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The Journal of the
TEXTILE INSTITUTE

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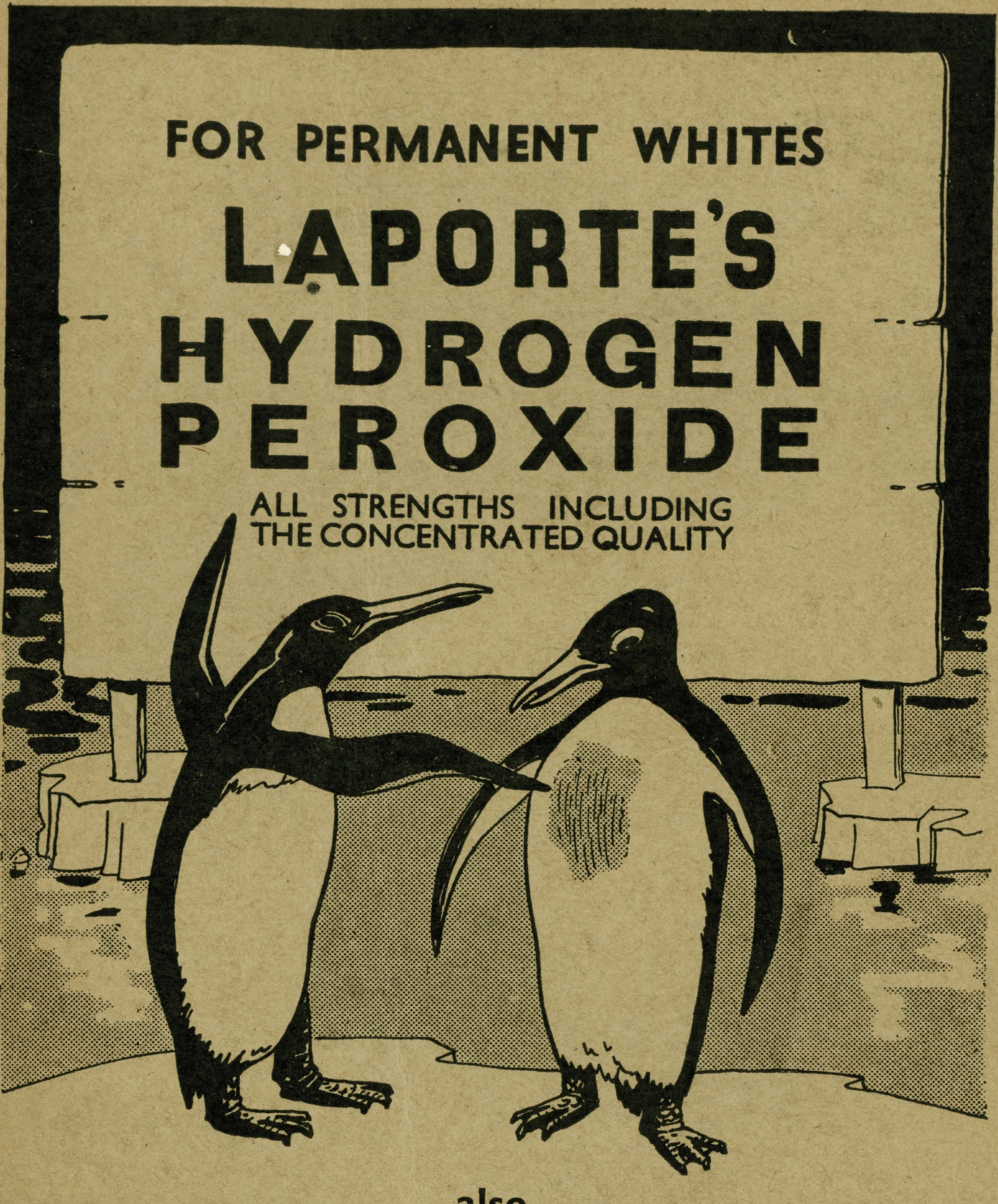
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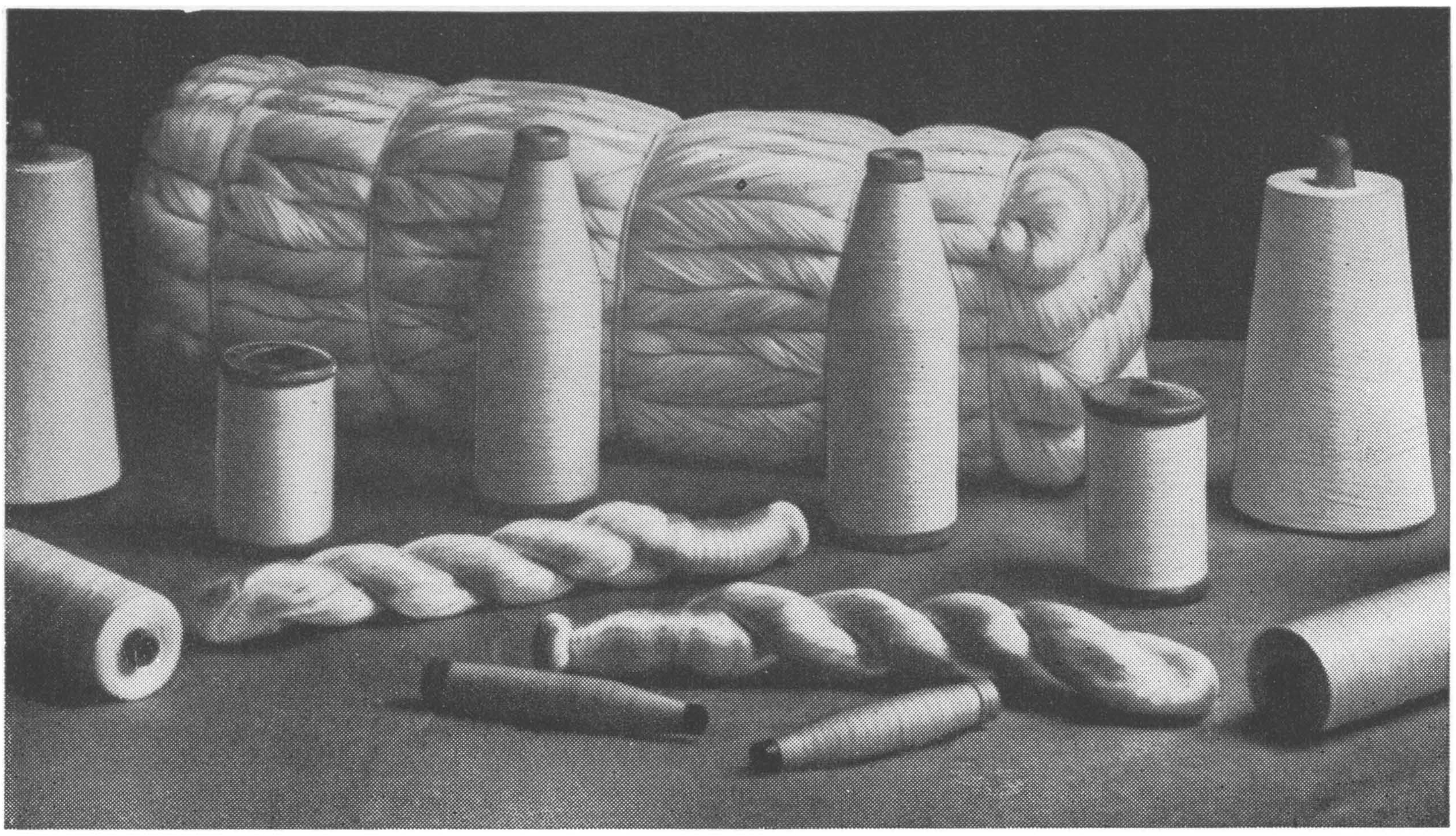

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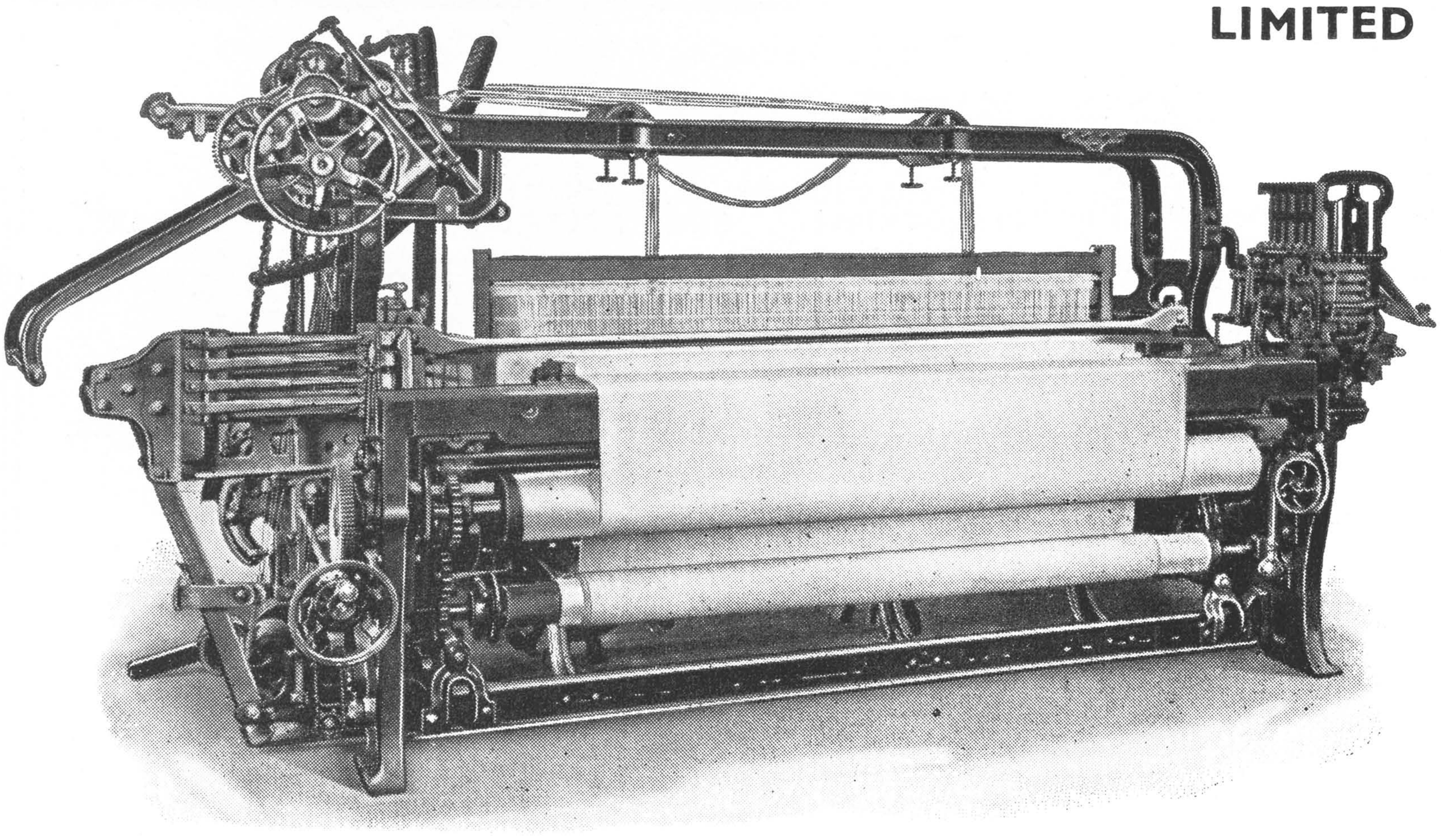

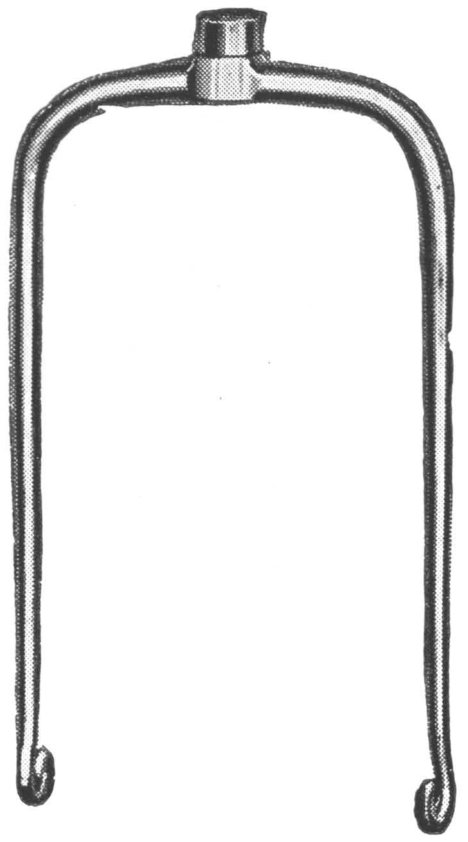

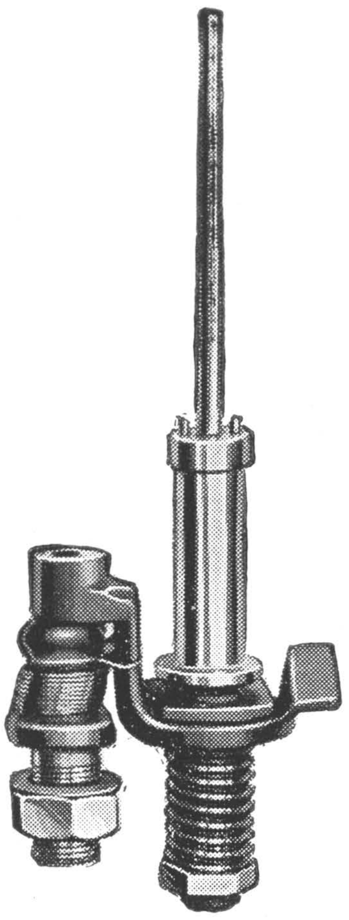

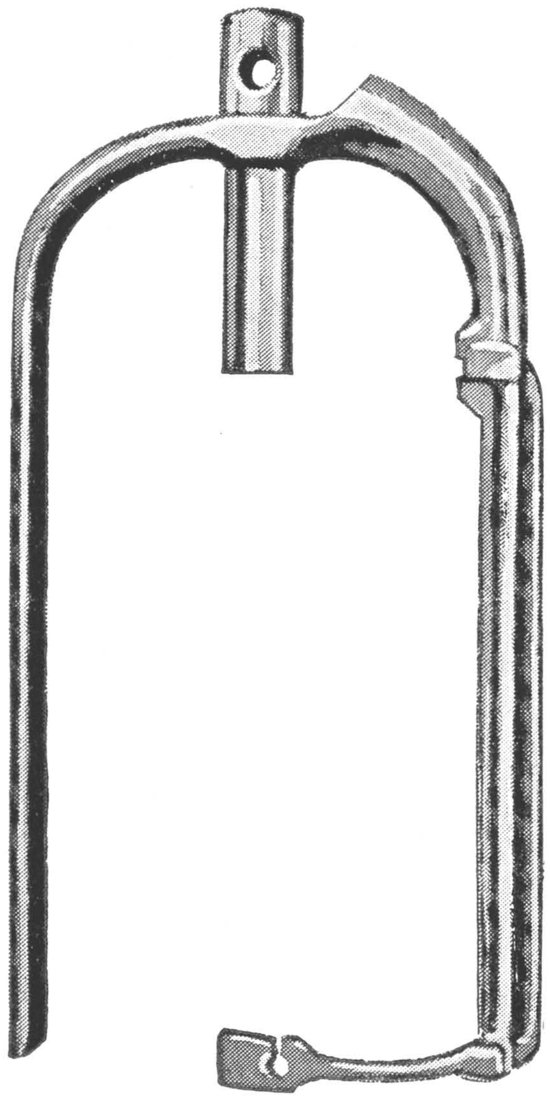

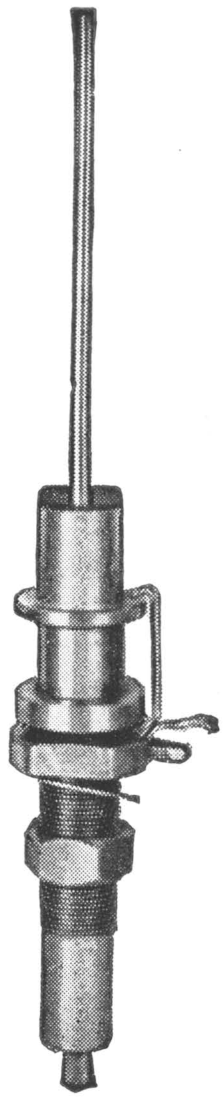

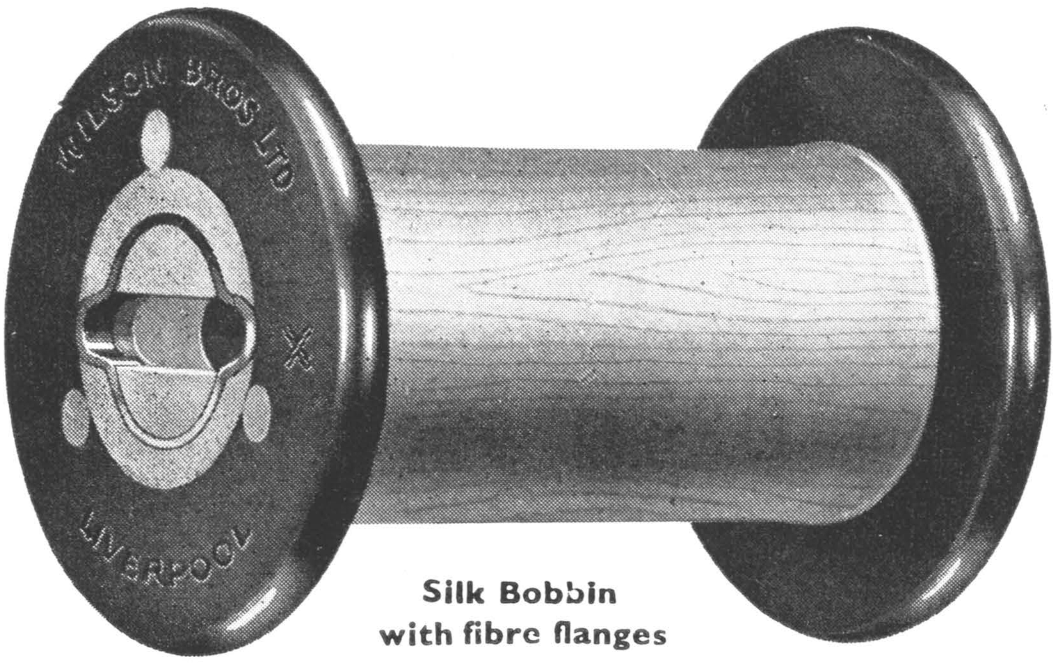
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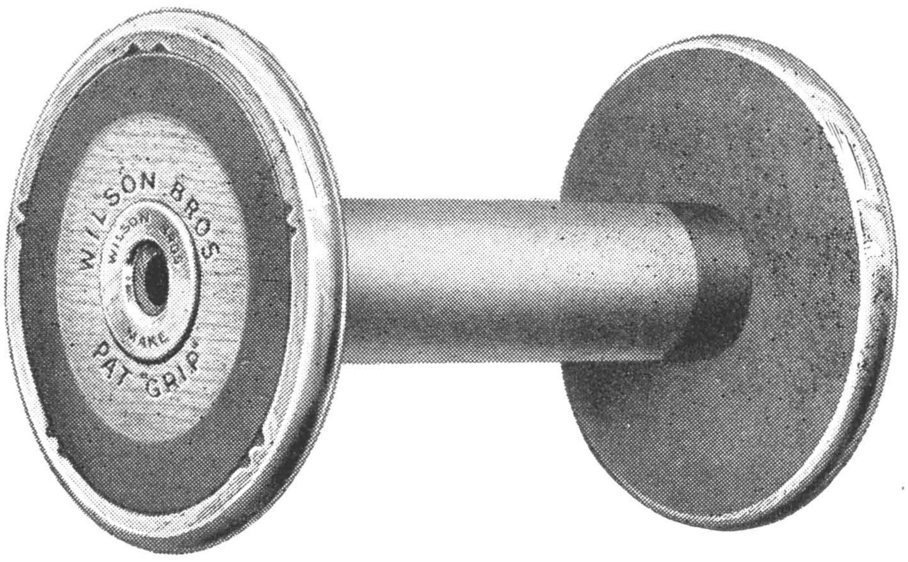
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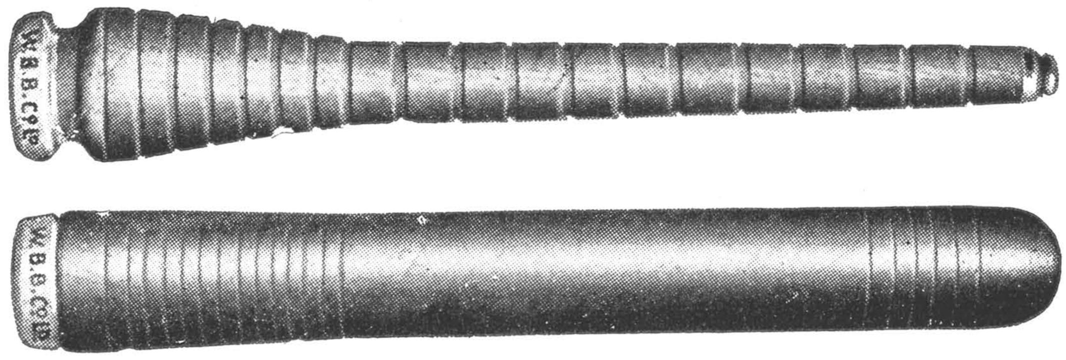
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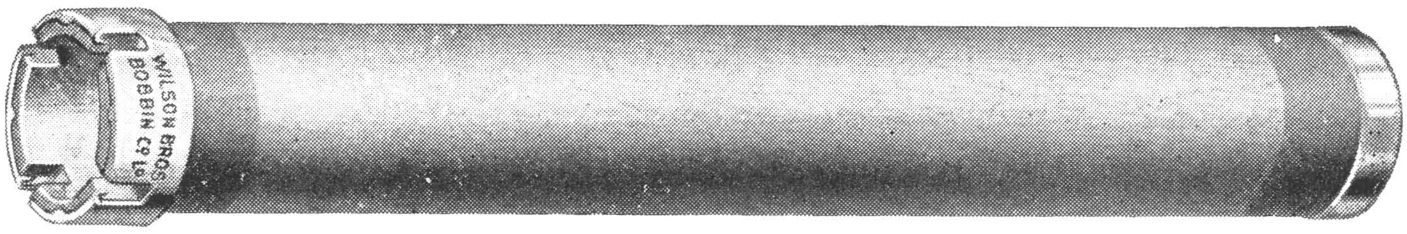
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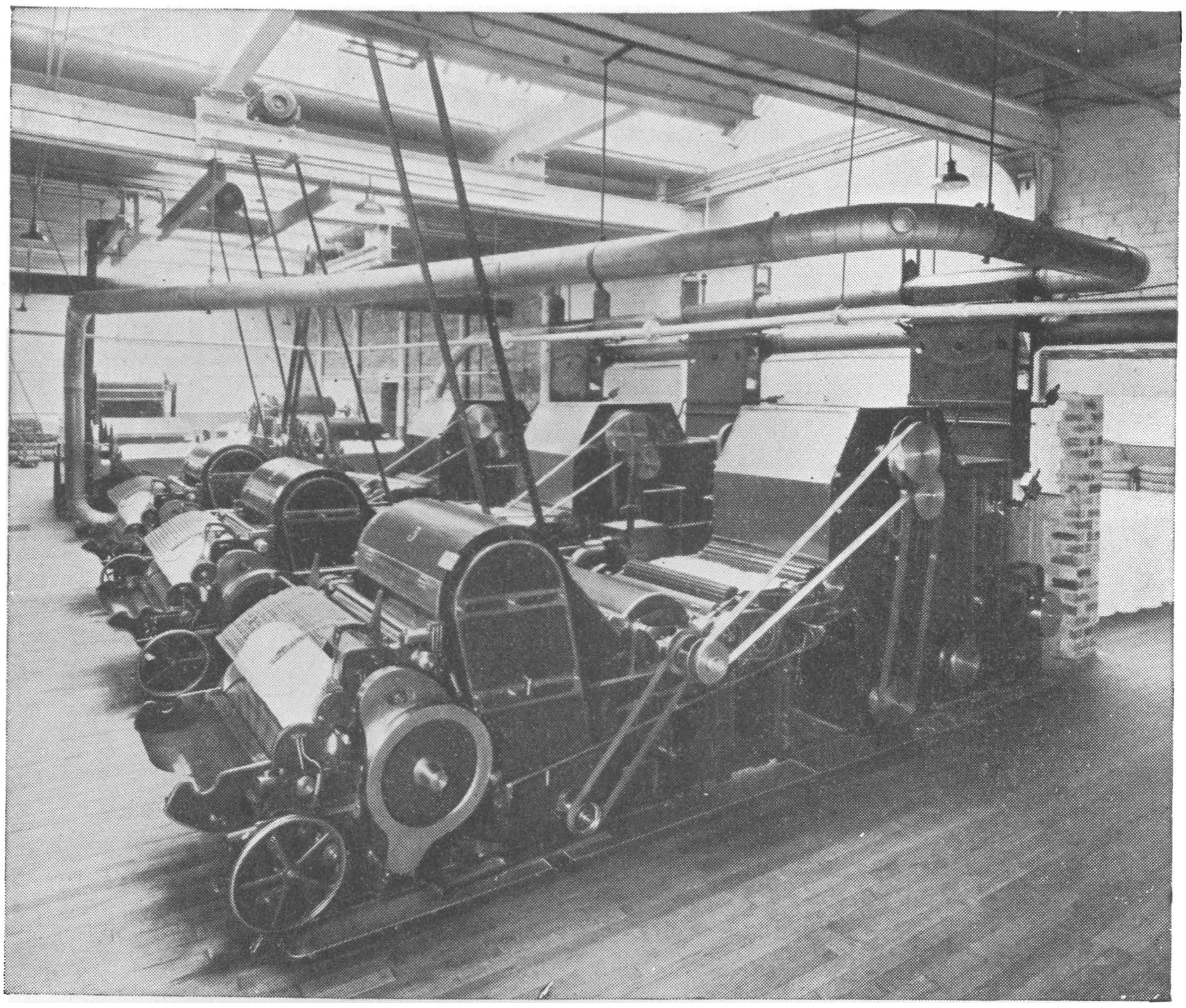

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THE JOURNAL OF THE

TEXTILE INSTITUTE

Vol. XXIX SEPTEMBER 1938 No. 9

PROCEEDINGS

NOTES AND ANNOUNCEMENTS

Council Meeting, September 1938

The first meeting of Council after the holiday interim was exceptionally well attended and indicates sustained interest in the Institute's activities. The meeting took the form rather of reporting on the various matters under consideration than of arriving at any particular decisions. The U.S.A. Delegation's report has not yet received consideration from two of the Committees to which it was referred since in neither case has a meeting of the Committee concerned been called. It has, however, been given very serious consideration by the Development Committee which has already met twice in this connection. The line of attack is through the question of Section functions and activities: any question of the establishment of Sections overseas must necessarily be related to the conditions obtaining in the existing Sections. The Development Committee hopes to be able to present definite recommendations to Council at its next meeting.

Arrangements are now complete for the visit of Council members to the Textile Machinery Exhibition on October 19th. Those attending will lunch as the guests of the Exhibition Directors and the afternoon will be spent in a tour of the stands. The preliminary list of Exhibitors indicates that a very comprehensive collection of machinery and accessories will be on view.

The general question of Competitions in respect of fabrics and design in relation to Textile productions is to form the basis of an informal discussion between representatives of the Institute and of the Royal Society of Arts. The mutual desire of the two organisations to foster appreciation of Art in relation to Industry is the background upon which this discussion is founded. Confidence is felt that grounds for common and complementary action will be found.

The question of venue for the Annual Meeting and Annual Conference in 1939 was introduced. Reference having been made to the very successful Annual Meeting held in Halifax this year, it was decided to invite Section Committees to offer suggestions.

Institute Staff Changes

During the past two years the Institute's Staff has undergone considerable change. After twenty-one years' service Mr. J. D. Athey was compelled to retire owing to ill-health. Intimation was given to the April meeting of Council that Miss A. Whittaker had resigned owing to her approaching marriage. At the September meeting the resignation of Miss M. Mitchell was received and accepted with expression of regret and appreciation of nearly twenty years' service. Miss Mitchell commenced work at the Institute in March, 1919, and has rendered excellent service to the *Journal* of the Institute and as Staff Secretary of the Savings Association and also for some years as Secretary of the Ring Yarn Association. Her resignation, due to her approaching marriage, takes effect at the end of September.

The National Register of Industrial Art Designers

The National Register of Industrial Art Designers is an Association established by the Board of Trade, on the recommendation of the Council for Art and Industry, to maintain and improve the Standard of Design in the products of British Industry and to foster good relations and close collaboration between designers and manufacturers. The Register is charged:—

1. To compile and keep up to date a national register of qualified designers for industry.
2. To establish conditions and standards of qualification for admission to the Register.
3. To examine and to accept or reject candidates for registration.
4. To bring registered designers seeking employment or a market for their designs into touch with manufacturers and others seeking to obtain the services of designers.
5. To act as a centre of information on matters pertaining to industrial art and design.

The Register is administered by a governing body composed of representatives of the following organisations:—Council for Art and Industry ; Federation of British Industries ; Association of British Chambers of Commerce ; Royal Academy of Arts ; Royal Society of Arts ; Design and Industries Association ; National Society of Art Masters ; Conference of Central Art Institutes of Scotland.

Registration is open to any qualified designer who is a British subject or who, not being a British subject, ordinarily works and resides in the United Kingdom and whose work, in the opinion of the Governing Body and its Advisory Committees, reaches the required standard. Applicants for registration will be required to submit examples of their work for adjudication by a Standing Committee composed of three members of the Governing Body and two members co-opted from the Register's Board of Honorary Advisers. The registration fee is £1 1s. 0d. to be paid at the time of registration and renewable every three years. Communications should be addressed to the Registrar at 32, St. James's Street, London, S.W.1.

Scottish Section

Annual Meeting

The Annual Meeting of the Section was held at the North British Station Hotel, Edinburgh, on Saturday, 14th May, 1938.

Prior to the Business Meeting, members of the Section met for Lunch in Crawford's Tea Rooms, North Bridge, and entertained as guests Mr. A. Cameron, Controller of Edinburgh G.P.O., Mr. Frame, Deputy Controller, and Mr. Potts, Assistant Controller (Telegraphs).

After Lunch, a visit was paid to the Sorting and Telegraph offices of Edinburgh G.P.O., where members had an opportunity of inspecting the work being carried on at the peak period, and explanations were given by various members of the Staff who conducted the visitors through the different departments.

Thereafter the Controller entertained the party to Tea, when Dr. A. W. Stevenson expressed thanks on behalf of the Institute for the excellent facilities afforded and for the interesting manner in which the inspection had been carried out. Mr. Cameron, Controller, expressed the pleasure of the Post Office Authorities in having the opportunity to demonstrate the working of the Department, and appreciated the interest which the members had shown throughout.

At 5-30 p.m. the Annual Business Meeting of the Section took place in the North British Hotel, when Dr. A. W. Stevenson presided over a representative attendance.

After intimating apologies for absence, the Hon. Secretary read the Minutes of the previous Annual Meeting as printed in the *Journal* and already circulated to all members of the Section.

The Chairman then reviewed the principal events of the past session, and referred to the fact that the Scottish Section had held more meetings than any of the other Sections of the Institute, viz. six meetings and two Works Visits, one of the meetings being held jointly with the Society of Dyers and Colourists (Scottish Section). It had been the most successful season yet held by the Scottish Section, and thanks were due to the firms who had granted permission to visit works. The Chairman made reference to the Institute's Standardisation Scheme, particularly in regard to meetings held with the Jute Spinners and Manufacturers' Association, and the National Association of Scottish Woollen Manufacturers. He also expressed the Section Committee's thanks to the Hon. Secretary for his work throughout the session, and his personal thanks to the members of the Committee for their assistance and time devoted to work of the Section throughout the year.

The Hon. Secretary then submitted a report of membership at 28th February, 1938, there being 90 members, an increase of three on the previous year. The distribution of membership remained very much the same as usual.

The following members were rccommeneded to Council for election as Section Committee:—Messrs. J. P. Beveridge (Dunfermline), J. C. Campbell (Galashiels), W. Lockhart (Kirkcaldy), S. M. Roberts (Selkirk), A. W. Stevenson (Galashiels), W. Watson (Glasgow), W. H. Wilkinson (Edinburgh), A. W. Blair (Glasgow).

ANNUAL COMPETITIONS 1938 : Awards

A good entry was received for the current year's Competitions and the adjudicating committees have just completed their task of determining the winners. The list of prize-winners is given below.

An Exhibition of the Competitors' work will be held at the Institute (Geographical Hall) headquarters, 16, St. Mary's Parsonage, Manchester, 3, on Friday and Saturday, November 4th and 5th. Admission will be free and is by business card or by ticket to be obtained from the General Secretary.

The prizes and certificates will be distributed by Major Philip Godlee at 3 o'clock on the afternoon of Saturday, 5th November. Attendance at this ceremony is by invitation only.

(A) COMPETITION : WOVEN FABRICS

First Prize (£25 & Certificate)	J. Creswick (Burnley Municipal College).
Second Prize (£15 & Certificate)	C. Evans (Colne Municipal Technical School).
Third Prize (£10 & Certificate)	J. Boyd (Salford Royal Technical College).
Prizes of £4 each	J. Baker (Bolton Municipal Technical College). Miss K. Broadhead (Derrymore, Cookridge, Horsforth). W. A. Dyson (Nelson Municipal Technical School). F. Kirkham (Manchester College of Technology). S. Sanderson (Bolton Municipal Technical College)

(B) COMPETITION : YARNS

Class I : Novel Folded Yarns

First Prize (£5)	G. Lever (Bolton Municipal Technical College).
Second Prize (£3)	J. Thurman (Bradford Technical College).

Class II : Novel Single Yarns

First Prize (£3)	G. Lever (Bolton Municipal Technical College).
Second Prize (£2)	J. Thurman (Bradford Technical College).

(C) COMPETITION : SPECIAL WOVEN FABRIC

First Prize (£5)	T. A. Graham (Bradford Technical College).
Second Prize (£4)	T. Crawshaw (Halifax Municipal Technical College).
Third Prize (£3)	F. J. Alexander (Bradford Technical College).
Fourth Prize (£2)	R. Stewart (Manchester College of Technology).

(D) COMPETITION : WOVEN FABRIC

First Prize (£3)	W. Dobson (Burnley Municipal College).
Second Prize (£2)	H. R. J. Dowson (Burnley Municipal College).
Prize of £1	N. Yates (Nelson Municipal Technical Evening Institute).

(E) COMPETITION : KNITTED FABRIC

Equal First Prize (£4 each) ...	D. J. Burton (Leicester College of Technology). Mrs. E. Clark (Leicester College of Technology).
Third Prize (£2)	Miss E. M. Lynam (Nottingham University College).
Prizes of £1 each	K. F. Bettinson (Leicester College of Technology). Miss K. M. Elliott (Nottingham University College) Miss J. E. Underwood (Nottingham University College).

(F) COMPETITION : DESIGNS FOR PRINTED FABRICS

CLASS I : DESIGNS FOR DRESS MATERIALS

First Prize (£6)	W. Howard (Manchester School of Art).
Second Prize (£4)	Miss J. Hulton (Manchester School of Art).
Third Prize (£2 10s.)	Miss L. Haggis (Manchester School of Art).

CLASS II : DESIGN FOR FURNISHING FABRIC

First Prize (£6)	Miss M. Simmons (Manchester School of Art).
Second Prize (£4)	S. Richardson (Manchester Svhool of Art).
Third Prize (£2 10s.)	W. Parker (Manchester School of Art).

(G) COMPETITION : SPECIAL WOVEN FABRIC (WORSTED)

CLASS I : MEN'S WEAR

First Prize (£3)	W. Leng (Halifax Municipal Technical College).
Second Prize (£2)	J. Barraclough (Bradford Technical College).
Third Prize (£1)	J. J. Hartley (Halifax Municipal Technical College).

CLASS II : WOMEN'S WEAR

First Prize (£3)	G. T. Holmes (Bradford Technical College).
Second Prize (£2)	E. Holmes (Bradford Technical College)
Third Prize (£1)	F. J. Alexander (Bradford Technical College).

(H) COMPETITION : WOVEN FABRIC (WORSTED)

First Prize (£3)	D. Laycock (Huddersfield Technical College).
Second Prize (£2)	D. I. Evans (Huddersfield Technical College).
Prizes of £1 each	V. Jenkins (Halifax Municipal Technical College). J. S. Robinson (Halifax Municipal Technical College). E. Turbitt (Keighley Technical College).

Employment Register

The following announcements are taken from entries in our Register of Members whose services are on offer. Employers may obtain full particulars on application: —

No. 186—A.T.I., 37 years of age, desires position as Manager or Assistant Manager. City and Guilds Full Technological Cert. 22 years' experience in Spinning. Lecturer for 15 years in Worsted Spinning and Textile Calculations.

No. 187—Desires position as Buyer-Producer of Cotton and Rayon Piece Goods for Home trade. 17 years' experience. A.M.C.T., A.T.I. Full knowledge of manufacture, dyeing, and printing of all classes of cotton and artificial silk textiles and the merchanting of same for Home trade, Colonial, European and West African markets. Age 37 years.

No. 188—Desires position as Works Manager, Technical Manager or Chief Chemist. Age 35 years. B.Sc.(Chemistry), A.R.C.S., A.M.I. (Chem.)E. 3 years' experience as Plant Manager and Chief Chemist. Patentee. 9 years' experience in charge of Scouring, Bleaching, Dyeing and Finishing of Cotton, Wool and Rayon Fabrics and Crêpe-de-Chines.

No. 189—Young man, 24 years of age, desires position as Assistant Carder or Technical Assistant. Full Tech. Cert. in Cotton Spinning and Higher National Cert. in Cotton Spinning. Experience as Asst. Carder. Good knowledge of Textile Testing and Technology. Passed Institute Examination, Part II, 1938. Willing to go abroad.

No. 191—Young man requires position as Assistant Manager of Silk Throwing Mill or similar position in Silk Manufacturing. City and Guilds Final in Silk Manufacture and Drapers' Scholarship. 9½ years' experience in Manufacturing. 3 years Supervisor (clerical and technical) in Silk and Rayon Throwing and Spinning Mill. Willing to go abroad. Age 27 years.

No. 192—Young man, 25 years of age, desires position as Inside Manager or Research worker. 7 years' exeperience in Worsted Spinning and Drawing, as overlooker. City and Guilds Final Certs. in Woollen Yarn Manufacture, Fabric Design, Cloth Analysis and Testing and Cloth Finishing.

No. 193—Desires position as Works Chemist. Age 24 years. Assoc. M.C.T. in Chemistry. Higher National Certificate in Chemistry. 5 years' experience in Textile Laboratory in testing and Analysis, Investigation of faults. Experience with speciality finishes.

No. 194—A.T.I., 30 years of age, single, desires position as Manager at home or abroad. 12 years' experience as Loom Overlooker and Inside Manager in Fancy Dress Goods, Cotton, Rayon and Worsted. Practical knowledge of designing and costing. City and Guilds Finals A and B in Cotton Weaving.

Institute Membership

At the September meeting of Council, the following were elected to Membership of the Institute:—

Ordinary.

N. H. Baker, 62 Priory Road, West Bridgford, Nottingham (Hosiery Dyer).
N. N. Basu, 18 Sanvey Gate, Leicester (Student).
S. Beddow, 35 Dale Street, Manchester, 1 (Managing Director, Messrs. Richard Haworth & Co. Ltd., Salford).
J. B. S. Curr, 7 Wellmeadow Street, Paisley (On Installation Staff, Messrs. J. and P. Coats Ltd., Glasgow).
V. Daitz, 306 Oakwood Lane, Leeds 8 (Student, Leeds University).
G. S. Merrill, 364 Varnew Avenue, Lowell, Mass., U.S.A. (Prof. of Textiles in charge of Dept. of Cotton Yarns and Knitting at Lowell Textile Institute).
A. M. Ramadan, Misr Spinning and Weaving Co., Mehalla El Kobra, Egypt (Head Carder).
A. V. Slater, Messrs. D. Gestetner Ltd., Tottenham Hale, London, N.17 (Production Chemist).
S. F. Viccajee, Bomabjee Mistry Building, opposite Wimbridge, Sleator Road, Bombay, 7 India (Dyeing, Bleaching and Finishing Technologist).

Junior.

C. A. W. Beck, 38 Kliffen Place, Coronation Road, Halifax (Textile Chemist).
J. M. Constantinus, 63 Ashgrove, Morley Street, Bradford, Yorks.

Reviews

"Chemistry of the Proteins" (Second Edition). Dorothy Jordan Lloyd, M.A., D.Sc., F.I.C., and Agnes Shore, B.Sc., A.I.C. (532 pp. Published by J. & A. Churchill, Ltd., London. Price 21s.)

The "Chemistry of the Proteins" was first published in 1926, and Sir F. G. Hopkins in his Introduction said it stood alone in aim and scope. Whilst maintaining its individuality, the author, in collaboration with Miss Shore, has expanded it into a volume of about twice the original size. In so doing, the arrangement of the text of the first edition has been closely followed. The large number of different points of view from which the chemistry of the proteins is now approached can be gathered from the chapter headings: nature and constitution; biological classification; analysis; individuality; biochemistry; proteolytic enzymes; chemical linkages; architecture; combination with acids and alkalies; properties and theory of their solutions and the influence of salts, denaturation and coagulation. The increase in size of the volume has been caused mainly by the inclusion of recent advances in all these subjects. Even now its relatively small size is indicative of a remarkable achievement when the variety of subjects dealt with and the clarity of presentation is borne in mind.

Prior to 1920, biochemistry, and in particular protein chemistry, was neglected in this country. Possibly we were fascinated by the achievements of synthetic organic chemistry with its promise to provide so many of our needs from coal and its by-products. Even at the present day it is often taken for granted that students of chemistry should leave our Universities with a more detailed knowledge of dyestuff intermediates than of the proteins of which their bodies are largely composed.

No better book could be recommended to such students who are entering or who have entered the wool industries—to mention but one important industry using a protein as its chief raw material. With its help they will find their way along the well-trodden paths of academic chemistry into the less clearly defined tracks of the chemistry of everyday life. One reward they may expect which they may not foresee. They will find that the empirical observations of the scourer, dyer, and finisher on the effect of variations in their processes on the properties of wool are no longer without significance and meaning. They will also realise that the industry is not entirely a " machine " industry, and will no longer be led to believe that any fibrous material can be an adequate substitute for wool, provided it can be processed on woollen or worsted machinery. H.P.

Cotton in Mediaeval Textiles of the Near East. By Carl Johan Lamm. (Librairie Orientaliste Paul Guenther, Paris. Price 20 couronnes Suédoises.)

For the specialist this book presents a great deal of information and is furnished with a wealth of references. But its title is perhaps misleading, for to anyone wishing to enquire into the use and distribution of cotton at this period in the Near East its pages would prove a formidable labyrinth. The book is in fact an annotated catalogue of existing textiles (which are mostly extremely fragmentary) entailing discussions on such materials, for instance, as " mulham " (p. 107) and " buckram " (p. 122) ; whilst the second part is composed of an interesting series of excerpts from Mediaeval Texts. The examples considered are almost exclusively drawn from the Arabic Museum, Cairo, and the great Scandinavian Museums, besides the author's own collection. Unfortunately, some of the most important textiles which Dr. Lamm considers have not been microscopically examined ; for instance in class 4 (chain stitch embroideries) the piece in the Benaki Museum described as " by far the most important example of this class " cannot for certain be claimed to contain cotton (p.87) ; in class 3 (tapestries in wool and cotton) the question of the Sassanian origin of the Antinoe group is considered, but the analysis of the pieces themselves is largely lacking (pp. 55, 56 and note 6) ; and the same is the case with class 6 (Abbasid and Seljuk fabrics, including the inscribed pieces on white): " only a few were, unfortunately, available for microscopic examination " (p. 118).

The introduction gives a short general history of cotton and the author takes for his motto, as it were, the words of ath'Th'alibi (10th century) " people know that cotton belongs to Khurasan, linen to Egypt "; in trying to localise the methods of spinning to the right or to the left many exceptions have to be allowed for (p. 7), and this analysis seems at present to be no aid to attribution. Dr Lamm divides his material into fifteen classes, with sub-groups, and the classification is very complicated. His treatment of Class 2 is fairly typical ; this includes the wool and cotton fabrics from Egypt which have only recently made their appearance, and following Miss Vivi Sylwan, he describes them as " Polymita Twills " (distinguished from Polymita Reps.) A fine series is reviewed, but it is regrettable that the illustrations are so inadequate (see figs. 4, 6, 8) and depend so largely on drawings (cf. Plate II, E, and the drawing of it fig. 5 ; an excellent photograph exists of the piece drawn fig. 20). The conclusions as to the origin of the series are rather vague (p. 50, 51) but finally the suggestion is made that they are the " double weft fabrics (munaijar) mentioned by Arab geographers as special to Raiy (p. 52). This is rather sweeping considering the diversity of these stuffs, the fact that many contain no cotton at all (a number of these are illustrated: Pl. VI B and C, figs. 4, 5, 6, 7, 8, 10, 14, etc.), and a piece with an Equestrian Battle Scene belonging to

Mrs. Russell is anything but Sassanian in style, whilst the question of the importation of cotton yarn into Egypt is not discussed. Under Class 6 Dr. Lamm's conclusions about the undyed fabrics bearing inscriptions of the Albasid-Seljuk period differ from M. Pfister's thorough study (Revue des Arts Asiatiques, XI, p. 167) ; the latter quotes one example in cotton inscribed as made at Misr (Egypt), and two in cotton and linen mixed in which the style of the inscriptions is not Iraquian, besides mentioning other points which show that the problems here warrant the greatest care and discrimination.

This book is based largely on technical analysis, and a word should be said under this head. The description of " draw-loom " weaving as done with heddles in connection with its reference is erroneous (p. 11), and the description of the Polymita twill weave is inadequate (p. 17). With regard to the printed fabrics, it may be mentioned that M. Pfister, a great expert on dyestuffs, has very severely criticised this work in his book which has just appeared (" Les Toiles Imprimées de Fostat et l'Hindoustan, pp. 91-93 "). G.F.W.D.

Difetti di Tintura nei Tessuti di Lana. Luigi Rinoldi. (Editoriale Laniera S.A. in Biella. Price L16.)

In this monograph on " defects in dyeing woollen fabrics," the author deals with the subject from the view point of the dyer who is interested in recognising the causes of the defects, when they appear and in the means or measures to be taken to avoid them. Since many faults have their origin in causes outside the dyer's control, such as the quality of the raw wool itself, sufficient information is given in the first chapter on the chemical and physical properties of wool to enable the dyer, who in many dyeworks has no assistants with any chemical or physical training, to understand how faulty processing of the wool in spinning or weaving the fabric before he receives it may cause defects which are only revealed by the dyeing process, and for which he is in no way responsible. In the second chapter the more usual signs which indicate whether the defect is due to faulty dyeing, unsuitable choice of dyestuff, or to bad processing either before or after dyeing are described. The importance of avoiding any alkali in the wool is stressed ; the shade may vary 9-23 per cent. from the alkali adsorbed during scouring, and in alkali laden wool seems to favour bacterial attack with the resulting loss in strength of the fibre and of affinity for the dyestuff. In subsequent chapters faults are described with details as to their origin and the reasons they appear in dyeing, such as irregular quality in the wool, variations in twist and tension when spinning or weaving, unequal pressure in calenders or the carbonising, milling or potting processes. Over these the dyer has little control. Many causes of irregular dyeing are found in defective washing or drying, and the presence of acid or alkali in the fabric ; tests are described for these and means for avoiding them given. The author lays stress on the difficulty in removing mineral oil introduced during weaving or spinning to increase ease of working. Comparatively little space is devoted to the defects observed in the actual dyeing, such as depth of shade ; the methods of correction are simple if the shade is level. Throughout, the author is most concerned with spots, stripes and similar irregularities in shade. In the last chapters the textile assistants are described and discussed. The headings of the chapters are collected as an index, and enable the appropriate section of the book for any defect to be found if the introduction has been studied.

Lockstitch and Chainstitch Sewing Machines. W. Riches. (Published by Longmans, Green & Co. Ltd., 39, Paternoster Row, London, E.C.4. Price 3s. 6d.)

This work is a very plain and lucid account of the construction of the sewing machine written, as its title indicates, for the young mechanic. It appears to fufil its function admirably and the author is to be congratulated on the clarity of his diagrams from which all unessential matter has been wisely eliminated. The book should be very valuable to those for whom it is written. T.

Cotton Year Book, 1938. (Published by " Textile Mercury and Argus," 41, Spring Gardens, Manchester. Price 7s. 6d.)

The standard of this publication is well maintained in this 1938 issue and there are no radical alterations from that of the previous year. The few remaining half-tone illustrations might with advantage be replaced by line drawings which are not only cheaper to produce, but are clearer and far more informative in every way.

Textil-Hilfsmittel-Tabellen. By Dr. J. Hetzer ; 2nd Edition, 1938 ; 327 pages. [Berlin ; Verlag Julius Springer. Price RM 24.]

This most useful book gives in dictionary form particulars of German products for use as foaming, wetting, scouring, washing, dispersing, levelling " assistants " in textile bleaching, dyeing, mercerising and finishing. The first edition, published in 1933, described 921 products. Of these, 121 are now omitted because they are obsolete, and 99 have received other names ; 545 more products are now included, making a present total of 1,345. The author deserves the gratitude of all those who encounter the proprietary names of these agents in their reading. Companion dictionaries of the products made by other than German firms would be equally welcome.

