(No Model.)

T. J. PHILLIPS.

MEANS FOR SINKING SHAFTS IN SOFT EARTH.

No. 424,819. Patented Apr. 1, 1890.

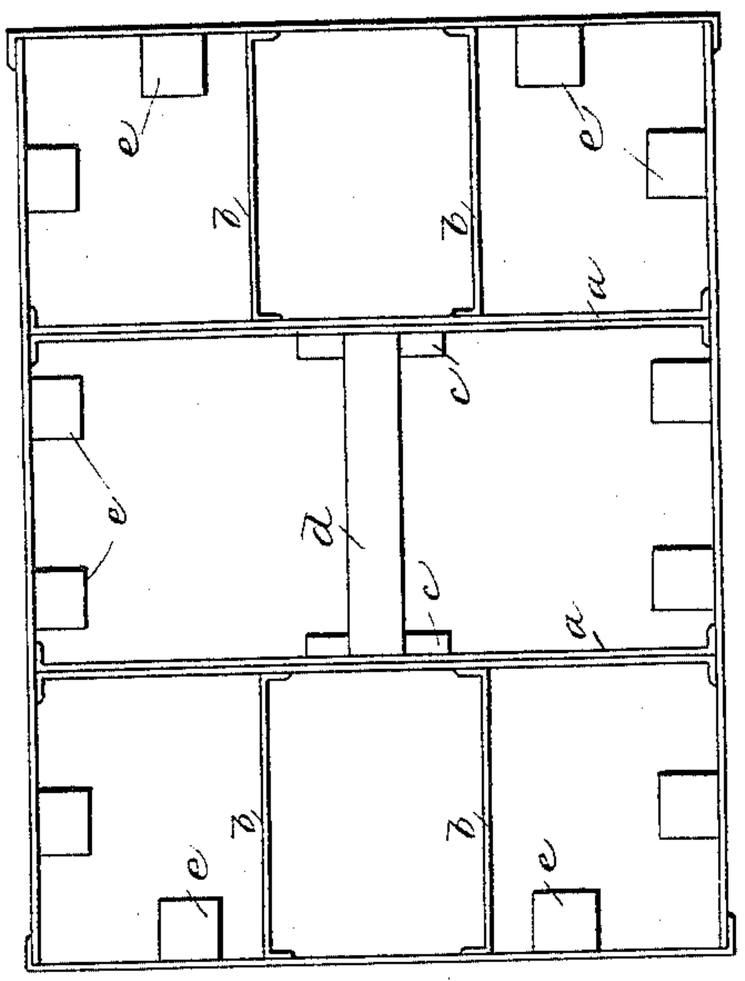

Fig. 2.

