No. 892,353. PATENTED JUNE 30, 1908.

R. S. BLAIR.

LEVEL.

APPLICATION FILED FEB. 5, 1908.

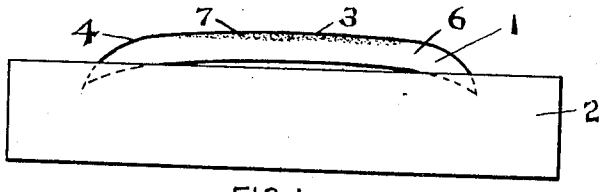


FIG. 1.

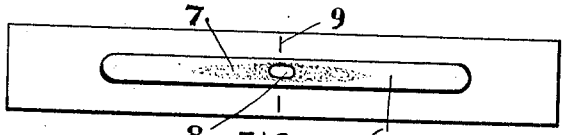


FIG. 2.

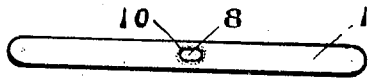


FIG. 3.

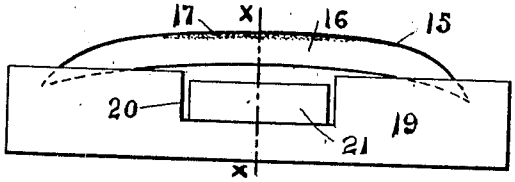


FIG. 4.

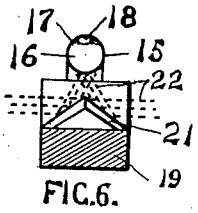


FIG. 6.

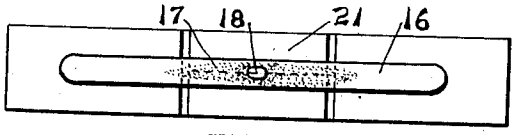


FIG. 5.

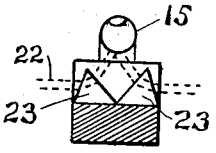


FIG. 7.

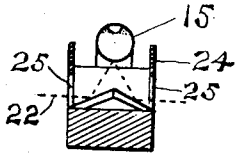


FIG. 8.

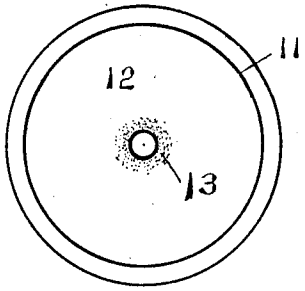


FIG. 9.

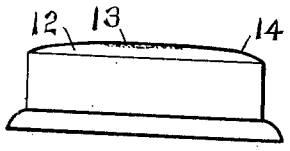


FIG. 10.

WITNESSES

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LEVEL.

No. 892,353. Specification of Letters Patent. Patented June 30, 1908.

Application filed February 5, 1908. Serial No. 414,294.

To all whom it may concern:

Be it known that I, ROBERT S. BLAIR, a citizen of the United States, residing at New Rochelle, in the county of Westchester and State of New York, have invented certain new and useful Improvements in Levels, of which the following is a full, clear, and exact description, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to devices for testing the levelness or inclination of surfaces, lines and the like.

One of the objects is to provide a practical and efficient device of the above nature which shall give an indication which is readily and quickly visible under all working conditions.

Another object is to provide an efficient level which shall be sensitive of indication and yet give quick results.

Other objects are to provide devices of the above nature which shall be cheap, reliable and durable and shall stand hard handling and severe weather conditions without serious impairment of efficiency.

Other objects will be in part obvious and in part pointed out hereinafter.

The invention accordingly consists in the features of construction, combinations of elements and arrangement of parts which will be exemplified in the construction hereinafter set forth, and the scope of the application of which will be indicated in the following claims.

In the accompanying drawing, wherein is shown one or more of various possible embodiments of the several features of this invention, Figure 1 is a side elevation of one of the same. Fig. 2 is a plan thereof. Fig. 3 is a plan of a slightly different form of tube. Fig. 4 is a side elevation of another level. Fig. 5 is a plan of the same. Fig. 6 is a sectional view taken along the line X—X of Fig. 4. Fig. 7 is a similar view showing a different form of light diverting means. Fig. 8 is a similar view showing the application of protective devices. Fig. 9 is a plan of another form of level. Fig. 10 is a side elevation thereof.

Similar reference characters refer to similar parts throughout the several views of the drawing.

