Vol. XXVIII No. 11 NOVEMBER 1937

The Journal of the TEXTILE INSTITUTE

Official Journal for Communications (Transactions) released for Publication by the British Cotton Industry Research Association (including its Rayon and Silk Sections), the Wool Industries Research Association, the Linen Industry Research Association and the Technological Laboratory of the Indian Central Cotton Committee

P-83
Biblioteka Główna

THE TEXTILE INSTITUTE
ST. MARY'S PARSONAGE, MANCHESTER

FOR
PERMANENT
WHITES

LAPORTE'S HYDROGEN PEROXIDE

ALL STRENGTHS INCLUDING
THE CONCENTRATED QUALITY

also

SODIUM PERBORATE
and SODIUM SULPHIDE

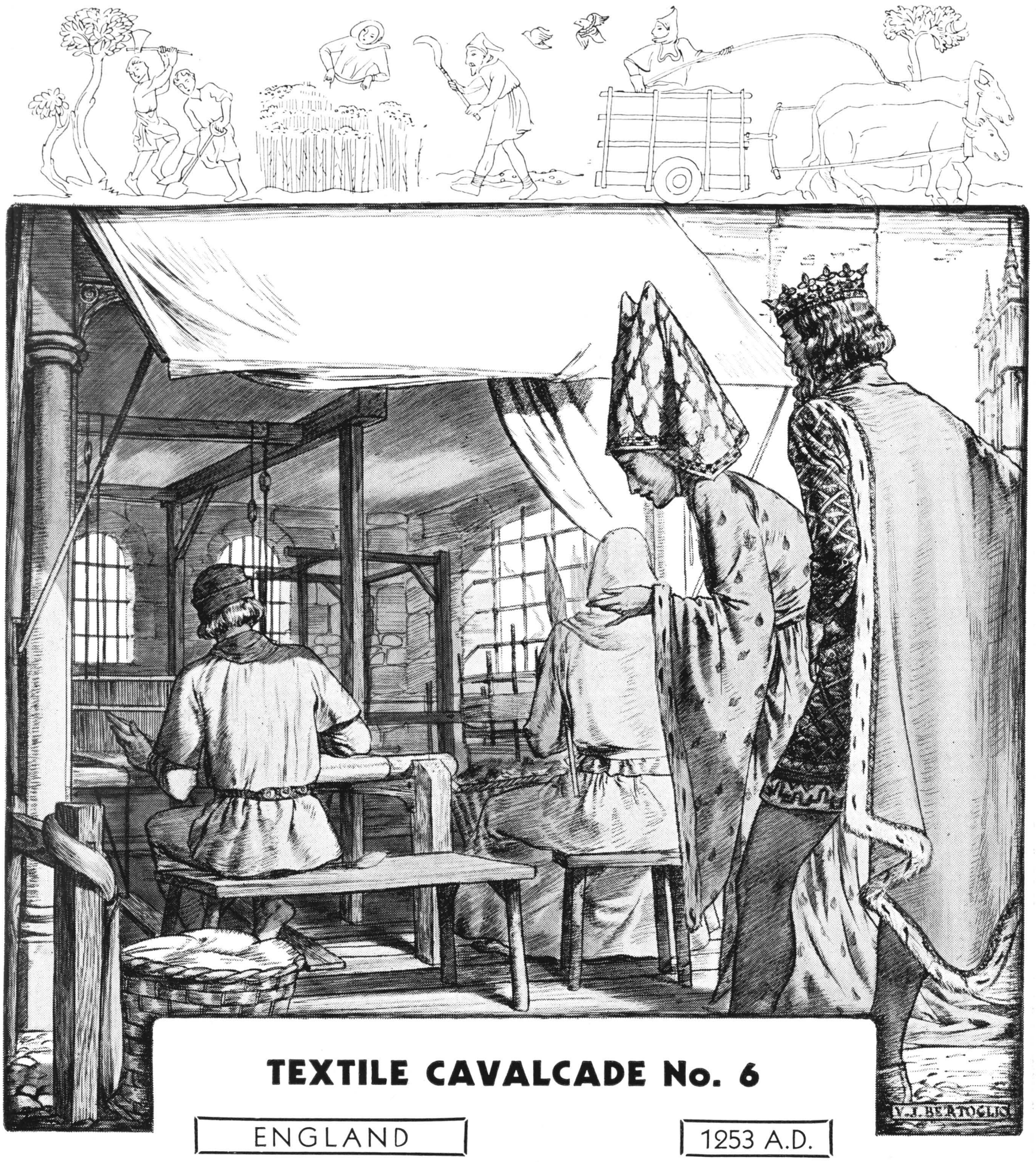
TELEGRAMS:
LAPORTE,
LUTON

B. LAPORTE LTD., LUTON

TELEPHONE:
LUTON 891

Lancashire Representative:

Mr. R. P. DELANEY, "Arundel," Higher Knutsford Road, Grappenhall, Warrington



TEXTILE CAVALCADE No. 6

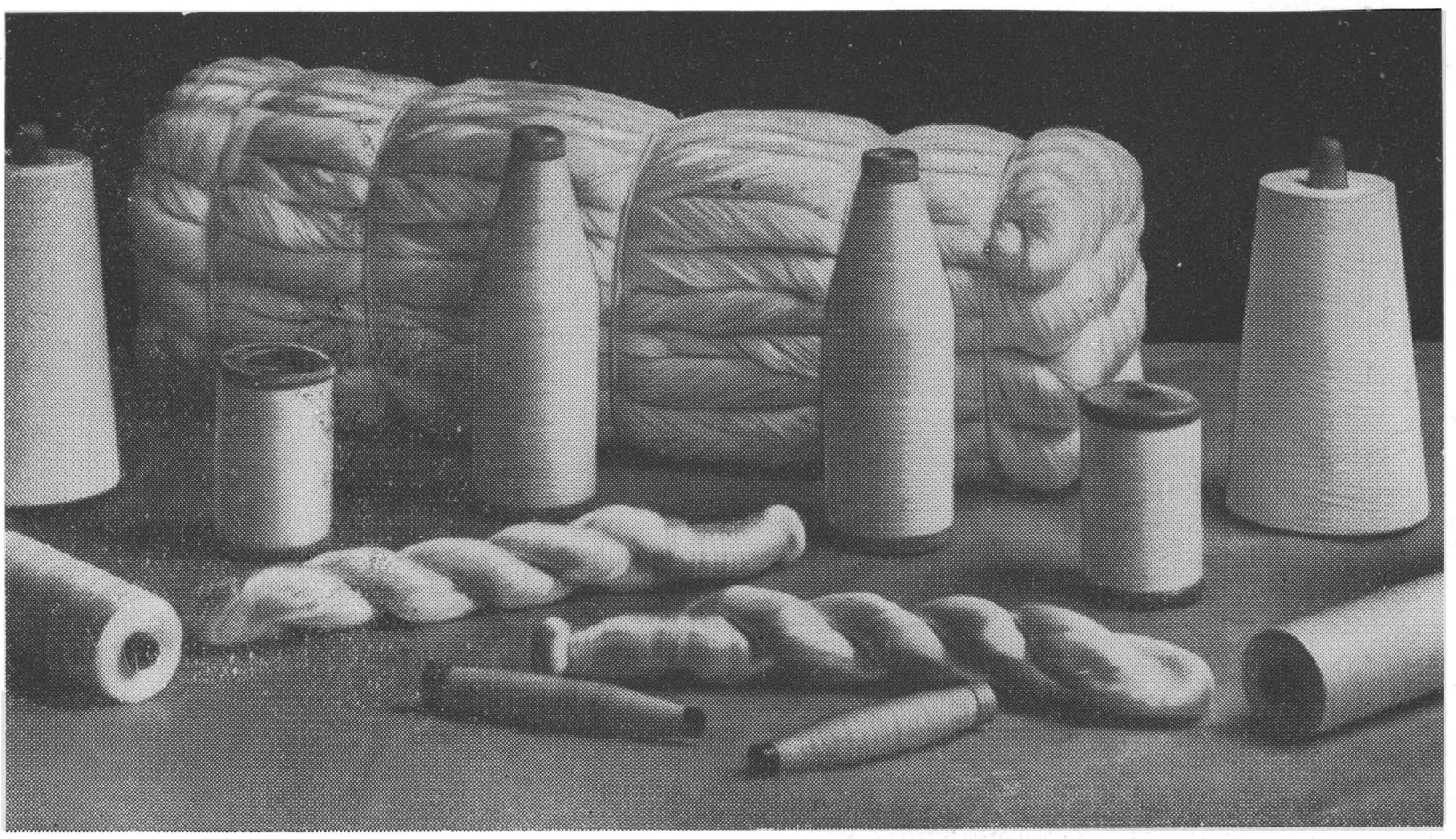
ENGLAND | 1253 A.D.

The reign of Henry III has been called a reign of misrule. Yet historians are agreed that Henry left two magnificent memorials to his name — one the re-building of Westminster Abbey — the other the beginning of the linen Industry here. For in 1253 Henry brought linen weavers from Flanders to England, established them under Royal protection and thus added another branch to our great Textile Industries.

'Celanese' Yarn
TRADE MARK
The Modern Textile for Modern Methods

Sole Manufacturers of 'Celanese' Yarns and Fabrics and Proprietors of the Trade Mark 'Celanese' : British Celanese Limited, London, W.1.

FROST'S



SILK YARNS

WM. FROST & SONS LTD.

SILK THROWSTERS : SINCE 1858

PARK GREEN MILLS, MACCLESFIELD

Phone : **Macclesfield 2284** (3 lines). *Grams :* **"Frost, Macclesfield."**

Representatives

Mr. C. MITCHELL SMITH, Tower House, Rothley, Leicestershire. *Phone :* **Rothley 192.**
JOHNSTON WATT & ADAM, 82, Union Street, Glasgow, C.1. *Phone:* **Central 168.**
GEO. WIGLEY & SONS LTD., Warser Gate, Nottingham. *Phone :* **41094.**

THE JOURNAL *of the* TEXTILE INSTITUTE

CONTENTS FOR NOVEMBER 1937

PROCEEDINGS SECTION Pages

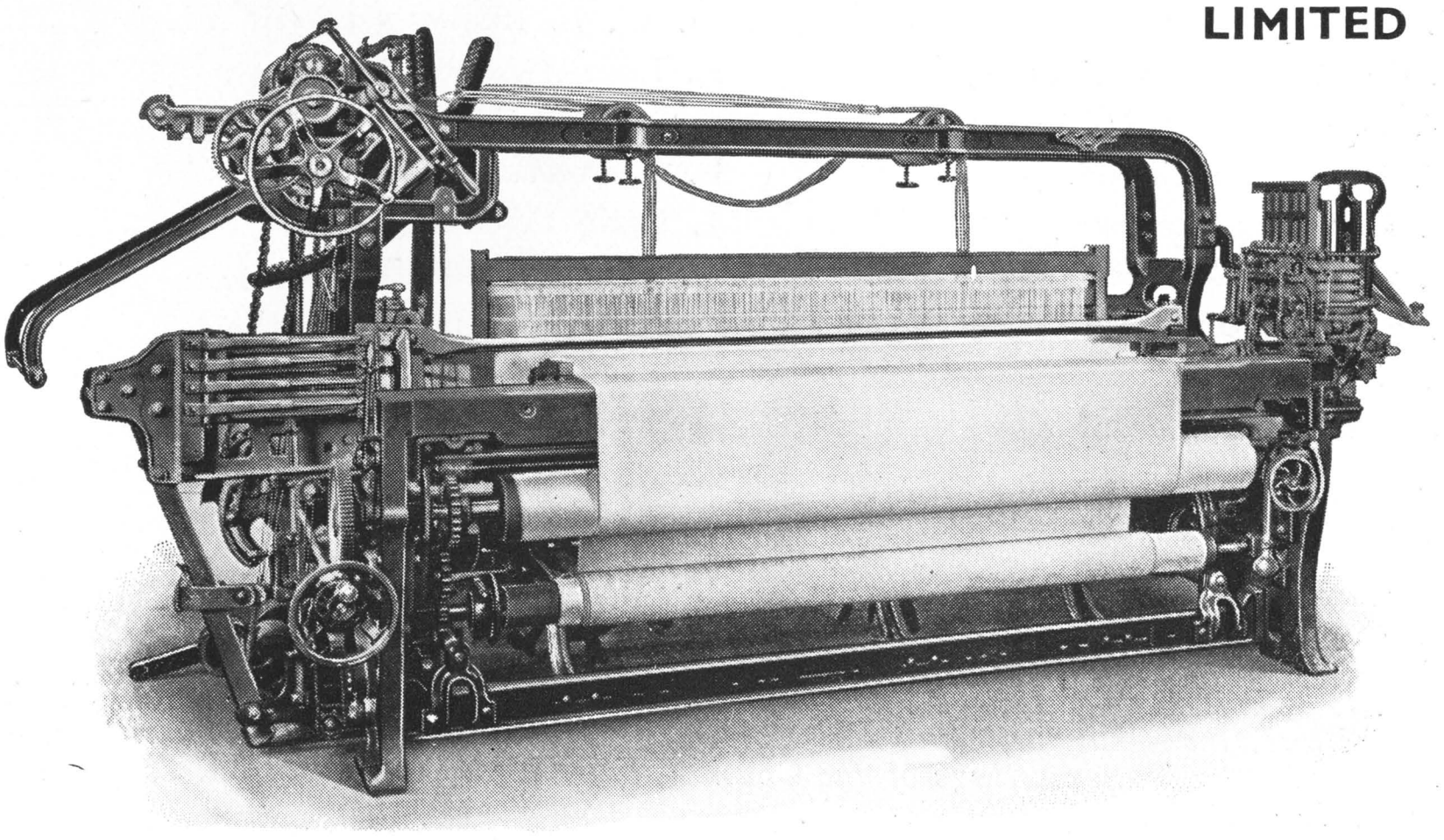
Notes and Announcements ... ... P377—P380
Lancashire Section ... ... P381—P390
Irish Section ... ... P390—P392
Scottish Section P393
Midlands Section... ... ... P393—P394
Correspondence ... ... P394—P398
Reviews ... ... P398—P400

TRANSACTIONS SECTION

21—The Effect of Twist on the Strength and Length of Fibre—*Navkal and Ahmad* ... ... T307—T338
Correspondence ... ... T339—T340

ABSTRACTS SECTION ... ... A593—A672

HUTCHINSON, HOLLINGWORTH & CO., LIMITED



Dobcross, Hollingworth & Knowles Fast Running Loom for Woollens and Worsteds, with 4 x 1 Colour Bobbin Changing Automatic Features.

The Dobcross Loom Works, DOBCROSS, Yorks.

THE TEXTILE INSTITUTE

Head Offices—16 St. Mary's Parsonage, Manchester 3

Office Hours 9 a.m. to 5.30 p.m. Weekdays. 9 a.m. to 12 noon Saturdays.

Telephone **BLACKFRIARS 2016, MANCHESTER**

OFFICERS

President JOHN CROMPTON, O.B.E., F.T.I.

Past Presidents

LORD ROTHERHAM, 1910-12*
Sir WILLIAM PRIESTLEY, 1913-14*
Sir WILLIAM MATHER, 1915-17*
Sir FRANK WARNER, 1918-19*
Sir HERBERT DIXON, 1920*
Col. F. R. McCONNEL, 1921
JOHN EMSLEY, J.P., 1922-26
WM. HOWARTH, J.P., 1926-29*
Lieut.-Col. B. PALIN DOBSON, 1929-31*
GEO. GARNETT, J.P. 1931-33
Sir W. CLARE LEES, O.B.E., J.P. 1933-34
Sir THOMAS ROBINSON, K.B.E., J.P., 1934-35
WILFRED TURNER, J.P., F.T.I., 1935-37.

*Deceased

Vice-Presidents

F. W. BARWICK
H. BINNS
W. KERSHAW
J. H. LESTER
F. NASMITH
S. E. WARD
W. H. WEBB

Chairman of Council H. JAQUES
Vice-Chairman of Council W. KERSHAW
Honorary Secretary F. NASMITH
Honorary Treasurer W. W. L. LISHMAN

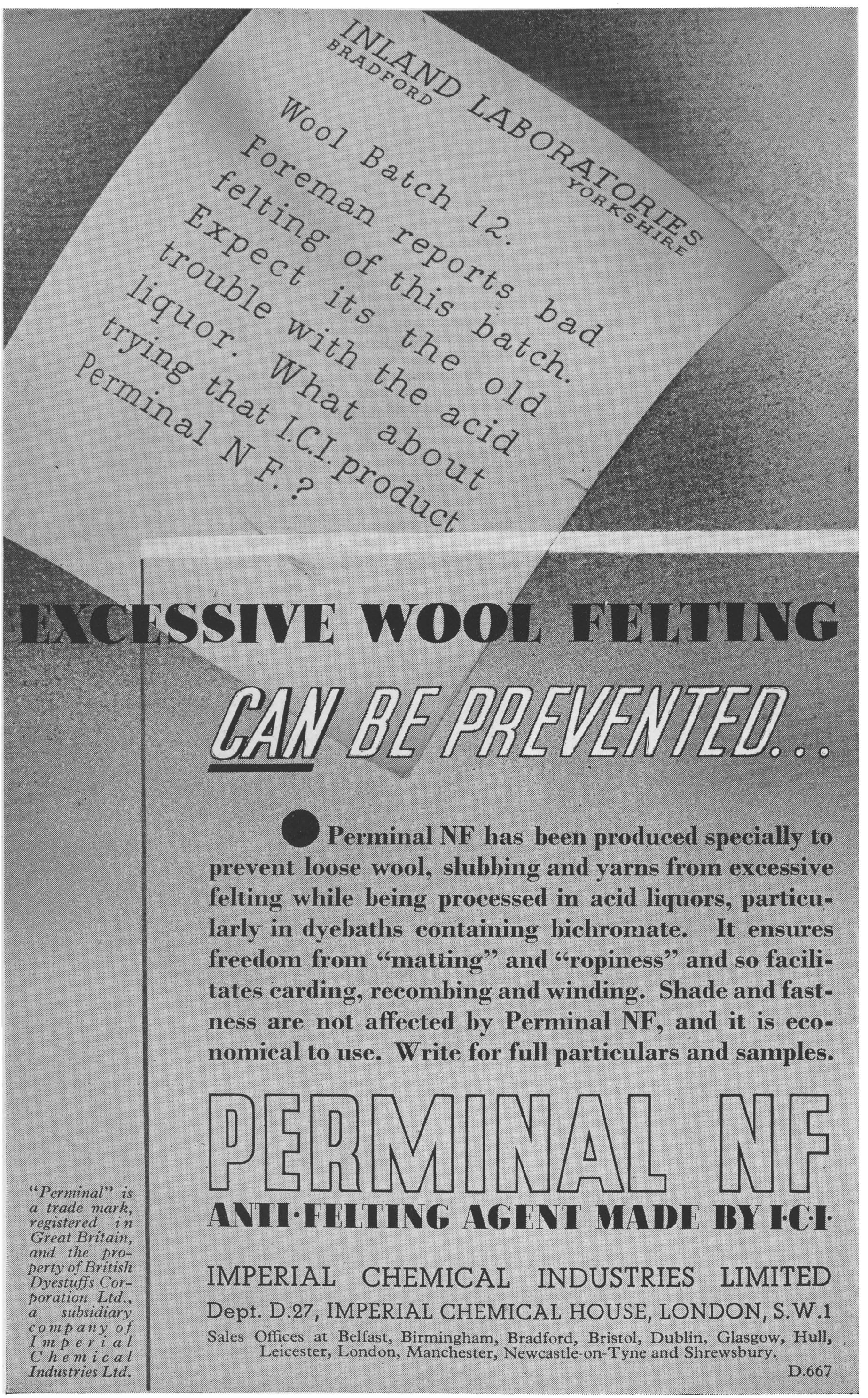
Ordinary Members of Council

H. C. BARNES (Manchester)
H. BROMILEY (Bolton)
F. CHADWICK (Preston)
J. CHAMBERLAIN (Leicester)
W. B. CROMPTON (Bispham)
W. DAVIS (Nottingham)
H. L. DILKS (Eccles)
N. C. GEE (Dewsbury)
J. R. S. GOODALL (Manchester)
A. GOWIE (London)
H. GREENWOOD (Bury)
H. G. GREG (Styal)
G. HAIGH (Bradford)
WM. HOWARTH (Bolton)
H. JAQUES (Bradford)
F. KENDALL (Bradford)
S. KERSHAW (Halifax)
W. W. L. LISHMAN (Todmorden)
R. LORD (Manchester)
H. NISBET (Manchester)
F. C. PORTER (Manchester)
J. READ (Worsley)
H. RICHARDSON (Bradford)
F .P. SLATER (Bollington)
J. B. SPEAKMAN (Leeds)
A. W. STEVENSON (Galashiels)
G. H. THOMPSON (Oldham)
E. WILDT (Leicester)
W. WILKINSON (Blackburn)
J. C. WITHERS (Manchester)

N.B.—Chairmen of all Standing Committees and, in the case of Section Committees, the Chairmen and the Honorary Secretaries of such Committees, are entitled to attend all meetings of the Council, but not to vote thereat unless they have been duly elected members of Council.

General Secretary: HUGH L. ROBINSON

Honorary Solicitors Messrs. KNOTT & CASTLE, 70 Spring Gardens, Manchester 2
Auditors ARTHUR E. PIGGOTT, SON & CO., 37 York Street, Manchester 1
Technical Editor W. J. HALL



EXCESSIVE WOOL FELTING

CAN BE PREVENTED...

● **Perminal NF has been produced specially to prevent loose wool, slubbing and yarns from excessive felting while being processed in acid liquors, particularly in dyebaths containing bichromate. It ensures freedom from "matting" and "ropiness" and so facilitates carding, recombing and winding. Shade and fastness are not affected by Perminal NF, and it is economical to use. Write for full particulars and samples.**

PERMINAL NF

ANTI·FELTING AGENT MADE BY I·C·I·

IMPERIAL CHEMICAL INDUSTRIES LIMITED

Dept. D.27, IMPERIAL CHEMICAL HOUSE, LONDON, S.W.1

Sales Offices at Belfast, Birmingham, Bradford, Bristol, Dublin, Glasgow, Hull, Leicester, London, Manchester, Newcastle-on-Tyne and Shrewsbury.

D.667

"Perminal" is a trade mark, registered in Great Britain, and the property of British Dyestuffs Corporation Ltd., a subsidiary company of Imperial Chemical Industries Ltd.



THE RINSO WASH-TESTED CERTIFICATE

Symbol of an Unique Scientific Testing Service

AFTER MONTHS OF RESEARCH the makers of Rinso have devised a means whereby good, reliable wash fabrics can be identified both by the Public and the Trade ! The Rinso Wash-Tested Certificate, symbol of an unique scientific testing service, is *certain* proof of a fabric's all-round excellence.

The Sanforizing Division at the Rinso Wash-Testing Laboratories is even now testing Manufacturers' cottons, linens and rayons from all over the country. Completely equipped to carry out every conceivable test which could be reasonably applied to a fabric, the Laboratories are steadily establishing a huge range of merchandise whose quality and good performance in washing are proved conclusively before being sold to the Public.

Manufacturers, Makers-up, Wholesalers and Retailers who sell merchandise which has been given the Certificate, may make the fullest use of it for publicity purposes, together with the special identification seal which accompanies it. This special Seal is in the nature of a 'hall-mark' — it signifies that the fabric concerned possesses the official Certificate and is therefore sound in every way. The Seal is available in a number of forms— as a woven label, tie-on ticket, showcard, etc., and its meaning will be widely advertised to the Public.

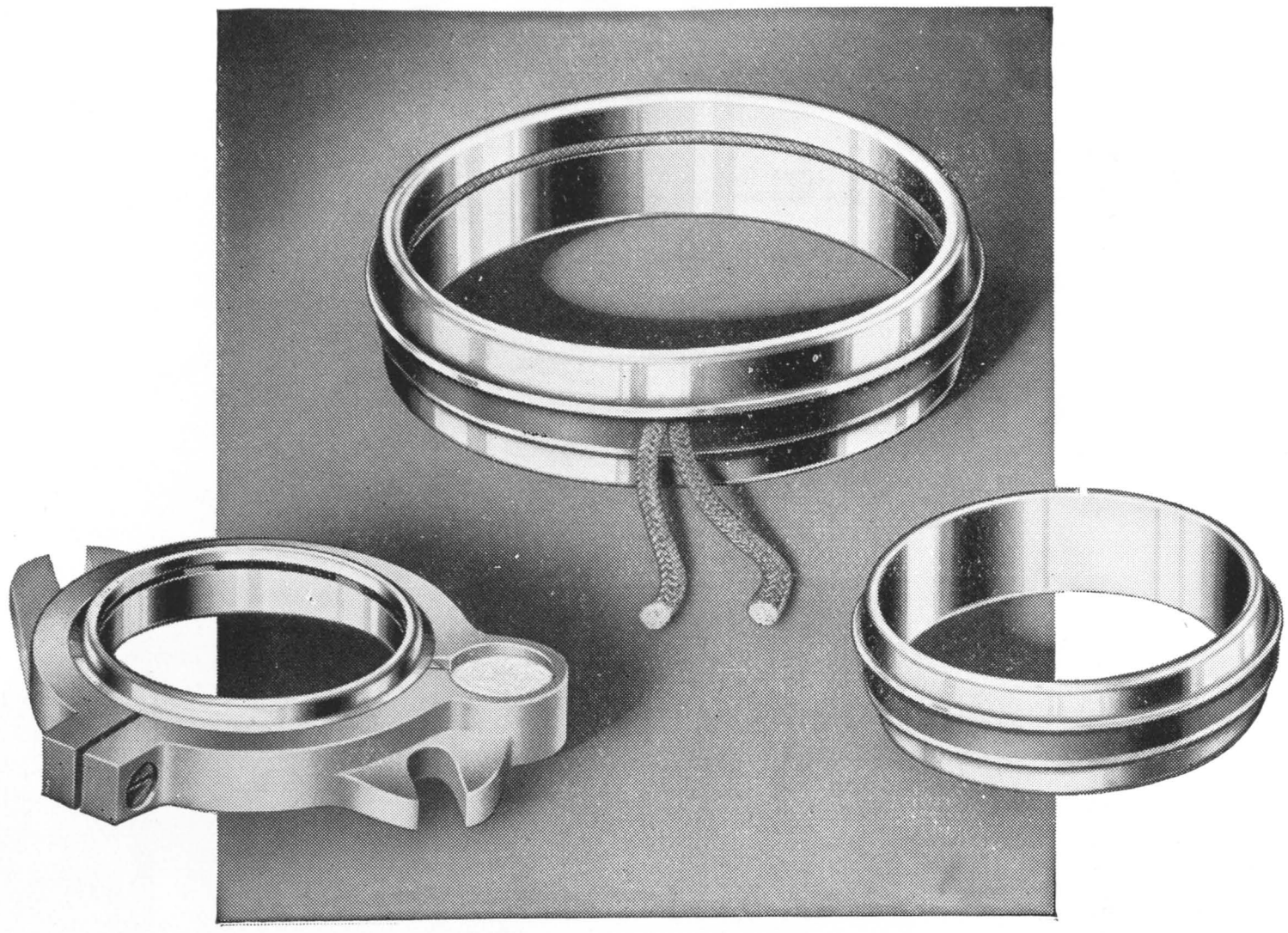
Manufacturers wishing to submit fabrics for testing should send 1½ yards of each material together with 1½ yard cuttings of the colour assortment. Tests are carried out *entirely free of charge* and notification as to the result of these tests will be given within seven days.

Fabrics should be sent to :—

RINSO WASH-TESTING LABORATORIES

(R. S. HUDSON, LIMITED)

Unilever House, London, E.C.4



DOUBLING RINGS . . .

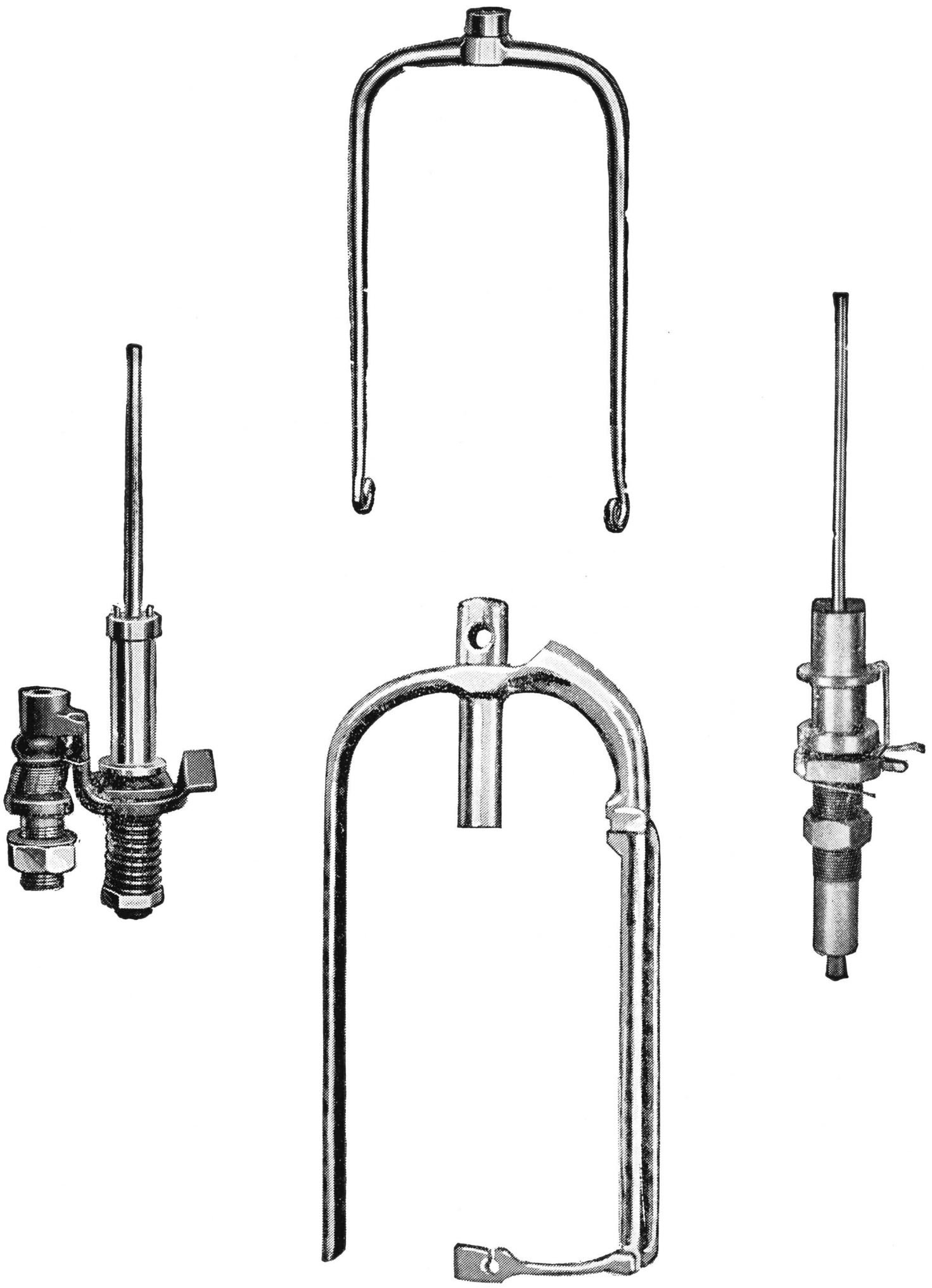
are becoming more and more specialised. We make them for oil or grease lubrication, for high speeds or heavy duty, for silk, rayon, cotton, worsted, wool, jute, and paper. Licensees operate Eadie patents all over the world and the combined experience is at your disposal.

EADIE BROS. & CO. LTD.

SHIP CANAL HOUSE, MANCHESTER, ENGLAND
and VICTORIA WORKS, PAISLEY, SCOTLAND

BODDEN

SPINDLES and FLYERS



For Cotton, Wool, Silk, and Artificial Silk.

WM. BODDEN & SON (1934), LTD.,

HARGREAVES WORKS, OLDHAM.

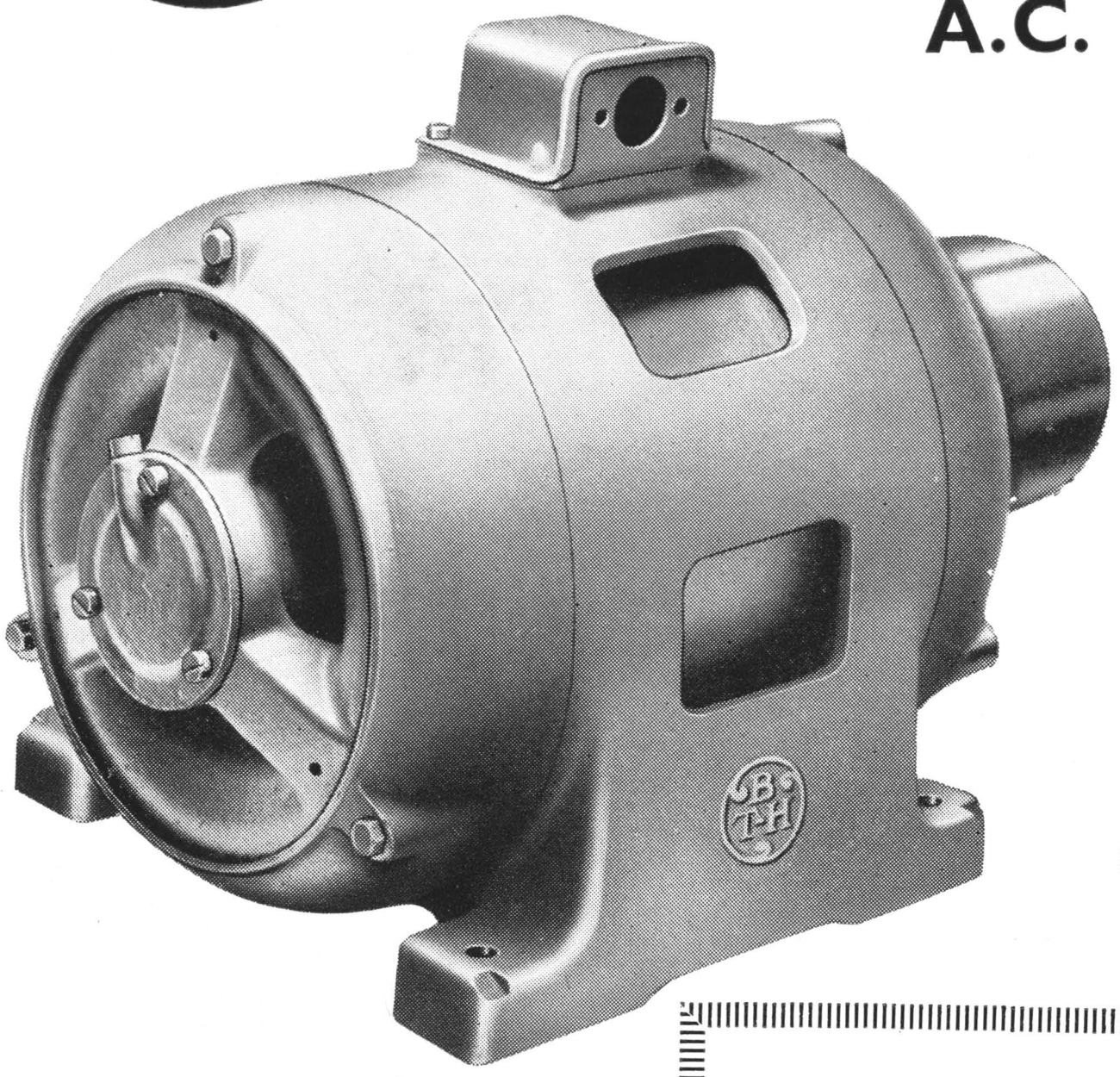
Telephone: MAIn 3818. :: Telegrams: "BODDEN, OLDHAM."

Manchester Royal Exchange, Pillar K2.

B T-H

ELECTRIC MOTORS

A.C. or D.C.



Standard A.C.
Industrial Motor
Squirrel-cage Type

No other manufacturer can offer a wider choice of electric motors, with appropriate control gear, for every drive in every industry.

Range includes :—

Standard Industrial, Mill, Crane, Textile, and Mining Motors; "No Lag" Synchronous, and Variable-speed A.C. Commutator Motors; Geared Motor and Built-in Motor Units; Fractional Horsepower Motors

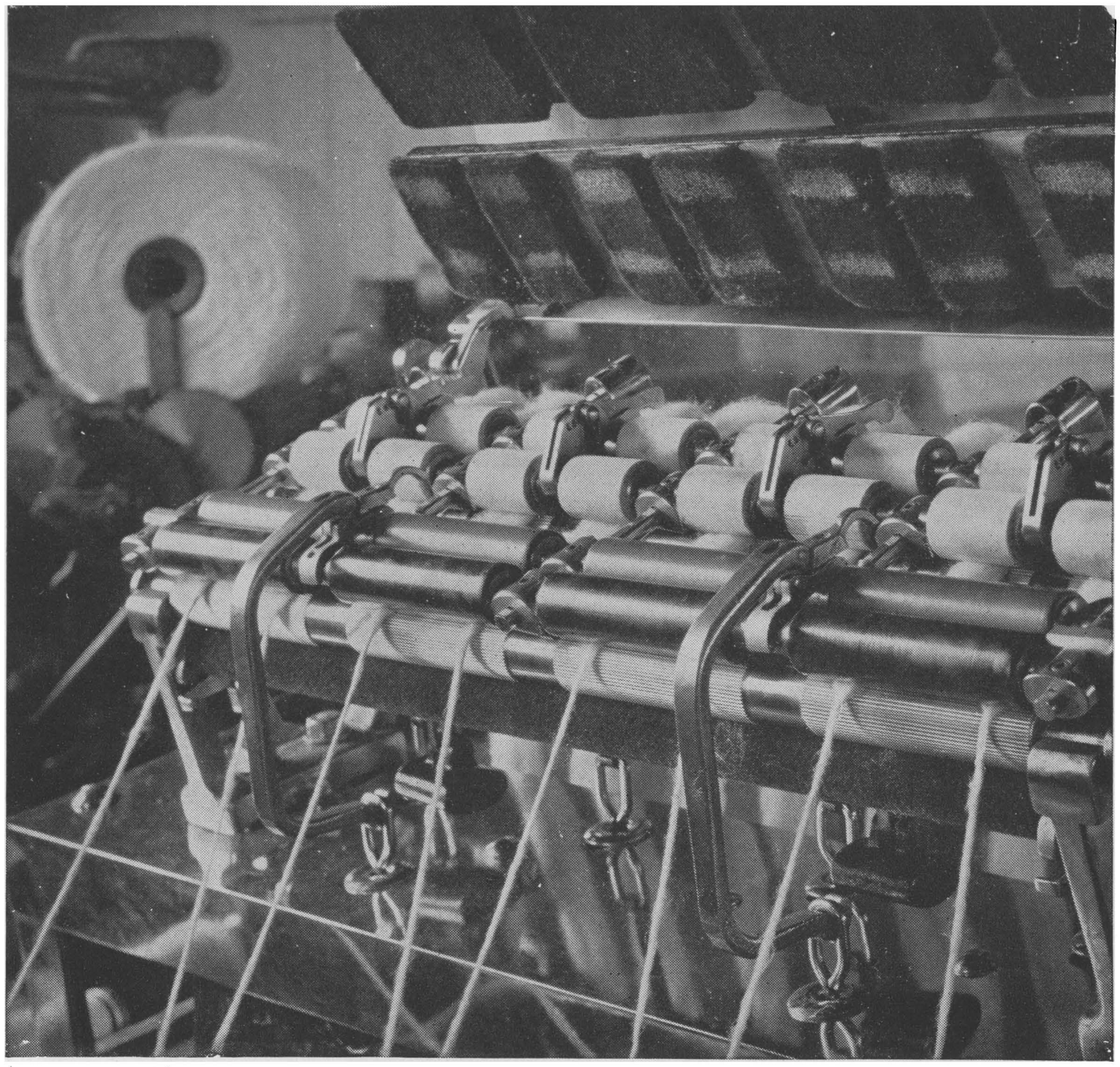
Send us your enquiries.

BTH RUGBY

THE BRITISH THOMSON-HOUSTON COMPANY LIMITED, RUGBY, ENGLAND

A2455N

ASSOCIATED ELECTRICAL INDUSTRIES LTD. AEI



The elimination of intermediate processes in the manufacture of cotton yarns has been the subject of much research in which regularity has received considerable attention.

HIGH DRAFT SPEED FRAME

Improved Model

In the H. & B. High Draft Speed Frame, "ZONE" drafting is employed, the roller arrangement consisting of two "zones" each with two lines of rollers making four lines of rollers in all. A novel and simplified weighting system is a further feature worthy of special comment.

Our recent booklet "The H. & B. High Draft Speed Frame," will be forwarded on request.

HOWARD & BULLOUGH LTD.

ACCRINGTON ENGLAND

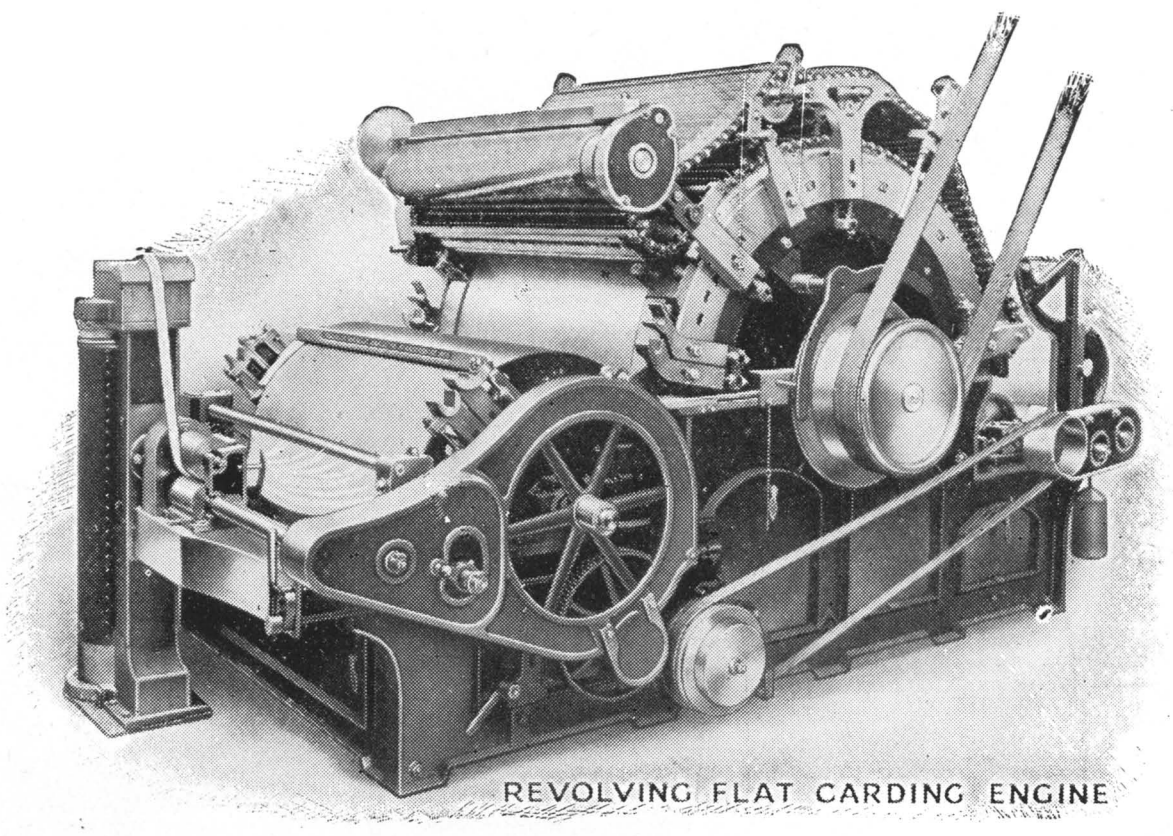
TELEPHONE
2121 (4 lines)

TELEGRAMS
"GLOBE" ACCRINGTON

Tweedales & Smalley

(1920), LTD.

CASTLETON, Manchester



REVOLVING FLAT CARDING ENGINE

Makers of Machinery for

Opening, Preparing, Spinning, and Doubling Cotton, etc. also Roller Cards for Waste

AGENTS

France (except Northern) LUNG, FILLEUL & Co., 49 Rue de Setteville, Rouen

Northern France, Belgium, Spain, Poland, Saxony, Silesia, Austria, Czecho-Slovakia, Hungary, Jugo-Slavia, Turkey, Argentine, and Uruguay—WHITE, CHILD & BENEY LTD., Broadway Court, Westminster London, S.W.1.

Alsace-Lorraine, South Germany, and Switzerland—R. HIBBERT, Rue Holbein 56, Bale.

Holland and Part Westfalia—S. TATTERSALL, Postbus 46, Enschede.

North Germany—F. BERGHOEFER, München Gladbach.

Italy—A. GHEZZI & Co., Via Boschetti 1, Milan.

Portugal and Mexico—G. W. THORNTON & SON 5 Blackfriars Street, P.O. Box 400, Salford, Manchester

Scandinavia and Finland—OHLSON & GREAVES, 47 Peter Street, Manchester.

Estonia, Latvia and Lithuania—H. THIESSEN, P.O. Box No. 49, Tallinn, Estonia.

Australia and New Zealand—NOEL P. HUNT & Co. LTD., 531 Little Collins Street, Melbourne, C.I., Australia.

India—TWEEDALES & SMALLEY (1920) LTD., Central Bank Buildings, Fort, Bombay.

China—THE CHINA ENGINEERS LTD., P.O. Box No. 1182, 15 Museum Road, Shanghai.

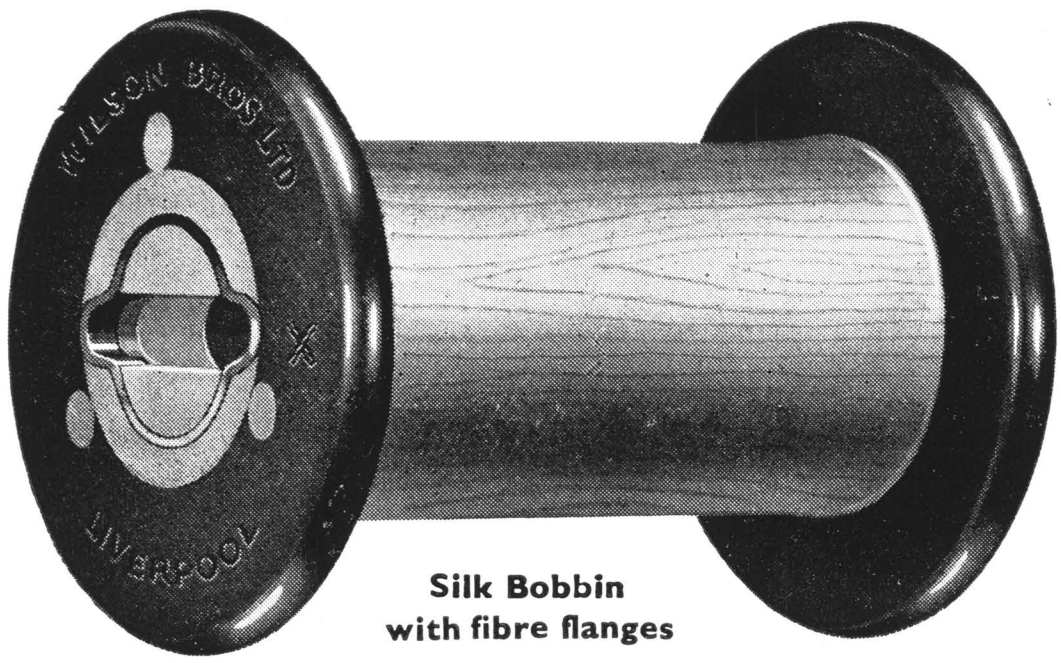
Japan—HODGKINSON & Co., 12 Itachi-bori, Kita-dori 5 Chome, Osaka, W.

Brazil—CHARLES HAHLO & SONS, LTD., 16 Mill Street, Bradford, Yorkshire.

ROYAL EXCHANGE MANCHESTER
Tuesdays and Fridays, Pillar H2

Telegrams "GLOBE CASTLETON-LANCS."
Telephone CASTLETON ROCHDALE 5871

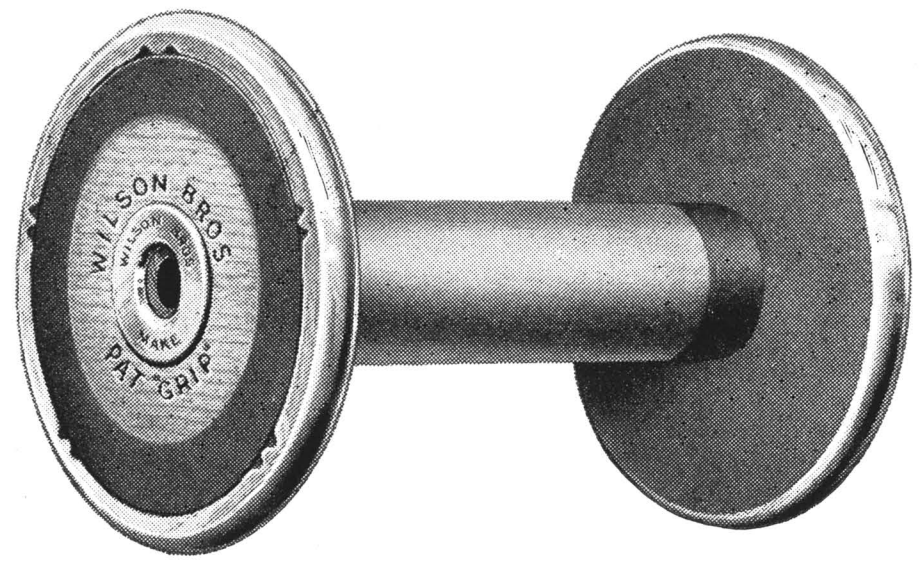
MAKERS *of all kinds of* BOBBINS *for* COTTON, WOOL, SILK, ARTIFICIAL SILK, etc.

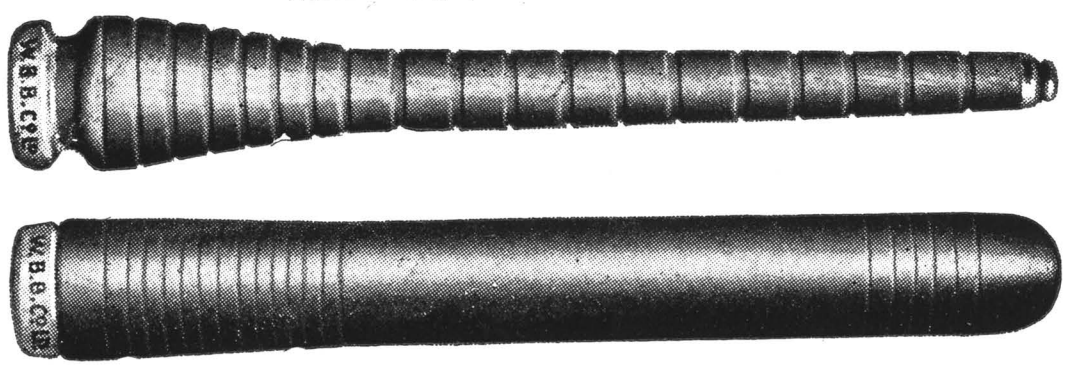


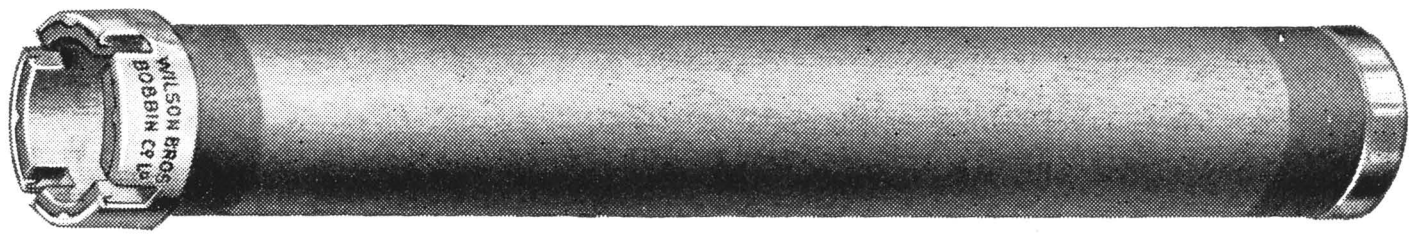
Silk Bobbin with fibre flanges

TRADE MARK

CARDROOM TUBES,
RING BOBBINS,
WINDING BOBBINS,
PIRNS, etc.







WILSON BROTHERS BOBBIN CO., LTD.

GARSTON, LIVERPOOL.

Tel.: 900 GARSTON **Telegrams: NUGGET, LIVERPOOL.**

THE JOURNAL OF THE TEXTILE INSTITUTE

Vol. XXVIII NOVEMBER 1937 No. 11

PROCEEDINGS

NOTES AND ANNOUNCEMENTS

Council Meeting for November

The monthly meeting was very well attended and while the time available was short—the presentation of the Institute Medal being made later in the afternoon—some important matters were discussed. At the outset members stood in silence as a mark of respect to Mr. Frank Wright and Mr. James Crawford to whose passing reference is made below.

The usual routine business having been disposed of, reference was made to the next Annual Conference. This is to be held in Scotland and one event in the programme will be a visit to the Empire Exhibition at Glasgow. This will occupy a whole day and lunch and probably tea will be taken in the Exhibition grounds. The venue chosen, subject to suitable accommodation being available, is Peebles and it is anticipated that a very attractive programme of events will be arranged. The Conference Committee has already met and is working in close association with the Scottish Section Committee to provide an interesting Conference.

The general subject for discussion is " Education in relation to the Textile Industries," and this will be dealt with on the plan adopted at Southport this year. Two speakers will open the discussion each session and other contributions, printed in advance, will be made. The Publications Committee will be glad to receive offers of written contributions as soon as possible and it is hoped in this way to build up a very valuable series of papers on this important subject.

Obituary: Mr. Frank Wright and Mr. James G. Crawford

The Institute has during the past few months been singularly unfortunate in losing several of its older and most staunch members. Of recent years, no one has taken more definite interest in our work than Mr. Frank Wright. On his retirement Mr. Wright appeared to have found in the Textile Institute something to which he could put his hand with enthusiasm and which would occupy, at least in part, some of his leisure. He served on several Committees and then became Chairman of Council. He interested himself in every detail and in an ex-officio capacity attended Section and Committee meetings whenever possible. Later he became a Vice-President and he was also awarded the Institute Medal. Up to a very late stage in his illness he evinced a real interest in Institute affairs. At his funeral on Saturday, 20th November, the Institute was represented by Mr. Frank Nasmith, Vice-President and Hon. Secretary, Mr. W. Kershaw, Vice-President, and Mr. H. L. Robinson, General Secretary.

Mr. James G. Crawford, Managing Director of the York Street Flax Spinning Co., Belfast, was a member of the Institute from its early days. Whilst never taking a very active part in its work, Mr. Crawford was always interested and responded readily to any requests made for specific help. The Irish Section will miss his very real support.

Presentation of Medal to Dr. F. W. Eurich

As announced in the October issue of this *Journal,* Council recently awarded the Institute Medal to Dr. F. W. Eurich, of Bradford, for his research work on Anthrax. The actual presentation of the medal was made on Wednesday, 17th November, after the regular meeting of Council. Mr. John Crompton, President, presided and Mr. George Garnett, Past-President, introduced Dr. Eurich to the President who then handed the medal to the recipient with appropriate remarks. Dr. Eurich giving thanks to the President and Council for the award referred to the work of other medical men in the field of Anthrax research and also to the work of the members of the Anthrax Investigation Board. The meeting was attended by representatives of Wool Trade organisations and by members of the Institute Council and by the press.

Rubber Technology

The Council of the Institution of the Rubber Industry announces that the Rubber Division of the American Chemical Society is willing to support the Annual Conference, to be held in London from 23rd to 25th May, 1938. In Part I, papers will be discussed dealing with methods of improving and evaluating the durability or rubber. In Part II the papers will deal with rubber generally. Particulars may be obtained from the Secretary, Institution of the Rubber Industry, 12, Whitehall, S.W.1.

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. 140—Young man, 29 years of age, desires position as Manager in Woollen Mill, able to take full control. At present employed by firm making all types of Fancy Woollen cloths—worsted warp/woollen weft, cotton warp/woollen weft, suitings, overcoatings, Ladies' dress and coating, etc. Conversant with designing and all processes from raw material to finished cloth and with customers' requirements. Holder of City and Guilds Certs. and Diplomas. Excellent references. Experience in handling workpeople.

No. 170—Young man, 26 years of age, requires responsible position in executive capacity with large Textile house. B.Sc.Tech. Two years' experience of Textile Testing and 5 years' as Shift Manager. Willing to go abroad.

No. 171—A.T.I., 32 years of age, desires position as Cotton Spinning Mill Manager or progressive position in Textiles. Full Tech. Cert. in Cotton Spinning. Nat. Cert. in Electrical Engineering. 5 years' experience in Electrical and Mechanical Engineering and 11 years' in all depts. of Cotton Spinning Mill.

No. 172—A.T.I. requires Managerial or Executive position. Full Tech. Cert. in Manufacture of Hosiery and Knitted Goods. 4 years' apprenticeship with Knitting firm, 1 year Nottingham University. Knowledge of costing, labour control and modern knitting machinery.

No. 173—Young man, A.T.I., age 30, married, desires position as Chemist-dyer, assistant manager or responsible position in dyeworks. 12 years' practical experience rayon and associated fibres, knitted fabrics, yarn and hosiery, also expert knowledge of Azoic and Vat colours. City and Guilds Full Tech. Cert. in Dyeing Silk and Rayon, Nottingham University College Diploma Textiles, present Examiner.

No. 174—Desires position of responsibility, preferably in India. Practical experience in erection of machines. 1st Class Diploma of City and Guilds' Institute in Plain Weaving (Final).

No. 175—Applicant desires position as Head Carder at a large Mill or inside Manager. Full Technological Certificate, 2nd Prize for Bolton Master Spinners on Cardroom processes. A.T.I. 5 years' experience as Head Carder.

Institute Membership

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

Ordinary

D. C. Allan, c/o John Shields & Co. (Perth) Ltd., Wallace Works, Perth (Secretary).
C. K. Altham, 4, Ribble Avenue, Grindleton, nr. Clitheroe (Mill Manager).
M. H. Brierley, c/o Universal Winding Co., 20, Dixon Street, St. Enoch's Square, Glasgow, C.1 (Scottish Representative).
E. W. Chan, Y.M.C.A., Forster Square, Bradford (Student).
J. Chirnside, 9, Queen's Road, Cheadle Hulme, Cheshire (Lecturer in Textiles, Manchester College of Technology).
C. C. Choudhury, c/o The Banga Sri Cotton Mills Ltd., Sodepore, 24, Parganas, Bengal, India (Mill Manager).
A. Collins, c/o Collins Brothers Pty. Ltd., Geelong, Victoria, Australia (Woollen Manufacturer).
R. Cuthill, M.Sc., Ph.D., 19, Bolton Villas, Bradford (Lecturer in Physical Chemistry, Bradford Technical College.
Sir John H. Grey, Livingstone Mill, Burnley (Cotton Manufacturer).
Wm. A. Guest, Rua Azevdo Coutinho, Avenida da Boa Vista, Porto, Portugal (Bleachworks Manager).
J. E. Haygarth, Seeburn, Baildon, Yorks. (Director, Preston Street Combing Co. Ltd., and Smith Adams Separator Co. Ltd.).
H. Hilton, A.M.C.T., 15, Canterbury Street, Chorley, Lancs. (Chemist Dyer, Dacca Mills Co., Heapey).
C. L. Hird, 39, Boulton Lane, Alvaston, Derby (Chemist, British Celanese Ltd., Spondon).
G. Keighley, 119, Westfield Road, Manningham, Bradford, Yorks. (Dyers' Chemist, Lister & Co. Ltd., Manningham Mills, Bradford).
H. King, 70, The Hollins, Sowerby Bridge, Yorks. (Anglo-Continental Drawing and Spinning Foreman).
N. J. Legg, "Rosslyn," Nether Close, Duffield, nr. Derby (Textile Assistant, Research Dept., L.M.S. Railway Co., Derby).
J. Longworth, 11, Wythburn Avenue, Smithills, Bolton (Technological Assistant, Haslam Spinning Co. Ltd., Bolton).
R. C. Mathur, Municipal College of Technology, Manchester (Student).
F. McKay, B.Sc.Tech., 45, Beechfield Road, Smithills, Bolton (Weaving Lecturer, Bolton Municipal Technical College).
A. Robinson, Arlen, Leyland Lane, Leyland, Lancs. (Works Chemist, John Stanning & Son, Ltd., Leyland).
A. Smith, 13, Bedford Avenue, Mansfield, Notts. (Cost and mill control clerk, Harwood Cash & Co. Ltd., Mansfield).
E. H. Stansbie, M.A. (Oxon.), Nelsons Silk Ltd., Caton Road, Lancaster (Silk Works Manager).
N. Williams, 151, Belmont Road, Bolton (Under Carder).

Junior

H. M. Appleyard, 21, Deneside Terrace, Bankfoot, Bradford (Woolsorter).
S. P. Chowdhury, University College, Shakespeare Street, Nottingham (Student).
G. Coppieters, c/o Mrs. Matthews, 4 Albany Terrace, Dundee (Student).
F. H. Dixon, "Burtrey," Laurence Road, Halifax (Woollen Manufacturer's Assistant).
N. N. Fearn, 1, Collin Street, Beeston, Nottingham (Works Chemist).
G. H. Green, The Grove, 75, Cleckheaton Road, Odsal, Bradford (Manufacturing and selling piece goods).

C. Howden, Wool Industries Research Association, Torridon, Headingley, Leeds, 6 (Testing of fibres, etc., Applied Physics Dept.).
G. Hughes, c/o Donaghy's Rope and Twine Ltd., Auckland, New Zealand (Mill Manager).
J. E. Priestley, Grove Mills, Halifax (Assistant Manager, Priestley Bros., Halifax).
N. Schofield, 86, Fagley Road, Bradford, Yorks. (Clerk and Colour Matcher to worsted spinners).
S. A. E. Seood, c/o Misr Spinning & Weaving Co., Mehalla el Kobra, Egypt.

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

Ordinary

C. Eugene Coke, M.Sc.(Man.), A.I.C., Dept. of Textile Research, The University, Leeds (Research Scholar).
J. G. Coutts, 103, Davies Road, West Bridgford, Nottingham (Departmental Manager).
J. A. Simoes de Almeida, Rua Castilho 15, 1°, Lisbon, Portugal (President of the Regulating Committee for Trade in Raw Cotton).
E. Jorgensen, 25, Ravenhill Park Gardens, Belfast (Foreman and Hosiery Machinist).
Dennis Moss, Albert Mills, Morley, nr. Leeds (Cloth Finisher).
D. W. C. Moulton, Boyne Hill Laundry, Maidenhead (Laundry Manager).
H. R. Mushlian, 62, Barton Arcade, Manchester, 3 (Chartered Patent Agent, William Gadd & Sons).
G. H. A. Sington, M.I.Mech.E., c/o Messrs. Platt Bros. & Co. Ltd., Hartford Works, Oldham (Director).

Lancashire Section

HIGH NICKEL ALLOYS FOR TEXTILE WET PROCESSING PLANT

N. C. MARPLES, M.Sc. (Messrs. Henry Wiggin & Co. Ltd.)

Abstract of Lecture given to the Lancashire Section of the Textile Institute in Manchester, on September 22nd, 1937.

While the art of dyeing and bleaching dates back over several centuries and mechanical processes for carrying out these operations have been in use for over a century, it is only in comparatively recent years that the textile worker has been able to obtain metallic materials other than steel, cast iron and copper for the construction of his equipment. In the present paper the properties of some alloys containing high percentages of nickel are discussed, particular stress being laid upon their suitability for use in the construction of plant for textile wet processing. Three materials will be considered:—

(*a*) Monel, an alloy containing 2/3rds nickel and 1/3rd copper.

(*b*) Inconel, an alloy containing 80 per cent. nickel, 12/14 per cent. chromium and approximately 6 per cent. iron.

(*c*) Malleable nickel.

Pure nickel will not be discussed as such but rather as a material termed nickel clad steel, which is so utilised in construction that the equipment presents only the pure nickel surface to the processing solutions.

All three materials have high resistance to corrosion by chemical action and this property is required, as will be agreed, from considerations additional to the mere prolongation of the life of the plant. Poorly resistant materials may, for instance, combine with some of the dyestuffs employed, thus putting the product offshade in an objectionable fashion. Similarly, poorly resistant materials may give rise to stains and marks on the goods undergoing treatment. They may have a catalytic effect on the chemical substances used in the process. Also under corrosive action they may become roughened and damage the goods. Before turning to a closer consideration of the three nickel containing materials mentioned, the limitations of the materials used as alternatives will be discussed briefly.

Steel has been little used in the textile industry except for constructional purposes. It may be used for such vessels as bleaching kiers, where the design is such that the fabrics do not come into intimate contact with the material. The readiness with which steel rusts and the possibility of the fabrics staining, naturally limit its usefulness quite apart from the fact that in the dyeing process a very large number of dyestuffs are affected by iron. Cast iron has been quite widely used for the construction of jiggers and can be successfully employed for certain ranges of dyestuffs. Copper has been quite widely employed but in certain circumstances it may produce unpleasant staining and has also a marked effect on some dyestuffs.

So limited has been the application of these three metals that it has been necessary in the past to supplement them with wood, slate, porcelain and ebonite. Each of these substances, while it may be satisfactorily resistant to corrosion over a wide range of processing solutions, is usually inferior to metals in toughness and resistance to temperature changes. Wood has been until recently, probably the most commonly used material for dye vat construction, and is in many ways admirable, except for the fact that its porous nature allows it to absorb the dyestuffs and in consequence a change over from one shade to another can be effected only if the vat is boiled out for a considerable period before introducing the new colour.

There is therefore a wide scope for materials which:—

(1) possess good general chemical and mechanical resistance,

(2) are readily worked and thus easily brought into the required shape,

(3) possess and retain a smooth non-porous surface.

Monel, which possesses these properties, therefore found ready acceptance in the textile industry when it was introduced into this country shortly after the war. Its excellence for many processes is widely recognised and it is only in the dyeing of wool fabrics, owing to its susceptibility to sulphur attack, that it is of limited utility. For this purpose, Inconel, which has similar strength and the ready workability characteristic of Monel, seems likely to meet all requirements in the way of immunity from staining by the acid liquors used in the wool dyeing processes.

The characteristics of the nickel alloys under consideration will now be reviewed.

Table I. Physical Constants of Monel.

Density	8·80
lbs. per cu. in.	0·318
Melting point	1350° C.—2460° F.
Specific heat (20°-400° C.)	0·127
Coefficient of expansion (25°-100° C.)	0·000014
(25°-300° C.)	0·000015
Electrical Resistivity (at 0° C.)—microhms/cm³	42·5
Young's Modulus, pounds per sq. in.	25,000,000 to 26,000,000
Rigidity Modulus, pounds per sq. in.	8,000,000 to 9,000,000
Magnetic transformation	95° C.—203° F.

Mechanical Properties of Monel.

NOTE.—Monel metal cannot be hardened by thermal treatment. Its mechanical properties can, however, be considerably enhanced by cold working, and for certain purposes it is definitely advantageous to employ it in a hard rolled or hard drawn condition. The mechanical properties of the hard rolled or soft annealed qualities in various forms are shown here.

Type	Condition	Ultimate Strength Tons/sq.in.	Yield Point Tons/sq.in.	Elongation On $4\sqrt{\text{area}}$	Hardness
Hot Rolled Rounds, Squares, Rectangles or Hexagons : Forgings	Normal	34-38	15-18	35%	120-140 Brinell
Cold Drawn Rounds or Hexagons : Cold Rolled Squares or Rectangles	Hard (A)	40-45	35-40	18/20%	190-210 Brinell
	Annealed (A)	30-35	14-17	35%	110-120 Brinell
(B) Full Finish Sheet	Normal	30-33	14-16	30%	18-20 Scleroscope
Cold Rolled Sheet or Strip	Hard (A)	45-50	40-45	15%	38-42 Scleroscope
	Annealed (A)	29-30	14-16	30%	16-18 Scleroscope
Cold Drawn Wire	Hard (A) for Springs	55-60	50-55	5/10%	—
	Annealed (A)	29-33	14-16	35%	—
Castings : Normal Quality	As Cast	19-23	12-15	12%	110-130 Brinell
Special Silicon Quality	Thermally Hardened	38-40	22-25	10/15%	190-210 Brinell

(A) Where desired, cold rolled or cold drawn material can be produced to hardnesses intermediate between full hard and soft annealed.

(B) This grade of sheet was previously designated hot rolled but is now finished by cold rolling to give a bright surface. The sheets are flat and are recommended for moderate drawing and all bending operations.

Monel

As already noted this alloy contains approximately 2/3rds nickel and 1/3rd copper and its physical and mechanical characteristics will be seen in Table I. It will be noted that in its softest condition it has a tensile strength of over 30 tons/sq. in. which is about 15 per cent. stronger than ordinary mild steel. Monel is silver white in colour and has a density similar to that of copper. Its coefficient of expansion is moderate so that undue distortion during welding does not tend to render this process difficult. Among all corrosion resisting materials Monel is indeed outstanding in the ease with which it can be fabricated. It can be fairly readily machined, drilled or screwed provided a slight adjustment to the tool angles is made. It can be cast into fairly intricate shapes which are resistant to corrosion and which do not depend upon being highly polished for immunity from rust. It can be pressed and spun and its annealing temperature of 800-900° is within the reach of the furnaces and equipment usually available. Naturally in all equipment, joints are of primary importance. As it is the practice to use Monel for the lining of cast iron or wood vats and to make such linings of sheet from 1/64″ to 1/32″ thick, it is advantageous that Monel can be joined by lock seaming and soft soldering. This method has been employed with success in some thousands of dye vat linings at present in use in this country. Provided care is used in forming the lock seam and a good quality soft solder is sweated into the joint from outside, the amount of solder exposed to the dye liquid is practically negligible, while the capacity of Monel for bonding with solder is so good that joints made in that way will last even under severe conditions for many years.

Where new machines are being built for which it is desirable to use heavier gauge sheet, i.e. say about 1/16″ thick, very good oxy-acetylene welded joints can be made and it is of importance that such joints possess corrosion resistance equivalent to that of the parent metal, and that descaling in the vicinity of these is not a necessary feature to obtaining full corrosion resistance. Moreover, no heat treatment of the welded portion is necessary to avoid the weld decay troubles common with some of the materials of the Austenitic stainless steel type.

Resistance to Corrosion in Dyebaths

Before considering further textile applications of Monel, it may be profitable to discuss the suitability of the alloy from the chemical point of view for the different classes of dyestuffs. Fortunately, besides practical experience in the dyehouse, there is also available the extensive series of tests made by the Clayton Aniline Company Limited upon the modifying influence of most of the possible constructional materials upon the shades of different classes of dyestuff.

Direct Cotton Colours. These dyes, generally applied from dilute solutions with additions of neutral salts (Glauber's salt, common salt) slightly alkaline salts (sodium phosphate, soaps or other wetting agents), are unaffected by Monel. Certain dyestuffs of this class may be after-treated by diazotisation and development. The process of diazotisation and development is dealt with in the section on developed colours.

Acid Colours. According to the results of the Clayton Aniline Company Limited, the behaviour of Monel with these dyes is good, being, however a little less satisfactory than pure nickel for a small proportion of the total number of dyes of this class that were examined. As a rule, the baths must be distinctly acid and it is advisable therefore to empty them at the end of each day.

Acid Chrome Colours. Where dyeing requires the use of an acid solution of bichromate, as in most of the methods of applying the chrome colours, the resistance of any metallic material is put to a much more severe test by the conjunction of acid and oxidising agent. It must, therefore, be admitted that these

colours are more liable to attack by Monel than by certain of the corrosion resisting ferrous alloys or by Inconel. Reference to this will be made later. The results of the Clayton Aniline Company Limited who used appropriate after-chroming treatment, show that many of the browns and blues are rendered redder in shade, although in compound shades it is possible to allow for this in varying the proportion of shading dyes.

Developed Colours and Azoic Colours. Here, again, one part of the dyeing process requires the use of somewhat strongly acid solutions of the oxidising agent. The nitrous acid is used, it is true, in the cold but since it is the nitrous acid in excess of that required for the diazotising reaction which is active in corroding metals, careful control can do much to avoid any corrosion of the metal. The form of dyeing in this process has also a marked effect, since the amount of chemical introduced into the diazotising bath varies with the weight of goods to be dyed. Consequently, therefore, in continuous processes such as jig dyeing, the effect on the metal is likely to be greater than in say, reel type piece goods dyeing machines where the weight of goods handled is in a much smaller ratio to the volume of dye liquor.

An actual test carried out in the Monel machine used in the dyeing of a fabric with developed colours, where care was exercised in controlling the conditions, showed that the amount of attack was only 0·0023″ per year ; practically a negligible amount and one which was borne out by the successful years of operation by that particular machine working mainly on developed colours. Nevertheless, where developed colour work is to be extensive, then the use of Inconel can usefully be considered.

In general Monel gives satisfactory results with basic colours when employing usually accepted methods of mordanting and dyeing.

Vat Colours. One of the principal features of Monel is its excellent resistance to the action of alkaline solutions and for vat colours applied in the orthodox way very good results are obtained. Cleanliness is of the utmost importance in vat dyeing and the ability to wash vessels perfectly clean between lots is very advantageous. Monel withstands the action of the alkaline or weakly acid oxidising agents required for oxidising the dyestuff.

Sulphur Colours. Since these colours are dyed from an alkaline bath of sodium sulphide, copper is attacked and the shade of materials dyed in copper vessels is severely modified. Iron is often used for dyeing sulphur colours and because of the generally good resistance of iron to alkaline liquors and also to the formation of a resistant layer of sulphide of iron on the container, the results are generally satisfactory. However, if the machines are used for other dyeing processes requiring acid or oxidising reagents this layer is removed and the net effect is one of corrosion. Sodium sulphide liquors have a bad effect on wood, if used continuously. With most sulphur dyes, very satisfactory results are obtained with Monel, and it is then not necessary to reserve certain machines for the use of sulphur colours only.

Dyehouse Equipment

Monel is being employed successfully in the dyeing of cotton, pure silk and artificial silk hosiery. It exhibits satisfactory resistance in the scouring, degumming and dyeing of hosiery. In some rotary machines the containers are lined and the cages are made from this material. In other rotaries an all Monel construction is employed.

In paddle machines Monel enables smooth surfaced well-balanced and durable paddles which do not warp or splinter to be built.

Winch dyeing machines are used frequently for fabrics too delicate to be dyed in jiggers and they require therefore that the construction of the machine shall avoid abrasive action. Monel by virtue of its smooth surface fulfils this condition satisfactorily. The becks of iron and wooden jiggers can be readily



Fig. 1.



Fig. 2.