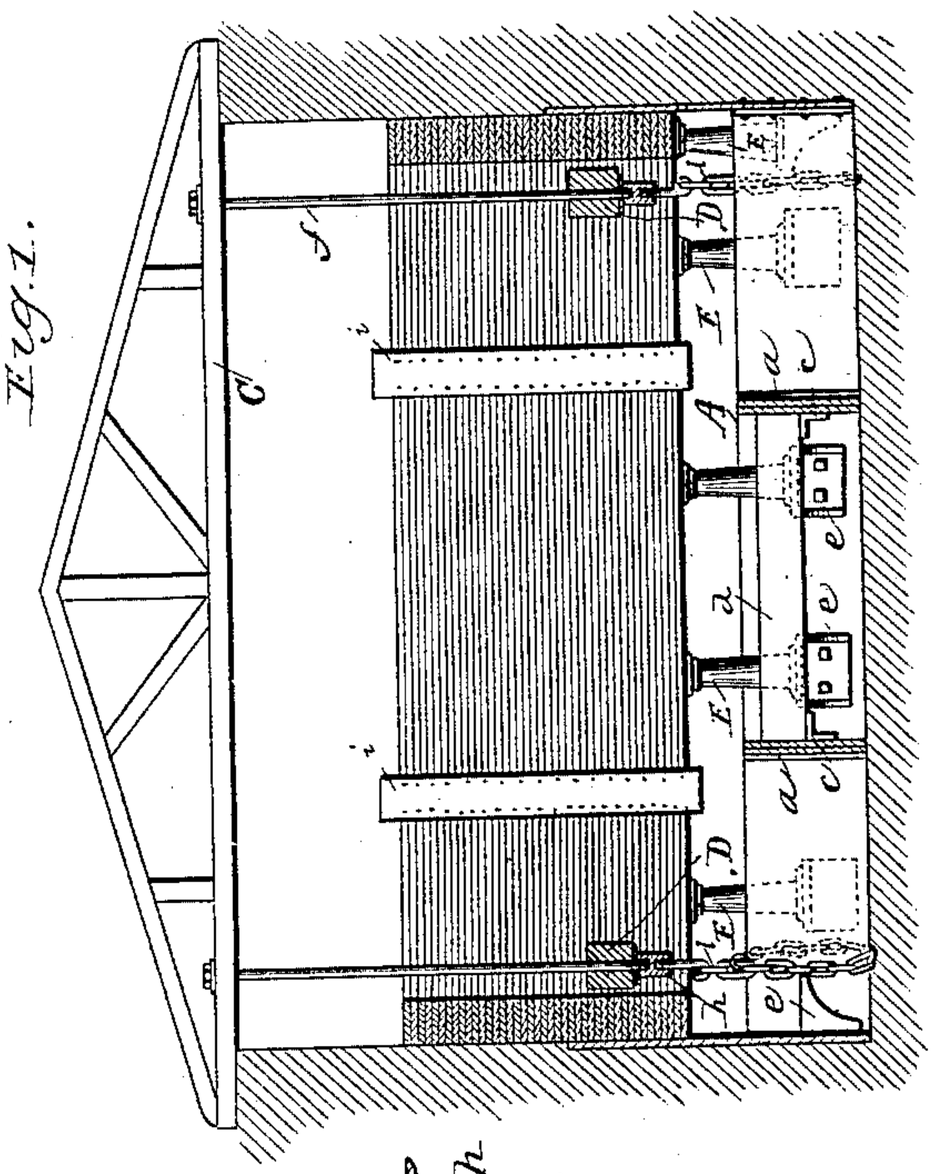

Fig. 1.

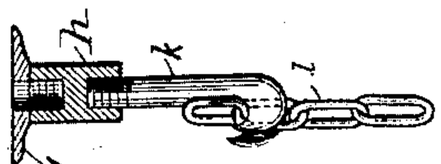

Fig. 4.

Fig. 3.

Witnesses.
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THOMAS J. PHILLIPS, OF CLEVELAND, IOWA.

MEANS FOR SINKING SHAFTS IN SOFT EARTH.

SPECIFICATION forming part of Letters Patent No. 424,819, dated April 1, 1890.

Application filed November 26, 1888. Serial No. 291,897. (No model.)

To all whom it may concern:

Be it known that I, THOMAS J. PHILLIPS, a citizen of the United States, residing at Cleveland, in the county of Lucas and State of Iowa, have invented certain new and useful Improvements in Sinking Shafts in Soft Earth; 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, reference being had to the accompanying drawings, and to letters of reference marked thereon, which form a part of this specification.

The machinery for sinking shafts through soft or watery soil or other shifting material for which I desire a patent is as follows: Assuming that the pit or shaft has been already excavated through the solid earth for a considerable distance—say to the depth of ten (10) feet—and that the size of the shaft desired is the same as that represented in the drawings, in which the curbing from outside to outside of the same is sixteen (16) feet eight (8) inches by twelve (12) feet two (2) inches in horizontal area, and assuming, further, that a stratum of shifting or watery soil has been reached which is too soft to form a wall about the excavation, and consequently falls or flows in upon the workmen from the sides of the excavation as fast as it is removed from the center, the problem for solution then is to prevent such inflow of earth from the sides of the excavation as it is being deepened, and also while an artificial wall or curbing is being constructed from within, following the excavation downward in its descent. I attain these objects by the mechanism illustrated in the accompanying drawings, in which—

Figure 1 is a sectional view. Fig. 2 is a plan of the shoe. Fig. 3 is a diagonal view from above looking downwardly into the excavation. Fig. 4 is a view of the coupling used to connect the rods together with hook attachment.

Similar letters refer to similar parts throughout the several views.

My invention and plan of procedure are to construct a shoe or frame of wrought-iron, as shown in Fig. 2 and at A of Fig. 3, the inside of which shall be large enough to allow the curbing B to extend down into it. This shoe or frame A for a shaft of the size indicated is constructed, preferably, of wrought-iron, although I do not limit myself to any special material in the construction of any of the mechanism, and any suitable material may be used. The sides and ends of this shoe are of three-quarter-inch wrought-iron, thirty-six (36) inches in width and of proper length to make a rectangular frame sixteen (16) feet eight (8) inches by twelve (12) feet two (2) inches in horizontal area and three (3) feet in depth. This rectangular shell, frame, or shoe is then braced as to its area at two points by ribs *a*, eighteen (18) inches deep, made of two plates of three-quarter iron, eighteen (18) inches wide, riveted or bolted together. These ribs are in turn strengthened by short braces *b* of the same depth and of a single thickness of iron extending from the ribs *a* to the sides of the shoe. The parts of the frame may be fastened together by bolts, rivets, or any desired method. The upper area of the shoe is left clear to allow of the curbing extending down into it, as hereinafter described. Two brackets *c*, preferably of a triangular shape, to receive, if desired, a shore or support *d*, of timber or other material, may be placed on the inner sides of the ribs for the purpose of resisting any unusual pressure on the side of the shoe. Twelve (12) iron brackets E, on which to locate jack-screws, are firmly fastened in any desired manner at intervals to the inner side of the shoe, as shown in the drawings. The shoe so constructed is now a rectangular iron frame stoutly braced and with lower edges adapted to penetrate soft earth under proper pressure from above. It may be either built within the shaft or constructed above ground and thereafter lowered into position upon the soft stratum of earth, as preferred.

