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THE JOURNAL *of the* TEXTILE INSTITUTE

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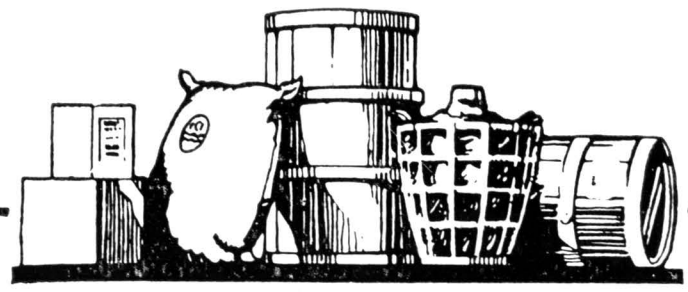

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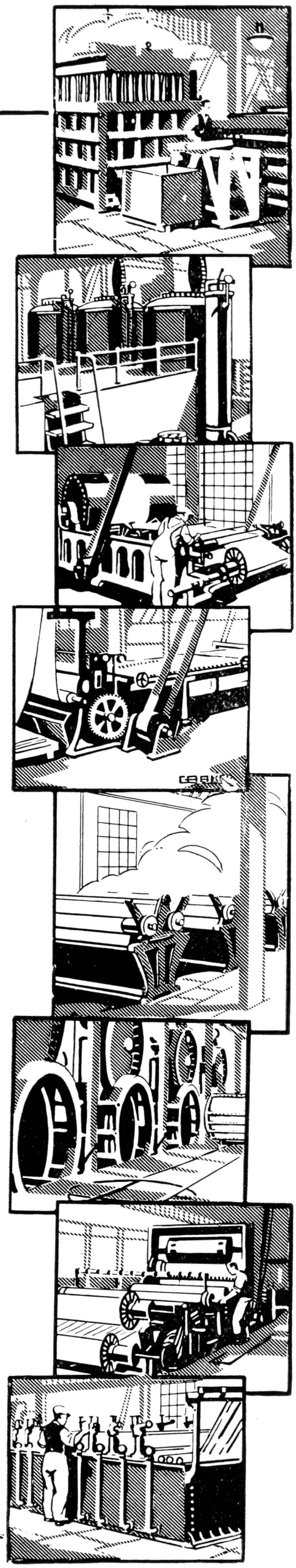


NOTICES—INSTITUTE MEETINGS

Wednesday 5th April *Manchester*—3 p.m. Meeting of Selection Committee, at Institute.

Tuesday 11th April *Manchester*—3 p.m. Meeting of Publications Committee, at Institute.

Wednesday 19th April *Manchester*—3 p.m. Meeting of Council, preceded by meeting of Finance and General Purposes Committee, at Institute.

Other Organisations

Blackburn Textile Society

Saturday 8th April Visit to British Goodrich Rubber Co. Ltd., Leyland.

Colne and District Textile Society

Friday 7th April *Colne*—7.30 p.m. Lecture, "Manipulation of Rayon from a Weaving Point of View," by A. Glover, at Technical School.

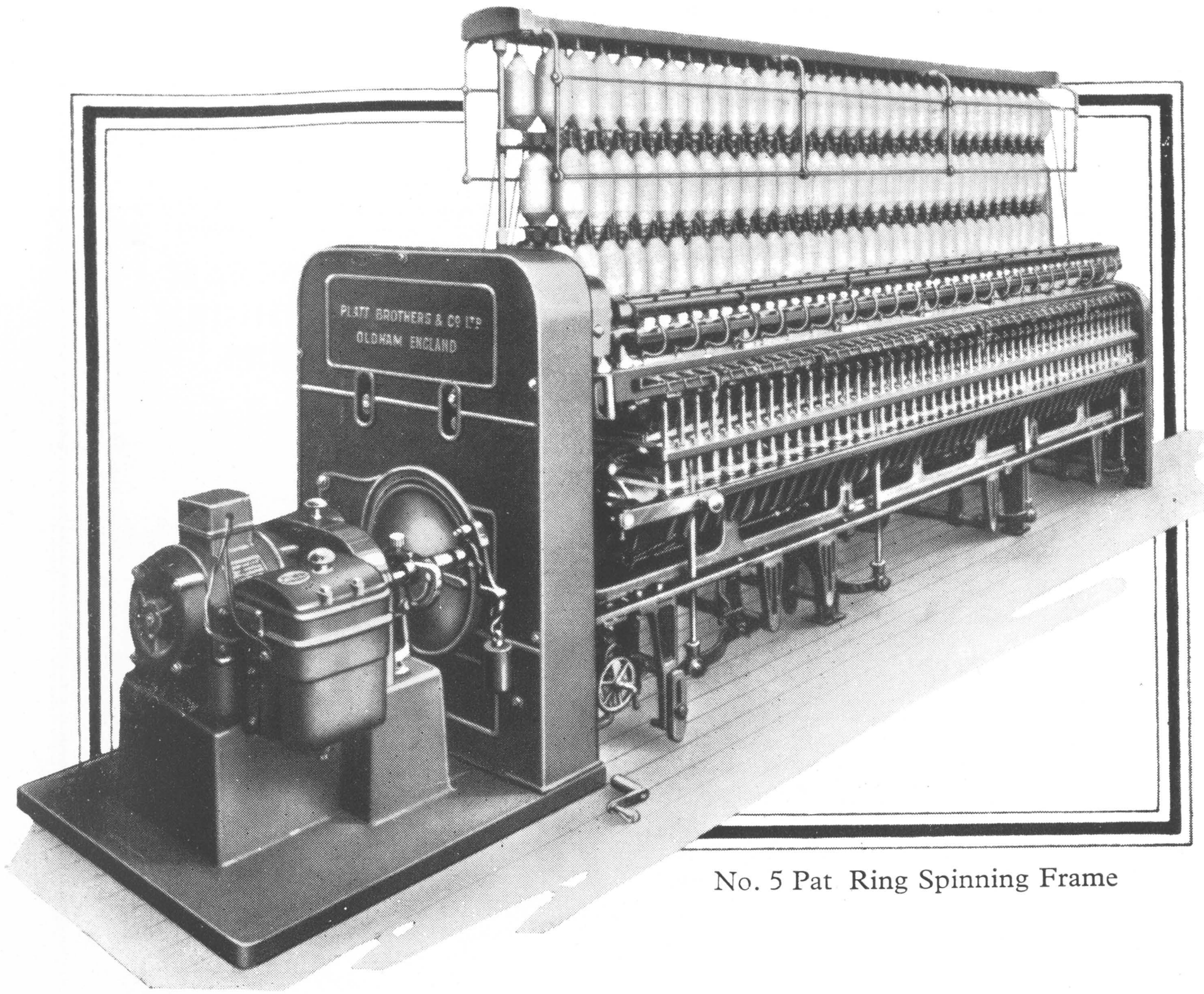
Nelson Textile Society

Saturday 22nd April Visit to the Lancashire Foundry Coke Co. Ltd., Moorfield, Altham, near Accrington.

Rochdale Cotton Spinning Mutual Improvement Society

Tuesday 11th April *Rochdale*—8 p.m. Lecture, "How, When, and Why we set a Card," by A. Martin, at Barlow Street.

Tuesday 25th April *Rochdale*—8 p.m. Lecture, "Modern Machine Shop Practice," by H. Lilley, at Barlow Street.



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THE JOURNAL OF THE
TEXTILE INSTITUTE

Vol. XXIV MARCH 1933 No. 3

PROCEEDINGS

BRITISH INDUSTRIES FAIR 1933

TEXTILES SECTION, White City, Shepherd's Bush, London

This survey has been prepared at the request of the Publications Committee by Mr. W. Wilkinson, of Blackburn, who deals with the technical aspect of fabrics exhibited; by a prominent Manchester producer, who reports on designs and colour; and by Mr. A. Trevor Handley, of Southsea, whose point of view is that of the distributor.

A Technical Survey of the Exhibits. By W. Wilkinson (Fellow).

A preliminary, yet fairly thorough, general scrutiny of the exhibition created one or two broad impressions which may be worth recording before turning to details of fabrics which were subsequently examined more attentively.

The exhibition must first be regarded as a gigantic shop window for the textile products of Great Britain and Northern Ireland. The broad effect, due mainly to the decoration of the halls themselves and to the general character of the stands, coupled with the excellent colour effects very definitely achieved by many exhibitors, was extremely good. Closer inspection revealed lack of balance and variations in intensity which must have had the effect of reducing the attractiveness of sections of the exhibition. What is meant is that certain sections or individual stands either did not display their goods to the best advantage, usually because they had too many good things to show in a restricted space, or, in a few cases it must be admitted, because their displays were not up to the general level of quality. Of the colour effects and how these were secured, another contributor will write in detail, but the opinion must be noted here that the general display owed at least 70% of its effectiveness to colour alone.

A minor point perhaps may be admitted to reference, since it certainly was real enough in the impression it made. It is that where a general plan has been adopted in regard to stands, any marked deviation from that plan repels rather than attracts attention.

Of fabric structures exhibited, it may, first, be stated that nothing absolutely new was noted. Since "there is nothing new under the sun" this is not perhaps to be wondered at, but claims made by salesmen that "This is absolutely new, sir," cannot be substantiated and certainly are not impressive.

On the other hand, the successful development or extension of an old idea to the point of commercial availability is a noteworthy achievement and several fabrics on show come into this category and to that extent may be called "new": their producers are to be heartily congratulated on their solutions of the technical problems presented.

Taking all fabrics exhibited by groups—the grouping adopted by this Institute in connection with its Fabric Competitions was adopted in this survey—that containing "Fabrics for Furnishing purposes" was outstanding at the exhibition.

All sections, cotton, wool, silk, linen and rayon, contributed their quota to this successful group, and some admirable fabrics, particularly soft furnishings, were on show. One "new" structure merits specific reference; this is a double velveteen, a reversible fabric, covered by a provisional Patent 3903/1932. It is a weft pile fabric, hence is a velveteen and not a true velvet, of about 375 picks to the inch, with the fast pile on both faces. Its density is such that when placed over a 100-watt lamp no light penetration occurs, and its colourings and finish are admirable. The quality of cotton used is such that excellent lustre is secured and the dyeing of the samples exhibited is a testimony to the dyer responsible. Its appeal as a reversible furnishing fabric with good wearing and draping qualities, coupled with its excellent appearance, should be very wide.

As an example of the need to make an appeal through the medium of the fibre employed, reference may be made to mohair pile fabrics exhibited in the soft furnishings group. Here distinctive "handle" is secured, whilst large jacquard patterns are introduced successfully. Imitation skins were noted as examples of enterprise in the substitution of textile products for more expensive goods. The employment of mohair yields clean, hard wearing, non-depressible pile fabrics.

More than one example was noted among furnishing fabrics of the employment of elaborate jacquard designs and effects. The introduction of jacquards of fine pitch and high needle capacity has resulted in the production of some excellent furnishings and Lancashire manufacturers might note that their Yorkshire and Scottish confrères seem mainly to be exploiting this development.

Coupled with the above-mentioned development, one exhibitor had introduced slub and condenser weft yarns with rayon warps into a series of outstanding fabrics for furnishing purposes. Cheaper lines utilising cotton warps and grandrelle wefts, as well as more expensive goods carrying woollen wefts were also shown, and the "historic" character of the goods added to their attractiveness—nothing better in range, structure and conception was to be seen. The wealth of goods available on the small stand utilised was its only drawback. No group excelled the furnishing fabrics in the Fair in regard to technical excellence and enterprise.

Book cloths are not, of course, new, but those on the stand of one exhibitor being "fadeless," non-spotting, and washable, struck a new note and are worthy of remark. Their attractive colouring, too, added to their appeal and they should be much in demand.

The principal "weave" employed in the women's dress goods group was the so-called pique voile, which should more properly be termed the "cord" voile. As a background for printed designs it is most effective, though evidence was seen of its break-down into "cheaper" lines by the employment of single yarns instead of two-fold, and by the securing of the same effect by printing alone.

Dress goods made on lace machines attracted attention and examples in checks and diagonal lines of cotton and wool substance were seen. These were of firmer structure than is usually secured on the lace machine and the tendency to "droop" was apparently overcome.

"Shadowlaine" is a name given to another "new" structure noted. This fabric is a cord with a silk handle. The structure is of the cord type with a spacing of plain fabric between the cords. Hard twisted worsted weft is employed, which brings the cords together, resulting in a springy fabric with a softer "feel" and better draping qualities. The same exhibitor showed very suitable yarn structures in union suitings designed not only for tropical wear, but to create so far as may be a demand on the part of "mere man" for light-weight attractive summer suitings. According to this theory the women are not to be the sole wearers of "clothing for the season."

No one would claim that the "cellular" structure was new; it would not be easy to say how long the "leno" weave has existed, but the extension of the

principle to yarns of different fibres and of heavier counts indicates enterprise and may be marked as progress. Examples of this fabric structure applied to sheets, bed spreads, light and heavy blankets, and suitings were to be seen. In one instance, at least, a chenille yarn had been introduced with excellent effect. Coupled with very attractive pastel shades in colourings, these fabrics were a good second to the soft furnishings.

For overseas markets further afield than the Continent of Europe, it was not to be expected that much could or would be exhibited, but one stand bore examples of West African goods in very vivid checks with rib structure patches of coloured rayon. These were novel and very attractive.

Space is not given here to the several examples of "uncrushable" fabrics, whether they derived that quality from their weave or from finishing processes. They have been described elsewhere in the literature at length on previous occasions.

Viewed geographically, though it may be said that Yorkshire and Scotland came more prominently into the picture this year: it may be that more experience in the display of their goods will enable these manufacturers to catch up with their Lancashire rivals in this aspect of industry. On the other hand, though quality masked may miss its object, lack-of-quality displayed does not always achieve its ends. It would seem that the Midlands and Ireland ought to claim a bigger share of the space available on such an occasion.

A new development in fabrics for underwear has been made possible by the introduction of weft yarns produced without twist, giving a soft silky feel and draping qualities almost equal to real silk. This yarn is being spun on special frames and is treated with a solution of an adhesive which when dry gives the necessary strength to the yarn and the resulting texture is in no way reduced in strength. Limbrics and other soft-faced fabrics are now being produced with this twistless weft and finished in pastel colours. The effect is very pleasing and one wonders how far the variation of twist (ranging from yarn without twist to yarns with a considerable number of turns per inch) will be responsible for a good portion of the future trade of Lancashire and Yorkshire.

Hard twisted weft is sized or doped to keep the twist and, at the other end of the twist scale, yarn without twist is sized to give strength sufficient for the weaving process.

Sizing weft yarn may be one of the problems for the future, and weaving sized weft will certainly be one of the developments in the textile industries.

Design and Colour Survey. By a Manufacturer.

On visiting the Textile Exhibition at the White City, the visitor felt overwhelmed by the enormous display of printed fabrics. The exhibition was laid out in long avenues with the stands on both sides displaying a multitude of printed fabrics produced by Lancashire and Yorkshire firms.

Apparently exhibitors imagined that the interest of buyers would be confined to prints, as with one or two exceptions every stand portrayed printed designs. For display purposes bright designs are no doubt attractive to the sight, but the exhibition failed to represent the great variety of beautiful plain dyed fabrics which Lancashire has put on the market during the last few years—fabrics which have replaced the Continental real silk and artificial silk fabrics formerly imported.

In the printed fabrics it was noticeable that each annual exhibition shows a great advance both in design and colour. The most popular and attractive designs this year were undoubtedly diagonal effects, chevrons and broken checks, all in very bright colours—blue, red, brown and gold predominating. There

were also some very attractive fancy spot designs on light grounds, suitable for summer wear.

The floral designs, although beautiful in design and colour, were not as striking as the above-mentioned styles, and did not show much advance on last year's exhibition. The fabrics printed in floral effects consisted of medium sized objects, not closely set, and the whole exhibition of these showed a definite leaning towards natural flowers rather than conventional. The colourings were mostly tones of blue, red, brown, and gold, and a soft shade of grey which is likely to be popular this year. Green did not appear to be in fashion, as there was an absence of this colour. One stand in particular had a very beautiful display of voiles and chiffons, all in light pastel shades—pinks, beige, and lemon predominating.

Two or three stands showed a good range of designs for children's wear in small (mostly geometrical) effects in bright colours on light grounds, which gave a very pleasing clean appearance to the cloth. These were all in fadeless colourings guaranteed to stand washing. This important section of the trade did not appear to receive the full attention which it deserved, and the great majority of the firms omitted to show any designs for children's wear.

The qualities of cloths which were printed consisted mostly of uncrushable crêpes, voiles, and chiffons. The large range of uncrushable qualities demonstrated the big advancement which Lancashire has made in the improvement of cotton and artificial silk fabrics.

There were some quite new fabrics introduced in heavy rough crêpe styles which are bound to be popular. These qualities are as good as anything seen from the Continent and should sell in large quantities in the plain dyed state, as well as printed.

The Retailer's Point of View. By. A. Trevor Handley (Southsea)

This year's exhibition marks a very great advance on the previous exhibitions in the Furnishing Fabric Section.

The various manufactures and factors are conveniently grouped together and the standard of the stall dressing has reached a very high level. It is a great convenience for retail buyers to be able to pass from stand to stand making comparisions of the various designs and colourings in comfort and ease.

Taking the section as a whole, the retailer must be struck at once by the fact that as far as designs are concerned, the modernist spirit seems to be declining, and there is a reversion to the more traditional period designs. The familiar and many very ugly jazz designs and colours appear to be almost non-existent. The colours themselves, both in plain and printed fabrics, show a much softer tendency, and the delightful shades of soft green, russet and new pink, which savours a little of terra-cotta, seem to predominate.

Another predominant note is the growth of glazed chintzes, which in many cases are quilted in various designs and appliques, which unquestionably enhance their appearance.

This year's exhibition also shows a very striking advance which has been made in the manufacture of artificial silk fabrics. Not very long ago they were somewhat crude in their colourings and particularly harsh in their texture, whereas now one is able to find most delightful shades in fast colour dyes and soft textures, reminiscent of pure silk.

London Section

Meeting at the Institute's Rooms, 104 Newgate Street, London, on 16th November 1932; Mr. Frank Henley in the chair.

LEGISLATION CONSIDERED IN RELATION TO RETAIL DISTRIBUTION; ITS ORIGIN AND DEFECTS

By G. B. Brooks

The word "legislation," according to Wharton's Law Lexicon, is "the act of giving or enacting laws," but in everyday parlance the word is generally understood as indicating the collective body of laws which have from time to time been enacted by the Legislature. Laws in this sense are understood to mean Statutory Enactments of the Supreme Legislative Power, *i.e.* Acts of Parliament, as distinguished from law which has grown up from time immemorial, derived from legal principles and judicial precedents, and known as the Common Law. There has always been a sharp distinction drawn between these two classes of law. The Romans, following the earlier example of the Greeks, called the one branch *Lex Scriptæ*—the written law—and the other *Lex non Scriptæ*—the unwritten.

It does not, in the least, follow that because the law purports to be set out and defined in an Act of Parliament it is thereby made clear and unambiguous, therefore, a third class of law arises which consists of written or Statute law as explained by the judges with the aid of these customs, rules, and maxims which are the Common Law.

In dealing with this subject, however, I have to confine myself as far as I can to the effects which the former class, namely, direct Acts of the Legislature, have had upon the retail and distributive trades. It is, in itself, a very wide field and I will only call attention to one or two of the principal Statutes which affect retail traders in the conduct of their business as distinguished from those which affect them, in common with everyone else, as ordinary citizens.

These seem to fall automatically under two heads or classes—

Class I—Statutes which affect the trader's relations with the public or the State.

Class II—Statutes which affect his relations with persons in his employ.

Class I readily adapts itself to sub-division into three headings—

A—His relations with those from whom he purchases his goods.

B—His relations with the general public to whom he sells and amongst whom he is the medium of distribution.

C—His relations with the State and the various Public Authorities who exercise control over such matters as hours of business, building, sanitation, escape in case of fire, transport, rating, and a large number of other matters.

Class II represents a variety of enactments designed, or supposed to be designed, mainly to safeguard the general well-being of the employés.

With regard to Class I, sub-headings A and B, I think that although there are still many anomalies, and hard cases occur, on the whole the Statute Law is reasonably clear and, at the same time, fair and effective.

With regard to sub-heading C, many traders are of opinion that legislature has, in some respects, gone farther than is essential, and that as regards Class II some of the legislation affecting employés is unduly irksome to the employer without being correspondingly beneficial to the employé.

I think the most important Statute falling within Class I, sub-headings A and B above, is the Sale of Goods Act 1893. It is a masterly codification of the whole accumulation of Common Law on the subject of sale of goods, and regulates the relations of buyer and seller in connection with every transaction of sale of

goods, wholesale or retail. It is obviously impossible to attempt any detailed examination of its provisions. One or two outstanding provisions may, however, be referred to, for instance, the definition of contract of sale, which is a "contract whereby the seller transfers or agrees to transfer to the buyer the property in goods for a money consideration called the price."

Any right, duty, or liability which may arise by implication of law may be negatived or varied by usage (*i.e.* custom of the trade) if that usage is such as to bind both parties. Then there is the provision as to the sale of goods of the value of £10 or upwards re-enacted from the old Statute of Frauds of Charles II. Its provisions have been the subject of endless litigation and questions as to its construction occur almost every day. This provision, which forms Section 3 of the Act, is—

> A contract for the sale of any goods of the value of £10 or upwards is not enforceable by action unless (*a*) the buyer accepts part of the goods, (*b*) gives something in earnest to bind the bargain, (*c*) or in part payment—or unless some note or memorandum in writing of the contract is made and signed by the party to be charged or his agent in that behalf.

There is a huge body of law as to what constitutes "acceptance" and what is a sufficient note or memorandum within the meaning of the section, but in passing I might perhaps refer to the rather curious expression "gives something in earnest to bind the contract," and Section 4 provides that "earnest" means a coin or something valuable given by a buyer to signify the conclusion of the bargain. A ring may be given or a coin, but the thing must be "given." It was held in a case decided in 1817 that the operation of "striking a bargain," that is to say drawing a coin across the hand of the seller and taking it back, is insufficient. The doctrine of *caveat emptor* (let the purchaser beware) is definitely recognised by the Act, but is subject to so many exceptions and qualifications that it has been said that whilst the general rule is *caveat emptor*, it has become in reality largely the exception, at any rate as regards quality and fitness. For instance, when the buyer makes known to the seller the purpose for which the goods are required so as to show that the buyer relies on the seller's skill or judgment, and the goods are of a description which it is in the course of the seller's business to supply, there is an implied condition that the goods shall be reasonably fit for such purpose.

A question which often arises is whether or not the property in the goods, the subject of a sale, has or has not actually passed to the buyer. It is important in many aspects, both as affecting the position of the storekeeper in his relations with the wholesaler, and to a less extent with his customers—particularly in case of bankruptcy or insolvency, or the like, and difficulties sometimes arise in case of goods sent on approval or subject to payment C.O.D., and possession of which is obtained by the customer either by accident or design under circumstances which make it desirable that the tradesman should be able to establish that the actual property had not passed, and that he is entitled to return of the goods in specie.

A familiar instance of this is when a transaction is thought to be risky and a messenger is sent with instructions to obtain the money in exchange for the goods, but the customer having got the goods into his, or her, physical possession, declines to hand them back and says the money will be sent on or makes some other excuse for not complying strictly with the bargain.

There may be very extreme cases in which the circumstances may amount to the criminal offence of larceny by a trick and, on the other hand, it may be fairly clear that there has been a waiver of the original arrangement, and the transaction amounts to an out-and-out sale and delivery, for which the only remedy is to sue for the price, but there are a number of intermediate cases where guidance as to the legal position is provided by the Statute in question.

All the effects of sale as regards both buyer and seller, the seller's right to recover the price, time and mode of payment, right of unpaid sellers against the goods, damages for non-acceptance, sale or return (appro.), sale in *market overt*, and a variety of other matters are dealt with, and in general the Act may be said to make provision for most questions which are likely to arise out of the daily transactions of the retail distribution of goods.

I have just referred to the expression "market overt." The Common Law on this subject in course of time became well settled, and the Sale of Goods Act, 1893, adopted and reproduced the rule of the Common Law, which is, in effect, that where goods (other than goods belonging to the Crown) are sold in *market overt*, according to the usage of the market, the buyer acquires a good title to the goods although the seller was not really the owner of them. *Market overt*, or open market, is defined by the act—or rather the conditions—under which the goods are sold and, in effect, it comes to this that the place where the goods are sold must be a public or legally constituted market or fair; and the whole transaction must be begun and concluded openly in the market or fair.

Besides the exception of the goods of the Crown, there is another exception, and that is where goods have been stolen and the offender is prosecuted to conviction. The property in the stolen goods in these circumstances revests in the person who was their owner and he is entitled to recover them notwithstanding any intermediate dealing with them, whether by sale in *market overt* or otherwise. Unless goods are sold in *market overt* the purchaser cannot retain them against the true owner.

By the custom of London, it has been recognised, from time immemorial, that a shop within the City of London is *market overt* between sunrise and sunset, except on Sundays and holidays. This custom was considered very carefully in a case in the year 1892. In that case pearls had been stolen from a society lady and sold to certain well-known jewellers at their establishment in the City, and on discovering the facts, she sued the jewellers for the return of her property; they contended that their shop being *market overt* within the meaning of the custom of the City and no prosecution having taken place they were entitled to keep the goods. Unfortunately for them, however, it appeared that the purchase took place *not* in the shop itself but in a showroom above their shop. The person who brought the jewellery for sale explained her business, and was thereupon taken behind the counter and into an upper room where the purchase by the defendants was effected, and this little piece of courtesy on the part of the purchasers put them out of court, it being held that whilst the shop itself, being in the City of London, was *market overt*, the showroom in which the sale actually took place was not within that description.

In the early part of the nineteenth century, public attention was much exercised with regard to alleged abuses arising out of the payment of wages wholly or partly in kind, and in 1831 was passed the Truck Act. Wharton's Law Lexicon describes the truck system as "the payment of wages in goods instead "of money and that the plan has been for masters to establish warehouses or "shops and the workmen in their employ have either had their wages accounted "for to them by supplies of goods from such depots without receiving any money "or they have had the money given to them with an express understanding that "they were to resort to the warehouses or shops of their masters for the articles "of which they stood in need."

By the joint effect of the Truck Act 1831, and the Truck Amendment Act 1887, the entire amount of wages earned by, or payable to, any workman must be actually paid to him in current coin of the realm, and any payment by delivery of goods, or otherwise than in current coin of the realm, is illegal, null, and void.

There have been numerous decisions as to the employés falling within the above description, but I cannot find that there has been any decision with regard

to drapers' assistants. Clearly, however, the Acts apply to those who are engaged in productive work.

Subject to certain conditions, involving either a contract signed by the workmen or a notice being kept constantly affixed in a place open to the workmen, certain exceptions to the rule regarding deductions from wages have been made, including fuel, medicine or medical attendance, materials, victuals (dressed or prepared under the employer's roof and there consumed by workmen), fines, damage to goods, machines, etc.

The Truck Act 1896, is the Act which sets out the conditions under which fines may be imposed, deductions may be made in respect of damaged goods, or in respect of materials. All these are dependent upon there being a contract, the terms of which are contained in a *notice* kept constantly affixed open to the workmen, in such a position as to be easily seen, read, and copied, or, in a contract, signed by the workmen.

With regard to fines, these are dealt with in Section I, and the conditions, in addition to those relating to the exhibition of the contract, are that it must specify the acts or omissions in respect of which the fine may be imposed, the amount of the fine or particulars from which that amount may be ascertained, that the fine is imposed in respect of some act or omission which causes damage or loss to the employer, or interruption or hindrance to his business, and the amount of the fine is fair and reasonable, having regard to all the circumstances of the case.

I have referred somewhat at length to this particular section because it is provided that this section shall apply in the case of a *shop assistant* in like manner as it applies in the case of a workman.

Another interesting and important Statute is the Merchandise Marks Act 1887, with its various amendments, culminating in the Merchandise Marks Act 1926.

Prior to the passing of the Act of 1887, that is to say, at Common Law, to copy a trade mark or wrapper for goods was not forgery and, unless the matter could be brought within the Criminal Law, the injured person was without remedy, but by the Merchandise Marks Act 1887, every person is guilty of a misdemeanour who, amongst other things, applies any false description to goods. The punishment is very severe, the maximum being two years hard labour or a fine, or both, and in addition to this, a person is guilty of a misdemeanour who sells or exposes for, or has in his possession for, sale or any purpose of trade any goods or things to which a false trade description is applied. In the latter case, however, he is entitled to relief if he proves that having taken all reasonable precautions against committing offences he had no reason to suspect the genuineness of the description, and that on demand made by the prosecutor he gave all information in his power with respect to the person from whom he obtained such goods.

By the Merchandise Marks Act 1926, it is not lawful to sell or expose for sale, advertise, or distribute in the United Kingdom any imported goods to which the name or trade mark of any manufacturer or the name of any place or district in the United Kingdom is applied, unless accompanied by indication of origin, that is by giving conspicuously the word "foreign" or Empire, or the country of manufacture or production. There are certain exceptions relating to coverings, labels or reels for manufactured goods, and blends or mixtures. The sale in the United Kingdom of certain imported goods, unless they bear an indication of origin, may be prohibited by Order in Council. Various Orders have been made which are daily the subject of consideration in connection with imported goods.

By the Irish Hand Loom Weavers Act 1909, Irish woven linen damask, cambric, or diaper, is to be marked with specified words, and there are numerous

Acts relating to the stamping of Irish linen, going back as far as the Linen (Trades Mark) Acts 1743 and 1744.

It has no doubt been remarked that in the case of certain goods, such as silks, jewellery, furs, or hand-made lace, these goods are always dealt with in the dispatch department as on the special footing of insurable goods. This is due to the provisions of the Carriers Act 1830, which was passed with the primary object of protecting common carriers from the great risk which they ran under the Common Law in carrying articles of great value in a small compass. With regard to lost property, the carrier attempted to protect himself by posting up notices limiting his liability, but there was great difficulty in fixing consignors with knowledge of such notices. Accordingly, the Act provides that no common carrier by land shall be liable for the loss of or injury to any article or property of certain specified descriptions, including the above, where the value of such property shall exceed £10, unless at the time of the delivery of the package at the carrier's office or to his servant, the value and nature of such articles or property shall have been declared by the person delivering the package, and an increased charge above the ordinary carriage paid or agreed to be paid, and the carrier is entitled, provided he affixed in a conspicuous part of his office or receiving house, a legible notice stating the increased rate of charge, to demand such increased charge.

Marks containing representations of the Royal Arms or colourable imitations thereof, or British Royal Crowns or National Flags, or the word "Royal" or anything giving the impression that the applicant has "Royal" patronage, may not be registered as a trade mark, and, in addition, the Registrar of Trade Marks has power to refuse marks containing representations of the Sovereign or any member of the Royal Family. There is, however, I believe, an exception with regard to certain very old marks.

The wrongful use of the Royal Arms is punishable by a fine of £20 or an injunction can be obtained. In effect, no one but those who personally hold the Royal Warrant can use the Royal Arms. Before the formation of the Royal Warrant Holders' Association, a good deal of misapprehension existed on this subject, it being thought in many quarters that the fact that a member of the Royal Family was a regular or even a casual customer was sufficient to authorise the use of the Royal Arms. This Association, however, which has now been in existence for many years, has by means of publicity and by instituting or threatening proceedings in certain cases, made the position tolerably clear, and few cases of misuse of the Royal Arms now occur.

Under the Geneva Convention Act 1931, a person may not without the authority of the Army Council use for the purposes of his trade or business the heraldic emblem of the red cross on a white ground, or the words "Red Cross" or "Geneva Cross," but there is a limitation in favour of the proprietor of a trade mark registered before the passing of the Act.

The question of giving change is one as to which, of course, no difficulty arises in practice, but the legal aspect is interesting. This is regulated by the law of legal tender and the material Statutes are the Bank of England Act 1833, the Coinage Acts of 1870 and 1891, and the Currency and Bank Notes Act 1928. First of all, it is abundantly clear that no one is bound to give change. It is the duty, which can legally be insisted on, of every customer to provide himself with the exact sum required and tender that sum in payment neither more nor less, and to be legally valid a tender of payment of money unless made in authorised paper currency, must be made in coin issued by the Mint. Such coins are legal tender (1) in the case of gold coins, as also Bank of England Notes, for any amount; (2) in case of silver, coins for an amount not exceeding 40s.; (3) in case of bronze coins for an amount not exceeding 1s. So if some cranky person proposes to pay your account of £5 in threepenny bits, or of 5s. in farthings, you

are at liberty to decline to take it, although, in practice, you would probably not do so. I have heard it suggested that if a larger sum than that due is tendered the recipient is entitled to keep it, but I do not think this would be upheld to-day, but tender of a larger amount than that due with a demand for change has over and over again been held to be bad.

Attention has been directed by a recent decision in *The Times* to the position of the employer in giving a reference or character to his employé. This is not strictly a matter of legislation, although, of course, the Statutes relating to libel and slander may have application to the subject under certain circumstances. However, it is a matter of interest and not wholly of common knowledge, and, therefore, I propose to include one or two observations on this point.

First, a master is under no duty either to give a servant a written testimonial as to character on his leaving employment or to answer inquiries of persons wishing to take him into their service, and the servant has, therefore, no remedy in the event of the master refusing to do so, however great the consequent injury may be.

If the master chooses to make a statement as to the servant's character and the servant, in consequence, suffers damage either by being unable to obtain employment or by being dismissed from employment which he may have obtained his right of action depends solely upon whether the statement is actionable as being defamatory. If, however, the statement is true, no action will lie against the master, and even though it is untrue it is a privileged communication, since it is of importance to the public that characters of servants should be readily given, and there is, therefore, a presumption that it is made *bona fide*. Privilege, however, may be rebutted upon proof of express malice.

In these circumstances the greatest care should be exercised in dealing with the question of references and statements made in regard to the character of any employé as, in the event of statements made on the faith of hearsay turning out to be untrue, the employer's only defence to an action is to rely upon privilege, which it is not always easy to substantiate. It has, however, been held that privilege attaches not only to communications made to persons who are thinking of engaging a servant or have already taken him into their service, but extends also to communications made to his previous employers or to an employment agency through which he may have been procured. Whether statements made to other persons are or are not privileged must be determined by the circumstances of each particular case.

A recent case in *The Times* emphasises the necessity of exercising extreme care when taking up a reference. In that case the defendants were watch and clock makers, and advertised for a clock winder. A man answered the advertisement, gave reference to a jeweller in a provincial town which was taken up by post and was engaged. Within a fortnight it was alleged, the employé, having been sent to the house of a customer to wind the clocks, stole jewellery to the value of over £300 belonging to the customer. It then turned out that the man had given a false name, that the address which he had given was an accommodation address, there was no jeweller of the name given as a reference at the place indicated, the address being one of a row of cottages, and it was alleged that the man had served several terms of imprisonment. In these circumstances the customer sued the firm for the value of the jewellery, alleging that they were under a duty to take all reasonable care that the clock winder whose duties took him into the houses of people of rank and means was a dependable person, and that they had not done so, and were accordingly guilty of negligence. The Court held that they had not taken sufficient care in making inquiry about the man and were liable to make good the loss.

A discussion followed the reading of the above paper and the meeting ended in a hearty vote of thanks to Alderman Brooks.

Midlands Section

Meeting in the University College, Shakespeare Street, Nottingham, on Thursday, 17th November 1932; *Mr. P. A. Bentley presiding.*

DEVELOPMENTS IN KNITTING MACHINES AND PROCESSES

In a lecture on the above-named subject given by Professor W. Davis, reference was made to the inter-action which takes place between the main fibres used in knitted goods. At one time cotton gained ascendancy for a particular branch, at another time wool or rayon. Cotton had recently scored an enormous advantage over wool in the production of interlock fabrics, which were being made in increasing quantity by many manufacturers in the Midlands. The British spinner had scored in this particular type of single yarn which was mainly produced from Peruvian cotton in counts from 40's to 60's single. After much experiment, the spinner had arrived at the ideal yarn for this particular purpose. There was little to equal the handle of the interlock fabric as produced to-day on the circular knitting machine. Its great merit was that there was no wrong side to it. This made it very smooth to wear next the skin, and also increased its absorbency. When cut up into garments this particular texture was extremely stable at the edges. It did not curl and could therefore be treated very efficiently in sewing and seaming.

The knitting industry, continued the lecturer, was at present following the trend in other branches of textiles, and using lustrous yarns such as silk and rayon with very high degrees of twist, to give crêpe effects and to produce what was termed a sheer lustre. This was giving considerable difficulty in manufacturing routine, as these yarns tended to kink and snarl on the needles. Stockings also very often showed variable lustre from point to point. The extra twist did not appear to give any difficulty with regard to a longer period of wear. The same tendency was to be noticed in rayon yarns, where high twist 20 to 30 turns per inch were now being used instead of the orthodox $2\frac{1}{2}$ turns per inch. To obscure the lustre of such materials was perhaps proving of an advantage to the lisle cotton stocking trade. Wearers were now adopting those articles in increasing quantities because they were nearly equal in point of lustre with the new dim-lustre rayon articles. On the other hand, the bathing costume trade had become of very great importance to the knitting industry, and, in this branch, wool had definitely displaced cotton for the great majority of articles. The wool used was of the cross-bred variety and produced in single counts to be knitted into one-and-one fabrics. The advantage of wool as compared with cotton for this purpose was that it wetted out more slowly and did not chill the bather as cotton garments did. There was one exception to this, and that was the bathing articles used for racing purposes. It was found that the wetted garment in wool caused a larger drag on the competitor as compared with the cotton article. Cross-bred wool had also shown very solid advantages in such articles as gymnastic hose and the thicker types of footwear required for the more strenuous walking exercises and various sports.

Stouter wools gave less felting and also provided a greater bulk of material to act as a cushioning agent in motions having the character of a thrust. The cross-bred wool used bordered on the Botany type. One of the most active branches of the spinning industry at the moment was that concerned with the provision of yarns for hand knitting. This was a national craze, and spinners had vied with each other in altering their merchanting methods to provide such thick yarns in a suitable form for convenient use by the home knitter. These were being developed very largely in an open character of stitch so that although the yarns were thick, the resulting texture was light in weight.

The lecturer also referred to the opportunity which the British spinner had obtained during the past year in replacing many types of yarns previously imported. Mule spun yarn produced on the Continent had hitherto been almost

indispensable for certain branches of the knitting industry. Owing to reduced supplies of such yarns, the British spinner had received encouragement. To produce yarns having that open character required for many purposes of knitting, frame spun yarn had hitherto provided a yarn which in general was too tight in character and possessed meagre cover for the interstices of the loops. The builders of such frames, however, had recently made notable improvements in construction, and it could be said that the frame spun yarn was making steady headway in all branches of the knitting industry.

In regard to rayon, the usual counts had proved too dense for purposes of knitwear, and there was a growing demand for types of rayon which were more bulky in handle, such as the aerated yarns. Staple fibre yarn was also used to an increasing extent in knitted productions, because fabrics made from such yarns were not so liable to ladder. They also exerted a better grip during wear, being less slippery than the usual types. Lilienfeld yarn, although it possessed a high degree of tensile strength, had so far proved unsuitable for use on knitting machines, owing to its lack of resilience under the pressure exerted by sinkers and needles. Recently there had been persistent production of even finer gauges in all branches of the knitting industry, and the slogan seemed to be "Warmth without Weight." Hitherto, the latch needle machine had not been able to handle very fine gauges, owing to the difficulty of obtaining a needle slender enough possessing adequate strength. In this respect, considerable progress was to be noted, and a new latch needle had been produced so that 31 of them could be arranged per inch in a circular stocking machine. This came very near to the limit possible by the spring needle, which in the past had held the monoply in fine gauge fabrics.

A discussion and a vote of thanks to the speaker terminated an interesting meeting.

NOTES AND NOTICES

Institute 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. 93—Mill or departmental management; age 23 years; practical experience in mill organisation and control; secondary education; City and G. Full Tech. Cert. in Cotton Spinning.

No. 94—Draughtsman, technical assistant, or full-time teacher; age 29 years; six years' as evening teacher and 15 years' experience as textile draughtsman; A.T.I., Nat. Cert. in Mechanical Engineering.

No. 95—Chemist (Research or Works) in artificial silk or general textiles; age 33 years; three years' Chief Chemist and three years' Technical Manager and Chief Chemist; Ph.D., M.Sc., B.Sc., F.I.C.

No. 96—Secretarial work in any branch of textile industry; age 29 years; 13 years' Asst. Secretary; secondary education; A.T.I. and City and G. Full Tech. Cert. in Cotton Spinning.

No. 97—Asst. Manager or Asst. Salesman; age 27 years; experience in general mill office and as cloth tester and costing clerk; secondary education; A.T.I., A.M.C.T.

No. 98—Draughtsman; experience in mill planning and mill construction; seeks post as cotton yarn and cloth testing clerk, or in research work; age 26 years; secondary education; A.T.I.

No. 99—Spinning Master or Asst. to Manager; age 29 years; 15 years' practical experience; A.T.I.

Textile Institute Diplomas

Election to Associateship has been completed as follows since the appearance of the previous list (February issue of this *Journal*)—

ASSOCIATESHIP

OSBORNE, George Gordon (Massachusetts, U.S.A.)

Institute Membership

At the March meeting of the Council, the following were elected to membership of the Institute: *Ordinary*—C. Ashworth, c/o The China Finishing and Printing Co. Ltd., P.O. Box 1199, Shanghai, China (Spinning and Weaving Mill Manager); A. Brooke, 108 Birkby Hall Road, Huddersfield (Assistant Manager, Middlemost Bros. & Co. Ltd., Huddersfield); D. A. Derrett-Smith, "Rostherne," Lambeg, Lisburn, Co. Antrim (First Assistant in Chemistry Department, Linen Industry Research Association); J. Galloway, 17 Barnstead Avenue, Withington, Manchester (Shippers' Greyman); H. Gruter, c/o S. A. Torcitura di Borgomanero, Via Solferino 19, Milan, Italy (Managing Director); H. Hammond, 91 Legrams Terrace, Legrams Lane, Bradford, Yorkshire (Loom Tuner and Part-time Instructor in Weaving Mechanism); V. L. Knowles, c/o Messrs. W. R. Bland & Co., 47 Lime Street, London, E.C.3 (Textile Engineer); J. A. Matthew, 165 Sandown Road, Knock, Belfast (Physicist, Head of Spinning and Weaving Department, Linen Industry Research Association); A. Scholes, 6 Brenka Avenue, Aintree, Liverpool (Textile Chemist, British Enka Artificial Silk Co. Ltd.). *Junior*—Wm. Forsyth, 20 Vicars Hall Lane, Boothstown, nr. Manchester (Loom Overlooker, Robert Farnworth Ltd., Boothstown); Wm. E. Kyle, "Ferndene," Hamilton Drive, The Park, Nottingham (Full-time Textile Student).

REVIEWS

Hosiery Cost Accounts. By Stephen F. Russell. Published by Sir Isaac Pitman and Sons Ltd. (168 pp. and index, price 10s. 6d. net).

This book will provide much valuable assistance in costing to the manufacturer of hosiery, the author dealing with phases of the subject which have hitherto been neglected in the literature on the subject. This volume is written from the viewpoint of the expert accountant and the subject matter related to practice in seamless and full-fashioned footwear, the author being a works accountant with a firm in this branch. Fundamental principles of hosiery book-keeping and accountancy are emphasised throughout and the careful student will find much which he can apply to any branch of knitted goods manufacture. A valuable feature is the number of forms given relating to all departments for the correct recording of statistical data relating to yarn stocks, goods at the various stages of manufacturing routine, and records of sub-standard hosiery.

The chapters relating to the correct allocation of overhead expenses, factory, warehouse, and general, will repay careful study and reliable methods are clearly illustrated by numerous practical examples. A number of examples of final cost summaries relating to different weights of hose are given, divided into the following sections—(1) Yarns of every sort used in the article, with proper allowances for waste and what is termed adjustment. Then follow in (2) departmental operation and process costs, including dyeing, boarding, folding, and boxing. These are given at different figures based on piece rates and not subject to cost-of-living bonus additions, as in common practice in the Midland hosiery towns. Then come in (3) the works office and general office expenses as a percentage of these operation costs. In the general overhead, and stated as a figure per dozen, are warehouse, despatch, sales, advertising and distributing costs. Then follows an allowance under the head of administration. The book is attractively written in a lively style and forms a valuable addition to the literature relating to the knitting industry. Mr. F. R. M. de Paula, late Professor of Accountancy, contributes the foreword. W.D.

Rubber Latex. By Henry P. Stevens and W. H. Stevens. Issued by The Rubber Growers' Association Inc., Eastcheap, London, EC3 (156 pp.).

The application of rubber to textiles in the past has been a special branch of the rubber industry rather than of the textile industry. The necessity for employing the rubber dissolved in inflammable and somewhat objectionable solvents and the difficult method of vulcanisation have combined to keep rubber proofing and finishing apart from ordinary textile processes.

The advent of rubber latex as a commercial raw material together with the production of vulcanisation accelerators has however brought the treatment of

cloth with rubber within the technique of the ordinary finisher, and latex is finding more and more use in the textile industry.

This book therefore will be of great interest to the textile manufacturer. It contains first-hand information about the production and properties of rubber latex and its manifold applications with a frank exposition of the practical difficulties and pitfalls. If the information on the use of latex in textiles is found to be meagre, it must be remembered that the subject is still in its infancy.

The latter half of the book is devoted to a very useful bibliography of patents on rubber latex preceded by some sane remarks on patents in general. The book will form an excellent manual for anyone wishing to pursue the subject thoroughly.

R. G.

Occupational Diseases. By Rosamond W. Goldberg. Published by the Columbia University Press, New York—London Agents, P. S. King & Son, Westminster, S.W.1. (253 pp. Bibliography and Index. Price, 22s. 6d. net.)

This volume is No. 345 of a series of publications edited by the Faculty of Political Science of Columbia University, U.S.A., under the group title of "Studies in History, Economics and Public Law." It has particular reference of course to conditions in the United States, but by anology is of interest to those who are concerned at the prevalence of occupational diseases, and in their prevention or cure. The book reviews the various hazards to which many workers are being regularly exposed and attempts to determine whether a system of health insurance can be applied to meet the large number of cases of occupational diseases and industrial poisoning. In dealing with systems of health insurance, Dr. Goldberg first surveys those of Germany and Great Britain, drawing a comparison between the two systems, and then briefly refers to those of other countries, such as France, Japan and Russia. She then surveys health insurance in the United States, dealing with attempts and early essays in some form of health or sickness insurance by voluntary effort, single corporations, or States. Reference is made to the failure of voluntary insurance and to the agitation for a Compulsory State Scheme, with particulars of legislative attempts placed before the Federal Government. Finally, a summary of reasons for the need of compulsory health or sickness insurance is given, and the conclusions drawn that such insurance provides a powerful stimulus to the adoption of health-saving devices and methods of operation; makes decided gains in the elimination of certain hazardous industrial processes and the prohibition of the use of certain deleterious substances; improves the health of the workers; reduces mortality and vitally affects the everyday activities of the population.

Among the hazards reviewed are those in which dusts occur, such as in the cotton, flax, hat, and carpet industries; those in which toxic gases, vapours, and fumes are encountered, such as the rayon and dyestuffs industries; and such diseases as anthrax, dermatitis, and cancer. Altogether the book summarises a mass of information admirably and, coupled with a useful and wide-flung bibliography, is a welcome addition to the literature of public health and industrial welfare.

T.

PUBLICATIONS RECEIVED AND ADDED TO THE INSTITUTE LIBRARY

Hints on Automatic Weaving: A Handbook for Automatic Loom Users. By M. Proctor-Greg. Published by the British Northrop Loom Company Limited, Blackburn. (106 pp. and Index. Price, 2s. 6d. net.)

This booklet describes in Part I, the Northrop Automatic Loom, giving details and drawings of the various parts and attachments. Part II describes the Northrop system, which concerns itself with the number of looms per weaver; the auxiliary labour in the shed; payment by the pick instead of by the piece; and continuous running. Notes are given on preparation, the warp, the weft, re-winding, lighting, power requirements and humidification.

Report of the British Association for the Advancement of Science, York, 1932.

This report contains the presidential address, by Sir Alfred Ewing ("An Engineer's Outlook"); the Section presidential addresses and brief abstracts of many of the papers read before the various sections. Reference has already been made in this *Journal** to papers thought to be of interest to members of the

J. Text. Inst., 1932, P288.

Institute. Of these papers that by Professor R. G. White, on "Sheep-Farming: a distinctive feature of British Agriculture," appears in full (pp. 229-256), and those by S. G. Barker and C. G. Winson; J. Firth and F. Buckingham; W. N. Haworth; H. Staudinger; E. L. Hirst; H. Mark; W. T. Astbury; W. B. Crump; H. C. K. Henderson; G. C. Allen; R. F. Wilson; W. O'D. Pierce; W. C. Miller; A. H. H. Fraser; and S. E. J. Best appeared in abstract.

Skinner's Cotton Trade Directory of the World, 1932-33. Published by Thomas Skinner & Co., London, Machester, Bradford, New York and Montreal. (888 pages. 20s. net.)

Contains a useful addition in the form of an index of all firms included in the Directory. A big reduction in size has been effected, mainly by the elimination of details under the Foreign Spinners and Manufacturers' Section, and by compounding the Bleachers, Dyers and Finishers' Section under Finishing. This is a sensible step, as it makes—with the index above—searching much less tedious. The general result is an easily handled volume.

Kingston's Sterling-Dollar Price Conversion Tables. Published by Kingston's Translations Institute, London. (Price, 2s. 7d. post free.)

These tables allow of conversions from Sterling per cwt. to Dollars per 100 lb., or from Sterling per Imperial ton to Dollars per 2,000 lb., at exchanges $3·00 to $3·95 to £, rising by single cents and by eighths of a cent.

British and Dominion Textile Industry (excluding Lancashire and Yorkshire), 1933. Published by John Worrall Ltd., Oldham. (319 pp. Price, 12s. 6d. post free; abroad 14s. 6d. net.)

The 43rd edition of this well-known directory, which covers the United Kingdom, except Lancashire and Yorkshire, the Irish Free State, and the Dominions of Australia, Canada, New Zealand and Tasmania. This is a very useful and handy work of reference. Maps would enhance its value.

"The Drapers' Organiser." Annual Directory of Trade Marks and Trade Names, including Shopfitting and Display Section, 1933. Published by the National Trade Press Ltd., London.

A useful compilation with introductory information on the choice and registration of trade marks and names. It would be definitely improved were the advertisements to be removed from the text and grouped together.