In order to render certain features more readily and fully understood, it may here be noted that in the use of leveling devices of various types, it is often difficult to read the indication of level, as on dark days and in dark locations in which the work must be carried on. It is, however, often of prime importance that the work be quickly carried on, and hence the instrument should not only be of a nature permitting quick reading, but should preferably be rapid in action. It is, of course, desirable, however, that the indications should be accurate and the instrument sensitive in action.

The above and other desirable features are attained without resultant disadvantages in constructions of the nature of those hereinafter set forth.

Referring now to the accompanying drawing, there is shown in Fig. 1 a tube or receptacle 1 mounted in a block 2 or other desired form of mounting. It is to be understood that with respect to the mountings shown herein the same are somewhat diagrammatically indicated, and the invention is susceptible of application in devices having mountings or supports of various types. The tube 1 is slightly convex throughout a considerable portion of its length as at 3, and the ends thereof are preferably downwardly turned as at 4, being more sharply convex and may be set in the mounting 2 as by plaster or any other desired means. It is to be understood that the convexity of the upper wall of the tube 1 is very slight in a longitudinal direction, and, in fact, may be almost straight in the most sensitive levels.

Tube or receptacle 1 is nearly filled with a liquid 6, as mercury, and a portion of the remaining space is occupied by another liquid 7, preferably colored alcohol. These liquids are so proportioned and disposed, and the tube so formed, as preferably to leave a bubble 8 which extends substantially through the fluid 7, and thus permits the bright upper surface of the mercury to reflect light upwardly at this point. In this manner the bubble is quickly discernible, not only by the contrast in color, but by the reflected light from the surface of the mercury at the bubble 8. These fluids are not only of different specific gravities, but are self-separating. That is, upon being shaken together they quickly separate into superposed layers or strata, and it may here be noted that the term "self-separating" as used throughout this description and the following claims is intended to denote such a quality or characteristic. It may also be noted at this point the

terms of the nature of "upper" and "lower" refer to the normal operative position of the instrument, and that by the term "convex", as used with reference to a wall or other element is meant that its under surface is rounded upwardly so as to be slightly hollowed or concave if viewed from beneath.

The operation and use of the above described embodiment of this invention is substantially as follows: With the tube filled and mounted as shown, the fluid 7 is in a position above the fluid 6, and the bubble 8 occupies the uppermost position of the tube or receptacle 1, due, of course, to the fact, that it seeks the highest point of the receptacle, thus indicating by its position, that is the position of the liquid which forms it, the position or inclination of the receptacle. If, then, it be desired to adjust a member until it be level, the mounting 2 is placed upon the same and the member swung until the bubble comes opposite a proper indicating mark as at 9 at the center of the instrument, whereupon the member is level. The mercury 6, by reason of its weight, quickly changes its position and tends to carry the lighter fluid 7 as a whole, and in this lighter fluid the bubble 8 finds the highest point. This results in a quick action of the instrument, and the contrast and other features above noted permit the ready observation of its indication under all conditions of use.

If desired, the lighter fluid may be small in amount, whereupon it will form a ring about the bubble as indicated at 10 in Fig. 3 of the drawings, and if the bubble be small, this ring will form in itself an indicating means. It is to be noted in connection with this type of instrument, as well as that first described, that the lighter fluid tends to spread out between the mercury and the upper wall of the tube or receptacle and act as a lubricant to permit a more ready action of the heavier fluid.

In Figs. 9 and 10 is indicated the so called "watch crystal" type of level in which the receptacle or holder 11 is substantially circular and equally rounded in all directions, thus indicating the precise direction in which adjustment is required, in order to bring the surface into level position. This receptacle 11 is filled with the heavy fluid 12 and lighter fluid 13 in a manner substantially identical with the filling of the tubular receptacle first described. The curvature preferably is more pronounced toward the edges of the instrument as at 14, in order to do away with any tendency of the bubble to stay at the edges of the instrument. It will thus be seen that there is provided a type of instrument in which the objects of this invention are achieved, and the above enumerated advantages are among others present. By the use of a plurality of fluids, I attain a more efficient action, irrespective of the contrast of color; and by the use of fluids of contrasting colors, and more particularly a substantially opaque fluid, as colored alcohol, used in connection with a reflecting medium, as the upper surface of the mercury, the position of the receptacle, by which is meant the levelness or lack of levelness of the member with which it is used, is quickly indicated.

