

June 21, 1949.

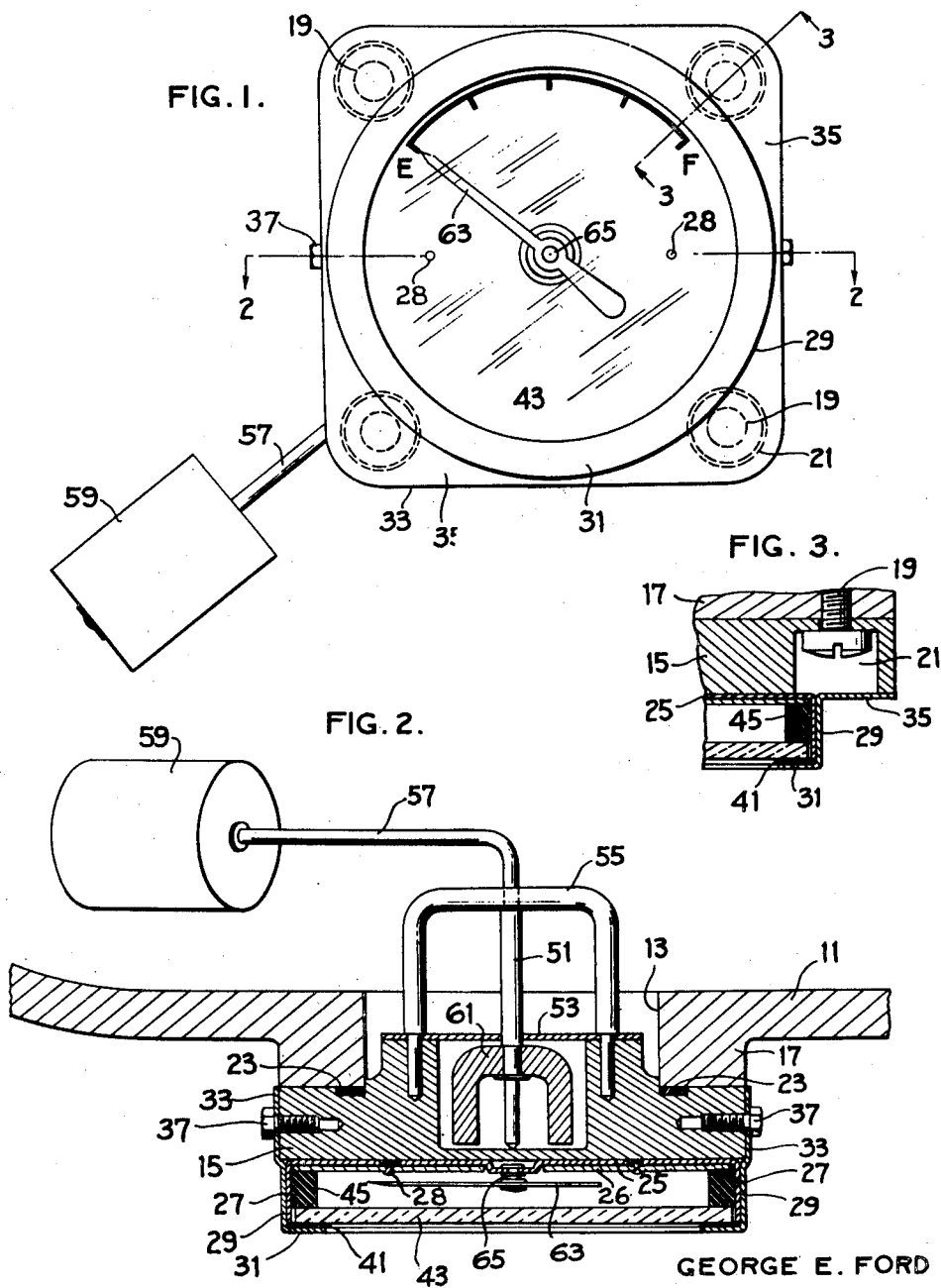
G. E. FORD

2,473,581

INDICATING INSTRUMENT WITH MAGNETIC DRIVE

Filed Dec. 4, 1945

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

FIG. 4.