GENERAL ITEM

THE WORLD FLAX CROP 1932 AND MARKET POSITION

The following Abstract has been compiled from three sources—

(1) the *International Review of Agriculture*, 1932, **23**, 613-614;
(2) the *Deutsch Leinen Industrielle*, of 24th November, 1st December, and 31st December 1932; and 21st January 1933; and
(3) *Het Vlas*, of 6th December 1932; 3rd January, 10th January, and 31st January 1933.

The shrinkage in the cultivation of flax, which has marked all seasons since 1928/1929, continued in all the important producing countries, except the Soviet Union, in 1932. The *International Review of Agriculture* holds the view that the average increase in the U.S.S.R. more than compensates for the decrease in acreage outside Russia, though this does not appear to be the general opinion. Yield per acre and quality of production are factors quite apart from mere acreage and are referred to specifically below.

Specified decreases in acreage are quoted [*see* (2) above] as follows—

In the Netherlands	not less than	70% decrease
In Belgium		42% ,,
In Germany		32% ,,
In Czecho-Slovakia		29% ,,
In Northern Ireland		18% ,,
In France	about	2% ,,
In Estonia, Latvia, and Lithuania	average	26% ,,

Though production figures are not available for all countries, those to hand indicate (outside Russia) about an average yield per acre. In most of the European

flax producing countries the weather conditions in August were favourable to the crop and to harvesting operations. [*See* (1) above.]

In the U.S.S.R. the crop had already been harvested by the 1st of September and according to the *International Review* [*See* (1) above], this was affected at the first yellow stage of ripening, a guarantee of good quality fibre. Russian estimates indicate that 2,510,000 hectares of fibre flax (Dolgunetz) were sown in Soviet Russia in 1932, but official figures for the 1932 crop, for comparison with the 537,000 tons yield in 1931, are not yet published. But in Russia, the "yield" figures available month by month have led to the realisation that an increase, even if only gradual, in yield per hectare is of much more importance than mechanical increase in acreage. The scientific institutes are making great efforts towards this end, and *Het Vlas* (3) records that chairmen of village councils, directors of tractor and machine stations, as well as other officials, have been dismissed from the Communist party as a result of their failure to secure the production aimed at. An example is quoted (3) of the dismissal and arrest of the Board of the White Russian Flax Trust at Minsk, for reporting a 102% carrying out of "the plan," whereas the true figure was 50 per cent. *Pravda* is quoted as saying that "the quality of the fibre is quite inadequate. The battle for better flax production is not organised in any way." In addition, Russian flax cultivation has been hampered by the conditions of the roads which in many cases is "indescribable." [*See* (2) above.] For broad success in cultivation, implying high yields of good quality fibre, time will be necessary, as high yields are ultimately dependent upon soil conditions which, after a long period of bad agriculture, cannot immediately be changed. There are signs that the collective enterprises in Russia have succeeded in increasing their yield very considerably and offer a successful alternative to individual concerns which cannot, apparently, be coerced into becoming good farmers.

In France the practical result of the flax subsidy has been limited, so far as the 1932 crop is concerned, to preventing further defection from flax cultivation by agriculturists. Faced with a 66% reduction in acreage from 1930 to 1931 the French Government tabled a subsidy of 60 million francs per year for a period of six years. Premiums were to be paid on a unit weight of processed fibre, and it was the intention to produce the effect of a guaranteed price of 10·50 francs per kilo to producers of flax of a given quality. This corresponds to a valorisation of approximately £86 (gold) per ton, which may be compared with the current quotation [*See* (2)] of £36 (gold) for B.K.K.O. The comparative failure of the scheme appears to be due to administrative difficulties arising in making the calculations on the unit of fibre and recently Department orders have been made to pay premiums at so much per hectare.

Prices at Ghent and Courtrai have risen from £35—£35 10s. 0d. (gold) at the beginning of December to between £38 10s. 0d. and £39 (gold) in mid-January. Russian deliveries of restricted quantities, and at these prices, have been spread over four to five months, and Ghent spinners appear to have combined for a substantial part of these Soviet supplies. In Courtrai ordinary weft flaxes which were at 6·50 francs in December were selling at 7·50 francs in early January. Other standard sorts showed a lesser advance. Attempts to buy heavily at present prices were frustrated by inadequate supplies. Riga reports indicate, later, that the Soviet monopoly appear to make a good profit out of flax, paying £27 gold per ton, to which may be added overheads at £7, and selling at £40 per ton. At this price, sales of 150-200 tons for the month are reported in mid-January.

The above survey of acreage, yield, and quality of crops indicates a growing "flax weariness" outside Russia, which had already made its appearance in preceding years. Russian predominance in Eastern markets cannot, perhaps, be doubled, but internal conditions indicate that supplies for export are not only likely to be restricted in volume, but inferior in quality, under which circumstances, such predominance must not be over-estimated. Despite good market reports, *Het Vlas* records the opinion that activity cannot be of long duration in view of the weakness of the cotton market. At the same time the world flax market is not over-supplied, and to that extent is healthy. The *Leinen-Industrielle*, on the other hand, takes the long view that the tendency towards restriction of cultivation conceals dangers which demand particular attention. L.

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12—AN INTRODUCTION TO THE MICRO-ANALYSIS OF YARN TWIST

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INTRODUCTION

A technique to clarify and supplement the usual mechanical analyses of yarn twist and structure is of considerable interest and importance. With the growing number of attempts to correlate the properties of strength and stretch in yarn with the structural conditions existing at the point of failure, some means for determining these conditions at closely spaced intervals without disturbance of the yarn is essential. The microscope when equipped with the proper accessories furnishes the necessary means. Proper treatment of the data thus provided gives the needful information.

Not only will a technique of this sort be of value for such work, but it will also make available a convenient means for inspection of yarns, and for the study of yarn and cord variation. A rational examination of the structural factors in single and plied yarns and an attempt to compare existing conditions with a theoretical or ideal condition will be described.

PREVIOUS WORK

Failure to recognise several factors involved in such an investigation has either minimised the value of, or led to error in, previous work.

Skinkle[1] gives a formula for determining yarn twist which is of the following form—

$$T=\frac{\tan A}{D}$$

where T=twists per inch
A=helix angle in degrees
D=yarn diameter in inches.

This entirely fails to take into consideration the helix effect and is derived trigonometrically from a plain triangle which has no real physical significance in the yarn structure.

Barker and Midgley[2] recognise the helix angle effect and base their trigonometric derivation upon a triangle which is a developed surface—the outer surface of the yarn. Their formula takes the form—

$$T=\frac{D}{\pi\ (\mathrm{Cot}\ \beta)}$$

Where D is the reciprocal of the yarn diameter written as a whole number
T is the twists per inch
β is the helix angle.

The authors say "The above formula may be usefully employed for both single and two-fold yarns, but the cloth constructor should think clearly and carefully respecting the differences between the two."

As will be shown, the cases of two-ply and single yarns represent the extremes of variation in the correct use of a twist formula and cannot, by their very nature, be treated by the same identical equation. A further point to be considered here is the use of an approximate diameter, computed instead of measured. Wakefield's[3] work in discussing the value of such a calculation has been either forgotten or else overlooked. J. A. Matthew[4] shows how certain empirical expressions for "D" may be obtained and similar work has been undertaken, among others, by Woodhouse and Brand.[5]

A modification of the formula by Barker and Midgley is derived by Herzog[6] but is not generalised as is done in the following work by the author. Such treatment was outlined in part by Gurney and Davis.[7] They use a value which they designate as the *mean diameter*. For a two-ply construction the value is assumed to be one-half the measured or nominal diameter. (D in Fig. 4.) Thus far the author is in agreement. But a statement that the ratio approaches two-thirds as the number of plies increases indefinitely is not correct. Gurney and Davis' derivation of the limit thus set forth is to be found in an earlier paper[8] based on data obtained from investigations conducted by the present author in 1923 and by two students working under his direction in the following year. These data were confined to constructions less than and including 6-ply No. 7's cotton yarns and the semi-logarithmic plot as extended to higher plies by Gurney and Davis is not believed by the author to be reliable. Gurney and Davis[9] state that, for a three-ply construction, the value of the constant is $\frac{K}{\sqrt{3}}$; for a $\frac{3}{5}$ 23's tire cord the constant is K; and, for a single 23's yarn, the constant is $\frac{K}{\sqrt{15}}$ (where $K=\frac{2}{3}$ in every instance). They give[9,7] the following formula for helix angles—

$$\text{Cord helix angle} = \tan^{-1} K\pi\,(T_0)\,(D)$$

$$\text{Ply helix angle} = \tan^{-1} \frac{K\pi\,(T_1)\,(D)}{\sqrt{3}}$$

$$\text{Single helix angle} = \tan^{-1} \frac{K\pi\,(T_2)\,(D)}{\sqrt{15}}$$

Substituting average measured values from a $\frac{3}{5}$ 23's tire cord (see Table III) we have

$$\text{Single helix angle} = \frac{\frac{2}{3}\,(\pi)\,(6{\cdot}9)\,(\cdot036)}{\sqrt{15}} = 27{\cdot}6°$$

$$\text{Ply helix angle} = \frac{\frac{2}{3}\,(\pi)\,(10{\cdot}2)\,(\cdot020)}{\sqrt{3}} = 24{\cdot}0°$$

$$\text{Cord helix angle} = \tfrac{2}{3}\,(21{\cdot}5)\,(\cdot0073) = 22{\cdot}8°$$

The actual values as measured are 30·3, 28·2, and 24·5 respectively. It will thus be seen that Gurney and Davis' values decrease progressively but are in each case lower than the true values. It is shown mathematically in the

following treatment that a logical and rigid demonstration is possible and that the limit of the ratio is not 0·67 but 1·00. The concept of *mean* diameter* as used by Gurney[7] and Davis is discarded as having no rational meaning here, and *helix diameter* (*d* Fig. 4) is substituted. This term, when employed with the *nominal diameter* (D Fig. 4) of the yarn, yields a factor to be known as "*k*," which is essential to a proper statement of the twist formula, as will be shown.

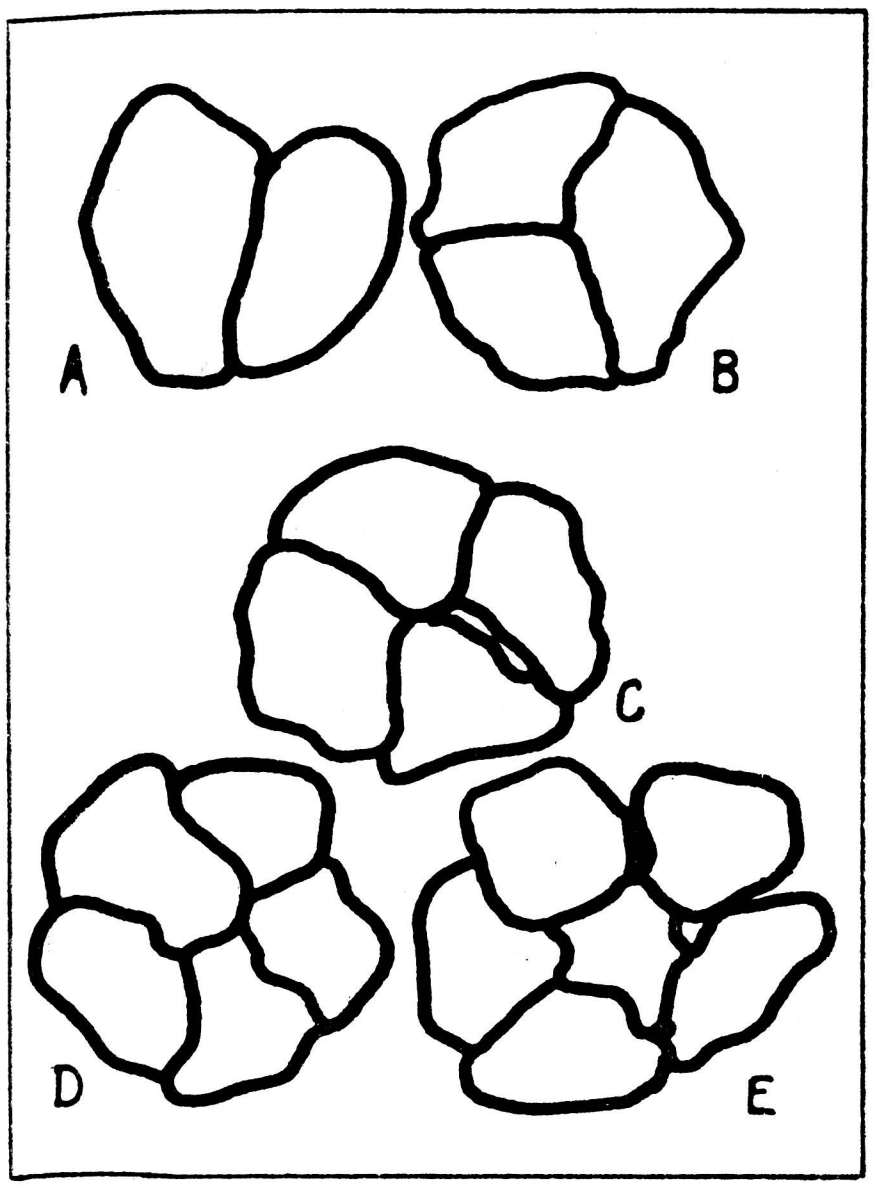

FIG. 3

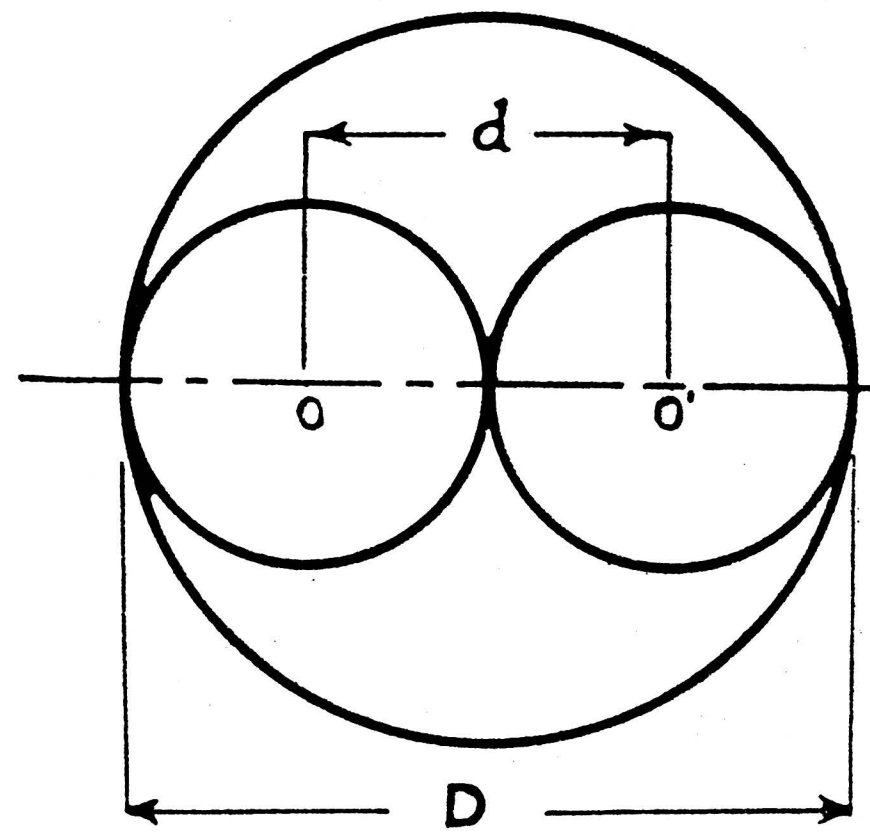

FIG. 4

Table 1

Authority	Cord Twist	Ply Twist as in Cord	Single Twist as in Cord
Twist Counter	6·9	10·2	21·5
Schwarz	7·5	13·6	25·5
Gurney and Davis[8]	7·3	14·3	38·2
Gurney and Davis[7,9]	6·0	22·2	14·7
Barker and Midgley[2]	4·0	8·6	25·5
Skinkle[1]	12·6	26·9	80·0

The above table shows the twist as actually measured by means of a Suter precision twist counter compared with the calculated values. It should be borne in mind that the values obtained by the author's formulæ are based on theoretical values of "*k*" and therefore do not take into account the yarn deformation. It will be seen that the author's values are the only ones consistently approaching the measured twists. Where agreement exists between the author's results and those of another writer, it is because the same, or nearly the same, constant "*k*" was used by them.

* $\frac{D}{\sqrt{n_2}}$ and $\frac{D}{\sqrt{n_1 n_2}}$ where n_1 = number of ply in first ply.
n_2 = number of ply in second ply.

SUMMARY

Theoretical yarn structure can be used as a guide for selection of a yarn for use. It may also be compared with the actual conditions to give information as to compactness, fibre density, and handle.

An important feature of the technique described is the possibility of measurement of the desired quantities with minimum or no alteration or destruction of the yarn.

A rational formula for the micro-determination of twist in single, plied, and cabled yarns is derived and its usefulness and limitations are pointed out.

Further, the relation of certain factors in this expression to the structure of the yarn is shown and the theoretical organisation of a range of plied yarns is given.

Finally, empirical methods for the determination of working values of an important factor in the formula for micro-twist analysis are described.

DISCUSSION

The density of the yarn is not the same as the density of the fibre—and, as Matthew[4] points out, it may be only one-third as great. He also states and quotes experimental data in support of his contention, that the variation in yarn densities noted between flax and cotton, for example, must be accounted for by changes in the arrangement and packing of the fibres. Thus, however far we may pursue the spinner's rule ($T=c\sqrt{N}$), this one factor of density prevents any statement more than that the twist is proportional to the twist constant and inversely proportional to the yarn diameter—other factors being equal. Since the density and yarn diameter may be on occasion interdependent, this apparently simple statement is not as satisfactory as it seems.

Anticipating an empirical treatment of conditions, it will be wise to study the variation of twist from another angle, and to so select the method of attack that the density of neither fibre nor yarn will be involved. This may be done by means of an equation of the same form as the spinner's rule.

It is evident that

$$T=f\,(Q,\,D)$$

where Q is the helix angle of twist and D is the yarn diameter, both as measured. Just what form the function of Q and D should take will be apparent from the following study of a theoretical yarn. It will be assumed that such a structure is made up of units of circular cross section and of uniform diameter throughout their length. This assumption is an approximation, but because of the properties of a helix, and the nature of the mathematical discussion to follow, is not unjustified for the common range of angles. A right circular cylinder, when completely sectioned at an angle other than 90°, will yield an elliptical cross section if viewed parallel with its axis.

But the elements of even an ideal yarn are not right circular cylinders. They are helically arranged cylinders, progressing in three rather than two dimensions. Thus truly elliptical sections cannot result. Further, it can be demonstrated, for helix angles less than 30°, that the section shape is closely approximated by a circle.

For angles greater than 30°, the distortion is circumferential and the radial width of section remains substantially unchanged at the point where the measurements called for in the following discussion are made. The circumferential distortion affects the value of the central angle, but this error is not

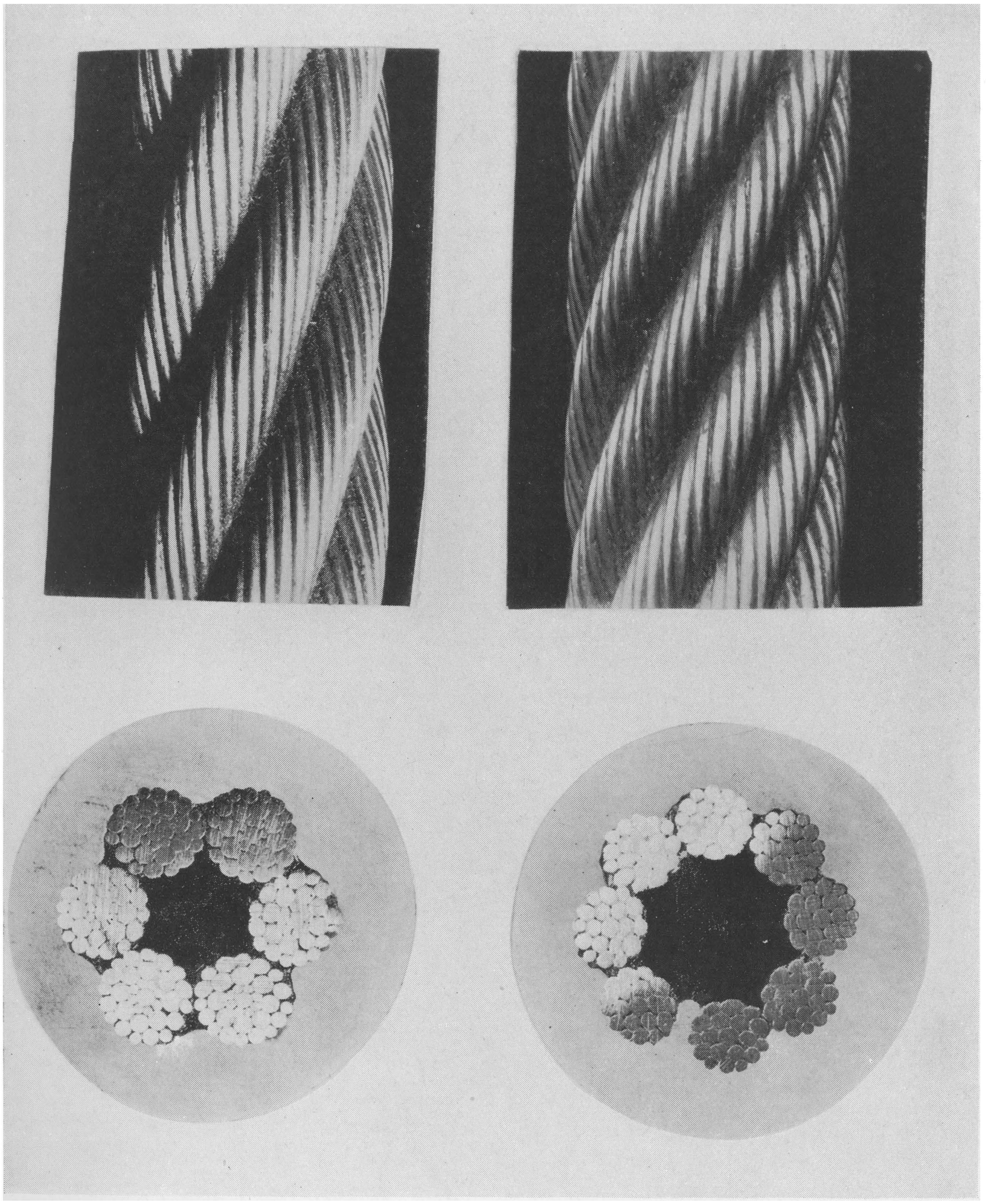

FIG. 1

$Q = 19°$ $Q = 24°$

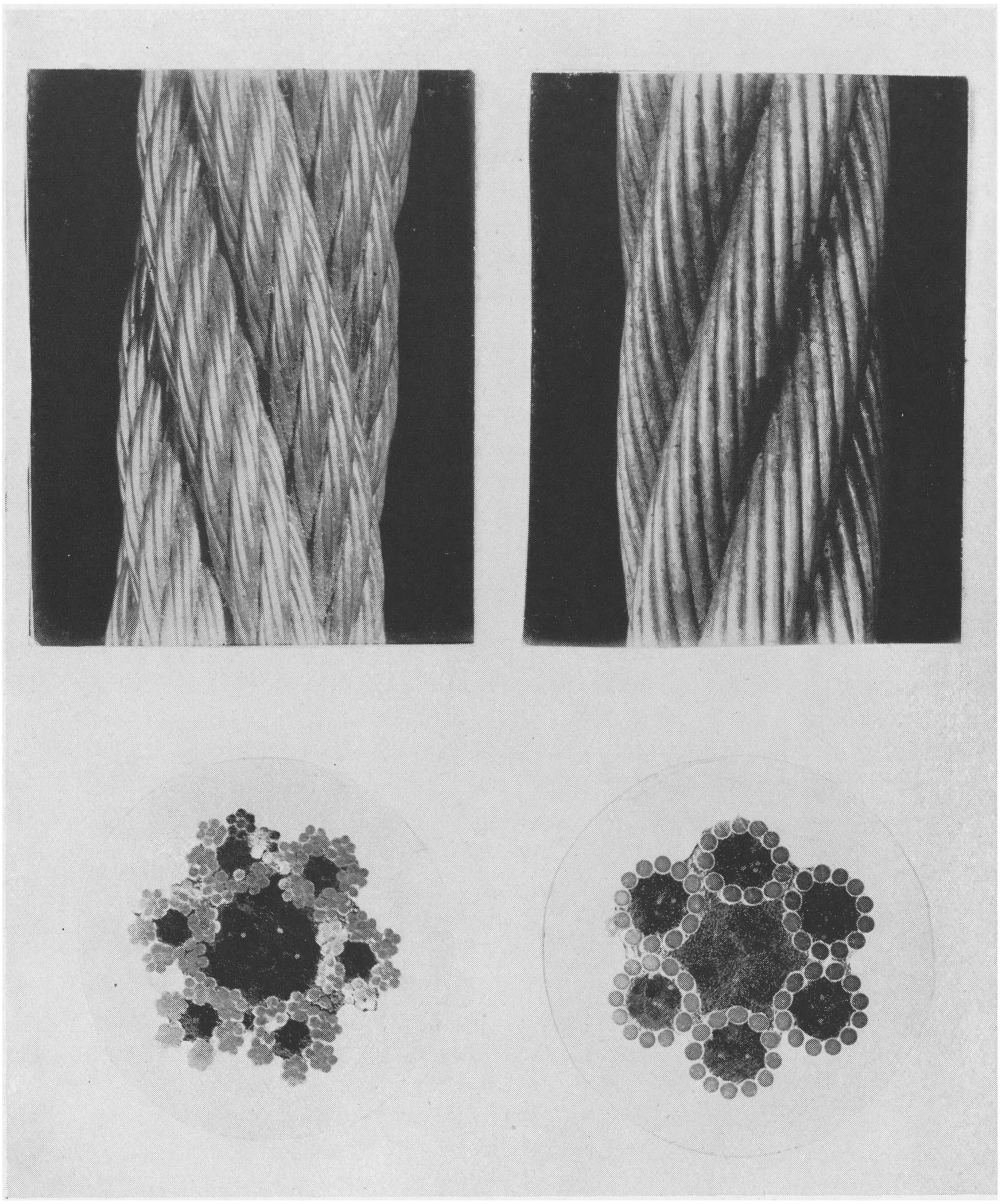

FIG. 2

$Q = 17°$ $Q = 19°$

serious for angles less than 45°, particularly in view of the data of Table II.

Particular attention should be drawn to the changes in shape of the individual wires of Figs. 1 and 2. The circularity is perfectly maintained at the outside of the strands, but on the inside where the helix angle of the individual wire relative to the rope axis becomes greater than 30° a slight tangential distortion occurs. This has been taken into consideration in the discussion which follows on single yarns. The radial dimension remains unaltered and this is the important consideration.

Barker and Midgley[9] state, for example, that a helix angle of 30° corresponds to a hard twist and that a helix angle of 45° represents normally an extremely high twist, and they print a nomographic chart by Dr. Brodsky which makes 45° its limiting angle. The author is in substantial agreement with this concept.

It follows, therefore, that the departure of the section shape from a circle will be slight for normal yarns.[13] For visual substantiation, the reader is referred to Figs. 1 and 2 which are photographs by the author of wire rope, longitudinally and in cross section. An ideal structure of essentially circular elements will be studied as a basis for later measurement of yarn deformation. The deformation may sometimes result in sections which are approximately elliptical, semi-circular, or even circular sectors. (See Fig. 3.) Thus valuable bases for comparison with the empirical values can be obtained later.

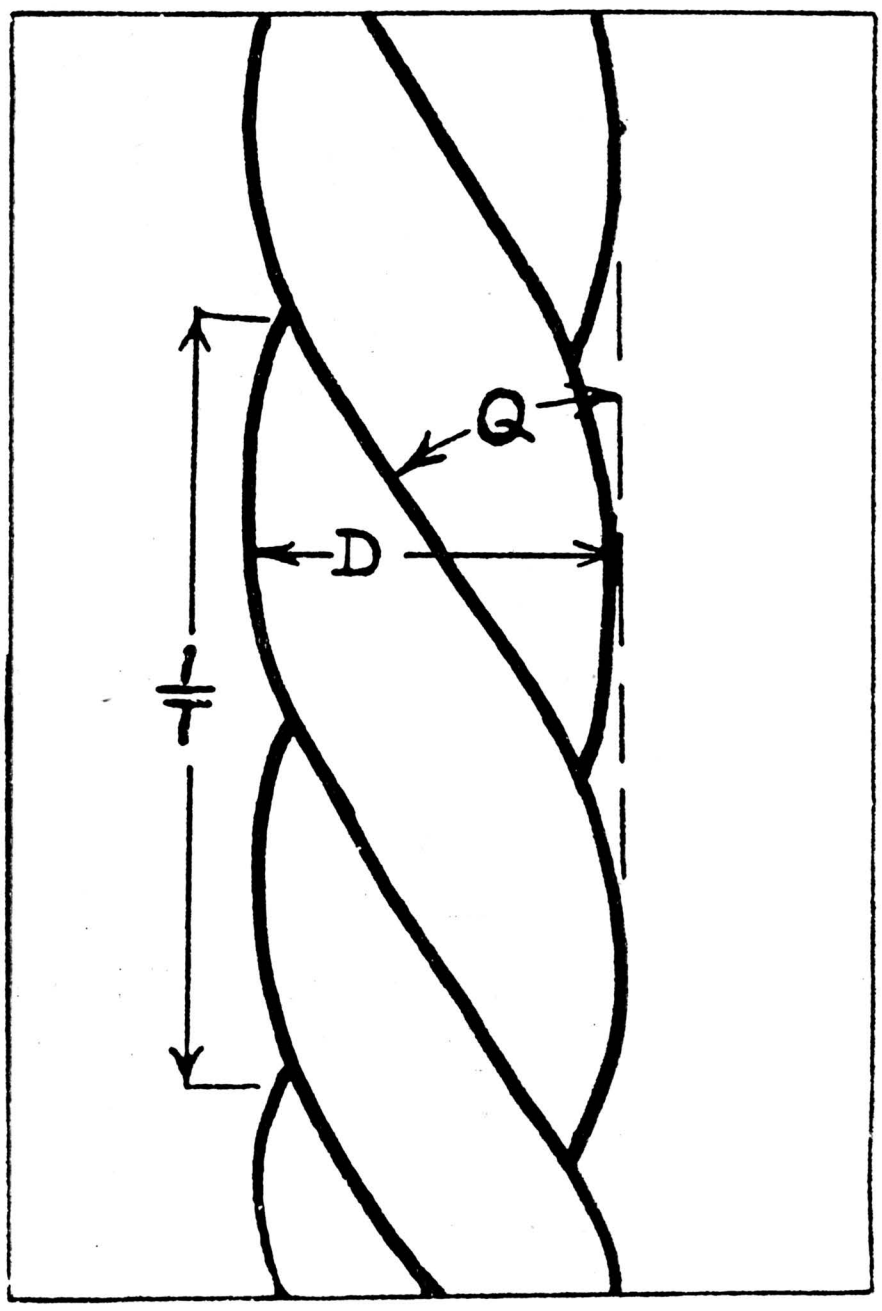

FIG. 5

Fig. 5 shows a diagrammatic, longitudinal view of such a yarn—which we shall assume for simplicity to be a two-ply structure. (The general case will be developed later.) If we designate the measured (nominal) yarn diameter by "D," the helix angle by "Q" and the twist per inch by "T" respectively, we shall have the following dimensional data applying to one complete helix.

1/T will be the length in the plied yarn occupied by the helix, and is expressed as inches per twist. D is measured in inches by the microscope (Figs. 6 and 7) as will be described, and "Q" is, for convenience, taken as the angle between a tangent to one side of a single yarn and a line tangent to the outer curves of the plied yarn. If our initial assumptions are granted, then it follows that the line tangents will be parallel to the respective centre lines (themselves not easily determinable) of the single and plied yarns—and, therefore, "Q" is the true helix angle. This angle actually exists at the centre of the single yarn and an equivalent angle on the yarn surface is measured.

In Fig. 4, points "O" and "O′" are the loci of this helix in cross section, and their separation is measured by the distance "d" called the *helix diameter*. In any yarn $d=F$ (D) and for a two-ply yarn, the constant of proportionality is 0·5, so that we may write—

$d=k$ (D) where k is 0·5 for a two-ply yarn.

Now $k=f(n)$ where "n" is a number of units involved in the construction. (The quantity will be more definitely defined in what follows.)

To derive the relationship, refer to Fig. 8. Here the circle ABC with centre "o" represents the core of a theoretical plied yarn and may contain as many units (single yarns) as desired. The ideal structure will be surrounded by a complete ring of units, tangentially arranged, several of which are shown. In the figure thus obtained, draw OG through the centre (D) of any one of the units of this outer ring. OG will cut the core circle at a point A. Draw also OJ through the centre F of the next adjacent unit. Let OJ cut the circle representing the limiting boundary of the core at C. Designate the point of tangency of the two adjacent units selected as E. Draw OE and produce it to H, letting it cut the core circle at B. Draw DF.

Now, by plane geometry,

DF will pass through E and will be perpendicular to OH at this point.

Thus the triangle OED is a right triangle.

Denote $< AOB$ as β

Now $OD = \dfrac{DE}{\sin \beta}$

DE is the radius of a unit circle and as such will be written as "r". Similarly, OD is the radius of the circle passing through the centres of the outer unit ring and will be denoted as R_0.

Thus $$R_0=\frac{r}{\sin \beta} \qquad \text{(1)}$$

Further $OG=OD+DG=R_0+r$

and, if we call R the radius of the plied yarn, we have—

$$R=R_0+r$$

and $$R=\frac{r}{\sin \beta}+r \qquad \text{(2)}$$

By definition, $$k=\frac{R_0}{R} \qquad \text{(3)}$$

Substituting (1) and (2) into (3) we have, after reducing—

$$k=\frac{1}{1+\sin\beta} \qquad \ldots\ldots(4)$$

From Fig. 8 $$\beta=\frac{360}{2n}=\frac{180}{n} \qquad \ldots\ldots(5)$$

where n is the number of units in the outer ring.

Substituting (5) into (4) gives—

$$k=\frac{1}{1+\sin\left(\frac{180}{n}\right)} \qquad \ldots\ldots(6)$$

If we now study the variation of this equation, which is evidently the form of the function which was required, we may write—

$$\text{Lim}_{(n\pm a)}\left[\frac{1}{1+\sin\left(\frac{180}{n}\right)}\right]=1$$

This is the same as saying that for a yarn of an infinite number of plies, the value of "k" will be unity. Since a single yarn may be considered as approximately a high plied construction in which the individual fibres correspond to the single yarns, it will be apparent that "k" will be only slightly less than unity. That it will not be a constant quantity for all single yarns can be understood when it is realised that quite a different value would be expected for a high counts yarn made of relatively few fibres as compared with a coarse yarn containing many fine fibres. Particularly is this true of rayon yarns. Further analysis will show applications.

When making use of formula (6) great care must be taken to avoid confusing the value of "n" with the number of plies in the yarn. If "N" is taken to indicate the latter quantity we may establish a relationship between "n" and "N" which, while not without flexibility, will nevertheless be of considerable value in interpretation of yarn structure. In Table II, the derivation of which follows, the theoretical structures are listed.

Referring again to Fig. 4 we see that

$$\frac{r}{OD}=\sin\beta$$

Also $$OD=OA+r$$

Substitution gives $$\sin\beta=\frac{r}{OA+r}$$

For a unit circle, r can be considered equal to 1.

Then $$\sin\beta=\frac{1}{OA+1}$$

and $$OA=\frac{1}{\sin\beta}-1$$

To determine how many units occupy the core and which must be added to those units comprising the outer ring, "n" in number, to give the ply "N" of the yarn, consider Fig. 8.

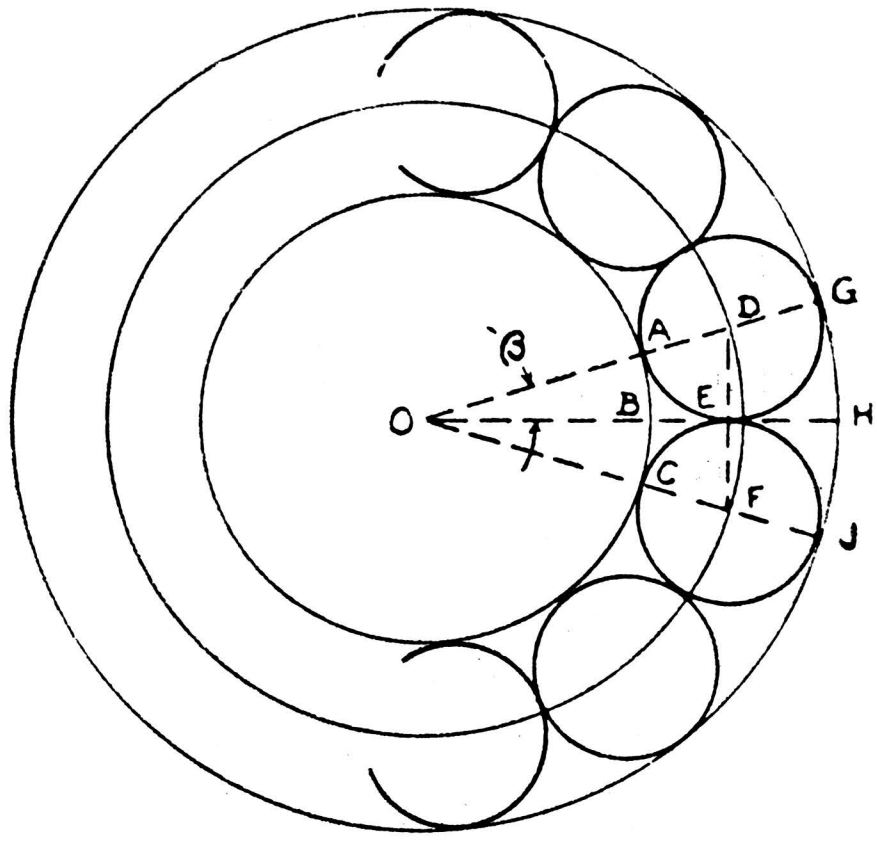

FIG. 8

OA is the radius of the core, and in order that this space may be occupied by one unit it must be at least equal to "*r*" in magnitude. From plane geometry it will be apparent that for two, three, four, and five-ply constructions there will not be room for a unit core; while for a six-ply there will be just enough room at the core for a single unit. This may be demonstrated mathematically as follows—

Let $n=5$ $$\beta=\frac{180}{n}=\frac{180}{5}=36^\circ$$

Substituting $$OA=\frac{1}{\sin 36^\circ}-1$$

$$=1{\cdot}701-1=0{\cdot}701$$

0·701 is less than 1·000

Let $n=6$ $$\beta=\frac{180}{6}=30^\circ$$

$$OA=\frac{1}{\sin 30^\circ}-1$$

$$=2-1=1$$

Similarly, the value of "OA" can be computed for any assumed value of "*n*." Eventually "*n*" will reach a magnitude such that "OA" will become equal to or greater than the radius of the circle which circumscribes two tangent circles. Evidently such a radius would be—

$$\frac{1}{\sin\left(\frac{180}{n}\right)}+1$$

and when $n=2$ this expression reduces to 2.

For a value ($n=9$), OA becomes 1·92, while for ($n=10$), OA becomes 2·23. Theoretically there would have to be 10 units in the outer ring before a core of two units could be formed, but practically the value of 1·92 is so

close to 2·00 that an 11-ply yarn could easily have a two-unit core. The author during the micro-examination of cross sections of 11-ply yarns has repeatedly seen this condition. As can be seen, it gives a flat yarn. We are concerned here, however, only with the theoretical construction.

It will also be seen that for a three-unit core, the value of OA must be at least 2·55. Hence, before such a core can theoretically be formed, "*n*" must reach a value of 11. This gives a value of 2·57. The close agreement here is indicative that a 14-ply yarn consisting of three units in the core, surrounded by 11 units would be a symmetrical structure and not liable to serious distortion under normal conditions.

When "*n*" reaches a magnitude sufficient for a core of more than six units, the theoretical structure resolves itself into a core surrounded by two or more concentric rings. Thus, if we let $n=13$, we obtain a value of OA=3·18. A new core OA′ to go with this would have a numerical value of 1·18, and in such a space there is room enough for a single unit. The construction is, therefore, a 20-ply yarn made up of a single unit core circumscribed by six units and the whole surrounded by 13 units.

The same method can be extended for more and more complex cases. A possible construction for a theoretical 50-ply yarn, such as would be employed for certain classes of camel hair belting, would then be a core of one unit surrounded by a ring of 10 units, surrounded by another ring of 16 units, the whole surrounded by an outer ring of 23 units. That this yarn must of necessity be distorted is evident when it is considered that there would be room for two more units at the core. Thus a 52-ply yarn is a better construction because it will be distorted less under normal conditions.

Study of Table II shows that certain constructions are inherently badly corkscrewed. That is, they contain unit cores. The yarn forming such a core must be shorter in length than those which twist about it, hence, when the plied yarn is strained, the core takes the load first and often ruptures before a breaking strain is reached in the outer units. Such a yarn is evidently weak. It has been shown that a seven-ply yarn is such a construction, as are also eight and nine-ply. These latter however, are almost certain to be flattened and thus the core effect is minimised. Yarns of 20-ply through 25-ply are weak, as are yarns of 40, 42, 43, 46, 48, 49, and 50-ply construction.

Since both three-and five-plied yarn are fairly stable combinations (the latter less so than the former), it is often of advantage to cable yarns of multiple units rather than to ply them. A 15-plied yarn for example, is not a particularly good construction. It consists of a core of four units (a most unstable combination) and an outer ring of 11 units. The load will first come on the four-fold core when the yarn is strained, and after this has failed, the remaining 11 strands take the stress. A better combination—and one which is widely used for tyre cords—is made up of three five-ply yarns cabled together. If tension and yarn sizes during manufacture are controlled and maintained uniform, such a construction will not be corkscrewed. Consideration of the theory just advanced in the foregoing will show that this organisation is somewhat better from the standpoint of stability than would be a series of five three-ply yarns cabled together.

It is well to point out here that constructions having multiple cores, while still corkscrewed in the strict sense of the term are, nevertheless, better than those made up with unit cores. The reason is that in addition to the

sharing of the early stages of the load by a number of strands rather than one alone, the core, by reason of its twist, necessarily possesses a greater degree of stretch than would a single unit. This, of course, is due to the "helical spring" effect familiar to all testers of twisted yarns.

Table II

Comment on Yarn Structure with Certain Alternative Arrangements	Apt to be Distorted	Very Stable	Unstable	Stable	5001	Corkscrewed	Corkscrewed	Corkscrewed 7002 (non-symmetrical)	Flat—Room for one more unit in core
Ply ... 1	2	3	4	5	6	7	8	9	10
n outer ring 1	2	3	4	5	6	6	7	8	9
1st inner rg. 0	0	0	0	0	0	0	0	0	0
2nd inner rg. 0	0	0	0	0	0	0	0	0	0
Core ... 0	0	0	0	0	0	1	1	1	1
k_t ... 1·00	0·50	0·54	0·59	0·63	0·67	0·67	0·70	0·72	0·75

Comment on Yarn Structure with Alternative Arrangements	Flat • two-unit core	Flat—9003 Room for three-unit core	Stable	Flat—10004 Room for four-unit core	Oval—Four-unit core is Unstable	Flat—Room for five-unit core	Stable Yarn	Very Flat Room for six-or seven-unit core	Somewhat Flat Room for seven-unit core	Corkscrewed
Ply ...	11	12	13	14	15	16	17	18	19	20
n outer ring	9	10	10	11	11	12	12	13	13	13
1st inner ring	0	0	0	0	0	0	0	6	6	6
2nd inner ring	0	0	0	0	0	0	0	0	0	0
Core ...	2	2	3	3	4	4	5	5	0	1
k_t	0·74	0·76	0·76	0·78	0·78	0·79	0·79	0·81	0·81	0·81

Comment on Yarn Structure with Certain Alternative Arrangements	Flattened Room for eight-unit core	Somewhat Flattened—Room for eight-unit core	Flattened Room for nine-unit core	Flattened	Very Flat Room for 11-unit core	Somewhat Flattened—Room for two-unit core		Very Flat Room for 13-unit core	Flattened Room for three-unit core	
Ply	21	22	23	24	25	26	27	28	29	30
n outer ring...	13	14	15	15	16	16	16	17	17	17
1st inner ring	6	7	7	8	8	9	9	9	10	10
2nd inner ring	0	0	0	0	0	0	0	0	0	0
Core ...	1	1	1	1	1	1	2	2	2	3
k_t ...	0·82	0·82	0·83	0·83	0·84	0·84	0·84	0·85	0·85	0·85

Further examination of this table shows that for a yarn made up to 50 units, the value of "k" is 0·88. While this approaches unity more nearly than previous values noted, it will only reach it when an infinite number of units are reached. For rayon yarns, certain fine worsted yarns, etc., there may be from 30 to 150 or more fibres or filaments present. In the latter case, "k" might be computed if "n" were known. To determine "n", however, is a somewhat lengthy process. A better method is to make a cross section of the yarn (a paraffin mount—Viviani cork method—or the Schwarz metal slide method[11]) and count the number of units in the outer layer or ring. A simple substitution in equation (6) gives "k" directly.

As an alternative method, "k" may be computed from direct measurements of the sample without the necessity of making a cross section. Since, in a single yarn, the units of the various layers are the fibres, the value of "r" is

evidently the fibre radius. Now a ratio of diameters may be taken just as well as a ratio of radii, and if this is done, we have—

$$k_e = \frac{D-d}{D} \qquad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(7)$$

where k_e is the empirical helix constant
D is the yarn diameter
d is the fibre diameter.

Both D and d should be the averages of a number of measurements and should be expressed in the same units.

One precaution must be observed. If the fibres are not circular or nearly so in section, but are oval as for certain wools,[13] for ramie, and Italian hemp; or reniform as for certains rayon and cotton; it will be found that the examination of a cross section should be made. If the majority of the fibres lie as in Fig. 9, the long diameter should be taken, while if they lie as in Fig. 10, the short diameter should be measured. In longitudinal mounts of the yarn, it will be impossible to measure the diameter of the fibre which is orientated in a radial position.

FIG. 9

FIG. 10

In many cases, notably for single cotton yarns, the sections of the single fibres are arranged in random order. It would seem advisable in such a case to take the average of the long and short diameters of a number of fibres for the working value of "*d*." In the case of a 50's cotton yarn recently tested in this manner it was found that the average long diameter was 7·64 ten-thousandths of an inch while the average short diameter was 4·00 ten-thousandths of an inch. This gives an average diameter of 5·82 ten-thousandths of an inch for the fibre. The mean diameter of the single yarn was 54·5 ten-thousandths of an inch and the yarn contained 26·7 twists per inch. The helix angle was found to be 23° and substitution in formula (8) (to be derived) yields a value of "*k*" of ·927. If the values of yarn and fibre diameters just noted are substituted in equation (7) the result will be very closely 0·9.

Further analyses by Stockwell[12] indicate that as "*n*" increases the formula becomes more and more reliable and is very satisfactory indeed for ordinary single yarns. In the case noted above "*n*"=approximately 50 and if the analysis of Table II were continued to this point a value of "*k*" slightly above 0·9 would be obtained.

Some idea of the distortion which may have taken place in a plied yarn may be gained by locating the centres of gravity of the units in the outer layer and measuring their respective distances from the centre of the plied yarn. The average of these distances, when subtracted from the plied yarn

radius, and this difference divided by the latter quantity, yields a value of "k_e" which may be less than, equal to, or greater than "k_t" *

If "k_e" is less than "k_t", the units must be nearer the centre than in the theoretical case, and the yarn is closely packed, or dense, in proportion to this difference. Three- and four-ply yarns formed of soft twisted singles frequently exhibit cross sections similar to those of the micrographs of Fig. 3. In the case of Fig. 3B, the value of "k_e" is 0·45, while "k_t" is 0·55.

Thus
$$\frac{k_t - k_e}{k_t} = \frac{0{\cdot}10}{0{\cdot}55} = 0{\cdot}182$$
or 18·2 per cent.

In many cases the units composing such a deformed yarn are very closely circular sectors and the centre of gravity of such a sector is given by the relationship
$$Ro = \tfrac{2}{3}\frac{R \sin \beta}{\beta}$$

where
Ro is the radial distance of the c.g. from the centre of the plied yarn.
R is the plied yarn radius.
β is one-half the centre angle subtended by the sector expressed in radians.

If "k_e" is equal to "k_t", the yarn corresponds in structure to the theoretical case.

If "k_e" is greater than "k_t", the yarn must be very loosely compacted. With the apparatus of Fig. 6 a value of "k_e" = ·60 was obtained for a loosely twisted three-50's and as the twist was increased "k_e" decreased fairly steadily. From a study of the data it was apparent that the decrease in the plied yarn diameter was a more important factor than was change in the single yarn diameter.

The apparatus of Fig. 7 designed by the writer and built under his direction enables the investigator to insert or remove known amounts of twist into single or plied yarns while they are held in position on the stage of the microscope. By means of suitably arranged drums, the circumference of each of which is exactly one inch, a controlled and constant dead weight tension may be applied along the axis of the yarn and at the same time provide facilities for the measurement of elongation or contraction to the nearest 1/100th of an inch as either may occur. Illumination may be in the ordinary fashion from above the stage obliquely; but a very convenient arrangement particularly for fine yarns is provided in the new Leitz Ultropak system as shown in the Figure. Here the use of the goniometer ocular to which reference will later be made is shown.

Having studied the derivation of "k" by both the theoretical and empirical methods, we now pass on to an analysis of the twist formula itself. The rational form for this is evidently—
$$T = \frac{\tan Q}{\pi k D} \qquad \text{.....(8)}$$

where
T is the twist per inch.
Q is the helix angle in degrees.
k is the helix constant.
D is the yarn diameter in inches.

*The theoretical value as given in Table II.

