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Some Remarks on Patents and Textiles

By W. A. Silvester

(Paper delivered to the Lancashire Section, 9th July, 1944).

About 4\(\frac{1}{2}\) years after the beginning of World War I, the late Lord Marks (then Sir G. C. Marks) lectured to the Textile Institute on patent law and the then pending amendment of the British law. Lord Marks included in his lecture a compact comparison of British, French, German and U.S.A. law and practice, saying about Germany that the novelty search is most rigorous and the German patent is frequently considered as being a kind of hallmark of originality.

In a short talk it is not possible to deal with more than fragments of a theme. Especially for a person with little more than an average household's knowledge of textiles and little experience of patent dealings on mechanical inventions it would be presumptuous to do more than refer respectfully to this lecture of 25 years ago; intervening amendments of patent laws have hardly touched the main differences between the countries discussed.

Lord Marks also remarked that "scientific men, strictly so-called," have had little to do with the great basic inventions of textile factory practice. Perhaps even nowadays mechanical inventions are not made by "scientific men, strictly so called"; but chemical inventions in or related to the textile industry are, by their nature, less and less likely to be made by persons other than scientific chemists.

The proportion of chemical inventions is high. This can be seen from any suitable abstracts periodical. The German Patent Office, unlike some other patent offices, provides fairly detailed statistics. Thus, of patents in force in Germany in the 1930 decade there were:

Class 8—Bleaching, washing, dyeing, textile printing, finishing about 2-0\%  
20—Textile fibres ... ... ... ... ... ... ... 0-7\%  
52—Stitching, embroidery ... ... ... ... ... ... 1-0\%  
73—Rope work ... ... ... ... ... ... less than 0-1\%  
76—Spinning ... ... ... ... ... ... about 1-0\%  
86—Weaving ... ... ... ... ... ... 1-0\%

This adds up to about 5 or 6 per cent. of the total patents in force, with a high proportion of chemical inventions. The proportions are nearly the same for applications or patents granted in any one year. Electrotechnology is, in Germany, almost three times more fertile of inventions than the textile industry, and even in non-specialised chemical processes and apparatus there is greater inventive fecundity, by German patent office measure.

Whether or no the proportions are the same in other industrialised countries it can be said, at least, that there is no simple relationship between the size of an industry, as measured by monetary value of output, and the birth-rate of invention therein, as measured by numbers of patents.
This might perhaps be deduced also from a consideration of the nature and flexibility of the plant employed in particular manufacturing operations; and of the relationship between the urge to invent, which must arise, and become manifest in individual persons or small co-operative groups; and of the circumstances in which a conceived invention is reduced to practice in a form sufficient for a patenting programme and is then carried through the periods of scientific and industrial gestation—to use the metaphor of the late Lord Stamp.

To digress no further in an attempt at an analysis of the textile and associated industries it may be said that whereas textile manufacturers may be largely influenced by market and fashion trends, which mainly involve operational variations in existing plant, those whose business it is to supply the machinery and such ancillaries as dyestuffs and sizing, softening, waterproofing, levelling and other agents are differently situated with respect to competitive urge and, particularly, to the flexibility of their manufacturing equipment.

At any one time there are about 90,000 British patents in force. Of these, 38 per cent. are less than five years old, and only 1 per cent. are in their sixteenth and, normally, last year of life. If the proportions in Britain are the same as in Germany, then there are only about 4,500 patents touching the textile industry in force at any one time, and so only about 45 are in their sixteenth year. Correspondingly, somewhat less than 50 first-class (measured by patent life) inventions are made and patented a year in the textile field in the United Kingdom.

Now, of all British patent applications, in the middle 1930’s, about two-thirds were from residents in the United Kingdom and one-third from foreigners. Consequently, one may judge that of the 50 or so first-class textile inventions a year, about 15 are made by foreigners.

On taking the whole of the patenting done, some possibly disturbing features appear. Thus, for sufficiently typical years:

<table>
<thead>
<tr>
<th>Year</th>
<th>Total</th>
<th>U.K.</th>
<th>Germany</th>
<th>U.S.A.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Apps.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1937</td>
<td>36,266</td>
<td>21,940</td>
<td>5,203</td>
<td>3,700</td>
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<tr>
<td>1938</td>
<td>37,963</td>
<td>22,351</td>
<td>5,449</td>
<td>3,412</td>
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<tr>
<td></td>
<td>Grants</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1937</td>
<td>17,614</td>
<td>8,629</td>
<td>3,752</td>
<td>3,204</td>
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</table>

<table>
<thead>
<tr>
<th>Year</th>
<th>Total</th>
<th>U.K.</th>
<th>Germany</th>
<th>U.S.A.</th>
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</thead>
<tbody>
<tr>
<td>1937</td>
<td>57,139</td>
<td>1,030</td>
<td>48,510</td>
<td>1,994</td>
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<tr>
<td>1938</td>
<td>56,217</td>
<td>939</td>
<td>48,241</td>
<td>1,957</td>
</tr>
</tbody>
</table>

Thus, of “home-grown” British inventions, only about 1 in 22 was thought worth a German application and, one may judge, only about this proportion was worth an American application, whereas of German-made inventions, 1 in 9 was thought worth a British application. Even Americans think that 1 in every 16 of their inventions is worth an attempt at a British patent.