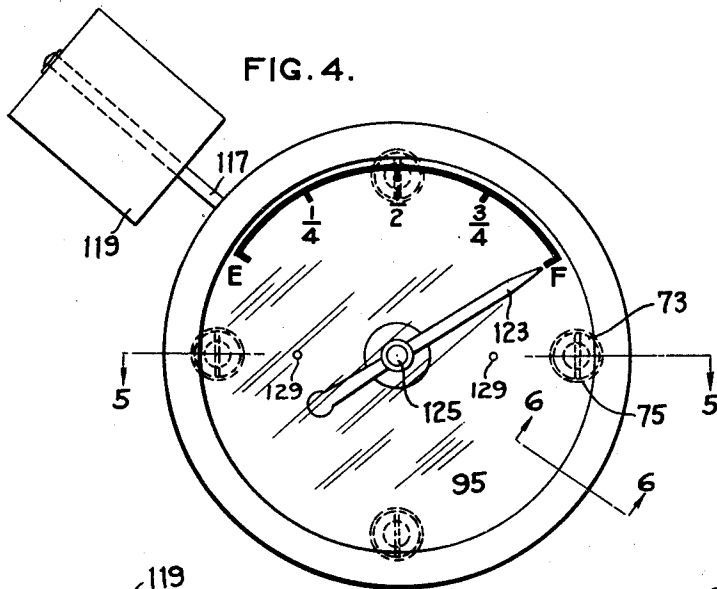


FIG. 6.

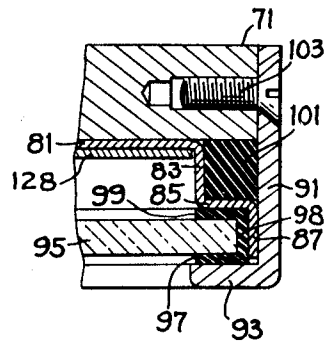


FIG. 5.

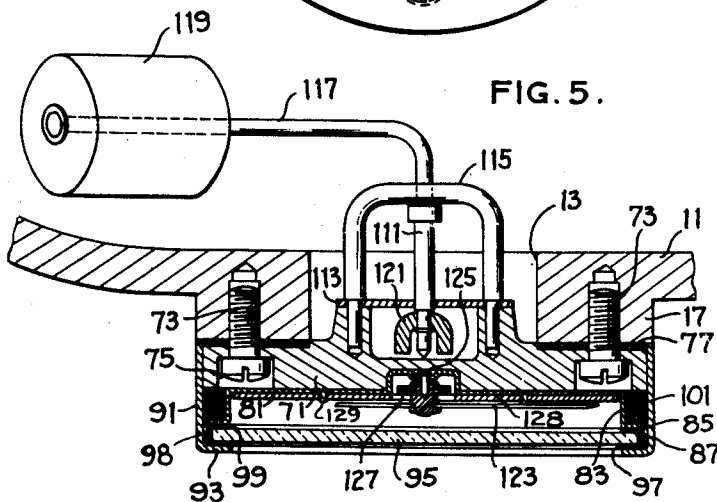
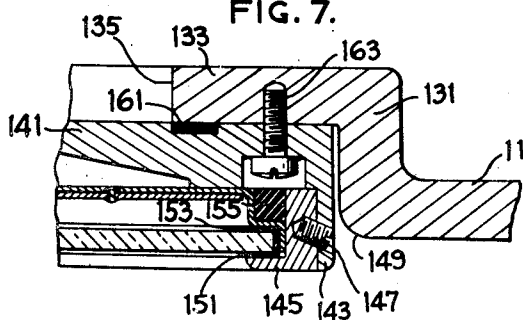


FIG. 7.



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INDICATING INSTRUMENT WITH MAGNETIC DRIVE

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9 Claims. (Cl. 177—327)

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The present invention relates to indicating instruments such, for example, as liquid level gauges and thermometers, and particularly to the construction of the casings of such instruments, and to the mounting and the sealing of such casings.