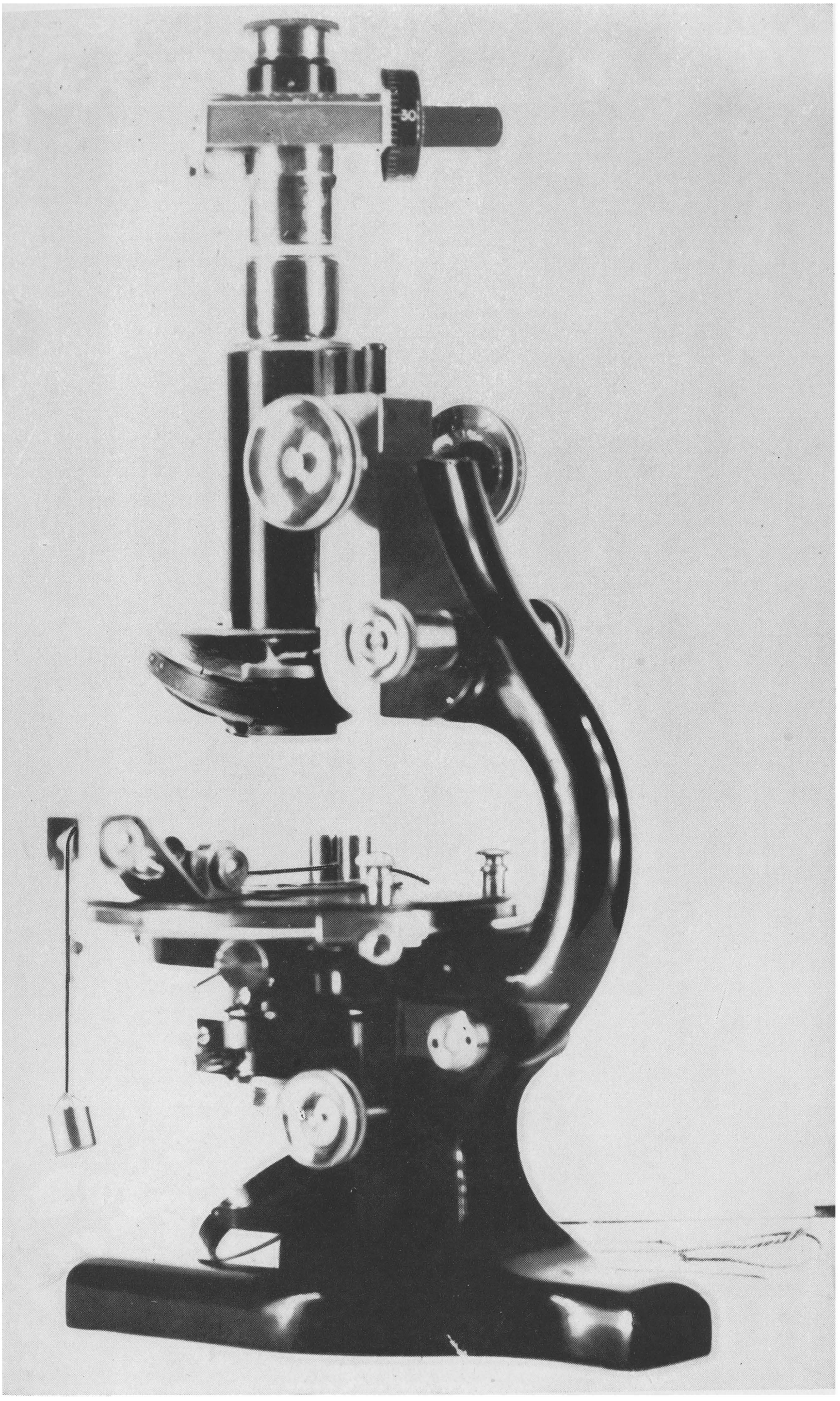

FIG. 6

Textile Microscope ready for insertion of proper objective.
Note Filar Micrometer and Special Yarn Holder.

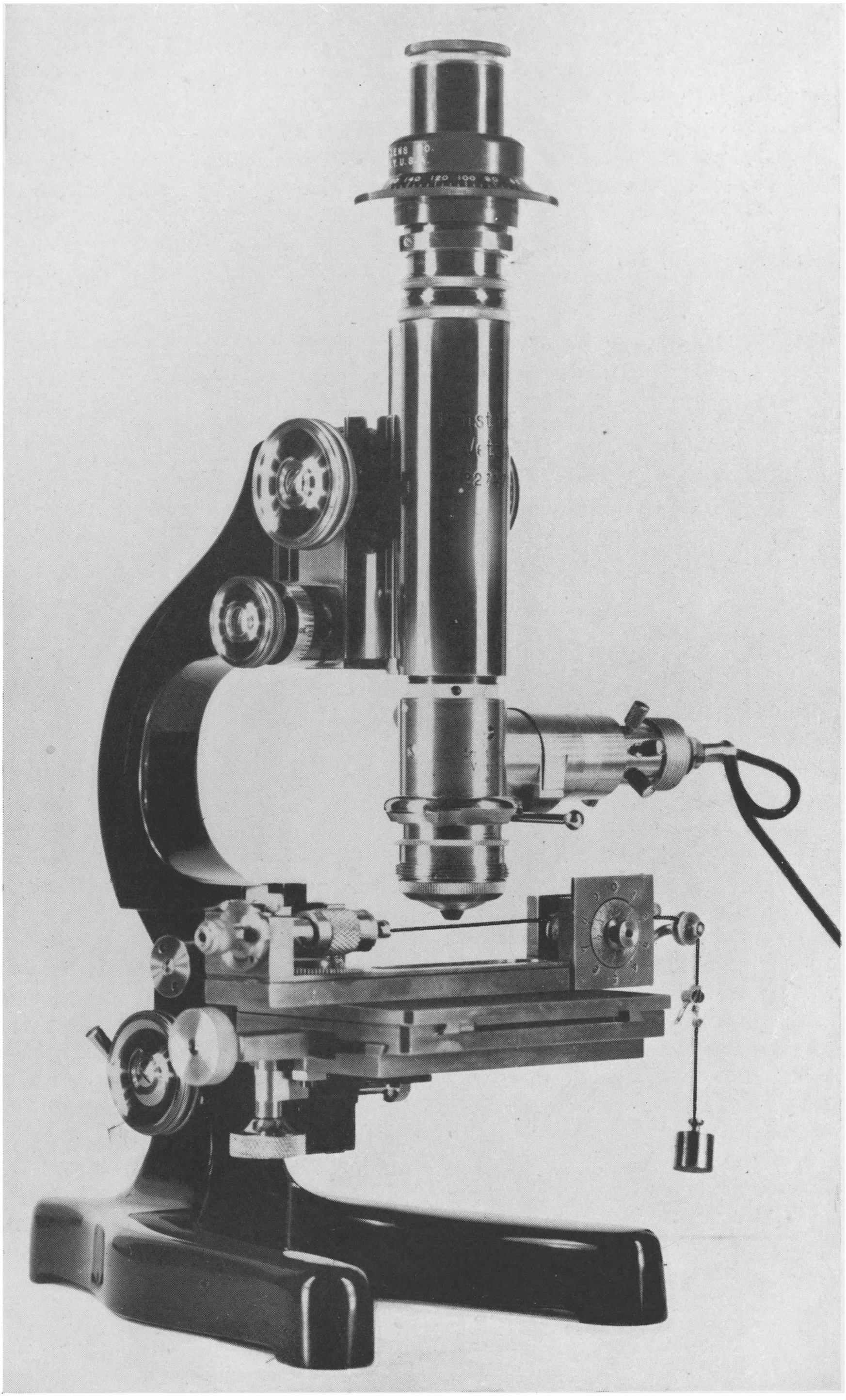

FIG. 7

Note Goniometer Ocular and Micro Twist Tester.

In the light of the foregoing, we may determine "k_t" quite readily, and knowing this value for any given case, it is only necessary to measure Q and D.

Several methods are available. One of the most satisfactory is to employ a microscope equipped with a rotating stage graduated in degrees and readable to the nearest half degree at least, and with a filar micrometer ocular which has been carefully calibrated. A slide can be built to carry the yarn under any desired tension and may take as simple a form as Fig. 6 would indicate. This is a very efficient device designed by the author and used by himself and in class work for twist measurements.

With the yarn in position and a 32-mm. objective (not shown) on the microscope, the instrument is sharply focussed on the surface of the yarn, so that the average direction assumed by the fibres may be clearly seen. The angle of illumination can be so adjusted by shifting the light source as to make the definition good. Just sufficient light should be directed up through the stage opening from the substage mirror (in the absence of the condenser which is not needed) to illuminate the scale of the filar micrometer. Set the rotating stage of the microscope to zero, and turn the filar micrometer until the traversing cross hair is parallel to the fibres—as closely as can be estimated. Leave the filar micrometer in this position, held by its set screw.

Focus on the edge of the yarn and rotate the stage, at the same time traversing the movable cross hair of the filar micrometer, until it is tangent to one edge of the yarn at three points. Read the micrometer scale and record the reading. Read and record the angle indicated on the stage vernier. Now traverse the cross hair to the opposite side of the yarn and to a similar position of tangency. Read the micrometer scale. The difference between the two filar scale readings is the plied yarn diameter. If the stage has had to be rotated (which will not ordinarily be the case) in order to achieve the second position of tangency, the new angle should be read, and averaged with the first in order to get a corrected value. The result is angle A and is the angle between the fibres and the plied yarn axis. Return the traversing hair of the filar micrometer to a position tangent to one of the single yarns at a point near the centre of the plied yarn. Read the angle indicated on the stage vernier (B), and the filar scale reading. Traverse the filar cross hair to a position of tangency at the opposite side of the single yarn, and a second reading of the filar scale, when compared with the first, will give the single yarn diameter.

The angles desired for use in computing the twist per inch may now be calculated. Angle B is the angle between the fibres and the single yarn, while either A + B or B—A will be the angle between the single and the ply depending upon whether the fibres are inclined to the same or opposite sides of the plied yarn centre line as the single yarn axis respectively. Table III shows data for three-five 23's tire cord determined microscopically.

If a graduated rotating stage is not available, and if no filar micrometer is at hand, a camera lucida enables the investigator to draw a sketch showing the required angles and diameters. Use of a stage micrometer makes measurement of the diameters possible, and the draughtsman's protractor can be used to measure the angles. Skilful handling of illumination is essential, and on the whole, the method is not so precise as the technique calling for a filar micrometer.

Table III

Test	Cord Diameter inches	Ply Diameter inches	Single Diameter inches	Cord Helix Angle degrees	Ply Helix Angle degrees	Single Helix Angle degrees
1	·0339	·0182	·0068	25·0	26·5	31·0
2	·0337	·0186	·0070	25·5	28·5	24·0
3	·0372	·0163	·0068	23·3	26·5	30·5
4	·0342	·0185	·0061	26·0	23·5	30·0
5	·0359	·0193	·0061	23·3	31·0	28·0
6	·0346	·0213	·0066	24·5	30·6	31·5
7	·0353	·0198	·0094	26·6	28·0	35·0
8	·0373	·0210	·0083	24·6	31·5	27·5
9	·0369	·0232	·0071	24·3	34·6	34·3
10	·0391	·0206	·0086	21·5	21·5	31·0
Avg.	·0358	·0197	·0073	24·5	28·2	30·3

Various forms of goniometer oculars are available. The readings of angle obtained from any but the expensive types are not particularly precise. nor are the ocular micrometer scales convenient to use.

Experimental work conducted in the Textile Microscopy Laboratory of the Massachusetts Institute of Technology by the writer to date indicates strongly that the optical measurement of single yarn twist is in most cases much to be preferred over other methods.

For plied yarns twist can most precisely be measured in a properly designed mechanical twist counter. Optical measurements involving as they do a somewhat variable factor "*k*" are of value largely in conjunction with the mechanically measured twist to indicate yarn structure and deformations. This is a field of investigation in which little work has been done but in which experimental endeavour is considered by the writer to be well justified. It is proposed to continue this work intensively.

The writer has long believed that the only way to intelligently study yarn structure of any kind is to really see it in as much detail as possible. He therefore hopes that the foregoing discussion may awaken further interest in the subject and lead to development of new and improved forms of optical equipment.

BIBLIOGRAPHY

[1] Skinkle, J. H. "Elementary Textile Microscopy," New York, 1930; Howes Pub. Co. p. 79.
[2] Barker and Midgley. "Analysis of Woven Fabrics," London, 1922; Scott, Greenwood & Son, p. 49.
[3] Wakefield, S. "On the Diameters of Yarns" (pamphlet).
[4] Matthew, J. A. "The Diameter of Yarns"; Textile Manufacturer, Vol. 48 (March 1922), p. 94.
[5] Woodhouse and Brand. "Analysis and Synthesis of Cloth Structure"; Textile World, 17th Dec. 1927 and 27th April 1929.
[6] Herzog, Alois. "Mikroskopische Untersuchungen der Seide u. der Kunstseide," Berlin, 1924; Julius Springer, p. 53. "Mikroskopische u. mechanisches technische Textiluntersuchungen," Berlin, 1931; Julius Springer, pp. 231-232.
[7] Gurney and Davis. "The Elastic Properties of Yarns, with special reference to Tyre Cords"; J.T.I., Vol. XXI, 1930, p. T446-467.
[8] Gurney and Davis. "Twist, Balance, and Strength Relation of Single and Plied 7's Cotton Yarn"; Cotton Research Co. Inc., Report, 15th Sept. 1925.
[9] Gurney and Davis. "Twist in Tyre Cord and Some Physical Effects"; Textile World, 11th July, 1925.
[10] Barker and Midgley. "The Analysis of Woven Fabrics"; London, 1922; Scott, Greenwood & Son., pp. 50-52.
[11] Schwarz, E. R. "Cross Sectioning Textiles"; Textile World, 18th Jan., 15th Feb., 1930.
[12] Stockwell, A. F. "An Investigation of the Micro-analysis of Yarn"; M.I.T. Thesis under direction of Prof. Schwarz.
[13] Barker, S. G. "Wool Quality," London, 1931; H.M. Stationery Office, p. 175.

13—THE SULPHUR CONTENT OF WOOL. PART IV. FURTHER EVIDENCE OF THE VARIABLE SULPHUR CONTENT OF WOOL

By J. Barritt and A. T. King
(Wool Industries Research Association, Leeds)

The inherent variation in the sulphur content of wool keratin has been clearly established in earlier papers[1, 2, 3], but in view of the conclusion of Marston[4], that the sulphur content of wool is constant, it was considered advisable to carry out further work on this question.

This paper deals with two lines of evidence both of which substantiate the authors' original conclusions.

(1) A comparison of the sulphur contents of wools purified by the methods of Marston and of the authors.

(2) The results obtained from an examination of a series of Scotch wools.

Sulphur Determinations on Wools Purified by the Method of Marston and of the Authors

From previous work on different wools a small series was selected which represented different types of wool keratin. The wools were adequately sampled (see experimental part) and then purified.

The essential feature of the Marston method of purification is that after removal of fat and foreign matter from the wool, it is treated with 0·01 N hydrochloric acid and in this process "It is not infrequent to find variable amounts of sulphates in the washings from this fraction, this sulphur being presumably bound in salt formation to the fibre, as no detectable hydrolysis occurs at this reaction." This has not been the experience of the authors. The results of this comparison are given in Table I, and details of the methods used will be found in the experimental part.

Table I

Wool	Purification by Marston's Method			Purification by Barritt and King's Method		
	Sulphur on Wet Weight %	Regain %	Mean % Sulphur on Dry Weight	Sulphur on Wet Weight %	Regain %	Mean % Sulphur on Dry Weight
Welsh Wool No. S. 64 Shoulder	3·38, 3·38	15·87	3·92	3·42, 3·38	16·93	3·97
Welsh Wool Ram W. 44 Shoulder	3·49, 3·52	16·04	4·07	3·47, 3·42 3·38, 3·46	16·78	4·07
Welsh Wool X. 40 Shoulder	3·17, 3·15	17·12	3·70	3·14, 3·16	16·90	3·68
Romney Corriedale Section 7	2·65, 2·63 2·62, 2·63	15·82	3·04	2·52, 2.50 2·53, 2·55	16·94 17·02	2·94 2·97
Australian Merino	3·07, 3·05	12·09	3·43	2·97, 2·99 2·99, 3·00	12·32	3·35

It will be evident from these data that the sulphur content of wool is inherently variable and that the method of purification has no great influence on the amount of sulphur found.

Apart from the treatment with the dilute hydrochloric acid, the procedure adopted was precisely the same for all the samples, so that even granting the possibility of some standard error (which if existing must be very small) it is difficult to imagine how such widely differing values of sulphur content as those for the Romney Corriedale and say the Welsh wools could possibly be obtained if the sulphur content of the wool were constant. It should be noted that the wools studied by Marston were all Australian wools though of different types. The authors, however, have analysed many different Australian wools which were found to possess varying sulphur contents[2] though the range of variation is not so wide as when some of the English and New Zealand wools are included. It would have been easy to extend the number of wools, but it is felt that sufficient has been said in previous papers[1, 2, 3] in addition to this further evidence to establish most definitely that the sulphur content of wool is variable.

Experimental. The Marston—Barritt and King Comparison

The greasy wools were separated into locks, the loose wool removed from the base and three fractions were obtained by taking every third lock (i.e. fraction one contained 1, 4, 7 . . . fraction two, 2, 5, 8 . . . .) . . . .

The samples were then pulled out by hand, thoroughly mixed, degreased with benzene, air dried, combed, benzened, air dried, washed off in numerous changes of distilled water and air dried as described in detail in Part I of this series.[1]

It should be noted that Marston degreases with ether and alcohol, but owing to the penetration of the fibre by alcohol, and the subsequent difficulty of removal, it was considered preferable to use benzene. In any event this stage is not the crucial one in the difference between the two methods.

One fraction was then treated with 0·01 N hydrochloric acid (100 cc./gm. of clean wool) for 12 hours at room temperature after which it was washed with ten changes of distilled water and air dried. Soluble sulphate could not be detected in the dilute hydrochloric acid or in the washings, and further after concentration and oxidising no trace of sulphate was detected.

The two fractions were allowed to condition and samples weighed off for determination of sulphur and moisture content by the methods described previously.

Examination of a Series of Scotch Half-bred Wools

The authors have been fortunate in having access to a series of Scotch half-bred wools, which have been the subject of experimental work at the Rowett Research Institute by Messrs. Fraser and Roberts, and they are much indebted to Mr. J. A. F. Roberts (formerly of this Association) for the supply of samples and for the figures giving the change in fineness of the samples from base to tip.

The sheep involved in this nutritional experiment were divided into various groups, and were fed on a basal diet with addition of supplements.

On examination of the fleeces a definite "break" or weak place in the staple was found in a number of the samples coincident with the change in diet. On holding the lock at each end, a gentle pull separated it into portions designated "base" and "tip" fractions. This paper is not concerned with the significance of the nutritional factors involved which will be discussed in a forthcoming paper by the above-mentioned authors. Also the figures relating to changes in fineness are only inserted as indicating the imposition of

the changed conditions which have been accompanied in most cases by a change in sulphur content.

The examination, however, of the sulphur values obtained indicates clearly the inherent variations from wool to wool in the same and different groups, and particularly the ensuing variation (e.g. No. 188 V.) between base and tip portions, which latter phenomenon was first indicated in the case of typical wool samples in Part II of this series.

Table II

Reference Number of Sheep	Sulphur Content on Dry Weight %			Average Increase (+) or Decrease (−) of Fineness of Base over Tip* %
	Total lock	Tip	Base	
112 I	3·59	—	—	—
146 I	3·47	—	—	—
150 I	3·70	—	—	—
153 I	3·63	3·41	3·73	+31·7
175 II	—	3·54	3·79	−3·0
122 III	—	3·17	3·39	+35·7
117 IV	3·64	—	—	—
120 IV	3·42	—	—	—
182 IV	3·62	—	—	—
183 IV	3·39	—	—	—
191 IV	3·47	—	—	—
130 V	—	3·68	3·68	+69·7
176 V	—	3·46	3·69	—
188 V	—	3·31	3·82	−17·2
118 VI	—	3·45	3·49	+4·5
132 VI	—	3·35	3·54	+46·5
160 VI	—	3·36	3·18	+120·9
187 VI	—	3·22	3·49	+9·3
189 VI	—	3·39	3·71	—
179 VIII	—	3·30	3·39	+28·0

* The fineness measurements are expressed in cms. of fibre/milligram, and it must be remembered therefore that the actual diameters of the fibres vary inversely as the square roots of their fineness.

EXPERIMENTAL

The gross samples were taken from the shoulder in all cases and locks removed in random fashion, sufficient being taken to give adequate sampling. The samples were then worked up in the usual way, and sulphur determinations made as described previously.

ACKNOWLEDGMENT

Mr. A. N. Davidson has ably assisted in the experimental work.

REFERENCES

[1] Barritt and King. *J. Text. Inst.*, 1926, **17**, T394.
[2] Barritt and King. *Ibid.*, 1929, **20**, T151.
[3] Barritt and King. *Ibid.*, 1929, **20**, T159.
[4] Marston. Bulletin No. 38, C.C.S.I.R., Australia, 1928.

14—TEST FOR CHEMICALLY DAMAGED COTTON FIBRES

By J. W. LEWIS, M.Sc.

[The following test for detecting damage due to acid or over-bleaching in cotton fibres was worked out in this Laboratory some years ago by Mr. J. W. Lewis, and has since been frequently used for distinguishing between chemical and mechanical damage. It is particularly useful for the examination of the fibres surrounding small holes in a fabric.—R. S. WILLOWS.]

Small pieces of fibres are teased out gently on a microscope slide, care being taken not to damage the fibres with the needle, and are covered with a cover slip. A few drops of sodium zincate are run under the cover slip, the fibres left for a few minutes till swelling is complete, and any excess liquid soaked off the slide with filter paper. A few drops of water are then placed on the slide at one side of the cover slip, and are drawn underneath by filter paper placed at the other side. Care is needed at this stage, as the water has a tendency to run round the cover glass, and the fibres must be washed substantially free from zincate if the full effect is to be obtained.

It will be seen that—

(i) In perfect or mechanically damaged fibres, such as unscoured sliver, the hairs are quite definite in outline, the cuticle entirely undamaged, and the ends bulged to a dumb-bell shape, as in the test given in *Jour. Text. Inst.*, 1922, 13, 240T.

(ii) In fibres very slightly damaged, such as those in a normally bleached fabric, most of the fibres appear as in (i), but a few are a little more swollen, less definite in outline, and their ends less clearly dumb-bell shaped.

(iii) In fibres sufficiently damaged as to cause weakness or holes in the fabric, the fibres are very much swollen, the edges and ends blurred, and some fibres partially dissolved.

In bad cases, the fibres almost entirely dissolve, leaving a shapeless mass of partially dissolved cellulose on the slide. See Plate I, Figs. 1–3.

PREPARATION OF SODIUM ZINCATE

Dissolve zinc chloride or sulphate in water, and raise nearly to boiling point. Add dilute ammonia (1:3) very gradually to the hot solution, to precipitate zinc hydroxide. Do not add excess of ammonia. Allow precipitate to settle, and decant off the liquid. Add more ammonia to the decanted liquid, and add any precipitate to the original precipitate. Wash the zinc hydroxide several times until it is free from chloride or sulphate. Filter under pump, to remove as much liquor as possible. Dissolve zinc hydroxide in hot 60° Tw. NaOH until the NaOH is saturated. Cool and filter through glass wool.

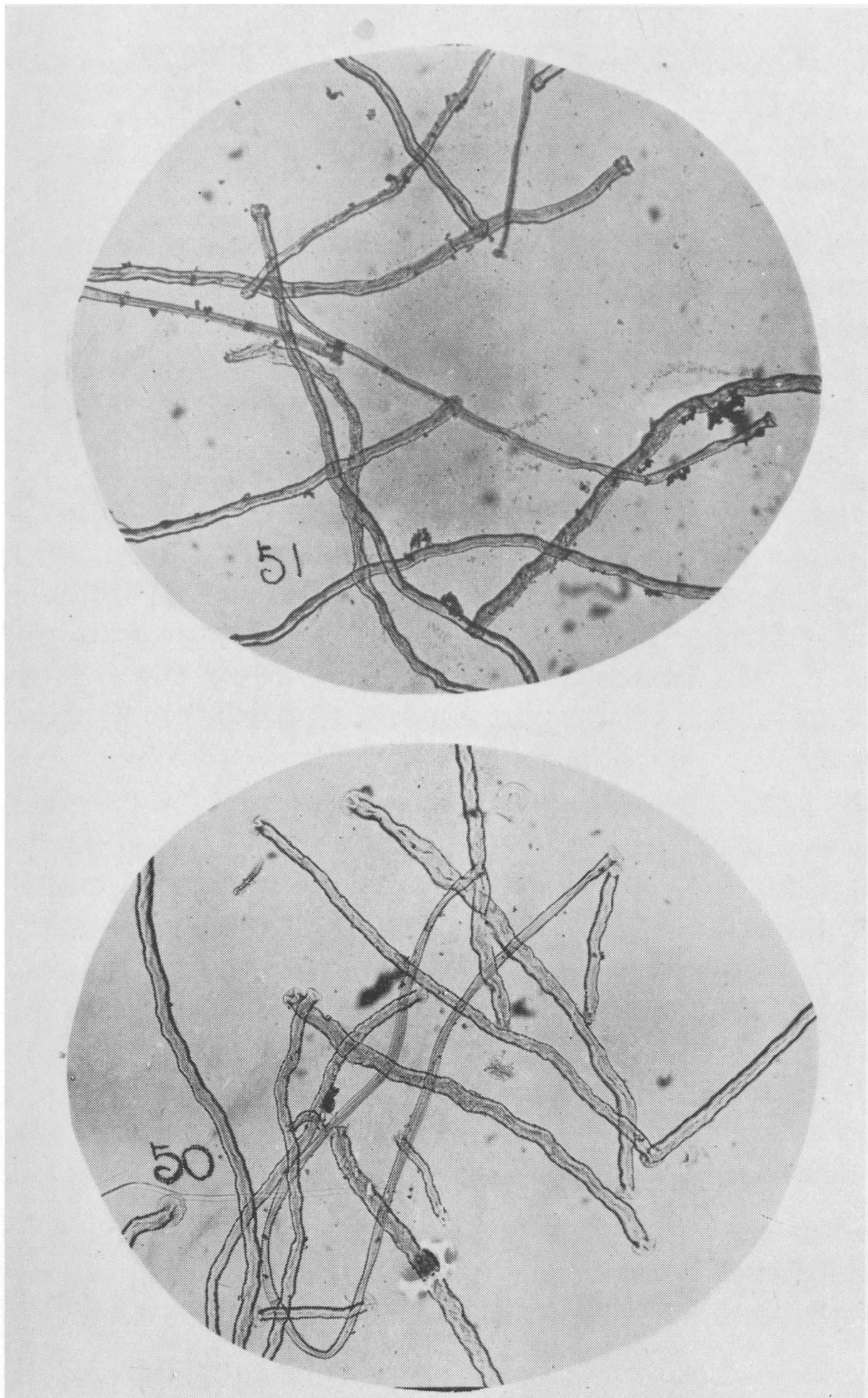

FIG. 1—Unscoured Fibres.

FIG. 2—Fibres fully scoured and bleached.

FIG. 3—Fibres overbleached.

15—INFLUENCE OF ASH CONSTITUENTS ON THE ELECTRICAL CONDUCTION OF COTTON

By A. C. WALKER and M. H. QUELL

It has been shown[1] that the electrical properties of textiles, such as cotton, silk, wool, and cellulose acetate silk, depend to a remarkable extent upon their moisture contents and chemical compositions. In addition, these properties have been considered to depend upon water-soluble, electrolytic impurities present in the fibres, since the insulation resistance of untreated* cotton has been improved very greatly by water washing.

Evidence will be presented in this paper to show that the improvement in d.-c. insulation resistance of cotton, secured by washing, is accompanied by a reduction in the inorganic ash content from about 1% of the dry cotton weight to a value generally less than 0·3 per cent.† Data will be given to show that the water-soluble salts present in raw cotton, which constitute about 70% of the ash weight, are principally potassium and sodium salts, and their removal by washing is accompanied by an improvement of between 50 and 100 fold in the insulation resistance. Since these salts are largely inorganic electrolytes, this improvement in resistance is termed *electrolytic*. A *total* improvement of between 150 and 200 fold can be secured if the washed cotton is dried under certain conditions. The difference between *electrolytic* and *total* improvement is due to changes in the moisture-adsorbing properties of the textile resulting from the manner of drying, and this difference, largely reversible by subsequent exposure of the cotton to high atmospheric humidities, is termed *transient* improvement. (The effect of atmospheric humidity on the insulation resistance of cotton is discussed in a subsequent paper (No. 17) which will appear in the April issue—*Editor*.)

The effects of ash constituents, other than Na and K on the insulating properties of cotton is small, and these effects are difficult to evaluate, since they are masked by the effect of atmospheric humidity.

In this investigation, primary consideration has been given to cotton since it is the most economical material available for use in telephone apparatus insulation, and the improvements in electrical properties secured by water-washing have led to its substitution for silk to a large extent in the telephone industry.

EXPERIMENTAL

Several years ago some experiments were made on the effect of salt electrolytes on the insulation resistance of commercially dyed cottons. The data are given in Table I.

These results indicated that the insulation resistance of raw cotton is lower than that of any of the dyed cottons; the resistance of the dyed cotton is increased as the quantity of salt added to the dye bath is decreased; the resistance is appreciably lower in the presence of even comparatively small

* Prior to these investigations on the electrical properties of cotton, a considerable quantity of cotton insulation used in telephone apparatus was undyed material, which received no treatment with water and therefore contained all of the naturally-occurring, inorganic salt impurities. Such untreated material is generally designated as "raw" cotton.

† See references given in an accompanying paper (No. 16) to similar results obtained by other investigators.

Table I

D.C. Insulation Resistance of Dyed Cottons

Colour	NaCl used in Dyebath in lb./100 lb. Cotton	Insulation Resistances* As Received	After Washing†
Green	None ...	272 ...	269
Slate	None ...	76 ...	333
Orange	1·00 ...	16 ...	183
Yellow	1·00 ...	15 ...	392
Blue	1·75 ...	5·9 ...	248
Red	1·75 ...	5·7 ...	338
Brown	1·75 ...	4·5 ...	255
White (untreated) ...	None ...	2·6 ...	133

* These d.-c. insulation resistance measurements were made according to a direct deflection method previously described (1), after equilibrating the textile with 75% relative humidity at 25° C. The resistances are expressed in kilomegohms per single thread of 30/2 cotton mounted between electrodes ½ in. apart.

† These measurements were made after washing 2-gram samples of each cotton in 1 litre of boiling distilled water and oven-drying at 105° C.

amounts of salt than when the salt is substantially absent; also the contaminating salt can be removed by water washing, and when the cotton so washed is dried in an oven at 105° C., surprisingly large improvements are observed in the insulation resistance.

It will be shown that raw cotton contains about 0·3% K_2SO_4 and NaCl, principally the former, in addition to some other water-soluble salts. Washing with distilled or tap water suffices to remove practically all of these electrolytes. Calculations show that the amount of NaCl which could contaminate the dyed cottons in Table I is of the order of not more than 0·05% of the cotton weight, based on the contamination of the cotton with all of the salt present in the dyebath (1·75 lb. of salt/100 lb. of cotton). This contamination is very small compared with the natural salt content of raw cotton. Some salt is present probably even in the green and slate dye, since these dyes contain salt, whether in their dry states or in their concentrated solutions. The process used for the green dye differed from the others, involving an acetic acid bath, and the conditions were more favourable for the removal of traces of salt than in the other cases. Experiments have shown that dilute acetic acid solutions have no harmful effects upon the electrical properties of cotton, particularly if the cotton is oven-dried thereafter.

Since it is impracticable to use distilled water in the commercial purification of cotton, a study was made of several natural waters which might be used for this purpose. The results indicated that cotton washed in waters containing alkaline-earth salts, and but small amounts of alkaline salts, consistently gave higher resistances than those washed in distilled water, or waters containing appreciable amounts of the alkaline salts. This behaviour suggested that ionic interchange occurs between dissolved alkaline-earth salts in the wash water and some electrolytes present in the cotton, resulting in a reduction in the electrolytic content of the material. Consequently a systematic investigation was made to determine the ash constituents of cotton, both before and after washing in distilled water and various salt solutions; also to determine the effects of changes in the ash constituents on the insulation resistance of the material.

Preliminary tests indicated that washing 200 grams of cotton with 20 litres of distilled water gave reductions in total ash content and increases in insulation resistance comparing favourably with results obtained using greater volumes of water; also the washing temperature did not appear to influence critically the results.

Programme of Washing Experiments

A programme of experiments was conducted as follows—200-gram bundles* of raw cotton were first washed in 20 litres of distilled water. Separate bundles so washed were then washed with 10 litres of 0·0025 N† solutions of $CaSO_4$, $MgSO_4$, K_2SO_4, Na_2SO_4, or HCl. Each salt-washed bundle was finally washed in 10 litres of distilled water to remove any residual salts left in the cotton during the salt solution washings. All washings were with solutions at 40° C. The method of washing is described in a separate paper (No. 16).

Ash Analyses

Table II contains complete ash analyses of raw cotton and laboratory washed cottons treated with different amounts of distilled water or solutions as described in the foregoing programme. In addition, values are given for cottons washed in commercial equipment, using tap water to which definite amounts of Ca or Mg sulphate were added to counteract the effects of appreciable amounts of alkali-metal salts already present in the water. The values for the raw cotton are averages of seven complete analyses on this material; in the other cases the data are usually averages of two complete analyses.

The basic constituents are reported as elements, with the exception of Mg, Fe, and Al, which are reported as oxides,‡ the acidic constituents as acid radicals.

It is seen that washing with but 5 litres of water removes all of the phosphate and chlorine; reduces the potassium from 0·361% to 0·042%, the sodium from 0·03% to a negligible amount, the Mg from 0·07% (as oxide) to 0·034%, the SO_4 from 0·156 to 0·05%, while the SiO_3, $Fe_2O_3+Al_2O_3$ and Ca contents are practically unchanged. Increasing the volume of wash water reduces the potassium content to a negligible amount and decreases the SO_4, SiO_3, and $Fe_2O_3+Al_2O_3$ somewhat. Since the principal reductions are in K, Na, SO_4, Cl, and P, and as will be shown elsewhere,[2] these reductions are due to the removal of potassium as sulphate, phosphate, and as organic compounds, and the sodium as chloride, it seems reasonable to relate the improvement in insulation resistance to the decrease in Na+K content.

In Table III a comparison is given of the insulation resistances and Na+K contents of raw and washed cottons. The insulation resistances under (*a*) are initial averages on samples from each of the eight 25-gram skeins composing a bundle. These values were secured immediately after washing and oven-drying the bundles at 105° C. The (*b*) values are similar averages secured more than a year later. In most cases, at least four sets of measurements were made on each bundle during the year, and as will be seen from the (*a*) and (*b*) columns, marked decreases occurred in the resistances; the higher the initial value the greater appeared to be the decrease. Only the raw cotton appeared

* Representative bundles were prepared by first winding a large number of 25-gram skeins of cotton formed from a five-end yarn. This yarn was composed of threads wound from five spools of cotton in parallel. The skeins were numbered in order of formation from the spools, and the 200-gram bundles were prepared from a representative selection of eight skeins each. Separate samples of the raw cotton taken from the five spools before and after winding the skeins showed no significant variation in insulation resistance from spool to spool or from the outside to inside of the spools.

† This normality was chosen as being of the same order of magnitude as the Ca content in a natural water, which gave the best apparent improvement in commercial washing.

‡ The reasons for reporting the data as given are discussed in a separate paper (No. 16).

Table II
Cotton Ash Analysis

Bundle No.	Treatment	No. of Analysis	Ash Constituents—in percentage of the Dry Cotton Weight: K	Na	Ca	MgO	CO_3	SO_4	SiO_3	$Fe_2O_3 + Al_2O_3$	Total	As Weighed
7	Raw Cotton	7	0·361	0·030	0·054	0·070	0·200	0·156	0·037	0·048	1·046	1·049
	(P_2O_7=0·045%; Cl=0·045%)											
	Washed with Distilled Water.											
2	5 litres H_2O	2	0·042	<0·01	0·054	0·034	0·053	0·051	0·036	0·050	0·320†	0·320
6	10 ,, ,,	2	0·025	<0·01	0·054	0·032	0·046	0·046	0·032	0·045	0·280†	0·285
8	20 ,, ,,	2	0·016	0·001	0·058	0·038	0·050	0·038	0·033	0·046	0·279	0·280
10	37 ,, ,,	1	0·002	0·008	0·061	0·046	0·054	0·038	0·019	0·036	0·264	0·275
40	40 ,, ,,	1	0·002	0·004	0·069	0·036	0·064	0·038	0·021	0·023	0·257	0·296
13	40 ,, ,,	1	0·002	0·001	0·054	0·027	0·042	0·038	0·019	0·019	0·202	0·200
80	80 ,, ,,	2	0·005	0·003	0·059	0·038	0·049	0·038	0·019	0·029	0·240	0·235
	Washed with Salt Solutions.											
1	K_2SO_4: 20–**10**–10*	1	0·031	0·007	0·049	0·022	0·042	0·034	0·018	0·017	0·220	0·226
9	Na_2SO_4 : 20–**10**–10	2	0·004	0·008	0·046	0·030	0·040	0·019	0·016	0·018	0·181	0·200
5	$MgSO_4$: 20–**10**–10	2	0·004	0·002	0·024	0·073	0·020	0·018	0·020	0·017	0·178	0·184
3	$CaSO_4$: 20–**10**–10	2	0·002	0·001	0·082	0·022	0·080	0·042	0·022	0·021	0·272	0·271
15	,, ,, ,,	1	0·006	0·003	0·085	0·014	0·082	0·038	0·028	0·028	0·284	0·272
E	$CaSO_4$: 20–**30**–10	1	0·004	0·001	0·081	0·002	0·090	0·028	0·019	0·024	0·249	0·254
B	$CaSO_4$: **30**–10	2	0·002	0·001	0·094	0·002	0·093	0·047	0·026	0·032	0·302	0·296
A	$CaSO_4$: **40**	2	0·003	0·004	0·093	0·011	0·092	0·045	0·030	0·035	0·313	0·314
C	$CaSO_4$: **40**	2	0·004	0·001	0·086	0·010	0·085	0·035	0·034	0·023	0·278	0·276
	Washed with HCl Solution.											
11	HCl : 20–**10**–10	2	0·004	0·002	0·007	0·002	none	0·004	0·018	0·009	0·046	0·047
	Commercial Washings—Tap Water used treated with 5 lb. MSO_4/800 lb. of Cotton.											
K–1	$CaSO_4$	2	0·007	0·001	0·091	0·002	0·112	0·011	0·019	0·032	0·276	0·282
K–3	$MgSO_4$	3	0·007	0·003	0·081	0·053	0·059	0·089	0·020	0·036	0·348	0·346
	Mixed Salt Solution—Laboratory Check on Commercial Test K–3. Solution used—0·005 N $MgSO_4$ + 0·0006 N K_2SO_4, Concentrations approximating those found in the Tap Water.											
F	Soln: 20–**20**	1	0·009	0·003	—	—	—	—	—	—	—	—

* The significance of the designation MSO_4 : 20–**10**–10 is—Each number indicates the volume of liquid used, the bold figures being the volume of salt solution (MSO_4), and the light figures being the volumes of distilled water, in litres per 200 grams of cotton. The sequence of the numbers is order of washing.

† Na values are estimated in these totals since contamination occurred in the Na analysis. The actual analyses reported were 0·012% and 0·016%, therefore it is probable that the true values were less than 0·010%.

Table III

Effect of Sodium and Potassium Ash Constituents on Insulation Resistance of Cotton Washed in Distilled Water and in different Salt Solutions

Bundle No.	Treatment	Percentage Alkali Elements			Insulation Resistance at 75% Relative Humidity—25° C. kilomegohms/single ½ in. thread		
		K	Na	Na + K	Initial (*a*)	One year later (*b*)	After 90/23* (*c*)
7	Raw cotton	0·361	0·03	0·391	2·6	2·6	1·6
	Washed with Distilled Water.						
2	5 litres H_2O	0·042	0·01	0·05	81	60	46
6	10 ,, ,,	0·025	0·01	0·035	160	101	45
8	20 ,, ,,	0·016	0·001	0·017	129	121	90
10	37 ,, ,,	0·002	0·008	0·01	415	111	61
40	40 ,, ,,	0·002	0·004	0·006	220	111	83
13	40 ,, ,,	0·002	0·001	0·003	220	126	41
80	80 ,, ,,	0·005	0·003	0·008	143	141	74
	Salt-Solution Washings.						
1	K_2SO_4 : 20–**10**–10	0·031	0·007	0·038	83	80	70
9	Na_2SO_4 : 20–**10**–10	0·004	0·008	0·012	84	64	41
5	$MgSO_4$: 20–**10**–10	0·004	0·002	0·006	275	142	100
3	$CaSO_4$: 20–**10**–10	0·002	0·001	0·003	215	141	98
15	$CaSO_4$: 20–**10**–10	0·006	0·003	0·009	210	68	60
E	$CaSO_4$: 20–**30**–10	0·004	0·001	0·005	354	126	68
B	$CaSO_4$: **30**–10	0·002	0·001	0·003	294	143	75
A	$CaSO_4$: **40**	0·003	0·004	0·007	229	176	59
C	$CaSO_4$: **40**	0·004	0·001	0·005	470	134	124
	HCl-Solution Washing.						
11	HCl : 20–**10**–10	0·004	0·002	0·006	55	38	30
	Commercial Washings.						
K–1	$CaSO_4$ test	0·007	0·001	0·008	99	no values	—
K–1	$MgSO_4$ test	0·007	0·003	0·010	207	no values	—
	Mixed Salt Solution.						
F	$MgSO_4 + K_2SO_4$: 20–**20**	0·009	0·003	0·012	46	no values	—

* *Note*—The heading (After 90/23) indicates that the samples were equilibrated at 90% relative humidity at 23° C., for several days, then thoroughly dried with air at room temperature before measurement at 75% relative humidity—25° C.

to be unaffected. In one case (Test E) the set of samples was equilibrated continuously for 18 days. The average insulation resistance dropped from 354 kilomegohms to about 250 in two days, and then more gradually to a final value of 204 after the 18th day.

This behaviour of washed cotton, together with the fact that the separate skeins in each bundle differed as much as 100% in insulation resistance, despite the fact that this seemed unreasonable in view of the care taken in the washing procedure, suggested that the exposure of the washed cottons to varying cycles of atmospheric humidity might be responsible for the marked changes.

As a result of these observations, experimental work was undertaken to correlate the insulation resistance of cotton with moisture content through several humidity cycles of from dryness to saturation and return. The results of this work are recorded in a separate paper (No. 17). They show definitely that the initially high insulation resistance of washed, oven-dried cotton is not retained if the cotton is exposed to very high atmospheric humidities or to air saturated with water vapour. Consequently it was concluded that a more satisfactory comparison between the insulation resistances of washed cotton and the soluble ash constituents might be secured by preconditioning the textiles at some high humidity. Therefore, the results in Table III under (*c*) were obtained after conditioning all samples then available at 90% relative humidity at 23° C. for three days, followed by air-drying at room temperature an equal length of time.

CONCLUSIONS

Washing with but 5 litres of water causes an improvement in the insulation resistance of raw cotton of about 40 fold, based upon the (*c*) values in Table III. Improvements of between 50 and 100 fold are observed if greater volumes of water or Ca and Mg sulphate solutions are used. Even dilute solutions of K_2SO_4, Na_2SO_4, and HCl give improvements of between 30 and 70 fold. Improvements based on these (*c*) values, with raw cotton as 1·06 kilomegohms, represent as nearly as can be ascertained with the data available, the effects of removal of alkali salt electrolytes.*

Total improvements of 160 to 180 fold in the resistance of cotton are possible, *e.g.* tests 10 and C. These improvements are calculated on the basis of 2·6 kilomegohms for the untreated cotton. The difference between the *total* improvement and that characterised as *electrolytic* (50 to 100 fold), is termed *transient*, since this difference appears to be in the nature of a reversible effect dependent upon exposure of the purified cotton to high humidities and consequent changes which take place in the gel structure of the material due to swelling as moisture is absorbed.[3]

With increasing volume of wash water, the alkali salt content of cotton shows a progressive decrease, though it is evident from Table III that a relatively small amount of distilled water removes practically all of the harmful electrolytic salts, and is responsible for nearly all of the *electrolytic* improvement in resistance. The effort made to bring all of the different

*As discussed elsewhere (No. 16), about one-fourth of the K and all of the Na appear to be present in raw cotton in the form of K_2SO_4 and NaCl respectively. In addition, some K is present as phosphate and silicate. These water-soluble, strong electrolytes constitute about 40% of the total ash of raw cotton. The remaining K, found in the ash as K_2CO_3, is presumably present in the cotton as readily-soluble organic compounds, and as such may contribute to electrolytic conduction, since they may ionise to some extent as weak electrolytes.

washed cottons to a comparable condition by equilibrating them at 90% relative humidity was not as effective as anticipated, and therefore the effect on insulation resistance of the removal of the last traces of alkali salt is masked by the much more pronounced effects of drying and atmospheric exposure. Although these results do not justify more quantitative discussion of the effects of electrolytic impurities and other factors, they have been most useful, not only in suggesting a more reasonable explanation of the behaviour of cotton after removal of electrolytic impurities, but also in improving inspection methods necessary in controlling the quality of washed textile insulation for telephone apparatus.

This transient effect explains some of the more important discrepancies in Table III. The fact that the insulation resistance of check tests* differed by as much as two fold in some cases, is considered to be due to the difficulty of uniformly drying the rather bulky bundles in the equipment available, and also to the possibility of exposure to high humidities soon after drying. This reasoning may apply also to those bundles of low Na+K content which did not change appreciably in insulation resistance during the year.

The resistance of the HCl-washed cotton is unexpectedly low, considering that the ash content is reduced to but one-fifth that of the other washed cottons, and the Na+K is negligible. Although it has been found that the strength of cotton yarn soaked in dilute HCl and dried at 105° C., is greatly reduced, this was not the case with the HCl-washed cotton followed by the distilled-water treatment, indicating that the final washing seemed to remove the acid effectively, a conclusion which could not be verified satisfactorily from the ash analyses, since any trace of the acid would have volatilised on ashing. It is significant that the acid washing did not alter the moisture adsorption of the cotton appreciably.† If acid hydrolysis had occurred it might be expected to cause a higher moisture content and, therefore, a lower insulation resistance. Therefore, it would appear that the unusual result in this case is due to some other cause, possibly the effect of the acid upon the gel structure of the cotton, perhaps in some manner changing the distribution of moisture and the mechanism by which current is conducted through the fibres.

The presence of 0·05% and 0·035% Na+K in the cotton from tests 2 and 6, Table II, may be responsible for the final (*c*) values of resistance being but 45 kilomegohms, as compared with higher values for washing with larger amounts of water, but this conclusion is of doubtful validity since tests 13 and 9 are lower in Na+K and have about the same final insulation resistances.

The initial values for the $CaSO_4$ and $MgSO_4$ solution washings are considerably higher than those of the other salt solution tests. Also, the 40-litre $CaSO_4$ solution washing (C) gave a higher resistance than the best of the water-washed cottons (test 10). These two exceptionally high values were not

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* *E.g.* experiments 15 and C were checks on 3 and A respectively. In Table I the ash constituents of 3 and 15 check surprisingly well. Those of A and C do not check so well, but this is no doubt due to the fact that no washing with distilled water followed the salt solution washing, and one of these bundles may have been squeezed slightly drier of washing solution than the other, since both Ca and SO_4 are higher in one than the other.

† At 75% relative humidity, 25° C., the moisture content of this HCl-washed cotton was 8·07%. Two water-washed cotton samples, which gave insulation resistances of 108 and 73 kilomegohms, had moisture contents under these conditions of 8·00 and 8·12% respectively. The HCl-washed cotton had a resistance of 55 kilomegohms.

duplicated by other samples washed similarly. The difficulty of insuring uniform drying conditions is believed to be responsible for these results.

The average insulation resistance of $CaSO_4$ washed cotton, after preconditioning at 90% relative humidity, is 80 kilomegohms, based upon tests 3, 15, E, B, A, and C. For cottons washed in at least the same total volume of distilled water, the similar value is 65 kilomegohms. This difference is insufficient to warrant definite conclusions regarding the relative merits of the washing procedures used, in view of the effects of other factors previously discussed. However, definite benefit from the use of $CaSO_4$ or $MgSO_4$ has been secured commercially, as previously mentioned, and it is possible that the above difference between 80 and 65 is significant.

Verification of this possibility must await more quantitative information regarding the effects of atmospheric humidity and temperature upon the insulation resistance of purified cotton.

Ionic interchange does occur when cotton is washed in salt solutions, and though the results indicate that consistently lower Na+K contents were obtained with the alkaline-earth solutions, these differences also are insufficient to reveal any material effect upon insulation resistance. The principal ionic interchanges appear to take place between Ca and Mg, and a more detailed discussion of this effect is contained in a separate paper (No. 17), since it appears to have little direct bearing on the electrical properties of cotton.

BIBLIOGRAPHY

[1] Murphy and Walker. *J. Phys. Chem.*, **32**, 1761 (1928).
[2] Walker and Quell. "Naturally-Occurring Ash Constituents of Cotton," page T131.
[3] A. C. Walker. "Effect of Atmospheric Humidity and Temperature on the Relation between Moisture Content and Electrical Conductivity of Cotton," page T145.

16—NATURALLY-OCCURRING ASH CONSTITUENTS OF COTTON

DISTRIBUTION OF ASH CONSTITUENTS AS SALTS AND CHANGES RESULTING FROM WASHING IN AQUEOUS SOLUTIONS

By A. C. WALKER and M. H. QUELL

Precise information on the inorganic ash constituents which are deposited in cotton fibres during growth, and on the changes which occur in these constituents when cotton is washed with distilled water or aqueous solutions, is desirable as an aid in understanding many of the properties of this important industrial fibre. In the previous paper (No. 15) reference was made to laboratory experiments in which raw (untreated) cotton was washed with distilled water and various aqueous solutions, and sufficient analytical data were given to show the effects of changes in the ash constituents upon the electrical properties of the cotton.

It is the purpose of this paper to present a discussion of the analytical data obtained in these experiments, together with a possible distribution of the ash constituents as salts occurring in the raw cotton. This distribution is based upon a somewhat unusual consideration of the analytical data. It will be shown that ionic interchange occurs when cotton is washed in aqueous salt solutions, the principal effect being the replacement of Mg^{++} in the cotton by Ca^{++} from $CaSO_4$ solutions used in washing, or the reverse if the solutions is $MgSO_4$. Although these analytical data were secured in an investigation of the electrical properties of cotton, they are the subject of a more general discussion in this paper, since it is possible that they may be of service in the study of other properties of cotton or other forms of cellulose.

EXPERIMENTAL

Table I gives ash analyses of 20 different washed cottons, and averaged analyses of seven separate determinations of the ash constituents of the raw cotton used in this work, together with analyses of two lots of commercially purified cotton and one partial analysis of cotton washed in a mixed salt solution, having concentrations of $MgSO_4$ and K_2SO_4, approximately the same as found in the tap water used in one of the commercial washings.

