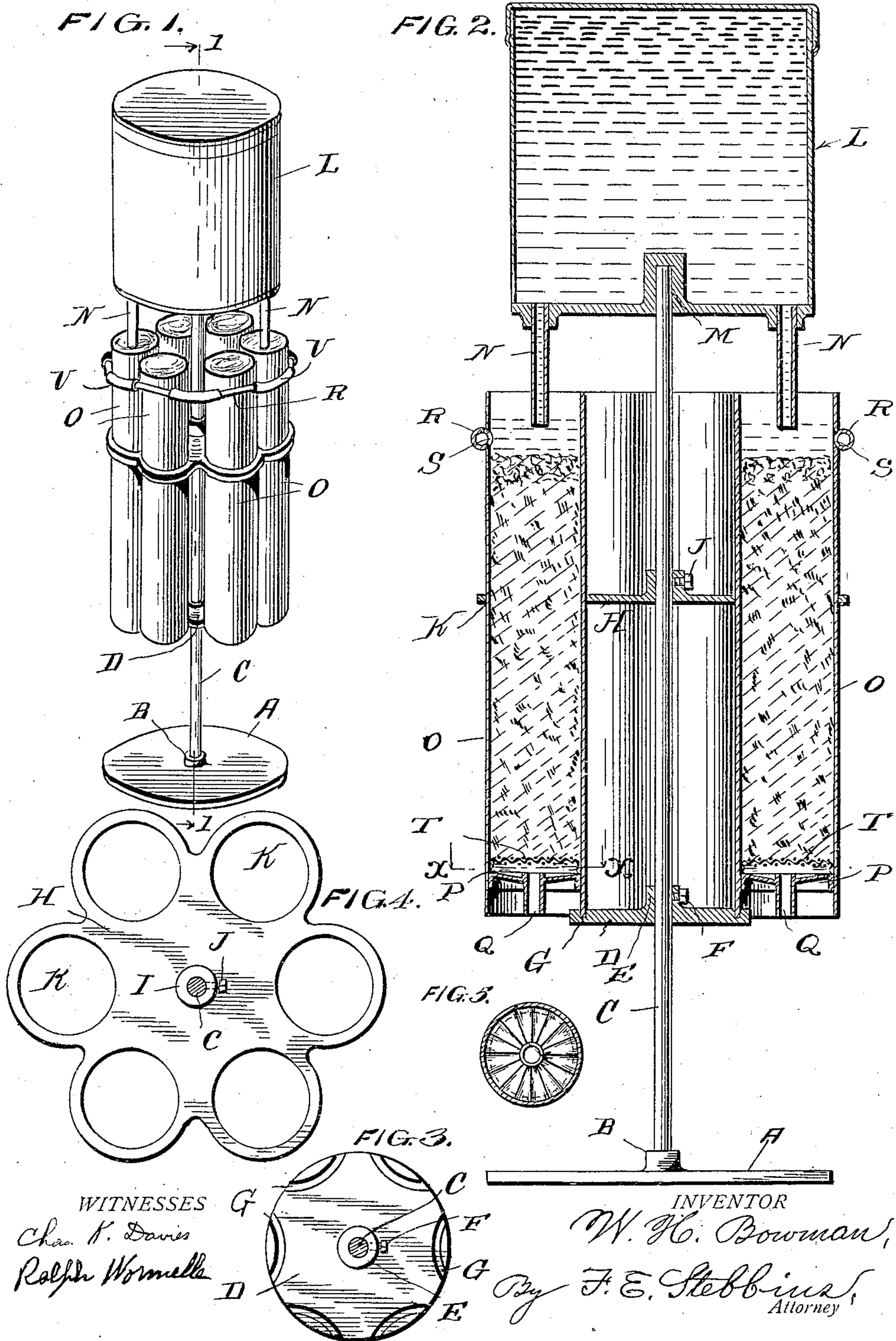


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 APPLICATION FILED FEB. 14, 1910.

966,078.

Patented Aug. 2, 1910.





# UNITED STATES PATENT OFFICE.

WALTER H. BOWMAN, OF DOVER, NEW HAMPSHIRE.

APPARATUS FOR TESTING SOILS AND FOR OTHER PURPOSES.

966,078.

Specification of Letters Patent.

Patented Aug. 2, 1910.

Application filed February 14, 1910. Serial No. 543,708.

*To all whom it may concern:*

Be it known that I, WALTER H. BOWMAN, a citizen of the United States, residing at Dover, in the county of Strafford and State of New Hampshire, have invented certain new and useful Improvements in Apparatus for Testing Soils and for other Purposes, of which the following is a specification.

The object of my invention is the provision of an apparatus especially adapted for use in testing soils to determine their relative porosities, the rate of flow of gases or percolation of water therethrough, their power to retain moisture, and for other experiments.

The invention consists in certain novelties of construction and combinations of parts as hereinafter set forth and claimed.

The accompanying drawing illustrates the apparatus as used in determining the rate of the percolation of water through different soils; but part of said apparatus may be employed independently in performing other experiments.