An object of the invention is the provision of an improved and more satisfactory casing construction, designed especially for a so-called flange mounting used on pressure vessels.

Another object is the provision of improved means for mounting the instrument casing on a tank or other article.

Still another object is the provision of an instrument casing so designed and constructed that the screws or bolts used in attaching the casing to its support are normally hidden from view, so that an inexperienced person is not tempted to loosen the mounting screws or bolts.

Still another object and in fact one of the major objects, is the provision of a flange-mounted casing so designed that the graduated dial may be of larger size in comparison to the size of the casing, than is possible with prior flange-mounted casings.

A further object is the provision of a casing so constructed as to prevent or greatly reduce the corrosion to which the attaching screws and other parts may be subjected under certain adverse conditions of use.

A still further object is the provision of an instrument casing so designed as to combine the advantages of neat and attractive appearance, with ease of installation, safety against accidental tampering and loosening, improved sealing against moisture, and maximum size of dial.

These and other desirable objects are accomplished by the constructions disclosed as illustrative embodiments of the invention in the following description and in the accompanying drawings forming a part hereof, in which:

Fig. 1 is a front elevation of an indicating instrument constructed in accordance with one embodiment of the present invention;

Fig. 2 is a transverse section taken substantially on the line 2—2 of Fig. 1;

Fig. 3 is a fragmentary transverse section taken substantially on the line 3—3 of Fig. 1;

Fig. 4 is a front elevation of an indicating instrument in accordance with a second embodiment of the present invention;

Fig. 5 is a transverse section taken substantially on the line 5—5 of Fig. 4;

Fig. 6 is a fragmentary section taken substantially on the line 6—6 of Fig. 4; and

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Fig. 7 is a fragmentary view similar to Fig. 6 showing a third embodiment of the invention.

The same reference numerals throughout the several views indicate the same parts.

The present invention is applicable to indicating instruments of various different kinds, such as liquid level gauges, thermometers, etc., and is here illustrated, for the sake of convenient example, in connection with a liquid level gauge intended to have a so-called flange mounting on a container or tank, a portion of which is shown at 11, certain operating parts of the gauge extending through an opening 13 in the tank, in front of which opening the gauge is mounted.

The gauge comprises a main base or mounting member 15 which, in the embodiment of Figs. 1-3, is in the form of a plate of generally square outline with rounded corners and which is held tightly against the mounting flange 17 of the tank 11, by means of four mounting screws 19 placed near the four corners of the member 15 and having their heads sunk in recesses 21 of the member, the shanks of the screws being threaded into the flange 17 of the tank. A gasket 23 interposed between the rear face of the member 15 and the front face of the flange 17, prevents seepage of liquid between these parts.

The plate 15 furnishes the base on which is mounted a cup-shaped case formed of a rear plate 25 having at its periphery a forwardly extending circular cylindrical flange 27. The plate 25 may itself constitute the dial plate carrying the indicia or graduations, but it is usually preferred to use a separate dial plate 26 lying against the front face of the plate 25, and fastened thereto as by means of rivets 28, these being preferably extruded rivets formed integrally with and extruded from the plate 25, in known manner. Embracing the flange 27 of the case is a bezel, the forward portion of which is made in the shape of a circular cylindrical flange 29 fitting snugly around the flange 27 and terminating at its forward end in an intumed annular flange 31. Flaring outwardly from the rear edge of the bezel flange 29 is a flat or plane web 35 integral with the flange 29 and of generally square shape with rounded corners, its outline being of the same size and shape as that of the base plate 15 so that the web 35 completely covers and hides those portions of the front face of the base 15 (and of the mounting screws 19) which lie outside of the outline or diameter of the bezel flange 29. At the mid points of two opposite sides of the bezel web 35 there are two rearwardly extending ears 33 which lie snugly against the sides of the base

plate 15 as seen in Fig. 2, and which are removably fastened to the base plate by bolts or screws 37 threaded into the base plate as shown.