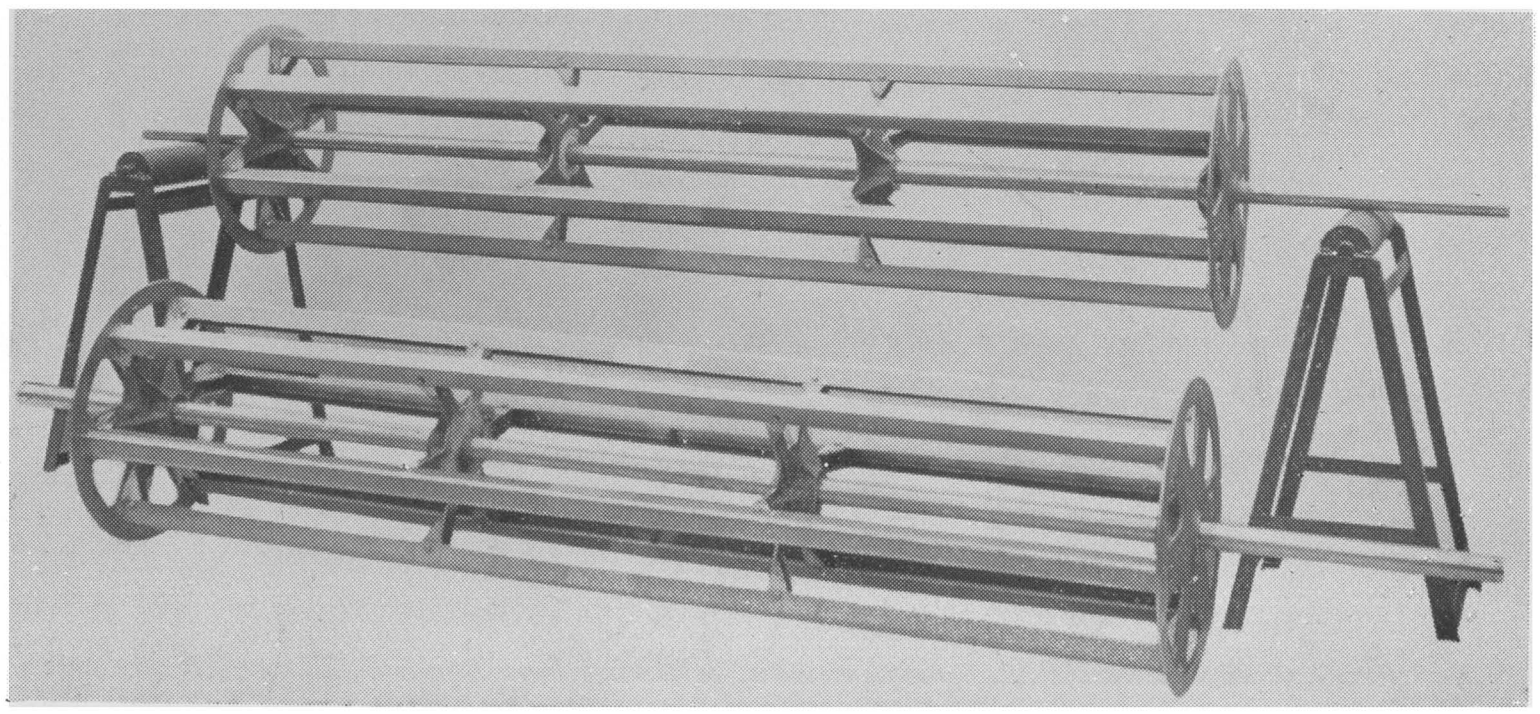


Fig. 3.

Facing p. 384

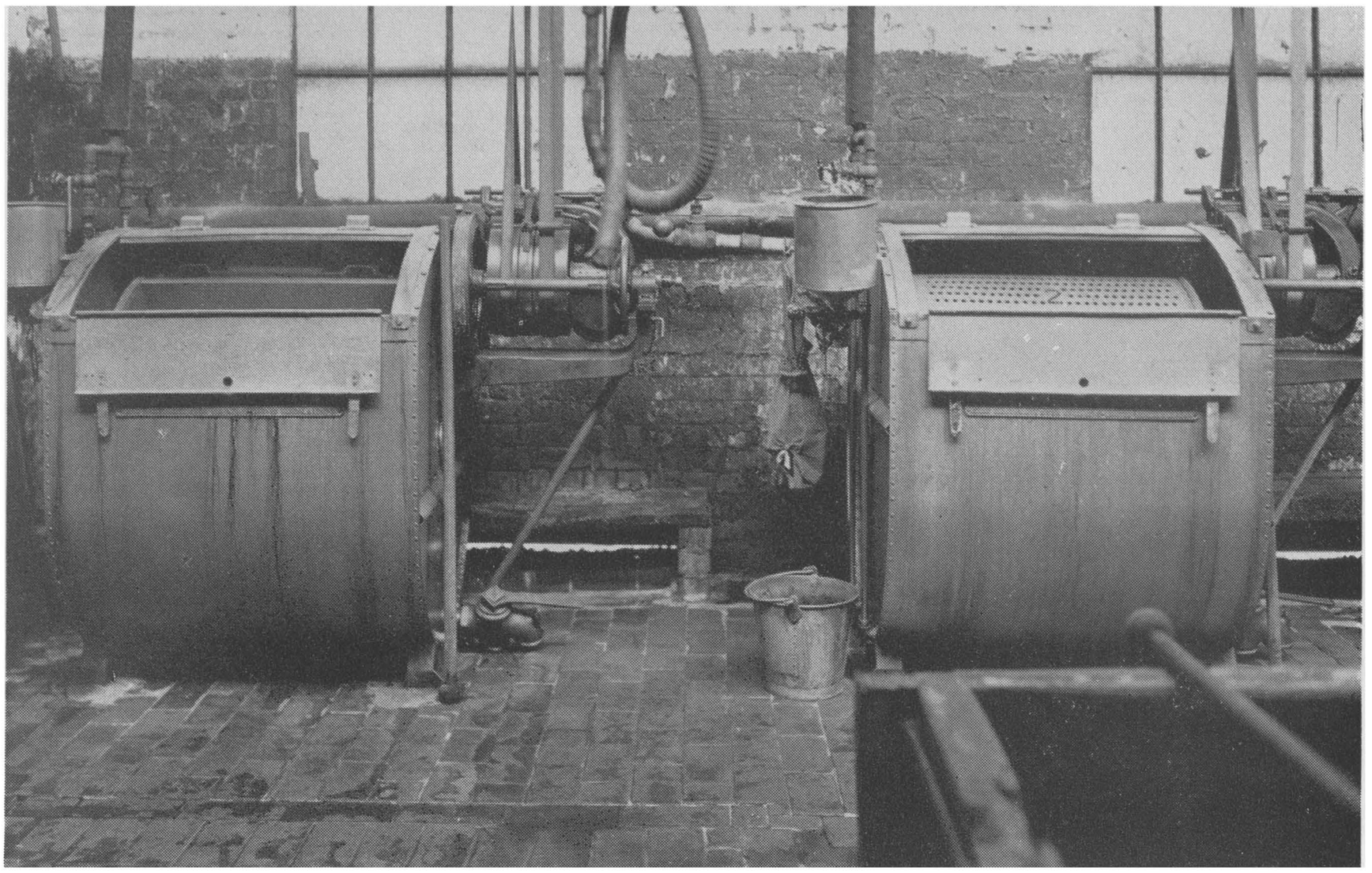


Fig. 4.

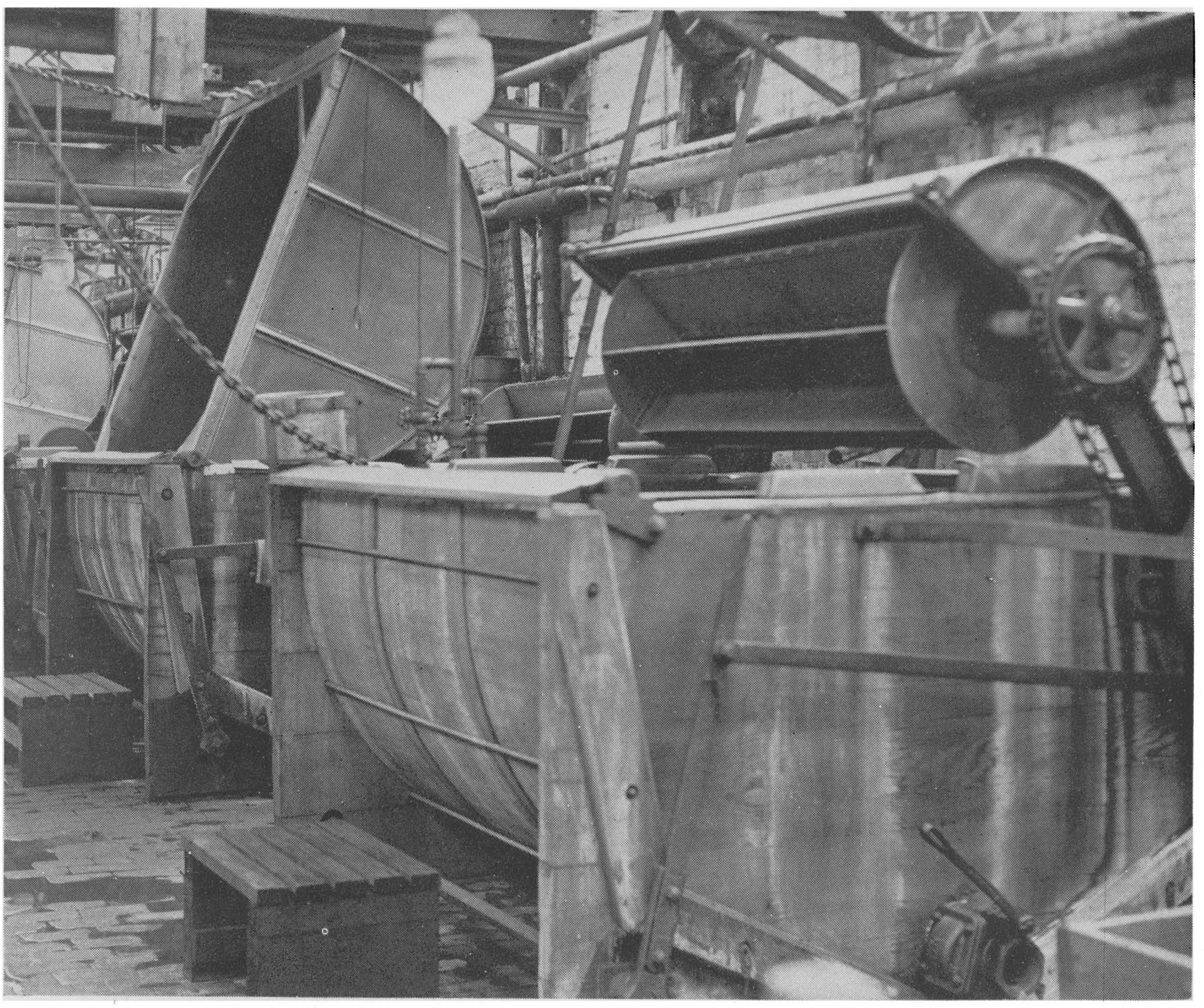


Fig. 5.

lined with Monel. With jiggers it is particularly useful to be able to clean up rapidly between batches since it may be necessary to dye several shades on the same machine during the day. This coupled with the rather awkward shape of the normal jigger beck call for a surface which can be easily washed down. Monel is also used for the rolls. Skein dyeing is carried out either by hand or by machines of the Gerber type. For the reel (Gerber) type, long becks are of course demanded. Some of these are of wood lined with Monel while others are in the form of all Monel tanks. A typical beck—constructed of 1/16″ thick Monel sheet—all joints welded, for use in the dyeing of artificial silk skeins shown in Fig. 1. This is 50′0″ long.

Monel in the form of tubes is widely used for the construction of heating coils for dye vats. Fig. 2 shows a coil constructed of 2″ outside diameter × 14 G. tube, suitable for heating 625 gallons of dye liquor from 50° F. to boiling point in 45 minutes. It will be noted that the coil is assembled by means of slip-on sleeves oxy-acetylene welded to the main parts.

Figures 3, 4 and 5 illustrate further the application of Monel.

Bleaching

Two classes of bleach liquor have to be considered. The first and most commonly used is the hypochlorite bleach now very generally used in the form of sodium hypochlorite. Tests on Monel with sodium hypochlorite solutions at atmospheric temperature showed negligible corrosion in solutions having concentrations of available chlorine below 3 gr. per litre. When the available chlorine concentration is increased to 4 gr. per litre, the corrosiveness of the solution is quadrupled, while at 7 gr. per litre, corrosion rates are ten times as high as at 3 gr. per litre. On the basis of these figures it has been the practice to recommend the use of Monel for holding hypochlorite solutions containing not more than 2½/3 gr. per litre of available chlorine. Practical experience during the past 15 years has demonstrated the soundness of these recommendations. In one artificial silk works using a large reel hank machine which was employed on both dyeing and bleaching and which over a particular period was in continuous use for white bleaching at about 3 gr. per litre, there was no evidence of any marking or pitting of the metal after two weeks' treatment. This firm, of course, took care to fill up the tank with water and soap immediately after bleaching and to obviate any rise in temperature of the solution due to the steam leaking into the heating coil. The continuous success of Monel in that particular works in reel type skein dyeing machines handling artificial silk has led to their standardising of Monel for all their machine linings.

So far as metals and alloys are concerned the particular difference between peroxide and hypochlorite bleaching solutions is the relatively non-corrosive nature of the peroxide solutions and their greater susceptibility to decomposition. Since peroxide solutions are practically non-corrosive their effects on metals are less important than the effects of metals on the solution.

According to Campbell* the factors influencing the stability of a peroxide bleach bath are temperature, hydrogen ion concentration (*p*H), type of alkalizing agent, the material being bleached, the water and the bleaching vessel. We are concerned principally with the last factor, and more especially with the metal or alloy of which it is constructed. It is known that if certain metal salts are added to the peroxide solution they increase the rate of decomposition. Both copper and iron are active in this respect, copper being more powerful than iron. However, this does not mean that contact of a peroxide solution with alloys containing copper necessarily accelerates decomposition. It is possible to estimate the effects of metals and alloys on peroxide bleach baths by exposing specimens to bleaching solutions, and

---

* *American Dyestuff Reporter*, Feb. 10th, 1936, p. 67.

determining the extent of decomposition after a given period of time as compared with a sample of solution containing no metal. In a preliminary test 100 volume hydrogen peroxide was found to retain its original strength after 24 hours, either in glass or in contact with nickel. Bleaching solutions containing about 10 grams per litre of hydrogen peroxide and 10 c.c. per litre of sodium silicate (*p*H 10-11) were made up in covered nickel, Monel and glass vessels. The ratio of exposed metal area to solution volume was 380 sq. cm. (59 sq. in.) per litre. This is comparable with the conditions in typical dyeing machines. The solutions were kept at about 185° F. for 80 minutes and then allowed to cool to atmospheric temperature and kept for about 17 hours, with the results noted in Table II, corrections being made for about 5 per cent. loss of volume by evaporation.

Table II. Rates of Decomposition of Peroxide Bleaching Solutions (containing 10 c.c. per litre of Sodium Silicate *p*H 10-11) in Monel, Nickel, and Glass Containers

		Glass Container		Nickel Container		Monel Container	
Time	Tem-perature	Peroxide Concn. in gr. per litre	Loss in Peroxide %	Peroxide Concn. in gr. per litre	Loss in Peroxide %	Peroxide Concn. in gr. per litre	Loss in Peroxide %
0 min.	185° F.	10·16	0	10·25	0	10·21	0
40 min.	185° F.	9·35	8	9·12	11	8·87	13
80 min.	185° F.	8·53	16	8·20	20	7·85	23
17 hr.	80° F.	7·62	25	7·28	29	7·05	31

Under these test conditions there was no important difference between the three vessels and it would seem safe to conclude that both nickel and Monel have a negligible catalytic effect on the decomposition of the peroxide bleaching solution. These tests are confirmed in practice. Thus in a plant processing cotton, cotton-rayon mixtures and rayon, all the bleaching and dyeing equipment is of Monel which has been in use for 10 years. The bleaching procedure involves a preliminary scour for 15 minutes at 175° F. using a mixture of pine oil, soap, and sodium silicate. The bleach bath contains 20 lbs. of sodium silicate and $3\frac{1}{2}$ quarts of 100 volume hydrogen peroxide per 300 gallons of solution for 150 lbs. of goods which are bleached in a period of 1 to 2 hours at 180° F. The operator has had complete satisfaction from the Monel equipment for such peroxide bleaching as well as for dyeing.

The foregoing refers of course to peroxide baths as made up for bleaching and it is now common practice to purchase hydrogen peroxide as such. If, however, the peroxide is being prepared by mixing sodium peroxide with acid, then this mixing should be carried out in a crock or wooden tub and the peroxide solution only added to the alkaline solution or sodium silicate solution in the Monel-lined vessels.

Mercerising

Monel has been used in the construction of expander bars on account of its satisfactory strength and its high chemical resistance to the action of caustic soda solutions under all conditions of temperature, concentration, etc. In the impregnating machinery the caustic boxes have been lined with the metal and the mangle rollers have been covered with a Monel shell.

Monel finds considerable application in the auxiliary plant of a mercerising installation. The storage tanks with their cooling coils, if made in this metal, avoid contaminating the caustic soda by iron and they are also not subject to corrosion particularly at joints, seams and edges. Monel wire cloth in a variety of gauges and patterns may be obtained for the construction of strainers to remove cotton residues and the deposits of calcium carbonate which form when the liquors are not made up with soft water. Various patterns of filters

are used to remove the calcium carbonate precipitated during recauticisation. For filter presses Monel wire cloth filters with rubber gaskets can be used while the same material forms the filtering medium on continuous rotary filters of the immersed suction drum type. Very satisfactory behaviour has been recorded for Monel and nickel tubes in vacuum evacuators for caustic recovery.

Drying and Finishing Machinery

The ability of Monel to retain a bright readily cleaned surface, free from rust makes it particularly well adapted for the construction of steam drying cylinders in dry ranges alone or in conjunction with pad mangles, backstarching and coating ranges, etc. In padding ranges, where cloth impregnated with chemicals goes to be dried, the scope of the machine is widened by a corrosion-resistant material, although the limits to the resistance of Monel given in the first part of this account must be observed. Not only on the drying cylinders but also in filling and coating operations where corrosion and abrasion resistant doctors are required, Monel may be the most appropriate material.

There are to-day, however, many new finishing processes of a highly specialised kind as for instance in the artificial leather, book-cloth, non-crease treatments, water-proofing and similar industries. Chemically active materials may be incorporated in the coatings or may be used for treating the cloth in other ways. These processes may call for very special properties in the chemical behaviour of the materials from which the plant is constructed, and here again Monel seems to offer promise of utility.

Perforated cylinders of Monel as steaming rolls for the cloth in the decatising process have been used with success.

For the special treatment of silk, tin-weighting ranges built on the lines of the automatic roller dyeing machines, with boxes, rollers and fittings made from Monel, have been successfully put into operation.

With the exception of the rollers, doctors and colour boxes, few of the metal parts of the printing machine and hot flux come into contact either with the cloth or with the chemicals printed on it before the cloth reaches the dry condition. Probably the machines connected with printing in which Monel is most widely used are the open soapers. Monel boxes, guide rollers and paddles built from the metal increase the variety of chemical treatments that can be carried out in this type of machine.

Inconel

This alloy became commercially available as a product of the International Nickel Co. in 1931 and is now being rolled in Great Britain. This material can really be described as a stainless nickel since it contains 80 per cent. nickel, 14 per cent. chromium, and 6 per cent. iron. It was soon found to possess good resistance to the corrosive action of several chemicals used in the wet processing of textiles. While it is too soon to estimate how important a place Inconel will occupy in the textile industry, it does seem certain that it has a definite future before it. The reason for this is that Inconel combines with its resistance to wool dyeing liquors the ease of fabrication and the reliability of soldered or welded joints which have characterised Monel.

It will be agreed that if equipment, however satisfactory from the point of view of the dye liquor, has to be too frequently in the hands of the engineering department for repairs to welds which have failed by corrosion, much of the benefit will be lost. The experience of firms utilising some of the Austenitic stainless steels has not been entirely unattended by difficulties in maintaining the equipment in good repair. One firm which has already had experience in this direction has now had in service for several months an Inconel dyeing machine, which is very satisfactory from the engineering standpoint.

Table III. Mechanical Properties of Inconel.

	Tensile Strength (tons/sq. in.)	Yield Point (tons/sq. in)	Elongation (per cent.)
Sheet and Strip—			
Annealed	35-40	13-15	45-55
Rod—			
Annealed	35-40	13-15	45-55
Cold Drawn	45-50	35-40	20-30
Wire—			
Annealed	35-40	13-15	45-55
Spring temper	78-85	—	—

In passing it might be noted that Inconel is considerably stronger than mild steel and is at the same time ductile as can be seen from Table III depicting its mechanical properties. Inconel is white in colour and can if necessary take a high and durable polish. Table IV summarizes tests recorded in America of the effect of Inconel on several sensitive dyestuffs, and it will be noted that no important off-shade effects were produced.

Table IV. Effects of Inconel on Several Sensitive Dyestuffs.

Dyestuff	Colour Index No.	How Dyed	Effect of Inconel
Alizarine Yellow 2G	36	Top Chrome	Slightly redder and brighter
Acid Alizarine Violet	169	Top Chrome	Practically no effect
Eriochrome Blue Black R ...	202	Top Chrome	Slightly greener and duller
Eriochrome Black T	203	Top Chrome	Practically no effect
Eriochrome Red B	652	Top Chrome	Slightly yellower
Alizarine Cyanine Green ...	1078	Top Chrome	Practically no effect
Anthraquinone Violet	1080	Top Chrome	Slightly brighter
Alizarine Sky Blue B	1088	Top Chrome	Practically no effect
Monochrome Brown BC Conc. S	—	Top Chrome	Very slightly yellower
Wool Fast Orange GA	—	Top Chrome	Very slightly yellower
Acid Anthracene Brown B ...	—	Top Chrome	Practically no effect
Metachrome Red G	—	Top Chrome	Practically no effect
Metachrome Olive GG	—	Top Chrome	Practically no effect
Eriochrome Grey SGL	—	Top Chrome	Practically no effect
Metanil Yellow	138	Acid	Slightly greener
Azo Yellow	146	Acid	Practically no effect
Azo Rubine	179	Acid	Very slightly bluer
Xylene Light Yellow	639	Acid	Practically no effect
Alizarine Saphirol B	1054	Acid	Practically no effect
Alizarine Rubinol	1091	Acid	Practically no effect
Alizarine Direct Blue A2G ...	—	Acid	Slightly greener and brighter
Wool Fast Orange GA	—	Acid	Slightly redder
Alizarine Irisol R	—	Acid	Very slightly greener

Laboratory corrosion tests show that Inconel is practically completely resistant to corrosion by the mixtures of acetic acid and sodium dichromate encountered in the chrome dyeing of wool. These tests are confirmed by actual practice. Inconel appears to be about five hundred times as resistant as Monel metal to corrosion by diazotizing solutions. The tests carried out were especially severe, since there was no dyestuff present to react with the nitrous acid and thereby cut down the amount available for corrosion of the metals.

It is the author's hope that this rather brief survey of the properties of Inconel has not been entirely without interest. There is certainly no doubt that it does offer something exceptional in the way of resistance to corrosion allied to mechanical strength and ready workability.

Nickel Clad Steel

This product, as the name implies, is one which consists of a steel plate carrying nickel cladding on one or possibly both surfaces. It is now being produced in this country and from the point of view of the textile engineer, seems

likely to be of particular interest for use in connection with peroxide bleaching. Normal nickel clad steel is rolled with 10 per cent. cladding on one side, i.e. nickel clad plate having an aggregate thickness of $\frac{1}{4}$" will carry 0·025" of nickel on one surface. Thicknesses between 3/16" and $1\frac{1}{4}$" are in normal production.

In welding nickel clad steel the steel side is welded with steel and the nickel side is then welded with nickel filler rod so as to give an unbroken nickel surface on the face which is exposed to the processing solutions. Nickel clad steel is essentially a hot rolled plate product. As mentioned above the peroxide bleaching kier seems to be a logical application for nickel clad steel.

A report from America states that about a year ago a Southern cotton mill installed a peroxide bleaching kier made from nickel clad steel for the bleaching of cotton thread in packages. The user recently reported that the nickel clad steel was satisfactory in every respect. The yarn is given a preparatory boil in a solution containing castor oil and soda ash at 200° F. The peroxide bleach itself is made up with 100 volume hydrogen peroxide and sodium silicate and bleaching is carried out at 180° F. The bleached yarn packages are given a preliminary drying in a Monel centrifugal extractor.

The reference to nickel clad steel has only been brief but may have been sufficient to indicate some of the potentialities of this material. It is essentially a product for use on relatively large and heavy equipment where the service is such as to demand thick plate to carry high pressures or heavy loads. For such conditions by the use of nickel clad steel the corrosion resistance of nickel is secured just where it is wanted and the use of nickel at a high price merely to secure strength or rigidity is avoided.

In conclusion, the author would like to mention that in the section dealing with Monel, he has drawn to some extent on the writings of Mr. Schofield of Manchester, while in connection with Inconel, he is indebted to the data published by Mr. La Que of the Research and Development Department of the International Nickel Company of Canada.

A Joint Meeting of the Lancashire Section of the Textile and the Oldham Technical Association was held at the Technical College, Oldham, on November 11th, 1937. Mr. F. P. Slater, M.C., M.Sc., M.A., F.T.I., gave a lecture on "The Textile Institute's Scheme for Standardisation in Textiles."

Mr. Slater opened his lecture with proofs of the need for testing textile materials under controlled conditions. With the aid of slides he demonstrated the variation in strength of cotton yarns with the relative humidity of the atmosphere. Unless the conditions are regulated within comparatively narrow limits the results of tests can be actually misleading. He then dealt more generally with the unification or standardisation of testing methods, to which he said the Institute at first proposed to confine its activities. Despite the great care exercised in drawing up the scheme, it has been misread and misinterpreted in some quarters. He wished emphatically to state that there was to be no attempt to standardise fabrics. He was quite convinced that unless the various sections of the textile industry followed the lead of the engineering and other industries in adopting standards, standardisation would be forced upon them by interests which do not possess the necessary technical knowledge and a state of chaos would be the result. The Institute, by virtue of its Royal Charter, was the body to undertake this work, because it is the only organisation supported by the technically qualified men in every branch of the textile industry. Mr. Slater described the machinery it was proposed to set up, emphasizing that it provided for complete control by the trade itself. In the main committee (i.e. the Representative Advisory Committee composed wholly of men in the textile industry) would rest the power of veto over proposals not considered to be to the interest of the industry as a whole. He showed how it would be linked up with the British Standards Institution which is the only organisation in this

country officially empowered to issue standards. By agreement with this Institute the British Standards Institution undertook not to issue standards which have not been discussed by the standardisation committees of the Textile Institute.

At Mr. Slater's request the General Secretary of the Textile Institute dealt very briefly with the financing of the scheme, showing clearly that no firm would find its contributions burdensome.

The Chair was ably taken by Mr. B. Shore, Wh.Ex., who invited questions from the large audience, which were duly answered by Mr. Slater and Mr. Robinson.

Irish Section

Meeting held at Belfast, Thursday, 28th October, 1937, *to discuss the Textile Institute's Standardisation proposals. The meeting was addressed by Mr. Frank Nasmith, Vice-President and Hon. Secretary of the Institute, Mr. C. Le Maistre, C.B.E., of the British Standards Institution, and Dr. W. H. Gibson, O.B.E., Director of Research, Linen Industry Research Association.*

Mr. Frank Nasmith, Vice-President and Hon. Secretary of the Textile Institute, opened with a brief description of the aims and objects of the Institute. Composed of members of every branch of the Textile Industry, with the object of furthering the progress of textile technology, the Institute is the only fully representative body. The objectives of the founders were education, publication and standardisation. These were embodied in the Royal Charter of 1925 and the Institute will fail in its duty if it does not implement the terms of that document.

The Institute Council, realizing the crying need for standardisation, set up about 2 years ago a committee to deal with the Unification of Testing Methods. This Committee has concluded the preliminary stages of its work and out of it will arise the Representative Advisory Committee. This in time will form the nucleus of the Textile Section of the British Standards Institution. The Representative Advisory Committee will deal with all work connected with standards and appoint the necessary sub-committees to deal with specific duties. It will receive the reports of these sub-committees, give the necessary publicity to tentative specifications and methods of test, and finally collaborate with the British Standards Institute in the official promulgation of standard specifications.

Mr. C. Le Maistre, C.B.E., of the British Standards Institution, dealt with the Textile Institute's Scheme in the light of his 35 years' experience in standardisation. He pointed out that while the scientific research worker seeks the complete confirmation of his work before publication, even if much time is thereby absorbed, the administrators of standardisation realize that delay must be avoided as far as possible. Standardisation unifies specifications in general practice without waiting for perfection, and by periodic review and revision embodies improvements which experience and research show to be practicable and not too costly.

Industrial standardisation covers an immense field. Most of the British Standard Specifications are intended to guide the technically competent purchaser, who acts for a branch of industry which uses the products of another trade. Such specifications safeguard manufacturers against unfair competition since sub-standard materials or appliances can be rejected. The specifications cover personal safety, as for example, lifting gear, electrical equipment, steam boilers, etc.

The British Standards Institution has always considered that its prime duty, before producing any specification, is to secure the consent of all interests concerned. This is the corner stone of the movement and the reason for the country's confidence in the British Standards Institution. There must be no coercion of any description or any arbitrary imposition of standards. The

British Standards Institution is thus a central co-ordinating body, which maintains contact between the various interested branches of industry. Every industry establishing a section for itself under the aegis of the British Standards Institution has complete technical autonomy under the general Council, which is solely concerned with policy and adherence to the fundamental agreed principles. The Representative Advisory Committee to be appointed by the Textile Institute will eventually become the Textile Section of the British Standards Institution and take its place alongside the three existing sections, engineering, building and chemistry.

The international aspect of standardisation is one of considerable interest to the Textile Institute. The British Standards Institution is already in direct touch with the International Standards Association and with the national standardising bodies in many European countries, the Dominions and America.

What possible hope would there be of an ordered development of standards unless there be one central organisation in each country through which they are promulgated, yet in U.S.A., the home of standardisation, there are numerous organisations drawing up standards. Even some of the great American stores have so-called Bureaux of Standards. However, the American Standards Association, the nationally organised Body, is doing its best to unify and co-ordinate these various efforts.

The Textile Institute will, it is hoped, look back with considerable satisfaction on its decision to throw in its lot with the British Standards Institution, the national centre. Not only is it following the advice and wishes of all the Imperial Conferences but it is helping to make the National standards more authoritative and so more useful to the Textile Industry. Finally the fact may again be emphasised that in joining the British Standards Institution it is the Textile Institute which will govern the work and determine its scope, the British Standards Institution placing its staff and specialised experience and particularly its central co-ordinating influence at the disposal of the Institute.

Dr. W. H. Gibson, O.B.E., Director of the Linen Industry Research Association, stressed the need for uniformity in the testing of textile materials. From the beginning the customer has always required some assurance that he was getting what he wanted and from this the practice arose of requiring deliveries to conform to a pattern. This is the simplest form of specification. The customer cannot rely on a mere inspection to show him whether deliveries do actually conform to pattern. With the progress of science and its application to textiles it has been open to the customer to apply tests, which are becoming ever more numerous and more searching.

The customer, however, has had to agree with the manufacturer in regard to the tests applied and the standard of performance in the tests which should be reached in each case. The customer is not a textile expert but he knows what his requirements are. The manufacturer, who is a textile expert, knows what is possible in manufacture to meet the requirements of the customer and what tests can reasonably be met. Many years ago it became apparent that if distrust and endless disputes were to be avoided it was necessary to have separate and impartial organisations to carry out the testing work whose verdict could be taken as an honest one and acceptable both to the manufacturer and the customer. By this process the modern textile specification was slowly evolved and it became customary to submit various textiles to a recognised testing house for test according to recognised specifications, which gave instructions on the tests required to be made, the manner of making them and the results required. These specifications were adopted at first by large users of textiles such as Government Departments and public utility companies, who required material to be satisfactory for a certain purpose, but who were not much concerned with its appeal to the individual taste.

For this reason, to begin with, most specifications were concerned with physical or mechanical tests as it was mainly a matter of whether the material was strong enough for the purpose or not. The adoption of such tests and satisfactory performance of them when adopted is not such a simple matter as it appears at first sight. There are some very important conditions, among which are:—

1. The proper conditioning of the sample to be tested, and the conditioning of the atmosphere in which the test is to be done.
2. The design of the machine on which the tests are to be made.
3. The correct manipulation of the testing machine.

Thus, tests are comparative rather than absolute and it is particularly dangerous to draw conclusions about fabrics which differ from each other in structure or finish.

The advent of large industrial research associations about 18 years ago has had a considerable influence on this question of testing. Research can be done on methods of testing as well as on other parts of the textile industry, indeed, since science is measurement, progress in any branch of textile science is dependent on testing and methods of testing. All the large Research Associations have been bound to investigate very fully the problems of testing. Their work has resulted in a steady improvement in testing, greater precision in existing tests, and the development of new tests.

The work of Research Associations has done more than this, it has developed to a remarkable degree the use of tests in process control, so much so, that this use of tests is more valuable and more vital to the textile industry than the original use as a guarantee that the requirements of the purchaser were being met. This has led to a much wider development of private research and testing departments by individual firms, where the primary object is to maintain the quality of the firms' products by means of process control through testing. The state of affairs now is that there is everything to be gained and nothing to be lost by unification of testing and testing methods. The two uses of testing, for process control and for specification work, must be reconciled. Unnecessary tests and the duplication of testing must be avoided. This can be secured by the centralisation of the control of testing in strong, responsible, representative and competent hands.

Steps must then be taken to raise the competency of all institutions or departments undertaking the testing of textiles to an approved level. So far as the Linen Industry is concerned, it has relied upon the Linen Industry Research Association for scientific and technical advice. The L.I.R.A. has always recognised the value of the Textile Institute as the general body for the promotion of knowledge in the textile industries. Under an arrangement with the L.I.R.A. all our members under a form of group membership are members of the Textile Institute.

This new standardisation scheme will be carried out by the Textile Institute. The work will be in the hands of a group of people who are reliable, responsible, and to a due degree representative of our industry. All the important technical issues here touched upon will be in safe hands and the industry can be assured that the advice of the Research Associations will be sought and followed. At the same time, the organisation dealing with testing to be set up by the Textile Institute will form part of the British Standards Institution and in this way will be recognised officially as the supreme authority in regard to Standardisation and Testing in the United Kingdom.

Scottish Section

The Scottish Section of the Textile Institute spent a very interesting day in the Border country on Saturday, 16th October, 1937. In the morning more than a dozen members, mainly from the jute and linen trades, visited the Scottish Woollen Technical College and were much interested in demonstrations of the teaching methods used in the College. Some of them were particularly curious in comparing the spinning of wool fibre with the methods used in their own industries, and expressed themselves as very highly pleased with the lucidity of the explanations given by the College Staff. They were also interested in the methods used for imparting " colour consciousness " to students.

After lunch at the Douglas Hotel, the party, strengthened to about 35 by the addition of local members and College students, proceeded by private S.M.T. omnibus to Jedburgh where arrangements had been made for them to see over the factory of North British Rayon Limited. Five guides took seven visitors each and not only explained all the processes fully but answered the numerous questions put to them by experts from other branches of textiles. After tea at the Royal Hotel, Jedburgh, Mr. Mullineux, works manager of the factory, gave a short lecture on Rayon Manufacture and, assisted by Dr. Pitter, chief chemist at the factory, answered further questions. The Institute members left feeling they had learned as much about rayon manufacture as an outsider to the industry could know and well pleased with the welcome given them in the Scottish Borders.

Midlands Section

On Wednesday, 20th October, Dr. Edwin Wildt, F.T.I., Chairman of the Midlands Section Committee, presided at a well attended meeting of the Section at the University College, Department of Textiles, Nottingham, when Dr. J. B. Speakman, F.I.C., F.T.I., gave a most interesting and instructive lecture on " Recent Research on Wool and its Industrial Application."

Dr. Speakman discussed briefly the chemical structure of wool, indicating how the behaviour of the fibres in various processes could be explained in terms of the salt and sulphur linkages between the peptide chains. When dry, the interior of the fibre is inaccessible to molecules larger than the *n*-propyl alcohol molecule, thus limiting the activities of the organic chemist. Use has, however, been made of this fact in modern methods of imparting an unshrinkable finish to wool. By using chlorine as gas, as in the Wool Industries Research Association's process, or by using sulphuryl chloride in white spirit, as in Hall's process, attack is restricted to the surface of the fibre and undue damage is prevented.

When the fibre is swollen in water, its accessibility to chemical compounds is increased, and the salt and sulphur linkages may be modified to give useful practical results. Breakdown of the salt linkage is, for example, a primary necessity in acid dyeing processes, but the latter are also aided by sulphur linkage breakdown, which becomes significant at temperatures above 45° C. Sulphur linkage breakdown is also responsible for the existence of a critical temperature in milling and peroxide bleaching, the temperature being again 45° C. in both cases. Similarly, the fact that disulphide bond attack increases rapidly at *p*H values above 10, at ordinary temperatures, is the reason why *p*H 10 is critical in milling and peroxide bleaching. The reactivity of the sulphur linkage in animal fibres was also discussed in connection with the sulphur dioxide bleach, the action of light on wool, and crabbing and blowing processes.

Finally, it was argued that since existing finishing processes are based on the properties of salt and sulphur linkages, new processes should become possible with the synthesis of new linkages between the peptide chains. One example is, of course, to be found in the fact that permanent set is due to the synthesis of

such new linkages, but examples of four other types of bond which have been synthesised were given.

In proposing a vote of thanks to Dr..Speakman, Mr. A. J. Hall referred to his lecture as being valuable light in the darkness of those struggling for information on the inner structure of wool fibres.

The meeting closed with a vote of thanks to the Chairman proposed by Mr. S. G. Blackburn of Nottingham.

Correspondence

THE STRUCTURE OF KERATIN FIBRES

To the Editor

Sir,

In two surprising communications[1, 2] that have appeared within the last few months* in this *Journal* and elsewhere W. Harrison repudiates our interpretation of the molecular structure and properties of the keratin fibres. Readers of the original papers on this subject[3] and on the X-ray interpretation of protein structure in general[4] will no doubt have noted the incomplete presentation both of fact and theory that marks these two communications, but for the benefit of those who have not followed closely the developments in this field, a brief statement on our part may be found useful in assessing which of the two views, Harrison's or ours, is the more worthy of consideration.

Harrison's arguments fall roughly under three heads:—(1) "It appears certain that the elastic properties of hair and wool are dependent on the cuticle."[1] "There can be no doubt therefore, that the different physical and chemical properties of the cuticle and the cortex are responsible for most of the phenomena met with in the supercontraction and permanent set of keratin fibres."[2] (2) He suggests that the change from the α- to the β-type of X-ray photograph which occurs when keratin is stretched need not be due to a straightening of normally folded polypeptide chains, but is more simply and more reasonably explained as due to a change in crystal form from orthorhombic to monoclinic (*sic*) by a process of shearing and reducing the distance between the polypeptide chains. (3) He refuses to believe that β-keratin can be an elongated stereo-isomer of α-keratin, since it can be produced during the changes leading to supercontraction, or even without stretching the fibre.

Under these three heads we should like to make the following remarks:—

(1) There are various indirect objections to this hypothesis of Harrison's—the climax of his reasoning—but there is one direct answer which disposes of it almost in a word. The characteristic elastic properties of the keratin fibres cannot possibly bear more than an insignificant relation to the cuticle, because they are shown by descaled fibres, strips of horn, porcupine quill, etc., cut from the interior, and also by isolated cortical cells. A detailed discussion of the X-ray photographs, long-range elasticity, relaxation, supercontraction and permanent set of the cortical cells is in preparation[5]—they all remain substantially unchanged when the fibres are disintegrated ; but preliminary accounts have already appeared[6] which were in Harrison's hands. It should be stated too, in fairness to the present writers, that the gist of these more recent results was communicated to Harrison privately.

(2) The crystallographic change from α- to β-keratin proposed by Harrison might appear plausible were it not for the fact that it involves a 50 per cent. increase in density! By experiment, the densities of unstretched and stretched keratin fibres are approximately the same—indeed, the most recent estimates indicate that, if anything, stretched fibres are slightly the less dense. It also offers no reason whatsoever for the *long-range* elasticity of keratin, since it could

---

* The delay in publishing this reply is due to the absence of one of us abroad.

bring about no more than a negligible elongation of the *long, oriented* crystallites that the properties of the fibres demand. To overcome these difficulties, Harrison makes the further suggestion[2] that " the constant density can only be accounted for by assuming some change in the other constituents of the fibre." What other constituents? To cancel out a 50 per cent. increase of density in those more perfectly organised parts of the fibre which give rise to the X-ray " fibre photograph "—and again it must be emphasised that these same photographs are given by the cortical cells—it would be necessary to postulate a considerable proportion of some constituent whose density on stretching falls correspondingly. It will be sufficient to await the discovery of such a constituent, or in fact of any important proportion of a constituent with properties substantially different from the main properties of the fibres and their cortical cells, before taking up this matter further. In the meantime the hypothesis we have proposed, that of the unfolding of folded polypeptide chains on stretching, the grid-like structure of the keratin complex, the breakdown of cross-linkages of the grid on " relaxation," and the further folding on supercontraction or the re-building of cross-linkages on permanent set, is at least consistent with the facts, and serves to co-ordinate an immense mass of experimental data, not merely in the field of the keratins, but in that of the proteins in general.

(3) The production of keratin in the β-form by methods which appear not to involve stretching—squeezing laterally *does* involve stretching—is simply one example of the general mechanism of protein denaturation.[7] If we heat any " globular " protein there is a liberation of polypeptide chains, some of which aggregate into regular bundles analogous in structure to β-keratin ; and here, of course, there is undoubtedly an elongation of a proportion of the molecules without stretching the system as a whole. We must protest against the one-sided version of our interpretation that Harrison has put forward, for we have already discussed at length the points he raises in this connection. It is neither possible here nor necessary to do this again, but we should like to repeat that the keratin fibres appear to be built of a continuous range of chain-bundles of varying size and degree of organisation. The regular X-ray patterns and the phenomena of permanent set are associated more closely with the better organised (or " crystalline ") regions of the fibre structure, as would be expected, while the phenomena of supercontraction are associated more closely with the less organised regions. It is possible to set parts of the fibre in the elongated form while other parts are still capable of contracting, or even of super-contracting. Generalised setting of the fibre substance follows only on more prolonged steaming in the stretched state: the initial rapid setting of the more crystalline regions produces only " temporary set " and is insufficient to counteract contractile power still remaining if the free fibre is afterwards again exposed to steam. Thus it is that when a hair that has been exposed for a short time in the stretched state to the action of steam is caused to contract, the β-photograph persists but is found to be *disoriented* after contraction, because of the necessity of accommodating contractile and non-contractile parts in parallel. If the stretched fibre has not been exposed to steam, the β-photograph maintains its orientation during contraction but is gradually replaced once more by the α-photograph.

There are two main reasons why a β-photograph should be observed *on treatment with steam or boiling water after breakdown of the cross-linkages of the grid*—supercontraction can be produced without the appearance of a β-photograph, it should be noted. One is the " statistical effect " common to denaturation in general, whereby on the breakdown of a specific folded configuration of polypeptide chains a proportion of the latter will form fully-extended bundles giving an interpretable X-ray photograph, while the remainder take up all sorts of irregularly folded configurations which cannot be expected to give such a photograph. We see a similar effect when rubber is " frozen " and here again,

without stretching, it is possible to obtain the photograph of stretched rubber, which without doubt must be ascribed to fully-extended polyprene chains. The second reason is that the violent contraction of the less organised, and therefore more contractile, parts of the fibre tends to increase the perfection, if not actually to augment the number, of the extended chain-bundles ; that is, the better organised parts, since these are in a specially favourable state of aggregation once the linkages stabilising the α-configuration have been broken down. This is a phenomenon that we have investigated experimentally and called " differential supercontraction." Myosin shows the effect in still more striking fashion. In every case, though there is no stretching of the system as a whole, there is a temporary development of tension, and the obvious inference, in view of the indications of the X-ray photographs, is that certain parts have contracted at the expense of parts that have been oriented or stretched. It is only the latter which would be expected to give a regular X-ray photograph, and it seems to us hardly reasonable to expect a new regular X-ray photograph for the supercontracted state.

To continue the argument further with the accumulated evidence from X-ray and related studies of other proteins would be merely to repeat again what has already been written in other journals. The X-ray interpretation of keratin is now only part of the interpretation of a whole group of substances, and they stand or fall together. The isolated muscle protein myosin, for instance, has X-ray and elastic properties remarkably similar to those of the supercontracting form of keratin,[8] and there is no question here of invoking any interplay between the properties of cuticle and cortex, or of postulating " other constituents." If, as Harrison contends, our ideas on keratin are wrong—we are not, of course, maintaining that every minute detail is right, and every subsidiary hypothesis—it still remains to be shown how they are wrong, and the correct explanation must still be part and parcel of the interpretation of all proteins.

Harrison has neither shown we are wrong nor has he put forward any such explanation, though surely we have a right to ask for one in exchange for ours. The most fundamental property of the many beautiful properties of keratin is that it is an *oriented* system with a potential range of elasticity of up to 300 per cent. If our explanation of this and so many other things is erroneous, what *is* the explanation?

Textile Physics Laboratory,
University of Leeds.

W. T. Astbury.
H. J. Woods.

November 16th, 1937.

REFERENCES

[1] W. Harrison, *J. Text. Inst.*, 1937. **28**, P110.
[2] W. Harrison, *Chem. & Ind.*, 1937, **56**, 731.
[3] W. T. Astbury and A. Street, *Phil. Trans. Roy. Soc.*, A 1931, **230**, 75 ; W. T. Astbury, and H. J. Woods, *ibid.*, A 1933, **232**, 333; W. T. Astbury and W. A. Sisson. *Proc. Roy. Soc.*, A 1935, **150**, 533.
[4] W. T. Astbury, Cold Spring Harbor Symposia on Quantitative Biology, 1934, **2**, 15; Kolloid-Z, 1934, **69**, 340; *Nature*, 1926, **137**, 803; *Chem. Weekbl.*, 1936, **33** 778; *J. Text. Inst.*, 1936, **27**, P282.
[5] H. J. Woods.
[6] H. J. Woods, *Proc. Leeds Phil. Soc.*, 1936, **3**, 132; W. T. Astbury, *J. Text. Inst.*, 1936, **27**, P282,
[7] W. T. Astbury and R. Lomax, *J. Chem. Soc.* 1935, 846; W. T. Astbury, S. Dickinson, and K. Bailey, *Biochem. J.*, 1935, **29**, 2351; W. T. Astbury, *Nature*, 1936, **137**, 803.
[8] W. T. Astbury, and S. Dickinson, *Nature*, 1935, **135**, 95 & 765; 1936, **137**, 909; "X-Ray Studies of the Molecular Structure of Muscle" (*in prepar tion*) ; " Protein Structure from the Viewpoint of X-Ray Analysis" (*Sörensen Jubilee Volume—in press*).

THE STRUCTURE OF KERATIN FIBRES

To the Editor.

Sir,

So far as the chemistry of keratin fibres is concerned, the letter[1] and a recent article[2] by W. Harrison contain a number of misconceptions which require correction. After reviewing the evidence we have advanced[3] in favour of the view that permanent set is due to the formation of new cross-linkages between the peptide chains by the interaction of basic chains (amino groups) and the products of hydrolysis of the sulphur linkage, Harrison states that this view would be " difficult to contest "[2] were it not that substances having no action on free amino groups and disulphide bonds can prevent permanent set. When first made,[1] this statement was unsupported by experimental evidence and did not merit comment, but in the recent article,[2] examples are given of substances which Harrison regards as preventing permanent set without affecting free amino groups and disulphide bonds. Chief among these is magnesium sulphate: " Thus whilst boiling water will produce permanent set in stretched fibres, the addition of 5 per cent. magnesium sulphate almost entirely prevents it." There is not the slightest foundation for this statement. Human hair fibres immersed at 40 per cent. extension in boiling 5 per cent. magnesium sulphate solution for 30, 60 and 120 minutes, were found to retain 0·5, 8·0 and 14·9 per cent. set, respectively, after release in boiling water for 60 minutes. In this, as in the other relevant cases, Harrison has failed completely to take account of the effect of the *p*H of the setting medium on the rate and extent of setting, although the subject has been fully discussed in a number of papers from this laboratory.[3]

Equally misleading are Harrison's comments on the phenomenon of supercontraction. He seems to have ignored the fundamental fact that the supercontraction to be interpreted is that which occurs when fibres are released in steam after being steamed for 2 minutes at 50 per cent. extension. The changes governing such supercontraction precede the reactions responsible for permanent set, and hydrolysis of main peptide chains is not an essential feature of either. In fact, the very reverse is the case because we have shown[4] that " hydrolysis of the main peptide chains permits their collapse despite the rebuilding of linkages between them." Consequently, in any attempt to elucidate the reactions responsible for the supercontraction which precedes permanent set, attention must be restricted to those reagents and processes which induce supercontraction without causing serious hydrolysis of main peptide chains. With such considerations in mind, we found that disulphide bond breakdown is essential for supercontraction by demonstrating that reagents such as sodium sulphide, potassium cyanide, sodium bisulphite and silver sulphate, which are known to attack the disulphide bond of cystine, cause supercontraction of wool fibres. Of these reagents, sodium sulphide and potassium cyanide might at first sight be regarded as questionable on account of possible main chain hydrolysis ; but the former was used in dilute solution in the cold for 60 minutes, the latter was used in dilute solution at the boil for only 30 minutes, and both were very much more effective in causing supercontraction than corresponding concentrations of caustic alkali under similar conditions. Finally, the list of reagents which attack the cystine linkage and cause supercontraction may be extended almost indefinitely. For example, chlorine peroxide, which is regarded by Schmidt[5] as having no action on the main peptide chains, causes supercontraction by breaking the cystine linkage ; and the combined action of sunlight and air, which has been shown to be restricted to the cystine linkage,[6] promotes supercontraction. Conversely, if a fibre is supercontracted by boiling in 5 per cent. sodium bisulphite solution for 1 hour, and is then washed, stretched and treated with oxidising agents or metal salts to reform linkages between peptide chains, supercontraction is prevented and the fibre acquires a true permanent set. Similarly, the fact that salt linkages oppose supercontraction was proved by showing that borax and

sodium sulphite, which are incapable of causing supercontraction with untreated fibres, cause supercontraction with deaminated fibres. There is thus overwhelming evidence to show that supercontraction is caused by the breakdown of salt and sulphur linkages, leaving the main peptide chains reasonably intact. The only logical way for Harrison to refute this view would be for him to name some reagent which *does* attack the cystine linkage and *does not* assist supercontraction. Instead, he states that " supercontraction is caused by quite a lot of other reagents which have no specific action on disulphide linkages."[2] No example was given in the original letter,[1] and only one example—" a hot concentrated solution of zinc chloride "—is given in the more recent article.[2] Unfortunately, this reagent causes supercontraction simply by hydrolysing the main peptide chains, and observations based on its use have no bearing on the supercontraction which precedes permanent set, because this supercontraction takes place *without* significant main chain hydrolysis.

In conclusion, it should perhaps be mentioned that Harrison's failure to realise supercontraction, when fibres are dried *slowly* after being boiled in sodium bisulphite solution, does not disprove our views on the chemical mechanism of supercontraction. It should have been obvious that the failure was due simply to the fact that disulphide bond rebuilding occurs in the extended fibres by atmospheric oxidation[7] of the abnormally large numbers of sulphydryl groups present in the bisulphite-treated fibres. Surely supercontraction must not be expected when the conditions are such as to impart permanent set!

Textile Chemistry Laboratory,
Leeds University.
November 16*th*.

J. B. SPEAKMAN.
J. L. STOVES.
C. S. WHEWELL.

REFERENCES

[1] Harrison. *J. Text. Inst.*, 1937, **28**, P110.
[2] Harrison. *Chemistry and Industry*, 1937, **56**, 731.
[3] Speakman. Nature, 1933, **132**, 930; *J. Soc. Dyers and Colourists*, 1936, **52**, 335; 423; *J. Text Inst.*, 1936, **27**, P231. Speakman and Whewell, *J. Soc. Dyers and Colourists*, 1936, **52**, 380. Speakman and Stoves, *J. Soc. Dyers and Colourists*, 1937, **53**, 236.
[4] Speakman. *J. Soc. Dyers and Colourists*, 1936, **52**, 337.
[5] Schmidt. *Ber.*, 1922, **55**, 1529; 1925, **58**, 1394.
[6] Speakman and McMahon. *Trans. Faraday Soc.*, 1937, **33**, 844.
[7] Speakman. *J. Soc. Dyers and Colourists*, 1936, **52**, 425.

Reviews

"Textile Design." By Antony Hunt. (No. 15, " How to do it " series). The Studio Publications, 44, Leicester Square, W.C.2. 7s. 6d. net.

The vigorous way the author has expressed his opinion upon this subject is infectious and makes the reader of this book quite enthusiastic about the problem of designing for textiles.

The various sections of the book are well planned and offer good advice in many directions even to the mounting and presentation of designs. Its main aim is, by word and illustrations (34 excellent photographs), to stimulate the artist designer and to help in the appreciation of the qualities of textile materials suited to various uses but especially to " interior decoration " in its most progressive form. This is excellently described and illustrated and should be studied by all who would progress in textile design by experimenting with the newer means of artistic expression now available for this purpose.

Whilst dealing primarily with the æsthetic side of the problem, the technical limitations are also considered with a view to making the individual " cloth conscious."

The book is worthy of better diagrams of printing processes than those on page 54. A more serious effort in this respect would have helped towards a clearer explanation of " Printed Fabrics "—an important element of the work.

According to the cover, the fundamental aim of the book is " To help to bridge the gap existing between designer and industry and to show methods whereby the artist may overcome the many technical problems involved. In this respect it makes great progress in the right direction and contains a wide range of information for all who deal with the problems of textile designing.

P.O'B.

Betriebs und Selbstkostenprobleme der Wollindustrie. von Dr. Ing. Cl. Sustmann (Verlagsbuchhandlung Julius Springer, Berlin W.9, pp. *VIII* and 157. Price 9·60 R.M.).

This very far reaching book covers costing in every process from the spinning of the yarn to the finishing of the piece. The deductions the writer draws, and the conclusions he comes to, are calculated to bridge the gulf between theory and practice. These are derived from the long study of machines and operatives, working under normal conditions in various modern factories, and the figures and statistics collected are most interesting in themselves, apart from their value to the costing plan subsequently developed.

A full set of tables, giving power, lighting, and other overhead costs for each process, as well as the production of every machine under normal conditions is provided. Against these calculated theoretical figures, there are the actual figures obtained under running conditions, a very different matter, as all know, and as the figures clearly demonstrate.

The costing system advocated is the one that almost all cost accountants recommend, the very minute examination of all costs and their allocation to the separate machines, so that each machine, or group of similar machines is rightly assessed and stands its fair share of overheads. This system is too well known to need further explanation. It may quite easily be adapted to any plant with fairly standardised machinery doing a plain trade, and this book will give many valuable hints as to the best procedure to adopt, and the pitfalls to avoid.

It is the method of establishing these costs that is the chief merit of the book. The thoroughness of the tests, and the number of tests taken, make the book a real reference work to the production manager. Whilst everyone knows roughly the variations in efficiency due to varying speeds, materials, and even operatives, there are few who could give actual figures, running into periods of years in some cases, to establish their claims.

Nothing is stated as a fact in the book without figures to prove it. Some of the articles on the various processes will create considerable surprise, when it is seen what a vast difference efficient methods can produce, particularly in the winding and warping. Mere speeding up of machinery as some very interesting tables show, may easily be a double-edged sword, and turn against its holder.

The root principles of efficient production are well known to all. They include good material, long lengths, suitable machinery running at a speed adapted to the material, and, most important, good craftsmanship from the operatives.

The detection of the weak link, however, is not so easy, but a thorough investigation of plant, on the lines of this book, and the systematic keeping of records should effect improvements in many establishments and might even make them approach some of the efficiences he suggests, which seem so far away from reality at first glance.

J.E.

Fundamentals of Textiles. A. Workbook. By Eda A. Jacobsen and Helen E. McCullough. Published by Chapman & Hall Ltd., London. (154 pp., 7s. 6d. net.)

In a review of this volume the following extracts from the preface appear to be vitally necessary. " The purpose of this book is to give those interested in textiles and clothing specific information which will serve as a guide in their buying problems. It provides exercises covering the fundamental material in the field of textiles, from raw materials through construction, identification, analysis, choice, use, and care of fabrics. The emphasis is on the practical and not on the highly technical and specialized phases of the subject." " Since this is a workbook best results will be obtained if the procedure outlined here is observed in using it. The student should read the introduction to a specific unit and study the references which have been assigned. She should then carry out

the directions given for the exercise, answer, either in writing or orally, any questions which the instructor may assign, and be prepared to participate in the class discussion and criticism that follow.''

Such a preface disarms criticism in advance. From the third sentence in the second quotation it is assumed that the book is meant for the use of the ladies who are usually considered to form the greater part of the textile purchasing public. A perusal of the volume leaves the impression that the book is intended more as a guide to the teacher than to the student, and that the latter, without the aid of the former, would derive little benefit from a study of the work.

There is no doubt that the user of textiles in the home could derive much information in a pleasantly discursive fashion from a course such as that outlined by the authors. Consequently it is a pity that in a book dealing with fundamentals, fundamentally wrong ideas, such as ''elasticity '' on p. 48, should be repeated. Even a shallow dipping into the scientific literature of textiles will show that the ready deformability of knitted fabrics must not be termed '' elasticity '' which has long had a precise scientific meaning. If the work of D.13 Committee of the American Society for Testing Materials can be studied with regard to twist in yarns (see Question 30, p. 25) surely it can be consulted on the exact distinction between '' extension '' or '' elongation '' and '' elasticity.''

Presumably the object of the questions which follow the various '' logical blocks '' or '' units '' is to stimulate the interest of the reader or students in as many directions as possible. If this is correct the questions, ranging as they do from simple fibre identification to textile trade unionism, are an unqualified success. A thousand page volume would be insufficient to contain the answers in many cases.

There is no doubt that this work will form a useful practical supplement to the dozen or so volumes on textiles to which the reader is referred. The purchaser who studies the course outlined and uses the knowledge thus acquired should be able to purchase wisely. T.

Toxicity of Industrial Solvents. Summaries of Published Work, compiled by Ethel Browning. Medical Research Council, Industrial Health Research Board. Report No. 80. (Published by H.M. Stationery Office, London. Price 7s. 6d.)

This volume cannot fail to be of the utmost use to all who employ volatile solvents and who are therefore concerned with the effects these substances may have on the health of workers. Attention to the possible dangers connected with the increasing use of volatile solvents in industry is drawn from time to time by fatal accidents and coroners' inquests thereon. The need for research is therefore perfectly clear and the first step in this direction is the collection of the available knowledge and its presentation in convenient form. Dr. Browning's summary, which does not claim to be exhaustive, will aid those who have to direct the research. T.

Kunststoff-Wegweiser durch die Kunststoff Ausstellung, 1937. G. Kränzlein and R. Lepsius. [Berlin ; Verlag Chemie G.m.b.H. ; 1937 ; 140 pages ; R.M. 1-15.]

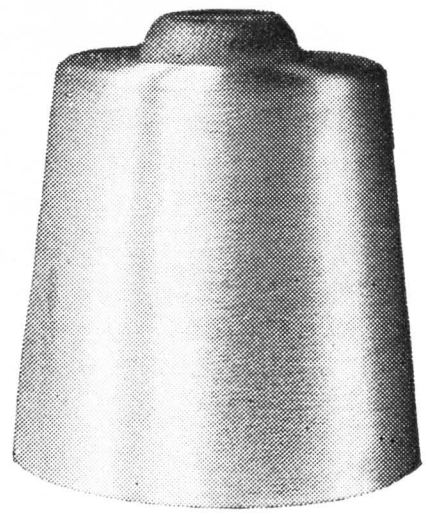
The special feature of the triennial Chemical Engineering Exhibition in Germany this year was Plastics. The present little book is essentially a guide to the exhibition but contains much information of a more permanent kind, especially an alphabetical list of the trade names of German plastics, their makers and their chemical origins.

Teoria delle Armature Fondamentali per Tessuti. Prof. G. Strobino. [Biella ; Editoriale Laniera S.A. ; 1936 ; 505 pages, 301 illustrations ; 8s. 6d.]

We welcome this Italian contribution to the theory of weave construction with the hope that it may be made accessible to English readers. In spite of the number of pages, it is not really a large book for the margins are extremely generous and the illustrations (drafting plans, etc.) occupy much of the space. It deals comprehensively with the geometry of weaves and is particularly welcome for its indications of other original work in this field.

A necessary Evil ?

We are not for a moment suggesting that our winding is bad, in fact the reverse is true, but there has long been a thought in the Industry that winding was a necessary evil. However, just as adversity strengthens a man so winding improves the yarn during the process. A cleaner and stronger yarn is produced and in a form which is eminently suitable for the next process it has to undergo.



UNIVERSAL WINDING COMPANY

Cables and Telegrams "LEESON MANCHESTER" **SAVILLE ST. MANCHESTER, 1** *Telephones* ARDwick 4304-5

LEESONA
Registered Trade Mark



Our ***Managing Director's*** *message to the Textile Industry . . . . .*

THE Textile Institute is representative of the whole Textile Industry, yet it is those who use cotton yarns in whom we are particularly interested. Our Company, which operates one-and-a-half million spindles and maintains the old established reputations of the twelve member firms, attaches the greatest importance to the high standard—regularity and consistent fine quality—of the yarns we produce.

The considered policy of the Company, which has resulted in our yarns becoming accepted and recognised as the standard for regular high quality, is that each member firm, whilst specializing in the production of yarns for differing purposes, shall produce the best of its class.

Consequently, whatever your requirement in cotton yarn, you can place your enquiries with every confidence with each and every member firm of this Combine, secure in the knowledge that we produce a yarn for every purpose.

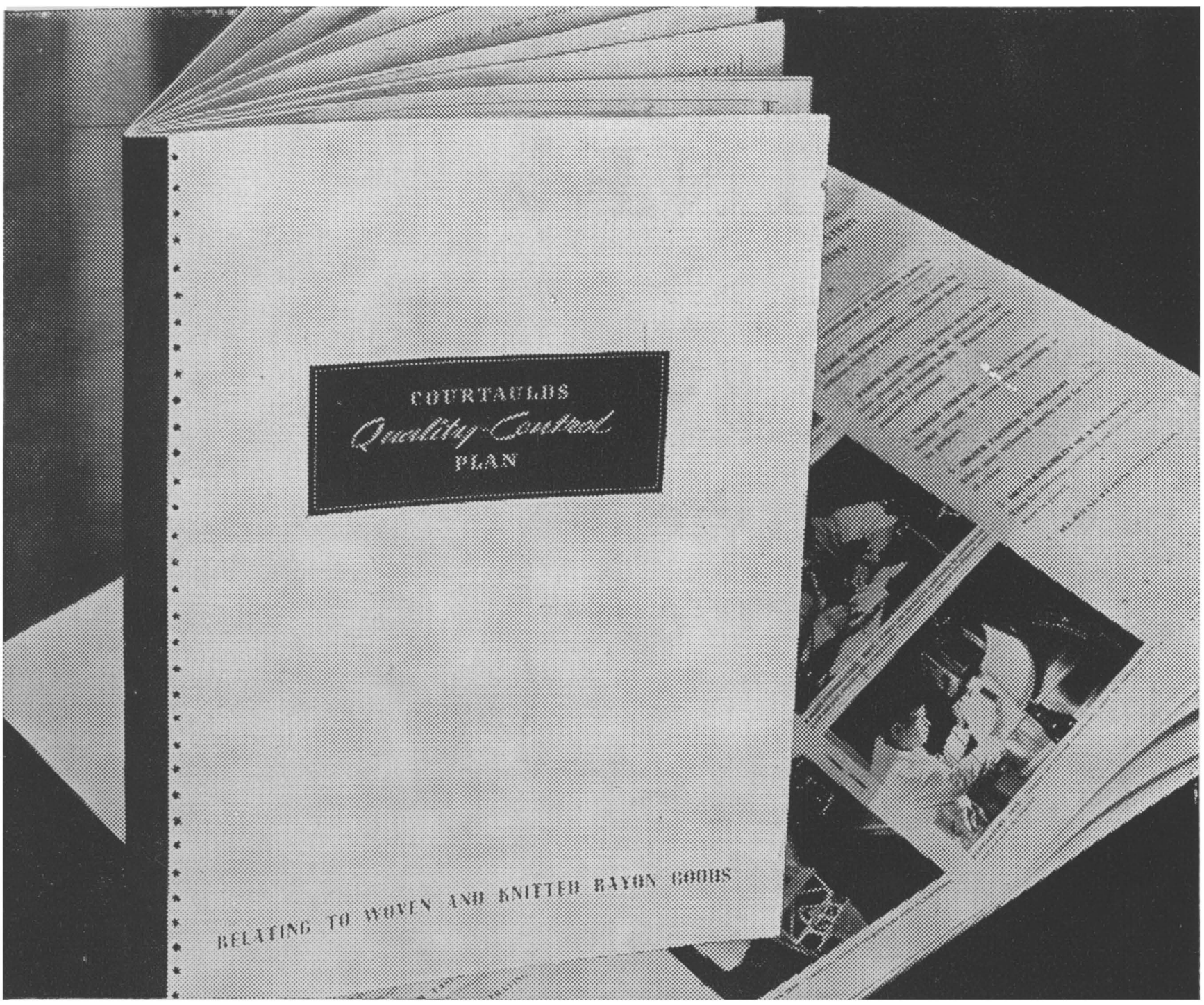
CROSSES & WINKWORTH CONSOLIDATED MILLS Ltd.

BOLTON——————LANCS.——————ENGLAND

Important to Manufacturers

The book that tells you all you want to know about

Courtaulds Quality-Control Plan



THIS Plan is designed to raise the quality-levels of fabrics and garments made from Courtaulds rayon yarns, and to enable such rayon goods which attain certain specified quality-levels to be identified by Courtaulds "Tested-Quality" mark and, thus publicised.

Courtaulds will throw the full weight of their advertising and publicity resources behind goods which bear the "Tested-Quality" mark, thus creating markets for manufacturer, maker-up, and retailer alike.

Before they are enabled to bear the "Tested-Quality" mark, materials or garments must be submitted to a series of tests against Courtaulds Specifications, conducted by impartial body—The Testing House of the Retail Trading-Standards Association.

The book illustrated above tells the full story of Courtaulds Quality-Control Plan, and gives full information on every aspect of its operation.

To obtain a copy of this book fill in the form immediately below and post it to Courtaulds Limited, Sales Dept., Foleshill Road, Coventry.

THIS IS COURTAULDS *"Tested-Quality"* TRADE MARK

. . . destined to become the accepted symbol of quality rayon merchandise

TESTED QUALITY — COURTAULDS — RAYON

Post in unsealed envelope (½d. stamp) to Sales Dept. 17A, Courtaulds Ltd., Foleshill Road Coventry.

Firm's name.....

Address.....

Signature .....

Wildt & Co LIMITED

For every class of

CIRCULAR KNITTING MACHINE

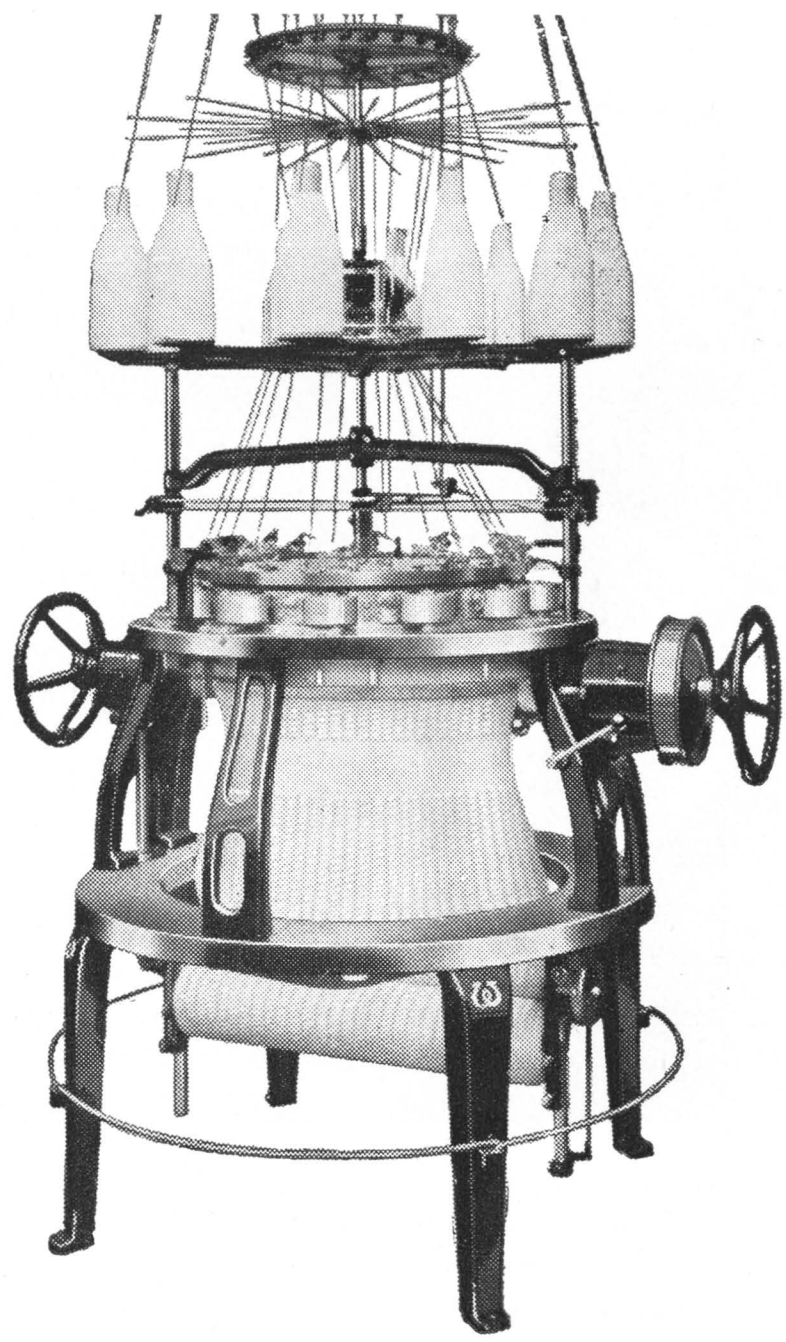
whether for . . .

Footwear
(Hose and Half-Hose)
Underwear
Outerwear

so long as it is . . .

WILDT-BUILT

you have the guarantee of reliable and dependable machines which will produce the up-to-date articles with a maximum production and a minimum of seconds.



CIRCULAR LATCH NEEDLE WEBBER
Model S.T.C.

Write for Illustrated Catalogue!

ADELAIDE WORKS
Leicester.

THE JOURNAL OF THE
TEXTILE INSTITUTE
TRANSACTIONS

21—THE EFFECT OF TWIST ON THE STRENGTH AND LENGTH OF COTTON FIBRE

By HARIRAO NAVKAL, M.Sc.
and NAZIR AHMAD, M.Sc., Ph.D., F.Inst.P.

(*Copyright by the Textile Institute*).

SUMMARY

Five Indian cottons capable of spinning from 6's to 34's warp yarn were chosen, and in each case the fibre strength and the percentage contraction were measured with zero twist and after inserting 25, 50 and 100 turns both in the right-handed and left-handed directions. For strength tests, Barratt's apparatus, with certain modifications, was used, while the contraction was read on a micrometer in the eyepiece of a telescope. The mean humidity for each of these twists was kept nearly constant, to avoid applying large corrections on this account. The following conclusions are derived from a consideration of the results:—

(1) The frequency distributions of the strength values are best represented by Pearson's Type I curve, whether the tests are made on whole fibres or centimetre lengths. When the fibres are twisted, the form of the curve is unaltered.

(2) If all the results are combined it is found that the effect of left-handed twist is slightly greater than that of right-handed twist.

(3) For Cambodia Co. 1, mean fibre-strength is unchanged up to 25 turns after which it increases by a small amount and then remains steady for higher twist. For the other cottons the fibre strength increases with twist from the outset, reaches a maximum value and then falls as the twist is gradually increased. But the rates of change of strength and the points at which the maximum values are reached are different for the different cottons. The maximum increase in strength for these cottons lies between 3 and 9 per cent. of the value at zero twist.

(4) Parabolic curves were fitted to the strength values and it was found that all cottons reach their maximum fibre strength only after some 40 turns per inch are inserted, and that the longer cottons could withstand a higher degree of twist than the shorter ones before reaching their maximum fibre strength, the peak value for Cambodia Co. 1 occurring at about 200 turns per inch.

(5) At 100 turns per cm. (254 turns per inch), there is a considerable fall in fibre strength, which is greater for the shorter than for the longer cottons. At this high twist, the shortest cotton, *viz.*, A. 19, lost as much as 24 per cent. of its fibre strength, while the longest, Cambodia Co. 1, lost practically nothing.

(6) Direction of twisting has no effect on the variability of fibre strength. Variation in fibre strength is very nearly constant up to 50 turns per cm., but

at 100 turns per cm. it is significantly higher for all cottons except Cambodia Co. 1.

Furthermore this increase in strength variability at 100 turns is greater for the shorter than for the medium cottons. Thus, at high twists the fibres of these cottons are not only rendered weaker but also more variable in strength, and in both the cases the effects are greater with the shorter cottons.

(7) When twist is increased from zero to 25 or 50 turns per cm., the skewness of fibre strength distribution curve falls for some cottons and rises with others. The skewness at 100 turns, however, is significantly higher, being nearly twice the value for 50 turns for all cottons except Cambodia Co. 1.

(8) Direction of twist does not make any difference to the mean value of percentage contraction up to 50 turns per cm. At 100 turns, however, there is a tendency for the fibres to contract more with the right-handed than with the left-handed twist.

(9) Fibres of all cottons contract on being twisted, the percentage contraction increases rapidly after medium twist (25 turns) is inserted and is greater for the shorter than for the longer cottons.

(10) Variability in length increases appreciably only after 50 turns are inserted and the increase is greater for the shorter than for the relatively longer cottons.

(11) The correlation coefficient between the strength and the percentage contraction of fibre is practically zero. Hence it is inferred that in many cases the fibre does not break at its thinnest point, which may in fact be rendered stronger, up to a limit, by the insertion of twist, but at a point where mechanical or bacterial injury has taken place.

(12) Variability in the properties of the cotton fibre with twist is discussed, and it is shown that so long as the twist is within the limits usually employed in spinning yarn, it improves, on the whole, the properties of the individual fibres. However, this improvement in fibre-properties in general and in fibre strength in particular can account for only a very small fraction of the increase in yarn strength observed for the same range of twist.

(13) The bearing of these results on the molecular chain theory of the structure of cotton fibre is discussed, and it is found that this theory is capable of explaining, in a general way, the principal effects of twist on hair strength observed by us.

Various errors that could have crept into this investigation have been examined and their effect shown to be negligible in a comparative study of cottons.

INTRODUCTION

The earlier attempts to find a relation between yarn strength and fibre strength led to certain results which were either unexpected or anomalous. Monie[1] and Bowman[2], who first studied this problem, found that in ordinary yarns only about 20 per cent. of the combined strength of the fibres is utilised, the remaining 80 per cent. being lost to all intents and purposes. Turner[3], in a critical study of the subject, showed that an arithmetical error had crept in the works of both Monie and Bowman, and that, if this error is removed, the percentage of total fibre strength actually utilised in the yarns examined by them falls down to low figure of 10, which is probably due to insufficient data, large sampling error and inaccurate methods of measurement. Miss Clegg[4] made an important advance in the investigation of this problem and not only studied the relation between fibre strength and yarn strength, but

also ascertained by employing Bright's Congo Red technique, the percentages of fibres which had broken and those which had slipped in the rupture of the yarn. Her experiments showed that about 40 per cent. of the total fibre strength may be utilised in the yarn strength, but, curiously enough, the natural corollary of this result that cottons with high fibre strength should yield comparatively stronger yarns, was not borne out by her observations, which failed to establish any correlation between hair strength and yarn strength. Turner[5], working with Indian cottons, confirmed Miss Clegg's conclusion as regards lack of correlation between these two properties, but showed further that if due allowance is made for the fineness of the fibre, and consequently, the number of fibres present in an average cross-section of the yarn, the negative correlation between hair strength and yarn strength is converted into a positive one, though it is still insignificant. This work was later extended by Turner and Venkataraman[6], who on analysing the results for 95 samples of standard Indian cottons, found that the *partial* correlation-coefficient between fibre strength and spinning value was only 0·10 as against 0·70 for mean fibre length.

It should be stated here that, in the experiments to which a brief reference has been made above, soft or moderately hard twisted yarns were employed. It was shown by Gulati and Turner[7] that if hard twisted yarns were used the percentage of total fibre strength utilised in the yarn rose to high values. Miss Clegg had earlier emphasised the necessity of distinguishing between the respective rôles of fibre-breakage and fibre-slippage in the rupture of yarn. Gulati and Turner gave quantitative data to show how one factor waned and the other waxed as more and more twist was inserted in the yarn, until at about 30 turns to the inch, the fibre slippage was reduced to insignificance. These conditions, however, held for special hard twisted yarns, while for the ordinary yarns, which are of general commercial importance, it was still true that 40 to 60 per cent. of the fibres did not make any *perceptible* contribution to the strength of the yarn. Turner has discussed at length the various factors which might be held responsible for this observed lack of agreement between total hair strength and yarn strength.