The values given for the ash constituents of the washed cottons are generally averages of at least two analyses, although in some cases only one analysis was made. In these experiments great care was taken to provide as uniform a washing procedure as possible. This procedure, as well as the methods employed in making the analytical separations and determinations are described in an appendix to this paper.

As indicated in this appendix, 200-gram bundles, each composed of eight 25-gram skeins of cotton, were prepared for these washing experiments. Preliminary tests were made on separate bundles, washings being made with 5, 10, 20, and 37 litres of water at 40° C., also at 80° C., using 10 and 20 litres of distilled water. From an examination of the insulation resistance values obtained immediately after washing and drying these cottons at 105° C., and from the total ash contents of these cottons it was concluded that 20 litres of distilled water gave reductions in ash content of nearly the same amount as though more water was used; also, the washing temperature did not appear to influence the results critically. The insulation resistance values

Table I—Cotton Ash Analyses

Bundle No.	Treatment	No. of Analysis	K	Na	Ca	MgO	CO_3	SO_4	SiO_3	$Fe_2O_3 + Al_2O_3$	Total	As Weighed
			Ash Constituents—in Percentage of the Dry Cotton Weight									
7	Raw cotton	7	0·361	0·030	0·054	0·070	0·200	0·156	0·037	0·048	1·046	1·049
			(P_2O_7 = 0·045%; Cl = 0·045%.)									
			Distilled-Water Washings at 40° C.									
2	5 litres H_2O	2	0·042	0·011*	0·036	0·034	—	0·051	0·036	0·050	—	0·320
6	10 ,, ,,	2	0·025	0·012*	0·034	0·032	—	0·046	0·032	0·045	—	0·285
8	20 ,, ,,	2	0·015	0·001*	0·058	0·038	—	—	0·033	0·046	—	0·280
12	20 ,, ,,	2	0·013	0·005*	0·051	0·051	0·042	0·040	0·022	0·026	0·250	0·243
10	37 ,, ,,	1	0·002	0·008*	0·061	0·046	0·053	0·041	0·016	0·036	0·263	0·275
40	40 ,, ,,	1	0·002	0·004*	0·069	0·036	0·064	0·038	0·022	0·023	0·258	0·296
13	40 ,, ,,	1	0·002	0·001	0·040	0·207	0·032	0·030	0·016	0·019	0·135	0·200
80	80 ,, ,,	2	0·005	0·003	0·048	0·038	0·049	0·036	0·010	0·029	0·218	0·235
			Distilled-Water Washings at 80° C.									
14	10 litres H_2O	1	0·018	0·009	0·055	0·029	0·045	0·041	0·020	0·027	0·244	0·256
4	20 ,, ,,	1	—	0·002	0·059	0·040	0·063	0·029	0·018	0·026	0·237	0·243
			$CaSO_4$-Solution Washings at 40° C.									
3	$CaSO_4$: 20–**10**–10	2	0·0015	0·001	0·082	0·022	0·079	0·042	0·022	0·021	0·271	0·271
15	$CaSO_4$: 20–**10**–10	1	0·006	0·003*	0·085	0·014	0·082	0·031	0·033	0·028	0·282	0·272
E	$CaSO_4$: 20–**30**–10	1	0·0035	0·001	0·081	0·002	0·090	0·021	0·013	0·024	0·236	0·254
B	$CaSO_4$: **30**–10	2	0·0015	0·001	0·094	0·002	0·093	0·032	0·025	0·028	0·277	0·296
A	$CaSO_4$: **40**	2	0·003	0·004	0·091	0·011	0·092	0·044	0·029	0·035	0·309	0·314
C	$CaSO_4$: **40**	2	0·004	0·001	0·086	0·010	0·095	0·035	0·033	0·023	0·267	0·276
			$MgSO_4$-Solution Washings at 40° C.									
5	$MgSO_4$: 20–**10**–10	2	0·004	0·002	0·024	0·073	0·020	0·018	0·020	0·017	0·178	0·184
			Other Salt-Solution Washings at 40° C.									
1	K_2SO_4 : 20–**10**–10	1	0·031	0·007*	0·049	0·022	0·042	0·034	0·018	0·017	0·220	0·226
9	Na_2SO_4 : 20–**10**–10	A	0·004	0·008	0·046	0·030	0·040	0·019	0·016	0·018	0·181	0·200
	,, ,, ,,	B	0·004	0·007	0·045	0·030	0·007	0·019	0·014	0·019	0·145	0·177
			Note—9–A was ashed normally—below 350° C.; 9–B was ashed at red heat—lost CO_2.									
11	HCl: 20–**10**–10	2	0·004	0·002	0·007	0·002	0·000	0·004	0·018	0·009	0·046	0·047
			Commercial Washings—using Tap Water to which 5 lb. MSO_4 was added/800 lb. Cotton.									
K–1	5 lb. $CaSO_4$	2	0·007	0·001	0·091	0·002	0·112	0·011	0·019	0·032	0·276	0·282
K–3	5 lb. $MgSO_4$	3	0·007	0·003	0·081	0·053	0·059	0·089	0·020	0·036	0·348	0·346
			Combined Salt Washing—Distilled H_2O to which Mg and K were added in same proportions as found in the natural water used for K–1 and K–3.									
F	$MgSO_4 + K_2SO_4$: 20–**20** ·005N ·0006N	1	0·009	0·003	—	—	—	—	—	—	—	—

The eight analyses marked with (*) indicates that the Na values may be somewhat in error due to contamination during analysis.

See page TI33 for explanation of the designation (20–**10**–10).

of the cottons washed in 10 litres or more of distilled water were of approximately the same order of magnitude, with one exception. This exception, as discussed in the previous paper (No. 15), gave an unusually high value, not due to important changes in the ash constituents, but to the method of drying.

On the basis of these conclusions a programme of washing tests was carried out, in which 200-gram bundles were first washed with 20 litres of distilled water to remove most of the readily water-soluble salts and bring the samples to as nearly a uniform ash content as possible. Each bundle was then washed in 10 litres of a 0·0025 N aqueous solution, these being $CaSO_4$, $MgSO_4$, K_2SO_4, Na_2SO_4 or HCl. Following these solution washings, each bundle was washed with 10 litres of distilled water to remove any residual salts. In several cases check washings were made; also several bundles were washed with $CaSO_4$ solutions only, or variations of the 20–10–10* programme above outlined. All washings were at 40° C., except the two at 80° C.

When the data, as originally reported, were tabulated according to the arrangement shown in Table I, the summations of the ash constituents for each sample were, in general, very close to the ash percentage as determined by weighing the ash before analysis, providing Mg, Fe, and Al were expressed as oxides and the remainder as elements or acid radicals.†

In Table I, the summation of the individual ash constituents checks very closely with the ash as initially weighed; in 12 of the analyses the differences between the summation and the gravimetric ash weight are less than 0·01% of the dry cotton weight; in six more they are less than 0·02%, in two others less than 0·04%, and only one, Bundle 13, shows a difference of as much as 0·065 per cent.‡

Bundles 2, 6, and 8 are not included in the above discussion of precision, since these bundles were analysed before the CO_3 determination was included in the procedure. Also SO_4 is missing in Bundle 8, for the same reason. These three bundles were used in developing the analytical procedure given in the appendix. Their analyses later assumed an importance not anticipated when the programme was outlined, and since several of the ash constituents were missing, and the Ca content appeared to be low in 2 and 6, an attempt was made to estimate the missing constituents and correct the others. A study of the data suggested a method by which this could be done with considerable accuracy. This method was useful also in correcting known or obvious errors in several of the analyses, and it was of particular importance in estimating the distribution of the ionic constituents of the ash as salts in the raw cotton. Further discussion of the data will be given after outlining this method.

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* In the tables, the different samples are designated—M SO_4:20–10–10. Each number indicates the volume of liquid used, the bold figure value being volume of salt solution (M SO_4 or HCl), those not in bold figures being volumes of distilled water in litres per 200 grams of cotton. The sequence is order of washing.

† Higgins[2] concluded from certain benzene extractions of cotton that some of the fatty acid is present as a magnesium salt; Schunk[3] treated cotton with Na_2CO_3, and concluded from subsequent treatments that Fe and Al are present in organic combination. Organic salts of these metals become oxides on ignition at 350° C., the temperature used in these experiments.

‡ The analyses for Bundle 13 are in error, save for the Na and K values, due to accidental spilling of part of the solution after taking aliquot samples for the Na and K determinations. They are included to provide a check on Na and K for washings in 40 litres of water. Bundles 10 and 40 have Na values which are too high due to a small though indeterminate contamination with Na during one of the analytical separations, before the method of aliquoting was adopted.

Table II—Cotton Ash Analyses

Bundle No.	Treatment	Ash Constituents—Milliequivalents/100 gr. Dry Cotton								Ratio*
		K^+	Na^+	Ca^{++}	Mg^{++}	$CO_3^=$	$SO_4^=$	$SiO_3^=$	$P_2O_7^=$	Cl^-	base/acid
7	Raw cotton	9·25	1·29	2·70	3·48	6·68	3·26	0·97	1·05	1·27	1·00
	Distilled-Water Washings at 40° C.										
2	5 litres H_2O	1·08	0·49	1·80	1·69	—	1·09	0·94	none	—	—
6	10 ,, ,,	0·64	0·52	1·72	1·59	—	0·96	0·84	,,	—	—
8	20 ,, ,,	0·40	0·03	2·92	1·90	—	—	0·87	,,	—	—
12	20 ,, ,,	0·34	0·23	2·57	2·54	1·41	0·83	0·57	—	—	1·035
10	37 ,, ,,	0·06	0·33	3·04	2·28	1·77	0·86	0·43	—	—	1·01
40	40 ,, ,,	0·04	0·16	3·43	1·79	2·14	0·79	0·57	—	—	0·99
13	40 ,, ,,	0·06	0·06	2·00	1·34	0·82	0·63	0·40	—	0·017	—
80	80 ,, ,,	0·13	0·13	2·39	2·18	1·64	0·63	0·27	—	0·011	1·04
	Distilled-Water Washings at 80° C.										
14	10 litres H_2O	0·47	0·40	2·75	1·44	1·50	0·86	0·53	—	—	1·11
4	20 ,, ,,	—	0·10	2·96	1·98	2·09	0·61	0·47	—	—	0·965†
	$CaSO_4$-Solution Washings at 40° C.										
3	$CaSO_4$: 20–**10**–10	0·04	0·06	4·08	1·09	2·64	0·88	0·57	—	—	1·01
15	$CaSO_4$: 20–**10**–10	0·15	0·13	4·25	0·70	2·73	0·65	0·87	—	—	1·065
E	$CaSO_4$: 20–**30**–10	0·09	0·06	4·04	0·10	3·00	0·44	0·33	—	—	1·11
B	$CaSO_4$: **30**–10	0·04	0·06	4·69	0·10	3·09	0·67	0·67	—	—	1·08
A	$CaSO_4$: **40**	0·08	0·16	4·53	0·55	3·05	0·92	0·77	—	—	1·01
C	$CaSO_4$: **40**	0·11	0·06	4·32	0·50	2·50	0·73	0·87	—	—	1·095
	$MgSO_4$-Solution Washings at 40° C.										
5	$MgSO_4$: 20–**10**–10	0·11	0·10	1·18	3·62	0·68	0·38	0·53	—	—	0·875
	Other Salt-Solution Washings at 40° C.										
1	K_2SO_4: 20–**10**–10	0·79	0·32	2·43	0·70	1·41	0·71	0·47	—	—	1·240
9	Na_2SO_4 : 20–**10**–10										
	A	0·09	0·35	2·29	1·48	1·32	0·40	0·43	—	—	1·270
	B	0·11	0·32	2·25	1·49	0·23	0·40	0·37	—	—	—
	B ashed at red heat—lost CO_2.										
11	HCl : 20–**10**–10	0·11	0·10	0·36	0·10	none	0·08	0·47	—	none	1·035
	Commercial Washings—Using Tap Water (see Table I).										
K–1	$CaSO_4$	0·17	0·06	4·54	0·10	3·72	0·23	0·50	—	—	1·07
K–3	$MgSO_4$	0·17	0·13	4·04	2·62	1·95	1·86	0·53	—	—	1·00

* In calculating this ratio, Na is omitted in the washed cottons, since errors vitiate this value in some cases—in all others it is substantially negligible. Mg is omitted also since it is assumed present as organic salt; the Fe and Al are omitted for the same reason.

†K omitted, since it was not determined.

The method involves the following considerations—

If the data are tabulated in terms of milliequivalents (m.eq.) of the separate ionic constituents per 100 grams of cotton (Table II), it is seen that the ratio of base/acid equivalents is surprisingly close to unity for the raw cotton, if only the constituents K, Na, Ca, CO_3, SO_4, SiO_3, P_2O_7, and Cl are used. These ratios for the different purified cottons are nearly unity in most cases if only K, Ca, CO_3, SO_4, and SiO_3 are considered. Mg, Fe, and Al are omitted, since the assumption on page T133 indicates that they should be reported as oxides, also the base/acid ratios are more nearly unity without them.

Further, it seems reasonable to assume that Na and Cl exist in raw cotton as NaCl, since these ions are present in nearly equivalent quantities and both are practically absent in all of the washed cottons.*

Phosphorus is assumed to be in a readily soluble inorganic salt form, since it is required in the base/acid ratio for raw cotton, but not in that for the washed cottons.† The logical water-soluble salt form for the phosphorus is K_2HPO_4, which becomes $K_4P_2O_7$ on ignition.[8]

The silicate content of raw cotton is reduced from 0·97 m.eq., in raw cotton to about 0·50 m.eq., after washing with at least 20 litres of distilled water. This suggests that part of the silicate is water-soluble, possibly being associated with potassium in the raw cotton, while the insoluble remainder may be $CaSiO_3$. Similarly the SO_4 content is reduced from 3·26 to a nearly constant value of 0·8 m.eq. It seems reasonable to assume that this residue is present as comparatively insoluble $CaSO_4$. In raw cotton, and in those washed samples in which SO_4 is appreciably in excess of 0·80 m.eq., the excess is assumed to be present as K_2SO_4, since K is the only element reduced by washing to as great a degree as the acid radical SO_4. All Ca and K in excess of the amounts associated with SO_4 and SiO_3 are assumed to be present in the cotton, both raw and purified, as organic salts which become carbonates on ignition at 350° C. On this basis the total CO_3 values of the different samples balance most effectively.

An outstanding feature of the data, thus corrected, is that the discrepancies between ash as weighed and as summed up from the individual analyses are less than 0·01% of the cotton weight in all but four cases.‡ Table II shows the distribution of the ash constituents as salts based upon this method of computation.

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* The sensitive silver nitrate test for Cl revealed no more than a trace of Cl in several of the washed cotton ash solutions. Also the Na content was in no case more than 0·01% in the washed cotton ash, and thus the omission of the Na in the ratio of base/acid introduces but a slight error. It is possible that a small amount of Na may be present in the ash of washed cotton, although all of the Na may be in the form of NaCl in the raw material. This may be the result of loss of Cl originally associated with Na, as volatile NH_4Cl through combination with the nitrogen present in cotton (0·1 to 0·2% N, according to Fargher and Withers).[4] A loss due to such interchange is discussed by Roberts[5] in studies of tobacco ash.

† Calvert[6] found that nearly all of the phosphorous in cotton could be removed by cold water extraction. His values (0·028—0·055% P_2O_5) and Lester's value (0·056%) [7] for raw cottons are of the same order as the value reported in Table I.

‡ The SO_4 content of Bundle 8 was assumed to be equivalent to the $CaSO_4$ content of raw cotton in milliequivalents (0·80 m.eq.). CO_3 was then estimated from the difference between total Ca and the portions assumed to be associated with SO_4 and SiO_3 plus the CO_3 combined with the excess of K over that associated with K_2SiO_3. Ca values in Bundles 2 and 6 seemed to be low in comparison with 8 and other water-washed cottons. These were corrected to the value for raw cotton (2·70 m.eq.) and the missing CO_3 values for these bundles computed as in the case of Bundle 8.

Table III

Distribution of Cotton Ash as Inorganic Salts

Bundle No.	Treatment	Ash Salts in Percentage of the Dry Cotton Weight: $CaSO_4$	$CaSiO_3$	$CaCO_3$	K_2SO_4	K_2SiO_3	K_2CO_3	MgO	$Fe_2O_3 + Al_2O_3$	Total Salts	Ash as Weighed	Difference in % of Ash
7	Raw cotton	0·054	0·029	0·070	0·214	0·036	0·364	0·069	0·048	1·046	1·049	0·003
		($NaCl = 0·075\%$; $K_4P_2O_7 = 0·087\%$)										
	Distilled-Water Washings at 40° C.											
2	5 litres H_2O	0·054	0·029	0·070	0·023	0·034	0·026	0·034	0·050	0·320	0·320	0·000
6	10 ,, ,,	0·054	0·029	0·070	0·014	0·026	0·010	0·032	0·045	0·280	0·285	0·005
8	20 ,, ,,	0·054	0·029	0·081	—	0·029	0·002	0·038	0·046	0·279	0·280	0·001
12	20 ,, ,,	0·054	0·029	0·064	0·003	0·005	0·010	0·051	0·026	0·242	0·243	0·001
10	37 ,, ,,	0·054	0·029	0·089	—	—	0·004	0·046	0·036	0·258	0·275	0·017
40	40 ,, ,,	0·054	0·029	0·107	—	0·005	—	0·036	0·023	0·259	0·296	0·037
13	40 ,, ,,	0·054	0·029	0·070	—	—	—	0·027	0·019	0·204	0·200	0·004
80	80 ,, ,,	0·054	0·029	0·070	—	—	—	0·038	0·029	0·232	0·235	0·003
	Distilled-Water Washings at 80° C.											
14	10 litres H_2O	0·054	0·029	0·072	0·005	0·002	0·025	0·040	0·027	0·244	0·256	0·002
4	20 ,, ,,	0·042	0·029	0·093	—	—	0·016	0·040	0·026	0·246	0·243	0·003
	$CaSO_4$-Solution Washings at 40° C.											
3	20–**10**–10	0·060	0·033	0·132	—	—	0·003	0·022	0·021	0·271	0·271	0·000
15	20–**10**–10	0·054	0·042	0·137	—	—	—	0·014	0·028	0·275	0·272	0·003
E	20–**30**–10	0·040	0·029	0·146	—	—	0·006	0·002	0·024	0·247	0·254	0·007
B	**30**–10	0·066	0·039	0·158	—	—	0·003	0·002	0·032	0·300	0·296	0·004
A	**40**	0·063	0·45	0·149	—	—	0·005	0·011	0·035	0·308	0·314	0·006
C	**40**	0·050	0·051	0·136	—	—	0·008	0·010	0·23	0·278	0·276	0·002
	$MgSO_4$-Solution Washing at 40° C.											
5	$MgSO_4$: 20–**10**–10	—	0·029	0·034	0·010	0·016**	—	0·067	0·017	0·173	0·184	0·011
	K_2SO_4- and Na_2SO_4-Solution Washings at 40° C.											
1	K_2SO_4: 20–**10**–10	0·046	0·028	0·064	0·047	—	0·010	0·014	0·017	0·226	0·226	0·000
9	Na_2SO_4 : 20–**10**–10	0·046	0·025	0·059	0·015*	—	0·007†	0·030	0·018	0·200	0·200	0·000
	Check analysis	0·046	0·025	0·032‡	0·006*	—	0·012†	0·030	0·014	0·165	0·177	0·012
	Acid Washing at 40° C.											
11	HCl : 20–**10**–10	0·005	0·016	—	—	(Na_2SiO_3) 0·006	0·009	0·002	0·009	0·048	0·047	0·001
	Commercial Washings with Tap Water (see Table I).											
K–1	5 lb. $CaSO_4$	0·022	0·029	0·186	0·015	($MgSO_4$) —		0·002	0·032	0·286	0·282	0·004
K–3	5 lb. $MgSO_4$	0·108	0·029	0·098	0·015	0·016	—	0·047	0·036	0·349	0·346	0·003

Notes—* Na_2SO_4. † Na_2CO_3. ‡ CaO. **$MgSO_4$

The base/acid ratios for Bundles 1 and 9 deviated from unity more than the others, and they were the most difficult to correct according to the method used in preparing Table III. The potassium content of Bundle 1 appeared to be higher than could be accounted for on the assumed basis, consequently the distribution of Ca as SiO_3, SO_4, and CO_3 was made first, and the remaining K over that associated with the residual CO_3 was assumed to be present as SO_4, necessitating an assumption that the SO_4 value for this bundle was too low.*

A similar attempt to evaluate the data for Bundle 9 was troublesome, particularly since the two check analyses of this bundle were made with unusual care. The separate ion-constituents, except CO_3,† check surprisingly well, but the totals are not in good agreement with the ash as initially weighed. On comparing these analyses with that of Bundle 1, the SO_4 values appear to be low. Consequently the procedure described for Bundle 1 was adopted in supplying correct values for the ash constituents as salts, with the exception that the Na values were assumed to be correct, and the discrepancy in SO_4 content was corrected to correspond with the Na content. On this basis the totals check much better with the ash as weighed.

Other possible explanations for the few discrepancies between ash summations and ash weights remaining after applying the above-discussed corrections are that in these cases the ashing of the cotton may have been somewhat incomplete, therefore giving too high an ash weight, or that the total ash may have absorbed a small amount of moisture from the air during weighing.

The principal facts revealed by an examination of the data as presented in Table III are as follows—The ash of cotton prior to any water treatment is very close to 1%,‡ and water washing reduces it to a value between 0·2% and 0·3 per cent. This reduction is not surprising, since it is found that over 0·4% of the raw cotton ash exists as K_2SO_4, K_2SiO_3, $K_4P_2O_7$, and NaCl, while the remaining potassium (0·364% as K_2CO_3) results from the ignition of organic potassium compounds, and it seems reasonable to assume these to be water soluble, since washing with more than 20 litres of water removes practically all of the potassium salts. Washing also halves the Mg content, but leaves the Ca, Fe, and Al contents almost unchanged.

The potassium content of purified cotton appears to depend upon the concentration of potassium in the water used in washing.§ The amounts of potassium present in any of the bundles washed with at least 40 litres of solution are almost negligible. The presence of $MgSO_4$ in water also containing K_2SO_4 appears to have little effect upon the retention of potassium by the cotton, since the water used for Bundle 1 contained no $MgSO_4$, while that

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* This does not seem inconsistent, since the SO_4 determinations are considered to be the least accurate in this work.

† One of these determinations was ashed at the customary temperature of 350° C., the other at a bright red heat where the $CaCO_3$ was converted to CaO, thus accounting for the difference in the CO_3 content between these two determinations.

‡ According to Matthews[9] the ash of cotton never exceeds 1%. Lester[7] found that 0·61% of cotton ash could be removed by water extraction from a cotton having an ash content of 0·82%. Other investigators have reported similar results.[10]

§ The same amount of K_2SO_4 was added to the water used to wash Bundle F as that reported in the analysis of the water used in the commercial washings K-1 and K-3, and the potassium contents of the cotton in all three of these washings are much the same. Further, Bundle 1 was washed in a K_2SO_4 solution of 0·0025 N, while the concentration of K_2SO_4 in the water used for Bundle F was 0·0006 N. This ratio 0·0025/0·0006 is surprisingly close to the ratio of K in the ash of these two cottons.

used for Bundle F contained this alkaline-earth salt in addition to the K_2SO_4. The marked effects of $CaSO_4$ or $MgSO_4$ in the wash water, on the Ca or Mg content of the cotton clearly indicate that ionic interchange does take place between Ca^{++} and Mg^{++}, but no clear evidence is found to show that alkaline-earth salts in the wash water aid materially in reducing the alkali metal content of the cotton by ionic interchange, as might be expected from the results of other investigators.*

Table IV

Ionic Interchange illustrated by a Comparison of the Ash Constituents of Cotton Washed in Water and in Aqueous $CaSO_4$ Solutions

Washing Conditions	Ionic Ash Constituents in milliequivalents per 100 grams of Dry Cotton					
	K^+	Ca^{++}	Mg^{++}	$CO_3^=$	$SO_4^=$	$SiO_3^=$
20 litres of Dist. H_2O... ... (Avg. Bundles 8 and 12)	0·37	2·70	2·22	1·53	0·80	0·72
$CaSO_4$: 20–10–10 ... ... (Avg. Bundles 3 and 15)	0·10	4·17	0·90	2·78	0·84	0·65
Net change	−0·27	+1·47	−1·32	+1·25	+0·05	−0·07

Table IV gives a comparison of the principal changes which occur in the ion-constitituents of K, Ca, Mg, CO_3, SO_4, and SiO_3 when cotton is washed in 20 litres of distilled water and when it is washed in this same amount of water followed by 10 litres of $CaSO_4$ solution and 10 litres of distilled water.

The decrease in Mg content is nearly equivalent to the increase in Ca and CO_3 contents. The magnitudes of these changes are much greater than any possible errors in the individual values, while at the same time the changes in all of the other ionic constituents are negligible by comparison. Therefore, it is reasonable to conclude that most of the gain in Ca is by ionic interchange with Mg in some organic magnesium salt. The small change in SO_4 emphasised the fact that the washing of cotton in sulphate solutions is not necessarily accompanied by appreciable contamination of the cotton with sulphate, provided the excess sulphate solution is removed by a final water washing. The ionic interchanges resulting from the other salt washings have been computed in a similar manner. The net changes are summarised in Table V.

Table V

Changes in the Ash Constituents of Cotton Resulting from Washing in Water as Compared with Aqueous Salt Solutions

Salt Washing	Net Change in Ionic Ash Constituents in milliequivalents per 100 grams of Dry Cotton						
	Na^+	K^+	Ca^{++}	Mg^{++}	$CO_3^=$	$SO_4^=$	$SiO_3^=$
$MgSO_4$	−0·03	−0·21	−1·52	+1·40	−0·85	−0·42	−0·22
K_2SO_4	+0·19	+0·47	−0·27	−1·52	−0·12	−0·09	−0·25
Na_2SO_4	+0·22	−0·22	−0·41	−0·74	−0·22	−0·40	−0·32

Discussion of Ionic Interchange as shown in Table V

There is a loss of 1·52 m.eq. in Ca and a gain of 1·40 m.eq. in Mg, resulting from the $MgSO_4$ washing, this being just the reverse of the effect produced by $CaSO_4$-solution washing. It is interesting to note that the loss of CO_3 is much less than the loss of Ca. The losses in SO_4 and SiO_3 are greater than the.

* Stiles[1] showed that in the adsorption of NaCl by carrot tissues, the excess Na^+ absorbed was replaced by Ca^{++}, K^+, and Mg^{++} in the solution. Similar replacements were found by Redfern[12], Stoklasa[13], and by Petrie.[14] Edge[15] found salt replacement in cellulose, while P. Rona and L. Michaelis ascribed marked adsorption of electrolytes (dyes) by cellulose to its mineral content, even in ash-free filter paper.[16]

changes in these ions in the $CaSO_4$ washings, suggesting that Mg replaces Ca in both organic and inorganic salts. The gain in Mg is less than the loss in Ca due perhaps to the loss of soluble $MgSO_4$ formed by interchange of Mg with Ca in $CaSO_4$, which appears to be quite insoluble when present in cotton.

The changes observed in the ash constituents due to washing in K_2SO_4 and Na_2SO_4 solutions are more difficult to interpret, and no doubt more work should be done to evaluate accurately these effects. However, one fact to be noted is that all of the changes in these alkali-salt washings are negative, except the changes in the metal ions which are present in the wash water. This suggests that whatever replacement occurs in washing is followed by solution of the greater part of the soluble alkali formed. The decrease in the ash content resulting from washing with HCl appears to be due to a displacement of the acid ions in the cotton by Cl^-, and subsequent solution of the chlorides thus formed. The residual ash consists mainly of calcium silicate with traces of Na and K silicates and calcium sulphate. The residual Mg, Fe, and Al are assumed, for simplicity, to be in organic combination. However, the actual distribution of these elements can have but little effect upon conclusions which may be derived from the assumed arrangement, since the quantities involved are small. It is not surprising that HCl and HF treatments are required in the preparation of ash-free filter paper, or that cotton can be rendered practically ash-free by proper bleaching and acid treatments, followed by careful washing with very pure, ash-free, distilled water. The unexpected feature of the acid-washing experiment is the low resistance of the cotton (I) notwithstanding its low ash content. This may be due to partial hydrolysis of the surfaces of the cotton fibres by contact with the acid as discussed in the previous paper.

BIBLIOGRAPHY

[1] A. C. Walker and M. H. Quell. See accompanying paper—"Influence of Ash Constituents on the Electrical Conduction of Cotton."

[2] Higgins. "Bleaching," p. 13. This reference was taken from Matthews, "Textile Fibres," p. 478, 4th Ed., J. Wiley & Son (1924).

[3] Schunck. *Mem. Manchester Lit. Phil. Soc.*, 1871, ser. 3, **24**, 95. This reference also from Matthews, "Textile Fibres," p. 480.

[4] Fargher and Withers. *J. Text. Inst.*, **13**, T1, 1922; also *Shirley Inst. Mem.*, **1**, **6**, 1922.

[5] Roberts. *Analyst*, **43**, 254 (1918).

[6] Calvert. *J. Chem. Soc.*, 20, 303 (1867).

[7] Lester. *Textile Mercury*, 17th and 24th Dec. (1904).

[8] Graham. *Phil. Trans.*, **123**, 253 (1833).

[9] Matthews. "Textile Fibres," p. 467, 4th Ed., J. Wiley & Son (1924).

[10] Knecht and Hall. *J. Soc. Dyers and Col.*, **34**, 220 (1918).
Fargher, Hart, and Probert. *J. Text. Inst*, **18**, T29 (1927); also *Shirley Inst. Mem.*, **V**, 261 (1926).
Hebden, J. *J. Ind. Eng. Chem.*, **6**, 714 (1914).

[11] Stiles. *Ann. Botany*, **38**, 617 (1924).

[12] Redfern. *Ibid.*, **36**, 167 (1922).

[13] Stoklasa, Sebor, Tymich and Swacha. *Biochem. Z.*, **128**, 35 (1922).

[14] Petrie. *Australian J. Exptl. Biol. Med. Sci.*, **4**, 169 (1927).

[15] Edge, Stephen R. H. *J. Soc. Chem. Ind.*, **48**, 118, 21T (1929).

[16] Rona, P., and Michaelis, L. *Biochem. Z.*, **103**, 19–30 (1920).

[17] Williams. *J. Text. Inst.*, **14**, 295 (1923).

[18] Talbot. "Quantitative Chemical Analysis," p. 19.
Ferguson. *J. Soc. Chem. Ind.*, **24**, 784 (1905).

[19] Talbot. *Ibid.*, p. 69.

[20] Johnston and Adams. *J. Am. Chem. Soc.*, **33**, 844 (1911).

[21] Treadwell and Hall. "Quantitative Analysis," **2**, 91, 7th Ed. (1928).

[22] *Ibid.*, p. 80.

[23] Barber and Kolthoff. *J. Am. Chem. Soc.*, **50**, 1625 (1928).

[24] Caley and Foulk. *Ibid.*, **51**, 1664 (1929).

[25] Scott. "Standard Method of Chemical Analysis," **1**, 411, 3rd Ed. (1922).

[26] *Ibid.*, p. 144.

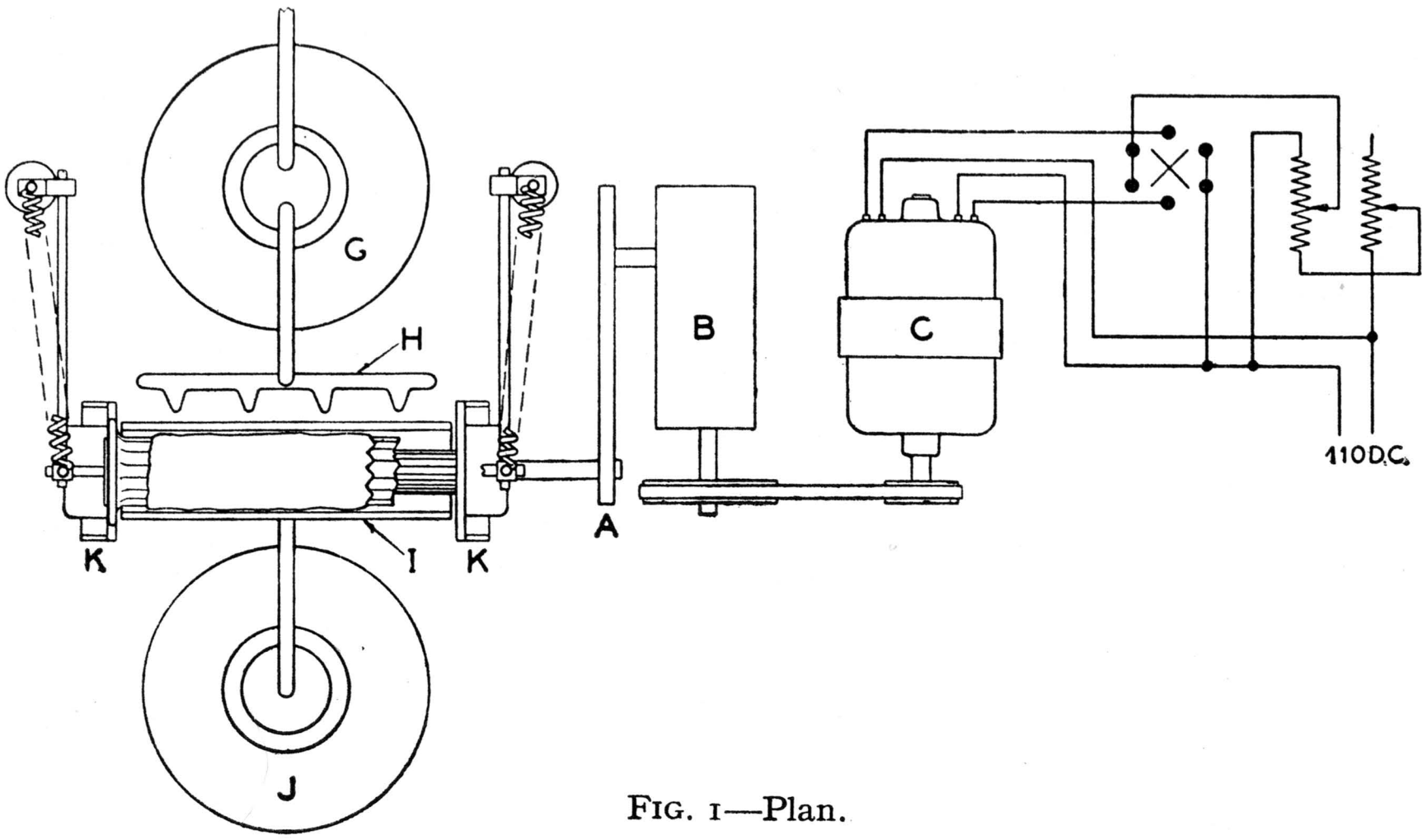

FIG. 1—Plan.

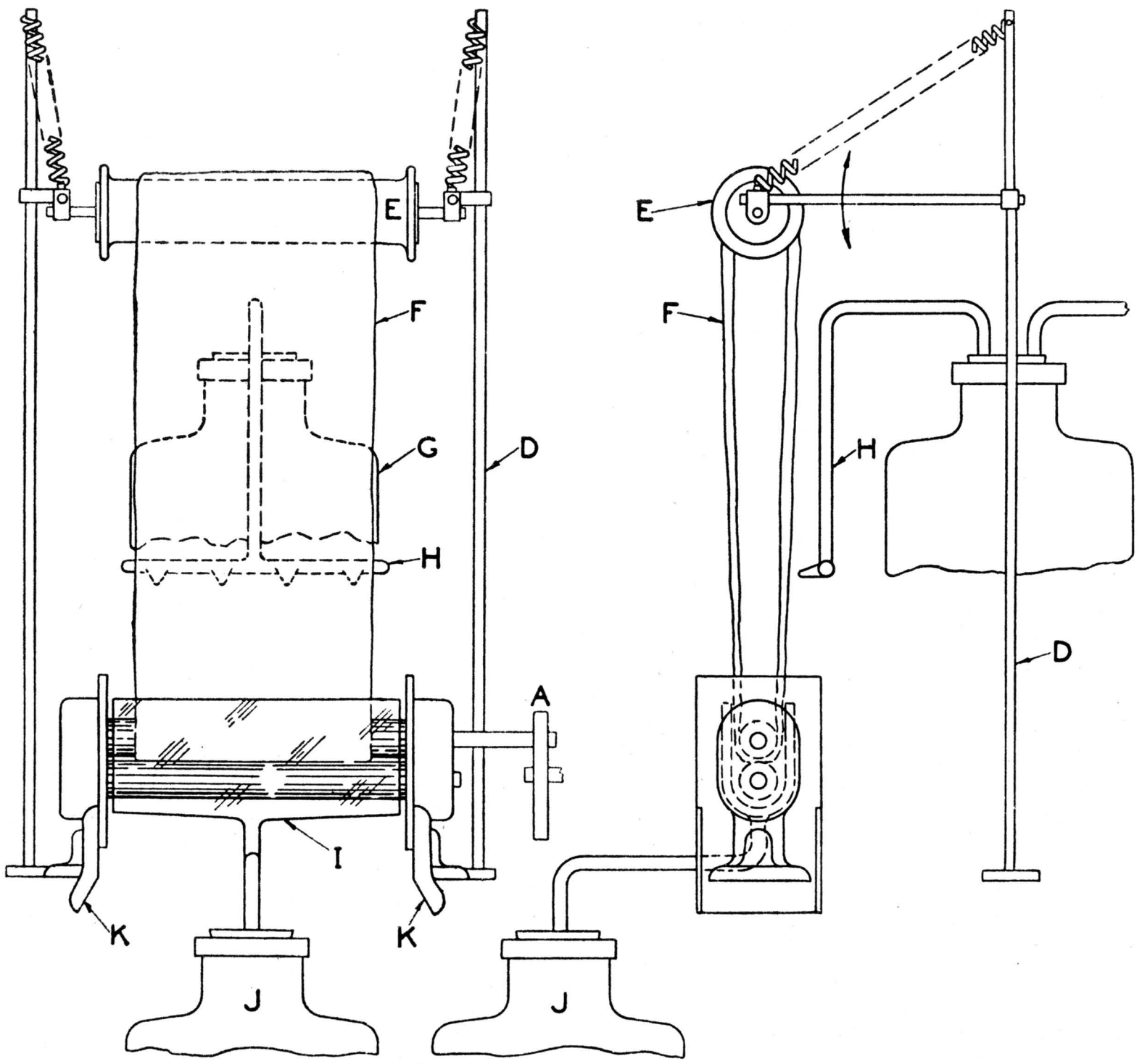

FIG. 1—Elevation.

APPENDIX

Method of Washing Cotton

Preparation of Bundles of Cotton for Washing—Uniform bundles of cotton of 200 grams each were prepared by first winding a large number of 25-gram skeins of cotton from a five-end yarn. This yarn was composed of

threads taken from five spools of cotton; thus one-fifth of each 25-gram skein was contributed by each spool. The skeins were numbered in order of formation from the spools, and the 200-gram bundles were prepared from a systematic selection of skeins so that both outside and inside of each spool would be represented in each bundle. Separate samples of cotton were taken from the five spools both before and after winding the skeins. Insulation resistance measurements and chemical analyses of these separate samples showed no significant variation from spool to spool or from the outside to inside of the spools.

It was found that the eight skeins composing each bundle could not be washed in the apparatus developed without tangling and breaking of threads. To overcome this difficulty each bundle was protected by enclosing it in a flat endless plain gauze bandage.

Apparatus for Washing Cotton—A simple, all-metal frame laundry wringer was set up as shown in Fig. 1. The wringer handle was replaced with a sprocket (A), driven by chain through a reducing gear mechanism (B), and variable speed motor (C). The motor was equipped with a reversing switch so that the rolls could be reversed in direction of rotation. Special rolls, made from rubber of low sulphur content were used, and these were washed for hours prior to use, with a clean bundle of cotton and distilled water to prevent contamination. Uprights (D) were placed in such a position that they supported a pyrex glass roller (E) about 12 in. above the upper wringer roll. This roller was supported on cantilever arms with spring tension so that it was free to move up or down to take care of shrinkage in the diameter of the bundle (F) during washing, and yet maintain the bundle under moderate tension. A 20-litre glass carboy (G) equipped with a spray manifold (H) having four calibrated tips of equal volume of discharge, supplied a continuous stream of wash water upon the band of cotton as it passed through the "bite" of the wringer. Air pressure applied to the water surface in the carboy maintained the continuous flow of water. On reversal of direction of wringer rotation, the water sprayed upon the cotton remained in contact with it, while the bundle travelled up over the idler roller (E) and down to the "bite" of the rolls on the other side, thus giving a somewhat longer time of contact of the water with the cotton.

Below the wringer roll, a special glass gutter (I) was mounted, in which the wash water drained to a large pyrex jar or carboy (J). Grit from the gears was excluded from the wringer rolls and glass gutter by close-fitting hard rubber panels (K) mounted at the end of the rolls. A blank test without a bundle showed that the amount of contamination caused by the flow of 20 litres of water through the system was negligible. Twenty litres of commercial grade distilled water gave 0·0439 gram residue on evaporation.* In the blank test this was increased to 0·0520 gram. Thus these residues corresponded to 0·022% and 0·026% of the weight of 200 grams of cotton, a gain of but 0·004 per cent.

* This relatively high residue in the commercial grade of distilled water, as well as the observation that occasional bottles contain visible residue, caused us to set up a separate still to prepare freshly distilled water for the washing of cotton, since the regular laboratory supply was inadequate for the washing of so many bundles. However, bundles 2, 6, 8, 10, and 40 were washed with the commercial water. Leaching of calcium from the glass by this commercial water may explain the fact that the Ca-content of the ash from bundles 10 and 40 was slightly higher than that of the raw cotton. It was not considered necessary to repeat the blank experiment on the wringer since the amount dissolved by the 20 litres of water in the above test was obviously very small.

It was planned to evaporate all of the wash water obtained in these tests, and analyse the residues to complete the balance of ash analyses of cotton. The accuracy of the cotton ash determinations made it unnecessary to carry out this part of the programme, particularly since the time available for this investigation could not be extended to include this additional work.

It was found that during the washing the bundle gradually decreased in length, due to the action of the rolls in causing a sort of loose kinking in the cotton threads within the bundle. Simply reversing the direction of rotation of the rolls caused immediate lengthening of the bundle, the reversal apparently serving to straighten out these kinks. Rotation in one direction could be continued for about 15 minutes before the reduction in length of the bundle became excessive. Reversals every five to ten minutes sufficed to keep the bundle in satisfactory condition, and washing has been continued for a whole day with no visible effect upon the cotton.

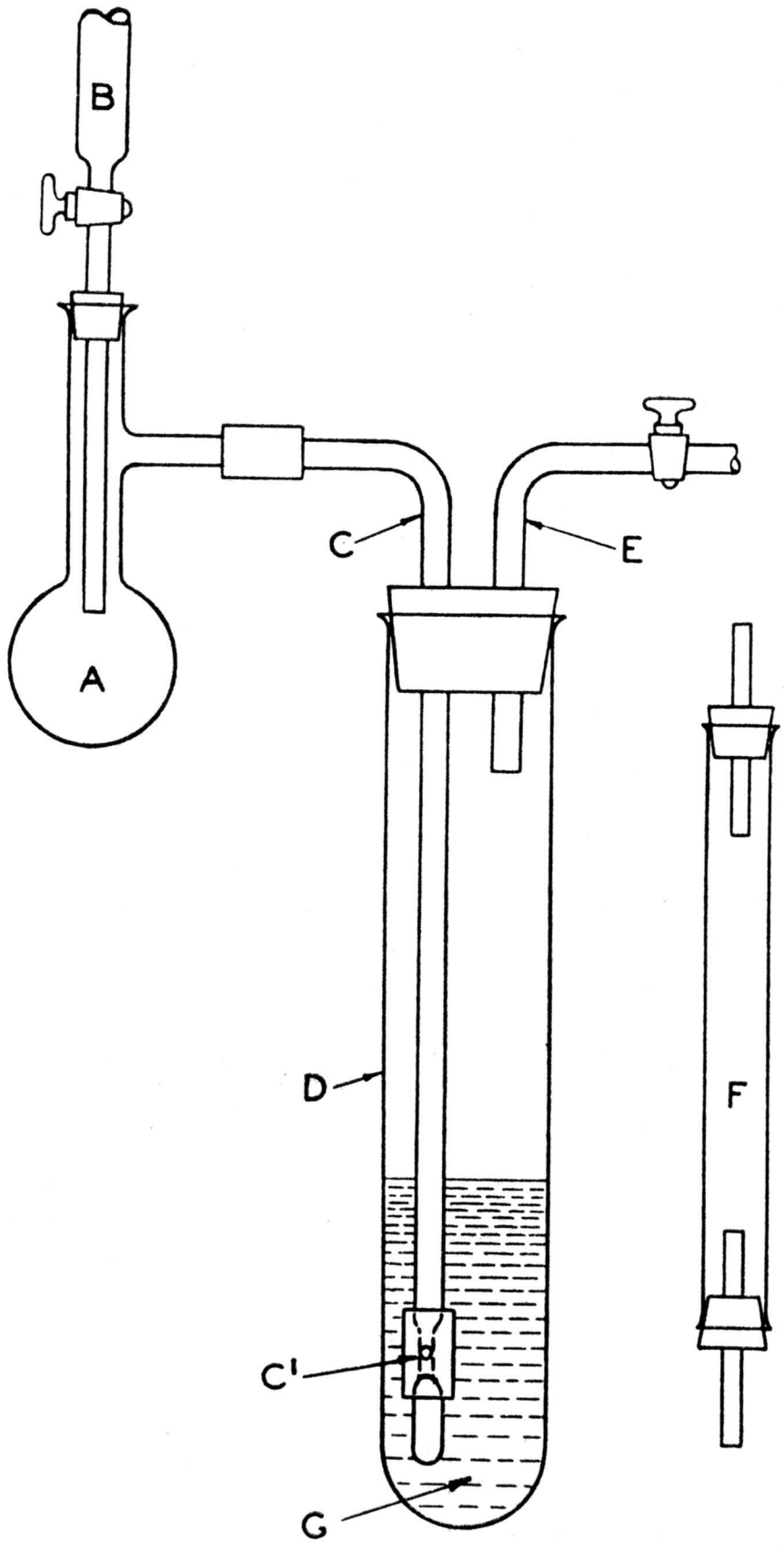

FIG. 2

Methods of Separation and Analysis of Cotton Ash

Preparation of Cotton for Analysis—Fifty-gram samples of cotton were formed into compact cylinders about 2 in. high by 1½ in. in diameter, using a hydraulic press and a pressure of about 60-80 tons/sq. in., a procedure similar to that described by Williams.[17]

Drying—These cylinders were dried overnight at 105-110° C., to determine the moisture-free weight.

Ashing—Total ash was determined by igniting single cylinders of cotton in a covered platinum dish, using an electric muffle furnace, until the cotton was completely charred and the ashing then continued with the cover removed, until free from carbon. The temperature did not exceed 350° C., and the ashing usually required from four to six hours.

Determination of CO_2—The CO_3-content of the ash was determined by means of a special apparatus shown in Fig. 2. The weighed ash was transferred to a 50 c.c. distilling flask (A) and 10 c.c. of approximately 4-N HCl placed in the funnel (B). The side-arm of A made a glass-to-glass connection to the glass tube (C), through heavy rubber tubing. The lower end of C was fitted with a Bunsen valve (C′), and C was inserted through one hole of a two-hole rubber stopper closing the mouth of the large pyrex test tube (D), which was about 13 in. long by 1 in. in diameter. The rubber stopper also contained an outlet tube fitted with a stop-cock (E).

This apparatus was first evacuated several times, after the ash was placed in A, by applying vacuum at E, with the stop-cock on funnel B closed. It was brought to atmospheric pressure after each preliminary evacuation with CO_2-free air from the soda-lime tube (F), connected to E. About 25 c.c. of a 0·2 N $Ba(OH)_2$ solution (G) was added to D and the system again evacuated. Stop-cock E was closed and the HCl from B slowly added to A. A few drops of acid were left in B to avoid the possibility of air entering A during the analysis. The acid solution of the ash was boiled gently with a small flame held under A until steam could be heard condensing in the cold $Ba(OH)_2$ solution, indicating complete displacement of CO_2 by steam in A. CO_2-free air was then admitted through E to bring the test tube to atmospheric pressure, the distilling flask was disconnected and all the CO_2 in D absorbed by shaking the test tube. The stopper was removed and the solution washed to the bottom of D with hot, distilled water. The excess $Ba(OH)_2$ solution was titrated with 0·1 N HCl, using phenolphthalein as indicator. The titration was carried out slowly, with frequent shaking, to prevent loss of CO_2 from interaction of the acid with the precipitated $BaCO_3$.*

Determination of SiO_2—The acid solution of the ash was transferred to a platinum dish and dehydrated three times with HCl, filtering each time, and finally washing with hot water. The precipitate of SiO_2 was ignited and treated with HF three times to remove SiO_2, a few drops of H_2SO_4 being added after the first treatment. The small residue of Fe_2O_3 and Al_2O_3 remaining after this treatment was added to the amount of these oxides determined later in the procedure.†

Separation and Determination of SO_4—The acid filtrate from the SiO_2 separation was evaporated to about 10 c.c. $BaCl_2$ solution was added, with constant stirring to precipitate $BaSO_4$, in as uncontaminated a state as possible. The conditions of precipitation were those recommended by Johnston

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* The following blanks are given to illustrate the accuracy of the method, using Na_2CO_3 prepared from the bicarbonate in accordance with the procedure of Talbot.[18]

Weight of Na_2CO_3 taken	(1) 0·1994 gram.	Found 0·200 gram.
	(2) 0·2132 ,,	,, 0·2130 ,,
	(3) 0·2343 ,,	,, 0·2340 ,,

Average deviation = 0·0004 gram.

† Fe and Al are likely to be precipitated as basic salts in the pores of the filter paper during filtration if the washing with acidified water has been stopped before all traces of the soluble Fe and Al salts are removed.[19]

and Adams.[20] The filtrate was then treated with this procedure reversed to remove excess Ba.

