



Circular No. 6. July 1943. Issued for the information
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only.

CLUB NOTES.

Membership.

It is encouraging to record that the membership of the Club continues to increase (an unofficial estimate gives a total of 169 members). Following the very successful meeting with the Institute of the Rubber Industry in Manchester, there has been a substantial increase in membership in the Manchester district and it is to be hoped that some local rheological activities may be arranged.

Meetings.

The next meeting of the Club will probably be held on a Saturday in September in the Leicester neighbourhood. Particulars will be circulated as soon as possible.

Publications.

The Committee has accepted a suggestion from Dr. Rawlins that, when a paper given at a meeting of the Club is not to be published elsewhere, the author be asked to submit a short summary for insertion in the Bulletin.

Rheological Books and Papers.

The Hon. Sec. has received two very useful additions to the collection of papers and books now belonging to the Club and available, on loan, to members. Dr. Mardles has sent a collection of his papers on the Rheology of Suspensions and Prof. Mark (President of the Society of Rheology) has contributed reprints of his work on High Polymers.

The Term "Stiffness".

The Committee is somewhat perturbed to find that there are two or three distinct rheological uses of the term "stiffness". As used by the Bingham school, this term is defined as the ratio of shear stress in excess of yield-stress, to rate of shear; has the dimensions of a viscosity and is the reciprocal of mobility (see J. Rheol. 1 p.511, 1930). Recently the term has been used in quite other senses (see Kosten, V.D.I. Zeits. 86, p.535, 1942)

and by speakers at the Manchester meeting in yet a third sense. The Committee expresses no opinion as to the best use of the term but members are warned of the dangers of ambiguity. The B.S.I. has been informed of the difficulty.

"Table of Deformations".

Just prior to the despatch of this Bulletin the following has appeared in "Chemical Abstracts". This reference, although we have not yet seen the original, appears to be of such interest to members in relation to our "table of deformations" that it is here reproduced. (Chem. Abstr. 37, 2632, 1943) H. Houwink, Kunst-Tech. u. Kunststoff-Anwend 11, p.228, 1941: Chem. Zentr. 1, p.719, 1942. "Presentation of a new proposal for nomenclature in the Dutch Academy of Sciences". In a table the proposed classification of deformations is given. In this scheme, the following considerations are emphasized: (1) whether the deformation disappears after the removal of the outside force; (2) in what way the deformation varies with time under constant force; (3) the significance of possible boundaries that the tension must exceed to produce a lasting deformation. W.F.B.

RHEOLOGY ABSTRACTS.

Note: The Club assumes no responsibility for the opinions expressed by abstractors; these are given in square brackets.

141. Analysis of the thixotropy of pigment-vehicle suspensions. H. Green and R.N. Weltmann, Ind. Eng. Chem. (Anal), 15, p.201, 1943. Following a discussion of the definition of thixotropy, reasons are given for believing that if the thixotropic breakdown, which is dependent on time and on velocity gradient, could be prevented, the flow curve determined by an ideal viscometer would be that of a Bingham plastic. An experimental study of the hysteresis loop in thixotropic systems leads to a number of comparatively simple relations, which may be related to the basic conceptions. L.R.G.T.

142. The Rolling Ball Viscometer. R.M. Hubbard and G.G. Brown. Ind. Eng. Chem. (Anal) 15, p.212, 1943. A theoretical expression is derived for the velocity of a ball rolling in an inclined cylindrical tube filled with a viscous medium, in terms of diameter and density of ball, diameter of tube, and density and viscosity of liquid. An exhaustive experimental study is given, in which the range of applicability of the theoretical equation is defined, and the effect of turbulence is considered. The possible experimental accuracy is discussed. The work makes possible the accurate design and use of this simple and very convenient form of viscometer. L.R.G.T.

143. The Viscosity of Pitches. W.F. Fair and E.W. Volkmann. Ind. Eng. Chem. (Anal) 15, p.235, 1943. A simplified falling cylinder viscometer is used to study the flow of pitches over a range of temperatures and shearing stresses. A particular group of pitches showed viscous flow at 25°C, but a special pitch distillate developed an increased viscosity and probably a yield value on standing. L.R.G.T.

144. Viscosity of Coal-tar Residues. W.F. Fair and E.W. Volkmann. Ind. Eng. Chem. (Anal) 15, p.240, 1943. An investigation of the application of the A.S.T.M. penetration test to asphaltic materials. The general validity of Saal's formula $\eta = 5.9 \times 10^9 / (\text{penetration})^{1.23}$ is confirmed, but important deviations are found in the higher viscosity region, e.g. $3 \cdot 10^6$ to $3 \cdot 10^9$ poises. L.R.G.T.