One of the factors which, it was thought, might throw some light on the problem and was capable of being studied experimentally, was the effect of twist on the strength and extension of cotton fibre. As is well known, in the measurement of hair strength, care is taken that the fibre is *not* twisted, while in the manufacture of yarn the fibres have to be twisted to give cohesion and strength to the yarn. It can be shown that if n be the number of turns per inch in the yarn then the angle α which the fibres make with the yarn axis is given by

$$n = \tan \alpha / d$$

where d is the diameter of the yarn in inches. So far as we know, the precise effect on its strength of twisting the fibre by a known amount has not been studied before. It was, therefore, an unknown factor in the consideration and elucidation of this important problem. Accordingly, it was thought desirable that a study of this factor should be made for a number of representative standard Indian cottons and the results of this study are described in this Bulletin. The study began, as stated above, with the object of throwing light on an hitherto obscure corner in the problem of relation between hair strength and yarn strength, but, as it developed, it yielded interesting and promising results in several directions, and our only regret is that, owing to the highly time-absorbing nature of the experiments, we have not been able to extend it to a larger number of cottons.

DESCRIPTION OF APPARATUS

The apparatus used in these tests consisted of three parts, (1) for recording the breaking strength of the fibres, (2) for inserting in the fibres the desired degree of twist, and (3) for measuring the contraction of fibres due to the insertion of twist. For the first, Barratt's fibre balance, with certain modifications, was used. As a description of this apparatus has been given by Barratt[8] and by Navkal and Sen[9], it is unnecessary to give it here in detail. Briefly, it consists of a balance, whose beam, instead of supporting two pans, supports at one end an iron rod E (Fig. 1) and at the other a metallic hook CB. The rod E passes through a central hole in a solenoid S and the

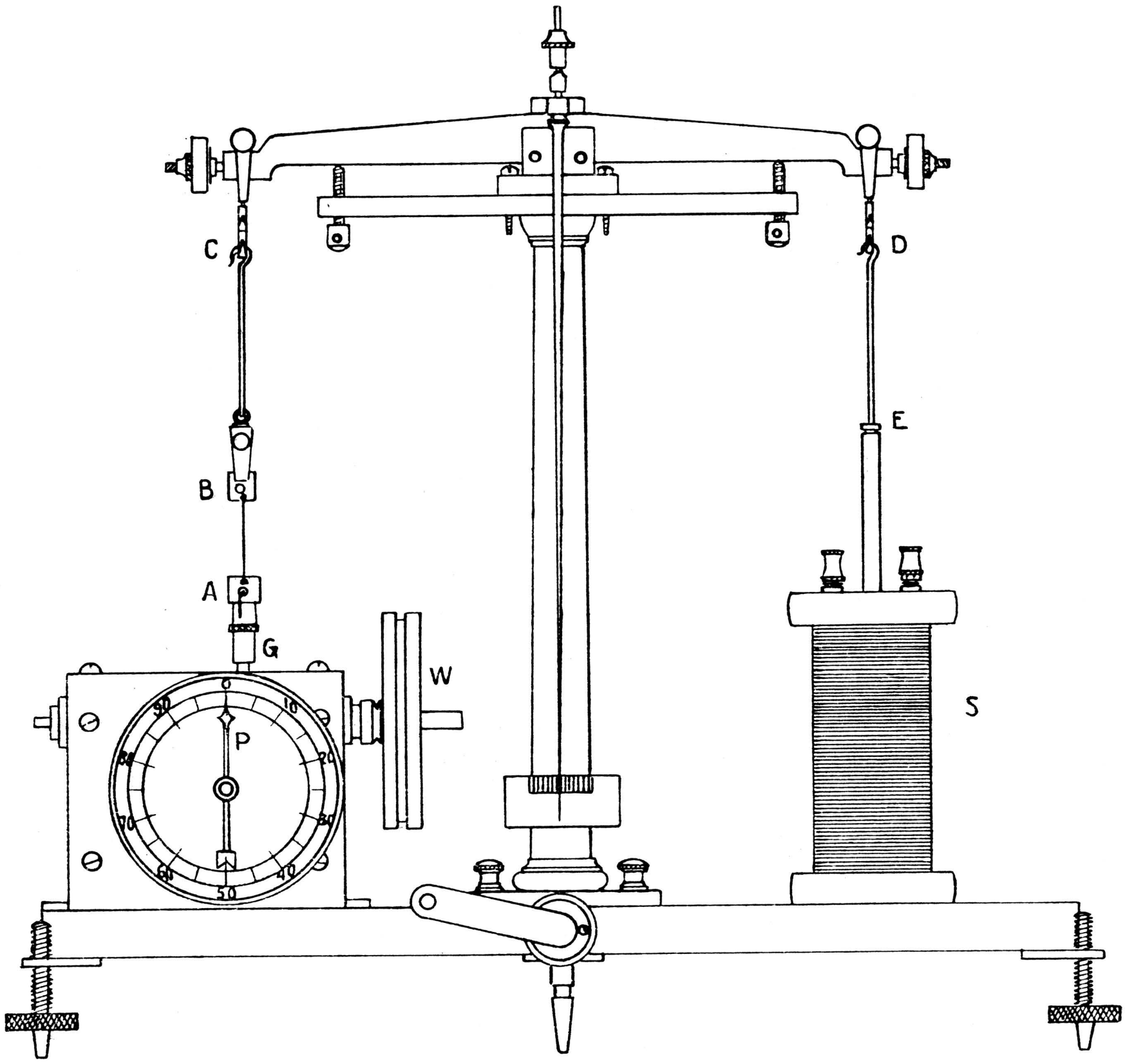


FIG. 1

attraction between the rod E and the solenoid S, which is a function of the current in the latter, supplies the tension on the fibre. The fibre is mounted on two eyelets, one of which is placed at the hook end B and the other is held by another hook A which can be raised or lowered at will and forms part of the reduction gear GPW. By means of this gear arrangement which is driven by a motor, the fibre can be twisted, either clockwise or anti-clockwise, to any desired degree and the number of turns inserted is shown by the pointer at P. After the required turns have been inserted in the fibre, a small current is made to flow through the solenoid. This current is gradually increased till the fibre breaks, its value at the breaking point is read from a milliammeter placed in series in the circuit, and the breaking strength of the fibre is noted

from a calibration table. The motor was run at 1,450 r.p.m. and the fibres were twisted at the rate of 15 to 20 turns per minute. The change in length with twist is read on a micrometer scale in the eyepiece of a telescope focussed on it.

The rod XX^1 (Fig. 2) which forms the axle of the wheel W carries a worm W_1, which is meshed with the teeth of a gear wheel T_1. It is the axle (YY^1) of this wheel (T_1) that carries the hook at A and in addition carries a worm W_2, which in its turn is meshed with the gearing wheel T_2. The pinion wheel P_1 and the toothed wheel T_2 have a common axial rod ZZ^1 and as P_1 and T_3 are geared, axle 33^1 rotates at a known speed ratio and the (P) pointer is easily made to indicate the number of turns inserted in the fibre at A. The main purpose of this box is to move the plane of rotation through 90° and to decrease the speed of rotation, so that the turns are inserted without breaking the fibre.

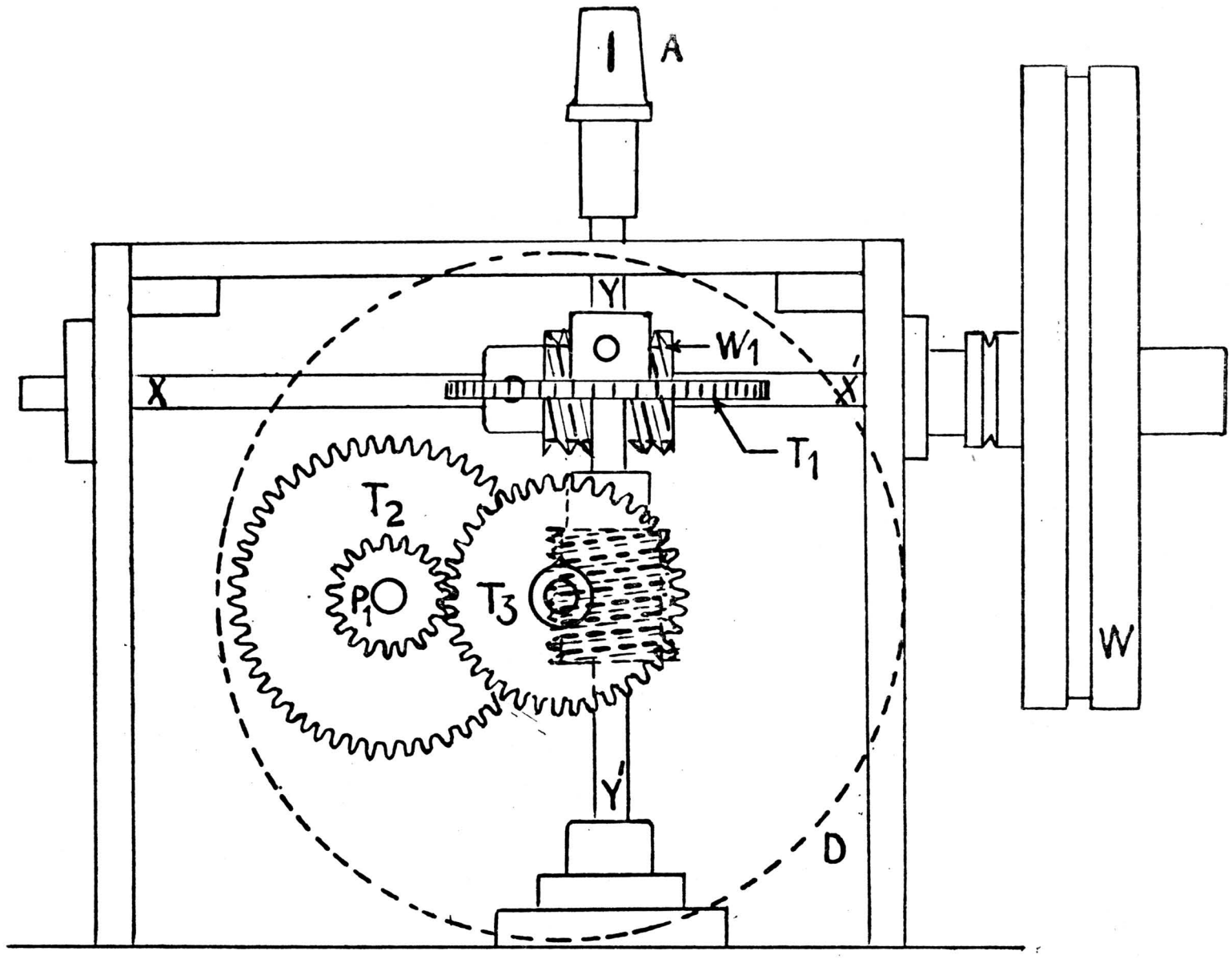
Method.

From each cotton, a representative sample was obtained by dividing the heap into several parts, drawing a tuft from each part and mixing the tufts well by hand. This sample was made into a hand sliver and from this sliver were taken seven sections which we shall call A, B, C, D, E, F and G. The direction and amount of twist given to fibres taken from each of these seven before they were broken were as follows:

Section.	Number of turns.	Direction.
A	Nil	—
B	25	Clockwise.
C	25	Anti-clockwise.
D	50	Clockwise.
E	50	Anti-clockwise.
F	100	Clockwise.
G	100	Anti-clockwise.

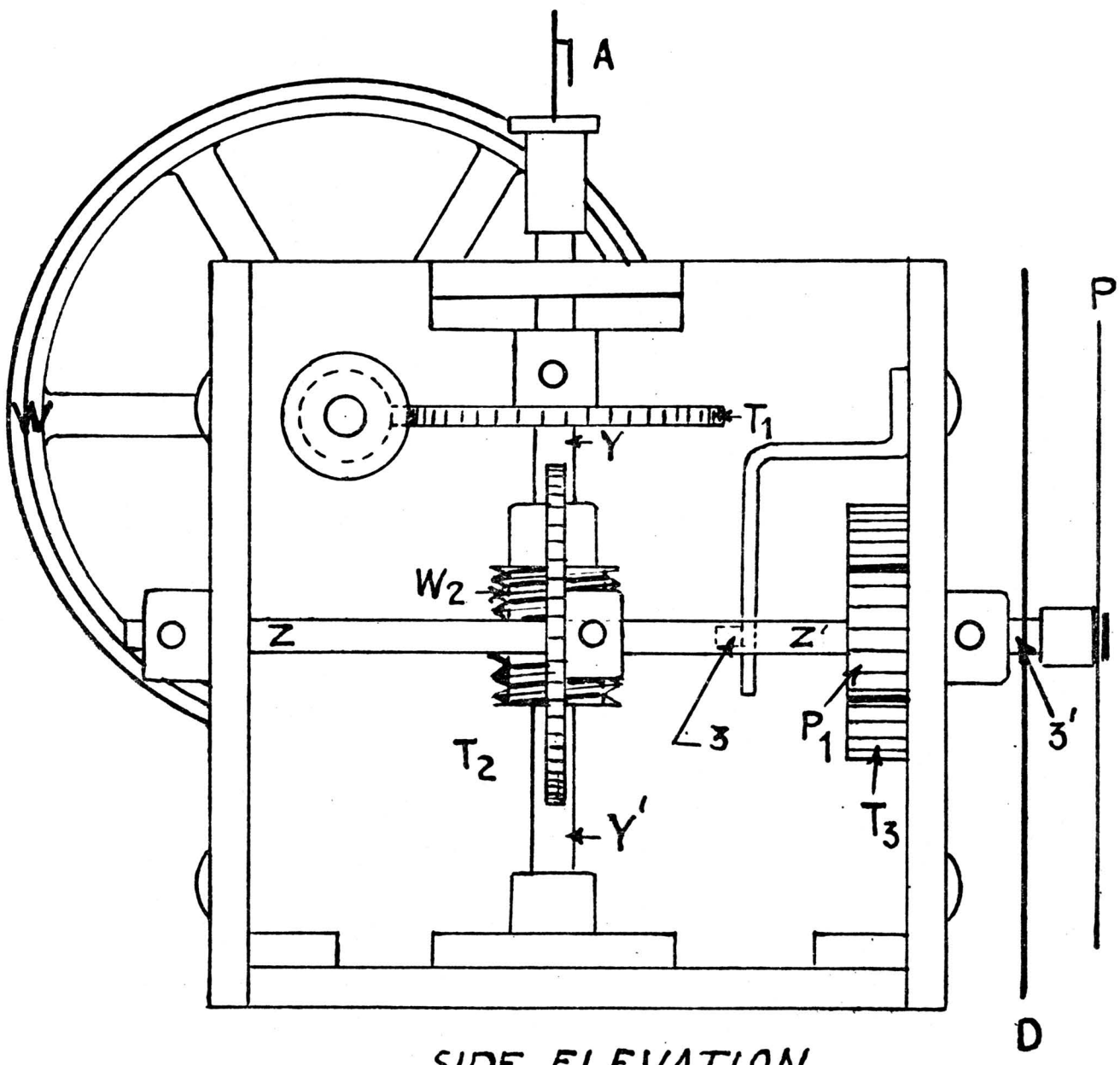
From each section, 500 fibres were taken for strength tests, thus making a total of 3,500 fibres for each cotton. For percentage contraction, however, it was found sufficient to examine about 100 fibres with low twist and about 300 fibres with 100 turns inserted in them. All the 500 fibres from each section were not tested consecutively, but, on the other hand, a few fibres from A were tested first, then a few fibres from B, C, . . . G. In the second cycle a few more fibres from A were tested first, followed by tests on fibres from sections B, C, etc. These cycles were continued until the tests were complete. This was done in order to eliminate the effect of variation in humidity as will be explained in the next section. Due care was taken to see that the different sections A, B, C, etc., were kept separate and that all the fibres taken from them were exhausted. Unless the latter precaution is taken, there is a likelihood of a bias in favour of the good fibres and a danger of rejecting the weak fibres.

It should be noted that, as pointed out by Schwendinger,[10] the weight recorded in Barratt's balance is the breaking strength of a fibre $+ x$, where x is the small weight required to change the position of the pointer from zero to the point at which the fibre breaks, i.e., through a distance equal to the extension of the fibre. The extension of a few fibres was measured and was found to be of the order of 7 per cent. agreeing with the value given by Barratt[11] and Collins.[12] Hence, the extension in this case is about 0·07



FRONT ELEVATION

FIG. 2.



SIDE ELEVATION

FIG. 2.

cms., and the weight required to deflect the beam through this distance is less than 0·1 gms. This weight remains very nearly constant in all the determinations and disappears in the differences with which we are mainly concerned in this paper. Some of the weaker fibres break in the act of twisting, before any tension is applied. The exclusion of such fibres would slightly raise the mean. It was found that a very small number behaved in this manner and they were noted down as possessing zero strength.

Effect of Humidity.

Perhaps the most important precaution that should be taken in tests of this nature is to see that the effects of humidity do not mask those of twist. This is essential in view of the fact that the rate of change of strength with humidity is high. Apart from the work of Willcomm[14] (a), the effect of humidity on fibre strength has been studied by Mann[13] and one of the authors in collaboration with Dr. Turner.[14a] Mann's mean curve (Fig. 2 in his paper) shows that the fibre-strength increases more or less in a linear ratio up to a relative humidity of 75 per cent. after which it remains practically constant. Similar results were obtained by the author for Indian cottons. We may, therefore, regard it as fairly definite that the humidity strength curve for cotton may be split up into two straight lines as shown in Fig. 3, where AB represents the portion in which strength changes rapidly

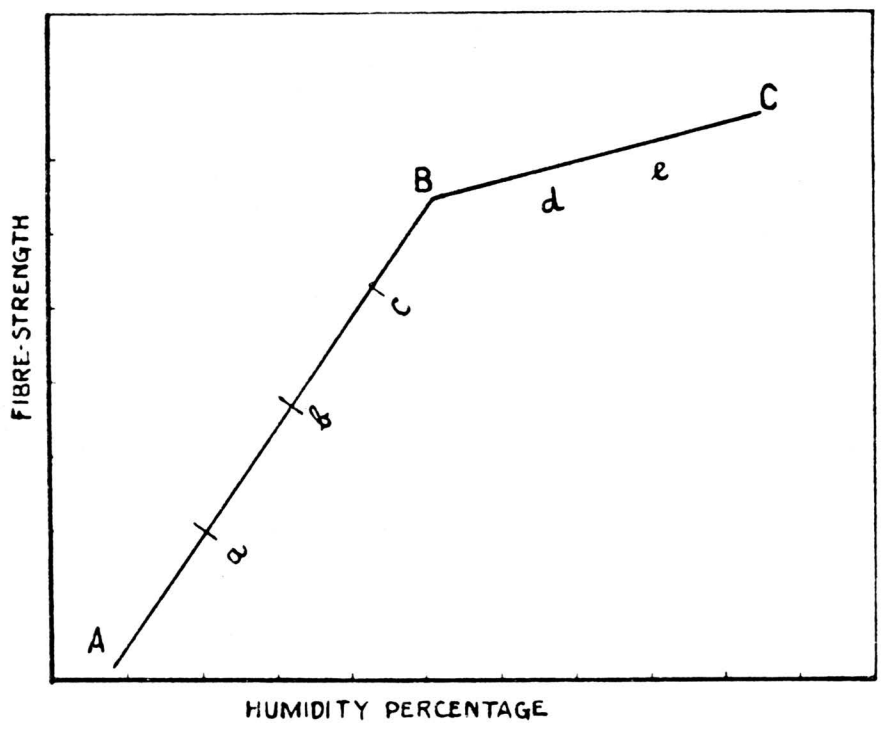


FIG 3

with humidity and BC the portion in which it remains nearly constant. Now, if all the tests for a certain twist θ_1 are made when the atmospheric humidity lies in the region ab, while all the tests for another twist θ_2, are carried out when the humidity has altered to lie in the region bc or de, then evidently the results of the two tests are not directly comparable unless we know exactly what part of the increase in strength is due to change in humidity. As this would have required a separate and prolonged investigation, it was decided that the best course would be to spread out the tests *in time*. This was done by testing a small number of fibres for each of the three twists and for no twist consecutively when the humidity was very nearly the same, so that the correction on account of humidity on each occasion, was very small. This method worked extremely well, as sudden and large fluctuations in humidity are not very common in Bombay. For the small changes in humidity, corrections, wherever necessary, were applied.

(*a*) Quoted by Mann. Willcomm found that the strength increased up to 80 per cent. R.H. It should, however, be noted that he broke bundles of hairs instead of individual fibres.

When, on the other hand, the humidity was found to be fluctuating rapidly, the tests were suspended until it became fairly constant. One advantage of working at fairly constant humidities is that the variation in ribbon width is small, and, therefore, the changes in strength may be taken as equivalent to changes in intrinsic strength.

Effect of Temperature.

In Bombay during the working hours the temperature fluctuations are generally small, being confined mostly to the range of 72° F. to 88° F. So far as we know, variation of fibre-strength with temperature has not been studied, but from the results obtained by Urquhart and Williams[15] it is known that within this limit fibre-weight varies only by about 0·2 per cent. when the humidity is constant. It may, therefore, be assumed that neither the length nor the strength of the fibres would be affected to an appreciable extent by small fluctuations in temperature. Therefore, no corrections were applied.

Material.

For the purpose of these tests five Indian cottons, namely, Cambodia Co. 1, Verum 262, Banilla, Mollisoni and Aligarh A 19 were selected. These cottons are very thoroughly tested each year (except Banilla) at the Technological Laboratory and the results of the latest tests, together with those for the earlier seasons, will be found in another Bulletin. Their chief fibre properties and spinning values are shown in Table I in which they have been arranged in the order of their spinning values which also happens to be that of their mean fibre length. It will be seen that they belong to different botanical species and cover practically the whole range of Indian cottons as regards staple length or spinning value. It should be mentioned that the values given in this table are both in British and C.G.S. units. In the succeeding tables the values are given only in the C.G.S. units, as the balance was calibrated only by using gram weights and a conversion to British units was thought unnecessary.

Table I.

Cotton	Highest standard warp count	Length		(f) Fibre weight		(s) Mean strength at 70 per cent. R.H.		Intrinsic strength s/f	
		in.	mms.	10^{-6} oz. per in.	10^{-6} gms per cm.	Oz.	Gms.	English units	C.G.S. units
Co. 1 (*G. Hirsutum*)	34	0·89	22·6	0·146	1·63	0·154	4·37	1·05	2·68
Verum 262 (*G. Verum*)	23	0·82	21·0	0·180	2·01	0·201	5·70	1·12	2·84
Banilla (*G. Cernuum* x *G. Indicum*)	16	0·76	19·2	0·159	1·78	0·218	6·18	1·37	3·47
Mollisoni (*G. Indicum*)	8	0·69	17·5	0·272	3·04	0·204	5·78	0·75	1·90
Aligarh 19 (*G. neglectum*)	6	0·64	16·3	0·262	2·93	0·198	5·61	0·76	1·91

NOTE.—The strength values have been obtained on the Barratt fibre balance and hence are likely to be somewhat higher than those got by the Balls or O'Neill Hair Testers, as shown by Navkal and Sen.[16]

Symbols.

In order to avoid repetition, the symbols used in this paper are here defined :—

θ_t = Twist (turns per cm.) inserted in a fibre.
θ_R = Twist in right-handed direction or clockwise.
θ_L = Twist in left-handed direction or anti-clockwise.
W = Breaking strength in grams.
W_θ = Breaking strength in grams for θ turns
K_θ = Percentage contraction after the insertion of θ turns.
h = Humidity percentage.
σ = Standard deviation.
e = Probable error of single observation.
e (%) = Probable error expressed as percentage of the mean.

RESULTS

These are discussed under the following heads :—

I. Effect of twist on mean fibre strength.
II. Effect of twist on fibre strength variation.
III. Variation of skewness and the type of curve for strength values with different twists.
IV. Change of mean length with twist.
V. Effect of twist on fibre length variation.
VI. Relationship between fibre strength and percentage contraction.
VII. The part played by twist in the fibre during the spinning process.
VIII. Variation of fibre strength with twist in relation to fibre structure.

I. Effect of Twist on Mean Fibre Strength.

The experimental results obtained are given in Table II. The mean strength has been reduced to a common humidity for the purpose of comparison. The mean humidity for each twist and this common humidity have been given side by side in the fifth and sixth columns so that it can be seen that the correlation is practically negligible.

It is well known that when the sap inside the cotton hairs dries up convolutions are formed, which are right-handed in some parts of the hair and left-handed in others. Recently Roehrich[17] has shown that when collodion tubes filled with water are dried in the oven, they produce spiral shaped ribbons similar to cotton fibres. According to him " the direction of the twisting is invariably controlled by that of the fibrillar spiral of the secondary membrane of the cell wall." Clegg and Harland[18] observed that in one cotton the left-handed convolutions occurred more frequently than the right-handed ones. Some preliminary observations made in this Laboratory showed that one kind of convolution occurs more often than the other in some Indian cottons. Therefore, if the fibres of the different cottons were twisted only in one direction (say left-handed), those cottons (if any) in which the convolutions occurred more frequently in the same direction would be tested under more favourable conditions than those in which the convolutions occurred equally frequently in both directions or more frequently in the opposite (right-handed) direction. The results for these two types of cottons would not be strictly comparable. To avoid any such error creeping into the results, the fibres were twisted in both directions. If the results for the two directions of twist agree within the experimental errors the mean could be taken for further analysis. If, on the other hand, the results differ by significant amounts, due allowance could be made for the effect of natural twists on convolutions present in the fibres. The differences in the strengths for the twists in the two directions are given in Table III.

Table II.

Cotton	Twist	Mean Strength (gms.) at the common humidity.	Number tested.	Common Humidity.	Mean Humidity.
Cambodia Co. 1	0	4·15 ± 0·07	500	60	60
	25R	3·92 ± 0·07	500	60	60
	25L	4·29 ± 0·08	500	60	61
	50R	4·38 ± 0·08	502	60	60
	50L	4·32 ± 0·08	500	60	60
	100R	4·29 ± 0·07	501	60	60
	100L	4·28 ± 0·07	512	60	60
Verum 262 ...	0	5·53 ± 0·08	533	64	64
	25R	5·63 ± 0·08	530	64	64
	25L	5·96 ± 0·08	530	64	65
	50R	6·17 ± 0·09	530	64	65
	50L	5·90 ± 0·09	530	64	64
	100R	5·04 ± 0·09	530	64	65
	100L	5·45 ± 0·09	530	64	65
Banilla ...	0	6·09 ± 0·10	510	67	67
	25R	6·38 ± 0·10	508	67	67
	25L	6·18 ± 0·10	508	67	68
	50R	6·02 ± 0·10	508	67	66
	50L	5·80 ± 0·10	508	67	67
	100R	5·10 ± 0·09	508	67	68
	100L	5·42 ± 0·10	508	67	67
Mollisoni ...	0	5·72 ± 0·08	500	68	68
	25R	5·88 ± 0·08	500	68	68
	25L	6·04 ± 0·09	502	68	68
	50R	5·97 ± 0·09	502	68	68
	50L	6·02 ± 0·09	504	68	68
	100R	4·60 ± 0·08	500	68	69
	100L	4·92 ± 0·09	505	68	68
Aligarh A.19...	0	5·50 ± 0·09	521	66	66
	25R	5·48 ± 0·09	520	66	66
	25L	5·84 ± 0·10	520	66	66
	50R	5·64 ± 0·09	529	66	66
	50L	5·59 ± 0·10	520	66	66
	100R	4·19 ± 0·08	523	66	66
	100L	4·17 ± 0·09	526	66	66

Table III—Percentage Differences.

Cotton	$W_{25R} - W_{25L}$		$W_{50R} - W_{50L}$		$W_{100R} - W_{100L}$		
Co. 1	−8·9	(2·7)*	+1·4	(2·7)	+0·2	(2·4)	−7·3
Verum 262	−6·0	(2·0)	+4·9	(2·3)	−7·4	(2·3)*	−8·5
Banilla	+3·3	(2·3)	+3·6	(2·3)	−5·3	(2·1)	+1·6
Mollisoni	−2·8	(2·1)	−0·9	(2·3)	−5·6	(2·1)	−9·3
A. 19	−6·6	(2·5)	+0·9	(2·4)	+0·2	(2·2)	−5·5

(The basis for calculating the percentages is the value for no twist. Probable errors are given in brackets.)

It will be seen that in 8 cases the values for the left-handed twist are greater than those for the right-handed twist (negative difference) while in the remaining 7 cases they are less (positive differences). However, in spite of the fact that these numbers are nearly equal, the differences are on the whole much larger in the former than in the latter case, the average difference for the former being 5·4 as against only 2·1 for the latter. It would thus appear that the insertion of a left-handed twist in the fibre has, on the average, a greater effect in modifying the strength of the fibre than the insertion of an equal amount of right-handed twist. This effect is

brought out in a more striking manner if we consider the algebraic sum of the differences for each cotton separately shown in column 5 of Table III. We note from it that for four out of five cottons the values for the left-handed twist exceed those for the right-handed twist, while for one cotton—Banilla—although the reverse is the case, the difference is small. Thus, the larger effect on the strength of the fibre of the insertion of left-handed twist is common to long, medium and short-stapled Indian cottons tested in these experiments.

If we now consider the significance of the individual differences by applying the standard error criterion, we find that only in the two cases marked with an asterisk are they significant, while in the remaining 13 cases they are either insignificant or on the border-line. Continuing this with the preceding discussion we conclude that although the difference between the effect of left and right-handed twist on fibre strength is statistically insignificant in most cases, yet there is a marked tendency for the left-handed twist to give greater values of fibre strength than the right-handed twist and that this effect is shared by the different types of cottons tested in these experiments.

We shall now consider the effect on its strength of progressively inserting higher twist in the fibre. For this purpose, we shall first take the mean values for the left-handed and the right-handed twists to enable us to draw general conclusions and will follow it up by considering also the values for each direction of twist when we shall judge the significance of the differences. The mean values are given in Table IV.

Table IV.

Cotton	W_0 (Gms.)	W_{25} (Gms.)	W_{50} (Gms.)	W_{100} (Gms.)
Co. 1	4·15 ± 0·07	4·10 ± 0·05	4·35 ± 0·06	4·28 ± 0·05
Verum 262 ...	5·53 ± 0·08	5·80 ± 0·06	6·04 ± 0·06	5·24 ± 0·06
Banilla ...	6·09 ± 0·10	6·28 ± 0·07	5·91 ± 0·07	5·26 ± 0·07
Mollisoni ...	5·72 ± 0·08	5·96 ± 0·06	6·00 ± 0·06	4·76 ± 0·06
A. 19	5·50 ± 0·09	5·66 ± 0·07	5·62 ± 0·07	4·18 ± 0·06

In this table the cottons have been arranged in the order of their mean fibre length. A cursory glance at this table will show that these cottons exhibit interesting differences in their response to the action of twist on fibre strength, which appears to be related to their quality. The longest among them, Cambodia Co. 1, behaves somewhat differently from the others inasmuch as its fibre strength undergoes practically no change up to 25 turns, increases slightly at 50 turns, after which it remains approximately constant. In the remaining four cottons, the fibre strength rises and then falls as the twist is increased, but the rates of change of strength and the points at which the peak values are obtained are different for the different cottons. In Verum 262, which follows Cambodia Co. 1, the fibre strength steadily increases up to about 50 turns and then declines, its value for 100 turns begin less than that for zero twist. In Banilla, which takes the third place in respect of staple length, the increase in fibre strength proceeds only up to about 25 turns, after which there is a steady decline, its values both for 50 and 100 turns being less than that for zero twist. In the two shortest cottons in this series, namely Mollisoni and Aligarh A. 19, the fibre strength increases on inserting 25 turns, remains practically constant for 50 turns,

but falls precipitately when 100 turns are inserted in the fibre. These cottons may, therefore, be divided into the following four types:

	Low twist.	Medium twist.	High twist.
Type 1	No change	Slight increase	Constant
Type 2	Increase	Increase	Decrease
Type 3	Increase	Decrease	Decrease
Type 4	Increase	Constant	Decrease

This differential behaviour of the cottons as shown by the trends discussed above and its relationship to their quality is also brought out in a remarkable manner if we consider the percentage decrease in fibre-strength on the insertion of 100 turns, taking the value for zero twist as the basis. The relevant data are shown in Table V from which it will be seen that the percentage fall in fibre strength increases steadily as we go down the table from the long to the short stapled cottons.

Table V.

Cotton	$\frac{100\,(W_{100}-W_0)}{W_0}$	e (%)
Co. 1	3·1	2·2
Verum 262	− 5·2	1·8
Banilla	−13·6	2·0
Mollisoni	−16·8	1·7
A.19	−24·0	2·0

So far we have considered the general trend of values without taking into account the significance of differences between them. To enable us to do so Table VI has been constructed in which the percentage differences between the values of strength obtained before and after inserting different twists in the fibre are shown together with the corresponding values of the probable error. The values in this table are given both for the right and the left-handed twist as well as for the means of the two directions, and the significant differences are marked with an asterisk.

We have seen above that as twist is inserted in the hairs, the fibre strength of these cottons increases up to a point beyond which in general it falls. In order to find the point for each cotton at which the maximum strength is attained, the experimental mean values of fibre strength have been plotted against twist in the graph in Fig. 4. Owing to the laborious nature of the tests it was not possible to have many more points and therefore the ordinary method of fitting the curves did not prove very helpful. However, taking the analogous case of the variation of yarn strength with twist, an attempt has been made to fit parabolae of the second order of the type given by the equation,

$$W = ax^2 + bx + c \quad (\text{where } x = \theta/25).$$

From the values given in Table VII, the two constants a and b can be calculated and the point of maximum strength in each case is given by

$$dW/dx = o$$

or

$$+2ax + b = o \text{ i.e. } x = \frac{-b}{2a}$$

Table VI. Percentage Differences.

(e % are given in brackets)

Cotton		Mean result.			R. twists only.			L. twists only.		
		W_{25}	W_{50}	W_{100}	W_{25R}	W_{50R}	W_{100R}	W_{25L}	W_{50L}	W_{100L}
Co. 1	W_0 W_{25} W_{50}	– 1·2 (2·2)	4·8 (2·2) 6·0 (1·9) †	3·1 (2·2) 4·3 (1·7) – 1·7 (1·9)	– 5·5 (2·4)	5·5 (2·6) 11·0 (2·6)*	3·4 (2·4) 8·9 (2·4)† – 2·2 (2·6)	3·4 (2·6)	4·1 (2·6) 0·7 (2·6)	3·1 (2·4) – 0·2 (2·6) – 1·0 (2·6)
Verum 262	W_0 W_{25} W_{50}	4·9 (1·8)	9·2 (1·8) * 4·3 (1·4) †	– 5·2 (1·8) –10·1 (1·4) * –14·5 (1·4) *	1·8 (2·0)	11·6 (2·2) * 9·8 (2·2) *	– 8·9 (2·2) * –10·7 (2·4) * –20·4 (2·4) *	7·9 (2·0) †	6·7 (2·0) † – 1·1 (2·2)	– 1·4 (2·2) – 9·2 (2·2)* – 8·1 (2·4)†
Banilla	W_0 W_{25} W_{50}	3·1 (2·0)	– 3·0 (2·0) – 6·1 (1·6)†	–13·6 (2·0) * –16·7 (1·5)* –10·7 (1·5)*	4·8 (2·3)	– 1·1 (2·3) – 5·9 (2·3)	–16·2 (2·3)* –21·0 (2·3)* –15·1 (2·3)*	1·5 (2·3)	– 4·8 (2·3) – 6·2 (2·3)	–11·0 (2·1)* –12·5 (2·1)* – 6·2 (2·1)*
Mollisoni	W_0 W_{25} W_{50}	4·2 (1·7)	4·9 (1·7) 0·7 (1·4)	–16·8 (1·7)* –20·9 (1·4)* –21·8 (1·4)*	2·8 (1·9)	4·4 (2·1) 1·6 (2·1)	–19·6 (1·9)* –22·4 (1·9)* –23·9 (2·1)*	5·6 (2·1)	5·2 (2·1) – 0·3 (2·3)	–14·0 (2·1)* –19·6 (2·3)* –19·2 (2·3)*
A.19	W_0 W_{25} W_{50}	2·9 (2·2)	2·2 (2·2) – 0·7 (1·8)	–24·0 (2·0)* –26·9 (1·6)* –26·2 (1·6)*	–0·4 (2·4)	2·5 (2·4) 2·9 (2·4)	–23·9 (2·2)* –23·4 (2·2)* –26·4 (2·2)*	6·2 (2·4)	1·6 (2·4) – 4·5 (2·5)	–24·2 (2·4)* –30·4 (2·4)* –25·8 (2·4)*

†Slightly significant.

*Highly significant.

The twist at which maximum strength occurs and the values of maximum strength are shown in Table VII.

Table VII.

Cotton	Maximum value occurs at $\theta =$ (calculated)	Maximum value in gms. (calculated)	Increase in strength %	$\frac{W_m - W_0}{W_0}$ (Actually obtained).
Co. 1	84	4·30	4·6	4·8
Verum 262	45	5·98	8·7	9·2
Banilla	15	6·16	0·3	3·1
Mollisoni	34	6·04	5·9	4·9
A. 19	28	5·72	4·4	2·9

$m = 25$ for A.19 & Banilla and 50 for the rest.

It will be seen that the longer cottons can stand a much higher degree of twist than the shorter ones before attaining the maximum fibre strength. Except for Banilla, which is anomalous, the amount of twist necessary to give the maximum fibre strength diminishes steadily as we go down the

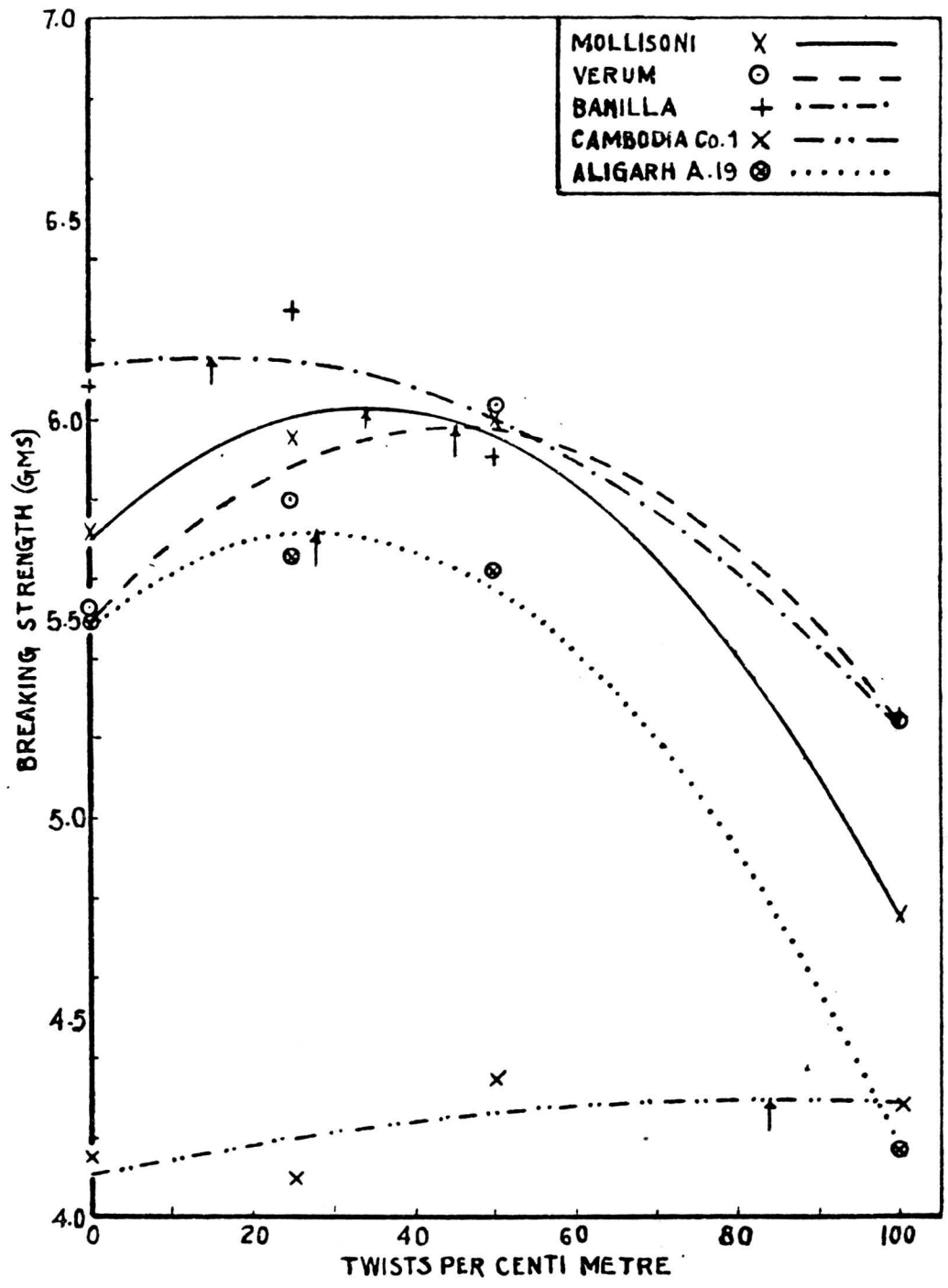


Fig. 4.

table in which the cottons are arranged in the order of the staple length. Furthermore, it will be remembered that the percentage decline in fibre strength resulting from the insertion of the highest degree of twist was much greater for the shorter than for the longer cottons, being 24 per cent. for A. 19 as against only 5·2 per cent. for Verum 262. In sharp contrast to this, the percentage increase in fibre strength at the peak value is very nearly the same for the three cottons, Cambodia Co. 1, Mollisoni and A. 19, somewhat greater for Verum 262, and rather small for Banilla. Thus, although the maximum fibre strength may be attained at very different

twists in the case of the long and the short cottons, the percentage increase in fibre strength at the peak is not very different for these cottons. Finally, it is to be noted that in the case of all cottons, the maximum strength occurs after 15 turns per cm., have been inserted.

II. Effect of Twist on Mean Fibre Strength Variation.

The strength of a yarn depends not only upon the mean fibre strength of the cotton from which it is spun but also upon the variation of this property in the cotton. Hence it is of some interest to study what effect, if any, the insertion of twist in the fibres would have on the variability of their strength.

In Table VIII are given the probable errors of single observations expressed as fractions of the mean strength (e per cent.) The fourth column gives the differences between the values for the right-handed and left-handed twists, which are less than three times the probable error in all cases, showing that the direction of twisting has very little effect on the variability of strength.

Table VIII.

1	2 Twist	3 e%	4 Difference	5 Mean Twist	6 e%	7 $e_{25}-e_0$ (%)	8 $e_{50}-e_0$ (%)	9 $e_{100}-e_0$ (%)
Cambodia Co. 1.	0	37·4 ± 1·0		0	37·4 ± 1·0			
	25R	38·6 ± 1·1	0·1 ± 1·6	25	38·6 ± 0·8	1·2 ± 1·3		
	25L	38·7 ± 1·1						
	50R	39·9 ± 1·1	0·5 ± 1·6	50	39·6 ± 0·8		2·2 ± 1·3	
	50L	39·4 ± 1·1						
	100R	36·6 ± 1·0	2·2 ± 1·4	100	37·7 ± 0·7			0·3 ± 1·2
	100L	38·8 ± 1·0						
Verum 262.	0	34·7 ± 0·9		0	34·7 ± 0·9			
	25R	33·8 ± 0·9	1·4 ± 1·2	25	33·1 ± 0·6	−1·6 ± 1·1		
	25L	32·4 ± 0·8						
	50R	33·6 ± 0·8	1·5 ± 1·2	50	34·4 ± 0·6		−0·3 ± 1·1	
	50L	35·1 ± 0·9						
	100R	41·0 ± 1·1	2·8 ± 1·5	100	39·6 ± 0·7			4·9 ± 1·1
	100L	38·2 ± 1·0						
Banilla.	0	35·7 ± 0·9		0	35·7 ± 0·9			
	25R	34·9 ± 0·9	2·5 ± 1·3	25	36·2 ± 0·7	0·5 ± 1·1		
	25L	37·4 ± 1·0						
	50R	37·0 ± 1·0	0·9 ± 1·4	50	37·4 ± 0·7		1·7 ± 1·1	
	50L	37·9 ± 1·0						
	100R	40·6 ± 1·1	2·4 ± 1·6	100	41·8 ± 0·8			6·1 ± 1·2
	100L	43·0 ± 1·2						
Mollisoni.	0	31·1 ± 0·8		0	31·1 ± 0·8	0·9 ± 1·0		
	25R	31·3 ± 0·8	1·5 ± 1·1	25	32·0 ± 0·6			
	25L	32·8 ± 0·8						
	50R	33·8 ± 0·9	0·3 ± 1·3	50	33·6 ± 0·6		2·5 ± 1·0	
	50L	33·5 ± 0·9						
	100R	36·1 ± 1·0	3·1 ± 1·4	100	37·6 ± 0·7			6·5 ± 1·1
	100L	39·2 ± 1·1						
Aligarh A. 19	0	38·6 ± 1·0		0	38·6 ± 1·0			
	25R	38·2 ± 1·0	0·6 ± 1·4	25	37·9 ± 0·7	−0·7 ± 1·2		
	25L	37·6 ± 1·0						
	50R	37·9 ± 1·0	3·5 ± 1·5	50	39·6 ± 0·7		1·0 ± 1·2	
	50L	41·4 ± 1·1						
	100R	45·6 ± 1·3	1·1 ± 1·9	100	46·2 ± 1·0			7·7 ± 1·4
	100L	46·7 ± 1·4						

In view of the small effect, if any, caused by the direction of twist, the mean values for the two directions are taken and the values of e per cent. calculated from them are given in columns 5 and 6, while columns Nos. 7, 8 and 9 show the various differences between e_{25} and e_0, e_{50} and e_0, etc. These differences are small up to 50 turns, though there is a distinct tendency for e_{50} to be greater than e_0, showing that the variability of fibre strength is not affected appreciably in any of these cottons so long as medium twist is employed. Beyond this stage, however, the difference $e_{100}-e_0$ is small only for Cambodia Co. 1, but quite significant for the other cottons. Furthermore, it becomes greater as we go down the table, or in other words, as we consider the comparatively shorter cottons. Thus, with the insertion of a higher degree of twist the variability of fibre strength increases, and the increase is greater for the shorter than for the longer cottons. The insertion of higher twist thus not only makes the fibres weak but also less uniform in strength, and it is highly probable that the diminution in yarn strength, especially with short stapled cottons, on increasing the twist is related to these two factors.

III. Variation of Skewness and Type of Curve for Strength Values with different twists.

The frequency distributions, given in Table XVII, have been used to calculate skewness and to study the effect of twist on it. Skewness has been defined in different ways, some of which are:—

If M = Arithmetic mean

M_d = Median

(*a*) S $= 3(M - M_d)/\sigma$[19] where σ = standard deviation.

(*b*) S $= (M - M_d)/c\sigma$ where $c = 0{\cdot}3309 - 0{\cdot}0846(M - M_d)^2/[\sigma^2 - 9(M - M_d)^2]$[20]

(*c*) S $= (E_1 - E_2)/M$[21] where E_1, E_2 are distances of the lower and upper quartiles from the arithmetic mean.

(*d*) S $= \mu_3/2\sigma^3$ (Gram-Charlier)[22]

(*e*) S $= \sqrt{\beta_1}(\beta_2 + 3)/2(5\beta_2 - 6\beta_1 - 9)$ where $\beta_1 = \mu_3^2/\mu_2^3$ and $\beta_2 = \mu_4/\mu_2^2$, μ_3 and μ_4 being the third and fourth moments about the mean (with Sheppard's corrections).

(*f*) S = As in (*e*) without Sheppard's corrections.

Since we know that fibre strength distribution is moderately asymmetrical, the formula (*a*) is suited to this work, besides offering ease in calculation. The formula (*e*) though somewhat more laborious in calculation is even better suited as it gives proper weight to the effect of individual values. Furthermore, it has the advantage that the probable error of skewness can be readily found from the published tables. It has not been considered necessary to apply Sheppard's correction to (*e*) as these are necessary for those curves which have high contacts at both ends, which is not the case in the present tests.

As regards the other formulae, (*b*) and (*c*) are likely to underestimate the abnormally high or low values while (*d*) is likely to overestimate them.

In view of these reasons, skewness was calculated for all cottons only according to formulae (*a*) and (*f*), while in the case of one cotton, namely, Banilla, all the formulae were used for purposes of comparison (Tables IX and X). It will be seen from Table IX that the order of skewness is the same regardless of the formula employed, with the exception of formulae (*d*) and (*c*) with 25 turns.

Table IX

Cotton	Twist	Formula (*a*)	Formula (*f*)	Formula (*e*)	Formula (*b*)	Formula (*d*)	Formula (*c*) × 10
Banilla...	0	0·31	0·42 ± 0·06	0·43	0·31	0·26	0·68
	25	0·29	0·41 ± 0·04	0·42	0·31	0·19	0·40
	50	0·42	0·61 ± 0·06	0·63	0·42	0·29	0·77
	100	0·69	1·11 ± 0·13	1·16	0·72	0·43	1·06

Alongside the values of skewness (formula *f*), the probable errors, as calculated from Pearson's " Tables for Statisticians and Biometricians "[24] are also given.

A study of Table X shows that in Banilla and Aligarh A.19 skewness has a tendency to increase with the twist, the increase being more marked with high than with low twist. A similar tendency is initially noticeable in Cambodia Co. 1, but here the skewness after increasing for $\theta = 25$ remains approximately constant for higher twists. In Verum 262 and Mollisoni, on the other hand, the skewness has a tendency to fall, its value for $\theta = 25$ and $\theta = 50$ being less than for $\theta = 0$, and then rises for $\theta = 100$. Thus, all the cottons have this feature in common, that the skewness of their fibre strength distribution increases significantly at high twists, though at intermediate twists their behaviour may be different from one another. Excessive twisting of the fibre, therefore, not only increases the variability but also the asymmetry of the strength property of the fibre.

Table X. Values of Skewness and K_1.

$$K_1 = 2\beta_2 - 3\beta_1 - 6$$

Cotton	Twist	Formula (*a*)	Formula (*f*)	K_1.
Cambodia Co. 1 ...	0	0·44	0·45 ± 0·06	−0·13
	25	0·59	0·60 ± 0·05	−0·79
	50	0·50	0·56 ± 0·05	−0·80
	100	0·50	0·58 ± 0·05	−0·71
Verum 262	0	0·36	0·42 ± 0·06	−1·15
	25	0·38	0·33 ± 0·03	−1·08
	50	0·26	0·34 ± 0·04	−1·38
	100	0·48	0·65 ± 0·06	−1·49
Banilla	0	0·31	0·42 ± 0·06	−1·13
	25	0·29	0·41 ± 0·04	−1·44
	50	0·42	0·61 ± 0·06	−1·51
	100	0·69	1·11 ± 0·13	−1·89
Mollisoni	0	0·25	0·44 ± 0·06	−1·28
	25	0·23	0·32 ± 0·03	−0·84
	50	0·25	0·36 ± 0·03	−0·93
	100	0·56	0·73 ± 0·07	−1·46
Aligarh A. 19 ...	0	0·57	0·58 ± 0·07	−1·12
	25	0·56	0·62 ± 0·05	−1·32
	50	0·58	0·71 ± 0·06	−1·51
	100	0·79	1·14 ± 0·17*	−1·67

* This value is rather uncertain, as it is obtained from the tables by extrapolation.

Koshal and Turner[25] have shown that fibre strength values of Surat 1027 (full fibres) were best represented by a curve belonging to Pearson's[26] type I, viz.:—

$$Y = y_0(1 + x/a_1)^{m_1}(1 - x/a_2)^{m_2}$$

where a_1, m_1, a_2, m_2 and y_0 are constants. The same type of curve was obtained when 1 cm. lengths were broken (Navkal and Turner).[25a] For this the condition is that

$$K_2=\beta_1(\beta_2+3)^2/[4(4\beta_2-3\beta_1)(2\beta_2-3\beta_1-6)]$$

should be negative.[27] For all the frequency distributions in this paper $4\beta_2$ is greater than $3\beta_1$, and K_2 will be negative if K_1 or $2\beta_2-3\beta_1-6$ is negative. Since in order to calculate skewness, β_1 and β_2 were already known, it was easy to find K_1 for all distributions. The values obtained are given in Table X. The calculation of K_2 and the probable error of K_2 is rather laborious, but taking certain approximate values, it was estimated that K_2 was significant and negative in practically all cases. From a comparison of the values of K_1, it would appear that twisting has very little effect on the type of the curve which best represents fibre strength distribution.

IV. Change of Mean Length with Twist.

As has already been stated, the length of a fibre was read off in a telescope before and after the insertion of the twist. From these observations the percentage contraction in length could be calculated, and the mean values thus obtained for the different cottons and twists are given in Table XI which also shows the number of fibres tested for this purpose in each case.

Table XI

1 Cotton	2 Staple length	3 Twist θ	4 K_θ	5 Difference between R and L values (R-L)	6 Mean contraction (%)	7 No. tested
Cambodia Co. 1	0·89 in.	25R	0·38 ± 0·05	−0·04 ± 0·06	0·40 ± 0·03	120
		25L	0·42 ± 0·04			120
		50R	0·78 ± 0·06	−0·17 ± 0·09	0·86 ± 0·05	120
		50L	0·95 ± 0·07			120
		100R	4·45 ± 0·14	−0·65 ± 0·19 (*a*)	4·78 ± 0·10	300
		100L	5·10 ± 0·13			
Verum 262.	0·82 in.	25R	0·50 ± 0·05	+0·19 ± 0·06	0·40 ± 0·03	100
		25L	0·31 ± 0·04			100
		50R	1·32 ± 0·10	0·22 ± 0·16	1·21 ± 0·08	100
		50L	1·10 ± 0·12			100
		100R	6·71 ± 0·19	1·44 ± 0·26 (*b*)	5·99 ± 0·13	320
		100L	5·27 ± 0·18			310
Banilla.	0·76 in.	25R	0·46 ± 0·05	0·08 ± 0·08	0·42 ± 0·04	100
		25L	0·38 ± 0·06			100
		50R	1·14 ± 0·08	0·04 ± 0·12	1·12 ± 0·06	100
		50L	1·10 ± 0·08			100
		100R	6·66 ± 0·17	−0·22 ± 0·25	6·77 ± 0·13	280
		100L	6·88 ± 0·19			280
Mollisoni	0·69 in.	25R	0·54 ± 0·05	−0·13 ± 0·08	0·60 ± 0·04	150
		25L	0·67 ± 0·06			150
		50R	1·80 ± 0·10	0·33 ± 0·13	1·64 ± 0·07	150
		50L	1·47 ± 0·08			150
		100R	11·24 ± 0·28	1·40 ± 0·39 (*b*)	10·54 ± 0·17	299
		100L	9·84 ± 0·26			305
A 19	0·64 in.	25R	0·44 ± 0·05	0·13 ± 0·06	0·38 ± 0·03	100
		25L	0·31 ± 0·04			100
		50R	1·80 ± 0·09	0·40 ± 0·13	1·60 ± 0·06	220
		50L	1·40 ± 0·09			220
		100R	11·66 ± 0·26	0·88 ± 0·39	11·22 ± 0·19	320
		100L	10·78 ± 0·28			320

In column 5 of this table are given the mean differences between values for the right-handed and the left-handed twists together with the probable errors of the differences. It will be seen that in Cambodia Co. 1 the left-handed twist produced greater contraction than the right-handed twist for all the three degrees of twist, though the difference is significant only in the case of 100 turns (marked *a*). In the other four cottons the reverse is found to hold, i.e. the percentage contraction is on the whole greater with the right-handed than with the left-handed twist, though here again the difference is significant in two cases only, namely for Verum 262 and Mollisoni (marked *b*) each with 100 turns. We may, therefore, conclude that up to 50 turns the percentage contraction in length is nearly the same for the left- and the right-handed directions of twist, although in a majority of these cottons there is a tendency for the fibre to contract more with the right-handed than with the left-handed twist, this tendency being shown at high rather than at low twists. In view of the fact, however, that the differences between the values for the right-handed and the left-handed twist are generally insignificant, the mean values for the two directions of twist have been calculated and are given in column 6 of Table XI.

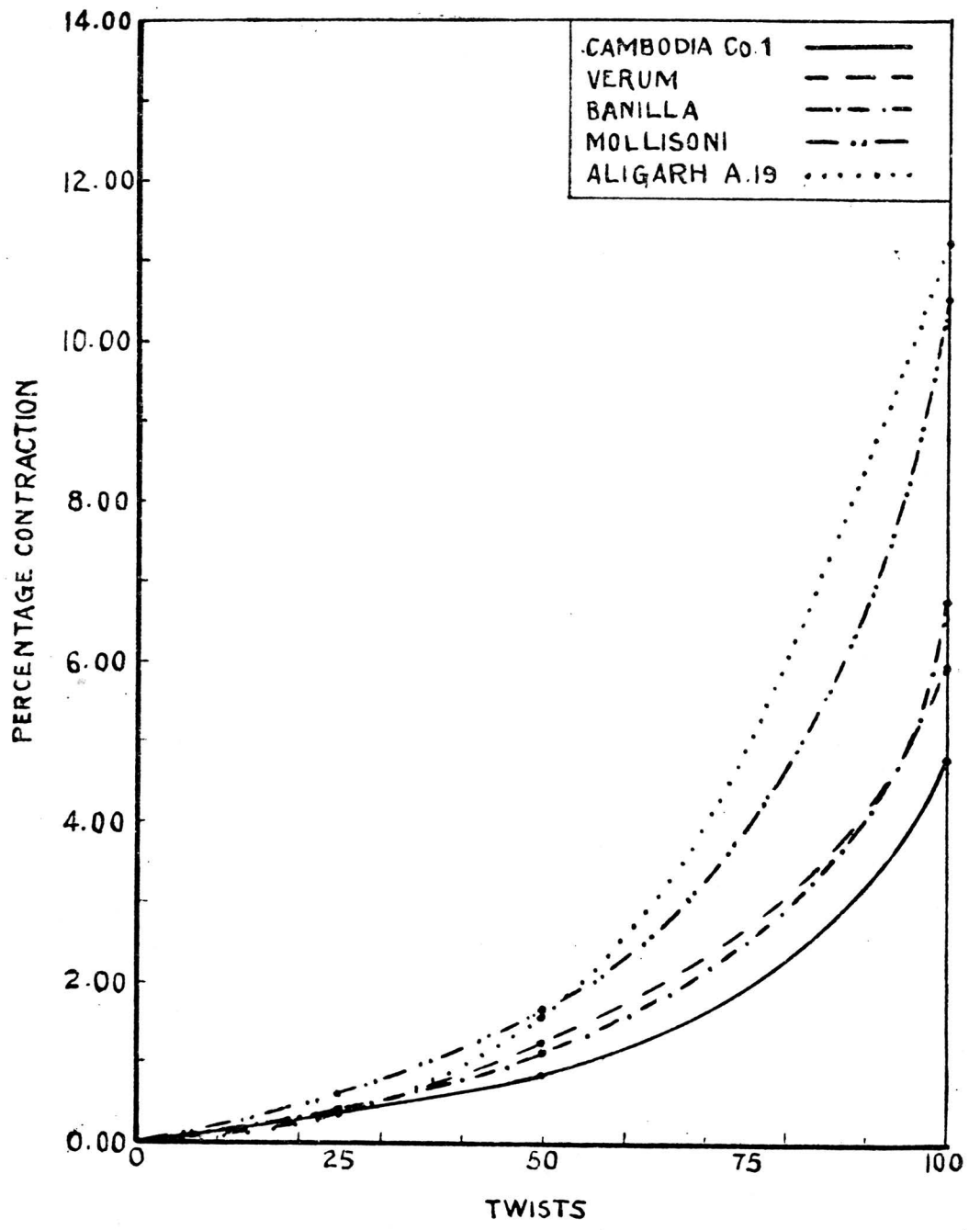


Fig. 5.

These mean values have been plotted in Fig. 5. It will be seen that in all cases the percentage contraction increases very rapidly with twist, its value at 50 turns being two to four times that at 25 turns, while its value at 100 turns is four to seven times that at 50 turns. Furthermore, it will be seen that the percentage contraction is nearly the same for all cottons up to 25 turns, but that at 50 turns the individual response of the cottons begins to be noticeable, which becomes quite pronounced at 100 turns. This response takes the form of causing greater contraction with the shorter than with the relatively longer cottons, their order in this respect being roughly the same

as that of their mean fibre-length. To sum up, the fibres of all cottons contract on being twisted, the contraction increases rapidly with twist, and for medium and high twists is greater for the shorter than for the longer cottons.

This difference in the behaviour of the long and the short cottons may be explained as follows. As in a yarn, the twist will have a tendency to run into the thin places in the fibre. If r′ be the mean radius of these thin places, then r′ will depend upon r, the mean wall thickness of the whole fibre. But r is positively correlated to the fibre weight per inch, and since fibre weight per inch and mean length are negatively correlated, it follows that the percentage contraction in length will be greater in the shorter than in the longer cottons.

If the cotton fibre were even in ribbon width, we would expect that the contraction in length would be directly proportional to twist. In a non-uniform fibre, on the other hand, the contraction would be proportional to twist only in the initial stages, but the proportionality would be lost when on increasing the twist, it begins to run more and more into other places. That this actually happens will be seen from Table XII in which the differences K_{50}-$2K_{25}$, K_{100}-$2K_{50}$ and K_{100}-$4K_{25}$ are shown. If a proportionality between contraction and twist had existed for all values of twist, these differences would have been negligible in most cases. Actually, not only are they significant in most cases, but increase with the degree of twist and are greater for the shorter than for the longer cottons.

As regards the effect of *direction* of twist on the percentage contraction, it will be seen from Table XI that the differences between the percentage contraction for the two directions of twist are practically equal to zero in most cases. We thus conclude that so far as percentage contraction with twist is concerned, the direction of twist makes practically no difference and that in this respect all the cottons behave in a similar manner.

Table XII.

Cotton	K_{50}-$2K_{25}$	K_{100}-$2K_{50}$	K_{100}-$4K_{25}$
Cambodia Co. 1...	0·06 ±0·08	3·0 ±0·1	3·2 ±0·1
Verum 262 ...	0·41 ±0·10	3·6 ±0·2	4·4 ±0·2
Banilla	0·28 ±0·10	4·5 ±0·2	5·1 ±0·2
Mollisoni ...	0·43 ±0·10	7·3 ±0·2	8·1 ±0·2
Aligarh A. 19 ...	0·84 ±0·09	8·0 ±0·2	9·7 ±0·2

Table XIII.

Cotton.	Right-handed twist.			Left-handed twist.		
	$K_{50R} - K_{25R}$	$K_{100R} - K_{50R}$	$K_{100R} - K_{25R}$	$K_{50L} - K_{25L}$	$K_{100L} - K_{50L}$	$K_{100L} - K_{25L}$
Cambodia Co. 1	0·40 ±0·08	3·7 ±0·2	4·1 ±0·1	0·53 ±0·08	4·2 ±0·1	4·7 ±0·1
Verum 262	0·82 ±0·12	5·4 ±0·2	6·2 ±0·2	0·79 ±0·13	4·2 ±0·2	5·0 ±0·2
Banilla ...	0·68 ±0·09	5·5 ±0·2	6·2 ±0·2	0·72 ±0·10	5·8 ±0·2	6·5 ±0·2
Mollisoni ...	1·26 ±0·11	9·4 ±0·3	10·7 ±0·3	0·80 ±0·10	8·4 ±0·3	9·2 ±0·3
Aligarh A. 19	1·36 ±0·11	9·9 ±0·3	11·2 ±0·3	1·09 ±0·10	9·4 ±0·3	10·5 ±0·3

V. Effect of twist on the fibre length variation.

All cottons show a certain amount of variability in the length of the fibres. Tests at the Technological Laboratory have shown that the percentage variability in length is very nearly the same ($e\% = 12$ to 15) for the

Table XIV.

Cotton	Direction of Twist	25 Twists				50 Twists				100 Twists			
		L	e_L	e_L (%)		L	e_L	e_L (%)		L	e_L	e_L (%)	
Cambodia Co. 1 ...	R	0·996	0·0052	0·52	0·5	0·992	0·0065	0·66	0·7	0·956	0·0249	2·60	2·5
	L	0·996	0·0049	0·49		0·990	0·0079	0·80		0·949	0·0228	2·40	
Banilla	R	0·995	0·0048	0·48	0·5	0·989	0·0083	0·84	0·8	0·933	0·0279	2·99	3·2
	L	0·996	0·0055	0·55		0·989	0·0085	0·86		0·931	0·0327	3·51	
Verum 262	R	0·995	0·0055	0·55	0·5	0·987	0·0097	0·98	1·1	0·933	0·0344	3·69	3·5
	L	0·997	0·0042	0·42		0·989	0·0122	1·23		0·947	0·0320	3·38	
Mollisoni	R	0·995	0·0056	0·56	0·6	0·982	0·0122	1·24	1·1	0·888	0·0485	5·46	5·2
	L	0·993	0·0069	0·69		0·985	0·0099	1·00		0·902	0·0448	4·97	
Aligarh A. 19	R	0·996	0·0048	0·48	0·4	0·982	0·0131	1·33	1·3	0·883	0·0458	5·19	5·4
	L	0·997	0·0034	0·34		0·986	0·0132	1·34		0·892	0·0502	5·63	

five cottons considered here. Balls,[28] in this connection, observes: " Usual relative variation of hair length is similar throughout the genus." If, however, the lengths of the individual fibres are modified, to a varying extent, by some such extraneous factors as twist, it is possible that the length variability may be altered and that the alteration may be different for the different cottons. If K be the percentage contraction due to twisting in fibres 1 cm. long, then their average length after the insertion of the twist is given by

$$L = 1 - K/100.$$

If their length variability is expressed in terms of the percentage probable error, then

$$e_L\,(\%) = e_L \times 100/L$$

$$\text{Now } e_L = e_K$$

$$\therefore\ e_L\,(\%) = 100e_K/(1 - K/100)$$

The values of e_L (%) calculated as above for different cottons and twists are given in Table XIV.

Several interesting points emerge from a study of this table. It will be seen, in the first place, that the contribution of twist to the length variability is practically the same for all cottons up to 25 turns and is negligible, i.e. up to this limit the cottons behave normally as if the fibres are untwisted. Beyond this stage, however, the length variability increases with the twist, and the increase is greater for the shorter than for the relatively longer cottons. Thus, as more twist is inserted in the fibres, the " spread " of the values of their length increases, the effect being more marked with the shorter than with the longer Indian cottons.

We have seen above that the fibres suffer contraction in length on being twisted and that the percentage contraction is greater for the short than for the relatively long Indian cottons. Now, it is highly probable that this phenomenon of variable contraction holds not only as between different cottons but also between short and long fibres of the same cottons, though to a lesser extent. If this view is correct, then it follows that the short fibres in a cotton will contract more than the long ones, thereby increasing the length variability of the cotton with high twists. Furthermore, as cottons with a low mean fibre length will contain more fibres of a low length grade (say $\frac{1}{4}$ in.), the modification in the length variability brought about by twist will be greater for the short than for the long cottons. We thus see that the effect of twist on the length variability arises out of the variable degrees of contraction of the long and the short fibres, which in its turn is related to the presence of the thick and thin places in the fibres.

VI. Relationship between fibre strength and percentage contraction.

Since the tensile strength (W) and the percentage contraction (K) for numerous fibres of each cotton are known, their values may be utilised for calculating the correlation coefficients between these two properties. These are shown in Table XV. In view of the fact that at least 300 fibres were tested at 100 turns, the correlation coefficients, r_{KW}, for 100 turns are given for all cottons, but as a smaller number of fibres were tested for 25 and 50 turns, the values of the correlation coefficients for these two twists are given only for one cotton, namely Mollisoni.

Table XV.

Correlation coefficients between K and W.

Cotton	Twists	r_{KW}	Significance
Mollisoni	25R	$-0{\cdot}14 \pm 0{\cdot}05$	Insignificant
,, ...	25L	$-0{\cdot}17 \pm 0{\cdot}05$	Just significant
,, ...	50R	$-0{\cdot}14 \pm 0{\cdot}05$	Insignificant
,, ...	50L	$-0{\cdot}09 \pm 0{\cdot}05$	Insignificant
,, ...	100R	$-0{\cdot}16 \pm 0{\cdot}04$	Just significant
,, ...	100L	$-0{\cdot}10 \pm 0{\cdot}04$	Insignificant
Cambodia Co. 1 ...	100R	$0{\cdot}09 \pm 0{\cdot}04$	Insignificant
,, ...	100L	$0{\cdot}07 \pm 0{\cdot}04$	Insignificant
Verum 262	100R	$-0{\cdot}19 \pm 0{\cdot}04$	Significant
,, ...	100L	$-0{\cdot}07 \pm 0{\cdot}04$	Insignificant
Banilla	100R	$-0{\cdot}17 \pm 0{\cdot}04$	Significant
,, ...	100L	$-0{\cdot}10 \pm 0{\cdot}04$	Insignificant
Aligarh A. 19 ...	100R	$-0{\cdot}07 \pm 0{\cdot}04$	Insignificant
,, ...	100L	$-0{\cdot}09 \pm 0{\cdot}04$	Insignificant

If the twist inserted in a fibre runs into its thin places the percentage contraction (K) will be proportional to the number and diameter of these places. If the twisted fibres, on tension being applied, break most frequently at *these* thin places, one would expect that the tensile strength (W) should bear some relationship to percentage contraction. Actually, as we see from Table XV the correlation coefficients are insignificant in most cases, and wherever they are not so, they are on the border line of significance.

This absence of any marked correlation, contrary to expectation, deserves to be considered in some detail. In developing the foregoing argument we assumed that the twist ran into the thin places of the fibre, which, on tension being applied, broke at one of these places. The latter assumption is supported by the observations of Miss Clegg,[29] who found that about 60 per cent. of the fibres ruptured at their thin places. It is, however, possible that, as in a yarn, the twist may have the effect of strengthening the weak places, and, consequently, the fibre rupture may not be restricted, for the most part, to the narrow sections where the contraction takes place, but may be distributed more or less uniformly over the whole length of the fibre. The fibre rupture would then take place at the cross-sections where the internal forces between the micellar chains are least, regardless of the diameter at these sections. Furthermore, it is possible that a certain fraction of the fibres in a cotton may have received injuries either in the ginning process or through the agency of the cellulose-destroying micro-organisms. These injuries, which may be seen under the microscope by staining the fibres with Congo Red dye, will not be restricted to the thin places, but will be distributed more or less uniformly over the surface of the fibre. Now, it is highly likely that twist, especially of a high degree, will have the effect of further weakening the already damaged parts, and, therefore, the rupture may take place just as frequently at the thick as at the comparatively thin places.

VII. Part played by Twist in the Spinning Process.

(1) *Variation of Yarn Strength with twist.* In the various stages leading up to the preparation of a yarn, the insertion of a certain amount of twist is necessary. In the roving stage, just enough twist is inserted to hold the

fibres together, while in the spinning process, the twist also serves the purpose of imparting additional strength. The number of turns per inch (T) in a yarn is generally expressed by the formula

$$T = t\sqrt{c}$$

where t is the twist constant and c the count to which the yarn has been spun.

The variation in yarn strength with twist has been studied by a number of workers, amongst whom may be mentioned English[30], Turner and his collaborators,[31, 32] Morton,[33] Balls,[34] Oxley[35] and Mercier and Schoffstall.[36] It may be mentioned that yarn strength may be expressed either as lea breaking strength or single thread strength, or alternatively, the ballistic work of rupture of a lea or a single thread may be used. The following general conclusions may be drawn from a study of the works of the above-named authors:—

(i) As the twist constant is raised from 3·5 to 5·0

(*a*) the lea strength increases, reaches a maximum and then falls. This maximum may be absent for short and coarse cottons.

(*b*) the single thread strength also increases with twist; but the maximum may not always be reached within the limit of $t=5$, especially for the coarse cottons ;*

(*c*) the ballistic count-work product also increases with twist, but no maximum is reached.

(ii) The values of the twist at which these maxima are reached are generally lower for the long staple than for the medium staple cottons and higher for the short staple varieties.

(iii) In a given range of twist, the strength as indicated by any of the methods mentioned above increases more rapidly for the medium than for the long staple cottons, while the short staple varieties appear to derive the maximum benefit from any increase in twist.

We will now summarise the effect of twist on the strength of a fibre which has been discussed in detail in the preceding pages. We may for this purpose refer to the curves in Fig. 4. We find that—

(1) As the twist in a fibre is increased, its strength increases, rapidly at first and more slowly afterwards, reaches a maximum and then falls. The type of the twist-strength curve for a fibre is very similar to the twist-strength curve for a typical yarn for lea or single thread strength.

(2) For a given increase in twist, the fibres of the shorter cottons show a greater increase in strength than those of the comparatively long staple cottons.

(3) The maxima for fibre strength are much higher than those for single thread strength, which, in their turn are generally higher than those for lea strength, no fibre showing its maximum strength until at least 40 to 60 turns per inch have been inserted in it.

Thus, broadly speaking, there is a close parallelism between the behaviour of a yarn and a fibre when twist is inserted in them.

(2) *Lack of correlation between the yarn strength and fibre strength.* If this parallelism is considered along with the fact that, like its component fibres, the yarn increases in strength with humidity or loses its strength with chemical or bacterial damage or under prolonged exposure to light, we are justified in expecting a high degree of association between fibre strength and

* It is remarkable that even in the case of worsted yarns, the maximum lies somewhere in this region as shown by Stanbury and Byerley.[37]

yarn strength. In actual practice, this expectation is not fully realised. Turner [38] obtained a small negative correlation coefficient between count-strength product (C.S.P.) and the fibre strength, while the correlation coefficient between C.S.P. and the intrinsic strength (fibre strength ÷ fibre weight per inch) was found to be zero. Burd[39], Clegg[40] and Morton[41], have all obtained similar results. Only Barritt,[42] working with 14 samples of Egyptian varieties spun into 140's, found that the correlation coefficient between fibre and yarn strength was fairly high. Recent values obtained in this laboratory give a moderately high correlation between the intrinsic strength and the highest standard warp counts for the standard Indian cottons, though it is definitely less than the correlation coefficient between highest standard warp counts on one hand and either the mean fibre length or the mean fibre weight per unit length of the cotton on the other.

(3) *Factors responsible for the lack of correlation between the two properties.* The question, therefore, arises: What are the reasons for this lack of a satisfactory relationship between fibre strength and yarn strength? This question has been considered in some detail by Turner[43] and only the more important reasons will be stated here.

In yarn tests the fibres are broken in groups and the group strength may be quite different from the sum of the strengths of the individual fibres, especially if the latter are bound together by twist. Furthermore, if due allowance is made for the number of fibres in a cross-section of the yarn, the rate of loading of the fibres constituting the yarn is different from that for a single fibre in a fibre test. Now, it is well known that within certain limits the breaking strength of a fibre depends upon the rate of loading, the faster loading giving a higher strength. Again, it should be remembered that fibre strength depends to a large extent upon the length of the test piece as shown by Clegg[44] and Balls.[45] In routine testing, fibres 1 cm. long are tested for strength, while in the yarn the fibres affected in yarn ruptures are generally less than one centimetre in length. We must also remember that in a yarn the fibres lie spirally around the yarn axis and, therefore, only a certain component, depending upon the twist, of the force applied is effective in breaking them. Finally, since it is highly probable that the properties of the fibres are modified to some extent by twist, we should take into account this factor in assessing yarn strength in relation to its component fibres.

(4) *Change of fibre properties with twist.* We will now examine the last point in its various aspects, confining ourselves to such changes in fibre-properties as occur up to a limit of about 35 turns per inch or 15 turns per cm. This limit is chosen, because no Indian cotton spun for warp purposes is given a higher twist. From the earlier sections of this paper it will be remembered that so far as length and its variation are concerned twist does not have a favourable effect from the beginning. The same is true of strength variation. However, a reference to Tables VIII, XI and XIV will show that the adverse effect of these three factors is practically negligible in the region under consideration. On the other hand, as shown in Table X, the skewness improves with twist in some cases. But more important than this is the fact, shown in Table IV, that the strength of the fibre increases with twist, while from the work of Peirce[46] it is highly probable that an improvement also results in the plasticity of the fibre. Thus, on the whole, twist up to 15 turns per cm. should have a beneficial effect upon the fibre by giving it greater strength and plasticity, while leaving the other properties

practically unaffected. We shall now consider the effect of twist on fibre strength, and its relation to yarn strength in some detail.

