In making a series of measurements, if care is taken in removing the pieces so as to avoid loss of mercury, the zero reading and adjustments need only be made after about every eight measurements.

The dust and dirt which slowly accumulate on the surface of the mercury in the tank may be very easily swept off with a small camel's hair brush. In fact, a slight layer of dust is somewhat desirable as it forms an envelope around the piece when immersed and helps to prevent the absorption of mercury.

An objection to the apparatus is that it requires two persons to operate it most satisfactorily and expeditiously. Furthermore, unless care is exercised in removing the pieces some mercury is likely to be lost. No doubt a more satisfactory means of fastening the piece could be devised which would overcome the tendency to lose mercury which collects around the screws, and which would decidedly shorten the time required for securing and removing the pieces.

A few of the measurements made with the apparatus are given here. These volumes were obtained on the same series of samples on different days, but always under the same temperature and relative humidity conditions of 70° F. and 65 per cent relative humidity, the apparatus being set up in the constant temperature and humidity room.

Samples	Volume in Cc.		Samples	Volume in Cc.	
S1.....	35.15	35.20	L3.....	40.05	40.05
S2.....	29.35	29.40	L4.....	39.80	39.80
S3.....	39.75	39.80	L5.....	42.95	42.95
S4.....	36.85	36.90	L6.....	47.85	47.90
L1.....	39.45	39.50	L7.....	37.20	37.20
L2.....	41.85	41.90	L8.....	34.40	34.40

A piece of hard rubber has been used as a standard to check the apparatus, and its volume determined at frequent intervals during a period of several months has ranged from 89.10 to 89.15 cc. The volume of this same piece calculated from loss in weight in water at 70° F. gave 89.14 cc.

CONCLUSIONS

An apparatus has been devised which is satisfactory for measuring the volume of comparatively large pieces of leather. The measurements can be duplicated and are reasonably accurate.

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AN EVAPORATOR FOR ACID LIQUIDS

FOR THE ECONOMICAL EVAPORATION OF ACID LIQUIDS OR OF ANY LIQUID DISCOLORED BY CONTACT WITH METALS

By EDWARD HART

Received February 7, 1918

This system of evaporation for which United States letters patent have been granted but not yet issued (Application No. 202,189) is especially indicated where the solvent is water. The tubes (Fig. 3 is a cross-section) which may be of any number and of any desired size and length (3-in. glass tubes 4 ft. long are recommended for most purposes) are supported on gas pipe covered with asbestos paper as shown in Fig. 3; cross-stirrup supports are not shown. There

are three 1-in. openings in each tube to permit the introduction of liquid and the escape of steam. These openings may, of course, take the form of tubes, and the solvent may be condensed if desired.

The fire grate and course of the fire gases are indicated by the arrows in Fig. 1. Two, three or more sets of tubes may be used (two are shown) and the liquid warmed in the first set boils and evaporates in the second, and is collected and discharged by the end manifold, shown in Fig. 2, into crystallizers. The concentration of the discharged liquid is controlled absolutely and with great accuracy by the feed.

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CONVERSION OF FORMULAS

By WILLIS H. COLE

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In practically all industries in the United States pounds and gallons are still the units of measure, while in the laboratories of these factories the metric system is almost universally used. Thus the industrial chemist is called upon to make many conversions

of formulas as made on a large scale in pounds and gallons, into a size suitable for laboratory batches, in grams and cubic centimeters. I have seen many good chemists waste all the way from minutes to hours doing this, looking up conversion tables and multiplying. By aid of the following simple rule, great saving of time and accuracy is effected. Call the gallons cc., and multiply the pounds by 0.12 (for very accurate work, 0.1198) to get grams. These figures may then be multiplied by any factor which will give a convenient sized batch for laboratory purposes.