145. The Significance of Coupling between Shear and Extension in the elastic behaviour of wood and plywood. R.F.S. Hearman, Proc. Phys. Soc., 55, p.67, 1943. The coupling coefficients "occurring" in the theory of elasticity are discussed, and shown to have an important bearing on the determination of the plastic constants of an anisotropic material such as wood, particularly when cut at an angle to the grain. L.R.G.T.

146. Mechanical Properties of Polymeric Materials. A. Tobolsky and H.J. Eyring. J. Chem. Phys., 11, p.125, 1943. An equation based on the theory of rate processes is applied to the calculation of deformation in materials where a number of different relaxation mechanisms operate simultaneously. For rubbers, relaxation is related to three mechanisms, i.e. primary cross-links, secondary cross-links and motion of chain segments. Theoretical relations are given for stress relaxation at constant deformation creep, rate of flow through tubes, amplitude of vibration under periodic force, etc. Where experimental data are available they seem to, agree well with the theory. L.R.G.T.

147. The Elasticity of a Network of long-chain Molecules.

L.R.G.Treloar, Trans. Faraday Soc., 39, p.36, 1943.

Discusses the recent history of rubber elasticity of Wall (Abs. 126) and shows that the application of certain corrections to the earlier theory of Kuhn leads to identical stress-strain relations from the two theories.

L.R.G.T.

148. The Softening of Thermoplastic Polymers, I. R.F.Tuckett

Trans. Faraday Soc., 39 p.158, 1943. Equations are given

which represent the components of "ordinary elasticity", rubber-like elasticity, and viscous flow in high molecular plastics. The dependence of deformation on temperature, stress and time is discussed. In practical tests of softening-point it is important to distinguish between deformation due to high elasticity and that due to viscous flow.

[A rather comprehensive paper, containing an intelligent discussion of a variety of experimental observations.]

L.R.G.T.

149. Physics of Pigments in dispersed Systems. H.Green,

J.App. Phys., 13, p.611, 1942. The aggregation of small particles in suspension is examined microscopically, and evidence advanced pointing to a "force of flocculation" in some cases. This force is considered to be the cause of the yield value in the plastic type of flow. Other types of flow (thixotropy, dilatancy) are considered in relation to the microscopic observations.

L.R.G.T.

150. The Mechanical Properties of Glass. F.W.Preston, J.App.

Phys., 13, p.623, 1942. The conception of glass as a

"crystalline liquid" is condemned, and it is shown that, considered as a liquid, glass has a viscosity at 20°C of 10^{30} to 10^{70} poises. These figures have no physical meaning, except that any viscous flow will be unobservably small, and in fact flow has never been observed in glass at room temperature.

L.R.G.T.

151. Frictional Phenomena. A.Gemant, J.App. Phys., 13, pp.688 and 732, 1942. XI & XII Solids. Discusses various physical

theories of plastic flow in solids. Creep and flow in plastics, glasses and metals are considered both from the practical and theoretical standpoint.

L.R.G.T.

152. Fatigue of Fabrics. Busse, Lessig, Loughborough and

Larrick. J.App. Phys. 13, p.715, 1942. The time for breaking

of textile fibres under alternating load was found to fit the formula $\log L = A/T + B$ Where L is the life in hours, and T the temperature. Log L was also found to be a linear function of the tensile load. These relations prove that the breaking is a property of the flow process in the single fibre, and is not due to slipping of the fibres past one another. Heats of activation for the flow process were calculated. A reversible decrease of length (at constant tension) with increase of T was observed with cotton and Nylon. This was attributed to the kinetic elasticity phenomenon.

L.R.G.T.

153. Penetrometer Method for Determining Flow Properties of High Viscosity Fluids. W.W.Pendleton. J. App. Phys.

14, p.170, 1943. The theory of the penetrometer is developed to give quantitative measurement of viscosity for both Newtonian and non-Newtonian viscous flow. For the latter a linear relation between $\log (d\epsilon/dt)$ and $\log S$ enabled the properties of a given material to be characterised. The penetrometer measurements were in close agreement with rotating-cylinder data. (See Abstr. 144).

L.R.G.T.

