J. F. O'ROURKE.

DEVICE FOR DETERMINING LOAD CARRYING CAPACITY OF SUBTERRANEAN AREAS.

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1,143,645. Patented June 22, 1915.

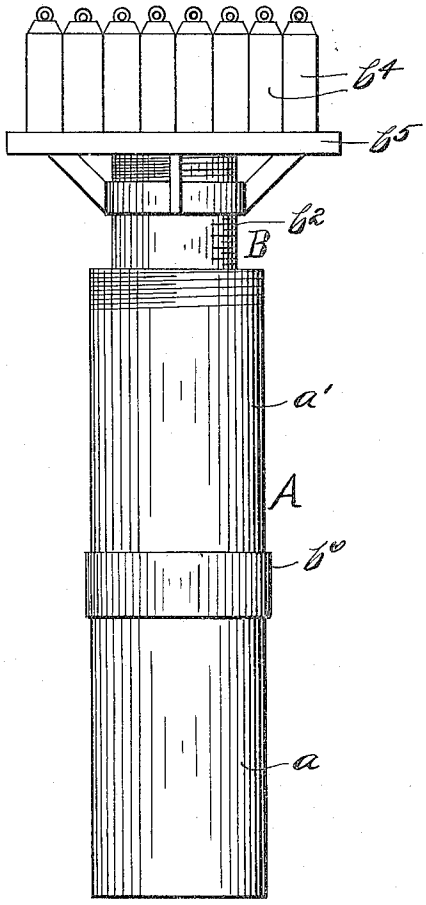


Fig. 1.

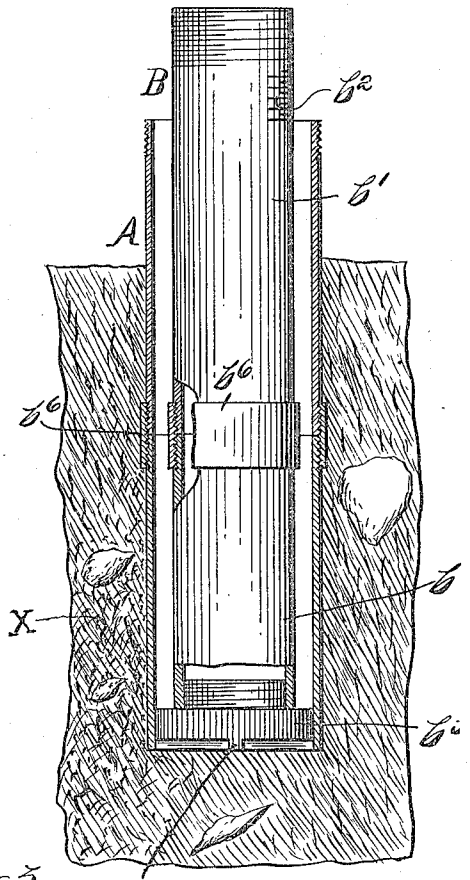


Fig. 2.

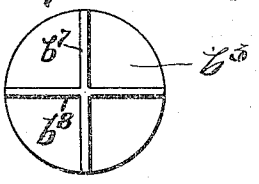


Fig. 3.

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UNITED STATES PATENT OFFICE.

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DEVICE FOR DETERMINING LOAD-CARRYING CAPACITY OF SUBTERRANEAN AREAS.

1,143,645. Specification of Letters Patent. Patented June 22, 1915.

Application filed August 27, 1908. Serial No. 450,443.

To all whom it may concern:

Be it known that I, JOHN F. O'ROURKE, a citizen of the United States, and a resident of the borough of Manhattan, city, county, and State of New York, have invented certain new and useful Improvements in Devices for Determining Load-Carrying Capacity of Subterranean Areas, of which the following is a specification, reference being had to the accompanying drawings, in which—

Figure 1 is an elevation of my devices, Fig. 2 is a central vertical section of parts of Fig. 1 showing same in operation on a subterranean area, Fig. 3 a bottom view of my plunger.

