of the impossibility of accurately estimating the total solids in cane juice by evaporating to dryness. When cane juice is evaporated to dryness, even in a vacuum, some of the bodies contained suffer decomposition into gaseous products, giving a residue less than the actual weight of solids originally held in solution; the decomposition of glycollic acid is no doubt responsible for a portion of this loss.

The presence of glycollic or hydroxyacetic acid, $CH_2OHCOOH$, in sugar-cane is full of suggestions to the physiologist. The principal amid of sugar-cane, glycocoll, CH_2NH_2COOH, is very closely related to this acid; in what relation do they stand in the plant? Is one formed from the other or have they each their separate rôle in the plant economy? Glycollic acid is readily obtained by oxidation of dextrose or levulose and so from cane-sugar; does it stand in any relation to the building-up of the cane-sugar in the plant? Glycocoll and glycollic acid are comparatively simple methyl compounds; how close do they stand to the supposedly simple first product of carbon assimilation? These and numerous other questions present themselves,—questions, the answers to which extend over the whole realm of plant physiology.

LABORATORY OF KOHALA SUGAR CO.,
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A NEW APPARATUS FOR THE DETERMINATION OF VOLUME.[1]

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THIS instrument has been devised in order to obviate certain objectionable features of those others, whose type is the Schumann or Candlot Volumenometer. Such objections are:

a. The reading is not delicate, since the caliber of the tube is large. Such instruments are limited in accuracy by our ability to read to 0.01 cc. This is obviously impossible in such tubes.

b. The solid must be introduced through the liquid on the lines where the reading is subsequently made. The slight coating here formed on the walls of the tube tends to increase the difficulty of making this observation correctly.

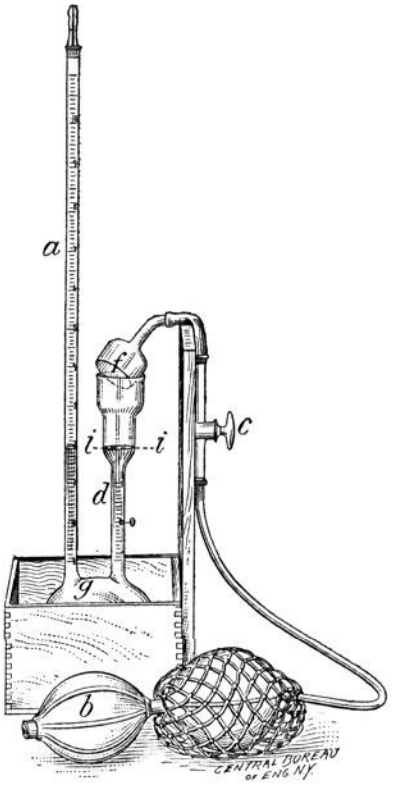
c. The ground joint by which the tube fits into the flask

[1] Read at the meeting of the New York Section, November 11, 1898.

usually leaks when a liquid like benzine is used. Any apparatus with a stop-cock in contact with the liquid is open to the same objection. An English form, recommended by Stanger and Blount, in which the tube is blown with the flask, is a good one.

In the apparatus I propose, the solid is introduced by one tube and the change of volume is measured on another one so slender that tenths of a cubic centimeter can be easily read and the hundredths quite accurately estimated.

The flask *g*, of about 175 cc. capacity, has two vertical tubulures blown into it; one, *a*, of the inner diameter of a pipette stem (five mm.) graduated in cubic centimeters and tenths, topped by a perforated glass stopper, and the other, *d*, with its middle portion similarly graduated for one or two cc. above and below a o mark, and this expanding into a receiving-tube about twenty-five mm. in diameter, closed by a ground-glass stopper *f*, with a glass tube prolong. This prolong is connected to a glass stop-cock and further on to a rubber bulb. The stop-cock, it will be noticed, is quite outside of the liquid-holding part of the apparatus.



In making a specific gravity determination of a mineral or other material in powder, begin by filling the flask through the receiving-tube with liquid up to a line about *ii*. Then place the stopper in above this, blow gently with the bulb and close the stop-cock *c* when the liquid stands in the tube *d* at the o mark. From this to the top of the column in *a* is the initial volume and the reading on *a* is to be noted.

Then remove *f*; the liquid flows back to *ii*, and presents a wide surface down through which a definite weight of the finely divided and dried powder can be sifted by using such an article as a porcelain Gooch crucible or a similar object spun from brass and fitting into the opening. Now replace *f* and blow the liquid

back. If any powder remains, the columns can be made to surge back and forth and carry every particle down. The column *d* is then forced down to o, the stop-cock *c* turned to hold it there, and the reading taken at the top of the column in *a*.

To insulate the flask it is well to enclose it in a box and surround it with asbestos, sawdust, sand, or some such material that will guard against expansion or contraction of the volume of the liquid by the influence of surrounding things. Should the air of vapor in the space from the o mark to the stop-cock be subject to such influences any error from it is nullified by making a differential reading on the two columns. Thus, if the column is blown down to o and the reading in *a* is taken to be say 5.42, and a half minute afterwards it is noticed on stem *d* to be at —0.07, let *a* be immediately read again and it will be found to be

	5.49
	0.07
True volume as before,	5.42

Taking three sets of such readings on the initial volume and three on the final volume after the addition of the solid, conduces very much to accuracy and to a check upon one's estimations of the hundredths. Thus an actual case was:

Initial volume.	Final volume.
6.38—0.02 = 6.36	9.57—0.00 = 9.57
6.38—0.01 = 6.37	9.67—0.10 = 9.57
6.37—0.00 = 6.37	9.59—0.03 = 9.56
6.38—0.01 = 6.37	9.62—0.06 = 9.56
	9.67—0.10 = 9.57

An instrument, designed thus with longer stem to hold the increase of volume caused by fifty grams of material, would be more accurate than one designed for ten grams; but ten grams is a convenient weight, and when it is used a table of reciprocals hanging in front of the apparatus would enable one to read off the specific gravity at once upon noting the difference of volume, multiplying the reciprocal by ten.

In this way many delicate determinations of specific gravity can be made in immediate succession with considerable economy of time and labor.

NEW YORK, November 1, 1898.