Sept. 15, 1942. J. LAURENCELLE 2,295,957

DEVICE FOR DETERMINING ELEVATIONS AND LEVELS

Filed April 7, 1941 2 Sheets-Sheet 1

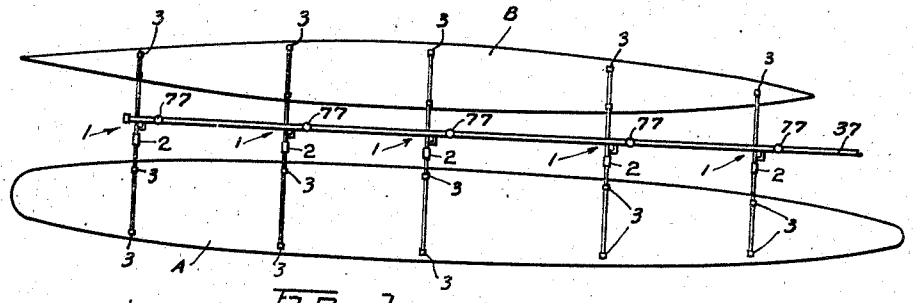


Fig. 1.

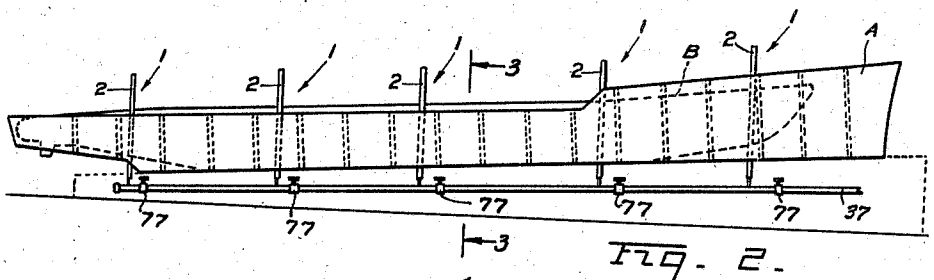


Fig. 2.

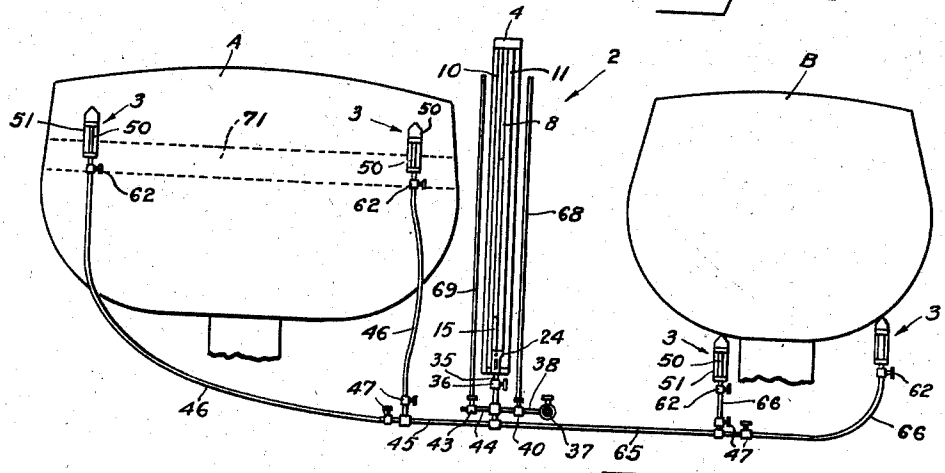


Fig. 3.