154. Simple Apparatus for Studying Deformation of Soft Materials under Compression and Tension at Constant Stress. G.W.Scott-Blair and B. Veinoglou. J.Sci. Inst. 20, p.58, 1943. An easily made rheometer capable of development.
H.C.T.

155. The Hardness and Scratch Resistance of Plastics - A New Method of Test. D.Starkie. J.Soc. Glass Tech., 26, p.150, 1942. The difficulties associated with the application of the conventional hardness tests to plastic materials are discussed, and a new method of test is devised in which a stream of SiC particles is allowed to impinge on the specimen; the scattering of light by the abraded spot thus produced is taken as a measure of the scratch resistance. The development of the test is described and details are given of the precautions needed to ensure accurate and consistent results. The results of tests on some common materials are included.
B.R.R.A.

156. High Speed Rotational Viscometer of Wide Range. H.Green. Ind. Eng. Chem. (Anal.) 14, p.576, 1942. An instrument is described for measuring the viscosity of pseudo-plastic materials and thixotropic plastics. Particular attention is paid to the elimination of slip.
B.R.R.A.

157. Sediment Volumes and the Specific Viscosity of Suspensions and solutions in mixed liquids. E.W.J.Mardles. Trans. Faraday Soc., 38, p.222, 1942. The close similarity in the shape of the curves relating the composition of mixed liquids with (a) sediment volumes of finely divided solids, (b) the dispersion and gelation of colloidal solutions and (c) specific viscosity of the suspensions and solutions in the mixed liquids, is traced for cellulose esters, resins, kaolin, mica, carbon black, and other powders in mixtures of acetone and water, cyclohexanone and benzyl alcohol, alcohol with acetone and benzene, and phenol with aniline and acetone. The significance of the similarity with regard to the theory of colloidal solutions, thixotropy, and other properties of suspensions is discussed.
B.R.R.A.

158. The Elasticity of glass at High Temperatures and the Vitreous Basaltic Substratum. F.Birch and D.Bancroft. Amer.J.Sci., 240, p.457, 1942. The elasticity and internal friction of a number of glasses were studied at temperatures up to 600°C. For one glass, B₂O₃, measurements of rigidity were given for an interval of temperature in which viscosity data are available. The relationship between rigidity and internal friction of glass is considered with particular attention to Maxwell's relaxation theory, which is shown to be inadequate. It is also considered that "viscosities" of the order of 10 poises are probably not Newtonian.
B.R.R.A.

159. The Plasticity of Clays. E.A.Hauser and A.L.Johnson. J.Amer. Ceram.Soc., 25, p.223, 1942. Because most industrial clays which contain kaolinite as the principal mineral constituent contain Ca in exchange positions, these clays are relatively plastic. They may be used, therefore, in most commercial processes after the addition of the proper amount of tempering water and suitable mixing. The particle-size distribution of such crude clays must contain sufficient amounts of material of an equivalent spherical diameter or less, to bring about the attraction forces necessary for plasticity. If it were necessary, for some reason, to enhance the yield point of a kaolinitic clay, the exchange of the Ca counter-ions for Al or H ions would be the most economical method. Because the introduction of the mono-
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valent H ion of trivalent ions causes further reduction of the charge on the particles, the attraction forces acting between the micelles are increased, thereby increasing the plasticity of the system. A systematic study of the plastic properties of other clay minerals and of the so-called non-plastic materials, in relation to the present discussion, is essential and would reveal interesting results. If plasticity is a colloidal phenomenon (as writers have attempted to show), it is entirely possible that, after the proper adjustments of certain variables have been made in systems which have not hitherto displayed plasticity, this property will reveal itself. It should also be possible, however, to change a plastic system to a non-plastic system by appropriate adjustment of certain variables which means that any degree of deflocculation (dispersion) of the system may be achieved.

B.R.R.A.

160. A Rheological Chart. L. Bilmes. Nature, 150, p. 432, 1942. An improved rheological chart classifies the types of flow and elastic deformation.

B.R.R.A.

161. On Relaxation Effects in Amorphous Media. R. Simha. J. Appl. Phys., 13, p. 201, 1942. The Maxwell relaxation theory leading to the concept of the viscous-elastic body is briefly stated. Extensions to systems built up from several such viscous-elastic components with different relaxation times are discussed. In the case of materials of high molecular weight it is more appropriate to assume a continuous distribution of relaxation rates. Equations are formulated whose solution gives the distribution function in terms of the rate of deformation and of the applied stress or the elongation in terms of the other two quantities.