(5) *Change of fibre strength with twist and its influence upon yarn strength.* It has been shown above that fibre strength, like yarn strength, increases with twist until a maximum is reached, and that the rate of increase of fibre strength is less for the longer than for the shorter cottons. The parallelism between the behaviour of the fibre and the yarn in regard to the effect of twist on their strength, however, does not extend much further. When we compare the magnitudes of increase in strength with twist, we observe large differences between the behaviour of the fibre and the yarn. In Table XVIA* we have given some results showing the percentage increase in lea and single thread strength of yarn when the twist constant is increased from 4·0 to 4·25 (3·5 to 3·75 for African cottons) from which the percentage increase C for a change of 1 turn per inch has been calculated and given in column (vi) of the table. In Table XVIB the value of C (percentage increase in strength for an increase of 1 turn per inch) is given for fibres of the cottons tested in the course of this investigation.

Table XVIA.

t = Twist Constant.
A = Percentage increase in strength when t is changed from 4.0 to 4.25 (3.5 to 3.75 for African Cottons).
B = Increase in the number of turns per inch for above-mentioned change in t.
C = A/B = Percentage increase in strength for a change of 1 turn per inch.

(i) Cotton	(ii) Test	(iii) Count	(iv) A	(v) B	(vi) C = A/B
Oomra	Lea	10-12	33	0·83	40
Mollisoni	,,	6-8	35	0·66	53
P.A. 4F	,,	26	1·0	1·27	0·8
Cambodia Co. 1	,,	20-48	1·1	1·46	0·8
Africans (average)	,,	40	4·1	1·58	2·6
Oomra	Single Thread	10-12	23	0·83	28
Mollisoni	,,	6-8	20	0·66	30
P.A. 4F	,,	26	8·1	1·27	6·4
Cambodia Co. 1	,,	20-48	4·5	1·46	3·1
Africans (average)	,,	40	5·1	1·58	3·2

Table XVIB.

C = Percentage change in fibre strength, per unit increase in the twist per inch, when the turns per inch are changed from 0 to 30.

Cotton.	C.
A. 19	0·10
Mollisoni	0·12
Verum 262 ...	0·14
Banilla	0·01
Co. 1	0·04

We notice that for the lea test whereas C is about 1-3 per cent. for the medium counts (26's-40's) spun from the better quality, it may be as high as 40-50 per cent. for the coarse counts (6's-12's) spun from the

* The material in Table XVIA is taken from the data collected at the Technological Laboratory for Indian and African cottons.

lower quality cottons. The values of C for single thread test, though somewhat different from those obtained for the lea test, are however of the same order of magnitude, being 3-6 per cent. for the medium counts and about 30 per cent. for the coarser ones. As against these comparatively large changes in yarn strength, we notice that for the same increase in twist in the same range the fibre strength increases only by 0·01-0·04 per cent. for the better quality cottons and by 0·1-0·14 per cent. for the shorter cottons. Thus, although the difference in the two classes of cottons in their reaction to twist is still maintained in the fibre as in the yarn, the percentage increase in fibre strength is much smaller than that in yarn strength, the former being only about a hundredth part of the latter. We should also remember that we are considering the effects in the neighbourhood of the twist constant 4, where the rate of change of yarn strength with twist is relatively small. If we take into consideration the initial stages of inserting twist in a yarn, the contribution of any increase in fibre strength would be even less. Hence, we conclude that when twist is inserted in yarn, the strength of its component fibres is likely to increase by a small amount, but that this increase in fibre strength can account only for a very small fraction of the increase which takes place in yarn strength, the rest being due to other factors.

VIII. Variation of Fibre Strength with Twist in relation to Fibre Structure.

In this section we will first describe briefly the structure of the cotton fibre and will then make an attempt to explain, on the basis of this structure, the main results obtained by us. We shall adopt the molecular chain theory of fibre structure which in our opinion better fits the experimental evidence, derived from chemical analysis and X-ray investigation, than any other theory.[47] According to the postulates of this theory the cotton fibre is ultimately made up of β glucose residues, which are linked together by primary valencies to form long molecular chains in which the glucose rings are faced alternately in opposite directions. A number of these molecular chains, which are held together by secondary valency forces, constitute micelles, which are of varying size and varying degrees of perfection, but which have this common feature that their length far exceeds their breadth. In the case of cotton fibre these micelles are arranged to lie more or less parallel to one another along lines which wind spirally round the fibre, with here and there regions in which the chain arrangement attains crystalline regularity. Superposed upon this fundamental structure of the cotton fibre are its natural twists or convolutions, which change direction at irregular intervals. Finally, the surface of the fibre is interspersed with a number of pits, fissures and cracks about which our present-day knowledge has been summarised by Osborne.[48]

We will now recapitulate the main results of our experiments. We found that, except in the case of Cambodia Co. 1, insertion of twist in the fibre at first increased its strength until it reached a maximum value after which, with further twisting of the fibre, the strength steadily diminished. We further saw that, as the twist was increased, the diminution in strength was accompanied by greater variability and higher skewness of the strength distribution. Furthermore, we noticed a slight tendency for the strength values to be lower with the right-handed than with the left-handed twist. In the case of Cambodia cotton it is highly probable that, if more twist had been inserted, its fibre strength would have diminished as in the case

of other cottons after reaching a certain maximum. We may, therefore, conclude that the foregoing observations hold for all cottons, which, however, differ from one another in respect of the rate of increase or decrease of strength with twist, the point at which the maximum strength is attained, the magnitude of change in skewness and variability, etc.

In the unstretched state when no tension is applied to the fibre the molecular chains or micelles are generally orientated in such a way as to make a certain angle with the fibre axis. This angle is by no means a constant quantity, but may vary at different points along the length of the fibre. When the fibre is stretched, these chains tend to place themselves along the axis of the fibre as shown by Astbury.[49] The angle of inclination becomes progressively less as the tension on the fibre is increased. A part of the force applied, therefore, is spent in straightening out the micelles so that they may lie more nearly parallel to the fibre axis. The greater the initial inclination of the micelles to the axis, the greater will be the force required to straighten them out. However, it is possible that before these chains are made to lie even nearly parallel to the axis the fibre may break under the action of the stretching force. It is highly probable that in most cases the rupture of the fibre, at least in the very initial stages, is not due to the breaking asunder of the molecular chains since it has been calculated that the force required for this purpose is greater than the average strength of the fibre. The process, in all probability, begins by the chains slipping over one another, and either it is continued right to the end, or up to a point when the force on the few remaining chains, which still hold out, is sufficient to break them, the final result in both cases being the rupture of the fibre.

When twist is inserted in the fibre, it will have the effect of (1) increasing the inclination of the micelles to the fibre axis and (2) of increasing the lateral pressure exerted by the micelles over one another as a result of which they are held more firmly together and (3) of improving the alignment of the micelles along the lines of force of twist as a result of which their area of contact increases, with consequent increase in the force holding the chains together, as shown by Mark.[50] These effects will increase with the amount of twist inserted in it. If the fibre is now stretched by applying tension to it, more force will be required to cause the micelles to lie nearly parallel to the fibre axis until the point is reached at which the fibre rupture takes place in the manner indicated above. When this point is reached and the molecular chains commence to glide over one another, the force required to separate them completely by overcoming their mutual cohesion will be greater. These effects will increase with the amount of twist inserted and, therefore on the molecular chain theory we should expect that the strength of the fibres would increase, at least up to a limit, with the amount of the twist inserted in them. This is precisely what is observed by us.

If the twist produced only these three effects, namely, increasing the average inclination of the micelles to the fibre axis, increasing the lateral pressure exerted by them over one another, and improving the alignment of the micelles, we should expect that fibre-strength would go on increasing indefinitely with increase in twist. But in addition to these three effects, the twist would produce other effects as well which may not be favourable to fibre strength and which we shall now consider. In the first place, owing to the elongation of the spiral lines brought about by the twist, the

longitudinal tension on the micelles would increase. Since the chains would now lie in a state of tension, they would be inclined to snap by the application of a smaller external force. Secondly, the shearing effect of the twist would tend to enlarge any fissures, cracks or pits on the surface of the fibre to which a reference has been made above. These enlarged fissures would also have the effect of weakening the fibre which would now be unable to withstand the same breaking force as it would have normally done. It stands to reason that both these effects, namely the longitudinal tension in the micelles and the enlargement of the fissures would be negligible at low twists, but would steadily increase as more and more twist is inserted in the fibre, until at high twists they would be quite large. As this state of affairs is being reached smaller and smaller external force would be required to break the fibre.

We see, therefore, that as a fibre is twisted and the amount of twist is gradually increased, two opposing sets of factors are brought into play, one of which tends to increase its strength, while the other tends to decrease it. The effect of the former predominates at lower twists as a result of which fibre strength rises, while that of the latter begins to assert itself at moderately high twists ; consequently the fibre strength reaches a maximum value and then declines as more and more twist is inserted in it. The molecular chain theory of the structure of the fibre, taken in conjunction with known facts regarding the surface appearance of the fibre, is therefore capable of explaining, in a general way, its behaviour under the action of progressively increasing twist.

We have seen that the cottons exhibit differential response to twist in respect of the rate of increase of fibre strength with twist and the point at which the maximum strength is attained. In the short staple cottons, as a rule, the fibre strength rises more rapidly with the twist than in the comparatively longer cottons and the point of maximum strength is reached earlier. If we were to assume that the micelles in the fibres of the short staple cottons are inclined to the axis at a greater average angle than in the fibres of the long staple cottons, both these observed facts would be readily explained. For, on this assumption, the insertion of a small amount of twist would result in the micelles in the short staple cotton fibres making a fairly large angle with the axis, while such would not be the case in the fibres of the long staple cottons in which the initial inclination was small. It can be easily shown that if a force f acts upon the micellar chain, the tension along the fibre axis (F) is $f \sec \theta$ where θ is the angle made by the tangent to the spiral line with the direction of the fibre axis. Consequently, after the insertion of the twist, since θ on the average is greater in the short staple cottons, the external force required to make the micelles lie nearly parallel to the fibre axis would be greater in these than in the long staple cottons. Furthermore, since $dF/d\theta = f Tan\theta sec\theta$ the former cottons would exhibit a greater rate of increase in fibre-strength with twist than the latter if f is constant. Again, owing to the greater inclination of the spiral lines, the longitudinal tension on the molecular chains produced by the twist after it exceeded a certain value would be greater in the fibres in which the micelles are inclined at larger angles to the fibre axis, therefore, in these cottons the point of maximum strength would be reached sooner than in those in which the micelles make smaller angles with the fibre axis. We thus see that the differential response of short staple and long staple cotton fibres to twist can be explained by assuming that in the former the spiral lines

along which the micelles lie make, on the whole, larger angles with the fibre axis than in the latter. We must admit that we have no direct experimental evidence for this assumption ; we offer it only as an indirect inference from the observed facts which it explains rather well.

We have referred, in the foregoing paragraphs, to the fissures and cracks in the surface of the fibre and the role played by them in accounting for the observed decrease in fibre strength after the twist has attained a certain value. It is highly probable that the number and general contour of these fissures would vary appreciably from fibre to fibre. When the fibres are twisted, the effect of twist on these fissures would depend upon their number and contour, and would, therefore, be different for the different fibres, even in the same cotton. Furthermore, the manner in which the micelles would be orientated in each fibre i.e. the inclination to fibre axis at different points, the frequency of reversals of direction of spiral lines, etc., would also be different in the different fibres, and it is possible that the insertion of twist may accentuate these effects. Thus, as a result of the working of both these factors, which have their origin in the secondary differences existing betwen individual fibres, we may reasonably expect that the spread of the strength values and the skewness of the distribution curve would increase somewhat with twist. This is what we have actually observed in our experiments.

The micelles are sub-microscopic structures whose existence has been definitely established by X-ray analysis, but there is some evidence to show that these are grouped together in thin long bundles called fibrillae. As stated above, the spirals along which these lie in a fibre reverse directions at irregular intervals, being clockwise in one region, anti-clockwise in the next and so on. According to Balls,[51] under certain conditions the reversals in the direction of the fibrillae correspond to those of convolutions, though it may not always be the case. If the spirals wound in one direction just as often as in the other, the effect of direction of twist would be negligible ; if, on the other hand, the spirals wound in one direction—clockwise or anti-clockwise—more often than in the other, the effect of twist in this particular direction would be greater than in the other. This is exactly what is observed by us, and we infer from the results of our experiments that, at least in the cottons examined by us, the reversal of the spiral along which the fibrillae lie is probably more frequent in the left-handed than in the right-handed direction. Again we repeat that this should merely be looked upon as an inference drawn by us to account for a certain observed phenomenon, but that more work is necessary before we can either accept it definitely or offer an alternative explanation.

ACKNOWLEDGMENT.

A part of the investigation was carried out by one of us under Dr. A. J. Turner to whom our thanks are due not only for his guidance but also for kindly going through the proofs of this Bulletin.

Received 21/6/1937

REFERENCES.

[1] Monie, H. " The Cotton Fibre," Manchester, 1904, p. 25.
[2] Bowman, F. H. " Structure of the Cotton Fibre," London, 1908, pp. 364-6.
[3] Turner, A. J. " The Foundations of Yarn Strength and Extension," Parts I and **II**, *I.C.C.C. Tech. Bull.*, Series B, No. 1, 1928, or *J. Text. Inst.*, 1928, **19**, T286.
[4] Clegg, G. G. " The breaking of yarns and single cotton hairs," *J. Text. Inst.*, 1926, **17**, T595.
[5] Turner, A. J. As Ref. 3, pp. 12-13.

[6] Turner, A. J. and Venkataraman, V. "The Foundations of Yarn Strength and Extension," Part V, *I.C.C.C. Tech. Bull.*, Series B, No. 17, 1933, p. 18, or *J. Text. Inst.*, 1934, **25**, T1.
[7] Gulati, A. N. and Turner, A. J. "The Foundations of Yarn Strength and Yarn Extension," Part IV, *I.C.C.C. Tech. Bull.*, Series B, No. 9, 1930, or *J. Text. Inst.*, 1930, **21**, T561.
[8] Barratt, T. "Measurement of breaking stresses, extensibilities and elasticities of single fibres of cotton," *J. Text. Inst.*, 1922, **13**, T17.
[9] Navkal, H. and Sen, K. R. "A comparison of some methods of testing breaking strength of single cotton fibres," *I.C.C.C. Tech. Bull.*, Series B, No. 5, or *J. Text. Inst.*, 1930, **21**, T267.
[10] Schwendinger, P. "Deforden testing apparatus, source of error," *B.C.I.R.A.*, 1935, XV, p. 366.
[11] Barratt, T. As Ref. 8, p. 27.
[12] Collins, G. E. "The extensibility of cotton hairs," *J. Text. Inst.*, 1930, **21**, T317.
[13] Mann, J. C. "The Influence of humidity on the elastic properties of cotton. On the breaking load at 20° C., *J. Text. Inst.*, 1927, **18**, T253.
[14a] Work done at the Technological Laboratory (unpublished).
[14] Wilcomm. Quoted by Mann, Ref. 13.
[15] Urquhart, A. R. and Williams, A. M. "The moisture relations of cotton" (Effect of temperature), *J. Text. Inst.*, 1924, **15**, T569.
[16] Navkal, H. and Sen, K. R. As Ref. 9, p. 9.
[17] Roehrich, O. "Twisting of cotton fibres," *Text. Res.*, Vol. V, p. 254.
[18] Clegg, G. G. and Harland, S. C. "A Study of convolutions in the cotton hairs," *J. Text. Inst.*, 1924, **15**, T21.
[19] Mills, F. C. "Statistical Methods," London, 1925, p. 167.
[20] Kelley, T. L. "Statistical Method," Cambridge (U.S.A.), 1923, p. 61.
[21] Koshal, R. S. and Turner, A. J. "Studies in the sampling of cotton for the determination of fibre properties," I and II, *I.C.C.C. Tech. Bull.*, Series B, No. 6, 1930, p. 32, or *J. Text. Inst.*, 1930, **21**, T325.
[22] Rietz, H. L. "Mathematical Statistics," 1927, p. 69.
[23] Jones, D. C. "A first course in Statistics," London, 1924, p. 205.
[24] Pearson, Karl. "Tables for Statisticians and Biometricians," Cambridge University Press, 1924, p. 67-77.
[25a] Work done at the Technological Laboratory (unpublished).
[25] Koshal, R. S. and Turner, A. J. As Ref. 21, p. 36-37.
[26] Elderton, W. P. "Frequency Curves and Correlation," London, 1927, p. 54.
[27] Pearson, Karl. "Tables for Statisticians and Biometricians," Cambridge University Press, 1924, pp. 46, 47.
[28] Balls, W. L. "Studies of quality in cotton," 1928, Macmillan & Co., London, p. 47.
[29] Clegg, G. G. As Ref. 4, T.600.
[30] English, W. "The relation between the breaking strength of cotton yarns and twist at the place of breaking," *J. Text. Inst.*, 1924, **15**, T388.
[31] Gulati, A. N. and Turner, A. J. As Ref. 7.
[32] Richardson, R. P. and Turner, A. J. "Limit Spinning Tests on Cambodia and Mollisoni Cottons," *I.C.C.C. Tech. Bull.*, Series A, No. 17, 1930, p. 9 and 10.
[33] Morton, W. E. "The spinning value of raw cotton," *J. Text. Inst.*, 1930, **21**, T205-17.
[34] Balls, W. L. As Ref. 28, p. 218-19.
[35] Oxley, A. E. "The regularity of single yarns and its relation to tensile strength and twist," *J. Text. Inst.*, 1922, **13**, T91.
[36] Mercier, A. A. and Schoffstall, C. W. "Effect of twist on cotton yarns," *Bureau of Standards Journal of Research*, 1928, p. 733.
[37] Stanbury, G. R. and Byerley, W. G. "The relation between the strength, count and twist of single worsted yarn," *J. Text. Inst.*, 1934, **25**, p. T295.
[38] Turner, A. J. As Ref. 3, pp. 12-13.
[39] Burd, L. H. "Spinning Tests of St. Vincent Sea Island Cotton," Kingstown, 1925.
[40] Clegg, G. G. As Ref. 4, p. 592.
[41] Morton, W. E. "The spinning value of raw cotton," *J. Text. Inst.*, 1930, **21**, p. 205-17.
[42] Barritt, N. W. "The intrinsic strength of cotton," *J. Text. Inst.*, 1929, **20**, T71.
[43] Turner, A. J. As Ref. 3, p. 14.
[44] Clegg, G. G. As Ref. 4, T599.
[45] Balls, W. L. As Ref. 28, p. 234-9.
[46] Peirce, F. T. "The plasticity of cotton and other materials," *J. Text. Inst.*, 1923, **14**, T390.
[47] Davidson, G. F. "The molecular structure of cellulose," *J. Text. Inst.*, 1936, **22**, p. 144.
[48] Osborne, G. G. "Micro analysis of textile fibres," *Text. Res.*, Vol. V, p. 275.
[49] Astbury, W. T. "The fundamentals of fibre structure," Oxford University Press, 1933, pp. 88-89.
[50] Mark. *Trans. Faraday Soc.*, 1933 **29**, 9.
[51] Balls, W. L. As Ref. 28, p. 20.

APPENDIX I.

Table XVII. Frequency Distribution for W.

Gms. (ω −0·05)	Co. 1				Verum				Banilla				Mollisoni				A. 19			
	0	25	50	100	0	25	50	100	0	25	50	100	0	25	50	100	0	25	50	100
0	7	13	16	10	3	11	10	18	1	9	8	8	0	4	2	5	3	9	15	22
1	46	97	101	87	21	36	45	66	26	51	51	69	11	34	40	57	33	47	55	109
2	79	178	162	152	68	81	90	154	45	85	96	156	43	73	79	188	52	116	125	230
3	96	199	170	197	49	114	94	136	57	107	131	148	69	104	116	153	77	143	139	184
4	83	159	153	179	89	144	157	132	58	105	129	132	65	117	136	142	75	144	131	152
5	63	112	126	128	57	161	109	126	57	110	105	109	67	139	107	120	55	118	137	94
6	57	94	93	102	63	125	108	102	51	102	100	88	75	144	112	89	44	98	76	61
7	29	55	58	53	47	100	115	76	50	98	95	70	47	116	115	88	48	80	78	52
8	19	42	51	45	53	100	90	85	53	80	93	69	48	86	101	68	47	89	96	46
9	10	20	33	26	36	70	83	47	32	76	50	42	31	65	58	37	28	58	56	28
10	3	16	20	15	21	48	73	54	34	62	51	40	18	51	69	29	21	51	45	19
11	4	11	13	10	10	43	41	33	16	54	40	30	16	28	31	16	17	38	39	20
12	2	3	1	3	9	13	25	14	15	51	37	20	5	22	18	6	7	21	20	15
13	1	0	2	5	5	7	13	7	5	11	14	17	4	10	10	3	3	12	8	3
14	1	0	1	1	1	6	4	4	3	5	8	7	1	3	7	3	7	10	23	3
15	0	0	1	0	0	1	1	5	5	3	4	9	—	4	2	1	2	1	2	3
16	0	1	1	—	1	—	2	1	1	5	3	2	—	—	2	—	0	2	2	0
17	—	—	—	—	—	—	—	—	1	2	1	—	—	—	0	—	2	2	2	2
18	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	0	1	—	—
Total ...	500	1000	1002	1013	533	1060	1060	1060	510	1016	1016	1016	500	1000	1006	1005	521	1040	1049	1043
Mean (calculated)	4·15	4·09	4·31	4·28	5·53	5·80	6·04	5·23	6·10	6·28	5·90	5·27	5·70	5·97	6·00	4·75	5·53	5·66	5·62	4·17

(*a*) Figures for the right-handed and the left-handed twists have been combined.
(*b*) The means given are the calculated ones. They will differ somewhat from the *actual* means given in the body of the paper. Only in two cases is this difference greater than 0·02 gms., i.e., $\frac{1}{2}$ per cent.

Correspondence

A REVIEW OF TESTING INSTRUMENTS AND AN IMPROVED RECORDING FIBRE TESTER

To the Editor,

Sir,

As one of the authors of the above paper, which appeared in the May issue of the *Journal,* may I express my appreciation of the comments made by Dr. Krais in his letter of June 17th.

With one of his points, that a testing machine cannot be free from the effects of friction and yet retain simplicity in construction and operation, the authors can hardly agree. Dr. Krais's skill and experience have provided the ingenious Krais-Keyl apparatus in which frictional effects are negligible.

In the Osumi-Kato instrument friction between the pen and the paper and that of the moving parts do not affect the indication of the tensile strength of the test piece. Friction can be ignored so long as its effects are under the control of the operator.

Large magnification of extension is generally a difficult problem. This, however, is not the case with the Osumi-Kato instrument, with which elongation may be magnified 100 times, using a relatively low grade magnoscope. The Improved Recording Fibre-Tester is highly sensitive and may be regarded as free from friction. It is simple to make and easy to use.

(Signed) G. OSUMI.

Tokyo University of Engineering,
11/10/1937.

YARN STRENGTH OF EGYPTIAN MIXINGS

To the Editor,

Sir,

In his letter in your October number, Mr. Pilkington reads into my paper on mixings the " suggestion that different growths of cotton could be mixed in Egypt with impunity," and that it might lead to the indiscriminate mixing of Egyptian types. This grave misapprehension must be at once cleared up, for the Ministry of Agriculture, of which I have the honour to be a humble servant, is the body in Egypt solely responsible for the vigorous and effective steps taken in recent years to preserve the purity and identity of our varieties.

As the paper published in your *Journal* was addressed to spinners, it was considered unnecessary to deal with the agricultural aspects of the mixing question, but we are nevertheless very much alive to the dangers of mixing varieties in Egypt. Mr. Pilkington's uneasiness will perhaps be dispelled by an extract from the account of these same mixing experiments published in Egypt. This article—a report on the year's work[1]—mentions that we found no nett loss in strength through mixing in the mill and continues as follows:

" On the other hand the tendency for mixing of seed to follow in the tracks
" of the practice of lint mixing by growers or ginners is a serious matter, but
" its importance is in agriculture, not in cotton-spinning as such. Here the
" situation is quite different, for extraordinary plants sometimes arise from
" crossings, and the character of the crop might change completely, through
" the operation of natural selection. The legislation recently put into opera-
" tion restricting mixing of varieties therefore loses nothing of its force, so
" far as growers and ginners are concerned."

These views are in agreement with the opinion that any mixing of growths should be done on the individual spinner's responsibility expressed by Mr. Pilkington.

I also agree that it is sometimes impossible to repeat experimental results satisfactorily on a commercial scale ; the fact is only too well known, and my account in the *Journal* was very carefully restricted to a description of our own experiments and the use we ourselves were able to make of the results. But the entire absence of any difficulty met with on the apron drafting system, even when using widely different cottons in the mixings, suggests that insuperable difficulties are not like to arise in commercial use, where the mixing components would usually be less extreme in type. A more difficult question in commercial mixing practice lies in the balancing of the purchasing advantages of a wider choice of cottons against the risk of introducing bars and stripes into the finished goods. All these points are quite beyond the scope of my paper and are more appropriately studied by undertakings with specific requirements in mind.

As regards the value to the spinner of staple regularity in unmixed varieties, distinction must be made between the wastiness of low grade cotton (caused chiefly by insect damage and invariably coupled with other defects), and the normal variation in staple length as found in higher grade cottons. Nobody questions the objection of the former type and it needs no further discussion here[2] ; but after examining the staple diagrams of one or two thousand high grade cottons, we conclude there is not that high association between regularity and yarn quality that we find between staple length or fineness and yarn quality. Such differences in staple regularity as occur are of smaller importance, and are largely masked by other factors. Sea Island cotton is much more irregular than staple fibre, but which makes the better yarn?

Now in deciding the type of seed to issue to growers, a breeder has to weigh up the relative value of the many characters available. Shall he go for high yield, long staple, ginning out-turn, whiteness, resistance to pests, regularity of staple, or what? If he selects primarily for regularity his choice of other characters is restricted ; yield or quality or something else must in part be sacrificed, for no cotton is ideal in all characters. And if, after all, staple regularity is not of the importance he attached to it, then the advantage of his selection is not as great as it might be and in the long run the spinner loses by it. In view of our enquiries, of which the mixing experiment is merely additional confirmation, staple regularity is now considered a factor of secondary importance, but that does not mean it is neglected. Of a much higher order of importance is the wastiness of low grade cotton, which increases the comber waste and is therefore noticed by spinners ; this type is not produced by healthy seeds, and is quite another problem, also under close study.

In reply to the criticism that Maarad was not included in the mixings, it should be noted that Sakha 4 is as long as Maarad, and Giza 26 is even longer, both of which were included ; the samples we selected covered the greatest possible contrast in length.

I would like to add that I do not consider it unreasonable for Mr. Pilkington to have arrived at his conclusions, for it is probable that few people are aware of the measures taken to maintain quality by this Ministry, with its extensive Seed Control Laws and the equally strictly enforced laws prohibiting the mixing of varieties. I am therefore grateful to have his views, and to have this opportunity of reply, which I trust will make the facts clear.

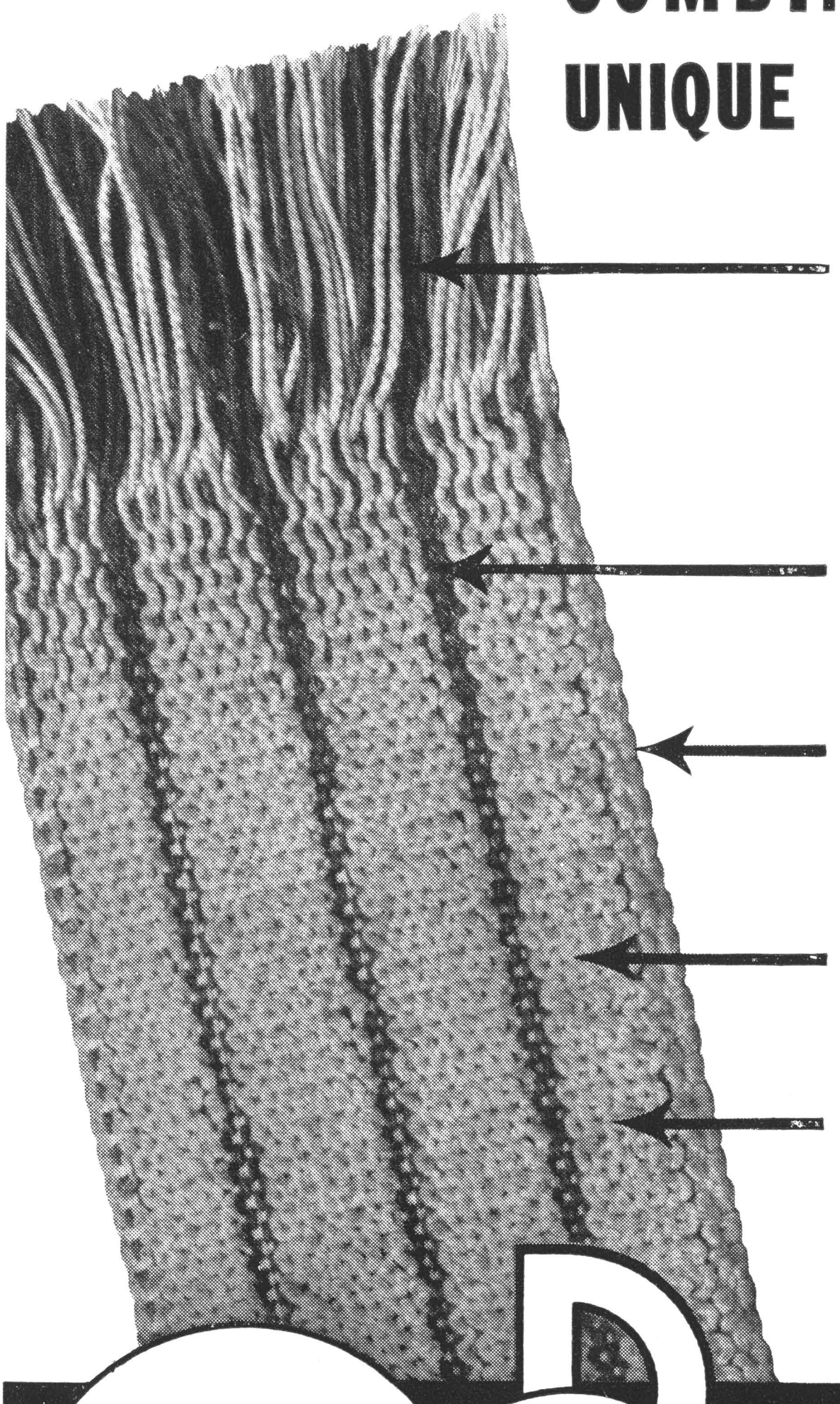
(Signed) F. DUNKERLEY.

Cairo, 11/11/1937.

[1] Studies in Spinning and Growing, 1935-6; Ministry of Agriculture Technical Bulletin No. 189, p.31.

[2] Strength, Price and Grade of Egyptian Cottons, *J. Text. Inst.* 1937, **28**, T183.

NO OTHER BELTING HAS THIS COMBINATION OF UNIQUE ADVANTAGES



The use of 100% pure camels hair yarn warp gives maximum elasticity to take care of shock loads and difficult drives and ensures **maximum belt life.**

Patent grooves eliminate air traps, and give maximum power transmission.

Patent non-fray edges of **cabled** cotton provide effective resistance to wear against guide forks.

Solid weave : therefore no plies to come apart.

Cotton pile driving surface has high co-efficient of friction, preventing slip and protecting the body of the belt.

Actual photograph of unproofed sample.

We have frequently replaced 4" belting of other types with 3½" "Grooved Roko" with infinitely better results in belt life and power transmission.

"GROOVED ROKO" BELTING

SMALL & PARKES LTD. HENDHAM VALE WORKS, MANCHESTER 9

G

If you could get a Cockill belt at the price of ordinary belting, would you choose it ?

Of course you would, because the name Cockill on a belt is a sure guarantee of quality and value for money.

We know that for some jobs it is unnecessary to have a very high quality belt and we want you to know that to-day, Cockill belts are made in varying qualities to suit every need, and are available at competitive prices.



TYRE YARN DOUBLING

HEAVY TYPE RING DOUBLING FRAME

(7″ gauge, 5½″ ring, 8″ lift.)

Specially designed to meet the demands of the Cabling Trade

Special Features:

Patent Self-Lubricating Ring giving increased life of traveller and decrease in consumption of grease.

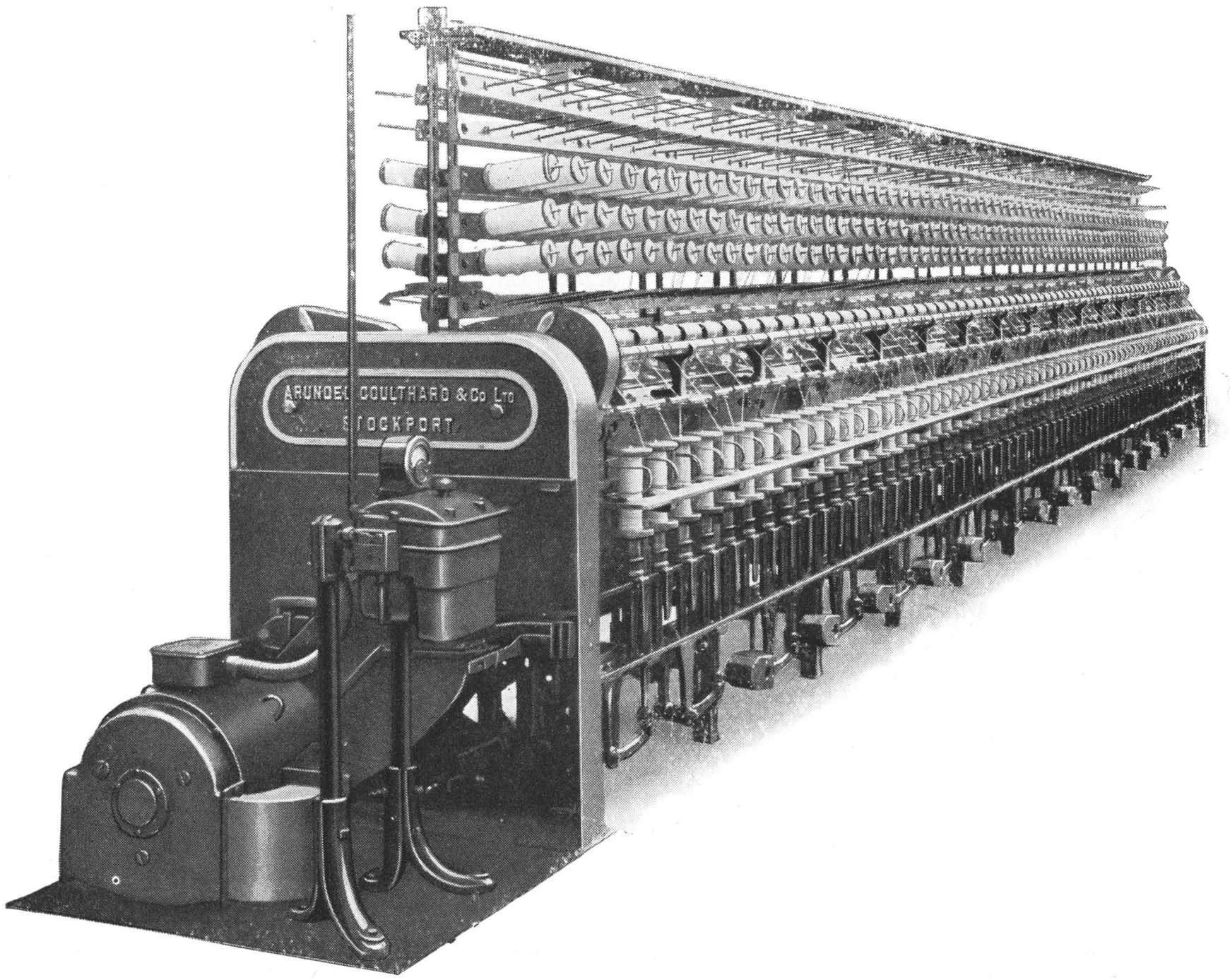
Massive Patent Ball Bearing Spindle.

The finished bobbin contains 3¼ lbs. of Knotless Yarn, produced at a greatly increased speed over any other method.

Increased production of more than 30% over existing frames.

Better Yarn. Saving of floor space.

Yard indicator to give measured length.



ARUNDEL, COULTHARD & CO. LTD.

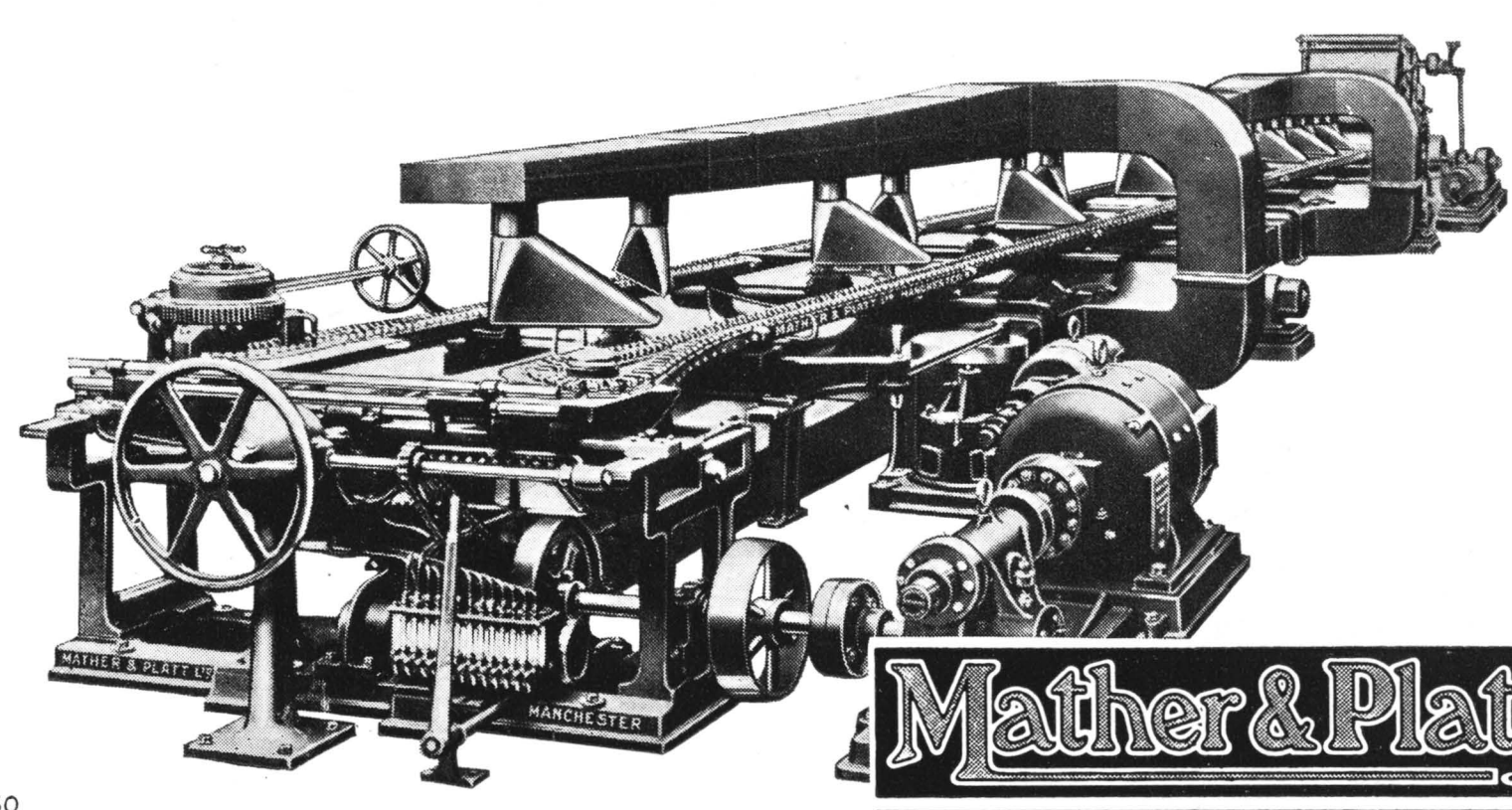
STOCKPORT



The Finish of Fabrics

- the quality on which they are judged at the counter is enhanced by the use of Mather & Platt finishing machinery.

Cataloques describing the full range of Printing and other machines for the complete equipment of Print Works will be forwarded on application.



MP 250

Mather & Platt Ltd

PARK WORKS, NEWTON HEATH, MANCHESTER 10

PARK HOUSE, GREAT SMITH STREET, LONDON, S.W.1

THE JOURNAL OF THE
TEXTILE INSTITUTE
ABSTRACTS

LIST OF ABSTRACTORS

The Abstracts in this Section of the "Journal" are supplied by the following Organisations, and the source indicated by the initials hereunder shown.

British Cotton Industry Research Association	C.
British Launderers Research Association	La.
Bureau of Hygiene and Tropical Diseases	T.
Cuthill, Dr. R.	S.
Imperial Bureau of Animal Genetics	W.
Imperial Bureau of Plant Genetics	C. or L.
Linen Industry Research Association	L.
Water Pollution Research Board	W.
Whitelegg, C. J.	C.J.W.
Wool Industries Research Association	W.

1.—FIBRES AND THEIR PRODUCTION

(A)—MINERAL

Textile Fibres: Photomicrography. *See* Section IB.

(B)—ANIMAL

State of the Sulphur in Oxidised Wool. M. Harris and A. Smith. *Amer. Dyes. Rep.*, 1937, **26**, P413-P415.

During treatment with oxidising agents, the disulphide sulphur in wool appears to be changed to higher states of oxidation. The existence of oxidised disulphide compounds is indicated by the alkali-solubility determination, the lead acetate test, by reduction with hydrochloric acid-potassium iodide solutions, and by cystine analyses. The intermediate oxidation derivatives of cystine are unstable under the conditions necessary for protein hydrolysis, and at least one of them, cystine disulphoxide, is partially converted to cystine. The results indicate that the values obtained for the cystine content of oxidised wool may be expected to be higher than the actual cystine content, since they represent the amount of cystine formed from partially oxidised as well as from unoxidised cystine. W.

Absorption of Acids by Wool. H. J. Henk. *Textilber.*, 1937, **18**, 377-378.

The absorption of acids by wool decreases with increasing temperature. A graph is given showing the absorption curves for oxalic, sulphuric, hydrochloric, formic and acetic acids. The action of nitrous and gallic acids on wool is discussed. W.

Textile Fibres: Photomicrography. Böhme Fettchemie-G.m.b.H. *Klepzig's Text. Z.*, 1937, **40**, 509-515.

Photomicrographs are given showing New Zealand wool (tip and middle), German merino wool (tip and middle), two wools of unknown origin with different scale formation, hair of the Cashmere goat, the Angora goat, the common goat and the camel, human hair, asbestos, casein wool and various types of cotton, flax, ramie and rayon fibres. For purposes of comparison, all the fibres were treated by the R-O-X process (Zeiss ; see *J. Text. Inst.*, 1936, A 94), and are shown at a magnification of 540. W.

Formation of Fur and Plumage: Mechanism and Metabolism. R. Jacquot. *Bull. Soc. Sci. Hyg. Aliment.*, 1937, **25**, 78-89 (through *Chem. Abs.*, 1937, **31**, 5852).

A review of recent work dealing with the agents responsible for epidermal productions (hormonal mechanism), chemical composition of hairs and feathers, and influence of their elaboration on the metabolism of N and S. W.

Wool Destroyers and Their Control. A. Herfs. *Umschau,* 1937, 41, 316-318 (through *Chem. Abs.*, 1937, 31, 6012).

A discussion with excellent photographs of various insects which attack wool. W.

Effect of Various Agents on Hair Growth. H. Steudel. *Arch. exptl. Path. Pharmakol.*, 1936, 183, 58-66 (through *Chem. Abs.*, 1937, 31, 6330).

Purified bile combines with lecithin to form a water-soluble additional product from which the lecithin cannot be extracted by ether. Applications of lecithin-cholesterol-bile combinations exert a favourable effect upon hair growth in the rabbit. W.

Control of Sheep Ticks. W. L. Stewart. *J. Roy. Agric Soc.*, 1936, 97, 81-95 (through *Brit. Chem. Abs. B.*, 1937, 56, 826).

A mixed sheep dip containing arsenious oxide (0·17 per cent.), phenol, and wool fat prevents infestation. W.

(C)—VEGETABLE.

Antilles Cotton: Cultivation in Granada. *Rept. Agric. Dept. Granada,* 1936, pages 3, 10-12.

Antilles cotton, staple $1\frac{1}{2}$-$1\frac{3}{4}$ ins., is preferred by native growers to Marie Galante. New strains with high lint index are being developed. C.

Cotton: Cultivation in Belgian Congo. *Bull. Trimestr. Comité Cottonier Congolais,* 1937, 2, 49-60.

A general review of the history of cotton cultivation in the Belgian Congo, its present condition, organisation for research and legislative control, and the ginning and marketing organisations. Statistics are tabulated. C.

Cotton: Cultivation in South Africa. S. Milligan. *Empire Cotton Grow. Rev.*, 1937, 14, 189-196.

The cultivation of cotton in South Africa is discussed and the difficulties caused by jassid, bollworm and stainer pests are pointed out. Plant breeding work has resulted in the development of a strain, U4, which, though not so jassid-resistant as some of the poor yielding varieties, has the advantages of earliness and rapidity in flowering and re-setting of bolls after a setback, prolificness, and low rate of shedding. The maintenance and improvement of soil fertility, the prevention of soil erosion, the preservation of moisture, crop rotation, and the spacing of plants are briefly discussed. C.

Cotton: Growing and Breeding in Anglo-Egyptian Sudan. T. Trought. *Empire Cotton Grow. Rev.*, 1937, 14, 197-205.

A review of the development of cotton cultivation and of cotton breeding work in the Anglo-Egyptian Sudan. C.

Long-staple Cotton: Cultivation in U.S.A. (S. Carolina). A. B. Bryan. *Cotton (U.S.)*, 1937, 101, No. 8, 55-7.

An illustrated account of the stimulus given to the production of long-staple cotton in S. Carolina during recent years. Favourite strains are Coker Wilds, Nos. 2 and 7 ; the former has a staple of $1\frac{3}{16}$-$1\frac{1}{4}$ in., and the latter $1\frac{7}{32}$-$1\frac{5}{16}$ in. In 1936, 72 per cent. of the S. Carolina crop was of one-inch or longer cotton and 94·7 per cent. above $\frac{15}{16}$ in. C.

Egyptian Cotton Plants: Manuring, Spacing and Sowing Date Experiments. F. Crowther, A. Tomforde and A. Mahmoud. *Bull. Roy. Agric. Soc., Techn. Sect.*, No. 30, 1937, 55 pages.

In the campaign against the Pink Bollworm in Egypt, earlier strains of cotton have been introduced that have necessitated closer spacing and therefore a more rapid absorption of food material. The various factors are being studied under a Joint Agricultural Research Scheme on the large scale at various sites, mostly in the Delta, and the present Bulletin describes in detail the observations made in 1936. They show again that Egyptian cotton, especially when sown early (February) responds remarkably well to nitrogenous manuring, which conflicts with the common impression that the soil of the Delta is phenomally rich. C.

Cotton Plant Root System: Characters and Disease Resistance. V. G. Panse and A. F. Patel. *Indian J. Agric. Sci.*, 1937, 7, 451-457.

A rapid method of exposing and examining roots of cotton plants is described and the results of studies of the roots of Rozi, No. 8, I.32/24, I.65/12, DS, BS,

KS and Broach 9 cottons are discussed in relation to resistance to root-rot. A long tap-root, a large number of laterals in the lower regions and a small number of laterals in the upper region are associated with greater resistance of certain varieties to root-rot. Similar differences exist between resistant and unselected plants within the Broach 9 variety. Such differences within a strain justify single-plant selection based on desirable root characters. C.

Boll Weevil: Occurrence in Haiti. A. Audant and A. Occénad. *J. Agric. Univ. Puerto Rico (Col. Sta.)*, 1937, **21**, No. 1, 69-76 (through *Exp. Sta. Rec.*, 1937, 77, 226).

The boll weevil was first noted in Haiti in 1932-33 and has now spread to most of the cotton-growing districts. The crop in 1935 was a complete failure in some parts. C.

Pink Bollworm: Nocturnal Habits. F. A. Squire. *Nature*, 1937, **140**, 69-70.

In St. Vincent, West Indies, the pink bollworm is attracted by light from 8 p.m. to 4 a.m., but by 5 a.m., though it is still dark, the moths are hiding as by day. There are always some moths that are not attracted, but this is not due to age, sex, or condition. Light attraction is strongest during the mating period, but prolonged exposure always fixes the response. Long and short cycle moths behave the same. Mating is restricted to the last two hours of the active period, takes place soon after emergence, and is not repeated. Moths feed at all hours of the active period on sugar solutions, fruit, or the secretions of the nectaries at the base of the cotton bolls. Oviposition, commencing about the third day after mating, also takes place at any time of the night. C.

American Cotton: Economics of Production. F. J. Woofter, Junr. *Works Prog. Admin. (U.S.A.), Div. Social Res., Res. Monogr.* No. 5, 1936, xxxiii + 288 pages (through *Exp. Sta. Rec.*, 1937, 77, 268-270).

The relationships between landlord and tenant and their average earnings in the cotton plantations of the Southern States are discussed at length. In 1934 the average net income per plantation was 6,024 dollars, the average net income of the operators (farmers, mostly tenants) was 2,572 dollars, and the average net income per family of the wage hands, croppers, share tenants and renters, 309 dollars. C.

Bombay Presidency Cotton Legislation. W. J. Jenkins. *Empire Cotton Grow. Rev.*, 1937, **14**, 206-214.

A brief account is given of the legislation which has been introduced within the past fifteen years in the Bombay Presidency to protect the interests of the cotton growers and to maintain the reputation of superior types of cotton now in general cultivation. The legislation includes the Cotton Transport Act, 1923, Cotton Ginning and Pressing Factories Act, 1925, Bombay Cotton Markets Act, 1926, and the Bombay Cotton Control Act, 1935. C.

Havre Cotton Market: Procedure. A. Bosshardt. *Rev. Fil. et Tissage*, 1937, **22**, 155-9.

The purchase of cotton on the Havre market is explained and various commercial terms are defined. C.

World Cotton Crops: Statistics. J. A. Todd. *Empire Cotton Grow. Rev.*, 1937, **14**, 221-230.

Statistics are given for world, American, Egyptian, Indian and Empire cotton crops, world's carryover of Egyptian cotton, world's consumption of cotton, U.S. consumption of cotton by varieties, highest and lowest futures prices, and Liverpool spot prices of American with the other varieties as percentages. The figures are discussed and a further increase in Outside Growths is noted. The world's total production of cotton reached a new record of 32,274,000 bales (excluding linters) in the 1936-37 season. C.

American Cotton Crop, 1936-37: Statistics. *Textile Weekly*, 1937, **20**, 253.

Statistics relating to American cotton for the past season, with comparisons for the previous four seasons, compiled from information in the New Orleans Cotton Exchange annual report, are given. The report reveals that the cotton marketed during the year amounted to 14,371,472 bales, compared with 13,321,308 bales in 1935-36 and 9,470,362 in 1934-35. In grade the crop averaged about middling, the staple being good. The U.S. Government disposed of about 1,550,000 bales of its loan cotton, reducing the amount still under Federal control

to 1,665,000 bales. The consumption in the United States mills of lint cotton grown in the U.S.A. amounted to 7,798,000 bales, a record high level. Exports amounted to 5,511,000 bales, against 6,018,000 bales the previous season and 4,837,000 bales in 1934-35. Among the importers of American cotton, Japan led with 1,585,000 bales, an increase of about 70,000 bales over the previous season. Great Britain's takings decreased by 244,000 bales and Germany's by 172,000 bales. In all, the consumption of American cotton in countries outside the U.S.A. decreased by about 700,000 bales. C.

Successful Scots Flax Crop. *Linen Trade Circular,* 1937, **23**, No. 1239, 4.

Encouraged by successful crops of flax and the higher remuneration received last year, farmers in the central areas of Scotland have sown a considerably increased acreage to flax. The flax is grown under a scheme of guaranteed purchase ; it has been particularly successful in Angus, Perth and Fife. L.

German Flax Production Enterprise. *Linen Trade Circular,* 1937, **23**, No. 1239, 4.

Efforts to increase the production of flax in Germany are being maintained and 150,000 acres, as compared with 110,000 in the previous year, were devoted to flax cultivation in Germany. Efforts are also being made to increase the capacity of the retting and scutching industry and a measure of the progress made is afforded by the increase in the production capacity of the German flax production industry from 50 million kilos at the beginning of last year to approximately 175 million at the present time. L.

Oregon Flax Enterprise. *Irish Text. J.*, 1937, **3**, No. 9, 15.

The PWA have offered to erect a flax rettery and scutch mill at Corvallis, Oregon, U.S.A., if 100 local farmers will advance from 10,000 to 12,000 dollars towards the cost, and each promises to grow 10 acres of fibre flax annually. At present there are some 3,000 acres of flax in the valley, and 50,000 acres are visualised. L.

Watering Experiments on Hemp. F. Tobler and H. Ulbricht. *Faserforsch,* 1937, **12**, 222-226.

The effect of continuous watering from the appearance of the plants up to the time of cutting is studied. The development of the plant is greatly increased by watering, but the percentage of fibre is not increased. Further experiments are necessary to determine whether or not the yield of fibre on the land is improved. L.

Cultivation and Breeding of Hemp. H. Neuer. *Faserforsch,* 1937, **12**, 192-197.

Hemp is suitable for low moorland which is not fertile enough for most crops. Varieties must be chosen which have a high fibre content and an early ripening of the seed, so that the harvesting does not coincide with other farming activities. L.

Textile Fibres: Photomicrography. *See* Section IB.

(D)—ARTIFICIAL.

Casein Fibres: Production. G. Vogt. *Kunstseide,* 1937, **19**, 241-246.

The supply and consumption of protein materials in Germany is discussed and it is pointed out that all the available animal protein is required for food. Research into the possibility of using plant protein material for the production of textile fibres is recommended. The properties of the Italian Lanital fibre are discussed and recent improvements in properties and increases in production are mentioned. Photographs of Lanital fibres and of Lanital-wool mixture yarns and fabrics are given. C.

Cellulose: Acetylation. I. Sakurada and Y. Tokuno. *J. Soc. Chem. Ind. Japan,* 1937, **40**, 77-79, 79-80B.

(1) Cotton (10 gm.) was heated for two hours at 100° C. with glacial acetic acid, cooled, drained and then acetylated with acetic anhydride (100), conc. sulphuric acid (1·2 c.c.) and benzene (300) at 10, 25 and 40° C. The rate of the reaction was followed by measuring the acetyl content ; the data are tabulated and graphed. The rate can be expressed by the equation $x = k.t^m$, where x is Mol. acetic acid / 100 Mol. $C_6H_{10}O_5$, and k and m are constants ; k rises rapidly with temperature and m rises but slightly. The heat of acetylation is calculated from the data to be about 14·5 k. cal., whereas the value obtained from heats of combustion is 12·5 k. cal. The conclusion is drawn, therefore, that the rate of the reaction does not depend on diffusion. The amount of acetic anhydride in

the acetylating mixture was varied between 200 and 50 gm., the weight with the benzene being always 400 gm. The rate of reaction was not affected, showing that the union of sulphuric acid with the anhydride is immediately responsible for the acetylation. (2) The above conditions of acetylation (steeping in hot acetic acid, etc.) were observed in experiments on cotton wool, bleached and mercerised ramie (various preparations), cotton paper, linters pulp, and fine and coarse rayon. The results are tabulated. C.

Sodium Sulphide Steeping Solution: Effect on the Viscose Rayon Product. S. Suehiro, S. Kobinata, M. Yamaguchi and M. Ishikawa. *J. Soc. Chem. Ind. Japan,* 1937, **40**, 43B-44B.

Tensile strength data are tabulated that have been obtained from experiments on the preparation of viscose when using 2-4 per cent. of sodium sulphide in the alkali steeping bath and 40 or 60 per cent. sulphuric acid in the coagulating bath. Addition of sodium sulphide has sometimes a favourable effect ; the ageing time is shortened and the quality of the threads is improved, especially when a 60 per cent. sulphuric acid bath is used. Data are also given for experiments with a spinning bath containing sulphuric acid, sodium sulphate and zinc sulphate. Four per cent. of sodium sulphide had a bad influence, but 2 per cent. was often favourable. C.

Viscose: Filtration. J. Boeglin. *Kunstseide,* 1937, **19**, 238-240.

Difficulties encountered in the filtration of viscose by means of the usual type of filter press are discussed, the causes of these difficulties are analysed and methods by which they may be reduced are indicated. A method of purification in which the viscose is first centrifuged 2 or 3 times at very high speeds and then filtered once is recommended and the advantages of this method are described. This method is particularly advantageous for the treatment of viscose delustred by incorporation of titanium dioxide. By suitably adjusting the speed of the centrifuge it is possible to remove particles greater than a specified size and to obtain a homogeneous mixture. By working in a vacuum it is possible to remove air from the viscose to such an extent that the viscose is ready for spinning. C.

Viscose Staple Fibre: Spinning at High Speeds. H. Jentgen. *Kunstseide,* 1937, **19**, 261-263.

The advantages that would be gained from an increase in spinning speed in the production of viscose staple fibre are outlined and some of the difficulties associated with increased spinning speeds are discussed. It is pointed out that the after-treatment apparatus can readily be adapted to deal with an increased rate of production but difficulties arise in the spinning operation itself. Trouble due to liquid friction and the carrying away of part of the spinning bath by the filaments may be reduced by arranging for the thread to be drawn from the bath in a direction which is as far as possible horizontal instead of in the usual almost vertical path. Vortex formation in the region of the nozzle may be reduced by placing this close under the surface of the bath. When the speed of spinning is increased it is necessary to increase the length of the coagulation bath and also to increase the temperature and concentration. In this way it is possible to increase spinning speeds to values up to 250 m. per minute. C.

Glass Fibres: Production and Application. P. Krüger. *Kunstseide,* 1937, **19**, 263-265.

The preparation of glass fibres is briefly described and it is pointed out that it is now possible to obtain fine fibres which are soft and flexible. Fast dyed fibres may be obtained by incorporating colouring materials in the liquid glass from which the fibres are spun. Glass fibres are longer than natural fibres but can be made into yarns by machines similar to the spinning and twisting machines used for ordinary textile fibres. Yarns and fabrics prepared from glass fibres are not affected by moisture, light and heat, resist attack by acids, alkalis, bacteria, fungi, etc., are fireproof, and are easy to clean. Particles rubbed off in wear do not injure the skin. Fabrics prepared from glass fibres are particularly useful for wall coverings and decorative materials. Samples of glass fabrics and a fabric containing glass, staple fibre and cotton are given. C.

Cotton Seed Husk and Linters: Utilisation. Chang-Kenk Kao and Chi-Hsing Yu. *J. Chem. Eng., China,* 1936, **3**, 331-9 (through *Chem. Zentr.*, 1937, i, 2897).

The mixture of seed husk and linters from cotton seed crushing gave nearly 25 per cent. of glucose. The husk alone gave 12-34 per cent. of xylose, 5·7-11·2

per cent. of furfuraldehyde and 19·5-24 per cent. of glucose. Linters lost 18-28 per cent. in weight on treatment with caustic soda. Bleached linters gave 87·3 per cent. of α-cellulose and had copper number 1·33. C.

Pulp: Production by the Pomilio Process. P. Waentig. *Zellstoff und Papier,* 1937, 17, 352-354, 392-394.

The author gives an account of the present position of the Pomilio chlorination process for producing pulp, with reference to the plants in operation in different countries. C.

" Benesto " Expanding Swift for Rayon Cakes. White, Child and Beney Ltd. *Silk and Rayon,* 1937, 11, 712-713.

A new expanding swift of French origin for the over-end winding of rayon from cakes is described that can be also made cone-shaped to suit cone cakes. Swift winding from cakes has been standardised by the combine Comptoir des Textiles Artificiels. C.

Cellulose: Esterification. I. Schettle and N. Kljutscin. *Shurn. prikl. Chimii,* 1936, 9, 1626-1633 (through *Chem. Zentr.,* 1937, i, 3430).

Comparative experiments are reported on the esterification of (a) cellulose ; (b) viscose rayon and (c) cellulose regenerated from alkali-cellulose. The mixture used was acyl chloride 6, pyridine 20, and benzene 102 to each Mol. of cellulose, dried in vacuum over phosphorus pentoxide. Native cellulose gave the smoothest reaction, followed by (c) and then (b). In acetylation and benzoylation, the reaction increased to a maximum with 4-7 per cent. of moisture in the fibre and then diminished. With the stearate, the esterification diminished from that for dry cellulose to nil at 18 per cent. moisture content. The extent to which esterification proceeded was acetate>benzoate>palmitate>stearate. C.

Linters: Acetylation; Influence of Properties. M. Swerdlin. *Prom. organ. Chimii,* 1936, 2, 515-8 (through *Chem. Zentr.,* 1937, i, 4881).

The influence of various characteristics of linters on the properties of cellulose acetate prepared from them has been examined. (1) The viscosity of the linters in cuprammonium (relative viscosity of 1 per cent. solution 30-400 ; specific viscosity of 0·25 per cent. solution 0·9-3·7) is without influence on the cellulose acetate prepared under the same conditions. (2) Linters of the same viscosity will give acetates of various viscosities under different conditions of acetylation. (3) Moisture content being constant (6-7 per cent.), the rate of acetylation under the same conditions is inversely proportional to the viscosity of the linters. (4) There is not a fundamental relation between the viscosity of the linters and the mechanical properties of acetate films produced from them. (5) The transparency of the acetate solution is directly related to the ripeness of the linters or cotton fibre. C.

Concentrated Viscose Solutions: Production and Spinning. S. Rogowin and F. Tschernaja. *Prom. organ. Chimii,* 1936, 1, 405-9 (through *Chem. Zentr.,* 1937, i, 2710).

Experiments are described on the preparation of stable, concentrated viscose solutions (13-14 per cent. cellulose) and their spinning into rayon. Reduction of the viscosity could only be achieved by altering the duration of the ageing of the alkali-cellulose. Concentrated solutions, however, tended to increase rapidly in viscosity and stability could only be secured by extending the xanthation, 15 per cent. of carbon disulphide being used on the weight of the alkali-cellulose. The breaking load and extension of the rayon were greatly reduced when the specific viscosity of the cellulose was below 0·4 and that of the rayon below 0·25. C.

Hemi-cellulose: Determination in Alkali-cellulose. F. Castellani. *Bollettino Cotoniera,* 1936, 31, 284-286.

The influence of the hemi-cellulose contents of the cellulose pulp and the mercerising alkali in the production of viscose rayon is discussed and it is pointed out that, although it is advisable to use materials of low hemi-cellulose content, satisfactory products have been obtained from raw materials having comparatively high hemi-cellulose contents. A method of determining the hemi-cellulose content of alkali-cellulose is described which depends on digestion with distilled water, filtration, and determination of the hemi-cellulose in the filtrate by oxidation with potassium bichromate in the presence of sulphuric acid.

Details of the procedure and calculations are given together with some typical results. C.

Hollow Viscose Filaments: Production. W. Barakow. *Prom. organ. Chimii,* 1937, 3, No. 1, 18-21 (through *Chem. Zentr.*, 1937, i, 4044).

According to experiments, the viscose should contain 7-7·3 per cent. of cellulose, 6-6·5 per cent. of sodium hydroxide and 3·5 per cent. of sodium carbonate ; the viscosity should be 35-40 secs. (falling sphere test) and the degree of ripeness not less than 17 (ammonium chloride). The 18 per cent. soda solution should not be added until about half-an-hour before the completion of the viscose solution. The bath should have sulphuric acid 127, sodium sulphate 250, zinc sulphate 25 (gms. per l.), *D* 1·27, and the temperature should be 35° C. The filament should traverse 35 cm. in the bath. C.

Sugars: Application in Viscose Spinning Baths. S. Danilow, J. Saitzewa and L. Zaplina. *Prom. organ. Chimii,* 1936, 2, 395-9 (through *Chem. Zentr.*, 1937, i, 3089).

Hexoses and especially pentoses are considerably decomposed in viscose spinning baths and humic substances formed may contaminate the filaments. Hemicelluloses in the viscose itself may also give rise to sugars and thus contaminate the bath. Since, however, hydroxy compounds may play a part in the formation of the filament, it might be useful to add poly-alcohols or hydroxy-acids to the bath instead of sugars. C.

Lanital. L. Geisser. *Deut. Textilwirtschaft,* 1937, 4, No. 5, 2-4, 6-11 (through *Chem. Abs.*, 1937, 31, 6012).

A detailed survey of the manufacture, properties and uses of the Lanital fibre. W.

Textile Fibres: Photomicrography. *See* Section IB.

PATENTS.

Wool Substitute from Viscose. W. Zetzsche and H. Faber (to I. G. Farbenind. A.-G.) U.S.P.2,082,814 of 8/6/1937 (through *Chem. Abs.*, 1937, 31, 5579).

Viscose is squirted into a precipitating bath capable of precipitating the viscose in the form of cellulose xanthogenate ; the spun threads are assembled into a thick fibre band, the latter is cut into staple fibres, and the cellulose xanthogenate is converted into cellulose hydrate by means of a liquid such as glycerol heated to 60-150°. The precipitating bath initially used may contain $(NH_4)_2SO_4$ in 30 per cent. solution. W.

Curly Wool-like Filaments of Rayon. L. Ubbelohde. U.S.P.2,086,651 of 13/7/1937 (through *Chem. Abs.*, 1937, 31, 6483).

Various structural and operative details are described of an apparatus for extruding filaments and subjecting them to the action of toothed distorting rollers. W.

Cellulose: Treatment Prior to Esterification. Gevaert Photo Production, N.V. E.P.467,954 of 30/11/1936 (Conv. 5/12/1935).

Cellulose to be esterified is first pressed and thereafter the pre-treating liquid is passed through the cellulose under pressure. According to one method the cellulose is centrifuged and the pre-treating liquid is sprayed on while it is still under centrifugal action. According to another method the cellulose is placed on the perforated floor of a vessel and is subjected to pressure by a piston. Relatively small amounts of pre-treating liquid are necessary and two or more liquids may be passed through the cellulose successively. C.

Wood Pulp: Refining. A. H. Stevens (Canadian International Paper Co.). E.P.468,306 of 9/5/1936.

Wood pulp is refined and freed from undesired colouring matter by subjecting it in high density to the action of a free alkali and an agent substantially reducing the surface tension of the alkali solution, e.g. oleic acid or sulphonated oils, at an elevated temperature which is maintained throughout the treatment. After the heat treatment the pulp is washed with water having only a small content of lime and magnesium and containing if desired up to 0·5 per cent. NaOH calculated on the fibre weight. C.

Cellulose Pulps: Preparation. I. G. Farbenindustrie A.-G. E.P.468,388 of 2/2/1936 (Conv. 13/2/1935.).

In a process of opening-up vegetable fibrous material by means of nitric acid, the cellulosic material is covered in a pressure vessel with weak nitric acid (2-7 per cent. by volume) applied under reduced pressure, the initial temperature being between 40° and 60° C., and the temperature is raised during some hours to about 70-90° C. When an excess pressure preferably of some atmospheres has been produced this pressure is maintained until the end of the reaction, whereupon the material is washed and subjected to an ordinary alkaline after-treatment, e.g. with caustic soda lye of 2·5 per cent. strength at 70-90° C. C.

Rayon Spinning Apparatus Guide Funnel. Algemeene Kunstzijde Unie N.V. E.P.468,662 of 16/10/1936 (Conv. 31/10/1935).

Each turn of thread in spun cakes of rayon is laid in an undulating path by forming indentations or undulations in the lower edge of the guide funnel. C.

Cellulose: Isolation. H. A. Knopf. E.P.468,669 of 30/12/1936 (Conv. 30/12/1935).

A method of preparing cellulose from vegetable raw material employs only a saturated lime solution containing no solid phase or only very small quantities thereof insufficient to cause deposition on the material being treated, the solution being circulated through the fibrous material and being maintained saturated by continuous addition of lime corresponding to its consumption. A suitable content of lime in the circulating liquor is 2·8 grams/litre, 1·4 grams of which are in solution and 1·4 grams in suspension. C.

Cellulose Esters: Stabilising. Afag Finanzierungs A.-G. E.P.468,880 of 9/10/1936 (Conv. 9/10/1935).

The process described in E.P.411,260 for removing the retained catalyst residues from simple or mixed cellulose esters prepared by esterifying cellulose in presence of a sulphur-containing catalyst is modified by treating the cellulose ester in the non-dissolved state with a hydrolytically inactive stabilising agent consisting of one or more compounds of the general formula $R'(OR'')n(COOR''')m$ in which the groups but not the linkages are indicated. R′, R″, R‴ are hydrocarbon radicals substituted if desired by halogen, nitrogen, or other group, or if desired R′ or R‴ may be hydrogen or R′ may be absent. The letters *n* and *m* are integral numbers, *n* being equal to or greater than zero, and *m* being equal to or greater than 1. The stabilising agent may be a polybasic organic acid or ester, an oxy-acid etherified in the oxy-group or an ester thereof, an acid-ether or ester thereof, or an ester of a polyhydric alcohol. C.

Cellulose Xanthate Solution: Preparation. Brown Co. E.P.468,993 of 24/7/1936 (Conv. 20/8/1935).

Cellulose xanthate solution is made by a single stage process in which cellulose of solution viscosity less than 1 c.g.s. unit, water, caustic soda and carbon disulphide are interacted at a temperature of 15-20° C. in such proportions as to yield a viscose containing from 6-10 per cent. each of cellulose and caustic soda. C.

Cellulose Ether-Cellulose Xanthate Spinning and Coating Compositions: Preparation. L. Lilienfeld. E.P.469,007 of 11/10/1935.

Artificial threads and fibres, bands, coatings, dressings, cements, plastic masses and other shaped structures are made from the product obtained by bringing together a cellulose ether in solution or suspension in caustic alkali, and a product of the reaction of carbon disulphide on alkali cellulose, such latter product not being in solution or in incomplete solution in water or alkali solution. By such method the cellulose xanthate is brought readily into solution and there is produced, even from undepolymerised cellulose, solutions containing a high total percentage of cellulose, e.g. 9-12 per cent. or more, which are flowable and easily filterable. The structures resulting from these solutions are of good strength and extensibility. Solutions can be obtained with the use of relatively small proportions of carbon disulphide. Solution of the cellulose xanthate in the solution or incomplete solution of the cellulose ether may be effected by cooling to 0° C. or lower. C.

Primary Cellulose Acetate Filaments and Films: Production. V. E. Yarsley. E.P.469,131 of 3/2/1936.

Primary chloroform-soluble cellulose acetate is dissolved in concentrated formic acid with or without the addition of an alkyl formate, and extruded or cast to form filaments, films or tubes which are coagulated in water or aqueous salt solutions. The cellulose acetate used preferably contains at least 59 per cent. of acetic acid. C.

Nitrocellulose: Preparation. Du Pont Viscoloid Co. E.P.469,424 of 24/1/1936 (Conv. 2/3/1935).

Sheets of cellulose pulp having a thickness of two to eight hundredths of an inch and a compactness of 50-115 are subdivided and the chips so produced are treated at a temperature not substantially less than 40° C. with a nitrating acid composition containing 50-75 per cent. of nitric acid. The compactness is the ratio of the weight in pounds of 415,000 sq. ins. of the sheet to 100 times the thickness of the sheet in inches. C.

Straw Cellulose: Isolation. Patentverwertung, Dr. M. Gunther Ges. E.P. 469,465 of 18/10/1935 (Conv. 20/10/1934).

In a process for the manufacture of artificial spun fibres, the cellulose is obtained from straw or the like, particularly annual plants and grasses, e.g. alfa grass, broom, hemp and flax stalks, corncobs or cereal straw, is converted into a solution for spinning and is spun, e.g. by the viscose process. The raw material is subjected to a pre-boiling at about 4-10 atmospheres pressure with a boiling lye derived from a final boiling. In the case of alkali, these lyes are still weakly alkaline but also contain organic substances. Advantageously, the pre-boiling is followed by a steaming under pressure, the final boiling then being carried out with fresh alkali, if necessary with the addition of reducing substances. C.

Pulp: Purification. British Celanese Ltd. (London), H. Dreyfus and S. C. Bate. E.P.470,764 of 18/2/1936: 18/8/1937.

Wood pulp or other cellulosic material produced by the partial delignification of lignocellulosic materials is treated in at least two stages at above 100° C. with an aqueous alkali solution, the concentration of which does not exceed 5 per cent. at any time during the treatment, and in at least two stages with a bleaching agent comprising free or combined chlorine in an acid medium, one or more of the bleaching stages being followed directly by a stage of the alkali treatment. Preferably the alkali concentration is of the order of 2 per cent. or less and the temperature above 110° C. An excess pressure of 2-10 atmospheres or more in the alkali treatment is advantageous. Preferably the bleaching is carried out at a temperature below 50° C. C.

Cellulose Esters: Preparation. E. Berl (Pittsburg, Pennsylvania, U.S.A.). E.P.471,181 of 29/1/1936: 30/8/1937.

A partially esterified cellulose ester of good quality is obtained from a fully esterified cellulose ester resulting from reacting cellulosic material with a fatty acid and an acid catalyst—and if desired with the appropriate anhydride—while retaining the fibrous state, by dissolving the fully esterified ester by heating it with a concentrated lower fatty acid in the presence of a salt of a weak acid capable of reacting with the residual acid catalyst, and terminating the hydrolysis within the acetone-soluble stage. Suitable hydrolysing acids are, for example, formic acid, acetic acid or propionic acid. Suitable salts for use with the hydrolysing acids are, for example, sodium formate, sodium acetate and/or borax, soaps and phenolates. C.

Cuprammonium Fancy Yarn: Production. British Bemberg Ltd. (London). E.P.471,313 of 4/3/1937: 1/9/1937.

A process for the production of fancy yarn by doubling and in some cases twisting part threads which shrink to a different extent is characterised by the feature that finished textile yarns or threads of any origin are doubled with a rayon filament, freshly made from cuprammonium cellulose solution by the stretch spinning process, as it is leaving or shortly after it has left the spinning funnel and while it is still in the alkaline state, and that the doubled yarn is thereupon acidified, in some cases twisted, washed and then finished in the usual way. C.

2—CONVERSION OF FIBRES INTO FINISHED YARNS

(A)—Preparatory Processes.

Carding Engine Taker-in: Action and Setting. *Textile Manufacturer,* 1937, 63, 307-308.

The action of the taker-in is explained, directions are given for setting the feed plate, taker-in, undercasing and mote knives, and the care of the taker-in is briefly discussed. C.

Lap Winder. Saco-Lowell Shops. *Saco-Lowell Bulletin,* 1937, 9, No. 3, 7-13.

The Model 37 lap winder has a high table placed at a convenient height, which allows the use of full cans at the back without any danger of the sliver tangling or rubbing on parts of the machine. Braces on each side also act as stops for the inside row of cans, insuring their correct positioning. Each side of the table section is equipped with a single bottom lifting roll, with the top rolls mounted on swinging arms. Contact between the top and bottom rolls when a sliver runs out operates a sensitive electric stop motion. The sliver guide is arranged so that each sliver must travel the same distance from the time it leaves its particular can until it joins its neighbour in the web before calendering. This construction also assures uniform tension on all slivers and eliminates unequal stretch. The sliver guides straighten out tangled bunches but hold snarls that cannot be straightened out securely so that the sliver breaks between the guide and the lifting roll. The calender head is equipped with a pair of extra large, heavy rolls which are lever weighted. The lap spool is held in place by an effective patented mechanism. The lap is compressed by means of pressure created by a friction break mounted on the rack gear shaft. The lap winder is driven by means of a geared motor, the driving shaft having an operating speed of 273 r.p.m. A solenoid brake of heavy construction is mounted on one end of the rotor shaft of the motor. The calender section is provided with a safety hood. The machine can be run at speeds one-third higher than previous models. C.

