regions, and that it is very probable that this heterochromatin is responsible for the end-to-end associations in the haploid *T. monococcum*. Associations between the heterochromatic (inert) regions of non-homologous chromosomes in *Drosophila* occur as a

GROUP OF CHROMOSOMES, DRAWN SEPARATELY, FROM ONE AND THE SAME SOMATIC METAPHASE PLATE (*Triticum monococcum* ROOT TIP).

rule in the salivary glands. Our case suggests that this phenomenon is probably more general and is of great significance for the hereditable variations in plants and probably in animals. This problem is being discussed elsewhere.

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[1] Kihara, H., and Katayama, J., *Agric. and Hortic.*, **8**, 1–17 (1932).
[2] Chizaki, J., *Bot. Mag.* (Tokyo), **48**, 621–628 (1934).
[3] Kostoff, D., *Genetica* (in the press).
[4] Kostoff, D., and Arutiunian, N. S., NATURE, **141**, 514 (1938).

Determination of Azeotropic Concentrations by the Twin Pycnometers Method

EXTREME precision and accuracy of the method of determining the density of liquid substances by means of twin silica pycnometers[1] opens up the way to precise determination of azeotropic concentrations. The new method is based upon investigating the relation between the density of a mixture of two components and its concentration. For this purpose, several mixtures covering either the whole scale of concentrations or the region about the expected concentration of the azeotrope under investigation, are prepared, and their densities are measured. Then an azeotropic mixture of the same components is distilled with an efficient column, its density is determined and the azeotropic concentration is read directly on the diagram, density/concentration.

The accuracy of this method depends upon the difference in density of the two components, but when dealing with organic liquids it is of the order of a few hundredths of one per cent or better. The certainty and the accuracy of this method are based also on working with high-purity substances and azeotropic mixtures as well as on the precise density determination. The easy means for measuring density of organic liquids within a few parts per million, which is secured by the use of the twin silica pycnometers method, and on the other hand the sensitive method of the control of purity of the liquids by the aid of Swietoslawski's[2] differential ebulliometer, makes this method of determining the azeotropic concentrations superior in accuracy to other methods formerly used.

Actual examples will soon be published elsewhere.

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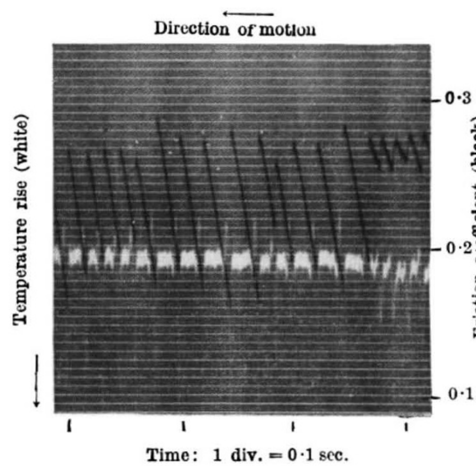
[1] Smith, E. R., and Wojciechowski, M., *Bull. Int. Acad. Polon.*, A, 281 (1936); *Roczniki Chem.*, **16**, 104 (1936).
[2] Swietosławski, W., "Ebulliometry" (Polish Academy of Sciences, Cracow, 1936; Chemical Publishing Co., New York, 1937).

Nature of Sliding and the Analysis of Friction

MOST methods of measuring kinetic friction merely record the *average* force necessary to maintain sliding. On theoretical grounds, and from the results of some earlier more primitive experiments, it was considered probable that the frictional force between sliding metals might not be constant. An apparatus was constructed which was capable of recording any fluctuations in the frictional force if they occurred. The lower surface was driven at a slow uniform rate, and the top surface, which rested on it, was attached to a high-frequency device for measuring the friction.

Experiments with this apparatus show that the frictional force is indeed not constant, but is undergoing most violent fluctuations. Sliding is not continuous; the motion proceeds in jerks. The top surface 'sticks' to the bottom one and moves with it until, as a result of the gradually increasing pull, there is a sudden and very rapid 'slip'. The process is then repeated indefinitely. Experiments with a



number of different metals and other solid surfaces prepared and polished in various ways show that this phenomenon is a general one. It is not due to surface scratches or irregularities. Even if the surfaces are lubricated with a mineral oil or other lubricants the behaviour may be essentially the same. Sliding proceeds by a process of 'stick and slip'. Certain long-chain fatty acids will, however, cause continuous sliding.

It is possible, by using two different metals as a thermocouple, to measure the surface temperature reached by the sliding metals. Earlier work has shown that this local surface temperature may be very high indeed[1]. A simultaneous analysis of the friction and the surface temperature is given in the accompanying photograph. In this case the top surface was of constantan and the lower surface was of steel. The metals were lubricated with medicinal paraffin and the lower surface was driven at a slow uniform rate of 0·3 cm. per sec.

The black trace measures the frictional force between the surfaces and it will be seen that large fluctuations are occurring in it. The slope of the darker portion of this trace corresponds to the speed of movement of the lower surface so that no relative motion is occurring; the surfaces are sticking together. Then suddenly a very rapid 'slip' occurs. This 'slip' is so rapid that it cannot be followed with