B.R.R.A.

162. Compression Creep of Rubber and Rock. J. S. DeLury. J. Geol., 50, 189, 1942. A compressible solid may overcome resistance to its bodily movement by a piece-meal operation, if the mass involved has dimensions permitting sufficient linear compression. Because resistance may be overcome locally and in successive stages; a small fraction of the force needed for an immediate effect will, given time, bring about the same bodily movement.

B.R.R.A.

163. An Apparatus for Measuring the Shear Strength of Soils.

H. O. Golder. Engineering, 153, p. 501, 1942. A shear box has been designed and constructed in which the rate of shear strain is controlled, and in which it is possible to test samples under different normal loads which remain constant during test. The samples can consolidate when necessary before the test; the vertical expansion or contraction of the sample during test is measurable; and progressive failure is eliminated as far as possible.

B.R.R.A.

164. Slag Systems: The Viscosity Determination of Blast Furnace Slags. R. Hay. J. West Scot. Iron Steel Inst., 42, p. 89, 1941-42. The paper opens with a short review of methods of determining the viscosity of slags and glasses. Results are given on the viscosity of a series of melts covering the field of composition of B.F. slags. The ratio of $\text{CaO}:\text{SiO}_2$ which gives the most fluid slag does not necessarily give the slag of lowest m.p.t. The reduction in viscosity caused by MgO and CaF_2 is clearly shown.

B.R.R.A.

165. Sheets: Structural Viscosity Studies of Coating Clay Compositions. H. George. Paper Trade J. 116 p.28, Jan. 1943. An instrument for measuring and distinguishing thixotropy dilatancy, plasticity and Newtonian flow is described. (The instrument is a modified Stormer viscometer in which the rotating cylinder is replaced by a paddle working in a circular trough.) Differences in the flow properties of several coating clays were found to be caused by differences in particle size distribution, clay species and hydrating ability. The amount of dispersing agent is the most important single variable, sodium silicate and sodium pyrophosphate giving thixotropic stiffening of the suspensions in certain circumstances. Acid washing and mild heat treatment of the clays altered their flow properties, without, however, changing the flow properties of one clay to those of another. It is possible to have clay systems which possess both dilatancy and thixotropy in the same slip. V.G.W.H.

166 The Fundamental Problem of the Theory of Viscous Fluids. H. Putman, J. App. Phys., 14, p.244. 1943. A general theoretical treatment of fluid motion, assuming constant viscosity. [Short, but requires familiarity with vector field methods.] L.R.G.T.

167. Flow and Recovery Properties of Viscose Rayon Yarn. J. J. Press, J. App. Phys., 14, p.224, 1943. The extension of rayon yarn was studied over times ranging from 10^{-2} to 10^6 seconds, and at loads from 1900 to 19000 lbs. per sq. in. The retraction was observed over a long time, and was aided by swelling in water when necessary. Three distinct regions were found. (1) Up to $3/4$ per cent extension, ideal elasticity, without structural changes. (2) $3/4$ to 4 per cent extension, non-ideal elasticity, with complete retraction only when wet, corresponding to breaking of secondary bonds between molecules. (3) 4 to 12 per cent extension, plasto-elastic behaviour, accompanied by permanent rearrangements of molecular cohesions. L.R.G.T.

168. Frictional Phenomena. XIII. Internal Friction in Solids.

A. Gemant, J. App. Phys., 14, p.204, 1943. The relation between internal viscosity and measurable quantities such as the logarithmic decrement of free vibrations is deduced. Experimental methods for the study of internal viscosity are discussed, and the experimental data are considered in relation to possible theoretical mechanisms, such as thermal processes and plastic processes. L.R.G.T.

169. Viscosity Methods. The New Edition of the Institute of Petroleum Standard Methods. Cantor, Driscoll and Osborn. J. Inst. Pet. 29, p.26, 1943. The kinematic viscosity method has been considerably enlarged on the lines of the A.S.T.M. method and the maximum permissible error has been raised to 0.3 per cent. In an endeavour to reduce inaccuracy due to slight timing errors, a specification for time recording devices supplied by the N.P.L. has been included, and the minimum time of flow has been increased from 80 to 120 secs. The B.S.I. instrument has been included in addition to the suspended level and the Fenske, as well as a modified suspended level viscometer designed to minimize top drainage error. The square shouldered suspended level viscometer has not been permitted, since its use involves a surface tension correction which is not required for the instrument with a spherical shoulder. For the B.S.I. instruments sugar solutions are permitted as primary calibrating liquids in addition to water, whilst oil standards of known viscosity are allowed as secondary calibrating standards. The minimum

flow time for oil standards has been raised to 260 secs. A full description of a thermostatically controlled bath capable of keeping within the prescribed temperature limit of $\pm 0.025^{\circ}\text{F}$ has been appended. Specifications for the necessary highly sensitive thermometers are also included.
E.M.