It may be added that almost half the Swiss patents are grants to foreigners, mostly German. Thus, in 1936, the grants were to citizens of Switzerland 3,229, Germany 1,919, U.K. 283, and U.S.A. 238. These figures alone give some indication of how much patenting is a home country affair and to what extent language differences are obstacles.

The eagerness to obtain British patents shown by both Germans and Americans is doubtless to be ascribed, at least in part, to the circumstance that the United Kingdom is still the manufacturing hub of the British Empire and the Commonwealth, i.e., of a population of 70 million or so whites and many millions of coloured people. But the British Empire and the Commonwealth are not covered by the British patent. For post-World War II circumstances, perhaps, this feature may need to be borne in mind.
Patenting involves documentary publication. Marketing a novelty involves its being open to imitation, which may be done at sight if the novelty is mechanical in nature, but which may involve a tedious analysis if it is chemical in nature. It is scarcely necessary to discuss these circumstances further and to recite the advantages of a patent system; it is perhaps necessary to emphasize that publication of specifications (and abstracts) involves publication to the whole world, so that opportunity is provided for residents in small countries to pick up printed information and profit therefrom unless there is patenting also in those small countries.

Within the textile industry there are small and large firms; inventors may be men in whom there is a flash of genius once in a while, or members of research teams. The occasional inventor may make a great invention, but unless he is careful he may not gather all the harvest he could from the seed he has sown. He should beware of short cuts to knowledge on the subject. The skilled patent agent will advise on tactics and deal with practice, but patent strategy is best planned by the inventor himself, if he has some knowledge of patent laws.

As one illustration of the need for attention to details the definition of "invention" may be discussed.

The U.K. patent law does not tell anybody clearly what an invention is. It says: "Invention" means any manner of new manufacture the subject of letters patent and grant of privilege within Section 6 of the Statute of Monopolies, and includes an alleged invention, but (Section 38A) in the case of inventions relating to substances prepared or produced by chemical processes or intended for food or medicine, the specification shall not include claims for the substance itself, except when prepared or produced by the methods or processes of manufacture particularly described and ascertained or by their obvious chemical equivalents, provided that in relation to a substance intended for food or medicine, etc."

Contrast this with the Dutch law (translation by Vereenigde Octrooibureaux, The Hague): Art. 1. "Under the name of Patent exclusive rights shall be granted on application to persons who have invented a new article of manufacture, a new process, or a new improvement of an article of manufacture or of a process. Art. 3. An invention is only patentable if it relates to means for obtaining some industrial result. Art. 4. If a patent has been granted for a process for preparing a product, or for an improvement in a process, the patent shall extend to this product, provided it be prepared according to such process or improvement thereof. For a product itself (i.e., a substance), no patent shall be granted."

Out of the jumble of verbosity and historical reference in our law, which also omits a self-sufficient definition of the word "patent," together with a survey of law-court judgments, one legal commentator has defined a manner of manufacture as an artificial operation which is performed on some selected matter and results in a vendible body having a definite useful property or collocation of useful properties.

This is scarcely a clarification. No wonder that in a book review (J. Text. Inst., 1937, 28, p145) it was said that "if there is one lesson to be learnt from this useful little work it is, that danger lies in advancing far into the complexities of Patent Laws without a guiding hand." The reviewer might not have been so pessimistic if British law had been as simply expressed as Dutch law.

Curiously enough, the law of the United Kingdom has not served as a model for the whole Empire. It has served for Australia, but in India "invention" means, unless there is anything repugnant in the subject or context, any manner of new manufacture and includes an improvement, and manufacture includes any art, process or manner of producing, preparing or making an article, and also any article prepared or produced by manufacture.

By South African law, however, "invention" (with proviso as in India) shall mean any new and useful art, process, machine, manufacture or composition
of matter, or any new and useful improvement thereof, capable of being used or applied in trade or industry. Even Palestine can rejoice in a fairly clear definition, whilst South Africa and Canada appear to have taken the American law as a model.