A compression gasket 41 is interposed between the front flange 31 of the bezel and a transparent plate 43 of glass or the like, a second thicker compression gasket 45 is interposed between the transparent plate 43 and the dial plate 26. The case flange 27 has a tight press fit within the bezel flange 29, and in the initial assembly operation these parts are pressed together with sufficient force to compress the gaskets 41 and 45 to the desired extent, which gaskets are thereafter kept permanently under compression by the press-fit immovable relation of the parts 25, 27, to the parts 29, 31. The bezel flange 29 may be staked to the case 25, 27, if desired, to help to hold the case in place in the bezel. Thus the case 25, 27 and the bezel 29, 31 together with the gasket 41, the closure 43, and all parts between the parts 25 and 43, constitute a permanently sealed unitary assembly which can be placed on or removed from the base 15 at will, without in any way disturbing the relationship of the parts within the case and bezel, which parts at all times remain permanently sealed against access of dust, moisture, etc., regardless of whether the assembly remains on or is removed from the base plate 15.

Heretofore when an indicating instrument of generally square configuration has been arranged for flange mounting on a flange of a tank (such as the flange 17 of the tank 11) it has been customary to place the mounting bolts or screws in an exposed position at the four corners of the instrument, and then to make the bezel of the dial sufficiently small in diameter to fit inside these exposed holding bolts or screws. In the past, rather serious accidents have sometimes occurred when an inexperienced person, seeing the mounting bolts in full view, has attempted to loosen them, with the result that the high pressure inside the tank has sometimes blown the loosened gauge or instrument away from the tank with great force. Such accidents are obviated by the present improved construction.

The present improved construction does not attempt to fit the bezel inside the holding bolts or screws, but on the contrary makes the bezel sufficiently large to encompass and cover the holding screws or bolts. As seen from Fig. 1, the forward flange portion 29 of the bezel, which determines the available diameter of the dial plate, is so large that it overlies portions of the heads of the mounting screws 19, so that the location of the mounting screws is no longer a limiting factor as to the diameter of the dial. Moreover, the bezel, and particularly the web portions 35 thereof, overlie and completely hide the mounting screws 19, as seen from Figs. 1 and 3, so that the inexperienced person does not see the mounting screws at all and does not readily understand on mere inspection how the instrument can be removed from the tank on which it is mounted. Consequently, such person is not tempted to tamper with the mounting screws. Yet the experienced repair man can, after taking suitable precautions to assure safety, remove with little difficulty the screws 37 which hold the bezel, and then take the bezel off the instrument so as to obtain easy access to the mounting screws 19 when it is necessary to remove the instrument.

This present construction has the important advantages, first, of permitting the use of a dial of larger diameter than has heretofore been possible with a casing of a given size, and second, of

completely hiding the mounting bolts or screws so that an inexperienced person does not see them and is not tempted to loosen them, and third, of providing a more attractive smooth, modern, and "streamlined" appearance, and fourth, of providing protection for the heads of the mounting bolts or screws so that they are less likely to become corroded.

As above stated, this invention is applicable to instruments of different kinds. Merely for the sake of a convenient example, the invention is here illustrated in connection with a liquid level gauge, in which a shaft 51, having a bearing in a transverse bar 53 and yoke 55, is provided with a lateral arm 57 carrying a float 59 which floats at the surface of the liquid to be gauged. The rotary motion of the shaft 51 as the liquid level rises or falls, is transmitted to a suitable hand or pointer in any conventional manner, such as by the conventional magnetic drive embodying a U-shaped or horseshoe magnet 61 fixed to the shaft 51, and operating magnetically upon the pointer 63 which is magnetized (or which may have a separate bar magnet fixed to it) and which is rotatable on the stud 65 fixed to the plate 25 of the case. The wall of the member 15, between the magnet 61 and the pointer 63, is preferably of non-magnetic material. When the float 59 is in its lowest position, the magnet 61 holds the pointer 63 so that it points to the letter E (indicating "empty") on the dial plate 26, and as the float 59 rises, the magnet 61 causes the pointer 63 to travel around the dial, passing suitable graduations, until it reaches the point marked F (indicating "full"). This float and magnetic drive is illustrated merely as a convenient example of conventional operating mechanism, and may be replaced by any other operating mechanism, responsive to either liquid level, temperature, or other factors, without in any way altering the present invention, which is concerned with the manner of mounting the base plate 15 on the flange 17 and with the arrangement of the dial, casing, and bezel, rather than with any specific details of the driving mechanism.

