Fertilizer constituents.		
Natural state.		Water-free basis.
Phosphoric acid.....	0.032	0.105
Nitrogen.....	0.588	1.928
Ammonia.....	0.715	2.343
Potash.....	0.313	1.026
Water.....	69.500	...

J. E. HALLIGAN.

LOUISIANA EXPERIMENT STATION.
BATON ROUGE, LA.SIMPLE SPECIFIC GRAVITY APPARATUS FOR
PORTLAND CEMENT.

Apparatus.—The apparatus consists of a 150 cc. flask having a mark and the neck above flared out, a 20 cc. pipette, and a Fahrenheit thermometer inserted in a cork. The internal diameter of the neck of the flask at the graduation should not be less than 8 mm. nor more than 10 mm. The pipette is set upright in a filter stand to drain when not in use. The flask need not be accurate but the pipette must be calibrated.

Calibration.—Clean pipette perfectly, and dry. Make a mark 10 or 15 mm. above the graduation and another the same distance below the graduation. Fill to upper mark, with distilled water at 60° F. from a beaker and empty back

again. Drain 10 minutes, blow out, and fill again. Empty into a weighed flask, drain 10 minutes, and blow out into flask. The weight of water delivered is that of the volume drawn up with the walls wet. Fill to lower mark, weigh, draining and blowing out as before. The difference between the two weights is the weight of the volume between the two marks. The position of the true graduation mark is then easily found and etched or scratched on, for example:

Distance between marks.....	20 mm.
Volume to upper mark.....	20.32 cc.
Volume to lower mark.....	19.76 cc.
Volume between marks.....	0.56 cc.
Volume for 1 mm. 20 (0.56).....	0.028 cc.
Volume of true mark above lowest mark..	0.24 cc.
Distance of true mark above lowest mark..	0.028 (0.24) 8.5 mm.

Use.—Fill the flask nearly to the mark with kerosene oil. Take the temperature with thermometer, remove, and make up exactly, reading the bottom of the meniscus. Wipe the inside of neck free from oil. Blow out the pipette and withdraw 20 cc. of oil from flask, draining the outside of the delivery tube against neck near mark before removing, empty and hang up to drain. Weigh out 65 grams of cement to 0.1 g. and pour from glazed paper into flask until the oil nearly rises to the mark. Use a small camel's hair brush to brush the cement with all adhering oil down the neck. Rotate flask to remove air till all the cement is suspended and cautiously add cement till the mark is reached. Rotate again, take temperature, and weigh the residue to 0.1 g. The weight of cement used divided by 20 gives the specific gravity. Correct for temperature change, 1° F = 0.01 sp. gr. When the temperature rises add the correction; when it falls, subtract. The flask can now be shaken out, rinsed with oil, and filled nearly full as before, ready for the next determination. The pipette needs only to be cleaned when cement or dust is seen on the inside.

Results.—The difference in temperature between the pipette and the oil in the flask should not be too great. The cement is usually warmer than the oil and apparatus even after standing together some time, probably due to the slow hydration of lime. The effect of the difference in the coefficient of expansion of various samples of oil is negligible. The coefficient for 1° F. is taken as 0.00050, that of glass is neglected. A sample of oil in use gave a coefficient of 0.00053 with the pycnometer, using two temperatures. In calibrating, the correction in volume for the density of water at 60° F. is practically equal to and counter-balanced the difference in volume between oil and water retained in the pipette, so that both can be ignored.

Oil retained in pipette.....	0.06-0.07 cc.
Water retained in pipette.....	0.04-0.05 cc.
Correction for 20 gr. at 60° F.....	0.02 cc.

Errors.—Any one of the following errors represents a difference of 0.01 sp. gr.

- 0.2 g. cement used.
- 0.065 cc. oil displaced.
- 1° F. change in flask.
- 6.5° F. change in pipette.
- 1 mm. meniscus above or below mark on flask.
- 0.00010 variation in coef. of exp. through 5° F. change.

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