But, to quote no further from Empire laws, nor from those of other foreign countries: there are here two aspects of affairs which deserve attention:—

(1) The British Empire comprises a multitude of separate areas so far as patent laws go, with different patent laws—it is not only on a definition of invention that there are differences.

(2) In some countries in the world the law is easy to be understood, and patent practice is simple and can be inexpensive.

In this country, it is not so. Whether if it were so there would be greater fecundity in patented invention in the textile field generally, may perhaps be debated, but seems a reasonable expectation. One country, Switzerland, not negligible in relation to textiles, has an odd provision, viz., "as excluded from patenting are inventions for obtaining products by the improvement (Veredlung) of raw or worked-up textiles of any kind by processes not purely mechanical, and of such processes so far as they come into consideration for the textile industry."

This is a legal prescription based on domestic economic-political considerations with a long history of debate, but the provision does not hinder invention in the textile field in Switzerland nor prevent Swiss inventors or their assigns from patenting such processes outside Switzerland. Generally speaking, the Swiss appear to be active students of other countries' patent laws; they are driven by circumstances either to export manufactured goods or to export ideas.

Perhaps some re-codification and resultant clarification of our patent law, with further amendment, may come from the deliberations of the Board of Trade Committee now sitting. Perhaps it is a pity that changes in United Kingdom patent law are not immediately followed by corresponding changes in the patent laws of other parts of the British Commonwealth.

DISCUSSION

The Chairman: One point that emerges is that the textile trade of this country only produces fifty live inventions a year. A second point is the frequent reference to the fact that the small firm must get busy! We had this stated in the Mercer Lecture of the Society of Dyers and Colourists, and now these firms are being exhorted to take to patenting. I would like to know whether my interpretation of Mr. Silvester's remarks is correct, viz., that the use of the British Patent Office by foreign applicants is a measure of the value of the British patent when once obtained. The lecturer said that a great many foreign nationals, in proportion, take out British patents. Is that because they value a British patent?

Mr. Silvester: I think it is almost impossible to measure the value of a patent. You cannot get it out of statistics. You can only reckon roughly on the way people stop paying renewal fees, in those countries where there are renewal fees. Renewal fees are fairly high in this country—from £5 for the fifth year up to £16 for the sixteenth year. What impresses me is, that working through an agent, it costs £15 to £20 for a British patent, but if one does not work through an agent it can be done for £6, and then one has two and a half years before the £5 renewal fee is asked for. I think the foreigner, especially if translations are involved, will spend through agents possibly half as much again, that is £25 to £30. It puzzles me that so much is done from the Continent. On the other hand, I think there is something wrong when the proportion going the other way is small, as I see from all the statistics. There was an amusing little German book published a few years ago. It gave an exposition of about 250 abstracts of patents with the author's comments upon them, and very amusing comments they were. The theme of the book was that small firms should grope among foreign patents and see if there was something in them which they had not got and if so, take it.

Dr. Wood: You told us there is no written statement as to what an invention is. Like the British Constitution, apparently, it is not written down. What rules and regulations determine the length of a patent? If you want to prolong a patent after its normal term, are there any Statutory rules governing this?

Mr. Silvester: There is a procedure set out in the Act and you can look up a few cases. Let us distinguish: In the extensions of which a fair number are being granted now, patentees have gone to the High Court for the grant of an extension—it is the
function of the High Court to do that—and pleaded they have lost trade during the war and have lost normal expansion. But also I remember the Hilger case. They put in a petition to extend a patent. I think they were allowed about five years more. This concerned an elaborate piece of physical apparatus of which they said they had made five in sixteen years and that it was very valuable, and they contended they should have a longer term. They might only sell two more, but they got five years on that. The judge considers what is a reasonable return, assuming that there has been a reasonable effort to exploit the invention. But if this reasonable effort is demonstrated and the return has not been reasonable, one gets an extension.

Mr. Chamberlain: Considering the tremendous expansion one hears about in Soviet technology, I should be very interested to know whether there is a Soviet patenting system under the Soviet political system, and also whether the Soviet inventions are patented in this country, the United States and other European countries.

Mr. Silvester: They have a patent law in the U.S.S.R. It can be seen in the U.S.S.R. handbook, published by Gollancz in 1936, I think there has been no substantial change since then. As regards what is an invention and what is the practice of the Patent Office, it is very nearly the German law translated with the further provision that any effective exploitation of all patents is to be done by the State. As regards individual inventors in the U.S.S.R., there is a further possibility; they can apply for an authorship or inventorship certificate—very small fees. Foreigners can get patents in the U.S.S.R. There are provisions for exploitation by the State which are very similar in regard to royalties as our emergency laws for dealing with enemy-owned patents. You will get what royalty the appointed body thinks is reasonable in the case. On paper their system looks reasonable enough. I do not know what the rate of patented invention as distinct from authorship certificates is in U.S.S.R. I have not seen any full statistics as regards Russian inventions abroad. There have been very few in this country. It is curious to see how the figures went up and down in Germany, though in 1938-39 there were still a dozen or so trickling in.