170. The Effect of Heat-treatment of Milk-in relation to Baking quality as shown by Polarograph and Farinograph Studies O.E. Stanberg and C.H. Bailey, Cereal Chem., 19, p.507, 1942. The Farinograph, which records the work output in the mixing and kneading of flour doughs, is used to study the effects of heat treatment on milk used in bread-making. Lactalbumen molecules of low molecular weight with exposed sulphhydryl groups tend to soften the doughs. These groups are destroyed in the heat treatment of milk.

G.W.S.B.

171. The Secondary Hardening of Butter. H. Mulder, Verslag. Handb. Onderzoek, 45, p.649, 1939. Chem. Zentr. 2, 1086 1940. [see Chem Abstr. 36, 5572, 1942.] The effects of pre-cooling of cream in butter making are studied. "Slow hardening" increases less rapidly when low temperatures are used than with high temperatures.

G.W.S.B.

172. The Effects of Varying Pitching Point and Rate of Scald on the Rheological Properties and General Quality of Cheese made from Milk of varying Acidity and from Pasteurised Milk. G.W. Scott Blair, F.M.V. Coppen and D.V. Dearden. J. Dairy Res., 13, p.73, 1942. [A continuation of the work described in abstracts 17, 66, and 117.] The treatment of milk has drastic effects on rheology of curd.

G. W. S. B.

173. Rheological Properties of Bovine Cervical Mucus. G.W. Scott Blair, A.T. Cowie and S.J. Folley. J. Physiol., 101, p.11P, 1942. A further account on relationship between rheological properties of mucus and bovine pregnancy. A significant but not yet fully reliable test for pregnancy is described. (see Absts. 119.)

G. W. S. B.

174. Rheology and the British Standards Institution. The British Standards Institution has recently issued a British Standard Code (B.S. 1042, 1943) entitled "Flow Measurement" which is of considerable interest to rheologists. The prime object of this British Standard Code is to set out fully the conditions governing the design installation and use of standard pressure-difference devices in order to obtain consistent and generally acceptable results within a specified tolerance from commercial instruments.

[Details are given of standard pressure-difference devices and orifice-plates together with methods for installation of these devices. There are some useful working formulae and a note on the Reynolds number together with a section on the choice and use of pitot tubes for flow measurement. The Code includes a very comprehensive series of appendices which contain many valuable tables including some fairly extensive data referring to the absolute viscosity of gases. All the data is sufficiently accurate for industrial purposes but some of it should be used with discretion where the highest scientific accuracy is required. Thus, for example, table 13 sets out a series of Viscometer conversions which will not always be entirely accurate owing to variations in the constitution of the materials employed. Thus, the relationship between Kinematic Viscosity and Redwood No. 1, seconds is now generally recognised as not

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being quite so simple as is indicated in table 13. Generally speaking, however, the document is an extremely valuable one and is well up to the usual high standard of the British Standards Institution publications. 7

Numerous other British Standard specifications are of interest to rheologists and whilst some of these are quite well known it may be interesting and useful to give the following brief references to some of the lesser known rheological tests which are included in British Standards Specifications.

B.S. 188 - 1937. Determination of Viscosity of Liquids in Absolute Units. This details the standard U-tube viscometers and the falling ball viscometer.

B.S. 688 - 1936. Bituminous Filling Compounds for Electrical Apparatus. In addition to the references to the standard softening point determinations, this specification includes a pouring point test and an adhesiveness test. The former employs a modified orifice viscometer whilst the latter is a simple arbitrary test to determine the extent to which the hot poured compound will adhere to metal after cooling.

B.S. 803 - 1938. Solid Bituminous Compounds for Cable Boxes. This specification includes similar rheological tests to those specified in B.S. 688 but also includes an interesting method for measuring the contraction and "depth of pipe" on cooling the compound from the pouring temperature to atmospheric temperature.

B.S. 674 - 1936. Rubber Joint Rings for Water Mains and Sewers. This includes tests for tensile strength, elongation and permanent set of the rubber forming the rings.

