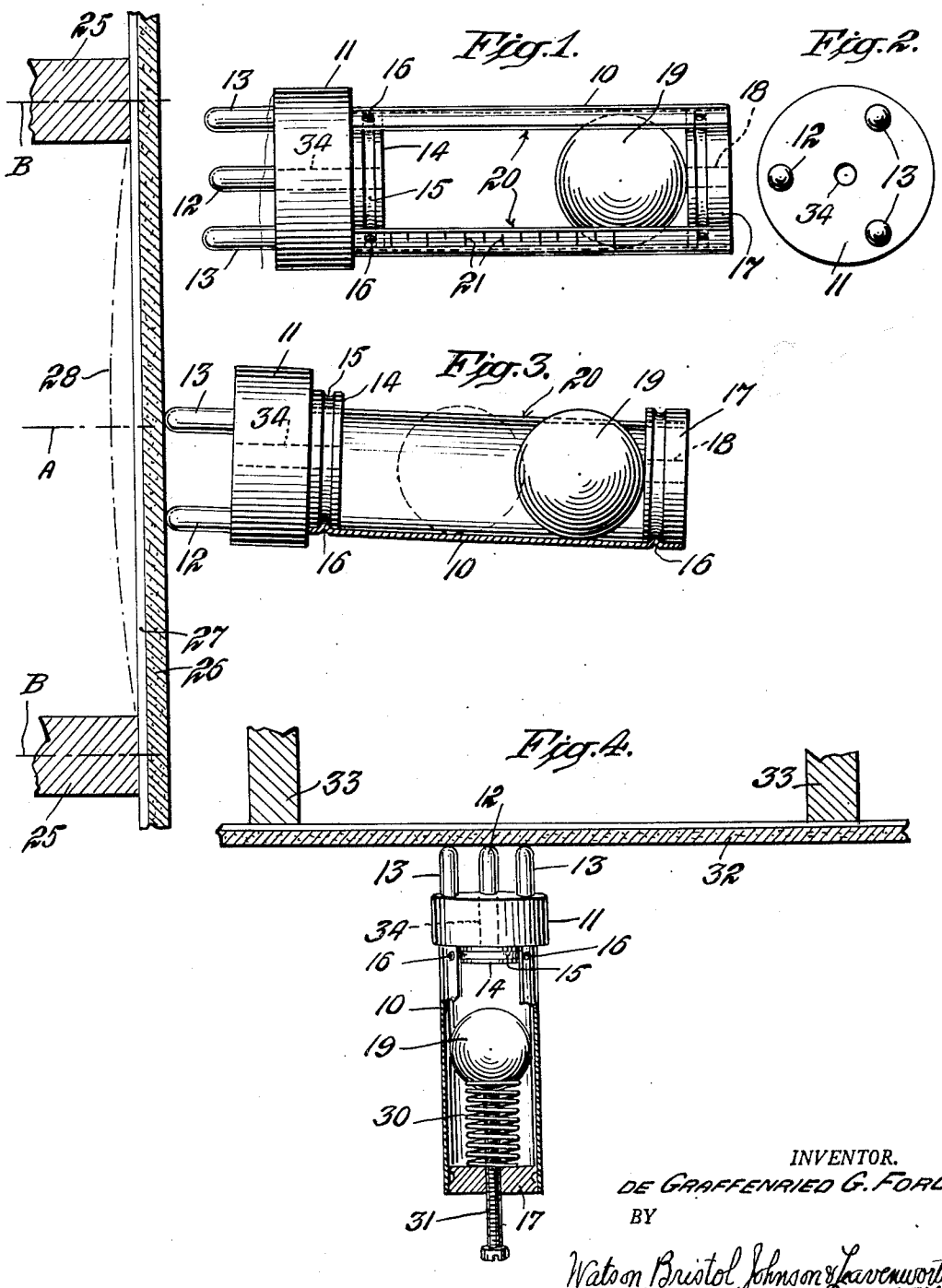
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FRAME MEMBER LOCATING DEVICE