In Figs. 4, 5, and 6 there is shown a second embodiment, indicating how the same principles of the invention may be applied to a flange mounted instrument of generally circular outline rather than of generally square outline. Here, as before, the tank on which the instrument is mounted is shown at 11, and is provided with an opening 13 surrounded by a flange 17 for receiving the instrument. The main base or mounting plate of the instrument is indicated at 71 and is of generally circular outline, being mounted on the flange 17 by any suitable number of bolts or screws 73 (four being here shown) having their heads sunk in recesses 75 in the front of the plate 71. A gasket 77 is interposed between the rear of the plate 71 and the front of the flange 17.

The cup-shaped case in this instance has a rear plate 81 from which a marginal flange extends forwardly as at 83, thence radially outwardly as at 85, and finally terminates in another forwardly extending portion 87. Closely embracing this latter portion 87 and having a tight press fit therewith is the circular cylindrical flange 91 of the bezel, the rear portion of which flange snugly but removably embraces the circular periphery of the base plate 71. At the forward edge of the bezel flange 91 is an annular flange 93 extending radially inwardly so as to overlie the margin of the transparent closure plate 95 of glass or other suitable material.

A suitable sealing gasket is interposed between the bezel flange 93 and the closure plate 95, also between the closure and the step or shoulder 85. Preferably this sealing is accomplished by using a single unitary gasket which is molded so as to be of U-shaped cross section embracing the periphery of the closure plate 95, and having one side wall 97 lying in front of the closure plate (between it and the bezel flange 93), a base web 98 lying against the peripheral edge of the closure plate (between it and the case flange 87), and a second wall 99 lying behind the closure plate (between it and the case step or shoulder 85). Behind the step 85, between it and the front face of the base plate 71, is another gasket 101 which is quite thick and completely fills this space, as shown in Fig. 6, this gasket being pressed tightly into the space between the flange 83 and the bezel 91. The bezel is removably held to the base plate 71 by a suitable number of screws 103 (Fig. 6) placed at intervals around the periphery of the bezel and extending through holes in the bezel and threaded into lateral openings in the plate 71. As in the embodiment previously described, the case, bezel, and transparent closure plate, when initially assembled with each other, are pressed together sufficiently tightly to place the sealing gasket 97, 98, 99 under adequate compression. Thereafter, due to the tight press fit of the case within the bezel, the structure remains permanently sealed against entrance of dust, moisture, etc., regardless of its attachment to or removal from the base plate 71. The holes for the attaching screws 103 are so placed that when the screws are tightened, they will tend to draw the bezel rearwardly, thus compressing the gasket 101 (which initially protrudes slightly beyond the adjacent rear face of the case 81) and providing a tight peripheral seal of the joint or junction between the base plate 71 and the case assembly. As in the previous embodiment, the bezel may be staked to the case, if desired.

In the flange mounted circular instrument casing construction which has heretofore been customary in this art, the mounting screws of the casing are fully exposed to view and the bezel is of sufficiently small diameter to lie inside the mounting screws. But with the present construction illustrated in Figs. 4-6 it is seen that, like the embodiment of Figs. 1-3, this new construction has the great advantages of completely covering and hiding the mounting screws (thus minimizing any tampering with them, and helping to protect them from access of moisture and consequent corrosion) and increasing the diameter of the dial so that the spacing of the mounting screws is no longer a limitation on the dial diameter, as well as providing a greatly improved and much neater appearance, compared to the appearance of prior indicating instruments wherein the mounting screws are fully exposed to view.

