published as a confirmation of the results presented by Schumacher and Sprenger.

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MECHANICS OF FLUIDS IN RECENT TEXT-BOOKS OF PHYSICS

EVERY few years it becomes necessary for a teacher of physics to choose a new text-book from the large variety offered by the publishers, or at least to look over the list to see if there is a new one which is more suitable than the one he has been using. If he has plenty of time, he may look carefully through many books; if not, he may, as I have done, choose one subject in the books and compare the authors' treatment of that. It has been my habit to study the chapters having to do with the mechanics of fluids, particularly liquids. Why is it that less care seems to be exercised in writing this part of a physics text than any other?

A quite recent and excellent text has this statement in italics: *"The force which a liquid exerts against any surface is equal to the area of the surface times its average depth times the density of the liquid,"* and later makes use of the formulas: $F = Ahd$ and $p = hd$. As the authors of this text define density in the usual way as the mass per unit volume of a substance, pressure can not be equal to height times density. The dimensions will not agree. The pressure at a given point in a liquid depends not only on the depth and the density but also on the pull which the earth exerts on each unit mass of the liquid, that is, on the value of the acceleration of gravity. $P = hdg$. We may write $P = hd$ if we choose to define density as the weight per unit volume as is sometimes done, but in that case we may not write the formula for the velocity of a compressional wave in an elastic medium in the form $V = \sqrt{\frac{E}{d}}$.

Very few text-books make a complete statement of the principle of buoyancy or Archimedes' principle. The usual statement is that a body wholly or partly immersed in a fluid is buoyed up by a vertical force equal to the weight of the fluid displaced. Is it not important to state that we may consider the center of gravity of the fluid which the body displaces as the point of application of the buoyant force? I find that the average student assumes, often incorrectly, that the buoyant force acts at the center of gravity of the immersed body.

The subject of "The Siphon in Text-books" has been very well discussed by Professor Harold C. Barker in SCIENCE.[1] I can add nothing to that except to call attention to the fact that some of the most recent texts discuss the siphon under the subject "Fluids at Rest" and that a very careful reading of some of them will fail to show even why a siphon starts to operate. No effort is made to show why it continues to operate, or to show that stable operation can take place only when the highest part of the tube is less than barometric height above the *intake and outlet*. If we discuss this with the author, perhaps he will say he considers the subject of fluids in motion and Bernoulli's theorem too difficult for beginning students. Perhaps it is, but it would be better to tell what a siphon does and state its limits of operation without explanation than to give an explanation which pretends to tell the story and does not do so.

[1] 51: 489–491, May 14, 1920.

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PETRIFIED WOOD IN THE NEW ALBANY SHALE

THERE have been frequent references to petrified wood in the black shales of Indiana, Kentucky and Ohio. Silicified tree trunks were reported from the vicinity of Lebanon, Kentucky, at the New Haven meeting of the American Association for the Advancement of Science in 1850. Reports of the state geological survey occasionally mention such wood in Indiana, and in 1914 Elkins and Wieland described an Indiana specimen as *Callixylom Oweni*. Petrified wood has also been found in the concretions of the black shale of Ohio, and several years ago Dawson described one Ohio specimen as *Dadoxylon Newberryi*. Aside from this, very little systematic study of this wood has been made.

Field investigations during the past summer showed that petrified wood is quite common, though widely scattered, throughout parts of these states. It is especially abundant in the New Albany shale of Scott County, Indiana, and probably occurs at numerous other places throughout the state where this shale is exposed.

The thickness of the New Albany shale and the readiness with which it weathers produce a rolling topography which is devoid of striking geologic formations or extensive rock exposures. Consequently the contained silicified wood is rarely found *in situ* but as loose material in stream beds and on gently sloping weathered hillsides. The shale is quarried extensively in southern Indiana for road construction, but in most instances the petrified logs are removed from the quarry as impediments as soon as they are discovered.

One exception, however, is worthy of note. In a quarry in the vicinity of Scottsburg a stump with the lower portion of the trunk attached was found still partly buried in the shale. The specimen was three feet broad near the base, tapered to two feet at the

opposite end and was over five feet long. The stump appeared to be bulbous but showed nothing of the attachment of the roots. Being completely decorticated it showed no surface characters. Several other large pieces of wood were scattered over the floor of the quarry, and according to the owner the largest specimen, measuring about three by eight feet, had been blasted to pieces and used in the construction of a bridge foundation.

