On a Bathometer, or Instrument to indicate the Depth of the Sea on board Ship without submerging a Line. By C. W. SIEMENS.

From the Lond. Civ. Eng. and Arch. Journal, Nov., 1861.

Those who are acquainted with the difficulties and expense attending the taking of deep-sea soundings by means of a weighted line, will readily perceive that an instrument capable of indicating depths upon a graduated scale in the cabin of the vessel would be of great advantage, as a means of extending our knowledge of ocean geography. In laying submarine telegraph cables through deep seas, such an instrument would be invaluable.

It occurred to the writer that the total attractive force of the earth must be sensibly influenced by the interposition of a comparatively light substance, such as sea-water, between the vessel and the solid portion of the earth below. This he demonstrated geometrically as follows:—Assuming the earth to be a perfect sphere of uniform density, two lines are drawn from a point on the surface, so as to intercept the circumference at the semicircles. A line is then drawn through the two points of intersection, which passes through the earth's centre, and a second line parallel to it, touching the circle at its lowest point. It was next demonstrated, that in dividing the solid cone represented by these lines into a number of slices of equal thickness, in a direction perpendicular to its axis, each slice would exercise the same amount of attractive force upon a body at the apex of the cone; the reason being that the mass of each slice increases in the proportion of the square of its distance from the apex, and the attractive force diminishes in the same ratio.

It was thus demonstrated that the true centre* of gravity of the earth in reference to an attracted body on its surface does not reside in its geometrical centre, but in a variable point between the centre and the attracted body. In dividing the sphere itself into slices of equal thickness a mathematical expression was obtained, representing the attractive force of any of these slices; and in integrating this expression for a series of slices it was the following formula:—

$$A_1 = 2\pi h \left(1 - \frac{2}{3} \sqrt{\frac{h}{2R}} \right)$$

in which A_1 signifies the attraction of the piece of the sphere sliced off, h the depth of this piece, and R the radius of the earth. In substituting $2R$ for h , the formula gives the total attraction of the earth,

$$A = \frac{4}{3} R \pi, \text{ agreeing with Newton's formula.}$$

Considering that the depth of the sea, which is represented by h , is exceedingly small as compared to $2R$, the expression $\sqrt{\frac{h}{2R}}$ may be entirely neglected, and the first formula may be written $A_1 = 2\pi h$.

$$\text{Consequently, } A : A_1 = \frac{4}{3} R \pi : 2\pi h, \text{ or, } A_1 : A = h : \frac{2}{3} R.$$

For moderate depths the attraction of the earth may be represented by a very obtuse cone, with $\frac{2}{3} R$ for its height. If sea-water were of no weight, the total attraction of the earth would be diminished upon its surface in the proportion as the depth to $\frac{2}{3} R$; but considering that sea-water has about one-third the weight (bulk for bulk) as the generality of rock, the actual diminution of gravitation was shown to take place in the proportion of the depth to the radius of the earth. Accordingly, 1000 fathoms of depth would produce a diminution by $\frac{1}{32100}$ part of the total gravitation, a difference so small, that it appears at first sight impossible to construct an instrument capable of indicating it with sufficient accuracy.

The second part of the paper described the instrument designed for this purpose, which consists of a tube containing mercury, diluted spirits of wine, and colored juniper oil. The mercury column, about 30 inches high, ascends in a tube from the bottom of a large bulb a^1 , containing imprisoned air, and terminates in the middle of a second bulb a^2 . The remainder of the second bulb is filled with the diluted spirits, which reach upward into a narrow tube provided with a scale. Upon this rests a column of the colored oil, which terminates in a third bulb a^3 , the remaining space being vacuous, or nearly so. This gauge is inclosed in a glass tube b , filled with distilled water, which in its turn is surrounded with ice, c , contained in an outer casing: the latter is suspended by a universal joint. The air in the lower bulb, being maintained in this way at a perfectly uniform temperature, will oppose a uniform elastic force against the column of mercury, which latter, being removed from all atmospheric influences, fairly represents the gravitation of the earth.

In moving this instrument from shallow water upon a sea of 1000 fathoms depth, the mercury column would rise $\frac{1}{32100}$ part of its length in the second bulb; but before any sensible attraction has taken place in the mercury level, the upper surface of the spirits of wine terminating in the narrow tube will have risen sufficiently to restore the balance of pressure, and the spirits being 20 times lighter than mercury, the scale of observation would be increased twentyfold. But the spirit column, in rising, displaces oil of very nearly the same specific gravity, which causes another increase of scale at least twentyfold. By these means a scale of 3 inches per 1000 fathoms of depth is obtained.

An instrument of this description was tried by permission of the Admiralty, and although it was still imperfect in some respects, its

indications agreed generally within 10 per cent. with the results of actual soundings.

In the course of the discussion which ensued, Prof. Tyndall suggested that the instrument would be equally applicable for measuring heights.

Destruction of Insects in Grain. By M. LOUVEL.

In M. Louvel's plan, the grain is put into a hollow cast iron cylinder, from which the air is then exhausted. No animal can then live in it: fermentation itself stops, since it has neither air nor moisture, without which it cannot continue. On a large scale, M. Louvel makes his vacuum, by previously filling another cylinder provided with proper valves, with steam of four atmospheres pressure, and then condensing the steam. A communication is then opened between this generator, as it is called, and the cylinder containing the grain. A vacuum of 38 centim. (15 inches) is easily obtained and perfectly effective. Indeed, M. Louvel has found that 50 centim. (19·7 inches) was quite sufficient for the purpose.—*Cosmos*.

Cement for Rooms.

From the London Builder, No. 992.

A recent invention by M. Sorel is described to us. He states that the invention consists in the discovery of a property possessed by oxychloride of zinc, which renders it superior to the plaster of paris for coating the walls of rooms. It is applied in the following manner:—“A coat of oxide of zinc mixed with size, made up like a wash, is first laid on the wall, ceiling, or wainscot, and over that a coating of chloride of zinc applied, being prepared in the same way as the first wash. The oxide and chloride effect an immediate combination, and form a kind of cement, smooth and polished as glass, and possessing the advantages of oil paint, without its disadvantages of smell,” &c.

For the Journal of the Franklin Institute.

Remarks on Mr. C. J. W., Jr.'s “Analysis of the Gamut in the Major and Minor Modes.” By J. C. B.

To the Editor of the Journ. of the Frankl. Insti.

A friend having handed me a copy of your March No. containing an article “Analysis of the Gamut of the Major and Minor Modes,” I desire to express my gratification on finding at least *one* scientific gentleman, so much interested in the “Art Divine” as to write a lengthy article on the subject. Although the conclusions of the writer are in the main just, yet the roundabout way in which he reaches them, is not, in my opinion, calculated to make them practical, which, after all, is the great desideratum in theory. I allow him, however, great credit for his originality. The immediate object of this communication is, to refer your readers to a work, viz: “The Introduction to the *Art and Science* of Music,” by Phil. Trajetta, which is considered good authori-