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DEVICE FOR DETERMINING ELEVATIONS AND LEVELS

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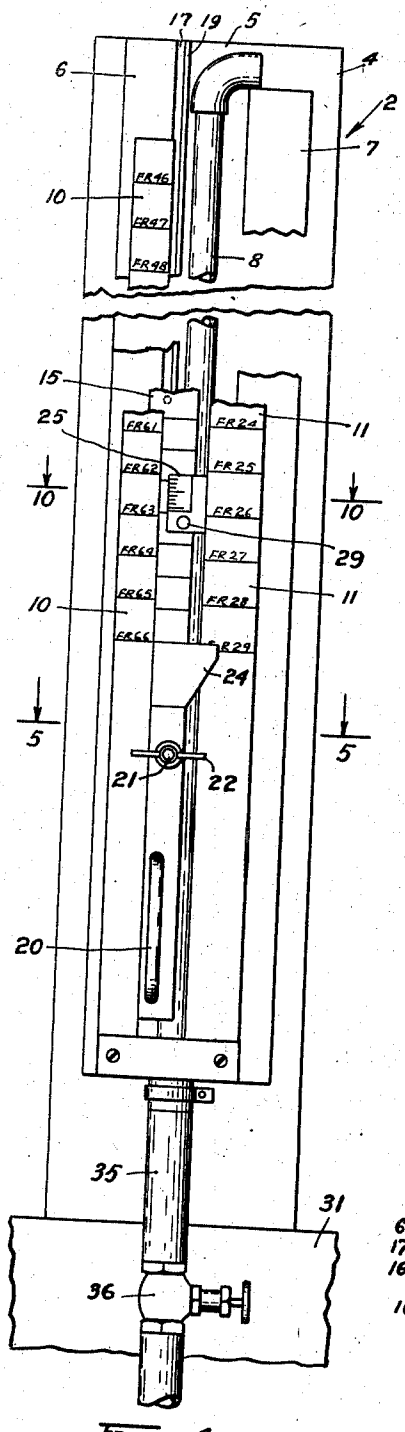


Fig. 4.

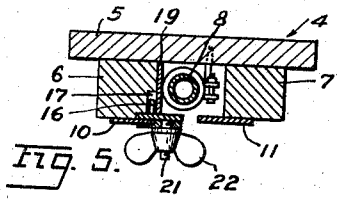


Fig. 5.

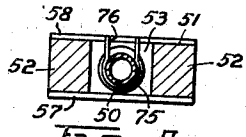


Fig. 8.

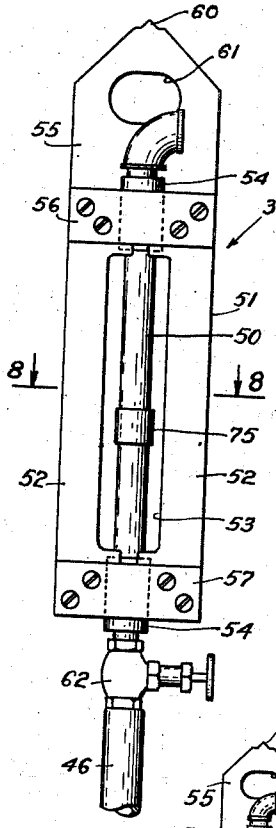


Fig. 6.

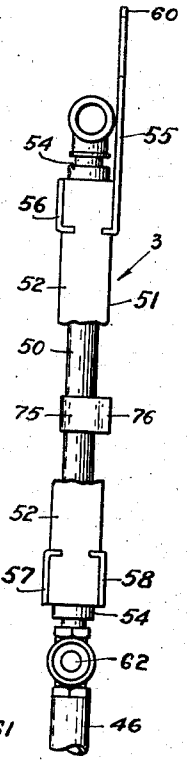


Fig. 7.

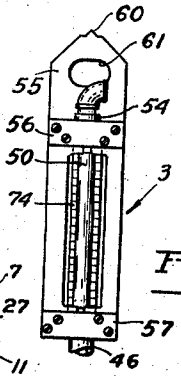


Fig. 9.

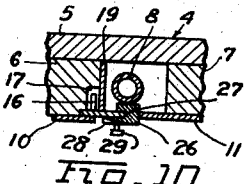


Fig. 10.

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UNITED STATES PATENT OFFICE

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DEVICE FOR DETERMINING ELEVATIONS AND LEVELS

John Laurencelle, Vallejo, Calif.

Application April 7, 1941, Serial No. 387,155

5 Claims. (Cl. 33—209)

This invention relates to a device for determining elevations and levels.

The object of this invention is to provide a device of the type described whereby the elevations of various parts of a structure may be easily determined and checked up without doing the actual measuring.

Another object of this invention is to provide a device of the type described in which all the elevations of the various parts of the structure are calculated and marked on a master board, whence they are transferred by hydraulic means to the points the elevation of which is desirable to determine or to check up.