Preliminary investigations show that the wood from the New Albany shale is Callixylon. This genus is also known from south Russia, the Hunton formation of Oklahoma, the Chattanooga shale of Kentucky, the black shale of Ohio and in great abundance throughout the lower half of the upper Devonian formations of central and western New York. It has also been found in the glacial drift of Michigan. In New York only fragments of small branches, twigs and roots are known, while in Indiana only large trunks have been seen so far. Specific determinations of the Indiana material have not been made.

Although the wood is widely scattered, it appears to occur mostly near the top of the New Albany formation. While formerly considered as belonging to the upper Devonian and of the same age as the Genesee shale of New York, the New Albany shale is now viewed by some competent authorities as being, at least in part, of lower Mississippian age. This would place the Indiana wood in the Mississippian, and thus extend the range of Callixylon from the Devonian up into the Carboniferous. However, there is no record of its occurrence any higher than this basal member.

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SCIENTIFIC APPARATUS AND LABORATORY METHODS

AN AUTOMATIC MICROSPIROMETER

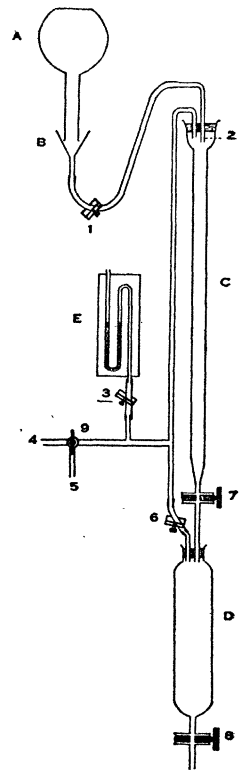
IN metabolic studies on the incubating hen's egg the writer has carried out continuous determinations of oxygen absorption and carbon dioxide production. At the beginning of incubation the egg is placed in a specially constructed metabolism apparatus in which it remains excluded from the outside air until hatched. The rate and total oxygen consumption and carbon dioxide elimination may be calculated at any time during the development of the embryo. A complete report will be published at a later date.

The oxygen spirometer developed to meet the requirements of the experiments has proved adaptable to a wide range of respiratory experiments. It is employed with satisfactory results by Dr. J. O. Ralls, of the biochemistry department of the University of Buffalo, in metabolic studies on rats.

The spirometer used in my experiments is illustrated in the accompanying figure. It is simple in construction, being made up of ordinary standard laboratory equipment. The neck of a 1,000 cc volumetric flask *A* rests snugly in funnel *B*. *C* is a 50 cc burette and *D* a 500 cc separatory funnel. *E* is an ordinary manometer constructed of 4 mm glass tubing and filled with red kerosene. These parts are connected as shown in the illustration.

In principle the apparatus depends upon the replacement of consumed oxygen by fluid without abnormal variations in pressure. In order to control humidity I have employed a saturated solution of sodium chloride.

The procedure for a continuous experiment is as follows: The manometer *E* being empty the volumetric flask *A* is filled with the sodium chloride solution and inverted in funnel *B*. By manipulation of cocks *7* and *6*, the solution is allowed to displace the air from the apparatus through the manometer. The solution is allowed to pass up in the manometer tubing until it reaches manometer fluid level at *e*. By closing pinch cock *1*, the fluid is drawn from the manometer through stop cock *8*, then by closing pinch cock *3*, the fluid is displaced through *8* by oxygen coming in at *5*, taking care to leave enough fluid to fill the lower end of burette *C* to the 50 cc mark.



By measuring the displaced sodium chloride solution the volume of the spirometer above and below cocks *6* and *7* is determined. The sum gives the total volume of the spirometer. The two volumes are determined separately so that the burette part may be used independent of the separatory funnel especially during the first eight days of incubation when the chick will not use over 50 cc of oxygen in twenty-four hours. The air volume of the egg chamber having been previously determined, the total volume of the apparatus is known. These data are necessary for barometric and temperature corrections. An ideal place of operation is a constant temperature room.