With the shoe in position a curbing B of two-by-twelve plank, laid in successive layers horizontally, is now built from below upward within the solid stratum of earth and above the shoe, the ends of the outside planks projecting in sections of six (6) or eight (8) planks into solid earth at intervals of about four (4) feet. The planks, as to their projecting ends, are reversed, so that a set of the projecting ends or struts alternately project from the

sides and ends of the rectangular crib or curbing into the soil to secure support for the curbing upon all sides. Besides the support afforded the curbing by the projection of the overlapping ends of the aforesaid sets of curbing-planks into the solid earth outside the curb, it is further supported against movement by gravity, as well as against upward pressure from below, hereinafter described, by a heavy girder C, of suitable size, strength, and weight, placed on the surface of the ground, which girder may be sixteen (16) inches square by thirty (30) feet in length and braced, as represented in the drawings. This girder C supports a lower timber or sill D, with ends projecting through the curbing, (which sill may be of oak timber,) eight (8) inches by ten, (10,) placed on edge. The girder C and sills D are connected by four (4) two and a fourth ($2\frac{1}{4}$) inch iron rods *f*, about ten (10) feet in length. These rods, however, may be of any desired length and size. The ends of the sill or timber D projecting through the curbing are intended and adapted to receive the weight of the curbing and to steady it. The lower portions of these rods extending through the sills are provided beneath the latter with washers *g* or other similar supports, upon which the sills rest, and are also provided with threaded coupling-joints *h* below the washers, into which sets of additional rods may be inserted as the work progresses downward to support and steady the additional sections of curbing as they are completed. Two (2) by twelve (12) planks, as at *i*, may be nailed against each side of the curbing as it progresses downward to assist the nails in holding until the support of the sills D is received. Any suitable material may be used for the curbing in lieu of planks.

The device has also an attachment for use in very soft earth or quicksand, consisting of hooks *k*, with threaded upper ends, as shown in Fig. 4, adapted to be screwed into the lower cavities of the coupling-joints *h*, and chains *l*, leading from said hooks to the shoe and attached thereto, either to the brackets or otherwise, as may be desired, whereby the shoe is prevented in such soft soil or quicksand from dropping below the curbing at any time, and thus allowing an inflow of soft earth or water from the sides. The iron frame or shoe A now resting in position upon the soft soil below, and the curbing being built upward to the surface or to any desired height, and when built reaching from such height downward to near the edge of the shoe, additional curbing-planks F at this point, without overlapping spurs, but cut to fit freely within the shoe, are nailed from below upward with sixty-penny nails or otherwise securely fastened flatwise against the under side of the curbing, thus extending the same downward inside the shoe, the inner edge of which fits closely around it. Hydraulic jack-screws E are now inserted between the brackets of the shoe and the lower face of the curbing-planks. Pressure is applied to the shoe by extending the jack-screws against the resistance of the curbing, and the shoe is depressed downward into the soft soil, thus allowing the soil itself to rise into the interstices of the frame between its ribs and braces, accessible to the workmen for excavation. This soil or earth then being excavated, the jack-screws are temporarily lowered, and additional curbing-planks, (also without overlapping spurs, as before,) cut to fit within the inner margin of the shoe, are nailed from below upward against the curbing, as before. The curbing is thus again brought downward the desired distance into the shoe, the intent being that the inner surface of the shoe shall play outside of the outer surface of the curbing when pressure is exerted and the shoe extended downward, and that the sides of the shoe and that part of the curbing above it shall make a continuous wall, protecting the excavation and the workmen at all times against the inflow of the soft stratum which is being perforated. The operation of depressing the shoe and following it by extending the curbing downward is repeated until the stratum of soft earth is passed or the desired depth is secured. The plank curbing as it descends is further steadied and supported in sections by additional sills and rods, the latter inserted in and supported by the threaded couplings hereinbefore mentioned.