Separation of Fe, Al, and P from Ca, Mg, Na, and K—The filtrate from the sulphate determination of raw cotton ash contained P in excess of the Fe content. Consequently sufficient standard Fe solution was added to take care of the P in the precipitation of Fe, Al, and P from the other salts. In washed cotton ash, numerous tests proved the absence of all but a trace of phosphate, rendering the addition of more Fe unnecessary. After adding the standard Fe solution, the solution was oxidised with a few drops of H_2O_2 to convert all Fe to the ferric state, and Fe, Al, and P were precipitated by neutralising carefully with NH_4OH, using methyl red as indicator.[21] The precipitate was ignited and weighed as $P_2O_5+Al_2O_3+Fe_2O_3$. To separate, this residue was fused with a mixture of anhydrous Na_2CO_3 and pure silica, cooled and extracted with water and filtered. The P_2O_5 was determined in the filtrate as $Mg_2P_2O_7$, and the Fe and Al by difference. Where excess iron was added the results were corrected for this additional amount, and in the absence of P, the fusion was omitted and Fe and Al ignited as oxides directly after filtration.*

Separation of Ca and Mg from Na and K—The filtrate from the Fe, Al, and P separation was evaporated to dryness in a platinum dish and the excess NH_4Cl fumed off. The residue was dissolved in 1 c.c. of concentrated HCl and washed into a 100 c.c. beaker, keeping the total volume to 15 c.c. Ca and Mg were precipitated as carbonates from this solution by adding 15 c.c. of 95% ethyl alcohol and 25 c.c. of 50% alcoholic ammonium carbonate reagent.[22] The combined carbonates were filtered off on a fritted-glass crucible (Schott-Jena 1-G/4) after standing overnight to permit the $MgCO_3$ to crystallise. The washed precipitate of mixed carbonates of Ca and Mg were dissolved in 5% HCl and the Ca precipitated as oxalate, filtered, dissolved in hot 5% H_2SO_4 and titrated with N/20 $KMnO_4$. Mg was precipitated from the filtrate overnight as NH_4MgPO_4, ignited and weighed as the pyrophosphate.

Separation and Analysis for Na and K—The filtrate from the Mg precipitation was acidified with HCl and evaporated to dryness in a platinum dish and the excess NH_4Cl fumed off. This residue of Na and K was dissolved in a few drops of HCl and transferred to a 100 c.c. volumetric flask and made up to volume. Fifty c.c. portions of this were used for the Na and K determinations.

Sodium—Na was determined by evaporating the 50 c.c. aliquot to 1 c.c. and precipitating the Na in the form of uranyl zinc sodium acetate, by the method of Barber and Kolthoff.[23] The method of Caley and Foulk[24] precipitating uranyl magnesium sodium acetate was used for raw cotton, since it was preferable for larger quantities of Na.

Potassium—Potassium was determined by precipitation as K_2PtCl_6 from an alcoholic solution.[25] Traces of SO_4 were first removed by precipitation as $BaSO_4$ to prevent contamination of the chloroplatinate precipitate with insoluble sulphate of sodium.

Determination of Chlorine—Chlorine was determined on a separate sample of the ash dissolved in HNO_3, and precipitated as AgCl. Tests were made on a number of the washed cottons, but no more than a trace was found in those tested.[26]

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* It is important to note that this separation was first practised using milk of $CdCO_3$ as precipitant. This method was abandoned after part of the analyses had been completed, since it was found that the supply of $CdCO_3$ was contaminated with Na. In Table II those analyses in which contamination occurred are marked with *.

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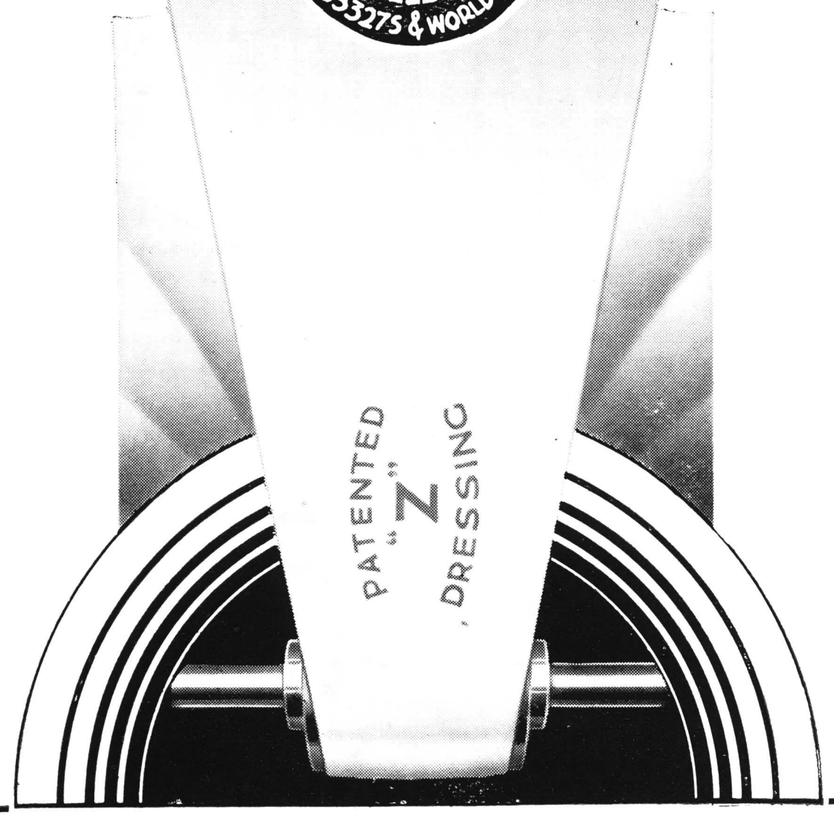

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THE JOURNAL OF THE TEXTILE INSTITUTE

ABSTRACTS

LIST OF ABSTRACTORS

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

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British Silk Research Association	S.
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Imperial Bureau of Plant Genetics	P.G.
Linen Industry Research Association	L.
Textile Institute	T.
Water Pollution Research Board	D.
Wool Industries Research Association	W.

1—FIBRES AND THEIR PRODUCTION

(B)—ANIMAL

Changes in Solubility and Absorption Spectra of Silk Fibroin caused by Tin Weighting. J. L. Southard and E. L. Tague. *J. Home Econ.*, 1932, **24**, 995-1002. (through *Chem. Abs.*, 1933, **27**, 193).

The absorption spectra suggest that silk protein consists of two distinct fractions. S.

The Sheep Tick and its Eradication by Dipping. M. Imes. *U.S. Dept. of Agric. Farmers' Bull.* No. 798. Revised Dec. 1932, 22 pp.

An account of the life history, nature, and habits of the sheep tick. The dipping process is described, and details given of nicotine and other dips, and of dipping plants and draining pens. W.

Constitution of the Keratin Molecule. J. B. Speakman and M. C. Hirst. *Trans. Farad. Soc.*, 1933, **29**, 148-172.

The micelles of the wool fibre consist of long peptide chains bridged across by salt linkages on the one hand and cystine on the other, the former being probably of glutamic or aspartic acid and arginine, lysine, or hystidine. The consequences of such a structure are reviewed in the light of extensibility, water absorption, dyeing properties, swelling, etc. Amino acid identification is of paramount importance in future work. Wool has not an isoelectric point, but a range. *Discussion*—E. Elöd said that the isoelectric point of wool is at *p*H 4·9, and even after prolonged investigation equilibrium is obtained at this value. Minimum reaction capacity and swelling also occur here. The presence of basic wool proteins such as arginine and lysine to the amount of 10% is inadequate to explain the existence of the Speakman isoelectric range from *p*H 5 to *p*H 7. W. T. Astbury said that the keratin of animal hairs exists in two forms (1) in which the polypeptide chains are folded, (2) in which they are extended into a straight configuration; in wool the transition is reversible. A common feature of both forms is that the larger side spacing is the same for both types. The paper states that the electro-positive centres of the basic side chains are linked across in salt linkage with the electro-negative centres of the acidic side chains, but since the two types of side chain are nearly equal in relative proportions, X-ray evidence would indicate that not only do the charged centres approach as closely as possible laterally, but also longitudinally. D. Jordan Lloyd said that with gelatin gels and collagen fibres, drying diminishes swelling capacity, and that possibly electro-valent linkages, which are theoretically extensible, may be converted

into inextensible co-valent linkages. T. R. Bolam said that the application of the Procter-Wilson theory by the authors seems inadequate, since according thereto the osmotic pressure is the force producing swelling and, other things being equal, it follows that the maximum amount of swelling in wool fibre should be identical for all monobasic acids. Statements made, therefore, regarding the swelling in formic acid need further elucidation. R. A. Peters pointed out that the possibility of salt linkages playing a significant part in protein structure had not been rejected, and referred to Sörensen and Cohn, etc. The view that salt linkages between groups other than the α-amino and associated carboxyl exist in wool, does not necessarily follow from the data. The facts rather point to the action of acid and alkali as titrating the —COOH and αNH_2 groups of the "*Zwitterion*." This also explains the isoelectric region as due to chemical combination —CONH— linkage of the terminal —COOH and NH_2 groups. S. M. Neale said that the isoelectric region finds a parallel in the swelling of cellulose in caustic alkalis. J. B. Speakman replied to criticisms and said that Bolam's contention is valid only for gelatin; Elöd's work is largely in agreement; and Peters' criticism is met by a table of analyses of egg albumin by Calvery. (Paper read at a General Discussion on the Colloid Aspects of Textile Materials and Related Topics, Sept. 1932.) W.

Electrical Resistance of Wool Fibres. M. C. Marsh and K. Earp. *Trans. Farad. Soc.*, 1933, **29**, 173-193.

A modification of the method of measurement of high resistances due to Townsend is used. The fibres are insulated and mounted in a thermostatic arrangement, so as to give control of conditions of humidity and temperature during the experiment. The hysteresis curves for resistance and humidity are given and in explanation thereof, it is suggested that longitudinal conduction in the fibre takes place through water paths of varying cross section. The large increase of resistance for small decreases of water content are accounted for by the assumption that the water channels break down, those of greatest cross section disappearing first at their widest points. The high value obtained for the specific resistance would indicate possible commercial uses of wool as an insulator. *Discussion*—J. B. O'Sullivan said that assuming the validity of the Kelvin equation we can calculate the effective capillary radius of the pores from the data for water vapour pressure of cotton at various moisture contents. Since most ions are hydrated and therefore carry an atmosphere of water with them, they would experience a resistance proportional to the viscosity of the liquid through which they migrate. In capillary tubes, the viscous hindrance is proportional to the fourth power of the radius, and if this rule holds down to the value of the radii calculated from the Kelvin equation, the electrical resistance would change to 10^8 fold. This is sufficient to account for the change in resistance with the moisture content. E. G. Cox said the hysteresis effect observed is paralleled in the determination of the adsorption isotherm of cellulose fibres under varying humidity. J. R. Katz said the measurement of the electrical resistance as a function of the degree of swelling presents a new method for the closer study of the orientation of water molecules on the surface of the micellæ, the existence of which is indicated in the diminution of entropy in swelling. (Paper read at a General Discussion on the Colloid Aspects of Textile Materials and Related Topics, Sept. 1932.) W.

Some Problems in the X-ray Analysis of the Structure of Animal Hairs and other Protein Fibres. W. T. Astbury. *Trans. Farad. Soc.*, 1933, **29**, 193-211.

A description of the X-ray analysis of the structure and constitution of hair, wool, and feathers. The existence of a protein chain of the type usually associated with proteins is found, except that in the case of wool, the chain takes a configuration of pseudo hexagons. The linkages and the possible methods of combination within the micelle are discussed and the fact elucidated that unstretched hair is not in a state of maximum contraction. Hair does not show any internal slipping when stretched and there is no evidence of discontinuity of molecular or crystalline structure. The results are compared and confirmed by swelling and other data, a full and detailed argument being set out. *Discussion*—D. Jordan Lloyd said that the molecules of the protamines are heavily loaded with polar groups, mostly of basic character, and electric repulsions between these might be expected to keep the backbone of the molecule extended. Protamines are undoubtedly involved in the chemistry of cell activity, and are intimately

connected with nuclear division and cell growth. It would appear that the form of the molecule in this case may possibly lead to the highest potentialities for chemical activity. H. Mark said that the cross linkages play an important rôle in the chemical behaviour of proteins. The analogy with slightly vulcanised rubber and the natural variety is drawn. R. A. Peters said that organised protein structure is an essential, responsible for co-ordinate activity. J. R. Katz said that in the unstretched state rubber shows, in X-ray analysis, an amorphous ring whilst when stretched it has a fibre diagram. Thus the stretching renders the amorphous part crystalline. A comparison of the X-ray pattern of amorphous rubber with that of different liquids seems to show that the period of identity of the amorphous ring of rubber and of liquid hydrocarbons measures the transverse distance of hydrocarbon chains lying parallel in small groups. Thus a group structure for liquids may be assumed. He suggests that heat of swelling of stretched and unstretched wool fibres be determined in a strong swelling agent, which causes permanent stretching to go back, and thus the heat of stretching wool fibres may be determined. W. T. Astbury replied. (Paper read at a General Discussion on the Colloid Aspects of Textile Materials and Related Topics, Sept. 1932.) W.

The Physical Significance of Crimp or Waviness in the Wool Fibre. S. G. Barker. *Trans. Farad. Soc.*, 1933, **29**, 239-250 and 254-257. (*Discussion*—E. Hill, pp. 251-254.)

An analogy to Euler's equation is postulated for the relationship between the various dimensional characters of the fibre, which is vindicated by actual measurement. A mathematical theory is given, showing that all forms of crimp fall within the range of the combination of action of two simple harmonic forces at the follicle. Thus, phase difference as it varies, accounts for the variation in the crimp configuration. The nature of such forces is discussed and it is suggested that the phenomenon may result from periodic physico-chemical reaction in the follicle, evidence in support being quoted. E. Hill in the discussion suggests that dehydration may be the determining factor. The author shows that crimp is a periodic function of time only, independent of the length of the fibre or of the thickness, etc. In conclusion attention is drawn to the curved nature of the cortical cells and also to the fact that the dehydration theory is in no way opposed to the periodic physico-chemical explanation. (Paper read at a General Discussion on the Colloid Aspects of Textile Materials and Related Topics, Sept. 1932.) W.

Chemical Considerations in Relation to the Study of Mammalian Hair Growth. Part I—The Sulphur Economy of Animal Fibre Production. A. T. King. *Trans. Farad. Soc.*, 1933, **29**, 258-271.

A discussion of the significance of the sulphur content of mammalian outgrowths, and in the case of wool particularly, the variations in this constituent in relation to yield and composition of wool. A review is made of possible factors contributing to this variation, especially the evidence as to whether the cystine yield of the fleece exceeds the cystine content of the foodstuff taken during its growth, and whether the sheep, in consequence, is an exception to the generally accepted view that animal metabolism is incapable of synthesising cystine from non-cystine sulphur in the diet. Special reference is made to the possible catalytic influence of iron in (1) changes involved in keratinisation, (2) the arresting of anæmic conditions which are at once reflected in poor yield and quality of wool, (3) increasing the efficiency of the rumen mechanism for synthesising cystine, which has been postulated to account for the excess yield of cystine above referred to. In this connection it is suggested that the change from the kempy birth coat to the true merino adult coat is associated with the development of the rumen, the animal being then no longer dependent upon preformed cystine in the diet for its wool growth. (Paper read at a General Discussion on the Colloid Aspects of Textile Materials and Related Topics, Sept. 1932.) W.

Chemical Considerations in Relation to the Study of Mammalian Hair Growth. Part II—Observations on the Chemico-histological System in Follicle Activity. A. T. King and J. E. Nichols. *Trans. Farad. Soc.*, 1933, **29**, 272-279.

The functions of the follicle, whether producing medullated or non-medullated fibres, are described and illustrated. In the formation of the fibre, each cell has emanated from a region, or matrix, in which all the undifferentiated cells are bathed in a fluid plasma or nutritive medium, which must be carried into the

follicle mechanism before being denuded of those protein constituents which form the fibre cells. As these dry, the exhausted fluid is left and deposits its solutes at the evaporation zone in the intercellular cavities. Observations are made regarding the "cementing medium" between the cells, and whatever its precise nature, its suggested origin agrees with the results obtained by other workers. After discussing the internal contaminations, the effects of the sebaceous and sweat glands are examined. The deposition of fatty matters on the fibre, before drying, might have the effect of slowing down the evaporation, with the consequent result of deposits being formed in a much more emulsified or colloidal state than by sudden precipitation. This might affect the subsequent handle, e.g. it has been claimed that wool grown with a steady flow of grease has a softer handle and more lustre than when the grease flow ceases low in the staple. The relation of the building up of the different layers of the fibre is discussed, and illustrated by photographs and diagram. The suggestion is made that there exists a "cystine-gradient" in the blood stream around the "involution" of the papilla boundary, from which it would be expected that the later "keratinised" fibre constituents would contain proportionately less sulphur and more of the residual amino acids. For a given follicle the fibre/blood stream distribution coefficient of the cystine is regarded as governed by the concentration of cystine in the blood and the latter's rate of flow into the follicle. The former can only vary within limits safe for the general health of the sheep, and while this may explain the proved variability of sulphur content in wool, the genetic type and disposition of the follicle remain the predominant variables concerned. Thus the fine slow-growing fibre of the adult Blackface coat would not be expected to develop a continuous medullary channel nor its coarse rapidly growing fibre to lose it, under physiologically admissible variations of cystine concentration. (Paper read at a General Discussion on the Colloid Aspects of Textile Materials and Related Topics, Sept. 1932.) W.

Nutritional Condition of Sheep and Susceptibility to Stomach Worm. A. H. H. Fraser and D. Robertson. *Nature*, 1933, **131**, 94.

Parasitic infestation frequently constitutes a limiting factor in the carrying capacity of pastures. An experiment is described to determine the degree to which differences in clinical condition produced by nutritional means might affect the degree of parasitic infestation of sheep exposed to an equal chance of infection. Thirty-two lambs comparable in weight and appearance were divided into two groups, one being poorly fed, the other well fed. After six weeks' grazing, the lambs were slaughtered, their fourth stomachs removed intact and the worms counted. The average number of worms in the poorly-fed group was 103, in the well-fed 31, there being a surprising individual variation within each group. It is therefore deduced that under natural conditions of infection, the nutritional state of the sheep plays a significant part in determining the degree of its susceptibility to stomach worm infestation. W.

Origin of Curls and Twists in Wool Fibres. J. E. Nichols. *Nature*, 1933, **131**, 201.

The work is reviewed of Wildman on the fœtal lamb's coat, of Duerden on the protorichs characteristic of the natal coat, and of Barker and his collaborators on "crimp." The different forms of spirals (for example, horns in sheep) which result from larger accretionary growths have been discussed by Thompson and Huxley on mathematical premises based upon the existence of growth gradients about different axes of the growing region. A suggestion is made that similar systems may operate within the comparatively restricted growth zones of hair follicles; the forces required to give rise to the various curved forms of fibre may conceivably follow upon different rates of elaboration of fibre substance at different aspects of the follicle. Thus the form growth of the wool fibre would simulate in miniature that of the sheep's horn (omitting, except in early stages, the increase of cross-sectional area). The definitive fibre would continue as the characteristic deformation associated with the type of follicle involved. On this basis an explanation of the rarity of straight fibres in fleece growth seems possible. W.

The Function of Cystine in Wool Production. O. H. Keys (Massey Agricultural College). *New Zealand J. of Agric.*, 1931, **43**, 262-266.

An article dealing with the utilisation of cystine-sulphur as supplied by the proteins in the diet of the animal. The failure on the part of a sheep to incorporate

sufficient cystine in the growing fibre may be due to a variety of factors, hereditary, seasonal, quantitative (inadequate supply of cystine), and physiological. The physiological chemistry of cystine is discussed as regards the general requirements of the animal body and the specific demands for particular purposes. W.

Influence of Dietary Iron on Hair and Wool Growth. I. J. Cunningham. *New Zealand J. of Agric.*, 1932, 44, 335-337.

Some effects are given of controlling experimentally the amounts of iron in the diets of rats on the growth of their hair coats. It seems that one effect of iron deficiency in the rat may be a reduced ability to grow hair. It is likely that similar fundamental conditions obtain for the growth of wool on the sheep and that iron may exert an important influence. The evidence submitted thus indicates that iron may be an important factor in promoting the growth of wool on sheep in iron-deficient areas. W.

The Isoelectric Point of Wool. M. Harris. *Amer. Dyes. Rep.*, 1933, **22**, 81-84.

An article dealing with the application of the results of the study of the isoelectric point of wool, as regards the relationship between the quantity of a dye absorbed and the electrical charge on the wool, and the processes of carbonising and scouring. W.

(C)—VEGETABLE

Indian Cotton: Supplies and Uses. *Abstr. Proc. 25th Meeting Indian Centr. Cotton Ctte.*, 1932, pp. 108-114.

The questions and answers in the Tariff Board inquiry into the Indian Cotton Textile Industry are reproduced in so far as they relate to the supplies of cotton of various staples and the counts for which they are suitable. C.

Cotton Cultivation Machines: Effect on Stand. D. G. Carter and E. B. Whitaker. *Agr. Engin.*, 1932, **13**, No. 5, p. 119 (through *Expt. Sta. Rec.*, 1932, **67**, 610).

A report from the Arkansas Experiment Station indicates that cultivation with large machines and large power units had no adverse effect on stands of cotton in one year's study. There were no significant differences in stand loss, indicating that 4- mule and tractor power and large capacity machines did not cause a loss in stand. C.

Cotton Roots: Strangulation. J. J. Taubenhaus, W. N. Ezekiel, and H. E. Rea. *Plant Physiol.*, 1931, **6**, 161-166 (through *Expt. Sta. Rec.*, 1932, **67**, 546-547).

The authors report having received from Texas, Arkansas, and Mississippi specimens of a peculiar cotton root trouble. The affected plants usually possessed well-developed root systems, but the upper parts of the tap and lateral roots were separated from the lower parts by constrictions often an inch or more in length and 0·3 to 0·4 mm. in thickness. No evidence of decay was present, and studies are said to have indicated that the malformation was of a non-parasitic nature. It is reported to occur only in flat, poorly-drained, heavy clay soils, which are compacted by continuous rain or irrigation, and then further hardened, in the absence of cultivation, by continued hot, dry weather. The affected plants were found to die when the constricted areas were killed, or when the moisture supply transported through the constricted areas became inadequate for the requirement of the plant. C.

Cotton Root Rot; Effect of Flooding on——. J. J. Taubenhaus, W. N. Ezekiel, and J. P. Lusk. *Amer. J. Bot.*, 1931, **18**, 95-101 (through *Expt. Sta. Rec.*, 1932, **67**, 546).

The authors report that root rot caused by *P. omnivorum* is uncommon in bottom lands in soils which are apparently favourable for the development of the disease. The root-rot fungus was introduced into creek bottom land through the artificial innoculation of the cotton plant,, and it reappeared the year following innoculation. In laboratory experiments, strands of *P. omnivorum* on naturally infected cotton roots were inactivated by submergence in saturated soil for more than three days, while in a parallel series, at the same temperature but stored in moist air, the fungus remained viable for two weeks and was still able to infect normal cotton plants. Flooding experiments in the field, during three seasons and continued as long as 120 days, failed to produce significant changes in the survival of the root-rot fungus or to eliminate roots of root-rot carriers in the soil. The survival in this case is considered due possibly to a lack of penetration of the water and the possible presence of sclerotia which are able to survive long periods of immersion. C.

Cotton Root-rot Fungus: Distribution in Soil. C. A. King and C. Hope. *J. Agric. Res.*, 1933, 45, 725-739.

An area infested with the cotton root-rot fungus has been thoroughly investigated. Evidence shows that the fungus is able to exist in an active state for a long period on buried roots that remain in the soil after trees have died or been removed. The mycelium that had penetrated into the inner tissues of large roots was protected for a long period from disinfectants that readily destroyed exposed strands and sclerotia. The injection of 1¼% formalin into the soil by pressure is said to kill all the mycelium on the outside tissues within ten months, and the sclerotia within 12 months. The distribution of sclerotia in infected soils is very uneven, both vertically and horizontally. C.

Cotton Wilt; Effect of Fertilisers on——. V. H. Young, G. Janssen, and J. O. Ware. *Arkansas Sta. Bul.*, 1932, 272, 27 pp. (through *Expt. Sta. Rec.*, 1932, 67, 547).

Field experiments are reported on the effect of fertilisers on cotton wilt in eastern Arkansas, the data being supplemented by fertiliser tests in other portions of the State. High potash applications alone and fairly high potash applications in combination with nitrogen- and phosphorus- containing salts gave definite control of cotton wilt at points in Central, Eastern, and North-eastern Arkansas. High nitrate applications, applications containing nitrogen and phosphorus only, and applications of cottonseed meal alone were inefficient in cotton wilt control. The control of cotton wilt through the use of potash-containing fertilisers seemed in nearly all cases to be correlated with or coincident to the control of rust, stimulation of vegetative growth, and increased yields of seed cotton. Other work at the station indicated varietal resistance to cotton wilt, and the authors conclude that on sandy alluvial soils where cotton wilt and rust are often found together in a severe form, a combination of a suitable wilt-resistant variety of cotton and the judicious use of a fertiliser containing potash will prove the best possible solution of the cotton wilt problem now available. C.

Verticillium Wilt: Characteristics. C. D. Sherbakoff. *Phytopathology*, 1929, 19, No. 1, p. 94 (through *Expt. Sta. Rec.*, 1932, 67, 547).

It is claimed that the wilt of cotton caused by *V. alboatrum* can be distinguished from that due to *Fusarium vasinfectum* by the shedding of the leaves and young bolls before the withering of the tips and branches, and by the absence of any discoloration of the cambium. The discoloration of the fibrovascular bundles present in both wilts is more evenly distributed in the case of Verticillium wilt. C.

Boll Weevil: Control. J. M. Robinson and F. S. Arant. *J. Econ. Entomol.*, 1932, 25, 759-766 (through *Chem. Abs.*, 1932, 26, 6056).

Experiments in the control of the boll weevil with calcium arsenate dust were conducted for eight years on small plots which received different amounts of fertiliser. Dust was applied when the average infestation reached or exceeded 10% of the squares on the plants, and was necessary during five of the eight years. Unfertilised cotton showed little increase in yield from dusting whereas fertilised cotton produced yields which increased with increasing quantities of fertiliser per acre. The number of dustings per season varied from 3 to 11, average 5·2; the amount of calcium arsenate per acre per season varied from 21 to 77 lb., average 36 lb. C.

Pink Bollworm: Occurrence in the Virgin Islands. V. C. Loftin. *Virgin Islands Sta. Rpt.*, 1931, pp. 19 and 20 (through *Expt. Sta. Rec.*, 1932, 67, 573).

A study of the pink bollworm at St. Croix, where it and the low price paid have been responsible for the abandoning of the growing of Sea Island cotton, resulted in the finding of the pest in large numbers on wild cotton and other host plants. It was found to be widely scattered over the entire wild cotton area, only a few estates on the island being free from it. It was rather commonly observed in okra, and a slight infestation was found in otaheite (*Thespesia populnea*) and in *Hibiscus vitifolius*. It is pointed out that okra is the favourite vegetable of the natives and is grown in every garden. *T populnea* grows very abundantly along the seashore on the northern and western coasts and *H. vitifolius* is a common, weed along roadsides and in pastures. The wide distribution of its wild host plants and the danger of its reintroduction from other islands led to the decision not to attempt its eradication in St. Croix but to clean up the wild cotton, its most

important host, and adopt a two-year or three-year closed season before planting cotton again. About half of the island had been cleared of wild cotton by September. Control was not attempted on the islands of St. Thomas and St. John, due to the small area of cultivated land and the proximity to other infested islands. C.

Cotton Harvesting Machines: Application. *Int. Cotton Bull.*, 1933, 11, 202.

Attempts have been made in Texas to breed a cotton with a large percentage of bolls open, which will lend itself to mechanical harvesting. Sledding of cotton is not regarded as practical except in the high plains region of North West Texas. The latest pattern of smooth-running revolving rubber stripping roller machine harvested 91·1% of the total yield from three varieties tested in 1931, but also collected 34·7% of trash, 32·1% being removed by subsequent cleaning. C.

American Cotton, 1932: Grade and Staple. *Int. Cotton Bull.*, 1933, 11, 194-195.

A table is given of the grade, staple, length, and tenderability of cotton ginned in the United States prior to 1st November 1932. There is a larger percentage of $\frac{15}{16}$ in. and $\frac{31}{32}$ in. cotton available this year than last but less of $\frac{7}{8}$ in. and $\frac{29}{32}$ in. Middling white makes up 41·2% of the crop as against 32·0% last year, and strict middling white 31·1% as against 43·9%. C.

Cotton: Cultivation in U.S.A. (S. Carolina). A. B. Bryan. *Cotton (U.S.)*, 1932, 96, No. 12, 37-38, 43.

A report of the improvements that have been made in the S. Carolina crop since the inauguration in 1926 of a contest "for better yield and staple value." About 80% of the cotton used by mills in the State is $\frac{15}{16}$ in. or longer. By 1925 the crop was so poor that most of the cotton required was obtained from outside; in 1931, the State supplied 61% of the staple needed. According to the records from more than 2,000 farmers, the return in dollars per acre for different staples averages as follows: $\frac{7}{8}$ in. 4·18, $\frac{15}{16}$ in. 8·70, $1\frac{1}{32}$ in. 14·44, $1\frac{1}{16}$ in. 11·07, and $1\frac{1}{8}$ in. 11·76. C.

Indian Cotton Crop, 1932-1933: Forecast. *Cotton (Mlcr.)*, 1933, 38, No. 1851, p. 9.

The cotton crop forecast is given in tabular form by States and by types. C.

(D)—Artificial

Pulp: Analysis. T. Nakashima and M. Negishi. *J. Cellulose Inst., Tokyo*, 1932, 8, (37)-(38).

Analyses are recorded of typical pulps produced for rayon and for paper. The content of α-cellulose was somewhat higher (85-87%) in the former than in the latter (79-81%), but the conclusion is drawn that the differences are not of sufficient importance to rule out pulp for paper as a raw material for rayon. C.

Rayon: High-speed Spinning. H. Jentgen. *Melliand Text. Month.*, 1932, 4, 493-495 and 545-549.

The advantages of high-speed spinning are the increased output and reduced labour costs. Difficulties arise owing to the formation of whirls and flow of liquid on the nozzle when the thread is forming, and by the carrying along of liquid by the thread. Patents for eliminating these disadvantages are described. Another difficulty is the formation of a cone of liquid when the thread leaves the spinning bath. A sheet lead cone has been devised over which this liquid can flow back into the precipitation bath. Bobbin and spindle arrangements, chemical conditions such as speed of coagulation and percentage of sulphuric acid, and factors such as ageing, acid content, and temperature are also discussed. C.

Cellulose Acetate: Production and Bleaching. T. Nakashima and F. Nakahara. *J. Cellulose Inst., Tokyo*, 1932, 8, (38)-(40).

Results are tabulated of experiments on the acetylation of purified pulps from different sources, and of bleaching cellulose acetate by permanganate and by hypochlorite. The result of bleaching, especially with hypochlorite, is to increase the viscosity without affecting to any great extent the solubility or acetyl content. C.

Viscose: Spinning Capacity. S. Iwasaki and E. Sugino. *J. Soc. Chem. Ind., Japan*, 1932, 35, 551-553B.

Four viscoses were investigated with regard to spinning capacity. Three were prepared from an alkali-cellulose which had aged for one, four, and nine days respectively. The other was prepared from an alkali-cellulose composed of

material aged one day, mixed with that aged for nine days, in such proportion that the Duclaux constant of the viscosity of the cuprammonium solution of cellulose regenerated from this mixture was equal to that of the alkali cellulose aged for four days. Three spinning baths were used, one containing glucose, the other zinc sulphate, and the third sulphuric acid, and the results of the "spinnometer" tests for the four viscoses are expressed in the form of graphs. C.

Cellulose: Preparation from Cotton Hulls. N. Chetverikov. *Masloboino Zhirovoe Delo*, 1932, **2**, 34-39 (through *Chem. Abs.*, 1932, **26**, 6120).

Cotton hulls contain 20-30% of fibre and are a valuable source for cellulose of high quality. By boiling the hulls for five hours with a 6-7% sodium hydroxide solution the author succeeded in separating the fibres from the hulls and obtained a pulp of 96·6% cellulose content. C.

Viscose: Viscosity. R. Aimaud. *RUSSA*, 1932, 7, 1136-1137.

Experiments are reported which show that the variation of the viscosity of viscose with temperature (provided that the coagulation temperature is not approached) is a reversible phenomenon which does not affect the physical properties of viscose. Viscosities were measured by a falling sphere method over the range 14-67° C. A minimum is indicated at 55° C. The preparation of the viscose is described. C.

Viscose Bobbin and Pot Spinning Machines: Power Consumption. *Text. Manuf.*, 1933, 59, 16-17.

The relative merits of spinning viscose by the centrifugal and bobbin systems are discussed and a graph is reproduced which shows power consumption with a standard 6-in. Bakelite pot and with a spindle only, plotted against revolutions per minute. It is concluded that the former is the more economical where the bulk of the production is in deniers of 150 and above, but where the demand is for finer deniers and perhaps varied twist, then the bobbin process will be favoured. C.

Patents

Rayon Spinning Frame Bobbin Support. Compagnie Générale d' Electricité. F.P.727,690 (through *RUSSA*, 1932, 7, 1187-1189).

The new bobbin support fits over the spindle and is provided with three wings which extend outwards from the centre a distance equal to the internal radius of the bobbin. One or more of these wings may be hollow and carry at its extremity an oscillating lever provided with a boss at each end. The lever is placed in a vertical position resting against two springs or elastic rubber buffers attached to a support inside the wing. When the bobbin is pushed over the support the lever is pressed against the springs and the action of the latter ensures a firm grip. C.

Cellulose Acetate Rayon Crepe Yarns: Preparation. C. Clémençon, V. C. Clémençon and Mme. V. P. Schmit. F.P.729,473 (through *RUSSA*, 1932, 7, 1189-1191).

In order to produce crepe effects on cellulose acetate rayon it is necessary to give the yarn higher twists than those required by crepe yarns of viscose rayon. In practice it is found that with such high twists the filaments of cellulose acetate frequently break and the breaking load and extension of the yarn are low. The difficulty may be overcome by treatment of the yarn with volatile swelling agents with or without the addition of colloidal substances capable of forming elastic coatings on drying. The concentration of the bath is arranged so that the yarn undergoes a contraction in length of 10-15%. After such treatment it is possible to give twists of 2,900 to 3,000 turns per metre to 100 denier cellulose acetate yarns. C.

Cellulose Acetate Rayon: Preparation. A. H. Stevens, London (E. Berl, Darmstadt). E.P.381,991 of 6/8/1931.

Highly acetylated cellulose acetates are produced by a process involving the pretreatment of the cellulose with glacial acetic acid containing a small proportion (e.g. 0·3%) of a catalyst such as sulphuric acid, the removal of a large proportion of the acetic acid and catalyst, and esterification (preferably at 0° C.) with an excess of acetic anhydride and a large proportion of a substance or mixture of substances having the property of not dissolving the cellulose acetate, but of swelling it. After removal of the esterifying bath, the product is substantially free from catalyst. An example is given in which benzene is the diluent used.

The products, consisting of cellulose triacetates, may be worked up with softening agents into films, threads, pressed articles, etc. C.

Rayon Bobbin Spinning Machine. L. Kohorn (Chemnitz). E.P.382,588 of 18/6/1932.

In machines for spinning rayon provided with rotatable bobbin carriers, the bobbin spindles being arranged at right angles to the axis of the carrier, the carriers are of S or Z shape, and are swung round when a bobbin is fully wound, the arrangement enabling the fully-wound bobbins to be readily removed from the side of the machine on which the nozzles are disposed, and, at the same time, maintaining a minimum width of the machine and ensuring a greater reliability in the engaging of the empty bobbins with the filaments. The carriers are in the form of casings enclosing the bobbin-driving gear and are arranged eccentrically around the driving shaft, so that the gearing of the fully-wound bobbin is disengaged during the rotation of the carrier. More than two bobbins may be arranged on each carrier. C.

Acetone-soluble Cellulose Acetate: Preparation. Kodak Ltd. (London). E.P. 383,043 of 29/10/31.

Cellulose is acetylated in the presence of an aldehyde, e.g. acetaldehyde, paraaldehyde, propionic aldehyde, or butyric aldehyde, in amount not less than 20% calculated on the weight of the cellulose, until the cellulose acetate produced is soluble in acetone. In an example, cotton linters, pretreated by means of glacial acetic acid in the presence of a sulphuric acid—phosphoric acid catalyst, are acetylated by means of a mixture comprising acetic anhydride and acetaldehyde, until the product is soluble in acetone. The amount of aldehyde used is between 25 and 100 c.c. per 100 gms. of cellulose. C.

Cuprammonium Rayon Stretch Spinning Apparatus. British Bemberg Ltd. (London). E.P.383,507 of 7/3/1932.

The laterally-diverted stream of precipitating liquid when operating the process for stretch spinning rayon according to the parent specification, is carried away through a closed system comprising pipes, pump and collecting vessel, for return to the spinning units. By this arrangement, losses of ammonia are avoided, deaerated water necessary for the continuance of the precipitation process being introduced into the circuit through a pipe. The ammonia is recovered from the liquid escaping from the outlet of the spinning unit, and collected in a trough. C.

Rayon: Wet Treatment. B. Borzykowski (Herzberg-on-Harz, Germany). E.P. 383,510 of 10/3/1932.

For the washing and other wet treatment of rayon, ribbons, etc., upon spinning bobbins or in spinning pots, the bobbins or pots are immersed in the liquid in a suitable vessel and liquid is supplied from an overhead receptacle to the interior of the bobbins or cakes so that it flows outwards through the layers of thread. The liquid may be delivered to the upper end of the bobbin or to the lower end of the bobbin; in the latter case the bobbin is sealed at the upper end. To protect the inner thread layers of the cakes, a perforated sleeve is mounted in the interior. The bobbins or pots may be mounted as a vertical tier, perforations being provided to allow for the passage of liquid to all members of the pile. C.

Carbohydrate Ethers: Preparation. I.G. Farbenindustrie A.-G. (Frankfort). E.P.383,617 of 13/2/1931.

Ethers of cellulose, starch, or the like, are obtained by acting with an alkylating agent or benzyl chloride on a product obtainable by causing a gaseous alkylene oxide or a mixture of an alkylene oxide and another alkylating agent to act upon a carbohydrate or a derivative of a carbohydrate at a reduced or partial pressure in the presence or absence of a basic agent. The products obtained may be used in the production of artificial filaments, as emulsifying and wetting agents, and they may be tanned and hardened. Examples are given. C.

Viscose Rayon: Spinning. E. Wurtz (Chemnitz). E.P.385,126 of 25/1/1932.

The strength and elasticity of the products obtained by the method described in E.P.379,604 may be further increased by adding salts such as sodium sulphate, zinc sulphate, chromium sulphate, magnesium sulphate, sodium acetate, or mixtures of these, to the second acid bath. Additions of organic substances, such as keratine, glucose, dextrin or gelatin, to the second bath only are also recommended. Such additions to the second bath produce increases of 15 to 20% in the strength and elasticity of the rayon. C.

2—CONVERSION OF FIBRES INTO FINISHED YARNS

(A)—Preparatory Processes

Cork Roller Coverings: Application. *Spinn. u. Web.*, 1932, 50, No. 52, p. 6.

Practical experience in drawing and spinning with roller coverings of fine-grained cork material having smoothly ground surfaces is reported. The quality of the product was the same as that obtained with the usual leather coverings and the number of breaks was about the same with cork and leather rollers. Slight irregularities in the cork surfaces observed after using for about six months could be eliminated by regrinding and this regrinding could be repeated several times before the covering was discarded. Reductions in costs and wages were effected by the use of cork coverings. C.

Scutcher and Opener Regulators: Setting. H. Abegg. *Textilber.*, 1933, 14, 3-5.

The importance of regularity in scutcher laps is discussed and it is shown that the speed of the pedal roller should vary with the weight per unit length of the laps fed to the machine A regulating system is shown in which the movement of the pedal is transmitted by levers to a device which adjusts the position of the belt on the cone that drives the pedal roller. The regulator may be set to give laps of any desired weight and its actual working is not influenced by changes in this weight or in the draft on the machine. Similar regulating systems may be applied to openers. C.

Olein Emulsions: Effect on Card Clothing. J. Vallée. *Revue Text.*, 1932, 30, 1045-1047.

The preparation of olein emulsions for the oiling of wool before carding is discussed. The finest emulsions are produced by means of the colloid mill. When these fine emulsions are used on wool it is found that the card clothing oxidises rapidly. The effect is attributed to retention of water by the oil. The emulsions prepared in the colloid mill contain particles of oil emulsified in water and also particles of water emulsified in oil; oxidation of the card clothing is due to the presence of the latter. Coarser emulsions prepared by mixing olein with water in the presence of suitable emulsifying agents are oil-in-water emulsions from which the water readily evaporates without causing oxidation of the card clothing. In order to prevent deterioration of card clothing from this cause it is advisable to use fresh olein, free from oxidation products, to reduce the fineness of the emulsions by reducing the speed of rotation of the colloid mill, and to add substances which reduce the surface tension of water and favour the formation of emulsions of the oil-in-water type. These conclusions are in agreement with the results of similar investigations described by other workers. C.

Cotton: Combing. *Text. Weekly*, 1932-33, 10, 365, 389, 418-419, 445, 467-468, 494-495.

A general account of modern practice, including details of developments by various machine makers. C.

Roving: Drafting. A. K. Landau. *Text. World*, 1932, 82, 1169.

A break draft of 1·08 has been customary on most frames (in the U.S.A.). It has been found, however, that medium roving may be stretched as much as 2% without any positive displacement of the fibres and that if the surface speed of the second roller is not at least 5% more than the speed of the feed roller, fibre displacement may not occur, and therefore no true drafting. If, in addition, the rollers are in bad condition, an excess speed of 10% may not be effective. An adequate break draft is important and the author believes that best results are secured by having a difference in speed ranging from 1·1 to 1·3, together with rollers in such condition that they do not slip and do not allow the roving to pull through. C.

Rubbing on the Four-height Tape Condenser. *Wool Rec.*, 1933, 43, 153-155.

The process of scribbling and carding is discussed, with special reference to the size of rubbers, type of card clothing and setting of speeds. W.

Efficacy of Length Control Motions. *Wool Rec.*, 1933, 43, 149-151.

An article dealing with the employment of length control motions at the finishing boxes, in cone and open drawing sets, on spinning and twisting frames, and in the reeling operation. W.

Card Clothing Foundation. *Text. Amer.*, 1933, 59, No. 2, pp. 17-18.
The card clothing foundation and the filleting are discussed, with particular reference to the carding angle and elasticity of the wire. W.

Combing Long Wools. Fusus. *Text. Amer.*, 1933, 59, No. 2, p. 49.
The process is described of combing long wools on a Lister comb. W.

The Reclothing of Carding Engines in the Mill. "Card-Nailer." *Text. Mfr.*, 1932, 58, 486.
The operations and equipment necessary for the upkeep of card clothing are described and illustrated. W.

The Setting of Woollen Carding Machines. "Scotch Feed." *Text. Mfr.*, 1933, 59, 3.
A table is given showing the actual size of the gauges used to determine the setting of the rollers in woollen carding machines. The actual setting to be used for any blend depends on the following factors—type of material in blend; truth of rollers in machine; condition of card clothing; relative speed of rollers to each other; function of the roller being set. W.

(B)—Spinning and Doubling

Hyperbolic Driving Cones: Determination of Shape. C. Berntzwiller. *Textilber.*, 1932, 13, 629-632.
The conditions that must be fulfilled by the pairs of hyperbolic cones used on fly frames are outlined and a graphical method of determining the shape of the cones is described. Examples are given showing the application of the method in the construction of cones to meet certain specified requirements. C.

Spinning Rings and Travellers: Designs and Speeds. D. Eadie. *J. Text. Inst.*, 1932, 23, P265-280.

Staple Fibre: Spinning. J. Lindenmeyer. *Textilber.*, 1932, 13, 523-525 and 578-579.
The physical properties of "Sniafil" staple fibre are compared with those of cotton and the working up of staple fibre on cotton spinning machinery is discussed. Suitable machines for this purpose are mentioned and the necessary modifications are described. Rollers should be set according to the staple length and the use of the drawing frames used for Egyptian cotton is recommended. Twist factors are lower than in cotton spinning. In order to avoid injury of the more sensitive fibre the number of machine passages should be as small as possible, and the speed of passage should be low. Parts of machines in contact with the fibre must be kept smooth and clean and control of temperature and humidity is advisable. C.

Cork Roller Coverings: Advantages. *Spinn. u. Web.*, 1933, 51, No. 3, 7.
Cork is said to be more efficient than leather for covering drafting rollers. The weighting in jute spinning can be reduced 30-40% and, correspondingly, the power required. C.

Ring Frame Yarn Balloon: Determination. W. E. Baltz. *Textilber.*, 1933, 14, 5-6.
An equation for the form of the balloon round the spindle on ring frames is deduced, neglecting the effect of air resistance. From the agreement of this expression with an approximate relation deduced by Lindner it is concluded that the effect of air resistance is negligible. This conclusion is confirmed by observations of the motion of a piece of yarn with one end free and the other attached to a rotating spindle. The use of a stroboscope for observations of balloon form is briefly discussed. C.

Rayon Twisting Spindle. L. Petit. *RUSSA*, 1932, 7, 1177-1179.
In order to reduce the effect of air resistance the usual form of cap at the top of the spindle on twisting frames for rayon is replaced by a ring which passes round the top flange of the bobbin from which the yarn unwinds. The yarn passes through the annular space between this ring and the flange. A piece of wire has a loop at one end which is threaded over the spindle whilst the other end projects beyond the ring. The wire is carried round by the yarn, and it is possible to regulate the influence of air resistance by adjusting the dimensions of the wire. The yarn bears against the edge of the ring and this contact prevents the twist running back to the bobbin. C.

"Velico" Spindle Bearing. Verson, Ulies, and Courcier. *L'Ind. Text.*, 1932, 49, 716.

The new spindle is provided at its lower end with a cup-like footstep which rests on a conical pivot fixed to the support or creel. It is claimed that wearing of the parts of the bearing is very much slower in this arrangement than in the usual system in which the inverted pivot is fixed to the end of the spindle and the cup to the frame C.

Worsted Top Qualities. S. Kershaw. *Text. Mfr.*, 1933, 59, 4-5.

A discussion of worsted top qualities, tables being given showing existing wool and top qualities, and qualities which will spin to quality numbers. W.

(D)—Yarns and Cords

Spun Latex Threads: Development. *Text. Exporter*, 1932, 9, No. 69, pp. 27-28.

Recent developments in the use of latex have resulted in the production of round rubber thread which can be produced as fine as 120 counts. New elastic yarns embodying cotton, silk, and other textile fibres can be knitted or woven into fabrics of all types, which are elastic in all directions. A new company, International Latex Processes Ltd., has recently been formed by the Anode Rubber Co. Ltd. and the United States Rubber Co. Ltd., for the purpose of consolidating patents on latex manufacture, co-ordinating research and development, and making patented processes and technical knowledge readily available to manufacturers. C.

Patents

Helical Groove Pressure Roller. M. Gillet. F.P.732,459 (through *Revue Text.*, 1932, 30, 1061-1063.)

A new form of pressure roller for the intermediate rollers of drawing systems is provided with a series of helical grooves. The pressure obtained with this type of roller is higher than that provided by the ordinary type. Applications on wool spinning machines are briefly described. C.

Sliver Can. R. Debrabant. F.P.733,669 (through *Revue Text.*, 1932, 30, 1061).

The new can consists of a cylinder of fibre or metal with detachable caps at each end. When the can is full a cap is placed on the top and the whole is inverted so that in the subsequent process the sliver is drawn out by the end that entered the can first. The constituent fibres of the sliver then always travel in the same direction and do not tend to spread out. C.

Winding Frame Stop Motion. J. F. Alauzet. F.P.735,829 (through *R USSA*, 1932, 7, 1197).

A small disc is placed on the spindle below the bobbin and underneath this disc passes a lever which carries a thread guide on one end. The yarn unwinding from the hank passes through this thread guide and when the tension on the yarn becomes abnormally high the guide is drawn upwards so that the lever comes into contact with the disc and lifts the spindle until its driving disc is separated from the driving wheel. C.

Short Fibre Spinning Frame Drafting Mechanism. Wool Industries Research Association and S. G. Barker (Leeds). E.P.384,822 of 2/1/1932.

The invention relates to the adaptation of Bradford type spinning frames for use with short wool, cotton, recovered fibres, or other short fibres by the provision of a method of drafting which ensures effective control of the short fibres. This control is ensured by the use of a front top or bottom drafting roller of small diameter co-operating with the other front drafting roller, the nip of the front drafting rollers being set close up to that of the front carrier rollers, and the small diameter roller being provided with a tensioned apron. C.

Flyer Spindle Bearing Sleeve. J. C. Leslie and David Keay & Leslie Ltd. (Dundee). E.P.384,831 of 22/1/1932.

The invention relates to spinning, roving, and like textile frames of that class in which the spindle provided with a wharve beneath the neck rail is journalled in a bearing tube fixed in the neck rail. The improved spindle is sleeved for substantially its entire length by a tube adapted to receive lateral thrust applied to the wharve, the upper end of the tube terminating adjacent to the boss of the flyer. A bearing bush is inserted into the upper end of the tube and may be provided with grooves whereby lubricant is circulated up the inside and down the

outside of the bearing bush. The wharve is secured to the lower end of the spindle with ball bearings interposed between the lower end of the tube and the wharve. The lower of a pair of ball bearings is located at or about the central transverse plane of the wharve, and the ball bearings are spaced apart by an inner distance piece sleeving the lower end of the tube and an outer distance piece fitted into the wharve. With this construction, vibration of the spindle is greatly reduced and the spindle is relieved from the lateral thrust applied to the wharve by the driving band. C.

Drafting Roller Bearing Members. J. von Trümbach (Dusseldorf-Oberkassel, Germany). E.P.385,174 of 20/4/1932.

The invention relates to a drawing apparatus for spinning machines of the kind wherein two top or press rollers are arranged in juxtaposition over a drawing roller and surmounted by a clearer roller. It consists in the provision of saddle-shaped bearing members adapted to embrace the supporting arms, the side plates of each member being provided with parallel grooves in which the shaft ends of the rollers are loosely guided. C.

High Draft System. Anna Kym-Krafft and Elisabeth Kym (Schopfheim-im-bad, Wiesenthal, Germany). E.P.385,739 of 22/12/1931.