EXAMPLE I			
Varnish Formula	Conversion	Convenient	
Factory Batch		Lab. Batch	
Kauri Gum.....	100 lbs.	12 g.	24 g.
China Wood Oil.....	10 gals.	10 cc.	20 cc.
Prepared Linseed Oil.....	4 gals.	4 cc.	8 cc.
Turpentine.....	25 gals.	25 cc.	50 cc.
Petroleum Spirits.....	7 gals.	7 cc.	14 cc.
YIELD.....	52 gals.	52 cc.	104 cc.

In this case you will see that there are more ingredients measured by volume than by weight. Should this condition be the reverse, it is more efficient to change the rule, calling pounds, grams; and multiplying gallons by $8\frac{1}{8}$ (for very accurate work, 8.3455) to get cc. Here follows a formula to illustrate this method.

EXAMPLE II			
Flat White Enamel	Conversion	Convenient	
Factory Batch		Lab. Batch	
Zinc Oxide.....	90 lbs.	90 g.	45 g.
Lithopone.....	90 lbs.	90 g.	45 g.
Whiting.....	25 lbs.	25 g.	12.5 g.
Silica.....	25 lbs.	25 g.	12.5 g.
Varnish.....	12 gals.	100 cc.	50 cc.
Benzine.....	10 gals.	83.3 cc.	41.6 cc.
YIELD.....	28 gals.	233.3 cc.	116.6 cc.

The factors used hold for U. S. Standard gallons only and not for Imperial gallons.

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ADDRESSES

TECHNICAL APPLICATIONS OF NEPHELOMETRY¹

By PHILIP ADOLPH KOBER

I—INTRODUCTION

Something over two years ago I had the privilege and honor of reading a paper² before the New York Section of the American Chemical Society on nephelometry in which I gave briefly the history of photometric analysis and a description of the development of nephelometric instruments. At the invitation and with the encouragement of your honorable Chairman, Dr. Alexander, I shall now venture to put before you some technical applications of nephelometry, which, owing to war and other conditions, I regret, are not nearly as complete as I originally planned to have them.

As most of you know, the method is based upon the measurement of the brightness of the light reflected by cloud—in other words, by the particles in suspension—very much as in an ultramicroscope. The intensity of the light reflected is a function of the quantity of suspended particles, when other conditions are constant.

The principle of the nephelometer can best be shown by the diagrammatic sketch, shown in Fig. I.

FIG. I
The path of light in nephelometer.

Let A and B represent tubes containing a precipitate in the form of a suspension, and L represent a strong light which throws its uniform beam on tubes A and B at right angles; then *a* and *b* will be the light in the eyepiece due to the reflections from the two suspensions. If tube A, for example, contained distilled water and the instrument were perfect, no light at *a* would be

¹ Lecture and demonstration given before the N. Y. Sections of the Society of Chemical Industry, American Chemical Society, and American Electrochemical Society, Chemists' Club, October 19, 1917.

² Kober and Graves, *THIS JOURNAL*, 7 (1915), 843.

FIG. II
Lamp house and instrument, showing the concentrated filament lamp, air space, condenser, and lamp house. When the doors (not shown) are closed, no light is visible except in the eyepiece. The inclined angle of the instrument, which allows air bubbles to escape from underneath the plungers, and the exact position and angle of reflectors are not shown in the sketch.

visible. As soon as the smallest amount of suspension is produced in the tube A, light is obtained in *a* in approximate proportion to the amount of suspended matter. This light *a* is never measured absolutely, but is always matched at *b*, which is that reflected by the precipitate of a standard solution—a known amount of the substance to be determined dissolved in a known volume.

The matching of the two lights could be done by changing the standard solution step by step until it would be exactly that of the unknown. In practice this would be tedious and, therefore, instruments were designed to eliminate this in whole or in part.

Fig. II shows a diagrammatic sketch of such instrument and lamp house, and is known as a nephelometer-colorimeter,¹ because it is both a nephelometer and colorimeter.

Fig. III shows the instrument without the lamp house, particularly the scales, verniers, and the screw arrangement for raising and lowering the cups, which is used to match the reflected light from the suspensions.

¹ *J. Biol. Chem.*, 29 (1917), 155.