(No Model.)

E. F. MACGEORGE.

METHOD OF AND APPARATUS FOR DETERMINING THE INCLINATION OF BORINGS.

No. 270,597. Patented Jan. 16, 1883.

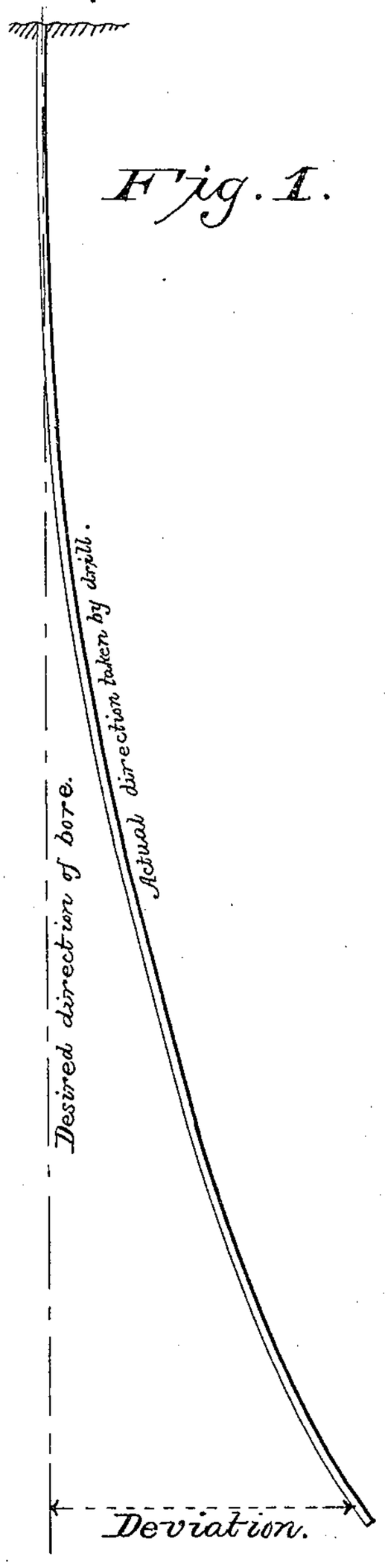

Fig. 1.

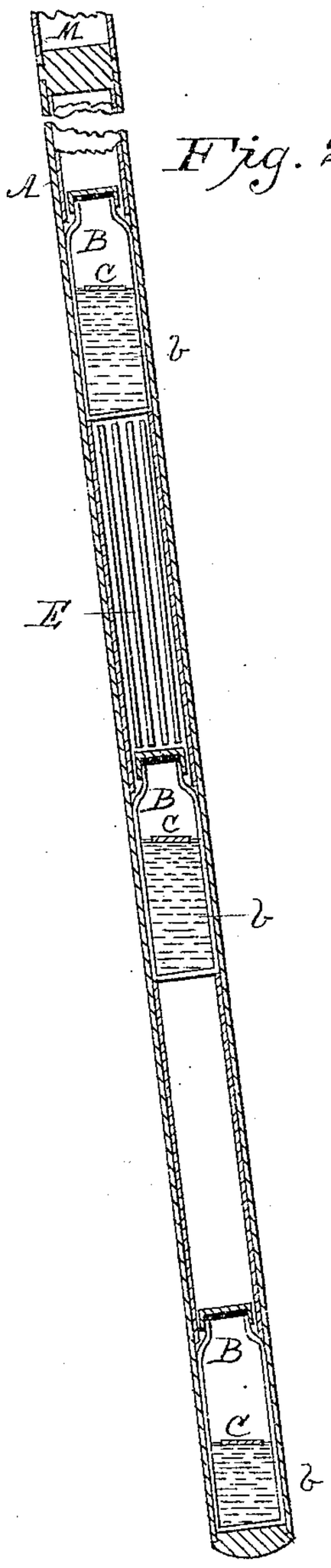

Fig. 2.

Attest:
T. W. Robertson
L. N. Kalb

Inventor:
Ebenezer F. Macgeorge
by his attorney
Thomas D. Stetson

UNITED STATES PATENT OFFICE.

EBENEZER F. MACGEORGE, OF ST. JAMES' PARK, HAWTHORN, NEAR MELBOURNE, VICTORIA.

METHOD OF AND APPARATUS FOR DETERMINING THE INCLINATION OF BORINGS.

SPECIFICATION forming part of Letters Patent No. 270,597, dated January 16, 1883.

Application filed May 5, 1882. (No model.)

To all whom it may concern:

Be it known that I, EBENEZER FARIE MACGEORGE, a subject of the Queen of Great Britain, residing at St. James' Park, Hawthorn, near Melbourne, in the British Colony of Victoria, gentleman, have invented an improved method of and apparatus for ascertaining the gradient of any internal or external surface, together with the magnetic bearing of such gradient; and I do hereby declare that the following is a full, clear, and exact description of the invention, which will enable others skilled in the art to which it appertains to make and use the same.