Additions to Library (since June, 1936)*

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- Education in 1936.
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- Examination papers, 1936, 1937, of Examination in Industrial Design.
- Examinations in Art, 1936.
- Memorandum on the Teaching of Cotton Spinning and Cotton Manufacturing in Evening Technical Schools, 1917.
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- Public Elementary Schools in England and Wales, 1936-37.
- Report of the Advisory Council of the Science Museum for the year 1937.
- Report of the Departmental Committee on Examinations for part time students.
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- Merchandise Marks Act, 1926—Report of the Standing Committee respecting Textile Smallwares, 1938.
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- Cotton Industry Act, 1937—Chapter 15.
- Cotton Spinning Industry Act, 1936—Accounts, 1936-1937.

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- Report on Economic and Commercial conditions in India, 1935-36.
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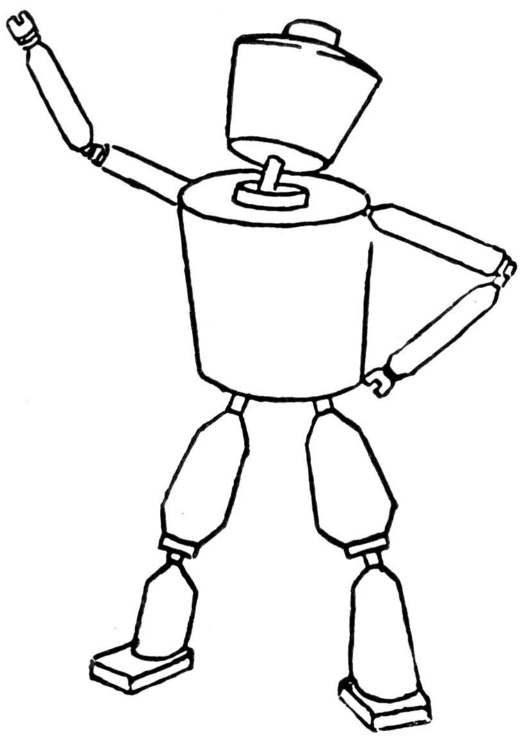
* A Further List of Additions since June, 1936, will be published in the next issue of this *Journal.*



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TRANSACTIONS

18—THE EFFECT OF ALKALIS ON THE MOLECULAR CHAIN LENGTH OF CHEMICALLY MODIFIED COTTON CELLULOSES, AS SHOWN BY FLUIDITY MEASUREMENTS ON THE DERIVED NITROCELLULOSES

By G. F. Davidson, D.Sc.
(British Cotton Industry Research Association)

SUMMARY

(1.) The combined processes of nitration with an anhydrous nitric-phosphoric acid mixture and denitration with ammonium hydrosulphide cause considerable degradation of cotton cellulose, but reasons are given for the view that this degradation is due mainly, if not entirely, to the denitration process.

(2.) From fluidity measurements on nitrocelluloses derived from oxycelluloses, the latter can be divided into two classes: (a) those prepared with alkaline oxidizing solutions, which give almost the same relation between nitrocellulose fluidity (in acetone) and cellulose fluidity (in cuprammonium*) as hydrocelluloses; the nitrocellulose fluidity of these is but little affected by alkaline treatments of the original oxycellulose: (b) those prepared with neutral or acid oxidizing solutions, which give considerably lower nitrocellulose fluidities than hydrocelluloses of equal cellulose fluidity; the nitrocellulose fluidity of these may be greatly increased even by cold treatments of the original oxycellulose with feebly alkaline solutions.

(3.) After boiling with dilute sodium hydroxide solution, all types of modified cotton give the same relation between cellulose fluidity and nitrocellulose fluidity.

(4.) Hydrocelluloses prepared from mercerised cotton show the same relation between cellulose fluidity and nitrocellulose fluidity as hydrocelluloses made from unmercerised cotton.

(5.) The relation between tensile strength and fluidity is widely different for different types of modified cotton when fluidity in cuprammonium is used, but it is very much more nearly the same for all types when nitrocellulose fluidity is used.

(6.) In the testing of cellulosic textile materials the cellulose fluidity measurement has the advantage over the nitrocellulose fluidity measurement of revealing latent damage that does not show itself as a loss of strength until the materials are treated with alkaline solutions.

(7.) The fluidity in cuprammonium of oxycelluloses prepared with neutral or acid oxidising solutions increases slightly for some time after dissolution, but no such increase is found with hydrocelluloses or with oxycelluloses prepared with alkaline oxidizing solutions.

(8.) The experimental results are interpreted in terms of the hypothesis that oxycelluloses obtained by oxidation with neutral or acid oxidizing solutions contain in their chain-molecules linkages that may be broken by dissolution in cuprammonium or by other alkaline treatment.

(9.) The mechanism of oxycellulose formation is discussed in the light of recent work on the oxidation of the simple glycosides, and a possible explanation of the scission of the oxidized chain-molecules by alkalis is suggested.

INTRODUCTION

It was shown by Clibbens and Ridge[1] that the relation between the fluidity in cuprammonium and the tensile strength of chemically modified cottons varied with the method of modification, the loss of strength for a given rise of fluidity being greatest for hydrocelluloses and least for oxycelluloses prepared by the action of dichromate in oxalic acid solution. It was also shown that when the modified cottons were boiled with dilute sodium hydroxide solution their fluidity was increased and their tensile strength diminished to an extent that also depended on the method of modification; for example, whereas neither the strength nor the fluidity of the hydrocelluloses was greatly affected, the dichromate oxycelluloses

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* "Cuprammonium" = a solution of cuprammonium hydroxide.,

suffered a great additional loss of strength, accompanied by a relatively small increase of fluidity. The changes of fluidity and strength produced by boiling the various types of modified cotton were such that the fluidity-strength relation found for the boiled materials was approximately the same whatever the method of modification. If the molecular chain theory of the structure of cellulose is accepted and both tensile strength and fluidity in cuprammonium are regarded as functions of the chain length, this behaviour of the dichromate oxycelluloses and other types prepared by oxidation with non-alkaline solutions presents a difficulty. As a solution of this difficulty it has been suggested[2,3] that oxidation does not necessarily result directly in the scission of the chain-molecules, but may so reduce the chemical stability of some of the linkages towards alkalis that they may be broken by dissolution in an alkaline solvent such as cuprammonium or by boiling with dilute sodium hydroxide solution. The object of the present investigation was to obtain further evidence by which to test this hypothesis.

It was thought that if the fluidity of the modified cottons could be determined without the use of an alkaline medium, then a true measure of the average length of the molecular chains as they exist in the fibre would be obtained in all cases. The method adopted for this purpose was to nitrate the modified cottons under standard conditions, and to determine the fluidity of the nitrocelluloses. The investigation thus resolved itself into a study of the " nitrocellulose fluidity " (fluidity of derived nitrocellulose in acetone) of different types of modified cotton, before and after treatment with various alkaline solutions, in relation to other properties such as " cellulose fluidity " (fluidity in cuprammonium) and tensile strength. No new strength measurements were made, however, the data employed being those of Clibbens and Ridge[1].

EXPERIMENTAL

(1) Preparation of Chemically Modified Cottons

The cotton used for the preparation of chemically modified cottons was a sample of linters that had been purified by boiling under pressure with dilute sodium hydroxide solution. The methods of chemical modification were selected from those employed in earlier work in these laboratories. A series of hydrocelluloses was prepared by steeping the linters for various times at 25° C. in solutions of hydrochloric acid containing 200 g. of the acid per litre, and another series was similarly prepared from linters that had been previously swollen (" mercerised ") by treatment with $7N$ sodium hydroxide solution. Six series of oxycelluloses were employed, the methods of oxidation being as follows[4] : (i) with $N/100$ hypobromite, $N/10$ in sodium hydroxide, (ii) with $N/25$ hypochlorite, $N/5$ in sodium carbonate (alkaline hypochlorite), (iii) with $N/25$ hypochlorite buffered at pH 7·5 with phosphate buffer (neutral hypochlorite), (iv) with $N/25$ hypochlorite buffered at pH 4·8 with acetate buffer (acid hypochlorite), (v) with $N/25$ potassium dichromate, $N/5$ in sulphuric acid, (vi) by steeping in $N/5$ oxalic acid solution to which was added a certain volume of $N/25$ potassium dichromate, and leaving until complete reduction of the dichromate had taken place. In methods (i) to (v) the degree of modification was controlled by varying the time of treatment and in the last method this was done by varying the volume of dichromate solution used. All the oxidations were done at room temperature and the ratio of cotton to solution was 20 g. per litre. The " neutral " and acid hypochlorite solutions were identical in composition with those used by Clibbens and Ridge[4] and described by them as having pH values of 7 and 4·6 respectively. These are the values that the buffer solutions used would give in the absence of the hypochlorite, but the addition of the latter results in a slight increase of pH[5]. The pH values given above were measured by means of the glass electrode.

(2) Nitration

For the purpose of the present investigation it was desirable to choose a method of nitration that would cause as little degradation of the cellulose as possible. Berl and Rueff[6] have shown that by the use of mixtures of nitric and phosphoric acids, rendered anhydrous by the addition of a slight excess of phosphorus pentoxide, nitrocelluloses are obtained that have higher viscosities than those prepared with the more usual nitric acid—sulphuric acid—water mixtures. The method adopted was very similar to that of Berl and Rueff, the nitrating acid having the following composition (by weight): HNO_3, 48 per cent.; H_3PO_4, 50 per cent.; P_2O_5, 2 per cent. The mixture was prepared quantitatively from 95 per cent. nitric acid, 89 per cent. orthophosphoric acid and phosphorus pentoxide, and its composition was checked by analysis. For this purpose the total acidity was determined by titration with *N*-sodium hydroxide solution, using the " 4·5 " indicator supplied by British Drug Houses for the titration of orthophosphoric acid as a monobasic acid. It was found advisable to add the indicator near the end of the titration, otherwise there was a change in the colours of the indicator due to the nitric acid. The concentration of nitric acid in the mixture was determined either by the nitrometer or the Devarda method.

The conditions of nitration adopted as standard consisted in steeping the cotton in the nitrating acid for four hours at 0° C. The cotton was previously dried over phosphorus pentoxide and the nitrating acid cooled to 0° C. before the cotton was added. The ratio of cotton to acid was 1 g. in 100 c.c. At the end of the nitration period, as much as possible of the nitrating acid was removed from the nitrocellulose by suction through a coarse Jena fritted glass filter, followed by pressure with a flat-ended glass rod. The nitrocellulose was then immersed in a large volume of cold water, and thereafter washed with numerous changes of water until the washings were neutral to methyl red; the washing process occupied about 24 hours. The nitrocellulose was then dried by exposure to the air. It did not receive any special stabilisation treatment, but it was used for fluidity and nitrogen content determinations as soon as it was dry. A comparison of the fluidities of nitrocelluloses prepared at 0° C. and 20° C. respectively showed that there was little difference between the products obtained at the two temperatures. The lower temperature was used, however, as probably giving the larger margin of safety with respect to possible degradation. As a check on the reproducibility of the results given by the method of nitration adopted, a hydrocellulose was nitrated at intervals during a period of eighteen months, and the fluidities of the products measured; the values found were 39·4, 38·4, 39·3, 38·5 and 39·5.

(3) Measurement of Fluidity

The fluidities of the chemically modified cottons in cuprammonium were measured by the method of Clibbens and Geake[7,8,9]. The results given are the fluidities in c.g.s. units of 0·5 per cent. cellulose solutions at 20° C.

The fluidities of the nitrocelluloses were measured in acetone solution in a viscometer of the U-tube type adapted for pipette filling[10], the important dimensions of which were as follows:

Capillary	length	10 cm.
	internal diameter	0·050 cm.
Upper bulb, capacity ...	...	1·24 c.c,
Mean head	...	10 cm. approx.

The viscometer was calibrated with water, for which the time of flow at 20° C. was 76·7 seconds and the calculated kinetic energy correction was 0·7 per cent. For acetone solutions of nitrocellulose at 20° C. the fluidity was given by the equation

$$F = \frac{9520}{t - (41/t)}$$

where t is the time of flow in seconds and the term $41/t$ represents the kinetic energy correction. The nitrocellulose fluidities given are those of solutions containing 0·25 g. of nitrocellulose in 100 c.c. of acetone, the use of this concentration allowing the whole range of nitrocelluloses to be covered with the viscometer described. Since the maximum fluidity recorded is about 180, the minimum time of flow was about 54 seconds, and the maximum kinetic energy correction was 1·4 per cent. of the observed time.

Approximately 0·125 g. of nitrocellulose was dried over phosphorus pentoxide in a vacuum desiccator, weighed and rapidly transferred to a glass tube about 30 cm. long and 1·5 cm. in diameter, sealed at one end and closed at the other by a rubber stopper. The appropriate volume of acetone was added and the tube attached to a slowly rotating wheel for eighteen hours. After the tube had been allowed to stand for an hour to allow any suspended particles to settle, 20 c.c. of the solution was pipetted into the viscometer. The latter was then closed by a fitting[10] which allowed the solution to be raised by air pressure into the upper bulb, but prevented evaporation of solvent or access of moisture during the measurement. The fluidity was calculated from the mean of at least five observations of the time of flow, except in the few instances where this time was very long, when fewer observations were made. The acetone employed was the middle fraction from samples of good quality that had been dried and then distilled.

The fluidities of the solvents at 20° C. are : cuprammonium, 72[9] ; acetone, 310[11]. By the use of these values the measurements recorded can be converted if necessary into relative fluidities or viscosities.

As it is certain that some of the solutions dealt with did not obey the laws of true viscous flow, the term " fluidity " in such cases is to be regarded as an abbreviation for " apparent fluidity."

(4) Nitrogen Content of Nitrocelluloses

As there is evidence that the fluidity of a nitrocellulose depends on the nitrogen content as well as the length of the chain-molecules, it was necessary to prove that the nitrogen contents of nitrocelluloses produced from modified cottons of various types by the standard procedure showed no serious variation. The method of analysis employed was a modification of that of Koehler, Marqueyrol and Jovinet[12]. About 0·35 g. of nitrocellulose, dried over phosphorus pentoxide and weighed, was digested at 35° C. with a mixture of 60 c.c. of water, 20 c.c. of 20-volume hydrogen peroxide, 50 c.c. of 30 per cent. (by weight) potassium hydroxide solution, and 5 c.c. of 95 per cent. ethyl alcohol, contained in a 750 c.c. round-bottomed flask closed with a pear-shaped glass bulb. After the nitrocellulose had dissolved completely 3 g. of powdered Devarda's alloy was added and the flask quickly connected to an ammonia distillation apparatus, the outlet tube of which dipped into 50 c.c. of $N/10$ sulphuric acid. When the evolution of gas had almost ceased the solution was boiled until about 100 c.c. had distilled.

The excess acid in the receiving flask was then titrated with *N*/10 sodium hydroxide, using methyl red as indicator. A "blank" determination, omitting the nitrocellulose, was also made and the results obtained with nitrocelluloses corrected accordingly.

As the result of some ninety determinations on nitrocelluloses prepared from modified cottons of all the types dealt with in this paper, it was found that the mean nitrogen content was 13·70 per cent., with extreme variations of ± 0·1 per cent.; 74 per cent. of the values lay between 13·65 and 13·75 per cent. The conclusion may therefore be drawn that for the materials here dealt with the degree of nitration is not greatly dependent either on the kind of chemical attack the modified cotton has suffered or on the extent of this attack.

(5) Effect of Time of Nitration on the Nitrogen Content and Fluidity of Nitrocelluloses

The results of an investigation of the rate of nitration and the relation between the time of nitration and the fluidity of the nitrocellulose produced are given in Table I.

Table I

Effect of Time of Nitration on Nitrogen Content and Fluidity

Time of nitration (hours)	Nitrocellulose from unmodified cotton		Nitrocellulose from hydrocellulose	
	% N	Fluidity (0·1% solution)	% N	Fluidity (0·25% solution)
0·1	13·54	45·1*	13·48	41·9*
0·5	13·59	43·7	13·55	40·2
1	13·69	43·2	13·64	39·5
2	13·67	40·6	13·63	39·8
4	13·67	41·0	13·64	39·4
8	—	—	13·65	39·8
20	13·71	41·6	13·65	39·5

(* Nitrocellulose not quite completely dissolved.)

These results relate to the unmodified cotton (cellulose fluidity, 5·6) and a hydrocellulose (cellulose fluidity, 17·2). Owing to the inconveniently long time of flow of 0·25 per cent. solutions of the nitrocelluloses derived from the unmodified cotton, the fluidity of these materials was studied in 0·1 per cent. solution. The nitrogen content figures show that the nitration process is extremely rapid, being nearly complete in 6 minutes. As the time of nitration is increased the fluidity falls to an approximately constant value, which is attained after a period of nitration of about 2 hours, and prolongation of this period to 20 hours is without further appreciable effect. The higher initial fluidity is due in part to incomplete solubility of the nitrocelluloses. The results show that the time of nitration adopted in the standard procedure (4 hours) is amply sufficient for the attainment of steady states both of nitrogen content and fluidity.

(6) Phosphorus Content and Yield of Nitrocelluloses

The average value (13·70 per cent.) found for the nitrogen content of the nitrocelluloses is considerably lower than the value corresponding to complete nitration (14·14 per cent. for the trinitrate), and as the nitrocelluloses contained easily detectable amounts of phosphorus, it was thought that the low nitrogen content might be due to partial phosphorylation of the cellulose rather than to incomplete esterification. Determinations of phosphorus and nitrogen contents were therefore made on a number of nitrocelluloses, and, as a check on the analytical results, the ratio of nitrocellulose obtained to cellulose used was also measured.

The nitrocellulose yield was determined in the following way. About 0·3 g. of cotton or chemically modified cotton, dried over phosphorus pentoxide and weighed, was nitrated and the washings from the nitrocellulose were filtered through a Jena fritted glass filter-crucible to collect fragments of fibres. The nitrocellulose was finally transferred to the filter crucible and dried to constant weight over phosphorus pentoxide in a vacuum desiccator.

The determination of phosphorus was made by Zinzadze's[13] modification of the molybdenum blue method, in which the blue colour is formed by reduction of molybdic acid with stannous chloride in the presence of the phosphate. The colour measurement was made with a photo-electric colorimeter. The nitrocelluloses were brought into solution for the analysis by heating with a mixture of sulphuric and nitric acids.

The results are given in Table II. The yields of nitrocellulose are expressed as percentages of (1) the weight of cellulose used, (2) the theoretical yield for nitration and phosphorylation to the degrees corresponding to the observed nitrogen and phosphorus contents. The phosphorus content of the nitrocelluloses is rather variable, but it seems to be definitely lower for nitrocelluloses from linters than for those from modified cottons. The values are much higher than the phosphorus content of the original cotton, which was found to be 0·002 per cent. Calculation shows that esterification is not complete, the number of hydroxyl groups per $C_6H_{10}O_5$ unit nitrated and phosphorylated varying from 2·87 to 2·90 and from 0·02 to 0·04 respectively. The yield of nitrocellulose is in all cases about 0·7 per cent. higher than the value calculated from the nitrogen and phosphorus contents, and this suggests that there is a constant error in the measurement of one or more of the quantities determined. The discrepancy would be accounted for if the nitrogen contents determined were from 0·10 to 0·15 per cent. too low.

Table II
Nitrogen Content, Phosphorus Content and Yield of Nitrocelluloses

Starting material	Cellulose fluidity	% N	% P	Yield as percentage of	
				cellulose used	theoretical yield
Unmodified cotton	5·6	13·73	—	182·8	—
,, ,, ...	5·6	13·70	0·26	182·2	100·7
,, ,, ...	5·6	13·77	0·23	182·5	100·6
Hydrocellulose	25·4	13·70	0·41	183·6	100·8
Dichromate-oxalic acid oxycellulose	23·5	13·74	0·32	183·0	100·7
Hypobromite oxycellulose ...	22·5	13·74	0·37	183·4	100·6
Neutral hypochlorite oxycellulose	25·0	13·68	0·35	183·0	100·8

In contrast with the results given above, Berl and Rueff[14] state that nitrocelluloses prepared by means of nitric-phosphoric acid mixtures contained only a trace of phosphorus. Nitro-starches similarly prepared, however, were found by Berl and Kunze[15] to contain considerably more phosphorus than the original starch.

Although the phosphorus content of nitrocelluloses from different types of modified cotton is rather variable, the degree of phosphorylation is so small that any effect of this variation on the fluidity of the nitrocelluloses may probably be neglected.

(7) Relations between the Cellulose Fluidity and the Nitrocellulose Fluidity of Modified Cottons, before and after Boiling with Sodium Hydroxide Solution

Hydrocelluloses and oxycelluloses were prepared by the methods already described, and, as soon as possible after their preparation, they were nitrated

Table III

Relations between Cellulose Fluidity and Nitrocellulose Fluidity of Chemically Modified Cotton Celluloses

Before Alkali Boiling		After Alkali Boiling	
Cellulose Fluidity	Nitrocellulose Fluidity	Cellulose Fluidity	Nitrocellulose Fluidity
Linters :—			
5·6	3·6	6·8	7·2
Modified by Hydrochloric Acid :—			
12·8	21·7	14·2	27·4
17·2	39·4	18·9	45·8
22·4	61·7	23·5	65·0
25·4	80·0	26·6	85·2
27·0	86·0	27·8	91·4
27·1	84·4	—	—
27·6	90·9	28·7	96·8
31·1	109·1	32·0	114·7
34·8	129·2	35·6	132·2
36·9	143·2	37·1	147·0
38·8	158·4	39·2	159·7
41·5	170·6	—	—
Modified by Alkaline Hypobromite :—			
11·8	16·0	15·8	32·4
17·1	34·5	22·3	63·4
22·5	60·3	27·0	88·5
26·4	80·7	29·7	103·5
27·4	83·4	31·1	110·8
29·8	100·4	34·2	127·4
35·0	129·8	37·7	148·8
40·6	167·3	43·0	183·6
Modified by Alkaline Hypochlorite :—			
11·6	16·3	13·9	25·9
18·5	38·3	21·0	56·9
21·5	52·0	24·1	70·8
22·9	60·7	26·7	81·6
23·5	65·1	27·1	88·4
23·9	64·9	26·5	86·0
26·7	79·7	30·1	102·9
29·9	96·6	33·1	120·7
33·4	116·8	36·0	135·9
35·5	128·4	36·8	143·5
38·0	147·0	39·8	159·2
Modified by Neutral Hypochlorite :—			
11·7	8·1	18·8	41·6
13·7	10·6	22·9	62·0
14·0	14·0	20·9	57·7
20·9	23·9	29·8	97·8
21·6	29·1	30·1	103·5
22·8	34·0	29·6	99·1
25·0	40·5	33·0	118·8
29·5	58·6	36·0	136·9
33·8	78·7	37·6	148·1
36·0	89·3	39·7	160·8
36·7	91·1	40·0	164·7
41·4	128·2	42·5	178·8
Modified by Acid Hypochlorite :—			
7·5	5·4	12·5	21·1
8·8	—	14·6	28·4
9·4	6·9	19·4	47·6
10·3	8·0	20·6	52·8
11·0	9·4	21·5	60·1
12·0	9·7	25·3	75·3
15·9	15·6	27·6	90·8
16·8	20·4	30·3	106·4
20·3	26·7	34·6	125·8
23·3	35·6	36·9	142·3
27·2	51·6	40·0	157·9
30·2	67·5	42·0	171·3
Modified by Dichromate in Sulphuric Acid Solution :—			
10·6	5·9	13·5	23·0
15·4	9·1	19·1	46·6
19·9	12·1	23·8	68·5
25·2	18·6	29·4	96·5
25·4	16·6	29·0	96·9
26·3	18·0	29·9	101·7
31·0	30·5	34·6	129·5
32·5	36·6	37·0	141·0
36·4	51·7	40·0	159·7
39·4	63·9	42·8	177·5
42·9	71·7	44·8	183·7
Modified by Dichromate in Oxalic Acid Solution :—			
12·0	4·7	14·9	30·5
15·2	4·8	17·9	42·7
19·9	6·6	23·3	66·5
23·5	7·6	26·2	82·8
28·4	10·1	30·2	104·6
32·5	12·7	34·2	125·0
37·2	18·2	38·1	148·3

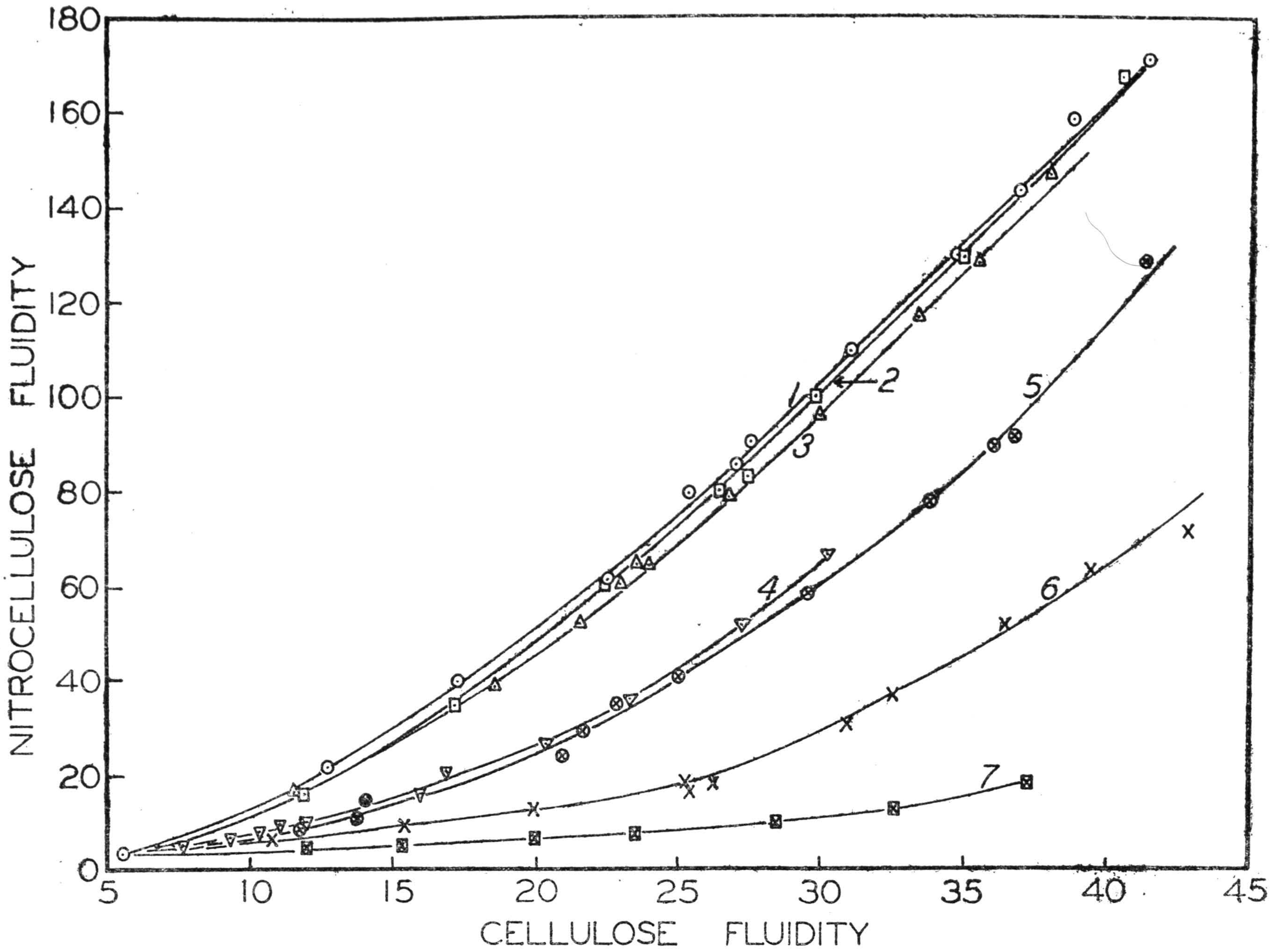


Fig. 1

1—hydrochloric acid; *2*—alkaline hypobromite; *3*—alkaline hypochlorite, *4*—acid hypochlorite; *5*—neutral hypochlorite; *6*—dichromate + sulphuric acid; *7*—dichromate + oxalic acid.

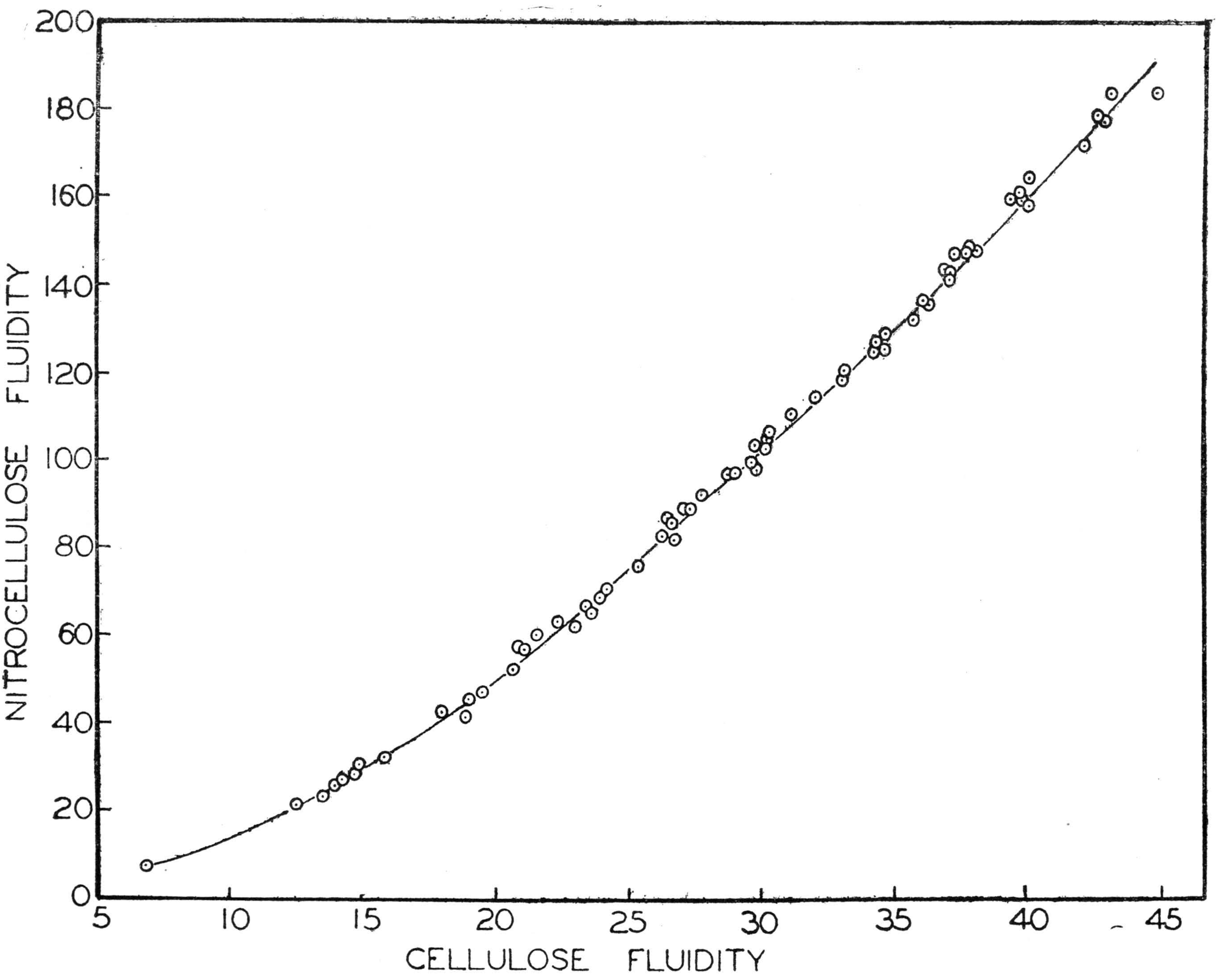


Fig. 2

by the standard procedure. A portion of each sample was also boiled with 1 per cent. sodium hydroxide solution for 6 hours at an excess pressure of 20 lb. per square inch, and the boiled material similarly nitrated. The cellulose fluidities and nitrocellulose fluidities are given in Table III, and the relations between them before and after boiling are shown graphically in Figs. 1 and 2 respectively.

Fig. 1 shows that within each series of modified cottons there is a definite relation between cellulose fluidity and nitrocellulose fluidity, but that this relation differs widely for different methods of chemical modification.

By boiling under pressure with sodium hydroxide solution the cellulose fluidity and the nitrocellulose fluidity are increased to a greater or less extent depending on the type of modification. The result of these changes is that the relation between the cellulose fluidity and the nitrocellulose fluidity of all the boiled materials, irrespective of the method of chemical modification, is expressed by a single curve (Fig. 2), and this curve is identical with that for hydrocelluloses before alkali boiling.

(8) Relation between the Cellulose Fluidity and the Nitrocellulose Fluidity of Hydrocelluloses prepared from Mercerised Cotton

In Table IV are given the results of measurements of the cellulose fluidity and nitrocellulose fluidity of cotton that had been swollen with $7N$ sodium hydroxide solution, and of a series of hydrocelluloses prepared from it. Graphical comparison shows that the relation between the cellulose fluidity and the nitrocellulose fluidity of these materials is the same as that found for hydrocelluloses prepared from unmercerised cotton (Table III).

Table IV
Relation between Cellulose Fluidity and Nitrocellulose Fluidity of Hydrocelluloses made from Mercerised Cotton

Cellulose fluidity	6·6	19·7	27·2	35·1	40·2
Nitrocellulose fluidity ...	5·5	50·4	88·7	133·5	165·6

(9) Effect of Milder Boiling Treatments on the Relations between the Cellulose Fluidity and the Nitrocellulose Fluidity of Modified Cottons

Table V shows the effect of milder conditions of boiling on the cellulose fluidity and the nitrocellulose fluidity of one member of each series of modified cottons. The results indicate that those types of oxycellulose that show a large increase of nitrocellulose fluidity when boiled under pressure with sodium hydroxide solution show a smaller, but still very considerable, increase when boiled with water. The increases produced by boiling with soap or sodium carbonate solution are intermediate between those obtained with water and sodium hydroxide solution. The acid and neutral hypochlorite oxycelluloses, which of all the types of modified cotton studied show the greatest rise of cellulose fluidity on boiling with sodium hydroxide solution under pressure, also show a considerable rise of cellulose fluidity on boiling with water, and the effect of boiling with soap or sodium carbonate solution is almost as great as that produced by the pressure boil. Hydrocelluloses, and oxycelluloses of the alkaline hypobromite and alkaline hypochlorite types show relatively small increases of cellulose fluidity and nitrocellulose fluidity when boiled with water, soap solution or sodium carbonate solution.

(10) Effect of Treatment with Cold Alkaline Solutions on Modified Cottons

As a preliminary to the investigation of the action of cold alkaline solutions on various types of modified cotton, the effects produced on the

Table V

Effect of Various Treatments on Cellulose Fluidity and Nitrocellulose Fluidity of Modified Cottons

Treatment.	Method of modification															
	Hydrochloric acid		Alkaline hypobromite				Alkaline hypochlorite		Neutral hypochlorite		Acid hypochlorite		Dichromate + sulphuric acid		Dichromate + oxalic acid	
			(1)		(2)											
	F_C	F_N	F_C	F_N	F_C	F_N	F_C	F_N	F_C	F_N	F_C	F_N	F_C	F_N	F_C	F_N
Original material	27·6	90·9	29·8	100·4	27·4	83·4	29·9	96·6	29·5	58·6	30·2	67·5	31·0	30·5	28·4	10·1
Water, 100° C, 6 hrs.	27·6	91·6	31·2	106·6	—	—	30·7	103·8	34·5	116·4	37·5	132·4	32·4	81·4	29·5	69·2
Soap, 1%, ,, ,,	27·6	93·8	31·4	109·4	—	—	30·0	102·9	35·6	128·9	42·0	168·5	34·5	115·1	29·2	85·7
Na_2CO_3, 1%, ,, ,,	27·9	94·6	32·0	115·0	—	—	30·9	106·0	35·5	132·5	41·9	169·4	34·5	125·1	28·6	96·0
NaOH, 1%, 126° C*, ,,	28·7	96·8	34·2	127·4	31·1	110·8	33·1	120·7	36·0	136·9	42·0	171·3	34·6	129·5	30·2	104·6
NaOH, 0·5 *N*,20° C, 24 hrs.	27·3	90·3	30·5	109·8	—	—	29·6	102·2	35·3	121·9	41·0	161·1	34·1	108·6	29·5	76·7
Na_2CO_3, 0·2 *N*, ,, ,,	—	—	—	—	28·6	92·1	30·6	101·3	—	—	40·3	160·6	34·1	103·2	—	—
NH_4OH, 200 g./l. ,, ,,	27·6	92·3	—	—	28·4	89·7	30·4	99·9	31·1	84·7	33·7	110·5	31·8	62·1	29·7	38·8
NH_4OH, 0·2 *N* ,, ,,	—	—	—	—	—	—	—	—	—	—	37·8	136·0	32·7	80·1	—	—

F_C, cellulose fluidity ; F_N, nitrocellulose fluidity.
*20 lb./sq. inch excess pressure.

properties of a neutral hypochlorite oxycellulose by treatment with various solutions for different times was studied. The cellulose fluidity, nitrocellulose fluidity and copper number (Schwalbe-Braidy)[16] of the treated samples were measured.

The results (Table VI) show that dilute solutions of sodium hydroxide and sodium carbonate rapidly increase both the cellulose fluidity and the nitrocellulose fluidity. A large part of the total increase occurs in the first hour of treatment, and prolongation of the treatment from 6 to 24 hours has little further effect. *N*/5 sodium carbonate solution is nearly as effective as *N*/10 sodium hydroxide solution. These treatments lower the copper number to an extent that varies with the alkalinity. Treatment of the oxycellulose with *M*/20 borax (*p*H 9·2) causes a gradual rise in cellulose fluidity and nitrocellulose fluidity, but the effects produced are small

Table VI

Effect of Alkaline Solutions at 20° C. on a Neutral Hypochlorite Oxycellulose.

Solution	Time of treatment (hours)	Copper number	Cellulose fluidity	Nitrocellulose fluidity
0·5 *N* sodium hydroxide ...	0	2·05	21·6	29·1
	1	—	28·3	81·0
	3	—	28·5	84·0
	6	—	28·4	85·3
	16	—	28·7	—
	24	1·67	28·7	87·9
0·1 *N* sodium hydroxide ...	1	2·03	26·4	78·7
	3	1·93	28·2	82·0
	6	1·90	28·4	84·6
	24	1·82	28·5	84·9
0·2 *N* sodium carbonate ...	1	—	26·4	68·9
	3	2·00	27·2	75·3
	6	—	27·4	78·8
	16	1·92	28·6	79·5
	24	1·86	28·6	82·2
0·05 *M* borax	3	—	22·6	34·9
	6	—	23·3	39·1
	16	—	23·6	44·3
	24	2·03	23·2	46·9
	48	—	24·1	51·3
Ammonia, 200 g./l. ...	1	—	22·0	36·8
	3	—	22·6	41·0
	6	—	22·7	41·9
	24	—	23·0	44·0
Ammonia, 0·1 *N*	24	—	25·8	64·0
,, 0·2 *N*	24	—	25·9	65·0
,, 0·5 *N*	24	—	26·3	66·1
,, 1 *N*	24	—	25·4	62·4
,, 2 *N*	24	—	25·6	61·6
,, 5 *N*	24	—	24·9	56·5
,, 10 *N*	24	—	24·2	49·2
0·5 *N* sodium hydroxide	3	—	28·2	85·3
0·5 *N* sodium hydroxide + 10 g./l. sodium hydrosulphite...	3	—	28·5	86·5
0·5 *N* sodium hydroxide freed from oxygen	3	—	28·1	84·6

compared with those of sodium hydroxide and sodium carbonate solutions; the effect on the copper number in 24 hours is insignificant. A solution containing 200 g. of ammonia per litre (the concentration of ammonia in the cuprammonium used for fluidity determinations) has about the same effect as the borax solution in spite of the greater alkalinity of the former. The results of experiments in which the ammonia concentration was varied show that dilute solutions (0·1-0·5*N*) increase the cellulose fluidity and the nitrocellulose fluidity more than concentrated solutions, but even these dilute solutions of ammonia have less effect than sodium carbonate solutions of approximately the same *p*H value.

In order to test the possibility that the effect of dilute alkaline solutions on the cellulose fluidity might be due to oxidation by dissolved oxygen, experiments were made in which the oxycellulose was treated with 0·5*N* sodium hydroxide solution that had been freed from dissolved oxygen either by the addition of 10 g./l. of sodium hydrosulphite or by bubbling nitrogen through the solution for several hours. As Table VI shows, the fluidities obtained were not appreciably different from those obtained in the absence of special precautions to remove dissolved oxygen.

Table VII shows the effect of treating a hydrocellulose with 0·1*N* sodium hydroxide solution. Although the copper number is progressively diminished, neither the cellulose fluidity nor the nitrocellulose fluidity is seriously affected by the treatment.

Table VII

Effect of 0.1 N Sodium Hydroxide at 20° C. on a Hydrocellulose

Time of treatment (hours)	Copper number	Cellulose fluidity	Nitrocellulose fluidity
0	3·71	41·5	170·6
3	3·63	40·5	170·4
6	3·59	40·9	—
16	3·46	40·7	167·6

The effects on the cellulose fluidity and the nitrocellulose fluidity produced by treatment of the various types of modified cotton with cold alkaline solutions are included in Table V to facilitate comparison with the effects of boiling treatments. As was found for treatments with boiling alkaline solutions, hydrocelluloses are not much affected by any solutions, and the changes of fluidity produced in the alkaline hypobromite and alkaline hypochlorite oxycelluloses are relatively small. The effects of treatment of the neutral hypochlorite, acid hypochlorite and dichromate oxycelluloses with cold dilute sodium hydroxide or sodium carbonate solution are also very similar to those produced by boiling with the same solutions, but the great increase of nitrocellulose fluidity which is the most notable of these effects is somewhat less for the cold than for the hot treatment. With these types of oxycellulose dilute ammonia produces a greater increase of cellulose fluidity and nitrocellulose fluidity than concentrated ammonia, but its effect is considerably less than that of dilute sodium hydroxide or sodium carbonate solution.

In contrast to the considerable losses of weight that may result from boiling modified cottons with dilute alkalis[17], the loss of weight arising from the above treatments with cold alkaline solutions was negligibly small.

(11) Variation of the Fluidity of Solutions of Modified Cotton in Cuprammonium with the Age of the Solution

It was shown by Clibbens and Geake[7] that the fluidity of an unmodified cotton in cuprammonium is not significantly affected by wide variation of the time between the addition of the solvent to the cotton and the measurement of fluidity and it has been tacitly assumed that this is true for modified cottons of all types. In view of the observation that treatment of certain types of oxycellulose with dilute alkaline solutions results in an increase of their fluidity in cuprammonium, it became necessary to investigate the possibility that treatment with cuprammonium for a period longer than that which is usual in the routine measurement of fluidity would cause an increase in the fluidity observed. Fluidity measurements were accordingly made in which the procedure was identical with the normal except that the time of treatment with cuprammonium was varied. The modified cottons used had fluidities of about 25, so that agitation on a rotating wheel for 15 minutes sufficed for their dissolution. Allowing a further 15 minutes for the viscometer and solution to come to the temperature of the thermostat, the minimum time from the beginning of dissolution to the measurement of the rate of flow was half-an-hour. The longest time used was 43 hours, or 24 hours longer than the average time in the routine determination of fluidity.

The results (Table VIII) show that for hydrocelluloses and oxycelluloses of the alkaline hypobromite and alkaline hypochlorite types, the fluidity changes very little with time. With the other four kinds of oxycellulose, however, there is a definite increase of fluidity during the first hour, followed by an increase at a much slower rate. The difference between the fluidity values for 19 and 43 hours is small for the dichromate types of oxycellulose, but it is more considerable for the acid and neutral hypochlorite types. The latter show the greatest increase of cellulose fluidity on treatment with cold dilute sodium hydroxide or sodium carbonate solution, but the effects produced by these treatments (Tables V and VI) are much greater than that produced by prolonging the time of treatment with cuprammonium from 19 to 43 hours.

Table VIII

Variation of Fluidity in Cuprammonium with the Age of the Solution

Time (hours)	Method of Modification						
	Hydrochloric acid	Alkaline hypobromite	Alkaline hypochlorite	Neutral hypochlorite	Acid hypochlorite	Dichromate + sulphuric acid	Dichromate + oxalic acid
				Fluidity			
0·5	25·0	24·4	24·4	23·1	24·8	22·9	24·4
1	25·5	24·6	24·4	23·7	25·7	23·9	25·4
4	25·3	24·3	25·2	24·2	25·7	24·9	25·6
19	25·4	24·4	24·6	24·6	26·1	25·1	26·0
43	25·6	24·5	24·8	25·3	27·2	25·4	25·7

(12) Effect of Nitration and Denitration on the Fluidity of Cotton.

With the object of obtaining information on the question whether cellulose is degraded by the nitration process, nitrocelluloses were denitrated and the fluidity of the product in cuprammonium compared with that of the starting material. In some cases the regenerated cellulose was again nitrated and the fluidity of the nitrocellulose measured. Three methods of denitration were employed, the nitrocellulose being treated under the following conditions: (i) with 14·9 per cent. aqueous ammonium hydrosulphide for 24 hours at 30° C. (cf. Atsuki[18]), (ii) with 6 per cent. aqueous ammonium hydrosulphide for 48 hours at 30° C., (iii) with a solution containing 6 per cent. of ammonium hydrosulphide and 60 per cent. (by volume) of ethyl alcohol for 20 hours at 20° C. (cf. Rassow and Dörr[19]). The ratio of nitrocellulose to solution was 1 g. per 100 c.c. The molar ratio H_2S/NH_3 in the hydrosulphide was 0·86, and the *p*H of the aqueous solutions used for denitration was 9·0. Treatment of unmodified and unnitrated cotton under the denitration conditions was found to produce no significant change in the fluidity of the cotton.

The results obtained are given in Table IX. They show that the first and second methods of denitration reduce the nitrogen content to less than 0·1 per cent. and the third method is only slightly less effective. In the application of the first method it was found that treatment for 10 hours, as recommended by Atsuki[18], was insufficient, the residual nitrogen content after this period of denitration being 1·43 per cent.

The cellulose fluidity of materials regenerated from nitrocelluloses is never less than 40, even when an unmodified cotton is used for the preparation of the nitrocellulose. When the regenerated cellulose is again nitrated the fluidity of the nitrocellulose is very much higher than that of the original nitrocellulose. The three methods of denitration, when applied to portions of the same nitrocellulose, give products differing in cellulose fluidity, the second method giving a higher value than the first and third. The nitrocellulose fluidities of the regenerated celluloses also depend on the method of denitration, but whereas the relation between cellulose fluidity and nitrocellulose fluidity for the products of the first and second methods approximates to that found for cotton oxidized with alkaline solutions, the products of the third method have a much lower nitrocellulose fluidity than corresponds to this relation. It was found that when a regenerated cellulose obtained by the third method of denitration was boiled with 1 per cent. sodium carbonate solution for 6 hours its cellulose fluidity rose from 40·0 to 42·3, while its nitrocellulose fluidity rose from 86·0 to 153·6. The nitro-

Table IX
Results of Denitration Experiments

Material	Original cellulose		Regenerated cellulose			
	Cellulose fluidity	Nitrocellulose fluidity	Method of denitration	% N	Cellulose fluidity	Nitrocellulose fluidity
Unmodified cotton	5·6	3·6	(ii)	0·06	43·9	—
,,	5·6	3·6	(ii)	0·07	43·4	160·3
,,	5·6	3·6	(ii)	—	43·7	—
Hydrocellulose ...	25·4	80·0	(ii)	0·05	43·6	—
,, ...	34·8	129·2	(ii)	0·04	48·2	—
Dichromate-sulphuric acid oxycellulose	25·2	18·6	(ii)	—	45·5	—
	32·5	36·6	(ii)	0·07	45·9	—
Unmodified cotton	5·6	3·6	(ii)	0·06	44·9	171·2
			(iii)	0·17	40·2	86·2
Unmodified cotton	5·6	3·6	(i)	0·06	40·5	143·6
			(ii)	0·06	45·5	175·0
			(iii)	0·22	40·0	86·0

cellulose fluidity of the boiled material was thus not much lower than that of alkali-boiled hydro- and oxy-celluloses of the same cellulose fluidity, so that regenerated celluloses obtained by denitration with the alcoholic hydrosulphide solution behave like oxycelluloses of the types given by oxidation with neutral or acid solutions.

