

MURPHY'S PATENT.
Automatic Depthometer.

By Leonard MURPHY.

The means of indicating the depth of liquids in distant vessels may be classed under three heads as follows : —

1. Mechanical Indicators.
2. Electrical Indicators.
3. Pneumatic Indicators.

1. The Mechanical Indicators consist chiefly of a float resting on the surface of the liquid, the depth of which is to be indicated, connected by means of a chain passing over pulleys to a sliding weight outside the vessel. The weight moves up and down a fixed scale and thus shows the approximate depth of liquid in the vessel to which it is attached. This type of Indicator is limited by friction on the distance over which it can be used, it can rarely be seen at night when directly attached to the outside of a tank, and is often put entirely out of action by frost. Rust and exposure limit its period of usefulness.

2. The Electrical Indicator while suitable for reading at considerable distances depends also in most cases on the action of a float and therefore subject to many of the troubles incidental to the mechanical gauge. In addition, the parts are delicate and cannot be sufficiently protected, while in the case of inflammable liquids there is always the risk that a spark may cause fire or explosion, and for this reason that type of indicator is barred from use in many cases.

3. The Depthometer (Pneumatic Indicator) is the only instrument which ensures accurate readings at a reasonable distance with absolute safety and continuous reliability.

The basic principle of the Depthometer is the production of a hydrostatic balance between the liquid in the tank and an indicating instrument such as a liquid manometer or a sensitive Dial Gauge through the medium of a small air pipe (containing air only).

Installation of an instrument is simple : —

The open end of the air pipe is lowered from the top of the vessel — the contents of which is to be indicated — till it reaches the bottom where it is secured in position.

The air pipe is then led, independent of level, above below or in line with the vessel, to the position where the reading is required, and is then attached to the indicating instrument, a branch on the air pipe close to the indicating apparatus is connected with an air compressor by means of which air is forced into the air pipe until all the liquid is driven out of the immersed end of the air tube followed by any excess of air. It will then be found that the column of liquid in the indicating instrument exactly corresponds with the depth of liquid in the vessel if similar liquids are used in each. In other words, a hydrostatic balance has been produced which is not altered by the addition of more air into the air pipe. A few strokes of the compressor produces this result each time an accurate reading is required.

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The Automatic Depthometer.

The most recent development of the Depthometer is the introduction of an Automatic system for the constant supply of air to each Indicator or series of Indicators, thus maintaining an accurate reading on every Indicator connected day and night, and obviating the necessity of using the compressor as heretofore each time a reading is required.

This development has been rendered practical by the almost universal introduction of compressed air supplies in garages, on board ship, and in most factories, as well as by the reduced cost of small air compressing units for use with the Depthometer when a compressed air supply is not otherwise available.

The simplicity of the Automatic Depthometer is obvious as will be seen from the Diagram which shows a rectangular air chamber laid on or attached to the bottom of each vessel connected to this system.

This air chamber is open at its base which has a serrated edge to ensure free access to the contents of the liquid in the vessel. From the top of the immersed Air Chamber a large bore pipe is taken out through the top of the vessel, and then extended by means of small bore tubes to any distant point where the Indicator is required, and is there connected to a Dial Gauge or Liquid Column Indicator as selected.

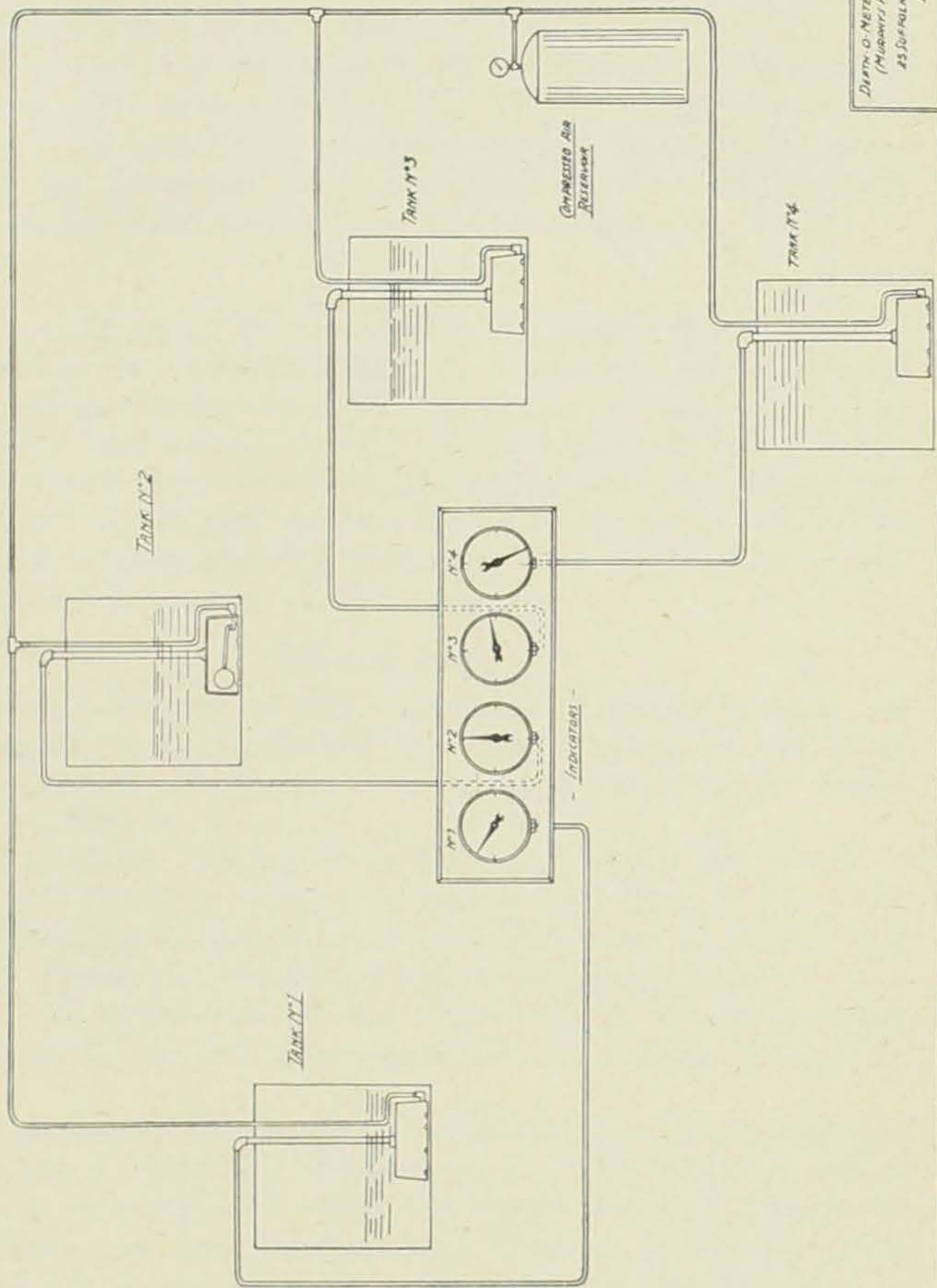
An Air Pipe is next taken from the nearest source of compressed air supply (see Diagram) and passing in through the top of the vessel is connected to the Air Chamber, inside which the end of the compressed air pipe is attached to a ball cock which at its lowest position cuts off the air, and on rising releases it, allowing the air to flow into the Air Chamber.