Figure 1 is a perspective view of the apparatus with the parts assembled. Fig. 2 is a vertical section of Fig. 1 on an enlarged scale, the section being taken on line 1—1 of Fig. 1. Fig. 3 is a top plan view of the lower adjustable support for the tubes. Fig. 4 is a plan view of the upper adjustable support for the tubes. Fig. 5 is a cross section of the tube on line  $x-x$ , Fig. 2.

Referring to the figures, the letter A designates a cast iron base, in this instance of a disk shape, with a perforated boss B to receive the lower end of a rod or standard C which is firmly secured to the base at right angles thereto; D, the lower adjustable disk shaped support or holder for soil tubes having a perforated boss E provided with a set-screw F and a series of grooves G in the top surface of the body of the metal adjacent the circumferential edge and each in the shape of an arc of a circle, the said support or holder being adjustable and held in adjusted position by the set-screw relative to the rod which passes through its center; H, the top adjustable holder consisting of a flat casing with a perforated boss I, set-screw J, and a series of circular openings K extending around the outer edge of the holder; L, a tank with a socket M having a seat to receive the top end of rod C, and two pipes or tubes N N passed through one of the heads of the tank at opposite

sides thereof; O, the soil tubes, each having a countersunk bottom P of cast metal, a tube or pipe Q at the bottom and a horizontal section of pipe R secured to the exterior surface of the tube near its top end by solder or otherwise and in communication with the interior of the soil tube by means of a hole S, the ends of the pipe R projecting each side of the hole S, as shown; T, a flanged wire gauze disk located at the bottom of the soil tube with the flange extended downwardly so as to leave an open space between the gauze and the countersunk bottom of the tube; and U designates short pieces of flexible tubing or rubber tubing passed over the free ends of the pipes R, coupling the same and forming with said pipes means for the passage of liquid from each soil tube to others adjacent thereto and thus maintaining a uniform height of liquid in all the tubes.

Special attention is directed to the construction of the bottom P of the soil tube, the upper surface of the same being corrugated and inclined from the circumferential edge downwardly to the tube Q, the top end of which projects approximately one-sixteenth of an inch above the top corrugated surface of the bottom. This construction insures that soil particles which might pass through the perforated disk will be held or retained upon the corrugated top surface and not pass out with the water for weighing. It also permits the free passage of air and water from every portion of the base of the soil column, even if the disk is placed with the flat surface downward.

The base and rod with the adjustable upper and lower holders constitute a rack for the support of the soil tubes and tank in their proper relative positions, the soil tubes being located within the holes in the upper adjustable holder and the lower edge of each tube being seated within a groove G in the lower holder.

In using the apparatus to determine the relative rates of the percolation of water through different soils, the soil tubes are first filled with the soils to be tested in a uniform compacted condition, as shown by Fig. 2 of the drawing, the tank is then filled with water, reversed and supported on the rod, as shown, with the open ends of the tubes N N located below the top edges of two tubes at opposite sides of the tank. The water flowing from the tank passes by way



of the rubber coupling tubes U to the other soil tubes and when the water rises to a uniform level in all the soil tubes so as to seal the ends of the tubes N N from the atmosphere the further flow or discharge of water from the tank will correspond to the amount or volume which percolates through the soil tubes and is discharged by way of the pipes Q into a flask or other receptacle beneath each soil tube. The quantity or volume of water which flows through a given soil in a given time can thus be determined. The apparatus or parts thereof obviously can be used for other experiments of a similar or different character.

What I claim is:

1. The combination in a soil testing apparatus, of a rack; a plurality of soil tubes supported by the rack; a tank with discharge pipes supported in a plane above the soil tubes with the said pipes located within oppositely disposed soil tubes and with their ends below the top edges of the said tubes; and means for coupling the soil tubes so a uniform height of liquid will be maintained in all the tubes.

2. The combination in a soil testing apparatus, of a rack with a vertical rod; a plurality of soil tubes supported by the rack; a tank with discharge pipes and a socket engaging the top end of the vertical rod, whereby the tank is supported in a plane above the soil tubes, the discharge pipes being located within oppositely disposed soil tubes and with their ends below the top edges of the said tubes; and means for coupling the soil tubes so a uniform height of liquid will be maintained in all the tubes.

3. The combination in a soil testing apparatus, of a rack comprising a base, a vertical upright, a lower holder adjustably supported by the upright and having means for engaging and holding in position the lower edges of tubes; a top holder with holes to bodily receive said tubes adjustably supported by the upright; soil tubes supported by the holders; and means for coupling the tubes near and below the upper ends thereof so that a uniform level of liquid may be maintained in all the soil tubes.

4. A soil tube having a countersunk bottom, a tube extending from said bottom and in communication with the interior of the tube, and a tube with open ends secured between said ends to the side of said soil tube near but below the end opposite the bottom end and at right angles to the longitudinal axis of the soil tube and in communication with the interior of the said tube.

5. The combination in a soil testing apparatus, of a rack; a plurality of soil tubes supported by the rack; means near the upper ends of the tubes connecting the interiors of the tubes so water can flow from one to another; a tank supported by the rack and above the said tubes; and means for delivering water from the tank to the tubes, said means forming with the water discharged from the tank a seal whereby the flow of water from the tank is regulated.

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

WALTER H. BOWMAN.

Witnesses:

RALPH S. MARSH,  
CHAS. W. HILLS.