In Fig. 4 of the drawings is shown a slightly different type of instrument in which the tube 15 is filled partially with a transparent fluid 16 as carbon-bisulfid (CS_2), and the upper fluid 17 may be as before colored alcohol, which is relatively opaque and is self-separating with respect thereto. The bubble 18 preferably extends substantially through the alcohol, and the mounting 19 in which the tube is positioned is cut away as at 20, and is provided with oppositely inclined mirrors 21, best shown in Fig. 6 of the drawings. These mirrors act to divert the rays of light, indicated at 22, and throw the same against the lower wall of the tube 15. In this manner the bubble is brightly illuminated by the light thrown through the carbon-bisulfid, and the indication of the instrument quickly read.

In Fig. 7 is shown a cross-section of a device similar to that of Fig. 6, the same employing refracting prisms 23 instead of the mirrors, and it is to be understood that, if desired, reflecting prisms or other means may be employed for directing the light through the carbon-bisulfid. In fact, certain of the advantageous features of this invention may be achieved by silvering the surface of the lower wall of the receptacle.

In Fig. 8 is shown a device similar to Fig. 6, with the exception that protective members 24 are provided at each side of the tube, and are formed with openings 25 therein to admit the light to the mirrors.

Certain broad features of the constructions employing the carbon-bisulfid are obviously common to the form of instrument first described, although the former instrument, as well as the latter, each possess advantages peculiar to itself.

It will thus be seen that there are set forth forms of instruments of simple, cheap and durable construction, which are sensitive and reliable in indication, and which, among other advantages already set forth, are susceptible of the hardest practical use and exposure without injury thereto.

As many changes could be made in the above construction and many apparently widely different embodiments of this invention could be made without departing from the scope thereof, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

Having described my invention what I

claim as new, and desire to secure by Letters Patent is:

1. A level tube having a liquid therein normally extending substantially from end to end thereof, and a liquid of darker appearance or color upon said first liquid and adapted by its appearance to indicate the position of said tube.

2. A level tube having therein a liquid normally extending substantially from end to end thereof, and a second liquid of contrasting color or appearance resting upon said first liquid, said liquids being so disposed and proportioned as to form a bubble of an appearance readily distinguishable from said second liquid and adapted to indicate by its position the position of said tube.

3. In level construction, in combination, a receptacle provided with a convex upper wall and a lower wall directly beneath the same, a body of mercury upon said lower wall and between the same and said upper wall and nearly filling said receptacle, and a lighter liquid extending between said mercury and said upper wall and acting to permit a more ready action of said mercury, said liquids forming a bubble by which the position of said receptacle is indicated.

4. In level construction, in combination, a receptacle provided with a convex upper wall and a lower wall directly beneath the same, a liquid upon said lower wall and between the same and said upper wall, and a second liquid resting upon said first liquid and so disposed and proportioned as to indicate by its position the position of said receptacle, said liquids being self-separating.

5. In level construction, in combination, a receptacle provided with a convex upper wall and a lower wall directly beneath the same, a liquid upon said lower wall and between the same and said upper wall, and a liquid of a darker color or appearance resting upon said first liquid and so disposed and proportioned as to indicate by its position the position of said receptacle.

6. In level construction, a receptacle provided with a convex upper wall and a lower wall directly beneath the same, a liquid upon said lower wall and between the same and said upper wall, and a second liquid of a color different from that of said first liquid resting upon said first liquid and so disposed and proportioned as to form a line of division with said first liquid visible through said upper wall, and indicate thereby the position of the receptacle.

7. A device of the class described, comprising a mounting and a level tube fixed upon said mounting and having therein a liquid normally extending substantially from end to end thereof, and a second liquid of contrasting color or appearance resting upon said first liquid, said liquids being so disposed and proportioned as to form a bubble of an appearance readily distinguishable from said second liquid and adapted to indicate by its position the levelness of a surface upon which said mounting is placed.

8. In level construction, in combination, a receptacle provided with a convex upper wall and a lower wall directly beneath the same, a liquid upon said lower wall and between the same and said upper wall, and a second liquid self-separating with respect to said first liquid and resting upon said first liquid and so disposed and proportioned as to form a bubble extending substantially to the surface of said first liquid and adapted to indicate by its position the position of said receptacle.

9. In level construction, in combination, a receptacle provided with a convex upper wall and a lower wall directly beneath the same, a liquid upon said lower wall and between the same and said upper wall, and a second liquid self-separating with respect to said first liquid and resting upon said first liquid and so disposed and proportioned as to form a bubble extending substantially to the surface of said first liquid and adapted to indicate by its position the position of said receptacle, said liquids being of different colors.