As mentioned in connection with Figs. 1-3, the instrument constructed in accordance with the invention disclosed in Figs. 4-6 may be of any kind, but is here illustrated for convenient example as a liquid level gauge embodying, as before, a rotary shaft 111 having a bearing in the cross bar 113 and yoke 115 and having a lateral arm 117 carrying the float 119. The horseshoe magnet 121 fixed to the shaft 111 operates the pointer or needle 123 rotatable on the stud 125 on the case plate 81, either by having the needle itself magnetized or by having a separate bar magnet 127 secured to the needle. The needle sweeps over suitable indicia or graduations as in-

dicated in Fig. 4, either placed directly on the front face of the case plate 81, or preferably placed on a separate dial plate 128 secured to the case plate by suitable means such as the rivets 129, preferably in the form of extrusion rivets formed integrally from the metal of the plate 81.

The same principles of construction may be applied to recess mounted or flush mounted instruments, as well as to those which are flange mounted. For example, there is shown in Fig. 7 a fragment of a tank 11 in which, instead of a forwardly extending flange on which the instrument is to be mounted, there is an inwardly or rearwardly extending flange 131 terminating in a flat radial or annular flange 133 surrounding the central opening 135. The instrument in this instance is mounted in the recess or pocket inside the flange 131, so as to be almost flush with the front wall of the tank 11. It is seen from Fig. 7 that the positions of the mounting plate and the bezel are somewhat reversed in this construction, the mounting plate being indicated at 141, and corresponding to the mounting plate 71 in the previously described embodiment, except that the mounting plate is provided with an integrally formed forwardly extending marginal flange 143. The bezel 145 here lies inside the flange 143, instead of surrounding the mounting plate as in the previous embodiment, and the bezel is held in place by screws 147 arranged at intervals around the periphery of the flange 143, and inclined at an angle as shown, both to obtain easier access to the screws 147 past the corner 149 of the tank recess, and also to obtain a rearward tightening action on the bezel as these screws are tightened, thus causing adequate compression of the gasket 155, which may be identical with the gasket previously described. As before, the case is a tight press fit into the bezel, permanent sealing being attained by keeping under compression the side walls 151 and 153 of the U-shaped gasket embracing the edge of the transparent closure plate. The gasket 161 seals the rear of the base plate or mounting plate 141 to the tank flange 133. All other features of the construction shown in Fig. 7 may be the same as the construction of Figs. 4-6, and need not be further discussed. As before, the mounting screws 163 are completely hidden from view, and the spacing of these screws is no longer a limiting factor in the determination of the dial diameter.

In addition to the already mentioned advantages of enabling the use of a larger dial, and of covering the mounting screws or bolts for increased safety, for better appearance, and for increased protection against corrosion, the construction of the present invention has the further advantage of enabling improved sealing of the parts. Gauges and other indicating instruments are frequently used in locations where they are subjected to salt spray or to other liquids or vapors which might cause excessive corrosion, either of the parts of the indicating instrument itself, or of the mounting screws or bolts. In the construction shown, for example, in Fig. 5, seepage of moisture from the exterior of the instrument casing toward the threaded shanks of the mounting screws 73 is prevented by the gasket 77, while the gasket 101 prevents seepage of moisture toward the heads of these screws, even if moisture attempts to seep from the back of the instrument forwardly through the joint between the bezel 91 and the margin of the base plate 71. Thus the mounting screws are protected against

corrosion even under extremely adverse conditions of constant exposure to salt spray or the like. The only moving parts of the instrument which are not inside the tank 11 (and thereby protected from external salt spray or the like) are the needle or pointer 123 and its magnet 127, which are protected by the gasket 97, 98, 99 effectively and permanently sealing against moisture the chamber formed between the case plate 81 and the transparent closure 95. This latter seal is not disturbed by removing the case and bezel assembly from the base plate when repairs or inspection are necessary.