The object of my invention is to provide means whereby can be more economically, and quickly, determined than heretofore, as for building purposes, the additional weight supportable without prohibitory disturbance by a subterranean area, and thus the depth to which foundations should be sunk, and the proper unit stress to insure their stability and that of the thereon to be erected structure and its load, and I attain these objects by my novel devices hereinafter described.

In constructing foundations where desired it sometimes occurs that subterranean bed rock or hard pan preferred for their support, is located at a depth below normal surface so great as to prohibit pneumatic work before such bed rock is reached, or there may be other reasons which render it undesirable to go to bed rock, in which cases, the support afforded by its overlying soil, gravel, sand, or other substances must be depended on. In all such cases this support, or resistance to the weight of the foundation and its superstructure, is in greater or less degree proportional to the nature, correlation and surroundings of the substances depended on, as for instance their compressibility and stability at, and surrounding, the subterranean area, to which the bottom of the foundation is to be carried.

It will be appreciated that while the compressibility of relatively minute specimens of the subterranean earth may be ascertained as now practised by borings to the point in question, excavating such specimens and testing them isolated from their natural environment, that this method fails to afford reliable information as to the depth required for safety since it is incompetent to disclose other factors on which adequate support is dependent such as for instance the support or resistance to be expected from the substances underlying or laterally proximate to the specimens so tested, and it may be said that as to subterranean areas, no certainty has been heretofore attained except by excavating thereto as in the usual manner for a foundation, and then by there actually erecting a test foundation, a procedure obviously in most cases prohibitorily costly and tedious, and furthermore unsatisfactory because necessarily excluding certainty as to the behavior of the pier so sunk when afterward loaded by the superstructure to be thereby supported.

My invention obviates the existing difficulties and enables the actual resistance of, or additional weight supportable, without prohibitory disturbance by any subterranean area in its natural environment, to be determined and thus the depth ascertained to which the foundation must be carried to insure stability.

Referring now to the drawings, my preferred means for practising my method comprise a combination of the following devices: A is a vertically disposed tube of aperture less than sufficient to admit passage therethrough of man. It is constructed of material sufficiently strong to resist the pressures to which it may be exposed, including lateral pressures thereto imparted by the therewith contacting surrounding earth by which the said tubular member is laterally supported, as well as vertically by the thereunderlying soil.

b^3 is a plunger vertically slidable, and horizontally rotatable within, much shorter than, and concentric with, the tube. The plunger is so shaped laterally as to, at all times, contact simultaneously opposite sides of the tube on lines at right angles to each other whereby the plunger is supported against lateral displacement or movement without interfering with either its said vertical, or rotatory, movements. I thus prefer to construct the plunger, as shown, in the form of a circular disk contacting slidingly on all sides with the correspondingly concavely curved interior of the tube. This construction also enables the plunger to bear simultaneously equally on a plurality of parts of the area the resistance of which is

in question. To increase, as is important, the extent of the bearing of the plunger on said area, I provide means for leveling the latter in advance of the plunger, these consisting, in the present instance, of a plurality of, alike, radially disposed projections, b^7, b^8, carried by the plunger, and extending downward, as shown in the drawings, from its bottom. By horizontally rotating the plunger disk around its central axis when these projections contact said area the latter is readily leveled so as to increase the extent and uniformity of the bearing thereon of the plunger.

I provide means whereby the plunger is vertically movable in the tube, and also, after contacting with the area in question, horizontally rotatable thereover. To this end there is carried by the plunger, extending upward from its top, a member, *i. e.* a core, or rod, B. This is longer, and less in diameter, than either the tube, or the plunger; its central longitudinal axis is concentric with that of both; and it therefore extends from the plunger throughout the tube without contacting the sides of the latter, and so as to project, at all times, not only above the surface of the earth, but, also, above the tube when the plunger is bearing on the subterranean area in question. The member B is provided, if desired, with a scale b^2, whereby the extent of the subsidence of the plunger is indicated.

I provide means, outside of the tube, for imposing on the member B, and thus on the plunger, the loads required to test the resistance of the subterranean area in question; these may be, as shown in the drawings, a platform b^5, carried by the member B, and a plurality of movable weights b^4 manually chargeable thereon as required.

