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ARTIFICIAL HORIZON

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FIG. 1.

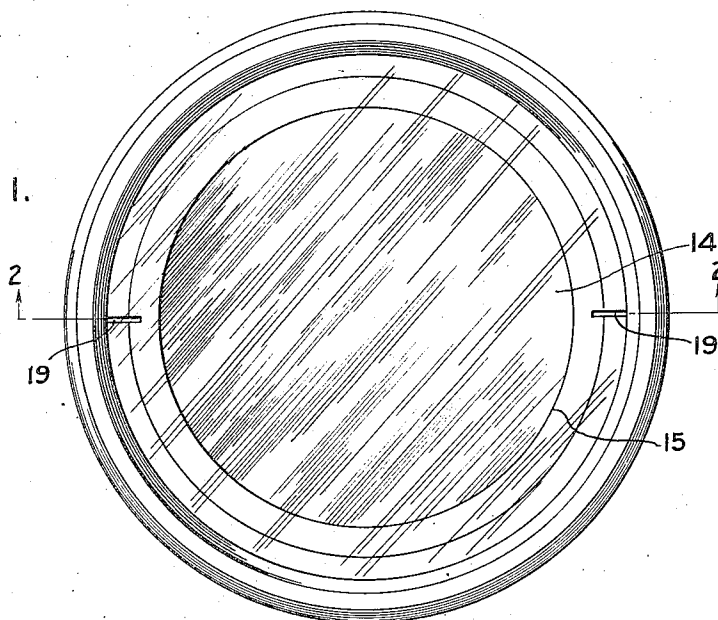
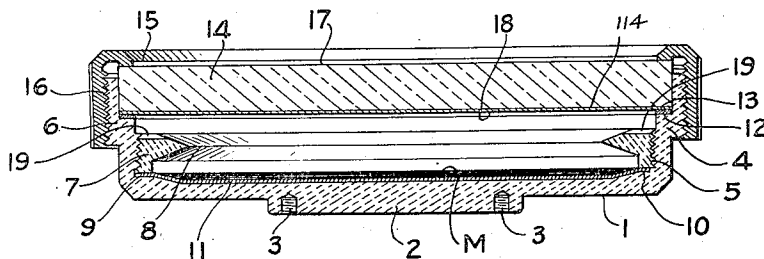


FIG. 2.



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ARTIFICIAL HORIZON

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This invention relates to artificial horizons of a type which may be permanently enclosed in a holder. One object of my invention is to provide an artificial horizon utilizing a pool of mercury as a reflector and to provide a means for keeping the mercury clean. Another object of my invention is to provide an artificial horizon comprising a holder, most of the parts of which are inert towards mercury so that the mercury cannot be contaminated thereby. A still further object of my invention is to provide an artificial horizon which can be occasionally opened for cleaning if desired and one in which there should be practically no loss of mercury during the use of the artificial horizon. Another object is to provide a means for reducing the surface tension on a pool of mercury so that substantially the entire surface thereof may be used as a reflector. Other objects will appear from the following specification the novel features being particularly pointed out in the claims at the end thereof.

Coming now to the drawing in which like reference characters denote like parts throughout:

Fig. 1 is a top plane view of an artificial horizon constructed in accordance with and embodying a preferred form of my invention;

Fig. 2 is a section taken on line 2—2 of Fig. 1.

In navigation and in position-finding instruments it is often desirable to provide an artificial horizon. In the past, pools of mercury have been used to provide upper reflecting surfaces which will assume horizontal positions and which can therefore be used as artificial horizons. Usually the artificial horizons have been unsatisfactory because it has been customary to provide open cups or containers into which mercury may be poured from a container before use and from which the mercury is returned to its container after use. Because of the nature of mercury it is difficult to control, difficult to keep clean, and difficult to handle in an open container. Attempts have been made to produce a wholly-enclosed mercury artificial horizon to overcome these usual difficulties, but so far as the applicant is aware these attempts have not been satisfactory for various reasons. One of these reasons is that mercury readily becomes dirty by attacking most metals with which it may come in contact, and it has been usually necessary to provide an extremely large pool of mercury to provide a reasonable area which would lie in a plane because of the high surface tension of the mercury.

I have overcome the usual difficulties in handling mercury for artificial horizons by providing a holder for a metallic cup which is made of a

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material that will readily amalgamate with mercury and yet is a material that has almost infinitely low solubility in mercury so that the surface tension of the mercury is reduced to such an extent that practically the entire pool of mercury may lie in a plane and only the extreme edges will be slightly affected by surface tension. By masking off these non-plane portions of the pool of mercury, I provide a large visible area which can be utilized as a reflector. I also provide a holder and all parts of the artificial horizon except the mercury holding cup of a material which is inert towards mercury so that the mercury cannot be contaminated thereby.

Referring to the drawing where a preferred form of my invention is shown, the artificial horizon may consist of a holder 1 which may have a flat portion 2 provided with threaded apertures 3. This enables the artificial horizon to be attached by screws to a suitable support which can be leveled by any suitable mechanism. The holder 1 is provided with an upstanding annular flange 4 threaded on the inside at 5 and on the outside at 6.

The threaded portion 5 is for supporting a ring-like mask member 7 which includes a pair of inwardly tapering walls meeting at 8 and constituting a mask which limits the view of a pool of mercury M when viewed through a window covered with a plane sheet of glass 14.

The glass 14 should have faces 17 and 18 which are parallel to within about one second of arc. The window can be made of a borosilicate crown glass if desired. The window 14 may be rested on a gasket 13 supported by the shoulder 12 of the holder 1 by means of an annular member 16 having a threaded connection with the thread 6 of the holder 1.