Still another object of this invention is to provide an inexpensive and reliable device of the type described which is easy to operate and maintain, and which gives accurate, speedy and foolproof readings of the elevation of various parts of a structure.

One embodiment of the invention is illustrated in the accompanying drawings wherein—

Fig. 1 is a diagrammatic plan view showing two hulls and a general arrangement of the device constructed in accordance with the teaching of this invention.

Fig. 2 is a diagrammatic side view of the Fig. 1.

Fig. 3 is a diagrammatic cross-sectional view on the line 3—3 of the Fig. 2.

Fig. 4 is a front view of a master gauge of the device.

Fig. 5 is a section on the line 5—5 of the Fig. 4.

Fig. 6 is a front view of a portable gauge.

Fig. 7 is a side elevation of a portable gauge.

Fig. 8 is a section on the line 8—8 of the Fig. 6.

Fig. 9 is a modified form of a portable gauge, and

Fig. 10 is a section on the line 10 of the Fig. 4.

In the drawings and the specification I have shown my device as being applied for the construction of ships. It should be understood that the same may be used with equal success in the construction of other structures, such as airplanes, buildings, machinery, etc., and I do not wish to limit the use of my device to the construction of ships only, and in the claims following this specification I desire to cover the invention in whatsoever form it may be embodied and for whatever use it may be applied.

My device may be used on two, or more, ships constructed alongside of each other. It consists of a number of stations 1, constructed between the two adjacent building ways, preferably from 50 to 75 feet apart from each other. The number of the stations depends upon the length of the hulls to be built.

As all the stations are similar, the description of one will suffice.

Each station 1 has a master gauge 2, which is preferably arranged between the ships A and B, and two pairs of portable gauges 3, one pair being used on each ship.

Each master gauge 2 consists of a frame 4 having a backing member 5 and two side members 6 and 7 secured to the member 5 in spaced relation to each other. A glass tube 8 is secured between said side members and extends practically the whole length of the frame 4. I provide two master boards 10 and 11 which are fixedly secured to said side members 6 and 7. The board 11 is preferably so secured as to cover partially the opening between said side members. On the board 10 are carefully marked the elevations of various points, lines, frames, supports, etc. of the ship A and the board 11 is similarly marked for the ship B.

It should be noted that the ships are constructed on building ways at a certain declivity so as to obtain the best possible launching conditions. This results in each frame station being at different height in space owing to said declivity. Hence, compensation should be made therefor by marking on the master boards 10 and 11 of the stations 1 the elevations of various frame stations in their true relative position.

Furthermore, due to the fact that the base line is built on a declivity, all the frame members are set at an angle to the vertical line, which angle is equal to the angle of declivity, and all distances which are given from the base line upward along or parallel to said frame members, should be corrected for true vertical measurement by multiplying the same by the cosine of the angle of the declivity. This also must be taken care of in calculating the respective elevations of various points of the ships.

Between the master boards 10 and 11 is arranged a sliding compensated scale 15. It carries two or more guides 16 adapted to slide in a groove 17 formed by the side member 6 and a guide plate 19. By means of this arrangement, the sliding scale 15 is movable in parallel relation to the master boards 10 and 11. For the purpose of convenience, a handle 20 is provided on the scale 15. Means for locking the scale 15 at any point on the board 10 is provided in form of a bolt 21 and a wing nut 22. The scale 15 also carries a pointer 24, the top of which coincides with the zero mark on said scale. It should

be noted that the scale 15 is preferably graduated in inches and in fractions of an inch multiplied by the cosine of the angle of declivity and for that reason is called "compensated scale."

A movable scale 25 is provided on the sliding scale 15, which consists of an abutment 26 having a groove 27, into which the edge of the scale 15 is admitted, and a scale portion 28 proper upon which is preferably marked a "compensated inch" graduated in "compensated fractions" thereof. The scale 25 slides between the edge of the scale 15 and the edge of the master board 11 and may be held in any desired position on said scale 15 by a stop screw 29. It should be noted that the abutment 26 extends to the glass tube 8 and, having a flat level top, permits the exact adjustment of the liquid level in the tube 8 in relation to said top of the scale 25. The graduated fractions of an inch on the scale 25 and inch marks on the scale 15 combined permit a minute selection of a desired liquid level in the tube 8.