It is obvious that shafts may be sunk in this manner of any desired size or shape, and I do not limit myself to the size or shape of shaft described, nor do I limit myself to the special kinds or sizes of material mentioned, as any material which will secure the same results may be used in the place of that mentioned. Neither do I desire to limit myself to any special size or shape of shoe, as these may be readily varied without affecting the results; nor to any special arrangement or number of ribs or braces or brackets within the shoe; nor to any special length or number of supporting-rods; nor special depth of and for the sections of added curbing, whether such sections be secured by rods and sills or otherwise; nor to the braced and trussed girder on the surface of the soil as an anchorage, as a wedging-curb or any adequate anchorage may be used; nor to the given space between the struts or spurs or number of the same; nor to the use of hydraulic jack-screws only. These may be varied to suit the dimensions of the shaft, the character of the soil, and the obstacles to be overcome. In some situations—as, for instance, where the soft stratum of soil to be perforated lies upon the surface—the anchorage of the heavy stringer C herein shown might be inadequate or unsuitable, in which case any suitable anchorage may be adopted which serves the purpose of securing a resistant body against which the pressure of the screws, wedges, or other power used may be exerted. In the

place of hydraulic jack-screws, wedges or other means of exerting power may be used.

It is known that a curbing of wood with a sharpened and iron-bound lower edge has been heretofore used in foreign countries in excavating soft soils. Said wood curbing is sunk into the soil in successive impulses by the use of jack-screws. Additional curbing is then fastened upon the top of this curbing with the sharpened edge, and the latter, with its addition, again depressed, as before. This addition of curbing from above and action of the screws is repeated until the required depth is reached or the friction upon the lengthened curbing exceeds the power of the screws to further depress it. In this foreign method the lower or cutting curb is never independent of but is fixed to and (except the sharpened edge) remains a part of the permanent curbing, and the entire curbing then built is each time depressed. Sheathing of boards and bands of straw are used in this method to prevent the inflow of water and sand over the descending curbing until the additional curbing can be added. This I do not claim, as in my system the upper area of the shoe, being clear and free from braces, acts as a constant sheathing of the descending curbing and need never be depressed sufficiently below its lower edge to allow an influx of soil. Again, my shoe proceeds independently in the penetration of the soil, and the curbing follows it to any desired depth without any increase of frictional surface, and the direction of progress is readily controlled by placing the added curbing from below upward accurately in the line of proposed descent or progress. Thus the lower edges of my added curbing successively control the shoe in its descent by contact with its inner margin, the chains preventing any undue dropping or canting of the shoe into soft cavities.

What I claim, and desire to secure by Letters Patent, is—

1. In a system of sinking shafts by pressure, a shoe or pioneer frame adapted to embrace a curbing, said shoe being supplied with sling-chains or their equivalent to control its descent, substantially as described, and for the purpose specified.

2. In a system of sinking shafts by pressure, the shoe A, with its upper area adapted to embrace curbing, the equilibrium of said shoe being secured by chains, substantially as shown and described.

3. In a system of sinking shafts, a suspended shoe or pioneer frame separate from and independent of a line of descending curbing and adapted to precede while protecting said curbing and to penetrate the soil under pressure, substantially as shown, and for the purpose specified.

4. The shoe A, in combination with the chains *l* and curbing F, substantially as shown and described, and for the purpose specified.

5. In a system of sinking shafts, the shoe A, jack-screws E, and anchorage C or its equivalent, substantially as shown, and for the purpose specified.

6. In a system of sinking shafts, the shoe A, jack-screws E, and curbing F, and anchorage C, substantially as and for the purpose specified.

7. The shoe A, hooks *k*, coupling-joint *h*, and chains *l*, when used substantially as herein described, and for the purpose specified.

8. In a system of sinking shafts, the coupling-joint *h*, in combination with the anchorage C, sills D, and rods *f*, when used to sustain and connect a descending curbing in sections, substantially as described and shown.

9. In a system of sinking shafts, the coupling-joint *h*, in combination with the sills D and rods *f* of a descending curbing, substantially as shown and described, and for the purpose specified.

10. In a system of sinking shafts, the coupling-joint *h*, in combination with the washer *g*, sills D, rods *f*, and anchorage C, substantially as shown and described.

11. In a system of sinking shafts, the coupling-joint *h*, in combination with the sills D, rods *f*, and curbing F, substantially as shown and described.

12. In a system of sinking shafts, the shoe A, in combination with the jack-screws E, curbing F, coupling-joint *h*, sills D, rods *f*, and anchorage C, substantially as shown and described.

13. In a system of sinking shafts, the shoe A, in combination with the chains *l*, screws E, curbing F, coupling-joint *h*, sills D, rods *f*, and anchorage C, substantially as shown and described.

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

THOMAS J. PHILLIPS.

Witnesses:

SIMEON STRAUS,

JOS. G. STRAUS.