APPARATUS FOR DETERMINING THE SPECIFIC GRAVITY OF LIQUIDS.

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The determination of the specific gravity of solids and liquids is one involving many precautions, if accurate results are to be attained. Water is the basis, its temperature being placed at 4° C. In practice it is the actual standard, the substance being generally compared in weight with an equal volume of real water. The water used should be distilled, and if not recently prepared, should be boiled and allowed to cool. This is necessary in order to be certain that it contains no dissolved gases. It may be said that reliable determinations of specific gravity have, as a rule, involved the use of a delicate balance. This condition has prevented accuracy in cases where no balance was obtainable, or where its use was inadmissible. The great family of hydrometers of Baume, Twaddell, Nicholson, and others, are far from exact, but have been devised to meet this want—an accurate method not requiring a balance.

The hydrometer is, for several reasons, an unsatisfactory instrument. Its accuracy depends on the invariable volume of a solid. If made of metal, it may become indented, and so destroyed. If made of glass, unless allowed to stand for a long time before graduation, its volume may slowly change. Such alteration of cubic contents is often observed in thermometers. From this cause one radical defect attaches to the system. To make them sensitive, the stem on which the graduations are marked has to be of small diameter, and, consequently, of great length in proportion to the range of its scale. Accordingly, to cover the cases of liquids of varying specific gravity, to which branch of the subject these notes are especially directed, several hydrometers are found necessary. Capillarity introduces another source of error. In the same liquid the same hydrometer will give different readings, according to the way it is manipulated. The liquid adhering to its stem, where it emerges from the surface, pulls it down to a greater or less extent. If the hydrometer is pressed down and allowed to rise slowly, it will give a lower reading than if just allowed to settle to a position of rest. In different liquids the error of capillarity is still more serious, and cannot be avoided or allowed for. Finally, as a mere matter of practice, it is impossible to read the instrument with any accuracy, the intersection of the liquid surface with the hydrometer stem not defining a sharp line.

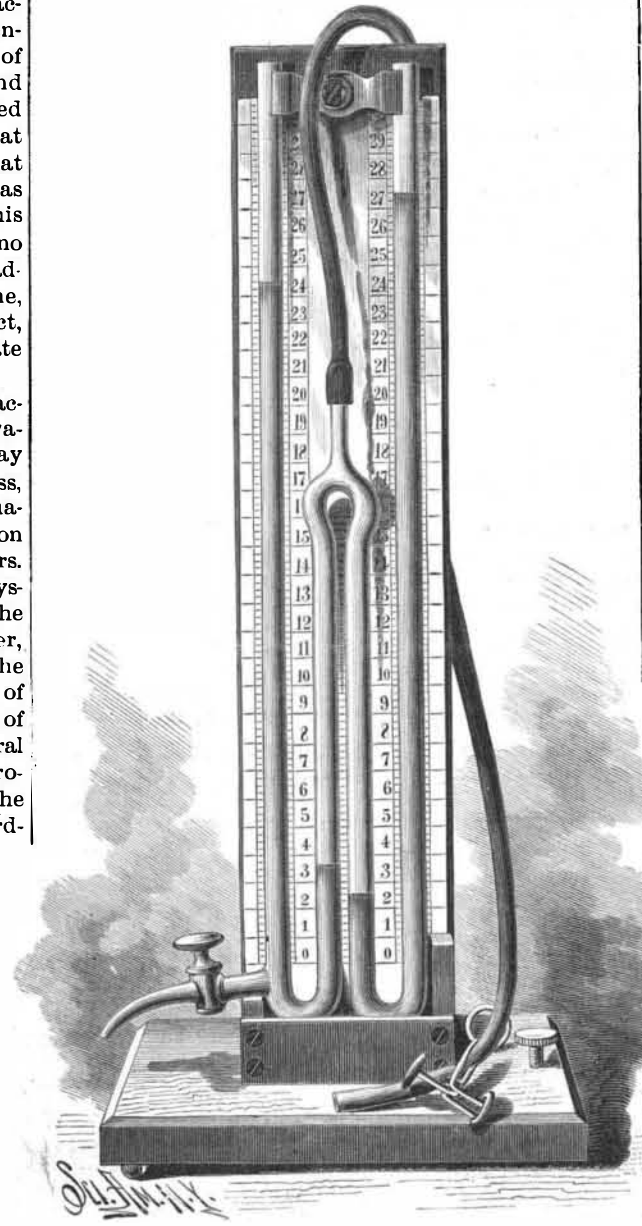
The apparatus here illustrated obviates these objections. It gives a definite reading. One apparatus can be used for liquids of all specific gravities, and errors due to capillarity are completely avoided. It is based on the law of the pressure of liquids, which states that the height of two columns of fluid that are in equilibrium is inversely proportioned to their specific gravity. This principle was the basis of Dulong and Petit's method for determining the coefficient of the absolute expansion of mercury.

