

of the wool. Similarly the cottonseed oil product extracted from the wool also contained sulphur.

From the above figures it appeared that the nature of the material upon which the oil was spread was of little consequence as regards oxidation. It was, however, different where oxidisable oils were exposed, when heating effects took place, because wool, silk, and inert materials did not fire, but cotton fired and burned fairly easily, the cotton charring at about 180° upwards.

Olive oil exposed to the oxidising action of air, when treated in the Mackey Tester, did not show any appreciable heating effect. The oil, however, became oxidised, and after extraction had decreased in iodine value; the oil was also somewhat thicker. If, however, the material were left in the Mackey Tester for about 4 to 5 hours, then the heat produced by oxidation or other causes became apparent and the rise in temperature took place quickly. If olive oil were exposed to the air at ordinary temperature, the absorption of oxygen took place so slowly, that after three years' exposure, in a thin film, the iodine value was reduced only by about 4 to 5%. That the iodine value did not govern the liability to oxidation and firing was proved from the following experiments in the Mackey Tester. Fatty acids of iodine value 77.8 registered 99.5° C. after five hours' treatment in the Tester, ethyl oleate (pure) of iodine value 75.6 registered 213° C. in five and a half hours, the ethyl oleate rising at first extremely slowly and finally very rapidly.

Mr. J. HYLAND, referring to the paper of Hyland and Lloyd, said that by oxidising oils on quartz at 50° C., until a maximum gain in weight was reached, a decrease in iodine value resulted very similar to that found after the oil had been through the Mackey Tester. Ethyl oleate gave a decrease in the tube of 31.4 and in the Mackey Tester 30.8. Also those oils with which a theoretical increase in weight was not reached on account of the decomposition of the oxidation products, were found to be more dangerous when tested in the Mackey Tester; and this, coupled with the fact that moist air was shown to aid in the decomposition of the oxidised oils, and particularly of the fatty acids, probably helped to explain why moist air should aid in the firing of the oils when on the fibre. That the nature of the fibre is of some importance from a firing standpoint was shown from the treatment of "Black Oil Cake," obtained in the Heavy Woollen District. Cake containing cotton fibre could not be stored without risk of firing, whereas cake free from cotton fibre might be stored for a considerable period.

Communications.

A SIMPLE INSTRUMENT FOR THE DETERMINATION OF VISCOSITY.

BY ALAN SPEEDY.

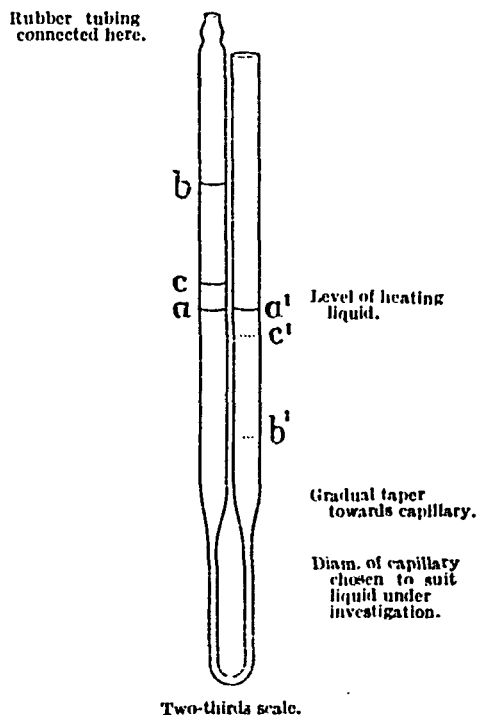
In the determination of viscosity by the aid of viscometers of the Ostwald type, it is customary to immerse the whole apparatus in a medium of high boiling point. The use of a fairly large quantity of some oil or wax transparent at the temperature of observation is thereby necessitated.

In the simple instrument described below, all difficulty in reading the marks is avoided by placing them above the surface of the liquid, which, therefore, need not be transparent and of which only a moderate quantity is required.

The instrument consists of a piece of glass

tubing drawn out to form a capillary and bent into U shape, as shown in the figure.

The liquid of which the viscosity is to be determined is filtered into the viscometer, which is clamped vertically in the bath so that the level



marks, aa' , are just above the surface of the heating liquid. The bath is now heated to the required temperature and after a few minutes the levels, aa' , are carefully adjusted. By means of a piece of rubber tubing the liquid is then slowly sucked up the left limb of the tube until it passes the level, b . It is then allowed to descend. The time taken to fall from b to c is recorded on a stop watch, and the experiment repeated as a check.

Part of the liquid under observation is above the surface of the heating liquid and is, therefore, at a slightly lower temperature, but as the level falls, this part of the liquid regains its former temperature. The error due to unequal viscosity in different regions arising in this way is negligible. It is only the viscosity of the liquid in the capillary tube that counts. The thinness of the wall of the capillary tube ensures that the liquid passing through the tube is at the temperature of the bath. It should be observed that the column of liquid, bc , never reaches the capillary. The level, b' , is well above the point where the constriction in the right limb of the tube begins. The time of flow is taken from b to c only, because on approaching a the motion becomes slow and uncertain.