In a new drawing apparatus for ring spinning machines and mules of the kind in which a yielding drawing assembly is arranged in the drawing field to follow a nipping feed point, the parts are so disposed that the distance between the nipping feed point and the yielding point of the drawing assembly, which is positively driven, is always less than the staple of the fibre to be drawn so that the fibres are nipped by the yielding drawing assembly before they are released from the nipping feed point. This arrangement permits an extremely high draft. The distance between the nipping feed point and the point at which the staple is nipped by the yielding drawing assembly varies during operation. The drawing assembly may conveniently consist of a non-yielding pressing part in the form of a roller having projecting edges or ribs, such as a roller polygonal in cross-section, and a yielding pressing part in the form, for example, of a belt of leather or rubber. The edges of the roller may run helically, or at an angle to one another, and they are preferably so spaced that fibres of average staple are always in contact with at least one edge. With this arrangement a combing effect is obtained and any thick parts or balling together of the fibres eliminated, particularly if the edges are provided with fine comb-like corrugation. The front or delivery rollers are placed so close to the yielding drawing assembly that they take any adherent or floating fibres off the latter. A special condenser consisting of two parts with suitable guide surfaces spaced at a small horizontal distance from one another is provided between the drawing assembly and the delivery rollers. The device producing the positive nipping before the fibres are gripped by the drawing assembly may conveniently take the form of a feed roller co-operating with a curved trough. C.

Doubled Crepe Yarns: Manufacture. British Celanese Ltd. (London). W. A. Dickie, and D. Finlayson. E.P.386,339 of 15/7/1931.

The invention is primarily, though not exclusively, concerned with yarns consisting of continuous filaments. A yarn according to this invention consists of at least two component yarns doubled together to a moderate or high degree, the final degree of twist in each component yarn being also moderate or high, and in at least one component yarn being substantially equal to the degree of doubling twist. Thus, one or more yarns twisted to a high or very high degree may be doubled together with one or more yarns having little or no twist, doubling taking place in the opposite direction to the twist of the high twist yarn and to such an extent that the yarn having little or no twist receives a moderate or high twist substantially equal to the doubling twist, while the twist in the high twist yarn is reduced to a corresponding extent. This method of twisting enables both components to take any applied load to much the same degree and therefore produces a doubled yarn of very high strength characteristics. When using such yarns for the production of crepe fabrics it is not essential to alternate yarns which have been twisted in one direction with yarns which have been twisted in the other direction. The components of the double yarns may differ in nature and in denier or counts. Any convenient twisting and doubling process may be used. C.

Receiving Apparatus for Balls of Sliver. G., N., and J. Fraser. E.P.376,666 of 3/2/1932.

In apparatus for receiving balls or rolls of sliver discharged from a sliver-balling machine, drag means, engageable successively with the rolls being traversed by the receiver carriage, is provided to prevent forward tilting of the rolls. As applied to the receiver described in E.P. 356,198 (wherein the rolls delivered down a shoot are moved along guide members by a thrust plate), a clamp is provided on an adjustable rod and is weighted so that its convex under surface exerts a drag on the rolls when propelled by the plate. The plate is set at a slight rearward inclination. W.

Gill Boxes. W Holdsworth. E.P.377,360 of 28/5/1931.

Detailed illustrations with a complete description are given concerning improved intersector gilling. W.

3—CONVERSION OF YARNS INTO FABRICS

(A)—Preparatory Processes

High Speed Rayon Warping Equipment. Universal Winding Co. *Silk J.*, 1933, 9, No. 104, 23-25.

Descriptions are given of the newest type of rayon cone creel, which is adaptable to horizontal, sectional, or beam warpers. Highest speeds are obtained on a cotton warping headstock and the advantages of this system are discussed. Particulars are given of the winding and spooling machines necessary to wind 3,000 lb. per week of 150 den. rayon from hanks or overend. C.

Rayon: Winding. E. H. Doute. *Rayon and Synthetic Yarn J.*, 1932, 13, No. 12, 12-14.

A great many imperfections in rayon fabrics are caused by faulty winding. The author recommends the two-bowl friction drive in this connection. Undue rubbing of the yarn should be avoided. Detailed instructions are given for winding rayon in such a way as to minimise sources of imperfections. The results of tests are given to show the great variations in yarn speed that commonly occur in hank winding. C.

Universal Cheesing and Coning Machines. F. Sidebotham (for Universal Winding Co.). *Text. Weekly*, 1932-33, 10, 390-391, 420-421, 446, 469, 525-526.

A detailed description of the "No. 50" machines and their manipulation. C.

Yarn Clearer. J. S. Columbier. *R USSA*, 1932, 7, 1179.

The humidity of the air causes deterioration of the steel plates of the usual type of clearer, necessitating frequent changing and, even when the plates are well polished, considerable roughening of the yarn is observed. An improved type of clearer is provided with polished agate plates mounted in metal supports. Various forms are shown in diagrams. C.

(B)—Sizing

Cotton, Rayon, and Wool Warps; Sizing Experiments on——. P. Krais and H. Weinges. *Leipz. Monats. Text. Ind.*, 1932, 47, 192-193, 220-222, 241-244.

An experimental sizing machine is described on which 10 cotton or 11 wool threads at a time were sized at a speed of 13 metres per minute. These warps, and also rayon sized in the hank, were tested on a machine that simulates the work of the loom; for example, each centimetre of warp receives 25 blows from a beat-up device. The breaking load and extension of the warps were determined before and after "weaving."

Rayon. Viscose rayon, 120 den., 22 filaments, was sized with three proprietary mixtures, the names of which are disclosed at the end of the series of articles. Results of tests are recorded, which show that the difference between sized and unsized warps in respect of loss of strength and extensibility is not very great. The chief influence of size is to prevent rubbing up of the warp and its value in this respect can best be assessed by actual weaving.

Cotton. Yarn of 20's count was sized in 16 different ways with farina and certain proprietary sizes, some mixings containing tallow, and some being prepared from farina treated with "Aktivin S." The weight of size added ranged from 2·7 to 8·5%. The value of the various mixings was assessed by observing the loss of

weight on "weaving" and breaking load and extensibility before and after "weaving." A "quality number" is arrived at by adding together two fractions and expressing the sum as a percentage. The fractions are (*a*) the loss of weight on weaving divided by the weight of size added and (*b*) the loss of strength on weaving plus the weight of size added, divided by the gain in strength on sizing. Thus, the "quality number" $=100\ (a+b)$. Values from 1 to 50 are classed as "very good" (the best in the present instance is 38), 50-80 as "good," 80-100 as "passable," and above 100 as "bad." Plain farina size gave the best results from tensile considerations but because of "dusting" came lower in the scale of "quality" than farina plus tallow. The addition of hydrolysed starch gave good results, but soap and mixtures of gelatin, wetting agents and softeners made the size worse.

Wool. Yarn of 36's count was sized with hydrolysed starch and various additions, the weight added ranging from 12·5 to 17%. The loss of strength on weaving was much greater than that experienced with cotton warps, owing to the greater elasticity of wool. A small quantity of a softener greatly improved the size. The "quality numbers" recorded are of a different order of magnitude; thus, the "best" is 96 as against 38 for cotton. C.

Rayon: Sizing. G. Rammer. *Spinn. u. Web.*, 1933, 51, No. 5, pp. 8-10.

The advantages and disadvantages of hank and warp methods of sizing rayon are discussed and it is pointed out that in warp sizing air drying is preferable to the use of drying rollers. A size prepared from potato flour, Aktivin S "Special" and Paltaganth MB is recommended for viscose and cuprammomium rayons. Sizes for cellulose acetate rayon are prepared from gelatin or glue and neutral wetting agents. Suitable formulæ are given and the preparation of the size mixtures is discussed. C.

Rayon Hanks: Sizing. P. Sisley, jun. *Revue Text.*, 1932, 30, 1091-1095.

Patent processes for the sizing of viscose rayon with solutions of linseed oil in organic solvents and with linseed oil emulsions are reviewed and a few of the difficulties experienced with linseed oil sizes, especially those of the solution type, are briefly discussed. C.

(C)—Weaving

Calico Loom. H. Nisbet (for Platt Bros. Ltd.). *Text. Merc.*, 1933, 88, 31 and 42.

A new Lancashire calico loom is described, embodying several new features. The picking motion consists of a symmetrical picking cam or tappet, bearing against a somewhat flattened spherical picking bowl or roller, instead of a conical bowl. The take-up motion is designed to afford a wide range of picks with few change wheels and without calculation. The train of wheels is set well back from the front of the loom, and thus does not obstruct the weaver. The letting-off motion is a simple adaptation of the rope or chain and weighted compound lever combination. Photographs are given. C.

Loom Drives. W. Lichtenheldt. *Textilber.*, 1932, 13, 581-585 and 639-641.

The construction of loom driving mechanisms is discussed and applications and advantages of six-membered couple systems are described. Numerous diagrams are given. Replacements of various mechanisms by couple drives which result in increased production are discussed. C.

Ribbon Looms: Construtional Improvements. F. Klages. *Melliand Text. Month.*, 1932, 4, 561-564.

New features in modern ribbon loom construction are described, such as the choice of bowed or straight shuttles, shuttle motions, the use of light metals, take-up motions, and ribbon disposal. C.

Shuttle Tapping Fault: Occurrence in Germany. W. Coordt. *Seide*, 1932, 37, 436.

The author discusses the paper by Kendall on the "shuttle-tapping" fault and states that this trouble is unknown in the Chemnitz area. C.

Jacquard Card Punching Device. A. Serra. *Revue Text.*, 1932, 30, 1071-1075.

A detailed description is given of an electrical system for punching Jacquard cards. C.

Loom Frame. H. Schubert. *Spinn. u. Web.*, 1933, 51, No. 5, pp. 4-6.

A new type of loom frame which is lighter and more stable than that in general use is described with the aid of diagrams. Its construction is simple and it may be used for treadle, Jacquard, and shaft looms. C.

Self-centring Jacquard Card Guide. Devoge & Co. Ltd., Manchester. *Text. Merc.*, 1933, 88, 88.

A self-centring card guide is described which enables more than one width of card to be cut on a piano machine. It ensures an accurate setting of all widths of cards, i.e. 4, 6, 8, 10, 12, or 16 holes wide, and performs the work quickly. A change of widths can be made in five seconds, and no card is wasted in making the change. The setting device does not alter or interfere with the practice of having a fixed wall against the left hand side of the card, and a free wall against the right, acting under gentle spring pressure. The centring pressure during the process of setting, being on the card itself, ensures that the card is brought central whatever its width. C.

Shuttle Braking and Stopping Device. J. Garcin. *RUSSA*, 1932, 7, 1173-1175.

Diagrams and a detailed description are given of a device consisting essentially of a special lever controlled by a roller mounted on a spring which is operated by the crank arm. The device may be applied to single or multiple shuttle boxes. With this device the shuttle is stopped before coming into contact with the picker, the recoil of the latter is suppressed and the shuttle boxes can be raised or lowered without danger of the shuttle point catching on the picker. C.

Weaving Costs: Calculation. E. Eigenbertz. *Leipz. Monats. Text. Ind.*, 1932, 47, 155-156, 174-175, 196-197, 222-225, 244-246.

Four systems of costs calculations are explained and applied to the determination of the selling prices of five dress materials. Details are tabulated. C.

Silk Loom Fixing. Care of Harnesses. G. Rice. *Silk*, 1932, **25**, No. 9, pp. 7, 8, 30. S.

(D)—KNITTING

Full-fashioned Hosiery Machine Loop-forming Mechanism. A. E. Parker. *Melliand Text. Monthly*, 1932, 4, 230-234 and 316-317.

A detailed explanation is given, with illustrations, of the formation of a loop on a full-fashioned hosiery machine. C.

Jacquard Mechanism: Application to Knitting Machines. *L'Ind. Text.* 1932, 49, 732-734.

The original Jacquard mechanism is described and its application to knitting machines is discussed. An example of its application to a Raschel machine is studied. C.

Stockings: Knitting on a Single Machine. W. Hildebrandt. *Textilber.*, 1933, 14, 14-16.

In the usual process for the production of stockings on Cotton machines the foot and leg sections are knitted on different machines. Machines on which a whole stocking can be knitted in a single process are now available. The advantages of the new machines are outlined and two systems are described. In one system the heel portion is knitted at the same time as the adjoining portion of the sole of the foot and in the other system the needles for the sole are put out of action while the heel portion is knitted. C.

Knitted Purl Fabrics: Improvements in Design. W. Davis. *Text. Rec.*, 1933, 50, No. 598, pp. 55-59.

Improvements in purl knitting machinery are discussed, with illustrations of the types of fabrics produced. W.

(G)—FABRICS

Chenille Pile Fabrics: Weaving. "Harleston." *Text. Recorder*, 1932, **50**, No. 594, pp. 23-24; No. 596, p. 28; No. 597, p. 27; No. 598, pp. 38-39.

A general article on the properties, appearance, and construction of chenille pile fabrics. The means by which various effects are produced in the fabric are discussed, and the operation of the loom is described. Diagrams are given of weaving arrangements. Photographs of patterned chenille fabrics and point-paper diagrams are given. C.

Driving Belts: Weaving. E Gräbner. *Spinn. u. Web.*, 1932, **50**, No. 52, pp. 1-5.

Woven driving belts are made from cotton, camel hair, or hemp yarns, or from mixtures. Several layers of fabric are superposed, being woven at the same time and connected by warp threads passing from one layer to another, or by weft threads passing gradually from the top layer to the bottom and back again.

Examples are discussed. Diagrams showing the structure of the woven belts and illustrations of looms used for this type of woven product are given. C.

Warp-way Fold Fabrics: Weaving. J. Funke. *Textilber.*, 1932, 13, 633-634.

One method of producing fabrics with fine warp-way folds depends on the use of two warps under different tensions, and another method depends on the use of two wefts, one of which is very fine and overtwisted, and is made to float behind the warp threads that form the folds. In a third method, additional layers of warp are used to form the folds and the shuttle travels alternately backwards and forwards through the additional layers; this method of weaving is very slow and difficult. Other methods of producing warp-way fold fabrics depend on the use of yarns of different extensibilities. C.

Tapestries: Weaving. A. Grote. *Textilber.*, 1933, 14, 8-11.

A general historical account is given of the development of tapestry weaving and a few of the technical difficulties are indicated. C.

Multi-ply Fabrics: Manufacture. E. Gräbner. *Spinn. u Web.*, 1933, 51, No. 3, 1-5.

Point paper and other diagrams are given for the weaving of multi-ply fabrics. C.

Patents

Weft Feeler Mechanism. Société S.T.A.F.O.R. F.P.731,542 (through *Revue Text.*, 1932, 30, 1077-1079).

A feeler sliding in a support fixed to the breast beam of the loom comes into contact with the cop in the shuttle when the latter is in the shuttle box. Inside this feeler slides a rod which is controlled by a spring in such a way that one end projects slightly from the end of the feeler. When the feeler comes into contact with the cop the end of the rod penetrates between the layers of yarn and the feeler is pushed back. When the cop is empty the rod is forced into the feeler causing the movement of levers which may be arranged to stop the loom or operate the change mechanism. C.

Thread Guide. E. Chaumienne. F.P.732,535 (through *Revue Text.*, 1932, 30, 1079-1081).

The new thread guide takes the form of a long narrow tube with widened ends and a narrow opening along the top extending throughout the whole length. The guide is embedded in the top surface of the shuttle and the yarn from the pirn passes out from the shuttle into one end of the guide through a suitable slot, and passes through the guide to the other end of the shuttle. With this arrangement looping and doubling back of the thread are avoided and breaks and irregularities in tension are reduced. C.

Yarn Tensioning Device. Etablissements Dufour et Chaboud. F.P.733,394 (through *Revue Text.*, 1932, 30, 1081).

The new yarn tensioning device designed for warping frames consists of a pair of small rollers which are free to revolve about their axes. The yarn unwinding from the bobbin passes between these two rollers and supports the upper one which can move in a vertical plane. C.

Rayon Size. L. Blumer (Zwickau). G.P.562,493 of 18/11/1929.

Aqueous emulsions of insoluble fatty acid salts of polyvalent metals and fatty oils, free from soluble soaps, are used for sizing rayon. C.

Circular Knitting Machine Needle Actuating Mechanism. Stibbe & Co. Ltd., Leicester (Wildman Manufacturing Co., Norristown, Pennsylvania, U.S.A.). E.P.382,289 of 23/4/1931.

A circular knitting machine is described in which the beard or latch needles are first operated on by a Jacquard controlled selecting device and those needles lifted are operated on or not by a cam which is controlled by a second Jacquard to cause the needles to knit, tuck, etc. C.

Hosiery Knitted in String Formation: Separation. W. Spiers Ltd. and W. Spiers (Leicester). E.P.382,365 of 3/9/1931.

A method of providing for and effecting the separation of articles knitted in string formation on a circular rib knitting machine comprises forming a welt upon completion of one article and prior to begining the next, slitting or nicking the fabric at one or more points in the region of the welt and withdrawing the cut

portions. An auxiliary welt to be subsequently removed can be knitted in close proximity to the ordinary welt. C.

Scotch Hose: Knitting. J. G. Robertson and J. P. Robertson (Dumfries) E.P. 382,552 of 13/4/1932.

Scotch hose is made on a flat machine by forming a gusset on each side of the instep, joining the instep and the gussets to a sole portion which stops at the gussets, and inserting a spliced heel portion which extends below the level of the junction between the instep and sole portions. C.

Lace Machine Spool Board. J. Jardine Ltd. and Sir E. Jardine (Nottingham). E.P.382,744 of 23/10/1931.

A knock-down spool board for a lace curtain or other machine comprises a skeleton base frame and supplementary bars mounted in saw cuts therein. Sockets for reception of spool pins are stamped in the bars. In another form, the spool supporting bars are threaded on wires which pass into sockets on reinforced end members. C.

Hosiery Welt Containing Rubber Band: Knitting. P. Schönfeld (Chemnitz). E.P.382,817 of 21/1/1932.

To enclose an endless rubber band in a hosiery welt while knitting it on a flat hosiery machine, a tensioning member is employed, on which the band is stretched. Prior to closing the welt, the welt fabric is drawn between the band and its tensioning member. When the article is completed and the member is removed the welt can be eased round the band until the edges approximately meet. C.

Openwork Fabrics: Production. Anciens Etablissements R. Cornely et Cie (Paris). E.P.382,838 of 20/2/1932.

The work plate of a thread drawing machine is hollowed out to receive parallel feed rollers which are driven intermittently. The rollers are rubber covered and after they have gripped the fabric it is stretched laterally by ribs on the work plate and correspondingly grooved rollers. A cutter rotates on a vertical shaft. C.

Elastic Fabric: Knitting. Hemphill Co. (Central Falls, Rhode Island, U.S.A.). E.P.383,026 of 20/10/1931.

A stocking, half-hose or other knitted fabric has incorporated in it an elastic thread which is knitted in it at one or more wales in one or more courses, but is otherwise floated. The elastic thread in a stocking is preferably located in a portion of the top which is partially separated from the remainder of the stocking to form a garter section. The separation may be effected by partly unravelling a suitably knitted course or by cutting the wales, and sewing stitches may subsequently be applied to the stocking top to prevent running of the disconnected wales. In knitting a rib fabric or rib top for a stocking the floated portion of the elastic thread may be held between the frame and rib loops, while in the formation of a plain, i.e. unribbed, fabric the floated elastic thread may be made to pass alternately in front of and behind the loops of the ground fabric. To do this alternate needles which do not knit the elastic thread are lowered so that the elastic thread is fed over the top of them, and the remainder of these needles are raised so that the elastic thread is laid against their shanks. Adhesive may be used to assist in holding the elastic thread more or less fixed with respect to its original position in the fabric. C.

Ribbed Knitted Fabric: Changing to Plain and Vice-versa. Hemphill Co. (Central Falls, Rhode Island, U.S.A.). E.P.383,626 of 9/5/1931.

A method of changing to or from rib knitting in circular knitting machines without actual stitch transfer comprises knitting one or more courses on co-operating rib and plain needles and one or more courses on a series of plain needles, including some of those co-operating with the rib needles and containing as many needles as there are co-operating rib and plain needles. Thus, where the rib courses are adjacent the plain courses there are the same number of wales in each. Two yarns are independently knitted in the courses in which the change to or from plain fabric is made. Loops may be cast off either from the rib needles or from some of the plain needles. When the invention is applied to stockings, etc., the welt may comprise two sections of fabric knitted from separate yarns. C.

Parallel Knitting Machine Feed Mechanism. H. Stoll and R. Stoll (Reutlinger Strickmaschinen-Fabrik H. Stoll & Co., Reutlingen, Germany). E.P. 383,647 of 12/6/1931.

A combined latch guard and feeder is applied to purl stitch machines to enable intarsia patterns to be made in purl fabric. The yarn is drawn over the edge of the ledge. If plated intarsia work is required a second yarn guide is added. There is also provided a feed mechanism of known type which, by means of adjustable stop blocks, limits or variably adjusts the course of the feeders. C.

Circular Rib Knitting Machine. W. Spiers Ltd. (Leicester) and A. W. Kent. E.P.383,731 of 29/10/1931.

A device is provided additional to the yarn feeding and plating mechanism of a rib machine of the superposed cylinder type whereby yarns after introduction to and engagement by the needles can be moved to a position for more favourable engagement by reverse plating sinkers, needles, etc. A pivoted finger extending radially from the feeder carrying block is swung away from the yarn guides during a yarn change and is almost immediately released and returned to operative position. The lever is attached to the pivot pin of a detent which holds the cam actuating the guides from rotation between yarn changes. The finger engages the ground yarn coming into action and holds it into proper relation with the continuously-fed free yarn and also in a favourable position to be engaged by the reverse plating instrumentalities. When a push rod is actuated to render the reverse plating instrumentalities effective or ineffective the finger is also placed in or out of action. C.

Warp Guiding and Tensioning Device. T. A. B. Carver (Cheadle Hulme). E.P. 384,660 of 9/3/1931.

The invention relates to a mechanism on looms, warping machines and the like, whereby the threads are guided and tensioned and the machine stopped, or a warning signal is given, or both, when any one of the threads breaks, or when the tension in any thread becomes lower than a predetermined limit. The threads pass through holes in a thread guide and under two rods parallel to the rows of holes and at such a height that the threads when passing in a straight line through the centres of the holes just touch the underside of the rods. Spring wires pass over the rods and are bent downwards between the rods to a depth equal to the diameter of the rods plus the thickness of the thread. The lowest part of the bend is straight and parallel to the line joining the centres of the two rods, so that in its travel in a straight line the thread while holding the wire in its state of spring, is not itself deflected. When a thread breaks or the tension on a thread becomes lower than a predetermined value the wire springs upwards and touches an adjustable contact rod or wire, which actuates a warning or stopping device. It is claimed that abrasion of the thread is reduced to a minimum. C.

Stationary Weft Supply Looms; Weaving in——. H. Dreyfus (London). E.P. 384,670 of 9/6/1931.

A method of weaving cloth on looms having stationary weft supplies is described, in which the weft is formed into measured loops and is then carried through the shed with the aid of inserting means, by causing the inserting means at each traverse through the shed to carry two or more of such weft threads simultaneously. The weft threads are laid in the shed and when the shed is closed and beat-up has occurred, the two or more weft threads remain parallel in the fabric. This method provides a means of increasing the rate of production without increasing the thickness of the cloth. The two weft loops which are to be inserted simultaneously may be formed simultaneously as parallel loops, and may even be drawn into loops on a single weft loop-forming apparatus and inserted by a single inserting means. The weft inserting means may take the form of a dummy shuttle having horns adapted to engage the weft loop at the side of the loom. The weft threads which are inserted simultaneously may be of the same kind of yarn or may differ in counts, twist, colour, chemical nature, etc. C.

Loom Constant Tension Oscillatory Bearer Motion. J. Rushton and J. Nelson Ltd. (Nelson). E.P.384,751 of 29/10/1931.

The invention relates to an oscillatory back bearer motion that is particularly designed for maintaining a constant tension on the warp threads during the opening and closing of the shed and which consequently acts as an easing motion

for relieving the warp threads from the increased tension to which they are normally subjected each time the shed opens. According to this invention the oscillatory back bearer comprises a roller carried in any one of a number of open bearings formed by slots in the upper edge of two pivoted arms, which are operatively connected with an arm connected by a link to a bell crank lever, which supports a connecting rod through the intervention of a spring. The connecting rod is forked at its lower end to embrace the weighting lever and formed with a number of holes, through any one of which a pin can be passed to bear against the under edge of the weighting lever which is connected directly or indirectly with the ropes or chains which pass round the ruffle of the warp beam. With this construction the ropes are automatically slackened and tightened each time the shed opens and closes, and the warp threads remain under a practically constant tension. C.

Loom Picking Mechanism. W. B. White & Sons Ltd. and W. P. White (Colne). E.P.384,861 of 3/3/1932.

The picking lever of an underpick loom is provided with a pivoted arm which is kept in contact with the picking tappet by means of a spring and is rigidly connected with the picking lever when required by an abutment on the arm engaging a catch pivoted in the picking lever and adapted to be released from the abutment by connections actuated from any suitable governing motion, to allow the tappet to depress the arm without operating the picking lever. The picking lever can thus be put into and out of operation at will. C.

Loom Shuttle. H. Beeck (München-Gladbach, Germany) and H. Greven (Rheydt, Germany). E.P.385,143 of 7/3/1932.

The invention applies to the type of loom shuttle in which a curved blade spring is fixed at its front end on the spindle shaft, the free end of the spring being loosely guided in a bore or milled out portion of the spindle or in a similar manner. The improvement consists in that the free end of the blade spring extending beyond the spindle head passes through a slot in the under spring, and is inwardly bent to form an arm acting as abutment, which presses against the inner slot end of the under spring, during the closing of the shuttle, in such a manner that the blade spring fitted on the shaft is compressed in longitudinal direction, thereby increasing the height of the curvature so that the spring bears with increased pressure against the inner wall of the slipped-on sleeve. The advantage of this arrangement is that the tensioned blade spring cannot cause an automatic opening of the shuttle shank when the loom shuttle is closed. Several blade springs can be automatically tensioned by pressure in the longitudinal direction. For this purpose a second blade spring is preferably supported in the bent arm of the first blade spring in such a manner that it is shifted therewith in longitudinal direction. C.

Shuttle Braking Apparatus. C. Valentin (Stuttgart).. E.P.385,250 of 27/8/1932.

On a loom in which a plurality of brake tongues is provided for the braking of the shuttle as it enters the shuttle box, a flexible band is interposed between the brake tongues and the position of the shuttle when the latter is in the shuttle box. The band is of sufficient length to be pressed upon the side of the shuttle by the brake tongues when the shuttle enters the shuttle box. The shuttle thus comes into contact with a single long braking surface, instead of with separate braking surfaces, and a smoother and more gradual braking results. The movement of the brake tongues to and from the shuttle box, to press the flexible band inwardly or to allow it to move outwardly from the shuttle, may be effected by the change of position of the slay crank in the reciprocation of the slay. C.

Thin Place Detector Loom Stop Motion. J. H. Pope and B. Morgan (Acworth, Georgia, U.S.A.) E.P.386,224 of 13/6/1932.

A bracket fixed to the loom near the breast beam carries a finger which is adjusted to ride on the cloth near the fell so that, if a thin place occurs, the finger drops, completes an electric circuit and thus stops the loom. C.

Crepe Yarns and Fabrics: Production. British Celanese Ltd. (London, W. A. Dickie, and R. W. Moncrieff. E.P.386,344 and 386,374 of 4/6/1931.

(1) The strength of crepe fabrics produced from highly twisted cellulose acetate yarns may be improved considerably by wetting the yarn with water or other aqueous liquid before at least a part of the crepe twist is applied. The requisite high degree of twist is thus applied in two or more stages with intermediate

wetting of the yarn. The total twist may be applied in equal or unequal stages. In practice it has been found particularly advantageous to apply in the first place a degree of twist of the order of that necessary to cause a close packing of the filaments of the yarn and then to impart the degree of twist necessary to give rise to crepe effects of the desired character. Yarn in which the filaments are closely packed or set, when further twisted appears to twist substantially as a whole, the applied twist causing the yarn to assume a helical form. The crepe effects appear to be dependent chiefly on the degree of twist imparted after the wetting treatment. The wetting may be effected with water either alone or in conjunction with wetting agents. If desired wetting agents or hygroscopic substances may be incorporated in the yarns or filaments before twisting. Non-aqueous liquids having a softening action on the yarn may be used instead of water or the filaments may be set by the action of heat alone. The twisting of the yarns and the liquid treatment may be carried out in any convenient manner. Sizes and lubricants may be applied to the yarns if desired, and fabrics containing the highly twisted yarns may be subjected to a treatment adapted to swell the filaments. The crepe yarns may be incorporated in the fabrics in any suitable manner. Examples are discussed.

(2) A method similar to the above involves twisting in two or more stages with intermediate treatment of the yarn with water vapour or with other vapours having a softening action. The results are similar to those obtained on treatment with water or the non-aqueous liquids specified previously. C.

4—CHEMICAL AND FINISHING PROCESSES

(A) Preparatory Processes

Wetting Agents: Action. E. Justin-Mueller. *TIBA*, 1932, **10**, 991-995.

The results of stalagmometric measurements and determinations of imbibition velocities on raw cotton indicate that the action of wetting agents, such as Nekal BX and Igepon T, is due primarily to their effect on the diffusing power of aqueous liquids, not to their effect on surface tension. The emulsifying action of wetting agents on fats and waxes is also an important factor in the wetting of unbleached textiles. C.

Some Observations on the Chemical Degradation of Linen Cellulose. C. R. Nodder. *Trans. Faraday Soc.*, 1933, **29**, 317-326.

Linen celluloses degraded (*a*) by dilute acids and (*b*) by approximately neutral hypochlorite solutions are compared from the point of view of the inter-relationships of copper number, solubility number, and viscosity. For a given solubility number linen cellulose degraded by dilute acids has a considerably lower viscosity (2% solution in cuprammonium) than cellulose degraded by hypochlorite. Equations are given which show the approximate relationships. The removal of degraded cellulose in the solubility number method is compared to the desorption of a direct dye.

A hypothesis is put forward in explanation of the observed inter-relationships and having regard also to fibre-structure and tensile strength. It is suggested that, if the view is held that the cellulose micelles are of unlimited length, the observed data might be explained by assuming that in the case of oxidative attack the micelles are modified in regions which are grouped more or less closely together, while in the case of acid attack the regions of modification are distributed more uniformly along the micelles. The possible relationship between "planes of segmentation" and the distribution of regions of modification is pointed out. A consideration of "planes of segmentation" is held to be of importance in interpreting fibre degradation. L.

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

Alkali Silicates: Application. W. Stericker. *Amer. Dyes. Rep.*, 1933, **22**, 8-13.

A general discussion of the properties of alkali silicates and their uses in scouring, bleaching, dyeing, and finishing processes. C.

Fatty Acid Oxychloride Soaps: Constitution. R. Vidal. *TIBA*, 1932, **10**, 1,021-1,023.

Referring to a paper by Beyer, the author points out that he has been granted a patent covering the action of hypochlorites on fatty acids and has developed a

method of preparing oleic acid oxychloride which is simpler than that described in the patents of Imbert. His products differ from those obtained by Imbert's methods and their properties cannot be explained by the theories advanced by Beyer. C.

Boil-off of Silk. B. S. Hillman. *Text. Colorist*, 1933, 55, 13-17 and 59.

The importance of *p*H in determining the efficacy of a degumming bath has been much exaggerated. Certain electrolytes may, without increasing the *p*H of the bath to a point which would be considered dangerous, have a very deleterious action on the strength of the silk, e.g. a bath of 0·75% soap and 0·75% sodium carbonate having *p*H 10·2 caused a loss of 30% in the tensile strength of a sample of silk. The degumming action of soap may be accelerated by sodium hydroxide or silicate; the alkali removes the bulk of the sericin, and the soap removes the remainder. S.

Precautions in Scouring, Carbonisation, and Chlorination of Wool. P. L. Mann. *Amer. Dyes. Rep.*, 1932, **21**, 711-712.

An article dealing with precautions to be taken in the scouring, carbonising, and chlorinating processes, and the effect of chlorine on fibres and fabrics. W.

Recovery of By-products in Wool Scouring. C. Skipton. *Dyer*, 1933, 69, 23-24 and 77-78.

The advantages are stated of the continuous system of wool scouring. Details are given of the composition of the foreign matter, the by-products which are potentially available, the principles governing their recovery, and methods used. The use of volatile solvents is discussed, a suggested plant for the recovery of wool by-products by means of carbon bisulphide being illustrated and described. W.

(D)—Milling

Sample Felting Machine. W. Quade, G.m.b.H. *Textilber.*, 1933, **14**, No. 1E, pp. 151-156.

The machine has been designed so that the motor also serves to weight the top felt sheet. It is hinged with the frame on the lower plate and is lifted up to use the machine, being simultaneously cut out. The sample of wool is then inserted and the upper plate with the motor is lowered again. A drying apparatus can also be supplied. It is stated that owing to the high speed of the motor the sample is soon ready and is always uniform. It is intended for milling small pads of loose wool for colour matching purposes. W.

(E)—Drying and Conditioning

Temperature Control in Setting Twist. *Amer. Silk and Rayon J.*, 1932, 51, No. 10, pp. 27-28.

For steaming rayon yarn a compact metal chamber, constructed steam-pressure tight, is recommended. By means of a pump a vacuum of from 10-15 in. is produced in the chamber, thus removing part of the air to insure thorough penetration of the steam later. The vacuum valve is then closed and steam admitted at about 3 lb. pressure, or the temperature raised to about 214° F. and held there for about 7 min., exhausting through a thermostatic steam trap. The trap remains open until all air has been driven out through it by the steam, the trap closing when live steam at a temperature corresponding to 3 lb. pressure hits it. Within the chamber is a well-designed baffle to prevent any condensation from dropping down on the yarns. With an automatic controller the time for the cycle is about 12 min., with the hand control process 30-40 min. W.

Conditioning Oven. *See* Section 5B.

(G)—Bleaching

Peroxide Bleach: Application. C. L. Eddy. *Amer. Dyes. Rep.*, 1932, **21**, 725-727.

A report of practical experience, followed by a discussion. The goods are first soured at the singer and then washed and run through a weak solution of caustic soda. They are then piled into a pump and heater type of kier by means of a piling machine which gives uniform pleating. A ten-hour caustic boil at 15-18 lb. pressure is sufficient. After the boil the kier is blown off in the regular manner and washed down for about 30 minutes. The peroxide is run in and the kier lid is left off during the bleaching operation. The temperature should be maintained between 180° and 195° F. A quick bleach may be obtained in about 1½ hours.

After bleaching, goods should be pulled out through a rope washer and washed in hot water. The peroxide should be mixed in a wooden tank and pipings should be coated with sodium silicate. Iron kiers should be lined with cement and boiled out with sodium silicate before using for peroxide bleaching. It is claimed that goods bleached with peroxide give better and more uniform dyeings than chlorine-bleached goods and that peroxide bleaching also gives better whites. C.

Chlorine and Hypochlorite Solutions: Colorimetric *p*H Determination. H. F. Lewis and S. I. Kukolich. *Paper Trade J.*, 1932, **95**, No. 11, 28-30 (through *Chem. Abs.*, 1932, **26**, 5868).

Experiments were carried out with sulphonephthalein and four nitrophenol indicators (using the glass electrode as reference instrument) to establish the maximum chlorine content in a chlorine water solution which will not interfere with the accuracy of a colorimetric *p*H determination. Sulphonephthalein indicators do not function at a chlorine content above 2 p.p.m., which is above the amount commonly used for slime control, although it is considerably less than that recommended recently; but unless the sample used for *p*H determination is taken after complete mixing of the chlorine, sufficient of the latter may be present to invalidate the determination. The nitrophenol indicators will stand considerably greater concentrations of chlorine and they are well adapted for the determination of *p*H in almost any type of slime control. The *p*H changes in single-stage bleaching cannot be followed by any of the colorimetric indicators studied, the glass electrode being the only available method of following these changes accurately. Changes in two-stage bleaching may be followed with some success by means of the nitrophenol indicators, which may be used in bleach liquors in the presence of much higher chlorine concentrations than would be the case in chlorinated water. When this is done it is necessary to carry out the colour comparison in a very short space of time. The most satisfactory method for following these changes, however, is by means of the glass electrode. C.

(H)—Mercerising

Cotton Goods: Mercerisation. O. Mecheels. *Textilber.*, 1932, **13**, 645-649.

The results of investigations of the influence of temperature, tension, and alkali concentration in the mercerising process, and of scouring, drying, and after-treatments on the lustre of the mercerised product are summarised. These results show that the most suitable alkali concentration for mercerisation is 27-30° Bé and that the temperature should be as low as possible and at most not higher than 18° C. The suitability of a cotton for mercerisation is not determined by its staple length but rather by the surface properties which determine its natural lustre. The lustre increase produced by mercerisation is not proportional to the shrinkage, but is related to the velocity of shrinkage. Lustre increases with the tension applied, but increases in length of more than 5% cause reductions in strength. A 60-second period of immersion in the mercerising alkali is generally the most suitable. A second mercerisation does not always give a further increase in lustre. A neutral boil with water under pressure is more suitable than an alkaline scour for goods that are to be mercerised. This process should be followed by souring and rinsing, and the goods should be centrifuged before passing into the mercerising alkali. Mercerisation should be followed by rinsing and, in the case of cloth, by souring and further rinsing. The lustre of mercerised yarns can be improved by steaming and glossing processes and that of cloth by calendering or pressing. C.

Mercerisation Assistants: Effect on Shrinking Power. H. Friedrich. *Leipz. Monats. Text. Ind.*, 1932, **47**, 254-255.

Some measurements of shrinking are recorded in which 2/4's Indian yarn was treated with 25, 30, and 32° Bé caustic to which 5 gm. per l. of (*a*) sulphonated oil and (*b*) a phenolic assistant were added. Shrinkage was measured after one, two, and three minutes and then a large quantity of yarn was left in the liquor for 20 hours. The shrinking power of the liquor was tested again, more yarn was added as before, and the tests repeated a third time. The data recorded are the percentage loss in shrinking power after the first and second attempts to "exhaust" the liquor. The results show that these assistants prevent excessive loss of shrinking power and that the addition of an assistant at the appropriate time to a spent liquor would have beneficial effects. C.

Yarn: Mercerisation. C. R. Merten. *Textilber.*, 1933, 14, 21-22.

In a combined bleaching and mercerising process the yarn is scoured in the usual way, treated for 15-20 minutes in a bath containing 0·05 to 0·5 g. of potassium permanganate per litre at 35-40° C. and then hung for half an hour to ensure uniform oxidation of the potassium permanganate. Excess liquid is removed and the yarn is mercerised in the usual way. Mercerisation is followed by scouring in a bath containing hydrochloric and sulphurous acids and finally by one lukewarm and two cold rinses. Brightening is effected in a soda bath containing suitable wetting and softening agents. Another improved mercerisation process involves a first mercerisation under very high tension followed by rinsing, neutralisation, and a second mercerisation under lower tension. After-treatments are carried out in the usual way. This method gives an improved lustre and is particularly suitable for spot yarns which are to be dyed with Indanthrene dyes. C.

Producing Lustrous Woollen Yarns: Chlorination and Mercerisation Processes. Ontario Research Foundation: Research Laboratory. *Canadian Text. J.*, 1932, 49, No. 26, p. 30.

An account of the chlorination and mercerisation processes for making lustrous woollen yarns. The wearing properties of the wool are affected detrimentally in proportion to the amount of lustre obtained. W.

(I)—Dyeing

Diazonium Solutions: Stabilising. P. P. Victoroff. *Rev. gen. mat. col.*, 1932, 36, 441-445.

Previous work on the means of increasing the stability of solutions of diazo compounds is reviewed with special reference to the work of Knecht and Platt, who found that a small amount of a reducing agent acts as a stabiliser. Experiments were carried out on several diazo compounds, using such reducing agents as $Na_2S_2O_5$, $K_2S_2O_5$, $NaHSO_3$ and $Na_2S_2O_4$. The results show that reducing agents have a definite value in stabilising diazo solutions, but not such a favourable one as Knecht and Platt supposed. The agents are only effective when the diazo solution is freshly prepared. Sodium metabisulphate, $Na_2S_2O_5$, is one of the best stabilisers. C.

Drying Machines: Theory and Design. A. Weisselberg. *Melliand Text. Monthly*, 4, 113-116, 177-179, 248-250, and 322-324.

The general principles of drying by hot air are discussed and conclusions drawn as to means for reducing the time of drying and increasing thermal efficiency. The principles are incorporated in the Buettner machines, illustrations of which are given. C.

Aniline Black Dyed Fabrics: Prevention of Stains. *Text. Weekly*, 1933, 10, 578.

Pale spots are often caused in aniline black dyeing by drops of water falling from the roof of the ager on to parts of the fabric in which the aniline pigment is not fully formed. If the emerging fabric be led back across the top of the ageing chamber it intercepts these drops, and, since the aniline black is by now fully formed, it is not affected by them. C.

Constant Speed Jig Dyeing Machine. Rice, Barton, and Fales Inc. (Worcester, Mass., U.S.A.). *Text. World*, 1932, 82, 1004, 1178-1179.

Particulars are given of an electrically driven jig in which the roller speeds are automatically adjusted as the cloth accumulates on one or other roller so that the cloth speed remains constant. C.

Indigo: Culture in U.S.A. J. E. Copenhaver. *Amer. Dyes. Repr.*, 1933, 22, 55-58.

An account is given of indigo culture in South Carolina, Georgia, and Louisiana from its introduction about 1690 to its decline during the American Revolution. The primitive method of extracting the dye is described. C.

Peregal O Dye Assistant: Application. G. Schwen. *Textilber.*, 1933, 14, 22-23.

Peregal O is a pale brown liquid which mixes with water in any proportion forming neutral solutions. It is stable to lime and insensitive to alkalis, behaves as a protective colloid and possesses a high dispersing power. In vat dyeing this product is a more effective assistant than glue or Dekol; it reduces the speed of adsorption of vat dyes by plant fibres and thus promotes level dyeing and better penetration. Lists of Indanthrene dyes which are affected to different extents by Peregal O are given and the proportions of the assistants used when

dyeing cotton, mercerised cotton, and rayon are indicated. Peregal O may also be used to remove dye from dyed goods which are too dark in shade. C.

Variamine Blue Salt FG: Application. W. Christ. *Textilber.*, 1933, **14**, 18-20.

The range of the shades obtainable with the Naphthol AS series has been extended by the introduction of Variamine Blue Salt FG. The dyeings obtained with this new compound are equal to those obtained with Variamine Blue B in fastness to washing, boiling, and chlorine, and slightly better in fastness to light. The naphthol-treated cloth is dried and passed through a neutral solution of the diazo compound and coupling is effected by passing through a bath of water at 50-60° C. Reserve and discharge prints may be produced. Examples are discussed and samples of dyed and printed fabrics are shown. C.

Vat Dyed Cotton; Influence of Light on——. A. Landolt. *Textilber.*, 1933, **14**, 32-36.

Tests were made of the effects of exposure to light of goods impregnated with leuco compounds, and of the effects of long normal exposures and of short exposures preceded by impregnation with alkali of cotton goods dyed with various Ciba, Cibanone, Indanthrene, and other vat dyes and combinations of dyes. Observations of fading of the dyes and changes in strength of the fabric are recorded together with the results of methylene blue tests. Certain of the dyes caused considerable deterioration of the fabric on normal exposure and on exposure after alkali treatment. When used in combination with Chlorantine Light Blue 4GL and certain other blue dyes these dyes caused fading of the blue dyes on exposure to light. It is suggested that the three effects are related and due to oxidation processes in which the cotton and the fading dyes act as acceptors of oxygen. Methods of avoiding injury of the fabric in practice are discussed. C.

The Use of Katonal W in Two-bath Union Dyeing. D. Kermode. *Dyer*, 1933, **69**, 129-131.

An article discussing the two-bath method of dyeing union piece-goods, with special reference to the use of Katanol W. W.

Dyeing Wool Fabrics: Merits of Acetic and Sulphuric Acids. Ontario Research Foundation: Research Laboratory. *Canadian Text. J.*, 1932, **49**, No. 26, pp. 30-31.

The function of acid in the dyebath is discussed as regards the liberation of the dye acid and the change of form of the wool protein by alteration of the *p*H value to enable combination with the dye. It is concluded that any acid (provided it is sufficiently strong) may be used, if care is taken that the *p*H of the solution is adjusted as required. This is discussed with particular reference to the merits of acetic and sulphuric acids for use with badly-levelling dyes. W.

Dyeing Wool with Alizarine. P. S. Chetti. *Indian Text. J.*, 1932, **42**, 419-422.

Methods of dyeing wool with alizarine are discussed, taking into account the character of the wool fibre and the properties of alizarine (discussed in a previous paper). Mordanting with aluminium, with iron compounds, and with chromium compounds is considered, also factors that tend to weaken the strength of the wool. W.

Colouring Wool without Dyes. J. T. Groll. *Pharm. Weekblad.*, 1932, **69**, 1132-1134 (through *Chem. Abs.*, 1933, **27**, 192).

The Sakaguchi reaction (*Chem. Abs.*, **19**, 3506) for arginine in proteins, whereby a red colour is obtained by treatment with dilute NaOH α-naphthol and NaOCl, may be used for dyeing wool. Variations in colour may be obtained by using other phenols in place of α-naphthol; thus β-naphthol and thymol give a yellow-orange, phenol gives a green, and resorcinol a brown colour. W.

Dyeing Wool Pieces with Vat Colours. *Wool Rec.*, 1932, **42**, 1415-1417.

An account of the process of dyeing wool piece goods with vat colours, where extreme fastness to washing and light are required in conjunction with bright, clear shades. As the dyeing method demands the use of a jigger, this process is limited in practice to the lighter weight cloths. W.

The Importance of Soft Water in Dyeing. *Dyer Calico Printer*, 1932, **68**, 23; *Chem. Zbl.*, 1932, **2**, 1517.

Water softening to 0° hardness is recommended for dyeing even when only 2-3° of hardness are present. Hardness in water leaves flakes of lime soap which

affect the colour, removes part of the acid from acid dyes, upsets the delicate equilibrium of azo dyes, is harmful in the silk degumming bath when dyeing is also carried out there, makes it difficult to obtain correct *p*H in dyeing fabrics containing animal and vegetable fibres, gives bad effects in dyeing artificial silks and causes flecks in the dressing processes. D.

(J)—PRINTING

Calico Printing: Difficulties. M. W. Alling. *Amer. Dyes. Rep.*, 1932, **21**, 469-476, 657-660, 679-680, 685-688, 715-716, 717-720, and 747-749.

The need for careful inspection is emphasised and important phases in printing are discussed. A list of 35 printing troubles is given and causes and remedies are described. Defects traceable to ageing are also described and methods of removing defects by rehandling are outlined. A suitable printing department layout is indicated and a "Task and Bonus" system for printing works is explained. C.

Cotton Bedspreads: Printing. *Text. Weekly*, 1933, **10**, 551.

Recipes are given for the application of direct and mordant dyes for the printing of cotton bedspreads. C.

Vat Dyed Cotton: Ageing. R. E. Rupp. *Amer. Dyes. Rep.*, 1932, **21**, 727-728 and 737-739.

In the ager used in the tests, pressures varied between 0·8 and 0·3 in. of water above atmospheric. This variation had no appreciable effect on the results obtained. When air is admitted to the ager, greens are the first to be affected. Temperatures were varied from 213° to 234° F. and 213° was found to be the most suitable. A definite falling off in colour value was observed as the temperature was increased. The increase in temperature observed during ageing is due to the heat of condensation of steam, rather than to heat of reaction or to heat coming from the top steam chests. This rise in temperature may be prevented to some extent by increasing the flow of steam through the ager or by introducing water into the ager by the cloth or in some other way. The time required for ageing depends on many factors, but a period of four minutes was found to be the most suitable under the conditions described. C.

Coloured Indanthrene Reserves: Production. A. Schneevoigt. *Textilber.*, 1933, **14**, 36.

The usual method of producing coloured Indanthrene reserves with Naphthol AS dyes is outlined, and improved patent processes giving greater colour range are briefly described. One of the new processes avoids the naphthol treatment and depends on the use of Rapid Fast or Rapidogen dyes. C.

Dyed Cellulose Acetate Rayon: Discharging. La Société pour la Fabrication de la Soie Rhodiaseta. *L'Ind. Text.*, 1932, 49, 740-742.

A patent process for discharging dyed cellulose acetate rayon depends on impregnation of the yarn or fabric with a paste containing animal or vegetable charcoal and a suitable thickener, followed by steaming. A variety of white, shaded, and coloured discharge effects may be produced on fabrics by addition of charcoal to printing pasts. Examples are discussed. C.

Printing Pastes: Composition. M. Frankfurt. *Textilber.*, 1933, **14**, 30-32.

The influence of the nature and state of the printing paste is discussed, and it is pointed out that a lubricant should be added to the paste in order to reduce the friction between the doctor and the roller. Oils have been used for this purpose but these become saponified with certain classes of dyes and the soaps give rise to foaming which results in poor prints and damaging of the roller by the doctor. The most suitable substances for this purpose are the hydrocarbons sold under the name "Printogen." With these products foaming is avoided and regular clear prints are obtained. The presence of resin soaps and oils in printing pastes should be avoided since these form deposits on the cloth which cause tendering on storing. C.

Rapid Fast and Rapidogen Colours: Overprinting Effects. H. Freund. *Textilber.*, 1933, **14**, 17-18.

The property of only developing on heating in the presence of organic acids shown by Rapidogen dyes forms the basis of a new method of producing conversion effects. When cloth printed with a Rapidogen dye is overprinted with printing pastes containing non-volatile organic acids and then dried and steamed,

the corresponding insoluble azo dye is only formed on the overprinted parts. The Rapidogen dye remains intact on the other parts and can be removed by washing and soaping. If the Rapidogen dyes are applied with the addition of zinc oxide or calcined magnesia and sodium thiosulphate and the overprinting paste contains reservable dyes in addition to non-volatile organic acids, the overprint design is reserved on the pre-printed parts, and the Rapidogen dyes are developed on the latter on steaming. Further variations may be produced by the use of Rapid Fast dyes in combination with the Rapidogen dyes; the former develop on steaming in the absence of organic acids. Samples of prints obtained by printing with Indigosols and Aniline Black over Rapidogen and Rapid Fast dyes are shown and formulæ are given. C.

(K)—FINISHING

Creaseless Rayon: Production. *Spinn. u. Web.*, 1933, 51, No. 2, pp. 10-11.

A short note on the new Tootal Broadhurst process for impregnating cotton and rayon fibres with synthetic resins. The writer appears to suspect that the process is attended by a grave risk of tendering by acids and of destruction of dyes, and believes that the producers and not the finishers are the more likely to solve the problem of "creaseless rayon." C.

Sanforizing Plant. A. Bodmer. *Textilber.*, 1932, 13, 656a-656d.

The Sanforizing process is outlined and the machines used are described. It is said that 20 licensees in the U.S.A. are now operating 25 installations and the output of cloth treated by the process in 1932 is given as 125,000,000 metres. European licensees are named. C.

