The metal caps cost a fraction of a cent each. The cost of the sturdy capping machine shown in Fig. 2 is about $35.00 and a cheaper one is procurable. The quart bottle seems to be the best size. It fits into the autoclave, allows ready penetration of heat and stores conveniently on shelves. There is no disadvantage in having to distribute a large lot of medium into a number of bottles. The large mouth milk bottle is more convenient to fill and to pour from (especially for agar) than the small mouth beverage bottle.

In 1925 I reported on "The Preservation of Bacteria in Vacuo."[2] Dried on small bits of filter paper in a vacuum bottle most bacteria remain viable without transplanting for many years. The dried cultures were enclosed in pint milk bottles, the mouths of which were ground down flat against small glass plates and these were sealed with a wax mixture. The labor and difficulty of grinding down the bottles against the glass plates has doubtless discouraged the more general use of this method of preserving cultures. We now find that a smaller milk bottle (one half pint) with a metal Crown Seal which has a special rubber composition ring lining makes a much more convenient and readily available vacuum bottle at small cost. The cultures, smeared on small bits of sterile filter paper in small cotton-plugged vials, are placed over some dehydrating agent (calcium chloride has been used) in the bottle. The edge of the bottle is rimmed with vaseline to make a more perfect contact with the rubber ring in the cap. The cap is placed lightly over the bottle (not crimped) and the bottle is placed under the bell jar of a vacuum pump. When a vacuum has been established within the bell jar the air is admitted suddenly. The inrush of air into the bell jar closes the bottle immediately without entering the bottle. To insure a permanent seal the bottle is then placed under the capping machine and the cap securely fastened into place. After using these bottles for several months we have noted no leakage as indicated by small manometers placed within the bottles.

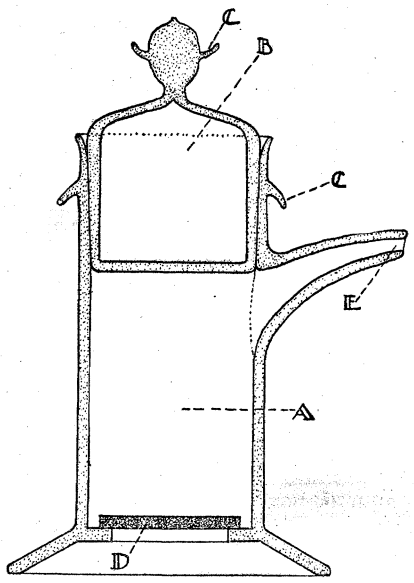
Quart milk bottles serve very well for the cultivation of anaerobic bacteria in test tubes. Pyrogallol and a strong solution of sodium carbonate are placed in the bottle along with the culture tubes and the bottle is promptly and securely sealed with one of the rubber composition lined caps.

J. HOWARD BROWN

A DILATOMETER FOR MEASURING THE SWELLING OF SEEDS

THE dilatometer here described—for measuring the rate and amount of swelling when immersed in an aqueous solution of seeds, dried fruits or other objects composed of or containing water-imbibing colloidal materials—is of the type in which the increase in volume of the test object is evidenced by the displacement of shot or sand surrounding it. The distinctive feature of the instrument is the avoidance of the use of metal in contact with the solution in which the test object is immersed, and is made possible by the utilization for the purpose in hand of two products of the glass industry which have recently appeared on the market:

(1) For the bottom wall of the dilatometer chamber, which is perforated to permit the flow of water through it, the perforations being too small to allow the escape of any of the enclosed shot or sand, use is made of a fritted glass filter disc manufactured by Schott and Gen., of Jena, Germany. In addition to avoiding the use of metal, this has the additional advantage of being more rigid than wire cloth.



(2) For the shot or sand surrounding the test object in the dilatometer chamber use is made of glass beads of very small sizes which are manufactured in Czechoslovakia and in Italy and which are employed in this country in the manufacture of decorative furniture novelties to produce a "crystal frosting" effect on fabric and paper surfaces. These glass beads are obtainable in sizes as small as 0.25 mm diameter, and in bright colors as well as in untinted glass. They are perfect spherules and roll and glide easily over one another when wet as well as when dry; they are greatly superior in this respect to the best grades of silica sand commercially obtainable. As compared with lead or steel shot these glass beads have the

[2] Abstracts of Bacteriology, ix: 1, p. 8, January, 1925.

obvious advantage of being of much lower specific gravity, in addition to being of a non-metallic material.