DISCUSSION

Effect of Alkaline Treatments of Modified Cottons on their Nitrocellulose Fluidity

As stated in the Introduction, the hypothesis that oxycelluloses prepared by the action of neutral or acid oxidizing solutions contain in their chain-molecules linkages that are unstable towards alkalis was advanced[2,3] to account for certain observations on the tensile strength of these oxycelluloses and their fluidity in cuprammonium solution. It was suggested that the alkali-sensitivity of the oxycelluloses had to some extent been obscured by the fact that cuprammonium is a strong alkali, and that the fluidity of the derived nitrocellulose in acetone might provide a more correct measure of the average length of the chain-molecules as they exist in the oxidized fibre. According to the hypothesis the treatment of certain oxycelluloses with alkalis, unlike similar treatment of hydrocelluloses, should produce an increase of the nitrocellulose fluidity due to rupture of alkali-sensitive linkages. That this expectation is fully borne out by experiment is shown by Fig. 3, which illustrates the effect on the nitrocellulose fluidity produced by boiling modified cottons with dilute sodium hydroxide solution under

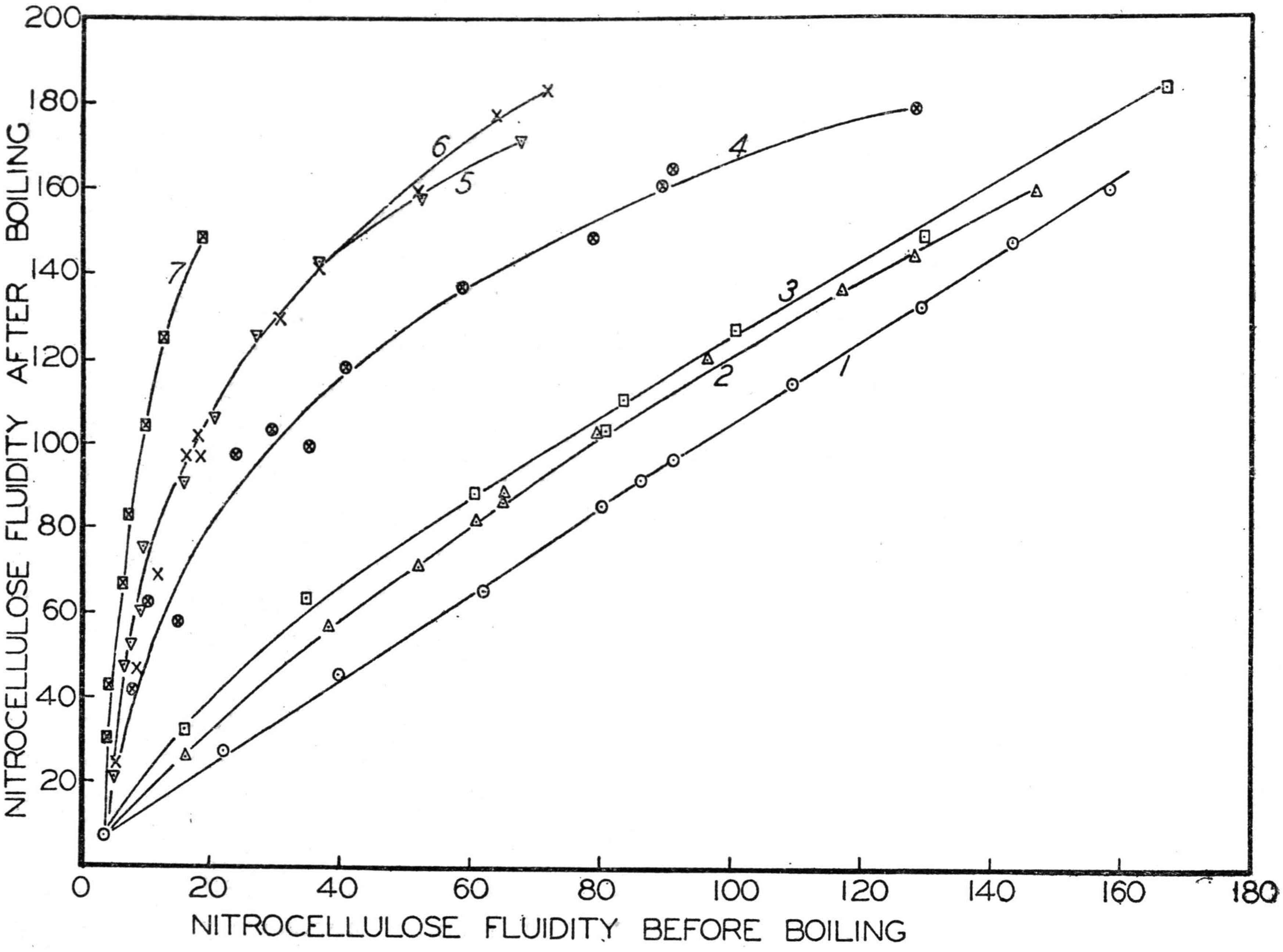


Fig. 3.

1—hydrochloric acid; 2—alkaline hypochlorite; 3—alkaline hypobromite; 4—neutral hypochlorite; 5—acid hypochlorite; 6—dichromate + sulphuric acid; 7—dichromate + oxalic acid.

pressure. The hydrocelluloses are little affected, but the oxycelluloses prepared with neutral or acid oxidizing solutions show a very great increase of nitrocellulose fluidity as a result of the boiling treatment. On the other hand, oxycelluloses prepared by the action of alkaline oxidizing solutions, which suffer relatively small losses of strength on boiling with dilute alkali[1], show relatively small increases of nitrocellulose fluidity. When milder conditions of boiling are employed, the increases in the nitrocellulose fluidity of the oxycelluloses prepared with non-alkaline oxidizing solutions are smaller than those which result from the pressure boil with sodium hydroxide solution, and vary with the alkalinity of the medium used (Table V) ; in this respect they are similar to the changes of tensile strength observed with dichromate oxycelluloses under similar conditions.[1] In both cases the interpretation is that boiling with water produces rupture of some of the weak linkages, and this process is promoted by increasing the alkalinity of the medium used in the boil.

In order to produce a large increase of the nitrocellulose fluidity of the oxycelluloses prepared with neutral or acid oxidizing solutions it is not, however, necessary to use a high-temperature alkaline treatment ; as Tables V and VI show, the nitrocellulose fluidity is greatly and rapidly increased by treatment of these oxycelluloses with cold dilute sodium hydroxide or sodium carbonate solution. This effect is a more striking confirmation of the hypothesis of alkali-sensitive linkages than the corresponding effect with boiling alkalis, for in the cold alkaline treatments there are no profound chemical changes and no considerable losses in weight such as are produced by boiling with alkalis. With hydrocelluloses (Tables V and VII) and with oxycelluloses prepared by the action of alkaline oxidizing solutions (Table V) the nitrocellulose fluidity is relatively unaffected by cold alkaline treatments. The absence of any important effect with this second type of oxycellulose is in accord with expectation, since any linkages that are rendered sensitive to alkalis by the oxidation will be broken by the alkali present in the oxidizing solution.

Relation between Cellulose Fluidity and Nitrocellulose Fluidity

It will be assumed provisionally that the chain-length distribution is the same in the nitrocellulose solution as it is in the modified cotton before nitration, consideration of the importance and validity of this assumption being deferred. It then follows that if an oxycellulose and a hydrocellulose have the same nitrocellulose fluidity, the presence of alkali-sensitive linkages in the oxycellulose will manifest itself in a difference between the fluidities of the two products in an alkaline solvent such as cuprammonium, the oxycellulose yielding a higher value than the hydrocellulose. It is in fact found (Fig. 1) that the relation between cellulose fluidity and nitrocellulose fluidity differs widely for different kinds of modified cotton, the cellulose fluidity corresponding to a given nitrocellulose fluidity being much higher for the neutral hypochlorite, acid hypochlorite and dichromate oxycelluloses than for hydrocelluloses. The oxycelluloses of the alkaline hypobromite and alkaline hypochlorite series, on the other hand, give almost the same relation as the hydrocelluloses. When the comparison is made on materials that have been boiled with dilute sodium hydroxide solution under pressure prior to nitration, it is found (Fig. 2) that the relation between cellulose fluidity and nitrocellulose fluidity is the same for all types, whatever the method of modification. This is what would be expected, since it is unlikely that a modified cotton that has been subjected to such severe alkaline treatment as a pressure boil will still contain linkages that can be broken by cuprammonium.

Relative Effects of Cuprammonium and Sodium Hydroxide Solutions on Oxycelluloses

It is of interest to compare the effects on the nitrocellulose fluidity produced by treatment of modified cottons with cuprammonium and sodium hydroxide solutions of approximately the same hydroxyl ion concentration. The effect of cuprammonium treatment has not been determined directly, since it can be readily deduced in the following way. If an oxycellulose has a fluidity X in cuprammonium, it is possible to read from Fig. 2 the nitrocellulose fluidity Y corresponding to the chain-length distribution *in the cuprammonium solution*. The nitrocellulose fluidity Z measured experimentally after nitration of the oxycellulose and dissolution in acetone corresponds to the chain-length distribution in the material that has not been treated with cuprammonium. A comparison of the two values Y and Z then shows the effect of the cuprammonium treatment on the nitrocellulose fluidity, and enables it to be compared with that of other alkaline treatments. Table X compares in this way the effect of treatment for 18 hours with cuprammonium under the conditions obtaining in the fluidity measurement with that of treatment for 24 hours with 0·5N sodium hydroxide at 20° C. (Table V). It is seen that the effects of the two alkalis are almost equal for the alkaline hypochlorite and dichromate-sulphuric acid oxycelluloses, and not very different for the alkaline hypobromite oxycellulose, but that sodium hydroxide has considerably more effect than cuprammonium on the neutral hypochlorite oxycellulose and very much more effect on the acid hypochlorite oxycellulose. With the dichromate-oxalic acid type, however, the effect of cuprammonium is rather greater than that of sodium hydroxide. These results suggest that the effectiveness of a solution for the breaking of the alkali-sensitive linkages is not determined solely by its hydroxyl ion concentration.

Table X
Effects of Cuprammonium and Sodium Hydroxide Solutions on Nitrocellulose Fluidity

Method of modification	Original material		Nitrocellulose fluidity after treatment with	
	Cellulose fluidity	Nitrocellulose fluidity	0·5 N sodium hydroxide	Cuprammonium
Hydrochloric acid	27·6	90·9	90·3	90
Alkaline hypobromite ...	29·8	100.4	109·8	102
Alkaline hypochlorite ...	29·9	96.6	102·2	102
Neutral hypochlorite ...	29·5	58.6	121·9	100
Acid hypochlorite	30·2	67.5	161·1	104
Dichromate+sulphuric acid	31·0	30·5	108·6	108
Dichromate+oxalic acid ...	28·4	10.1	76·7	94

The changes of cellulose fluidity that result from specific alkaline treatments of modified cottons must evidently be determined partly by the relative effectiveness for breaking alkali-sensitive linkages of dissolution in cuprammonium on the one hand, and of other specific alkaline treatments on the other. It has previously been shown[17] that on alkali-boiling the oxycelluloses suffer a greater increase of fluidity in cuprammonium than the hydrocelluloses, which are little affected, and that the neutral and acid hypochlorite oxycelluloses are distinguished from other types by the relatively great magnitude of the increase. These results are confirmed in the present work, but it has also been found that very similar changes of cellulose fluidity occur as a result of treatment with cold dilute sodium hydroxide and sodium carbonate solutions (Tables V and VI). The considerable increase of cellulose fluidity with the neutral and acid hypochlorite oxycelluloses indicates that these oxycelluloses, unlike dichromate oxycelluloses which are also formed in an acid medium, contain linkages that may be broken by sodium hydroxide solution but not by cuprammonium. This conclusion has already been reached from the comparison of the effects of cuprammonium and sodium hydroxide solutions on the nitrocellulose fluidity.

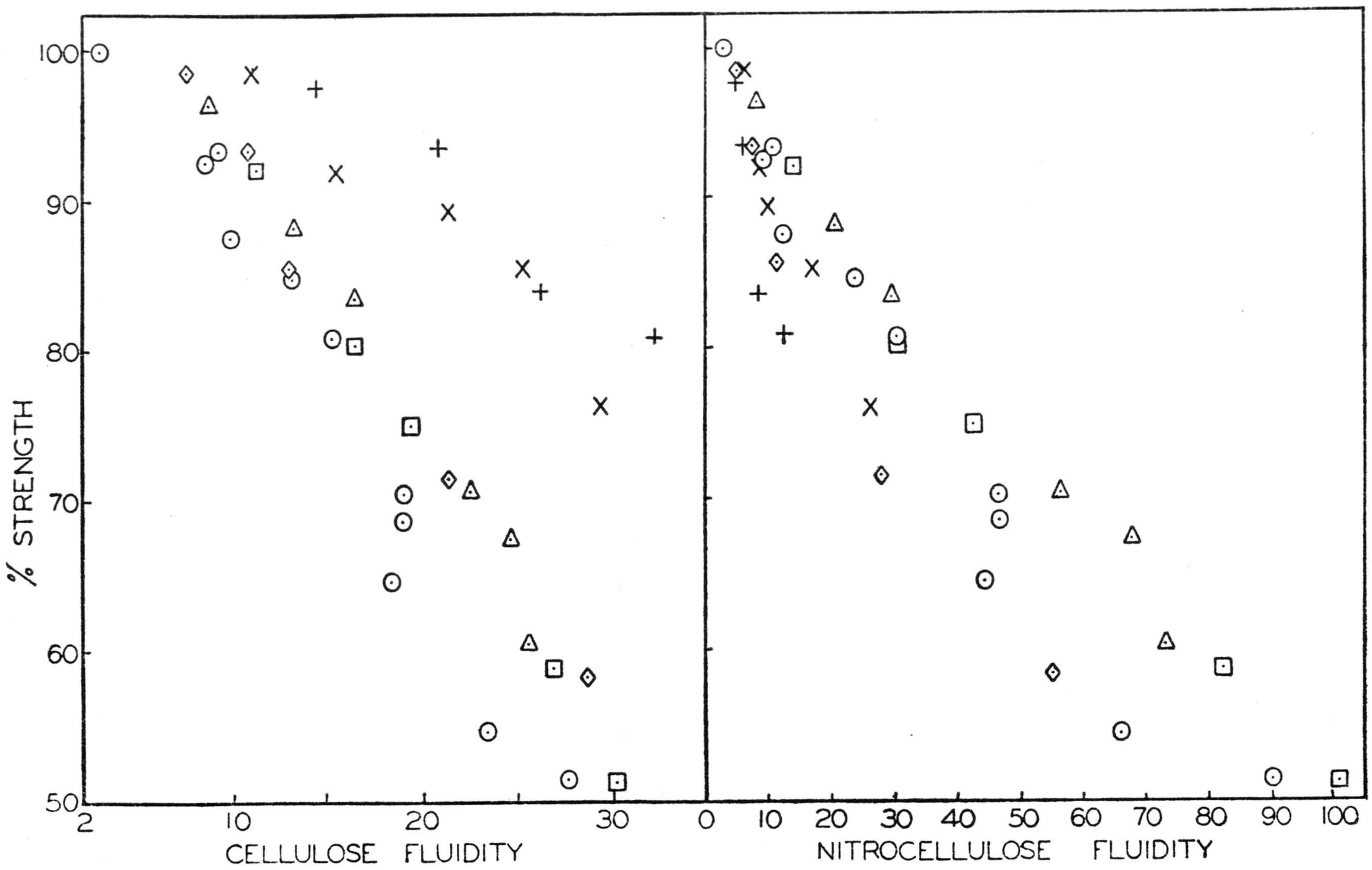


Fig. 4

Yarn 70C. ⊙ Hydrochloric or sulphuric acid ; ⊡ alkaline hypobromite ; △ alkaline hypochlorite ; ◇ neutral hypochlorite ; × dichromate + sulphuric acid ; + dichromate + oxalic acid.

Tensile Strength and Fluidity

If the nitrocellulose fluidity is a measure of the average length of the molecular chains as they exist in the fibre, and if tensile strength is also a function of chain-length, then, apart from possible differences in the frequency distribution of chain-length and of lateral cohesion between the chain-molecules arising from different methods of chemical modification, the relation between tensile strength and nitrocellulose fluidity ought to be the same for all types of modified cotton. This has been tested by reference to the data of Clibbens and Ridge.[1] It should be noted, however, that at the time when the investigations by these workers were made, the extreme sensitivity of certain oxycelluloses to alkalis was unknown, and the failure to realise this may have some effect on the comparisons now made. In Figs. 4 and 5, the tensile strength data are shown plotted against cellulose fluidity, and against nitrocellulose fluidity as found by interpolation on the curves in Fig. 1. It is obvious that there is a much closer approach to a general relation, applicable to all methods of modification, when nitrocellulose fluidity is used than when cellulose fluidity is used. For a given nitrocellulose fluidity, the strength of the alkaline hypobromite and alkaline hypochlorite oxycelluloses is, however, slightly greater than that of the other types.

It was previously suggested[2] that the difference in the relations between cellulose fluidity and tensile strength found for hydrocelluloses prepared from unmercerised and mercerised cotton respectively is due to a difference of frequency distribution of chain-length. The observation that the relation between cellulose fluidity and nitrocellulose fluidity is the same for both kinds of hydrocellulose (Tables III and IV) shows at least that the abnormality of hydrocelluloses made from mercerised cotton with respect to the relation between tensile strength and cellulose fluidity is due to a different cause from the similar abnormality of the oxycelluloses prepared with neutral or acid oxidising solutions.

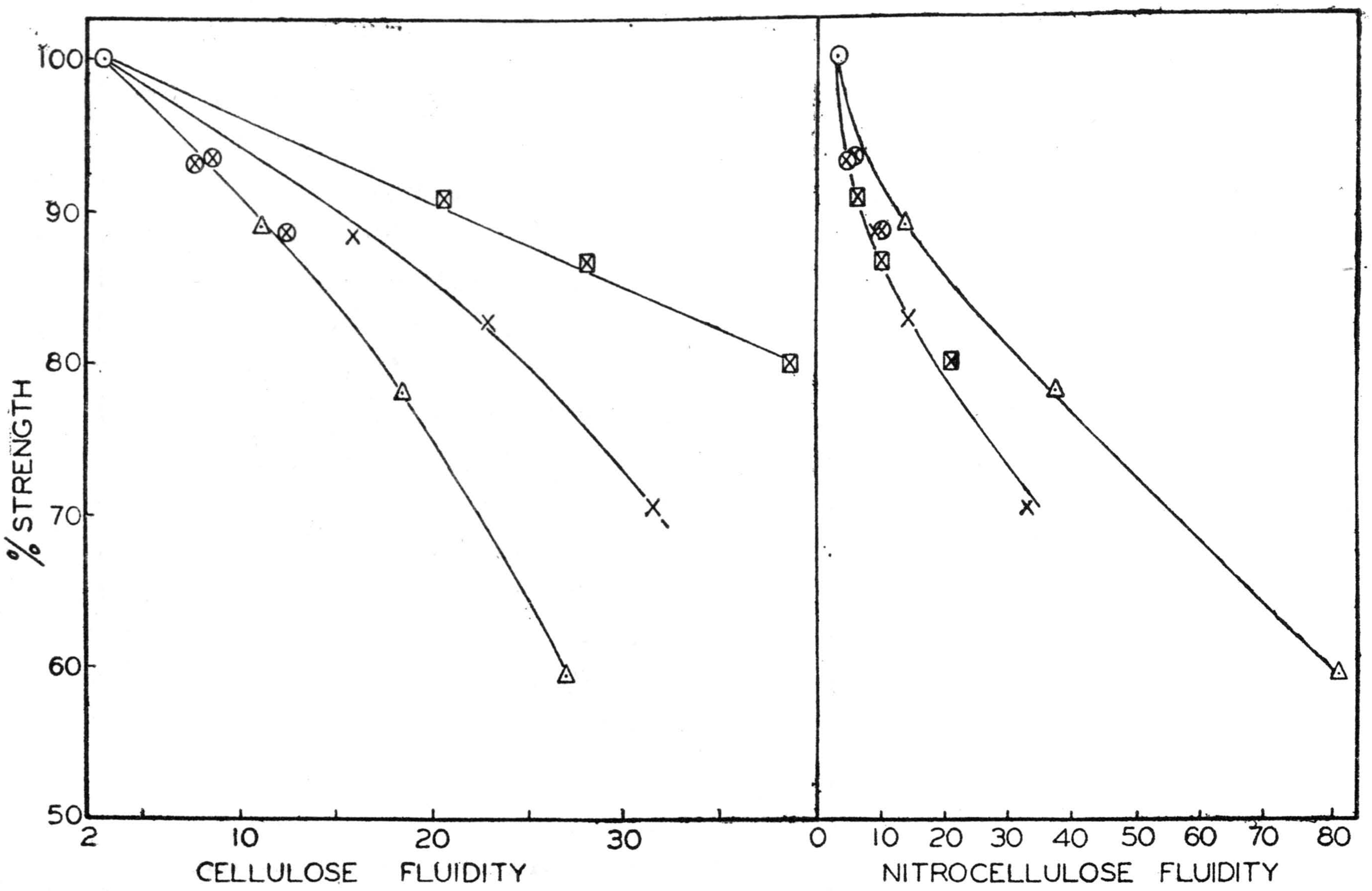


Fig. 5

△—Alkaline hypochlorite; ⊗—neutral hypochlorite; ×—dichromate+sulphuric acid; ⊠—dichromate+oxalic acid. Yarn No. 229.

Change of Fluidity in Cuprammonium with Age of Solution

The assumption that cuprammonium causes the rupture of molecular chains in oxycelluloses prepared with neutral or acid oxidising solutions receives strong support from the evidence already considered. The most direct evidence of the reality of this effect, however, is provided by the increase of fluidity of solutions of these oxycelluloses in cuprammonium that is found to occur immediately after dissolution, and the absence of any such increase with the hydrocelluloses and the oxycelluloses prepared by the action of alkaline oxidising solutions.

Effect of Alkalis on the Copper Number of Modified Cottons

Treatment of a neutral hypochlorite oxycellulose with cold dilute alkaline solutions produces a fall in the copper number (Table VI). This fall is, however, very gradual compared with the concurrent rise in nitrocellulose fluidity, and it is probable that the two changes are not intimately connected. This conclusion is strengthened by the observation that the copper number of a hydrocellulose is progressively diminished by similar alkaline treatment, although the nitrocellulose fluidity is not appreciably affected (Table VII). It seems probable that modified cottons may suffer two distinct kinds of chemical change under the influence of alkalis: (1) a scission of chains at linkages susceptible to alkaline hydrolysis, producing a large effect on the nitrocellulose fluidity, (2) a modification of reducing groups, producing a fall in copper number but little effect on the fluidity. The second of these changes only becomes prominent under the influence of more drastic (e.g., hot) alkaline treatments, and it then leads to considerable loss of weight owing presumably to the splitting-off of short fragments, soluble in the alkaline solution, from the ends of the chain-molecules.

Effect of Nitration on Chain-length

In the foregoing discussion it has been assumed that the nitrocellulose fluidity of a modified cotton provides a measure of the length of the chain-molecules in the fibre before nitration. It is not, however, necessary that there should be no degradation during the nitration process, since the quantitative comparisons that have been made between different modified cottons on the basis of measurements of nitrocellulose fluidity will still be valid even if some degradation occurs, provided that all the modified cottons examined are equally affected. It has been shown[4] that for a number of combinations of methods of chemical modification and within the limits of modification here dealt with, modification of cellulose by one method does not increase susceptibility to chemical attack by other methods. It is therefore probable that if the method of nitration employed does cause some degradation, the extent of this degradation will be the same for all the materials studied. If the alkali-sensitive linkages that have been postulated were also broken by the nitrating acid, then the effects which have been observed with the oxycelluloses prepared with neutral or acid oxidising solutions would not occur, and alkali-sensitive linkages would escape detection by the methods employed in this investigation.

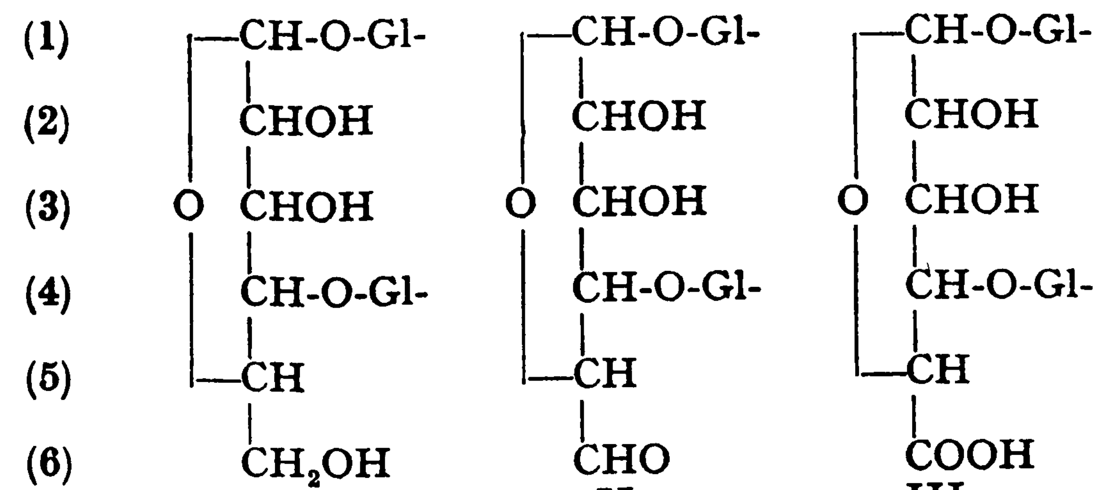
An answer to the question whether degradation occurs in the nitration process may be sought from experiments in which cotton is nitrated, the nitrocellulose is denitrated, and the product so obtained is again nitrated. If the fluidities of the original and regenerated celluloses in cuprammonium, or of the two nitrocelluloses, are the same, then neither the nitration nor the denitration process causes degradation. If the fluidities of the celluloses or the nitrocelluloses are different, as is in fact found (Table IX), then the degradation indicated by this difference may be due to either process, or to both, and rigorous proof that either process causes no degradation is excluded. Although it is consequently impossible to prove by fluidity measurements that the method of nitration used produces no scission of the chain-molecules, there is nevertheless reason to believe that the contribution of the denitration process to the combined effect of nitration and denitration is the greater, and that degradation by the nitration process, if it occurs, is probably slight. The evidence for this belief is the following. (1) The nitrating acid is initially anhydrous, and the water produced by the esterification has only a transient freedom before it is removed by the metaphosphoric acid present; the probability of hydrolytic attack on the cellulose is therefore small. (2) The nitration process is extremely rapid, and the nitrocellulose formed is very stable towards the nitrating acid (Table I); consequently, possible degradation is limited to the short time during which the degree of nitration is still low. (3) Variation in the temperature of the nitration within the range 0° to 20° C. has little effect on the fluidity of the nitrated product. (4) The nitrocelluloses from a series of hydrocelluloses show a much wider range of relative viscosity in 0·25 per cent. solution (86·1 to 1·82) than the parent hydrocelluloses in 0·5 per cent. solution (12·9 to 1·73), whereas any considerable degradation would probably have resulted in a much more restricted range of nitrocellulose fluidity. (5) Conversely, the fact that nitrocelluloses of widely different fluidity give, on denitration, celluloses of approximately the same high fluidity suggests that the degrading action of the denitration process is relatively great (*cf.* Rogowin and Schlachover[20]). There is an extensive literature[21] to show that saponification of the nitrates of simple alcohols by alkalis leads to profound oxidative degradation of the alcohol, and in view of the fact that relatively slight oxidation of cellulose produces large effects on its fluidity in cuprammonium, it is not surprising that even the ammonium hydrosulphide method of denitrating nitrocelluloses does not obviate degradation of the cellulose as judged by fluidity measurements. Evidence has been adduced that the relatively high fluidities of the denitrated products result primarily from oxidation, rather than hydrolysis, of the cellulose chain-molecules.

The Use of Fluidity Measurements in Assessing Chemical Damage in Cellulosic Materials

Since loss of strength is usually the most important result of chemical damage of cellulosic textile materials, it might be thought that for practical purposes the nitrocellulose fluidity would provide a better indication of such damage than the fluidity in cuprammonium. The nitrocellulose fluidity is undoubtedly the more reliable guide to the loss of strength that a modified cotton of unknown history has actually suffered, but a material which would be passed as satisfactory by this test might nevertheless lose a large proportion of its strength on laundering. The fluidity in cuprammonium has the great advantage that it takes account of such latent damage to a considerable extent. The most generally satisfactory method of using the fluidity measurement as an indication of the extent of damage is to make it after the cotton has been boiled with dilute alkali, and when this is done it is immaterial whether fluidity in cuprammonium or nitrocellulose fluidity is used. If a judgment is to be based on a fluidity determination on the unboiled material, then fluidity in cuprammonium is to be preferred. Moreover, the measurement of fluidity in cuprammonium by the method of Clibbens and Geake[7,8,9] is so simple and rapid compared with the determination of nitrocellulose fluidity that the use of the latter in routine testing could only be justified if it could be shown to possess outstanding advantages over the cuprammonium method.

Mechanism of Oxycellulose Formation

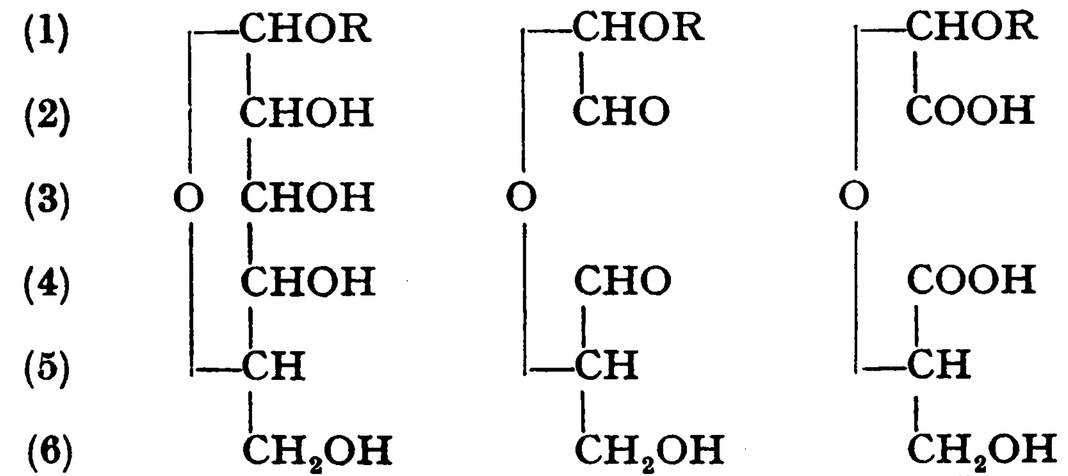
According to the view now widely accepted, cellulose consists of long chains of glucose units joined by primary valencies; the structure of a cellulose chain-molecule is represented in formula I, which shows the structure of a glucose unit and the way in which the latter is linked to its neighbours (represented by the symbol Gl).



I. II. III.

The linkages between the glucose units are glycosidic, and it is to be expected that these will be ruptured by acid hydrolysis, producing hydrocelluloses the properties of which can be explained in terms of a shortened chain-length[2,3]. It seems, however, improbable that oxidative attack will begin at these linkages, and oxidation at other points will not produce an immediate splitting of the chain. In order to explain the properties of oxycelluloses, which also necessitate the assumption of shortened chain-length, the primary oxidation step must therefore presumably be followed by a secondary reaction involving hydrolysis of glycosidic linkages. The chemical character of the oxycelluloses enable them to be divided into two main groups—the reducing and the acidic types. The first group is prepared by the action of acid oxidising solutions and is characterised by high copper number and low absorption of basic dyes ; the second group is prepared by oxidation with alkaline oxidising solutions and is characterised by high absorption of basic dyes and low copper number. In addition, there are types, exemplified by the products of oxidation by hypochlorite at *p*H values round the neutral point, which are intermediate in properties between the two extreme types. In order to account for the development of reducing and acidic properties it has often been assumed that the oxidative attack occurs at the primary alcohol groups in the cellulose chain-molecules. It has been supposed that the reducing oxycelluloses are formed by the oxidation of some of these groups to aldehyde groups, and that the acidic oxycelluloses result from the further oxidation of the aldehyde groups to carboxyl groups. This reaction mechanism is illustrated by formulae II and III.

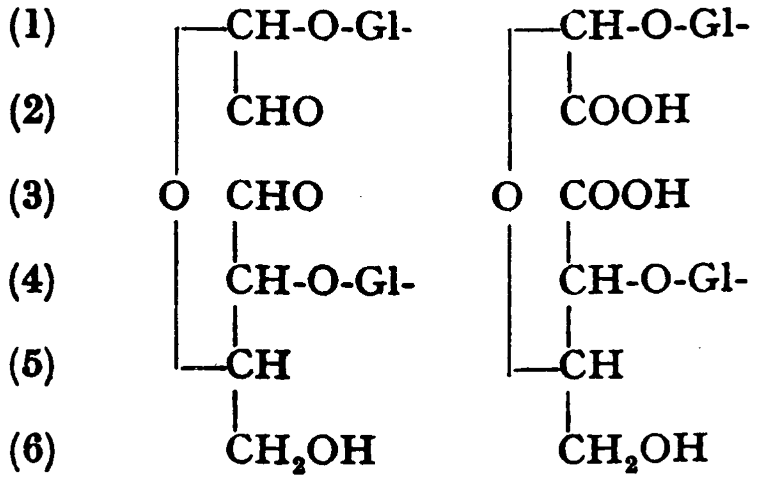
Recent work on the oxidation of the simple glycosides suggests that attack of the primary alcohol group may not in general be the first step in the oxidative degradation of cellulose. From the analytical results obtained in the oxidation of alkyl glycosides of glucose, mannose and galactose (IV) with periodic acid and the known reactions of this oxidising agent with polyhydric alcohols[22,23,24], Hérissey, Fleury and Joly[25] concluded that the glycosides were probably oxidised to the dialdehyde V, carbon atom 3 being eliminated as formic acid.



IV. V. VI.

(R = alkyl radical)

The correctness of this view has been established by Jackson and Hudson[26], who have also shown that oxidation of methylmannoside by alkaline hypobromite yields the corresponding dibasic acid VI. In view of the similarity in structure between the methyl-hexosides and cellulose, Jackson and Hudson[27] have suggested that oxidation of a non-terminal glucose unit (I) in a cellulose chain-molecule by periodic acid should lead to the product VII; for the same reason, oxidation by alkaline hypobromite might be expected to give the product VIII, with the product VII as an intermediate stage.



VII. VIII.

As already stated, it is necessary to assume that a further step in the cellulose degradation consists in the hydrolysis of glycosidic linkages in the primary oxidation product. This must occur under conditions that produce no hydrolysis of unoxidised cellulose, and the primary oxidation product must therefore be more susceptible to hydrolysis than unoxidised cellulose.

Of the two kinds of primary oxidation processes formulated (II, III and VII, VIII), the one in which rupture of the pyranose ring occurs (VII, VIII) appears likelier to affect the ease of hydrolysis of neighbouring glycosidic linkages than that in which oxidation of a side group occurs (II, III). The hydrolysis of the product VII might conceivably occur either at the glycosidic linkage attached to carbon atom 4, or—simultaneously with rupture of the oxygen bridge between carbon atoms 1 and 5—at the glycosidic linkage attached to carbon atom 1.

It might be anticipated that the oxidation of cellulose under suitable conditions would lead to the formation of oxycelluloses in which the oxidative degradation was confined to the first step, that is, in which the postulated secondary hydrolysis had not occurred. Oxycelluloses of this kind, whilst exhibiting pronounced reducing properties, should not possess much higher nitrocellulose fluidities, or lower tensile strengths, than the original cellulose, since these latter properties are related to the length of the chain-molecules. In comparison with other kinds of oxycellulose, those described in this paper as prepared with dichromate in the presence of oxalic acid approximate in their properties to the products which are postulated above as resulting from the first step of oxidative degradation of cellulose. Compared with other oxycelluloses of the same reducing power they possess much greater tensile strength and lower nitrocellulose fluidity. Very mild alkaline treatment is however sufficient greatly to increase their nitrocellulose fluidity and lower their strength. The secondary hydrolysis of the glycosidic linkages in the primary oxidation product must, according to this theory, occur very easily in a slightly alkaline medium.

The oxidation product represented by formula VII contains a glycosidic linkage (carbon atom 4) between an erythrose and a glucose unit. The conclusion has been drawn by Evans and his co-workers[28] that the corresponding disaccharide, 2-glucosido-erythrose, which they regard as an intermediate product in the alkaline degradation of maltose and cellobiose, must be hydrolysed by alkali, and it therefore seems probable that a glycosidic linkage between an erythrose and a glucose unit in an oxycellulose chain-molecule would also be susceptible to alkaline hydrolysis. Whether the rupture of the chain-molecules of oxycelluloses by the action of alkalis does in fact occur in this way is a question that cannot be answered until the study of the oxidation of cellulose by the methods of sugar chemistry has made considerably further progress.

It is, of course, quite possible that oxidation under certain conditions produces simultaneous splitting of the pyranose ring and oxidation of the primary alcohol group. There is no evidence that the primary alcohol group of the methyl-hexosides is attacked by periodic acid, but Jackson and Hudson[26] have shown, by isolation of methyl-mannuronide from the products of the oxidation of methyl-mannoside by alkaline hypobromite, that this group may be oxidised in alkaline solution.

It has been shown by Jackson and Hudson[27] that cellulose is readily oxidised by aqueous periodic acid. In view of the importance of periodic acid oxidation for the theory of the formation and behaviour of oxycelluloses outlined above, oxycelluloses prepared by the action of this oxidising agent are being studied in these laboratories by the methods described in this paper. Preliminary work has shown that, as expected, these oxycelluloses belong to the extreme reducing type. Their nitrocellulose fluidity is, for a given fluidity in cuprammonium, even lower than that of the oxycelluloses prepared by the action of dichromate in oxalic acid solution, and it is greatly increased by treatment of the oxycellulose with cold dilute sodium hydroxide solution. Further work is in progress, and the detailed results will be reported in a later communication.

Some of the experimental work was done by Miss R. C. Craig and Mr. T. Brownsett, B.Sc. The phosphorus determinations were made by Mr. R. S. Higginbotham, B.Sc.

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Received 21/4/38

19—THE EXAMINATION OF "SULPHUR STOVED" AND "SULPHITED" WOOL FABRICS FOR SULPHUR DIOXIDE AND SULPHITE

By Frank F. Elsworth, B.Sc., and Henry Phillips, D.Sc., F.I.C.

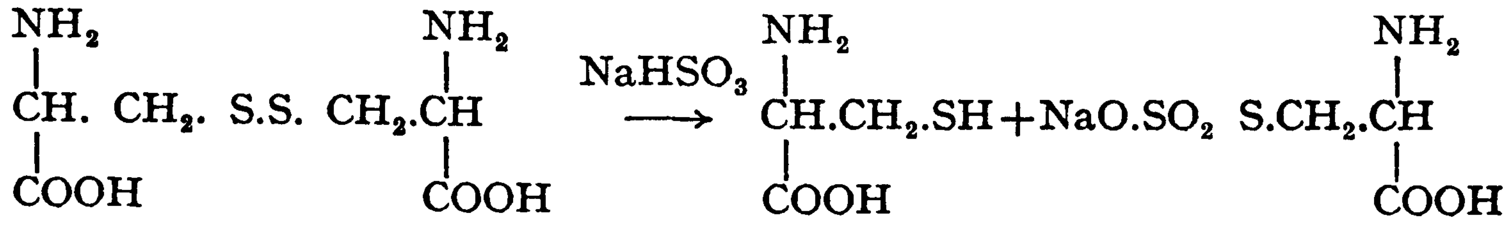
(Wool Industries Research Association)

Most woollen underwear is bleached by exposure for several hours in moist alkaline condition to sulphur dioxide in a closed chamber. The sulphur dioxide is produced by burning sulphur in a corner of the chamber or " stove " and the process is known as " sulphur stoving ". This method of bleaching gives the wool an attractive creamy white appearance and a lofty handle, and usually, in order to retain these desirable characteristics, the garment or fabric is sold without any further wet processing. Sometimes however the garment or fabric may be rinsed in water or in dilute sulphuric acid and then dried and pressed.

Some woollen materials are bleached by treatment with solutions of sodium bisulphite or sulphurous acid, the process being usually followed by bleaching in a solution of hydrogen peroxide. Although underwear and fabrics may be bleached with peroxide before sulphur stoving, they are seldom bleached with peroxide after sulphur stoving.

Hitherto considerable doubt has existed as to the nature of the main action of sulphur dioxide and bisulphite on wool. Reychler[1] concluded that sulphur dioxide combines chemically with wool, the extent of combination reaching a maximum corresponding to 0·88 mols. of sulphur dioxide per 1,000 grs. of wool. Raynes[2] obtained similar results and suggested that the ketonic groups in wool might combine to form bisulphite compounds. Later King[3] suggested that natural colouring matter in wool might combine with sulphur dioxide when a suitable quantity of alkali was present, and drew attention to possible similarities between such bleaching action and the lightening of the shade of certain azo-dyestuffs when sulphited either by solutions of sulphites or by the action of sulphur dioxide in the presence of alkali. It was further assumed that wool which had been stoved and dried could contain residual sulphurous acid and methods for its determination were proposed. Trotman[4] advised the following procedure:—10 gms. of the wool with a little water and a few drops of phosphoric acid are distilled in a stream of carbon dioxide and the distillate is passed into bromine water or hydrogen peroxide, the sulphuric acid formed being weighed as barium sulphate. Goodall[5] proposed—mainly as a method of distinguishing between stoved and unstoved wool—that the wool should be distilled with stannous chloride in hydrochloric acid and the hydrogen sulphide evolved absorbed in an alkaline iodine solution and determined as sulphate.

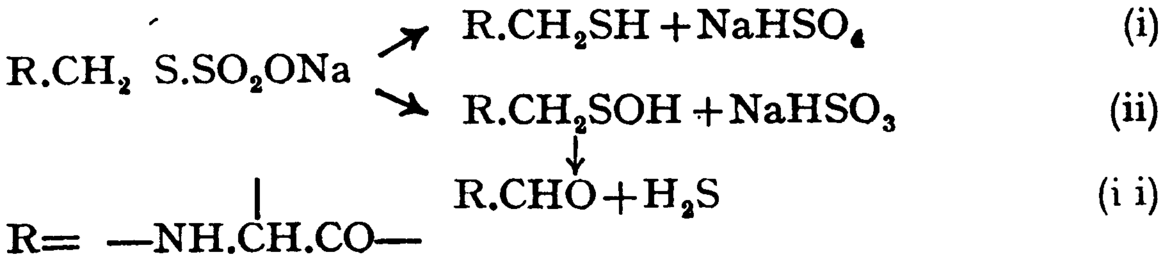
More recently however evidence has accumulated which suggests that the disulphide linkages of the wool react with sodium bisulphite and that the nature of this reaction must be taken into account when the " sulphite " or " residual sulphurous acid " content of stoved or sulphited wool are being determined. Clarke[6], using sodium bisulphite, converted cystine, the disulphide amino-acid of wool into sodium *S*-cysteinesulphonate and cysteine:



$$\underset{COOH}{\overset{NH_2}{CH}}.\ CH_2.\ S.S.\ CH_2.\underset{COOH}{\overset{NH_2}{CH}} \xrightarrow{NaHSO_3} \underset{COOH}{\overset{NH_2}{CH}}.CH_2.SH + NaO.SO_2\ S.CH_2.\underset{COOH}{\overset{NH_2}{CH}}$$

Speakman[7] concluded from the contraction in length produced on boiling wool fibres with sodium bisulphite that the disulphide linkages in wool undergo a similar reaction. This conclusion was proved to be substantially correct by the determination of the increase in the thiol (-SH) content of wool caused by treating it with a solution of sodium bisulphite (Elsworth and Phillips[8]).

Sodium *S*-cysteinesulphonate decomposes in two ways. Clarke[6] showed that when heated with dilute alkalies it decomposed into sodium bisulphite and an organic reducing substance or substances, whereas when boiled with acids, it gave sodium bisulphate and cysteine. Elsworth and Phillips[8] showed that the *S*-cysteinesulphonate groups in bisulphite treated wool underwent similar decompositions, the amount of sulphur dioxide produced on distillation with dilute phosphoric acid being greater than that obtained when a stronger acid was used. In addition, when sodium bisulphite is produced sulphenic acid groups probably arise and these have been shown by Schöberl[9] and Harris[10], to decompose with the liberation of hydrogen sulphide. In all therefore, the three following reactions may occur during the decomposition of *S*-cysteinesulphonate groups present in stoved or sulphited wool.



$$R.CH_2\,S.SO_2ONa \begin{cases} \nearrow R.CH_2SH + NaHSO_4 & \text{(i)} \\ \searrow R.CH_2SOH + NaHSO_3 & \text{(ii)} \\ \quad\downarrow \\ \quad R.CHO + H_2S & \text{(iii)} \end{cases}$$

$$R = \text{—NH.}\overset{|}{\text{CH}}\text{.CO—}$$

The Determination of the "Combined" and "Free" Sulphur Dioxide in Bisulphited and Stoved Wools.

The following experiments were made to find the best conditions for the liberation of sulphur dioxide from bleached wool, and to ascertain whether it would be possible to determine the free sulphur dioxide (present either as sulphurous acid or alkali bisulphite and sulphite) and the sulphur dioxide combined with the disulphide linkages in the wool.

The determinations were made on a loosely-woven woollen flannel which had been treated overnight with sodium bisulphite solution (containing 3% sulphur dioxide), rinsed in two changes of distilled water, dried and allowed to condition in a room maintained at 70% relative humidity and 22·5°C. The treated flannel was thoroughly sampled by cutting into small squares and mixing before weighing out for analysis. The moisture content (by the method of Barritt and King[11]) and the total sulphur content (by the method of Barritt[12]) of the untreated and the bleached wool were determined on representative samples.

(*a*) *Influence of Time of Distillation.* Preliminary work had indicated that the complete liberation of sulphur dioxide from bleached wool was a slow process and hence direct distillation methods, as recommended by Trotman[4], were unsuitable for the present work as the large volume of distillate which would be produced could not be readily dealt with in the subsequent analytical procedure. The method used by Monier-Williams[13] for the determination of sulphur dioxide in foodstuffs was therefore adopted:

Samples of wool (3·0 grms.) were boiled with dilute phosphoric acid (1 ml. phosphoric acid, *d*.1·75 in 500 ml. water; *p*H of this solution—2·1), and the sulphur dioxide evolved was swept through a reflux condenser by a slow stream of carbon dioxide into 20 ml. hydrogen peroxide (10 vols.) and determined as sulphuric acid by titration. The time of distillation for each of these determinations was varied in order to determine the minimum time necessary for the complete distillation of the sulphur dioxide. Similar estimations were carried out using *N*-hydrochloric acid in place of dilute phosphoric acid. The results obtained are given in Table I.

Table I

Determinations of the Sulphur Dioxide Expelled from Sulphited Wool by Distillation

Reagent	Time of Distillation (hrs.)	SO_2 expelled, % on dry weight of wool
(*a*) Water, 500 ml. Phosphoric acid, *d* 1·75, 1 ml.	0.5	0·78, 0·71
	1·0	0·91, 0·89
	2·0	0·99, 0·99, 0·97
	3·0	1·01, 0·99
	4·0	1·00
(*b*) *N*-Hydrochloric acid, 500 ml.	1·0	0·24, 0·21
	2·0	0·24, 0.25

These results illustrate clearly that by distillation with dilute phosphoric acid of the concentration indicated practically all the available sulphur dioxide had distilled from the wool after two hours and no advantage is gained by more prolonged distillation. The wool after sulphite treatment contained 4·30% of sulphur calculated on its dry weight, compared with 3·73% in the untreated wool. During bisulphite treatment therefore the sulphur content had increased by 0·57% corresponding to an absorption of 1·14% of sulphur dioxide. This latter value is however a maximum value since it includes any sulphate or sulphuric acid formed in the wool during bleaching or by atmosphere oxidation during drying and conditioning. The experimental value, 1·00% of sulphur dioxide, shows that 88% of the sulphur taken up by the wool during bleaching had been regenerated as sulphur dioxide under these experimental conditions, and indicates that the *S*-cysteinesulphonate groups decompose according to reaction (ii) giving sulphur dioxide in the weaker acid solution. The sulphur dioxide evolved must therefore include that from the *S*-cysteinesulphonate groups as well as that present as bisulphite or sulphurous acid.

When the sulphited flannel was distilled with *N*-hydrochloric acid a much smaller amount of sulphur dioxide was liberated in confirmation of the result previously obtained (Elsworth and Phillips[8]). The *S*-cysteinesulphonate groups decompose according to reaction (i) and only the uncombined bisulphite and sulphurous acid are therefore decomposed to yield sulphur dioxide.

(*b*) *Influence of the pH of the Solution with which the Sulphited Wool is Distilled.* The following experiments were made in order to determine the precise effect on the liberation of sulphur dioxide from bleached wool of the *p*H value of the solution with which it is distilled. Further samples of the flannel used in the previous series of determinations were taken for these analyses; the flannel had by this time been exposed to air for over a month and the total amount of available sulphur dioxide had decreased owing probably to oxidation and volatilisation. For each determination 3 gms. of wool were distilled for 2 hours with 500 ml. of various buffer solutions containing phosphoric acid and potassium dihydrogen phosphate. The initial *p*H of these solutions and their *p*H at the end of the distillation were determined with the glass electrode. The sulphuric acid was determined by titration and also by precipitation as barium sulphate in order to show that the results were not affected by the distillation of hydrogen sulphide or other volatile acids. The results of this series of determinations are given in Table II and are summarised in Fig. 1, in which the sulphur dioxide expelled (as determined by titration) is plotted against the initial *p*H of the solution with which the wool was distilled.

Table II

Determinations of the Sulphur Dioxide Expelled from Sulphited Wool by Distillation with Buffer Solutions of Different pH.