10. In level construction, in combination, a receptacle provided with a convex upper wall and a lower wall directly beneath the same, a body of mercury upon said lower wall and between the same and said upper wall; and a lighter liquid resting upon said mercury and so disposed as to form a bubble extending substantially to said mercury and adapted to indicate by its position the position of said receptacle.

11. In level construction, in combination, a receptacle provided with a convex upper wall and a lower wall directly beneath the same, a body of mercury upon said lower wall and between the same and said upper wall, and a lighter liquid resting upon said mercury and so disposed as to form a bubble extending substantially to said mercury and adapted to indicate by its position the position of said receptacle, said second liquid being of a contrasting color with respect to said mercury.

12. In level construction, in combination, a receptacle provided with a convex upper wall and a lower wall directly beneath the same, a liquid upon said lower wall and between the same and said upper wall, and a second liquid self-separating with respect to said first liquid and resting upon said first liquid and so disposed and proportioned as to form a bubble extending substantially to the surface of said first liquid and adapted to indicate by its position the position of said receptacle, said receptacle being of tubular form.

13. In level construction, in combination, a receptacle having upper and lower walls, a liquid extending between said walls, and a

lighter fluid substantially opaque and of a different color from said liquid and floating thereon beneath said upper wall, whereby the contrasting line between said liquid and said lighter fluid is visible through said upper wall and is adapted to indicate the position of said receptacle.

14. A level tube with a liquid therein forming a bubble to indicate the position of the tube, and means presenting a bright surface extending to a point above the lower portion of the tube and immediately beneath said bubble, and liquid whereby said bubble is given a bright appearance and is readily distinguishable from surrounding portions of said liquid.

15. A level tube with a substantially opaque colored liquid therein forming a bubble to indicate the position of the tube, and means presenting a bright surface extending to a point above the lower portion of the tube and immediately beneath said bubble, and liquid whereby said bubble is given a bright appearance and is readily distinguishable from surrounding portions of said liquid.

16. In level construction, in combination, a receptacle having an upper wall slightly convex in its central portion and more sharply convex at portions remote from the center, a liquid in said receptacle, and a lighter liquid in said receptacle and resting upon said first liquid, said liquids being adapted by their position to indicate the position of said receptacle.

17. In level construction, a receptacle having an upper wall slightly convex in the central portions thereof and more sharply convex at portions remote from the center, a body of mercury in said receptacle, and a lighter liquid in said receptacle resting upon said mercury, said mercury and said lighter liquid being adapted by their position to indicate the position of said receptacle.

18. In level construction, a receptacle having an upper wall slightly convex in the central portions thereof and more sharply convex at portions remote from the center, a body of mercury in said receptacle, and a lighter liquid of contrasting color in said receptacle resting upon said mercury, said mercury and said lighter liquid being adapted by their position to indicate the position of said receptacle.

19. In level construction, a tube slightly convex at the center and more sharply convex at its ends, a liquid in said tube, and a lighter liquid in said tube and resting upon said first liquid, said liquids being adapted by their position to indicate the position of said tube.

20. In level construction, in combination, a tube having downturned end portions, a body of mercury within said tube and extending from end to end thereof, and a lighter liquid within said tube resting upon said mercury and adapted to indicate by its position the position of said tube.

21. A level tube having a liquid therein extending substantially from one end to the other thereof, and a second and lighter liquid within said tube floated upon said first liquid and so proportioned as to form a bubble visible through said tube whereby, as the inclination of said tube is changed, said first liquid carries said second liquid toward one or the other of the ends of the tube and said bubble moves with said second liquid and adjusts itself therein to its highest point.

22. A level tube having a liquid therein extending substantially from one end to the other thereof, and a second liquid of a darker color and lighter weight within said tube floated upon said first liquid and so proportioned as to form a bubble visible through said tube and readily distinguishable from the surrounding liquid whereby, as the inclination of said tube is changed, said first liquid carries said second liquid toward one or the other of the ends of the tube and said bubble moves with said second liquid and adjusts itself therein to its highest point.

23. A substantially straight level tube having a liquid therein extending substantially from end to end thereof and having floated upon said liquid and visible through the upper wall of the tube a substantially opaque substance of contrasting appearance with respect to said liquid, and substantially surrounded by said liquid and freely movable lengthwise of the tube whereby the position of the tube is indicated by the position of said substance therein, and whereby said substance is readily distinguishable through said upper wall by its contrast with said liquid.

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

ROBERT S. BLAIR.

Witnesses:
C. CORSON,
B. CORSON.