In boring through rock of unequal hardness or irregularly interspersed with seams or strata of sand or clay much difficulty is experienced in ascertaining how far, if at all, the bore has deviated from its original direction, and whether such deviation be on one side or another. My invention is intended to indicate these facts.

I fix to the drill-rod, or to another, which may be a lighter rod, properly formed in lengths and united, a few feet of brass, copper, or other non-magnetic material, terminating in a length of tubing of similar material, with a convenient coupling for making a rapid and reliable connection. This must be strong enough to withstand any pressure of water that may exist at the depth to be tested, and be securely plugged and capped at each end for the same reason. Inside it I place one or more vials or tubes of clear glass, secured at top and bottom, containing a hot solution—say of gelatine—of a proper strength, capable of congealing when cooled down to the temperature of the position to be examined. These vials must accurately fit the copper or brass tube, already described, so that their sides shall be parallel with the tube and the drill-rod, and they should be placed with spaces of nine inches, or thereabout, between them at intervals in the said tube until it is filled, such spaces being filled with heated bolts of copper, with hot water or oil, or with any slowly-cooling material, so as to delay the congealing of the fluid in the vials until they are in position in the bore to be tested. The fluid in the vials may be a hot solution of gelatine; or it may be any other fluid, hot or cold, which will become solid or of firm consistency after the lapse of the time requisite to place the whole apparatus in its destined position. A crystallizing solution would answer the purpose—melted sperm or wax—or a chemical mixture, either hot or cold, which has the property of being at first fluid, and then after a time of becoming solid or of firm consistency. Upon the surface of the fluid contents of each vial I place a floating card, of wood, cork, or hollow metal, with a magnetic needle immovably attached to it, and the card divided into the points of the compass or into degrees, as thought desirable.

When the apparatus above described is introduced into the position to be tested it should be allowed to remain a sufficient time for the fluid contents of the vials to congeal or crystallize or become of firm consistency, and then be withdrawn. Taking out any one of the vials and supporting it on a leveled table in such a position that the surface of the congealed fluid is in its natural and level position, and the compass-card so that the north point is toward the north, the angle which the vial makes with the surface of the table will be the angle made with the level line or surface of the earth by the vial when in the place where its contents congealed, and the direction in which the vial inclines is the magnetic bearing of the gradient tested. From these data the exact deviation of any bore-hole, &c., from the initial direction may be exactly ascertained.

The accompanying drawings form a part of this specification.

Figure 1 is a section of the earth, showing how a hole is liable to incline. Fig. 2 is a central section through a portion of my apparatus.

Referring to Fig. 2, M is a portion of the drill-rod. A is the non-magnetic metal tubing; B, a set of vials placed therein and fitting so tightly that their axes coincide in direction. *b* is a congealable fluid—as fat, wax, gelatine, or the like—partially but not completely filling the several vials; C C, floating disks, of wood or other suitable material, resting on *b*, and carrying each a magnetic needle reliably fixed so that it will turn the disk while the material *b* is fluid; and E, a set of copper bars or other convenient material, non-magnetic, which are heated and introduced to aid in maintaining

the complete fluidity of *b* until the apparatus is fully in place and its surface has come to rest.

The apparatus may be used to take the gradient of surfaces and chambers other than drill-holes when desired. It may be varied widely in proportions.

Having thus described the nature of this invention and the manner of performing same, I would have it understood that what I claim as my improved method of and apparatus for ascertaining the gradient of any internal or external surface, together with the magnetic bearing of such gradient, is—

1. The method of ascertaining the inclination of borings or analogous chambers or surfaces by means of a fluid suitably inclosed and transported to the required position while in a fluid state, and allowed to remain there until it has ceased to be fluid, and then withdrawn and examined, substantially as herein specified.

2. The method of ascertaining both the inclination and the direction relatively to the meridian by means of a vessel partially filled with a fluid, and inclosing, also, in the same or a different vessel a freely-turning magnetic needle, the whole so arranged and operated that the fluid will harden in the position, and show by the inclination of its surface and the position of the magnetic needle the facts required, substantially as herein specified.

3. The rod M, tubing A, and transparent vessels B, containing gelatine or analogous material, *b*, so that it may present a level surface in all required positions, combined and arranged to serve as herein specified.

4. The heating means E and transparent vessels B, containing a fluid capable of changing to a solid, but only partially filled therewith, in combination with the tube A and rod M, as herein specified.

5. The compass or freely-turning magnetic needle C, in combination with the fluid *b*, capable of changing to a solid in the required position, and with the transparent vessel B, tube A, and rod M, as herein specified.

E. F. MACGEORGE.

Witnesses:

EDWD. WATERS,

W. S. BAYSTON.