*p*H, Initial	*p*H at end of distillation	SO_2, % by titration with 0·1 *N*-NaOH (on dry weight)	SO_2, % determined as $BaSO_4$ (on dry weight)
0·34	0·34	0·32	0·33
1·00	1·01	0·46	0·47
1·00	0·99	0·47	0·51
1·00	1·00	0·45	0·48
1·36	1·94	0·73	0·76
1·36	1·91	0·74	0·76
1·80	1·68	0·80	0·84
1·80	1·63	0·82	0·85
2·08	2·28	0·86	0·89
2·08	2·28	0·86	0·89
2·57	2·60	0·88	0·91
2·57	2·60	0·85	—
3·13	3·30	0·86	—
3·13	3·33	0·86	—
3·36	3·53	0·86	—
3·36	3·54	0·85	0·86
3·71	3·92	0·84	0·84
3·71	—	0·79	—
4·10	4·34	0·72	—
4·10	4·26	0·74	0·77
4·55	4·57	0·61	0·64
4·55	4·58	0·62	0·62

From Fig. 1 it will be seen that the acidity of the solution, as expected, plays an important part in deciding the amount of sulphur dioxide expelled. When the solution becomes less acid than *p*H 3·5, the sulphur dioxide is retained in the solution, whilst when the solution is more acid than *p*H 2·0, a rapid decrease in the amount of sulphur dioxide liberated occurs, probably because the *S*-cysteinesulphonate groups in the wool are decomposed with the formation of sulphuric acid as in reaction (i). Only when the *p*H of the solution is within 2·0-3·5 is both the sulphur dioxide combined with the wool and the sulphur dioxide present as alkali bisulphite expelled from the wool.

A similar series of determinations was made on wool from a blanket which had been commercially bleached by sulphur stoving instead of by a solution of bisulphite. The results obtained are given in Table III and are also illustrated in Fig 1.

The results obtained are substantially the same as those obtained with the bisulphite treated wool, and suggest that the changes which take place on stoving wool with sulphur dioxide gas are similar to those occurring on treating wool with bisulphite solutions.

Table III
Determinations of the Sulphur Dioxide Expelled from Sulphur-Stoved Wool by Distillation with Buffer Solutions of Different pH.

*p*H Initial	SO_2, % (on dry weight)
0	0·39
0·94	0·57
1·45	0·71
2·00	0·76
2·50	0·75
3·10	0·78
3·60	0·69
4·10	0·54
4·50	0·46

(*c*) *The Producton of Hydrogen Sulphide during the Distillation of Sulphur Stoved Wool.* Although only traces of hydrogen sulphide are evolved when cystine is boiled with 20% hydrochloric acid (Hoffman and Gortner[14]), Barritt[15] found that apparently greater quantities were evolved during the acid hydrolysis of wool. The probable source of this hydrogen sulphide is the decomposition of the sulphenic acid side-chains as indicated in reaction (iii). When bisulphited wool is distilled with dilute phosphoric acid in order to determine the total sulphur dioxide it contains sulphenic acid side-chains may arise [reaction (ii).] It therefore appeared advisable to determine the amount of hydrogen sulphide evolved during such distillations and to consider its possible influence on the accuracy of the determinations. Apparently the interaction between sulphur dioxide and hydrogen sulphide occurs comparatively slowly when the two gases are

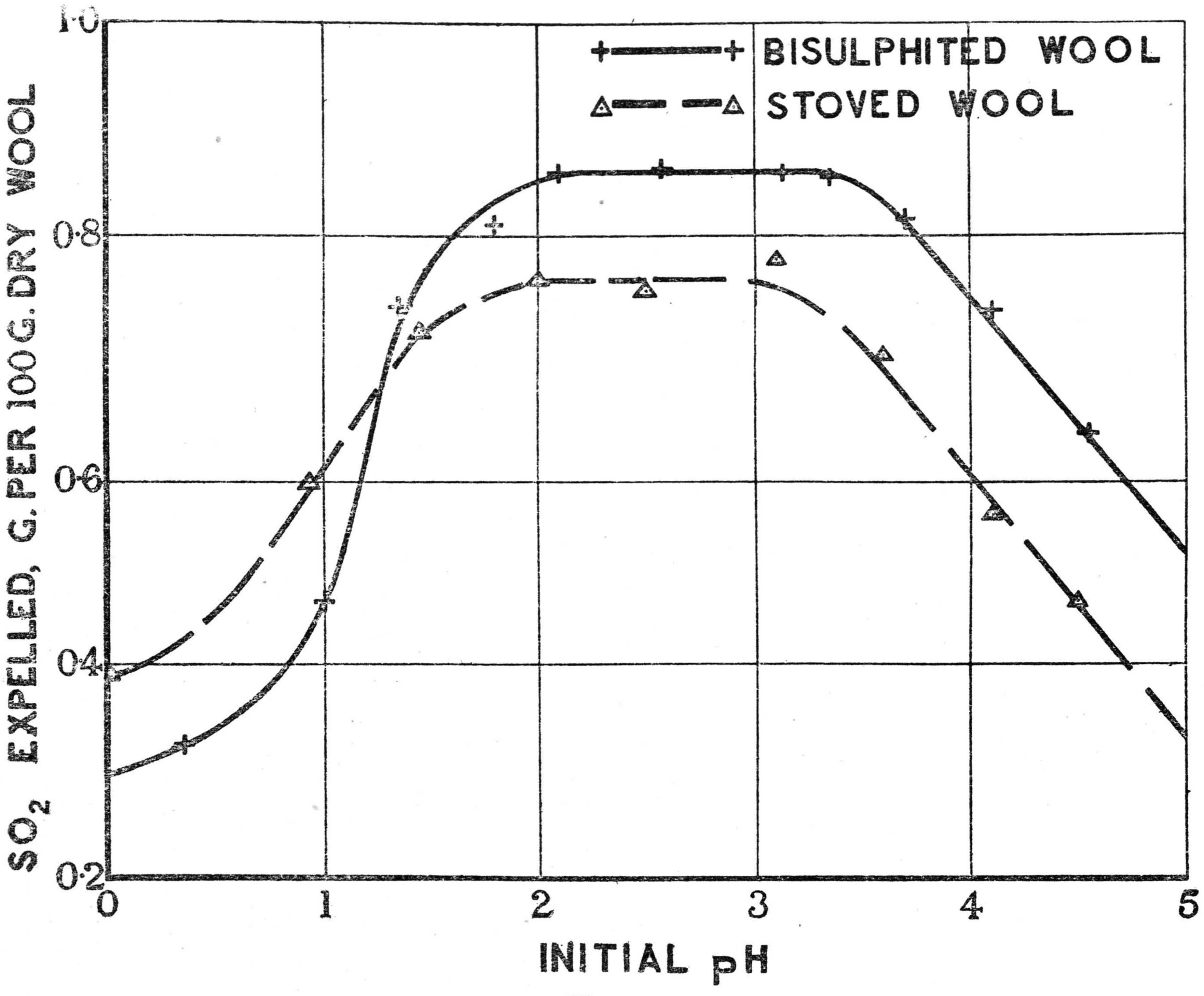


Fig. 1

in dilute solution or are mixed with a large volume of an inert gas (Heinze[16]). Monier-Williams[13] considered that the determination of sulphur dioxide in foods containing volatile sulphur compounds by distillation into hydrogen peroxide would give reliable results provided that the precipitation and filtration of the barium sulphate were carried out at room temperature, because hydrogen peroxide, when cold, does not oxidise appreciable amounts of hydrogen sulphide.

In order to determine the hydrogen sulphide which was evolved during the sulphur dioxide determinations, the gases leaving the bulbs containing the peroxide were passed through two further absorption tubes containing cadmium sulphate solution. After the usual time of distillation (2 hrs.), 200 ml. 0·02 *M*-potassium iodate were added followed by excess of an acidified iodine solution. The amount of iodine required to oxidise the precipitated cadmium sulphide to sulphur was determined by titration with 0·1 *N*-sodium thiosulphate using a micro-burette. The wool used for these experiments was in the form of a yarn which had been commercially sulphur stoved. The amounts of hydrogen sulphide which distilled, calculated as percentages on the weight of yarn conditioned at 70% humidity are given in Table IV.

Table IV

Determinations of Hydrogen Sulphide Evolved when Sulphur-Stoved Wool is Distilled with Acids.

Composition of Acid	H_2S, % (on conditioned weight of wool)
250 ml. conc. HCl, 250 ml. water	0·059
100 ml. conc. HCl, 400 ml. water	0·033
50 ml. conc. HCl, 450 ml. water	0·023
1 ml. H_3PO_4, 500 ml. water	0·014

From Table IV it will be seen that the amounts of hydrogen sulphide evolved are very small and decrease with decrease in the concentration of hydrochloric acid with which the wool is distilled. It can be concluded from these results that only very small amounts of hydrogen sulphide are liberated when stoved wool is distilled with dilute phosphoric acid and with 5*N*-hydrochloric acid in order to determine the "free" and "combined" sulphur dioxide respectively.

Complete Analysis of Sulphur Dioxide Bleached Wool.

The presence of "combined" sulphur dioxide as *S*-cysteinesulphonate groups and of "free" sulphur dioxide as alkali bisulphite or sulphurous acid has already been demonstrated in wool which has been stoved or treated with sodium bisulphite. It is also well-known that some sulphate or sulphuric acid may at the same time be formed in the bleached wool. This may arise either by atmospheric oxidation or by the decomposition of *S*-cysteinesulphonate groups according to reaction (i). It follows therefore that the sulphur taken up by the wool during bleaching must be present in these three forms and when the bleached wool is dissolved in strong hydrochloric acid, this additional sulphur must be either converted to sulphate or liberated as sulphur dioxide. These fractions together should therefore be equal to the increase in sulphur content of the wool.

Mease[17] has shown that when untreated wool is dissolved in strong hydrochloric acid no sulphur of constitution appears in the hydrolysate as sulphate. In addition, Mease[17] showed that any sulphate acquired by wool during carbonising or during finishing processes could be precipitated as barium sulphate from its solution in hydrochloric acid without any interference from the protein material present. This method, together with the estimation of the " free " sulphur dioxide given off when the wool is dissolved in hydrochloric acid, has been used to complete the analysis of sulphited wool.

These determinations were carried out on woollen flannel which had been extracted with alcohol and rinsed in several changes of distilled water. One piece of this fabric (A) was bleached by immersion for 17 hours in a solution of sodium bisulphite containing 3% sulphur dioxide, whilst the other piece (B) was similarly treated with a solution containing 1·5% sulphur dioxide. The pieces of flannel were allowed to stand for one hour in distilled water before drying, after which they were allowed to condition for 2 days in a constant humidity room before weighing out for the estimations. The total sulphur content and the total sulphur dioxide content (by the method previously described) of the bisulphited wools and also the total sulphur content of the untreated flannel were determined.

For the determination of sulphate and " free " sulphur dioxide 1 gr. of bisulphited wool was gently boiled under reflux for 30 minutes with 20 ml. 5*N*-hydrochloric acid. A slow stream of carbon dioxide was passed through the boiling acid and the sulphur dioxide evolved was then driven through the reflux condenser into two scrubbers containing hydrogen peroxide where the sulphur dioxide was retained as sulphate and was estimated gravimetrically. The hydrolysate was filtered through a sintered glass funnel to remove insoluble material and after dilution to about 250 ml. the sulphate it contained was precipitated and weighed. The sulphate present in the untreated wool was also determined.

The results obtained are summarised in Table V. For convenience all the figures are expressed in terms of sulphur on the conditioned weight of wool.

Table V
Complete Analysis of Sulphited Wool.

	S, %	
	A	B
(i) Total Sulphur before bleaching	3·12	3·12
(ii) Total Sulphur after bleaching	3·76	3·62
(iii) Sulphur present as sulphate before bleaching	0·04	0·04
(iv) Sulphur present as sulphate in HCl solution of bleached wool...	0·55	0·43
(v) Sulphur liberated as sulphur dioxide by distillation with dilute phosphoric acid	0·51	0·34
(vi) Sulphur liberated as sulphur dioxide by distillation with 5N Hydrochloric acid	0·10	0·10

These results show that when a bisulphited wool in distilled with hydrochloric acid, the sulphur dioxide liberated together with the sulphate formed during the hydrolysis accounts for the whole of the increase in the sulphur content of the wool. For example, the sulphur content of A increases by 0·64% (ii-i) and this is approximately equal to the sulphur, 0·61%, present as sulphate and " free " sulphur dioxide (iv-iii + vi). The increase in the sulphur content of B (0·50%) also agrees closely with the sulphur (0·49%) obtained as sulphate and " free " sulphur dioxide (iv-iii + vi).

Further it will be seen that the increase in sulphur content of A (0·64%) is somewhat greater than the increase in sulphur content which can be accounted for by the presence of " free " and " combined " sulphur dioxide, as determined by distillation with dilute phosphoric acid (v). Assuming that the distillation with 5*N*-hydrochloric acid (vi) gives the true value for the " free " sulphur dioxide, the sulphur combined with the wool as *S*-cysteinesulphonate is 0·41% (v-vi). The value is lower than the figure 0·51% (iv-iii) obtained from the determination of the sulphate in hydrochloric acid solution, which should correspond to the sulphur content of the *S*-cysteinesulphonate groups were they the only source of sulphate. Similar differences occur in the analysis of sample B, for, of the 0·50% increase in sulphur content, only 0·34% can be accounted for as available sulphur dioxide (v) and the " combined " sulphur dioxide value, 0·24%, (v-vi) is considerably lower than the sulphate sulphur, 0·39% (iv-iii), obtained by dissolving the wool in 5*N*-hydrochloric acid.

There appears to be no reason for assuming that distillation with dilute phosphoric acid yields a low result because all the " free " and " combined " sulphur dioxide is not expelled from the wool, although the possible production of some sulphate must be borne in mind. It is far more probable that the wool acquires sulphate during and after bisulphiting, either by atmospheric oxidation or by decomposition of *S*-cysteinesulphonate groups according to reaction(i). On this assumption, the complete analyses of the two samples of wool would be as shown in Table VI.

Table VI
Sulphur Distribution in Sulphited Wools.

	S. %	
	A	B
Total sulphur in untreated wool	3·12	3·12
Sulphur present in bleached wool as " combined " sulphur dioxide (v-vi)	0·41	0·24
Sulphur present in bleached wool as " free " sulphur dioxide (vi)	0·10	0·10
Sulphur present as sulphate formed during stoving (iv—iii—v +vi)	0·10	0·15
Total sulphur in bleached wool (sum of the above values) ...	3·73	3·61
Total sulphur in bleached wool by direct determination ...	3·76	3·62

Thanks are due to the Council of the Wool Industries Research Association for permission to publish this paper.

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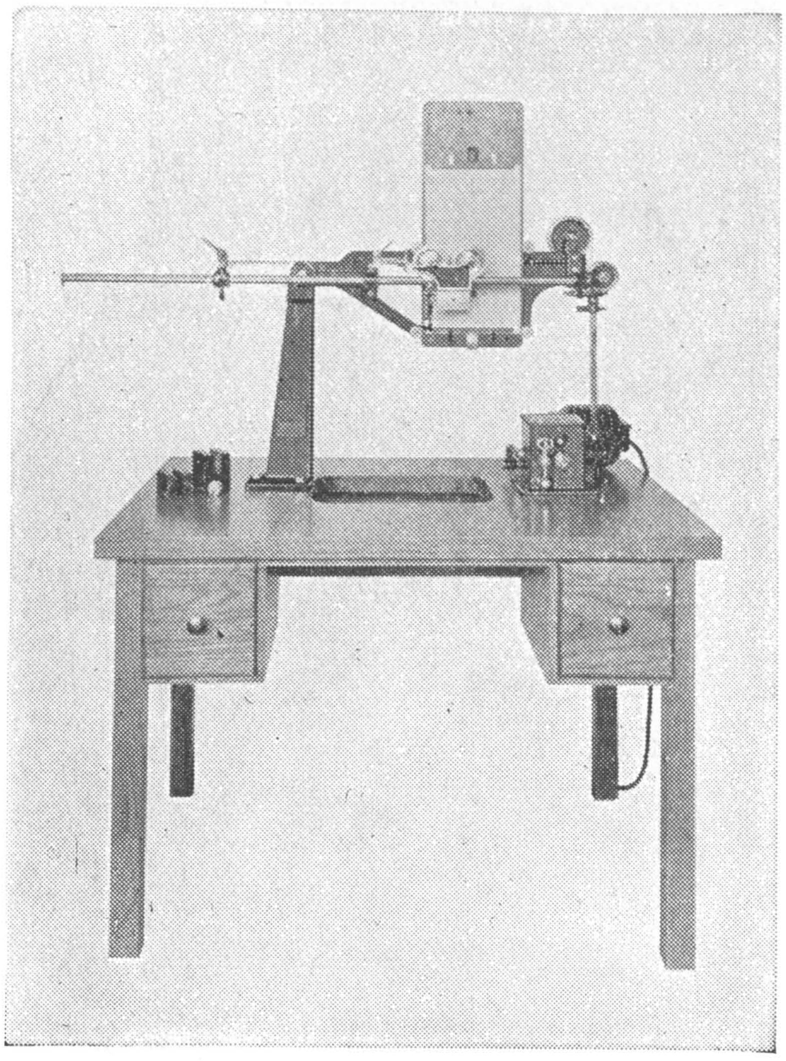

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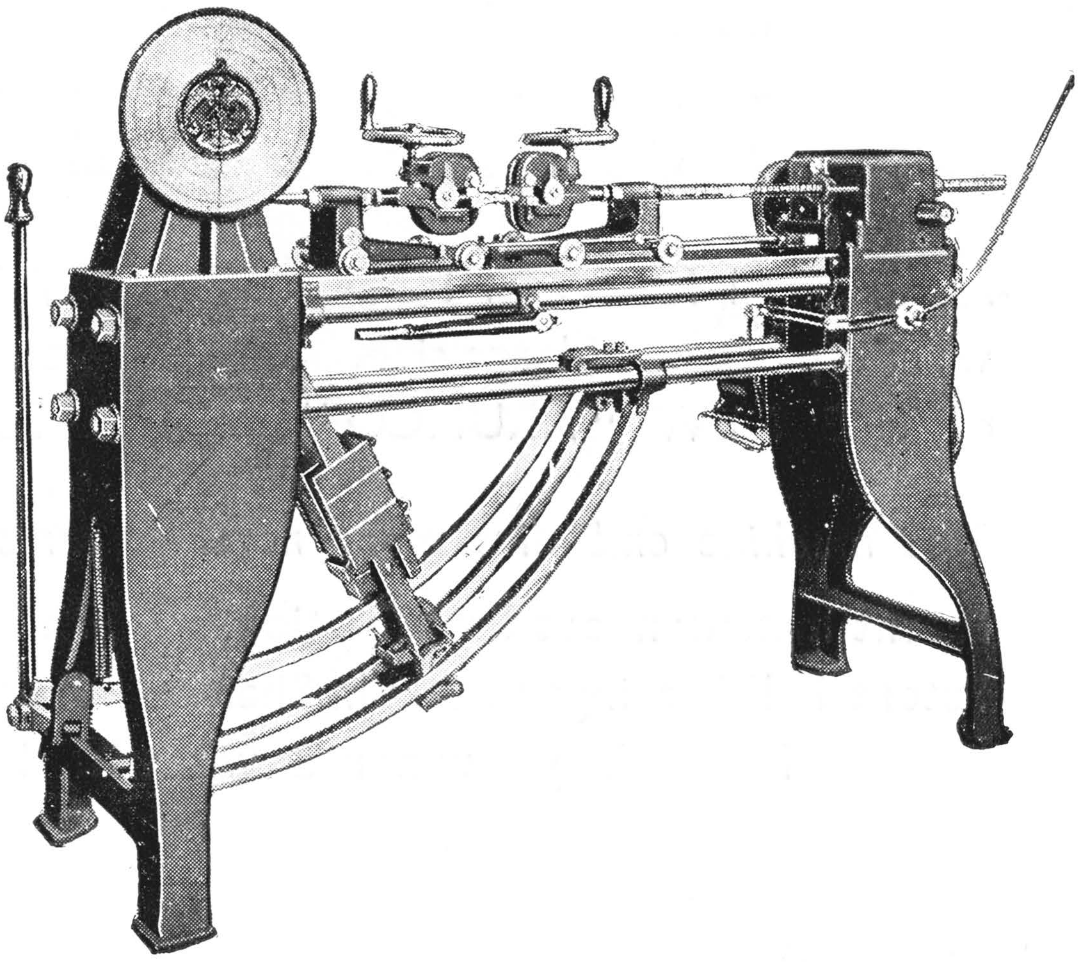

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THE JOURNAL OF THE TEXTILE INSTITUTE
ABSTRACTS

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Whitelegg, C. J.	C.J.W.
Wool Industries Research Association	W.

1—FIBRES AND THEIR PRODUCTION

(B)—ANIMAL

Silkworm: Effect of Frequency of Feeding on Cocoons. T. Nakahama and S. Nishimura. *J. Agric. Chem. Soc. Japan,* 1936, **13**, 898-904 (through *Chem. Abstr.,* 1938, **32**, 3488^3).

Cocoons from silkworms that were fed often were larger, heavier and whiter, but the silk was not of such good spinning quality. C.

Silkworms: Feeding with Sugar. K. Kato, S. Miwa and S. Negi. *Bull. Agric. Chem. Soc. Japan,* 1937, **13**, 88-89, 89-90 (through *Chem. Zentr.,* 1938, i, 3857; *Chem. Abstr.,* 1938, **32**, 3488^4).

(1) The addition of 1-2 per cent. of sugar to mulberry leaves fed to silkworms has a favourable effect. (2) The influence of the sugar on the composition of the silkworm is described. C.

Preservation of Hair during Liming (Hides and Skins). Two-bath Liming and Immunisation (Protection of Hair Fibres against Sulphides) by Means of Alkali. G. Vágó. *Collegium,* 1937, pp. 512-521 (through *Brit. Chem. Abs. B.,* 1938, **57**, 698).

Hair is removed from hides without damaging the hair shaft by immersion first in a bath of NaSH or $Ca(SH)_2$, then washing well, and finally treating with $Ca(OH)_2$ solution. The washing is controlled so that the sulphide is washed out of the hair shaft but not out of the hide or hair roots. Hydrolysing agents other than NaOH, such as boiling H_2O and ultra-violet light, make hair resistant to the action of Na_2S. A loss of 5-10 per cent. of the total S due to treatment with 0·1 *N*-NaOH is sufficient to produce immunisation; many S.S. linkings remain unchanged. A small number of linkings stable to sulphides is sufficient to prevent the loosening of the hair. Hair may be similarly immunised by treatment with CH_2O, but the hide is simultaneously tanned. W.

(C)—VEGETABLE.

Cotton Crop: Profit Return and Fertilising. C. B. Williams. *N. Carolina Sta. Bul.,* No. 313, 1937, pp. 16 (through *Exp. Sta. Rec.,* 1938, **78**, 707).

This Bulletin records the acreage yields and returns per acre above cost of producing, harvesting and ginning with seed cotton at 2·5, 5 and 8 cents per lb. (*a*) in 13 fields representing 11 different types of soil during several years without fertiliser but under proper cultivation and (*b*) on experimental and other fields where various fertilisers were tried on various soils. Profitable fertiliser treatments are discussed. C.

Cotton Blackarm Disease: Control. Plant Protection Station of the Pan-Soviet Institute for Scientific Research on Cotton. *Plant Prot., Leningrad,* 1937, **15**, 99-112 (through *Rev. Appl. Mycol.,* 1938, **17**, 391).

The following notes by various authors are recorded. (1) Formalin (1 : 100) was the most effective of nine seed disinfectants. (2) Strains of cotton that proved immune on artificial infection with *B. malvacearum* all belonged to the 26-chromosome group. (3) Seed treated with hot water at 56-57° C. for one hour was almost completely sterilised. (4) The bacteriophage of *B. malvacearum* was found in herbarium specimens of cotton, living diseased plants, and water near the plantations and proved to be highly resistant to heat and drought. C.

Cotton Leaf-curl Disease: Occurrence in Azerbaidjan. S. N. Moskovetz. *Plant Prot., Leningrad,* 1937, **14**, 102-3 (through *Rev. Appl. Mycol.,* 1938, **17**, 392).

Leaf curl disease was first observed in Azerbaidjan in 1934 and the incidence of infection in 1935 amounted to 7·8 per cent. on Egyptian Fouadi cotton, 10·2 on Maarad, and 0·5-1 per cent. on Upland varieties. The disease appears to be spreading still further. Reduction of yield and lint length are reported. C.

Cotton Root-rot Disease: Control by Crop Rotations. C. H. Rogers. *J. Amer. Soc. Agron.,* 1937, **29**, 668-680 (through *Exp. Sta. Rec.,* 1938, **78**, 645).

Field experiments at the Texas station showed that a 4-year rotation with corn, sorghum and oats was effective in reducing cotton root-rot. A 3-year rotation was not effective. C.

Cotton Wilt Disease: Effect on the Plant. P. V. Sabourova. *Plant Prot., Leningrad,* 1937, **15**, 61-68 (through *Rev. Appl. Mycol.,* 1938, **17**, 392).

Upland cotton artificially infected with *Verticillium dahliae* suffered considerable reduction in transpiration and in the osmotic pressure in the leaves. Planting in closer stands, affording denser shade, is recommended as a control measure. C.

Boll Weevil: Control. R. C. Gaines. *J. Econ. Entomol.,* 1937, **30**, 845-8 (through *Exp. Sta. Rec.,* 1938, **78**, 670).

Records are reported of a Latin square arrangement of plats in which Ca arsenate alone and mixed with equal parts of sulphur or lime were compared. It appears that significantly greater yields of cotton were obtained when dusting was resorted to but that the three insecticides did not give significantly different results. C.

Boll Weevil: Resistance to Cold. E. Hixson and C. A. Sooter. *J. Econ. Entomol.,* 1937, **30**, 833-6 (through *Exp. Sta. Rec.,* 1938, **78**, 671).

Observations in Oklahoma over a period of 7 years indicate that the boll weevil is much more resistant to cold that was supposed ; on 991 weevils the " undercooling temperature " ranged from 26·6 to -9·4° C. C.

Cotton Flea Hoppers: Control. (1) F. L. Thomas and W. L. Owen. (2) K. P. Ewing and R. L. McGarr. *J. Econ. Entomol.,* 1937, **30**, 848-850, 850-4 (through *Exp. Sta. Rec.,* 1938, **78**, 665-6).

(1) Injury of cotton by the flea-hopper is observed to be due more to the scarcity of its favourite host plants than to a preference for cotton. (2) Arsenical dusts gave good results in the control of the flea-hopper. C.

Cotton Plant Insecticides: Toxicity. G. L. Smith and A. L. Scales. *J. Econ. Entomol.,* 1937, **30**, 864-9 (through *Exp. Sta. Rec.,* 1938, **78**, 662).

The efficiency of Ca arsenate, Paris green, cube root and pyrethrum has been tested in cage experiments against the boll weevil, cotton leaf worm and the tarnished bug. Details of promising single and combined insecticides are recorded. C.

Pink Bollworm: Control. (1) A. J. Chapman and H. S. Cavitt. (2) C. S. Rude. (3) L. W. Noble and W. T. Hunt. *J. Econ. Entomol.,* 1937, **30**, 837-8, 838-842, 842-4 (through *Exp. Sta. Rec.,* 1938, **78**, 668).

(1) Field trials in Texas indicate that the over-wintering population of the pink bollworm would be greatly reduced by growing early cotton and clearing the ground as early as possible. (2) Parasites of the pink bollworm found in northern Mexico are described. (3) Trials at the Texas experimental station with imported parasites of the bollworm are reported. C.

Thrips: Damage of Cotton Plant by —. (1) E. W. Dunnam and J. C. Clark. (2) and (3) J. G. Watts. *J. Econ. Entomol.*, 1937, 30, 855-7, 857-860, 860-3 (through *Exp. Sta. Rec.*, 1938, 78, 663-4).

(1) Reduction of yield of seed cotton and fibre strength are observed to result from the attack of most varieties of cotton in experimental plots by flower and tobacco thrips. (2) Thirteen species of thrips found on cotton in S. Carolina are described. (3) Reduced vitality and later fruiting, accompanied by loss of the terminal buds are reported to result from attack by thrips. C.

Co-operative Cotton Gins: Business Operations in Oklahoma. O. T. Weaver and O. W. Herrmann. *U.S. Farm Credit Admin., Co-op. Div., Bul.* No. 12, 1937, pp. 96 (through *Exp. Sta. Rec.*, 1938, 78, 713).

This Bulletin gives detailed financial reports and statements of income and expenses for 95 co-operative gin associations operating in Oklahoma. C.

Cotton Root-rot Disease: Occurrence in Arizona. R. B. Streets. *Arizona Sta. Tech. Bul.*, No. 71, 1937, pp. 293-410 (through *Exp. Sta. Rec.*, 1938, 78, 796).

An exhaustive review is given of work on the root-rot disease begun in 1925, dealing with the geographical distribution, origin, losses caused, host range, symptoms, the causal fungus, and control. Previous work is also reviewed, with 157 references to the literature. C.

Raw Cotton: World Production by Staple Length. D. de Prat. *L'Industrie Textile*, 1938, 55, 263-265.

Statistics are given showing the mean length of American cotton for the years 1928-35, the consumption of the different lengths of American cotton during the same period, and world production of cotton classified into four groups according to length. Production, utilisation, demand and future prospects of each group are discussed. C.

Ramie: Marketing and Commercial Classificaton. *L'Industrie Textile*, 1938, 55, 265.

The production of ramie is briefly discussed and methods of marketing in China are described. It is pointed out that classifications are very variable; the most common system is explained. C.

Hemp: Breeding for Fibre Content. G. Bredemann. *Faserforsch.*, 1938, 13, pp. 81-87.

Hemp breeding experiments in which selections were made of both male and female plants were continued in 1937 from preceding years. A further appreciable increase in fibre content was obtained in the plants grown in 1937. The breeding is being continued. L.

Sowing of Flax with Carrots: Effect on Quantity and Quality of Fibre and on Yield of Oil from Seeds of Fibre Flax and Oil Flax. H. Ulbricht. *Faserforsch.*, 1938, 13, pp. 87-93.

While mixed sowing of flax with carrots has an unfavourable effect on the development of the flax plant, the sowing of flax with either alternate rows or perpendicular rows of carrots does not diminish, and may improve the quality of the flax in regard to length and thickness of stem, quantity and quality of fibre, and yield of oil from the seeds. L.

Effect of Length of Day on Development Rhythm of Hemp and Ramie. R. Fleischmann. *Faserforsch.*, 1938, 13, pp. 93-99.

The growth of hemp and ramie is affected by the length of day. Experiments were carried out in which the plants were exposed to daylight for only 12 hours each day, and it was found that flowering takes place earlier when the day is shorter. Artificial darkening may be of value in cross-breeding varieties which normally flower at different times. L.

National Importance of Home-grown Flax. *Irish Text. J.*, 1938, 4, No. 4, p. 1.

Refers to the difficulties of importing fibre from Russia during the late war, and because of the present uncertainty in European affairs the necessity of a supply of home-grown fibre is stressed. In 1937 the United Kingdom imported 56,129 tons of flax and tow, and in the same year Northern Ireland produced only 4,187 tons. It would prejudice the home linen industry to place an import duty on foreign flax until a large home supply is assured, and for a sound national policy a home production of at least 30,000 to 40,000 tons of flax should be attained with government assistance. In five years, with organisation and the necessary financial support from the government, the following national flax programme should be possible—Northern Ireland 100,000 acres, England and Scotland 40,000 acres, Irish Free State 25,000 acres. Assuming a low yield of 32 stones per acre, this would produce 33,000 tons per annum of flax fibre. Not only would this assist agriculture, but it would give employment to thousands of workers in fibre and seed production, and would retain in our own country at least £2,000,000 yearly. Great progress can be made in the mechanical and scientific developments of the operations and processes. New methods of harvesting and decortication have been worked out and a valuable industry can be built up at home and in the Empire which would be of inestimable benefit to the linen trade and the nation. L.

Irish Flax as War Insurance. *Irish Text. J.*, 1938, 4, No. 4, p. 6.

Describes the plight of the linen industry in 1916/1917 when the trade was practically crippled by the scarcity of supplies. When in 1914, England declared war on Germany, our flax spinning mills consumed 95,000 tons of fibre annually. Of this quantity 60,000 tons were imported from Russia, the balance being made up by imports from Belgium, Holland and France, plus the flax grown in Ireland. Should war come it is certain that all sections of the linen industry will be controlled by the government, and in order that the industry may not be dependent on foreign supplies British flax production must be stimulated by government encouragement and support. L.

Australian Flax Growing Enterprise. *Irish Text. J.*, 1938, 4, No. 4, p. 9.

The article states that previous attempts to grow flax in Australia failed because of the low quality of the seed, yielding such poor fibre that the price realised did not cover cost of production. With pedigree seed now available expert investigators have formed the opinion that good prospects now exist for the cultivation of the fibre and local manufacture of flax products. A company has been formed with £20,000 available for development work and the Government will provide an initial sum of £2,000 to the Council for Scientific and Industrial Research for investigation of the various problems connected with cultivation of fibre. L.

Flax Production in Northern Ireland. *Linen Trade Circ.*, 1938, 24, No. 1268, p. 1.

The government of Northern Ireland has made a grant of £150,000 to stimulate the flax industry in the six counties. A committee is to be set up to prepare administration plans and members from the Flax Spinners Assn., the Farmers' Union, the Linen Industry Research Assn., the Scotch Mill Owners' Assn., and the Institute of Chartered Accountants will be elected to control the scheme. Pedigree seed will be the keystone of the project and the use of modern machinery for pulling. Two possibilities pointed out by Mr. McCready at the last annual meeting of the Linen Industry Research Assn. were as follows—(1) Central retting on the lines of the Norfolk Experimental Flax Factory. (2) To omit retting and use natural (mechanically decorticated) straw in the spinning mill. L.

Hemp Wool—a New Raw Material for the Cloth Industry. E. Volkel. *Klepzig's Textil-Z.*, 1938, 41, 127-8 (through *Chem. Abs.*, 1938, 32, 3621).

A description of the manufacture and properties of the new raw material made from hemp (*Cannabis sativa*) which is suitable for the manufacture of cloth. A sample of overcoat material (dyed black) is shown. L.

Flax Production and Processing. S. A. G. Caldwell. *Textile Manufacturer*, 1938, 64, 185-186.

A review of some of the achievements and new proposals for flax fibre production. Reference is made to the following improvements—1. Production of pedigree seed by the Linen Industry Research Assn. 2. Mechanical pulling machine. 3. Development of the system of tank retting giving a more uniform control of the process and better fibre. 4. Development of the automatic scutcher to eliminate the expensive method of hand-feeding to a power-driven wheel. 5. New methods of decortication, and machines to extract fibre from unretted flax straw. L.

Urena Lobata as a Fibre Plant in Belgian Congo. F. Tobler. *Faserforsch.*, 1938, 13, *pp.* 108-109.

The plant *Urena lobata* yields a fibre similar to jute, and is cultivated in a number of tropical countries. Details are given regarding the cultivation and retting of the plant under the conditions prevailing in the Belgian Congo. L.

The New Agave Amaniensis compared with Agave Sisalana. F. Tobler. *Faserforsch.*, 1938, 13, pp. 114-115.

The new *A. amaniensis* grown in East Africa is shown to possess certain advantages over *A. sisalana*. On comparison with *A. sisalana* grown in Java, however, it shows little or no superiority, because the latter is favoured by the damp climate of Java, while the drier East African climate is better suited to *A. amaniensis*. L.

Pedigree Seed Pays: Blue versus White Blossom. *Irish Text. J.*, 1938, 4, No. 7, p. 4.

Gives a brief description of the principal characteristics of the pure strain varieties of flax seed. Tables are given showing the average yield per acre in Northern Ireland for the year 1937, and the result of flax variety trials conducted in the same year by the Northern Ireland Ministry of Agriculture. L.

Flax Growing Revival in East Africa. *Irish Text. J.*, 1938, 4, No. 7, p. 5.

Refers to efforts being made to revive the production of flax in Kenya Colony. Previous attempts proved that flax of a high quality could be produced and in 1920 the flax acreage in Kenya was 25,000 acres, but in 1925 the area under flax had declined to 552 acres, and flax pioneers switched over to sisal. It was proved that the temperature of Kenya Highlands permits flax to be grown and worked all the year round and in some cases two crops have been raised in the same year. L.

Flax Facts. *Irish Text. J.*, 1938, 4, No. 7, p. 16.

The Belgian Government is now studying a project to erect a huge pumping station to distribute Lys water to retteries throughout Flanders where supplies of retting water from artesian wells have been causing dissatisfaction. L.

A Lesson from Lancashire. *Linen Trade Circ.*, 1938, 24, No. 1280, p. 4.

Belfast can learn a lesson from Lancashire. The practical support and financial assistance of British cotton users have won for the Empire raw material an established place on the cotton map. Linen men, with the Government assistance that will not be denied them if they show that they are capable of the effort, can do the same for Empire flax. L.

Modern Methods of Flax Production. *Textile Manufacturer*, 1938, 64, pp. 337-344.

Refers to the rapid decrease in flax exports from Soviet Russia during recent years and stresses the necessity of finding an alternative source of supply at an economic price. Mention is made of the requirements in flax harvesting for fibre quality and yield and the latest developments in mechanical pulling and other agricultural operations are discussed. L.

(D)—ARTIFICIAL

Casein and Casein Wool: Preparation. F. Defalque. *L'Industrie Textile*, 1938, 55, 186-187, 238-239.

Patents relating to the preparation of casein for the manufacture of textile threads are reviewed and the method developed by Ferretti is described. A general account is given of industrial processes for the preparation and spinning of casein and the after-treatment of the filaments and cut fibres. C.

Cuprammonium Rayon: Chemistry of Spinning Process. S. Danilow, and others. *Shurn. prikl, Chimii*, 1937, 10, 1598-1614, 1457-67, 1615-23 (through *Chem. Zentr.*, 1938, i, 2651, 1904, and 2652; *Chem. Abstr.*, 1938, 32, 1928^4).

(1) The properties of two basic salts obtained by precipitation of copper sulphate with soda, and of copper hydroxide obtained by precipitation with ammonia or sodium hydroxide are described. The basic salts dissolved more readily than the hydroxide in 10·2 per cent. ammonia, but the ammoniacal solution of the hydroxide had the greatest solvent power for cellulose. (2) The influence of

ammonium salts, sodium acetate, lithium chloride and Li, Na and K hydroxides on the solubility of the above basic salts and copper hydroxide in ammonia is described and also the effect of the salts on the solubility of cellulose in the ammoniacal solutions. (3) The influence of glucose is described. An addition of 3-4·5 per cent. is without influence on the solubility of the basic salt in ammonia or on the solubility of cellulose, but with 15-20 per cent. there is a reduction in the Cu and NH_3 contents of the solution and more glucose causes coagulation of the cellulose. The addition of glucose protects the dissolved cellulose to a considerable extent against oxidation. C.

Rayon Spinning Plant: Application of Centrifugal Force. *Silk and Rayon,* 1937, **11**, 406, 644, 744, 846, 945, 1024, 1048, 1150; 1938, **12**, 80, 178, 284.

A general account of the various steps in rayon manufacture where centrifugal force is applied. Centrifugal pumps of " Tantiron " steel, pumps coated with " Ceratherm " and similar stoneware dressings, the Kestner glandless horizontal pump, pump linings of " Linatex " (a rubber latex product), centrifugal clarifiers, the colloid mill, the centrifugal spinning machine, hydro-extractors, and centrifugal fans are considered in turn. C.

Artificial Wool: Possibilities and Limitations. A. F. Barker. *Text. J. Australia,* 1938, **13**, 149-150.

The manufacturing possibilties of staple fibre are considered as compared with wool, from the point of view of quality and nature of the fibre, thread structure, cloth structure and finish. W.

Lanital, the Artificial Wool from Milk. J. Krenn. *Osterr. milchw. Ztg.,* 1938, **45**, 60-65 (through *Chem. Abs.,* 1938, **32**, 4791).

An account is given of the development of casein fibre, its manufacture, and properties. W.

PATENTS.

Artificial Wool. I. G. Farbenind. A.-G. F.P.47,973 of 28/8/1937 (addn. to 797,779, *see J. Text. Inst.,* 1936, A595) (through *Chem. Abs.,* 1938, **32**, 4802).

Threads made from viscose are treated as in F.P.797,779, but without cutting into staple lengths. The product has a woolly character. W.

Artificial Wool. I. G. Farbenind. A.-G. F.P.48,142 of 25/10/1937 (addn. to F.P.797,779, *see J. Text. Inst.,* 1936, A595) (through *Chem. Abs.,* 1938, **32**, 4802).

Viscoses of high viscosity, corresponding to the fall of a steel ball of above 200 sec., are used. Examples are given of the use of viscoses having a ball fall of up to 4,000 sec. **W.**

Curly Rayon: Spinning. British Bemberg Ltd. B.P.484,253 of 21/5/1937 (Conv. 29/12/1936).

Rayon of curly and granular appearance is obtained by a process in which a spinning solution is forced impulsively through a spinning nozzle with wide nozzle apertures, the impulsive variation of flow through the nozzle having a frequency of 50-250 impulses per minute, and the capillary threads of fluctuating thickness thus produced are stretched by means of a slowly-acting precipitant. The threads are then subjected to treatment for completion of coagulation and to finishing treatments. For producing the impulses there may be provided in the solution-supply pipe at a point near the spinning nozzle, a frictional cock capable of being opened and closed with an appropriate frequency. C.

Rayon Spinning Apparatus. W. Wuppermann. B.P.484,605 of 9/11/1936 (Conv. 9/11/1935 and 25/1/1936).

Apparatus for making rayon, particularly from viscose or similar solutions comprises a rotary nozzle and a rotary coagulating bath container connected therewith, the whole of the coagulating liquid being supplied under pressure to the container at the end thereof enclosing the nozzle through a passage taking part in the rotary movement, and the container being provided with a narrow delivery orifice for the thread and the coagulating liquid. The size of the delivery orifice of the coagulating bath container, the speed of rotation of the system, and the pressure under which the coagulating bath is supplied are such that the formation of the surface of the bath into a paraboloid shape is avoided and the threads are thereby coagulated within the bath so far that sticking of individual filaments is avoided. The container may be reduced in cross-section gradually or abruptly from the nozzle towards the delivery end. It may be subdivided into sections removably connected together. To avoid twisting of the thread in the coagulating bath, the container may be provided at its top with a thread-brake device taking part in the rotary movement. The pipe carrying the spinning solution may be constructed and mounted so as to set itself with its centre of gravity in the axis of rotation. C.

Cellulose Derivative—Carbohydrate Ester Rayons: Production. W. W. Groves (Aceta Ges.) B.P.484,661 of 4/11/1936.

Artificial threads, films or the like are prepared from a mass consisting of a cellulose derivative and an ester of a polymeric carbohydrate or carbohydrate derivative with an organic sulphonic acid or sulphamic acid, which ester is soluble or converted to a plastic mass in organic solvents. The products may be obtained by wet or dry spinning methods, by casting or the like. There may be added to the mass to be shaped also synthetic resinous substances containing reactive groups having an alkylating function; substances which possess, or are converted by mild hydrolysis into bodies which possess a greater capacity for swelling in water than the main component, e.g. polymerised vinyl compounds; high molecular resinous or polymeric substances having acid or latent acid groups, e.g. polymerisates containing unsaturated acids; mixed polymerisates from maleic anhydride and vinyl derivatives, or cellulose derivatives containing carboxyl groups. The threads, films and the like may be aminated, or the aminating agent or its equivalent, a number of which are specified, may be added to the spinning or like solution. Equivalents of aminating agents are substances such as dimethyl sulphide and trimethyl phosphine. The products have an increased affinity for acid dyes, and in some cases also for direct cotton dyes, azo components, vat dyes and insoluble dispersed dyes. In an example rayon spun from a solution containing cellulose acetate, toluene sulpho-cellulose and the mixed polymerisate from vinyl methyl ether and maleic anhydride is aminated with N-butyl ethylene imine. C.

Curled Threads and Staple Fibres: Production. W. W. Groves (I.G. Farbenindustrie A.-G.). B.P.485,106 of 14/11/1936.

The process described in B.P.462,184 for obtaining curled staple fibres from viscose is carried out by subjecting the cellulose xanthate threads while on a draft roller to the action of scrapers or doctors which check the threads in their path and thereby curl them, and then converting the curled cellulose xanthate threads to cellulose hydrate threads. C.

Vinyl Resin Threads: Production. W. W. Groves (I.G. Farbenindustrie A.-G.). B.P.485,115 of 16/11/1936.

Chlorinated polyvinyl chloride is worked up by strongly cooling a solution thereof in an organic solvent to form a gel and precipitating by a non-solvent. A solution of chlorinated polyvinyl chloride, e.g. of 10 per cent. strength in tetrachlorethane, may be gelled by cooling to 0-40° C. and a non-solvent, e.g. methanol or other lower aliphatic alcohol or aliphatic hydrocarbons such as petroleum ether or gasoline, added with stirring. Alternatively, a gel obtained in the same way may be extruded, e.g. as a band or fibre, into the preferably pre-cooled non-solvent, which may move in countercurrent or may be situated in more than one bath. C.

Staple Fibre: Production. Courtaulds Ltd. (London), R. Coleshill and J. H. McKeown. B.P.485,507 of 8/1/1937:22/6/1938.

In the production of staple fibre by a process in which a continuous thread, filament or the like, or bundle thereof, is stretched by passing it in succession round two or more peripheral surfaces each rotating with a peripheral speed greater than the previous one and is thereafter cut, a more uniform length of staple is obtained if the thread or bundle of threads after it has passed round the stretching device, but before it arrives at the cutting device, is passed round another peripheral surface rotating with a peripheral speed so much less than that of the last of the stretching surfaces as to compensate approximately for the contraction of the thread which takes place. The thread may be stretched by passing it in succession round two rollers, the peripheral speed of the second of which is greater than that of the first. After it leaves the second roller it is passed round a third roller rotating at a slower peripheral speed than the second roller. This third roller may be driven by a shaft separate from that bearing the second roller, or it may be on the same shaft, or it may form a part of the second roller with reduced diameter. C.

Rayon Cake Treatment Apparatus. Hampton Co. B.P.485,669 of 27/11/1936.

The apparatus described in B.P.471,005 is used for subjecting rayon cakes to treating processes other than dyeing. When used for centrifugal drying the perforate sleeve with a series of cakes supported by the flange and held by the removal cover is placed within a perforate basket. The basket is mounted on a base affixed to a rotatable shaft. C.

2—CONVERSION OF FIBRES INTO FINISHED YARNS

(A)—Preparatory Processes

Cardroom: Planning. F. Münch. *Leipz. Monats. Text. Ind.*, 1938, 53, 117-9.

A discussion of the distribution of work in the preparatory processes of cotton spinning and points to be considered when planning for maximum efficiency. Tables are given showing numbers of cards, combers, drawing and speed frames required and productions under specified conditions. C.

Rayon Filaments: Breaking between Drafting Rollers. O. Kay. *L'Industrie Textile*, 1938, 55, 233-235.

The breaking of rayon filaments between the rollers of a drafting system in the production of staple fibre is studied and the influence of various factors on the theoretical lengths of the longest and the shortest fibres produced is examined. It is shown that the maximum length is proportional to the distance between the rollers and the extension at break and inversely proportional to the draft, and the minimum length is proportional to the distance between the rollers, the elasticity and the extension at break and inversely proportional to the draft. It is pointed out that the variation in length of staple fibre produced by this method is considerable and the product is therefore not entirely satisfactory from the spinner's point of view. The possibility of obtaining a more regular fibre is briefly discussed. C.

Carding Problems: Discussion. Southern Textile Association (S. Carolina Division), *Cotton* (*U.S.*), 1938, **102**, No. 5, 91-2.

The following subjects are discussed. (1) Elimination of neps; close settings and low production are advocated. (2) Blending reserves for single-process scutching; more even laps are reported as the result of installing them. (3) Licker-in speed; the question is raised whether the common practice of keeping the licker-in speed constant is the best. C.

Carding Problems: Discussion. Southern Textile Association (Northern N. Carolina-Virginia Division). *Cotton* (*U.S.*), 1938, **102**, No. 5, 94-95.

The following subjects are discussed. (1) Scutching and carding of rayon staple fibre; practical hints are given. (2) High-draft roving; spinners report more ends down than on ordinary draft, though strength and regularity were not affected. (3) Calender roller and coiler head trumpets; questions are raised about the dimensions of these trumpets and the distance from the trumpet to the nip of the coiler-head rollers. (4) Speed of draw frame front rollers; one spinner finds 240 r.p.m. to be the best speed in the range 175-313 r.p.m. for 1⅜-in. cork-covered rollers. C.

Cotton Waste Opening and Cleaning Machines. C. Oswald Liebscher, Chemnitz. *Textil Lloyd*, 1938, **12**, No. 13, 20-21.

In a machine for cleaning, mixing and opening low-grade cotton and various types of cotton waste, the cotton is fed by a lattice to a cylinder carrying series of strong pins which carry the fibrous material round inside a cylindrical grid having pins projecting inwardly from its upper wall. Impurities fall through the grid and the cleaned and opened fibre is removed from the top of the machine. A fan is provided to remove dust by suction. In an arrangement for recovering good fibre from the elevator waste of a willow, the waste is caused to slide into a rotating cylindrical cage arranged in an oblique position in an enclosed space. Small impurities pass through the cage and the fibres, together with the larger impurities, are carried away by suction and combined with the material being fed to the willow. C.

Mineral Oils for Textile Processing. L. Billings. *Amer. Dyes. Rep.*, 1938, 27, P265-P269.

A discussion of the properties of mineral oils and of compounded mineral oil and mineral sulphonate products as wool fibre lubricants. An oil has now been produced which forms colourless oxidation products of an acidic nature ; the acids formed assist the scouring. Minerals oils show very little oxidation and heating in the Mackey test. The problem of the addition of inhibitors has not yet been solved and the resistance of oils to oxidation is better achieved by careful selection and treatment of the constituents of the blend. Mineral oil products are also used as finishing compounds and as wax emulsions. W.