In the accompanying line cut, illustrating the instrument in vertical section, "D" indicates the fritted glass filter disc cemented into the bottom wall of the chamber "A." A wide opening is provided at the top of the chamber for insertion of the test object (not shown) and filling with the glass beads (also not shown). After having been thus filled, the dilatometer chamber is closed by the hollow ground glass stopper "B" which is held in place, against the pressure developed in the chamber, by strong rubber bands wound around the projecting hooks "C" on the stopper and on the outside chamber wall. The dilatometer is then immersed in the solution the swelling effect of which on the test object is to be determined, above the level of the orifice "E" but below that of the hooks "C" on the outside chamber wall, to avoid immersion of the rubber bands in the solution. As the test object in the dilatometer chamber swells, glass beads are extruded from the chamber through the orifice "E"—the number or volume of the beads extruded serving as an indication of the increase in size of the test object in the chamber.

It should be noted here that the volume occupied by a quantity of shot, sand or glass beads is not constant, but will vary somewhat with the packing of the particles.[1]

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SPECIAL ARTICLES

LAND TYPES OF THE TRINITY BEDS

THE Trinity beds are a conspicuous feature in the geology of the state of Texas. There they extend as a broad belt thirty or so miles wide for a distance of 300 miles from the Red River valley across Wise, Palopinto, Erath, Comanche and other counties, south-southwesterly to Fredericksburg (seventy miles due west of Austin). Along its eastern edge the Trinity overlaps the Pennsylvanian, and then south and west the beds run under several later horizons. The series consists in flotation sands, finer conglomerates and thin shelly, limy layers of fresh to brackish and fluvial marine origin, in all 500 feet thick. The invertebrates found in abundance at many points in thin interfingerings of limy rock are fairly well known. Also, R. T. Hill early used for the Trinity series the very good common name of "dinosaur beds" as further noted for their petrified forests, and somewhat later for three isolated and rare petrified cycads.

Occasional finds of land forms in the Trinity long gave little indication of wealth or variety of type; but other and fine discoveries have been accumulating for several years. Through the interest of Mr. Jene W. Wagner, of Burkburnett, Texas, and Mr. Bart Johnson, of Comanche, a splendid cycadeoid trunk from just east of the latter town was some years ago presented to the U. S. National Museum. This specimen I have sawn and studied in detail. Later, another handsome specimen from the neighborhood of Fredericksburg was turned over to Dr. Sellards, of the Texas survey; and I have since cut this stem, which bears young fronds. While, on visiting the general locality with Professor Plummer, of the University of Texas, early this year, we collected additional specimens as associated with the conifers. Again, Mr. Ross R. Wolfe, of Stephenville (Erath County), through persistent inquiry and effort has assembled a varied and most important series of the cycadeoid stems from the Stephenville country. Of these he has donated representative forms to Yale.

During a visit to Stephenville last March and April, aided by Mr. Wolfe and other friends, I was enabled to see why the land types of the Trinity beds and the general facts relating to them have appeared to view rather slowly. In that grassed and forested country fossil hunting is not easy. But the cycads can be found, and it is not too much to say that, considering their wide extent, the Trinity beds must be ranked as one of the five great cycad-yielding terranes of North America—the other four being the Arundel of Maryland, the Lakota of the Black Hills region, the Como of the Black and Freeze Out Hills, and the Mesaverde of the Chuska Mountain region of New Mexico and Arizona.

On inquiry, it was learned that some ten miles from Stephenville along the Paluxy River various portions of a reptilian had been noted. A visit to the locality resulted in the assemblage of a large part of the skeleton of a dinosaurian standing about six feet high at the hips, and thus one of the few lower Cretaceous dinosaurs from North America. Accurate determination of the form and species is greatly to be desired. It was found, too, that the general locality yields small Testudinates. In addition, large serial three-toed dinosaur tracks were pointed out as they occurred. A single track of yet larger form had been found; and cutting across a stream bed three miles from Glen Rose, another and splendid bipedal series of lesser three-toed tracks was seen. These latter tracks could have pertained to the skeletal type of the Paluxy.

[1] Smith, Foote and Busang, *Physical Review*, 34: 1271–1274, 1929.