in 100 cc. of urine. Further work is of course necessary to determine which of these values is the more accurate, and if the conditions for the application of the nephelometric method are satisfactory. It is possible that the ammonia used for neutralization has a slight inhibitory effect, and that sodium or lithium hydroxide will give better results.

TABLE II.

s.		*y.*	Ratio of solution to standard = $1/x$.	Mg. P. in 1 cc. solution (1 cc. of standard 0.001034 mg. P).	G. of P in 100 cc. urine (total vol. dilution for 100 cc. = 40,000 cc.).
14.8	(*a*)	17.2			
15.0		17.5			
		17.35	Av., 1.218	0.001259	0.0504
14.9	(*b*)	17.4			
14.9		17.2			
		17.30	Av., 1.215	0.001256	0.0502
	(*c*)	17.4			
		17.5			
14.90		17.45	Av., 1.226	0.001267	0.0507
					0.0504

VI. Summary.

1. The reagent of Pouget and Chouchak has been modified, so as to be: (*a*) stable, (*b*) colorless, (*c*) quantitatively and (*d*) nephelometrically applicable.

2. It is shown that 0.005 mg. of phosphorus in 10 cc. of solution, or one part of phosphorus in 2 million parts of water, is easily determined quantitatively with the nephelometer.

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NOTE.

Alternating Current Thermoregulators.—Davis[1] has recently described an alternating current thermoregulator, designed for operation on the usual 110 v., 60 cycle lighting current. In my description of a large incubator[2] a very similar system was described, differing mainly from Davis' in that a 200 ohm, main line, telegraph relay was used to break the circuit, this relay operating in series with a 10 watt lamp and being controlled by a "fire-alarm" thermometer. This system operated very well for several months, the only trouble it gave being that incident to the sparking at the mercury-platinum contact of the thermometer; replacing the thermometer with a thermoregulator of larger bore improved

[1] THIS JOURNAL, **37**, 1520 (1915).

[2] *J. Ind. Eng. Chem.*, **6**, 939 (1914).

this, but it seemed best to replace the 110 volt current in the control circuit, and in accordance with the suggestion at the end of my note (supra) a Westinghouse bell-ringing transformer was connected with its primary across the main supply, and the relay and thermoregulator operating on the outside 24 v. secondary terminals. This arrangement has given practically no trouble, and is at present used on the large incubator described; on three gas-heated water baths, using the Beans electromagnetic gas valve; and on a large electrically heated air-current drier, taking about 30 amperes in the heating circuit; in the latter case, the 200 ohm relay operating on the 24 v. circuit controls a branch of the 110 v. circuit which operates a large motor-starting relay ("Contactor"), the coil of which takes 0.4 ampere. Two different makes of these contactors are at present in satisfactory use in this Institute, one A. C., and the other D. C. They are rather clumsy for handling currents of less than 15 amperes, and there would appear to be some demand in laboratories for a well-constructed relay operating on 110 v. A. C. or D. C., to control circuits carrying from 2 to 15 amperes—such relays do not appear to be made at present; the ordinary main line relay will usually take care of 2 amperes, though the lead to the armature may warm up a little.

I believe that the lower voltage at the break is a decided advantage; the little bell-ringing transformers take very little current, and one will operate a large number of such temperature-control circuits.

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THE DETERMINATION OF VOLATILE ESTERS IN CITRUS OILS AND EXTRACTS.

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I. Theoretical.—The citrus oils have been shown, by a large number of investigators, to be very complex mixtures, as is true of practically all of the volatile oils. The principal representatives of the class, lemon and orange oils, are very similar in composition.[1] Each contains over 90% of hydrocarbons, the terpene *d*-limonene being in preponderance. Aldehydes constitute about 4–6% of lemon oil, about 1–3% of orange oil. Citral is the most important member of this group present, but is accompanied by smaller proportions of citronellal and other aliphatic members such as nonyl and decyl aldehydes. A number of other substances are present, to which some of the finer characteristics of the odors of the oils are due. The most important of these are theesters, the identity of which has been fixed as linalyl and geranyl acetates.[2]

[1] "The Volatile Oils," by Gildemeister & Hoffman.

[2] Umney and Swinton, *Pharm. J.*, **61**, 196, 370 (1898).