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FRAME MEMBER LOCATING DEVICE

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The invention relates to a device for locating frame members in hollow wall constructions. It is frequently desirable to locate a stud, joist or beam or similar concealed frame member in a building and, of course, to do so if possible without injuring the wall surface. Various expedients such as endeavoring to interpret the sound from rapping on the wall have been resorted to with varying results depending upon the circumstances and skill and experience of the operator. For accurate and dependable results it has commonly been the practice to drive a nail into the wall at a series of progressively spaced points to locate the solid backing member with the consequent injury to the surface particularly in the case of plaster or composition walls.

The present invention comprises a simple small portable device capable of being manually applied to the surface to be explored and adapted by easily performed manipulations to locate frame members of the character described. The device may be employed to advantage in a wide variety of places or conditions and always without injury to the surface being tested. The device utilizes the phenomena that if a non-rigid wall is struck a blow at a point between two supporting beams such as wall studs, the wall will be flexed or displaced an appreciable distance which will be a maximum midway between two such beams and the displacement will be progressively less as successive blows are struck along a line approaching one of such beams. The device embodies an inertia member such as a steel ball arranged to be freely movable longitudinally of an elongated supporting frame or barrel. In a typical application of the device in connection with a vertical wall the device is held manually in firm endwise engagement against the wall so that it partakes of any movement thereof. Through the provision of appropriate adjustable means the supporting barrel is arranged at a slight incline to the horizontal. The wall is then rapped adjacent the testing device and due to the inertia of the ball it has imparted thereto a certain momentum roughly proportional to the amount of displacement of the wall at the point of application. The ball will, therefore, travel up the incline of the barrel a distance proportional to its energy of momentum which in turn is proportional to the amount of wall displacement at that point. By applying the device to successive spaced positions along a line points of minimum or zero displacement may readily be located and these points will comprise beam locations. On walls or locations

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where the device cannot be applied with the barrel at a small angle to the horizontal, as, for example, in the case of a ceiling, auxiliary elements readily associated with the device enable the weight of the ball to be partially balanced by spring means and the device thereby rendered sufficiently sensitive under such conditions of use.

Other objects and advantages of the invention and the details of a specific device embodying the principles thereof will be described hereinafter.

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

For a fuller understanding of the nature and objects of the invention, reference should be had to the following detailed description taken in connection with the accompanying drawing, in which:

Fig. 1 is a plan view of the assembled device;

Fig. 2 is an end view looking from the left in Fig. 1;

Fig. 3 illustrates the application of the device to a vertical wall construction; and,

Fig. 4 illustrates the application of the device to a ceiling, the device in this case having certain auxiliary elements added thereto to enable it to respond satisfactorily to such type of application.

As depicted in Fig. 1 the device includes a main frame or casing in the form of a tubular member 10 having a base or abutment member 11 which is generally cylindrical in form and is provided with three legs of which one, indicated by the reference character 12, is of a different length from the other two indicated at 13, for a purpose to be described shortly. The end member 11 is provided with an extending boss 14 adapted to receive the sleeve 10. The member 11 and its boss 14 are made rotatable with respect to the sleeve 10 in some suitable manner as, for example, the boss 14 may have therein a groove 15 and by staking or other suitable operation the shell 10 may be provided wtih a bead or spaced projections 16 extending into the groove 15 as shown particularly in Fig. 3. The opposite end of the cylindrical shell 10 is provided with a closure member 17 which may be secured therein in any suitable manner such as by means similar to that described in connection with the abutment member 11. The closure member 17, however, should be made normally non-rotatable

with respect to the casing shell 10 to enable a set screw to be threaded into the opening 18 when desired, for a purpose to be later described.

Within the supporting shell 10 is mounted an inertia member of substantial weight which is required to be freely movable longitudinally of the shell 10 and accordingly in the construction shown it is preferably a ball 19 which may be a standard steel ball accurately made to roll in the hollow cylinder.

