, OF SUDENBURG-MAGDEBURG, PRUSSIA, GERMANY.

METHOD OF SINKING SHAFTS, BUILDING FOUNDATIONS, &c., IN AQUEOUS STRATA.

SPECIFICATION forming part of Letters Patent No. 363,419, dated May 24, 1887.

Application filed October 21, 1886. Serial No. 216,846. (No model.)

To all whom it may concern:

Be it known that I, FRIEDRICH HERMANN POETSCH, a citizen of Germany, and a resident of Sudenburg Magdeburg, in the Kingdom of Prussia, Germany, have invented new and useful Improvements in Methods of Sinking Shafts, Building Foundations, Tunnels in Aqueous Strata and Under Water, of which the following is a specification.

The present invention relates to an improved method of sinking shafts, and of building foundations, tunnels, canals in aqueous strata and under water, and has for its object the building of a wall around the working place. This wall consists of two or more rows of columns of cement and of the aqueous material or water between the several columns, which is to be frozen to make the wall water tight.

In order that my invention may be fully understood, I shall now proceed to describe the same more particularly, reference being made to the annexed sheet of drawings, in which the same letters indicate same parts in all the figures.

Figure 1 shows in plan the arrangement of the boring or sinking pipes around the working place A. Fig. 2 represents in vertical section three of the boring-pipes and the manner of junction of the U-shaped freezing-pipes contained in them. Figs. 3 to 5 show the columns of cement or other solid material with the freezing-pipes and bottom plate after the boring-pipe has been removed. Fig. 6 represents in a vertical section some of the cylinders of cement constituting the above-mentioned columns.

In carrying out the sinking of a shaft in vertical or inclined direction or the building of a horizontal tunnel or other underground work according to my invention, I proceed in the following manner: After having determined the dimensions of the object to be made, I calculate the number of pipes suitable or requisite for building the structure or wall of appropriate size around the space in which the work is to be carried on, and which pipes in the present case are indicated by c' to c^{26} in Fig. 1 of the drawings. These pipes are at their lower ends inserted or driven into the ground somewhat deeper than the shaft or other object will finally have to reach. The pipes c', c^2, c^3, c^{16}, and c^{17} are first sunk in the ground. When these columns c', c^2, c^3, c^{16}, and c^{17} have been put into place the bottom plate, a^2, (into which the iron or metal tube a is screwed,) is inserted into the pipe c', and this serves to close the bottom of the tube, and to form a flat base for the cylinders or blocks d d. These tubes may serve also to aid (as may be needed) by affording means for connecting the whole structure together at the top and strengthening it, as shown at a', (Figs. 2, 3, and 4.) a is a tube of iron or other metal. Of course a rod may be used for the same purpose, but this will be much heavier than a tube. In Fig. 5, a indicates only the place for the tube, the latter being withdrawn. The enlarged parts at the top of the tubes a are not nuts, but shoulders or small supports for the connecting-piece of the tubes a. Figs. 3 and 4 are in accordance with the other figures of the drawings. The hatched surface just above the bottom plate, a^2, represents a layer of cement for filling up the space in which the tubes b b have a curved shape. Further, the U-shaped freezing-pipes b b are inserted in the pipe c', and the latter is then filled with cylinders or blocks d d of cement or other resistant material, Fig. 6, which in their position, one above the other, represent a column. Then the pipe c', Fig. 1, is drawn out from the ground, so that only the cylinders d d, of cement or other material, and the tube a', with the U-shaped freezing-pipes b b, remain in the ground, and finally the tube a' is screwed off from the bottom plate, a^2, and likewise drawn out in order to be used again at the following pipe, c^2, Fig. 2. I then use the boring-pipe c' (drawn out from the ground, as above mentioned,) for the bore-hole c^4, Fig. 1, and sink it into the ground, while I introduce into the boring-pipe c^{16} the tube a', provided with a new bottom plate, a^2, and then, as before stated, the U-shaped pipes b b and the blocks d d next the boring-pipe c^{16} and guiding-tube a' are drawn out from the ground and used for subsequent bore-holes, and the same steps are repeated for the whole series of the pipes. It is obvious that by means of the before-described method and of the small expense for sinking pipes and tubes a great number of columns c' to c^{26} of cement or other suitable material can be built around

the place on which a shaft is to be sunk, or a bridge-pillar or tunnel, &c., is to be built, each of these columns being provided with a bottom plate, a^2, and with the U-shaped freezing-pipes *b b*. I then, by means of coupling or connecting pipes *b' b'*, unite one of the U-shaped pipes of each tube or column with the adjacent pipe *b* of the next adjacent tube or column, and so on, and bring a refrigerating medium—as, for example, a solution of chloride of calcium, or other liquid of a very low freezing-point at a temperature under zero Celsius—in circulation, (through the united system of the U-shaped pipes by means of a pump connected with the terminal pipes of the above-mentioned system,) whereby the water or quicksand or other aqueous strata contained between the columns c' to c^{26}, Fig. 1, becomes frozen and unites all the columns to a firm and resistant wall, which protects the inner space against lateral pressure.

If such a combined wall of columns and frozen material can be based on a water-tight stratum, then a tightening of the bottom may be dispensed with. In cases where such water-tight strata do not exist at the bottom of the water and underneath where the structure is to be placed, it becomes necessary to excavate under water, and then to tighten the bottom or sole of the structure by means of large blocks of rock and béton. Outside and inside of the wall of columns and of frozen material I dispose the rings *g* and *h*, Fig. 1. These are placed at the upper end of the structure and serve to keep the whole to place. It is obvious that within such a wall, shafts, bridge-pillars, tunnels, &c., can be built with all security without the necessity of compressing the air.

In case of tunnelings, the pipes and columns are disposed horizontally, or nearly so. When a canal is to be built, these tubes and columns are disposed vertically, and in all other cases they receive a slightly-inclined direction.

After the building has been finished the frozen wall is thawed up and the rectilineal parts of the U-shaped pipes, Fig. 5, are drawn out from the solid columns as far as possible in order to be used again.

Having thus described my invention, I claim as new and desire to secure by Letters Patent—

An improved method of sinking shafts, building bridge-pillars, tunnels, canals, or foundations of all kinds in aqueous strata or under water, which method consists in forming an inclosing-wall around the work to be done, of materials adapted to be consolidated by freezing, embedding in the said wall freezing-pipes, and circulating a freezing medium through said pipes, substantially as described, whereby a water-tight wall is formed around and serving to protect the working-chamber.

Signed at Berlin, in the Kingdom of Prussia, this 1st day of October, A. D. 1886.

FRIEDRICH HERMANN POETSCH.

Witnesses:
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