The size of the master gauge 1 depends upon the height of a ship to be built and is usually somewhat higher than the latter so as to take care of all the vertical dimensions of the same. The master gauges 1 are resting on foundations 31 and are securely supported by special frames, not shown in the drawings, having a number of observation platforms. The master boards 10 and 11 are fixedly attached to the side members 6 and 7 and their positions are not disturbed unless careful measurements show that the same have changed from some cause.

It is usually necessary to connect several lengths of glass tubes together by suitable rubber hose or other connections in order to build up a glass tube 8 to the proper height. The bottom of the glass tube 8 has a hose or a pipe 35 connected thereto and having a shut-off valve 36. The pipe 35 is connected to a main water supply pipe 37, common to all stations 1, by a pipe 38 having a valve 40 by means of which water from the pipe 37 may be admitted into the glass tube 8. A needle valve 43 is also connected with the pipe 35 by means of a pipe 44, through which valve water from the glass tube 8 may be controllably bled out.

The pipe 35 is connected by a pipe 45 and preferably rubber hoses 46 to a air of portable gauges 3. The pipe 45 has valves 47 by means of which the passage of water to said portable gauges may be opened or restricted. Each portable gauge 3 comprises a glass tube 50, supported in a frame 51. The latter consists of two halves 52 having a central window 53 through which the glass tube is observed. The upper and lower portions of the frame halves 52 are adapted to clamp the rubber hose connections 54 on the glass tube 50 thus holding the latter. The frame halves 52 are held together by brackets 55, 56, 57 and 58. The bracket 55 is elongated and has a tapered top 60, and a hole 61 therein. A valve 62 is inserted between the glass tube 50 and the rubber hose 46.

A pipe 65 and rubber hoses 66 connect the pipe 35 with the portable gauges 3 used on the ship B.

As it has been stated, the master gauge 1 is usually of a considerable height and may have several platforms therearound for the convenience of operation. Therefore, reach rods 68 and 69 extending practically all the height of the master gauge are provided for convenient manipulation of the valves 40 and 43 respectively, so that an operator being on any one of said platforms may open or close either of said valves without any outside assistance and without leaving said platform.

The operation of the device is as follows:

Suppose a frame member 71 is to be secured to the hull of the ship A, and its position is marked on the drawing as ten and three sixteenths inches above the level of the frame number fifty nine. In this case the compensated scale 15 is moved upwardly until the pointer 24 is set exactly opposite the elevation mark for said frame number fifty nine, and the movable scale 25 is so adjusted on the scale 15 that the graduation corresponding to three sixteenths from the top of the scale 25 down coincides with the ten inch mark on the scale 15. The top of the scale 25 is then exactly ten and three sixteenths inches from the level mark of the frame number fifty nine. Then the portable gauges 3 are brought in close proximity to the frame member 71 raised to approximate elevation and temporarily secured to a some fixed member. Thereafter the valve 40 is opened as well as the valves 36, 47 and 62. Water is allowed to fill the master gauge tube 8, the pipe and hose connections between said tube 8 and the tubes 50, and the latter tube until the water level in the tube 8 is slightly above the top of the movable scale 25. Thereupon the valve 40 is securely closed by means of the reach rod 68. If desired, the positions of the portable gauges 3 may be adjusted now. Thereafter, the needle valve 43 is opened and water is bled out until the water level in the glass tube 8 reaches exactly the top of the movable scale 25. The water level in the portable gauges will show the correct vertical position of the frame 71.

In order to facilitate the comparing of the water level in the tube 50 with the level of frame members and other points as well as to facilitate the transferring of the level in said tube on said members, a spring clamp 75 having straight ends 76, is provided. The clamp 75 is adjusted on the glass tube 50 so that its top coincides with the water level and its ends 76 are directed to the frame member to be set. The sight is taken along the top of said clamp, thus assuring great accuracy in determining the vertical position of said member.

Preferably two portable gauges 15 are used simultaneously because in addition to giving the exact vertical position, they also permit to level a frame member or may be otherwise instrumental in fixing the lateral position of the same.