Ramie Fibre, II: Degumming, Dressing and Preparing of Ramie. J. B. Pears. *Text. Mfr.,* 1937, 63, 410-411.

Describes the processing of ramie which is carried out by various methods, but chiefly by the " waste " silk spinning processes. The system is fully outlined and illustrations of ramie machinery are shown. L.

The Drying of Retted Flax-Hemp. *Technische Blätter im Verlag der Deutschen Bergwerks-Zeitung,* 1937, 27, 588.

A popular scientific article. Natural drying is a seasonal occupation. To increase production a method capable of being worked throughout the year was required, and artificial drying was adopted. This is carried out in a tunnel drier working with a fibre temperature of 35-40° C., and a drying time of 25 minutes. The process is worked in such a manner that it simulates natural drying ; water is removed at a low temperature by large quantities of air. During the past year 30 retteries have been equipped with artificial driers working on this principle. L.

Flax Cottonisation in Poland. *Irish Text. J.,* 1937, 3, No. 9, 6.

The agricultural bank has granted the Linen Company in Vilna credits for the purpose of purchasing machines for the preparation of flax and hemp for cottonisation. L.

Roumanian Flax Spinning. *Irish Text. J.,* 1937, 3, No. 9, 3.

The new Roumanian Union for promoting the industrial utilisation of textile plants is already ordering decorticating machinery for flax and hemp. Apart from the first three mills which will be erected in the districts of Gorj, Vasluj and Fetesti, a large spinning mill will be built on the slopes of the Carpathians. L.

Cottonisation: Opinions on ——. P. Krais. *Faserforsch,* 1937, 12, 186-187.

To compete successfully with artificial fibres it is necessary to cottonise good quality material (flax and hemp). Of other possible fibres, mulberry is the most promising. L.

New Observations on the Course of, and variations in, Retting in the Flax Stem. H. Fried. *Faserforsch,* 1937, 12, 197-222.

Retting experiments with 6 kg. quantities of flax straw were carried out, as far as possible under conditions prevailing in practice, at a temperature of 30° C.

Three methods of determining the progress of retting are described:—(1) removal of the bast from the wood by hand in the wet state, (2) ease of removal of bast by rubbing after drying, (3) treatment of sample with boiling water, then cooling and shaking, when the bast separates from the stem. Anatomical and microchemical tests of the degree of retting are also made. While Tobler and Müller maintain that the bacteria penetrate the surface of the stem through fissures, Davis asserts that they enter at the ends of the stem. The author shows that the former view is correct. The distribution of the bacteria in the stem at different stages of retting is described. While the middle lamella is completely destroyed by the bacteria, the primary membrane is only slightly affected by dissolution and oxidation of the pectin. The reduction in pectic acid content in retting is about 50 per cent. The observations are confirmed by microchemical investigations, in which staining with ruthenium red gives valuable assistance. The causes of retting variations within the stem are discussed. The lower part of the stem is fully retted sooner than the upper part, and this is due, not to the smaller number of bacteria in the upper part, but to their slower action. In general thick stems ret more rapidly than thin ones, and thin uniform stems are therefore preferable for producing uniform fibre. The rate of retting also depends on the swelling of the constituents of the stem. While the wood swells rapidly, the outer skin swells more slowly. The proportion of outer skin to wood increases up the stem. There are also differences in swelling of the middle lamella in the stem, which are the result of progressive hydrolysis of the methyl ester of pectic acid to the acid with increasing age of the stem. The rate of retting is also influenced by fertilisers, of which phosphorus has an unfavourable effect. L.

Cottonisation of Flax and Hemp: Theory and Illustrations. F. Tobler. *Faserforsch,* 1937, **12,** 178-186.

The object of cottonisation in Germany is to replace cotton by products of home origin. The original plan was to use flax waste and flax grown for oil but the present practice is to use good unretted flax, as it gives a more uniform product. The degree of breakdown of the fibre bundles determines the length of fibre and the nature of the spinning process. Uniformity of breakdown is essential and is best achieved by combining a chemical with a mechanical process. The degree of uniformity can be ascertained by microscopic examination, and photomicrographs of cottonised flax and hemp are reproduced showing different degrees of breakdown of the fibre bundles. The mechanical treatment might perhaps be eliminated if a stronger circulation, higher temperature, or higher pressure were employed in the chemical treatment. The finer the material, the more important it is that it should be kept parallel. L.

Fibre Structure and Cottonisation [of Flax]. K. Schneider. *Faserforsch,* 1937, **12,** 169-178.

The action of cottonising agents depends on their ability to break down the cementing substances between the fibres. These consist of three layers:—a structureless middle lamella consisting mainly of pectin substances, and two primary membranes, one on each side of the middle lamella, which have a cellulose skeleton and also contain pectin. The secondary wall determines the physical properties of the fibre and consists mainly of pure cellulose together with pectin substances and hemicelluloses. It is constructed of layers of fibrils having a spiral formation. The fibrils each consist of about 4,500 micelles, which in turn are composed of cellulose chains. For cottonisation purposes the chemical composition of the different layers is important. The middle layer consists of various pectin substances and lignins can also occur. These are not hydrolysed by acids, but dissolve in hot caustic soda solution, while mild oxidation gives acidic substances soluble in alkalies. The chlorination products are soluble in dilute alkalies. Most cottonisation processes attempt to break down the middle layer with alkalies, while certain processes employ acids, chlorine, mechanical breakdown, or enzyme action. Difficulty is experienced in preventing the fibres from adhering together again on drying. The degree of destruction of the middle layer is important ; it should not be carried too far. The lustre depends on the degree and nature of the breakdown of the fibre bundles. The composition of the middle layer, and hence the resistance to cottonising agents, depends on the sort of flax and its age and nutrition. L.

Softening of Hard Fibres: New Attempts. F. Tobler. *Faserforsch,* 1937, **12,** 232.

Trials of the Hayes-Gratze impregnation process for sisal, without regard to the cost, show that a long, white, and very soft material of excellent strength can be obtained. L.

Investigation of the Fibre Plants of Brazil, and a new Decorticating Machine. F. Tobler. *Faserforsch,* 1937, **12,** 231-232.

A number of Brazilian leaf-fibre plants, capable of providing a good substitute for jute, are described. Reference is also made to a new and simple decorticating machine which is suitable for fibre plants of many different kinds. L.

Hemp in Cotton Spinning Mills. A. Ferrario. *Atti dei Sindacati Provinciali Fascisti Ingenieri di Lombardia,* 1936 (through *Faserforsch,* 1937, **12,** 227-230).

In order to make possible the spinning of hemp on cotton spinning machines it is necessary to break down the fibre bundles, that is, remove the pectin. An account is given of the Peufaillet process, in which the pectin is dissolved by warming under slight pressure with an emulsion containing alkali and naphtha. The process is effective in breaking down the fibre bundles, but the removal of the naphtha in bleaching is difficult. The fibres are subsequently mechanically separated on an opener-card without damaging them. The hemp is mixed with cotton in about equal proportions for spinning, and the final yarn strength is about 10 per cent. less than that of cotton. The final yield of hemp, based on the retted weight, is 62 per cent. L.

(B)—Spinning and Doubling.

High-draft Speed Frames. Howard and Bullough Ltd. *Textile Manufacturer,* 1937, **63,** 319-320.

A high-draft speed frame with five lines of rollers is designed to produce from the draw frame sliver either intermediate or roving size bobbins for use in the final spinning process. The drafting is divided into two zones, the first or back zone comprising three lines of rollers similar to those of an ordinary slubbing frame, whilst the second or front zone comprises only two lines of rollers. Between these two zones is a condenser or constrictor unit carried on a rod which moves in unison with the back traverse rod. The mouth of the constrictor is flared and the throat is a vertical oval. This unit guides the rove during its passage between the two drafting zones and also controls and folds in the flank fibres. The first or back zone is weighted by the well known H. and B. " Quick Release " saddle weighting arrangement and an ordinary simple saddle is used for the second or front zone. The top clearers are divided into two sections, one for each drafting zone, and the front and second rollers in each zone are equipped with underclearers. The back zone underclearer is connected to the top clearer and swings forward when the latter is lifted. In a high-draft speed frame with four lines of rollers for rovings for low and medium counts, the rollers are set at an angle of 15° and improved weighting and underclearer arrangements are provided. C.

High Draft Systems: Application to Speed Frames. R. Siegl. *Leipzig. Monats. Text. Ind.,* 1937, **52,** 173-175.

The use of high drafts on speed frames is discussed and the Platt, Casablancas, Howard and Bullough, and Saco-Lowell systems are briefly described. C.

Roving Drafting System. Saco-Lowell Shops. *Saco-Lowell Bulletin,* 1937, 9, No. 3, 1-6.

The Model M drafting system for roving comprises a system of rolls and a Uniset weighting assembly. The roll system contains three lines of rolls. The first and second lines of bottom steel rolls are of standard construction and the first and second top lines are cushioned rolls covered with leather or synthetic material. In the back or third line the usual fine fluted bottom steel roll, with its cushioned top roll, is replaced by a pair of metallic rolls which are fluted to create a very effective fibre-holding unit. The Uniset weighting assembly is arranged to provide weighting for two spindles and is designed to combine all the advantages of the dead weight system with those of the spring weighting system and to eliminate the disadvantages of each. Details of this system are described and shown in a diagram. In the Model M frame it is possible to increase the

draft in the primary zone to 1·35 and that in the final zone to 6·60. A smooth even roving is produced. The application of this frame, mainly in the production of coarse rovings, is discussed and details of some typical carded yarn and combed yarn organisations in which it is included are given. A concrete example illustrating the changes in mill economics effected by the use of the Model M system is also given. C.

Single-belt High Draft Mechanism. O. Johannsen. *Leipzig. Monats. Text. Ind.* 1937, **52**, 149-157.

The author traces the developement of drawing mechanism with a single or lower endless belt in a review of the patent literature and discusses the use of such mechanisms in the production of staple fibre and mixture yarns. C.

Mule Spindle Bevel and Cylinders: Setting. *Textile Mercury,* 1937, **97**, 204.

Detailed instructions are given for setting the bevel of the spindles and assembling and setting the cylinders on the mule. C.

Ring Rail Rising and Falling Motion. L. Brugeois. *Revue Textile,* 1937, **35**, 325-327.

The author describes the mechanism producing the rising and falling motion of the ring rail which in turn controls the formation of the bobbin and shows how to determine the ratchet required to give a bobbin of specified weight. C.

Standardised Spinning Rings. R. von Weöres. *Textil Lloyd,* 1937, **11**, No. 11, 15-17 ; No. 12, 15-17.

Standardised forms and dimensions (with tolerances) of German spinning rings are described and a brief account is given of the manufacture of rings by the firm of Carl Hoffmann, Chemnitz. Directions are given for the selection, care and handling of rings. C.

Egyptian Cotton Mixtures: Spinning and Yarn Strength. F. Dunkerley. *J. Text. Inst.,* 1937, **28**, T255-T262. C.

Roving Frames: Adaptation for Larger Packages. L. Fogel. *Textile World,* 1937, **87**, 1777-1778.

An account is given of the changes made in the traverse and the lay, taper and bottom cone gears of 8 × 4 fine-roving frames in order to increase the amount of roving on the full bottoms from 14 to 16·5 oz. This increase means a reduction in doffing of approximately 18 per cent. The possibilities of further increases in the size of the packages are briefly discussed and the importance of correct tension and twist on the roving frame is pointed out. C.

Speed Frames: Roller Spacing and Twist. *L'Industrie Textile,* 1937, **54**, 377.

Factors influencing the roller settings on the speed frames are discussed and the results of tests on Indian cotton of 1-inch staple spun to 25's (French counts) after three passages at the speed frames are given. The breaks per hour in spinning are shown for samples produced with different twists and roller spacings in the preparatory processes and the effects of variations in these conditions are briefly discussed. C.

Yarn: Contraction Due to Twist. *Textile Weekly,* 1937, **20**, 263, 265.

In order to maintain a uniform tension of the yarn during twisting at the head on the mule it is essential that the rate of delivery of the rollers should be exactly equal to the rate of contraction of the spinning yarn. Methods of determining the contraction due to twist and the rate of contraction are explained. C.

A simple new flax spinning spindle drive. *Irish Text. J.,* 1937, **3**, No. 9, 5-6.

Refers to a new spindle drive for flax spinning spindles, patented by Mr. Thomas Barbour, of Fibres (Belfast) Ltd. In this invention, the wharve is removed from the revolving spindle and located on the lower end of the fixed collar bearing. The base of the wharve is made to engage in any convenient manner with a disc to the rotating spindle to which the drive is thus transmitted. A hand, foot or knee lever may be fitted to disengage the wharve and its adoption permits the operative use of both hands in piecing. The arrangement removes side strains from the rotating spindle and the inventor claims that higher speeds are attainable, longer life is ensured for the working parts and spindle vibration is reduced to a minimum. L.

Hemp as Raw Material for Bast-Wool. C. Flader. *Faserforsch,* 1937, **12,** 187-192.

The advantages of hemp over flax are its ease of cultivation on poor soil and its cheapness. The alkaline treatment is discussed and the necessity for uniformity of starting material is emphasised, hemp waste being unsuitable. To secure uniformity the plants must all be cut at the same age, and the time of ripening of the seeds is recommended as a criterion for this. Unretted hemp is easier to work than retted. Cottonised hemp is considered as a substitute for cotton. L.

Finer yarns from sisal. *Text. Mfr.,* 1937, **63,** 391.

A method of preparing sisal to reduce the normal hardness and make the fibres firm, softer and more flexible is described. The decorticated fibres are treated with a weak alkaline solution, pressed and washed to soften and remove gums present. After drying, the softened material is subjected to a mechanical softening treatment such as crimping and rubbing so that the fibre is split finer. Material treated in this manner can be spun to a much finer lea, which should extend the use of sisal to finer twines and matting. L.

Roumanian Flax Spinning. *See* Section 2A.

Hemp in Cotton Spinning Mills. *See* Section 2A.

(C)—Subsequent Processes.

" Lydon " Twist Setting Steam Box. Unisel Ltd. *Silk and Rayon,* 1937, **11,** 755.

The Lydon steam box used for setting twist in silk and rayon, with vertical and cross flow air circulation, is illustrated and described. C.

Patents.

Lubricants for Fibres. J. van Puymbroeck. G.P.647,113 of 28/6/1937 (through *Chem. Abs.,* 1937, **31,** 6904).

Lubricants having a basis of vegetable mucilage are used to facilitate the spinning and fulling of mordanted animal hairs, e.g., in the manufacture of mixed hair and wool fabrics. Aqueous decoctions of the roots, leaves or stems of yew, mallow or plants of the family *Compositæ* are suitable lubricants. W.

Staple Fibre Yarns: Production from Continuous Filament Yarns. British Celanese Ltd. (London), D. Finlayson and L. Latham. E.P.470,342 of 12/2/1936: 12/8/1937.

Yarns containing staple fibres are produced by continuously drawing yarns composed of continuous filaments over a razor edge in such a way that, at intervals along the yarn, some but not all of the filaments are severed. Relative motion between the yarn and the razor edge along the length of the edge as well as across it is advantageous and can be effected by causing the yarn to pass through a reciprocating guide whereby the yarn is traversed laterally to and fro along the razor edge. The razor may, alternatively or in addition, be reciprocated or otherwise moved alternately towards and away from the yarn in such a way as to bring it intermittently into and out of contact with the yarn. The yarns treated should preferably be lightly twisted but untwisted yarns may be used provided that suitable means are adopted to maintain the necessary coherence between the severed and unsevered filaments, e.g. by sizing or by the insertion during winding of twist which runs back from the collecting devices as far, or nearly as far, as the razor edge. C.

High-draft Mechanism. F. Casablancas (Sabadell, Spain). E.P.470,441 of 15/9/1936: 16/8/1937.

In a drawing mechanism for textile rovings of the type having a pair of feed rollers, a pair of drawing rollers and a pair of intermediate rollers carrying a pair of endless belts, the feed and drawing-rollers are subjected to a heavy pressure to prevent sliding of the fibres between them and the intermediate rollers are pressed towards each other with a small preferably regulatable pressure which is sufficient to ensure the correct movement of the belts but is low enough to permit sliding of the fibres along the tangential line of the rollers. The intermediate rollers carrying the belts are provided with toothed wheels for positively transmitting the movement from one roller to the other and the surfaces of these rollers may be fluted or grooved to prevent slipping of the belts thereon. With this system

it is possible to treat any type of fibres, both long and short, or fibres of varying length, provided that the length does not exceed the total length between the feeding and delivery rollers. C.

High-draft Mechanism Belt Guide. F. Casablancas (Sabadell, Spain). E.P. 470,446 of 20/11/1936: 16/8/1937.

The two arms of the V-shaped member guiding the front loops of the belts in drawing mechanisms for textile rovings are of approximately flat shape and are inclined or convergent in cross-section, and the profile of the front part of the side plates of the frame are so formed that the lower arm of the V-shaped member is supported by the side plates both at the front and rear portions of its lower face and is at the same time engaged on its upper face by a stop or projection on the side plates, which prevents the rocking of the V-shaped member in the forward direction. With this arrangement, any sliding movement of the V-shaped member in the forward direction is also prevented owing to the inclined position of the two limbs. The upward movement of the V-shaped member is prevented or limited by the same arrangement of the lower arms, or a small projection may be formed on the side plates to engage the upper arm of the V-shaped member, thus preventing raising thereof. C.

Ring Frame Yarn Separator. E. Meadowcroft and F. Griffiths (Heywood). E.P.470,603 of 31/10/1936: 18/8/1937.

A yarn separator for preventing broken ends from lashing on ring frames consists of a combined vertical plate and a bottom plate. The length and depth of the separator depend on the width of ring plate and length of bobbin chase required. A slot is cut out of the vertical plate and a hole is drilled in the bottom plate so that a bolt can be passed through the hole to secure the separator to the ring plate. A piece is cut away from the bottom plate to allow the fly catcher on the ring plate to function without interference. C.

Staple Fibre Yarns: Production from Continuous Filaments. British Celanese Ltd. (London), W. I. Taylor and A. H. Woodruff. E.P.470,794 of 22/2/1936: 23/8/1937.

Means are provided to draw a bundle of continuous filaments between and in contact with a cutting surface and a further surface by which the bundle is pressed against the cutting surface, and the pull of the bundle of continuous filaments is utilised to bring about the desired movement of the cutting surface. The cutting surface is thus driven in the same direction as the bundle but at a lower speed without the necessity for providing positive driving means connected to the cutting surface. Driving means of a non-positive nature may, however, be employed, especially in the production of fine yarns, to assist the bundle of filaments to drive the cutting surface. The cutting surface is preferably in the form of a freely mounted roller, the cutting action of which may be derived from flutings preferably cut at an angle, e.g. of 45°, to the length of the roller. The weight of the pressing roller may be allowed to rest upon the cutting roller so as to press the bundle of continuous filaments against the cutting roller. Various means may be adopted for adjusting the difference in speeds of the surface of the cutting roller and the continuous filament bundle. C.

Yarn Twisting Device. C. T. Pastor (Hüls über Krefeld, Germany). E.P. 471,033 of 20/1/1937: 26/8/1937.

A twisting device for textile yarns or the like is provided, between the twisting spindle and the winding-up device, with a nozzle-shaped guide with an opening having a minimum diameter equal to or less than ten times the diameter of the yarn and a length equal to or greater than ten times the minimum internal diameter of the nozzle. The minimum internal diameter of the nozzle is preferably not less than four times the diameter of the yarn. C.

Mule Ring Spinning Machine "Doubles" Preventing Device. Prince-Smith and Stells Ltd. (Keighley) and W. Prince-Smith. E.P.471,239 of 31/3/1937: 31/8/1937.

In a mule ring spinning machine, co-acting pairs of devices are located between the spindle and the drafting rollers and are so shaped as positively to confine the rotary movement of a broken thread to a circular path about the spindle axis. Associated with each pair of devices is a pair of separators serving to protect the adjacent threads from being fouled by a snarl. In one form a

pair of plates is hinged above each spindle, the adjacent edges being shaped so as to combine to present an aperture of an elliptical configuration in plan view through which aperture the thread extends between the drafting rollers and the spindle, the front and rear edges of the plates being separated in each case by a narrow constriction. An anti-ballooning tin or separator may depend from each plate. C.

False Twist Mechanism. F. Casablancas (Salford). E.P.471,350 of 13/1/1937: 2/9/1937.

A false twist mechanism for textile rovings comprises a false twist tube slotted along its length and a driving wheel, the twist tube being removably mounted within the driving wheel and being formed with a shoulder which is adapted, when the tube is inserted in position in the driving wheel, to be engaged by a shoulder formed on the latter to cause the driving wheel to rotate the tube. C.

Yarn Steaming Apparatus. British Celanese Ltd. (London). E.P.471,382 of 28/4/1936: 3/9/1937.

Apparatus for steaming a running cellulose acetate or other textile thread, more particularly when it is desired to insert crêpe twist while the thread is under the influence of steam, comprises a steam chamber having an aperture for the entrance of the thread, and means for retaining in the neighbourhood of the path of the thread approaching the aperture a mixture of air with the steam issuing from the aperture. For example, a shield in the form of a funnel may surround the path of the thread approaching the steam chamber. The funnel may be perforated. The steaming device may be used with various crêpe twisting devices. C.

Bobbin Stripping Apparatus. J. Dronsfield (Oldham). E.P.471,383 of 1/5/1936: 3/9/1937.

In stripping apparatus of the type in which the bobbin to be stripped is embraced about the butt by yarn stripper jaws and pushed endwise by a mechanically reciprocated push spindle, the actuation of the push spindle in a forward direction by means of the travelling carriage is initiated through a trigger or like movable contrivance which is moved by the operator to bring into action the means provided to drive the travelling carriage. Means are also provided to disengage the travelling carriage after the stripping and return it to the starting position and reset the trigger. C.

Heilmann Comber Drawing-off Device. Sächsische Textilmaschinenfabrik vorm. R. Hartmann A.-G. (Chemnitz, Germany). E.P.471,750 of 9/3/1936: 9/9/1937.

A drawing-off or detaching device for Heilmann combers with an endless travelling belt for conveying the drawn-off or detached tufts of fibres is characterised in that a stationary block is employed instead of one of the rollers of the pair of drawing-off or detaching rollers usually employed. The block has on the drawing-off or detaching side a projecting lip extending partly around the other roller. C.

Heilmann Comber Piecing and Delivering Device. Sächsische Textilmaschinenfabrik vorm. R. Hartmann A.-G. E.P.471,751 of 9/3/1936: 9/9/1937.

In a Heilmann comber provided with a detaching or drawing-off device which is continuously driven and operates in association with a pair of piecing rollers arranged behind this device and driven periodically in the same direction, the pair of piecing rollers and a driving wheel are mounted in a support in such a manner that, when the support is swung to and fro, the wheel is brought periodically into contact with a continuously rotating wheel of the drawing-off device and the drive of the piecing rollers is alternately established and interrupted. C.

3—CONVERSION OF YARNS INTO FABRICS

(A)—Preparatory Processes.

Cone Cross Winding Machine: Application and Advantages. P. Kronenberger. *Monatsh. Seide u. Kunstseide,* 1937, **42**, 312-318.

The advantages of the supply of rayon yarns wound in cone form instead of on flanged bobbins are discussed and the increases in output in winding, warping

and weft winding processes obtained by the use of cones are indicated. The corresponding savings in costs are estimated. When a short writing-off period is allowed for the cone winding machine the costs of winding on cones may be somewhat higher than the costs of winding flanged bobbins but the difference is more than compensated by the savings in subsequent warping and weft winding processes. C.

Cylindrical Bobbin Winding System. *Revue Textile,* 1937, **35**, 321-323.

An arrangement for use in the winding of cylindrical bobbins is described by means of which it is possible to vary the length of tube covered by the yarn without changing the cam controlling the to-and-fro motion of the thread guide. The construction is shown in diagrams and the action of the system is explained. C.

Winding and Warping Machines: Production Calculations. W. Schulze. *Leipz. Monats. Text. Ind.,* 1937, **52**, 200-202.

Formulae are given for the calculation of the theoretical productions of warp winding, twisting, weft winding, and warping machines and numerical examples are worked out. The purposes of such calculations are indicated, the differences between actual and theoretical productions are pointed out, and average efficiency values for the different machines are given. C.

Conical Bobbins: Winding. O. Thiering. *Textil Lloyd,* 1937, **11**, No. 16, 18-19.

A study is made of the winding of conical bobbins and equations are deduced for the winding velocity components in different directions and the angular velocity of the spindles. It is shown that the winding of the yarn in an archimedian spiral with the individual spires at equal distances from each other would necessitate the use of very complicated mechanism. If the thread is wound in a logarithmic spiral the speeds of the spindle and thread guide will not require to be varied but the distance between the spires will not be constant. In practice the thread is wound so that successive spires are touching or close together. The horizontal speed of winding is maintained constant and the angular velocity of the spindle is inversely proportional to the radius of the bobbin. The vertical velocity of the thread guide is also inversely proportional to the radius. C.

"Leesona" Winding Machine Yarn Measuring Device. Universal Winding Co. *Silk and Rayon,* 1937, **11**, 713.

A new measuring device for "Leesona" machines has a new stopping motion to effect the stoppage of the winding spindle quicker and more accurately. The old type of dial with a travelling pointer has been replaced by a recording counter mechanism, showing a visible record of the amount of yarn already wound and the amount still to wind. C.

Silk: Winding in Staggered Layers. V. Hildebrand. *Rev. Fil. et Tiss.,* 1937, **22**, 357-361.

The usual arrangement of yarns on bobbins and the difficulties arising when unwinding caused by irregular distribution of the spires of yarn on the bobbin are discussed. When winding silk on to bobbins with small flanges it is customary to displace successive layers in relation to each other in order to produce a bobbin which unwinds smoothly. Various mechanisms for producing a staggered arrangement of the layers of yarn are briefly described and shown in diagrams. C.

(B)—SIZING

Carob Bean Flour: Application. *Spinner u. Weber,* 1937, **55**, No. 33, 8-9.

Carob bean flour is recommended for use in sizing, printing and finishing in order to save starch for food purposes in Germany. Difficulties in making a paste are mentioned. For size, the flour should be sifted into cold water and agitated until wetted before steam is turned on. C.

High-speed Warp Sizing System. Saco-Lowell Shops. *Saco-Lowell Bulletin,* 1937, **9**, No. 3, 15-27.

The Model 38 high-speed warp sizing system comprises a Model 38 head end with transitory drive, a drying cylinder assembly, a size box and accessories, a magazine creel, size preparation equipment, and a control system. Descriptions

and photographs of the different sections are given. New features include a large copper size vat provided with a brass-ribbed type of immersion roll, and squeeze rolls which are covered with worsted yarn and are carried by a framework supported in a cross head which can be raised by a hand wheel so that the position of the rollers can be reversed at will. C.

High-speed Warp Sizing System Temperature Controls. Saco-Lowell Shops. *Saco-Lowell Bulletin,* 1937, 9, No. 3, 27-29.

A modification of the Taylor control system for a high-speed slasher is described. The time-schedule temperature-recording "Fulscope" controller is used on the size cooking kettle and makes possible the exact duplication of the cooking cycle. The storage or blending kettle is also under automatic temperature control and on the tape frame the temperature and level control are employed. The Type-P temperature controller and Motosteel diaphragm valves are used on the storage kettle and size box. This controller is a dependable, accurate and durable expansion stem instrument which maintains its setting point exactly with the help of the smooth throttling characteristics of the valve. The admission of steam to the cylinders, and consequently their respective temperatures, are controlled by the temperature of the condensate. This is accomplished by installing the bulbs which actuate the steam condensate valve in the condensate line. No traps are used. This type of temperature control makes possible a temperature gradient as the yarn passes to successive cylinders, which retains the required moisture in the yarn and keeps it elastic and pliable. C.

Temperature Controls: Application on Tape Frames. F. A. Westbrook. *Cotton (U.S.),* 1937, **101,** No. 8, 67-69.

A diagram is given of a tape frame indicating the location of various temperature control instruments, which are briefly described. The importance of the maintenance of accurate temperature control is briefly discussed, and the superiority of automatic over manual control is demonstrated by means of sample charts from recording instruments of a mill. The charts are discussed. A table recording warp stops in several mills, with and without automatic control, shews decreases of stoppages varying from 46·2 to 13 per cent. C.

Cotton Warp Yarns: Sizing; Fuel Consumption. R. Béha. *L'Industrie Textile,* 1937, 54, 387.

Estimates are made of the steam used in the cooking of the size and sizing and drying of the yarns and of the coal required to produce the steam for two different rates of production. C.

(C)—Weaving.

Heald Stop Motion. *Leipz. Monats. Text. Ind.,* 1937, 52, 158.

The advantages of heald stop motions over warp stop motions employing separate detectors behind the healds are pointed out and a simple form of heald stop motion is briefly described. In this device the healds themselves act as detectors and the upper bars of the shafts act as contact bars. When in the lower shed the warp threads hold the healds up out of contact with the top bars of the shafts but if a warp thread is broken or very slack the corresponding heald falls and makes contact with the bar, thus completing an electric circuit and causing instantaneous stoppage of the loom. When in the upper shed the shaft bars are not connected with the source of current. C.

Sample Weaving Equipment. H. Boffey, R. M. Kilgour, and J. A. Matthew. *J. Text. Inst.,* 1937, 28, T211-T223. C.

Weft Stop Motions. G. Tissier. *Revue Textile,* 1937, 35, 333-337.

The author discusses the action and adjustment of weft stop motions having side-fork and centre-fork mechanisms and points out the superiority of the latter type. C.

Woodcroft Tappet Motions. W. Wilkinson. *Textile Manufacturer,* 1937, 63, 314-315, 328.

The development, uses and merits of side shedding motions are discussed and a modern Woodcroft tappet motion is described and shown in diagrams. C.

Looms: Adjusting. B. H. Hawkins. *Cotton (U.S.),* 1937, **101,** No. 7, 43-46; No. 8, 72-75.

Practical hints are given on the adjustment of the picking, heald and beat-up mechanism of the loom, based on a wide experience in American mills. C.

Weaving Mills: Quality Statistics. O. Bitzenhofer. *Leipz. Monats. Text. Ind.*, 1937, **52**, 179-180, 204.

The value of quality statistics in weaving mills is discussed and the causes of variations in the quality of cloth are outlined. A case in which the pieces were classified into four qualities is studied and graphs are given showing the percentages of each quality produced each week throughout a period of one year. The causes of some of the variations are indicated. It is shown how such statistics can be used to determine the effects of the quality of the raw material, and the influence of the loom used and of the weaver on the quality of the product. A table is given showing the percentage of first quality pieces given by each of a group of 100 looms together with observations on the weaver, the loom, and the quality of the raw material. C.

Loom: Assembly. I. Moberg. *Textile World*, 1937, **87**, 1764-1767.

Detailed instructions are given for the assembly of a loom and the setting of the various parts. C.

Rayon Loom First-pick Stop Weft Fork. J. W. Hutchinson. *Silk and Rayon*, 1937, **11**, 706 and 755.

A new type of first-pick stop weft fork made by Hattersley, Sons & Co. Ltd., for rayon is described in detail. C.

Silk Warps: Preparation. F. J. Luettgen. *Textile World*, 1937, **87**, 1805-1806.

The cotton system of drawing warp ends through the eyes of the heddles is explained with the aid of diagrams and a new method of entering silk warps, based on the same principle, is described. This new method makes it possible to enter silk warps without a hander-in. The same principles are employed as in the old method of entering silk warps. The one exception is that, instead of the cross rods being placed in a position to make them convenient for the hander-in, they are lowered so that the eye of the heddle is in the centre of the two rods. The two rods are then fastened to the harness, and they are placed close together so that there is not more than 1 in. space in the cross. The enterer puts his hook in the eye and reaches into the cross with it, separates the end, and pulls it through. C.

Tubular Goods: Weaving. M. D. Churgin. *Textilberichte*, 1937, **18**, 585-588.

It is pointed out that important factors in the weaving of tubular goods are the direction of the weft on the cylindrical surface of the tube, the type of weave used, the number of shuttles used, and the number of warp threads. These factors are discussed and a method of determining the required number of warp threads is explained. The production of tubular goods in plain, twill and sateen weaves, by means of one shuttle and by means of more than one shuttle, is studied. C.

Vulkan Fibre Shuttle. Maschinen- und Webschützenfabrik, F. Erdmann. *Textilberichte*, 1937, **18**, 616.

A durable, non-splintering shuttle has its walls and base made of Vulkan fibre (a German synthetic product) and ends filled up with wood. Iron fittings are not required and the shuttle can be perfectly balanced so that it does not tilt when projected. Vulkan fibre walls can be made thinner than wooden walls, thus leaving room for a larger pirn. The weight of the new shuttle is not greater than that of an ordinary wooden shuttle with iron mountings. C.

Warp Shed: Work Performed in Shedding. G. Svéd. *Textilberichte*, 1937, **18**, 592.

The author points out two errors in Kreiling's paper and deduces an expression for the work performed in raising the shafts. This work is proportional to the fourth power of the height of the shed and is smaller the more extensible the yarn. C.

Warp Weights: Determination. H. Schmidt. *Textil Lloyd*, 1937, **11**, No. 17, 28-31.

A method of calculating the weight of silk or rayon in a warp for use in warp knitting processes or the weights on individual beams is explained and the construction and use of a nomogram for the determination of such warp weights are described in detail. C.

Weft Stop Motion: Upkeep and Setting. *Textile Weekly*, 1937, **20**, 266-7, 269.

A discussion of the causes and prevention of defective operation of side weft fork motions. C.

(D)—KNITTING.

Cellulose Foil: Application in Knitting. *Textil Lloyd,* 1937, **11**, No. 11, 21-4 ; No. 12, 23-6.

The production of cellulose foil is briefly described. German products on the market are 0·02 mm. thick, and 0·75 mm. and 1 mm. wide, also 0·04 mm. × 1 mm. and 0·6 mm., and the dry strength is about 10-12 kilo. per sq. mm. A general account is given of the manipulation of the material in knitting. C.

Eight-lock Flat Frame: Patterning Possibilities. E. Oblistil. *Textil Lloyd,* 1937, **11**, No. 7, 22-27 ; No. 8, 19-22 ; No. 10, 24-28.

A detailed account is given of the mechanism of the eight-lock flat frame and its application in the production of novel striped and barred fabrics. C.

Full-fashioned Hosiery Machines: Adjustment. A. J. Cobert. *Cotton (U.S.),* 1937, **101**, No. 7, 103-105 ; No. 8, 117-121.

Needle bar settings on the full-fashioned hosiery machines are discussed and instructions for making a correct adjustment are given. The position of any relative motion should be changed rather than needle height ; this should be considered a basic setting for everything else. The horizontal motion of the needles is considered. Proper angle of needles, determination of amount of press, uniformity of press, alignment of needle bars on old (double needle bars) and new machines, functions of the regulator, and of loose course cams, and rockers are discussed. C.

Inlaid Pattern Knitted Goods: Production. E. Oblistil. *Textil Lloyd,* 1937, **11**, No. 13, 21-26.

A detailed account of the mechanism by which inlaid effects are produced in flat-frame knitting. C.

Dropped Stitches: Causes, Prevention and Correction. A. Elster. *Textil Lloyd,* 1937, **11**, No. 15, 19-25 ; No. 16, 24-30.

Dropped stitches or ladders in knitted goods may be caused by unsatisfactory preparation of the yarn, defective winding, yarn and needle breaks, incorrect setting of the knitting machine parts, and failure to lay the yarn over certain needles. These causes are discussed and hints on their avoidance are given. Various devices by means of which dropped stitches may be knitted up again are described. C.

Half-hose Knitting Machines: Adjustment, Maintenance and Repair. I. C. Moore. *Textile World,* 1937, **87**, 1585, 1790.

Useful advice is given on the grinding of cams, the removal of broken sinker butts, the selection of eyelets for use with rayon yarns, the examination of transfer rings, the care of belting, the replacing of needles, and the oiling of needles and sinkers on half-hose machines, the maintenance of sizes on these machines, and the moving of machines. C.

Hosiery Seam Stitches: Structure. W. Davis. *Silk and Rayon,* 1937, **11**, 731-32.

The production of chain stitch and lock stitch in sewing machines, and their advantages and disadvantages are discussed. The most useful seam for hosiery is a three-thread overlock seam involving the formation of an overlock stitch followed by " felling." C.

(E)—LACEMAKING AND EMBROIDERING.

Braiding and Bobbin Machines: Construction and Action. H. Diegmann. *Textil Lloyd,* 1937, **11**, No. 17, 15-23.

The author describes the construction and action of various braiding and bobbin machines for the production of gland packings, insulating tapes and tubes. Numerous diagrams are given. C.

(G)—FABRICS.

Cloqué Ribbons: Structure. E. Gräbner. *Textil Lloyd,* 1937, **11**, No. 13, 18-21.

Point-paper diagrams and illustrations are given of cloqué effects obtained by means of crepe threads in ribbons. C.

Piqué Fabrics: Structure. G. Rammer. *Textil Lloyd,* 1937, **11**, No. 14, 25-27.

Point-paper diagrams and illustrations are given of some piqué fabrics with diamond and trellis-work patterns. C.

Rayon Crepe Fabrics. A. Hamann. *Kunstseide,* 1937, **19,** 287-291.

Photographs, designs and details of the construction of ten modern rayon crepe fabrics are given. C.

Rayon Sail Fabrics: Application. *Silk J. Rayon World,* 1937, **14,** No. 159, 14.

The American yacht " Ranger " carries a quadrilateral jib which is more than 4,000 sq. ft. in area and is made of du Pont's " Condura " rayon. The warp and weft are of 1,000 denier viscose of approximately 400 filaments. The weave is the ordinary 1 up and 1 down, 56 ends per in. and 36 picks per in. With such a thread and weave a very firm, full, strong and heavy cloth is produced. Rayon sail fabric has a greater resistance to bias distortion than cotton sail fabric and it is now possible to produce rayons which are strong enough to make sails of slightly greater strength than the best available cotton sails, on the basis of equal units of weight. Rayon yarns of comparatively low twist are used giving better cover, increased resistance to air leakage through the sail, and greater smoothness of surface. A further advantage of rayon is its resistance to mildew. Rayon sail fabric is coated with a very light, flexible material to enhance some of its inherent features, such as wind resistance and resistance to bias distortion. This coating also makes the sail partially waterproof. C.

Staple Fibre Flannels. R. Hünlich. *Kunstseide,* 1937, **19,** 302-303.

The use of staple fibre for the production of flannel and similar raised fabrics such as blankets, travelling rugs and shawls is discussed. Plain and twill weaves are generally used and pattern effects may be obtained by the use of dyed and fancy yarns or by combinations of staple fibre with wool or cotton yarns. C.

Warp Loom Rayon Fabrics: Production. W. Davis. *Silk J. and Rayon World,* 1937, **14,** No. 159, 27-29.

Six patterns, including stripe, spot and lace effects, for rayon fabrics produced on warp looms are shown and details of the methods of knitting are given. C.

Aircraft Furnishing Fabrics. *Textile World,* 1937, **87,** 1778.

Types of textiles used in aircraft are briefly discussed and it is pointed out that those for the newest types of aircraft are bought according to definite specifications. Cotton, wool, linen, mohair, silk and rayon fabrics are used. For sound proofing, use is made of kapok felt and of " Seapack," a commercial product combining kapok with paper pulp. C.

Candlewick Bedspreads: Production. *Textile World,* 1937, **87,** 1768-1769.

The first candlewick spreads were probably made about 1650 by New England settlers who gradually turned homespun coverlets, mended with pieces of cotton from the wicks of candles or strings from fish nets, into decorative embroidery work. There has recently been a revival of this old art of tufted embroidery and needlepunch work and it is estimated that last year 7,000,000 yd. of wide sheeting and 2,000,000 lb. of yarn were used in the production of some 2,000,000 spreads which were shipped to all parts of the United States and many other countries. Of the 11,000 persons employed in the industry, 10,000 work in their homes. The handmade spreads are collected by the dealers and laundered and finished. In the finishing treatment they are rubbed with an old-fashioned cotton card which pulls off lint and fluffs the tufts. Fluffing is completed by beating the spread with a stick and letting it hang in the cool dry air. Final treatment comprises trimming each tuft with scissors by hand. In the production of such spreads by machines the designs are produced on the sheeting by rubbing a block of coloured wax over the sheet which is stretched tightly over a raised pattern. It then goes either to the chenille or needlepunch department. The chenille department is equipped with a special sewing machine which puts in the tufts and cuts the loops at a rate of 1,500 to 2,000 stitches a minute. In the needlepunch department sheeting is stretched over large hoops and skilled operators fill in the designs with a small machine about the size of an automatic pistol attached to a flexible shaft and so arranged that hundreds of stitches a minute are put in the cloth. Sometimes chenille and needlepunch are combined in the same spread, and it is not uncommon to mix handwork in with either or both. The sheeting used is 64 × 64's and 64 × 60's, and the yarn is mostly 8's (12 or 16-ply) for handwork and 10's (10-ply for chenille and 2 or 4-ply for needlepunch) for machine work. Sheeting and yarn are pre-dyed with vat dyes. C.

Large Pattern Fabrics: Weaving on Dobby Looms. E. Gräbner. *Textil Lloyd,* 1937, **11**, No. 16, 20-24.

The author shows by a series of examples how it is possible, by the use of stage passes and orders of treadling, to produce patterns having large repeats on dobby looms. C.

Rayon Crêpe Fabrics: Design. J. Henriess. *Silk and Rayon,* 1937, **11**, 686-687.

Illustrations and point-paper diagrams are given of blister or cloqué effects on rayon crêpe fabrics obtained by the use of an ordinary fine warp and a heavier crêpe weft or reverse-twisted warps. C.

Staple Cotton Fabrics: Structure. J. Hoye. *Textile World,* 1937, **87**, 1791.

Details are given of the constructions, finishes used, and uses of piqués and Bedford cords. C.

Patents.

Wavy End and Pick Fabric Reed. Les Successeurs de G. Deglas & Cie. F.P. 814,429 (through *Fils et Tissus,* 1937, **25**, 489).

A reed for the production of fabrics in which both warp and weft threads form wavy lines is provided with dents which are the generatrices of a left surface of revolution, the directrices of which are constituted by the ribs in the form of arcs of a circle of opposite curvature arranged alternately and joined tangentially. The reed is given a suitable rising and falling motion. C.

Shuttle Threading Device. H. Gebhardt (Magdeburg). D.R.P.630,950 of 15/9/1934 (through *Spinner u. Weber,* 1937, **55**, No. 33, p. 7).

A tool for threading a shuttle has a rubber compression ball and a transparent tube for insertion in the eye of the shuttle. The tube is shaped internally in a manner that secures sudden suction on releasing the ball and it is made of transparent material so that the weaver can see at a glance if the shuttle has really been threaded. C.

Knitting Machine Napping Apparatus. Princeton Inc. E.P.467,226 of 12/10/1936.

A circular knitting machine is provided with means for raising nap on the (then) inside of the tubular fabric. The needle bed and the fabric rotate whilst the cam-carrying frame is stationary and supports the napping apparatus. The latter comprises two flat-ended brushes which are mounted on separate shafts and rotated in opposite directions by belts. The brushes act at diametrically opposed points on the fabric just below the needle cylinder and above spring supports. In the same plane as the brushes is a driven napping wheel acting longitudinally of the fabric and in a slightly lower plane is a fixed brush which straightens out the nap. C.

Picot-edged Stocking Welt: Knitting. Hemphill Co. E.P.467,538 of 10/9/1936 (Conv. 21/10/1935).

A stocking or other knitted fabric has a selvedge devoid of rib stitches and substantially non-curling, the selvedge courses forming a picot-edge and courses adjacent to the selvedge course having incorporated therein an elastic thread which is knitted at alternate wales and alternate courses, e.g. at every fourth wale in every fourth course. The picot-edge is formed by knitting on alternate needles at certain positions and forming tuck stitches at the remaining wales. The elastic thread may be floated diagonally from course to course, or it may be knitted at a wale in two successive courses to simulate a seam. C.

Elastic Fabric: Knitting. R. F. Raven and H. A. Raynor. E.P.467,659 of 17/9/1935.

A knitted corset, surgical or like constricting garment or article, or fabric therefor, incorporating elastic threads, has, over a group of wales constituting a portion only of the wales through which the elastic threads extend, these threads more closely pitched than they are over the remainder of the wales, when the fabric is in its relaxed condition. A method in which the elastic thread is incorporated in every cylinder needle wale in the constricted panels and in every alternate wale in the rest of the fabric is described. C.

Pile Fabric Knitting Machine. M. Nebel. E.P.467,739 of 30/12/1935.

In a flat machine for making pile knitted fabric the ends of the dividing sinkers are reduced in height and the plush thread is deposited, when the needles

descend, on a horizontal edge which is not higher than the level of the lower corners of the plush throats of the jack sinkers. In this way, the ground and plush threads are kept separate, during the dividing operation, by the dividing sinkers and the use of special instruments for this purpose is avoided. It is necessary, also, for the needles to be lowered at a quicker rate than usual and a suitable contour of cam for effecting this is described and shown. C.

Circular Knitting Machines; Normal and Reverse Plating on——. L. Mellersh-Jackson (Standard-Trump Bros. Machine Co.). E.P. 468,003 of 2/1/1936.

The production of normal and reverse plating to form patterned articles such as stockings, etc., by selective manipulation of the sinkers is described in relation to circular machines with elongated rotary-reciprocating needle cylinders. C.

Knitting Machine Pattern Presser. E. H. Wirth, H. D. Donner, J. M. Loschner and E. H. Wirth. E.P.468,128 of 1/2/1937 (Conv. 22/2/1936).

A pattern presser for a warp machine comprises individual presser pins arranged in accordance with the pattern and cast in lead. The needle-engaging end of each pin is provided with a groove. The lead is provided with an aperture for securing it in position. C.

Synthetic Resin Film Strips: Application. British Celanese Ltd., W. A. Dickie and D. Finlayson. E.P.468,430 of 5/10/1935.

Narrow strips formed by slitting a thin film of polyvinyl acetate or other synthetic resin may be formed into or incorporated in woven or knitted fabrics. C.

Rayon-Natural Fibre Mixture Yarns: Steam Treatment. British Celanese Ltd. E.P.469,463 of 17/10/1935 (Conv. 17/10/1934).

Yarns containing both artificial and natural fibres are subjected to a treatment with steam before being woven or otherwise associated together to form a fabric. Preferably, the steam treatment is carried out just prior to the weaving, knitting, warp knitting or other fabric-forming operation so that this operation is effected while the yarn is in a warm moist condition. The artificial fibres may be of regenerated cellulose, cellulose acetate or other cellulose ester, ethyl cellulose or other cellulose ether. The artificial fibres may be cut or broken to staple length and mixed or doubled with fibres or yarns containing wool, cotton, flax or silk. The mixed yarns may be formed into cones, bobbins, cheeses or spools which are placed in a chamber filled with steam. The steam may be wet or dry and at atmospheric or raised pressure. If desired the steam may be forced or sucked through the yarn packages. Steam treatment may be carried out just after twisting the yarn and again just before forming the yarn into fabric. C.

Loom Shedding Mechanism. J. Nelson Ltd. (Nelson) and J. N. Eastwood. E.P.470,210 of 26/6/1936: 11/8/1937.

The invention relates to tappet looms for weaving in which the tappets are driven by gearing from a gear wheel on the top shaft and consists in the provision of means for putting such gear wheel out of driven connection with the top shaft enabling the weaver to turn the tappets backwards or forwards to take out picks to get back to a broken thread or pick by turning such wheel without turning the top shaft of the loom. For this purpose, instead of the tappet driving wheel being fixed to the top shaft of the loom it is freely mounted thereon and detachably connected to an additional or supplementary balance or hand wheel to which is detachably coupled a coupling member which is rigidly fixed on the top shaft and provided with means whereby it can be uncoupled from the balance wheel for enabling the latter to be turned to turn the tappets backwards or forwards without turning the top shaft. The invention is particularly applicable for silk looms using five, six, seven or any other number of heald staves, also for weaving with a two and two mixed weft which may comprise cotton or silk, or vice versa, and in which any number of shuttles in rotary or circular boxes are employed. C.

Weft Stop Motion. Société Alsacienne de Constructions Mecaniques. E.P. 470,340 of 10/2/1936: 10/8/1937.

In weft stop motions for looms of the type in which on failure of the weft the stoppage of a normally reciprocating stop operating member causes the operation of the loom clutch engaging and disengaging handle and of a loom brake by means of a clutch control member on the slay and a co-operating clutch operating member, the clutch control member slidable up- and down-wards is resiliently

connected to the stop-operating member and lifting means controlled by the movement of the clutch operating member itself are provided to displace the control member at the end of its clutch operating movement. C.

Electrical Pattern Control System. W. E. Perry (Scranton, Pennsylvania, U.S.A.). E.P.470,368 of 29/9/1936: 13/8/1937.

A method of controlling the pattern produced in fabrics by a textile machine (e.g. a loom or Nottingham lace machine) comprises providing a stack of separate non-connected cards each of which has been perforated to control one operating cycle of the machine, feeding the cards one at a time to a reading position, electrically reading the whole of the perforations of the card simultaneously to control the operating cycle, displacing the read card from the reading position and feeding it to a discard stack, and feeding another card from the supply stack into the reading position. Suitable apparatus for this purpose comprises a feeder for feeding a plurality of separate perforated cards one at a time from a stack into a reading position, a device for electrically reading the whole of the perforations of the card simultaneously and for transmitting corresponding operative motions to the pattern-making parts of the machine, and an ejector for removing the read card from the reading position prior to the advancement of another card. Thin flexible paper cards which may be cut by a punching machine arranged like a typewriter or adding machine are most satisfactory. These cards are fed in the form of a stack to an electrical reading machine which is connected by means of cables and wires to a plurality of solenoids arranged to connect or disconnect the various heddles or jacks. C.

Loom Shuttle. Pilkingtons, Ltd. (Heywood) and R. Pilkington. E.P.470,587 of 24/3/1936: 18/8/1937.

In a loom shuttle of the type in which a peg or projection in the shuttle is caused to enter a hole or recess in a weft tube or pirn for holding the latter in position when the tongue is moved to its weaving position and to leave such hole or recess when the tongue is turned outwardly from the shuttle, the peg or projection is carried by a fitting detachably mounted in the shuttle so that the latter can be used for weaving with weft carriers which are not formed with a hole or recess. For this purpose the peg or projection comprises part of a U-shaped clip which is sprung into a recess formed transversely across the shuttle, any suitable positioning device being provided for causing the hole or recess to come opposite the peg or projection so that the latter which remains stationary will enter the hole when the tongue occupies its weaving position, and securely hold the weft carrier in position. When the tongue is turned outwardly from the shuttle the hole or recess in the weft carrier is moved clear of the peg or projection leaving the weft carrier free to be drawn off the tongue. C.

Loom Spring Reverse Motion. Gebr. Stäubli (Horgen, Switzerland). E.P. 470,602 of 15/10/1936: 18/8/1937.

A spring reverse motion for looms wherein the spring force is transmitted through an intermediate lever to a lever which guides or connects with the shaft cord is characterised by the feature that the intermediate lever has connections with the second mentioned lever and spring respectively which are adjustable in such a manner that with the same initial spring force the pressure acting on the shaft cord lever may be varied. C.

Needle Loom Weft Inserting Needle Guiding Means. R. Dewas (Amiens, France). E.P.470,776 of 20/2/1936: 20/8/1937.

Guiding means for the weft inserting needles of needle weaving looms is characterised in that the heel of the needle is guided wholly by means of guiding strips in needle guiding boxes connected to the slay whilst the arm of the needle which enters the shed has, on its lower edge, facing the fell of the cloth, a strip guided in the four principal perpendicular directions, two by two, in grooves of corresponding shape formed in the upper ends of guides fixed to the slay towards the fell of the cloth and set as far as possible from the reed. C.

Loom Reversing and Weft Stop Motion. Maschinenfabrik Rüti (Rüti, Switzerland). E.P.470,895 of 4/12/1936: 24/8/1937.

A loom reversing and weft stop motion which is controlled by the weft detector, and in which on breakage of the weft the slay is automatically brought out of braking position into open-shed position without beating-up of the defective pick is characterised in that on the forward movement of the slay, when

the slay is uncoupled in known manner from the drive and subject to the action of the braking device, a pawl connected with a cam is brought by retraction of a stop element into engagement with a continuously rotating driver and by means of the now rotating cam a continuously running reverse gearing is coupled to a crank shaft of the loom until on completion of the backward movement of the slay the pawl by bearing on the stop element is moved away from the driver and thereby the cam is arrested in inoperative position, so that the coupling between the reverse gearing and the crank shaft of the loom is released. C.

Shuttle Cop Regulator. Premier Waterproof and Rubber Co. Ltd. (Manchester) and S. Ridings. E.P.471,275 of 7/5/1936: 1/9/1937.

A cop regulator for supporting and controlling yarn in cop form within a shuttle comprises a number of very resilient flexible projections or fingers projecting from a base or holder in such manner that when a cop is placed in the shuttle it will bend the resilient fingers out of their normal positions, and as the cop becomes gradually reduced in size by the withdrawal of yarn, the resilient fingers will gradually and automatically return to their normal position and at all times support the cop firmly in position but in a yielding manner. The cop regulator is also provided with means adapted to guide and to exert a tensioning effect on the yarn while it is being drawn from the cop to the eye of the shuttle. C.

Loom Picker. J. Etienne (Fontenay-sous-Bois, France). E.P.471,715 of 24/12/1936: 9/9/1937.

A loom picker has a bore which takes the form of two truncated conical surfaces which widen towards the ends of the bore, the smaller ends of the cones being of slightly larger diameter than the picking spindle such that during reciprocation the picker has line contact with the spindle along generators of both the conical surfaces of the bore. The friction is thus distributed over a greater surface which reduces wear and keeps the play with respect to the spindle very much the same throughout a considerable period of use as it was initially. C.

4—CHEMICAL AND FINISHING PROCESSES

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

Cellulose Acetate Rayon Crêpes: Processing. E. Gansel. *Textile Manufacturer,* 1937, **63**, 332-333, 336.

A general account is given of the preliminary treatment, crêping and scouring, crêpe setting, boiling-off, dyeing and finishing of cellulose acetate rayon crêpes, and the machines used in these processes are briefly discussed. C.

Molecular Damage in Wool Crabbing. G. L. Atkinson. *Amer. Dyes Rep.,* 1937, **26**, 478 and 488.

An account of the molecular structure of wool and of its relation to the practical aspects of the crabbing process. A fabric which has been properly crabbed and then damped will increase in temperature within a few hours, absorb moisture, and improve in finish and handle. If molecular damage has occurred during preparing, these changes will not take place. W.

Uses of Solvent Scouring Agents. *Wool Rec.,* **52**, 213-215 and 223.

Solvent scouring agents are economical in application when the usual scouring methods do not remove the spinning lubricant. The use of a retarding agent in the dyebath is recommended, e.g. Peregal, for correcting goods containing modified oils that are difficult to remove during preparing. W.

Modern Views on the Washing of Textiles and the Constitution of the New Washing Agents. A. Chwala. *Monatsh. Seide Kunstseide,* 1937, **42**, 268-269, (through *Chem. Abstr.,* 1937, **31**, 6470).

In dilute solutions soaps exhibit a linear dependence of electrical conductivity upon concentration. At a certain concentration a sudden break occurs and the conductivity decreases. This characteristic behaviour of soaps and similar substances is due to the formation of micelles. Various washing agents affect differently the establishment of equilibrium in the four stages: (1) complete dissociation of soaps into large colloid anions and small cations, (2) aggregation of the large ions to preliminary micelles, with simultaneous mechanical and electrostatic union of the small ions, (3) further aggregation with the formation of ion micelles of higher stability, and (4) absorption of dissociated soap particles by the natural particles and electrical charging of the latter. W.

(C)—WEIGHTING.

Silk: Weighting and Dyeing Black. B. Faden. *Leipzig. Monats. Text. Ind.*, 1937, **52**, 189-190.

Details are given of a method of weighting silk and dyeing it black. The process involves weighting with ammonium stannic chloride, treatments with ferric nitrate, potassium ferrocyanide, catechu and a tin salt, catechu, and ferrous acetate, and final dyeing with logwood. C.

(G)—BLEACHING.

Linen bleaching. *Linen Trade Circular*, 1937, **23**, No. 1239, 5.

A continental authority maintains that a more complete removal of the waxy substances can be effected by the addition of emulsifying agents to the boil, and that the subsequent bleaching operations are thereby facilitated. He also recommends the buffering of hypochlorite solutions with sodium carbonate. L.

(H)—MERCERISING.

Cotton Yarn: Mercerisation; Effects of Temperature and Impurities in the Lye. S. M. Edelstein. *Amer. Dyes. Rept.*, 1937, **26**, 423-427.

Skeins of cotton yarn have been mercerised in caustic soda of 30, 35, 50 and 60° Tw at 60°, 90° and 110° F. under a constant tension, and the finished mercerised samples examined for dye affinity, tensile strength, elongation, baryta absorption, and lustre. The force necessary to keep a 3-gm. skein from shrinking in each solution has also been measured. The results shew that the mercerising power of caustic solutions near 50°Tw—the usual commercial concentration—is not very sensitive to variations of concentration and temperature. The practice of cooling to 60° F. does not therefore present any great advantage to offset its cost. The dye affinity and strength of the material mercerised at 60° F. in 50° Tw caustic is only slightly greater than that obtained by mercerisation in 50° Tw caustic at 90° F. The lower temperature gives a slightly inferior lustre. The results shew that the temperature of the liquor should not be allowed to vary over a wide range, and especially not above 90° F. where the properties of the mercerised material change more rapidly with changes in temperature than below 90° F. The presence of sodium carbonate (0·2-4 per cent.) and pectic materials (1 per cent.) as contaminants of the caustic leads to a decrease of the lustre and dye affinity of the resultant mercerised yarn. Cotton yarns, 2/40's, were mercerised at 85° F. in contaminated 50° Tw lye. The higher the amount of impurity the greater was the decrease in lustre and dye affinity ; tensile strength, elongation, and baryta number remained unaffected. C.

Cotton Yarns: Mercerisation; Removal of Pectic Substances and Dye Affinity. S. M. Edelstein. *Amer. Dyes. Rept.*, 1937, **26**, 427-432.

Experiments are described that were designed to ascertain the conditions under which non-cellulosic constituents are removed from cotton in mercerisation, and the effect of their removal on the dye affinity of the final yarn. The results shew that variations in the wetting out treatment before mercerisation, and in the caustic washes cause variations in the amount of pectic substances removed and the mercerised yarn shews variation in dye affinity. If all the material soluble in water and caustic soda is removed from the yarn either before or after mercerisation, variations in the wetting out treatment or caustic washes cause no variation in the dye affinity of the final yarn. Hence these variations in dye affinity are due only to the variations of the amount of pectic substances left in the cotton. Removal of the water-soluble pectic substances increases the dye affinity much less than the removal of the remainder of the pectic material. The more pectic substance is removed from a yarn the greater is its final affinity for direct dyes, and the less is it for basic dyes. Tests, based chiefly upon this fact are described which have been developed to shew whether dye affinity variations of a sample of mercerised yarn are due to uneven removal of non-cellulosic substances, or to some other cause. C.

Mercerisation Bibliography. S. M. Edelstein and W. H. Cady. *Amer. Dyes. Rept.*, 1937, **26**, 447-460.

Titles of papers on mercerisation are arranged in alphabetical order of authors' names, year by year from 1853 to 1935. C.

Padding and Chainless Mercerising Machine: Application. Zittauer Maschinenfabrik A.-G. *Leipz. Monats. Text. Ind.*, 1937, **52**, 209-210.

The padding and chainless mercerising machine comprises an alkali treatment section and a washing section. A strong squeezing system is arranged between these two sections. The fabric is passed over a number of rollers and the tension in the direction of the length arising during the impregnation presses the fabric against the rollers, the adhesion between the two hindering shrinkage of the fabric in width. The construction is shown in a photograph and a diagram and the advantages of the machine are discussed. In addition to its use for high-lustre mercerisation, the machine can be used for the alkali treatment of fabrics before dyeing and printing. Such treatment is particularly valuable for mixture fabrics, e.g. cotton-staple fibre, for improving the shade and levelness of dyeings. C.

(I)—DYEING.

Azo Dyes: Constitution and Colour. H. Rivier and J. Zeltner. *Helv. Chim. Acta*, 1937, **20**, 691-704.

Anilides and thio-anilides of *m*- and *p*-nitrobenzoic acids, the thiazoles obtained by oxidation of the thio-anilides, the isomeric *m*- and *p*-nitranilides of benzoic and thiobenzoic acids, and the corresponding thiazole derivatives have been prepared and reduced to amines of three different types. These have been used to prepare azo dyes containing one or other of the chromophores :C:O, :C:S, or ·S·CR:N·, by diazotising and coupling with β-naphthol or H-acid. The naphthol colours were developed on cotton ; they ranged from orange to red but were not fast to washing. The acid colours were isolated ; on wool they gave deep-red to blue-violet shades, those derived from amino-anilides being fast to light but the thiazole derivatives fugitive. The connections between structure and shade are discussed, with reference also to the corresponding dyes from aniline. The ·C:O group in the anilides causes a very slight deepening of colour. The ·C:S group produces a marked deepening but the dyes are sensitive to acids, readily losing sulphur. The thiazole dyes are intermediate in shade between the other two series. C.

Silk: Chrome Mordanting. K. Hishiyama. *J. Soc. Chem. Ind., Japan*, 1937, **40**, 86-89.

Experiments are reported on the effects of adding sodium chloride or sulphate to chromium chloride or sulphate baths in the mordanting of silk by the boiling process. The results are expressed as graphs of the weight of Cr_2O_3 taken up by 10 gm. of silk against the concentration of the sodium salt, the initial Cr concentration being constant. The practical conclusion is that chromium chloride, which is much inferior to the sulphate for mordanting silk, will give good results if a suitable amount of sodium sulphate is added. C.

Silk Hosiery: Processing. L. O. Koons. *Amer. Silk and Rayon J.*, 1937, **56**, No. 8, 27-30.

The damaging of silk by alkaline solutions, the causes of two-tone effects in dyeing silk hosiery, the use of the split-bath method of dyeing in order to prevent spots, the use of protective colloids to reduce damage by alkalis and by prolonged boiling, the reduction of creases, crowsfeet and broken fibres by the addition of higher sulphonated fatty alcohols to the dyebath, the prevention of reduction of the dye by addition of oxidants, a procedure for redyeing, and treatment with water repellent finishes are discussed. The results of tests on the Frazier hosiery testing machine of stockings dyed with and without additions of protective colloids, and of stockings before and after finishing with various water repellent compounds are given. C.

Wool-Staple Fibre Mixtures: Dyeing. G. Nitschke. *Kunstseide*, 1937, **19**, 266-268.

Single- and two-bath processes for the dyeing of wool-staple fibre mixtures are briefly described and it is pointed out that it is not possible by these methods to obtain dyeings as fast as those produced on all-wool goods by dyeing with chrome or vat dyes. For mixtures to be used for men's clothing and dyed in medium or dark shades it is advantageous to use staple fibre which has been dyed by incorporation of dyes or pigments in the spinning solution and then treat the mixture as an all-wool material and dye with chrome dyes. Uniform and mingled colour effects can be obtained and the fastness is as good as that of dyed all-wool materials. Staple fibre dyed in spinning is available in only a limited

number of shades but the shades of the final dyed mixtures can be varied to a certain extent by varying the shades produced on the wool and by varying the staple-fibre content of the mixtures. C.

Bemberg Rayon: Dyeing and Finishing Characteristics. E. Higgs. *J. Soc. Dyers and Col.*, 1937, **53**, 305-310.

A discussion of the characteristics of Bemberg rayon, the selection of suitable dyes and the methods of application, preliminary scouring and desizing processes, methods of finishing, and the characteristics of Bemberg crêpe weft yarn. C.

Cellulose Acetate Rayon: Dyeing with Napthol AS Dyes. R. Metzger and H. Röhling. *Textilberichte*, 1937, **18**, 644-647.

The use of Napthol AS in the dyeing of cellulose acetate rayon is discussed and patent procedures are quoted. The preparation of solutions of various Napthol AS products and of Fast Yellow GC and Fast Scarlet RC bases, Cellitazol R, RB and BN is described and samples of yarns dyed with combinations of these Napthols and bases are given. The dyeing procedure is outlined and the fastness properties of the dyed materials are tabulated. C.

Garment Dyes: Selection. J. G. Grundy. *J. Soc. Dyers and Col.*, 1937, **53**, 310-317.

An account is given of a detailed survey of the dyeing properties of acid dyes on wool under varying conditions, and the levelling properties and affinities of substantive dyes for vegetable fibres. The results of temperature range tests and boiling-off tests with direct Chlorantine Fast and developed dyes on bleached cotton yarn are tabulated and discussed. Dyeing tests with mixtures of bleached cotton, bleached mercerised cotton and viscose rayon and with materials after exposure to atmospheric conditions for considerable periods in summer are described. The selection of dyes for re-dyeing processes and for combination shades, and procedures for the dyeing of cotton and wool unions are discussed. C.

Staple Fibre: Dyeing. H. Brandenburger. *Textilberichte*, 1937, **18**, 649-651.

The dyeing of staple fibre and staple fibre-wool mixtures is discussed and it is pointed out that in order to obtain fast dyeings of the latter the staple fibre should preferably be dyed first in the form of loose fibre or combed sliver. Staple fibre dyed in the spinning process may also be used. Difficulties encountered in dyeing loose staple fibre and combed slivers with substantive cotton dyes, naphthol, sulphur and vat dyes are discussed, some general precautions are described, and procedures for the application of substantive and sulphur dyes are outlined. C.

Variamine Blue B: Application. J. Podreschetnikow and N. Fedorowa. *Chloptschatobumashnaja Prom.*, 1936, **6**, No. 12, 29-32 (through *Chem. Zentr.*, 1937, i, 3875).

The coupling of the diazonium salts of diphenylamine derivatives with Naphthol A.S. occurs only in neutral or faintly alkaline media so that the respective acidity and alkalinity of the two solutions must be correctly adjusted. If an excess of nitrite is used the shade of the dye is too red. Recipes are given. C.

Vat Dyes: Application. J. Lanzer. *Textilberichte*, 1937, **18**, 626-628.

The reduction of Indanthrene dyes is discussed and useful hints are given on the preparation of dye baths with these dyes. Precautions to be taken in the use of standing baths and in oxidation treatments are outlined and the results of determinations of the rates of absorption are discussed. Absorption numbers are given for various Indanthrene dyes at various bath ratios. The amounts of the dyes to be added to standing baths are briefly discussed. It is pointed out that, when dyeings are to be made with mixtures of dyes, the dyes should be reduced separately and mixed just before dyeing. C.

Cobbling of Weathered Pieces. *Wool Rec.*, 1937, **52**, 93-95.

The causes of weathering of pieces before dyeing are discussed. The following methods of correction are suggested: for dark or heavy shades, stripping with bichromate and acid and then re-dyeing from a strongly acidified bath or with mordant dyestuffs ; for pale to medium shades, stripping with a hydrosulphite preparation in an acidified bath e.g. Formosul, followed by treatment in a peroxide bath before re-dyeing. W.

Some Results of Patch Tests. A Compilation and Discussion of Cutaneous Reactions to about 500 Different Substances, as Elicited by over 10,000 Tests in Approximately 1,000 Patients. A. Rostenberg, Jr. and M. B. Sulzberger. *Arch. Dermatol. Syphilol.*, 1937, **35**, 433-454 (through *Chem. Abs.*, 1937, **31**, 5429).

Of all substances tested, soaps caused more positive reactions than any other, and arsenic, nickel sulphate, biological agents, halogens, solvents, metals, mercurials, proteins, insecticides, dyes, cosmetics and oils, followed in diminishing order of importance. The prevalence of soap sensitivity is interpreted as due to a lowered capacity of the skin to neutralize alkali. Of the dyes studied, para reds produced the highest percentage of positive reactions. In cosmetics, face creams gave the most positive reactions, followed by rouge, lipsticks, face powders and eye cosmetics. Hair tonics produced 50 per cent. more positive reactions than hair dyes. Far more patients were sensitive to goose feathers than to duck or chicken feathers. W.

Fastness of Wool Dyeings to Wet Treatments. IV. F. L. Goodall. *J. Soc. Dyers and Col.*, 1937, **53**, 317-323.

The available experimental evidence concerning the effect of temperature on the rate of removal of dye from acid-dyed wool is discussed. Temperature has a marked influence on the rate at which a new equilibrium distribution of dye is approached on immersion of dyed fibres in new aqueous surroundings ; the rate of approach of Acid Orange GG to equilibrium, for example, is nearly four times faster at 40° C. and more than eleven times faster at 80° C. than at 0° C. New experimental evidence shows that for two sets of conditions, the distribution of colourless acid (hydrochloric acid) at equilibrium is independent of temperature. On the other hand, the equilibrium distributions of Acid Orange GG and Polar Yellow R conc. show appreciable variation with temperature, the amount of dye removed at low temperatures being less than at high temperatures in both cases, but being proportionately very much less with Polar Yellow R conc. than with Acid Orange GG. This behaviour is explained by the effect of temperature on fibre swelling and the particle size of colourless acid and the two dyes in solution, and is incompatible with a purely chemical theory of dye fixation for Polar Yellow R conc. Contrary to a purely chemical theory, the theory of fibre swelling and particle size requires that a different equilibrium distribution of dye should be reached under particular conditions of treatment, according to whether or not this equilibrium was approached from the dye being originally distributed throughout the fibre only, or throughout the liquid only ; experimental evidence has been produced to show that such is actually the case. W.

Dyeing Cotton for Use in Road Construction. G. Rice. *Text. Col.*, 1937, **59**, 525-526. W.

Nature of the Acid Dyeing Process. A. Smith and M. Harris. *Amer. Dyes Rep.*, 1937, **26**, P416-P419.

The dye-combining capacity of untreated wool has been determined for the typical acid dye, Orange II, and shown to be equal to the acid-combining capacity. Treatments with nitrous acid, hydrogen peroxide, sodium hypochlorite, and strong solutions of sulphuric acid decrease the basicity of the wool and correspondingly decrease the affinity for acid dyes. Chlorinated wool absorbs acid dyes at a greater initial rate than untreated wool, but at equilibrium the latter absorbs more dye. The resist to acid dyes produced in the sulphuric acid carbonising process is caused by the conversion of basic amino groups to sulphamic-acid derivatives. The results of the investigation constitute further evidence in support of the chemical theory of acid dyeing. W.

Acid Wool Dyeing, its Scientific Basis and Conclusions of Practical Significance. C. H. Fischer. *Deut. Textilwirtschaft*, 1937, **4**, No. 3, pp. 20-23 (through *Chem. Abs.*, 1937, **31**, 5585).

The literature is reviewed and the conclusions drawn are that the *p*H value of the dyeing bath must be kept constant ; it should not be less than 1·3, as the dye adsorption is not increased thereby, the fibre is harmed greatly and the increased acid consumption is uneconomical. To produce level dyeing, either the dyeing liquor or the textile must be uniformly agitated. At the beginning of the dyeing lower acid concentration and lower temperature should

be employed. At the lower temperature the dye penetrates into the interior of the fibre and during the gradual increase in temperature and acid concentration it combines with the chemical activated groups of the woollen protein. Twenty-nine references. W.

Silk: Weighting and Dyeing Black. *See* Section 4C.

(J)—PRINTING.

Gum Arabic Printing Solutions: Influence of Ferric Salts. R. Haller and B. Frankfurt. *Kolloid Z.*, 1937, **80**, 68-72.

A study has been made of the effects of trivalent metal salts on the viscosity of gum arabic solutions. Sulphate, chloride, or nitrate are equally effective ; the effect is therefore due to the trivalent metal ion. Results are described for iron salts, but Cr and Al salts produce similar effects. If minute amounts of ferric chloride are added to 12 per cent. gum solution this remains clear though the viscosity decreases slightly. When the salt concentration is greater than 0·01 gm. Fe_2O_3 per c.c. flocculation gradually occurs but the flocculate can be made to disappear by careful shaking. The viscosity increases steadily with the iron content till a stiff jelly is formed but on addition of further salt liquefaction takes place. This behaviour is not observable in a 1 per cent. gum solution, but as the gum concentration approaches 12 per cent. so does the behaviour approximate to that described above. The effects are closely similar at 20° and 50° C. A 25 per cent. gum solution gives a stiff dark brown gel, insoluble in cold water, but soluble in hot water and acids. It swells in hot water, though not in cold. Its colour is due to hydrolysis of the ferric chloride and the formation of an absorption compound. The behaviour of gum solutions with trivalent metal ions is applied to the printing of textiles ; a new method of fixing, especially vat dyes, is based on the insolubility of iron-gum-gels in the dry state, and their solubility in acid when wet. In printing the formation of an insoluble membrane on the fibre is to be avoided, unless it can be used to prevent discharge of the dyes. Iron-gum-gels can be used, on this principle, instead of " Coloresin " to obtain prints with vat dyes. The dye and a solution of the gel in acetic acid are printed on the fabric and the gel is regenerated on drying as a thin membrane enclosing the pigment. When the print is placed in the sodium sulphoxylate and potash developing bath impregnation takes place without bleeding of the dye. After drying the impregnated fabric is steamed, washed, and soaped. C.

Rayon-Cotton Mixture Fabrics: Printing. C. Baur. *Teintex*, 1937, **2**, 422-427.

Methods for the production of direct, discharge and reserve prints with various types of dyes on rayon-cotton mixture fabrics are described and printing paste recipes are given. The preliminary bleaching of the fabrics and the finishing of the printed materials are briefly discussed. C.

Screen Printing. A. Franken. *Leipzig. Monats. Text. Ind.*, 1937, **52**, 190-192.

A general account is given of the methods and apparatus used in screen printing. Recipes for printing pastes are provided. C.

Vat Printing Paste Thickeners: Preparation, Thickening Value, and " Colour Yield." S. N. Glarum. *Amer. Dyes. Rept.*, 1937, **26**, 437-445.

The influence of the method of preparation of thickeners on thickening value and colour yield in printing has been investigated with the aid of a special stirring apparatus which is described. The method adopted was to choose a standard thickener formula and examine the effects of the following factors: duration of cooking, temperature, dilution after cooking, addition of alkali at various stages of cooking, and the effect of the dye on the thickener. The results are expressed graphically. They shew that the method of preparation has a great influence on thickening power, and colour yield, the best values being obtained from corn and wheat starch thickeners when cooked for a long time at high temperatures and not diluted after cooking, alkali being added at as late a stage in the process as is practical. The data on the effects of dye on the thickener in preparing colour standards shew the imperative need of control methods if colour standards with uniform properties are to be produced. A description is given of the methods under investigation for making quantitative determinations of the amount of dye fixed on the fibre. The results indicate a minimum of 25 per cent. dye lost. At present, colour yield is determined by organic solvent extraction, and comparison with colorimetric standards. Present

knowledge of the chemistry of the process is briefly summarised, and mention is made of an apparatus for making a detailed study of the process. C.

Printed Cloth: Cooling before Ageing. M. Mackay. *Textile World,* 1937, **87,** 1785.

The two general methods of controlling the temperature during the ageing of goods printed with vat dyes are (1) cooling the cloth before ageing, and (2) regulating the moisture content of the ager atmosphere. Methods of pre-cooling the cloth include (1) swinging the goods, (2) the use of cold-water cans immediately behind the drying cans, (3) blowing steam on to the back of the goods entering the ager, (4) drying the printed goods by means of a hot flue instead of by drying cans, (5) the use of a control steam valve on the drying cans set to give just enough steam to dry without over-drying, and (6) passing the dried goods through a fog chamber. These methods are briefly discussed. C.

(K)—Finishing.

Rayon-Wool Mixture Fabrics: Dry Finishing. D. Welsh. *Textile World,* 1937, **87,** 1782.

A superior appearance and handle is imparted to napped rayon-wool fabrics by passing through a combination of a regular two-brush steam brushing machine and a dewing machine arranged to run as one machine. The goods run through with the nap down so that the fabric can be brushed with the lay of the nap. No steam is used unless the pieces require to be narrowed. After passing over the brushes the pieces are carried over the stretch roll of the dewing machine which works on the back of the goods, thus avoiding a roughening up of the nap. The face of the goods receives a fine spray. After passing through the machine the goods are rolled up and the rolls placed in racks and left for at least 12 hours. As the moisture dries out, the finish is set ; no pressing is required. Rayon and wool fabrics that are not napped will also take a beautiful finish on the combination steam brush and dewing machine. A handy truck for the rolls is shown. C.