The use of the device depends upon visual observation of the movement of the ball within its supporting barrel 10 and accordingly the construction should suitably provide for such function. If desired the shell may be made of, for example, transparent plastic material and accordingly unbroken in its circumference. Preferably, however, as shown in Figs. 1 and 3 the shell is made of metal such as brass provided with a cut away observation opening 20 extending longitudinally thereof whereby the position of the ball 19 may be readily observed. With such a construction the shell will have a substantial flexibility radially and may be flexed open sufficiently to remove it or assemble it to the boss 14 of the abutment member 11 whereby the steel ball 19 and other means may be readily assembled in or removed from the barrel 10. If desired one or both edges of the tubular shell adjacent the longitudinal opening may be provided with scale markings 21 with which the position of the ball 19 may be related.

Fig. 3 shows the device applied to a vertical wall having spaced frame members 25 which may correspond to horizontal extending stringers or vertical studding arranged to support the flat wall surface 26 which may, for example, be a plaster surface applied to lathing 27. It is pointed out that the elements are not shown in normal accurate proportions in Fig. 3 but are shown in a manner more conveniently to illustrate the principles of the device and its use. The beam members 25, for example, may be ordinary studding having a dimension of 2 inches by 4 inches and spaced any normal distance apart such as 18 inches or 2 feet or however they might happen to be located in any particular wall construction. On the other hand the testing device shown may be relatively small as, for example, the barrel 10 need be no more than about 2 or 3 inches in length and adapted to accommodate a ball having a diameter of, for example, ½ or ¾ of an inch.

If the wall 26 is rapped sharply it will partake of a certain amount of deflection or displacement which will be at a maximum at the line A midway between the supports 25 and this displacement will be a lesser amount as the center lines B of the respective supporting members 25 are approached. The displacement is indicated by the curved line 28 which, of course, is greatly exaggerated in the drawing as to the degree of displacement which would normally take place from any normal blow struck by the fist of the operator.

The device is so arranged and proportioned that when the abutment end is pressed against a vertical wall the barrel 10 will not be perpendicular to the wall but will be inclined at a slight angle with respect to such perpendicular, or more importantly the barrel will be inclined at a small angle to the horizontal so that, in being applied to the vertical wall as shown, the ball 19 will normally assume a position at one end of the barrel. For example, in Fig. 3 the axis of barrel 10 is inclined downwardly to the right

away from the wall so that the ball normally remains at the outer or right end of the barrel as shown in Fig. 3. This is readily accomplished in the device shown by providing a tripod type of support in which one of the legs is of a different length than the other two. In other words the leg 12 is shorter than the legs 13, as heretofore described.

With the device applied to the wall as shown in Fig. 3, the wall is rapped sharply which may be done with the fist or a hammer or mallet. Under the flexing of the wall the inertia member 19 acquires a certain momentum which will carry it to some position such as that shown in dotted lines in Fig. 3. As heretofore noted this displacement of the ball 19 for blows of approximately equal degree will be at a maximum midway between the supporting members 25 and the displacement will decrease in amount progressively as the device is moved to successive positions nearer to a frame member 25 and a blow is struck for each position. By observing the extent of displacement of the ball 19 at successive positions along the line, one can readily locate the concealed supporting member. In other words the supporting member will be determined to be at the point of minimum displacement of the ball 19. For accurate and uniform results the device should be maintained in firm non-rocking engagement with the wall and the tripod type of wall engaging means is particularly advantageous in that respect.

It is, of course, characteristic of building constructions that some walls are more rigid than others. An important feature of the present device which provides compensation for such variation is that of being able to vary the inclination of the barrel 10 to vary the sensitivity of the device. When the device is used on a relatively rigid wall the inclination should be relatively slight to avoid the necessity of employing excessively heavy blows which would otherwise be necessary to displace the ball 19 a sufficient distance for visual observation. On less rigid or what may be termed flimsy walls the angle of inclination may be made more steep. The characteristic of being able to vary the inclination of the device is provided by the construction heretofore described of making the abutment end 11 rotatable with respect to the barrel 10 and providing a tripod support with one leg of a length different from the other two. In Fig. 3, with the shorter leg 12 at the lowermost position, the barrel 10 has the maximum inclination. With the inspection slot 20 maintained in the uppermost position as shown in Fig. 3, if the abutment end 11 is rotated, the inclination can be varied from the maximum shown to zero amount and in fact if the short leg 12 is rotated to the uppermost position, still retaining the inspection slot 20 in the position shown, the inclination can be adjusted to a maximum in the opposite direction in which the ball 19 occupies an extreme position to the left.