The gasket 12 should be made of a material which is insoluble in and is inert towards mercury, I have found that Vinylite is a desirable material to use.

One of the most important features of my invention is the way the pool of mercury M is carried in the holder 1. I provide a metal cup 11, the major portion of which lies in a plane extending up a slight incline near the periphery. A pool of mercury M is positioned in the cup which is held in place by means of the lower edge of the masking ring 7. This may be turned on the thread 5 by means of a suitable tool or spanner wrench, entering the notches 19 until the cup 11 is clamped in place.

As above pointed out, the cup 11 must be made of a material which will readily amalgamate with

the mercury and of a material which has an exceedingly low solubility in mercury. I have found that platinum successfully fills these requirements. In assembly the surface of the platinum cup 11 may be amalgamated with mercury either by using metallic sodium as a scavenging agent or by physical means. This reduces the contact angle between the mercury and the platinum to nearly zero. The mercury will therefore flow smoothly and evenly over the surface of the platinum cup 11. It will readily produce a plane surface even though the depth of the pool of mercury is extremely small. I have found that the depth of the pool need not be greater than a millimeter or even somewhat less. This is desirable because it reduces the trouble which results from vibration waves in a deeper pool of mercury. The platinum should be refined and substantially free from silica and other impurities.

It is also possible to improve the operation of my artificial horizon by the addition of a light coat 114 of sputtered platinum to the underside of the window 14 so as to render the glass surface electrically conductive and so as to prevent the accumulation of charges which under certain conditions tend to destroy the flatness of the surface of the pool of mercury M.

My instrument is extremely simple to use. The parts are readily assembled and the pool of mercury M is permanently enclosed in the holder. Thus there is no liability of spilling the mercury, and since there are no materials which can be attacked or dissolved by the mercury it should remain clean almost indefinitely. However, it is possible by merely unscrewing the retainer ring 15 to remove the glass plate 14 and clean or renew the mercury as well as other parts of the artificial horizon. It is expected, however, that such cleaning and renewals will be required only after long and continued use, for experiments indicate that there is little if any tendency for the mercury to become contaminated in the holder described above.

I have found that the holder 1 can be readily formed from any one of the numerous types of plastic materials which are inert towards mercury, such as polystyrene, Plexiglass or other like materials. I have found that platinum is the most satisfactory material tried to date for carrying the pool of mercury, but probably other materials such as rhodium might prove satisfactory. It is desirable that the material used should have the properties of providing a surface which will amalgamate with the mercury and yet the material should have the lowest possible solubility in mercury, in order to produce the desired results.

If the artificial horizon is carried or moved to positions other than the substantially horizontal position shown in Fig. 2, the mercury will collect beneath the masking flange 8 and the platinum cup 11 except when the artificial horizon is tilted toward a nearly vertical position in which case the mercury may flow about the flange 8 and against the underside of the glass window 14. This will do no harm. The material of which the mask 7 and the holder 1 is made as well as the material of which the gasket 13 is made are all inert with respect to mercury so that the mercury will not attack any of these materials. It

will also not attack the glass window 14. When the artificial horizon is again leveled, the mercury will later flow back into the cup 11 and will again form a smooth plane surface. Because of the reduction in the contact angle between the mercury and platinum substances, substantially the entire pool of mercury may be used as a reflecting surface and only the extreme edges of the pool contacting with the inclined edges of the cup 11 will lie in a non-higher plane condition. However, since this portion of the pool is masked off by the mask flange 8, it is not visible to an operator, so that the entire visible portion of the pool of mercury M may be utilized.

While I have described a preferred embodiment of my invention in detail and while I have described preferred materials of which my artificial horizon may be constructed, it is obvious that other materials may be found which are suitable, and I claim as within the scope of my invention all such forms as may come within the scope of the appended claims.

I claim:

1. An enclosed artificial horizon comprising a cup made of platinum having an upwardly and outwardly extending flange, a holder for the cup shaped to fit the cup and including an upwardly extending flange having threads thereon, an annular member including threads engaging the threaded flange and including a rim engaging the outwardly extending flange of the cup to hold it firmly in position and including walls extending inwardly and over the upwardly and outwardly extending cup flange, a thin layer of mercury in the cup, the marginal portions of the pool lying beneath the inwardly extending wall of the annular member, a transparent window carried by the cup holder flange and spaced above the mercury, and an annular threaded ring for holding said window in place by engaging threads on the cup holder.

2. An enclosed artificial horizon comprising a shallow cup made of platinum having an upwardly and outwardly extending flange, a holder for the cup including a bottom wall shaped to receive and support the platinum cup and its upwardly and outwardly extending flange, and upwardly extending threaded flange on the holder, an annular masking member threaded to the threaded flange and including a rim engaging the outwardly extending flange of the cup to hold it firmly in the cup holder, the annular masking member extending inwardly and over the upwardly and outwardly extending cup flange, a thin mercury layer of mercury in the cup, the marginal portions of which lie beneath the annular masking member, a transparent window spaced from the annular masking member and mercury, and means for holding the window in sealed relation to the cup holder whereby the mercury is normally retained sealed in the container and beneath the annular masking member.

3. An enclosed artificial horizon as defined in claim 2 characterized by the annular masking member and the cup holder between the transparent window and platinum cup being so shaped that the mercury will immediately flow into the cup when the artificial horizon is placed in a horizontal position of use.

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