Dyeing and Finishing of Crushed Felt. F. Dutoit. *Teintex,* 1937, **2,** 355-356 (through *Chem. Abs.,* 1937, **31,** 6010).

Practical hints and recipes. W.

Use of Alkaline Earth Salts in the Finishing of Textiles. A. Foulon. *Deut. Textilwirtschaft,* 1937, **4,** No. 8, pp. 33-35 (through *Chem. Abs.,* 1937, **31,** 6017).

The use of barium carbonate, magnesium chloride, barium sulphate, calcium sulphate, and magnesium sulphate is reviewed. Several less important alkaline earth salts are briefly mentioned. Strontium salts are not used in the textile industry. W.

(L)—Proofing

Aluminium Soap Waterproofing Agents: Application. A. Vendor. *Leipz. Monats. Text. Ind.,* 1937, **52,** 120-122, 143-144, 170-171.

A general discussion of the treatment of various types of fabrics with aluminium compounds and soap in order to impart water-repelling properties. Single- and two bath processes, light and heavy impregnations, and the effects of additions of glue, starch, fats, waxes, loading materials, antiseptics, etc., are considered. C.

Moth-proofing Agents: Efficiency. D. R. Musser. *J. Kansas Entomol. Soc.,* 1936, **9,** 116-125 (through *Exp. Sta. Rec.,* 1937, **77,** 218-9).

Results of a systematic study of agents on the market for proofing fabrics against moths and carpet beetles are reported. All the agents tested (mostly fluorine and arsenic compounds) were effective. Complete immersion of the fabric in the solution gave slightly better protection than spraying. Claims of permanent protection that is not impaired by dry cleaning or washing should be regarded with suspicion. The author comes to the conclusion that sodium silicofluoride, applied as a concentrated solution, secures a high degree of success. C.

" Plextol " Resins: Preparation, Properties and Uses. K. Walter. *Textil-berichte,* 1937, **18,** 652-655.

The products sold under the name " Plextol " are polymerisation products of acrylic acid, methacrylic acid, or their derivatives. They can be obtained in the form of milky, aqueous dispersions or as viscous solutions in organic solvents.

The general method of preparation is outlined and the properties of the various products are described. Their uses in the finishing of various types of fabrics are discussed and details of the methods of application are given. The finishes obtained are fast to washing. Plextols may be used instead of rubber in the production of waterproof and coated fabrics, artificial leather and similar materials. C.

Rubberised Fabrics: Causes of Faults in ——. *Bull. Lab. Anal. et Rech. Ind., Roubaix,* 1937, No. 35, 9-18.

Bluish bars across the face of a white cotton fabric with a rubber-coated back were found to be due to contact with the cross-bars in the vulcanising oven and the yellowing of white rubberised cotton and rayon fabrics on storing was traced to the oxidation of hydrocellulose which was present in the fabric before treatment with rubber, the oxidation being catalysed by traces of ammonia from the neutralisation treatment following vulcanisation. Details of the methods of investigation are given. A study of the effect of rubberising on the fastness to rubbing of dark blue dyed fabric is described. Samples of the dyed fabric before and after treatment with rubber were caused to rub to and fro on bands of white fabric and the colour transferred to the latter was analysed by means of a photo-colorimeter. A suitable rubbing device is briefly described. The results show that the rubberising treatment does not have any unfavourable effect on fastness to rubbing. C.

Waterproofing Pile Fabrics. *Wool Rec.,* 1937, **52**, 457-459.

Methods are described using aluminium oxide or acetate, waxes or other lustrous agents, shellac and rubber. W.

Insect Pests Affecting the Storage of Textiles. E. Wagner. *Deut. Wollen-Gewerbe,* 1937, **69**, 700-702 (through *Chem. Abs.,* 1937, **31**, 5588).

A survey covering the damage caused by insects and its systematic prevention by the use of naphthalene, camphor, "Globol" (*p*-dichlorobenzene) and hexachloroethane, impregnation of wool dyes with tungstic acid, gassing with sulphur dioxide, carbon disulphide, Areginal, carbon tetrachloride or hydrocyanic acid, the storage of textiles in boxes made of red cedar wood which contains aromatic ethereal oils capable of killing insect eggs and moth worms, sunlight and finally refrigeration for several days to -5° followed by permanent storage at 4·5°. Various textile pests are discussed. W.

Patents.

Treating Textile Materials. Tootal Broadhurst Lee Co. Ltd. F.P.807,562 of 15/1/1937 (through *Chem. Abs.,* 1937, **31**, 5599).

Textile fibres are given a series of permanent or semi-permanent local distortions which are fixed by means of a synthetic resinous product. The fibres may be impregnated with the constituents of a synthetic resin, distorted and the resin is then formed by heating. W.

Treating Textiles. I. G. Farbenind. A.-G. F.P.807,984 of 26/1/1937 (through *Chem. Abs.,* 1937, **31**, 6481).

Textiles are softened and their affinity for water and dyes increased by treating them with a solution of a polyamine obtained by causing a haloalkylamine to react with a nontertiary amine the molecule of which contains at least 6 C atoms. Thus, cotton or rayon is treated, with an aqueous solution of *N*-stearyl-*N'*, *N'*-diethylethylenediamine-HCl (from stearylamine and diethylchloroethylamine) and wool is treated with *N*-stearylethylenediamine-2HCl (from stearylamine and chloroethylamine-HCl). W.

Treating Textiles. Società italiana Resine. F.P.808,028 of 27/1/1937 (through *Chem. Abs.,* 1937, **31**, 6481).

Textiles made of cotton, rayon, hemp or wool are made resistant to rubbing by impregnating them with PhOH-CH_2O or urea- or thiourea-CH_2O resins in known manner and then heating them under pressure to 100-110°. W.

Sulphocarboxylic Acid Amides. Soc. pour l'ind. chim. à Bâle. F.P.808,270 of 2/2/1937 (through *Chem. Abs.,* 1937, **31**, 6376).

Aromatic sulphocarboxylic acids or sulphonic salts of aromatic carboxylic acids or their substitution products, in which a SO_3H group is meta to the COOH, or their anhydrides, halides or esters are caused to react with primary or secondary amines containing more than 2 C atoms or their derivatives, if

necessary in the presence of solvents. Examples are given of the preparation of amides from sulphophthalic acid and methylcetylamine, amylamine, *p*-aminoanilide of lauric acid and *p*-aminoanilide of stearic acid. The products are wetting, cleansing and dispersing agents. W.

Felt from Wool and Hair. Chem. Fabrik J. A. Benckiser G.m.b.H. F.P. 808,386 of 4/2/1937 (through *Chem. Abs.*, 1937, **31**, 6483).

Water-soluble phosphates poorer in water of constitution than orthophosphates are used as fulling agents. Thus, a mixture of Na hexametaphosphate and pyrophosphate may be used. W.

Compounds Having Capillary Activity. Henkel & Cie. G.m.b.H. F.P.808,852 of 17/2/1937 (through *Chem. Abs.*, 1937, **31**, 6376).

Water-soluble salts of aromatic compounds in which the ring carries at least 1 radical having 4 or more C atoms and a radical containing a carboxylic group or groups joined to the ring by a multivalent atom other than C, e.g. O, are used as wetting, emulsifying, dispersing, washing and penetrating agents. An example is Na salt (*p*-octylphenoxy)-acetic acid (by heating *p*-octylphenol in EtONa with Et ester of $ClCH_2$-COOH and then boiling with NaOH lye). A mixture of Na salts of alkylated cresoxyacetic acids may also be used. W.

Waterproofing Textiles. I. G. Farbenind. A.-G. F.P.809,289 of 27/2/1937 (through *Chem. Abs.*, 1937, **31**, 6905).

Textiles are waterproofed by treating them with mixed polymerization products of carboxylic acids of olefins with other olefin compounds, which carry besides the C chain formed by the polymerization aliphatic radicals of at least 12 C atoms. Thus viscose rayon is treated with a solution of a mixed polymerizate of Et ester of butadienylcarboxylic acid and vinyl stearate (I). Other polymerizates used are those from I and maleic anhydride (II), vinyl palmitate and II, vinyl octodecyl ether and II, vinyl dodecyl ether and II, dioctodecyl ester of maleic acid and vinyl ethyl ether, and acrylic acid and vinyl octodecyl ether. W.

Chlorine-proof Fabrics. L. L. L. Dehaffreingue. F.P.810,075 of 15/3/1937 (through *Chem. Abs.*, 1937, **31**, 6903).

Fabrics are made impervious to Cl by coating them with a composition obtained by boiling rubber latex with soda extracted from seaweed of the genus *Fucus*. W.

Weighting Wool. Chemische Fabrik Stockhausen & Cie. G.P.640,508 of 7/1/1937 (through *Chem. Abs.*, 1937, **31**, 5599).

Wool ware is first treated with an acidified solution of a highly sulphonated oil and then with a solution of a Pb salt such as $(AcO)_2Pb$. An example is given. W.

Washing and Carbonizing Wool. Deutsche Hydrierwerke A.-G. G.P.641,190 of 22/1/1937 (through *Chem. Abs.*, 1937, **31**, 6483). Addition to 639,535 (see *J. Text. Inst.*, 1937, A443).

The method of 639,535 is modified by replacing the C-sulphonic acids by acids of the general formula $RXY(HSO_3)_x$ or their salts, in which R represents an alkyl or alkylene group with at least 10 C atoms, or a cycloalkyl group, X represents O, S, or substituted or unsubstituted imino or sulphone group, and Y a short aliphatic chain or an aromatic residue with or without OH substituents. The examples mention 3-laurylthio-2-hydroxypropane-1-sulphonic acid as agent for washing wool prior to carbonization. W.

Shrinking Textile Goods. A. Prescher. G.P.643,539 of 10/4/1937 (through *Chem. Abs.*, 1937, **31**, 6032).

Fabrics woven wholly or partly with wool are shrunk by suspending in an evacuated chamber and treating with an aqueous emulsion of wool fat. Condensation products from higher fatty acids and amino- or hydroxy-alkylsulphonic acids, or salts of acid H_2SO_4 esters of higher fatty alcohols, may be used as emulsifiers for the wool-fat emulsions. Examples are given. W.

Bleaching. Kübler & Niethammer. G.P.645,482 of 28/5/1937 (through *Chem. Abs.*, 1937, **31**, 6032).

For the purpose of measuring or regulating the proportion of a bleaching agent in a bleaching bath, observations are made of the potential difference between an

indicator electrode immersed in the bath and a similar electrode immersed in a suspension free from bleaching agent, of the material under treatment. W.

Waterproofing Wool. Merkel & Kienlin G.m.b.H. G.P.645,814 of 3/6/1937 (through *Chem. Abs.*, 1937, **31**, 6483).

The wool is soaked for a short time in a solution of an Al salt of a mineral acid at ordinary or raised temperature, e.g. in a 5-20 per cent. aqueous solution of $Al_2(SO_4)_3$, and then immersed in a bath of boiling water. The material may then be optionally treated with a bath of AcOH. W.

Wetting, Dispersing, Foaming and Washing Agents. Böhme Fettchemie-Ges. m.b.H. G.P.646,290 of 11/6/1937 (through *Chem. Abs.*, 1937, **31**, 6375).

Use is made of the alkali salts of acids having a molecular weight above 200 and covered by the formula $RCHOHPO(OH)_2$ or $R_2COHPO(OH)_2$, where R is an alkyl or aryl group. These acids are obtainable by treating aldehydes or ketones with PCl_3, and treating the products with water. Examples of the use of typical products are given. W.

Fireproofing Compositions. "Antignis" chem.-technische Schutzstoffe Ges. m.b.H. Austrian P.149,356 of 26/4/1937 (through *Chem. Abs.*, 1937, **31**, 5488).

A mixture containing anhydrous $CaCl_2$ 40, $ZnCl_2$ 10 and CH_2O (40 per cent. solution) 5 parts is mixed with a mixture containing anhydrous $CaCl_2$ 30, H_3BO_3 10 and NH_4Cl 5 parts. The whole mixture is then used, in the form of a 10-15 per cent. solution, for coating or impregnating wood, fabrics and like materials. W.

Fireproof and Waterproof Fabrics. V. Pollak. Austrian P.149,561 of 10/5/1937 (through *Chem. Abs.*, 1937, **31**, 6482).

A fabric is made fireproof by impregnation with a solution of $PhPCl_2$ or like water-insoluble reaction product of an aromatic compound and a chlorine compound of P. The solution is preferably neutralized, e.g. with α-naphthylamine. The fabric is then dried, and afterwards waterproofed, e.g. by treatment with a solution of cellulose acetate or benzyl cellulose. Examples are given. W.

Proofing Composition. F. G. Dowd. Australian P.100,678 of 15/4/1937 (through *Chem. Abs.*, 1937, **31**, 6382).

A composition for proofing against damp and insects consists of paraffin wax, petroleum jelly, rubber solution and gasoline, to which is added Al flour and (or) palmitic acid emulsion and (or) CS_2. Bitumen and As compounds may be present. W.

Moth-repelling Agent. M. Reich. Hungarian P.116,389 of 1/6/1937 (through *Chem. Abs.*, 1937, **31**, 6382).

A mixture of naphthalene and *p*-dichlorobenzene is melted, filling or colouring matters such as camphor and pigments may be added, and the product is moulded. W.

Textile Dressings. Soc. pour l'ind. chim. à Bâle. Swiss P.188,763/4 of 1/4/1937 (through *Chem. Abs.*, 1937, **31**, 6770).

Additions to Swiss P.185,942 (see *J. Text. Inst.*, 1937, A500). Phthalic acid-β-sulphonic acid or a derivative which becomes a carboxylic acid monoamide on treatment with an amine, is treated with *p*-aminolauric acid anilide (188,763), or with *p*-aminostearic acid anilide (188,764). The products are strong foam-formers and are used for washing and softening wool, rayon, etc. W.

Textile Dressing. Soc. pour l'ind. chim. à Bâle. Swiss P.189,302 of 1/5/1937 (through *Chem. Abs.*, 1937, **31**, 6770).

Addition to Swiss P.187,421 (see *J. Text. Inst.*, 1937, A501). *m*-Aminocyclohexanol is treated with stearic acid chloride and the product treated with conc. H_2SO_4. On neutralization, a product with strong wetting, emulsifying and washing qualities is obtained. W.

Steaming Fabrics, as in Use of "Decating" Machines. W. J. Koch (to Van Vlaanderen Machine Co.). U.S.P.2,085,222 of 29/6/1937 (through *Chem. Abs.*, 1937, **31**, 6032).

In treating fluid-pervious fabrics in succession, a fabric to be treated is wound together with a fluid-pervious blanket and the composite mass is subjected to

the action of steam, unwound, and the blanket is then wound independently of the fabric and subjected to a vacuum to effect desired drying and this sequence of steps is repeated as to each succeeding fabric to be treated. Apparatus is described. W.

Device for Protecting Clothes, etc., from Moths and Like Insects. R. J. Preston. U.S.P.2,086,046 of 6/7/1937 (through *Chem. Abs.*, 1937, **31**, 6033).

A foraminous casing is provided holding a pad of fibrous material such as wool or hair comprising a moth larvae food and serving as a moth lure including an oleaginous material such as an animal fat or oil and associated with a material such as As_2O_3 or $BaCl_2$ serving to devitalize the moth eggs and to kill the insect larvae. W.

Iron Salt and Hydrogen Peroxide Compositions, Stabilized and Suitable for Bleaching Rabbit Skins, etc. H. I. Eisenman. U.S.P.2,086,123 of 6/7/1937 (through *Chem. Abs.*, 1937, **31**, 6032).

A fluoride or nitrate of Fe is used in an aqueous H_2O_2 solution together with NaF or NH_4HF_2. W.

Quaternary Ammonium Compounds. L. Taub and F. Leuchs (to Alba Pharmaceutical Co.). U.S.P.2,086,585 of 13/7/1937 (through *Chem. Abs.*, 1937, **31**, 6419).

Bactericidal and fungicidal quaternary ammonium halides containing only one quaternary N atom which is once substituted by an alyklthioalkyl group of 8 to 20 C atoms and which quaternary N atom is otherwise substituted only by saturated lower alkyl groups as organic substituents and by the anion of a hydrohalic acid are prepared, e.g. by reacting upon a saturated primary, secondary or tertiary amine with an ester of a higher-molecular aliphatic alcohol containing an interrupting ether-like bound S or N atom. Details are given of the production of trimethyldodecyl thiomethylammonium chloride, m. 180°, dimethyldodecyl dodecylthiomethylammonium chloride, m. 164-5°, dimethylhydroxyethyldodecylthiomethylammonium chloride (having no definite melting point), trihydroxyethyldodecylthiomethylammonium chloride, methyldiethyloctylthioethylammonium iodide (a viscous sirupy liquid which crystallizes on long standing), and general mention is made of the possible transformation of the hydrohalic acid salts into other salts such as those of nitric, sulphuric, alkyl- and benzenesulphonic, phosphoric, formic, acetic, lactic, citric, tartaric, benzoic and salicylic acids. W.

Refining and Improving Wool. A. Nathansohn (to Deutsche Kunstseiden-Studienges. m.b.H.). U.S.P.2,086,676 of 13/7/1937 (through *Chem. Abs.*, 1937, **31**, 6482).

A process of refining wool to produce softness and brightness and improve its spinning property without essential change of the dyeing properties comprises treating the clean dry wool after grease extraction with HCOOH vapour diluted with air in the substantial absence of water at a temperature between room temperature and 50° whereby to effect a moderate esterification, and terminating the treatment prior to any substantial change in the dyeing property of the wool. W.

Sulphonation Products of Acylated Amines. W. Zerweck and E. Gofferje (to General Aniline Works). U.S.P.2,086,690 of 13/7/1937 (through *Chem. Abs.*, 1937, **31**, 6376).

Wetting, dispersing and detergent compounds are obtained by acylating and sulphonating an unsaturated aliphatic amine containing more than 8 C atoms, details being given of the production of sulphonation products of benzoyloleylamine, methylbenzoyloleylamine and methylbutyryloleylamine, suitable for use in aqueous liquids for treating textile materials. W.

Waterproofing Textiles, Felts, Leathers and Like Goods. C. F. Fabian and A. N. Sachanen (to Non-Mercuric Carrot Co.). U.S.P.2,086,792 of 13/7/1937 (through *Chem. Abs.*, 1937, **31**, 6484).

The material is treated with a volatile fluid such as gasoline, $CHCl_3$ or CCl_4 in which is dispersed a small proportion (suitably about ¼-6 per cent.) of a stable nonsweating mixture containing a viscous refined petroleum oil and a blend of ceresin wax in sufficient amount to prevent sweating and a relatively much

larger amount of paraffin wax or solid fatty acids. U.S.P.2,086,793 also relates to generally similar mixtures for like uses. W.

Bactericidal and Fungicidal Quaternary Ammonium Compounds. L. Taub and F. Leuchs (to Alba Pharmaceutical Co.). U.S.P.2,087,132 of 13/7/1937 (through *Chem. Abs.*, 1937, **31**, 6419).

By usual synthetic methods, thickly liquid or crystal compounds are obtained such as (γ-dodecyloxy-β-hydroxypropyl) trimethylammonium chloride, the corresponding bromide (γ-dodecyloxy-β-hydroxypropyl), tributylammonium chloride, methylcyclohexylethyl (γ-dodecyloxy-β-hydroxypropyl) ammonium iodide, trimethyl (octyloxyethyl) ammonium bromide, tris (hydroxyethyl) octyloxethylammonium bromide, and methyldiethyl (decyloxyethyl) ammonium iodide. For certain purposes these hydrohalide salts may be converted into nitrates, sulphates, alkyl- or benzene-sulphonates, phosphates, formates, citrates, acetates, lactates, tartrates, benzoates or salicylates. Several examples with details of procedure are given. W.

Reserving Animal Fibres in Mixed Fabrics. F. Guenther, H. Haussmann, J. Nuesslein, H. Schuette and C. Schoeller (to General Aniline Works). U.S.P. 2,087,284 of 20/7/1937 (through *Chem. Abs.*, 1937, **31**, 6481).

A fabric containing both animal and vegetable fibres is treated with a dye bath for the latter containing an acid sulphuric acid ester of an aliphatic, cyclo-aliphatic or mixed aromatic-aliphatic compound containing at least 8 C atoms and at least one group capable of being converted into a sulphuric acid ester group, having an olefinic linkage or OH group but free from carboxylic groups, which serves to prevent dyeing wool, silk and the like. W.

Quaternary Ammonium Salts of High Molecular Weight. Melvin de Groote (to Tretolite Co.). U.S.P.2,087,506 of 20/7/1937 (through *Chem. Abs.*, 1937, **31**, 6376).

Wetting, washing, frothing, emulsifying, dispersing, softening, levelling and plasticizing agents for use in the textile and other industries are produced by treating a tertiary amine such as triamylamine or pyridine with halohydrins such as chlorohydrins from ethylene glycol or glycerol and utilizing the resulting product for the neutralization of products such as those derived from the sulphonation of castor oil or mahogany acids such as are produced in petroleum refining or mono- or di-phthalated ricinolein. Numerous examples and details are given. W.

Quaternary Ammonium Compounds. G. Balle and K. Eisfeld (to General Aniline Works). U.S.P.2,087,565 of 20/7/1937 (through *Chem. Abs.*, 1937, **31**, 6375).

Quaternary NH_4 compounds suitable for use as cleansing, emulsifying or wetting agents for treating textile materials, animal skins, leather, etc., as in brightening, fulling, sizing, dyeing, levelling, or mercerizing, as foaming agents in flotation processes, etc., are made by causing esters of such carboxylic acids as contain a reactive halogen atom or another reactive anion to react with tertiary organic bases. The esterlike products thus obtained may be saponified or may be transformed into amide-like products by means of NH_3 or primary or secondary amines or derivatives thereof. The new products correspond to the general formula: X:N(Y)RZ, where the group X:N means a tertiary base, Y stands for an anion, such as, for instance, halogen, or the hydroxyl group, R means a hydrocarbon radical and Z stands for a carboxyl group which may be esterified or may be amidated, e.g., there may be formed by the action of chloro-acetic acid Me ester upon tributylamine the chloride of the tributylbetaine Me ester of the formula: $Bu_3N(Cl)CH_2CO_2Me$. Temperatures of about 70° to 150° are suitable for the reaction with various initial materials of different molecular weights and the products are in some instances crystalline and in other instances are of honey- or fat-like consistency. By treating the ester-like products with saponifying agents there are obtained, with elimination of the respective alcohol, salt-like or soap-like compounds, which are easily soluble in neutral acid or alkaline aqueous solutions. Under suitable conditions, e.g., by warming with alkaline agents, such as baryta or $BaCO_3$ it is possible to substitute the OH group for the halogen. By treating the ester-like products with NH_3 or organic primary or secondary bases or their substitution products, new products of amide-like nature are obtained which have the same solubilities. W.

Carrotting Fur. C. F. Fabian and A. N. Sachanen (to Non-Mercuric Carrot Co.). U.S.P.2,087,854/7 of 20/7/1937 (through *Chem. Abs.*, 1937, **31**, 6484).

A carrotting solution contains an oxidizing agent such as H_2O_2 or NH_4 persulphate and acid hydrolyzer such as HCl or H_2SO_4 together with an inhibitor comprising a water-soluble, organic, O-containing compound such as molasses, ethylene glycol, EtOH or quinoline present in an amount (suitably about 3-10 per cent.) to prevent harmful action on the fur of the oxidizing agent and hydrolyzer (the solution being substantially free from heavy metal catalytic agents). U.S.P.2,087,855 relates to otherwise similar carrotting solution in which the inhibitor used is a water-soluble, organic, N-containing compound such as urea or a tetrazene, etc. U.S.P.2,087,856 relates to like use of an S-containing inhibitor such as benzene-sulphonic acid, etc.; and U.S.P. 2,087,857 relates to the like use, as inhibitors, of water-soluble, organic, O-containing, carbo-acid compounds such as formic acid, etc. W.

Sulphuric Acid Derivatives of Secondary Alcohols. J. N. Wickert and B. T. Freure (to Union Carbide and Carbon Corp.). U.S.P.2,088,014 of 27/7/1937 (through *Chem. Abs.*, 1937, **31**, 6770).

Compounds suitable for use as wetting, impregnating, foaming and emulsifying agents in the textile and leather industries, etc., are produced by the sulphation of a secondary branched-chain 4-tetradecanol such as 7-ethyl-2-methyl-4-undecanol the Na salt of the monosulphate of which is a snow-white wax-like solid compatible with hard waters (readily yielding a lather with sea water). The alcohol to be sulphated may be formed by the reaction together of methyl isobutyl ketone and ethylpropyl isobutyl ketone or ethylhexaldehyde, dehydration and catalytic hydrogenation of the reaction product. W.

Secondary Alkyl Sulphates as Wetting Agents. J. N. Wickert (to Union Carbide and Carbon Corp.). U.S.P.2,088,019 of 27/7/1937 (through *Chem. Abs.*, 1937, **31**, 6769).

Products suitable for use as wetting, penetrating, scouring, dye-levelling or softening agents, as in the textile or leather industries, are formed by sulphating a saturated secondary branched-chain high aliphatic mono-hydric alcohol having 8 or more C atoms in its molecule such as 2-ethyl-1-hexanol, 3-ethyl-6-heptanol, 2-methyl-4-nonanol, 5-ethyl-2-nonanol, 3-ethyl-8-methyl-6-nonanol, 3-ethyl-6-undecanol, 7-ethyl-2-methyl-4-undecanol, 3, 9-diethyl-6-undecanol, 9-ethyl-5-methyl-6-tridecanol, 3, 9-diethyl-6-tridecanol, 5, 11-diethyl-8-pentadecanol, 7-ethyl-2-methyl-4-undecanol or 3, 9-diethyl-6-tridecanol. Various examples with details of the preparation, sulphation and use of these compounds are given. W.

Protease Degumming Preparations: Application. Wallerstein Co. Inc. (New York). E.P.414,778 of 16/2/1933 : 16/8/1934.

Silk containing its natural gum is treated with a proteolytic enzyme preparation under such conditions that the gum is not removed and is then dried without heating. Silk so treated can be processed in the same way as untreated silk and yarns and fabrics containing it may be degummed by the usual methods in a much shorter time or with milder soap solutions. Suitable enzyme preparations include bacterial enzyme preparations, papain, trypsin and pepsin. C.

Thermoplastic Resin Stiffened Fabric: Production. F. Eaton. E.P.467,905 of 24/12/1935.

A stiffened fabric for collars, cuffs, shirt fronts, etc., comprises two or more plies interwoven together by warp or weft threads, some or all of which, or of the weft yarns intermediate between the plies, are formed of or coated or impregnated with a thermoplastic material composed of a cellulose derivative which may be cellulose acetate or other cellulose ethers or esters, or a blend of polyvinyl resins, such as a mixture of polyvinyl acetate and the interpolymer of vinyl chloride and vinyl acetate. Heat and pressure are applied to the woven fabric to fuse the thermoplastic material and spread it throughout the fabric to stiffen this. C.

Vat Dyes: Production. G. W. Johnson (I. G. Farbenindustrie A.-G.). E.P. 467,971 of 20/12/1935.

Mono-phthaloylcarbazole mono-carboxylic acid halides, or monocarboxylic acid halides of compounds of the azimino series which are capable of conversion to monophthaloylcarbazoles, are reacted with aminoanthraquinones, the resulting

compounds being heated to split off nitrogen and form the carbazoles. The products are vat dyes difficultly soluble in the usual organic solvents and dyeing vegetable fibres fast shades. C.

Methine and Polymethine Dyes: Production. W. W. Groves (I. G. Farbenindustrie A.-G.). E.P.467,983 of 23/12/1935.

Unsymmetrical methine and polymethine dyes of the pyridine series are made by causing an unsymmetrical methine or polymethine dye of the pyrylium series to react with ammonia or a primary amine. The products dye silk and tannin-mordanted viscose rayon and mixed fabrics. C.

Monoazo Dyes: Production. A. Carpmael (I. G. Farbenindustrie A.-G.) E.P. 467,984 of 24/12/1935.

Monoazo dyes are manufactured by coupling diazo compounds of amines of given general formula with any coupling components. In examples (1) 1-(N-ω-sulpho-ethyl-N-acetylamino-4-aminobenzene→(acid) 2-amino-8-naphthol-6-sulphonic acid ; the product dyes wool and silk yellowish shades and (2) 1-(N-ω-sulpho-ethyl-N-benzoylamino)-4-aminobenzene→(alkaline) 2-phenylamino-8-naphthol-6-sulphonic acid ; the product dyes wool and silk deep brown shades. C.

Alkylene Oxide Waterproofing Agents: Application. W. W. Groves (I. G. Farbenindustrie A.-G.). E.P.467,992 of 27/12/1935.

Textile materials are rendered more water-repellent by treatment first with an alkylene oxide and then by the surface action of a quantity, not exceeding the weight of the textiles, of an organic esterifying agent containing an uninterrupted chain of at least 10 carbon atoms in the molecule. Ethylene oxide, propylene oxide, butadiene dioxide and epichlorhydrin are specified alkylene oxides. These may be used in aqueous or organic solvents or in gaseous phase. One molecular proportion of alkylene oxide for two molecular proportions of cellulose, $C_6H_{10}O_5$, may be used. The esterifying agent may be an anhydride or chloride of a higher fatty acid or an isocyanic ester containing an alkyl group of more than 10 carbon atoms. C.

Black Dye Mixtures: Preparation. A. Carpmael (I. G. Farbenindustrie A.-G.). E.P.468,037 of 24/12/1935.

Mixtures of dyes are produced by incorporating dyes of the dibenzanthrone and/or isodibenzanthrone series with halogenated derivatives of alkaline condensation products of 1-(Bz1-benzanthronylamino)-4- or 5- or 8- acylaminoanthraquinones. Other dyes may be added, and the mixtures may be produced in the dyeing liquor or printing paste. The dyeings and prints obtained with the mixture dye full black shades, fast to light, washing, and boiling sodium carbonate solution. C.

Phthalocyanine Dyes: Production. A. Carpmael (I. G. Farbenindustrie A.-G.). E.P.468,043 of 31/12/1935.

Phthalocyanines are prepared by heating, alone or in the presence of metals or their compounds, aroyl derivatives of phthalonitriles, or compounds which are converted into these in the course of the reaction. The products are suitable for graphic wall-paper printing and for colouring viscose or cuprammonium rayon. By sulphonation, they can be used for dyeing textiles, or may be converted into alkaline earth metal salts for use as colour lakes. C.

Thermoplastic Resin Compound Fabrics: Production. British Celanese Ltd. E.P.468,099 of 29/6/1936 (Conv. 29/6/1935).

Shaped articles are formed by superimposing a number of fabrics at least one of which contains a derivative of cellulose, and simultaneously shaping and uniting the layers of the assembly with the aid of heat and pressure in the presence of an aqueous medium, e.g. water or steam, and a plasticizer for the cellulose derivative. The cellulose derivative may be woven, knitted, braided or netted from continuous yarns or filaments of a cellulose derivative or yarns spun from short staple lengths, or from a cellulose derivative in the form of artificial hair, bristles or straw. Mixed fabrics containing also non-thermoplastic cotton, linen, regenerated cellulose, wool or silk yarns or fabrics woven from mixed yarns may be employed. The plasticizer may be added to the spinning solution from which the yarns are formed or may be applied as such or in solution to the formed yarn or fabric. The plasticizer may be applied locally to produce local stiffening and adhesion. C.

Protease Colour Stripping Agents: Application. Pancreol Ltd. and C. E. Pickard. E.P.468,154 of 27/5/1936.

Materials such as textiles or leather, coloured by pigments or proteins are stripped, using as stripping agent a vegetable protease, e.g. papain, bromelin or similar proteases, derived from the banana, fig or mulberry, alone or in conjunction with activators such as sodium sulphide, polysulphides, cyanides and soda ash or with other enzymes such as pancreatin. Fillers, diluents or de-odorants, such as sugars, dextrin, camphor or scents may be added, as well as disinfectants such as phenol or arsenic. After the pigment has been loosened it may be removed with water or soap and water. C.

Azo Dyes: Production. Society of Chemical Industry in Basle. E.P.468,189 of 28/11/1936.

Insoluble azo dyes are made on the fibre by printing or padding the goods with a mixture of a product capable of conversion to a diazo compound by means of nitrous acid, a nitrite and a coupling component, followed by treatment with an acid to which formaldehyde has been added, and if required treating with an acid-binding agent. Products specified are salts of aromatic N-nitramines or nitrosohydroxylamines and primary amines, especially a monoacyl derivative of a *p*-phenylenediamine derivative, e.g. an alkyl ether of 2:5-diaminohydroquinone. Coupling components specified are arylides of acetoacetic or of 2:3-oxynaphthoic acid. C.

Anthraquinone Vat Dyes: Production. I. G. Farbenindustrie A.-G.). E.P. 468,214 of 30/12/1935 (Conv. 29/12/1934).

Anthraquinone vat dyes are prepared by heating in the absence of such compounds as under the reaction conditions would split off hydrogen chloride to any substantial extent, a compound of the formula: Aryl-CO-NR-Aryl, wherein at least one aryl is an anthraquinonyl residue and both aryl residues contain a halogen atom in *o*-position to the CO- or NR-group respectively, R standing for hydrogen or a hydrocarbon radical, with such a quantity of copper as is sufficient to combine with two halogen atoms with the formation of cupric halide. Solvents or diluents may be present, preferably those forming addition products with copper salts, such as pyridine or quinoline. The products are phthaloylphenanthridones. They dye cotton yellow shades. C.

Azo Dye Metal Compounds: Application. A. G. Bloxam (Society of Chemical Industry in Basle). E.P.468,362 of 30/12/1935.

Dyeings fast to washing and to light are produced upon vegetable fibres by dyeing them with direct cotton dis- or poly-azo dyes containing lake-forming groups and treating the dyeings with agents yielding metal, at least one phase of the process being performed in a caustic alkaline medium at a raised temperature. Alternatively the fibres are dyed with a complex metal compound of a direct cotton dye in a caustic alkaline medium at a raised temperature. Specified metals are copper, chromium, cobalt, nickel, aluminium, manganese, zinc, vanadium and titanium. C.

Tetrahydrohydroxynapthoic Anilide Azo Dyes: Production. G. W. Johnson (I. G. Farbenindustrie A.-G.). E.P.468,375 of 1/1/1936.

The alkaline solution of 5:6:7:8-tetrahydro-2:3-hydroxy-naphthoic acid anilide yields a brown dye by coupling in substance or on the fibre with diazo compounds, e.g. with diazotised *p*-nitraniline. A method for the preparation of partially hydrogenated hydroxy compounds is described. 5:6:7:8-Tetrahydro-2:3-hydroxynaphthoic acid anilide is obtained by hydrogenating 2:3-hydroxynaphthoic acid anilide in the presence of a nickel-chromium catalyst. C.

Phenolic Resin Wetting Agents: Preparation. Rohm and Haas Co. E.P. 468,399 of 5/2/1936 (Conv. 13/2/1935).

Phenolic products primarily adapted for use as soaps, wetting, emulsifying, tanning and germicidal agents are obtained by heating an alcohol containing a primary alcoholic group and a halide or sulphate of a phenolic amine obtained by condensing a phenol, formaldehyde and a secondary amine of the formula $XNHX_1$, in which X and X_1 are alkyl groups which may link up to form a polymethylene ring. Not more than one molecule each of the phenol and formaldehyde is used for each molecule of secondary amine and the term phenol covers mono and polycyclic phenols and Novolak resins which are soluble in dilute caustic soda. The products may be used in washing, bleaching, bucking,

tanning, mordanting and dyeing processes, in hydrolysing fats, emulsifying oils and fats in water, breaking petroleum emulsions and dispersing pigments and dyes. The products may be coupled with diazotised aromatic amines to give azo dyes, and the product obtained by reacting lauryl alcohol with the condensate from *p*-chlorophenol, formaldehyde and dimethylamine is stated to be a soft resin. C

Sulphur Dyes: Production. I. G. Farbenindustrie A.-G. E.P.468,416 of 2/1/1936 (Conv. 12/1/1935).

Sulphur dyes dyeing cotton brown tints are obtained by sulphurizing decacyclene or a derivative thereof. In modifications, the sulphurization may be effected in the presence of a metal salt, e.g. a copper salt or the dyes may be treated with alkylating or aralkylating agents, e.g. dimethylphenyl-benzyl-ammonium chloride, or with copper sulphate or potassium chromate. In examples, decacyclene is sulphurized by refluxing with sulphur chloride, or heating with sulphur followed by a baking treatment. C.

Rubberized Yarn: Production. J. H. Fenner and Co. Ltd., J. H. Fenner and S. B. Hainsworth. E.P.468,428 of 3/10/1935.

Yarn for the manufacture of driving and conveyor belts is rubberized by passage through a sequence of baths of compounded rubber latex, the twist being taken out of the yarn temporarily while so passing, and the yarn being subjected to mechanical treatment during or subsequent to each treatment with latex, as by passage over guide bars or rollers, or between squeeze rollers. The yarn may be of cotton, ramie, wool, hair, silk, etc. The baths are preferably of increasing concentration, and between each bath the yarn may be partly dried ; before entering the first latex bath, the yarn may be treated with a wetting agent and then partly dried. Prior to coagulation as by acetic acid, the latex-impregnated yarn is preferably rendered uniform and smoothed by passage through a die ; and finally the yarn is washed, dried and passed through a mass of zinc stearate or treated with an alcoholic solution of stearic acid. During the treatments, by the use of grooved rollers distortion of the yarn is prevented. After weaving the yarn into a belt, the latter is coated or impregnated with rubber or rubber latex by passage through baths, or by treatment in a closed vessel, impregnation being assisted by the application of a vacuum with or without subsequent application of pressure, and finally the belt is vulcanized. C.

Dye Vat Ventilating System. H. Greatorex. E.P.468,523 of 27/2/1936.

A current or currents of hot air is/are directed horizontally across the surface of the liquid in a dye vat or other similar open-topped vessel for subjecting materials to the action of hot or boiling liquids to carry off the vapours formed, suction means being provided also to assist the flow of hot air. C.

Monoazo Dyes: Production. I. G. Farbenindustrie A.-G. E.P.468,597 of 19/10/1936 (Conv. 22/10/1935).

Monoazo dyes are manufactured by coupling the diazo compounds of aromatic amines of the general formula $NH_2 \cdot C_6H_4 \cdot N(CO \cdot R) \cdot CH_2 \cdot CO_2H$ with 2-aryl-amino-8-naphthol-6-sulphonic acids or 3′-hydroxy-(benzo-1′:2′:3:4-carbazole)-5′-sulphonic acids in an alkaline medium. The products dye animal fibres brown shades. C.

Sulphurised Decacyclene Vat Dyes: Production. I. G. Farbenindustrie A.-G. E.P.468,627 of 3/1/1936 (Conv. 12/1/1935).

Vat dyes are prepared by subjecting decacyclene, in the presence of chlorsulphonic acid, to sulphurization and halogenation, either simultaneously or successively. In an example, decacyclene is treated in chlorsulphonic acid with sulphur chloride which effects both sulphurization and chlorination ; the product is refluxed with sodium sulphide to give a dye soluble in sodium sulphide that dyes cotton copper brown tints, and a dye insoluble in sodium sulphide that dyes cotton orange tints from a hydrosulphite vat. C.

Fluoranthene Vat Dyes: Production. A. G. Bloxam (Society of Chemical Industry in Basle). E.P.468,648 of 14/2/1936.

Vat dyes or intermediates are made by heating fluoranthene with an *o*-dicarboxylic acid anhydride in presence of a condensing agent, at least $2\frac{1}{2}$ mols. of the anhydride being used for each mol. of fluoranthene. The product may be halogenated. The products may be converted to their leuco derivatives, such

as their leuco- sulphuric acid esters, and are in part dyes dyeing cotton strong reddish-yellow shades, and in part intermediates. C.

Aminotriazine-Aldehyde Condensation Products: Preparation. A. G. Bloxam (Society of Chemical Industry in Basle). E.P.468,677 and 468,746 of 8/10/1935.

(1) Non-resinous condensation products are prepared by reacting aminotriazines or derivatives thereof containing at least one replaceable hydrogen atom with formaldehyde or substances yielding this. Derivatives of the *iso*-aminotriazines wherein the hydrogen attached to the cyclic nitrogen atoms has been replaced may also be used. Other substances capable of forming resins with aldehydes such as phenol, urea, thiourea and aniline may be present during the condensation, may be added to the initial condensate, or their condensates with aldehydes added to the aminotriazine aldehyde condensate. Dyes, fillers, plasticizers and water-repelling agents may be added at any stage. The products may be used as binding in the production of moulded or laminated products, as adhesives in the wood-working industry, and as dressing, anti-creasing and matting agents in the textile industry. (2) Aminotriazines or derivatives thereof containing at least one replaceable hydrogen atom are condensed with aldehydes or substances yielding aldehydes other than aliphatic mono-aldehydes in the presence, if desired, of a solvent, diluent or condensing agent. Other substances may also be added and the products used for the purposes indicated in (1). C.

Triazoloanthraquinone Vat Dyes: Production. G. W. Johnson (I. G. Farbenindustrie A.-G.). E.P.468,686 of 6/12/1935.

Vat dyes of the triazoloanthraquinone series are manufactured by coupling the diazo compound of an amine NH_2.R.A, where A is a radical capable of being vatted which may be attached to R by an atomic bridge and R is a cyclic radical having up to two isocyclic non-hydrogenated rings, with a 2-amino-anthracene and oxidising the resulting *o*-aminoazo compound, or, when A is a second triazoloanthraquinone radical by coupling 1 molecular proportion of a tetrazonium salt with 2 molecular proportions of a 2-aminoanthracene and oxidising the resulting disazo compound. The oxidation may be effected in a single operation, or in two stages with intermediate production of a triazoloanthracene. Examples describe the production of products dyeing cotton yellow and brown shades. C.

Yarns and Slubbing: Treatment with Cellulose Solutions. F. Drechsel. E.P. 468,694 of 6/1/1936 (Conv. 4/1/1935).

Slubbing, yarns, threads, etc. are improved in gloss and given an increased volume and strength by treatment with alkali lye, then, without washing, with a cellulose solution, e.g. in ammoniacal copper oxide, and finally with fixing agents or precipitants for the cellulose. C.

Rayon Wet Treatment and Drying Apparatus. Vereinigte Glanzstoff-Fabriken A.-G. E.P.468,742 of 1/1/1937 (Conv. 9/1/1936).

In a modification of the apparatus described in E.P.468,742, the non-metallic rollers consisting preferably of porcelain or quartz are constructed as hollow cylinders and are gripped by elastic pressure from the interior, preferably outside the heating zone by means of a hub element on the driving shaft. C.

Coloured Resist Prints: Production under Aniline Black. W. W. Groves (Durand and Huguenin A.-G.). E.P.468,751 of 7/1/1936.

To produce coloured resists under aniline black by means of ester salts of leuco vat dyes, a fabric previously or subsequently padded with an aniline black preparation and dried, is printed with a paste containing an ester salt of a leuco vat dye, an alkali salt of a non-volatile organic acid and an aluminium chlorate and is dried and steamed for about 2 minutes to develop simultaneously the ground colour and the resist effects. C.

Cellulose Ester and Ether Materials: Dyeing. L. S. E. Ellis (Soc. Rhodiaseta). E.P.468,863 of 24/2/1936.

To obtain more even coloration in dyeing cellulose ester or ether material with dyes insoluble or sparingly soluble in water, an inert insoluble powdered substance is added to the bath and maintained in suspension during the dyeing. Specified substances are kaolin, silica, calcium sulphate and zinc oxide. C.

Wetting Agents: Preparation. A. Ofner. E.P.468,956 of 13/1/1936 (Conv. 31/5/1935).

Sulphonated products having wetting, washing, emulsifying and lime-soap protective properties are prepared by the sulphonation and condensation of completely saturated cyclic hydrocarbons and aliphatic hydroxy compounds or their corresponding olefines. The products, which may be formed from more than one cyclic hydrocarbon or more than one hydroxy-compound or olefine, may be neutralised with metal hydroxides or organic bases. Petroleum distillates or coal distillation products rich in cyclo-paraffins may be used as starting materials. C.

Cellulose Ester Yarns and Fabrics: Saponification. British Celanese Ltd., G. H. Ellis and A. J. Wesson. E.P.469,025 of 16/1/1936.

Filaments, fabrics, films and the like of organic esters of cellulose are subjected to saponification in selected areas only, washed, and treated with a saponifying agent which under the conditions of the exposure intensifies the saponification of the already saponified areas without substantially saponifying the unsaponified areas. The preliminary saponification may comprise local treatment with aqueous caustic soda, caustic potash, barium hydroxide or the like, preferably under such conditions that no saponification occurs during application and then effecting the saponification by drying the materials under heat. Again, the treatment may be a bath treatment applied to materials which have been locally reserved by means of a resist. The extent of the preliminary saponification may be sufficient to remove from less than 10 per cent. up to 20 per cent. or more of the original acidyl content of the materials. The intensification of the saponification may be effected with weakly alkaline or weakly acid aqueous baths, e.g. of sodium carbonate, trisodium phosphate, sodium borate, sodium phenate, ammonia or nitrogenous organic bases. C.

Perforated Telescoping Yarn-dyeing Tubes. J. Annicq. E.P.469,222 of 23/11/1936.

Perforated telescoping tubes on which bobbins or cops with compressible cores are threaded for liquid treatment, such as dyeing, are made so that there are free liquid-circulating passages between the overlapping portions of the tubes communicating with the perforations in both the tubes. This may be done by making one of the tubes of elliptical form or of regular or irregular polygonal form, or of general circular shape with a corrugated outline. C.

Cellulose Methyl Ethers: Preparation. Imperial Chemical Industries Ltd., R. R. H. Brown and A. J. Watters. E.P.469,391 of 23/12/1935.

Water-soluble methyl ethers of cellulose are obtained by a two-stage process comprising the treatment of cellulosic material in the presence of aqueous alkali with a restricted proportion of dimethyl sulphate in such manner as to form a simple methyl ether insoluble in water but capable of being brought into solution in dilute caustic soda, and the subsequent treatment of the intermediate product with a lower alkyl chloride at a raised temperature. If desired, a further proportion of aqueous alkali may be added to assist the second etherification step. Aqueous solutions of the cellulose methyl ethers may be used as adhesives or sizes for paper, cloth or leather and as thickening or emulsifying agents in aqueous coating compositions. C.

Alkylene Oxides: Application to Improve Fastness of Dyeings. Aceta Ges. E.P.469,457 of 25/1/1936 (Conv. 25/1/1935).

To improve the fastness to water and washing of dyeings on goods containing basic nitrogen, e.g. wool, leather or cellulose acetate rayon containing a basic artificial resin or a basic cellulose derivative, the dyed goods are treated, in the absence of any other alkylating agent, with an alkylene oxide, sulphide or imine which reacts with opening of the ring, or with a compound yielding such under the conditions of treatment. The treatment agent is advantageously applied in a gaseous medium, especially in an atmosphere having a high moisture saturation. The dyed goods are advantageously subjected to a preliminary treatment with a reagent which swells the material or enhances the speed of the reaction, or such reagents may be incorporated in the treatment liquor. The treatment may also be effected in presence of vapour of a volatile swelling agent and/or in presence of a bleaching agent or a fibre-protecting agent. In the treatment of cotton or rayon impregnated with a basic artificial resin, a

pre-treatment of the dyed goods with acid, e.g. formic, lactic or tartaric acid, or treatment in presence of carbon dioxide, is advantageous. The fastness of the dyeings may be further improved by an after-steaming, if desired in the presence of acid. C.

Crease-resistant Textile Materials: Production. Calico Printers' Association Ltd. (Manchester) and J. R. Whinfield. E.P.470,097 of 8/11/1935: 9/8/1937.

Yarns, threads, fabrics, fibres or other materials of cellulosic nature such as cotton and rayon, are rendered less liable to creasing and to shrinking on washing by impregnating with a neutral aqueous solution of a primary water-soluble condensation product of urea or a derivative thereof, with formaldehyde, and subsequently working the impregnated material in a cold concentrated acidified solution of a salt having a strong affinity for water but without a specific swelling action on cellulose. Textile materials after impregnation with the urea-formaldehyde condensation product, drying and conditioning, may be subjected to a mechanical treatment in order to modify their appearance, and thereafter worked in or impregnated with a cold concentrated acidified solution of a salt having a strong affinity for water but without a specific swelling action on cellulose. In this way any effect produced by a mechanical impress, such as embossed, schreinered or glazed effects, can be rendered fast to washing without the necessity for employing any high temperature heat treatment in order further to polymerise the primary condensation product. A suitable salt solution is a calcium chloride solution containing 600 g. per litre. Magnesium and aluminium chlorides may also be used. C.

Cellulose Ester and Ether Materials: Dyeing. British Celanese Ltd. (London), A. Mellor, G. Bingham and W. Pool. E.P.470,333 of 6/2/1936: 6/8/1937.

Uniform dyeings, fast to rubbing, are produced on cellulose ester or ether materials by impregnating the material with a solution in a volatile organic liquid of a dye having direct affinity for the cellulose derivative and thereafter subjecting the impregnated material to the action of substantially saturated vapours of an organic liquid for a period of 5 secs. to 2 mins., and finally drying. The whole series of operations may be carried out in a continuous manner. Suitable apparatus is described. The volatile organic liquid in which the dye is dissolved and/or the vapours of the organic liquid may consist of dichlorethylene. The method described may also be used for the incorporation of dye components, substances capable of increasing the fastness of dyeings, and other organic substances in cellulose derivative materials. C.

Fabric Drying System. British Celanese Ltd. (London), A. Mellor and W. Pool. E.P.470,334 of 6/2/1936: 6/8/1937.

A layer, sheet or web of material containing a volatile liquid is dried in a plurality of stages, in at least the first of which the material is subjected to the action of super-heated vapour of the liquid so as to vaporise liquid from the material, liquid being subsequently recovered from the vapour by condensation, and in at least one other stage, including the final stage, the material is subjected to the action of a gas to complete the removal of the liquid. The method is particularly applicable to the drying of layers or sheets of permeable materials such as fabrics, e.g. fabrics which have been impregnated with a liquid containing a substance dissolved in a volatile solvent, since in this case the drying currents may be caused to pass through the material. Suitable apparatus comprises an endless support, e.g. an endless band of permeable fabric or other material, the support receiving the fabric at one point of its travel and, after passing through a plurality of drying chambers in which the superheated vapour and the gas are circulated through the fabric, delivering it dry or substantially so at another point. C.

Resin Alcohol Sizing and Finishing Agents: Application. Deutsche Hydrierwerke A.-G. (Berlin). E.P.470,424 of 15/2/1936: 16/8/1937.

A process for the sizing, dressing and rendering fast to slipping of yarns and fabrics is characterised by the use of a treating agent comprising one or more alcohols obtained by the reduction of natural resins or resin acids, e.g. copals, dammar resins, abietic acid, colophony or tall-oil resin acids, or deviatives of such alcohols, for instance esters of ethers thereof. Solutions or emulsions of the alcohols, alone or with the addition of softening agents and/or emulsifying agents

are employed. The alcohols, esters or ethers may also be used together with starch paste, glue solution or similar aqueous preparations. C.

Synthetic Resin Impregnated Fabrics: Treatment to Improve Strength. W. J. Tennant, London (Raduner & Co., Horn, Switzerland). E.P.470,948 of 8/10/1936.

The tensile strength of fabrics that have been weakened by treatment with synthetic resins or aldehydes may be improved by treating the fabrics with weak acid solutions or acid salt solutions, the treatment being only carried out to such an extent that the non-creasing or similar effect produced by the resin is substantially retained. Inorganic acids, organic acids, e.g. oxalic or formic acid, or acid salts such as aluminium chloride may be used. Dilute acids are used at temperatures of about 50° C. C.

Roped Fabric Opening Apparatus. J. Dungler (Thann, France). E.P.471,025 of 28/12/1936:26/8/1937.

In apparatus for restoring fabrics in rope form to the open condition of the type in which the roped fabric is led to opening means while being subjected to a positive rotating operation to take out the rope twist, controlling members make contact with the moving fabric rope and are movable by and in accordance with the direction of the twist therein, connections being provided between the controlling members and the means for rotating the fabric rope to control the direction of rotation of the latter for taking out the twist. The controlling means in contact with the fabric rope may consist of grids between which the rope passes, the grids being oscillatable together around the fabric rope by the twist contained in the same. C.

Air-permeable Waterproof Fabrics: Production. F. F. Schwartz and M. A. Chavannes (Paris). E.P.471,231 of 10/11/1936:31/8/1937.

A process for the manufacture of air-permeable waterproof material comprises applying to a woven or knitted fabric a water-insoluble plastic or elastic substance in amount insufficient to close the interstices between the threads of the fabric and thereafter subjecting the coated fabric to mechanical pressure and if desired to heat so as to reduce the size of the interstices of the fabric to a point at which passage of water therethrough is prevented, the fabric still remaining permeable to air. Suitable water-insoluble substances are rubber, waxes and synthetic resins. C.

Textile Materials: Rot-proofing and Waterproofing. National Processes Ltd. (London) and W. J. Carter. E.P.471,415 of 3/12/1935:3/9/1937.

Textile and other porous materials are treated with a normally water-insoluble rot-proofing agent and a normally water-insoluble waterproofing agent, either simultaneously or successively. The rot-proofing agent is applied in the form of a stable suspension or of an aqueous solution formed with the aid of a solubilising agent, e.g. ammonia, and the waterproofing agent is used in the form of a stable suspension in a liquid vehicle, either the same as that of the rot-proofing agent or one capable of holding the rot-proofing agent in stable solution or suspension, a suitable stabiliser or stabilisers for the waterproofing agent being incorporated if required. The liquid vehicle(s) or stabilising medium or both may be removed by volatilisation or neutralisation so that both rot-proofing and waterproofing agents are deposited together on or in the material. The rot-proofing agents may be metallic salts or esters of tar or petroleum acids, complex organic sulphur compounds or sulphur-nitrogen compounds, or water-insoluble organic derivatives of inorganic complex acids. Suitable waterproofing agents include rubber, rubber latex, cellulose esters, polymerised vinyl esters, natural and synthetic resins, wax, bitumen and asphaltic compositions. C.

Vegetable Globular Proteins: Application in Coating and Impregnation of Yarns and Fabrics. W. T. Astbury (Leeds) and A. C. Chibnall (London). E.P.471,591 of 3/3/1936:3/9/1937.

Yarns and fabrics are coated or impregnated by treating with a solution of a vegetable globular protein which has been degenerated and/or denatured, in a suitable solvent, and then coagulating the protein which is in association with the material by means of a suitable precipitant solution, namely a dilute aqueous medium adapted to counteract the dispersive effect of the solvent. The

elasticity and the affinity for acid dyes of cotton yarns and fabrics may be improved by this treatment. C.

Washable Stiffened Fabrics: Production. A. Carpmael, London (I. G. Farbenindustrie A.-G., Frankfort). E.P.471,866 of 10/3/1936: 10/9/1937.

A fabric layer is coated in the presence of water with a solution or emulsion of a polyvinyl ester resin which softens and is capable of sticking together fabric layers at normal ironing temperatures, and the coated fabric is united with other fabric layers by the action of heat and pressure to form the desired semi-stiff article. Suitable polyvinyl ester resins include polyvinyl acetate, mixtures of polyvinyl acetate and polyvinyl chloride, and polymerisates of mixed vinyl acetate and vinyl chloride. C.

5—ANALYSIS, TESTING, GRADING AND DEFECTS

(A)—FIBRES.

Cotton Fibre: Effect of Processing on Strength. F. Ahmad. *Indian Textile J.*, 1937, 47, 364-368.

A general account is given of the effects of processing on cotton quality, recent investigations by Braschler, Underwood, Navkal and Turner, and Colin being cited, and, especially, work at Reutlingen on blowroom processes. The article concludes with the suggestion that spinning should be brought nearer to the field in India and the cleaning operation associated with ginning. C.

Cotton Motes: Cause. M. Afzal. *Indian J. Agric. Sci.*, 1937, 7, 487-495.

The number and position of motes in the locks of the three most important *desi* varieties of cotton, namely, 10 Rosea, 12 Sanguineum and 15 Mollisoni, were determined during 1931 and 1932. The total number of motes in *desi* cottons was far less in comparison with Punjab-American cotton, but the disposition of the motes in the various seed positions was similar. The number of motes was least in the centre of the locks. The number of perfect bolls with three locks was more than three times the number of perfect bolls with four locks. The early and late pickings had a greater number of motes than the middle pickings. It is suggested that by far the most important cause of mote production is the defective nutrition of the developing ovules. C.

Fibroin Fibre: Effect of Micelle Orientation on Properties. C. Matano and T. Ozawa. *J. Soc. Chem. Ind., Japan,* 1937, 40, 174-179B.

Experiments were made on regenerated silk fibres in which the micelles had different degrees of orientation. The results indicate that when the number of micelles having their axes parallel to the fibre axis increases (1) the strength increases, (2) the elongation decreases, (3) the reversible elongation decreases and the irreversible elongation increases, and (4) flow under constant load increases. When mechanical work is done on the fibres for a short period the ultimate strength is practically unchanged even for fibres of low degree of orientation but if work is performed over a long period the ultimate strength is markedly increased, especially when the humidity is high and the degree of orientation of the micelles is low. When the number of micelles having their axes parallel to the fibre axis increases (1) the effect of sorption hysteresis becomes smaller, (2) both the transverse and longitudinal swellings decrease, (3) the sorption velocity of magenta by the fibre decreases, but (4) the sorption and desorption velocities of water vapour by the fibre do not change so markedly as the sorption velocity of magenta. C.

Rayon: Strength in Aqueous Solutions. S. Iwasaki and T. Miyamoto. *J. Soc. Chem. Ind., Japan,* 1937, 40, 163-164B.

The results of determinations of the wet strength and extensibility, the regularity of wet strength and extensibility, and strength-extensibility products of rayon in water, soap, caustic soda, sodium carbonate, and alkaline buffer solutions are shown in tables and graphs and briefly discussed. In all cases the wet strength varied with time of immersion, showing a fall to a minimum value during the first few minutes, then a rise to a maximum after a period of about 30 minutes, and finally a slow fall from this maximum. The other properties also varied in a similar manner with time of immersion. In soap solution the rayon had a lower wet strength but higher extensibility, regularity, etc., than in pure water. In free alkalis the wet strength and related properties decreased with increasing concentration. C.

Regenerated Silk: X-ray Structure. I. Sakurada and Y. Matsushita. *J. Soc. Chem. Ind., Japan,* 1937, **40**, 59B.

A table records the X-ray interferences for degummed silk and silks regenerated from solution in cuprammonium, " copper-alkali," and mixtures of Zn and Ca chlorides. The regenerated silks give the same diagram as native silk, even to the new X_1 and X_2 interferences. This is in contrast with the differences observed between native and regenerated celluloses. C.

Silk Fibroin: X-ray Structure and Elastic Properties. I. Sakurada and Y. Matsushita. *J. Soc. Chem. Ind., Japan,* 1937, **40**, 58-59B.

The X-ray spectrograms of Japanese silks (*Bombyx mori* and two wild species) have been examined. Data are recorded for the raw silk and various degummed products. Two new interferences, X_1 ($d=4\cdot6$ to $4\cdot9$) and X_2 ($d=2\cdot56$) are reported. X_1 corresponds with the interference ascribed by Trogus and Hess to sericin but it does not disappear entirely on degumming. X_2 is a weak meridianal interference, present in all the diagrams. It cannot be fitted to the known fibroin lattice with fibre period of about $7\cdot0$A, the period ascribed to straightened polypeptide chains, and suggests the presence in these silks of other micelles with coiled chains. This would explain the high elasticity of silk. C.

Staple Fibre: Application Problems. A. Jaumann. *Kunstseide,* 1937, **19**, 298-9.

A discussion of difficulties in the substitution of staple fibre yarns for cotton yarns caused by the differences in covering power and in swelling properties of the two types of yarns, the care required in ironing staple fibre fabrics, precautions to be taken to avoid creasing especially in packing, and the distortion of staple fibre-wool mixture fabrics due to the different reactions of the two types of fibres to variations in humidity. C.

Staple Fibres: Breaking Load and Extension. W. Weltzien, H. Biermann and E. Husung. *Monatsh. Seide u. Kunstseide,* 1937, **42**, 302-308.

Breaking load and extension data are given for viscose, cuprammonium and cellulose acetate staple fibres and for casein and glass fibres. The general laws of extension are outlined and the influence of time on the extension produced by a constant load is discussed. The variations in the three quantities, load, extension and time, are shown in three-dimensional models. The models obtained for the rayon staple fibres are intermediate between the two extreme cases of wool and cotton. The models show the effects of applied loads and the changes after removal of the loads. Models obtained at 65 per cent. R.H. and at 60 per cent. R.H. are shown and the effects of humidity are discussed. The elastic after-effect is also discussed. Load-extension curves or isochrones obtained by cutting the models in a direction perpendicular to the time axis are shown for wool, silk and cotton and it is pointed out that the curves obtained in this way show higher extensions than the corresponding load-extension curves given by the usual type of strength testing devices. C.

Staple Fibre: Solubility in Alkalis. H. Christoph. *Kunstseide,* 1937, **19**, 295-8.

The mercerisation of cotton-staple fibre mixtures is briefly discussed and work on the solubility of rayon and staple fibre in alkali hydroxide solutions is reviewed. The results of determinations of the solubility curves at 20° C. of six typical German viscose staple fibre products are discussed. The curves gave a swelling and solubility maximum at 9 per cent. NaOH (about 13° Bé). The amount dissolved at this maximum varied from 5 per cent. to 45 per cent. The nature of the dissolved portion, and the effects of time of ageing of the alkali-cellulose and of stretching during spinning on solubility are discussed. The effects of stretch-spinning on moisture absorption are also briefly discussed. C.

Staple Fibres: Surface Structure. R-O-X Embedding Medium: Application. H. Reumuth, W. Kling and H. Schwerdtner. *Kunstseide,* 1937, **19**, 247-260.

In the R-O-X embedding process, 12 to 15 fibres are stretched across and attached to a rectangular frame made from glass strips which is designed to fit round an ordinary microscope slide. The slide is coated with an R-O-X reagent which after evaporation of the solvent gives an embedding agent having a refractive index as near as possible to that of the fibre. R-O-X reagents of different refractive indices suitable for use with the different fibres are available. The thickness of the coating is such that the fibres are only half immersed in it. After drying, the fibres are cut along the edges of the slide and the latter carrying

lengths of fibre embedded in R-O-X up to half their thickness is transferred to the microscope and observed by transmitted light. In this way it is possible to observe details of the surface structure and obtain photographs in which effects to the back half of the fibre are eliminated. Details of the microscope and photographic arrangements are briefly described. Photo-micrographs (×540) of various staple fibres, including Cuprama, Vistra, Lanusa, Schwarza, Rhodia-Albene, Dravinella Artilana, Lanital, Glanz-Courto, Flox, Sniafiocco, etc., are shown and compared with those of wool and cotton. Photo-micrographs of cross-sections of the fibres are also given and the use of R-O-X as an embedding agent in the preparation of cross-sections is described. C.

Photo-electric Scattered Light Measuring Device. Institute of Paper Chemistry. *Paper Trade J.*, 1937, **105**, *TAPPI*, 129-131.

A photo-electric device is described for measuring (a) the amount of light scattered by small particles such as a single fibre, smoke and dust particles and (b) the surface fuzz of paper. Diagrams of the two adaptions are given. C.

Cellulose Fibres: Detection by Refractive Index. A. Frey-Wyssling. *Mikrochemie, Molisch Festschrift*, pp. 106-117.

Cellulose hydrate has a much lower refractive index than native cellulose and slightly degraded hydro- and oxy-celluloses have slightly higher indices. They can therefore be distinguished by the Becke line method; the fibre, mounted in a liquid medium, shows a bright line which moves to the higher-refractive substance on racking up the microscope tube. The medium can be adjusted until the Becke line disappears and its index measured in a refractometer. Although nitrocellulose and cellulose acetate have lower refractive indices than native cellulose, the test is not so suitable for general distinctions because of possible irregularities in the fibre surface. It reveals unevennness of esterification (or the reverse in saponified material) in a striking manner. C.

Cellulose Fibres: Photometric Quality Test. A. Sakoschtschikow and D. Tumarkin. *Prom. organ. Chimii*, 1936, **2**, 404-412 (through *Chem. Zentr.*, 1937, i, 3089).

The turbidity of solutions of cellulose fibres in sulphuric acid (due to the "transverse elements") is used as a measure of purity. A simple photo-element is employed to determine turbidity and brightness and thus, indirectly, the "whiteness" of the cellulose, which is expressed as an "index" figure. The purest American linters give figures up to 99·6 per cent. It is found that the transparencies of nitrocellulose and cellulose acetate are directly related to the transparency of the parent cellulose. Further, the transparency of linters is indirectly related to the fat content and directly to wettability. C.

Mercerised Cotton: Iodine Adsorption. (1) Garkuscha. (2) K. Schwertassek. *Textilberichte*, 1937, **18**, 622-626, 626.

(1) Tests for mercerised cotton based on measurements of iodine adsorption are discussed and an account is given of investigations of the adsorption of iodine by mercerised and unmercerised cotton yarn from iodine solutions of different concentrations. Details of the procedure are given. The results show that from iodine solutions of concentrations in the neighbourhood of $N/100$ the amounts adsorbed by mercerised and unmercerised cotton are of the same order, whilst from more concentrated solutions the mercerised cotton adsorbs greater amounts and from more dilute solutions smaller amounts than the unmercerised cotton. For testing purposes solutions of concentrations $N/400$-$N/500$ and $N/10$-$N/5$ are recommended. The adsorption of iodine from iodine solutions saturated with Glauber salt, and the influence of the moisture content of the cotton on its iodine adsorption are discussed. Data showing the influence of the concentration of the mercerising alkali and the time of treatment on the adsorption of iodine from $N/10$ and $N/400$ solutions and also the effects of various preliminary treatments are tabulated and discussed. C.

(2) The author discusses the above method of testing mercerised cotton and points out that it is not as sensitive as his own. C.

Rhodia Staple Fibre: Properties. P. Braun. *Textilberichte*, 1937, **18**, 572-573.

A general account is given of the properties and uses of Rhodia staple fibre. This is a cellulose acetate product of 3·7 denier and is particularly useful for mixing with wool. It is delustred in spinning and is crimped. It can be

obtained in several colours. Samples of white and green fibre are given. Mention is also made of Lanalbene, a yarn with wool-like properties and high strength and extensibility. C.

Italian Silk: Properties. G. Colombo and B. Jona. *Boll. uff. R. Staz. sperim. Seta,* 1936, **6**, 61-73 (through *Chem. Zentr.*, 1937, i, 3895).

The volume, weight, degumming loss and properties of silks from Japanese species reared in Italy are recorded in tables. C

Sericin: Detection with Phthalaldehyde. H. Kaneko. *Bull. Sericult. Silk Ind. Japan,* 1937, **9**, 113-4 (through *Chem. Zentr.*, 1937, i, 3895).

Sericin gives with *o*-phthalaldehyde a characteristic violet colour that may be used to detect sericin in degummed silk. The reaction is not shown by silk that has lost 25 per cent. of its weight in degumming. Fibroin A and B obtained by fractional precipitation with ammonium sulphate give a violet, and a scarlet colour, respectively. The scarlet colour of fibroin gives place to a violet colour when the silk is boiled for some time with dilute alkalis. On prolonged boiling with alkali, fibroin almost completely dissolves, the solution containing peptone and polypeptides. The dispersed fibroin in the solution is precipitated by the addition of acids or neutral salts ; it gives the scarlet colour of fibroin B with *o*-phthalaldehyde. C.

Protection of Textile Fibres by the Destruction of Bacteria. A. Foulon. *Deut. Wollen-Gewerbe,* 1937, **69**, 683-684 (through *Chem. Abs.*, 1937, **31**, 5587).

There is no great difference in the resistance of cotton and linen goods to bacterial attack although cotton fabrics have a greater tendency to mould formation. Weft yarns are more easily affected than are warp yarns. Black mould (*Tilletia auranticum*) is the most common variety of mould, grows rapidly and can be removed easily. Red moulds occur less often, have a shorter life period and disappear by themselves. Mildew forms frequently because of the extensive distribution of its spores in air and water. The destructive action of these micro-organisms can be overcome by means of " Raschit " " (R) " (6-chloro-3-hydroxy-1-methylbenzene). The compound is water-soluble and practically neutral. " R " also prevents the decomposition of oils and emulsions used for textile treatments and is applied for such purposes by addition of a solution of 1 kg. " R " in 3 litres alcohol to 500 kg. of the oil or else by direct addition to the oil which had been heated to 70°. The use of " R " in the much more easily decomposed emulsions employed in the textile industry has the advantage of stabilizing these sizes for several weeks. Various operations are reviewed. W.

Effect of Moisture and Heat on Wool. M. Loescher. *Deut. Textilwirtschaft,* 1937, **4**, No. 3, pp. 24-26 (through *Chem. Abs.*, 1937, **31**, 6012).

The penetration of moisture through the cuticular layer of wool fibre increases with temperature and with increased acidity or alkalinity. The cuticular layer softens slightly and yields to the more affected inner parts after they have swollen upon coming in contact with the liquid. The thickness of the woollen fibre may thus be increased 17·5 per cent. ; the swelling is caused by a slight hydrolysis. The same swelling action can be produced by treatment with chlorine which combines with the amino acids. During the washing of worsted fabrics at moderate temperatures and in the absence of tension or pressure the fibres are only slightly affected. Changes will occur if stresses are present ; they are more noticeable with carded yarn than with worsted yarn fabrics. Carded yarn fabrics can be prevented from shrinkage by fixation on a madder machine with hot water and steam. The process is discussed in detail. The change of α-keratin to β-keratin and the reversal of this change are important factors in the behaviour of wool in the processes of finishing and dyeing. These reactions occur at an increased rate during acid felting. Treatment of wool with hot baths and acid results in the solution of a small amount of the protein ; thus the bath is enriched with constituents which are helpful during the later treatment of the wool. W.

Study of Some of the Factors that Alter the Colour and Staple Length of Frosted and Regular Wool. J. H. Kennedy, Jr. *Lowell Textile Inst. Bull.*, 1937, Series 40, No. 4 (through *Text. Res.*, 1937, **7**, 465).

Presents the results of a thesis prepared under the direction of Prof. H. J. Ball of Lowell Textile Institute, the specific objectives being to measure the

colour of frosted and regular wool top, to study the factors that influence the colour difference and to analyse the factors that change the average staple length of top. Conclusions were mainly as follows. Frosted wool top had better colour than regular wool top processed in the same manner. The colour of top, both frosted and regular, varies with the degree of cleanness of the scouring liquor. Four bowls of scouring for frosted wool produce top of better colour than do three or less. The staple lengths of frosted wool and regular wool tops scoured in medium dirty scouring bowls are alike. The staple length of naphtha treated frosted wool is slightly longer than that of naphtha treated regular wool. Under certain conditions the frosted process tends to decrease somewhat the fibre length of top. The wool scouring process appears to have more effect on the length of staple in the top than the frosting process. W.

Microscopical Detection of Viscose Silk Mixed with Cotton and Other Textile Fibres. *Boll. Staz. sperim. Ind. Carta Fibre Tess.*, 1937, **32**, 89-90 (through *Brit. Chem. Abs. B.*, 1937, **56**, 768).

The fibre, after immersion in 6 per cent. caustic soda for 1 minute is treated with a solution of a direct dye and observed under the microscope. Viscose silk is swollen and evenly dyed with marked longitudinal striations. Cotton, even if mercerised, is almost unattacked. Hemp may be dyed, but always unevenly. Cuprammonium silk is dyed like viscose, but is less swollen and lacks the striations. Approximate determination of the viscose content of mixed textiles is possible. The method is not applicable to textiles which have received an anti-crease treatment, owing to the impermeability of the resin, but provides a means of controlling this process. W.

(B)—YARNS

Cotton and Rayon Yarns: Relation between Twist Factor and Take-up. (1) A. T. Wister ; (2) G. R. Merrill. *Cotton (U.S.)*, 1936, **100**, No. 1, p. 81-3 ; 1937, **101**, No. 7, 47.

(1) Data ascribed to the Lowell Textile Institute on the connection between twist factor and per cent. contraction in singles cotton yarn are plotted as a straight line (no points are shown) beginning at 0·4 per cent. contraction for a twist factor of 2 and ending at 14·4 per cent. for T.F. 7·2. The graph is independent of count. (2) This graph is reproduced on a similar one for rayon plotted from data due to the Liberty Throwing Co., New York, for threads varying in denier from 70 to 450 and in twists from 15-80 turns per inch for the fine threads and 15-40, for the coarse threads ; contractions ranged from 1·5 to 36·5 per cent. The denier and twist figures are converted into equivalent cotton counts and twist factors. The rayon curve is not quite a straight line, but is remarkably close to the cotton curve and is independent of denier ; the maximum divergence is at T.F. 5·5 where the contraction for rayon is shown as about 1·5 per cent. more than that for cotton. C.

Rayon Yarns and Fabrics: Crease-resistance. E. Ullrich. *Kunstseide*, 1937, 19, 293-294.

The effects of bending a yarn or fibre are discussed and it is pointed out that the resistance of rayon yarns to creasing increases with increasing twist and that fibres of round cross-section have a higher crease-resistance than fibres of flat section. The crease-resistance of fabrics is influenced by the fabric structure, irregular weaves being more resistant than plain weaves. Stiffened fabrics crease more than fabrics which are free from finishing materials, and thin fabrics more than thick and weft backed fabrics. C.

Cotton Yarns: Strength and "Substance Efficiency." O. Schmidhäuser. *Textilberichte*, 1937, **18**, 567-571.

The influence of the various fibre properties on the characteristics of yarns is discussed and a study is made of the "substance efficiency" of cotton yarns. This quantity is defined as the ratio of the actual yarn strength to the theoretical strength obtained by multiplying the fibre strength by the number of fibres in the yarn cross-section. The values for cotton yarns range from 35 to 50 per cent. Tables showing fibre properties and yarn counts, twists, strengths and substance efficiencies for American, Egyptian and other types of cotton are given. The influence of fibre fineness, yarn twist, and injury of fibres during processing are discussed, and curves are given showing the variations in yarn strengths and substance efficiencies with twist. C.

Textile Testing Nomographs. L. Shapiro and J. M. Durand. *Textile World*, 1937, 87, 1793-1796.

Nomographs for the conversion of moisture content to moisture regain, the conversion of degrees Centigrade to degrees Fahrenheit, the correction of yarn strength to 7 per cent. regain, the correction of fabric strength to 7 per cent. regain, the conversion of yards per pound to ounces per yard, and the conversion of specific gravity to degrees Twaddle and Baumé are given together with notes on their use. C.

(C)—FABRICS

Abrasives: Application in Wear Testing. J. H. Lester. *J. Text. Inst.*, 1937, 28, P209-P210. C.

Aniline-black Dyed Cotton: Baryta Activity Measurement. S. M. Edelstein. *Amer. Dyes. Rept.*, 1937, **26**, 460.

The effect of alkaline treatment on aniline-black material is shewn by the baryta activity numbers obtained on samples of black unmercerised cotton fabric. A 20 per cent. difference was found between the value for the desized material and that desized, boiled in soap and soda ash, boiled in 1 per cent. sodium hydroxide, scoured and rinsed. The first high value is ascribed to the presence of acidic substances in aniline-black dyed material. C.

Dress Fabrics: Serviceability and Cheapening for Clothing. C. M. Whittaker. *J. Text. Inst.*, 1937, 28, P173-P180.

Fabrics: Serviceability. *J. Text. Inst.*, 1937, 28, P240-P249, P250-P263. C.

Fabrics: Tactile Judgment. H. Binns. *J. Text. Inst.*, 1937, 28, P193-P199. C.

Fabrics: Tests for Wearing Qualities. F. T. Peirce. *J. Text. Inst.*, 1937, 28, P181-P192. C.

Fabrics: Test of Liability to Fraying. J. H. Lester. *J. Text. Inst.*, 1937, 28, P210-P211. C.

Underwear Fabrics: Testing Resistance to Abrasion. J. C. Mann. *J. Text. Inst.*, 1937, 28, P220-P222. C.

Fabrics: Testing Serviceability; Consumers' Standards. J. G. Williams. *J. Text. Inst.*, 1937, 28, P225-P232. C.

Knitted Fabrics; Wear Testing. W. Davis. *J. Text. Inst.*, 1937, 28, P215-P217. C.