A glass tube is bent into the shape indicated, and provided with a nozzle at the central bend for the attachment of an India rubber tube. A pinch cock is used to close the latter. As shown in the cut, one of the lower bends is provided with an outlet cock, also of glass. This may be omitted, as it is only a matter of convenience and neatness, enabling the manipulator to more easily change the fluid where several determinations are to be made in succession. The tube should be about 12 millimeters (½ inch) internal diameter. In height it need not exceed 400 millimeters (16 inches), though for accurate work it should be two or three times as high. This applies to the long members. The central portion should be a little more than half as high.

The tube is mounted on a stand provided with a leveling screw. Back of it is a mirror, which should be of good quality, free from striæ or bubbles. The tube lies snugly against this. On the mirror a scale is marked for all four members of the tubing. The graduation must be executed with the greatest accuracy. The lines must lie all in one direction, parallel to each other, and those on one side should be continuations of those on the others. If this condition is departed from, at the very least the scales for the short and long tube on either side must be identical in level as far as the short one extends. The scale need not be etched or engraved on the mirror. It may be marked upon the front of the tube.

To determine the specific gravity of a liquid, water is first poured into the right hand tube, until the short tube is filled nearly to the bend. The apparatus is now leveled with the leveling screw seen passing through the base, the water being used as the gauge.

In reading the height of the columns, the eye is so placed that the division of the scale nearest to the water level bisects the reflection of the retina in the mirror. The level of the water can then be read off within a small fraction of a millimeter. The fluid to be tested is poured into the left hand tube,



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in about equal quantity. By blowing into the rubber tube, the water and other fluid are forced down the center tubes and up in the outer. When the inner columns have sunk nearly to the bottom of the tube, the rubber tube is closed by a pinch cock. The pinch cock is best applied close to the glass nozzle. Upper and lower readings for both liquids are taken, just as in a siphon barometer. The lower readings are subtracted from the upper ones, giving the true and relative heights of the supporting columns. The height of the water column is divided by that of the other column, and the quotient is the specific gravity.

The best method of leveling the apparatus is to first pour water into both sides, to force it upward as described, and take regular readings and adjust the leveling screw by these observations.