"Passive" and "Crystal" Yarns: Properties. *Spinn. u. Web.*, 1933, 51, No. 4, 9-10.

An account is given of the behaviour and properties of "passive" and "crystal" cotton yarns. These yarns are chemically treated by a patented process which causes them to be indifferent to cotton dyes and to be coloured by acetate rayon dyes. They are, however, unaffected by boiling, unlike acetate rayon, and have a duller lustre. They are useful for the production of fancy woven fabrics. "Passive" yarns are made from ordinary cotton and "crystal" from mercerised cotton. In the process there is an increase in weight and volume and reduction in counts. For example, on bleaching and treating by the new process, 2/120's become 2/100's, 2/80's become 2/65's, and 2/40's become 2/30's. C.

Double-action Shearing Machine. E. Honegger. *Text. Manuf.*, 1933, 59, 25; also *Textilber.*, 1933, 14, 83-84.

A new large-scale shearing machine is described embodying spiral cutters, ledger blades mounted on suction boxes, and automatic stopping of cutters on seams, etc. A novel feature is that each of the two spiral cutters works against two ledger blades, one above and one below, so that each cutter makes two contacts with the cloth. The cloth is led twice to each cutter and thus sheared on both sides twice. (The German version ascribes the machine to S. Vollenweider, of Horgen, Switzerland.) C.

Hosiery Steaming Chamber. P. Morizot. *L'Ind. Text.*, 1932, 49, 735-737.

In order to improve the shape and appearance of stockings and other knitted articles, the articles are placed over wooden or metal forms and heated in steam. A new steam chamber for this purpose is supplied with a boiler or steam generator and with gas burners for heating purposes. Temperatures of 170-180° may be employed and the temperature may be controlled by means of a thermostat arranged to regulate the gas supply. A pressure regulator is also provided. Heating by gas can also be advantageously applied to the old type of press used for the finishing of knitted articles. C.

Predetermined Shrinkage in Sanforising. H. D. Clayton. *Amer. Dyes. Rep.*, 1932, 21, 739-741.

A description of a washing test for predetermining the shrinkage of cloth, followed by an account of the sanforising process. W.

The Dry Gas Tentering Machine in Finishing. G. L. Atkinson. *Text. Amer.*, 1933, 59, No. 2, pp. 13-14.

A dry gas tentering machine having a single layer chain is illustrated and described. The chain, upon which are fastened the fine tentering pins, passes round cogged wheels at either end of the machine. Two steaming boxes and ten or

twelve gas jets are placed along the machine, both boxes and jets extending the full width of the machine. At the far end are two loose rollers and a cuttling arrangement, designed to prevent creasing, crimping and cockling. W.

Aromatics for Reodorising Textiles. *Text. World*, 1932, **82**, 1173.
An account of the characteristics, methods of application and uses of aromatics for reodorising textiles. W.

Finishing of Venetian Cloths. *Wool Rec.*, 1932, **42**, 1423-1426.
An account of clear and milled finishes on Venetian cloths. W.

Precautions in Scouring, Carbonisation, and Chlorination of Wool. *See* Section 4B.

Producing Lustrous Woollen Yarns: Chlorination and Mercerisation Processes. *See* Section 4H.

Finishing Machine Individual Electric Drives: Application. *See* Section 8D.

(L)—PROOFING

Mackintosh Fabrics: Preparation and Proofing. —. Kehren. *Textilber.*, 1932, **13**, 533-535, 601-604, and 652-655.
The method of waterproofing with rubber is briefly described and the factors affecting the durability of the product are discussed. Fabrics that are to be treated with rubber should be free from acid, fat, copper, and manganese; analytical data are given for typical fabrics. The copper content of textiles may be derived from contact with copper vessels in processing, particularly in dyeing, from after-treatments with copper sulphate, or from the dyes used; owing to their high copper contents, green and brown sulphur dyes should not be used on goods which are to be proofed with rubber. The copper content should not exceed 0·005%. The manganese content is usually much less than the copper content and is traced to the water used in processing. Methods of determining the copper and manganese contents of yarns and fabrics are described and results of copper determinations on cotton, woollen, silk, and rayon goods dyed with various dyes are given. C.

"Revertex" Waterproofing Agent: Application. W. Obst. *Kunststoffe*, 1932, **22**, 269-271.
Revertex is rubber latex thickened by artificial means until it contains 75% instead of 33-40% of dry matter. It can be diluted with water, thereby avoiding the risk of fire caused by the use of organic solvents. It finds application in the proofing of mackintoshes and the making of shoe linings, balloon fabrics, etc. A typical waterproofing mixture consists of Revertex 130, chalk 50, zinc white 5, sulphur 2, "Vulkazit P" (an accelerator of vulcanisation) 0·2, 10% casein solution 5, and water about 10. C.

PATENTS

Dyed Acetate Rayon: Stripping. I.G. Farbenindustrie A.-G. (Frankfurt). G.P. 562,297 of 22/1/1931.
Oxidising or bleaching agents are used in conjunction with the salts of aromatic quaternary ammonium compounds. C.

Urea-Formaldehyde Resins: Application. Pollopas Ltd. (Nottingham). G.P. 562,509 of 19/6/1928.
Soluble condensation products of urea or thiourea and formaldehyde are formed in known manner in textiles or leather, hardened, and the material is then dyed or printed. C.

Alkyloxyalkyl Cellulose Ether Paste Thickener. I.G. Farbenindustrie A.-G. (Frankfurt). G.P.562,985 of 28/1/1930.
The alkyloxyalkyl ethers of cellulose or its derivatives, alone or mixed with oils, fats, waxes, soaps, etc., are claimed as thickeners for sizing, printing, and thickening pastes. C.

Hank Conditioning Device. Maschinen-und Apparate-Bauanstalt G.m.b.H. (Rheydt). G.P.563,180 of 11/4/1931.
The hanks are carried on rods against a device for spraying them from both sides and a blast of air from underneath. C.

Acetate Rayons: Crepeing. Société pour la Fabrication de la Soie artificielle "Rhodiaseta" (Paris). G.P. 563,888 of 19/6/1930.
Crepeing of highly twisted acetate rayon, without sizing the threads before twisting, is effected by treating the fabric in a bath that has as strong a swelling

effect as possible without causing peptisation to any extent, so that a permanent shrinking in length of at most 8% is caused in the acetate threads. C.

Cotton Fabric Scrooping Bath. K. Brass (Prague). G.P.563,965 of 22/4/1929.

Bleached or unbleached, dyed or undyed, mercerised cotton, or cotton that has had a preliminary boil with 2% caustic soda, is treated in a bath containing 0·05-0·2 *N* caustic soda at room temperature or at about 50° C., then mangled and treated for a short time in a bath containing 0·06-0·3 *N* acid. C.

Azo Dyes: Production. Society of Chemical Industry in Basle. E.P.381,767 of 1/12/1931.

Azo dyes are made in substance or on the fibre by coupling a diazo or tetrazo compound with an acylated amine made by condensation of a primary aromatic monamine or diamine containing no carboxyl group with a hydroxycarboxylic acid of the benzene series, which is so substituted that it couples with a diazo compound in *o*-position to the hydroxyl group, or by condensation of one molecular proportion of a primary aromatic diamine containing no carboxyl group with one molecular proportion of such a hydroxycarboxylic acid and one molecular proportion of another aromatic hydroxycarboxylic acid. They may be used for dyeing vegetable and animal fibres, lacquers, cellulose acetate rayon, and regenerated cellulose, or for producing lakes. Fast brown shades are generally obtained. In one of the examples given, cotton is impregnated with di-(*p*-cresotinic acid)-dianisidide and developed with a solution of the diazo preparation from 4-chloro-2-aminodiphenyl ether and naphthalene-1:3:6-trisulphonic acid. C.

Swollen Rayon: Dyeing. A. G. Bloxam, London (Society of Chemical Industry in Basle). E.P.381,943 of 6/7/1931.

Artificial materials made from solutions of cellulose esters or ethers or made by acidulating products obtained by precipitating cellulose from solution, are washed and thereafter dyed by treatment in a dyebath while they are still in a swollen condition brought about in the course of their production. The process is applicable to rayon, horsehair, ribbons, films, etc. C.

Azo Dyes: Production. W. W. Groves, London (I.G. Farbenindustrie A.-G., Frankfort). E.P.381,944 of 6/7/1931.

Azo dyes are made in substance, on a substratum or on the fibre, by coupling a diazo compound with an arylide of a 6-alkoxy-2:3-oxynaphthoic acid. Bluer shades are obtained than when using the unsubstituted arylides. Examples of the production of various dyes on cotton are given. C.

Injecting Needle Yarn Package Dyeing Machine. Eclipse Textile Devices Inc. (New York). E.P.382,021 of 3/9/1931.

An absorbent mass of yarn is dyed or otherwise treated with liquids in a cylindrical form, the liquid being introduced by two sets of injecting needles, which are mounted to move towards and away from the yarn by means of levers, rods, and eccentrics driven by a countershaft. The yarn is enclosed by a work holder, which consists of a fixed lower part mounted on a pedestal and a hinged upper part or cover which may be tipped back to permit the insertion of the yarn and locked in closed position by a spring latch. The needle carriers are of such a size that they just fit within the work holder and completely enclose the yarn when the needles are inserted. The needles operate automatically and means for causing an angular movement are provided. Limited quantities of liquid are forced to the needles by a pump and springs allow the needles to remain fully injected for a brief period. C.

Yarn Package Multi-colour Dyeing Machine. Eclipse Textile Devices Inc. (New York). E.P.382,030 of 21/9/1931.

A wound mass of yarn is multi-colour dyed by evenly compressing an extended portion of the yarn and simultaneously injecting dye therein. The yarn on a holder is reciprocated towards and away from a pump, and is evenly compressed by the surface of a presser. The pump then makes one compression stroke, which forces dyes of different colours through a series of passages and bores with nozzles. Additional compression is secured by providing transverse ridges on the pressure surface, between the sets of nozzles which communicate with the different pump cylinders. C.

Dyed Cellulose Acetate Rayon: Production. H. T. Böhme A.-G. (Chemnitz). E.P.382,089 of 12/11/1931.

In processes for the production and finishing (e.g. dyeing, improving the feel, etc.) of rayon, films, and the like in one operation, there are added to the crude cellulose product serving as bases, or to the spinning solution, higher aliphatic monohydric alcohols or their sulphuric acid esters, i.e. those containing more than five carbon atoms in the molecule. For example, cellulose acetate can be dyed under addition of one or more of the said substances, and dissolved and spun to give dyed structures, or the dye and the substance may be added to the spinning solution, which is then spun. In an example, a small quantity of octadecyl alcohol is added to a cellulose acetate solution, which is spun in known manner. In a further example, cellulose acetate is dyed by means of 1, 4-diamino-2-methoxy-anthraquinone in the presence of the sulphuric ester of lauryl alcohol, and thereafter formed into artificial filaments, films, or the like. C.

Dye Vat. C. Callebaut (Leeds) and J. de Blicquy (Brussels). E.P.382,259 of 22/7/1932.

A vat for the dyeing, washing, or other treatment of textiles, skins, etc., has one wall substantially circular merging into the base and its opposing wall at an obtuse angle to the vertical, and is provided with a paddle wheel mounted to rotate in the upper part of the vat to direct the liquor against the inclined wall. A perforated partition serves to collect scum, fluff, etc. C.

Mercerising Liquor Wetting Agents: Application. Chemische Fabrik vorm. Sandoz (Basle). E.P.382,345 of 12/8/1931.

The action of alkali lyes upon natural and artificial cellulosic fibres in mercerising processes is improved by the presence of a mixture of phenols, including halogen-phenols, ethers of polyhydric alcohols still containing at least one free hydroxy group and alicyclic carboxylic acids. Polyhydric alcohols containing at least one more carbon atom than the number of hydroxy groups may also be present. In examples, mixtures containing commercial naphthenic acids or colophony, commercial xylenol mixture and diethyleneglycol-*n*-butyl ether are employed. Abietic and pimaric acids are also specified. C.

Aniline Black Coloured Reserves: Printing. Durand & Huguenin A.-G. (Basle). E.P.382,466 of 28/12/1931.

Fast colour reserves under Aniline Black are obtained by printing the white material with an ester salt of a leuco vat dye, together with a usual reserve for Aniline Black, steaming if required, producing the Aniline Black ground colour in known manner, and finally producing the reserve effect by a short passage through an acid bichromate bath. C.

Wetting Agents: Preparation. J. Y. Johnson, London (I.G. Farbenindustrie A.-G., Frankfort). E.P.382,718 of 28/9/1931.

Products having wetting, cleansing, and dispersing properties are prepared by the reaction of neutral sulphites with carboxylic amides or N-substituted amides containing a mineral acid ester residue and an aliphatic or cycloaliphatic chain of more than five carbon atoms. The said chain may form part of the carboxylic acid residue of the amide or may be linked to the nitrogen atom, and the mineral acid residue may be present in either component of the amide. Methods of preparing such amides are described. The reaction with the sulphites is generally effected at 80-250° C., if desired under pressure and preferably in an aqueous medium which may contain a solvent, e.g. methyl or ethyl alcohol, acetone, or dioxane, and an emulsifying agent, e.g. soap, turkey red oil, or a sulphonate, particularly a sulphonate obtainable in the process. The products may be applied as such or as alkali salts in the textile, leather, and paper industries, and may be used alone or associated with salts, acids, alkalis, glue, oils, and solvents. The alkaline earth and aluminium salts of these products are useful as emulsifying agents. A typical product is that obtained by heating chloroacetic acid octadecylamide with sodium sulphite in dilute alcohol. C.

Ethereal Sulphate Wetting and Softening Agents: Preparation. W. W. Groves, London (I.G. Farbenindustrie A.-G., Frankfort). E.P.382,942 of 17/7/1931.

Ethereal sulphates are obtained by treating alcohols containing more than 10 carbon atoms with aminosulphonic acid or derivatives of this acid. The same method may also be applied to ethers, esters, amines, or amides containing hydroxyl

groups. Organic sulphamic acids or their salts may be used instead of the amino-sulphonic acid. The invention also includes the production of the sulphuric acid esters of lower and higher primary, secondary, and tertiary alcohols by heating them with salts of aminodisulphonic acid, if desired, in the presence of a solvent such as pyridine. The product obtained by treating lauroylhydroxylethylamide with aminodisulphonic acid and converting the ammonium salt of the sulphuric ester thus obtained to the sodium salt can be used as a softening agent for fabrics. The aqueous solution of the product obtained by heating butoxyethyl alcohol with aminodisulphonic acid possesses a good wetting-out action. C.

Azo Dyes: Production on Fibres. Society of Chemical Industry in Basle. E.P. 383,064 of 14/11/1931.

Azo dyes are made on the fibre by coupling anilides of 2:3-oxynaphthoic acid in which the benzene nucleus is substituted in at least the ortho or para position by an alkyl or alkyloxy group with a diazotised 2-amino-1:1′-diphenyl ether of the formula NH_2-R-O-R′. Vivid scarlet to blue-red tints are produced fast to light and chlorine. For example, cotton is impregnated with the *o*-anisidide or 4-chlor-2-anisidide of 2:3-oxynaphthoic acid and developed with diazotised 4:4′- or 4:2′-dichloro-2-aminodiphenyl ether. C.

Rayon: Delustring. British Bemberg Ltd. (London). E.P.383,149 of 16/3/1932.

Rayon is delustred by treating in two separate baths with the solution of a metal hydroxide and with the solution of a metal salt which are such that chemical interaction on the filament results in the formation of a water-insoluble metal salt and a water-repelling metal hydroxide. A protective colloid such as glue may be added to one or both of these baths. By way of example, cuprammonium rayon is treated firstly with a solution of barium hydroxide, centrifuged, and then treated with a solution of aluminium sulphate containing an addition of glue. Zinc sulphate may replace the aluminium sulphate. C.

Skein Multi-colour Dyeing Apparatus. Eclipse Textile Devices Inc. (New York). E.P.383,183 of 22/4/1932.

Loose textile materials such as skeins of yarn are multicolour dyed by immersing portions in liquid dye and alternately compressing and releasing the portions. Apparatus is described. C.

Foam-preventing Agents: Application. Imperial Chemical Industries Ltd. (London) and A. Macarthur and A. Stewart (Manchester). E.P.383,293 of 29/7/1931.

The prevention of frothing or foaming in aqueous solutions, suspensions, or pastes is effected by the addition of a small proportion, e.g. 1% by weight or less, of a water-insoluble metallic soap dissolved in pine oil. The soaps employed include the stearates or oleates of aluminium, barium, calcium, and zinc, and from 2 to 10% by weight of the soap is used in making the solution. Included in the applications described is the use of the solution in textile printing. Examples are furnished of the solution of aluminium stearate, zinc stearate, and calcium oleate in pine oil. C.

Wetting and Reviving Agents: Preparation. Chemische und Seifenfabrik R. Baumheier A.-G. (Zschöllau, Saxony). E.P.383,312 of 6/8/1931.

Unsaturated oils, fats, and the corresponding acids, having more than ten carbon atoms are sulphonated by first treating them with a sulphuric acid derivative in which single or double substitution of the hydrogen atoms has been effected by means of alkyl, aryl, acyl, or aralkyl groups and then with an acid condensing agent. Castor oil may be treated with *n*-butyl-sulphuric acid, dimethylsulphate, or acetylsulphuric acid and then with chlorsulphonic acid. Other examples are also given. The products are stated to be wetting agents and may be used for the production of emulsions and pastes in the textile industry. Reference is made to use of the products after neutralisation as reviving oils in cotton dyeing. C.

Coated Fabrics: Preparation. Dunlop Rubber Co. Ltd. (London), Anode Rubber Co. Ltd. (St. Peter's Port, Guernsey), and G. W. Trobridge (Birmingham). E.P.383,432 of 26/11/1931.

Fabrics before being coated with aqueous dispersions of rubber and the like are coated with a non-coagulating composition, comprising one or more polyhydroxy compounds or their derivatives in admixture with one or more volatile solvents. Examples of polyhydroxy compounds are glycerol, glycol, diethylene

glycol, or alkyl ethers of these such as the monoethyl ether. Examples of volatile solvents are acetone, alcohol or ether. The deposits are coagulated in known manner by the application of heat and/or coagulants. C.

Bactericidal and Fungicidal Compounds: Preparation. I.G. Farbenindustrie A.-G. (Frankfort, Germany). E.P.383,493 of 20/2/1932.

Aliphatic and aromatic aldehydes or compounds yielding the same are condensed by means of acid condensing agents with *o*:*o*:*p*-substituted halogenated phenols having at least one free *m*-position, whereby di- and triaryl-methanes, hydrols, or anhydrides thereof or hydroxydibenzyl-ethers are obtained. The products may be used for moth-proofing or for bactericidal or fungicidal purposes. The material, e.g. wood, may be impregnated with a solution of the products in an inorganic solvent or the products may be applied as in an acid dyeing process. C.

Dyeing Apparatus. J. Rabassa (Barcelona, Spain). E.P.383,552, of 5/5/1932.

Textile materials are washed or dyed in receivers to which treating liquid is introduced from tanks. The articles are placed on movable perforated bottoms which are then lowered into the liquid by levers. The receivers are mounted to oscillate on a shaft by means of an eccentric and lever and may be rotated round the shaft by a belt to drain off liquid. A vacuum may be created by a pump to assist draining. C.

Rayon Yarns: Oiling and Finishing. British Celanese Ltd. (London). E.P.383,610 of 10/2/1931.

Yarns containing continuous filaments of silk or rayon are rendered amenable to textile operations, e.g. knitting, weaving, winding into packages, etc., by applying thereto a finely-divided pigment or other solid material. The yarn, dry or wetted with a liquid or solvent, may be run through the dry powder, but preferably, the material is ground with liquids, oils, or finishes and applied to the yarn in transit to packages or hanks. Oils, finishes, and pigments may be separately applied. Hanks may be dipped in baths containing the finishes, or the finishes may be forced through the windings of a bobbin, cop, or other package. The finishes may be applied to artificial filaments immediately after formation, either inside or outside the spinning cell. Artificial filaments may consist of cellulose organic esters or ethers, or regenerated cellulose. Solid materials specified are barium sulphate, carbonate and phosphate, calcium sulphate and carbonate, titanium dioxide, pumice, glass, carborundum, emery, kaolin, and starch. A suitable quantity of pigment, etc., is 0·2-2% on the weight of the yarn with 5-15% of oil, etc., finish. The pigment, etc., may be removed from the finished fabric by scouring or during dyeing or finishing treatments; in certain cases it may be removed by chemical treatment, e.g. calcium carbonate or barium phosphate may be removed by treatment with dilute hydrochloric acid. In an example, a cellulose acetate yarn is passed over the surface of a slowly rotating roller dipping into a lubricant containing 9 parts of diethylene glycol and one part of titanium dioxide, the rate of feed being such that 8-10% of diethylene glycol is applied to the yarn. C.

Acid Dyed Cotton and Rayon: Improving Fastness to Water. A Carpmael, London (I.G. Farbenindustrie A.-G., Frankfort). E.P.383,634 of 4/5/1931.

The fastness to water of dyeings on vegetable fibres and fibres from regenerated cellulose with dyes containing carboxylic and/or sulphonic acid groups is improved by treating the dyeings with an aliphatic or araliphatic amine or organic ammonium compound of the aliphatic or araliphatic series containing more than seven carbon atoms or a salt thereof. Salts of the dyes are thus formed on the fibre. The amines used may contain substituents, e.g. carboxyl, sulphonic or sulphonic ester groups, halogens, or hydroxyl. Various classes of amino compounds are specified and numerous examples of the treatment of dyed cotton goods are given. C.

Stamping or Printing Apparatus. Bleachers' Association Ltd. and G. Hodson (Manchester). E.P.384,775 of 21/11/1931.

A hand stamp for stamping headings in two colours on textile materials comprises a member or members having upon the operative face the part of the stamp to be used for one colour, and having a further member or members movable within or upon the first mentioned member or members which is, or are, provided upon the operative face with the stamp to be used with the other colour, the movable member or members being adapted for movement with reference to the

other member or members, so as to project beyond, to recede within and to lie level therewith, means being provided to hold the respective parts in any and all of such relative positions. C.

Sulphonated Oil Insecticide and Fungicide: Preparation. E. V. Hayes-Gratze (London). E.P.384,996 of 9/6/1931.

A diluted aqueous mixture of a neutral sulphonated and electrically ionised oil is employed, either alone or in combination with a small percentage either of carbon tetrachloride or soap, sodium hypochlorite, caustic alkali or camphor, or a mixture of any of these, or other insecticidal or fungicidal substances. Any suitable neutralised sulphonated oil may be used, but a vegetable oil, such as castor or olive oil, is preferable. The oil is electrically ionised by electrolysis or by the action of high tension or high frequency discharge or by a combination of both. C.

Vat Dyes: Application. Bleachers' Association Ltd. (Manchester) and C. S. Parker, C. L. Wall, and F. Farrington. E.P.386,365 of 19/9/1931.

New or improved coloured resist effects are obtained by combining the two methods commonly employed for dyeing fabric with vat dyes. In one of these methods the fabric is treated with a composition containing a vat dye, an alkali and a hydrosulphite reducing agent and is then aged to fix the vat colour. In the other method the fabric is treated with a composition containing a vat dye and a ferrous reducing agent and is then passed through hot caustic alkali to fix the vat colour. According to the present invention the fabric is printed as for vat dyeing by one of these methods by applying a composition having either a hydrosulphite or a ferrous reducing agent and which contains an ingredient or ingredients adapted to render ineffectual the ferrous or hydrosulphite reducing agent as the case may be of a second vat dyeing composition which is thereafter applied to the fabric as for dyeing by the other method. Thus the fabric may first be printed with a paste containing a vat dye, alkali, and a formaldehyde-hydrosulphite compound, aged and then treated with a paste containing a ferrous reducing agent and weak acid. The alkali in the first paste reacts with the ferrous reducing agent in such parts of the second paste as come into contact with the first and renders it ineffective. Examples are given. C.

Textile Materials. H. Dreyfus. F.P.730,752 of 30/1/1932 (through *Chem. Abs.*, 1933, **27**, 429).

Threads of filaments have deposited thereon a substance which roughens them and is capable of being easily removed without modifying the material of the threads, etc. The substance may be applied in the form of a solution or by sublimation or by chemical reaction. Examples of substances are chlorides of NH_4, Ba or Pb, nitrates of Ba, K or S, sulphates of Al, NH_4, Fe, Mg, K or S, acetates, oxalates, tartrates, $C_{10}H_8$ and benzoic, citric, phthalic, salicyclic or tartaric acids. W.

Degumming of Silk. L. Wallerstein (New York). U.S.P.1,877,097 of 2/2/1927.

Silk fabric or yarn, after a preliminary washing with a $\frac{1}{4}$-$\frac{1}{2}$% soap solution at 50-90° for a short time to remove dirt, grease, and other impurities, is treated for some hours at 40-60° with a liquor obtained according to U.S.P.1,227,525 by cultivating bacteria of the *subtilis* or *mesentericus* species in a wort or mash rich in nitrogen, the *p*H of this liquor being adjusted to 7·0-7·6 for degumming. Finally the silk is rinsed in warm water or soap solution. The initial soap treatment may be omitted if soap is added to the bacterial bath, which is then adjusted to *p*H 7·5-8·0. The process may be modified by soaking the silk in the bacterial liquor for a short time, then exposing it to a warm moist atmosphere until the gum is sufficiently softened to be removed by warm soap solution. S.

Recovery of Tin Compounds in Silk Weighting. W. Meitner (Vienna). U.S.P. 1,878,507 of 11/12/1931.

Tin may be removed from the phosphate bath by filtration through active aluminium hydroxide or some material containing it. By treatment of the filtering medium, which takes up no phosphoric acid, with a sodium sulphide solution containing sulphur, the tin is removed as thiostannate and the filter is reactivated. The aluminium hydroxide is prepared by decomposing bauxite or precipitating an aluminium salt and by heating at 100° converting the aluminium hydroxide into a granular mass containing 50-70% of water. S.

Felts for Paper-making Machines. T. Hindle. E.P.378,157 of 27/6/1931.

Dryer felts used on paper-making machines are joined by overlapping the ends, stretching on hooks, and seaming by a travelling sewing machine which has an arm engaging between the overlapping ends. The machine has a bank of four needles which sew four rows of stitches simultaneously. W.

5—ANALYSIS, TESTING, GRADING, AND DEFECTS

(A)—Fibres

American Cotton: Grading. H. H. Willis. *Cotton (U.S.)*, 1932, 96, No. 12, pp. 28-31.

This article points out the importance of proper classing and grading by the mill's cotton buyer. It also explains the meaning of grade, length, strength, and uniformity of staple and character, and describes the practice of the U.S. Department of Agriculture with the "Universal Standards." The average percentage of "total visible waste" in the nine grades is plotted on a graph. C.

Ashed Fibres: Microscopy. K. Czapla. *Faserforsch.*, 1932, **10**, 20-42.

Fibres of various origins give different ash structures when previously impregnated with solutions of salts of the rare earth series, such as thorium and cerium nitrates. Wool and acetate rayon are not impregnated by these solutions and burn without ash. Jute and hemp do not give characteristic structures, but cotton, flax, ramie, nitro, cuprammonium, and viscose rayons, and raw, souple, schappe, and bourette silks give characteristic ash structures, which are described in a table. A second table gives the characteristic ashes for fabrics, of the same or different fibres for warp and weft. C.

Capacitance Moisture Content Determination Apparatus: Application. R. K. Schofield. *Nature*, 1933, **131**, 96-97.

A criticism of Balls' method for determining the moisture content of soils and cotton bales. The author points out that it is necessary to prove whether the capacitance readings are sensitive to frequency. C.

Fibres: Microscope Analytical Tests. M. Lüdtke. *Faserforsch.*, 1932, **10**, 43-58.

This article describes the following methods of analysing vegetable fibres—decomposition by means of caustic soda or sulphite, swelling tests in cuprammonium solution, carbonisation, followed by measurement of the fibrillæ, reaction with alcoholic phloroglucinol, detection of cellulose with chlor-zinc-iodide and other colour reactions, and chemical tests for xylan and mannan. Microphotographs are reproduced. C.

Fibres: Regain Testing. *Textilber.*, 1932, **13**, 634-636.

Official German standard procedures for conditioning, sampling, and determinations of commercial weights are described and charts for the recording of results are shown. C.

Cotton and Mercerised Cotton; Sorption of Vapours by——. K. Atsuki, H. Sobue, and K. Kitajima. *J. Soc. Chem. Ind. Japan*, 1932, **35**, 584-587B.

Experiments are reported on the rate of absorption of vapours of organic solvents by scoured and by mercerised cotton. The conclusion drawn is that sorption is conditioned by adsorption and swelling, adsorption being governed by the vapour density, surface tension, and vapour tension of the liquid, and swelling by the polarity of the hydroxyl groups and oxygen bridge in the cellulose molecule. C.

Indian Cotton: Testing. *Abstr. Proc. 25th Meeting Indian Cent. Cotton Ctte.*, 1932, 41-49.

A report is given of recent work done at the Technological Laboratory, Bombay, in the spinning and research laboratories and in the moisture testing section. C.

Wool: Measurement of Resilience. C. G. Winson. *J. Text. Inst.*, 1932, **23**, T386-T393.

Microbalance. W. W. Loebe and R. Kühn. *Z. Instrumentenk.*, 1933, **53**, 21-27.

A robust balance for the range 1·5 to 3 mgm. is described. The beam is of quartz and T-shaped. The ends of the cross piece are attached to the centres of two spiral springs and the outer ends of these are connected with a stirrup mounted in a special bearing. The end of the axle of the stirrup piece carries a glass pointer

which moves over a glass dial on which graduations are photographed so that they appear white on a black background. The adjustment of the zero and manipulation are explained. C.

Testing the Hairiness of the Fleece. Massey Agric. Coll. *Meat and Wool*, 1932, 46, No. 3, p. 23.

Present knowledge indicates that the desirability of the first fleece from the point of view of hairiness may be sufficiently judged from kemps and from the wavy tipped fibres which are abundant in the coat of the new-born lamb, and which may become hairy as they develop. Some slightly hairy-tipped sheep were shorn to the skin on one side, and on the other were left unshorn, or the wool was left about 2 in. long. On the side shorn in the ordinary way, the wool grown after shearing was a little hairy, but on the other side the wool grown under the protection of a longer or shorter covering was free from hair. The shorn side responded to the stimulus of cold, for in growth rate experiments it has been shown that a hairy part grows faster than a non-hairy part of the same fibre. The question of the hereditary factor in hairiness is briefly discussed. W.

(B)—YARNS

Cellulose Acetate Rayon: Electrostatic Behaviour. M. Speter. *Kunststoffe*, 1932, 22, 181-182.

Various samples of acetate rayon (described) were found to become negatively electrified on rubbing slowly or vigorously with the hand, and positively on rubbing with glazed paper. After being scoured to remove oil, the yarns were found to acquire a + charge on rubbing slowly with the hand or with cotton gloves, but a — charge if rubbed quickly. Cellulose acetate films behaved in the opposite sense, acquiring a — charge on being rubbed slowly and a + charge by vigorous rubbing. C.

Conditioning Oven. Messrs. Goodbrand & Co. Ltd. *Text. Recorder*, 1933, 50, No. 598, 46-47.

The new model has a fan for forced draught and an auxiliary chamber in which the material to be tested is exposed for a time to the exhaust from the main chamber. The rate of drying is about 2½ times as fast as that of natural draught ovens, the capacity being about 12 samples of cotton per working day. Costs for heating are quoted. C.

Yarns: Regain and Count Testing. *Textilber.*, 1932, 13, 636-638.

Official German standard procedures for conditioning, sampling, and count determination are quoted. C.

Yarns: Testing. E. Lipowsky. *Textilber.*, 1932, 13, 518-521 and 576-577.

A general account is given of the methods of testing yarns, including determinations of twist, strength, counts, etc., and of the nature, staple, fineness, and strength of the constituent fibres. The Moscrop, Holzach and Dietz, and Herzog yarn-testing devices are briefly described and the evaluation of the results is discussed. Data are given for cotton and woollen yarns. C.

Yarn and Cloth: Finger and Thumb Tests. *Spinn. u. Web.*, 1933, 51, No. 2, pp. 1-4.

Some finger and thumb tests for yarns and fabrics are described for use in factory routine. They include rough comparisons of count and tests for strength. C.

"Deforgarn" Tensile Testing Apparatus. P. Krais, G. Krauter, and H. Weinges. *Leipz. Monats. Text. Ind.*, 1932, 47, 238-239.

Improvements are described in the Deforden testing instrument for fibres, yarns, and fabrics. The new machine consists of three parts; first a special motor drive giving seven different rates of loading from 35 to 160 seconds, and requiring only 15 seconds for unloading; second, a loading system providing for maximum loads of 15, 35, 200, and 500 gms.; and third, the actual breaking device, which is based on that of the old Deforden apparatus but provides for loading and unloading, and a length between the grips from 0 to 20 cm., and has a recording device for tracing load-extension diagrams. Typical curves are reproduced for rubber band, 120 den. viscose rayon, viscose rayon filament, and wool. C.

Sisal and Manilla Ropes; Effects of Water on——. *Bull. Imperial Inst.*, 1932, 30, 407-412.

Experiments were carried out to compare the behaviour of East African Sisal and manilla ropes when immersed in water with respect to rate of absorption of

water, increase in girth of the rope, and reduction of girth of rope when allowed to dry in the air. Sisal rope absorbs water very rapidly during the first hour, after which the increase in weight is comparatively small. Manilla rope has a slower rate of absorption, but after prolonged immersion takes up as much or more water than the Sisal. With regard to increase in girth, that of manilla is largest at first, but subsequently becomes equal to that of Sisal. When the ropes are shrunk the rate of skrinkage is about the same, but Sisal returns more nearly to its original girth than manilla. C.

(C)—FABRICS

Closely Woven Fine Fabrics: Analysis. A. Homann. *Seide*, 1932, 37, 431-433.

A closely woven fabric may be analysed as follows—A small square of the fabric is prepared with the warp and weft threads protruding at each side to form a cross, and the threads are taken in bunches between thumb and finger and moved up and down at right angles to their length. This has the effect of loosening the structure, which can then be more easily examined under a pick counting glass. Diagrams are given. C

Double Cloth: Analysis. A. Hamann. *Textilber.*, 1932, 13, 642-644.

A procedure for the analysis of double cloth is described in detail. C.

Vat Dyed Cellulose Materials: Tendering. C. M. Whittaker. *J. Soc. Dyers and Col.*, 1933, 49, 9-19.

Tests are described on the tendering of cellulose treated with different vat dyes, when exposed to open and indoor air, industrial, suburban, and seaside atmospheres. Full details and particulars of the dyes used are given. Blue vat dyes and direct cotton colours are found to have an inhibiting effect on the tendering of cellulose. It is shown that the causative factors in tendering are sunlight, impurities, and humidity, and their relative effects might be explored by experiments on Caledon Red BN, which is on the border line between safe and troublesome dyes, as far as tendency to enhance tendering is concerned. A discussion is appended. C.

Cloth: Shrinkage Tests. American Association of Textile Chemists and Colorists, Sub-Committee on Shrinkage of Textiles. *Amer. Dyes. Rept.*, 1933, **22**, 44-45.

Details are given of the tests prescribed by the U.S. Navy and the U.S. Laundry-owners National Association. Both involve several washings and are therefore considered to be too cumbersome for process control. C.

Testing of Silk Bolting-cloth. H. Kühl. *Z. ges. Text.-Ind.*, 1932, 34, 527 (through *Melliand Textilber.*, 1933, 14, 94).

The determination of the elasticity and its ratio to the tearing strength is recommended. Actual sifting tests are too costly to be generally practicable. Results of tests of elasticity and tearing strength with miller's gauzes of various origins are reproduced. S.

Insects Pests of Textiles. C. O. Clark. *Text. Mfr.*, 1933, 59, 11-12.

A review of the damage done to textiles by the following insects—cockroaches, *Niptus hololeucus* ("cloth spider" or "cloth bug"), "silverfish," weevils, wood-boring beetles (infesting bobbins holding yarn), *Glycyphagus domesticus* (furniture mite), and clothes moths. Methods of preventing and remedying the damage are discussed, with particular reference to the use of Eulan for mothproofing. W.

Defects caused by Mildew. *Wool Rec.*, 1933, 43, 146-147.

The occurrence of mildew in cheeses of worsted yarn is discussed, and suggestions given for the level dyeing of the yarn. A "skittery" effect produced in materials made from mildewed yarn may in some cases be overcome by dyeing with direct cotton colours. Woollen yarns and other wool-containing mineral oils, e.g. pulled waste, shoddy or mungo, are less liable than worsted yarns to damage by mildew. Wool oiled with olein soap and mucilaginous extracts are susceptible to mildew. A practical illustration of mildew participation in a defective fabric is given. W.

Faults Due to Rust Stains. *Wool Rec.*, 1933, 43, 203 and 208.

The following two examples are given of faults due to rust stains—patchy and mottled dyeing, due to the drying of single worsted warps over rusty drying cans in sizing, the rust forming an iron soap with the soap used in the sizing; an overhand and underhand shade, giving the appearance of bronziness, and the presence of almost parallel lines of darker hue than the main body of the material.

In the latter case the material was dyed by bottoming with a good heavy shade of Indigo, and then topped with after-chrome colours. It was found that the eyelets of the harness and the reeds of the looms that had produced the defective pieces were rusty. This iron content, although very small, had the effect of increasing the difficulty of scouring the goods to remove the spinning lubricant, especially after setting. The more severe the crabbing, the greater the iron soap formation, this increasing the polymerisation of the otherwise unaltered spinning lubricant. This is particularly the case where olive oil has been adulterated with tea seed oil. The presence of iron is particularly undesirable when goods have to be dyed with Indigo or with mordant colours, or with a combination of these. W.

Aniline Black Dyed Fabrics: Prevention of Stains. *See* Section 4I.

(D)—Other Materials

Dyed Textiles: Fastness Determinations. J. Pinte and R. Toussaint. *Textilber.*, 1932, 13, 596-598 and 650-652.

The disadvantages of the usual methods of determining fastness are discussed and a method depending on the use of the Toussaint photocolorimeter is described. Six points of the luminous intensity-wave length curve are plotted for wave lengths in the violet, blue, green, yellow, orange and red, respectively. The luminous intensities of the original sample are taken as 100 for each wave length and those of the faded sample are referred to the original. The area between the curve for the faded sample and the the horizontal line at luminous intensity 100 gives a measure of the fading. Values for changes in tone (brightness or darkness) and in colour are obtained by comparing the average of the ordinates with the ordinate of the original (100), and by determining the ratio of the sum of the changes at each wave length to the average tone. The results of determinations of the fastness to light, boiling, chlorine, and acids of various dyes on cotton are given and it is shown that when classified according to the results obtained by the authors' method, the German fastness standards are not in the same order as that given by the German Commission. C.

Lubricating Oils and Greases: Examination in Ultra-violet. J. Muir. *Ind. Chemist*, 1932, 8, 437-438.

A general article on the ultra-violet radiation test for lubricating oils and greases. Mention is made of the Callophane apparatus, which utilises daylight as the source of ultra-violet rays. C.

Influence of the Width of a Sample of Leather on the Coefficient of Strength in the Determination of Tensile Strength. J. P. Sybin. *Collegium*, 1932, 17-22 (through *Chem. Abs.*, 1932, **26**, 2615).

Tensile strength strips of different widths were cut from leather blocks after grooving the blocks so that a section 2 cm. long and exactly 0·4 cm. thick was left in the centre of each test piece. The coefficient was constant for strips wider than 0·5 cm. but decreased rapidly as the width decreased below 0·5 cm.; it was 0 at 0·04 or 0·06 cm. The formula for the true coefficient of strength (q) is $q = Q/a(b—a)$, where Q is the load, a the thickness of the leather, b the width of strip, and a the width of strip along the cut edges which has 0 strength because it consists of cut fibre ends. W.

Patent

Viscosity Regulating Apparatus. A. Osbourne (San Franciso). E.P.384,827 of 14/1/1932.

Improvements in viscosity determining and regulating apparatus utilising the torque required to rotate a body in the liquid as a measure of the viscosity are effected by pivotally supporting the motor which imparts the rotary movement to the body in the liquid and maintaining the motor and transmission elements in equilibrium by suspending weights from the motor supports and elements to balance the torque of the rotatable body. When the viscosity of the liquid becomes greater than the required value, the motor supports and elements swing through a small arc and actuate an electrical system which opens a valve to allow a diluting fluid to flow into the container and mix with the liquid. The improved regulator may also be used for determining and controlling the percentage of solids in a liquid. C.

6—DESIGN

PATENT

Device for Feeling the Jacquard Design by Means of Cells Sensitive to Light. O. Schleicher. G.P.530,623 of 13/11/1929 (through *Textilber.*, (*Eng. Edit.*) 1933, 14, No. 1E, p. 23).

According to this invention the relative motion between the point paper design and the electric light cell is interrupted and simultaneously the source of illumination is switched off in accordance with the requirements of the card at any moment, while the card stamping machine and the drive of the feeling device actuated by it, are steadily in operation. When the feeling device is stationary and the design is moved past it, a coupling arrangement is attached to a driving disc, which is steadily driven at a uniform speed by change gear. The coupling arrangement is put out of mesh with the teeth of a dividing wheel at certain places, by means of stationary cover plates that can be changed, and the dividing wheel is disposed upon the same shaft as the drum which forms a basis for the design, whereby the current circuit for the source of illumination is interrupted by a contact device connected with the coupling device. W.

8—BUILDINGS AND ENGINEERING

(A)—CONSTRUCTION OF BUILDINGS

Machine Foundation Materials: Elasticity and Transmission of Vibration. B. E. Eisenhour and F. G. Tyzzer. *J. Franklin Inst.*, 1932, **214**, 691-707.

A comparison is made of the effectiveness of materials used as flexible supports by measuring their stiffness under a wide range of loads. The various devices used for testing are described, and graphs and equations are given. A table of coefficients of elasticity under various pressures is reproduced. The materials tested are helical spring, cork of various kinds and thicknesses, wood fibre board, felts of hair, jute, asbestos, and wool, gelatinous compounds, and gelatinous compound sponge. C.

Journal in Sleeve Bearing: Whirling. D. Robertson. *Phil. Mag.*, 1933, **15**, 113-130.

An investigation is made of the whirling of a journal in a sleeve bearing. Both rigid and elastic rotors are considered and also the forces in the film of lubricating oil. C.

Stainless Steel in the Textile Industry. K. E. Luger. *Amer. Dyes. Rep.*, 1933, **22**, 98-102.

A discussion on the typical properties of annealed sheets of the alloy 18-8 (which contains approximately 18% chromium and 8% nickel), as compared with copper and common steel. The results are given of laboratory tests on 18-8, a tabulation of the effects on it of some solutions commonly used in the textile industry indicating its corrosion-resisting characteristics. Possibilities are stated for its use in dyeing and bleaching. W.

(C)—STEAM RAISING AND POWER SUPPLY

Miersbe Steam Heating System. Heenan & Spencer Ltd. *Text. Manuf.*, 1933, **59**, 24.

In the Miersbe system, steam is circulated in a complete closed circuit so rapidly that the velocity is practically the same throughout. A high velocity injector is used for introducing the make-up steam, this injector inducing a flow from the return end of the circuit and so keeping the body of steam in rapid movement. C.

Smoke Density Meter. R. D. Bean. *J. Sci. Inst.*, 1932, **9**, 391-392.

A smoke meter is described in which a portion of flue gas containing smoke is made to pass between a source of light and a photo-electric cell. The chart of the recording instrument is calibrated to read in % smoke density, and the indicating scale may read in % or in terms of Ringelmann smoke scales. C.

Boiler Feed Water. C. N. Ridley. *Steam Eng.*, 1932, **1**, 341, 397, 444, 488; and **2**, 28.

The sections of this article are as follows—I—Dealing with practical problems of boiler feed water. II—Dealing with the scale and sludge forming salts. III—Dealing with corrosion. IV—Conditions of treating water within the boiler.

V—Dealing with the fundamental reaction of water-softening plants. VI—Feed water conditioning. VII—Boiler water control. D.

(D)—Power Transmission

Finishing Machine Individual Electric Drives: Application. R. Herlt. *TIBA*, 1932, **10**, 941-945, 1013-1019.

A general account is given of the types of motors most suitable for individual electric drive of finishing machines. C.

Loom Drives. *See* Section 3C.

(F)—Lighting

Rayon Weaving Sheds: Lighting. N. Goldstern and F. Putnoky. *Seide*, 1932, 37, 316-322, 396-400, and 428-431.

A report is given of an experiment in which the lighting was changed from a system of 40 or 60-watt lamps with flat enamelled reflectors to one with special matt-glass reflectors, and the two systems were compared with daylight. Graphs and tables show that the improved lighting resulted in better quality and increased output, which amply compensated for the cost of installation. C.

(G)—Heating, Ventilation, and Humidification

Air Conditioning Plant: Application. W. A. Hanley. *Ind. Eng. Chem.*, 1933, **25**, 9-12.

A general account of air conditioning technique as employed in a large manufactory of pharmaceutical chemicals. In some processes air of as low as 5% relative humidity at normal temperatures is required. There seems to be a definite point (about 12 or 15% relative humidity) below which it is cheaper to take out the moisture with absorbent materials such as silica gel than by reducing the temperature of the air in a washer. C.

Dust: Control. H. C. Murphy. *Aerologist*, 1932, 8, No. 6, 6-8; No. 7, 9-12 (through *Bull. Hyg.*, 1933, 8, 24).

The author discusses some of the modern practices in the control of dust. A new type of filter medium, consisting of a felt-like mat of gauzy cellulose tissue and treated with a viscous material, is first described. The automatic filter, used in the removal of dust in certain industrial operations, is next presented. The author then discusses the small ventilating units used in offices and homes. Many examples of typical installations of large and small filtering units are cited. C.

Humidification Plant: Application. W. Hudson. *Text. Weekly*, 1933, **10**, 608-609.

A report of a lecture. Steam jet and spray systems are discussed and the following relative humidities are recommended: for blow room 50%; card room, not above 65%; spinning department, 45-65%; winding, that corresponding with maximum strength of the yarn; weaving, not above 70%, for pure sized goods. C.

Air-conditioning for Railway Passenger Cars. H. K. Williams. *Ind. Eng. Chem.*, 1933, **25**, 13-18.

The advantages are shown of the steam ejector (or vacuum) method of cooling water as compared with the compression methods. The cooled water is used in the spray chamber of a small air-conditioning plant carried on each car. W.

(H)—Water Purification

Water De-oiling Technology. *Chem. Age*, 1932, **27**, 204.

The small quantities of oil normally present in returned condenser water often cause considerable damage, since a layer of oil on the heated boiler wall has ten times the heat-insulating power of boiler scale and oily feed water tends to form with suspended mud agglomerations capable of storing up heat with subsequent explosive consequences. Further, in the textile industry and in ice and ice-cream manufacture a trace of oil in the water will ruin the product. The de-oiling processes adopted in industry may be classified as mechanical, chemical, and electrolytical. The action of each of these methods is briefly described. Recently a system based on the adsorption of oil, benzole, etc., by activated carbon has proved successful. Reference is made to an article by M. Jaenicke, illustrating the value of activated carbon in removing oil from potable water and sewage. D.

(I)—Waste Disposal

The Utilisation of Cellulose Waste Lyes with Regard to Recent Results of Lignin Research. I and II. C. Harnist. *Chem. Ztg.*, 1932, 56, 529 and 550.

After a brief general consideration of the disposal of sulphite cellulose waste lyes with special reference to Strehlenert's process of recovering sulphuric acid from the lyes, their use as fertiliser is dealt with. The constitution and tannin character of lignin and its occurrence in living and dead vegetation are discussed. The fertilising value of sulphite waste lyes after removal of sulpho-lignins which would otherwise affect the porosity of the soil is then considered. Patents dealing with the preparation of a compact fertiliser from the lyes are mentioned and the removal of tanning materials and the recovery of potassium chloride, ammonium chloride, and sodium sulphite from the lyes are discussed. The advantages of the sodium sulphite or bisulphite process are pointed out. D.

Patents

Improvements in the Treatment of Feed Water for Boilers and Similar Plants. Allis-Chalmers Mfg. Co. F.P.715,181; *Chim. et Indust.*, 1932, **28**, 582.

The removal and prevention of deposits and the fixation of the corroding oxygen and carbon dioxide in water and other liquids can be obtained by treatment with a very finely-divided oxidising substance, such as is produced by the action of an electric arc on a metal of the iron group in an aqueous solution of a colloidal substance such as sodium silicate. (This patent is covered by E.P.382,269.) D.

Improvements in the Treatment of Water. J. M. Hopwood. F.P.715,256; *Chim. et Indust.*, 1932, **28**, 582.

A chemical compound which has undergone intra-molecular dehydration, such as pyrophosphate, meta-phosphate, etc. on addition to boiler water becomes hydrated at boiling point and gives an acid salt which neutralises the alkalinity of the water, while the alkaline orthophosphate formed precipitates the calcium or magnesium salts as a non-adherent sludge. The alkaline pyro- or meta-salts of other polybasic acids (phosphites and arsenates), can equally well be used. Addition of tannin to feed water containing such a compound tends to retard deposition of sludge until the boiler is reached. D.

Working up Waste Liquid from Rayon Spinning. Seta Bemberg S.A. · G.P. 550,877; *Chem. Abs.* (*U.S.*), 1932, **26**, 4952.

Dilute precipitating liquid containing copper from the spinning of cuprammonium silk is worked up by treatment with excess alkali, e.g. cotton-bucking lye, and an equivalent amount of magnesium sulphate. The precipitated copper and magnesium hydroxides are separated from the lye. The magnesium hydroxide on treatment with sulphuric acid forms soluble magnesium sulphate leaving the copper hydroxide which is worked up into copper. D.

Recovery of Alkali Sulphide in Viscose Manufacture. T. Kamiba (to Kurasiki Kensyoku K.K.). Japanese P.92,952; *Chem. Abs.* (*U.S.*), 1932, **26**, 4175.

Waste liquor from the viscose rayon process, containing alkali polysulphide or poly- and mono-sulphides, is shaken with carbon disulphide to separate excess sulphur and filtered to recover the alkali mono-sulphide solution. D.

Air Conditioning Apparatus. W. W. Triggs, London (Industrial Dryer Corporation, Stamford, Connecticut, U.S.A.). E.P.384,666 of 4/6/1931.

Horizontal partitions are arranged in a suitable housing, in such a way as to provide a continuous tortuous channel for the flow of air. Tubular members covered with wicking, which is saturated with water, cross the air channel and radiators are provided at suitable places within the channel. Air is circulated by means of a blower or exhauster and is alternately heated and humidified until the required temperature and degree of saturation are reached. A saturation of 100% may be given when required. The evaporation of moisture from the tube coverings results in cooling of the tubes and this cooling effect may be used to condense moisture from a current of air circulating through the tubes. Means may be provided for heating or cooling this dehumidified air. C.