Organic Polysulphide Resin Impregnated Aircraft Fabric: Permeability to Hydrogen. T. P. Sager. *Ind. Eng. Chem.*, 1937, 29, 747-749.

A closely woven fabric coated with 5·2 ounces per square yard of a compound containing the resin formed by reaction of dichloroethane and sodium polysulphide was found to have a permeability to hydrogen of 0·014 cu. ft. per sq. yd. per 24 hours. A fabric coated with the same weight of a rubber compound would have a permeability about 20 times this value. The polyethylene polysulphide product cannot be dispersed in suitable solvents and has an unpleasant odour. Tests have therefore been made on the disulphide and tetrasulphide derivatives obtained by the reaction between 2:2′- dichloroethyl ether and sodium polysulphide. The permeability values of unsupported films of both the disulphide and tetrasulphide derivatives are much lower than those of corresponding thicknesses of rubber, and those of the tetrasulphide product are consistently lower than those of the disulphide derivative. A closely woven balloon fabric coated with these derivatives had a much lower permeability than the unsupported films. The data show the same relative difference in the permeability of the two derivatives as was obtained in the unsupported films. Curves showing the change in permeability with weight of coating are given. For both derivatives an abrupt increase in permeability occurs with decrease in weight of coating below about 2·6 oz. per sq. yd. Tests on coated fabrics show an average helium permeability/hydrogen permeability ratio of 0·64. The effects of pigments and the mechanism of permeation are briefly discussed. C.

Rayon Crêpe Fabrics: "Blistering" and Yarn Strength. W. J. Hall. *J. Text. Inst.*, 1937, 28, P223-P224. C.

Staple Fibre Wadding and Bandage Mull: Sorptive Power. *Spinner u. Weber,* 1937, **55**, No. 25, 1-2.

Some rough measurements are reported of the amount of water or 10 per cent. glycerin solution held after wringing out by Vistra and cotton mulls and card laps. These are supplemented by measurements of the amount of water held by pieces of cotton fabric and various mixtures of Vistra and cotton. The rate of drying of cotton fabric and a 1:1-mixture is also recorded. The conclusion is drawn that staple fibre is as absorbent as scoured cotton and quite suitable for surgical purposes. C.

"Pralka" Fastness-to-Washing Testing Apparatus. W. Kaczkowski. *Textilberichte,* 1937, **18**, 637-638.

The "Pralka" apparatus for testing the fastness of dyeings to washing, water and perspiration, as recommended by the Polish standardisation commission, comprises a cylindrical vessel provided with a perforated cover and with a thermometer and an outflow tube. Through the centre of the cover passes a shaft carrying two bakelite rings which can be moved up and down at a rate of 60 times a minute in the cylindrical vessel. The latter is surrounded by a water bath. A circular sample of the dyed fabric to be tested is placed between two discs of white fabric and the three layers are held between the two bakelite rings which are pressed together by means of screws. In order to test for fastness to washing, a soap and soda solution is placed in the cylinder and tests are made at different temperatures. After 15 minutes treatment with the liquid the sample is removed and classified according to the transfer of colour to the white samples. These may be of cotton, wool, rayon, silk or linen and in the results it is necessary to state the type against which the tests are made. For testing the fastness to water, the cylinder is filled with distilled water and the effects of treatment for 10 minutes and for 1 hour are determined. Fastness to perspiration is determined by means of a solution of ammonia and salt which is acidified with acetic acid after a certain period of treatment. C.

"Rinso" Wash-testing Laboratories: Organisation. *Textile Weekly,* 1937, **20**, 255, 257.

The methods of testing the shrinkage, colour-fastness and quality of fabrics used in the Rinso wash-testing laboratories in connection with the scheme for the issue of guarantee certificates and identification seals are briefly described. In the testing of Sanforized-shrunk fabrics, fine cuts are made in the fabric 18 in. apart and in different places, warp-way and weft-way and the fabric is treated in the immediate area of the cuts to prevent fraying. After washing, the fabric is then again subjected to the marking device, one end of the 18 in. marker being placed exactly over one of the original cuts. The shrinkage is shown by the difference between the positions of the marks made by the other end of the marker before and after washing. For determining the shrinkage a micro-projector is used and measurement is made by photometric means to one-sixty-fourth of an inch. The percentage shrinkage should not exceed 0·75 per cent. In an ironing test, the iron, electrically heated and thermostatically controlled to a given temperature, is attached to a pantograph, by means of which the same movement of the iron can be given by the expert operator to every piece of fabric tested. In the fastness tests the fabrics (except rayons) are boiled for three hours and are then given a soaking test and a washing test. Quality tests are conducted by methods used in the textile industry and are carried out in a room maintained at 70° F. and 70 per cent. relative humidity. C.

Urine, Sweat and Textile Products. H. Günther. *Deut. Färber-Ztg.,* 1937, **73**, 245-247 (through *Chem. Abs.,* 1937, **31**, 6016).

Various ancient methods of utilizing human and animal urine for dyeing and other treatments of textiles are briefly reviewed. Modern uses of urea in the textile industry are discussed as well as the damage caused in textiles by urine and sweat. The fastness of textiles to sweat is determined by the use of a standard mixture containing common salt, magnesium phosphate, potassium and calcium chlorides and sulphates, butyric, caprylic and propionic acids, urea and several additional compounds. For practical purposes it is sufficient to use common salt, ammonia and acetic acid alternately at about 45°. The reason for the damage caused by sweat in textiles is not accurately known. One of the chief factors is the urea of the sweat which is hydrolyzed into carbon dioxide

and ammonia by bacterial action. Attempts made to increase the acidity of wool by artificial means in order to enable it to neutralize any ammonia that may be formed have been unsuccessful so far. W.

Fabrics: Identification. *Färber Ztg.* (through *TIBA*, 1937, **15**, 127).

The sample is treated with carbon tetrachloride to remove fatty matter and then with a pancreatic enzyme to remove size, etc. Acetate silk is eliminated by solution in acetone, and silk and regenerated cellulose by treatment in an aqueous solution of sulphocyanide of calcium (density 1·20 and 1·36 respectively). The cotton is destroyed by a soluton of aluminium chloride, and the wool dissolved in a boiling 10 per cent. solution of caustic potash. The results should be accurate to 2 per cent. W.

Defects in Papermaking Felts. H. Mendrzyk. *Papier-Fabr.*, 1937, **35**, 125-128 (through *Brit. Chem. Abs. B*, 1937, **56**, 770).

Defects commonly encountered in woollen paper machine felts, arising both from defects inherent in the fibres as well as from damaging conditions of manufacture and use, are described. The extent of alkali damage may be estimated by Allwörden's chlorine water reaction, producing blisters on sound fibres only, or by zinc chloride, which colours the damaged portions brown. The extent of acid attack is shown by the formation of bubbles on the fibres after treatment for 1·5-3 minutes with ammoniacal caustic potash. W.

Transparency of Fabrics. *Irish Text. J.*, 1937, **3**, No. 8, 16.

An apparatus for studying the transparency of fabrics has been designed by the Actinometrical Institute at Slutsk, U.S.S.R. By the aid of this apparatus it is claimed that it will be possible to determine the proportion of the sun's rays reflected from the surface of a fabric and the proportion which passes through it. L.

(D)—MILLING.

Cellulose Acetate Dyes: Fading; Action of Burnt Gas Fumes. F. M. Rowe and K. A. J. Chamberlain. *J. Soc. Dyers and Col.*, 1937, **53**, 268-278.

The chemical reaction between 18 anthraquinone dyes for cellulose acetate rayon and burnt coal gas fumes has been investigated. "Fading" is shewn to occur only when oxides of nitrogen are present. Orange, yellow, and red dyes do not shew fading to any great extent, but blue and violet dyes are very sensitive. Standard laboratory conditions for determining the fastness of dyed cellulose acetate rayon to burnt gas are suggested as important. The dyes can be extracted from the fibre and identified. Treatment of the dyes on the fibre and in substance with gas fumes, and with oxides of nitrogen prepared from acidified sodium nitrite, and with mixtures of oxides of nitrogen, sulphur dioxide and acid gave no products that could be identified in the extract, except in the case of 1-methylaminoanthraquinone (red) when the N-nitrosamine was isolated. This dye is not liable to fading in practice because the acids in the atmosphere prevent the nitrosamine formation, and even if it is formed it is readily re-converted into 1-methylaminoanthraquinone. The primary cause of the attack of the dyes by oxides of nitrogen as shewn by the behaviour of aqueous suspensions of the dyes is diazotisation or N-nitrosamine formation ; there is no evidence of nitramine formation or of oxidation. The behaviour of several of the dyes is described individually. The ease with which the reactions occur varies greatly with the constitution of the dye, and appears to be dependent on its basicity and/or on the protective influence of groups in adjacent positions to the sensitive basic group. Most blue anthraquinonoid dyes can be given some protection by after-treatments of the dyeing with sodium thiosulphate which will absorb oxides of nitrogen preferentially. Constitutions that are likely to prove unaffected by burnt gas fumes in practice are mentioned. Sulphur dioxide alone has little effect on anthraquinone dyeings of cellulose acetate rayon, but it is capable of modifying the action of oxides of nitrogen on the dyes considerably. Thus the action of controlled quantities of sodium nitrite, sodium bisulphite, and sulphuric acid on cellulose acetate rayon dyeings approaches the effect produced by burnt gas fumes. A test based on the use of these reagents is outlined and may be employed as a rapid preliminary method for evaluating the fastness of new dyes to burnt gas fumes, with subsequent confirmation by the use of actual burnt gas fumes. C.

Topped Dyeings: Analysis. J. Lanzer. *Leipz. Monats. Text. Ind.*, 1937, **52**, 141, 167.

Difficulties encountered in the identification of dyes are briefly discussed and classification according to fastness to soap followed by tests for the different groups of dyes is recommended. It is pointed out that dyeings may be topped (a) to produce brighter effects (e.g. direct or sulphur dyeings topped with basic dyes), (b) in order to level uneven dyeings or to improve shades (e.g. vat dyeings topped with direct dyes), or (c) to produce combination dyeings of increased fastness (e.g. indigo dyeings topped with chrome dyes). Procedures for the identification of the dyes used in each of the three types are described. C.

Cellulose and Paper Testing Appliances. K. Berndt. *Zellstoff und Papier*, 1937, **17**, 309-314, 349-352.

The article gives a convenient review with illustrations of various new optical and other instruments used for testing cellulose and paper in the laboratory. C.

Paper: Measurement of Oil Penetration. Institute of Paper Chemistry. *Paper Trade J.*, 1937, **105**, *TAPPI*, 119-122.

An oil film is applied to the specimen by means of a small roller and the sheet is illuminated in contact with opal glass. The light transmitted is measured by a photo-cell (a diagram of the arrangement is shown) and plotted as a function of time. The rate of oil penetration is computed by a formula that depends on the fact that the exponential law of light absorption is obeyed. This is verified experimentally. C.

Paper Smoothness Tester. F. M. Williams. *Paper Trade J.*, 1937, **105**, *TAPPI*, 123-127.

The author has devised a new instrument of the air-flow type for measuring the smoothness of paper, by observing the time in seconds required to pass a given volume of air at a definite pressure between the two folded surfaces of the sample of paper held in contact at a definite pressure upon a definite area. Two vertical concentric cylinders rest on a base, the space between forming a mercury reservoir with a third movable cylinder open at the bottom resting in it. The inside cylinder is connected to the sample clamp and conducts the compressed air to the sample. At the starting position the movable cylinder is raised to a stop above the surface of the mercury, the paper is clamped in position and the middle cylinder focibly pressed down into the mercury, causing the mercury in the outside cylinder to rise. A side tube from the latter contains an adjustable wire contact point. As the air passes through the sample the mercury level is lowered, the end of the contact point is reached and the broken circuit registered by a telechron clock. C.

Paper and Nitrocellulose Films: Permeability to Air. E. Manegold and K. Solf. *Papierfabrikant*, 1937, **35**, *Techn.*, 321-327, 329-336.

The authors give a full discussion of porous systems, classifying materials such as paper and cellulose into (a) those consisting of separate empty spaces in connecting material, (b) those with connecting empty or hollow spaces in connecting material and (c) mixtures of the two. Diagrams explaining the classification are given. The total volume of the empty space in a material consists of three different magnitudes beginning with the spaces between the atoms. For measuring the permeability of material to liquids and gases capillary structure must be taken into account. The properties of a capillary system depend on the thickness of the system, the volume of the capillary space per c.c. and the permeability of the system to water and air. The capillary volume is calculated by formulae from a knowledge of the thickness, measured by a micrometer or, with a very thin membrane, from the surface area, the weight of the membrane saturated with water and the weight when dry. Modifications of the methods for exact determinations using various formulae are given. The permeability of the material to water and air is measured by a darcymeter. Formulae and diagrams are given for two kinds of darcymeter, one for liquids and the other for gases. Tables of values for a large number of papers and nitrocellulose films are provided. C.

Starch: Paper-making Qualities. R. M. Cobb, D. V. Lowe, E. Pohl and W. Weiss. *Paper Trade J.*, 1937, **105**, *TAPPI*, 105-108.

Experiments are described on the formation of sheets of paper in solutions of various starches and on the bursting and folding strengths of the resultant sheets.

The conclusion is drawn that starch acts like a highly hydrated cellulose but that it is intrinsically weaker than cellulose. It enhances the strength of paper by virtue of its power to bind the fibres together. C.

Methods of Determining Oil, Soap and Other Extraneous Matter in Textile Materials. I.—Investigation of the Nature of the Material Obtained by the Extraction of Wool with Ethyl Alcohol. B. A. Ryberg. *Amer. Dyes. Rep.*, 1937, **26**, P461-P467.

An investigation has been made on the alcohol soluble material obtained from wool and on its approximate composition, with the object of developing a new and more accurate method for the determination of soap in wool. Fine Australian wool in top form was prepared as follows: (a) the wool was cleansed from grease, etc., by the solvent method, rinsed in warm water, carded and dry combed, no oil, soap or alkali being used other than those naturally present in virgin wool (lot 1) ; (b) the wool was scoured by the conventional method, using a Red Oil soda soap and sodium carbonate (lot 2). Both lots were carded and combed with the addition of oil, then backwashed with a sulphated alcohol. By modifications of existing methods the two wools were analysed (i) for alcohol and ether soluble fats and greases before and after drying at 105-110° ; (ii) for total organic matter soluble in ether after treatment with hydrochloric acid. The extracts obtained in (ii) were analysed in detail and tabulated results are also given for the complete analysis of the material extracted from the wools with alcohol after a preliminary extraction with alcohol-free ethyl ether. W.

Determination of Light Fastness of Colours and Dyestuffs. R. Toussaint and J. Pinte. *Österr. Chem.-Ztg.*, 1937, **40**, 266-268 (through *Chem. Abs.*, 1937, **31**, 6009).

The samples are subjected to direct sunshine under controlled conditions. The light intensity is measured by a photoelectric cell connected to a recording instrument ; the fading after exposure is measured by a colorimeter, also containing a photoelectric cell. W.

7—LAUNDERING AND DRY CLEANING

(A)—Cleaning.

Machinery Cleaning Cloths: Washing. O. Pennenkamp. *Leipzig. Monats. Text. Ind.*, 1937, **52**, 189.

Washing tests were carried out on cotton cloths for cleaning machines in the unsoiled state and after soiling by use in engineering and printing works and soiling by the application of old oil containing dust, filings, etc. Commercial washing agents and a soap-soda mixture were used. The effects of washing are compared with the effects of chemical purification by means of solvents. The strength of the cloths was not appreciably affected by the mechanical action involved in use and in washing. Loss in strength in chemical purification was less than in the wet washing processes. The two types of treatment appeared to be equally effective in regard to removal of dirt but chemical purification was more effective in the removal of oil. The washing agents left deposits of silicates on the cloth. It is concluded that, in the case of light or medium soiling, chemical purification with solvents is not appreciably better than ordinary washing, but for greater soiling, chemical purification has a more favourable effect on durability and serviceability. C.

Organic Solvents: Recovery. *Spinner u. Weber*, 1937, **55**, No. 27, 9-13.

A general account is given of the use of volatile solvents in the manufacture of rayon and the extraction and dry cleaning of raw fibre and textiles. This is followed by a review of the application of activated charcoal in the recovery of solvent vapours. C.

Shale Oil Soap: Wetting Power. I. R. Kljatchko. *Shurn. prikl. Chimii*, 1936, 9, 1596-1604 (through *Chem. Zentr.*, 1937, i, 4156).

Owing to the difficulty of measuring wetting powers on cellulose, tests have been made on paraffin of about the same dielectric constant (2-2·5). Shale oil soap is much superior to olive oil or curd soap and is relatively indifferent to *p*H. A solution containing 0·2 gm. per l. has exceptional foaming power. The drawback to the use of the soap in textile operations is its dark colour. C.

Soap: Wetting Power. H. L. Cupples. *Ind. Eng. Chem.*, 1937, **29**, 924-926.

The wetting power of a soap solution as measured by its spreading coefficient on mineral oil is closely related to its foam-producing power, dirt-suspending power and efficiency as a detergent and depends on the *p*H value of the solution. The present paper extends previous work to the following fatty acids: *n*-caproic, *n*-caprylic, *n*-capric, lauric, myristic, and palmitic. Experiments were carried out on the surface tension, interfacial tension and spreading coefficient on mineral oil of solutions of sodium hydroxide with the fatty acid. The surface tension decreased with increasing molecular weight of the fatty acid. Palmitate, myristate, laurate and *n*-caprate formed one group and *n*-caprylate and *n*-caproate another, although the two latter were more widely separated from each other than the members of the first group. C.

Soap Solutions; Influence of *p*H on Adhesional Wetting by ——. J. Powney and H. F. Frost. *J. Text. Inst.*, 1937, **28**, T237-T254.

Detergents: Activity. P. A. Rehbinder. *Zentr. wiss. Forsch. Inst. Fett. Ind. Unters. Physikochem. Waschwirk.* [U.S.S.R.], 1935, 5-34 (through *Chem. Zentr.*, 1937, i, 2702-4).

All detergents are classified into (1) surface-active materials (e.g. soaps) and (2) solid emulsifying agents (e.g. clay) that depend on selective wetting (flotation) in the water/oil system. The physico-chemical basis of detergent action is discussed in the light of modern work by the author and Russian colleagues. (See following abstracts.) C.

Soaps: Surface Activity. J. K. Wenstrem and A. B. Taubman. *Zentr. wiss. Forsch. Inst. Fett. Ind. Unters. Physikochem. Waschwirk.* [U.S.S.R.], 1935, 35-48 (through *Chem. Zentr.*, 1937, 1, 2704).

The surface tension of Na oleate, stearate and palmitate solutions has been measured by the maximum bubble pressure method. The surface activity increases with temperature. At 40°, oleate has the greatest activity, followed by palmitate and then stearate. At 60° the usual dependence of activity on chain length is observed (stearate>oleate>palmitate). On ageing, oleate and stearate solutions show a rise of activity to a maximum, followed by a fall. C.

Soaps: Colloid Properties. N. N. Petrowa. *Zentr. wiss. Forsch. Inst. Fett. Ind. Unters. Physikochem. Waschwirk.* [U.S.S.R.], 1935, 49-66 (through *Chem. Zentr.*, 1937, i, 2704).

The surface activity, and foaming and emulsifying power have been determined at 20° and 60° on soaps from (a) lard, (b) linseed oil, (c) hard fat, (d) fatty acids obtained by oxidising hydrocarbons, (e) naphthenic acids and (f) colophony. Various comparisons between the soaps are described in detail and the effect of additions of soda on the colloid properties is reported. Judged by their ability to lower the surface tension of water the soaps can be arranged in the order b>a>c>d>e>f. The soaps also differ in respect to the concentration at which the surface tension is lowest ; for (a), (b) and (c) this is 0·06 per cent., and for (d) 0·125 per cent. C.

Soaps: Flotation and Peptising Power. N. N. Sserb-Sserbina and G. W. Sacharowa. *Zentr. wiss. Forsch. Inst. Fett. Ind. Unters. Physikochem. Waschwirk.* [U.S.S.R.], 1935, 67-92 (through *Chem. Zentr.*, 1937, i, 2704-5).

In small concentrations soap solutions effect flotation of graphite suspensions in benzene, but more concentrated solutions cause peptisation. The optimum concentrations are: Na oleate, 0·05 per cent. for flotation, 0·4 per cent. for peptisation ; technical soaps, 0·05-0·1 per cent. and 0·5-1 per cent., respectively. With clay (hydrophilic) there is not a clear break between flotation and peptisation ; the optimum concentrations are 0·1 and 0·2 per cent., respectively. The rôle of flotation in detergent action is discussed. C.

Soaps: Surface Activity and Foaming Power. N. N. Petrowa. *Zentr. wiss. Forsch. Inst. Fett. Ind. Unters. Physikochem. Waschwirk.* [U.S.S.R.], 1935, 93-115 (through *Chem. Zentr.*, 1937, i, 2705).

The foaming power and surface tension of curd, coconut oil and castor oil soaps have been measured at various concentrations. The foaming power rises to a maximum with increasing concentration, the curve resembling an adsorption curve. For castor oil soap the maximum is at 0·25 per cent. The *p*H has a strong effect ; the maximum is at *p*H 9·6—10·3. C.

Soaps: Emulsifying Power. N. M. Smirnow. *Zentr. wiss. Forsch. Inst. Fett. Ind. Unters. Physikochem. Waschwirk.* [U.S.S.R.], 1935, 116-125 (through *Chem. Zentr.*, 1937, i, 2706).

Experiments are described on phase reversal in benzene emulsions stabilised by soap, the formation of a persistent foam being taken as the criterion of reversal. The emulsifying power is greatest for castor oil soap, followed by Na oleate and coconut oil soap ; this is the reverse of the order for foaming power. China clay stabilises oil-in-water emulsions but not water-in-oil. C.

Soap Mixtures: Surface Activity. N. N. Petrowa and A. M. Wjasnikowa. *Zentr. wiss. Forsch. Inst. Fett. Ind. Unters. Physikochem. Waschwirk.* [U.S.S.R.], 1935, 126-137 (through *Chem. Zentr.*, 1937, i, 2706).

The surface tension, foaming power and emulsifying power of soaps from hard fat, sunflower oil, colophony and naphthenic acid and their binary mixtures have been measured in concentrations of 0·015-0·25 per cent., at 20, 40 and 60° C. The addition of the optimum amount of resin soap to a solution of hard-fat soap causes an increase in molecular activity in the range of soap concentrations 0·1-0·125 per cent., that is, so long as the adsorption layers of the hard soap are not saturated. The higher the concentration of hard soap, the lower is the amount of resin soap required to produce the maximum effect. In concentrations of 0·13-0·2 per cent. hard soap, the same quantities of resin soap have a de-activating effect. The activation due to the second component in a mixture is greater at 40° than at 20° but ceases altogether at 80°, the activity of the mixture then becoming that of the more active component. C.

Reactions of Three All-wool Blanket Fabrics to Three Types of Laundering. R. E. Elmquist and M. B. Hays. *Amer. Dyes. Rep.*, 1937, **26**, 469-476.

Three blanket fabrics made from different blends of wool were laundered by three procedures and tested at intervals for changes in physical and chemical properties. In general, both repeated laundering and wear plus laundering caused a decrease in strength, air permeability, sulphur and nitrogen contents and resistance to bacterial attack, and an increase in weight per square yard, thickness, thread count, moisture and ash contents, methylene blue absorption and scale breakage. Process A using the cotton rib-washer was more damaging than Process C using the Y-pocket machine, and the latter was more damaging than the squeeze-roll Process B. Every physical and chemical test for measuring deterioration showed that wear plus laundering caused more damage than merely repeated laundering. Shrinkage was found to be dependent on the fineness of the wool as well as on the laundry procedure. W.

PATENT

Ironing Appliance Temperature Regulating Mechanism. British Launderers' Research Association and H. W. Richards. E.P.470,831 of 22/2/1936: 23/8/1937.

An electrically heated or gas heated iron has a heat-regulating mechanism which is constructed or provided with means so as to compensate wholly or partially or to over-compensate for the difference between the temperature to which the heat-regulating mechanism is subjected and that of the working surface of the iron, and so that the compensation operates with a time lag which is considerably greater than the time lag of the heat regulating mechanism. According to one embodiment of the invention the temperature regulating mechanism may contain two elements of different materials of which one has a considerably greater coefficient of thermal expansion than the other. The element having the greater coefficient of thermal expansion is conveniently the sole of the iron, whilst the other element is made of a material having a small but not negligible effective coefficient of thermal expansion. The difference in the thermal expansion between the two elements is utilised, with or without mechanical magnification, to control the amount of heat supplied to the iron. In another embodiment of the invention the heat regulating mechanism may consist of two elements of different materials of which one has a considerably greater coefficient of thermal expansion than the other, whilst the compensation is effected by providing a subsidiary thermostatic element of bimetallic or other known type which is disposed in some part of the temperature regulating mechanism which is not in close proximity to the working surface of the iron. C.

8—BUILDINGS AND ENGINEERING

(A)—Construction of Buildings

Synthetic Resins: Use in the Construction of Textile Plant. *Textile Manufacturer,* 1937, **63**, 321-322.

The use of synthetic resins for the construction of textile plant is discussed and their advantages for this purpose are pointed out. Haveg, which consists of asbestos fibres embedded in synthetic resin, is used for the construction of containers, hank frames, winches and dye vats. Heating and cooling coils and steam jet pipes may be constructed of the usual metals and then coated externally with Silasit, a synthetic resin material of high heat conductivity. A closed type of dye vessel reduces steam consumption but closed vessels of wood have been found to deteriorate rapidly. This difficulty is avoided by the use of closed dye vessels made of synthetic resin and because of the low heat conductivity of the synthetic product a bigger steam saving is effected than is possible with wooden construction. The results of tests in a wool dyehouse show that, compared with an open vessel, a closed vessel gives a saving of approximately 21 per cent. when bringing to the boil, and about 51 per cent. for maintaining at boiling point. Synthetic resin material is also used in the construction of scouring and milling machines, jiggers, etc. C.

(C)—Steam Raising and Power Supply.

Boiler Compound Feeding Service. J. L. Smith. *Ind. Eng. Chem., Anal. Ed.,* 1937, **9**, 330.

A diagram is given of a feeding device for adding boiler compound at steady rates to boiler feed water. It maintains constant head and weight by floating the intake end of the delivery tube. C.

Steam Turbines: Application for Rope and Belt Driving. *Textile Weekly,* 1937, **20**, 269.

The advantages of steam turbines for textile mills are pointed out and typical installations are briefly described. In one case a 600 kw. condensing steam turbine, running at 6,000 r.p.m., with steam at 170 lb. per sq. in., and 500° F. with vacuum of 28½ in. mercury is operating a 300 kw. alternator and the rest of the power is used for driving the mill by ropes. In another case a 2,000 h.p. condensing turbine is driving a mill by ropes, operating the main driving pulley through reduction gearing, the whole installation having been erected on the foundations of an old compound beam engine. In the " Hick Hargreaves " turbine the vital parts can be opened up separately and examined during the week-end. Each turbine disc wheel is separately mounted on the shaft, a pair of mounting rings being employed to allow ample clearance between each disc. A two-spring centrifugal governor is installed with double beat governor valves, along with an auxiliary governor to prevent over-speeding. C.

Black Smoke Prevention. D. Brownlie. *Irish Text. J.,* 1937, **3**, No. 9, 9.

Discusses the methods to adopt in the operation of steam boiler plant for the prevention of black smoke. Reference is made to a new type " Turbine " forced draught furnace, suitable for any type of boiler, and operated by hand or mechanical stoking (on the sprinkler principle). L.

(D)—Power Transmission.

Cotton Spinning Machinery: Driving; Power Required. J. Wiernsberger. *Rev. Fil. et Tissage,* 1937, **22**, 151-5, 204-7, 252-7.

A general theoretical discussion of the power distribution in a mill and the main, group and individual systems of driving. Estimates are given of the horse power required for openers, scutchers, cards, drawframes, combers, speed frames, mules and ring frames. C.

" Gyral " Variable-speed Reduction Gear. Gyral Gears Ltd. *Engineering,* 1937, **144**, 277-279.

A detailed description with section drawings is given of a variable-speed gear that consists of two main elements, a differential set of bevel wheels and a device for providing a gradual and positive acceleration of the speed of rotation of one of the two driving wheels of the differential gear. Both parts are simultaneously driven by the same input shaft, which is in line with the output shaft. The controlling mechanism can be manipulated in various ways. One illustration

shows a gear with handwheel control and pointer moving over a graduated scale. Another shows a gear with a control lever moving over a notched quadrant. C.

(F)—LIGHTING.

Artificial Daylight: Colour Correction. A. R. Pearson. *Light and Lighting,* 1937, **30**, 192-194.

The differences between sunlight, electric light and gaslight are illustrated by means of spectral energy curves. Correction by filtration or selective reflection entails a loss of efficiency. Blue glass electric bulbs are classified into three groups according to their degree of correction. Spectral distribution curves of the average of each group are given, compared with the curve for sunlight. Gas mantles can be corrected by reducing the ceria content and further by using reflecting shades coloured a suitable blue combined with pale blue glass globes. A table is presented that summarises the experimental data discussed. It gives the spectral energy value of the various units reduced in each case to an arbitrary scale of 100 at wave length $0{\cdot}57\mu$. All the values are the results of comparison against a standard acetylene flame by means of a Hilger-Nutting spectrophotometer. C.

Cloth Inspection Room: Lighting. W. Kircher. *V.D.E. Fachber.,* 1936, **8**, 118-120 (through *Physikal. Ber.*, 1937, **18**, 1493).

The author discusses the lighting of places for the inspection of metallic objects and textiles. For cloth inspection he recommends sodium vapour lamps ; the contrast between correct cloth and defects is about nine times as great as under ordinary filament lamps. C.

Workshops: Lighting. Technical Committee of the Illuminating Engineering Society. *Trans. Illum. Engng. Soc.*, 1937, **2**, 123-125.

A comprehensive table of recommended illuminating values in foot-candles is given for various kinds of work. No specific reference is made to spinning or weaving, but for cloth cutting, inspecting and sewing the recommendations are 15-25 foot-candles for dark goods and 8-15 for light goods. C.

(G)—HEATING, VENTILATION AND HUMIDIFICATION

Dust: Measurement. H. B. Meller and F. F. Rupert. *J. Applied Physics,* 1937, **8**, 473-478.

A general review of the " physics of air hygiene," including methods for making dust counts. The Greenburg-Smith impinger, the Owens jet dust counter and the Bausch and Lomb dust counter are described. C.

Humidity Measuring Apparatus. A. Kufferath. *Leipz. Monats. Text. Ind.*, 1937, **52**, 205-206.

A device for measuring the humidity of the air in textile mills is described in which electrical resistance thermometers are used. A container for water is placed near the centre of a ring-shaped casting and above this container is placed the wet thermometer which is covered with cotton which dips into the water. Below the water container are placed two dry thermometers and, by means of a small fan driven by a motor, air is caused to pass over the dry thermometers and then over the wet thermometer. This apparatus may be arranged to operate suitable indicating and recording devices and to control air conditioning installations. A pocket device for measuring relative humidity, the Hygrotherm, is provided with a bi-metal thermometer and with a membrane impregnated with a chemical substance which changes its colour with change in humidity. The colour change is converted to a change in brightness by means of a filter and comparison with a grey scale gives the moisture content of the air directly. From this value and the temperature it is possible to obtain the dew point from tables supplied with the device. C.

Thermo-couple Psychrometer. J. S. Cammerer. *Messtechnik,* 1937, **13**, 21-23 (through *Physikal. Ber.*, 1937, **18**, 1540).

A sensitive psychrometer comprising thin thermo-couple wires is described that records, even in still air, the correct psychrometric temperature difference. With several of these in series it is possible to use a robust millivoltameter and thus have a portable apparatus that can be used, for example, in the study of the " sweating " of walls. C.

Air Conditioning Plant: Thermodynamic Principles. E. Altenkirch. *Z. ges. Kälte Ind.*, 1937, 44, 110-116 (through *Sci. Abstr.*, 1937, B.40, 477).

The author considers that the essential air-conditioning operations may be achieved by means of practically reversible open cycles involving interchanging of heat and material but not mechanical work. Processes based on the absorption of moisture by hygroscopic materials and other means, and the cooling of air by a cold multiplier are described in detail. C.

Air Conditioning Systems. *Spinner u. Weber*, 1937, 55, No. 35, 17-18.

Air conditioning systems for textile mills are discussed and the general principles of construction are described. A diagram of a system working on the dew point method is given. C.

Domestic Insects and Atmospheric Humidity. P. A. Buxton. *Inst. Heat. Vent. Eng. J.*, 1937, 5, 80-81 (through *Building Sci. Abs.*, 1937, 10, 256).

The bed-bug (*Cimex lectularius*) in common with certain insects, possess great power of reducing water-loss from its body and is more or less indifferent to atmospheric humidity conditions. Adult fleas can also survive over a wide range of humidity, but the larvae can exist only in air in which the humidity is very high. It is suggested that a reduction of humidity in warehouses, either by utilising solar radiation in a suitable climate, or by artificial air conditioning, would tend to reduce infestation by moths and beetles which do much harm to many stored products. W.

Humidity Measurements at Temperatures Below 0° C. H. Ebert. *Zeits. f. ges. Kälte-Ind.*, 1937, 44, 127-132 (through *Sci. Abs. B.*, 1937, 40, 559).

A review of methods employed for the measurement of humidity at low temperatures in which a comparison is made of the results obtained by means of psychrometric, dew-point and absorption methods. The differences are appreciable and need for further work is indicated. Preference is given to the psychrometric and dew-point methods. Data which exist as to the performance of hair hygrometers at low temperatures are also somewhat conflicting. W.

(H)—Water Purification.

Boiler Feed Water: Purification. P. Hamer. *J. Soc. Dyers and Col.*, 1937, 53, 265-268.

Natural water supplies are classified into river and surface, well, and moor-land waters. Each group has characteristic properties which, together with the difficulties that may be caused in boilers, pipes, etc., are briefly described, especially those due to suspended substances and colouring matters, iron, and hardness. Methods of overcoming these difficulties are described for each class separately. Colloidal suspension may be removed by cataphoresis, by adding ions of opposite charge to neutralise the particle charge, or by adding an oppositely charged colloid. Aluminium sulphate plus alkali is frequently used in this connection ; when the former is used alone the temporary hardness of the water should be sufficient to precipitate the aluminium. Lately, more successful results have been obtained with sodium aluminate plus aluminium sulphate. Iron in solution can be separated by aeration or filtration through minerals of the type of Polarite and Birm. C.

(I)—Waste Disposal

Effect of Trade Wastes on High- and Low-temperature Digestion. W. Rudolfs. *Ind. Eng. Chem.*, 1937, 29, 803-804.

The effect of the addition of organic trade wastes on the transformation of putrefactive organic solids by bacterial action to gases and odourless, well-draining residues is discussed. Addition of 10 per cent. by volume of wool scouring waste had only a slight effect on digestion, although some retardation was apparent. With 20 per cent. addition, the digestion time was increased about 25 per cent. W.

Patents.

Conversion Product of Wool Fat. H. Cohn and C. Siebert. G.P.647,451 of 5/7/1937 (through *Chem. Abs.*, 1937, 31, 6825).

Wool fat is saponified at atmospheric temperature with a mixture of alcoholic KOH and petroleum ether, and the solution obtained is separated from insoluble substances and treated with water, whereby a new conversion product of wool is precipitated. The product swells in water, and is useful as a constituent of pharmaceutical or cosmetic salves and creams. W.

Dust Separator. N. V. Machinefabrick " Jaffa " v/h Louis Smulders and Co. (Utrecht, The Netherlands). E.P.471,843 of 23/1/1937: 13/9/1937.

A process for separating dust or other solid particles from a gas, in which the dusty gas is put in rotatory movement by means of a rotatory separating member and the purified gas is removed through apertures provided in the rotatory member, is characterised in that the removal of the gas is interrupted by closing the apertures when the speed of rotation approaches or attains a value at which the solid particles are able to reach the circumference of the separating member. A suitable device comprises a drum adapted to rotate within a container for the fluid to be purified and having apertures at its circumference, the apertures being provided or not with pivotably mounted blades or flaps and adapted to admit the purified fluid into the drum from which it is removed by means of an exhauster, a pump or the equivalent. A regulating device is provided which closes the apertures, e.g. by moving the blades or flaps or sliding lids, when the speed of rotation of the drum approaches or attains the value in question. The drum may be driven by means of a freewheel clutch, in such a manner that, when the drive ceases the speed of the member or drum decreases less rapidly than the speed of the prime mover and especially less rapidly than that of the means removing the fluid from the rotatory zone. The freewheel clutch may be combined with a brake device for the exhauster or pump. C.

9—PURE SCIENCE

Photo-electric Lustre Photometer. H. Ransom and S. M. Edelstein. *Amer. Dyes. Rept.*, 1937, **26**, 432-437.

A wiring plan is given of an arrangement for illuminating a sample at any angle by a parallel beam from a tungsten filament lamp and receiving the light reflected at 45° in a photo-electric cell. A second cell receives light direct from the source and the two currents are balanced by means of a potentiometer. Fabrics are mounted on small cards and yarns are wrapped by a special device on cards. Typical curves of angle of incidence against intensity of reflected light are reproduced for mercerised yarns, plain and mercerised fabrics, and dyed yarns. The method is acknowledged to be less satisfactory than visual inspection for fabrics. C.

Citric Acid Forming Moulds: Staling and Regeneration. T. Chrzaszcz and M. Zakomorny. *Biochem. Z.*, 1937, **291**, 312-324.

The authors have frequently observed that strains of *A. niger* that are characterised by their capacity for producing citric acid from sugar, become " degenerate " in repeated culture, so that the citric acid yield fluctuates widely, and as it falls the production of oxalic acid increases. Similar experiences of other workers are discussed and the possibility of regenerating a stale culture is systematically investigated. It is shown that repeated culture on malt wort containing peptone will completely restore the power to produce citric acid. Strains that are not good acid-producers normally, however, cannot be altered by culture. C.

Potato Starch Paste: Hydrolysis by Malt Amylase at Different Temperatures. J. L. Baker, and H. F. E. Hulton. *J. Inst. Brewing*, 1937, **43**, 301-307.

A series of samples of potato-starch paste have been hydrolysed with precipitated malt amylase for 1 and 12 hours respectively at 15·5, 50, 65, and 74° C., and the products analysed. The results are summarised in a table. Maltose and probably one dextrin only are produced as the sole ultimate products at any temperature up to 50° C. and the whole of the " apparent maltose " is fermentable by yeast. Only part of the apparent maltose found in digestions made at above 50° C. is fermentable by pure yeast and there is evidence of the presence of malto-dextrin. This malto-dextrin formation and survival in starch conversion products therefore depends on the temperature of the conversion ; it is nil at 50°, definite at 65°, and very marked at 74°, where only 50 per cent. of the apparent maltose is free, fermentable maltose. This is attributed to the restriction of the saccharifying amylase at higher temperatures. Malto-dextrin is probably an intermediate compound formed in starch hydrolysis at all temperatures, but at 15·5° and 50° C. it is hydrolysed to maltose by the unrestricted enzyme, and thus cannot be detected in the final products. C.

Starches: Action of α-Malt-amylase. M. Samec. *Z. physiol. Chem.*, 1937, **248**, 117-128.

Amylo-amyloses, Lintner starch, erythroamyloses, and amylodextrin (Meyer), have been prepared from potato starch, and hydrolysed by means of α-malt-amylase, the reaction being followed by measurements of reducing power, by the iodine test and by observations of the enzymatic coagulation. The amylo substances gave a much greater yield of sugar in the early stage than erythro substances ; with β-amylase the reverse is the case. The richer the starch product is in erythro substances the lower is the degree of saccharification at which the reaction is arrested. The same applies to the length to which saccharification proceeds. C.

Starch: Zymolysis with β-Amylase. A. Tychowski. *Biochem. Z.*, 1937, **291**, 247-253.

Potato starch, raw or the Lintner modification, is scarcely attacked by (α + β)- or β-amylase at room temperature. Starch paste is attacked by β-amylase, the viscosity falling very slowly but the reducing power, due to maltose, rising rapidly ; after 18 hours it corresponds with about 60 per cent. conversion to maltose and after 30 days to about 81 per cent. Thus β-amylase rapidly digests the amylose, leaving amylopectin, and this appears to suffer some hydrolysis after prolonged action. The results indicate a ratio of 58 amylose to 42 amylopectin in potato starch. C.

Taka-amylase: Purification and Activity. T. Kitano. *J. Soc. Chem. Ind., Japan*, 1937, **40**, 37-43B.

Taka-amylase has been obtained free from maltase, saccharase, and protease by the adsorption method. The hydrolysis of starch with the enzyme at varying *p*H, temperature, and enzyme concentration has been examined and *p*H optima are tabulated. The relationship has been traced between the hydrolysis and the colour given by iodine ; blue is passed at an early stage. The end product is maltose. The hydrolysis is a uni-molecular reaction until saccharification has reached about 75 per cent. and thereafter proceeds very slowly. The rate of hydrolysis and the velocity constants have been measured for the purified taka-amylase, takadiastase, and takamaltase. C.

Starch Dehydrogenase: Occurrence. T. Thunberg. *Skand. Arch. Physiol.*, 1937, **75**, 259-267 (through *Bot. Zbl.*, 1937, **171**, 356).

Cucumber seed contains an enzyme that is capable of the direct oxidative degradation of raw starch. It acts in the presence of phlorrhizin, which is a specific poison to phosphatase, and is not stimulated by Mg, which is thought to promote the splitting off of phosphorus. C.

Benzylcellulose: Production. H. Saegusa and Y. Nakayama. *J. Soc. Chem., Ind., Japan*, 1937, **40**, 63-64B.

The authors have studied the influence of alkali concentration in the preliminary steeping, the temperature, ratio of benzyl chloride and addition of agents like aniline in the production of benzylcellulose. Best results were obtained with about 17 per cent. alkali at 100-110° C., and benzyl chloride about 10 times the weight of the cellulose. C.

Cellulose: Nitration; Thermodynamics. I. Kagawa. *J. Soc. Chem. Ind., Japan*, 1937, **40**, 151-153B.

Experimental evidence is given in support of the theoretical deduction that for all nitrating acids in equilibrium with nitrocellulose of the same N- content the ratios of the activity (or partial pressure) of the nitric acid and the water should be the same. By applying Mass Action considerations to the data it is deduced that nitrocellulose can be regarded thermodynamically as an ideal solution of NO_3,OH and a cellulosic residue. It follows further, that the specific gravity and heat of formation should be linearly related to N- content, which has previously been established experimentally. C.

Cellulose Acetate Mixtures: Solubility. M. Taniguchi and I. Sakurada. *J. Soc. Chem. Ind., Japan*, 1937, **40**, 119-120B.

Some examples of the effect of one " soluble " component of a mixture on the solubility of another " insoluble " component are discussed. (1) The solubility (per cent. of the solid dissolved) of a 1 : 1 mixture of cellulose triacetate and cellodextrin acetate (obtained by precipitation from chloroform solution) and also

of the components is recorded for a series of mixtures of chloroform and benzene (50-87 per cent. of chloroform). Up to about 74 per cent. of chloroform the solubility of the mixture is less than that indicated by the mixture rule but with 80 per cent. of chloroform the solubility is complete instead of only 64·9 per cent. (2) The solubility of cellulose triacetate alone in similar mixtures of chloroform and benzene is recorded, and the effect of 0·5 per cent. of cellodextrin acetate in the chloroform component is studied ; there is a slight increase of solubility due to this addition. (3) The solubility of films of primary and secondary cellulose acetates and of mixtures (prepared from solutions in methyl formate) is recorded for acetone, methyl acetate, chloroform and tetrachloroethane. A mixture of 71 parts of the primary acetate (soluble in acetone and methyl acetate) to 29 parts of the secondary acetate (soluble in the chlorinated solvents) is completely soluble in all the solvents. C.

Cellulose Fibres; Action of Liquid Ammonia on ——. K. Hess and J. Gundermann. *Ber. Dtsch. Chem. Ges.*, 1937, **70**, 1788-1799.

It is shewn that treatment of cellulose fibres with liquid ammonia yields two addition compounds, the formation of which is dependent upon temperature. Between $-20°$ and $-30°$ they can be reversibly inter-converted. The compound stable at the lower temperature, NH_3-cellulose-II, possesses a fibre period of $15·20A = 3 \times 5·05A$, and trigonal symmetry. The fibre axis is probably trigonal-spiral. The dimensions of the usual hexagonal elementary cell are $a = c = 14·50A$, $b = 14·20A$ (fibre axis), $\beta = 60$. The probable composition is $C_6H_{10}O_5(NH_3)_6$. The form stable at higher temperatures possesses a fibre period of $10·30 = 2 \times 5·15A$. A reliable Röntgen diagram of this compound has not yet been obtained, and the evidence does not allow of a decision as to whether the two compounds are enantiotropic. When the ammonia compounds are decomposed a new modification of cellulose is formed, known as cellulose III. Its Röntgen diagram is similar to that of cellulose hydrate, and possesses the same fibre period as native cellulose and cellulose hydrate, namely 10·3A. It differs from cellulose hydrate in that, on treatment with water at high temperature (about 200°) it is converted to native cellulose ; a modification that is unstable compared with native cellulose is also formed. These interconversions are almost exactly repeated in native and mercerised cellulose fibres, and this makes possible a change of cellulose hydrate to native cellulose by way of cellulose III, in a circuit which has not been before observed. The results obtained are compared with previous observations. C.

Fibrous Acetone-soluble Cellulose Triacetate: X-ray Structure and Film Strength. I. Sakurada and I. Watanabe. *J. Soc. Chem. Ind., Japan*, 1937, **40**, 60-61B.

A form of cellulose triacetate that is fibrous but soluble in acetone has been prepared. It gives a sharp X-ray picture with the same interferences as the ordinary fibrous triacetate, but whereas the ordinary powdery or fibrous triacetates form brittle films the new product resembles " Cellite " in forming strong, elastic films. C.

" Hydrate " Cellulose: Conversion into Native Cellulose. K. H. Meyer and N. P. Badenhuizen. *Nature*, 1937, **140**, 281.

Regenerated cellulose with the space lattice $a = 8·14A$, $b = 10·3A$, $c = 9·14A$, $\beta = 62°$, is converted into native cellulose with $a = 8·35A$, $b = 10·3A$, $c = 7·9A$, $\beta = 84°$, by heating, especially with polar solvents. The change has been observed by (1) heating Lilienfeld stretch-spun viscose rayon with water at 200° C. for half-an-hour, (2) boiling viscose rayon with formamide, (3) similar treatments on mercerised ramie, though not to the same extent, (4) heating dry viscose rayon at 300° C., the effect being slight. Alkali-cellulose is partially converted into native cellulose by the action of water at 60° C., and almost completely by the action of formamide at 140° C. C.

Hydrocelluloses: Preparation and Properties. H. Staudinger and M. Sorkin. *Ber. Dtsch. Chem. Ges.*, 1937, **70**, 1565-1577.

The effect of acids of various strengths on purified cotton of polymerisation grade (p.g.) 1,650 has been investigated. After times of treatment varying from 1 to 1,226 hours the viscosities of the hydrocelluloses were measured and the values of p.g. deduced. The results are tabulated for water, sodium bisulphite

and bisulphate, and *N*-solutions of hydrochloric, boric, acetic, formic, phosphoric, sulphuric, and nitric acids at 53° C. Change of p.g. plotted against time shews rapid degradation at first which then slows down and comes almost to a standstill. Strong acids effect the greatest decrease in p.g., but the number of broken bonds of cellulose is not much increased by duration of length of the treatment. Thus the effect on cellulose of *N*-hydrochloric or nitric acids at 53° comes to a standstill after 120 hours, and the p.g. is then 150-200. Only 10 bonds in the long cellulose chain have been broken (this takes into account only the solid products for some of the cellulose goes into solution in the acid). The changes in breaking strength, bending strength (Franz), and extensibility with decreasing p.g. have also been examined. The results obtained shew similar curves for the three quantities when p.g. is plotted against log. breaking load, bending strength and extensibility. Very little decrease in mechanical properties is observed till the p.g. sinks below 600. This applies also to rayon ; thus in producing rayon the p.g. of the cellulose should be greater than 500, but need not be as great as that of natural fibres. Only the breaking load is significantly improved with increase of p.g. Since the mechanical properties are conditioned by the length and arrangement of the macromolecules a decrease can be related to the number of " gaps " between the fibre molecules. The " gap number, (" Lückenzahl ") is greater the shorter the macromolecules, and inversely proportional to the p.g. " Gap number " and p.g. have been plotted against bending strength, extensibility, and log. breaking load. The viscosity of solutions of hydrocellulose, p.g. 80-470, in cuprammonium, 2·8 *N* sodium hydroxide and 2·5 *N* lithium hydroxide has been measured. When the results are compared with viscosities of cellulose solutions of equal concentration, products of the same p.g. shew the same ratio of viscosities in all three solvents. Thus the state of the cellulose in solution is the same in each case, and, since cellulose is molecularly dissolved in cuprammonium the same must apply to alkali solutions. C.

Trimethylcellulose: Preparation. K. Freudenberg and H. Boppel. *Ber. Dtsch. Chem. Ges.*, 1937, **70**, 1542.

Methycellulose (methoxyl content 43-44 per cent.) prepared by the action of dimethyl sulphate, is suspended in liquid ammonia, sodium is gradually added and, after standing, the mixture is treated with methyl iodide. The product is snow-white and, when free from sodium iodide, insoluble in cold water. Chloroform solutions are less viscous than those of the ordinary ether ; this becomes less viscous by treatment with sodium and ammonia alone. Some difficulties encountered in micro-analysing the substance are mentioned. The methoxyl content was found to be 44-46 per cent. (calculated value for trimethylcellulose 45·5 per cent). C.

Amorphous Starch: Occurrence. J. R. Katz. *Rec. Trav. Chim.*, 1937, **56**, 785-793.

In 1930 Katz described a new X-ray diagram of starch called the *V* (" Verkleisterung ") pattern that is characteristic of fresh bread and preparations obtained by adding a large volume of alcohol, all at once, to starch paste. A number of facts are now mentioned that suggest that the earlier interpretations of the diagram need to be modified. It is more probable that the diffuse blackenings are due to the ring pattern of an amorphous starch lying over a true crystalline pattern. The micelles in dilute, fresh starch pastes are probably amorphous for the greater part, and the staling of bread may be accompanied by crystallisation of amorphous starch. Starch pastes gelatinised by alkali and precipitated with alcohol show a special X-ray pattern which changes to a *V*-pattern when the preparation is thoroughly washed with acidified alcohol. C.

Amorphous Starch: Preparation and X-ray Diagram. M. Samec and J. R. Katz. *Rec. Trav. Chim.*, 1937, **56**, 776.

A starch preparation showing an " Amorphous " X-ray diagram is obtained by adding in succession 20 separate volumes of 96 per cent. alcohol to 1 volume of starch solution, with continuous stirring. C.

Starch: X-ray Diagram; Effect of Drying. J. R. Katz *Rec. Trav. Chim.*, 1937, **56**, 766-772.

Several examples are discussed of changes in the X-ray pattern on drying starch preparations over phosphorus pentoxide. It is suggested that X-ray

negatives of the quite dry material should be compared with those of the air-dry substance in the characterisation of starch products. All starch preparations appear to contain water as water of crystallisation or a closely allied form. C.

Starch Paste: Hydrolysis by Heating under Pressure. A. Tychowski and S. Masior. *Biochem. Z.*, 1937, **291**, 399-405.

Acid hydrolysis is brought about by heating starch paste under pressure. The product given by a 5 per cent. paste of *p*H about 5 at 120° is soluble starch (blue with iodine ; no reducing power) but on raising the temperature, which causes an increase in acidity, dextrins are formed. At 150° not only dextrins and maltose appear but also glucose, and the dark brown solution obtained at 155° gave 59 per cent. of glucose and 35 per cent. of maltose on crystallising. The addition of chalk is found to stop the reaction by making the solution slightly alkaline and the addition of phosphoric acid hastens it. C.

Acid Soap: Properties. P. Ekwall. *Kolloid Z.*, 1937, **80**, 77-100.

The steps by which the existence of acid soaps has been demonstrated are reviewed. The appearance and properties of the separated acid soaps and the methods of establishing their constitutions are described. The nature of acid soaps is explained, and a theory of the hydrolysis of soap solutions is developed. C.

" Globular " Proteins: Cyclol Structure. D. M. Wrinch. *Proc. Roy. Soc.*, 1937, **A161**, 505-524.

The cyclol hypothesis implies the existence of one or more series of space-enclosing protein molecules, each series comprising numbers of residues given by a quadratic function of the natural numbers 1, 2, 3, - - - n, - - -, and in particular of a series C_1, C_2 - - -, C_n, - - -, comprising 72,888, - - - $72n^2$, - - - residues the medium networks of which lie on the surface of truncated tetrahedra. It is further implied by the hypothesis that certain types of molecule may exist in solution in varying states of association. The number of residues in such " associated " molecules will correspondingly be varying multiples of the number of residues in the molecule of which they are built. These predictions are in accord with, and offer an interpretation of the results obtained by Svedberg and his collaborators. Thus it is found that certain proteins are " globular " molecules, which in appropriate circumstances are monodisperse. The cyclol theory implies the existence of space enclosing molecules containing certain specific numbers of amino acid residues ; their polyhedral character is in accord with and offers an interpretation of the nature of this " globularity." Further, it is found that certain molecules exist in different degrees of association in solutions of different *p*H having a maximum molecular weight in a certain *p*H range, and dissociating reversibly into molecules with sub-multiple molecular weights of one or both sides of this range. The cyclol theory implies that, in certain types of protein the molecule will form multiple molecules at appropriate *p*H values, the process of dissociation on changing the *p*H being reversible. Finally, it is found that the molecular weights of proteins are not distributed at random, but fall into a sequence of widely separated classes, the molecular weights in one class varying by as much as 20 per cent. from a mean value. This is interpreted to mean that the proteins falling into one of these classes have a common structure as regards the arrangement of the constituent amino-acids, and it is suggested that each class denotes one closed cyclol network, or an association of a certain number of such units. The variation of molecular weight within a class is then accounted for by different selections of residue in the various proteins which can yield an average residue weight varying (say) from 100 to 136 which may also entail the presence of different numbers of water molecules in the molecule. C.

Pectin: Constitution. G. G. Schneider und (1) U. Fritschi, (2) H. Bock. *Ber. Dtsch. Chem. Ges.*, 1937, **70**, 1611-1617, 1617-1630.

(1) Investigations on the degradation of nitropectin and pectin ester, with evidence provided by other workers lead, (2) to a revision of Ehrlich's conception of the structure of pectin substances. A new formula is based on a galacturonic acid chain with 75 per cent. of the carboxyl groups esterified by methyl. C.

Phenol-Formaldehyde-Ammonia System: " Emulsification Time." S. Tsuruta. *J. Soc. Chem. Ind., Japan*, 1937, **40**, 125-127B.

The time at which a turbidity appears (" emulsification time ") in the production of phenol-formaldehyde resins is sometimes taken as a measure of the

rate of reaction. This is only valid if the ratio of phenol to formaldehyde is constant, and also the temperature ; otherwise, the yields of resin (the true measure of a reaction velocity) at the " emulsification point " may differ widely. Experimental evidence is given. The " emulsification point " may be used correctly in a study of the effect of the concentration of one catalyst and data are recorded for the system 10 c.c. phenol-formalin (mol ratio 1 : 1) and 1 c.c. of ammonia ranging from 1 to 7 *N*, at 70, 80, 90 and 98·5° C. C.

Carborundum Ultra-filters: Preparation. J. Duclaux and M. Amat. *C. R. Acad. Sci.*, 1937, **205**, 315-316.

In order to make an ultra-filter, the particles of the material must be of determinable fineness, chemically neutral, and completely insoluble. Carborundum satisfies these conditions. Filters have been constructed with particles of mean diameter 3, 0·6, and 0·3μ. The first retains suspensions of gamboge, copper cobalticyanide or arsenious sulphide of sub-microscopic size. A colloidal solution of cupric or ferric ferrocyanide passes through the first but is completely retained by the second. The third arrests a finely divided solution of ferric hydroxide. The diameter of the pores depends only on the size of the grains, and, with grains of uniform dimension a series of rigorously defined ultra-filters could easily be prepared. C.

Continuous-feed Super-centrifuge. E. J. Jefferies. *J. Sci. Instruments*, 1937, 14, 282-4.

A description, with sectional view, is given of a super-centrifuge for the continuous treatment of liquids when the problem is to remove a small proportion of unfilterable impurity from a large bulk of liquid. C.

" Electrotor " Meter: Application for Counting and Weighing Particles. S. C. Blacktin. *J. Soc. Chem. Ind.*, 1937, **56**, 281T-283T.

An instrument is briefly described which will count or weigh particles of dust, smokes, and other dispersions, or combine these functions. The many advantages claimed for the instrument are enumerated. C.

Saybolt Viscometer: Conversion of Readings to C.G.S. Units. S. Erk and H. Eck. *Physikal. Z.*, 1937, **38**, 469-476.

New measurements on castor oil and recent data obtained by others are utilised in an attempt to relate Saybolt seconds to C.G.S. units. Theoretical considerations are also applied. The most probable conversion formula reduces to $\nu = 0{\cdot}212_5\, S$, for outflow times, S, of more than 400 seconds (ν = kinematic viscosity in centistokes). It is shown that Poiseuille's law does not apply when the outflow time is small, for the parabolic distribution of velocity in the capillary is not realised. The conversion formula is independent of temperature. C.

Solid Surfaces: Wetting. D. H. Bangham, S. Mosallam and Z. Saweris. *Nature*, 1937, **140**, 237.

A number of observations are recorded that demonstrate how sensitive the contact angle of a drop of liquid on a solid is to the degree of saturation of the vapour phase and the presence in it of minute traces of a second adsorbable component. For example, by playing a jet of the superheated vapour on a fresh surface of mica a film of benzene, methyl alcohol or water can be built up that is thick enough to show interference colours but on which a drop of the same liquid does not spread. Methyl alcohol will not spread on mica in the presence of its own vapour although it spreads readily in air. A drop of concentrated acetic acid will drive a drop of water before it on mica. C.

High Molecular Compounds: Solubility and Precipitability. G. V. Schulz. *Z. physikal. Chem.*, 1937, A179, 321-355.

The existence of a quantitative relationship between the solubility of a high-molecular compound, the molecular weight, and the amount of agent which it is necessary to add to the solution to give a precipitate has been investigated. The shift of the distribution relationship of a substance partitioned between two liquid phases to one phase on addition of a precipitation reagent provides a good example of the precipitation process. A quantitative expression has been deduced relating distribution ratio, molecular weight of solute, and concentration of the precipitating reagent. The deduction of an analogous expression for the partition of a solute between solvent and residue can be only approximately made. The expression for the solubility (c) is $c = Ke^{-P(A+B\gamma)/R\delta}$ where P is

the degree of polymerisation of the solute, γ the concentration of the precipitating reagent, δ a temperature function, and A, B, and K are constants. A series of simple relationships between two variables are given by this solubility equation ; for example, between the solubility and the concentration of the precipitating reagent, between the molecular weight and the amount of reagent required to precipitate, between the molecular weight and the solubility of the high-molecular substance. The expression has been experimentally verified (experiments on polystyrenes) and a new method for estimating molecular weight is given based on precipitation capacity. Some conclusions are drawn concerning solution condition in high-molecular substances. C.

Hydrosols: Purification by Filtration, Dialysis and Electrolysis. E. Manegold. *Trans. Faraday Soc.*, 1937, **33**, 1088-1094.

In order to purify a hydrosol contaminated by a molecularly disperse system (e.g. a foreign electrolyte) filtration, dialysis, electrolysis, or any desired combination of these three fundamental methods, may be used. To compare the efficiencies of these methods a prescribed experimental arrangement and a given membrane must be employed ; the other essential factors concerned are the hydrosol and the foreign electrolyte. These factors affecting working conditions are briefly described. The velocity equations for each of the seven available methods are quoted, shewing that only with filtration, dialysis, or filtration-dialysis is the time of purification, t_c, independent of the absolute value of the initial concentration. The final concentration expressed as a fraction, x, of the initial concentration is plotted against t_c, and the curves obtained shew that the purification due to electrolysis is relatively small compared with filtration or dialysis. By taking as unity the time required to attain a final concentration by dialysis the six other purification methods can be placed in an order of efficacy for any given value of current strength or filtration pressure. The contribution of electrolysis to the purification resulting from filtration or dialysis is only material when the current strength employed is large compared with the original concentration of contaminant. Alteration of the size of the hydrosol particle permits alteration in the type of membrane used. C.

Cellodextrin Acetate: Diffusion in Acetone. M. Taniguchi and I. Sakurada. *J. Soc. Chem. Ind. Japan.*, 1937, **40**, 120-121B.

Satisfactory conditions for the measurement of diffusion coefficients, D, of high-molecular compounds by the 4-layer method in the Oeholm apparatus are met when the values of $h^2/4Dt$ are less than 0·16 (h=layer thickness, cm. ; t=time in days ; D in sq. cm. per day.) Such measurements require much time. By a 3-layer method the limiting value becomes 0·36 and the time is reduced to half or one third. Results by both methods are recorded for cellodextrin acetate in acetone. C.

Cellulose Acetate: Osmotic Measurements in Glacial Acetic Acid. H. Staudinger and D. V. Schulz. *Ber. Dtsch. Chem. Ges.*, 1937, **70**, 1577-82.

Molecular weights of cellulose acetate (" cellite ") have been calculated from measurements of osmotic pressure in glacial acetic acid solution, the concentration of " cellite " used being very small. The results agree with those obtained from viscosimetric measurements on acetone solutions. This is in direct opposition to the Hess-Ulmann hypothesis that direct osmotic measurements of " cellite " in such small concentrations in glacial acetic acid is impossible since molecules of the size of cellobiose acetate diffuse through the membranes usually used. The osmometer cells were filled with " biosan acetate " solutions and " cellite " and surrounded with pure glacial acetic acid, and the concentration of the inner cell was measured after a certain time ; the results tabulated shew that cellobiose octa-acetate diffuses most quickly, biosan acetate next, and " cellite " (p.g.=80) hardly at all. This evidence constitutes a proof that " cellite " does not split up into smaller units on dilution as postulated in the Hess-Ulmann hypothesis. C.

Cellulose Derivatives: Film Formation. S. E. Sheppard and P. T. Newsome. *J. Soc. Chem. Ind.*, 1937, **56**, T256-T261.

A systematic account is given of the factors affecting the formation of films of cellulose derivatives, principally cellulose esters. It includes a brief summary of the properties of the basic substances, and of solutions and dopes ; the formation and characteristics of (a) molecular and thin films, and (b)

technical films ; a brief summary of the present ideas on film structure ; and some indications of the influence of structure on the physical characteristics of films. C.

Nitrocellulose: Diffusion in Solution. M. Taniguchi and J. Sakurada. *J. Soc. Chem. Ind. Japan,* 1937, **40**, 121-122B.

Diffusion coefficients are recorded for a nitrocellulose of medium N-content on which solubility and viscosity measurements have previously been made. The particle radius is calculated from the data and is tabulated with the specific volume ϕ and the shape factor a, calculated from the earlier data. All three factors decrease with increase in the solvent power of the medium (acetone> methyl acetate>methyl formate>ethyl acetate>nitrobenzene), indicating that the better solvent causes the greater dispersion. C.

Colloid Particles: Orientation in Capillary Flow. K. Hess and J. Gundermann. *Ber. Dtsch. Chem. Ges.,* 1937, **70**, 1800-1808.

Aqueous sols of vanadium pentoxide, mercury sulphosalicylate, ferric hydroxide and sodium oleate have been röntgenographically investigated when flowing in a capillary. Fibre diagrams of vanadium pentoxide and mercury sulphosalicylate indicate long-shaped particles of crystalline character which, in both cases, are probably surrounded by a sheath of water molecules arranged in a lattice. On the other hand sodium oleate particles are plate-shaped in laminar flow, the platelets being like laminated packets in which the oleate molecules stand perpendicular to the basal surface. With increasing dilution the packets flake to give thinner and thinner platelets till finally a bi-molecular layer of oleate chains arranged in pairs is reached. This result is in agreement with existing ideas on the structure of soaps. C.

Fibrous Cellulose Acetates: X-ray Study of Swelling. I. Sakurada and Y. Matsushita. *J. Soc. Chem. Ind. Japan.,* 1937, **40**, 61-63B.

X-ray diagrams are reproduced and the interferences are tabulated for ordinary and acetone-soluble fibrous cellulose triacetates, products obtained by swelling them in acetone or acetic acid (liquid or vapour), and for their films. C.

Ethylcellulose Solutions: Viscosity-Concentration Relations. T. A. Kauppi and S. L. Bass. *Ind. Eng. Chem.,* 1937, **29**, 800-803.

The equation proposed by Philippoff relating the viscosity of a polymer to its concentration is applied to ethylcellulose solutions. The eighth root of the absolute viscosity is shown to be a linear function of the concentration under conditions of viscosity measurement obtaining in an Ostwald viscometer at concentrations above 5 per cent. of ethylcellulose. The effect of a change in solvent is to displace the straight line obtained above 5 per cent. concentrations for a given intrinsic-viscosity ethylcellulose without altering the shape of the curve. A viscosity-concentration chart is given which expresses the viscosity of commercially available ethylcellulose at concentrations from 5 to 20 per cent. by weight as straight-line relations. A blending chart is also given by means of which ethylcellulose of varying intrinsic viscosities may be blended to obtain intermediate viscosities. The construction of the charts is outlined. C.

Gelatin Gel: Liquefaction by Calcium Salts, and Spinning Capacity. H. Erbring. *Kolloid Z.,* 1937, **80**, 20-27.

Viscosity measurements have been carried out on concentrated gelatin solutions containing Ca thiocyanate, nitrate or chloride. Increase in Ca content of the solution produced a sharp decrease in viscosity to a minimum for 1·4 molar solutions of the Ca salt, followed by a further sharp rise. This is explained by considering the interaction of two opposing effects that Ca salts have on gelatin ; until the minimum is reached the dispersive influence exceeds the coagulating influence but thereafter the effects are reversed. The absolute viscosity is determined by the anion present. Directly after the beginning of gel liquefaction, i.e. at a relatively low Ca concentration, as well as at the beginning of coagulation, i.e. at high concentration, the solutions display marked sol thixotropy. Solutions lying between these concentrations shew these effects less (not in the Höppler viscometer, but in the Tsuda viscometer). Pressure/viscosity curves have been constructed, and they shew a sub-division of structural viscosity into the mechanically-stable and the mechanically-labile. Spinning tests were made on the various gelatin solutions. The length of thread obtained was

found to correspond to the viscosity. Spinning capacity was found to be especially marked in the concentration ranges where liquefaction of the gelatin gel began as well as where coagulation began. During spinning, double refraction is produced in the threads due to tension. C.

Raw Rubber: Viscosity. H. M. Smallwood. *J. Applied Physics,* 1937, **8,** 505-10.

Eyring's reaction rate theory of the viscosity of simple and non-Newtonian liquids is outlined and it is shewn that Mooney's data on the rheology of a sample of raw rubber can be fitted by Eyring's equation for the viscosity of a non-Newtonian fluid except for the lowest shearing stress. The behaviour at low shearing stress may be explained by any of the following assumptions: (1) the moving particle is larger at low shearing stress than at high ; (2) the rubber as a whole is less orientated by the lower shearing stress ; (3) the distance " jumped " by the molecules may be less at high than at low stresses. According to the present interpretation the moving particle, corresponding to the molecule of a simple liquid, is larger than the rubber molecule. It does not seem profitable to interpret this as evidence of the existence of a rubber micelle. Both the activation of energy of viscous flow for this particular sample of rubber, and the factor determined by the spatial requirements which must be fulfilled by the moving particle, are much larger than the analogous quantities for low-molecular hydrocarbons. C.

Sodium Oleate Solutions: Viscosity. W. Philippoff and K. Hess. *Ber. Dtsch. Chem. Ges.,* 1937, **70,** 1808-1814.

Flow curves of sodium oleate solutions and the dependence of viscosity on concentration and temperature have been examined. At high temperatures and pressures sodium oleate solutions shew well-marked structural viscosity which is manifested by a decrease of the hitherto constant viscosity. The same type of structural viscosity is shewn by cellulose derivatives. In regions of low concentrations (up to 10 per cent.) the cellulose eighth-power law is valid for sodium oleate solutions, and the viscosity constant $[\eta]$ is about 0·0777, like that of sodium palmitate and stearate solutions, that is about three times the value of the Einstein constant. With rising concentration the curve bends sharply and for 35 per cent. solutions rises very steeply, almost asymptotically, to the value 950. The temperature/viscosity curve shews a very low temperature constant which is comparable with that of cellulose ester solutions. The similarity of properties of sodium oleate and cellulose ester solutions is shewn by a table in which they are compared. C.

Nitrocellulose Films: Absorption Spectra. K. Masaki. *Bull. Chem. Soc., Japan,* 1937, **12,** 1-3 (through *Physikal. Ber.,* 1937, **18,** 1065).

The absorption spectra of thin films (about 0·01 mm. thick) of nitrocellulose have been studied in the range 2,300-3,700 A. Bands typical of the nitro-group are found at 3,000 and 2,500 A. C.

Colour: Theory and Measurement. H. Schober. *Physikal. Z.,* 1937, **38,** 514-555.

A comprehensive review under the following main headings: I—Basis of colour conceptions and theories: (1) present position of the physical-physiological theories of colour ; (2) fundamental laws of colour and colour measurement ; (3) current colour theories. II—Theoretical basis of colour measurement: (1) the colour triangle ; (2) inter-conversion of various colour triangles ; (3) expression of colour by hue, saturation and brightness ; (4) other systems, especially Ostwald's ; (5) the basic sensation curves ; (6) physics of the sense of sight. III—Methods of colour measurement: (1) testing the eye ; (2) analytical, equivalence, and brightness methods ; (3) heterochromatic photometry. IV—Practical measurements: (1) colour of light sources ; (2) colour of filters ; (3) pigments. A bibliography of 358 items is provided. C.

Eye: Colour Vision Characteristics. J. H. Nelson. *Proc. Phys. Soc.,* 1937, **49,** 332-7.

The luminosity curve, trichromatic coefficients, mixture curves, complementary wave lengths and their mixture in terms of luminosity, and the hue-and-saturation-discrimination curves have been obtained for the author's eyes, and the results tabulated. The Wright colorimeter was adapted for the purpose, and the modification and method of measurement are described. C.

Eye: Saturation Discrimination. W. D. Wright and F. H. G. Pitt. *Proc. Phys. Soc.*, 1937, **49**, 329-331.

Measurements have been made by means of an adaptation of the Wright colorimeter to determine the values, for the author's eyes, of the saturation discrimination expressed in the conventional manner as log. $[(L_w+L_s)/L_s]$ for the just noticeable first step from white for a range of spectral colours. (L_s is the luminosity of the spectral colour that has been mixed with white of luminosity L_w to produce the just-noticeable step.) A pronounced minimum occurs in the curve obtained at about $0{\cdot}57\mu$ for both observers. C.

Lubricants and Soap: Double Refraction Effect. L. Bellingham. *Nature*, 1937, **140**, 70.

Certain fatty materials give an effect of double refraction due to the fact that they have two refractive indices. On the ordinary refractometer in which the light is transmitted through the test material, the border line of total reflexion due to the higher index is not usually seen, there being a much greater contrast at the border line due to the lower index. The space between the two border lines is plane polarised, the vibrations taking place in a direction parallel to the border lines. Vaseline, lanoline, rubber lubricant, ordinary yellow soap, and pure green soft soap give two border lines, but various thick lubricants give only one. If vaseline, lanoline, and rubber lubricant are dripped onto the refractometer prism only the border line due to the lower index is seen, but if the material is smeared, thus removing any possibility of orientation of the micro-crystals, the second border line appears, and, for lanoline, even a third. The projection refractometer is particularly suitable for the examination of such materials. C.

Pigments: Particle Size and Size Distribution; Measurement by Scattering in the Infra-red. D. L. Gamble and C. E. Barnett. *Ind. Eng. Chem., Anal. Ed.*, 1937, **9**, 314-314.

Present methods of measuring particle size and size distribution of powders are reviewed ; none is quite suitable as a rapid method for pigments. A method based on the transmission of suspensions at various wave lengths in the visible and near infra-red is described. The relative size and size distribution characteristics of the powder can be estimated from the shape of the spectral transmission curve obtained. The method is limited with coloured materials by the selective absorption which is superimposed on the reflection and scattering phenomena. Because of the effect of the refractive index between the suspended particles and the medium, inter-comparisons are limited to systems in which the optical constants are similar. In spite of these limitations the method is helpful in pigment investigations. C.

Stereoscopic Photomicrograph: Production. C. W. Wilman. *Photographic J.*, 1937, **77**, 491-6.

Optical considerations in the production of low-power stereoscopic photomicrographs are discussed and a diagram is given of a suitable outfit. Typical results include a photograph of a ladder in a silk stocking. C.

Electrically Conducting Silica Fibre and Wire Instrument Suspensions: Preparation. L. Walden. *J. Sci. Instruments*, 1937, **14**, 257-268.

Practical hints are given on the " shooting " of silica fibres and on coating them with calcium chloride, colloidal graphite, gold and silver, and sputtered and distilled films of metal. Methods of suspending the fibres are described, with a table of breaking loads, diameters and areas of cross-section. The production of fine " Wollaston " wires is also discussed. C.

Fibre Crystallites: Orientation Measurement. R. Hosemann. *Z. physikal. Chem.*, 1937, A**179**, 356-360.

A photometric procedure involving the use of a small photometer table that can be turned through 360° is described for estimating the degree of orientation of crystallites to within a small percentage error. C.

Cotton Leaf Sap: Composition. E. Phillis and T. G. Mason. *Nature*, 1937, **140**, 370-372.

Experiments on the extraction of sap from cotton leaves give evidence for two kinds of sap, true vacuolar sap extracted by direct pressure and cytoplasmic sap, derived by the destruction of the cytoplasm by the use of shearing force. The concentration of the cytoplasmic sap is more than double that of the

vacuolar sap. The authors consider the continuous phase of active cytoplasm to be " vitaid," the molecule of which is not decomposed by direct pressure but only by shearing forces as applied in a vice, by freezing or hand rubbing, the products formed being proteins, lipoids and water. This explains the fact that more sap, and of a different composition, can be obtained after freezing, by using anaesthetics, or by pressing in a vice than by hydraulic pressure. C.

Caustic Soda Solutions: Concentration; Baumé Correction Table. J. Griswold. *Ind. Eng. Chem., Anal. Ed.*, 1937, 9, 388.

A table is given for correcting the Baumé hydrometer readings on caustic soda solutions at any temperature between 50° and 130° F. to degrees Baumé at 20° C. referred to water at 4° C., allowing for the thermal expansion of the glass. C.

Moisture Content: Volumetric Determination. N. C. Mitra and K. Venkataraman. *Current Science*, 1936, 5, 199-200 (through *Chem. Zentr.*, 1937, i, 3523).

Dioxan forms an azeotropic mixture with 20 per cent. of water that boils at 86·8° C. The distillate is trapped by a standardised mixture of acetic anhydride and pyridine (1:3) and the acetic acid formed is titrated. C.

Cellulose Hydroxybutyl Ethers: Preparation. (1) S. N. Danilow and W. A. Konkowa. (2) W. A. Konkowa. *Shurn. prikl. Chimii*, 1936, 9, 1863-8, 1869-1873 (through *Chem. Zentr.*, 1937, i, 4708).

(1) Cellulose hydroxybutyl ether is obtained by the action of pseudobutylene oxide on soda-cellulose in a sealed vessel. It is slightly soluble in water and soluble in dilute alkali or aqueous pyridine. (2) By the further action of alkali and benzyl chloride it is converted into a cellulose hydroxybutyl benzyl ether. C.

Cellulose Hydroxyethyl Ethers: Properties. P. P. Schorygin and J. A. Rymaschewskaja. *Shurn. prikl. Chimii.*, 1936, 9, 1634-7 (through *Chem. Zentr.*, 1937, i, 3430).

Lower members of the series of hydroxyethyl ethers have been obtained by limiting the action of alkali on cellulose to 20 minutes and the subsequent action of ethylene oxide (in acetone solution at 30°) to 6 hours. Products are described for which the ratio of ethylene oxide to cellulose was 1:1, 1:2 and 1:4. The first is insoluble in water (the higher ethers are soluble) but soluble in caustic soda ; the second is partially soluble in alkali and the third insoluble except in the cold. C.