B.S. 894 - 1940. The Determination of the Flow and Drop Points of Fat and Allied Substances. This specification sets out the details of the Ubbelohde type of apparatus which was suggested for this purpose in Germany some years ago and has now been adapted and adopted for many purposes in this country.

B.S. 618 - 1935. Emulsions of Road Tar and of Road Tar Asphaltic Bitumen Mixtures. This includes a test for viscosity as determined in the Engler viscometer and also a test for coagulation of binder.

B.S. 434 - 1935 Asphaltic Bitumen Road Emulsions. This includes tests similar to those set out in B.S. 618.

B.S. 598 - 1940. Sampling and Examination of Bituminous Road Mixtures. Only one rheological test is included in this specification and this consists of a very simple test known as the Pat Stain test which is designed to determine the "physical richness" of the mixture.

B.S. 902 - 1940. Latex Raw Rubber and Unvulcanised Compounded Rubber. This specification includes methods for plasticity and "mastication number". The former uses a parallel plate plastimeter whilst the latter is a scheme for determining the number of times it is necessary to pass a sample through the usual standard laboratory mixing rolls to produce a material of specified fluidity.

B.S. 903 - 1940. Testing Vulcanised Rubber. This specification includes reference to tensile stress strain tests and also tests for permanent set, hardness number and

swelling/

swelling. The tensile stress strain tests normally consist of the determination of tensile strength of dumbbell shaped specimens or alternatively the determination of breaking elongation, elongation at constant load or modulus as a result of testing ring shaped specimens. The permanent set tests are carried out on rings, dumbbells or strips whilst the hardness number tests measures the indentation of a ball ended plunger.

B.S. 76 - 1943. Tars for Road Purposes. This specification is of particular interest to rheologists in that for the first time materials are classified according to their "equi-viscous temperature" or E.V.T. This is the temperature in degrees centigrade at which the tar has a time of flow of 50 seconds measured by the standard Tar Viscometer which is of the usual orifice type, being a modification of the Redwood Instrument. The test is specified as being carried out at various temperatures according to the consistency of the material so that the tar shall be well within the range of the apparatus at the temperature of the test. A nomogram is given relating E.V.T. to viscosity at various temperatures according to the Standard Tar Viscometer. References are also made in this and other specifications to softening point determinations in accordance with the requirements of the Ring and Ball method and the Kraemer Sarnow method.

B.S. 988 - 1941. Mastic Asphalt for Roofing. In this specification there are references to the standard methods for penetration and ductility of the asphaltic cement employed and also a "hardness number" test on the finished mastic asphalt. In the latter test one records the depth of indentation of a $\frac{1}{4}$ " diameter steel rod under a load normally of 100 kilogrammes per square centimeter applied for one minute.

B.S. 1076 - 1942. Mastic Asphalt for Flooring. This includes similar rheological tests to those quoted in B.S. 988.

B.S. 1093 - 1953. Pitch Mastic Flooring. This includes no rheological tests other than one for softening point carried out on the binder.

B.S. 1092 - 1943. Pitch Mastic Horizontal and Vertical Damp-Proof Courses. See B.S. 1093.

B.S. 1067 - 1942. Coal Tar Pitch Felt Damp-Proof Courses. Rheological problems arise in connection with the manufacture of these materials in order to get adequate saturation of the felt fibres. In addition the coating material has to be such that if finished with a sand surfacing the sand or grit must firmly adhere to the base. No definite rheological tests are, however, included in the specification to safeguard these points.

B.S. 743 - 1941. Materials for Horizontal Damp-Proof Courses. See B.S. 1067. 1942.

B.S. 989 - 1941. Bituminous Roofing Felts. See B.S. 1067.

B.S. 599 - 1939. Pump Tests. This specification includes methods of volumetric measurement of fluid flow by weirs and notches. In connection with these matters reference should also be made to B.S. 722 - Bore-hole and Well Pump Tests, B.S. 723 - Sewage Pump Tests and B.S. 724 - Vapourising Liquid Pump Tests.

/ B.S. 726

B.S. 726. 1937 Measurement of Air-flow and the Free Air delivered by Compressors. This specification contains useful information concerning the measurement of the rheological properties of air. Reference should also be made to B.S. 848 - Testing of Fans for General Purposes and B.S. 707 - Testing of Mine Fans.

It should be noted that the above list is not complete but is merely intended to be indicative of the kind of rheological tests which are included in British Standard publications.

D.C.B.