Ammonium Oleate Rust Preventing Solution: Application. British Thomson-Houston Co. Ltd. (London). E.P.386,542 of 17/6/1931.

Rusting of iron and steel surfaces is prevented by coating with an aqueous solution of ammonium oleate and drying. On evaporation of the solution to dryness, the compound breaks down into ammonia and oleic acid, the latter being left as a film on the metal surface. C.

9—PURE SCIENCE

Starch: Acetolysis. R. Sutra. *Compt. Rend.*, 1932, **195**, 1079-1080.

It is shown that during acetolysis of starch an intermediate acetyl compound is first formed which is then converted into α-octo-acetyl maltose with a small proportion of the β-isomeride. The yield is about 40% of the dry weight of starch used. The acetolysis is conducted as follows—10 gms. of maize starch are put into a cold mixture of 40 c.c. acetic anhydride and 5 cc.. concentrated sulphuric acid. The mixture is very slowly warmed to 70°, stirring continually. The temperature is raised to 95° to finish the reaction. The reddish brown solution is filtered and poured into ice and water, stiring vigorously. The acetate formed is washed and dried; it melts at 96° C. C.

Starch: Composition. S. Nishimura. *J. Agric. Chem. Soc., Japan*, 1932, 8, 400-403. (Through *Chem. Abs.*, 1932, **26**, 5783).

Starch (5 g.) was boiled with 1 litre of water and then cooled. Amylopectin was precipitated and washed 6-7 times with water. There was found 70% in corn starch, 65% in wheat starch, 85% in sweet potato starch, and 78% in potato starch. Potato starch solution is very viscous, and the separation of amylopectin from amylose is difficult but is facilitated by the addition of a little acid. The view that starch consists of 80% amylose and 20% amylopectin is erroneous. There was no difference in the actions of amylase on amylopectin and amylose. C.

Proteins: Reaction with Hydrochloric Acid. D. I. Hitchcock. *J. Gen. Physiol.*, 1932, 16, 357-366.

Electromotive force measurements of cells without liquid junction, of the type $Ag/AgCl/HCl+protein/H_2$, have been made at 30° C. with the proteins gelatin, edestin, and casein in 0·1 *M* hydrochloric acid. The data are consistent with the assumptions of a constant combining capacity of each protein for hydrogen ion, no combination with chloride ion, and Failey's principle of a linear variation of the logarithm of the mean activity coefficient of the acid with increasing protein concentration. The combining capacities for hydrogen ion so obtained are $13{\cdot}4\times10^{-4}$ for edestin, $9{\cdot}6\times10^{-4}$ for gelatin, and $8{\cdot}4\times10^{-4}$ for casein, in equivalents of combined H^+ per gm. of protein. C.

Cotton Hairs: Development. V. R. Ayyar and G. S. Ayyangar. *Empire Cotton Grow. Rev.*, 1933, **10**, 21-24.

The writers bring evidence to show that the lint hairs continue to be produced from the seed coat for a number of days after flower opening. More details will be given in a future publication which will show how the primordial lint cells may be differentiated. Drawings and photographs are given. C.

Cotton Plant: Genetics. S. C. Harland *Empire Cotton Grow. Rev.*, 1933, **10**, 17-20.

An account of work done on the genetics of cotton (and of other plants) reported at the Sixth International Congress of Genetics. Attention is especially directed in this paper to the inheritance of leaf form and yellow leaf (the latter due to lack of chlorophyll). C.

Cellulose: Fermentation by Bacteria. Y. Tomoda. *J. Soc. Chem. Ind., Japan*, 1932, 35, 534B-536B.

A bacterium, thought to belong to a species of *Clostridium thermocellum*, has been isolated from stable manure. It has the power of rapidly decomposing some forms of cellulose, the forms most easily attacked being the natural ones such as cotton wool, hemp fibre, or wood cellulose. Rayon is less easily attacked. The author considers that the fermentability of cellulosic materials depends upon their microscopical structures rather than their colloidal structures. The natural cellulose fibre, being porous and spongy, is more easily attacked than the smooth compact artificial fibre which the bacteria cannot enter so easily. C.

Starch: Zymolysis. C. S. Hanes. *Biochem. J.*, 1932, **26**, 1406-1421.

A study is made of the effect of starch concentration upon the velocity of hydrolysis by the amylase of germinated barley. An "initial slope" method of measuring the velocity of starch hydrolysis in the presence of amylase is described. The effect of starch concentration upon reaction velocity has been investigated, using the amylase of germinated barley. The observed relationship is in close

agreement with that predicted by the Michaelis theory. The relationship between initial reaction velocity and enzyme concentration has been found to be linear over a wide range of enzyme concentration. C.

Amylase: Effect of pH on Activity. A. Oparin and A. Kurssanow. *Biochem. Z.*, 1932, **256**, 190-195.

Experiments are described which show the effect of varying *p*H on the activity of amylase. Within the limits 3·5 to 6·2, the altered activity of the amylase is only connected with the physical changes in the substances added. Further deviations either in the acid or alkaline region, however, produce changes which are accompanied by an irreversible loss of activity to the ferment. C.

***Aspergillus* Moulds: Influence of Zinc on——.** R. A. Steinberg. *Brit. Chem. Abs. A.*, 1932, 1168-1169 (from *Zentr. Bakt. Par.*, 1932, II, **86**, 139-142).

The rôle of zinc as an essential nutrient rather than a stimulant is emphasised. C.

Mould Fungi: Respiration. H. Tamiya. *Brit. Chem. Abs. A.*, 1932, 1167-1168 (from *Acta Phytochim.*, 1932, **6**, 227-263, 265-304).

The gaseous exchanges of *Aspergillus oryzæ* and of other moulds during rest and in the presence of various carbon-providing substrates were investigated. The *R.Q.* is proportionately > or < the combustion quotient (*C.Q.*) of the substrate, according to whether the value for the *C.Q.* is > or < approximately 0·875, a value equal to the *C.Q.* of the mould constituents taken as a whole. Thus the differences recorded depend on the increased or decreased provision of carbon dioxide and oxygen together with the effect due to growth and variations in metabolism. Various theoretical concepts of the energy exchange are applied to moulds utilising different substrates as a supply of carbon. The energy resulting from respiration during vital synthesis appears to be mainly utilised for (*a*) the maintenance of enzymic and structural energy, (*b*) replacement of heat loss during certain stages of synthesis, and (*c*) the activation of the substrate necessary for acceleration of the velocity of the reactions during synthesis. C.

***Penicillium* Moulds: Metabolism.** P. W. Clutterbuck, A. E. Oxford, H. Raistrick, and G. Smith. *Biochem. J.*, 1932, **26**, 1441-1458.

The metabolism of 15 species or strains in the *Penicillium brevi-compactum* series has been examined, and mycophenolic acid, $C_{17}H_{20}O_6$, together with four new mould metabolic products of the formulæ $C_{10}H_{10}O_5$, $C_{10}H_{10}O_6$, $C_{10}H_{10}O_7$, and $C_8H_6O_6$ have been isolated. The best yields of mycophenolic acid are obtained by using cultures freshly isolated from natural sources. After keeping for a long time in artificial cultivation, such cultures tend to lose their power to form mycophenolic acid, but do not lose their power to form the products of smaller molecular weight. The grouping on morphological grounds of these species in one series is therefore supported by their biochemical characteristics. C.

Cellulose Acetate: Solubility. I. Sakurada and S. Lee. *Kolloid Z.*, 1932, **61**, 50-54.

The article discusses the possibility of cellulose acetate dissolving molecularly in organic liquids. The work of Staudinger is criticised, and experimental results are given which show that his simple viscosity formula is not applicable to naturally organised substances without further investigation. C.

Coal Tar Carcinogenic Hydrocarbons: Isolation. J. W. Cook, C. Hewett, and I. Hieger. *Nature*, 1932, **130**, 926.

Three hydrocarbons have been isolated from coal tar which have not previously been recognised as coal tar constituents. One, 1:2-benzpyrene, is much the most actively carcinogenic hydrocarbon known. The others are perylene and 4:5-benzpyrene, isolated from coal tar pitch, and 1:2-benzanthracene from the chrysene fraction of coal tar. C.

Cellulose Esters: Swelling. I. Sakurada. *J. Soc. Chem. Ind., Japan*, 1932, **35**, 500B-503B.

A table records the swelling power of 2*M* solutions of various organic solvents in benzene for cellulose triacetate. The active agents are those with large dipole moments. Cellulose triacetate, acetone-soluble acetate, and nitrocellulose fall in the same increasing order of ease of swelling (or solution) for each of ten common solvents, showing that their individual properties are not of much moment in

respect of the phenomena concerned. Chloroform appears to be a solitary exception seeing that it readily dissolves the triacetate but not the other two esters. C.

Cotton Cellulose : Rate of Moisture Sorption. S. Oguri. *J. Soc. Chem. Ind., Japan*, 1932, 35, 507B-515B.

The sorption of water vapour by cotton cellulose under constant pressure and temperature proceeds in two stages at least. The velocity of sorption in each stage is expressed fairly well by Lagergren's equation $dx/dt = k(x_\infty - x)$ where x and x_∞ denote the amount of water adsorbed at time t and at equilibrium respectively, and k is a constant. C.

Fibres and Films: Action of Water on Fine Structure. F. Rinne. *Kolloid Z.*, 1932, 61, 304-308.

The loosening of fine structures by water is caused by its high dielectric constant and a corresponding weakening of the electrochemical fields. Experiments were carried out on bromophenanthrene sulphonic acid, which can be brought from the crystalline state into a paracrystalline condition by increasing imbibition of water. The occurrence of myelin fibres of cerebrosides and phosphatides from spheroliths under the influence of water is demonstrated. High water content is stated to be the cause of the chemical lability of the organic plasma. C.

Films and Fibres : Colloid Dimensions. W. Ostwald. *Kolloid Z.*, 1932, 61, 136-140.

A general discussion is offered of the colloid structure and dimensions of films and fibres. A table is given of the various states of discontinuity of matter, and examples of each state in each size are mentioned. Another table shows the dimensions of bodies with volume of 1 cc. when in various states of laminar and fibrillar deformation. Examples are given of solid, liquid, and gaseous films and fibres. C.

Colour : Measurement. T. Smith. *Sci. Abs. A.*, 1932, 35, 1047 (from *Trans. Opt. Soc.*, 1931-1932, 33, 214-227).

The meanings to be assigned to the symbols =, +, and − in a colour equation, and the extent to which elementary algebraic manipulation is permissible, are considered. The nature of the colour triangle and of the variables used in colorimetry are discussed. C.

Trichromatic Colorimeter. R. A. Houstoun. *Sci. Abs. A.*, 1932, 35, 1047 (from *Trans. Opt. Soc.*, 1931-1932, 33, 199-208).

The design and construction of the instrument are described. It is on a new principle, the intensity of the comparison field being altered by an iris diaphragm, and the colour by moving a magenta-yellow and a blue-magneta filter relatively to one another. Results are given. C.

Dust, Smokes, Mists, and Fogs : Differentiation. (1) W. E. Gibbs and (2) S. C. Blacktin. *Chem. and Ind.*, 1932, 1042-1043, 1077-1078.

(1) Gibbs offers some criticisms of Blacktin's scheme for classifying dust, etc. on a principle of ilfe tendency of the particles and suggests a somewhat similar classification according as to whether the aerosol is formed by disintegration or condensation. (2) Blacktin's reply. C.

Colorimeter : Application. C. Frick. *Chem. Fabrik*, 1932, 5, 481-484.

A source of error in colorimetry is discussed which is caused by the varying adaptability of the eye of the observer. Experiments with liquids of different colours and with various sorts of lighting show that the error is least in green liquids. The use of a projection apparatus permitting simultaneous reading with both eyes is highly recommended. C.

Membranes : Physical Properties. E. Manegold. *Kolloid. Z.*, 1932, 61, 140-160.

The general nature of membranes is discussed, and a classified table of laminar forms is given. Hollow space structures are divided into canal, framework, and lattice structures, and the characteristics of each are shortly described. A modification of Malfitano's method for preparing a membrane is described with a diagram, together with a method for studying the permeability of membranes. Calculations for the various properties are given. C.

Membranes : Equilibrium Conditions. F. P. Donnan. *Kolloid Z.*, 1932, 61, 160-167.

Previous work on membrane equilibrium is shortly discussed, and some points concerning the author's theory are explained with examples, particularly drawn from biology. C.

Fibrous Crystals: Forms of Aggregation. H. W. Kohlschütter. *Kolloid Z.*, 1932, 61, 270-280.

A general review with extensive bibliography on the formation of fibrous and other crystals of metals, minerals, organic liquids, and inorganic compounds. Diagrams are reproduced and the causes of the phenomena are discussed. C.

Chemistry of Mildew. I—Chemical Factors in Growth of Fungi and their Environment. II—Chemical Effects and Damage on Textile Fibres and Fabrics. III—Chemical Prevention of Mildew. A. A. Cook. *Amer. Silk J.*, 1932, 51, No. 8, 34-36, No. 9, 34-37 and 47, and No. 10, 35-38.

I—The principal factors influencing the growth of fungi are reviewed.

II—The available information on the attack of the various textile fibres by mildew and the methods for detecting and estimating the damage are summarised. Silk fibroin seems to resist weakening by mildew, but moist, softened sericin affords an excellent food supply for many fungi.

III—The literature relating to chemical mildew preventatives is critically reviewed. S.

The Iodine Content of the Thyroids in Sheep and Cattle in Chile. B. Blanco. *Anal. quim. farm.* (Chile), 1931, 1, No. 1; and *Rev. sudamericana endocrinol. inmunol. quimioterap.*, 1932, 15, 790-791 (through *Chem. Abs.*, 1933, 27, 329 W

The Laws of Swelling. J. R. Katz. *Trans. Farad. Soc.*, 1933, 29, 279-300.

A critical discussion of the phenomenon of colloidal swelling and the laws which are entailed. The phenomenon is characterised under three headings which are defined and studied, namely, intermicellar, intramicellar, and permutoid. The cases are differentiated with the aid of X-ray analysis. The heat of inbibition and volume contraction, and also the mechanical properties of the solid before and after swelling, are discussed fully. The paper constitutes a complete and thorough review of the subject. *Discussion*—J. B. Speakman pointed out that the swelling of wool was mainly intermicellar, but that all three forms of swelling were present. G. F. Davidson suggested that the difficulty of definition of the true volume of a solid could be obviated by making specific volume measurements with helium as immersion medium. This had been successfully applied to wood. W. W. Barkas also discussed the specific volume of wood. Mr. Miles raised the matter of nitrocellulose and pointed out that in acetone-water both intramicellar and permutoid swelling occur. He referred to X-ray data in support. H. Staudinger said that synthetic products of well-known molecular structure, such as polystyrols, had yielded results showing that swelling phenomena increase with increase in the degree of polymerisation. (Paper read at a General Discussion on the Colloid Aspects of Textile Materials and Related Topics, Sept. 1932.) W.

Protein Structure and Protein Hydration. D. J. Lloyd and H. Phillips. *Trans. Farad. Soc.*, 1933, 29, 132-148.

The hydration of proteins in water is due to the co-ordination of water molecules with the oxygen, nitrogen, and hydrogen atoms of the hydroxyl, carboxyl, amino, amido and, to a lesser extent, the imino and keto groups. Water-soluble proteins contain high proportions of the residues of serine or other hydroxy acids, lysine, arginine, and proline. At the iso-electric point, protein molecules carry an equal positive and negative charge. Salt formation, between adjacent protein molecules, and between oppositely charged groups of the same molecule, will not lead to hydration owing to the equal size and valency of the two ions involved. In acids and alkalis, the two ions of the protein salt produced differ enormously in valency, size, and the readiness with which they hydrate. This leads to increased hydration by the orientation of water molecules around the charged centres in the protein molecule. Acid-soluble proteins contain the residues of lysine, arginine and, to a less extent, histidine. Alkali-soluble proteins contain the residues of aspartic and glutamic acids and, to a less extent, the amides of these acids. The hydration of protein molecules in solutions of neutral salts is promoted because the protein molecules become associated with the small ions of the salt. If protein ions exist in a system under restraint while other ions are freely diffusible, a Donnan equilibrium will also affect the distribution of the water. Solubility and hydration of proteins is greatly affected by the closeness of packing of the molecules into organised structures with cross linkages between the molecules. Cross

linkages involving co-valent bonds will be more resistant than those involving electro-valent bonds. Fibrous proteins, particularly those with a preponderance of residues of the short chain aliphatic amino acids are the most resistant to solvents. With the development of oriented structure in proteins, a stability range towards hydrating influences appears. This range extends from about *p*H 4 to 8. The *p*H value at maximum hydration in acid solutions moves continually to a lower figure as the protein structure becomes more and more fibrous in character. The *p*H of maximum osmotic hydration in alkaline solutions becomes greater under the same conditions. W.

A Sensitivity-control for the Lindemann Electrometer. L. G. Grimmett. *Proc. Phys. Soc.*, 1933, 45, 117-119.

A circuit is given for varying the sensitivity of the Lindemann electrometer by means of one adjustment only. W.

Action of Dyestuffs on Enzymes. III—Urease. J. H. Quastel. *Biochem. J.*, 1932, 26, 1685-1696.

The action of 23 dyestuffs on urease, prepared from soya bean and jack bean, has been investigated. Acidic dyes are entirely inert, but most basic dyes are toxic. The triphenylmethane series of basic dyes is highly toxic to a soya bean preparation of urease, brilliant green being toxic at a concentration of 1/1,000,000. This toxicity diminishes and may disappear at low concentrations on purifying the urease preparation. The toxicity of other dyestuffs such as Janus green or neutral red increases with increased purification of the enzymes. The unsaturated glycerides (especially linseed oil) which are present in soya bean oil greatly enhance the toxicity of the basic triphenylmethane dyes towards purified urease. It seems that the unsaturated glycerides act as highly specific mordants between urease and the basic triphenylmethane dyes. Urease is protected from the toxic action of dyes by such substances as urea, α-amino-acids, sarcosine, ethylenediamine, methylamine, dimethylamine, hydrazine, and hydroxylamine, the combining group of the protective substances being either a basic amino-group or imino-group. Trimethylamine, betaine, urethane, methylurea, diethylurea, oxamic acid, etc., are without effect. Combination of α-amino-acids, basic amines, etc., takes place reversibly at acidic or negatively charged groups which constitute either wholly or partially the active centre of urease. Basic dyes appear to combine with these groups irreversibly. Urea is combined at these groups, activation of the molecule then occurring. Potassium cyanate protects urease from the action of brilliant green, but ammonium carbamate has little or no effect. This is evidence for combination between cyanic acid (but not carbamic acid) and the enzyme, and supports the contention that cyanic acid is produced from urea by urease. (Parts I and II of this work appeard in *J. Text. Inst.*, 1932, A354.) W.

The Photo-activity of Clothing Stuffs and Building Materials after Exposure to Ultra-violet Rays. K. Otsubo. *Fukuoka-Ikwadaigaku-Zasshi* (*Fukuoka Acta Med.*), 1932, **25**. [In Japanese. German summary 135-136.] (Through *Bull. Hygiene*, 1933, 8, 158.)

It is well known that certain foods when exposed to ultra-violet rays acquire antirachitic properties and the author has made various experiments to determine whether any change occurs in clothing stuffs and building materials by exposing them to these rays, and whether such materials have any effect on living processes.

Various clothing materials of cotton, wool, hemp, silk, artificial silk and wool were tested and only silk was found to become photo-active. The experiments were made on rabbits and guinea-pigs. It was found that cotton wool would become active if it was coloured with a 0·5% watery solution of Methylene Blue or Indigo.

Among building materials almost all kinds of wood, Japanese rush matting, linoleum, cork mats, and nine kinds of marble were found to become photo-active, whilst bricks, cement, Japanese roofing tiles, slates, granite, clay and earth remained inactive. The degree of this photo-activity depends on the method and length of exposure and its nature is not yet clear. If articles which have been rendered photo-active are placed in a vessel of glass permeable to ultra-violet rays the activity is lost. It seems possible that this photo-activity is not due to radiations, but to some substance which is given off in a gaseous form and can be extracted by ether from the rayed materials. In his experiments on the effects of photo-active materials on the living processes the author used rats and small beans.

A number of rats were placed singly in boxes with double walls of netting and fed on insufficient food. Some of the boxes were covered with silk or cotton wool coloured with Methylene Blue or Indigo, some of which had been exposed to Ultra-violet rays and some not. It was found that the length of life of the animals covered with the photo-active material was longer than that of the animals not so covered and that the ratio was 13 to 6.

Small red Japanese beans were allowed to sprout in a dark room and some were covered with photo-active materials. It is well known that ilght inhibits the growth of young plants and here it was found that the growth was inhibited by the photo-active material. There is no doubt that there is some substance at present unknown which has a considerable influence on the living processes of animals and plants. H.

10—ECONOMICS

Cotton Goods: Wholesale and Retail Prices. (1) Sir Amos Nelson. (2) A. P. Besley. *Text. Weekly*, 1933, 10, 528-529, and 553-554.

A report of a debate. Sir Amos Nelson gave figures to show that he receives only 1⅞d. per yard for weaving a high-class cotton cloth, whereas the converter gets 1½d., the merchant 2d., and the retailer 5¼d. Besley replied by giving details of the services rendered by the retailer to account for the charge and stated that a Government inquiry has revealed the fact that average distribution costs in England work out at 23%, which is lower than the figure for other countries. Of this 23%, wages absorb 55% and rent and rates about 6%. C.

Cotton Trade Index, November 1932. W. H. Slater. *Text. Weekly*, 1932, 10, 415.

During November 1932, when the sterling exchange value depreciated 32·8% below the 1913 level, the general level of prices showed only an increase of 1·1% on the same basis, whilst cotton trade prices were actually ½% down. A table is given of index numbers of cotton trade prices. C.

Cotton Trade Indices, 1932. W. H. Slater. *Text. Weekly*, 1933, 10, 519-521.

Statistics for 1932 are given showing that prices in Great Britain have mostly been held stable around the 1913 level. The index for "All cottons" was 96·0 and of "All commodities" 101·5, compared with 100 for 1913. C.

Lancashire Cotton Industry: Economics. E. M. Gray. *Text. Weekly*, 1932, 10, 253-254, 333-334, and 491-492.

The history of the depression in the Lancashire cotton industry is outlined, and its causes analysed with the help of relevant statistics. C.

Japanese Rayon Industry: Progress. S. Makishima. *J. Soc. Chem. Ind., Japan*, 1932, 35, 487B-490B.

The rayon industry in Japan has made extremely rapid strides and is third on the export list after silk and cotton. Ten rayon companies are operating, one by the Bemberg process and the rest viscose, and more may be formed in the future, the total paid capital now amounting to 50 million yen. Tables of statistics are provided. C.

German Pulp Industry: Economics. K. Eisemann. *Dissertation*, Heidelberg, 1930, pp. 88.

This dissertation is a comprehensive review of the German pulp industry. Subjects treated are—the manufacture of pulp of various kinds, production of pulp in Germany before and after the war, the reserves of raw material in Germany and abroad, financial problems of the industry, the relation of the pulp industry to other main industries of Germany, and the importance of pulp in world commerce. C.

Kilo-man-hour Costings System: Application. L. P. Alford and J. E. Hannum. *Mech. Eng.*, 1932, 54, 821-824 and 878.

Two papers on the kilo-man-hour system of analysing manufacturing operations are reviewed. The system is based on the theory of control of rates, that is, if the rates of expenditure for labour, material, and expense factors of production are controlled, the total expenditure is controlled, The base of the rates, or denominator in the principal ratios, is 1,000 man-hours, or "k.m.h." Tables of figures are given for various industries. These include the following for textiles, the data referring to the year 1925—

Selling values in dollars per k.m.h.—Yarn and thread, 548; knitted underwear 1,115; cotton fabrics 1,320 (wages 273 dollars per k.m:h.); rope and twine 1,330; hosiery 1,390; knitted sweaters 1,447. C.

American Cotton Spinning Industry: Competition. E. G. Field. *Cotton (U.S.)*, 1932, 96, No. 12, 32-33.

The writer seeks to show the evils of over-competition in the American cotton industry, and urges co-operation between mills. Some statistics relating to "active spindles" are given. C.

Chinese Cotton Spinning and Knitting Industry; State of——. *Int. Cotton Bull.*, 1933, 11, 256-263.

A report of the state of the cotton industry in Kiangsu province (including Shanghai). An account is given of the types of machinery used and their origin. Medium grade American cotton, and Indian cotton, are the only kinds imported. Fair progress has been made in yarn output. Statistics are given for the market for yarns, and a short account of the knitting industry is appended. C.

The Wool Situation and Outlook. H. M. Stoker. *Farming in S. Africa*, 1933, 8, 5.

The world statistical position of wool is reviewed, and especially the wool producers' outlook in South Africa. Improvement in conditions is indicated, in that general price levels have ceased to recede since the middle of 1932. W.

A German Reply to the British Industries Fair. *Deutsche Leinen-Industrielle*, 26th January 1933.

Considerable concern has been felt in Germany at the increasing attractiveness of the textile section of the British Industries Fair to foreign buyers, and several German visitors have returned from London with the conviction that it is necessary for the German textile industry to counter-attack without further delay, if they are not to run the risk of losing their foreign customers. The German textile industry is, accordingly, organising this year a special textile section of the Leipzig Fair, which is to be developed in following years and which, it is hoped, will divert the stream of buyers from the textile section in London. L.

11—INDUSTRIAL WELFARE, INDUSTRIAL PSYCHOLOGY, AND EDUCATION

Does Cancer of the Lung Occur among Chromium Workers? K. B. Lehmann. *Zent. f. Gewerbehyg. u. Unfallverhütung.*, 1932, 19, 168-170 (through *Bull. Hygiene*, 1933, 8, 131).

The author was asked to express an opinion on two cases of "probable cancer" of the lung which had occurred some years before simultaneously in a large chromium works. This led him to make a thorough investigation of the literature on chromium poisoning in factories and, finding no mention of lung cancer, he concludes that these two cases are exceptional, even if they were cancer. His investigations showed that of recent years there has been an increase in the cases of cancer of the lung. This can be largely attributed to improved methods of diagnosis and keeping statistics, and also to more persons reaching the cancerous age. To-day in many parts 15% of the deaths from cancer are due to cancer of the lung. Chromium may act as a chronic irritant of the lungs, but no certain case of cancer resulting had come to the author's knowledge up to June 1932. H.

Human Anthrax in Katanga. P. Brutsaert and P. Reyntjens. *Bull. Med. de Katanga*, 1932, 9, 93-95, 97-100, 103-104, and 106 (through *Bull. Hygiene*, 1933, 8, 135).

Though anthrax in animals has been known to exist in Katanga for some time, these three cases of malignant pustule are put on record as the first reported there in man. One was a European who carried out post-mortem examination on an infected ox; the other two were natives. One of these contracted infection from the carcase he was burying; the source in the other patient, who died, was not discovered. The pustule was situated on the neck and infection may have been conveyed by some biting fly. H.

Adult Diseases in an Industrial Population. R. V. Ward. *Canadian Pub. Health J.*, 1932, 23, 420-428 (through *Bull. Hygiene*, 1933, 8, 101).

The results are reported of an analysis of sickness records dealing with 1,200 women employed in industry, and some 2,100 men. The records deal with the number of days of sickness absenteeism, rather than with the number of cases. The age distribution of the men and the women as usual was very diverse, since

over 87% of the women, but only 44% of the men were under age 30. Throughout the three years investigated, 1929 to 1931, the percentages of working time lost on account of sickness by the women exceeded that for men. When analysed by season, peaks were found to occur during January and February, with falls to a minimum in the late summer and early autumn.

When the cases of sickness were considered, minor respiratory diseases were found to stand easily first, accounting for 27·6% of the total for women, and 22·9% for men. For the women minor digestive disturbances came second, with 12·8%; but this cause only claimed 7·1% for the men. Having regard to the fact that 11·3% of the female lost-time was due to dysmenorrhoea, the high percentages claimed by respiratory and digestive troubles are notable. In both groups tuberculosis claimed just over 9%. Naturally, the causes of lost time among the much older group of men differed considerably from the younger group of women; here arthritis, gout, and lumbago are found claiming 9·7%, and heart disease 6·9%. The industrial population considered were all cared for medically with a nurse on duty all day, and a physician for part of the day, at the factories concerned. This analysis indicates in what direction the activities of the medical services provided should be directed. H.

Vision in Industry. J. Pike. *J. Roy. San. Inst.*, 1932, 53, 261-267 (through *Bull. Hygiene*, 1933, 8, 102).

A number of investigations in recent years has been made into the use of vision in industry, which are scattered in many different publications. The author usefully brings together all the work, and shows how it interlocks. He deals with the reactions of the eye to radiations, and with the injuries which originate from flying particles. Both of these risks can be obviated by the use of suitable goggles. Next the visual requirements of special occupations are discussed; here colour perception becomes of great importance, and its absence should be a bar to certain employments. In other industries calling for fine visual perception, visual assistance can be rendered by various devices, such as suitable magnifying binocular lenses, associated with an amply sufficient illumination. Spectacle wearers are more likely to have normal vision than the "unglassed," since human vision was not evolved for the close work of modern occupations. Correction of visual aberrations is an important consideration for the avoidance of accidents. H.

Diseases of the Eyes caused by the Use of Nitro-lacquers in the Straw Hat Industry. E. Kruger. *Arch. f. Gewerbepath. u. Gewerbehyg.*, 1932, 3, 798-807 (through *Bull. Hygiene*, 1933, 8, 108).

The straw hat industry in Germany is a seasonal one, beginning with early winter and lasting several months. The author made observations on 17 workmen employed in the finishing room of a straw hat factory in the 1931 season and found that 11 of them complained of a burning sensation in the eyes, a feeling as of a foreign body in the eye, lachrymation, photophobia and of the lids sticking together first thing in the morning. There was noticed conjunctivitis with swelling of the lids. In three cases the cornea was involved and had a punctate appearance. The lacquer used consisted of a mixture of nitrocellulose, spirit and shellac, butylacetate and butylalcohol (Butanol). For the finishing process the hat is drawn over a heated block and in consequence when the lacquer is applied it evaporates very quickly. The men have to bend forward and in consequence their faces are exposed to the vapour. The finishing rooms in Germany are often cellars which are quite unsuitable. The heating of the hat blocks with gas or steam causes the air of the room to be hot with relative humidity and the heat is also increased by the proximity of the drying ovens. Although the use of the special lacquer can scarcely be avoided, much can be done to improve the hygienic conditions of the workrooms. This work should only be done in large lofty rooms with good air supply and exhaust ventilation. H.

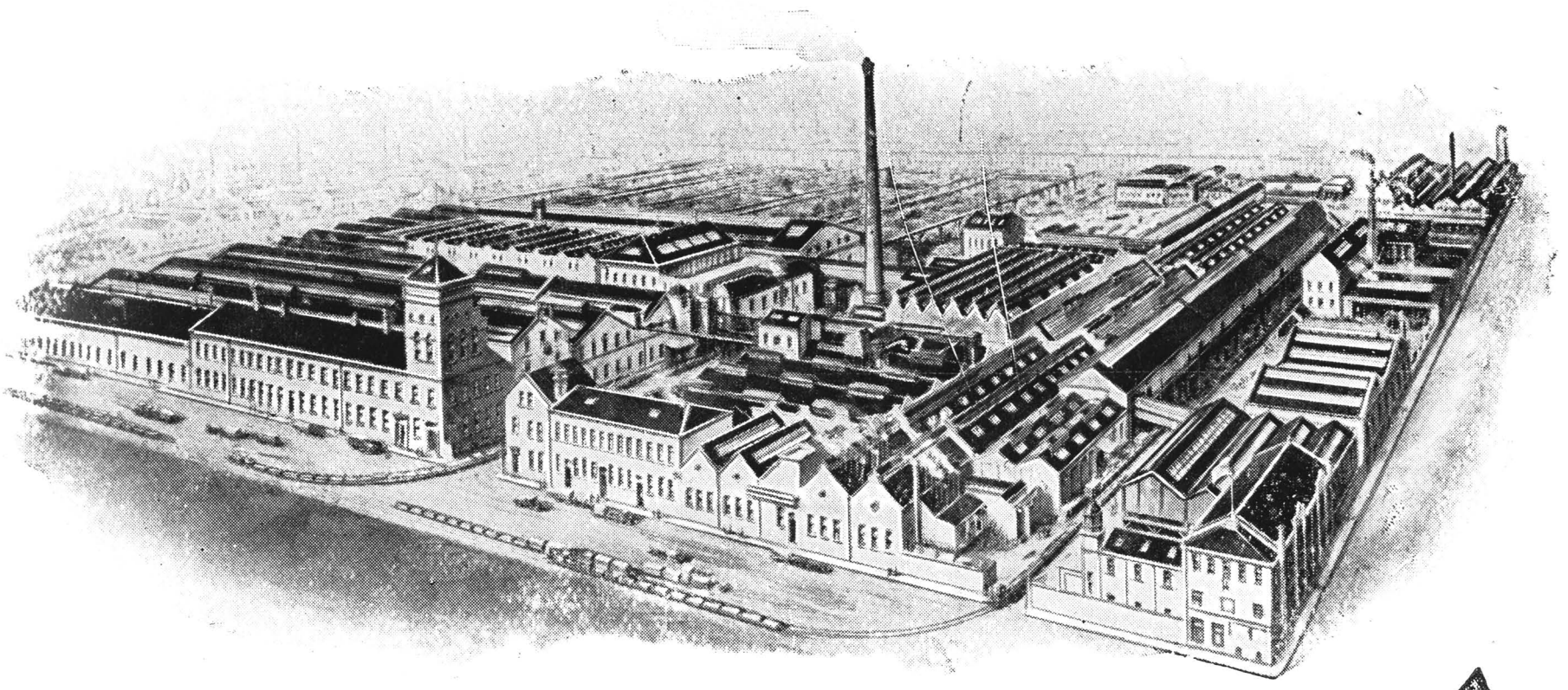
NOTES—In the references to publications abstracted the name of the publication is followed by the Year, Vol., Issue No., or Date if necessary, and Page No. (or Nos.).

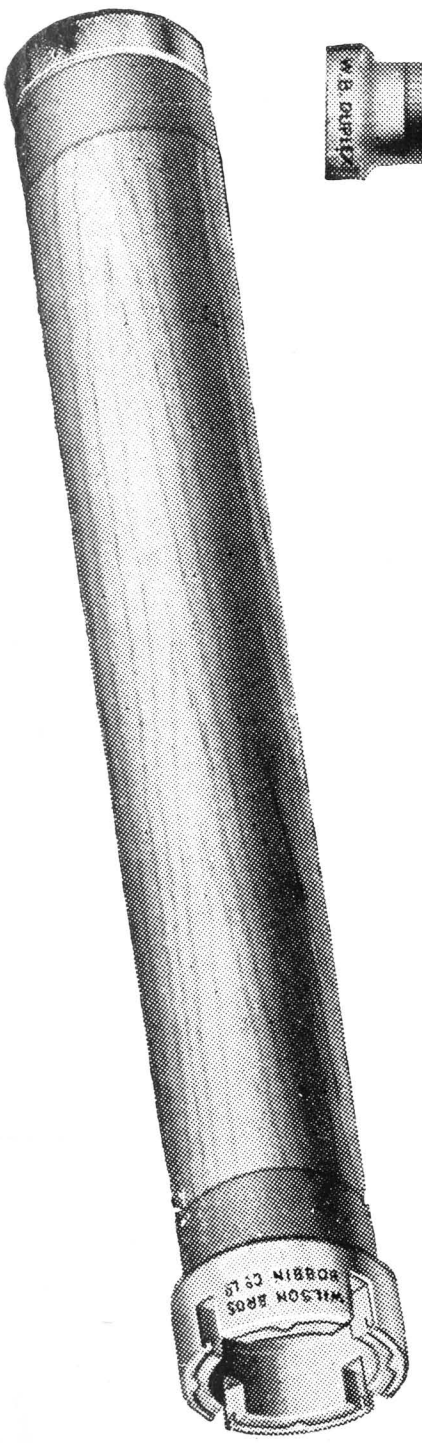
Literature relating to the composition and manufacture of dyestuffs is not dealt with in the abstracts of this *Journal*.

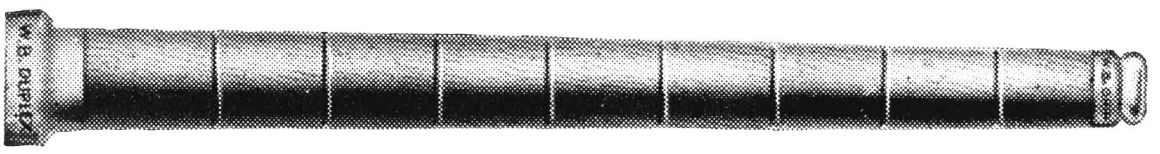
BOBBINS and SHUTTLES

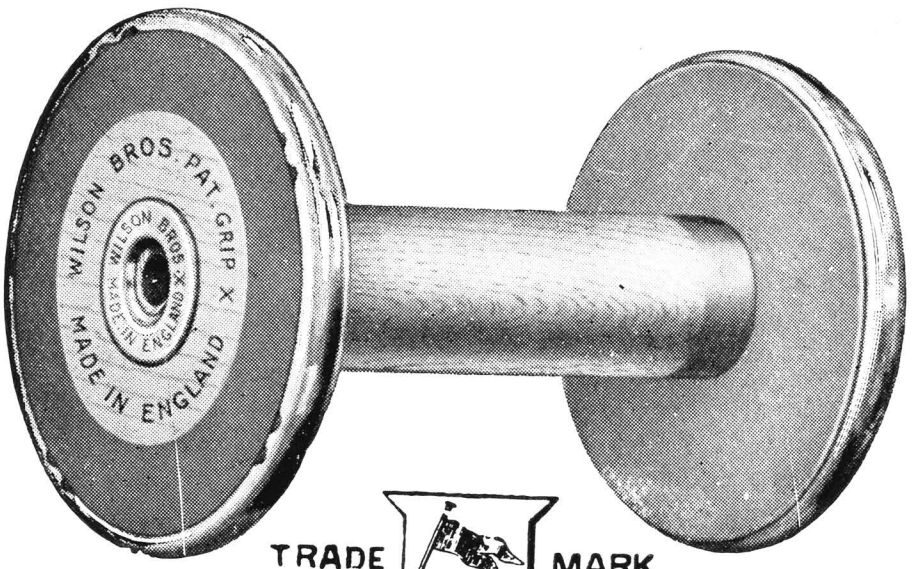
FOR THE

TEXTILE TRADE









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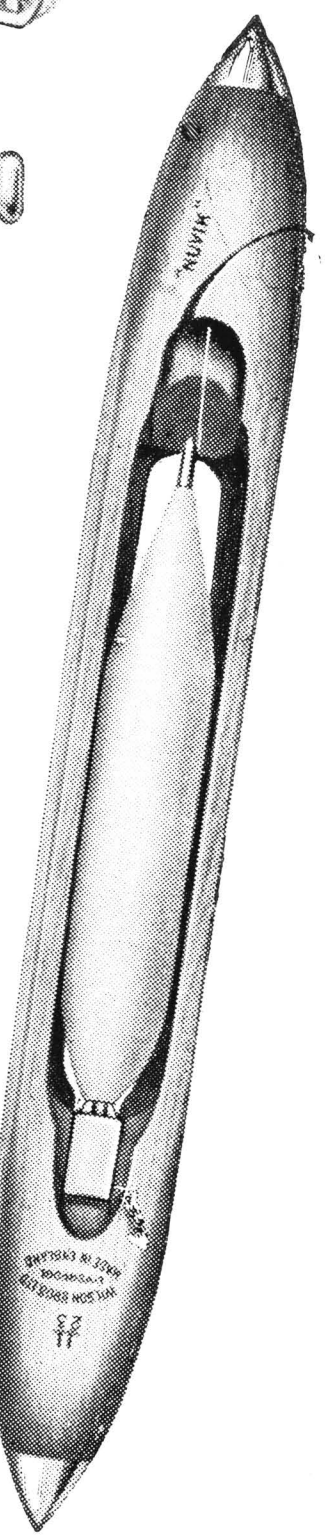

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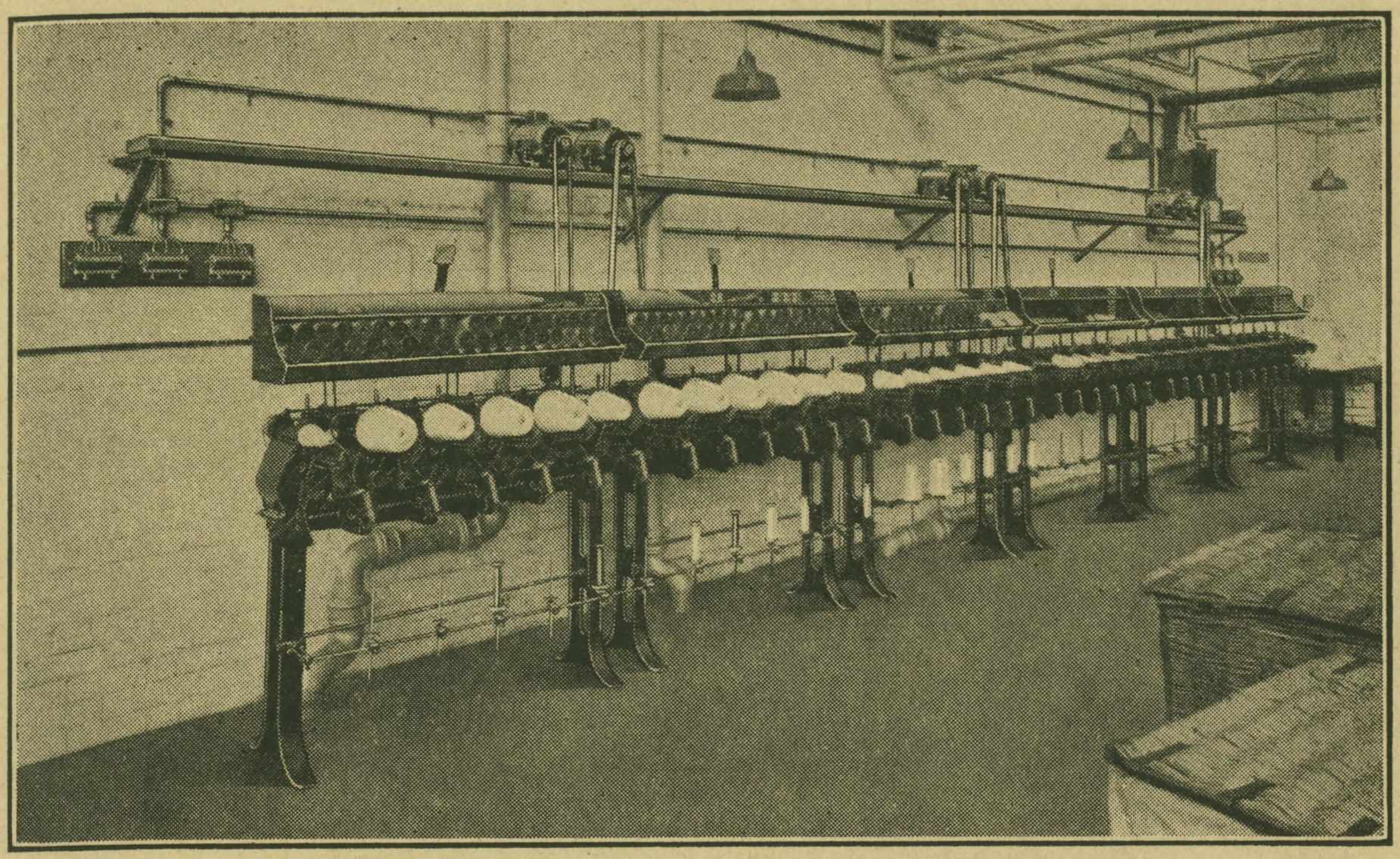

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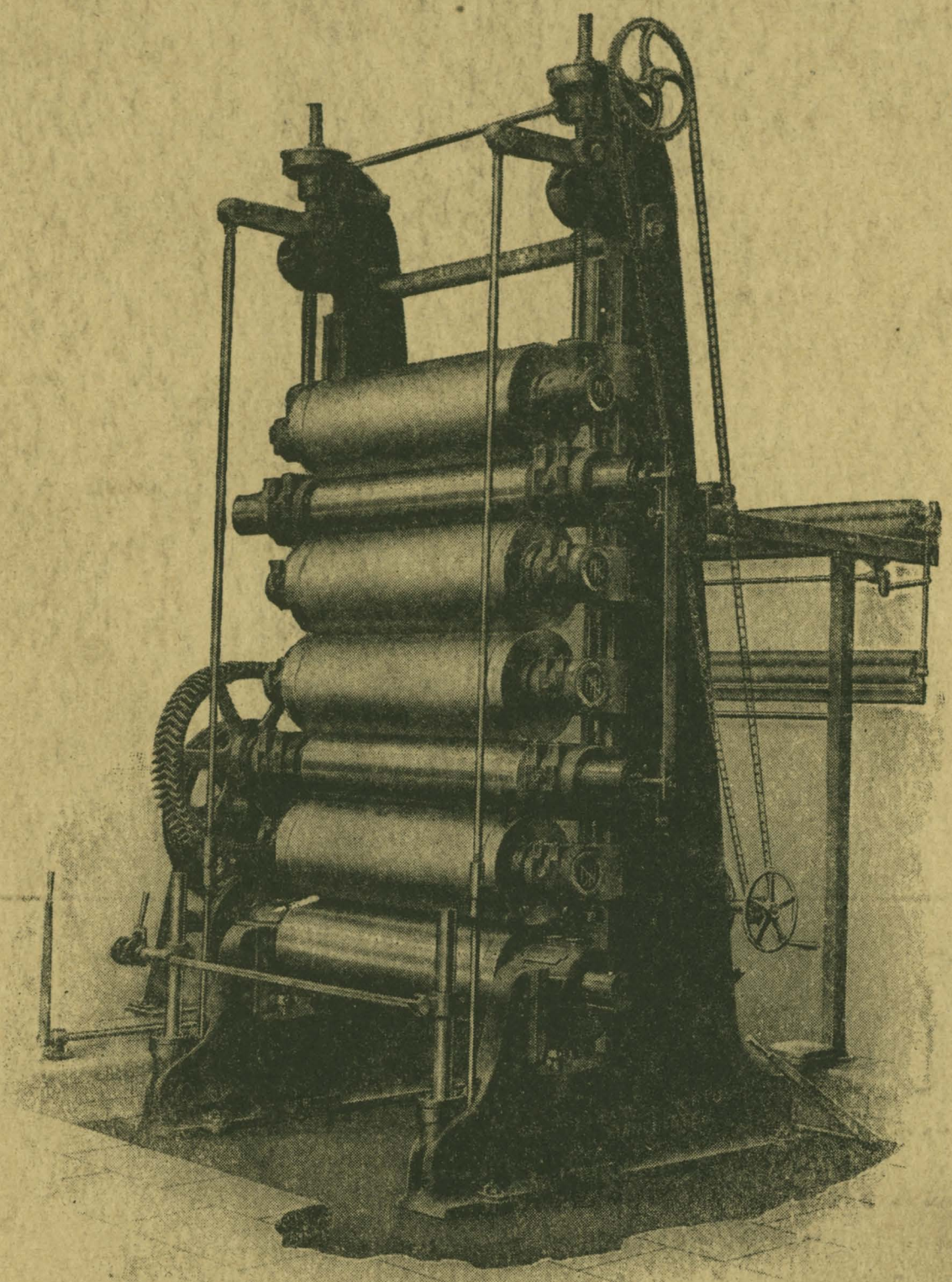

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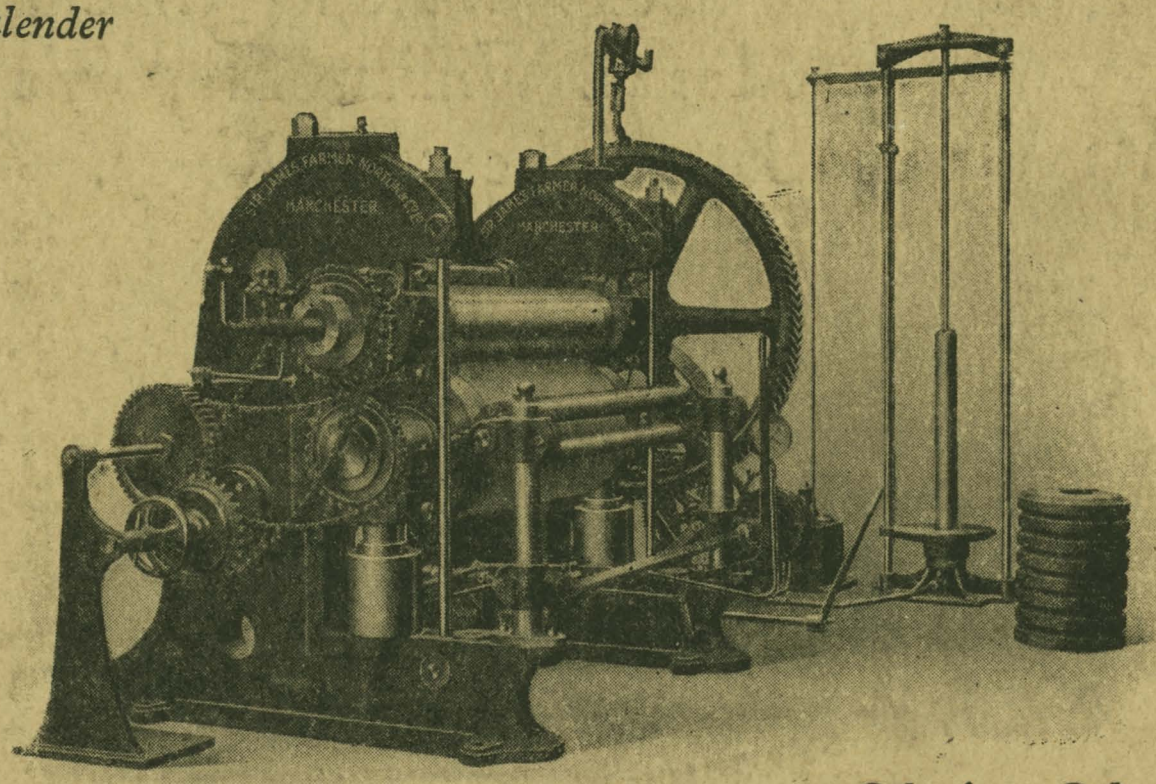

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