Lastly, the authors say:—

"We have again pleasure in thanking Professor Stokes for his much-valued advice during the course of our investigations. To our assistant, Mr. Fram, we are indebted for his able co-operation, and we have to thank Mr. H. Reynolds for his aid and skill in taking photographs."

II. "Researches on the Action of Organic Substances on the Ultra-Violet Rays of the Spectrum. Part III. On Examination of Essential Oils." By W. N. Hartley, F.R.S.E., &c., Professor of Chemistry in the Royal College of Science for Ireland, Dublin, and A. K. Huntington, F.I.C., F.C.S., Associate of the Royal School of Mines. Received July 22, 1879.

(Abstract.)

Much chemical and physical research by various investigators has been devoted to the class of bodies known as Essential Oils, as, for instance, the work of Dr. J. H. Gladstone ("Journal of the Chemical Society," vol. xviii, p. 1; vol. xxiii, p. 147; vol. xxv, p. 1); of Dr. C. R. A. Wright ("Journal of the Chemical Society," vol. xxvi, pp. 549 and 686; vol. xxvii, pp. 1, 317, and 619, Isomeric terpenes and their derivatives); and of Dr. W. A. Tilden (*loc. cit.*, vol. xxviii, pp. 514 and 1258), as well as of many others.

The new method of research employed by us and described in a paper about to be published in the "Philosophical Transactions," has been applied to the examination of these substances. We have to acknowledge the kindness with which several gentlemen have supplied us with samples of essential oils, namely, Dr. Gladstone, Mr. Farries, of the firm of Burgoyne, Burbidges, Cyriax, and Farries, Dr. Septimus Piesse, and Dr. W. A. Tilden.

As in our previous experiments (Abstracts of Parts I and II, "Proc. Roy. Soc.," No. 192, 1879), photographs were taken of the spectrum transmitted by the undiluted liquid, and then of that transmitted by the liquid in various states of dilution, the dilutions ranging in some cases from 1 in 50 to 1 in 500,000 volumes of alcohol.

The following is a list of substances examined, classified according to the optical properties they were found to possess.

Oils and hydrocarbons transmitting continuous spectra.

Australene, from oil of turpentine.
Birch bark.
Cajputene dihydrate.
Carraway hydrocarbon (No. 2).
Calamus.
Citron.
Citronella.
Cedar wood.

Cedrat hydrocarbon.
Cubebs.
Elder.
Hesperidene, from oil of orange-peel.
Indian Geranium.
Juniper.
Lavender.
Lign-Aloes.
Melaleuca Ericifolia.
Menthol, from oil of mint.
Nutmeg hydrocarbon.
Patchouli, oil of, Nos. 1 and 2.
Rose, otto of.
Rosewood.
Rosemary.
Santal wood.
Terebene.
Terebenthene.
Vitivert.

Hydrocarbons showing the absorption bands of cymene.

Thyme.
Lemon.
Nutmeg.
Carraway (No. 1).

Substances showing strong bands of absorption in the spectrum transmitted by dilute solutions.

Oils of Aniseed.
,, Bay.
,, Bergamot.
,, Bitter Almonds.
,, Cassia.
,, Cloves.
Carvol, oxidised derivative of carraway oil.
Myristicol, the same from nutmeg oil.
Patchouli, blue oil of.
Oils of Peppermint.
,, Pimento.
,, Thyme.

For the most part these latter substances are known to contain the aromatic nucleus as an essential part of their constitution. Thus the oils of bay, pimento, and cloves, contain the substance eugenol, or $C_6H_3.OH.OCH_3.C_3H_5$; oil of cassia consists of cinnamic aldehyde, $C_6H_5.C_2H_2.COH$; oil of aniseed of anethol, $C_6H_4.OCH_3.C_3H_5$; and oil of thyme contains thymol, $C_6H_3.OH.CH_3.C_3H_7$, as well as much cymene, $C_6H_4.CH_3.C_3H_7$.

Some other oils, such as bergamot and oil of peppermint, as likewise the bodies menthol, carvol, and myristicol, have an unknown constitution. The three latter substances are known to be isomeric ("Journal of the Chemical Society," vol. xxv, p. 1).

Great interest is attached to our examination of these bodies, since we consider it to be proved from the character of the spectra they transmit that the nucleus of menthol is a terpene, while the benzene ring is the inner basis of carvol and myristicol. Bergamot appears to be a terpene mixed with some derivative of the aromatic series, but the oil of peppermint on the other hand is essentially a substance belonging to this latter class. The refraction equivalents of carvol and myristicol are abnormal, like those of benzene derivatives, a fact which confirms our conclusions regarding the constitution of these substances.

The following is a summary of our observations with regard to the terpenes:—

1. The terpenes with the composition $C_{10}H_{16}$ possess, in a high

degree, the power of absorbing the ultra-violet rays of the spectrum, though they are inferior in this respect to benzene and its derivatives, to which class of bodies they are so closely allied.

2. Terpenes with the composition $C_{15}H_{24}$ have a greatly increased absorptive power for the more refrangible rays, that is to say, they withstand dilution to a greater extent the greater the number of carbon atoms in the molecule.

3. Neither the terpenes themselves nor the oxidised or hydrated derivatives occasion absorption bands under any circumstances when pure, but always transmit continuous spectra.

4. Isomeric terpenes transmit spectra which generally differ from one another in length, or show variations on dilution.

5. The process of diluting with alcohol enables the presence of bodies of the aromatic series to be detected in essential oils, and even in some cases the amount of these substances present may be estimated.

Several diagrams in illustration of the kind of absorption exerted by the different substances are presented with the complete paper.

III. "Preliminary Note on Magnetic Circuits in Dynamo- and Magneto-Electric Machines." By Lord ELPHINSTONE and CHARLES W. VINCENT, F.R.S.E., F.C.S., F.I.C. Received July 26, 1879.

The experiments which form the subject of the present note were made in connexion with an investigation as to the best form for the construction of a dynamo-electric machine, intended to furnish currents of high intensity in great quantity. The principle deduced applies equally to magneto-electric machines.

The source of power in all dynamo-electric machines being electro-magnets whose cores are already slightly magnetic, it appeared to us necessary to consider the conditions under which the initial force of such machines is best obtained.

For this purpose we made use of a ∪ electro-magnet having a core of soft iron 2 inches in diameter and 36 inches long. The arms of the ∪ were 4 inches apart. The exciting helices were two sheet copper reels, 12 inches long, fitting closely upon the uprights of the ∪, but readily removable. Each of these reels was coiled with 200 yards of No. 14 double covered copper wire.

Two cores of soft iron, of the same diameter, and each $12\frac{1}{4}$ inches long, and which could be magnetised by the same helices, were also employed.

The principal armature was of soft iron, 8 inches in length, by 2 inches in width, and 1 inch thickness, rounded at the ends. Its face