The constant of the instrument can be obtained by calibrating it with pure phenol (see A. E. Dunstan, this J., 1912, 31, 1003) or sulphuric acid (see Proc. Chem. Soc., 1914, Vol. 80).

The instrument may conveniently be strapped to a thermometer and suspended in the heating liquid, which is contained in a boiling tube. The cheapness of the apparatus renders it possible to choose from a range of tubes one with a capillary of diameter best suited to the viscosity of the liquid which is to be investigated. The best results are obtained if the time of flow is about 1–2 mins. at the temperature of observation.

As an illustration of the degree of accuracy that may be expected from this form of viscometer, the examples contained in the table below are given.

Six oils, of which five were kindly supplied by Messrs. Ragosine and Co., were tested for viscosity in the instrument just described, and also, for the sake of comparison, in two other forms of viscometer, of which one is the totally immersed type,* and the other the well-known Redwood form.

Knecht's process of titration with titanous chloride (J. Soc. Dyers and Col., 1905, 21, 3—6; see this J., 1905, 154) to determine the amount of fading and washing out, etc., of a series of azo dyes, but after numerous trials it was abandoned. It was thought that probably the titanous chloride is so strong a reducing agent that under the conditions of the titration it to some extent decomposes the water of the solution or the carbon dioxide atmosphere in which the reduction is carried out.

Sample.	Nominal sp. gr.	T°	" Dunstan.	" New type.	Secs. Redwood.	Closed flash pt.* F.
Genuine refined pale East Indian rape oil	0.910	60° F. 70° F. 140° F. 200° F.	— 0.7680 0.1864 0.0815	— 0.7660 0.1872 0.0818	535 312 98 55	
American pale oil A.	0.900	70° F. 140° F. 200° F. 250° F.	0.7600 0.1230 0.0497 0.0283	0.7592 0.1224 0.0495 0.0283	348 60 41 34	390
American pale oil B.	0.908	70° F. 140° F. 200° F. 250° F.	— 0.1580 0.0583 0.0328	— 0.1575 0.0578 0.0327	490 80 45 36	400
Russian pale oil	0.908	70° F. 140° F. 200° F. 250° F.	— 0.2624 0.0853 0.0121	— 0.2611 0.0859 0.0423	1235 134 53 40	384
Neptune brand lubricating oil	0.850	150° C. 180° C. 200° C.	0.0718 0.0450 0.0348	0.0714 0.0452 0.0355		
Shale oil distillate	0.840 to 0.860	40° C. 80° C. 100° C.	0.0316 0.0145 0.0114	0.0310 0.0149 0.0117		

The readings of the first two instruments agree within the limits of experimental error. At 140° F. it will be seen that Redwood seconds may be obtained approximately by multiplying these readings by 500.

It is believed that the extreme simplicity of the instrument, and the increased accuracy due to choice of a suitable capillary, as well as its convenience in use, may recommend it to all who have measurements of viscosity to make.

THE USE OF KNECHT'S PROCESS FOR DETERMINING THE FASTNESS OF DYES TO LIGHT AND OTHER AGENCIES.

BY ARABINDA SIRKER.

In a previous investigation carried out in this laboratory (Watson, Sirker, and Dutta, this J., 1911, 30, 6—9) an attempt was made to use

* A. E. Dunstan, *ibid.*

Further experiments proved that this surmise was not correct, and that the difficulties previously experienced were due to the presence of air in the apparatus. For the titration of dyes which are not readily reduced it was necessary to exclude completely every trace of air from the apparatus. When this was done Knecht's process gave quite satisfactory results. It has been found that dyes can be estimated on wool as well as on cotton.

Preparation of dyed samples.—Well-washed wool was dyed in each case in a bath containing 2% dye-stuff and 2% sulphuric acid (on the weight of wool) by boiling for one hour. In each titration, about 100 c.c. of water and 15—20 c.c. of concentrated hydrochloric acid were added to the material to be examined, excess of titanous chloride was added, and the excess was determined by means of standard ferric alum solution. Every precaution was taken to prevent access of air.

Dye.	Mol. wt.	Theoretical value of 0.04 gm. of each dye-stuff expressed in c.c. of titanous chloride (1 c.c. = 0.00166 gm. Fe).	Titanous chloride solution required by the bath after dyeing c.c.	Titanous chloride solution required by the dyed wool (2 grms.). c.c.
1. Benzene-azo-phenol	198	27.29	8.07	19.22
2. Benzene-azo-resorcinol	210	25.01	2.90	22.11
3. Sulphobenzene-azo-phenol	278	19.43	2.76	4.17
4. Benzene-azo-phenol-o-sulphonic acid	278	19.43	0.70	18.73
5. Benzene-azo-salicylic acid	242	22.23	1.20	21.03
6. Bromobenzene-azo-phenol	277	19.50	1.01	18.49
7. Nitrobenzene-azo-phenol	243	55.57	14.19	39.98
8. Benzene-azo-dibromoniline	355	15.22	3.59	11.63
9. Amino-azo-toluene	225	24.01	0.97	23.04
10. Amino-azo-benzene	197	27.29	10.06	17.23
11. Chrysoidine	285	18.05	15.72	3.25
12. Orange II.	328	16.46	0.970	15.48