Wool-spinning Oils. D. de Prat. *Mat. grasses*, 1937, **29**, pp. 248-250, 282-283, 307-308 ; and 1938, **30**, 4-6.

The qualities required of a good oil are indicated, and the properties of various potential worsted oils are discussed. Conclusions: No oil at present in use is entirely satisfactory. Olive and arachis oils are improved by the addition of antioxidants but oxidise if storage is prolonged. Mineral oils are unsatisfactory on account of the difficulty of their removal. W.

Olein or Mineral Oil for Shoddy and Woollen Oiling? (1) K. Götze, (2) Kehren. *Textilber.*, 1938, **19**, 416-418.

(1) The conclusion drawn by Kehren in an earlier paper (*J. Text. Inst.*, 1938, A268) that mineral oil mixtures are still inferior to olein, both on technical and economic grounds, is disputed. (2) Kehren's reply. W.

Piecings in Open Drawing. H. D. Walker. *Textile Recorder*, 1938, **56**, No. 664, pp. 25-26.

The author discusses defects caused by the faulty joining of slubbings during creeling. Methods, illustrated by diagrams, are given for making plaited and twisted types of piecings. W.

The Manufacture of Hemp and Hard Fibres. Dressing, Breaking and Cutting. S. A. G. Caldwell. *Textile Manufacturer*, 1938, **64**, pp. 318 and 328.

Describes methods of preparation of hard and soft cordage fibres with special reference to the dressing, breaking and cutting processes. The different machines in use are fully described and methods of operating outlined. L.

Hemp Wool—A New Raw Material for the Cloth Industry. *See* Section 1B.

Flax Production and Processing. *See* Section 1C.

Weft Winding Machine and Methods. *See* Section 2C.

(B)—SPINNING AND DOUBLING.

Mule Cops with "Protruding Tails": Spinning. N. H. Pomfret. *Textile Recorder*, 1938, **56**, No. 663, p. 22.

Continental thread manufacturers sometimes demand mule cops with both ends accessible or "protruding tails." The extra trouble entailed by this is discussed and simple aids are described. C.

Spinning Machinery: Historical Development. *Textile World*, 1938, **88**, No. 7, 69-84.

To commemorate the 200th anniversary of Paul's invention of drafting by rollers, the early history of invention in cotton spinning is reviewed and modern advances are brought out in an account of a hypothetical mill for the production of cotton, woollen, worsted and spun-rayon yarns, equipped throughout with up-to-date machines. The progress made in recent years, the results of research, and some of the more important directions in which research on yarn manufacturing problems is at present being conducted are discussed. C.

Spinning Mule: Causes of Irregular Winding. *Textile Weekly*, 1938, **22**, 178-9.

Irregular winding on the mule is due to one or other of the factors (*a*) spindle revolutions per draw, (*b*) average diameter of cop chase, and (*c*) length of the stretch being out of unison. Mechanical defects that can influence these factors are reviewed. C.

Spinning Problems: Discussion. Southern Textile Association (S. Carolina Division). *Cotton* (*U.S.*), 1938, **102**, No. 5, 92-3.

The following subjects are discussed. (1) Causes of cockled yarn; effects of the roller settings, roller covering, cleaning, temperature and humidity are mentioned, but one spinner claims that the twist in the roving and lack of uniformity in staple have more influence than the nature of the roller covering. (2) Spinning on long bobbins; the change to longer bobbins (6½ in. to 7½ in. or 7⅞ in. to 8 in.) is recommended by several spinners. C.

Spinning Problems: Discussion. Southern Textile Association (Northern N. Carolina-Virginia Division). *Cotton* (*U.S.*), 1938, **102**, No. 5, 95, 131.

The following subjects are discussed. (1) Preventing fuzziness in high-draft yarns; heavier travellers are suggested and also oil spraying. (2) Spindle tapes; one spinner favours a herringbone weave but another makes his own tape with strength in the warp and not so much weft, thus avoiding a stiff tape. C.

Spinning Problems: Discussion. Southern Textile Association (Gaston County Division). *Cotton* (*U.S.*), 1938, **102**, No. 5, 97.

The following subjects are discussed among others. (1) Shape of ring traveller; a test is reported that showed advantages, not only in cost, of square-pointed travellers in comparison with round-pointed ones. (2) Spindle tapes; advantages of the light-weight tape now on the market are reported, but the difficulty of making fair comparative tests on tapes is brought out in the discussion. C.

Flyer Doffer Frames. Prince-Smith & Stells Ltd. *Textile Recorder,* 1938, **56**, No. 663, pp. 46 and 48.

A description, with illustrations, of the principal features of the A.P.S. model and the R.S.D. model flyer spinning machines. W.

Large Package Spinning. D. Wilson. *Wool Record,* 1938, **53**, 1301-1307 and 1361-1367.

The author discusses knotless yarns, bobbin size, diameter of ring, ring plate traverse, yarn strength, large package spinning frames, Magnum ring spinning frame, mule ring spinning frame (Velox) and Parawind ring spinner. W.

(C)—SUBSEQUENT PROCESSES

Weft Winding Machine and Methods. Flaxman. *Textile Recorder,* 1938, **56**, No. 662, p. 26.

Discusses the features of weft winding machinery and methods adopted in the winding of linen weft yarn. L.

(D)—YARNS AND CORDS.

Metal Threads: Production. R. Battentier. *L'Industrie Textile,* 1938, **55**, 169-170, 223-224.

Metal threads used in weaving, knitting, and in the production of lace, trimmings, etc., seldom consist wholly of metal. They generally comprise cores of textile material around which are wrapped metal threads. The latter usually consist of copper threads coated with silver or gold, or silvered or gilded by surface treatment with zinc, nickel or white metal. The various types are described and the methods by which they are produced are outlined. The wrapping of textile yarns with the metal threads and the influence of the nature of the textile yarn on the characteristics of the composite threads are discussed. Flattening and twisting operations for producing a more brilliant effect, coating with colourless varnish as a protection from oxidation, the production of iridescent effects by heat treatment under special conditions, and coating with coloured varnishes are mentioned. C.

New Linen Thread Works. *Linen Trade Circ.,* 1938, **24**, No. 1282, p. 4.

A new thread works equipped with British machinery has been established in Buenos Aires by the Cia de Hilos de Lino, for the twisting and finishing of yarn imported from the United Kingdom. The company, previously a selling agency, has entered the manufacturing field following the increased local competition and in view of the high import duties. It is not intended to instal a spinning unit until such time as flax is grown in Argentina for fibre as well as for seed. L.

PATENTS.

Composite Yarn. D. Finlayson and J. F. Levers. B.P.482,425 of 29/9/1936.

A composite yarn, resembling a wool yarn, comprises one or more yarns of crinkled cellulose acetate having in the composite yarn at most only a low degree of twist, associated with one or more high twist yarns having in the composite yarn a degree of twist such that they will shrink on treatment with hot aqeous liquor and the proportion of crinkled yarn in the composite yarn being substantially greater than the proportion of high twist yarn. The yarns may be associated by a doubling twist and a length of high twist yarn may be doubled with a greater length of crinkled yarn. The denier of the crinkled yarn is preferably substantially greater than that of the high twist yarn and at most 30 per cent. of the total denier of the composite yarn is constituted by the high twist yarn. The high twist yarn may be of high tensile strength. The crinkled yarn may be produced by subjecting cellulose acetate filaments of flat cross-section to the action of hot aqueous liquors and the spinning solution may contain a plasticizing agent. The high twist yarn may be crêpe shrunk after the doubling operation by treatment with hot aqueous liquors. The crinkled filaments may be continuous or discontinuous and the high twist yarn may be of a natural or artificial material. C.

Regenerated Cellulose Threads: Twisting. H. Dreyfus. B.P.482,514 of 30/9/1936.

A thread of regenerated cellulose is subjected to the action of heat and, as the final twisting operation and while the thread is hot, twist is inserted to a degree insufficient to impart crêping power to the thread. The twist may be inserted while the thread is subjected to the action of hot water or steam, preferably under such conditions that moisture is present. Twisting may be effected by drawing the thread off over the end of a rotating package through a guide fixed in line with the axis of rotation, the thread being passed through a steam chamber on its way to a bobbin on which it is collected. A ring twister may also be used. The twisting spindle, the guide and the steaming or hot water treatment device should be so arranged that at least the last part of the twist is inserted under the influence of the steam or hot water. A floating ring device may be used to prevent the twist from running back to the package. A suitable steaming device consists of a horizontal pipe mounted over a row of spindles and provided with eyes at appropriate points on top and bottom for entrance and exit of the threads. The pipe may be provided with upwardly projecting tubes communicating with the inside of the pipe at their lower ends and containing eyes for the passage of the threads at their upper ends. The presence of moisture may be assured by arranging for the condensation of steam, or by wetting the thread with water before it enters the steam. The steam may be at 95-100° C. and under slight pressure, and the length of the path of the thread through the steam chamber 1-3 or 3-6 inches. The water may contain wetting agents and a small proportion of acid. The degree of twist imparted may be 40-50 turns per inch when a thread is used which has crêping properties with a twist of 55 turns per inch. The threads may be sized, lubricated, or treated with hygroscopic or deliquescent substances before twisting. C.

Spinning and Twisting Spindles. J. S. Sio. B.P.483,721 of 10/7/1936 (Conv. 23/9/1935). [Void.]

Spinning, twisting, and like spindle apparatus comprises a central dead spindle supporting a driven hollow bobbin-carrying part by means of bearings which may be in the form of balls, rollers or the like, a lubricating chamber being formed in the upper end of the bobbin-carrying part. C.

Self-centering Spindle. Manufacture Alsacienne de Broches (Soultz, France). B.P.487,613 of 9/2/1937:23/6/1938.

A bearing for a spindle of the kind referred to as "self-centering" or "flexible," is characterised in that, between the journal sleeve and the bolster is mounted an unsplit ring of rubber or rubber-like material tight-set on the sleeve and without play in the bolster, always with at least a slight degree of compression. C.

Spinning Frame Drafting Mechanism. A.-G. J. J. Rieter & Cie (Winterthur, Switzerland). B.P.487,626 of 1/5/1937:23/6/1938.

A drafting head of a spinning frame in which a small endless band supports the fibres being drafted and is acted upon by a tension roller, the trunnions of which are received in slots serving as guides or bearings and formed in the arms of a pivotally mounted carrier, is characterised by the provision of a stop or retaining means which, on movement of the carrier about its pivot, prevents the trunnions of the roller from moving out of the slots. The stop or retaining means may comprise a suitable spring or an abutment formed by providing the slots with single or double elbows. C.

Slubbing: Production on Drawing Frames. B. Pross and F. Baldus (Bocholt, Germany). B.P.487,630 of 11/6/1937:23/6/1938.

In a method of producing slubbing on drawing frames, the substantially parallel slivers from the drawing frame rollers are passed through condensing funnels provided with resilient clamping members which engage and condense the slubbing around the whole or a substantial part of the periphery thereof, the slubbing then being led directly through the known calender rollers to the coiler can or like container. The ends of the resilient clamping members extend directly up to the nip of the calender rollers. It is claimed that the fibres are drawn out, parallelised and condensed into a very firm slubbing which may be spun directly on the ring spinning machine. C.

Sliver Guiding Device. H. and B. American Machine Co. (Pawtucket, Rhode Island, U.S.A.). B.P.487,727 of 7/7/1937:24/6/1938.

A sliver guiding device comprises a member having a helical groove adapted to support the sliver throughout its passage from one set of drafting rollers to the next succeeding set and to guide the sliver or roving in the path of a helix between successive drawing operations in such a way that the sliver is condensed and is given a uniform false twist. C.

Drafting Roller Underclearer Mountings. Howard and Bullough Ltd. (Accrington) and W. Wilson. B.P.487,910 of 18/5/1937:28/6/1938.

An underclearer mounting comprises a rocking lever mounted for pivotal movement between two localised positions in which an underclearer roll supported at the free end of the lever is alternatively in operative contact with the associated drafting roller, or conveniently disposed for stripping, a finger-piece or handle being furnished at the free end of the lever for the purpose of effecting the movement. The rocking lever is pivoted about a centre so disposed relatively to the operative position of the underclearer and the centre of the associated draft roller that, when moved from the operative position, the rocking lever must pass over a dead centre, and the seating of the underclearer roll is adapted to yield sufficiently to permit of such movement at the times desired. Adjustable stops, abutments or the like, may be provided for regulation of the precise settings of the underclearer in the operative and "stripping" positions. C.

Hydraulic Mule Drive. Sächsische Textilmaschinenfabrik vorm. R. Hartmann A.-G. (Chemnitz, Germany). B.P.487,922 of 9/8/1937:28/6/1938.

A spinning mule is provided with a hydraulic device for running the carriage in and out. In a suitable arrangement, a cylinder or the like is directly connected with the carriage and moved to and fro on a stationary piston rod through the influence of hydraulic pressure. A hydraulic device may also be employed which co-operates with some known transmission means, such as a rack, screw spindle, gear wheels and the like, for moving the carriage in and out. C.

Roller Covers: Preparation and Application. Sonoco Products Co. (Hartsville, South Carolina, U.S.A.). B.P.487,924 of 19/8/1937:28/6/1938.

A roller for textile machines comprises, in addition to the customary metallic core having a cylindrical surface, a cover member made of resilient synthetic rubber-like material encircling the core, and a tubular fabric member between the cover member and the core, the intermediate tubular fabric member being glued to the core and also attached to the cover member by a bond comprising a material identical or substantially identical with the material of which the cover member is fabricated. The method of assembling the several component parts of the roll involves the preliminary formation of a hollow cylindrical cover member of resilient synthetic rubber-like material, this cover member being preferably formed by an extrusion process or by a moulding process so that it is entirely seamless. As a preliminary step also a seamless tube of textile fabric is made, being preferably woven, knitted or braided of cotton yarn, the outer diameter of this fabric tube being approximately the same as the inner diameter of the cover member, and the inner diameter of the fabric tube being approximately the same as the outer diameter of the metallic core. The fabric tube is then inserted within the cover member and heat applied to effect the bonding of the fabric tube and the cover member, the temperature of these members being raised to that at which the synthetic material of which the cover member is composed softens or fuses and intimately engages the fabric tube. Thereafter the cover member as thus lined is allowed to cool and the bond to solidify. Finally, the inner surface of the fabric lining of the cool cover member is coated with glue and allowed to dry. The lined cover member may then be readily assembled with a metallic core by moistening the inner coating of glue, drawing the lined cover member over the core while the glue is in moist condition, and allowing the same to harden. C.

Drawing Frame Dust Binding Device. A.-G. J. J. Rieter & Cie. (Winterthur, Switzerland). B.P.488,134 of 11/6/1937: 1/7/1938.

A device for clearing dust or the like from drawing frames is characterised in that clearer rollers of an electrostatically excitable material are provided, the peripheries of the clearer rollers being in contact with the rollers of the drawing frame and being driven thereby. Preferably the clearer rollers are hollow and are electrostatically excited by friction members associated with the inner periphery of the clearer rollers due to relative movement between the members and rollers during operation. This renders it possible in a simple manner for the fibre and dust floating around to be collected on the clearer rollers themselves. C.

Long-fibre Drawing Apparatus. F. O. Wolf (Spinnerei Cossmannsdorf Wolf & Co. Kom.-Ges.), Hainsberg, Germany. B.P.488,146 of 13/10/1937: 1/7/1938.

Drawing apparatus for use in spinning medium and long fibrous material, especially worsted wool, schappe silk, rayon and the like, in which every two adjacent pressure rolls are arranged overhung and rotatably on a stationary pressure-loaded axle is characterised in that the axle of a pair of pressure rolls is mounted only in its loading lever which grips over the axle on the whole or on almost the whole length of the axle between the pressure rolls, and the loading lever is mounted stationary on a support by means of pins. C.

Yarn Clearer Plate. J. O. Whitaker (Accrington). B.P.488,239 of 10/7/1937: 4/7/1938.

A clearer plate for use in textile spinning, twisting and winding machines, comprising a plate having a plurality of radially or otherwise disposed slots extending to its periphery and each of the slots being of a gauge suitable for clearing a given count of yarn, is centrally apertured so as to be adapted to fit upon the cup of a ball-drag tensioning device, so as to project around the same, and to be secured together therewith on the same mounting. Where the cup of the ball-drag device is spigoted, as is usual, the clearer plate may fit closely over the spigot and be held between the shoulder formed by the latter and the machine frame member whereon the cup is supported. C.

3—CONVERSION OF YARNS INTO FABRICS

(A)—Preparatory Processes

Adjustable Warp Beam Flanges. J. E. Thornton (Thornton & Scott). *Textile Mercury,* 1938, 99, 75.

In an arrangement for adjusting and securing beam flanges in any desired position, the flanges are secured to the barrel by means of patented grips inside the barrel. At both ends of the barrel three slots are cut at equal distances apart, e.g. 120°. The slots can be any length, but 14 in. long at each side is sufficient as this gives a maximum variation in the distance between the flanges of 27 in. The flange and collar are in one piece and the collar has three square holes 120° apart, adapted to receive the square shanks of the grips. In fitting a flange in place, it is pushed along the barrel with the square holes in the collar in alignment with the slots in the barrel. The grips are then inserted and instantly fixed by tightening nuts on the outer ends of the shanks. When adjustment of the flanges to a new position is necessary all that is required is a half-turn of the three nuts, which allows the flange to slide along the slots in the barrel to the desired position, and a further tightening of the nuts. It is claimed that the flanges can be moved and fixed in a few seconds and when fixed cannot slip even with the heaviest warps. The beam is all metal and is light in weight. C.

Ribbon Loom Quills: Winding. *Textile Recorder,* 1938, **56**, No. 664, p. 27-9.

The best types of quill for ribbon weaving are discussed and the advantages of parallel-wound over cross-wound quills in output and force required to move the traverse are demonstrated with the help of calculations. C.

Rayon and Silk Warp Beam. J. Tomkinson & Co. Ltd. *Textile Weekly,* 1938, **22**, 151; *Textile Mercury & Argus,* 1938, **99**, 107.

Particulars are given of a warp beam with adjustable flanges to suit any normal demands in rayon and silk warping. C.

Schlafhorst Automatic Warp Winder Feed. V. Hildebrand. *L'Industrie Textile,* 1938, **55**, 277-280.

The Schlafhorst automatic feed system for warp winders is described. The usual bobbin peg is replaced by a star piece comprising four pegs of which the upright peg carries the bobbin which is unwinding, the peg pointing forwards receives a new bobbin, that pointing towards the back carries the empty tube until the latter is automatically removed, and the peg pointing downwards is empty. Arrangements for turning the star through an angle of 90° to bring a new bobbin into working position when required are provided. Various arrangements for automatically feeding the bobbins to the pegs by means of travelling carriages, bands or chains are described. C.

Weft Winding Machine and Methods. *See* Section 2C.

(C)—WEAVING.

Harness: Selection. S. C. Veney. *Textile World,* 1938, **88**, No. 7, 63.

When possible, the number of shafts to be used should be equally divisible by the number of ends per dent and the quotient thus obtained should be an even number. Or, in heavier counts, the number of shafts to be used should be the same as the ends per dent. When this method is used, the drawing-in operative can throw a lease with the shafts, which, when the proper shafts are raised, will permit him to draw the reed in record time. Where such a division is not possible, it is necessary to pick out end for end from a false lease. The methods used for five-leaf satins, two-beam, taffeta and satin matelasses, twills and romaines are discussed and leasings for characteristic drawing-in drafts and reading plans are shown. C.

Loom Sley: Adjustment. *Textile Weekly,* 1938, **22**, 80-81.

It is pointed out that satisfactory loom operation depends to a large extent on the good condition and proper setting of the lathe and its fittings, and instructions are given for testing the lathe, setting the reed and box backs, the shuttle-box fittings and the box fronts, and fitting the shuttles in the boxes. C.

Weaving Mill: Cost Calculations. E. Eigenbertz. *Kunstseide,* 1938, **20**, 44-49, 92-99, 141-143, 181-184, 199-206.

The importance of cost determinations in weaving mills, the difference between selling price and cost price, and the problem of determining the latter are discussed. The relations between individual and common costs are examined, a critical study of four methods of determining costs is made, typical figures are given, and the values obtained for a particular case by the different methods are compared. The value of cost determinations for comparison and control purposes is pointed out. C.

Weaving Process: Work and Time Study. E. F. Mayer. *Leipz. Monats. Text. Ind.*, 1938, **53**, 121-123.

The value of "Refa" work and time studies in the textile industry is discussed and the need for trained observers is pointed out. A study of the operation of eight Rüti automatic looms weaving heavy cotton cloth under the control of one weaver is described. Charts showing the time taken by the different operations performed by the weaver and the number and duration of stoppages on each loom are given and discussed. It is claimed that the efficiency of the weaver could be increased to 90 per cent. by increasing the number of looms per weaver to 9, and that a weaver could attend to 14 looms if provided with a young assistant who would place the cops in position. C.

Cross-border Dobby Machines. W. Wilkinson. *Textile Manufacturer*, 1938, **64**, 232-233.

The development of cross-border motions is briefly reviewed and an automatic cross-border dobby is described. Details of the construction are shown in a diagram and the action is explained. C.

Dobby Loom Shafts: Lifting. W. Shuttleworth. *Textile Weekly*, 1938, **22**, 120-2.

Practical hints are given on the causes and prevention of the faulty lifting of dobby loom shafts. C.

Figured Elastic Fabric: Weaving. Société du Caoutchouc Manufacturé. *Fils et Tissus*, 1938, **26**, 351-355.

A method of weaving figured elastic fabrics characterised by the use of only one shuttle is explained with the aid of diagrams. To produce the pattern effects, warp threads of different nature or colour from the ground warp are used and at certain points the weft is made to loop round a pattern warp thread and pull it, in the form of a loop, through the shed so that it forms a partial double pick. C.

Loom: Output. A. Wanger. *L'Industrie Textile*, 1938, **55**, 176-177, 280-282.

The determination of theoretical and actual loom productions is explained and methods of increasing production are discussed. The importance of the use of yarn of good quality and of careful preparation of both warp and weft is emphasized. The possibility of increasing production by the use of larger cops and shuttles and by increasing loom speeds, the relation between loom speed and width in looms of the same type, and the superiority from the point of view of production of broad compared with narrow looms are discussed. C.

Loom Accessories: Life. *Cotton* (*U.S.*), 1938, **102**, No. 5, 131.

The following records are given of loom-hours operated by various accessories over a year on two shifts of 8 hours (1936) and a year of three shifts of 8 hours (1937):

	Shuttles	*Check straps*	*Lug straps*	*Pickers*	*Picker sticks*
1936:	4,659	4,322	4,751	2,259	6,779
1937:	4,157	3,594	4,300	1,360	5,324

C.

Weft Separators. P. Thiébaut. *Fils et Tissus*, 1938, **26**, 347-351.

Two weft separators for multiple-box looms are described and shown in diagrams. Both devices employ needles, which are raised in accordance with the box motion, for the purpose of raising the wefts from shuttles not in action so that they are not dragged into the shed by the working shuttle. C.

Wire Testing Sieves: Manufacture. D. MacCalman. *Industrial Chemist*, 1938, **14**, 64-6, 101-6, 143-8, 197-200.

In continuation of an account of the accuracy obtainable in sieving tests, and in order to indicate the difficulties encountered in the production of test sieves to a precise specification, the author describes the processes of wire drawing, wire winding, beaming and weaving, and the selection of the cloth and its mounting in a sieve. Illustrations are given of looms and winding machines. C.

Non-stop Weft-mixing Device for Dobcross Looms. J. W. Wray. *Textile Manufacturer*, 1938, **64**, 199 and 212.

A Dobcross box loom is convertible to run two shuttles with two-pick weft-mixing as a semi-automatic, an exhausted shuttle being changed by a weft feeler. No special bobbins or magazine are necessary. W.

(D)—KNITTING.

Warp Loom: Output. J. B. Lancashire. *Silk & Rayon*, 1938, **12**, 626-8.

Examples are given of the calculation of the output in lb. of rayon fabric per hour on warp looms, by means of the formula

$$(60L \times T \times N \times D) / (36C \times 840 \times 5315)$$

where L = laps knitted per minute, T = warp take-up, N = number of ends on warp beam, D = denier of rayon, and C = courses per inch. A nomogram is provided. C.

Hilscher " Speedwelt." G. Hilscher. *Hosiery Tr. J.*, 1938, **45**, No. 533, pp. 68-70.

On the new Hilscher welt turner the welt bar guiding mechanism consists of a mechanical device for delivering the welt bars to the needle bars and performing the picking-up of the first course and the transfer after completion of the welt. Illustrations are given. W.

(E)—LACEMAKING AND EMBROIDERING

" Perfect " Tufting Machine. Alex. Ross & Co. *Textile Weekly*, 1938, **22**, 77-8.

The " Perfect " tufting machine for decorating materials with projecting bunches, clusters or tufts of ornamental material operates noiselessly and without vibration at speeds of 2,700 to 3,000 stitches per minute. A special feed construction permits easy tracing on pattern guide lines, and straight or curved-line work does not require great skill. Cotton, wool, rayon, staple fibre, silk and ply yarns can be used. Tufted articles improve with washing and do not require ironing. They are used as bedspreads, mats, curtains, towels, dressing gowns, beach capes, etc. C.

(G)—FABRICS.

Glass and Crash Towellings: Structure. J. Hoye. *Textile World*, 1938, **88**, No. 7, 64.

Yarns and weaves used for glass towelling and crash towelling are discussed. Illustrations are given. C.

Variable-count Yarns: Application. E. Braschler. *Leipz. Monats. Text. Ind.*, 1938, **53**, 123-126.

Apart from the effects produced by the use of knop, flake and other fancy yarns, pleasing effects in fabrics can be obtained simply and cheaply by the use of yarns spun from mixtures of materials of different nature or colour or by the use of yarns in which the count varies. The latter type of yarn is discussed and the influence of the length of the repeat twist, maximum, minimum and mean counts, and the ratio between the maximum and minimum counts in a given yarn is studied. A curve showing the variations in counts in a typical yarn of this type is given and the adaptation of a ring spinning machine for the production of this type of yarn is briefly described. Precautions to be taken in weaving and finishing processes are indicated. Applications of variable-count yarns as warp and weft are discussed and samples of imitation linen and raw silk fabrics prepared from Vistra staple fibre yarns showing count variations are given. C.

Fabrics in the Film Industry. *Linen Trade Circ.*, 1938, **24**, No. 1281, p. 3.

The field for fabrics in the film industry is likely to expand if plans for technicolour production are developed. The picture industry looks to manufacturers to demonstrate that suitable fabrics can be produced for colour-film work. The chief requirements will be that such materials will translate themselves into pleasing tone effects when filmed. L.

PATENTS.

Loom Framework. J. E. Robinson. B.P.482,371 of 27/8/1936.

One or more frame members of a loom are constituted by reinforced metal tubes of any desired cross-section. The tubes are reinforced by providing their walls with longitudinal corrugations and/or by members, e.g. of cruciform section, secured within the tubes by welding or riveting. The corrugations or members may extend along only that part of each tube which is subjected to maximum stress. C.

Ladder Webbing: Structure. J. Carr & Sons Ltd. and J. Redman. B.P.482,406 of 30/3/1937.

In ladder webbing or Venetian blind tape with webs of different colour including warp threads connected by binder straps, each binder warp thread, where it is bound into a web by passing under a web weft thread, has a plurality of adjacent web warp threads floated over the same and an additional weft thread. These adjacent warp threads tend to conceal the binder strap warp thread and prevent its colour being visible on the face of the web. One web may be of the same colour as the binder strap. One or both webs are so woven that the twill weave therof does not change in direction for the number of warp ends covered by the binder strap warps. C.

Bobbin Creel. H. Stanier. B.P.482,412 and 482,421 of 13/5/1937.

(1) In a yarn beaming or warping machine, the bobbin supporting pins project in rows at right angles from parts having surfaces each lying in a plane at right angles to the front comb, the rows distant from the comb being higher than the nearer rows. The threads from each row of bobbins pass through separate short combs arranged on the creel and each secured by a set screw in a guide on a bracket. The threads of each row pass over or under a loosely mounted porcelain roller and between this and a rod. (2) The threads pass through a series of short combs, one for each row of bobbins, thence to the front comb of the warping and beaming machine. There are the same number of dents in each comb as bobbins in each row. The threads also pass above or below a porcelain roller rotatable on a rod, and between this and another rod. The roller may be eccentrically mounted to give a vertical movement to the passing threads. Each comb may be carried by a bracket bolted to the creel frame and be removably secured by a set screw, etc., in a guide. A creel as described in (1) may be used. C.

Elastic Thread. J. R. Kendrick Co. Inc. B.P.482,928 of 26/7/1937 (Conv. 3/8/1936) and 482,932 of 21/9/1937.

(1) An elastic thread comprises a rubber core, inner covering threads surrounding the core, outer covering threads surrounding the inner threads, and a flat strip of rubber extending longitudinally around the core between the inner and outer covering threads and transversely deformed by the outer covering threads to embrace the core and inner threads. The core may be maintained stretched from its normal length to a greater extent than the flat strip of rubber. (2) An elastic thread comprises an elastic rubber core and an elastic rubber ribbon extending longitudinally of the core and folded to surround and contact with the core by covering threads. Two ribbons may be used to envelop the core. The core and ribbon are maintained stretched to a length greater than their normal lengths and the extent to which the covering threads maintain the core stretched is greater than the extent to which they maintain the ribbon stretched. The ribbon or the core may be formed of rubber which offers greater resistance to stretching than that offered by the other element. The rubber used may have sufficient resistance to being stretched as to be required to be held by the covering threads stretched only to a limited extent. C.

Double-faced Fabric. C. Clutsom. B.P.482,837 of 10/10/1936.

A double-faced fabric having face wefts and back wefts has a knitted selvedge at one or both edges. This may comprise interknitted loops of the front weft formed into a chain of loops engaging loops of the back weft, or loops of both wefts may be knitted together. One or more weft laying members and latch needles may be used, and there may be several sets of the mechanism arranged one above another as in the production of separate webs or pieces. The fabric may have a silk or rayon or like lustrous front and a cotton, wool or like back. The fabric may comprise elastic threads. It may be used for corsets, belts, girdles, etc. The invention may be applied to ribbons. C.

Loom Warp Protector Device. J. T. Harris. B.P.483,030 of 10/10/1936.

The protector finger has a cylindrical or truncated conical recess fitting a disc having a polygonal hub fitted on the polygonal end of the protector rod, which penetrates the wall of the recess and is provided with a washer and nut, whereby the finger may be secured in an angularly adjusted position on the rod. When the swell becomes worn the nut is slackened and the finger is rotated until it engages the swell, the nut being then tightened. C.

Hosiery Knitting Machine. Hemphill Co. B.P.483,188 of 17/4/1937 (Conv. 18/4/1936).

A machine for knitting a sock, stocking, etc., wherein the sole and instep are knitted of different yarns which overlap throughout a few wales at either side of the foot and float across the inside thereof, is provided with means for enabling wrap threads to be knitted throughout the leg and instep, and with trapping and severing mechanism for controlling the floats in the foot to prevent interference with the wrap threads. C.

Hosiery Knitting Machine. M. C. Miller. B.P.483,289 of 14/10/1936.

A straight-bar full-fashioned foot and leg knitting machine is provided with an instep-fabric supporting bar having a series of loop-lifting points and with means for moving the bar for removing the instep needle loops from the needles so that they are held behind the needle line during the knitting of the heel flaps. Knock-over elements, each having two substantially parallel knock-over surfaces at slightly different levels are employed. The narrowing mechanism for the leg and foot narrowings comprises bars actuated by the usual narrowing cams on the main cam shaft and can be locked in inoperative position by a manually-operated lever. The main cam shaft is moved axially for narrowing by a roller and cam discs under control of the pattern chain. Automatic welt setting-up and closing mechanism, and mechanism for laying in a welt wire are provided. An instep bar is provided for each section of the machine, and is supported upon the hanging frame for the welt bar. C.

Circular Warp Knitting Machine. M. Fritzsche (trading as Textilmaschinenfabrik M. Fritzsche). B.P.483,327 of 17/10/1936 (Conv. 17/10/1935).

In circular warp knitting machines the needles are rocked out of the normal path during movement in one direction by pawl and rack means on the needles and needle bed. C.

Knitting Machine Yarn Feeding Mechanism. Scott & Williams Inc. B.P.483,360 of 28/5/1937 (Conv. 24/7/1936).

To permit all the yarn fingers to occupy substantially the same feeding position, as well as to introduce the yarns at substantially the same needle, means are provided to maintain a yarn in substantially normal feeding relationship with the needles as a yarn finger is being withdrawn from feeding position. These means comprise movable blocking pins, the end of the upper pin being disposed radially outward of the end of the lower pin. A hooked finger for placing the ingoing yarn in position to be readily taken by the needles, a yarn guard, main yarn-clamping means, an auxiliary spring yarn clamp, and a yarn cutter are also provided. C.

Fully-fashioned Stockings: Knitting. R. Frenzel and L. Bahner. B.P.483,546 of 14/8/1936.

Fully-fashioned stockings with French feet are knitted from the toe on a straight-bar knitting machine, the fashioning being carried out by widening which is effected by thread guide control. In one method, when the traverse of the thread guide is increased to include another needle the looping and distributing sinkers are completely withdrawn into the sinker head so that the yarn can be led laterally past them, the yarn being correctly presented to the added needle when the needles rise again. The altered movement of the sinkers at widening is effected by a special eccentric which is put into use by a known controlling chain. In another method, the lower end of the thread guide is hinged to the upper part (or the guide is made flexible), and the lower end is rocked outwards away from the sinkers by a pressure member which is operated by a known lever and eccentric drive. C.

Weft Cutting Mechanism. K. Schwabe. B.P.483,626 of 12/8/1937 (Conv. 12/8/1936).

In an automatic weft-replenishing loom with a three-cell drop box, the cutting operation is controlled by a shaft rotating at the same speed as the crank shaft and by the change shaft rotating during the weft replenishment, the actual release of the cutter being determined through the medium of stepped latch devices carried by the drop box at the replenishing side. The cutter may comprise three parts or groups of parts, for example, a blade, a counter blade and clamping fingers rotatably mounted on a shaft on the lay. C.

Circular Knitting Machine. M. Fujisawa and K. Urayama. B.P.483,637 of 20/7/1936 (Conv. 18/7/1935).

A circular knitting machine is provided with a stationary needle cylinder carrying two sets of sliding bearded needles arranged alternately. A main fabric is produced from yarn drawn off bobbins by the rotary movement of a ring carrying, say, 20 sets of cams. At the same time a secondary design fabric is built up over the main fabric from two sets of yarns. One set of design yarns is drawn from upper bobbins mounted on a rotary cylinder, which also supports a perforated ring for guiding the yarns. The other set is drawn from lower bobbins mounted on brackets carried by a gear ring. The brackets support a ring perforated with guide holes for the yarns. Various diagonal designs are obtainable. C.

Loom Picker. J. Sengstschmid. B.P.483,689 of 26/7/1937.

The guide bush of a picker extends almost the whole width of the picker but is half cut away between the two limbs of the picker. The hole for the picker spindle may be eccentric or concentric with the bush. C.

Warp Beams. J. E. Thornton. B.P.483,942 of 25/2/1937.

The collars of warp beam flanges have square holes registering with longitudinal slots in the barrel. After the flanges have been adjusted, square bolts are inserted through the slots and holes and nuts are tightened thereon. C.

Braiding Machine Stop Motion. Siemens Bros. & Co. Ltd., and H. N. Elliot. B.P.484,024 of 26/2/1937.

A stop motion actuated by increased tension in the core thread consists of a spring-urged slotted frame slidable on a block carried by a bracket. A cable movable in a sheath connects the frame to a lever on a shaft which operates on the clutch connecting the braiding machine with the main drive. The core in passing behind a pulley mounted on the frame holds the parts in normal position against the pressure of adjustable springs and is itself deflected slightly out of the vertical. If the tension on the core increases sufficiently, the lever is moved to throw out the clutch. This also happens if any one of the braiding bobbin threads breaks. C.

4—CHEMICAL AND FINISHING PROCESSES

(A)—Preparatory Processes.

Wetting Agents: Testing. J. Rière. *TIBA,* 1938, **16**, 193-201, 245-251.

The general properties of wetting agents are discussed and the different types, classified according to chemical nature, are compared. Methods for the evaluation of wetting agents based on determinations of (1) surface tension, (2) wetting power, and (3) content of active products are reviewed and methods of determining foaming power and resistance to hydrolysis are outlined. The characteristics required in wetting agents for use in bleaching, mercerising, dyeing and finishing processes are described and a scheme for the examination of a textile assistant is presented. C.

Piece-end Sewing Machine. Singer Sewing Machine Co. Ltd. *Textile Manufacturer,* 1938, **64**, 241.

A new type of machine, 158KSV2, is mounted on a stand comprising legs and slide rails. The cloth is held at full stretch between two points and the machine travels from end to end, automatically stitching and trimming as it goes, and an automatic blower disposes of the trimmings. After the thread has been severed by a hand-operated cutter, the machine is brought back by operation of a handwheel. A control lever on the machine is automatically tripped when the machine completes the seam and a stitch-crowding device is incorporated which strengthens the stitching at the ends of the seam. A flat seam in which the pieces are joined end to end without overlapping is produced. Photographs showing details of the machine and the type of stitch and join are given. C.

(B)—Boiling, Scouring, Degumming and Washing.

Textile Processing Liquors: *pH*. L. H. and I. Fischer. *Deut. Textilwirt.,* 1937, **4**, No. 22, 22-4 (through *Chem. Abstr.,* 1938, **32**, 1104^2).

The following *pH* values are recommended as the best for the processes mentioned: Washing with soap, minimum at 9, maximum at 10·7; Washing with Gardinol, Igepon and Igepal, 2-12; Enzyme desizing, malt, 4·6-5·2, pancreatic enzymes, 6·6-6·8; bacterial enzymes, 7; Silk degumming and weighting, 10; Peroxide bleach in the presence of water glass, 6·8-8·4; Hypochlorite bleach, 8; Finishing acetate rayon, not more than 10; Clarifying feed water with alumina, 5·5; Boiler feed water, 10-12. C.

Buffer Action in Cloth Scouring. G. L. Atkinson. *Textile Mercury,* 1938, **98,** 494.

A test has been made on the hydrogen ion concentration of borax and borax with soap. Soap samples (ivory soap and Octogan soap with and without the addition of borax), calculated on a dry basis, were dissolved in 30 min. at 35-40° C. The solutions were then saturated for 15 min. with hydrogen and readings taken on the potentiometer at 5 min. intervals for three consecutive periods, the last reading being taken as a factor for comparison of hydrogen ion values. A table showing the results is given. With the addition of borax, equilibrium *p*H values were reached quickly, but in the absence of borax the *p*H values rose to an indefinite extent. W.

Scouring Fancy Worsteds. D. Welsh. *Textile World,* 1938, **88,** No. 6, p. 70.

Fancy worsteds need particular attention in burling and mending. The scouring process is described, the function of the soap being softener as well as cleanser. If the fabric contains silk decorations, it should be treated for a few minutes in a weak acetic acid bath before being removed from the washer. The goods are best dried to about 60 in. width. For brushing, a bristle or fibre brush gives better results than sandpaper or emery. W.

(E)—DRYING AND CONDITIONING

Pulp and Paper Sheets: Drying. T. K. Sherwood, H. S. Gardner and R. P. Whitney. *Paper Trade J.,* 1938, **106,** *TAPPI,* 327-333.

Experimental work is reported on the removal of water from pulp and paper in the Fourdrinier and press sections of a sulphite pulp machine and on a drum drying machine. Drying on the paper machine gave results comparable with the air drying of sulphite pulp sheets in the laboratory. Periods of constant-rate and falling-rate drying were clearly indicated and sheet temperature measurements showed that 80 per cent. of the water removed was lost when the sheet was in actual contact with the rolls. Consequently the greater part of the water is transferred from the sheet to the felt rather than directly to the air. The importance of felt in machine drying is discussed. C.

(G)—BLEACHING.

Ceramic Bleaching and Dyeing Apparatus. A. Foulon. *Leipz. Monats. Text. Ind.,* 1938, **53,** 137-138.

The general requirements of apparatus and containers for use in dyeing and bleaching processes are outlined and the materials used for their construction are critically discussed. In the Keraplast process for the production of dye vats, a support of concrete, iron or other suitable material is first coated on the inside with Keraplast, a rubber-like substance containing mineral materials and a lining of acid-resistant ceramic plates is attached by means of Keratol cement. For cold bleaching liquor containers, the supports are provided with coatings of Kerasolith-Keratex, the first being a mixture of bitumen and mineral substances, and the second a chlorinated rubber lacquer. Vessels for hydrogen peroxide bleaching processes are lined with ceramic glazed plates fixed in a special acid mortar on a Keraplast protective layer. The advantages of such ceramic materials are pointed out. C.

Redox Potential: Control in Textile Processes. M. Déribéré. *TIBA,* 1938, **16,** 251-255.

The importance of redox potential and its control in bleaching, dyeing and other textile processes is discussed. It is pointed out that redox potentials can be measured by electrometric or colorimetric methods and suitable indicators are mentioned. C.

(I)—DYEING.

Dispersed Pigment Vat Dyes: Padding. *Textile Weekly,* 1938, **21,** 825, 827; **22,** 93, 95.

The advantages of the pigment padding process, especially for heavy materials, are pointed out and the preparation of padding liquors, the padding process, the actual fixation of the dye by treatment in the dye-jig with developing liquors containing hydrosulphite and caustic soda, and subsequent oxidation and after-treatment are described. The occurrence of faults is discussed and precautions necessary for the production of level shades and satisfactory shade matching are indicated. C.

Wool-staple Fibre Mixtures: Dyeing. Imperial Chemical Industries Ltd. *Textile Weekly*, 1938, **22**, 89, 91.

Heavy shades that are fast to light, perspiration and milling and do not stain adjacent cotton during washing are produced on wool-staple fibre mixtures by a two-bath process. The viscose staple fibre is first dyed with Thionol dyes, using the bicarbonate process to ensure that the wool is maintained in a satisfactory condition, and then the wool is dyed with Solochrome dyes from a separate bath. This second dyeing operation may be effected by either the chromate or the after-chrome process, according to the particular Solochrome dye in use. The bichromate present in the second dyebath for the development of the Solochrome dye also improves the fastness properties of the Thionol dye. Recipes and details of the procedures are given. C.

Direct Dyes for Viscose Rayon: Properties. J. Boulton. *J. Soc. Dyers & Col.*, 1938, **54**, 268-274.

The following particulars are tabulated for 156 direct dyes: (1) the precise amount of dye absorbed, *E*, as a percentage of that in the bath, at that point when exhaustion proceeds no further with time, that is, at the point of " equilibrium " dyeing; (2) the amount of salt, as a percentage of the weight of yarn, required to give the degree of exhaustion *E*; (3) the logarithm of the number of seconds required for the attainment of ½ *E*; (4) the actual time in minutes for ½ *E*; (5) the grade of fastness to washing when known. The necessary measurements were made with 0·5 per cent. of dye on the weight of the yarn, in a 40:1 liquor:yarn ratio, at 90°C., and in the presence of sufficient salt to give a nominal value of 50 per cent. for *E*. The bearing of the data on practical problems in dyeing is discussed, and the value of the " time of half-dyeing " is emphasised. The range is about 1-3,000. The times are tabulated separately for the dyes arranged in shade groups, so that the dyer is assisted in the selection of mixtures with approximately the same rate of exhaustion. C.

" Fibro " Staple Fibre: Dyeing. C. M. Whittaker. *J. Soc. Dyers & Col.*, 1938, **54**, 255-263.

A report of a lecture and demonstration of many factors that influence the dyeing of " Fibro " staple fibre. Variations in shade due to the effect of thickness are first stressed and it is pointed out that the range of filament thicknesses now produced in " Fibro " (1·5 to 4·5) and in continuous viscose rayon (2·5-5·5) is greater than that of the whole field of cottons from Sea Island (1·23) to Indian (2·52). Next it is pointed out that direct cotton dyes vary from 1 to 3,000 in the rate at which dyeing to half-equilibrium proceeds; for compound shades, therefore, dyes should be selected that come as near as possible to one another in this range. The sensitivity of direct dyes to electrolytes is emphasised. It is shown that much different degrees of exhaustion can be obtained merely by changing the water supply and the importance of carefully controlling the addition of salt by the dyer is emphasised. The percentage exhaustion of a large number of direct dyes when dyed on viscose rayon without salt is shown in a table. Difficulties encountered in pack dyeing are described and dyes that exhaust slowly are recommended; they should be used in the most concentrated commercial form and without salt if feasible. Tests are described for determining (*a*) the suitability of direct dyes for dyeing " Fibro " in pack machines, (*b*) the penetration of direct dyes, and (*c*) the nature of the " strike " to be expected with vat dyes. Hints on the application of Soledon and Indigosol dyes are given; the salt effect is emphasised and the dyeing properties of a wide range of these dyes are indicated in a table. General directions are given for the treatment of " Fibro " in loose form or sliver, as yarn, as knitted fabric, and as piece goods. Drying at a low temperature is essential. Practical problems in the dyeing of " Fibro " and wool mixtures are described and the possibilities of producing a staple fibre with the dyeing properties of wool are shown, by reference to Courtauld's " Rayolana," to be within reach. C.

Sodium Alginate: Application in Union Dyeing. Kelco Co. *Amer. Dyes. Rept.*, 1938, 27, 337.

Tests are reported to show the value of sodium alginate as an agent for protecting wool from damage by alkali in dyeing unions and as a levelling agent in dyeing cotton with vat and direct colours. A brand called " Keltex " is mentioned. C.

Hair Dyes. I. The Chemistry and Analysis of Henna. H. E. Cox. *Analyst*, 1938, 63, 397-404. W.

Dyeing Mixed Fabrics. E. W. Pierce. *Canadian Text. J.*, 1938, 55, No. 12, p. 39.

Fibre identification and the use of selective dyestuffs for each class of fibre are necessary for controlling the dyeing operation. A substitute for Neocarmine W is suggested, this consisting of a solution of three stated dyestuffs and Glauber's salt. A table is given of colours imparted to the various fibres. W.

Dye and Lake Pigments for Rubber. H. Jones. *Trans. I.R.I.*, 1937, 13, 298-316.

The organic colouring matters available for rubber work are divided into four main groups according to their chemical constitutions, viz., insoluble organic pigments, partially soluble dyestuffs, insoluble salts of the latter, and lakes from acid and basic dyes. The relative advantages of these types are considered and some suggestions are given for the testing of samples of colour. Some account is given of the advantages of auxiliary chemicals such as powder dispersers and co-precipitation agents. The advantages of the various types of paste colours are discussed. C.J.W.

(J)—PRINTING

Vat-printed Rayon: Preparation, Printing and Finishing. P. J. Wood. *Amer. Dyes. Rept.*, 1938, 27, 299-302.

The preparation of vat-printed rayon fabrics is described under the following headings: (1) preparation for dyeing, (2) caustic treatment, (3) dyeing for discharge, (4) printing, (5) washing and (6) finishing. C.

Calico Prints: Factors Influencing Fixation of Dyes. E. Kartzov. *L'Industrie Textile*, 1938, 55, 242-244.

Dyes used in printing are classified into (1) dyes used in solution, (2) dyes used in suspension, (3) dyes used in emulsion form, and (4) dyes of a mixed character. The application of each class is discussed and the advantages of the use of soluble dyes are described. The influence of the number of baths used on the production of lakes on cotton and the influence of the order in which the padding and printing operations are applied are studied, and the formation of impermeable layers on the surface of the fibres when using several baths is pointed out. It is shown that, whenever possible, preference should be given to the use of soluble dyes and procedures based on a single-bath treatment. C.

Antique Satins: Processing. L. Pink. *Silk & Rayon*, 1938, 12, 637, 682-3, 746.

" Antique satins " are furnishing fabrics composed of viscose rayon and cotton and woven with a satin-type face. They are usually sold in 48- and 38-inch widths and range from about 35 to 85 lb. per 120 yds. Specimens are provided with (*a*) Indian and (*b*) condensor weft. Hints on processing are given, with recipes for dyeing. C.

Vat Prints: Production. R. W. Jacoby (Ciba Co.). *Amer. Dyes. Rept.*, 1938, 27, 349-352.

A report of a lecture describing a survey of the widely different recipes employed in 33 print works in Canada and the United States in the production of vat prints. The amounts of thickener, alkali, hydrosulphite, and hygroscopic material in pastes for the same purpose, and the costs, varied by nearly 300 per cent. C.

New Printing Process. *Linen Trade Circ.*, 1938, 24, No. 1278, p. 4.

It is reported from America that with a new method of textile printing employing entirely new printing materials and technique, all steaming, ageing and washing operations are eliminated. Developed by the Aridye Corporation, Fairlawn, N.J., U.S.A., it is claimed that the process will decorate cloths of almost any type and fibre, with new and unusual colour effects that show marked fastness to laundering and light. L.

(K)—FINISHING.

" Fractol " Delustring Agent. Imperial Chemical Industries Ltd. *Textile Mercury & Argus,* 1938, **99**, 108.

" Fractol A " is described as a fine dispersion of a white pigment, faintly acid, without oil or fat that can become rancid, odourless, and resistant to washing or dry cleaning. Its application in the dulling of rayon fabrics and silk hose is described. C.

Losses in Wool Cloth Manufacture. *Canadian Text. J.,* 1938, **55**, No. 15, p. 35.

Figures are given showing weight losses during weaving, dyeing and finishing, using both Canadian and English yarns. W.