Cellulose Triphenylmethyl Ethers: Properties. P. P. Schorygin, A. J. Weitzman and N. N. Makarowa-Semljanskaja. *Shurn. obsch. Chimii*, 1937, 7, 430-9 (through *Chem. Zentr.*, 1937, i, 4938).

Cellulose triphenylmethyl ether does not swell or form a compound in alkali and cannot be xanthated. It reacts slowly with methylating agents and after introduction of about one methoxyl group triphenylcarbinol is expelled. Acetylation is also difficult and accompanied by removal of triphenylcarbinol. C.

Cotton and Viscose Rayon " Incrusting Substances ": Chlorination. A. Spitalny and J. Meoss. *Prom. organ. Chimii*, 1936, 2, 282-4 (through *Chem. Zentr.*, 1937, i, 2710).

" Lignin " contents as measured by treatments with 72 per cent. sulphuric acid were filter paper 0·32, scoured cotton linters 0·29, oxycellulose 0·38, glucose 0·08-0·05, viscose rayon 1·1-1·5 per cent. The products of the action of hypochlorite had the following Cl contents: extracted cotton 0·21, viscose rayon 0·20 per cent. Chlorolignin from raw cotton had 8·72 per cent. Cl. C.

Soda-celluloses: X-ray Structure and Identity. W. Schramek and O. Succolowsky. *Kolloid Z.*, 1937, 80, 129-138.

A critical review is given of recent work, based on X-ray diagrams, a large number of which are reproduced and compared, on the identity of the various soda-celluloses I-V. The authors consider that the mass of evidence can be reduced to the following series of reactions between cellulose and caustic soda. By the *direct action of alkali on cellulose* are formed (A), between 10 and 20 per cent. alkali, Soda-cellulose I, fibre period 10 or 20A ; (B) from 20 per cent. upwards, Soda-cellulose II, fibre period 15A (a pure diagram when the alkali concentration is more than 28 per cent. By *gradual dilution of the system,*

from (A), Soda-cellulose IV, fibre period 10A, and from (B) Soda-cellulose IIh, period 15A, both modifications changing into cellulose hydrate under analogous but quantitatively different conditions. The so-called Soda-cellulose III (or V) is an unstable intermediate modification derived from cellulose hydrate according to process (B). The identity of II and IIh (a new designation) is discussed in detail. Soda-cellulose II is obtained from cellulose or soda-cellulose I by the action of the more concentrated alkali (>28 per cent.) at room temperature ; IIh, at 80-90° C. C.

Canna Starch: Molecular Structure. W. Z. Hassid and W. H. Dore. *J. Amer. Chem. Soc.*, 1937, **59**, 1503-1508.

The usual methods of methylation, acetylation and hydrolysis show that the canna starch molecule is built up of about 27 anhydroglucose units, and support the hypothesis that the chemical units of starch, consisting of chains of about 27 anhydroglucose units bound by primary valencies, are associated probably by secondary valencies to form a larger colloidal unit $[(C_6H_{10}O_5)_m]_n$, n being the number of chains and m the number of glucose units in the chain (26-30). There is no evidence that the insolubility of starch is due to its phosphorus content, as claimed by Samec. C.

Starch: Hydrolysis. A. Tychowski and S. Mesior. *Biochem. Z.*, 1937, **292**, 141-147, 218-220.

(1) Experiments are described on the influence of 7·5 per cent. and 15 per cent. hydrochloric acid on potato starch at 20° C. for different periods of time. With both acids, the native starch was converted within a day into soluble starch. This remained in the weaker acid almost unchanged as an insoluble residue for 30 days. With the stronger acid, however, there was evidence of a substance resembling amylohemicellulose and dextrins being formed at different times. Consequently the hydrolysis of amylophosphoric acid does not take place simultaneously with the change of native starch into soluble starch but after a considerable amount of hydrolysis has taken place. The author gives a probable explanation of the behaviour of starch under these conditions. (2) After heating starch paste for ten hours at 120° an almost complete saponification of the amylophosphoric acid is brought about. The calcium salt of amylophosphoric acid formed by heating starch paste with calcium carbonate under pressure shows a greater resistance to high temperatures than the amylophosphoric acid of the original starch, its saponification starting at 155° and scarcely being evident at 150° even in ten hours. Graphs of the saponification in the presence of buffer solutions show that the higher stability of the starch in the presence of calcium carbonate is due to the formation of the calcium salt. The hydrolysis curve obtained on heating starch paste in the presence of buffers shows steps corresponding to different phosphoric oxide percentages at different temperatures. C.

Macro-molecular Systems: Calculation of Molecular Weight Distribution. H. Dostal and H. Mark. *Naturwiss.*, 1936, **24**, 796 (through *Chem. Zentr.*, 1937, i, 3457).

Staudinger's viscosity measurements lead to a viscosity value ($\Sigma f_i M_i$) and osmotic measurements to a van't Hoff value ($1 : \Sigma f_i / M_i$) for the mean molecular weight of polymeric-homologous substances, M_i being the individual molecular weights and f_i the corresponding fractions of the total mass. The material is divided into two fractions and further mean molecular weights determined. If the partition of the molecular weights in the fractionation is known, six independent equations can be derived from which, to a certain approximation, the molecular weight distribution can be calculated. C.

Polymerides: Formation. E. Dreher. *Kunststoffe*, 1937, **27**, 137-142, 221-228.

A review of polymerisation phenomena. The author begins with observations on natural and artificial polymerisation. The differences between substances of high molecular structure and those of low are tabulated. Polymerisation mechanism is then dealt with, including chain formation and condensed polymerisation. Different types of polymerisation products are discussed with a table of natural and synthetic high polymers formed according to different methods. The author then deals with isopolymerisation and mixed polymerisation, dehydro- and hydro-polymerisation, with examples. The influence of constitution on the polymerisation power of compounds of low molecular weight

is discussed and also the influence of substituents on the power of polymerisation of low polymers, examples being grouped in tables. C.

Azo Compounds: Catalytic Reduction. W. F. Whitmore and A. Revukas. *J. Amer. Chem. Soc.*, 1937, **59**, 1500-1503.

The catalytic reduction of azo compounds under 1 to 4 atmospheres absolute pressure and at room temperature may be effected by the Raney nickel catalyst, the best results being obtained in a neutral or slightly alkaline solution in a solvent in which the azo compound is entirely soluble. The water-soluble sulphonated azo dyes can be analysed by this method, giving the percentage of colour (by the amount of hydrogen absorbed) and permitting the characterisation of the cleavage products with a sample of ten grams. C.

Azo Dyes: Influence of Substituents on Colour. A. Rollett, R. Birkner and K. R. Posselt. *Monatsh. Chemie*, 1936, **68**, 403-6 (through *Chem. Zentr.*, 1937, i, 2871).

Previous work on azo dyes made by coupling 1:4 and 1:5-naphthylamine- and naphthol-sulphonic acids with diazotised *p*-substituted anilines is extended to the *o*- and *m*- series. Substitution in the *m*- position gives much weaker effects than, and *o*- substitution nearly the same effects as, *p*-substitution. Corresponding experiments in the series of 1:6- and 1:7- sulphonic acids (coupling in position 4) show that in general groups that are active in *o*- and *p*-positions give very little difference in *m*- position but that a group that causes deepening of colour in *m*- position may give rise to paler shades in *o*- and *p*-positions. C.

Phenols: Azo-coupling Power. D. H. Richardson. *J. Chem. Soc.*, 1937, 1363-5.

A method of measuring the polar effects of halogens in the benzene ring is found in effecting coupling of *p*-nitrobenzenediazonium sulphate with the halogenophenol in competition with phenol and determining halogen in the mixed azo dye. The effects of other substituents can also be tested by comparison with bromine, *o*-bromophenol being used as the reference component in the mixed coupling. In this way it is shown that Cl exerts a more powerful de-activating effect than Br and the ratio of their effects is nearly the same whether they are meta or ortho to the coupling position. Iodine activates the coupling position but not much more when ortho than when meta to it. The methoxyl group exerts a very powerful activating effect on the coupling position meta to it. C.

Phenol-formaldehyde Resins: Production. F. S. Granger. *Ind. Eng. Chem.*, 1937, **29**, 860-866.

The formation of phenol-formaldehyde resins involves (a) condensation to phenol-alcohols and (b) their resinification. The first stage was discussed in a previous paper (1932) and the second process is now investigated with the pure di-alcohols of *o*- and *p*- cresol. General conclusions are drawn as follows. Resinification is promoted slowly by heat alone and accelerated by acidity or alkalinity. Under alkaline conditions, the velocity is largely independent of the OH-concentration but varies greatly with the parent phenol and the ratio of the components. Under acid conditions, the reverse is true. Three types of resin are obtainable, non-, semi-, and highly-curable. C.

Clay: Colloid Properties. E. A. Hauser. *Paper Trade J.*, 1937, **105**, *TAPPI*, 111-113.

The use of clay as a loading material for paper depends on the size and shape of its particles and its base exchange property. The author reviews the physical and chemical properties of clay from this point of view. C.

Molecules and Micelles: Determination of Size. A. Boutaric. *Ann. Soc. Sci., Bruxelles*, 1935, *B*.**55**, 101-106 (through *Chem. Zentr.*, 1937, i, 3771).

A mathematical discussion is given of the possibility of calculating the magnitude of molecules and micelles by determining the limiting concentration of an adsorbent that is sufficient to raise the surface tension of the solution to that of water, that is, to remove all capillary-active molecules. The measurements could be based on an improved form of du Nouy dynamometer. C.

Protein Solutions: Dialysis. F. W. Bernhart, L. E. Arnow, and A. C. Bratton. *Ind. Eng. Chem., Anal. Ed.*, 1937, **29**, 387-388.

To increase the speed of protein dialysis the sample is first passed through a simple dialyser and then through an electro-dialyser. An additional check for the absence of ions is afforded by placing an ammeter and a voltmeter in the

circuit, measuring the conductivity of the protein solution in comparison with distilled water placed in the jar at the same level as the protein solution. Diagrams and detailed explanations of the dialysers are given and a test is described on 350 c.c. of a solution containing 9 gm. of ammonium sulphate and 35 gm. of egg albumin. C.

Cellulose Acetate Film: Micellar Structure and Deformation. F. Breuer, O. Kratky and G. Saito. *Kolloid Z.*, 1937, **80**, 139-148.

Phenomena accompanying the deformation of swollen cellulose ester film are characterised by two limiting cases, the one in which micelles are considered to be freely moving in the swelling solution and the other in which the ester is partially swollen and the film is in the form of a network. For the first limiting case formulae are given which describe the orientation that occurs on stretching when the original film has (a) irregular structure and (b) a ring fibre structure with the axis normal to the film surface. Measurements of specific double refraction on strongly swollen cellulose amyl oxalate are discussed ; the results agree exactly with the curve connecting double refraction and tension. For the second limiting case, realised in cellulose hydrates, a characteristic double refraction increasing only up to 57 per cent. extension is to be expected from the theory but this has not been experimentally proved owing to complications due to strain-optical effects. Inter- and intra-micellar swelling are discussed ; with slight swollen cellulose acetate shows effects that suggest a network structure, whereas the strongly swollen film—just before intra-micellar swelling sets in—shows a structure that approaches the limiting case of free moving particles. Under tension cellulose acetate film increases in volume up to 35 per cent. ; that is stretching increases the swelling. The explanation given is that the effective component of the tension applied causes a separation of the bundles of main-valency chains that hang together only at isolated points. C.

Cellulose Products: Micellar Structure. O. Kratky. *Silk and Rayon*, 1937, **11**, 714-720.

As all cellulose products give more or less sharp X-ray diagrams, the conclusion is drawn that the long-chain molecules lie side by side forming bundles with a definite crystalline order. There is evidence, however, that neighbouring chains are not always parallel or equidistant from each other, so that the structure has fissures. There are two limiting cases for the deformation of a film. On the one hand the film undergoes such extreme swelling that the arrangement of the micelles is destroyed and the long bundles of the long chains may be considered to be suspended in the swelling medium. On stretching such a film (e.g. cellulose amyl oxalate) the axes of the particles become more and more drawn into the direction of stretching, forming a fibre structure approaching more and more to the ideal state and the relation between the degree of elongation and the degree of parallel orientation can be calculated from hydrodynamic theory. On the other hand, in moist cellulose hydrate the fissures between the chains expand by swelling, causing a certain extensibility with an interlocking of the whole system forming a net structure, without possibility of a gliding of the " long chains." This film can be stretched alternately in two perpendicular directions, the film returning to the original dimensions on release. Theoretically the extension cannot exceed 57 per cent. and all measured extensions for cellulose hydrate films are below this value. Transition between the two limiting cases is shown by cellulose acetate, with dioxane and water as the swelling medium ; at first intermicellar swelling is displayed and then intramicellar swelling, the film lying nearer to the " network " state when slightly swollen and nearer to the state of " free " bundles when strongly swollen. C.

Cellulose Ethers: Cataphoresis. S. A. Glikman and E. S. Medvedkov. *Kolloidny Shurnal*, 1937, **3**, No. 2, 3-15 (through *Brit. Chem. Abstr.*, 1937, A1, 133).

The cataphoresis of various particles covered with benzyl- or ethyl-cellulose or with nitrocellulose has been studied. The electrokinetic potential is very small in organic liquids but high in water. In mixtures of water and acetone the potential increases abruptly at the same concentration as that at which viscosity abruptly falls. The stability of lyophilic sols is not affected by the potential. C.

Direct Dyes: Conductivity and Electrophetic Mobility. B. N. Acharya, A. M. Patel and B. N. Desai. *Proc. Indian Acad. Sci.*, 1936, B.4, 503-513 (through *Chem. Zentr.*, 1937, i, 2578).

The viscosity, electrophetic mobility and conductivity of Benzopurpurin 4B. Congo red, and Sky blue F.F. solutions have been measured at various concentrations, degrees of purity, and salt contents. The results point to a continual increase in particle size of the dyes on the addition of salts and the authors draw the conclusion that best results are obtained in dyeing when the salt concentration and temperature are such that the dye micelles have the dimensions of the pores in the fibre. C.

Cellulose: Hysteresis of Moisture Absorption. F. Walker, W. B. Campbell and O. Maass. *Canadian J. Research,* 1937, **15**, 340-344.

An investigation of the hysteresis effect is described in which absorption and desorption equilibria were established at 0° C. with cellulose that was evacuated to a pressure of 10^{-2} mm. in one experiment and 10^{-5} mm. in another. The hysteresis effect was exactly the same in the two series. It is pointed out that Patrick's data on which he based his denial of a hysteresis effect are in reality sufficient evidence of the effect. C.

Clay: Drying. W. S. Wesselowski and (1) I. A. Sseljajew, (2) W. N. Perzow. *Kolloidny Shurnai,* 1936, **2**, 417-423, 467-474 (through *Chem. Zentr.*, 1937, i, 2562).

Measurements of the shrinkage of clay on drying at various temperatures, and of the influence of electrolytes on the process are used in the development of a conception of drying in which stress is laid on the surface tension in the liquid films surrounding the clay particles. C.

Clay Paste: Moisture Content and Properties. W. N. Perzow. *Kolloidny Shurnal,* 1936, **2**, 475-477 (through *Chem. Zentr.*, 1937, **i**, 2563).

The relation between moisture content and shearing resistance of clay paste has been investigated and the data are expressed as functions of the thickness of liquid films between the particles. C.

Gelatin Gels: Dehydration by Alcohols. J. A. Saunders. *Biochem. J.*, 1937, **31**, 1093-1096.

The monohydric alcohols dehydrate gelatin gels, some of the alcohol being absorbed. The gel structure is readjusted by swelling in water. The equilibrium weight of a gel in ethyl alcohol varies slightly with its shape. In very dilute ethyl alcohol the gel first decreases and then increases in weight. When the alcohol concentration is above 20 per cent., the gel steadily decreases in weight. C.

Silica Gel: Heat of Wetting. D. T. Ewing and G. T. Bauer. *J. Amer. Chem. Soc.*, 1937, **59**, 1548-1553.

The structure of silica gel is discussed and a method of destroying the large surface area by water or its vapour is described. This destruction was carried out in steps and the remaining surface energy measured as heat of wetting. Activation of silica gel must be brought about in such a way that the water on the gel is evenly distributed over the surface or at least is in a state of equilibrium with the gel surface energy. Silica gel is most highly activated by keeping it in a vacuum for many hours at 260° to 275°. The measurements described do not show any hysteresis in the adsorption-desorption curve. Heat of wetting is at a maximum at 4 per cent. water content. C.

Casein Solutions: Viscosity and Adhesive Properties. A. W. Pamfilow and J. N. Rossljakowa. *Shurn. prikl. Chimii,* 1936, **9**, 1057-1060, 1664-1674 (through *Chem. Zentr.*, 1937, i, 2526, 3582).

The viscosity and adhesive properties of solutions of casein in various alkalis have been measured. Caustic soda is the best solvent but the solutions are very viscous and tend to form gels. The most suitable solvent is a mixture of 15 per cent. borax and 5 per cent. sodium carbonate (on the weight of casein). C.

Blocking-layer Photo Cell. R. H. Mighell. *Gen. Elec. Rev.*, 1937, **40**, 372-375.

A new blocking-layer type of cell has a layer of selenium deposited on a steel plate and covered by a transparent layer of conducting metals, the whole being protected against atmospheric effects by a transparent lacquer. The performance

of the cell is demonstrated by a series of graphs. It has a very high value of micro-ampères per lumen, averaging 444 at 20 foot-candles, 25° C. and low external resistance. It is recommended for light measurements. C.

Brightness Meter. M. Luckiesh and F. K. Moss. *J. Opt. Soc. America,* 1937, **27**, 292-293.

A simple instrument for measuring relative brightness and brightness contrasts is described. The image of the object is seen in the centre of the photometric field surrounded by a mirrored portion, which is the comparison brightness. The brightness of the object focussed is varied by means of a circular gradient of extensive range in transmission factor. The relative brightness is read off from a scale. The actual range in brightness obtainable by the gradient is of the order of 2,000 to 1, and reducing and multiplying screens can be inserted to extend this range. Conversion of relative into absolute brightness is easily attained by means of foot-candle meters. C.

Colour: Specification. D. L. MacAdam. *J. Opt. Soc. America,* 1937, **27**, 294-299.

The use of the I.C.I. 1931 Standard Observer and Co-ordinate System for Colorimetry for all general colour specifications and calculations is urged for the elimination of confusion in the field of colorimetry. Methods for constructing other co-ordinate systems are exhibited and interpretations are given for the eight independent constants in the equations for transformation from the I.C.I. to other co-ordinate systems. The author discusses luminosity coefficients in detail. Only well-known principles of transformation of colour mixture data and projective geometry are used in the discussion. C.

Synthetic Resins: Physical Testing. R. Vieweg. *Kunststoffe,* 1937, **27**, 213-6.

Refractive index and thermal conductivity are recommended as characteristics of plastics. As refractive index depends on temperature, the refractometer should be furnished with an ultra-thermostat. Data are recorded for several products. Indirectly, heat conductivity, λ, can be calculated from the temperature conductivity, a, measured by Steger's apparatus, the specific heat, c, measured by Bunsen's condensation calorimeter with special arrangements for artificial materials and the specific gravity ρ by the equation $\lambda = a\rho c$. The technique of these measurements is described and specific heats are tabulated. C.

Hydrogen Bond: Behaviour in Molecular Associations. E. N. Lassettre. *Chemical Reviews,* 1937, **20**, 259-303.

A useful review is given of evidence for the existence and strength of the hydrogen bond operative in processes of polymerisation and chelation. C.

Methylene Blue and Phenylhydrazine Sulphonate System: Quantum Sensitivity in Yellow and Red Spectral Ranges. G. Holst. *Z. physikal. Chem.,* 1937, A179, 172-194.

The quantum yield (γ) of the reversible photo-reaction methylene blue (A) + phenylhydrazinesulphonate(BH_2)⟶leucomethylene blue(AH_2) + benzenediazosulphonate (B) has been investigated in two essentially different types of apparatus for $\lambda = 579$ mμ and about 667 mμ, at pH3 and 20° and 15° C. With complete absorption, and practical suppression of the simultaneous dark reaction the values were $\gamma = 0{\cdot}11$ and $0{\cdot}14$ for $\lambda = 579$ and 667 mμ respectively. Some preliminary measurements in the green spectral range ($\lambda = 546$ mμ) gave a somewhat smaller value $\gamma = 0{\cdot}08$. The concentration of the donator BH_2 was thereby always at least ten times greater than that of the photo-actor A, and the dominating absorption effects in layers of 2-3 cm. in thickness were of the order of magnitude of $4 \times 10^{-5} - 1 \times 10^{-5}$ Einstein per litre per minute, corresponding to the energy values 2 or $0{\cdot}4$ cal. per litre per minute. Under these conditions one stationary end condition was generally reached within 2-4 hours, the stationary dye concentration amounting to about 5-10 per cent. of the initial concentration in the absence of B in the original reaction mixture. In the presence of B the stationary dye concentration was significantly larger. The back reaction occurring after the irradiation was estimated by extinction measurements, and the quantum sensitivity under stationary conditions was evaluated. This shewed for 667mμ and a total dye concentration of 1×10^{-4} Mol per litre a much smaller value (γ_{stat} about $0{\cdot}06$) at a very low stationary dye concentration ($3 - 4 \times 10^{-6}$ Mol per litre), and consequently incomplete absorption, but for $\lambda = 579$ mμ this was not the case.

The relation between γ and A or BH_2 is discussed in terms of the Bodenstein reaction mechanism. Whether the relatively low γ values are to be attributed primarily to a small activation factor or whether they are due to a large deactivating constant cannot be definitely stated. The absorption spectra of the three components A, B, and BH_2 were investigated photographically but the AH_2 spectrum could not be definitely established owing to experimental difficulties. C.

Colour Mixtures: Subjective Study. V. H. Pavlović. *C. R. Acad. Sci.*, 1937, **204**, 1635-1636.

A new method for obtaining mixtures of colours has been devised in which Newton's coloured disc and the stroboscopic disc are combined, and the spectrum of the luminous source employed corresponds as nearly as possible to that of sunlight. A disc of fairly large diameter is chosen, so that it can be divided into a large number of equal sectors. Diametrically opposed sectors are coloured with the component colours of the mixture. The mixture is instantaneously obtained if the disc is periodically illuminated with the white light, there being in a given time twice as many flashes of light as rotations of the disc. By varying the speed of the flashes, or the angular velocity of the disc mixtures of two, three or more colours, not in diametrically opposed sectors, may be obtained. C.

Synthetic Resins: Thermal Conductivity. S. Erk, A. Keller and H. Poltz. *Physikal. Z.*, 1937, **38**, 394-402.

Apparatus for the rapid determination of the thermal conductivity of poor conducting solid materials in plate form by a comparison method is described. A comparison plate of Borkron glass 23890, of which the thermal conductivity has been determined by an absolute method, is used. The comparison method is explained and sources of error are pointed out. The uncertainty under the conditions described amounts to $\pm$ 2 per cent. Results are given for various synthetic resins, hard papers, pressed masses, and similar products and details of densities, compositions, filling materials, etc., are given. The influence of composition, conditions of preparation, etc., on the thermal conductivity is briefly discussed. C.

Field Plot Experiments: Statistics; Pseudo Factorial and Incomplete Randomised Block Methods. C. H. Goulden. *Canadian J. Res.*, 1937, **15**, 231-241.

Uniformity data for eight different crops have been studied in order to compare the efficiency of the Incomplete and Randomised Block methods ; 26 different comparisons have been made. In general the Incomplete Block method gives increases in efficiency that are partially correlated with soil heterogeneity. If the field is very uniform there may be a loss in efficiency but this is rather unlikely on the average field with careful planning of the experiment. The increase in efficiency due to use of this method appears to vary on the average between 20 and 50 per cent. In view of the greater adaptability of these methods to irregularly shaped fields, in addition to greater efficiency, this use is generally recommendable. The relative efficiency of Incomplete and Complete Block methods has been studied in relation to the size and shape of plots and blocks. The former method gives the greater gains in efficiency when the Incomplete Blocks are nearly square, and are made up of long narrow plots. C.

Malvaceæ Floral Nectaries: Occurrence. Ch. Janda. *Oesterr. Botan. Z.*, 1937, **86**, 81-130 (through *Bot. Centr.*, 1937, **171**, 298).

The author has examined more than 100 representatives of the family *Malvaceæ* for the occurrence and structure of extra-nuptial nectaries. Flower stalk nectaries are peculiar to three genera, including *Gossypium*, and sepal nectaries to *Hibiscus* and *Gossypium*. Glandular hairs are also common and appear to be related to the nectaries not only phylogenetically but also in their function of controlling transpiration. C.

Fluorescent Indicators: Application. M. Déribéré. *TIBA*, 1937, **15**, 349-355.

Various substances showing a change in their fluorescence in ultra-violet light with change in the *p*H of the medium may be used as indicators for *p*H determinations and are of particular value for use in turbid and coloured solutions. A list of such indicators, showing the *p*H of the appearance or change in colour of fluorescence and the type of fluorescence in Wood's light is given. Methods

of use are outlined and various applications are discussed. It is shown that the fluorescence of these compounds is affected by the oxidising or reducing state of the media as well as by the *p*H and the possibility of preparing a range of fluorescent indicators for determinations of *r*H is suggested. C.

Benzylcellulose: Mechanism of Formation. E. J. Lorand and E. A. Georgi. *J. Amer. Chem. Soc.*, 1937, **59**, 1166-1170.

Alkali-cellulose prepared from cotton linters has been benzylated under conditions favourable to the preservation of the fibre structure and the course of the reaction followed by photomicrography. A series of the pictures are reproduced. The reaction is shewn to be greatly influenced by the presence of two immiscible liquid phases, water and benzyl chloride, which give rise to diffusion difficulties. As the alkali-cellulose reacts with benzyl chloride, the originally hydrophilic system becomes hydrophobic, whereby aqueous lye is expelled, and a dispersion is formed. The increased number of benzyl groups attached to the fibre render it progressively more organophobic, so that the benzyl chloride diffuses more rapidly into it, and acts as a swelling agent. The progress of chemical conversion depends on the ratio between reaction velocity and speed of diffusion ; at about 60° the two are equal, and, as a result, the reaction zone progresses continuously towards the centre of the fibre. Even under these favourable conditions, the reaction, starting at the surface of the fibre is propagated from layer to layer ; i.e. it is of the topochemical macro-heterogeneous type. With rising temperature reaction velocity increases more rapidly than rate of diffusion, causing differences in the degree of benzylation of the fibre layers. The highly substituted outer layers form an insulating jelly shell round the unreacted region, thus preventing diffusion, and the reaction comes to a stop unless the shell is mechanically broken. C.

Cellulose: Crystalline Structure. H. Mark and K. H. Meyer. *Z. physikal. Chem.*, 1937, B**36**, 232-236.

The authors criticise the methods and conclusions of Sauter and point out that their theory of the structure of cellulose is supported by X-ray data. C.

Cellulose: Structure. H. Staudinger. *Papier Fabrikant*, 1937, **35**, *Techn.*, 233-242.

A report of a lecture before Swedish chemists, giving a useful review of the contributions of Staudinger and his school to the problem of the structure of cellulose. C.

Chemical and Immunological Mechanism of the Infection and Immunity by Anthrax. I. Chemical Structure of the Capsular Substance of *Bacillus Anthracis* and of the Serologically Identical Specific Substance of *Bacillus Mesentericus*. G. Ivanovics and V. Bruckner. *Z. Immunitäts*, 1937, **90**, 304-318 (through *Brit. Chem. Abs.*, A.III, 1937, p.294).

The haptens of the membranes of *B.anthracis* and *B.mesentericus* are serologically and chemically indentical, hydrolysis (HCl) indicating a polypeptide consisting only of *l*-glutamic acid. W.

Oil from Unripe Olives. G. Lucente and M. Barnaba. *Ann. Chim. applicata*, 1937, **27**, 102-104 (through *Chem. Abs.*, 1937, **31**, 5605).

The Bellier test when applied to oils from unripe olives shows an anomaly in all cases in that a reddish violet coloration is obtained, similar to that given by colza oil, although this oil is known to be absent. W.

Antigens of Anthrax Bacteria. W. Schaefer and G. Sandor. *Compt. Rend. Soc. Biol.*, 1937, **125**, 336-338 (through *Brit. Chem. Abs.*, A.III, 1937, p.294).

An antigen similar to that from the anthrax capsule is present in certain mucous strains of *B.mesentericus*, whilst the somatic antigen from the anthrax bacterium itself is specific. W.

Viscous Protein of Anti-anthrax Serum. L. Placidi and C. Morel. *Compt. rend. Soc. Biol.*, 1937, **125**, 234-236 (through *Brit. Chem. Abs. A.III*, p.250).

The precipitin of anti-anthrax serum is localised in the viscous protein. W.

Fission of the Disulphide Linking with Sodium Sulphite and Potassium Cyanide and Colorimetric Determination of Thiol Compounds and Disulphides. A. Schöberl and E. Ludwig. *Ber. dtsch. Chem. Ges.*, 1937, **70**, (B), 1422-1432 (through *Brit. Chem. Abs.* A.II, 1937, p.328).

Folin's colorimetric method with $(H_2O)_3P_2O_5(WO_3)_{18}$ gives accurate results with $SH.CH_2.CH(NH_2).CO_2H$, $SH.CH_2.CO_2H$, $SH.CMe_2CO_2H$, $SH.CPh_2.CO_2H$, $SH.CHMe.CO_2H$, $CO_2H.CH(SH).CH_2.CO_2H$, and $CHPh:C(SH).CO_2H$. Rapid oxidation and constancy of colour intensity are best attained at *p*H 5 but in practice it is necessary to await the development of maximum colour in an acetate buffer. $SH.CH_2.CH_2.CO_2H$ is a less powerful reducing agent under these conditions but behaves normally in presence of $NaHCO_3$. The presence of H_2SO_3 increases the intensity of the colour given by Folin's reaction which may become doubled in presence of much H_2SO_3. The changes are

$$2R.SH + (H_2O)_3P_2O_5(WO_3)_{18} \rightleftharpoons SR.SR + H_2O + (H_2O)_3P_2O_5(WO_3)_{17}WO_2 \text{ and}$$

$$SR.SR + H_2SO_3 = R.SH + R.S.SO_3H,$$

which are repeated until R.SH is completely converted into $R.S.SO_3H$. It is essential for the success of the method that oxidation of R.SH and reaction of SR.Sr with sulphite occur with sufficient rapidity. In general determinations with SO_3'' which allow measurement of very small concentrations of $SH.CH_2.CH(NH_2).CO_2H$ are as accurate as those with CN'. Quantitative doubling of colour intensity is not reached with $CHPh:C(SH).CO_2H$, $SH.CH_2.CH_2.CO_2H$, or $SH.CH_2.CO_2H$, whilst the determination of $SH.CMe_2.CO_2H$ and $SH.CPh_2.CO_2H$ is not influenced by the presence of SO_3''. The ready fission of the S.S linking in cystine by SO_3'' gives a simple method for its determination by means of the Pulfrich photometer. It is necessary to use a very large excess of the reagent at *p*H about 5. Attempts to apply Folin's reagent to the determination of disulphides other than cystine were not generally successful, union of S.S to *sec.* and *tert.* C atoms usually causing non-reducibility. The most important source of error in the determination of SH by Na nitroprusside is the fugitive nature of the red colour. Measurements (in glycine buffer at *p*H 10·4) must be made very rapidly. KCN stabilises the colour in a remarkable degree owing to its restriction of the oxidation of the SH-compound by O_2. The intensity of the colour is not the same for different substrates. In the main, disulphides show the same differences in their behaviour towards KCN as towards SO_3''. W.

Analytical Constants of Algerian Olive Oil. *Sabatie. Ann. Falsif.*, 1937, **30**, 18-22 (through *Brit. Chem. Abs. B.*, 1937, **56**, 805).

Variations in the analytical constants of North African olive oil (1934-5 produce) are given. Most samples had an iodine value of 80-86. All oils showed a yellow and brick-red fluorescence with Wood's light. Adulteration with cereal oils gives a blue-violet fluorescence. W.

Fluorescent Indicators. M. Déribéré. *Documentation Sci.*, 1937, **6**, 114-116 (through *Chem. Abs.*, 1937, **31**, 6086).

A list of 36 fluorescent indicators for the determination of *p*H between 0 and 14 is given with the ranges covered, which vary from 0·2 to 3·5 units. In coloured or turbid solutions these substances are much better than colour indicators, and in general are at least as good. At 3·0-3·5 salicylic acid changes from colourless to dark blue in filtered ultraviolet light ; eosin at *p*H 3·9-4·5 from colourless to yellow green ; fluorescin at 3·8-4·3 from blue to green ; quinine at 3·8-4·5 from blue to violet, and at 8·5-9·0 from violet to colourless ; acridine at 4·8-5·0 from green to blue violet. W.

Occurrence of the Specific Capsular Substance of the Anthrax Bacillus in a Variety of Aerobic Spore-forming Saprophytic Bacilli. G. Ivanovics. *Zentr. Bakt., Parasitenk, I. Abt., Orig.*, 1937, **138**, 211-220 (through *Chem. Abs.*, 1937, **31**, 3097).

Definite amounts of the sp. capsular substance of the anthrax bacillus occurs in related bacilli, but the specific carbohydrate of the body of the bacillus was not found in others. W.

PATENT

Fluid Flow Observation Apparatus. Société Provencale de Constructions Aeronautiques (Paris). E.P.470,211 of 26/6/1936: 11/8/1937.

In apparatus for rendering visible the stream-lines of flow of fluid, particularly of air, round solid bodies, means are provided, ahead of the stream-lines to be

observed, for emitting a succession of small soap bubbles inflated with air or any other gas. Such bubbles present, by reflection, very bright points when they are illuminated by means of a light beam. The frequency of emission of the bubbles is preferably so chosen that on account of the persistence of vision the eye does not detect any interruption between the passage of one bubble and that of the next one, the trajectory of the bubbles therefore having the appearance of a luminous ribbon. Means are also provided for adjusting the size and weight of the bubbles. C.

10—ECONOMICS

Cotton Piece-goods: Exports in 1936. *Bd. Trade J.*, 1937, **139**, 250-253.

Cotton piece-goods export figures are given for 1913 and 1936 and details of the exports of the different types to the various geographical areas in 1913, 1934, 1935 and 1936 are tabulated and discussed. Aggregate exports of cotton piece-goods in 1936 amounted to 1,993 million linear yards, as compared with 2,013 million in 1935, 2,060 million in 1934 and 7,075 million in 1913. Comparing the figures for 1936 with those for 1935, declines occurred in exports of printed goods and grey, unbleached goods and increases in exports of coloured cottons and dyed and bleached goods. Exports to West Africa, the Dutch East Indies, Europe (excepting Balkans), North Africa, United States and Canada, Australia and New Zealand, and South America increased in 1936 whilst the most important declines were recorded for British India, the Balkans, Near and Middle East, and China and Japan. India is still the largest market for cotton piece-goods and South America is the second largest market. Although aggregate exports of cotton piece-goods have declined annually since 1932, the average value of the goods exported has risen in each year since 1933. India takes the cheapest goods and China, Japan and Hong Kong the dearest. The average weight per square yard of the total exports in 1936 was the highest figure so far recorded. The average width was slightly less than in either of the previous two years. C.

Production Costs: Economic Limit to Rationalisation. R. Boye. *Leipz. Monats. Text. Ind.*, 1937, **52**, 163-164.

The cost " valency " (ratio of variable to fixed costs) of an industrial concern is discussed and it is pointed out that a low value of the cost valency indicates high fixed costs and reduced power of an undertaking for adaptation to varying market conditions. By means of this conception of cost valency it is possible to determine the permissible rise in fixed costs for a given fall in variable costs, and vice versa, for a given production and the same total costs. Various cases are studied and it is shown that with increase in the fixed cost component there is a progressive narrowing of the economic rationalisation possibilities. C.

Raw Materials for Industry: Agriculture as a Potential Source. Sir Harold Hartley. *J. Text. Inst.*, 1937, **28**, P151-172.

Rayon and Staple Fibre: Production and Use in Germany. H. O. Koecke. *Kunstseide*, 1937, **19**, 281-286.

A general discussion of the importance of rayon and staple fibre as substitutes for imported raw materials in Germany, the development, production and uses of these products, costs of production, the use of staple fibre in the cotton and wool industries, the suitability of staple fibre materials for clothing, and the future prospects of staple fibre. C.

Textile Production Statistics, July, 1937. *Bd. Trade J.*, 1937, **139**, 290.

Monthly averages are given for raw cotton delivered to mills, wages paid in the wool industry, percentages of insured workers unemployed in the cotton and wool industries, production of rayon yarn and waste, and deliveries of silk for home consumption in 1930, 1935 and 1936, April-June, 1936, to April-June, 1937, June, 1937, and July, 1936 and 1937. Raw cotton delivered to mills in July, 1937, amounted to 130 million lb., and the unemployment index for the cotton industry was 10·1. Production of rayon yarn and waste was 14·60 million lb. and silk deliveries amounted to 514 thousand lb. C.

Piece Rate Wages: Graphical Determination. J. Lung and L. Schultz. *Rev. Fil. et Tiss.*, 1937, **22**, 345-355.

The use of graphs for the rapid determination of piece rates in spinning and weaving is explained and illustrated by a study of examples. In the case of

rates of payment for spinners the method is based on the application of theoretical formulæ of production, whilst the determination of rates of pay for weavers is based on a study of the work of the operative and factors influencing his output. C.

Textile Price Index Numbers, July, 1937. *Textile Weekly,* 1937, **20**, 237.

Index numbers are given for raw cottons, cotton yarns and piece goods, all cottons, wool, other textiles, and all commodities for the years 1913-1936, and the months January-July, 1937. The general index number for all commodities advanced to a new high level during July, 1937, but cotton trade prices continued the slump which set in during April. The index number for American cotton for July was 94·08, for Egyptian cotton 79·80, based on 1913 as 100. The numbers for American and Egyptian yarns were 129·9 and 115·1, and for cotton piece-goods 141·6. The cotton trade index for July was 123·4 and the index for all commodities 132·7. C.

The Merchant's Function. P. G. Donald. *Irish Text. J.*, 1937, **3**, No. 9, 7.

Refers to the need for an efficient organisation to carry out the functions of distribution. This article describes the work of the merchant and his place in the economic scheme of things. L.

11—INDUSTRIAL WELFARE, INDUSTRIAL PSYCHOLOGY, AND EDUCATION.

Light Metal Workers: Wound Hazards. W. Ehrlich. *Arch. Gewerbepath. Gewerbehygiene,* 1936, **7**, 517-531 (through *Bull. Hygiene,* 1937, **12**, 557).

From experience of some thousands of wounds received by workers in a large aeroplane factory from light metals such as duraluminium, hydronal and elektron, the author issues a warning about the high incidence of septic conditions. He finds that particles of these metals, after exposure to air, give an enormous growth of pathogenic organisms (chiefly staphylococci) when incubated on agar. Particles of copper, iron, zinc, brass, nickel or steel scarcely infect agar plates at all under the same conditions. By providing extra first-aid facilities, warning the workers not to neglect the slightest wound, taking care to remove any splinters of metal and applying an efficient cleansing solution ("rivanol" with hydrogen peroxide) the high proportion of septic wounds has been reduced to about 5 per cent. C.

Rayon Crêpe Fabric Research Programme. *Amer. Dyes. Rept.*, 1937, **26**, 419-23.

Particulars are given of a programme of research, divided into four projects, which is being sponsored jointly by the American Association of Textile Chemists and Colorists and the Throwsters' Institute in order to trace the causes of defects in crêpe fabrics. The work involves measurements of winding tensions, weaving of yarns with different dressings, sampling and testing large numbers of yarn deliveries, and large-scale dyeing and finishing trials. C.

Experience and Experiments in the Textile Industry. R. Taine. *Text. Mfr.*, 1937, **63**, 415.

A French view on the necessity for co-operative research and technical progress. L.

Non-cancerous Mule Spindle Oil. *Text. Mfr.*, 1937, **63**, 264.

The Accidents Committee of the Federation of Master Cotton Spinners' Associations has issued to members the following recommendations on the purchase of mule spindle oil in relation to "mule spinners' cancer" (epithelioma): "Mule spindle mineral lubricating oils should have a specific refractivity below 0·5539 when the specific gravity is above 0·895, or a specific refractivity below 0·5569 when the specific gravity is below 0·895 at 60° F. vacuo." By specific refractivity is meant $(n\text{-}1)/d$ where n is the refractive index for D line sodium light, and where d is density in grammes per millilitre at 20° C. The test methods are those of the Institute of Petroleum Technologists and the British Standards Institution. W.

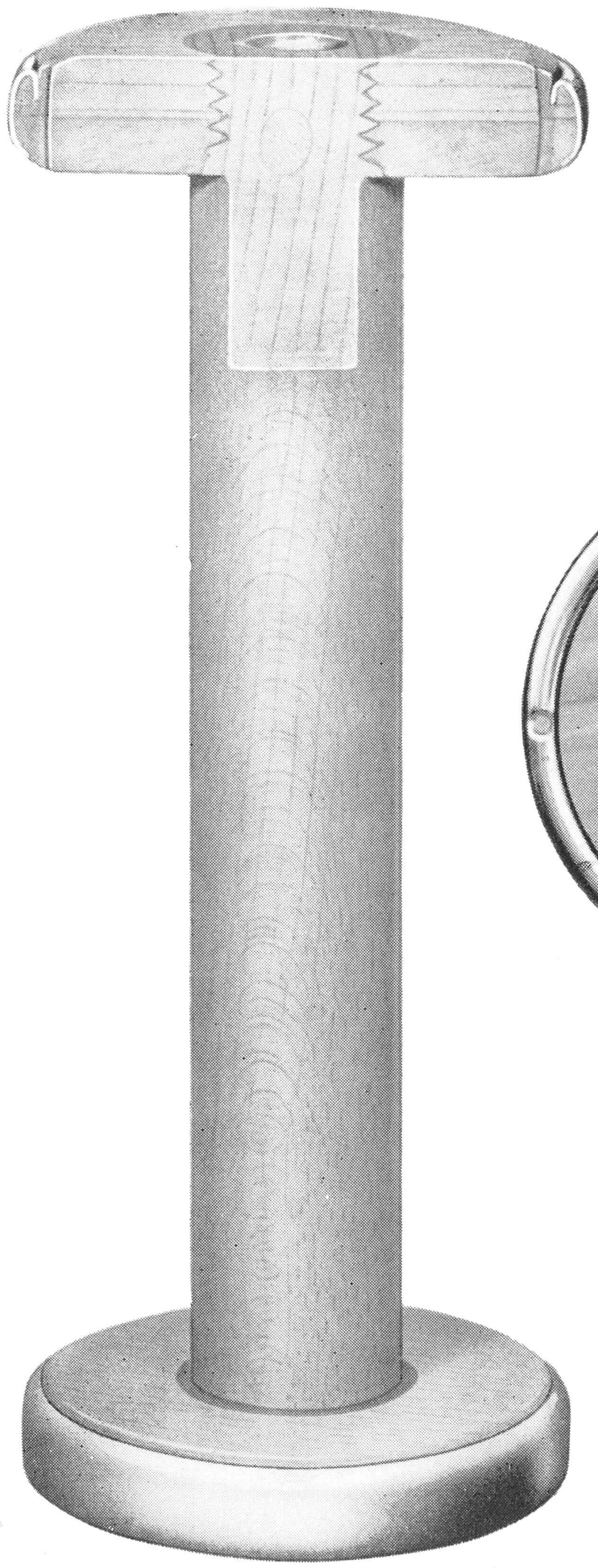
NOTES—In the references to publications abstracted the name of the publication is followed by the Year, Vol., Issue No., or date if necessary, and Page No. (or Nos.).

Literature relating to the composition and manufacture of Dyestuffs is not dealt with in the abstracts of this *Journal*.

ESTABLISHED 1795

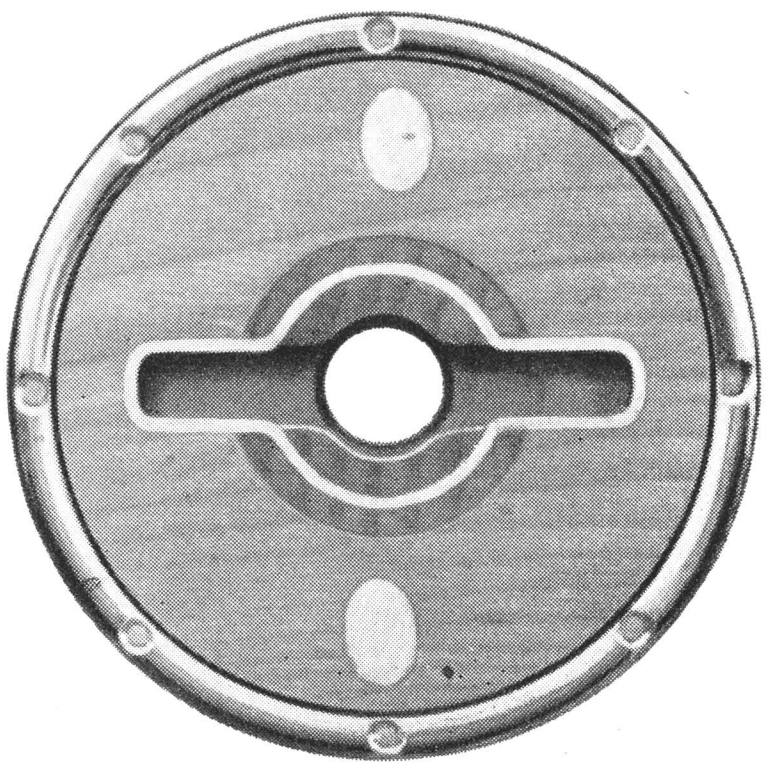
JOHN DIXON & SONS LTD.

Bobbin Manufacturers



RING DOUBLER BOBBIN

made with two-ply ends screwed and pegged to the barrel. Tested on spindles to run without vibration at high speeds.



Section showing Brass Driving Protector in bottom.

Dixon & Lee's Patent 3279, 1886. Still universally adopted.

STEETON, NEAR KEIGHLEY

Telephone : **STEETON 47 & 48 (2 lines).** *Telegraphic Address :* **"DIXONS, STEETON"**

M

TO SIZERS AND FINISHERS

RAPIDASE

(Methods of Manufacture and applications patented)

FACILITATES CONSIDERABLE SAVING OF TIME IN STARCH BOILING

All particulars from

NORMAN EVANS & RAIS LTD Dudley Road MANCHESTER 16

Telephone MOSS SIDE 2706 *Telegrams* "CHRIEVAN"

WHIPP BROS & CO

(DARWEN) LTD.

JACQUARDS **954 LOOMS**

Weavers of

BROCADES—All Classes RAYON or ARTIFICIAL SILK CLOTHS

Cashmeres, Voiles, Fancy Stripes 100% or Half Cotton

26 in. to 68 in. CLOTH SOLD IN THE LOOM STATE ONLY—NOT DYED

Telephone DARWEN 175 **COTTON HALL SHED, DARWEN**

PATENTS

Blackfriars 7782

J. OWDEN O'BRIEN, M.I.Mech.E.
GEO. H. O'BRIEN, B.Sc.Tech., A.I.Mech.E.
Members of the Textile Institute

J. OWDEN O'BRIEN & SON

PATENT AGENTS

Late of and Successors to W. P. THOMPSON & CO: **of Manchester**

LLOYDS BANK BUILDINGS 53 KING ST. MANCHESTER 2

Agents for procuring Patents and Registering Trade Marks and Designs

National Provincial Bank Ltd

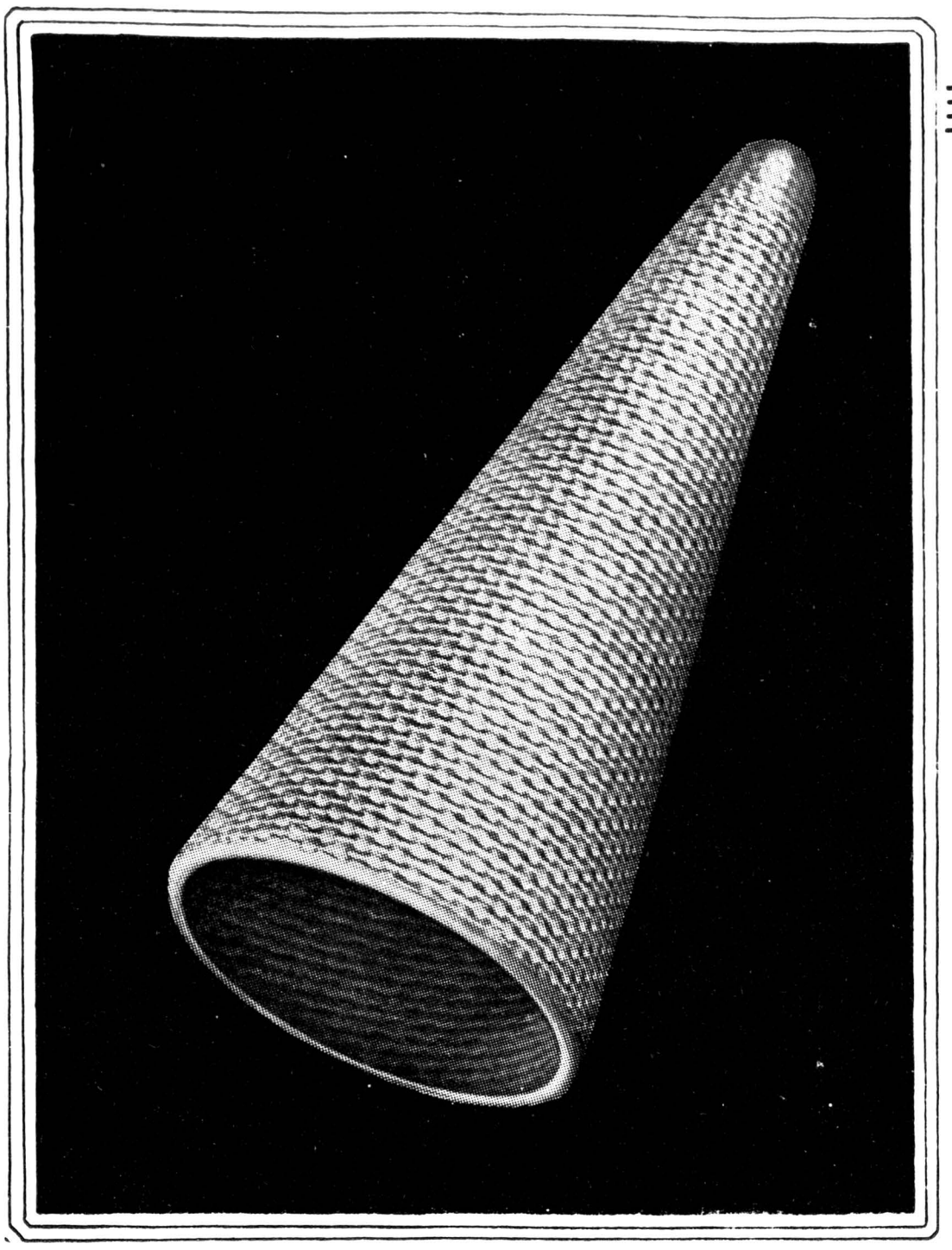
Overseas Trade

CURRENCY and STERLING DRAFTS issued
MAIL and TELEGRAPHIC TRANSFERS effected
FOREIGN BILLS, CHEQUES, COUPONS, etc. collected and purchased
DOCUMENTARY CREDITS established

Principal Manchester Office:

41 SPRING GARDENS

Latest Foreign Exchange Rates available.
Direct Telephone Lines to Principal Centres.



" The Cone with the Burnished Base "

The

FOUNDATION OF PERFECT WINDING IS THE PERFECT CONE

For HIGH-SPEED WINDING use O'NEILL'S CONES, seamless, perfectly balanced, and regular in fitting.

Makers of PAPER TUBES of every description.

RING TUBES
PERFORATED
SPOOLS . .
ABSOLUTELY
IMPERVIOUS
TO MOISTURE

Telephone :
5892 Castleton (Rochdale). 3 lines.

Telegrams :
" O'Neill, Castleton, Rochdale."

S. AML. O'NEILL & SONS LTD
CASTLETON · ROCHDALE

Stenolat EMULSIFIERS

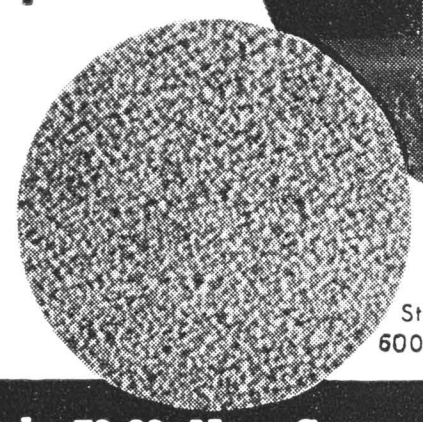
in modern softening technique

Softeners prepared on the basis of STENOLAT emulsify in **cold** water. Boiling of the emulsion is unnecessary.

Ask for Leaflet **P 270**



How Stenolat Softener disperses on emulsifying in water.



Stenolat Emulsion 600 × magn.

PELERIN

The Gardinol Chemical Co., Ltd., 78-80, New Street, Milnsbridge, Huddersfield
Manchester Office: Danlee Buildings, 53, Spring Gardens, Manchester, 2

Agents for Midlands—Messrs. CHRISTIAN & CO., Farben Works, Slater Street, LEICESTER.
Agents for Scotland—Messrs. BARR'S CHEMICIAL CO. LTD., 211 St. Vincent St., GLASGOW, C.2.
Agents for Northern Ireland—Messrs. JAMES A. BECK & SON, LTD., Dalton Street, BELFAST.
Agents for the Laundry and Dry Cleaning Industries—Messrs. B. LAPORTE LTD., LUTON.
For Australia and New Zealand please apply to:—
GARDINOL CHEMICAL COMPANY (AUSTRALASIA PTY. LTD.)
Appleton Street, Richmond, E. 1., MELBOURNE.

SRI KRISHNARAJENDRA SILVER JUBILEE TECHNOLOGICAL INSTITUTE

Applications are invited for the post of the Head of the Sri Krishnarajendra Silver Jubilee Technological Institute, Bangalore, Mysore State, who should be a person with suitable theoretical and practical experience in Textile Technology and processes. He should also have good organising and administrative capacity and possess experience in the teaching of textile technology in its various branches.

Applicants are required to furnish complete information on the following points:—

1. Age.
2. General Educational qualifications with a statement of Academic career.
3. Technical qualifications.
4. Experience in technical teaching.
5. Industrial experience.
6. Publications and patents.
7. Research work done or directed by him.
8. Certificates of qualifications and character.

Salary will be between Rs. 600 and Rs. 1000, the initial salary being fixed according to qualifications. Term of service F I V E years subject to extension. The appointment is non-pensionable but will carry with it the benefit of the State Provident Fund.

Applications should reach the undersigned not later than 5th Dec., 1937

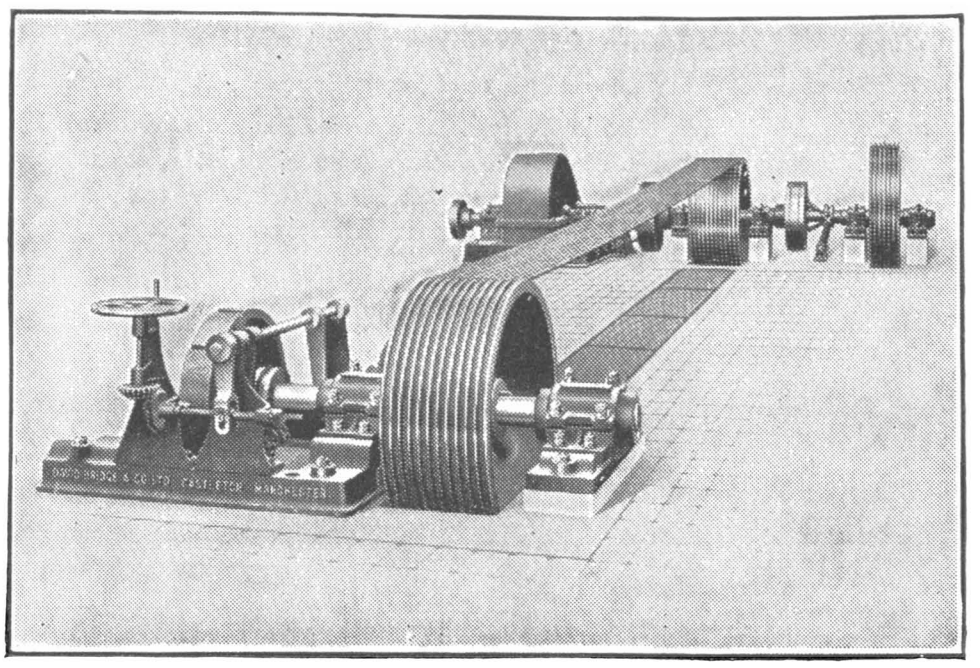
The Trade Commissioner for Mysore,
Grand Buildings,
Trafalgar Square,
LONDON, W.C.2.

Heywood & Bridge's

FRICTION CLUTCHES AND MODERN MILLGEARING

IMPROVED PATENTS

EFFICIENT and ECONOMICAL



Heywood & Bridge's Clutches, well known for their satisfactory application to diverse and exacting work, effect substantial savings not only by effective transmission of power, but also by promoting a smooth, even drive. This eliminates shock and jar and considerably lengthens the life of belts and gearing.

The illustration on the left shows a Main Drive from large Oil Engine, with Type "A" Clutch and Reduction Gear for Slow-speed Shaft.

Write for free illustrated Catalogue

MODERN MILLGEARING

Machine Moulded Gearing a speciality. Numerous Wheel-moulding machines, and over 8,000 Wheel blocks.

DAVID BRIDGE & CO. LTD.

ENGINEERS, IRON AND BRASS FOUNDERS

Castleton, Manchester

London Office — 35 Queen Victoria St. E.C.

and at — Aldwych House, Aldwych, London, W.C. 2.

METALLIC SERRATED WIRES

We are specialists of every description of Pointed or Flat Topped Toothed Wires.

Any size or shape of Tooth supplied in Mild Steel, Hardened and Tempered or Cast Steel.

Sole Agents to the Cotton Trade of Great Britain for

PLATTS PATENT METALLIC CARD CLOTHING

NO STRIPPING. NO GRINDING.

(50% Saving of Card Waste.)

All types of Serrated Wire for Cotton or Silk Fibro Cards, Woollen Cards, Lickers-in, Comber Doffers, Waste Breakers, Cylinders, Doffers, Breasts, or any other type of Roller (Grooved or Plain) requiring Saw Tooth Wire.

CROLT ENGINEERING LTD.

BENTINCK STREET, BOLTON. TEL. 3247.

AMOA EMULSIONS

FOR SCOURING AND FINISHING

THE LUXURY FINISH

REPRINTS

A few copies of the following reprints are available. Orders should be sent to The Textile Institute, 16 St. Mary's Parsonage, Manchester

Current Changes in the Technology of Cotton Spinning	*W. L. Balls*
Standard Test Sheets	*A. W. Bayes*
Monthly Wool Growth Studies, II	*R. H. Burns*
Ring and Traveller Designs and Speeds	*D. Eadie*
The Effects of Laundering Processes on Fabrics ...	*R. E. V. Hampson*
Recent Industrial Tendencies. The Substitution of Knowledge and Co-operation for Instinct and Competition	*H. G. Hughes*
Shuttle Tapping : A Source of Fabric Defects ...	*F. Kendall*
Official Report concerning a Test of Automatic Looms made in 1931	*Lancashire Cotton Corporation*
Comparison of the Cloth Qualities of Continental and Noble Combed Materials	*E. Midgley*
The Human Element in the Textile Industries ...	*T. Oliver*
Cotton Research and Academic Physics	*F. T. Peirce*
Ceremonial Fabrics	*A. Rushton*
Liberal Education and Modern Business	*Sir M. E. Sadler*
Loom Requirements in Relation to Artificial Silk ...	*W. Wilkinson*
Industrial Leadership	*A. P. Young*

Price 1/- each post free

GLYCERINE

We supply all grades of Glycerine for the textile industry. May we have your enquiries?

GLYCERINE LIMITED

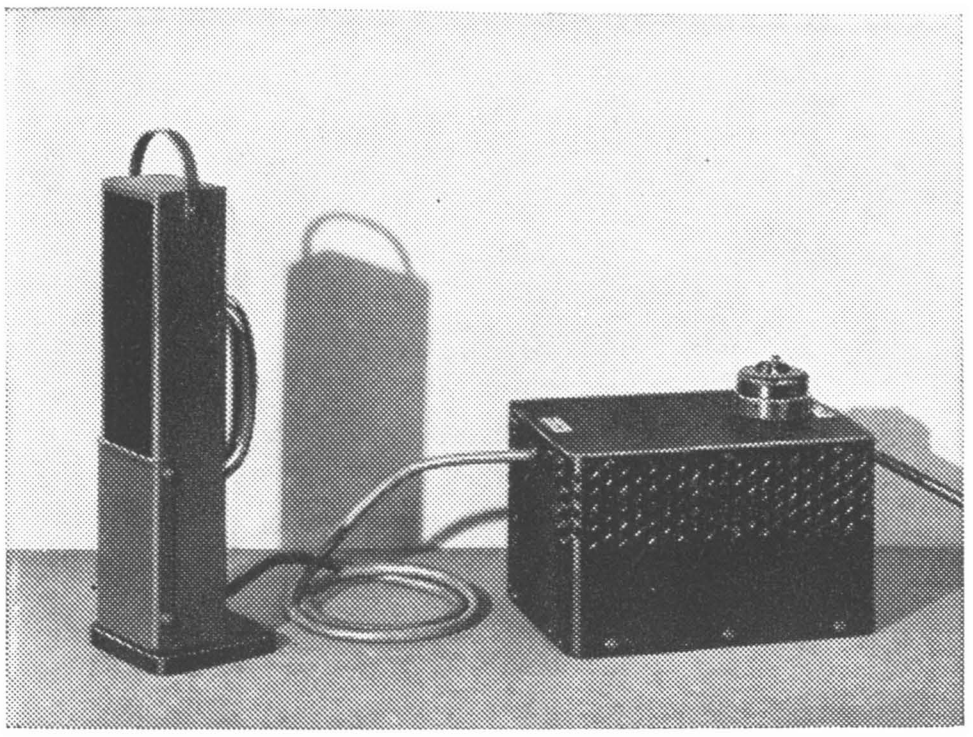
UNILEVER HOUSE

BLACKFRIARS, LONDON, E.C.4.

Phone: Central 7474. Grams : Glymol, Telex, London.

GET.75C-189a.

FLUORESCENCE TESTS
ON FABRICS



TEXTILE SCANNING LAMP . . .

This small Portable fluorescence lamp for examining fabrics has been developed in conjunction with the Linen Industry Research Association, Lambeg.

Full particulars on application to the makers :—

THE THERMAL SYNDICATE LTD.

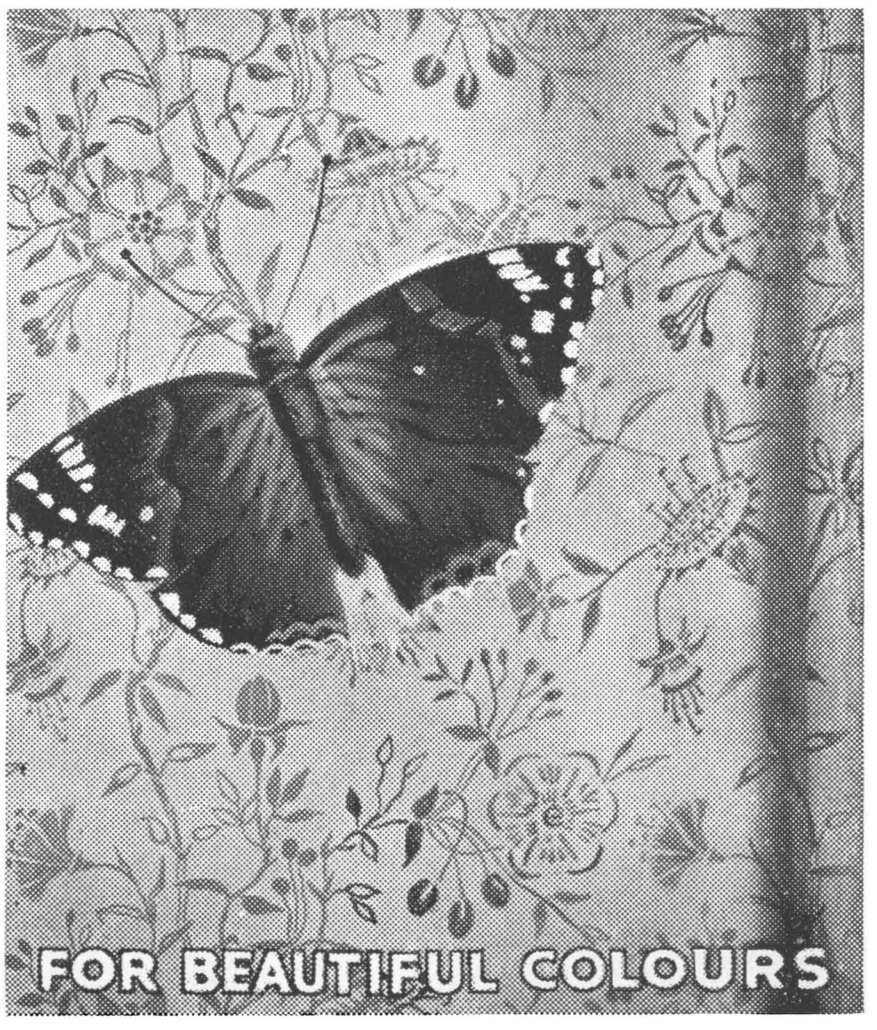
Head Office & Works: WALLSEND, NORTHUMBERLAND

London Depot : 12-14, OLD PYE ST., WESTMINSTER, S.W.1 Estab. over 30 years.

TRAGASOL AND TRAGON
IN DYEING AND PRINTING

- Excellent for colour suspension.
- Produce uniformity and regularity of shade.
- Give clarity of colour—definition of design.
- Highly viscous—ideal as a thickeners.
- Work admirably with soluble and suspended colours giving good penetration.

Booklet "Tragasol Products and Their Uses" *free on application.*



Telephone Hooton 27.

Telegrams: "Tragasol, Little Sutton.

TRAGASOL PRODUCTS LTD. HOOTON CHESHIRE

A NEW AND IMPROVED

TYPE OF

DELUSTRANT

"SPECIAL X"

of particular interest to

SILK HOSIERY FINISHERS

THE MULSOID CO. LTD.

National Buildings, St. Mary's Parsonage,

MANCHESTER, 3

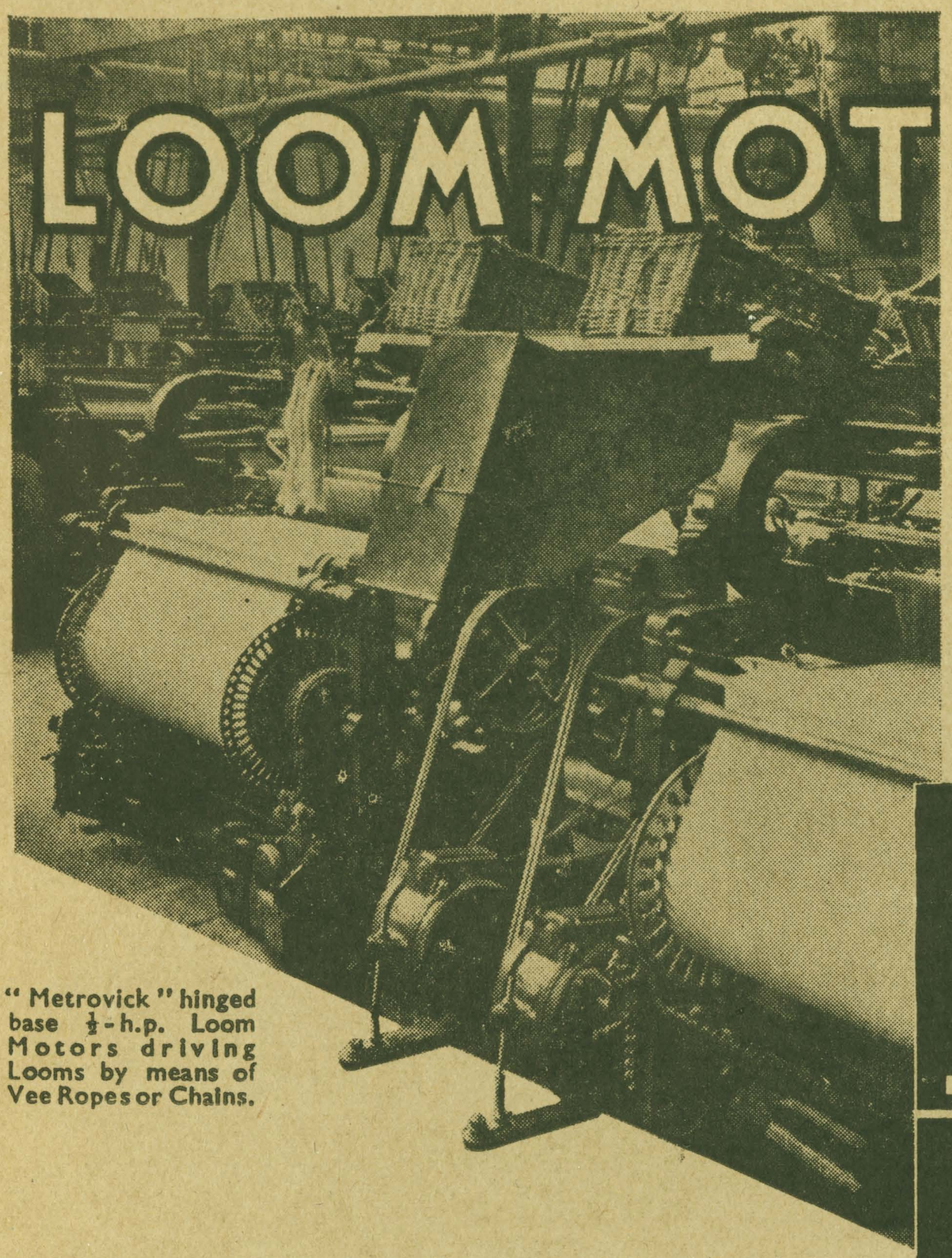
'Phone: BLAckfriars 3521. *'Grams:* "Mulsoid, Manchester."

Works: Widnes, Lancashire.

Alphabetical Index to Advertisements

	PAGE
Amoa Chemical Co. Ltd.	xxvi
Arundel, Coulthard & Co. Ltd.	xix
Bodden, Wm., & Son Ltd.	viii
Bridge, David, & Co. Ltd.	xxv
British Celanese Ltd., ...	i
British Thomson-Houston Co. Ltd. ...	ix
Cockill, H. E. & Sons Ltd. ...	xviii
Courtaulds Ltd.	xv
Crolt Engineering Ltd.	xxv
Crosses & Winkworth ...	xiv
Dixon, John & Sons Ltd.	xxi
Eadie Bros.	vii
Evans Norman & Rais Ltd.	xxii
Farmer, Norton, Sir James & Co. Ltd.	Fourth Cover
Frost & Sons, Wm., Ltd.	ii
Gardinol Chemical Co. Ltd.	xxiv
Glycerine Ltd.	xxvi
Howard and Bullough Ltd.	x
Hutchinson, Hollingsworth, & Co. Ltd.	iii
Imperial Chemical Industries Ltd.	v
Laporte, B. Ltd.	2nd cover
Mather & Platt Ltd.	xx
Metropolitan-Vickers Electrical Co. Ltd.	Third Cover
Mulsoid Co. Ltd.	xxviii
National Provincial Bank Ltd. ...	xxii
O'Brien J. Owden & Sons Ltd. ...	xxii
O'Neill, S. & Sons Ltd. ...	xxiii
Rinso Wash Testing Labs. ...	vi
S. K. Silver Jubilee Tech. Inst.	xxiv
Small & Parkes Ltd.	xvii
Thermal Syndicate Ltd.	xxvii
Tragasol Products Ltd.	xxvii
Tweedales & Smalley (1920) Ltd.	xi
Universal Winding Co.	xiii
Vickers, Benjamin R. & Sons Ltd.	Insert
Whipp Bros. & Co. (Darwen) Ltd....	xxii
Wildt & Co. Ltd.	xvi
Wilson Bros. (Bobbin) Co. Ltd. ...	xii

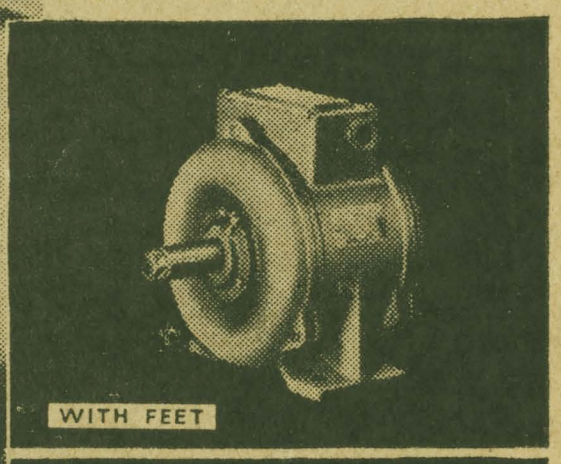
LOOM MOTORS

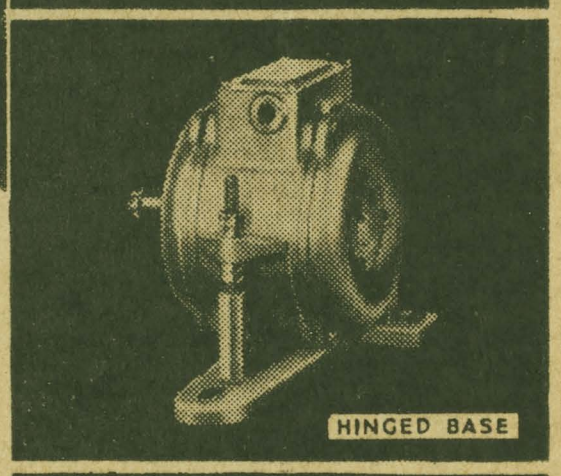


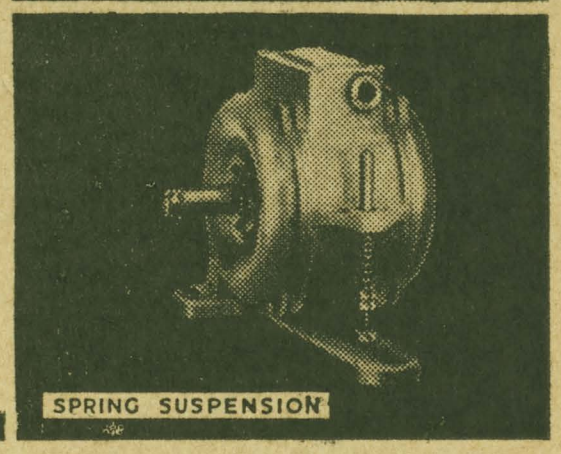
"Metrovick" hinged base ½-h.p. Loom Motors driving Looms by means of Vee Ropes or Chains.

"Metrovick" Loom Motors are designed to withstand the arduous conditions prevailing in Weaving Sheds and are giving unfailing service throughout the Textile Industry. As illustrated, the motors are supplied either with feet, hinged base or spring suspension.

3 TYPES of MOUNTING







METROPOLITAN Vickers
ELECTRICAL CO., LTD.
TRAFFORD PARK ··· MANCHESTER 17.

Send your Enquiries to the **TEXTILE DEPARTMENT**

J/N703

SANFORIZE YOUR FABRICS and SATISFY *the* USERS

THE public demands that cotton fabrics shall not shrink when laundered.

Sanforized cloth is shrunk to within ¾ or 1% of the pre-determined shrinkage. This means about ¼ of an inch in 36 inches.

SIR JAMES FARMER NORTON & CO. LTD.,
ADELPHI IRON WORKS . . MANCHESTER

Printed and Published for the Textile Institute (Offices—16, St. Mary's Parsonage, Manchester) by C. Tinling & Co. Ltd., Liverpool, London and Prescot.