The same effective permanent sealing of the needle is achieved by the gasket 151, 153 in the construction shown in Fig. 7, and by the gaskets 41 and 45 in the construction shown in Figs. 2 and 3. In these two constructions, if the instrument is to be subjected to such severe conditions that further protection of the mounting screws is desired (in addition to the protection already afforded by having the screws completely covered and enclosed) then the gaskets 23 and 101 can readily be made wider in a radial direction (like the gasket 77 in Fig. 5) so that the mounting screws pass through holes in the gasket, thus protecting the mounting screws against seepage attempting to come in behind the main base or mounting plate.

Moreover, the same stepped construction of the edge of the case, as shown in Figs. 5 and 6, together with the sealing gasket 101, can be used with an instrument of generally square outline, as in Figs. 1-3, just as well as in an instrument of generally circular outline, as in Figs. 4-7, whenever it is anticipated that the instrument will be subjected to excessive moisture, spray, etc., and will require especially good sealing.

It is seen from the foregoing disclosure that a construction is provided which admirably fulfills the above-mentioned objects of the invention. It is to be understood that the foregoing disclosure is given by way of illustrative example only, rather than by way of limitation, and that without departing from the invention, the construction may be varied within the scope of the appended claims.

What is claimed is:

1. An indicating instrument including a relatively thick base member having an imperforate central portion, magnetic driving means mounted on said base member on the rear of said imperforate portion, a plurality of fastening elements extending through said base member for mounting said member on a support, said fastening elements having tool-receiving heads sunk into the thickness of said base member and accessible at the front thereof, a transparent plate in front of said base member, and a bezel surrounding and retaining said transparent plate and having portions extending rearwardly in external overlapping and embracing relation to the lateral edges of said thick base member to support said bezel from said base member, said bezel at least partially overlying and hiding said fastening elements, and magnetically responsive indicating means mounted within said bezel and detachable from said base member as a unit with said bezel when said bezel is detached from said base member.

2. An indicating instrument including a relatively thick base member having a plurality of openings therethrough near the margins thereof and having an imperforate central portion, said openings each having a larger diameter at its front than at its rear end and being adapted to

receive screw threaded fastening elements inserted from the front of said base member for mounting said member on a support, magnetic driving means mounted on said base member on the rear of said imperforate portion, a case member removably mounted in front of said base member, a transparent plate positioned in front of said case member, magnetically responsive indicating means mounted within said case member, and a bezel surrounding and retaining said transparent plate and case member, said case member and bezel together overlying and hiding said openings, said bezel having portions extending rearwardly in external overlapping and embracing relation to the lateral edges of said thick base member to support said bezel from said base member.

3. A construction as described in claim 2, in which said case member, transparent plate, and bezel are permanently sealed to each other and are placeable as a unit on and removable as a unit from said base member.

4. An indicating instrument including a main member to be mounted on a support, said member having a central portion which is imperforate and having a plurality of openings therethrough adjacent the margins thereof, each opening having a larger diameter at its forward end than at its rear end and being adapted for receiving a headed fastening element with the head thereof sunk below the front face of said member, magnetic driving means mounted on the rear side of said main member, a case plate and a transparent plate mounted in front of said member, magnetically responsive indicating means mounted between said case plate and said transparent plate, and a bezel mounted on said member and embracing said case plate and transparent plate to hold them in cooperative relation to said member, the maximum lateral dimensions of said bezel being greater than the maximum diametrical space between said openings so that said bezel at least partially overlaps and covers said openings.

5. An indicating instrument including a main member to be mounted on a support, said member having a central portion which is imperforate and having a plurality of openings therethrough adjacent the margins thereof, each opening having a larger diameter at its forward end than at its rear end and being adapted for receiving a headed fastening element with the head thereof sunk below the front face of said member, magnetic driving means mounted on the rear side of said main member, a case plate and a transparent plate mounted in front of said member, said case plate and transparent plate having a generally circular outline, magnetically responsive indicating means mounted between said case plate and said transparent plate, and a bezel mounted on said member and having a forwardly extending generally circular cylindrical portion for surrounding the edges of said case plate and transparent plate to hold them in cooperative relation to said member, said generally circular cylindrical portion of said bezel having an external diameter greater than the diametrical space between said fastening-receiving openings in said member so that said bezel at least partially overlaps and covers said openings.