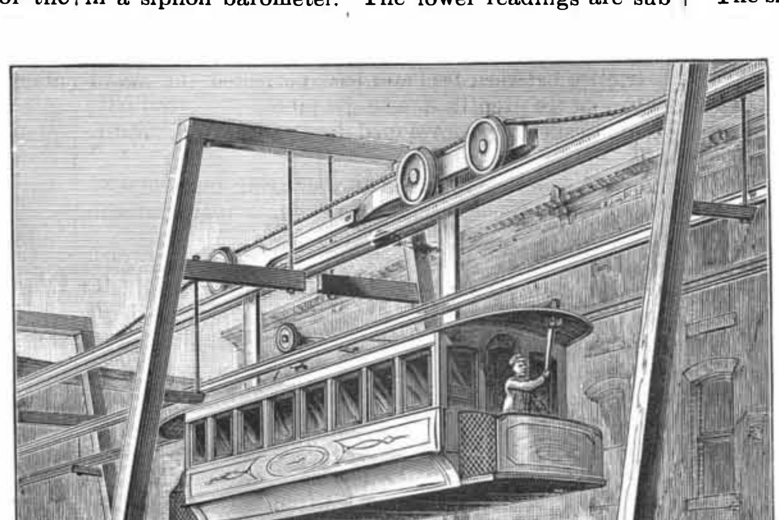
The different capillarity of various liquids does not affect the observations, as the surfaces counteract each other's effects. There is no trouble in reading within one or two tenths of a millimeter, so that in an apparatus a meter high the readings would be within two ten-thousandths, and the quotient expressive of specific gravity of course much closer. As the same water will answer for a series of observations, no cock need be supplied for drawing it off. For extremely accurate work, a rather large diameter of tube should be fixed upon (20 mm. or ¾ inch), and the tubes should be made long. As above suggested, a meter (39·37 inches) effectual height would be sufficient for any work, especially if the readings were taken with a cathetometer.

New Albumen Precipitate.

Dr. Gad has made a communication to the Berlin Physiological Society respecting the peculiar, strange albumen precipitate with salt recently described by Dr. Wurster. If to the white of eggs lactic acid, peroxide of hydrogen, and common salt were added, almost the whole of the albumen was precipitated as a white flaky mass, perfectly similar in appearance and taste to newly precipitated caseine (curd), but distinguished from caseine by its chemical reactions. The easy digestibility of this form of albumen, which had hitherto been precipitated by no other reagent, was especially remarkable. It was interesting that, in accordance with the reactions shown by Dr. Wurster's test paper for active oxygen, hydrochloric acid was formed on the mixture of lactic acid, peroxide of hydrogen, and common salt, and this acid *in statu nascendi* might be the specific precipitate for this new form of albumen, which could be obtained just as well from blood serum as from white of eggs.

ELEVATED CABLE ROAD WITH SUSPENDED CAR.

The road herewith illustrated has many novel features in the construction of the car and method of suspending the same, and in the device for gripping the cable. The car is hung upon two rods suspended from a narrow truck having four wheels at one end and two at the other; these wheels run upon rails suitably supported at the top of the structure. The truck carries the gripping device and small sheaves over which the cable runs. Extending across the roof of the car is an axle provided at each end with a wheel adapted to run upon side rails, as shown in the engraving; these wheels prevent the swaying of the car, and serve to keep it in proper position. The car may be hung at any desirable distance from the ground, to leave sufficient head room in the street.



KIRCHNER'S ELEVATED CABLE ROAD WITH SUSPENDED CAR.

The small engraving represents the grip, which is so constructed that the cable moves from one side to the other when passing a curve. The cable, B, is held between one of the jaws, C, and the revolving jaw, A, which is pivoted upon the pin, E. When rounding a curve, the cable slips to the opposite side of the grip and takes with it the revolving jaw around to the other catch, and engages that plate, C. This insures the cable being always in a straight line. The wedge, D, is drawn downward to separate the lower arms of the jaws, D, pivoted on the pins, F, and cause their upper arms to grip the cable, and is raised when it is desired to release the cable. This wedge is operated through suitable connections from the platform of the car.

This invention has been patented by Mr. N. Kirchner, Davis Hotel, Market Street and Delaware Ave., Philadelphia, Pa., who may be addressed for additional information.

Washing out the Stomach.

This operation, such a novelty a few years ago, is coming quite in vogue. A Maryland doctor employs the method very extensively in some cases of dyspepsia. The following is the *modus operandi:* A soft red rubber tube is passed gently down into the stomach, quite to the pylorus; with this is connected about a yard of common flexible tubing and a glass funnel, which is held on a level with the patient's breast, and tepid water is poured slowly into the funnel until a sensation of fulness is experienced. The funnel is then depressed to the level of the waist, and the fluid allowed to siphon out. The process is repeated until the water returns quite clear.