The respective length of the tube A, and also of the member B may be increased, or varied, to enable them, and the plunger, to reach as described from the surface of the earth to, the particular subterranean area in question. Such variations may be effected in any convenient manner, as, for example, by constructing these members of detachable sections a, a', b, b', coupled together by screw rings b^6, b^6, as shown in Fig. 2.

The diameter of the plunger at its bearing surface may be as desired though it is convenient that it should be such as to present an area of a square foot or multiple thereof as nearly as may be.

My method is practised as follows: I, first, excavate a vertical shaft from the earth's surface, vertically downward, until the subterranean area in question is thereby reached and exposed; meanwhile, and thereafter, supporting the materials surrounding said shaft against lateral displacement. Such excavation and support is most conveniently effected by driving the tube A vertically down through the earth from its surface to said area, and, as this proceeds, removing, in any well known means, the earth or other substances from the interior of the tube; meanwhile, as aforesaid, lengthening the latter if required. This done, my vertical shaft, of diameter insufficient to admit passage therethrough of a man, is complete, and properly supported for the purposes in hand. My next step is, as is important, to level the area exposed at the foot of the shaft. This I accomplish most conveniently by depositing thereon through the tube my plunger b^3 provided with the projections b^7, b^8, and then horizontally rotating it by appropriately rotating the above described, thereby carried, member B.

The above described shape of the plunger, its environment, and said leveling, adapts it to bear simultaneously equally on a sufficient number of portions of the area exposed at the foot of the tube. It being essential that the plunger, thus properly positioned, be supported effectively against any lateral displacement without impairing its freedom to move up or down, I accomplish this, as shown in Fig. 1, by sinking the tube sufficiently to inclose the plunger in its said operative position. My next step is, from outside the shaft and above the surface, to impose on the member B, and thus upon the plunger, and the area thereby covered, loads, as for example, b^4, b^4, of known weight until the weight-bearing capacity of the area is thereby sufficiently indicated, the weights of the plunger, of the member B, and of the thereby carried platform b^5, for holding the loads, being, of course, previously ascertained and considered in the computation.

If the soil or other underlying substance is found inadequate to support there safely the required load, the plunger is withdrawn, the tube sunk further and its contents further excavated and another test made, and so on indefinitely until satisfactory results are obtained, or the same procedure may be further carried on at successive depths to further determine the character and resistance of the underlying soil at still greater depths.

After the test has been completed the plunger is unloaded and withdrawn, also the movable cylinder if required, and the field cleared thereby for subsequent operations of excavation and building.

What I claim as new and desire to secure by Letters Patent is the following, viz:—

1. For use in determining the additional weight supportable without prohibitory disturbance by a subterranean area, in combination a tube of length sufficient to extend vertically upward from adjacent said area to above the earth's surface; a plunger shorter than said tube vertically movable

and horizontally rotatable within said tube concentric with said tube, laterally supported and guided thereby, a member carried by said plunger and extending, from its top, concentrically through, out of contact with, and beyond the tube; and means to impose loads on said member, and thus on said plunger, until said weight is indicated.

2. For use in determining the additional weight supportable without prohibitory disturbance by a subterranean area, in combination a tube of length sufficient to extend vertically upward from adjacent said area to above the earth's surface; a plunger shorter than said tube vertically movable and horizontally rotatable within said tube concentric with said tube, laterally supported and guided thereby, a member carried by said plunger and extending, from its top, concentrically through, out of contact with, and beyond the tube; said plunger having means to level said area underneath said plunger; and means to impose loads on said member; and thus on said plunger, until said weight is indicated.

3. For use in determining the additional weight supportable without prohibitory disturbance by a subterranean area, in combination a tube of length sufficient to extend vertically upward from adjacent said area to above the earth's surface; a plunger shorter than said tube vertically movable and horizontally rotatable within said tube concentric with said tube, laterally supported and guided thereby, a member carried by said plunger and extending, from its top, concentrically through, out of contact with, and beyond the tube; also carried by said plunger a plurality of radially disposed projections from its bottom; and means to impose loads on said member, and thus on said plunger, until said weight is indicated.

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Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."