Montan Wax and Montan-wax Soaps in Textile Finishing. Ohl. *Allgem. Oel- u. Fett-Ztg.,* 1938, **35**, 58-61 (through *Brit. Chem. Abs. B.,* 1938, **57**, 683).

The preparation of montan-wax soaps and their application for sizing, waterproofing, and dressing of textiles are briefly considered. W.

Faults in Shrinking. *Wool Record,* 1938, **53**, 1359 and 1367.

The London shrinking process is described. In the steaming process the presence of cropping dust may cause bad fastness to rubbing and small amounts of insoluble soaps may show as a listed defect. An unsatisfactory method of shrinkage is wetting by immersing the goods in rigged and cuttled form in a solution of soap or soap and alkali, followed by sponging towards the selvedges. The use of standing wetting baths may lead to the development of mildew. W.

Bonding. B. J. Habgood. *Trans. I.R.I.,* 1937, **13**, 136-159.

The introduction of the synthetic rubbers has increased the complexity of bonding problems. Surfaces which it may be required to bond are natural rubber, synthetic rubber, and metal. Tests on various bonds were made by tearing apart sections of the bonded materials 4″ × ½″. The bonding of natural rubber to itself is relatively simple, but high wax and stearic acid contents of the mix should be avoided. The bonding of synthetic to natural rubber may be brought about by the use of an accelerator concentrated at the bond, or a tie-gum composed of a sodium butadiene rubber, or chlorinated rubber compounds. When both the surfaces are of synthetic rubber the problem is more difficult. Neoprene is the least non-tacky of the synthetic rubbers. A tie-gum mix of sodium butadiene rubber is again useful. In the case of natural rubber and metals the " brassing " and cement methods are discussed. For metals and synthetic rubber a solution of chlorinated rubber is found to be a successful bonding agent. C.J.W.

(L)—PROOFING.

Sulphamic Acid: Production and Application in Flame-proofing. M. E. Cupery. *Indust. Engng. Chem.,* 1938, **30**, 627-631.

A new process for the production of sulphamic acid, HSO_3NH_2, is based on the reaction of urea with fuming sulphuric acid. The properties of the acid are described in detail. Its salts are suggested as flame-proofing agents for fabrics, papers, etc. The special feature of ammonium sulphamate is that it does not cause stiffening, or adversely affect the handle of fabrics or show tendency to effloresce to the surface on prolonged storage. Sulphamates are not removed by dry cleaning treatments. C.

Cellulose Derivatives: Application in Airplane Dopes. G. M. Kline and C. G. Malmberg. *J. Research. Natl. Bur. Stands.,* 1938, **20**, 651-671.

The fundamental factors involved in the formulation of airplane dopes containing cellulose esters, mixed esters, and ethers so as to obtain optimum tautness and durability have been investigated. The viscosity and composition of the test materials and the composition of the dopes are given. The measurements of tautness of the fabrics were made on prepared panels, 12½ ins. square, with a spring-loaded tautness meter that is essentially a Schiefer compressometer.

The tautness and flexibility data obtained in ageing tests are tabulated. It was observed that the most important single factor involved in the initial tautening property of a dope is the solvent composition. In order to obtain a maximum tautening effect, it is necessary to formulate a dope so that a minimum of active solvent will be present during the final drying stage. The selection of this solvent is also an important factor in avoiding the formation of a film that is initially brittle or rapidly becomes brittle upon exposure out of doors. The highest initial tautness values were obtained with cellulose triacetate and a practically completely acylated cellulose acetobutyrate. Varying the acyl or ethoxyl content of partially hydrolysed cellulose derivatives did not have a pronounced effect on the ability of the compounds to tighten the fabric. The initial tautening property is also apparently independent of the size of the cellulose molecule, as indicated by certain flow characteristics. C.

PATENTS

Dyeing Feathers, Furs, Hair, etc. I.G. Farbenind. A.-G. F.P.47,846 of 31/7/1937 (addn. to F.P.775,459, *see J. Text. Inst.*, 1936, A277) (through *Chem. Abs.*, 1938, **32**, 4799).

Instead of using salts of di- or poly-hydroxy-benzenes as in F.P.45,135 see *J. Text. Inst.*, 1936, A277), salts of their ring substitution products are used, e.g. salts of 4-aceto-, 4-trichloraceto- or 4-chloro-1,2-dihydroxybenzene, 4-nitro-1,3-dihydroxybenzene, 5-nitro-1,2,4- and 4-bromo-1,2,6-trihydroxybenzene. W.

Treating Textiles. Kammgarnspinnerei Stöhr & Co. A.-G. F.P.771,928 of 19/10/1934 (through *Chem. Abs.*, 1935, **35**, 1660).

The slipping capacity of textiles is increased by treatment with agents composed of three principal elements: (1) hydrophobe compounds, insoluble in water, such as paraffin, mineral oil, wax, etc., (2) hydrophile compounds, insoluble in water, such as aliphatic alcohols, amines and amides containing more than 7C atoms and (3) an aqueous solution of a hydrophile compound which is soluble in water and is capable of forming emulsions or suspensions such as soap, and salts of esters of aliphatic alcohols and H_2SO_4 and sulphonic acids containing more than 7C atoms. W.

Treating Textiles. Kammgarnspinnerei Stöhr & Co. A.-G. F.P.47,559 of 4/6/1937 (addn. to 771,928, *see J. Text. Inst.*, 1938, A540) (through *Chem. Abs.*, 1938, **32**, 4800).

The lubricating agent consists of solutions, emulsions or suspension of: (*a*) a hydrophobe compound, particularly of paraffin of m.p. 38-42°, (*b*) a hydrophile support, soluble in water, which possesses the property of hydrating strongly, e.g. certain kinds of albumin, degradation products of albumin and salts of pectinic, mucic and mucleinic acid, (*c*) an emulsifying agent. Water may be replaced by an alcohol or a chloro hydrocarbon of the aliphatic series. Weighting or waterproofing agents, dyes, insecticides, etc., may be applied at the same time. W.

Fireproofing Compositions. Harle Frères & Co. F.P.802,021 of 25/8/1936 (through *Chem. Abs.*, 1937, **31**, 1534).

A coating for miners' fuses, electrical cables, etc., is composed of a mixture of tetrachloronaphthalene (I), chlororubber (II) and a plastifier, with or without fillers. At temperatures above 150° large amounts of ammoniacal compounds are formed. An example contains I (m.100°) 450, II 60, tritolylphosphate 40 and lampblack 20 g. W.

Fireproofing Coating. Soc. Harle Frères & Co. F.P.47,891 of 14/8/1937 (addn. to F.P.802,021, *see J.T.I.*, 1938, A540) (through *Chem. Abs.*, 1938, **32**, 4698).

Tetrachloronaphthalene is replaced by other chloro derivatives of C_6H_6, $C_{10}H_8$ or Ph_2. W.

Hair Washes. Firma Hans Schwarzkopf. G.P.658,246 of 25/3/1938 (through *Chem. Abs.*, 1938, **32**, 4729).

Powdered alkaline hair wash compositions containing hygroscopic constituents are stabilized to storage by coating the particles of hygroscopic material with a water-repelling substance which, when the composition is dissolved in water, forms a soap by reaction with the alkaline constituent. Stearic acid is a suitable coating substance. Specific compositions are described. W.

Sulphonated Higher Alcohols. H. Bertsch (to American Hyalsol Corp.). Can.P. 372,884 of 29/3/1938 (through *Chem. Abs.*, 1938, 32, 4694).

Neutralized sulphonated or sulphated higher alcohols are prepared in dry form by rapidly heating to high temperature and then cooling the sulphonation or sulphation products of higher alcohol mixtures obtained from coconut or palm-kernel oil. The product is used in the textile and leather industry to increase capillary activity. W.

Exterminating Insects. M. E. Hummel and R. W. Whitaker. U.S.P.2,114,494 of 19/4/1938 (through *Chem. Abs.*, 1938, 32, 4697).

Insects and their eggs, etc., such as those in the spaces and interstices of buildings, bedding, etc., are subjected to a relatively confined current of air heated to about 120° and supplied (by a described apparatus) at a velocity of about 24 ft. per sec. to effect coagulation of the insect protein constituents. W.

Waving Human Hair. J. C. Brown (to E. Frederics, Inc.). U.S.P.2,115,156 of 26/4/1938 (through *Chem. Abs.*, 1938, 32, 4729).

The hair is heated while treated with a primary aliphatic amine containing 2-6 C atoms, such as ethyl amine, having a boiling point below 100° and which in a 1·5 -5 per cent. aqueous solution has a *p*H of about 11·6-12·2, the treated hair being heated to above the boiling point of the amine. NH_3 also may be used. W.

Waving Human Hair. E. O. Frederics and J. C. Brown (Brown to Ernest O. Frederics). U.S.P.2,115,161 of 26/4/1938 (through *Chem. Abs.*, 1938, 32, 4729).

The hair is coiled about a rod and subjected to the successive action of the vapours of a plurality of different amino compounds containing 2-6 C atoms such as ethylamine and diethylamine, with which NH_3 also may be used. W.

Aryloxy Polyalkylene Ether Sulphonates. H. A. Bruson (to Röhm & Haas Co.). U.S.P.2,115,192 of 26/4/1938 (through *Chem. Abs.*, 1938, 32, 4694).

Compounds useful as textile assistants, as dispersing, wetting, cleansing, introfying and spreading agents, and which have the general formula $R\text{-}O\text{-}A\text{-}(O\text{-}A)_n\ \text{-}O\text{-}A\text{-}SO_3M$ in which R is an aromatic hydrocarbon radical, A represents alkylene groups having at least 2 C atoms, *n* is zero or one, and M is a metal are prepared by heating a metal sulphate with an aryloxy polyalkylene ether chloride having the general formula $R - O - A\ \text{-}(O\text{-}A)_n - O\text{-}A\text{-}X$ in which X is a halogen atom. The aryloxy polyalkylene ether halides used may be prepared by condensing a phenol with a dihalopolyalkylene ether of the type $X\ \text{-}A\ \text{-}O\text{-}\ (A\text{-}O)_n\text{-}A\text{-}X$ in the presence of a strongly alkaline condensing agent under such conditions that only one of the halogen atoms is substituted by the aryloxy group. Numerous examples are given. W.

Organic Nitrogen Bases and Their Salts. H. A. Bruson (to Röhm & Haas Co.). U.S.P.2,115,250 of 26/4/1938 (through *Chem. Abs.*, 1938, 32, 4694).

Amines having the general formula $ROA(OA)\ OAN_n =$ in which R is a hydrocarbon radical containing an aromatic nucleus at its point of attachment to the ether O atom, A is an alkylene radical having more than one C atom, *n* is zero or one, and N is a N atom derived from NH_3, a primary or secondary aliphatic, cycloaliphatic, arylaliphatic or hydroxyaliphatic amine or secondary heterocyclic amine are prepared by condensing one molecule each of a monohydric phenol and a polyalkylene ether, having a halogen substituent on each of its terminal C atoms, in the presence of an alkaline condensing agent, then treating the product thus obtained with NH_3, a primary or secondary amine and treating the resulting amine hydrohalide with an alkali or alkaline earth hydroxide. Numerous examples are given, and water-soluble quinquevalent N-derivatives of bases formed such as lactates, phosphates, acetates and quaternary NH_4 salts obtained with benzyl chloride, diethyl sulphate or dimethyl sulphate may be used as capillary active agents as in dyeing, bleaching, mercerizing and mordanting operations, as spreaders for insecticides, dispersing agents for pigments as wetting and penetrating agents, pickling inhibitors, and assistants in tanning and finishing operations. W.

Quaternary Ammonium Compounds. A. Carpmael (I. G. Farbenind. A.-G.). E.P.483,368 of 14/7/1936.

Fibrous material of animal origin, e.g. textiles, hides, leather, furs and feathers is protected from attack by moths and other pests by incorporating therein an aromatic or heterocyclic compound having a substituent containing at least one quaternary nitrogen atom. The substituent may contain one or more carbon atoms, and the carbon chain may be interrupted by O, S, SO_2, N or P. A preferred substituent is an aliphatic radical containing at least 6 carbon atoms. The compounds may be substituted by halogen, hydroxyl, amino, sulpho, sulpho-ester, carboxylic acid, ether or thioether groups. Examples of compounds are given. W.

Fabrics for Wool Packs. J. Carlin. E.P.483,381 of 19/4/1938.

A container such as a wool pack is composed of two pieces of latex-treated fabric (see E.P.483,393) laid one across the other and secured together with an adhesive substance. An example is described and illustrated in which the fabric is coated with latex and agents such as powdered sulphur and talc applied except where one pice of fabric is to be stuck to the other. W.

Rubberised Bale Fabric. J. Carlin. B.P.483,393 of 12/11/1936.

Fabric containers such as wool-packs and bales made from jute, cotton, hemp and flax are made by treating the fabric before or after making up with rubber latex, partially drying and applying a powdered compounding material such as sulphur or zinc oxide. A smoothing agent such as talc may be applied together with or after the compounding material. The material may be pressed before or after the application of the compounding material and talc. Twine or thread used for closing and repairing the containers may be similarly treated. C.

Tyre Fabrics: Production. Cela Holding Soc. Anon. B.P.483,534 of 27/8/1937 (Conv. 28/8/1936).

The process of making pneumatic tyre covers described in B.P.449,588 is modified by subjecting the fabric, after treatment in the contracting and swelling bath, which may contain a wetting agent, to an alkaline boiling treatment, e.g. by sodium carbonate lye under pressure. A suitable lye contains also soda soap and is used at 115° C. under a pressure of 1·5 atmospheres for 4 hours. The fabric is then washed in hot water, then in cold water, neutralised, e.g. with hydrochloric acid, again washed and dried. Treatment with rubber follows. In a further modification the threads are contracted and swollen before weaving. Before stretching and vulcanizing the impregnated tubes, the borders may be cut off to avoid buckling C.

Endless Belts: Manufacture. Cela Holding Soc. Anon. B.P.483,535 of 27/8/1937 (Conv. 28/8/1936).

The process of making endless belts described in B.P.443,156 is modified by subjecting the fabric, after treatment in the contracting and swelling bath, which may contain a wetting agent, to an alkaline boiling treatment, e.g. by sodium carbonate lye under pressure, and is then washed as described in B.P. 483,534. Treatment with rubber follows. In a further modification the threads are contracted and swollen before weaving. Before stretching and vulcanizing the tubes, the borders may be cut off to avoid buckling. C.

Tentering Clip. J. Dalglish. B.P.483,688 of 7/5/1937.

The pivoted jaw of a tentering clip is held in either the open or closed position by a spring-pressed plunger and a cam on the tail of the jaw. On the idle return journey of the clip, when it is upside down, the clip is supported on a bearing surface. C.

Coating Machine Air Doctor. S. D. Warren Co. B.P.483,998 of 28/10/1936.

An air doctor for coating machines comprises an elongated nozzle consisting of a large plenum chamber, a throat portion and spaced lip portion forming a slit, at least one lip portion being convex so that a non-divergent stream is produced. The three parts are rectilinear and co-extensive. C.

Artificial Leather: Production. Tufide Products Corporation. B.P.484,007 of 30/10/1936 (Conv. 30/10/1935).

Respirable artificial leather is made by forming a dry, loosely fluffed layer of vegetable fibres, uniformly impregnating the layer with a binder and compacting the impregnated layer into a sheet by successive compression steps. The fibres may be cotton, linen, hennequin, sisal, hemp or wood pulp. The preferred binder is rubber latex to which glue, ammonia, a volatile organic liquid and formaldehyde may be added. Fish, hide, casein, blood or egg albumin glues may be used. The organic liquid contains alcohol and preferably consists of a mixture of ethyl and methyl alcohols, acetone, ethyl acetate and gasoline. The product may contain 35-80 per cent., preferably 50-65 per cent., of fibre and may be from $\frac{1}{4}$ to $\frac{1}{2}$ inch thick. It is suitable for wall and floor coverings and inner soles for footwear. C.

Peroxide Bleach: Application. A. Kammer. B.P.484,184 of 27/7/1936 (Conv. 27/7/1935). [Void.]

Raw cotton goods are bleached by treatment at normal pressure in a boiling aqueous liquor containing hydrogen peroxide or other compounds splitting off active oxygen and turkey red oil in an amount of at least 2 per cent. based on the weight of the goods. In an example, the treatment is effected in an iron or steel boiler, the liquor containing 1 per cent. of hydrogen peroxide and 2·5 per cent. of turkey red oil and the boiling being continued for 3 hours ; the goods may then, if desired, be treated for 1-2 hours with a boiling sodium carbonate solution and thereafter, if desired, with a weak solution of a hypochlorite, hydrogen peroxide or other compound splitting off active oxygen. C.

Methylolurea: Preparation. N. Lubicz. B.P. 484,209 of 2/11/1936.

Mono- and di-methylolurea, or mixtures thereof, are prepared in solution or in crystalline form by condensing urea and formaldehyde in the presence of a sufficient quantity of an ethanolamine to make a neutral or alkaline solution, preferably at normal temperature. Solutions of methylolurea prepared with monoethanolamine are capable of further condensation on heating without the addition of acidic substances, a property which is made use of in textile treatment. Solutions prepared with other ethanolamines may also be used in the treatment of textiles. C.

Printing Pastes and Dye Preparations. Society of Chemical Industry in Basle. B.P.484,214 of 6/11/1936 (Conv. 12/11/1935).

An alkylated aminocarboxylic acid of the benzene series or a salt thereof is incorporated in a printing paste, or in a dye preparation suitable for making such a paste wherein the dye used is one which is applied in the form of its leuco compound or in conjunction with a reducing agent, e.g. a vat or sulphur dye. Thus, mono- or di-methyl- or mono- or di-ethylaniline-2-, 3- or 4-carboxylic acids or nuclear substitution products thereof or their sodium, potassium, ammonium, or ethanolamine salts may be used with or without a heavy metal salt, e.g. tin chloride, ferric chloride, copper sulphate or chloride, serving as catalyst for the oxidation. The printing pastes or dye preparations may contain in addition the usual assistants such as water-soluble alcohols, hydrotropic agents, reduction catalysts, reducing agents and/or alkalis. C.

Electrical Insulating Material. British Thomson-Houston Co. Ltd. B.P. 484,262 of 8/7/1937 (Conv. 8/7/1936).

An electric conductor is insulated by means of a fibre covering, e.g. of rayon, impregnated with a lacquer comprising a mixed polymer containing polyacrylates and polyvinyl cyanide. C.

Soluble Cellulose Derivatives: Preparation. Kalle & Co. A.-G. B.P.484,386 of 8/11/1937 (Conv. 21/11/1936 and 22/6/1937).

When preparing water-soluble or alkali-soluble salts of cellulose ether carboxylic acids, such as the sodium salt of cellulose glycollic acid, by the reaction of alkali-cellulose with a halogen fatty acid, such as chloracetic acid, there is added to the reaction mixture a chemically indifferent salt (e.g. sodium chloride) which impedes the hydrolysis of the alkali-cellulose. Such a salt may be added to the extent of 20-80 per cent. of the cellulose. If a water-soluble product is required there is used 1 to 1·5 mol. of halogen fatty acid to 1 mol. of cellulose ; but if a product soluble only in alkali is required less than 1 mol. of halogen fatty acid per mol. of cellulose is used. C.

Mothproofing. J. R. Geigy A.-G. E.P.484,448 of 17/7/1937.

Materials such as wool, hair, skins and feathers are rendered mothproof by treatment, e.g. by brushing, spraying or immersion, with a solution containing a halogen-substituted compound of the formula: B-SO*n*-X, where B is a halogen-substituted benzene radical, *n* is 1 or 2 and X is -R, -SR or -SO_2R in which R is an aryl, aralkyl or alkyl radical, and wherein the aralkyl or alkyl straight or branched chain may contain further atoms or atom groups, e.g. halogen, oxygen, sulphur, SO, SO_2, NH, CO, NHCO as substituents or as a bridge in the chain. Suitable solvents are hydrocarbons, chlorinated hydrocarbons, alcohols, ketones or mixtures of these. The example describes the use of an alcohol solution of $4:4^1$-dichloro-diphenylsulphoxide, $4:4^1$-dichlorodiphenylsulphone or $4:4^1:3$-trichlorodiphenylsulphone. A number of suitable sulphoxides and sulphones is specified. W.

Disazo Dyes: Production. A. Carpmael (I. G. Farbenindustrie A.-G.). B.P. 484,577 of 5/11/1936.

Secondary disazo dyes are made by coupling diazo-monoazo dyes of given constitution with J-acid or its N-aryl or N-alkyl derivatives. They dye cellulose and regenerated cellulose in clear greenish blue shades, which on after-treating with agents yielding copper, scarcely change in shade, but become faster to light and washing. In examples the following components are mentioned: *p*-amino-salicylic acid with 4-amino-6-methyl- or 6-chloro-1-phenol-2-carboxylic acid ; 1-amino-2-carboxymethoxynaphthalene and its 6- or 7-sulphonic acid ; the N-phenyl, *p*-tolyl-, *p*-anisyl-, 4′-hydroxy-3′-carboxyphenyl-, (diphenyl-4-)-, 4′-benzoylaminophenyl-, *n*-butyl-, and diethyl derivatives of J acid with 5:5′-dihydroxy-2:2′-dinaphthylamine-7:7′-disulphonic acid. C.

Azo Dye Copper Compounds: Production. I. G. Farbenindustrie A.-G. B.P. 484,597 of 7/11/1936.

Tetrakisazo dyes containing copper are obtained by treating dyes of given general formula, containing at least 3 solubilising groups, with an agent yielding copper in a caustic alkaline medium at an elevated temperature until, with substitution of halogen by hydroxyl, the copper complex compound of the corresponding *o*:*o*′-dihydroxyazo dye is formed. The products give grey dyeings, very fast to light, on fibres of natural or regenerated cellulose. In an example the sodium salt of the dye, 2-aminonaphthalene-5:7-disulphonic acid→1-aminonaphthalene→1-aminonaphthalene-7-sulphonic acid→1-chloro-2:5:7-aminonaphtholsulphonic acid→2-naphthol is heated for 4 hours at 85-90° C. in an aqueous solution containing copper sulphate, glycerol and caustic soda ; the product dyes cellulose fibres reddish grey. C.

Anthraquinone Dye: Production. E. I. Du Pont de Nemours & Co., and J. Deinet. B.P.484,678 of 6/11/1936.

3 : 3′-Dichloro-N-dimethyl-1 : 2 : 2′ : 1′-anthraquinoneazine (3 : 3′-dichloro-N-dimethylindanthrone) is manufactured by subjecting 1:3-dichloro- or 1-bromo-3-chloro-2-methylaminoanthraquinone to condensation with a copper catalyst, e.g. copper powder or a copper salt, e.g. copper acetate, in the presence of an acid binding agent, e.g. sodium carbonate or sodium or potassium acetate, and a high boiling solvent, e.g. *o*-dichlorobenzene, nitrobenzene or naphthalene. The product dyes cotton blue shades from a red-brown hydrosulphite vat by the cold dyeing method. C.

Urethane Textile Assistants: Preparation. I.G. Farbenindustrie A.-G. B.P. 484,683 of 9/11/1936 (Conv. 8/11/1935).

Urethanes useful as assistants in the textile and related industries are prepared by reacting chlorocarbonic esters of abietinols with aliphatic, cycloaliphatic or aromatic aminocarboxylic acids, aminosulphonic acids or amine-sulphuric acid esters. The reaction is preferably effected in an aqueous alkaline medium to which a small amount of a dispersing agent has been added. If the products are not water-soluble they may be made so by sulphonation. C.

Cellulose—Cellulose Derivative Mixtures: Dyeing with Azo Dyes. G. H. Ellis and C. F. Topham. B.P.484,684 of 9/11/1936.

Mixed textile materials containing fibres of an organic derivative of cellulose and cellulose fibres are dyed with azo dyes by impregnating them with the diazotisable base component and the coupling component of the dye for the cellulose derivative and with the diazotisable base component for the cellulose and then effecting diazotisation and coupling, the coupling component for the cellulose being applied to the materials after the diazotisation. Numerous suitable diazotisable bases and coupling components are specified. Examples describe the dyeing of cellulose acetate-cotton and cellulose acetate-viscose rayon fabrics. C.

Shrink-resisting Textiles: Production. Raduner & Co. A.-G. B.P.484,691 of 4/8/1936 (Conv. 2/8/1935). Void.

Textiles are rendered resistant to wrinkling and shrinking during washing by treating with aldehydes or substances liberating aldehydes, or other specified substances, in the presence of a catalyst, preferably at about 100° C., with or without a preliminary swelling treatment. The impregnation may be carried out under pressure, or with alternating pressure and vacuum. Substances which may be used in place of aldehydes are (1) condensation products obtained from aliphatic or aromatic alcohols with aldehydes, (2) products obtained by methylating substances of the aliphatic or aromatic series with methyl chloride, dimethyl sulphate or *p*-toluene sulphonic acid methyl ester and by condensing the resulting products in an alkaline or salt-containing solution, (3) amides of organic acids, particularly higher aliphatic acids, or resin-acid amides. Other substances such as sizing agents, pigments, dyes, softening, wetting and buffering agents may be added. C.

Wool—Cellulose Fibre Mixtures: Dyeing. W. W. Groves (I. G. Farbenindustrie A.-G.). B.P.484,796 of 6/10/1936.

Mixed fibres of wool and cotton or regenerated celluloses are dyed in even shades with substantive dyes containing chromable groups in a bath containing chromium acetate. Alternatively, the material is pretreated with a chromium acetate solution and while still wet dyed by adding the dye to the same bath. The dyeings may be after-chromed as usual. In an example, the mixed fibre is treated in an aqueous bath at 75° C. containing chromium acetate, acetic acid, sodium sulphate and sulphite cellulose waste liquor and after cooling to 50° C. a dye combination comprising 4:4′-dihydroxy-3:3′-dicarboxyazobenzene, Gallo navy blue S. pulv., and salicylic acid$\leftarrow$benzidine$\rightarrow$1:3:6- or 1:3:7-naphthol-disulphonic acid is added and the dyeing continued at 80° C., it may be followed by after-chroming with potassium dichromate and acetic acid. C.

Fibrous Material Delivery Apparatus. N. W. Scoular and R. W. Blackwood. B.P.484,820 of 26/11/1936.

The delivery of fibrous textile material to be treated with liquid, i.e. wool with oil, is controlled automatically by gravity-actuated receptacles which are moved in succession by the weight of material from a receiving position to a discharging position, in which position they are located by means provided, the material being discharged on to a conveyor which carries it past a liquid treating station. C.

Lustrous Silk and Regenerated Cellulose Rayon Fabrics: Printing. Durand and Huguenin A.-G. B.P.484,836 of 10/2/1937 (Conv. 11/2/1936).

Fabrics of lustrous fibres made of silk or regenerated cellulose rayon or mixtures thereof are printed with pastes containing a mordant dye, gum arabic thickening, a chromium mordant, lactic acid or a salt or ester thereof with the addition of an alkali salt of another aliphatic oxy-carboxylic acid or, when the mordant used is chromium lactate, with the addition of an alkali lactate. Such additions enable the elimination of the step of washing the fabric in lukewarm water to soften its feel after the steaming. C.

Textile Dressing Emulsion. British Celanese Ltd. B.P.484,858 of 12/6/1937 (Conv. 12/6/1936).

A textile dressing emulsion is obtained by incorporating together an oil, water, an electrolyte which is a hygroscopic salt, and a sulphonated higher fatty alcohol or a sulphuric ester of a higher fatty alcohol. Other additions which may be made are a higher fatty acid or an alcohol or soap thereof. Suitable hygroscopic salts are magnesium chloride, chlorate and nitrate, calcium chlorate and nitrate, zinc chloride, and ammonium or magnesium citrates. Suitable oils are mineral oils, or olive or castor oil. Suitable fatty alcohol derivatives are products obtained by the action of sulphuric acid on lauryl, oleyl and palmityl alcohols, and other such products containing sulponic and/or sulphate groups; such products may be used in the form of water-soluble sodium, potassium or amine salts, particularly with triethanolamine. The dressing may be applied to artificial filaments at any stage in their manufacture or be added to the spinning solution. The dressing is particularly suitable for staple fibres. C.

Imidazole Wetting Agents: Preparation. Society of Chemical Industry in Basle. B.P.484,862 of 21/6/1937 (Conv. 20/6/1936).

An imidazoline which may contain as a substituent or substituents not more than two aromatic nuclei is dehydrogenated by treatment at a raised temperature with a dehydrogenation catalyst or a hydrogen acceptor. The imidazoles of low molecular weight may be used for the preparation of medicaments, and those having an aliphatic chain of at least 6 carbon atoms or their salts or sulphonic acids have strong capillary active properties in dilute aqueous solution, and may be used in the textile industry as wetting, washing, cleaning, levelling, emulsifying, softening or water-resisting agents. An example describes the dyeing of cotton with Chlorantine Red 8 BN, the goods being treated after dyeing with a dilute solution of 2-heptadecylimidazole obtained by heating 2-heptadecylimidazoline with nickel to 180-240°C. C.

Liquid Delivery Device. N. W. Scoular and R. W. Blackwood. B.P.484,897 of 26/11/1936.

The delivery of liquid, such as oil, to fibrous textile material to be treated, such as wool, is controlled by a tipper arranged to receive and discharge successive measured quantities of the liquid to a container from which it is delivered as a substantially continuous spray. The tipper preferably has two compartments and is so arranged relatively to the liquid supply that when one compartment receives liquid the other is discharging it. The tipper tilts under gravity, but may be held by catches which are released in accordance with the operation of gravity-actuated devices for feeding the fibrous material, to proportion the quantities of liquid and material. A number of tippers of different capacities may be provided and used singly or in combination, as desired, and these may be released in accordance with the operation of the receptacles so that the liquid is supplied in proportion to the material. C.

Silk, Wool and Artificial Fibrous Materials: Treatment to Introduce Basic Groups. Aceta Ges. B.P.484,903 of 10/8/1936 (Conv. 8/8/1935).

Basic groups are introduced into natural or artificial fibrous or film-like materials containing hydrogen bound to carbon or nitrogen and capable of reacting with carboxyl compounds by treating the materials with reactive substances of given general formulae. Specified fibrous and film-like materials treated are silk, wool, hair, tanned or untanned hides, artificial threads or films of fibroin, polyamides of high molecular weight, e.g. polyacrylic acid amide, cellulose xanthate, fatty acid amides and novolaks. Specified reactive substances are dimethyl aminomethanol, piperidomethanol, tetramethylmethylenediamine, the product of reaction of dimethylolurea (1 mol.) with dimethylamine (2 mols.), an N-dimethylaminomethylamide of a fatty acid, methoxymethylpyridinium chloride, the product of reaction of $\alpha:\alpha'$-dichlorodimethyl ether (1 mol.) with pyridine (2 mols.), a pyridinium salt substituted in 2-position by halogen, SH, O-alkyl or SO_3H, the product of reaction of diethylaminomethyl chloride with methylmercaptan, condensation products of β-ketonic acid esters or β-diketones with formaldehyde and dimethylamine. The treatment may be by way of impregnation or printing and may be facilitated by the presence of a swelling agent for the fibrous or film-like materials. The treated materials have an increased affinity for dyes, dye components, mordants, softeners, insecticides and matting agents of acid reaction and such affinity may be further increased by a treatment with an alkylating agent such as a toluenesulphonic acid alkyl ester, an alkyl halide, a halogen fatty acid ester, an alkylene oxide or sulphide, epichlorhydrin, trimethyloxidopropylammonium iodide, diethylethylene-iminium chloride or 3-chloro-1:2-propylene sulphide. Such alkylation may be effected before or after dyeing. C.

Basic Ether Wetting Agents: Preparation. W. W. Groves (I.G. Farbenindustrie A.-G.). B.P.484,906 of 7/10/1936.

Carboxylic compounds containing nitrogen are manufactured by causing an aliphatic halogen ether of an aromatic or hydroaromatic hydroxy compound which is substituted by one or more saturated aliphatic hydrocarbon radicals having more than three carbon atoms or by one or more carbocyclic hydrocarbon radicals having more than three carbon atoms and in which the aliphatic halogen ether radical, which may be interrupted once or several times by oxygen bound in an ether-like manner, contains at least two carbon atoms, the α-carbon atom being free from halogen, to react with ammonia or an organic compound containing primary, secondary or tertiary nitrogen. The products may be further reacted by treatment with sulphonating agents, organic compounds containing carboxylic or sulphonic acid groups or functional derivatives thereof, or with alkylating or aralkylating agents. The products or their derivatives may be used in the pharmaceutical industry and as insecticides or fungicides in solution or dispersion in water or dissolved in an organic liquid, whilst those that are soluble in water have foaming, dispersive, wetting and cleansing actions. C.

Amide Wetting Agents: Preparation. W. J. Tennant (Henkel & Cie., Ges.). B.P.484,910 of 9/11/1936.

Amides are obtained by the reaction of carboxylic acids or their derivatives with hydroaromatic primary or secondary amines substituted in the nucleus by an aliphatic hydrocarbon radical containing at least four carbon atoms. The acids may be aliphatic or aromatic carboxylic acids such as acetic acid, methoxyacetic acid, alkylmercaptoacetic acids, pyromucic acid, propionic acid, stearic acid, behenic acid, montanic acid, abietic acid, benzoic acid, phenoxyacetic acid or cresoxyacetic acids. Products useful as wetting, washing, emulsifying and dispersing agents are obtainable from carboxylic acids containing a hydrophile group or a radical which facilitates the introduction of a hydrophile group, i.e. an additional free acid group or a hydroxyl, ether, mercapto, amino or ester group. C.

Cotton and Rayon: Modification of Dyeing Properties. W. W. Groves (I. G. Farbenindustrie A.-G.). B.P.484,984 of 11/8/1936.

The affinity for dyes of undyed fibrous and film-like materials containing no basic groups but comprising firmly fixed substances in which acidic salt-forming hydroxyl or acidic mercapto groups, other than thiocarbonic acid groups, are attached to carbon, is modified by treatment with an alkylene imine which reacts with opening of the imine ring or with a salt thereof. The material treated may be organophilic, e.g. acetyl- or ethyl-cellulose or a vinyl polymerisate or hydrophilic, e.g. cotton or regenerated cellulose. The acid groups may be produced by a preliminary saponification or oxidation. Specified types of acid components include polymeric carboxylic acids, anhydrides and esters and interpolymerisates therefrom, ester acids of cellulose, pectin esters, alkyd resins, phenol-aldehyde resins, etc. The acid groups are advantageously saturated with organic bases carrying halogenalkyl groups prior to treatment with the alkylene imines. Specified alkylene imines include ethylene imine and its C-methyl, N-methyl, N-butyl and N-cyclohexyl derivatives and various quaternary iminium salts. In some cases they may have an aminating action and may be used with other aminating or similarly acting agents, e.g. pyridine, trimethylamine, isoquinoline or triethylphosphine. The fastness of the dyeings and their uniformity when admixtures with animal fibres are to be dyed may be improved by treatment before, during or after the dyeing with an alkylating agent such as dimethyl sulphate, epichlorhydrin, etc. C.

Napped Fabrics: Dyeing and Finishing. A. J. Stephens (Collins & Aikman Corporation). B.P.484,991 of 9/11/1936.

Napped fabrics are dyed and finished in a continuous process by passing them at constant rate relative to, and in brief contact with, a vehicle containing a dye having a low exhaustion rate to impregnate the fabric with the dye-containing vehicle, forcing the dye-containing vehicle into the fabric and removing excess thereof by pressure, as by means of press rolls, and completing the fixation of dye on the fibres while in transit to finishing devices. The fabrics may have both animal and vegetable fibres or their synthetic equivalents in the backing or in the pile or in both, the dye bath then containing dyes which colour uniformly, or complementary dyes may be used one of which has a greater affinity for vegetable than for animal fibres and the other the reverse, in such combinations as will produce the required similar or contrasting effects simultaneously. The dye vehicle may vary and may be made in the form of a paste by thickening with a water-soluble or water-dispersible thickener. The vehicle may also contain salts capable of dissociation by heat or steam to release acids or acid vapours or gases capable of reacting with dyes to promote exhaustion into and fixation of dye in and on the fibres. Gaseous vapours or gases may be substituted for or combined with the steam employed in the apparatus for fixing the dye. After fixation or ageing, the exhausted vehicle and any thickener employed is washed from the fabric in a continuous washing operation, the rate of feed of the fabric throughout all the continuous dyeing and finishing operations being from 10 to 30 yd. per minute, a certain amount of slack being provided between certain operations as a reservoir. After washing, the fabric may be treated with acids, or acid materials, metal salts, etc., to improve the fastness of the dye, and, after rinsing, hydro-extraction and raising, napping or opening, etc., as by tigering, it may be dried in a continuous type of drier. After drying, the material passes continuously at the same rate through synchronised pile-finishing apparatus, nappers, or tigers, beating, shearing, brushing, humidifying, inspection and packing apparatus. C.

Disazo Dyes: Production. W. W. Groves (I G. Farbenindustrie A.-G.). B.P.485,116 of 16/11/1936.

Disazo dyes insoluble in water are made by diazotising an aminoazo compound of given general formula and coupling with an arylide of 2:3-oxynaphthoic acid in substance, on the fibre or on a substratum. In an example, cotton is grounded with the anilide and developed with 2:5-dimethoxy-4-amino-2′-chloro-4′-nitro-6′-trifluoromethyl-1:1′ azobenzene diazotised in presence of formic and sulphuric acids and neutralised with sodium acetate (blue black). C.

Anthraquinone Dyes: Production. G. W. Johnson (I. G. Farbenindustrie A.-G.). B.P.485,175 of 13/11/1936.

Anthraquinone dyes are made by condensing compounds having a carbonyl group in adjacent position to a double linkage in an open chain with an amino-anthraquinone or a derivative thereof having a ring attached to an anthraquinone nucleus, e.g. an aminobenzanthrone, anthrapyridine, anthrapyrimidine or anthraquinone oxazole. As carbonyl compounds may be used vinylketones of the formula $R.CO.CH:CH_2$ where R is an aliphatic, cycloaliphatic or aromatic radical, e.g. vinyl methyl, ethyl and phenyl ketones, acrolein, crotonaldehyde and citral. Instead of vinyl methyl ketone vinylacetylene may be used in the presence of water under conditions in which the ketone is formed. The reaction may be carried out by heating in the presence of diluents, e.g. alcohols, and assistants, e.g. piperidine or chloracetic acid may be used. Some of the products are converted into azobenzanthrones by ring closure. Examples describe the production of dyes for cellulose acetate rayon. C.

Crease-resisting Fabrics: Production. H. Dreyfus, D. Finlayson and R. G. Perry. B.P.485,182 and 485,199 of 16/11/1936.

(1) Fabrics comprising natural or regenerated cellulose are impregnated with resin-forming matter in solution and dried, and the resin-forming matter is converted into a water-insoluble product, the fabric being subjected at any stage after the drying to a mechanical treatment adapted to break up the film of resin-forming matter on the outside of the fabric. The mechanical treatment may consist in passing the fabric between pairs of rollers, one of each pair being provided with studs and the other being resilient, or between pairs of rollers provided with relatively staggered projections ; or the fabric may be drawn over a sharp edge or blade which may be moved relatively to the fabric ; or the fabric may be subjected to a beating operation, or crumpled and passed between rollers repeatedly. After such mechanical treatment the disintegrated coating is

removed, e.g. by brushing or blowing. Any synthetic resin may be employed, particularly urea-formaldehyde. (2) The treatment described above is applied to fabrics comprising organic derivatives of cellulose. C.

Crease-resisting Cellulose Derivative Yarns and Fabrics: Production. D. Finlayson and R. G. Perry. B.P.485,198 of 16/11/1936.

Yarns, fabrics, films and the like of organic derivatives of cellulose are rendered crease-resisting by causing the material to absorb a dispersed intermediate resin condensation product which is converted into a water-insoluble synthetic resin in the material, preferably by heating. The condensation product is preferably applied in aqueous dispersion containing an acid organic dispersing agent, which may also act as catalyst for the formation of the resin. Suitable resins include aldehyde-ketone and amide resins, particularly formaldehyde with urea, thiourea, guanidine, aniline and certain substitution products thereof, aromatic sulphonamides and phenols ; polybasic acids with polyhydric alcohols. Any suitable dispersing agent may be used. Local effects may be produced by effecting the polymerisation locally. The treated materials have an increased affinity for cotton dyes, retain mechanical effects such as crimping in yarns or embossing, and have an increased resistance to water. The resistance to water may be further increased by coating the material with wax-like substances applied in solution, e.g. in chlorinated hydrocarbons. C.

Printing Compositions. E. I. Du Pont de Nemours & Co. B.P.485,290 of 12/10/1936 (Conv. 10/10/1935).

Compositions in the form of powders, pastes or solutions, for use in printing textile materials, e.g. cotton, regenerated cellulose, cellulose esters or ethers, wool or silk, in dark brown and black shades of satisfactory fastness to washing, chlorine, chlorine laundering and light, comprise an unsubstituted aminonaphthol and a diazoamino compound from a diazotised arylamine which may be substituted by alkyl, aralkyl, aryl, alkoxyl, aralkoxyl, aryloxyl, hydroaryloxyl, trifluoroalkyl or halogen. C.

Fibre Liquid Treatment Apparatus. J. H. Nightingall. B.P.485,319 of 24/3/1937.

Fibre for liquid treatment is supported on crossbars which are carried by a pair of endless conveyor chains in a path dipping downwards at one end into a bath and upwards at the other end of the bath, the ends of the bars travelling in guides in the sides of the bath to cause the fibre to travel below the surface of the liquid. C.

Azo Dyes: Production. I. G. Farbenindustrie A.-G. B.P.485,336 of 14/5/1937 (Conv. 15/5/1936).

Cellulose esters and ethers are dyed by means of water-insoluble azo dyes of the general formula Alkyl.CO.R.N:N.A., where R is a radical of the benzene series and A is the radical of a coupling component, which dyes contain no free carboxylic or sulphonic acid groups, the dyeing process being performed with the addition of a dispersing agent. The dyes are obtained by coupling the diazo compounds of aminoketones of the general formula Alkyl.CO.R.NH_2 with coupling components, e.g. aromatic amines, phenols, pyrazolones, hydrogenated quinolines and substitution products thereof, neither component containing free carboxylic or sulphonic acid groups. C.

Crease-resistant Cellulose Derivative Yarns and Fabrics: Production. H. Dreyfus, D. Finlayson and R. G. Perry. B.P.485,372 of 16/11/1936.

Yarns, fabrics, films and the like of organic derivatives of cellulose are rendered crease-resisting by causing the material to absorb from a non-aqueous solution in a liquid having a swelling action on the material, synthetic resin components or an intermediate condensation product of such components, and forming a water-insoluble resin on the material. The material is preferably dried at room temperature after impregnation and before heating to condense the resin, and the impregnation and drying may be repeated several times. Impregnation is preferably effected under acid conditions. All reagents used are free from water, and the material to be treated is preferably subjected to a preliminary treatment to remove water, e.g. an extraction with anhydrous alcohol, or by heating. Formation of a resin film on the material is prevented by subjecting to mechanical treatment or by scouring with a mildly alkaline solution. Materials so treated also have an increased affinity for acid dyes, retain mechanical effects such as crimping in yarns or embossing, and have an increased resistance to water. Local effects may be produced by effecting the polymerisation or condensation locally. C.

Vat Dyes: Production. Courtaulds Ltd. and T. H. Morton. B.P.485,466 of 17/11/1936.

Anthraquinonoid or indigoid vat dyes are prepared by oxidising leuco vat dyes, or their derivatives, in a solution containing an albumin, so rapidly that a colloidal dispersion which is not separable by filtration is formed. The albumins used are those proteins that are soluble in water and whose solutions can be coagulated by boiling. Sulphonated castor oil or a derivative thereof may also be incorporated in the solution of the leuco vat dye. Specified rapid oxidants are hydrogen peroxide, sodium hypochlorite and sodium nitrobenzene sulphonate. C.

Treating Wool. R. Haddan. E.P.485,543 of 16/11/1937.

Wool and other animal fibre containing grease or oil is refrigerated to congeal the grease thereon and carded whilst in that state. The wool may be opened and/or cleaned whilst refrigerated and may then be stored for a period, all before the refrigeration and carding. Subsequent processing such as gilling, combing and regilling may be performed whilst the wool is still refrigerated. The machinery may conveniently be located within refrigerating chambers. E.P.398,683 (see *J. Text. Inst.*, 1934, A86) is referred to. W.

Azo Dyes: Production. W. W. Groves (I. G. Fabenindustrie A.-G.). B.P.485,592 of 23/11/1936.

Azo dyes insoluble in water are made in substance, on the fibre or on a substratum by coupling the diazo compound of an amine of given general formula, or a derivative thereof, with an arylide of 2:3-oxynaphthoic acid. In an example, cotton is grounded in a liquor containing 1-(2′:3′-oxynaphthoylamino)-2:4-dimethoxy-5-chlorobenzene, alcohol, pyridine, caustic soda, formaldehyde and turkey red oil and developed with a solution made by diazotising 4-methoxy-3-aminophenol-1-trifluoromethylsulphone in presence of acetone and zinc chloride with subsequent addition of sodium acetate and salt (yellowish red). C.

Fabrics: Coating. F. F. Schwartz and M. A. Chavannes. B.P.485,607 of 30/9/1937.

Surfaces are coated by spraying a liquid on to the surface and moving the sprayed surface in an enclosed space in contact with the gaseous suspension formed of droplets of the spraying liquid which are not deposited on the surface to be coated during the spraying, the gaseous suspension being carried along the enclosed space by a current of a gas introduced independently of the spraying device. As applied to the process described in B.P.482,844, wherein a web of fabric is coated by spraying with rubber latex and is immediately passed to a drying chamber and then returned after drying to the spraying chamber, the apparatus may comprise a spraying chamber through which the fabric may be carried by a chain conveyor, between it and an endless felt support, latex being sprayed by spray guns mounted on rods so as to be given a longitudinal or rotary movement from outside the chamber. The mist of the sprayed liquid is maintained in contact with the fabric by passing a gas, such as air, along an inclined conduit adjacent the spraying chamber in the same direction as the travel of the fabric. Baffles in the conduit direct the current of mist-laden air into contact with the fabric. C.

Wetting Agents: Preparation. W. J. Tennant (Henkel & Cie, Ges.). B.P. 485,633 of 23/11/1936.

Aromatic hydroxy compounds substituted by at least one alkyl or cycloalkyl radical with at least four carbon atoms are treated with di- or polyethylene-glycolhalohydrins. In an example, 4-sec. alkylcresols obtained from *o*-cresol and olefines having 8 to 14 carbon atoms in the molecule are condensed with tetra-ethylene glycolmonochlorhydrin in the presence of perchloric acid. The products have wetting, emulsifying and washing properties and may be used in the textile, leather, paper and rubber industries. The use of alkylated or cycloalkylated aromatic hydroxy compounds containing nitro, carbonyl, sulpho, ether, ester and halogen atoms is mentioned. C.

Monoazo Dyes: Production. I. G. Farbenindustrie and W. W. Groves. B.P.485,757 of 24/11/1936.

Monoazo dyes insoluble in water are manufactured by coupling, in substance or on a substratum, the diazo compound from an amine of given general formula with an arylide of 2:3-hydroxynapthoic acid of specified general formula. The products may be used for the manufacture of colour lakes and for colouring cellulose esters and ethers, natural and artificial resins, plastic masses and rubber. In an example 1-amino-2:5-diethoxy-4-benzoylaminobenzene is diazotised and coupled with 2:3-hydroxynapthoyl-1′-aminobenzene-4′-sulphocyclohexylamide; the product may be converted into lakes, or the coupling may be effected in the presence of a substratum for this purpose. C.

Urethane Water-repellent Finish: Production. M. Flores and W. Essers (trading as Farberei-Gesellschaft Flores & Co.), Krefeld, Germany. B.P. 487,645 of 16/10/1937:23/6/1938.

Textiles are treated with aqueous solutions of α-halogen ethers or α-halogen thio-ethers of the higher fatty alcohols, which contain at least 10 carbon atoms in the molecule, in the form of quaternary ammonium compounds, with the addition of soluble cyanic acid salts, the impregnated textiles being then dried and heated. A surface formation of urethane, and thus a water-repellent effect, is thereby obtained. C.

Sheet Cellulose Materials: Flameproofing. British Sidac Ltd., London (W. L. Morgan; Hammond, Indiana, U.S.A.). B.P.487,702 of 18/2/1937: 24/6/1938.

Sheets and films of regenerated cellulose and similar materials composed of organic hydrophilic colloids are flameproofed by treatment with an aqueous solution of an ammonium or other alkali salt of an acid formed by replacing one or more hydrogen atoms of an oxygen-containing acid of phosphorus with an aralkyl, alkaryl or aryl group which contains one or more sulphonic acid residues, e.g. sulphonated triphenyl phosphate. The effect may be improved by the addition of an ammonium salt of an inorganic acid. C.

Mercerising Liquor Wetting Agents. M., R. and W. Schwarz and F. and E. Zschimmer (trading as Zschimmer and Schwarz Chemische Fabrik Dölau), Greiz-Dölau, Germany. B.P.487,927 of 28/9/1937:28/6/1938.

Mixtures of alcohols with hydroxyalkylbenzyl alcohols or xylylene glycols are used to increase the wetting and penetrating powers of strong alkali lyes. Such mixtures are almost odourless, are not troublesome in waste liquors, and are as effective as cresol products. C.

Roving Packages: Pattern Dyeing. J. Brandwood (Southport). B.P.487,934 of 26/9/1936:27/6/1938.

A process for the application of colour patterns to wound packages of textile fibrous material in a condition prior to spinning, such as textile roving, consists in causing a softening of the bulk of the package as wound, to equalise its penetrability as a whole to fluids under pressure, applying by a pattern stencil to such package whilst mounted upon a foraminous holder sufficient pressure to compress and consolidate, and define as to their edges those parts which come under the solid parts of the stencil, and passing colouring liquid through the stencil, the uncompressed parts of the wound package within the stencil, and the foraminous holder, by differential pressure. C.