This feature of having the barrel 10 rotatable with respect to the abutment member 11 is of further advantage, particularly when the casing is of the opaque character shown with an observation slot 20 therein. For example, on a vertical wall if the device were being employed at a location below the level of the eyes it would be desirable to have the observation slot 20 at approximately its uppermost position as shown in Fig. 3. On the other hand if the device were being used over head it may be rotated into a

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position such that the observation slot 20 was in the lowermost position and of course the abutment member 11 rotated relative to the barrel 10 to provide the desired inclination of the latter.

Figure 3 particularly illustrates a vertical wall having spaced horizontal beams and the testing device would be moved progressively to positions up or down. If one were attempting to locate vertical studding and such studding were indicated by the members 25 in Fig. 3, then of course the testing device would be applied so that the axis of the tube 10 were inclined with respect to the plane of the paper.

The description thus far has been in connection with the location of supporting members in vertical walls. The device is likewise adapted, with a slight modification or addition of auxiliary elements, to the location of joists or other supporting frame members in horizontal walls such as ceilings or floors. In Fig. 4 it is shown applied to a ceiling. It will be apparent, however, that with the device extending vertically as shown, the inertia of the ball 19 would be too great such that a normal blow on the ceiling would not impart any noticeable displacement of the ball 19. This normal inertia, however, may be largely reduced and compensated for by the addition of, as shown, a compression spring 30 and an adjustable screw abutment 31. By selecting a spring of suitable strength and adjusting the screw 31 in the threaded opening 18 of the end member 17 the ball 19 may be made to rest normally very lightly on the upper end of the screw 31 whereby it is relatively sensitive to movement and rapping of the ceiling wall 32 will effect a substantial upward displacement of the ball 19 at points relatively remote from any joist 33, but decreasing in amount progressively as the device is moved over toward a joist. If desired the device may correspondingly be used in locating supporting joists or beams in floors. In that case the position of the spring and screw 31 are shifted to the other end, the screw 31 being threaded into the opening 34 provided in the base member 11. The effect of the slight inclination of the axis of the casing 10 by reason of the variation in the length of the legs of the tripod support would of course be negligible under the conditions of use just described.

For purposes of illustration the device has been described as applied to the locating of frame members in walls which are either substantially vertical or substantially horizontal. It will be understood, however, that it may be used for the same purpose on walls which are at an angle to both the horizontal and the vertical by an appropriate location and adjustment of the spring and abutment screw to render the response of the inertia ball sufficiently sensitive under the conditions of the particular case.

Since certain changes may be made in the above construction and different embodiments of the 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 drawing 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 device for locating frame members in hollow walls comprising an elongated hollow cylinder provided with end closures, a weight freely movable therein and a tripod abutment means at one end of said cylinder adapted to be engaged against the surface to be tested said abutment means having one leg of a length different from the other two to position the cylinder at an angle inclined from a perpendicular to the wall.

2. A device for locating frame members in hollow walls comprising an elongated hollow cylinder, a ball of substantial inertia freely movable longitudinally in said cylinder, said cylinder being of a character to render the position of the ball visible from the exterior, external abutment means at one end of said cylinder adapted to be pressed against the surface to be tested, and abutment means internally of said cylinder at the opposite end thereof to limit the movement of the ball in that direction, the parts being so proportioned and related that upon engagement of the abutment against a vertical wall the axis of the cylinder is inclined downwardly away from the wall surface at a small angle to the horizontal whereby a blow struck against the wall will cause the ball to move from the far end toward the wall a distance proportional to the amount of movement of the wall at that point and then return to the far end.