Another pair of portable gauges 3 is used on the ship B in which case the marks on the master board 11 are used. By providing two pairs of portable gauges 3 in combination with one master gauge 2, the necessity of providing a separate set of master gauges 2 for the ship B is eliminated.

The position of a point on a bottom or other places may be checked up by abutting the tapered top 60 of the portable gauge 3 against said points and holding said gauge in vertical position, as shown in Fig. 3. In this case, the water level in the master gauge 2 is set a certain distance below the mark corresponding to the vertical elevation of said point. The length of the bracket 55 being known, the distance from the lower end of said bracket to the water level is carefully measured, for which purpose a scale 74 is preferably arranged between the brackets 55 and 58 as shown in Fig. 9. The off-set in the water level in the master gauge 2 should be equal to the distance between the top of the bracket 55 and the water level in the portable gauge 3.

The base line of a ship may be established with-

out reference to surveying by setting the first master gauge in reference to a known bench mark and setting the remaining master gauges in reference to the first. To set one master gauge in communication with an adjacent one, the valves 38 and 40 of said gauges must be opened and the valves 47 closed. The valves 77 in the main line should be so opened as to let water into said master gauges, and the valve 77 of the next following main gauge must be closed. When water rises above the desired mark in the first master gauge, the preceding valve 77 is closed, and the excess of the water is bled out through the valve 43.

The variation of temperatures may affect the exactness of reading, but the same may be avoided by changing water in the device from time to time, or by correcting the level indicated by the portable gauges for the contraction or expansion of water according to the well known tables of expansion of a water column under various temperature conditions.

I claim:

1. A device of the type described comprising a plurality of stations; each station including a fixed master gauge having a stationary master board with a plurality of elevation marks thereon which are to be transferred to points distant from said master gauge, a plurality of portable gauges associated with each master gauge and having tube connections therebetween; said stations being connected with a liquid supply pipe; each station having valves for opening and closing the passage of liquid from liquid supply pipe to the gauges, and a valve for controllably bleeding liquid out of the same.

2. A device of the type described comprising a plurality of stations; each station including a fixed master gauge having a stationary master board with a plurality of elevation marks thereon which are to be transferred to points distant from said master gauge; a plurality of portable gauges associated with each master gauge and having tube connections therebetween; said stations being connected with a liquid supply pipe; each station having valves for opening and closing the passage of liquid from liquid supply pipe to the gauges, and a valve for controllably bleeding liquid out of the same; and valves in said liquid supply pipe permitting intercommunication between the two or more adjacent stations.

3. A device of the type described comprising a plurality of stations; each station including a fixed master gauge having a stationary master board with a plurality of elevation marks thereon which are to be transferred to points distant from said master board, and a transparent liquid holding tube in near proximity thereto, a plurality of portable gauges movable to the points to which said elevation marks are to be transferred, liquid holding tubes extending from the lower end of said transparent tube to the lower end of said portable gauges; said stations being connected to a liquid supply pipe; each station having valves for opening and closing the passage of liquid from liquid supply pipes to said gauges, and a valve for controllably bleeding liquid out of the same.

4. A device of the type described, comprising a system of stations; each station consisting of a fixed master gauge, having a stationary master board with a plurality of elevation marks thereon which are to be transferred to points distant from said master board, and a transparent liquid holding tube in near proximity thereto, a plurality of portable gauges movable to the points to which said elevation marks are to be transferred, liquid holding tubes extending from the lower end of said portable gauges; said stations being connected to a main pipe, each station having valves for opening and closing the passage of liquid from the master gauge to said main pipe so that any two or more stations may be put into communication; and valves for controllably bleeding liquid from each of the master gauges.

5. A device of the type described, comprising a system of stations; each station consisting of a fixed master gauge, having a stationary master board with a plurality of elevation marks thereon which are to be transferred to points distant from said master board, and a transparent liquid holding tube in near proximity thereto, a plurality of portable gauges movable to the points to which said elevation marks are to be transferred, liquid holding tubes extending from the lower end of said transparent tube to the lower end of said portable gauges; said stations being interconnected so as to put any two or more stations into communication; and means for bringing the liquid level in said transparent tubes to a desired elevation.

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