Esterified Textile Oils. Lister & Co. Ltd. (Bradford) and W. Garner. B.P. 487,949 of 30/10/1936:30/6/1938.

Textile materials either in the loose form, or as sliver, yarn or fabric or in intermediate stages of processing or in other form, are treated with a textile oil consisting of an ester or mixture of esters with or without a diluent, the viscosity of the textile oil being between 200 and 650 seconds Redwood at 60° C., and after subjecting the treated materials to one or more textile operations (e.g. carding, combing, spinning, weaving or knitting), they are then scoured. The ester or esters used are fully esterified synthetic liquid esters comparatively resistant to oxidation and substantially insoluble in water, incapable of dispersing in water alone by simple agitation but capable of being removed in a scouring bath, i.e. soap solution with or without alkali, and are such esters of the following groups as have these properties. (1) An ester of a monohydric alcohol and an unsaturated fatty acid, subsequently polymerised and/or oxidised. (2) An ester of a monohydric alcohol and an unsaturated fatty acid, the latter having been polymerised and/or oxidised as such or as an ester which is subsequently hydrolysed. (3) An ester of a di- or tri-glycol and an unsaturated fatty acid, the latter having been polymerised and/or oxidised, prior to esterification, as such or as an ester which is subsequently hydrolysed. (4) An ester of a di- or tri-glycol and a fatty acid, saturated or unsaturated. The oils may be applied to textile materials consisting of or containing animal hairs such as wool, mohair, angora, recovered wool (e.g. shoddy) either alone or mixed with each other or with other fibres, e.g. silk, rayon or cotton. C.

Oil Emulsions: Application in Mordant Dyeing. I. G. Farbenindustrie A.-G. (Frankfort). B.P.488,054 of 18/6/1937:30/6/1938.

In a process for the production of mordant dyeings on cotton bottomed with oil, oil emulsions prepared with neutral emulsifying agents are used for the bottoming treatment. Suitable neutral emulsifying agents include the reaction products of ethylene oxide or polyglycol ethers on organic compounds containing in the molecule one or more hydroxy, carboxyl, amino or mercapto groups. C.

Thermoplastic Collar Interlining Fabric: Application. E. Elöd (Karlsruhe, Germany). B.P.488,264 of 1/1/1937:1/7/1938.

A process for the manufacture of semi-stiff collars is characterised by the feature that adhesive and stiffening media are employed which consist of thermoplastic polymers of vinyl compounds and/or acrylic acid derivatives and homologues thereof, such as methacrylic acid derivatives, which contain free hydroxyl groups, swell in water, and soften at temperatures between 70 and 100° C. such as, for example, partly saponified polyvinyl acetate, together with minor amounts of added substances such as resins, plasticisers, pigments and the like. During laundry treatment the individual plies become detached from one another but are subsequently reunited on ironing. C.

5—ANALYSIS, TESTING, GRADING AND DEFECTS

(A)—FIBRES.

Cotton Fibres: Variation of Strength and Weight. C. Nanjundayya and N. Ahmad. *J. Textile Institute,* 1938, **29**, T75-110. C.

Ethylcellulose Embedding Medium: Application. C. M. Barlow. *J. Textile Institute,* 1938, **29**, T111-116. C.

German Rayons: Photo-micrography. B. Hauptmann. *Kunstseide,* 1938, **20**, 218-220.

Photo-micrographs of filaments and cross-sections of further Kasultra and other German viscose rayons are given. C.

Rayon Staple Fibre: Spectroscopic Tests for Metals. R. Ramb. *Metallwirtsch., Metallwiss., Metalltechn.,* 1937, **16**, 1102-7 (through *Chem. Zentr.,* 1938, i, 2407).

Examples of the application of the spectroscope in analysis are described. They include the semi-quantitative determination of metallic impurities in rayon staple fibre. C.

Crimped Staple Fibre: Crimp Measurement. H. J. Henning. *Textile Manufacturer,* 1938, **64**, 229.

The author suggests that the difficulties experienced in measuring the crimped and straightened lengths of a fibre can be overcome by using a torsion balance as used for tests for breaking and extension of single fibres. A very small load can be applied to the fibre, say, 5 mg. to determine the original length, and a load of 250 mg. to determine the straight length. A measure of the permanence of the crimp can be obtained by then unloading the fibre and measuring the recovered crimp. Typical results and loading and unloading curves are given. " Work " done in decrimping (in ergs) is possibly the best measure of the crimp resistance, and the permanence can be measured by percentage of work recovered. Precautions are necessary in regard to moisture condition of the fibres, the time factor and degree of swelling of the fibres. C.

Value of Staining Tests for Detecting Damage in Wool. R. Folgner and G. Schneider. *Textilber.*, 1938, **19**, 273-276 and 366-368.

Samples of wool yarn of increasing and known degrees of damage by alkali and by acid respectively were submitted to the various staining tests reported as suitable for detecting such damage, to compare their value as absolute measures of damage to wool at all stages of processing. The tests applied were (1) Cotton Red 10 B (Sieber), (2) Lacto-phenol-Cotton Blue II (Galloway, Nopitsch), (3) Indigo-Carmine (Herzog) and (4) Methylene Blue BB (Kronacher and Lodemann). Comparisons and measurements were made in the light of accepted theories of the acid dyeing process. It is concluded that no test is reliable for measurement of damage in early stages. Method (4) is fairly reliable for alkali damage. Method (3) is reliable for detecting both acid and alkali damage, but is only applicable to quantitative use if carried out at *p*H 3 and under strict conditions of temperature and time. W.

(B)—YARNS

Gassed Cotton, Staple Fibre and Mixture Yarns: Regularity. K. Langer. *Kunstseide*, 1938, **20**, 207-217.

Methods of determining the regularity in thickness of yarns, including those based on the use of the apparatus of Herzog and Frenzel, the photo-electric apparatus of Franz and Henning, and Berthold's Gleifometer are briefly described and a report is given of tests by the weighing method on 45 gassed cotton, staple fibre and mixture yarns from different spinning mills, including three yarns that had been the subject of complaints. These showed much higher irregularity than other yarns of the same type and count. The results are tabulated and a number of graphs are given. No remarkable difference in regularity is observed between cotton, staple fibre and mixture yarns. With increasing staple fibre content the regularity appears to improve. In general there is an increasing tendency to irregularity with increasing fineness. For the yarns tested the irregularity varies between 5 and 9 per cent. C.

Lunometer Testing Devices. A. Niemeyer. *Leipz. Monats. Text. Ind.*, 1938, **53**, 78, 127-128.

The Lunometer and its application are discussed and the Lunometer universal yarn tester, tension regulator, tension measuring device, thread brake, single-thread thickness measuring device, twister, illuminator, colour finder, daylight lamp, and reel are briefly described. C.

(C)—FABRICS

Cotton Fabric: Effect of Heat. N. Koshin. *Chloptschatobumashnaja Prom.*, 1936, **6**, No. 3, 29-30 (through *Chem. Zentr.*, 1938, i, 2096).

Observations on the tendering of cotton by heat are reported. When dyed with Indanthren red RG the fabric withstood heat better, but when dyed with Alizarin red the tendering was more severe. C.

Crease-resistant Cotton Fabric: Permanency Test. E. Freedman. *Bulletin American Society for Testing Materials*, 1938, No. 92, 13-14; also *Textile Manufacturer*, 1938, **64**, 296.

A " cotton dotted fabric " was tested for strength, resistance to rubbing, and resistance to creasing before and after being treated with a " so-called permanent crease-resistant finish " (unspecified) and after the treated fabric had been washed ten times by three methods. The results are tabulated. Tests on glazed chintzes that were also described on the American market as permanently finished and fadeless are also mentioned. The evidence is that the fabrics in question did not answer to the description. C.

Finished Textiles: Consumer Testing. Nannene Gowdy. *Bulletin of American Society for Testing Materials*, 1938, No. 92, 9-13.

A discussion on the need for guarantees in textiles that should be understood by manufacturer, processer, retailer and consumer. C.

Permanent Textile Finishes: Testing. K. H. Barnard. *Bulletin of American Society for Testing Materials*, 1938, No. 92, 14-16.

For testing permanent finishes it is suggested that on cottons a washing test should be repeated five times, namely washing at 160° F. with soap and soda in a rotary washing machine, and if possible, on a square yard of fabric. For rayon the sample should be dry-cleaned five times. C.

Piece Goods Shrinkage Chart. W. T. Leggis. *Cotton* (*U.S.*), 1938, **102**, No. 5, 98-99.

A full-page chart is given on which shrinkage values in 1 per cent. steps up to 25 per cent. are connected with grey cloth lengths from 50 to 60 yards in steps of one eighth of a yard. Finished lengths can thus be read off from known grey lengths and percentages of shrinkage, or vice versa. The construction of other charts with different ranges is explained. C.

" Rectifinder " Cloth Examination Device. E. H. Firth. *Textile Mercury and Argus*, 1938, **99**, 138-9.

Illustrations are given of a device for cloth inspection and pick and end counting that permits operation on larger areas of cloth than can be dealt with at any one setting by the usual piece glasses. It is a box-like structure, 10 × 4 × 4 inches with a 6D lens occupying most of the width of the top face. One model is fitted for attachment to electric mains and has a 40-watt daylight lamp. Another model has dry cells and two 2·5 flash-light lamps. C.

Stiffness Tester. Taber Instrument Co. *Instruments*, 1938, **11**, 164.

The V-5 Stiffness Gauge and Triple-cut Shear has been designed for the measurement of stiffness and resilient qualities of paper, coated fabrics, light metallic sheet and wire. The shear accessory blanks out test specimens accurate to size, insuring against dimensional errors associated with single shears. Both units are light and portable, and can be used in laboratory, office or plant by those without previous technical experience. Special features include metric calibration with continuous scale from 0-2,000 gram-centimetres, and bearings sealed in lubricant for years of service without further attention. A photograph is given. C.

Determination of Acidity in Knitted Wool Goods. S. R. Trotman and A. Bramley. *Analyst*, 1938, **63**, 405-410.

Various methods are discussed and three methods: (1) extraction with pyridine, (2) distillation with sodium acetate and (3) a new method, extraction with borax, are examined in detail. In the borax method, the sample (1-2 gr.) is soaked in 50 c.c. 0·2 N borax for six hours. The liquor is filtered through glass wool and wool washed ten times with water. The filtrate and washings are titrated with 0·2 N hydrochloric acid, using methyl red as an indicator. The authors conclude from a series of determinations using the three methods that for large acid concentrations the pyridine method does not remove the whole of the acid present. The effect of storage and drying at high temperatures on the acid control of wool is examined. Sulphurous acid may be determined by distilling into hydrogen peroxide and determining the sulphuric acid formed. W.

Guaranteed Fastness. *Wool Record*, 1938, **53**, 1473-1475 and 1490.

Discussion of the difficulties in assessing fastness properties of dyed materials which arise from the individual judgment which is used, and from the sensitivity of certain dyeings to slight variations in testing conditions. The use of the term " exceptionally fast " is suggested rather than a guarantee of unlimited fastness which is not feasible for any dyed material under all conditions. W.

(D)—OTHER MATERIALS.

Light: Tendering Action. W. H. Cady. *Amer. Dyes Rept.*, 1938, **27**, 325-7.

A report of a lecture, reviewing recent work on the tendering action of light on textiles and the catalytic effect of certain vat dyes. C.

Rapid Detection of Accelerators. E. P. Slepushkina. *India Rubber J.*, 1938, **95**, 290-391.

Methods are described for the qualitative detection of some of the commoner accelerators in uncured rubber compounds. C.J.W.

Plastics: Some Applications and Methods of Testing. T. S. Taylor. *India Rubber J.*, 1938, **95**, 109-112, 140-144, 179-181.

A review of the natural and synthetic plastic materials now available, and a detailed description of the preparation of test pieces to be used for tensile strength determination. C.J.W.

Simple Tests for Dry Cleaning Solvent. *See* Section 7A.

PATENT

Yarn Tension Testing Device. W. Reiners (W. Schlafhorst & Co.), Munchen-Gladbach, Germany. B.P.488,088 of 24/11/1937:30/6/1938.

An appliance for testing the tension of running textile threads or yarn comprises a resilient or spring loaded feeler having a natural high vibration frequency and to which is fixed directly a mirror, and a source of light adapted to project a beam on to the mirror by which light is directly reflected on to a travelling strip of light sensitive paper to produce a record of the tension, the light from the mirror being in some cases simultaneously projected on to an observation member provided with a scale to indicate the tension, and the feeler being adapted to be held in contact with the thread or yarn. C.

6—DESIGN

(A)—TEXTILE DECORATION

Variograph. Textile Engineering Co., Mass. *Textile World,* 1938, **88,** No. 7, p. 106.

The instrument, by means of a projector and several series of prisms, projects—either on a screen, design paper, fabric, or photographic film—an endless variety of central, rhythmical or asymmetrical (scattered) vari-coloured designs. The device is applicable to design production for a variety of fabrics. W.

7—LAUNDERING AND DRY CLEANING

(A)—CLEANING.

Coloured Goods: Classification in the Laundry. F. C. Harwood. *J. Textile Inst.,* 1938, **29,** P119-121. C.

Printed Cotton Fabrics: Fastness Requirements. E. M. Edgerton. *Amer. Dyes. Rept.,* 1938, **27,** 320-324.

In order to clear up uncertainties about wash fastness and to be able to interpret the results of various tests in terms of actual performance, 18 pieces of percale, covering the complete colour range, were subjected (1) to 30 consecutive washings at each of 30 commercial laundries, (2) to tests at various testing laboratories, (3) to Fadeometer exposure tests and (4) to home washing. The following conclusions are drawn. (1) A single commercial laundering was comparatively the least severe of all tests ; in fact there was no exceptional fading after 30 washes at some of the laundries. (2) Home washing resulted in more fading than any commercial laundering or standard test, this being traced to exposure of the wet cloth to the sun in drying. (3) Test No. 2 of the American Association of Textile Chemists and Colorists with 0·5 per cent. soap and 0·2 per cent. soda at 160° F. for 30 minutes, the test in most general use, was not sufficiently severe to identify all the colours that would not withstand thirty commercial launderings, but any shade which did withstand five repetitions of the test did not fade appreciably more in thirty commercial launderings. (4) The interpretations and classifications of the degree of fastness such as "excellent," "good" and "fair" by various testing laboratories using different methods, were conflicting. There appears to be a need for two standards of fastness—"Fast to Washing Colours," that is, colours which would pass a moderately severe test satisfactorily, and "Guaranteed Fast Colours," which should comprise the best available colours and pass the most severe tests. It is also suggested that the standardisation of these two classes of colour fastness should be brought about by the finishers, be sufficiently severe to be able to pass any reasonable test of the laboratories and should carry some Fadeometer specifications to guarantee against the effects of home laundering. The A.A.T.C.C. test No. 2 is recommended with modifications for the two standards of fastness. C.

Simple Tests for Dry Cleaning Solvent. N. L. Cooperider. *Amer. Dry Cleaner,* 1938, 5, No. 1, pp. 37-39, No. 2, pp. 35-37(through *Chem. Abs.,* 1938, 32, 4793).

Non-technical quick tests for the presence of impurities in dry-cleaning solvent include: (1) Evaporation on a watch glass. A greasy residue indicates dissolved impurities. (2) Adsorption in concentrated H_2SO_4. A dark colour or over 5 per cent. adsorption indicates the presence of unsaturated compounds which may be odour forming. (3) Addition of KMn-O_4 crystals. A purple colour shows the presence of moisture. (4) Filtration through ordinary filter paper. After the paper has dried, suspended soil or grease becomes readily noticeable. (5) Addition of phenolphthalein to test for free alkali. (6) Agitation with a concentrated NaOH solution. Dissolved soap will settle in a layer between the solvent and water layers. (7) Direct titration of free acid or alkali. W.

The Separator-washing Process. O. Uhl. *W.P.Z.*, 1938, **41**, 471.

The claims of Dr. Ecksrom for his washing process (*W.P.Z.*, 1938, 41, 391-400) are regarded with considerable dubiety by the author. La.

Static Electricity in Dry Cleaning Processes. L. Hartshorn and W. H. Ward. *J. Soc. Chem. Ind.*, 1938, **57**, T178-183.

The formation of high voltages with the consequent danger from sparks in dry cleaning machines can be prevented by increasing the conductivity of the solvent. Soap causes such an increase, the active constituent being water. Successive charges of fabrics remove the water but it is impossible to replace this loss by the addition of water alone. It is essential to add fresh supplies of soap at regular intervals. The authors also describe an instrument for the measurement of low conductivities (of the order of 10 micro-micro-ohms per cm.) which is portable and simple. La.

PATENTS.

Washing. A. Ekstrom. E.P.481,721 of 21/10/1937: 17/3/1938.

In laundry washing by means of an alkaline soap solution, the solution is prepared in a storage tank common to a plurability of washing machines which may contain goods of different degrees of dirtiness and the solution is run to the machines and used without any further addition of detergents irrespective of the degree of dirtiness of the goods. The liquid is continuously circulated through a centrifugal separator to remove dirt and fat particles emulsified in the washing liquid and is preferably returned to the storage tank. La.

Ironing-presses. British Thomson-Houston Co. Ltd. E.P.482,250, Aug. 13th, 1937. Conv. date Aug. 13th, 1936, Accepted March 25th, 1938.

A device to prevent convection currents which cool the surface of the head of the press when open is described. The device consists of a flange which comes into postion when the press is open. La.

8—BUILDING AND ENGINEERING

(A)—CONSTRUCTION OF BUILDINGS

Cast R.R. Aluminium Light Alloys: Properties. *Nickel Bulletin*, 1938, **11**, 131.

The chemical composition, physical, mechanical and tensile properties are tabulated of three aluminium light alloys, R.R.50, R.R.53 and R.R.53C. C.

(B)—FIRE PREVENTION.

Prevention of Fires in Wool Factories. O. Brauer. *Feuerschutz*, 1938, **18**, 40-45.

The numerous fires which have occurred in recent years through spontaneous combustion of oiled wool, especially in shoddy production, are discussed. Possible causes for their development are indicated and methods of prevention suggested. W.

(C)—STEAM RAISING AND POWER SUPPLY.

Steam: Equation of State. J. Juza. *Engineering*, 1938, **146**, 1-3, 34-6.

An account is given of steam research in Czechoslovakia that greatly extends the range of actual measurements of enthalpy and specific heat and leads to a more precise form for the equation of state. Tables of computed and observed data are provided. C.

Electric Power: Advantages. Electrical Development Association. *Textile Weekly*, 1938, **21**, 550, 593, 730, 862; **22**, 204.

A statement of the advantages for textile mills of obtaining power from public electricity undertakings. C.

" Gako " Gas Burners for Boilers. Liptak Furnace Arches Ltd. *Textile Weekly*, 1938, **21**, 550, 593, 730, 817, 862, **22**, 204.

Illustrations are given of gas burners for vertical or Lancashire boilers, suitable for town's, producer or coke-oven gas, whether clean or dirty. The advantage of gas firing for small textile establishments is mentioned. C.

(G)—HEATING, VENTILATION AND HUMIDIFICATION.

" Rosenblad " Spiral Heat Exchanger. G. Thomas & Co. Ltd. *Textile Recorder*, 1938, **56**, No. 663, p. 47-8.

A relatively small heat exchanger is formed of two plates rolled spirally around each other so as to form spiral passages through which the two fluids travel in opposite directions. Three types are shown: (1) for heat exchange between two liquids, (2) for surface condenser working on the cross-flow principle, and (3) for a counter-flow condenser. Applications in a mercerising and dyeing plant are discussed. C.

Humatagraph Hygrometer. C. L. Burdick. *Textile Weekly*, 1938, **22**, 74, 78.

The Burdick " Humatagraph " direct-reading hygrometers employ pine cone fibres as sensitive elements. These are claimed to be more consistent than human hair or textiles for the purpose. Hair has a " linear reaction to humidity " of about 2½ per cent. whereas the figure for the selected and treated pine cone fibres is 12½ per cent. C.

Nomogram-type Humidity Control Device. R. G. Bateson. *Engineering*, 1938, **146**, 57.

The author's humidity recorder, that makes mechanical application of the relative humidity nomogram, is now adapted to effect control. The link that moves proportionately to R.H. and carries the recording pen is caused to float between two air valves or electric contacts so that steam or water vapour supplies can be opened as the case may be. C.

Notes on the Control of Humidity and the Construction of a Constant Temperature and Humidity Cabinet for Laboratory Use. F. E. Humphreys. *J. Inter. Soc. Leather Tr. Chem.*, 1938, **22**, 224-232.

It has been found that hair hygrometers set to read correctly at one given relative humidity will not necessarily do so at a different relative humidity. Although fairly satisfactory for small vessels, a saturated solution of common salt has been found to be ineffective in maintaining a consistent relative humidity in a large cabinet containing a considerable amount of dry leather. A saturated solution of common salt containing excess undissolved salt does not appear to reduce the moisture content of a more humid atmosphere to 75 per cent. relative humidity. An apparatus has been described that will maintain the air in a cabinet of about 20 cubic feet capacity at a given relative humidity and temperature, irrespective of internal conditions or, within wide limits, of the moisture content of material placed in it. W.

Discussion on Air Conditioning. I. Ventilation Conditions and Their Investigation. R. C. Frederick. **II. Air-conditioning in Factories.** C. W. Price. **III. Air-purification and Allergic Conditions.** E. M. Fraenkel. *Proc. Roy. Soc. Med.*, 1937, **30**, 1541-1543, 1544-1547, 1547-1549 (through *Brit. Chem. Abs. A.III*, 1938, p. 611). W.

(H)—WATER PURIFICATION.

Chemical Methods in Slime and Algae Control. H. K. Nason. *J. Amer. Water Works Assoc.*, 1938, **30**, 437-452.

The causes of slime and algae growths are reviewed, and also their effect on water supplies, especially with reference to taste and odour. As preventives, the use is described of Cl, $Cl.NH_3$, $CuSO_4$, Hg, oxidizing agents, acids and various newly developed toxins There is a useful bibliography. W.

A Flow Indicator for Water Cooling Systems. M. Cady. *Rev. Sci. Insts.*, 1938, **9**, p. 229.

The water flow is directed through a jet and falls on to a vertical or horizontal surface in a tube having an air lock. The position at which the jet strikes the surface can be made to be proportional to the rate of flow. L.

PATENTS.

Modified Wool Fat: Making Emulsions. A. Carpmael. E.P.483,315 of 15/10/1936.

A product which is colloidally soluble in water is obtained by bringing wool fat, or purified fractions thereof, into contact with an alkali metal, either at an elevated temperature or in the presence of an organic solvent which is indifferent towards the alkali metal used. The metal which remains undissolved is filtered off or removed, and the solvent, if used, evaporated. The product, which is of soft wax-like consistency, forms a cream-like emulsion, on triturating with a small quantity of water, which on further dilution yields a weakly alkaline colloidal solution. In examples, wool fat is heated in the presence of metallic sodium or potassium, a solution of wool fat in petroleum ether, benzene or xylene is boiled in the presence of sodium or potassium, and wool fat dissolved in benzine is allowed to stand in contact with sodium. W.

Direct-reading Psychrometric Apparatus. J. Crapez (Mons-en-Baroeul, France). B.P.487,654 of 5/11/1937:23/6/1938.

In psychrometric apparatus for direct reading of the hygrometric state at any temperature and the weight in grams per cubic metre of water vapour contained in the air, the dry bulb thermometer is adapted to move so that the level of its thermometric column may be brought into horizontal alignment with a horizontal wire stretched on a frame rendered movable by means of a screw with a milled knob whereby the wire can be made to coincide with the level of the thermometric column of the wet bulb thermometer, the movement of the dry bulb thermometer being effected in such a way that the angle between the original and final directions of its axis may be representative of the hygrometric state as given by tables correlating the temperatures indicated by the thermometers. The dry thermometer is formed rigid with a pointer, the upper end of which moves in a groove and the lower end of which slides on a cam having a profile corresponding to the trace of this groove, that is to say, this profile is such that for any displacement of the pointer, the point of intersection of the axis of the dry thermometer with the axis of the same dry thermometer in its initial position is always equidistant from its zero graduation. Thus each angle formed for any displacement of the dry thermometer in order to bring the level of its thermometric column on the horizontal line through the level of the thermometric column of the wet thermometer, will correspond exactly to the hygrometric state indicated on a dial placed above the guide slot and the graduations of which will correspond to the numbers given in the tables used with the ordinary psychrometer. C.

9—PURE SCIENCE

Dew Point: Accurate Determination. A. W. Hixson and G. E. White. *Indust. Engng. Chem., Anal. Ed.*, 1938, **10**, 235-240.

An apparatus is described by which accurate direct determination of the dew point of confined samples is accomplished through a sensitive photo-electric means of dew observation, combined with a technique of intermittent temperature rise calculated to minimise the quantity of dew deposited. A periodically reversed circulation of the gas body through the dew chamber (which is kept in a thermostat) is maintained by the stroke of a brass piston, moving in a steel cylinder. The connecting coils provide added surface for the maintenance of constant and uniform temperature of the gas. A Bourdon pressure gauge is connected with the dew chamber through a loop filled with oil and mercury, to minimise dead-end space. A precision of about ±0·01° C. is possible at 90 per cent. humidity, and ±0·05° C. at 100 per cent. humidity. The structure of gaseous films adjacent to the liquid phase, and the mechanism of dew formation and evaporation are discussed, and an explanation of the difficulty in obtaining concordant dew point indications by visual means is advanced. C.

Turbulent Flowing Air: Velocity Distribution. J. J. Sommer. *Physikal. Z.*, 1938, **39**, 454-460.

Experiments on turbulent flow are described to show the dependence of sectional velocity on pressure. The measurements were made with air in circulation at different pressures from about 150 mm. downwards. From the velocity profiles acquired at different pressures the dependence of the boundary layer thickness on pressure was obtained as a measure of this transformation. The results so obtained were compared with statistical considerations and were found to be in close agreement. Diagrams are given of the brass tube fitted with pumps showing places for the oil manometer to be affixed to measure the air pressure and also of the hot-wire bolometer for measuring the sectional flow. C.

Cellulose Derivatives: X-ray Diffraction Analysis. W. A. Sisson. *Indust. Engng. Chem.*, 1938, 30, 530-537.

A brief outline is given of the results of X-ray diffraction analysis of cellulose derivatives under the following headings: (1) interpretation of X-ray data regarding the mechanism of derivative formation ; (2) factors which affect the structure ; (3) types of orientations ; (4) mechanism of swelling and dispersion in organic liquids and (5) mechanism of hydrolysis and structure of resulting products. Reproductions of X-ray diagrams are given and 102 references are included in the bibliography. C.

Nomographic Calculating Mechanisms. W. Meyer zur Capellen. *Z. Instrumentenkunde*, 1938, 58, 221-8.

The author shows how nomographic principles can be applied in the design of a number of mechanical calculating devices. C.

Action of Sulphites on the Cystine Disulphide Linkages in Wool. I—The Influence of *p*H Value on the Reaction. F. F. Elsworth and H. Phillips. *Biochem. J.*, 1938, 32, 837-843.

It is shown that the disulphide linkages of wool react with sodium bisulphite solutions at ordinary temperatures and thiol and S-cysteinesulphonate side-chains are formed. The S-cysteinesulphonate side-chains decompose when the sulphited wool is heated with water, either thiol groups and bisulphate, or sulphenic acid groups and bisulphite being produced, depending on the acidity of the water. The presence of thiol groups in sulphited wool which has been brought to equilibrium with water at *p*H 5 increases the alkali-combining power of the wool. The mechanism of the reaction between the disulphide linkages of wool and sodium bisulphite is discussed. W.

Photo-electric Method for the Micro-determination of Sodium in Serum and Urine by the Uranyl Zinc Acetate Precipitation. W. S. Hoffman and B. Osgood. *J. Biol. Chem.*, 1938, 124, 347-357.

The criteria for exact analysis of sodium by the uranyl zinc acetate precipitation are studied. A new method for the determination of sodium in serum and urine is offered which depends upon the photo-electric measurement of the yellow colour of solutions of uranyl zinc sodium acetate in water to which NH_4SCN has been added to stabilise the colour against temperature change. W.

***Aspergillus Niger*; Effect of Heavy Metal Salts on——.** F. Yoshimura. *Bot. Mag. Tokyo*, 1937, 51, 349-354 [from *Japanese J. Botany*, 1938, 9, (97).]

In the culture of *Aspergillus niger* the production of amylase and invertase is decreased by decreasing the concentration of Fe or Zn in the nutrient medium. The same effect is obtained by using sucrose or glucose as the carbon source of the nutrient solution. Mn and Cu have no special effect, though in the entire absence of Mn there is a slight diminution in the formation of the enzymes. C.

Malt Amylase: Effect of Starch Substrate on Activity. S. Redfern and W. R. Johnston. *Cereal Chemistry*, 1938, 15, 327-341.

The influence of the starch in enzyme activity determinations is studied. The ferricyanide method of sugar analysis has been used for determining the reducing substances formed by the diastasis of 13 soluble starches. Rate curves were computed according to Hanes's procedure (1932) for studying the early stages of saccharification of soluble starch (by malt amylase). The curves give support to Ling's rule (1936) that saccharifying power is a linear function of the time, or mass, provided that the reducing power expressed as per cent. of maltose on the dry starch does not exceed 30 per cent., but do not confirm the supposed correlation between reducing power and initial rate or between the *p*H of the unbuffered starch solution and the initial rate. In order to determine the quantity of reducing substances present, whether maltose, glucose or perhaps low dextrins, the biological method of Schultz and Kirby (1933) was employed with slight modifications. Results show that there is a good agreement between the amount of fermentable substances and the initial rate. The soluble starches studied are separated into two groups, one of which is called " normal " in the sense that when used with the same amylase concentration it gives the same rate curve within a precision of ± 2 per cent., or the same Lintner value for the enzyme preparation when using the starch as the substrate. C.

Pentachlorophenol: Properties and Uses. T. S. Carswell and H. K. Nason. *Indust. Engng. Chem.*, 1938, **30**, 622-626.

The chemical, physical and toxic properties of pentachlorophenol are described, with a table of its solubility in organic solvents and water. The compound and its sodium salt are now available as commercial fungicides. Fungicidal values as determined by the standard Petri plate test are tabulated and compared with those given by β-naphthol and *p*-chloro-*m*-cresol. Applications include the control of sap stain and slime in timber and the preservation of pulp and paper, starches, dextrins, gums, proteins such as casein, albumin, gluten, leather, glue, rubber latex and textiles. C.

Starch: Inactivation against Amylase. St. J. Przlecki. *Sprawozdania Posiedzen Towarzystwa naukowego warszawskiego*, 1936, Cl. IV, 29, 186-7 (through *Chem. Zentr.*, 1938, i, 1992).

Starch was precipitated in alkaline media in the presence of calcium chloride or guanidine, giving compounds of constant composition. The Ca compound is free from Cl and soluble in acids. The guanidine compound is soluble in acids and alkalis. At *p*H 7 and 6, saliva and pancreas amylases are without action on the compounds. Diastase at *p*H 6 attacks the Ca compound but not the guanidine compound. The normal activity of the enzymes is not impaired by the compounds. C.

Lignified Cells: Detection. J. Kisser and K. Lohwag. *Mikrochemie*, 1938, 24, 179-191.

A review of methods for the detection of lignification in wood is given. Friesen's reaction with mercury acetate and ammonium sulphide (1935) is shown to be not specific and his objections to the phloroglucinol test unfounded. C.

Cellulose Acetates: Chromatographic Fractionation. G. R. Levi and A. Giera. *Gazz. Chim. Ital.*, 1937, 67, 719-723 (through *Brit. Chem. Abstr.*, 1938, *A.I.*, 139; also *Chem. Zentr.*, 1938, i 1791).

Cellulose diacetate is fractionally adsorbed from solution by animal charcoal, the least viscous molecules being adsorbed most. Cellulose triacetate is adsorbed to about the same extent but does not give different fractions. The conclusion is drawn that pure α-cellulose and the triacetate are substantially of one order of polymerisation but that depolymerisation occurs in the usual processes for converting the triacetate into the diacetate. C.

Cellulose Acetate: Solublity in Mineral Salt Solutions. L. Brissaud. *Rev. gén. Matières plast.*, 1937, 13, 227-230 (through *Chem. Zentr.*, 1938, i, 1904).

Salt solutions that dissolve cellulose will dissolve cellulose acetate readily. Additional salts that in aqueous or aqueous-alcoholic solution dissolve the acetate are, in decreasing order of solvent power, K iodide, K thiocyanate, Ca or Mg perchlorate, and Ca nitrate. On the other hand, a metallic acetate will precipitate cellulose acetate from an alcoholic solution. C.

Cellulose Acetate Solutions: Effect of Lime on Viscosity. S. Papkov. *J. Phys. Chem. Russia*, 1937, 10, 418-427 (through *Brit. Chem. Abstr.*, 1938, A1, 139).

The viscosity of cellulose acetate solution is the lower the smaller the ash content. Lime causes gelation of the solutions, followed later by syneresis. On the assumption that the minimum amount of lime sufficient to cause gelation corresponds with 1 mol. per principal valency chain, the minimum mol. wt. of cellulose acetate is 15,000. C.

Cellulose Ethers: Molecular Weight Determinations. H. Staudinger and F. Reinecke. *Liebig's Ann. Chem.*, 1938, **535**, 47-100.

Work on the molecular weight determination of cellulose ethers by the viscosity and osmotic pressure methods is reported under the following subtitles. (1) Fractionation of ethyl-celluloses by precipitation from solution in dioxane. (2) Viscosity measurements in different solvents. (3) Osmotic pressure measurements on chloroform solutions and calculation of molecular weight; values of 20,000-64,000 are recorded. (4) The K_m constants and calculation of molecular weight from viscosity; the results agree with the osmotic values. (5) Production of ethylcellulose acetates, thereby substituting the remaining free hydroxyl, their analysis and (6) viscosity, (7) osmotic pressure and (8) K_m constants, and (9) demonstration from the results that the ethylcelluloses can be converted into "polymeric analogous" ethylcellulose acetates. (10) Transformation of cellulose acetate into "polymeric analogous" ethylcellulose acetates. (11) The anomalous behaviour of solutions of ethylcelluloses in benzene; the viscosity is very greatly reduced if the solution contains moisture (0·1 per cent. of water to a 2 per cent. solution of the ether), but the ethylcellulose acetates do not behave in this way. A similar programme is also presented with methylcellulose, and the paper concludes with a discussion on macromolecular structure of celluloses and their derivatives. C.

Built-up Protein Films: Optical Properties and Structure. W. T. Astbury, Florence O. Bell, E. Gorter and J. Van Ormondt. *Nature*, 1938, **142**, 33-4.

Films composed of up to 1,764 mono-layers have been built up from recrystallised egg albumin at its isoelectric point. The thicker films could be stripped off the metal slide and examined by means of X-rays, etc., without interference. The first of them showed between crossed nicols numerous boat-shaped holes—presumably negative tactoids—all pointing parallel to the direction of movement of the slide and framed by regions of much higher birefringence. The birefringence of the intact film approaches that of wool and in the immediate neighbourhood of the holes is as high as that of silk. The fastest vibration lies therefore in the plane of the film and the intermediate vibration perpendicular to the film. The most perfect film of 1,450 mono-layers showed similar optical properties; the boat-shaped holes were absent but there was a fringe of delicate fibres, parallel to the direction of movement. By dint of repeated folding, stripped ribbons of film were formed into flat, correctly oriented pads and photographed by X-rays. The photographs were found to correspond to polypeptide chains lying roughly parallel to the direction of movement of the slide, with their side-chains roughly perpendicular to the plane of the film. The thickness of films of 600, 800, 1,000, 1,450 and 1,764 mono-layers was measured by an interferometer and screw micrometer and the results agreed in fixing the thickness per mono-layer at about 9½ or 10A. C.

Mono-molecular Film Model. H. Devaux and L. Pallu. *C. R. Acad. Sci.*, 1938, **206**, 1693-5.

A model of a mono-molecular layer can be made by pouring a mass of grains (e.g. rape-seed) from a slight height on to the cleaned surface of mercury in a flat trough. The grains spread out over the entire surface to form a mono-layer. If there are not enough grains to cover the entire surface, the layer is made of shreds, separated by spaces but if a vibration is set up all the local heaps fall to pieces, the grains become individually free and bombard each other like the molecules of a gas. If this discontinuous sheet of floating grains is touched with a thread of oiled glass, or breathed upon, they are driven quickly back, leaving a dark circle of mercury surrounded by a field of grains in close contact. Ripples can be formed by compression, in fact most of the phenomena associated with monomolecular layers can be demonstrated. C.

Surface Films: Electrocapillary Theory and *p*H. S. R. Craxford, O. Gatty and T. Teorell. *Phil. Mag.*, 1938 [vii], **25**, 1041-61, 1061-6.

(1) The electrocapillary equations previously discussed (1934-1936) have been extended to surface films and applied to a typical and simplified case. The theory of two co-existent surface phases is discussed. It is shown that a possible factor contributing to the high capacities of specifically adsorbed anions may be the existence of a gradual change from gaseous to condensed films of adsorbed anion at potentials close to those corresponding to the formation of a solid

precipitate of a salt of the metal in the capillary electrode. Measurements of surface tension and chemical potentials alone are held to be incapable of supplying full information as to the degree of dissociation of a substance in an interphase or in a surface film. (2) The bearing of the above conclusions on the definition and measurement of surface *p*H is discussed. C.

Surface Tension: Measurement. V. Naggiar. *C. R. Acad. Sci.*, 1938, **206**, 1882-4.

A method for measuring the surface tension of liquids is described that gives results within one per cent. The liquid is suspended in a circular hole in a plane-parallel disc a few millimetres thick. The quantity of liquid is regulated so that the two free surfaces of the drop are concave. The surface tension is calculated from the equation $2A(1/R_1-1/R_2)=\rho g e_0$, where A represents the surface tension of the liquid, R_1 and R_2 the radii of curvature at the centre of each of the free surfaces, ρ the density of the liquid, g the acceleration due to gravity and e_0 the thickness of the drop along its axis. The apparatus comprises two microscopes placed vertically along the axis of the drop, one on each side, and the radii of curvature are measured by auto-collimation. This method gives the highest point of the surface studied and the thickness of the drop along its axis is deduced by comparison with a plane-parallel plate of known thickness by use of the same device. The positions of the highest points of the two surfaces and of the two centres of curvature are adjusted by means of a cathetometer microscope with a micrometer eye-piece. Measurements on benzophenone are given as an example. This method requires only about twenty milligrams of liquid and is especially suitable for studying the variation in surface tension with change of temperature. C.

Liquids: Structure and Effect of Temperature on Diffusion Processes. H. S. Taylor. *J. Chem. Phys.*, 1938, **6**, 331-334.

Eyring's concept of holes in liquids and his theory of absolute reaction rates indicate that diffusion coefficients should vary exponentially with temperature. Published data indicate that this is true. It is shown that empirical observations concerning the relation between diffusion velocity and its temperature coefficient, hitherto generally assumed to be linear, are readily explained on the basis of holes in liquids as a controlling factor. As with viscosity, relatively high activation energies of diffusion are found in liquids containing hydrogen bonds. Data for small diffusing molecules should not show a constant diffusion-viscosity product as required by the Stokes-Einstein relation at constant temperature, but a product varying within restricted ranges with the dimensions of the solvent molecules. Data already available tend to confrm this conclusion. C.

Soap Solution: Specific Volume. M. Ulmann. *Z. physikal. Chemie*, 1938, **A182**, 18-30.

The specific volume of sodium oleate solutions has been determined for concentrations from 0·005 to 1·2 per cent. by means of Moser's buoyancy method, which allows changes of density to be measured with an accuracy of $\pm 6 \times 10^{-7}$. Higher concentrations from 3·03 to 16·85 per cent. were examined by a pyknometer. The measurements were made after shaking the solutions and after allowing them to rest for various periods of time. There appear to be three sharply defined regions of concentration in which the specific volume is a linear function of the concentration, transition points occurring at about 0·03 and 0·9 per cent., that is 9·860 and $328 \cdot 66 \times 10^{-4}$ moles per litre. The specific volume is therefore not linearly dependent on the content of the disperse phase over the whole range of solubility, though it is often assumed to be so in the case of a large number of hydrophobic and hydrophilic sols. In such a system extrapolation from regions of very high concentrations to the most dilute is inadmissible. In this property sodium oleate solutions show very great similarity to solutions of high organic polymerides. The complexity of sodium oleate in solution is indicated by the fact that solutions from 0·025 to 0·9 per cent. are thixotropic. When shaken these solutions suffer a diminution in specific volume, but in the course of several days the original state returns. Dilatometric measurements on a 1·6 per cent. solution show an increase in specific volume during transition from the sol state to the gel state, the conversion lasting several hours. Here also the state of rest (the gel state) is distinguished by a smaller density. Resemblances to the methylcellulose-water system and differences from the gelatin and ferric hydroxide systems are discussed. C.

Nitrocellulose Solutions: Osmotic Pressure, Dilution Entropy and Heat of Dilution. C. G. Boissonas and K. H. Meyer. *Z. physikal. Chem.*, 1938, B40, 108-114.

An equation for the calculation of dilution entropy and heat of dilution is developed from the dependence of osmotic pressure on temperature and experimental results for the nitrocellulose-cyclohexane system are recorded. An error of calculation is pointed out in the values given by Schulz for the nitrocellulose-acetone system. C.

Far Infra-red Spectrometer. P. Barchewitz and M. Parodi. *C. R. Acad. Sci.*, 1938, **206**, 1891-3.

A spectrometer is described for use in conjunction with a radiomicrometer for the far infra-red from 20 to 100μ. The energy from an Auer burner is concentrated on to a slit of 6 mm. width by means of a concave mirror. The radiation is reflected by another mirror to give a parallel beam, which falls on a wire grating and finally on to a second mirror of 70 cm. focal length. A second slit defines a certain region of about 2μ in the spectrum. The energy is then concentrated into the cone of a radiomicrometer by means of two mirrors. The grating is made of copper wires of 0·25 mm. diameter and 0·25 mm. apart, the total number being about 200. Such a grating gives a large number of spectra but only that of the first order is used. Two paraffin screens and a quartz screen are placed in position to eliminate the near infra-red. The substances to be studied are also deposited on paraffin plates. Measurements of absorption are made in absolute values from the two deflections of the radiomicrometer, with an identical paraffin screen and with the paraffin plate. The spectrometer is graduated in wave-lengths by use of the general formula for screens. Results are obtained with a precision greater than 5 per cent. C.

Photoelectric Spectrogram Photometer. R. Herz. *Z. wiss. Photographie*, 1938, 37, 107-111.

A simple photoelectric photometer for measuring the blackening of X-ray spectrograms and the like consists of a wooden table to which is attached the lighting apparatus over which is a movable arm with blocking-layer selenium cell. On the top of the table is a matt plate with slit and light filter. The incandescent lamp is fed with a 6-volt battery to give constant lighting effects and a heat filter is placed between the lamp and the matt plate to protect the film strips. The advantage of this device lies in the fact that exact results can be obtained without complicated compensation methods, which seem to be necessary with the usual photo-electric methods. Full details for use of the instrument with photographic reproductions are given. C.

Photoelectric Spectrophotometers. R. Sewig. *Archiv tech. Messen*, 1938, Lief. 83, T69-70.

Spectrophotometers with filters and monochromators are briefly reviewed and Hardy's self-registering spectrophotometer is described in detail. Sources of error in spectrophotometric work are discussed. C.

Ultra-violet Photographic Photometer. P. Gesteau. *C. R. Acad. Sci.*, 1938, **206**, 1630-1.

An apparatus for the comparison of photographic emulsions or sources of radiation in the ultra-violet comprises a spectrograph furnished with a system of two Glan prisms. A synchronous motor draws the photographic plate with a uniform movement in a direction perpendicular to the spectrum and at the same time rotates the polariser. The method of measurement depends on the one hand on the relation between the intensity of the incident and transmitted light and the angle between the prisms, and on the other hand on the threshold value for the emulsion. Two light sources would be compared by the blackening produced on the same plate, the lengths of the blackening giving the angle between the prisms and therefore the intensities, and two emulsions would be compared by exposure to the same light source, the lengths of blackening giving the ratio of their threshold intensities. The comparisons are thus reduced to two measurements of length. Tables can be constructed by which to transform the lengths into optical densities. The difference between the optical densities found in the table is equal to the logarithm of the desired ratio. The theory of the device is discussed and equations derived. C.

Ultra-violet Radiation: Luminescent Photographic Measurement of Energy Distribution. L. N. Ananeva and A. A. Schischlovski. *C. r. Acad. Sci. U.R.S.S.*, 1937, **17**, 183-7 (through *Brit. Chem. Abstr.*, 1938, A.I., 118, and *Sci. Abstr.*, 1938, A.41, 165).

A thin gelatin film impregnated with Na salicylate and mounted on silica is placed in contact with the emulsion of the photographic plate used in ultra-violet spectroscopy. The blackening due to the blue fluorescence is proportional to the intensity of the radiation. The hydrogen spectrum has been examined by the method. C.

Fluorescent Substances: Energy Yield. H. Hellström. *Arkiv Kemi, Min., Geol.*, 1937, **12**, A, No. 17, 12 pp. (through *Brit. Chem. Abstr.*, 1938, AI, 119).

A " fluorometer " is described for the direct measurement of the ratio of fluorescence energy emitted to the light energy absorbed. Measurements are recorded for fluorescein, eosin, rhodamine-B (in water) methylene blue (in alcohol) and ætioporphyrin (in ether). C.

Inorganic Colloid Photo-chemical Catalysts: Activity. J. C. Ghosh and others. *J. Indian Chem. Soc.*, 1937, **14**, 495-626 (through *Brit. Chem. Abstr.*, 1938, AI, 151-2).

A series of 14 communications on the photochemical activity of sols of V, W, Mo, U, Fe and Cr oxides in the oxidation of alcohol, glucose, fructose and formaldehyde. C.

Intra- and Inter-molecular Hydrogen Bonds: Occurrence. R. Freymann. *C. r. Acad. Sci.*, 1938, **206**, 1812-4.

It is known that the infra-red absorption spectra of oxonium and similar intermolecular compounds give evidence of two OH bands, one characteristic of the free molecule and the other of the associated molecule. In chelation and keto-enol isomerism, on the other hand, whilst the spectra give no indication of the " free molecule " type of OH band, there is some doubt about the existence of the other type. The author has therefore compared methyl salicylate with methyl benzoate, salicylaldehyde with benzaldehyde, and acetylacetone with ethyl acetoacetate. Curves connecting wave-length with the ratio of the transmission by a layer 5 cm. thick to that of a 10 cm. layer, as measured on the same sensitised paper, show that the OH band typical of associated molecules is also exhibited by that liquid which is capable of chelation or keto-enol isomerism. A difference in the strength of the hydrogen bond between the intra- and inter-molecular cases is, however, apparent. Rise of temperature causes an increase in the intensity of the " free molecule " type of OH band in the inter-molecular case and a disappearance of the " association " type of OH band. In the intra-molecular case, the " free " type does not appear even in the spectrum of the vapour and the associated type is not affected by rise of temperature. C.

Powders: Reflexion Spectra. M. Billy and A. Berton. *C. R. Acad. Sci.*, 1938, **206**, 1631-4, 1958-1960.

(1) A reproduction is given of absorption spectra of powdered materials obtained by reflexion in the ultra-violet. It is suggested that such spectra supplement the information given by X-ray diffraction spectra and might be used in the study of any thermal changes in solids. (2) The plane surface of the solid is placed at a mean distance of 5 mm. before the slit of a spectrograph and at an angle of 30° with the vertical. A vertical beam of light of the continuous visible or ultra-violet spectrum is focussed on to this surface. For convenience the powders are placed in small cells of 10 x 2 and 5 x 1 mm. made of black ebonite and by means of a horizontal slipping movement appear successively in front of the slit of the spectrograph ; 10 to 5 cg. of material are necessary for an experiment and the powdered surface is levelled by means of a glass plate held in the hand. When successive reflections are necessary two thin slabs of ebonite are used and placed in such a way that the two surfaces of the powder are opposite and parallel to each other at a distance of 1·5 mm. The reflecting power of magnesium oxide has been taken as unity because it is constant for all wave-lengths between the red and 2,500 A. C.

Eye: Brightness Discrimination. C. H. Graham and E. H. Kemp. *J. General Physiology,* 1938, **21,** 635-650.

An investigation has been made of brightness discrimination as influenced by the duration of the increment in intensity, ΔI. Data are presented on intensity discrimination for seven durations of ΔI (0·002-0·5 second), and the results are related theoretically to the Bunsen-Roscoe law and to Hecht's theory (1935). The data are accounted for on Hecht's theory if it is assumed that brightness discrimination is determined by a constant amount of photolysis. C.

Human Body: Heat Loss from —. J. D. Hardy (and E. F. Du Bois). *Proc. Nat. Acad. Sci.,* 1937, **23,** 624-631, 631-637 (through *Sci. Abstr.,* 1938, A41, 181).