3. A device for locating frame members in hollow walls comprising, an elongated supporting member, an inertia element carried by said supporting member and adapted to be freely movable longitudinally thereof, a tripod abutment means for said supporting member located at one end thereof for engagement against a wall surface to be tested with said supporting member extending outwardly therefrom, and structural means internally of said cylinder at the opposite end thereof to limit the movement of the ball in that direction, said tripod abutment means being rotatably adjusable with respect to said supporting member and the axis of said supporting member being inclined at a small angle to the axis of the abutment means and likewise to the perpendicular to the plane of the outer ends of the tripod legs thereby to enable the angle of the axis of said supporting member with respect to said surface to be varied.

4. A device for locating frame members in hollow walls comprising, an elongated hollow supporting member, a ball of substantial inertia freely movable longitudinally of said supporting member, structural means associated with said supporting member for positively limiting the longitudinal movement of said ball in each direction, a tripod support for said member located at one end thereof for engagement against a wall surface to be tested with said supporting member extending outwardly therefrom, the longitudinal axis of said supporting member being at an angle to a perpendicular to the plane of the outer ends of the tripod legs and said supporting member being rotatably adjustable with respect to said tripod thereby to vary the direction of inclination of said supporting member with respect to the wall surface.

5. A device for locating frame members in hollow walls comprising, an elongated hollow casing provided with abutment means at one end adapted to be pressed against the surface to be tested, an inertia element freely movable longitudinally therein, a compression spring adapted to be located within said casing between an end thereof and said element and an adjustable stop for limiting the compression of said spring under the weight of said element when the device is arranged in a position wherein said element gravitates against said spring.

6. A device for locating frame members in hol-

low walls comprising a hollow elongated cylinder, a ball of substantial inertia freely movable longitudinally of said cylinder the latter having a longitudinal slot in the wall thereof for visual observance of the position of said ball, a tripod support at one end of said cylinder with the ends of the legs adapted to be engaged against the wall to be tested, means at the opposite end of said cylinder for limiting the movement of said ball in that direction, said tripod support having an axis inclined at a small angle to that of said cylinder and being rotatable thereabout whereby the direction of inclination of the axis of said cylinder with respect to the wall surface may be varied.

7. A device for locating frame members in hollow walls comprising, an elongated supporting member, a weight carried by said supporting member and adapted to be freely movable longitudinally thereof, structural means associated with said supporting member against which said weight is adapted to engage for positively limiting the longitudinal movement of said weight in each direction with respect to said member, and an abutment means for said supporting member located at one end thereof for engagement against a wall surface to be tested the parts being arranged such that the axis of the supporting member extends outwardly from the wall but inclined at a small angle with respect to the perpendicular to the wall surface when the abutment means is so engaged.

8. A device for locating frame members in hollow walls comprising an elongated hollow cylinder, a ball of substantial inertia freely movable longitudinally in said cylinder, a support at one end of said cylinder adapted to be pressed against

a wall surface to be tested and arranged and proportioned with respect to said cylinder such as to position the axis of the cylinder at a small angle with respect to the perpendicular to said surface, and abutment means associated with said cylinder arranged to be engaged by said ball and limit its movement in the direction toward the end of said cylinder opposite to said support.

9. A device for locating frame members in hollow walls comprising, an elongated supporting member, an inertia element carried by said supporting member and adapted to be freely movable longitudinally thereof, structural means associated with said supporting member for positively limiting the longitudinal movement of said element in each direction with respect to said member, and an abutment means for said supporting member located at one end thereof for engagement against a wall surface to be tested the parts being arranged such that the axis of the supporting member extends outwardly from the wall but inclined at a small angle with respect to the perpendicular to the wall surface when the abutment means is so engaged, said abutment means being rotatable about its axis with respect to said supporting means thereby to vary the direction of inclination of said supporting means with respect to the wall surface.

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