The action of the Automatic Depthometer can now be visualised. —

While the Vessel is empty the Ball Cock in the Air Chamber on the air supply pipe is at its lowest position and **no compressed air can escape**. The indicating gauge stands at Zero showing the vessel to be empty. Next, in the course of ordinary usage, the vessel is partly filled with liquid, it flows over the bottom of the vessel and some of it passes through the serrations of the rectangular air chamber, rising simultaneously inside and outside. In a short time sufficient liquid will have entered the air chamber to float the ball of the air cock, causing the latter to open and admit air from the air reservoir. This air enters the Air Chamber, but having no means of escape accumulates and creates pressure causing the Indicating Gauge to rise, it then expels the liquid which had previously entered the Air Chamber till there is sufficient liquid left within to support the ball float. The Ball Float in falling again cuts off the air supply or is kept partly open while the vessel is being filled. The gauge reading advancing with each addition till the vessel contains the quantity of liquid intended for it. This point having been reached the Indicating Gauge will cease to rise and will continue to show the exact depth of liquid in the vessel upon the basis of the hydrostatic balance established between the liquid in the vessel and the air in the immersed Chamber which will be full of air at the pressure of the liquid surrounding it, the **Ball Cock** will rest at its lowest position once more, closing off the air supply and preventing further use of air till again required by the Indicator. It is at this point that the outstanding merit of the Automatic Depthometer is demonstrated, as no other Hydrostatic air connected gauge will maintain its reading continuously without attention, owing to contraction of the air due to the fall of surrounding atmospheric air temperature, absorption of air, or slight air leakage from the Apparatus as a whole.

All these causes of error are provided for and corrected in the Automatic Depthometer by the ball float which remains

— *DIAGRAM SHOWING AUTOMATIC DEPTHOMETER AS APPLIED TO A SERIES OF TANKS FOR SHIPPING FACTORIES WELLS, ETC.* —
 (PATENT N° 327916)



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in a state of balance, and on the slightest difference of pressure opens the air cock and allows the entrance of sufficient air to restore that lost by contraction or the loss caused by absorption or leakage.

Discharge of liquid from vessel.

On the discharge of liquid from the vessel the indicating column of dial gauge follows the fall of liquid within the vessel, and the surplus air enclosed escapes through the serrations of the immersed Air Chamber, so that an accurate reading is obtained throughout the operation.

Shipping.

Of the many uses on board ship for which the Automatic Depthometer is available such as Fuel Oil Tanks, Water Tanks, Ballast Tanks, etc., one of the most interesting is its use for load line measurements. A pair of these instruments attached to sea cocks fore and aft, and another pair connected to port and starboard, enable the trim of the vessel to be ascertained, and in addition give the **actual tonnage** of Cargo, Coal or Oil taken on or discharged.

Plimsol Line.

A special feature of the Automatic Depthometer is its arrangement for giving **Board of Trade readings of the Load Line**, no matter what water, fresh, salt, or brackish, the vessel may be loading in.

Thus a vessel loading in a Harbour where the water is fresh in the morning owing to a heavy river flow, at low tide, may be floating in salt water in the afternoon when the tide returns. These are conditions which frequently lead to overloading and immersion of the Plimsol Line as can be seen from the many successful prosecutions of Captains of Trading Vessels .

The Automatic Depthometer however compensates all day long for these variations of the density of the water in which the ship is floating, and when the vessel leaves the Harbour and reaches true salt water it will float at its correct mark if loaded according to the readings on the Depthometer.

In addition, this instrument without attention causes a bell to ring when the true Plimsol Mark is reached even though in fresh water that mark will be immersed.

Thus the utmost safety for Vessel and Crew is attained by the use of this Automatic Depthometer.