6. A construction as described in claim 5, in which said case plate has a tight press fit within said bezel permanently retaining said case plate and said bezel in cooperative relation to each other.

7. An indicating instrument comprising, in

combination, a first unit and a second unit, said first unit including a base member adapted to be mounted against the front face of a support, said base member having a plurality of openings therethrough near its marginal edges, each opening being of larger diameter at its forward end than at its rear end and being adapted to receive a headed fastening member inserted in the opening from the front and extending rearwardly from said base member to fasten said base member to a support, said first unit further including a shaft extending rearwardly from said base member and a magnet mounted on said shaft near the forward end thereof, said second unit including a casing, a transparent closure plate for the front of the casing, a sealing gasket interposed between the casing and said closure plate, a bezel having a front flange overlying a portion of the front face of said closure plate and having a side wall embracing a side wall of said casing and having a tight fit thereon to retain said casing, closure plate, and bezel in sealed relation to each other, said bezel having a rearwardly extending flange lying against a surface of said base member, screw threaded means threaded laterally into said base member and engaging said rearwardly extending flange of said bezel to hold said bezel in cooperative relation to said base member, and a magnet-responsive pointer movably mounted within said casing, said second unit being detachably mounted on the front of said first unit and having such lateral dimensions as to overlie and hide the forward ends of said openings through said base member of said first unit.

8. An indicating instrument comprising, in combination, a first unit and a second unit, said first unit including a base member adapted to be mounted against the front face of a support, said base member having a plurality of openings therethrough near its marginal edges, each opening being of larger diameter at its forward end than at its rear end and being adapted to receive a headed fastening member inserted in the opening from the front and extending rearwardly from said base member to fasten said base member to a support, said first unit further including a shaft extending rearwardly from said base member and a magnet mounted on said shaft near the forward end thereof, said second unit including a casing, a transparent closure plate for the front of the casing, a sealing gasket interposed between the casing and said closure plate, a bezel having a front flange overlying a portion of the front face of said closure plate and having a side wall embracing a side wall of said casing and having a tight fit thereon to retain said casing, closure plate, and bezel in sealed relation to each other, said bezel having a rearwardly extending flange lying against a surface of said base member, screw threaded means threaded laterally into said base member and engaging said rearwardly extending flange of said bezel to hold said bezel in cooperative relation to said base member, and a magnet-

responsive pointer movably mounted within said casing in position to be influenced by said magnet of said first unit, said second unit being detachably mounted on the front of said first unit and having such lateral dimensions as to overlie substantially the entire front face of said first unit and to cover and hide the forward ends of said openings through said base member of said first unit.

9. A liquid level gauge comprising, in combination, a first unit and a second unit, said first unit including a base member adapted to be mounted against the front face of a support, said base member having a plurality of openings therethrough near its marginal edges, each opening being adapted to receive a headed fastening member inserted in the opening from the front and sunk below the level of the front face of said base member and extending rearwardly from said base member to fasten said base member to a support, said first unit further including a float-controlled shaft extending rearwardly from said base member and a magnet mounted on said shaft near the forward end thereof, said second unit including a casing, a transparent closure plate for the front of the casing, a bezel having a front flange overlying a portion of the front face of said closure plate and having a side wall embracing a side wall of said casing and having a tight fit thereon to retain said casing, closure plate, and bezel in sealed relation to each other, said bezel having a rearwardly extending flange lying against a surface of said base member, screw threaded means threaded laterally into said base member and engaging said rearwardly extending flange of said bezel to hold said bezel in cooperative relation to said base member, and a magnet-responsive pointer movably mounted within said casing, said second unit being detachably mounted on the front of said first unit and having such lateral dimensions as to overlie and hide the forward ends of said fastening members in said openings through said base member of said first unit.

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