(1) Extensive observations of temperature, humidity, radiation, convection and vaporisation were made on two naked men during winter, spring and summer months in a large respiration calorimeter. The thermal conductance of the body tissue remained constant below 28° C., the body reacting to temperature changes in this region in much the same way as any warm inanimate object. (2) The human body is thermally equivalent to an elliptical, black, galvanised-iron cylinder, 50 cm. long, with axes of 18 and 30 cm. When lying stretched out with the hands close to the body, 78 per cent. of the total surface area of the human body is effective in heat loss. The loss increases with a fall in skin temperature when exercise is performed or air currents are played on the body. Under these conditions the heat loss is not proportional to the difference between skin and air temperatures. A depth of 2-3 cms. is involved in the thermal gradient from the internal tissue to the skin surface. Few materials have a higher thermal insulating power than living tissue. Superficial circulation plays little part in heat transfer at 23-28° C. Between 28 and 30° C. thermal conductance begins to increase with a corresponding increase of superficial blood flow. C.

Field Plots: Balanced and Random Arrangement. (1) " Student." (2) J. Neyman and E. S. Pearson. (3) E. S. Pearson. *Biometrika,* 1938, **29,** 363-379 ; 380-388 ; **30,** 159-179.

Student's paper (his last) is part of a controversy with R. A. Fisher, and advocates the use of balanced arrangements in co-operative agricultural trials at several centres, in preference to purely random arrangements. The other two papers set out " Student's " arguments and develop the thesis in algebraic terms. It is argued that balanced arrangements are likely to give smaller errors and a greater chance of detecting real effects, where they exist, than random arrangements. C.

Frequency Distributions: Approximate Normalisation. J. B. S. Haldane. *Biometrika,* 1938, **29,** 392-395.

The author discusses transformations of χ^2 and the variate of a binomial series that have distributions converging more rapidly to the normal as the size of sample increases than the untransformed variate. The transformations are intended to be used when expectations are small. C.

Non-normal Populations of Data: Sampling. G. B. Hey. *Biometrika,* 1938, **30,** 68-80.

Sampling experiments with four non-normal populations suggest that, for these populations, tests of significance of correlation and regression coefficients and ratios of variance, based on normal theory, are sufficiently accurate for practical purposes. The sampling and computation were done automatically with the aid of tabulating machines. C.

Non-normal Populations of Data: Sampling, Application of *z*-Test. R. A. Chapman. *Biometrika,* 1938, **30,** 188-190.

A sampling experiment shows that the distribution of Fisher's z for samples from a population described by a Poisson series with a mean of 1·0, is very similar to that derived from normal theory. C.

Normal Distributions of Data: Variability and Correlation Calculations. G. U. Yule. *Biometrika,* 1938, **30,** 1-10.

A discussion of the possibility of measuring variability and correlation from the sums and sums of squares of the frequencies in frequency distributions, without reference to the values of the variate. The method gives a good measure of variability but not of correlation. C.

Plant Breeding Research: Statistical Problems. Y. Tang. *Biometrika*, 1938, 30, 29-56.

Plant breeding involves (i) the production of new varieties and (ii) the testing of new varieties for quality. The testing of varieties requires field trials, and to decide how many replicate trials are necessary to make unlikely the rejection of varieties that are really of improved quality, it is necessary to know (among other things) the frequency distribution of the quality of varieties. The paper discusses how this may be estimated from past experience and how the results may be used in arranging trials. C.

Populations of Unequal Variance: Tests for Significance of Differences between Means. B. L. Welch. *Biometrika*, 1938, 29, 350-362.

Consideration is given to the effect on the *t*-test for the significance of the difference between two sample means, of the variances for the samples being different, and it is found that in some circumstances the criterion can be seriously biassed. When the ratio of the two population variances is known, allowance can be made for this bias, but when it is not known, another somewhat similar criterion, using the two sample estimates of variance rather than a common estimate as in the usual *t*-test, is less likely to give seriously biassed results. C.

Statistical Data: Fisher's *z*-Test; Generalization. D. N. Lawley. *Biometrika*, 1938, 30, 180-187.

A generalized form of Fisher's *z*-test is developed for testing composite hypotheses concerning the variances, co-variances and regression and correlation coefficients in groups of observations. C.

Statistical Data: Tests of Significance. E. S. Pearson. *Biometrika*, 1938, 30, 134-148.

The results of a number of independent tests of significance may be combined by regarding the probabilities for the separate tests as individuals from a rectangular population ranging from 0 to 1. Criteria developed from this idea by several writers are examined. C.

Statistical Data: Tests for Homogeneity. (1) E. J. G. Pitman. (2) B. L. Welch. *Biometrika*, 1938, 29, 322-335 ; 30, 149-158.

The usual tests for the significance of the excess of variance between groups over that within groups in a grouped sample, by means of Fisher's *z* or the correlation ratio, is made by regarding the sample as one from a normal population. An alternative test may be made by regarding the particular arrangement of the given individuals into groups as one of all the possible arrangements of those individuals. (1) Pitman deduces the first four moments of the sampling distribution of a criterion related to *z*, on this last assumption. (2) Welch deduces the mean and variance of a similar criterion and extends the results to finding the sampling distribution in samples from an infinite, non-normal universe. As a particular case he also suggests a method of testing a binomial series for homogeneity, when expectations are small and the χ^2 test does not apply. C.

Chinese Cottons: Breeding. Y. J. Chen. *Proc. Assoc. Econ. Biol. Coimbatore*, 1937 (1936), 4, 78 (through *Plant Breed. Abstr.*, 1938, 8, 215).

Earlier cotton breeding work in China is reviewed, the chief feature being the acclimatization of American cottons. The search for drought-resistant strains is an important problem of to-day. C.

Cotton Flower: Petalody. J. B. Hutchinson, R. L. M. Ghose and Ramanatha Ayyar. *Current Science*, 1937, 6, 99-100 (through *Plant Breed. Abstr.*, 1938, 8, 103).

A type of petalody previously reported to be a simple recessive is now found to be incompletely recessive, the heterozygotes having a quarter to half their stamens slightly petaloid. C.

Hybrid Cotton Plants: Effect of Pollination on Lint Length. E. H. Pressley. *Arizona Sta. Tech. Bul.*, No. 70, 1937, pp. 253-292 (through *Exp. Sta. Rec.*, 1938, 78, 777).

Observations are reported on the length and weight of lint from selfed seeds of Delfos, Red Acala and Pima cottons and from seeds obtained by applying pollen from Red Acala to Delfos or Pima, or vice versa. There did not appear to be any significant effect due to the pollen used but the heavier seeds, with one exception, gave the longer and heavier lint. C.

Indian Herbaceum Cottons: Breeding. V. Ramanatha Ayyar. *Proc. Assoc. Econ. Biol. Coimbatore,* 1937 (1936), **4**, 80-9 (through *Plant Breed. Abstr.,* 1938, **8**, 215).

Evidence is given that *G. herbaceum* is not a native of India. The prospects for *herbaceum* cottons are discussed and breeding experiments are urged. C.

Interspecific Cotton Hybrids: Breeding. M. Tanaka. *Mem. Coll. Agric. Kyoto,* 1937, No. 39, 1-7 (through *Plant Breed Abstr.,* 1938, **8**, 156).

Reciprocal crosses were made between *G. herbaceum* and *G. hirsutum* and immediately after pollination plants in one group were bound tightly with wire round the internode below the flower, another set were ringed at this point and deprived of other flower buds and apical growing point, and the remainder were left untouched, the object of the special treatments being to increase the supply of food to the pollinated flower. Both treatments, especially ringing increased the number of bolls that set. C.

Interspecific Cotton Hybrids: Breeding. N. N. Konstantinov. *C. r. Acad. Sci. U.R.S.S.,* 1937, **17**, 485-8 (through *Plant Breed. Abstr.,* 1938, **8**, 261).

Hybrids between *G. lanceoeforme* (*Thurberia thespesioides*) as male parent and *G. barbadense, G. peruvianum, G. hirsutum* and *G. arboreum* as female parents are described and the conclusion is drawn that *Thurberia thespesioides* should be included in the genus *Gossypium.* C.

Lintless Asiatic Cottons: Genetics. J. B. Hutchinson and P. D. Gadkari. *J. Genetics,* 1937, **35**, 161-175 (through *Plant Breed Abstr.,* 1938, **8**, 216).

Studies in the inheritance of lintlessness among Indian glabrous-lintless and hairy-lintless strains are reported. No satisfactory evidence of linkage was found for any " lintless " factors but there was some connection with leaf shape in the Punjab hairy-lintless forms. C.

Mysore Cottons: Breeding. V. N. Ranganatha Rao. *J. Heredity,* 1937, **28**, 311-6 (through *Plant Breed. Abstr.,* 1938, **8**, 156).

Two promising strains have been obtained by crossing *G. herbaceum* (Kumpta variety) with *G. arboreum.* One designated H.190 has a yellow corolla, broadly lobed leaf and green seeds, yield 300-350 lb. seed cotton per acre, ginning out-turn 30 per cent., and giving a good class cotton, $\frac{7}{8}$-1 in. staple, capable of being spun to 32's-35's. The other, Strain 19, has red corolla, green seeds, and ginning out-turn 30 per cent. C.

Micro-organism Wet-crushing Mill. V. H. Booth and D. E. Green. *Biochem. J.,* 1938, **32**, 855-861.

A mill is described for the wet-crushing of micro-organisms. The essential unit of the instrument is a special roller bearing, the inner race of which is tapered and is made to expand by forcing it on a tapered shaft. Each roller is tightly gripped between the races which it distorts. The pressure which causes this distortion tends to smooth out small scratches or inaccuracies on the contact surfaces and any material coming between roller and race must be crushed. All parts coming into contact with the grist are made of non-corrodible steel. A suspension of the micro-organism is circulated continuously through the mill by a pump. The minimum volume of fluid required to fill the mill, including pump to a level just above the rollers is 40 ml. Tests with yeast and *Bact. coli* show that efficient crushing takes place in a relatively short period. The enzymes extracted are described. C.

Potato Starch: Zymolysis. K. Myrbäck, B. Ortenblad and K. Ahlborg. *Compt. rend. Trav. Lab. Carlsberg,* 1938, **22**, 357-365 (through *Brit. Chem. Abstr.,* 1938, AII, 174).

When amylase acts on starch, maltose and the so-called " limit dextrins " are formed. These are non-hydrolysable parts of the starch molecule. Probably none has been obtained pure. A series of nine fractions obtained by the action of taka-diastase on potato starch is described. They differ in molecular weight, percentage of P, and amount of glucose formed on hydrolysis. Fractions with low mol. wt. give bromoacetyl derivatives that yeild only traces of maltose hepta-acetate on hydrolysis, so that they are not composed of maltose units. C.

Glass Electrode: Temperature Effect. A. A. Smirnov. *J. allg. Chem.* (*Russia*), 1937, **7**, 796-807 (through *Physikal. Ber.*, 1938, **19**, 1445).

The effect of temperature on the difference in potential between the calomel electrode and the glass elctrode has been examined. The glass electrode is shown to behave as a reversible H-electrode and capable of measuring *p*H at temperatures up to 60°. The potential of the glass electrode rises with temperature. An equation connecting *p*H with temperature, etc., is established. C.

Glass Electrode: Theory. B. P. Nicolsky. *J. phys. Chem.* (*Russia*), 1937, **10**, 495-503, 504-512 & 513-523 (throngh *Physikal. Ber.*, 1938, **19**, 1445-6).

(1) A thermodynamic theory of the glass electrode is developed. (2) The effect of B and Al oxides on the electrode properties of glass is described. (3) The transformation of the H-ion function of the glass electrode into that of the Na-ion on raising the *p*H is discussed. C.

Atmospheric Ozone: Concentration and Measurement. F. A. Paneth and J. L. Edgar. *Nature*, 1938, **142**, 112-113.

A method for the determination of ozone depends on condensation by silica gel at liquid air temperature and recovery by distillation. If distillation is performed at −120° C. nitrogen peroxide is held back and can be determined separately. The ozone is then determined by (1) titration with potassium iodide and starch or (2) collecting it in a glass tube with quartz windows and measuring its absorption of ultra-violet light. At least 500 litres of air should be condensed. The mean ozone content of the London atmosphere is $1 \cdot 1 \times 10^{-6}$ vol. per cent. C.

Amino Acids: Manometric Determination. M. F. Mason. *Biochem. J.*, 1938, **32**, 719-724.

A manometric method for determining amino-acids depends on their decarboxylation when heated with ninhydrin in aqueous solution. The apparatus consists of a combustion tube and condenser used in conjunction with the Van Slyke-Neill manometric gas machine and an Ostwald-Van Slyke pipette. Results of analyses of 24 common amino-acids and of a series of peptides are given in tables. Of the acids, all yielded one mol. CO_2 except aspartic and cystine which yielded two and alanine, serine and tryptophan which evolved slightly less than one. Peptides did not react unless they had free adjacent α-amino and carboxyl groups. C.

Formaldehyde: Determination. J. M. Hambersin. *Bull. Soc. chim. Belgique*, 1937, **46**, 519-524 (through *Chem. Zentr.*, 1938, i, 2924 ; *Chem. Abstr.*, 1938, **32**, 2870[4]).

The colour reaction between formaldehyde and the naphthols in the presence of sulphuric acid has been studied. For the determination of traces the author recommends mixing 100 c.c. of saturated β-naphthol, about 5 mg. of formaldehyde and 25-30 c.c. of concentrated sulphuric acid, and weighing the pink precipitate. The compound appears to be an acetal and the equivalent amount of formaldehyde is one-tenth the weight of the precipitate. C.

Maize Starch: Determination in Wheat Flour. G. Brückner and B. Thomas. *Z. ges. Getreide-, Mühlen-, und Bäckereiwesen*, 1938, **25**, 34-39 (through *Chem. Zentr.*, 1938, i, 3554).

Methods for the detection of maize starch in wheat flour include gelatinisation with $0 \cdot 16 \cdot N$ potassium hydroxide which leaves maize starch unchanged. Details are given of a biuret test for colorimetric determinations. The alcoholic extract of pure maize starch gives a dark bluish-violet colour and that of pure wheat starch a pale yellowish-green colour. Additions of maize starch up to 12 per cent. can be determined in steps of 1 per cent. C.

Tyrosine and Tryptophan: Determination in Protein Hydrolysates. J. W. H. Lugg. *Biochem J.*, 1938, **32**, 775-783.

Errors in the determination of tyrosine and tryptophan in the products of acid and alkaline protein hydrolyses are discussed, namely, (1) failure to liberate the amino-acids completely from the original combinations, (2) destruction or modification of the amino-acids by the hydrolysing reagent or by other substances during liberation and (3) destruction or modification of the amino-acids subsequent to their liberation. Experimental work was carried out to investigate thoroughly the last class of errors. Tyrosine is practically unaffected by digestion for 20-30 hr. at 100° in 7 *N* sulphuric acid, 5 *N* caustic soda and alkaline stannite solutions. With the addition of carbohydrate there is considerable loss of tyrosine in acid digests but no appreciable loss in alkaline digests. Tryptophan is much more stable when digested with acid than is commonly believed. With alkali there is less extensive modification and the indoles produced can be extracted apparently completely with ether or toluene at *p*H 7-14. There is almost complete loss of tryptophan when it is heated in acid solution with much carbohydrate. C.

Cellulose: Action of Sodium Sulphide on —. I. Sakurada and J. Matusita. *Bull. Inst. Phys. Chem. Res., Japan,* 1937, **16**, 1437-1441 (through *Brit. Chem. Abstr.*, 1938, AI, 181).

The X-ray diagram of cellulose is unaltered by the action of 15 per cent. sodium sulphide at room temperature. With a saturated solution (18·5 per cent., weight) the diagram corresponds with that of a mixture of Na-cellulose I and native cellulose. On washing the product with alcohol the mixture changes to Na-cellulose III′ and cellulose, and on washing with water to hydrated and native cellulose. Cellulose hydrate and 18·5 per cent. sodium sulphide give Na-cellulose I. C.

Cellulose: End-group Determination and Structure. K. Freudenberg and E. Plankenhorn. *Naturwissenschaften,* 1938, **26**, 124 (through *Chem. Zentr.*, 1938, i, 3776 and *Brit. Chem. Abstr.*, 1938, AII, 175).

A methylcellulose with 44·0 per cent. methoxyl, from unbleached ramie, gave 0·05 per cent. of tetramethylglucose. On further methylation under liquid ammonia to a product with 45·0 per cent. methoxyl, the yield of tetramethylglucose was not quite 0·2 per cent., but the viscosity was very much reduced. The end-group values indicate that the cellulose had been degraded from a chain-length of 2,000 to 500, but according to Staudinger cellulose derivatives of chain length 500 should still be highly viscous. Cellulose appears to consist of aggregates of looped macromolecules. C.

Cellulose: Acetate: Solubility. S. Papkov, V. Kargin and Z. Rogovin. *J. Phys. Chem. Russia,* 1937, **9**, 156-7 ; **10**, 607-619 (through *Brit. Chem. Abstr.*, 1938, AI, 24, 189).

The phase rule is applied to solutions of cellulose acetate. With chloroform and with methylene chloride cellulose acetate forms two liquid pairs, and the critical temperature of dissolution is about 57°. Cellulose acetate is deposited as a solid phase on cooling its solutions in nitrobenzene, methyl propyl ketone, methyl ethyl ketone, methyl alcohol, benzene, and ethyl acetate, the critical temperatures being 80°, 115°, 25°, 120°, 210° and 10°, respectively. It separates as a gel from phenylethyl alcohol. Swollen cellulose acetate is a solution of the solvent in the solid. C.

Wood: Bleaching with Hydrogen Peroxide. W. G. Campbell and G. Swann. *Biochem. J.*, 1938, **32**, 702-707.

In the bleaching of wood by hydrogen peroxide in the presence of ammonia or dilute caustic soda the order of events observed was as follows: (1) darkening of the wood followed by the leaching out of a dark-coloured extract, (2) the simultaneous bleaching of the wood and the extract with evolution of gas. In no case did the extract finally become colourless nor did the wood assume its palest shade of colour until after it had been thoroughly washed with water. The bearing of the work on the chemistry of wood is discussed. C.

Wood Cellulose: Methylation. D. J. Bell. *Biochem. J.*, 1938, **32**, 699-701.

Thiriena pulp, a mild sulphite-bleach pulp from soft woods, has been methylated to form a trimethylcellulose with more than 43 per cent. of methoxyl. Over 90 per cent. of the product was transformed into simple glucosides by hydrolysis with methyl alcoholic hydrochloric acid at 80° ; the only cleavage product identifiable was 2:3:6-trimethylglucose. The author therefore agrees with Barsha and Hibbert that wood celluloses do not contain any appreciable amount of material defying complete etherification or cleavage, but he claims that the complete identification of cotton and wood celluloses remains still an open question. C.

Limit Dextrins and Starch: Constitution. K. Myrbäck. *Svensk Kem. Tidskr.*, 1937, **49**, 271-4 (through *Brit. Chem. Abstr.*, 1938, *A.II*, 221).

When treated with acetyl bromide and acetic acid and then with silver carbonate in ether, Zulkowski starch and maltose give maltose hepta-acetate in good yield but " limit dextrins " do not. The part of the starch molecule that furnishes limit dextrins is therefore not formed from maltose residues. C.

Starch and Dextrin: End-group Determination and Structure. K. Freudenberg, H. Boppel and M. Meyer-Delius. *Naturwissenschaften*, 1938, **26**, 123 (through *Brit. Chem. Abstr.*, 1938, A.II, 175).

Methylation of unbleached native starch with sodium and methyl iodide in liquid ammonia gave a derivative with 44·5 per cent. methoxyl that yielded 1 per cent. of tetramethylglucose and 6 per cent. of dimethylglucose on hydrolysis. The chain-length of starch, is therefore, 80-100 units. Schardinger's α-dextrin gave a methyl derivative with 45·5 per cent. methoxyl but this yielded only 2:3:6-trimethylglucose on hydrolysis. C.

Starch Paste: Preparation with Dextrin Solution. F. Ohl. *Gelatine, Leim, Klebstoffe*, 1938, **6**, 3-6 (through *Chem. Zentr.*, 1938, i, 4138).

To reduce the consistency of farina paste the author recommends using a boiling 2-5 per cent. solution of dextrin instead of water. C.

Sericin: Composition. T. Ito and K. Komori. *Bull. Agric. Chem. Soc. Japan*, 1937, **13**, 115-6 (through *Chem. Zentr.*, 1938, i, 4253; *Chem. Abstr.*, 1938, **32**, 3160).

Raw silk contains 20-25 per cent. of sericin that can be extracted by hot water. Ammonia is evolved, the more the higher the temperature and longer the treatment; 100 gm. of cocoons gave 174·8 mg. NH_3 when boiled for 8 hours at 110°. The aqueous solution is resolved into two fractions when adjusted to *p*H 3·6-3·8; sericin B is precipitated and sericin A remains in solution and can be precipitated by alcohol. C.

Raw Silk Sericin: Fixation by Chromium Salts. M. Oku and Z. Hirose. *Bull. Agric. Chem. Soc. Japan*, 1937, **13**, 121 and 1938, **14**, 14-15 (through *Chem. Zentr.*, 1938, i, 4253).

The absorption of Cr from the basic sulphate (cationic Cr) and the basic oxalato-chromiate (anioic Cr) by α- and β-sericin powder is investigated. [α-Sericin is the fraction that is precipitated at *p*H 3·8; other workers call it sericin B.] Freundlich's adsorption isotherm is followed. The products are more resistant to water than the free sericins. Sericin on the silk fibre adsorbs more Cr and becomes more resistant to water than isolated sericin powder. C.

Drying Oils and Resins: Polymerisation. T. F. Bradley. *Indust. Engng. Chem.*, 1938, 30, 689-696.

General concepts about polymerisation are discussed and their mathematical treatment is applied to the chemistry of the heat-thickening processes of tung and linseed oils. In both cases the loss of unsaturation and increase in molecular weight conform most closely to the theory for a hexa-functional system. The agreement of observed and theoretical values for tung oil is attributed to the absence of intramolecular or other extraneous reactions. With linseed oil and " superheated " tung oil, the evidence demonstrates that intramolecular additions, which may in some cases originate concurrently with the polymerisation or, more usually, as a result of depolymerisation, and thermally induced partial hydrolysis, are prominent and proceed concurrently with the polymerisation in varying degree in accordance with the conditions of the processing treatment. Determinations of iodine number and molecular weight should both be included in the examination of heat-thickened drying oils. The observed analytical values of processed drying oils should not be referred to such a complex function as the over-all viscosity of these concentrated polymeric species but rather to their average molecular weights or the viscosity constant at extreme dilution. C.

Long-chain Molecules: Elasticity. H. Mark. *Österr. Chemiker Ztg.*, 1937, **40**, 321-7 (through *Chem. Zentr.*, 1938, i, 3453).

The high, reversible elasticity of rubber-like materials is regarded as a statistical effect and traced to the presence of very long, flexible fibre-molecules with sufficient internal mobility. The discussion is based on thermodynamic principles and appears to be an extended version of a letter published in *Nature.* C.

Formaldehyde-protein System: X-ray Pattern. G. L. Clark and R. Rowan. *Science*, 1938, **87**, 487.

The action of formaldehyde on proteins was observed by X-ray diffraction methods. Two new interplanar spacings corresponding to the values 2·6 and 3·9 A. were given by fibrous proteins characterised by ready swelling in alkali (feather, hair and tendon) but not by proteins that are relatively inert to alkali, such as silk. The new interferences were interpreted as due to reaction at the amide nitrogen but they could be accounted for by polymerisation of formaldehyde retained in the protein. C.

Bibliography on the Chemistry of Wool. A. L. Smith and M. Harris. *Amer. Dyes. Rep.*, 1938, **27**, P363-P392.

Conclusion of bibliography (*see* also *J. Text. Inst.*, 1938, A457). W.

Notes on Procedures for Assessing the Biological Activity of Mineral Oils. C. C. Twort and J. M. Twort. *Oil & Co. Tr. J.*, 1938, **94**, 251-254 and 315-318.

The physical characteristics of mineral oils, e.g. specific refractivity and viscosity are discussed in relation to their carcinogenic and dermatitic activities. W.

Separation of Magnesium from Sodium and Potassium with "Triton B." T. Krokovski. *Z. anal. Chem.*, 1938, **112**, 183-186 (through *Chem. Abs.*, 1938, **32**, 4464).

Triton B (Röhm and Haas) is a solution of organic quaternary ammonium base. It will serve to precipitate $Mg(OH)_2$, which can be filtered off and the filtrate tested for Na and K. For qualitative analysis, it is more satisfactory than $Ba(OH)_2$, because NH_4 salt is decomposed by boiling, so that the precipitation will take place at the boiling point of the solution without previous removal of NH_4 salt. It is better in such cases not to add all the reagent at one time but to add it in portions followed by boiling. W.

Phosphoric Acid Deficiency in Some Fibre Plants. W. Schropp. *Phosphorsaure*, 1937, **6**, 163-168 (through *Soils and Fertilisers*, 1938, **1**, No. 1, p. 32).

Pot tests with flax, hemp and jute, drawing attention to the need of P fertilisers for these plants on many German soils. L.

The Influence of Potassium and the Anions of Potash Salts on the Development of the Fibre Cells of Flax. K. Schmalfuss. *Ernahr. Pflanze*, 1938, **34**, 100-3 (through *Chem. Abs.*, 1938, **32**, 3883).

The results of Alten and Goeze and of Tobler were confirmed (cf. *C.A.*, **30**, 1936, and *C.A.*, **29**, 271). The K in the fertiliser increased the succulence of the cells. Growth and cell structure were better with the sulphate than with the chloride. L.

Proteins in Preserved Hevea Latex. C. Bondy and H. Freundlich. *India Rubber J.*, 1938, **95**, 513-516.

Two proteins, differing in isolectric point and solubility in water and 70 per cent. of alcohol, were isolated from the serum of preserved latex. C.J.W.

10—ECONOMICS

Indian-East African Cotton Trade. *Indian Textile Journal*, 1938, **48**, 281.

Cotton production figures for the three British East African territories, Kenya, Uganda and Tanganyika, for the years 1931-1937, and Indian import figures for East African cotton during the same period are given. The estimated production in 1937 was 346,000 bales of 400 lb. each and further increases, possibly up to 1,000,000 bales per annum, are expected in the future. About

80 per cent. of the output is produced in Uganda. India imports a high percentage of the British East African crop, the 1937 figure being 84·1 per cent. It is pointed out that these import figures are sufficient to justify a demand for concessions in the form of preferential duties on and large quotas for Indian textile imports into the East African territories. Imports of African cotton by the United Kingdom are insignificant compared with those of India but exports of piecegoods from the United Kingdom to East Africa are disproportionately larger. Agitation for a trade treaty to secure increased trade in Indian textiles and other goods or a direct co-ordinated effort for capturing the East African piecegoods and other markets for India is urged. C.

Rayon Yarn and Staple Fibre: World Production. *Rayon Organon,* 1938, **9**, 90-92.

Tables of rayon production show figures for all producing countries and total world supply for (1) rayon yarn production in thousands of pounds from 1890-1937 ; (2) yarn production by process in per cent. 1929-1937 ; (3) rayon staple fibre production in thousands of pounds, 1929-1937 ; (4) rayon yarn and staple fibre production in thousands of pounds, 1929-1937. Graphs are given for the principal countries and the total world production. C.

American Cotton Prices: Forecast. *Textile Weekly,* 1938, **22**, 144-147.

A graph of monthly cotton prices from 1929 to 1938 is given and factors affecting the market for the 1938-39 season are discussed. The 1937 crop suffered the smallest amount of damage for any year since 1914 when estimates of damage were first tabulated. (The U.S. Department of Agriculture table is reproduced.) Consequently, the yield per acre, 267 lb., was the highest on record. C.

Textile Price Indices, June, 1938. W. H. Slater. *Textile Weekly,* 1938, **22**, 129.

The index numbers for June are: Raw cotton, American 65·05; Egyptian 68·50; Cotton yarns, American 106·8; Egyptian 96·9; Cotton piece goods, 116·3; " All cottons " 98·5; Wool group 124·6; Other textiles 72·2; All commodities 119·8 (1913=100). A downward trend is noted in all items. C.

New Linen Thread Works. *See* Section 2G.

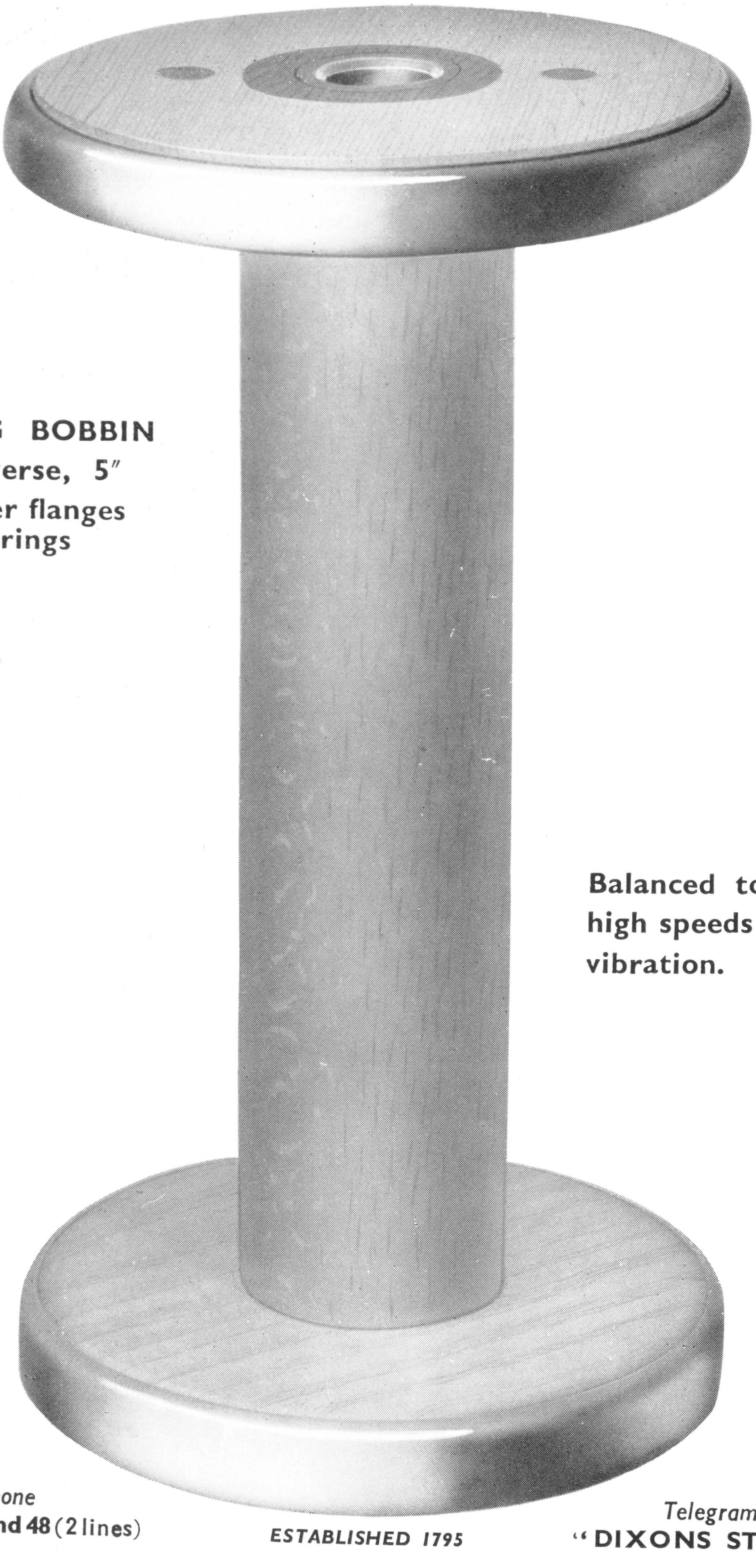
11—INDUSTRIAL WELFARE, INDUSTRIAL PSYCHOLOGY, AND EDUCATION,

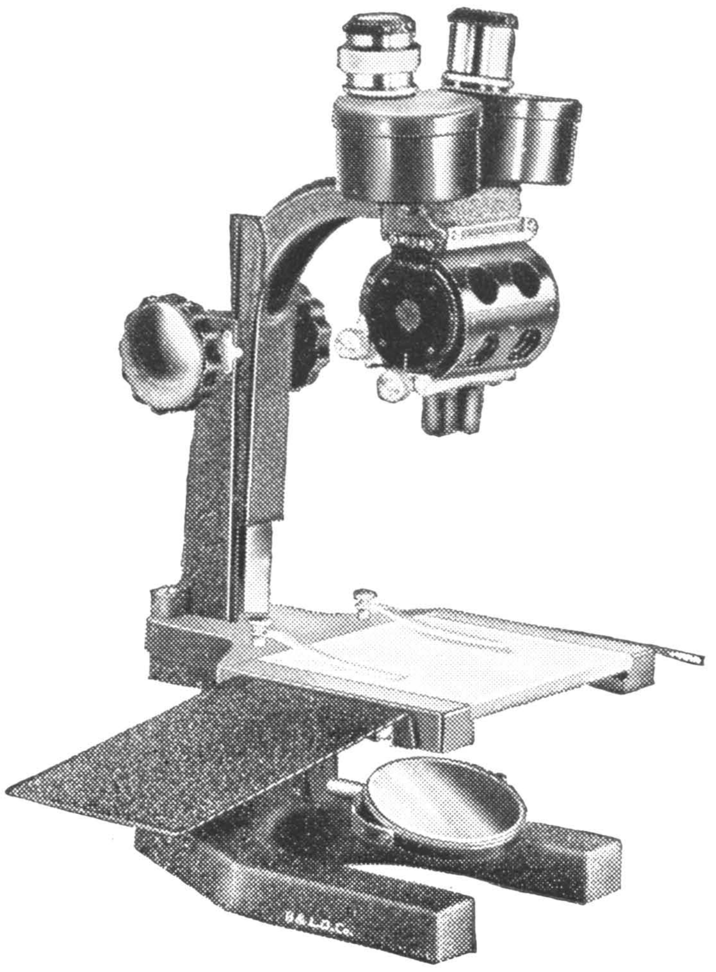
American Textile Trade Associations: Activity. *Cotton (U.S.).*,1938, **102**, No. 5, 63-83, 141-145.

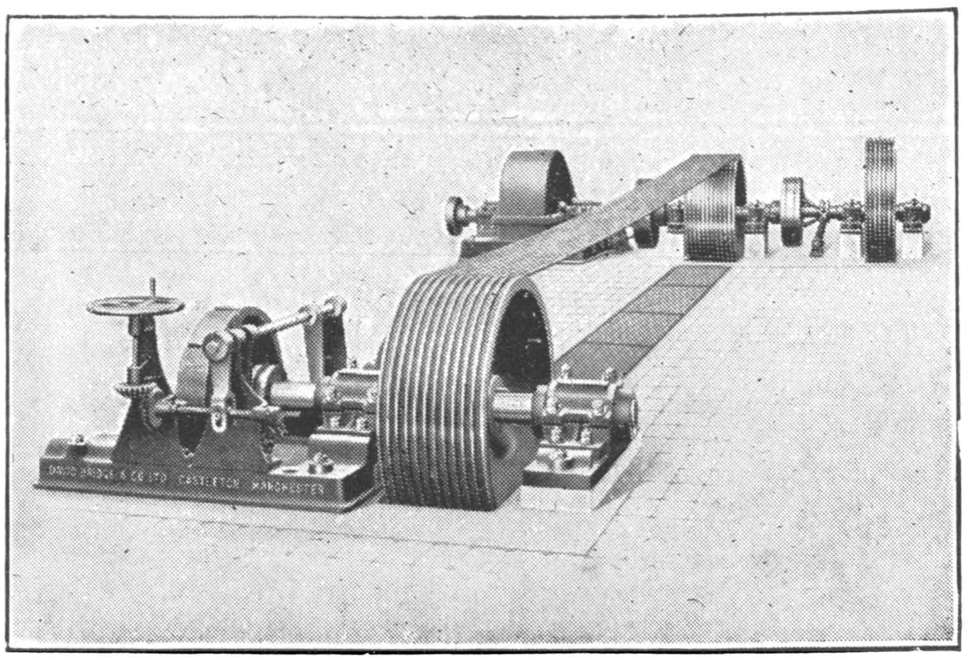
Particulars are given of the organisation and activities of the following bodies:—Cotton-textile Institute, by C. T. Murchison (p. 63); American Cotton Manufacturers' Association, by W. M. McLaurine (p. 65); National Association of Cotton Manufacturers, by R. T. Fisher (p. 67); Southern Textile Association, by E. M. Holt (p. 69); Association of Cotton Textile Merchants, by W. R. Bell (p. 70); American Association of Textile Chemists and Colorists, by A. Eavenson (p. 71); National Association of Wool Manufacturers, by A. Besse (p. 74); Durene and Mercerisers' Associations of America, by D. Hill (p. 76); National Federation of Textiles, Inc., by G. H. Conze (p. 77); National Rayon Weavers' Association, by C. W. Dall (p. 78); United States Institute for Textile Research, Inc., by C. H. Clerk (p. 80); National Association of Hosiery Manufacturers, by E. Constantine (p. 141); Underwear Institute, by R. A. Cheney (p. 143); and National Knitted Outerwear Association, by H. R. Lhowe (p. 145). C.

Zurich Polytechnic Textile Department: Equipment. E. Honegger. *Revue Textile,* 1938, **36**, 169-183.

A short account is given of the equipment of the textile section of the Ecole Polytechnique Fédérale de Zurich, and the nature of the training provided is briefly discussed. The section comprises a textile testing laboratory, a machine room, and a museum containing a collection of apparatus and textile products of general interest. C.



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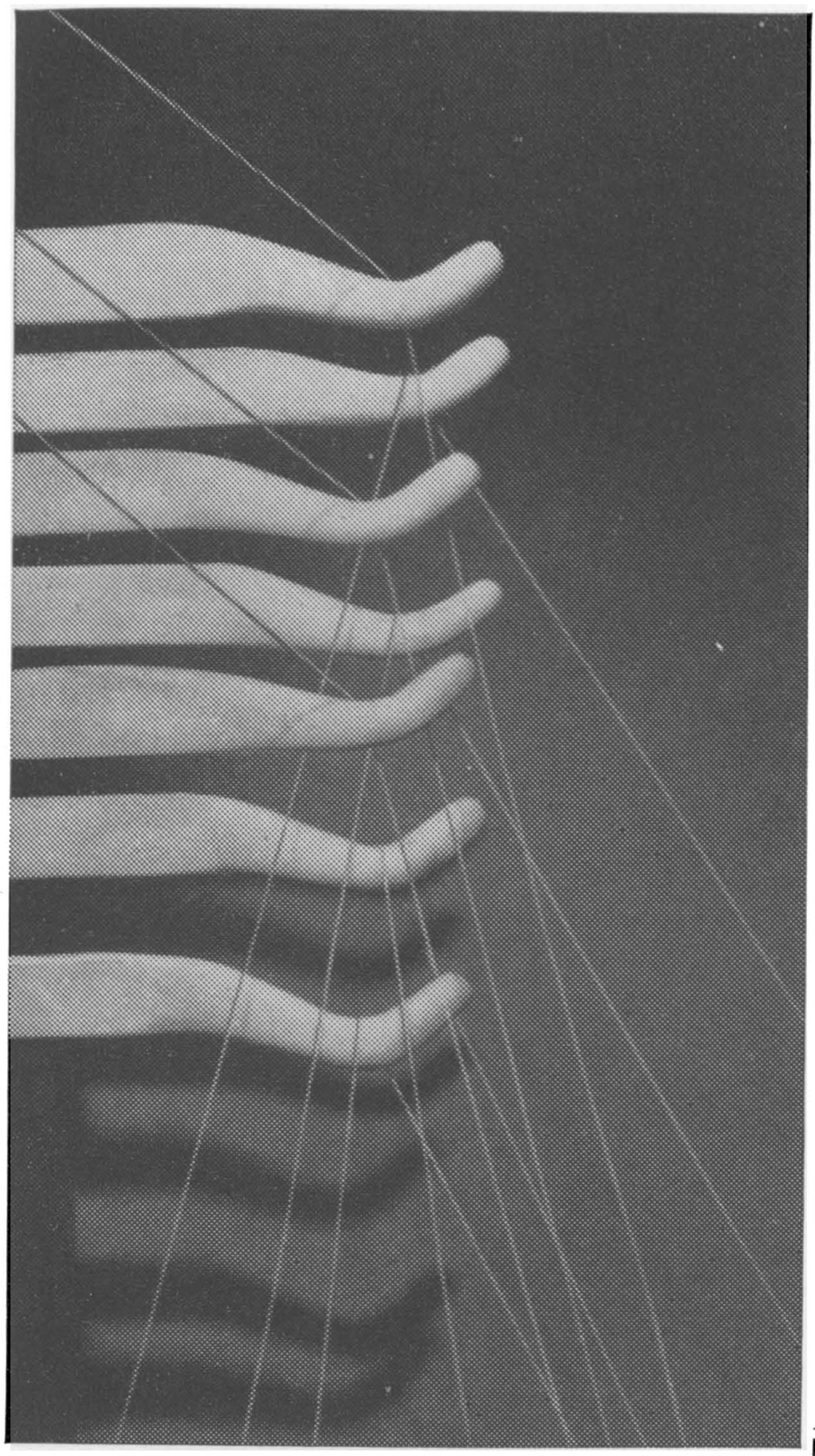

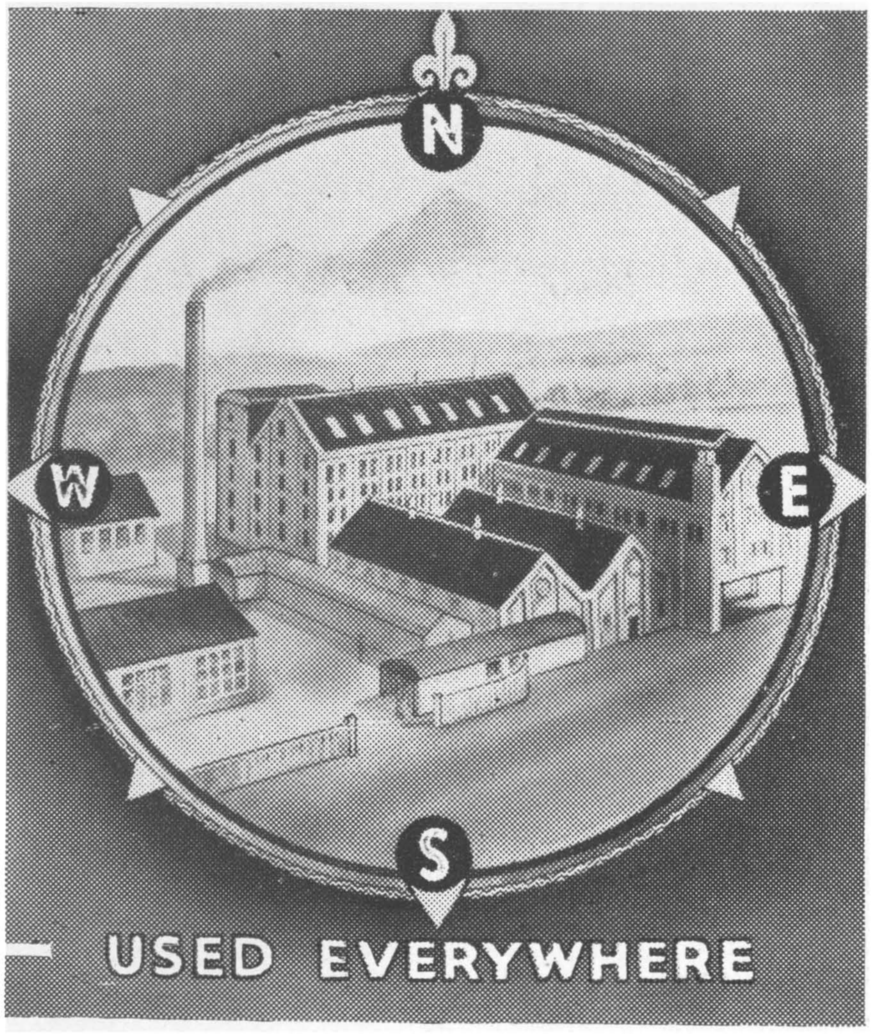
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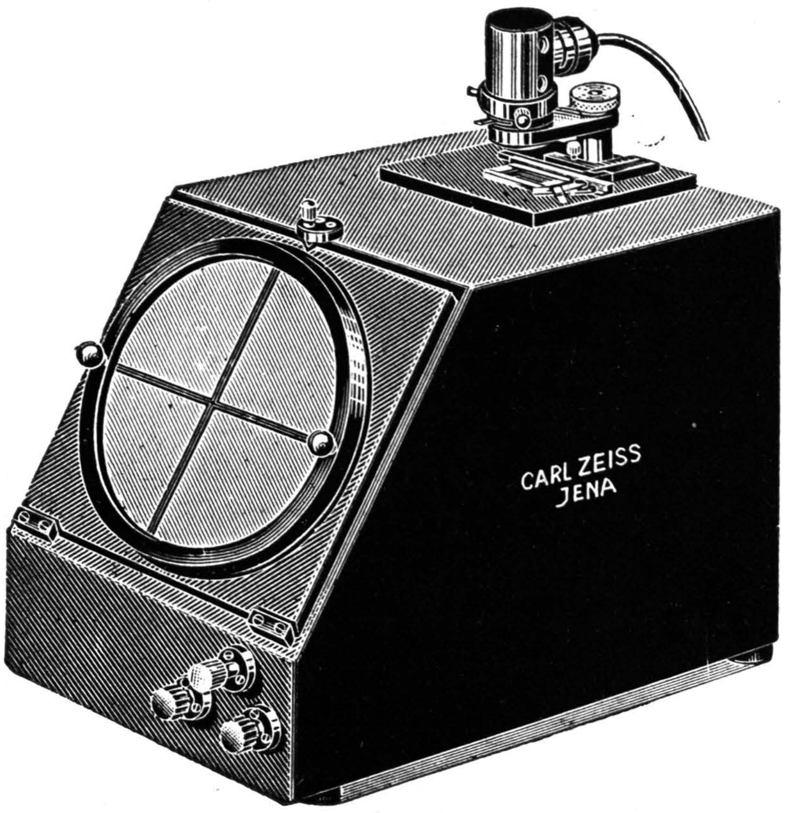

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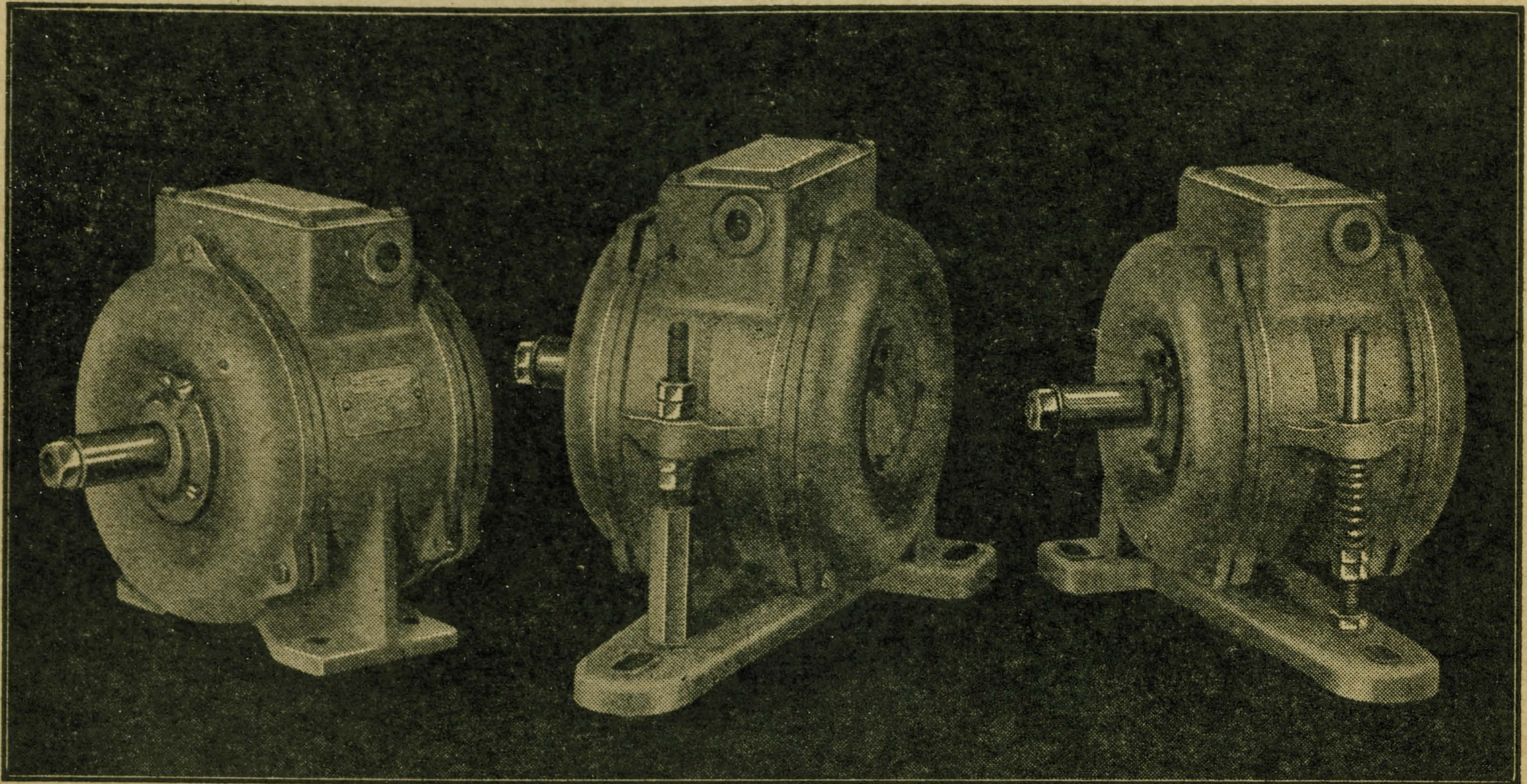

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