Dr. Wood: Some time ago I was told in connection with patent matters that a legal adviser had said, "what you do not claim you disclaim," in a British patent. On another occasion the same adviser said "you cannot be penalised for inventing something which is better than you knew." Are those two statements antagonistic? At first sight it seems these statements are incompatible.

Mr. Silvester: Let us consider the American patent law which is simple on that point. The specification is a dissertation on the subject. It should contain all the matter that you want to back up your claim. There should be something in the specification on which every claim can rest, then if you do not claim, in one of these particular claims at the end, what you want to claim, so much the worse for you. That is one of the reasons for the multiplicity of American claims, though there are other reasons. In British law the thing has never got crystallised down to such hard logic. There has always been an allowance for the weakness and pliability of language. There is more looseness about the phraseology in British claims. As you can see, no language, and particularly English language, is capable of getting things down with mathematical precision. On the second point, it strikes me there is some indication there as to the impossibility of limiting you by way of language from claiming something that you did not think about. There has been a fair amount of talk about covetous claims but in a great many instances covetousness was not present at the start but was due to the fact that one must use general terms in order to get the idea down. You are forced to use a generic term because there is no other term open to you, and yet it may not involve covetousness.

Mr. Simcox: There is one question I would like to ask: in the United States particularly, there are said to be certain monopoly concerns which are interested in buying up patents and suppressing their use because, should such patent inventions come on the market they could render a lot of existing machinery obsolete. If that is a fact, does it not reflect badly on the whole patent system? Does it not defeat its own object?

Mr. Silvester: That's a grand point! It bobs up in a book, "Germany's Master Plan," which is having a vogue at the present time. It bobs up, too, in Professor Bernal's "Social Function of Science." I do not think there is anything in it as a general allegation. Anyone who wants details can get them from an official publication by Professor Hamilton on curious American practices.

Dr. Wood, proposing a vote of thanks to Mr. Silvester for his address, said: I gleaned from Mr. Silvester's talk, that apparently the German Patent Office is not under the control of Goebbels, and is a truthful organisation. Mr. Silvester has given us a very good account of the excellence of the German Patent Office. There is another point of praise for the German office I would like to give. When anybody goes down to the Patent Office in London, it is very easy to find German specifications. They are all classified in duplicate, one set numerically, and one set in subject categories, but British specifications take an enormous time to trace. There is room here for improvement. I have much pleasure in proposing a hearty vote of thanks to Mr. Silvester. This was carried.

Mr. Silvester, in acknowledging the vote, said: I think the Dutch Patent Office is as good as the German.
SOILING OF UNION FABRICS.

By C. S. Whewell, K. H. Messina, and A. Selim

The value of a particular fabric for use as outer clothing is determined by a number of factors, of which appearance, handle, durability, and the ease with which it will be soiled during wear are important. Fabrics which soil easily are unsatisfactory unless dyed in dark shades, and even then they need to be dry cleaned frequently. It is common knowledge that fabrics of different composition, structure or finish, show varying degrees of resistance to soiling, but very little information has been published. The present investigation was therefore undertaken to examine the relative ease of soiling of fabrics composed of wool in admixture with "Fibro" or "Rayolanda."

The method chosen for this estimation was to expose a fabric to conditions likely to be encountered during actual wear, and then, after a suitable time, to measure the "greyness" of the exposed pattern by means of a photometer. The limitations of such a method are obvious; the most serious is the difficulty of obtaining absolute values, for it is impossible to ensure reproducible conditions of outdoor or ordinary indoor exposure. The order of soiling of a number of patterns will, however, probably be independent of the actual conditions employed. In any event, it was considered that the method would yield results which will bear a close connection with the performance of the various fabrics in use.

EXPERIMENTAL

Method of Measuring Soiling

Patterns (6 in. by 12 in.) of the fabrics to be tested were mounted on a board and exposed to the weather on the flat roof of the Mining Department of the University of Leeds. Other similarly mounted patterns were exposed in a laboratory in general use. After a period of ten weeks the patterns were removed and their "greyness" measured on a general-purpose photometer which records electrically the amount of light reflected from the sample placed in a fixed position in the instrument. The greyer the fabric, the less will be the amount of reflected light and the lower will be the reading on a voltmeter connected to the receiving photocell. The "greyness" of the fabric, or the degree of soiling was expressed as the reciprocal of the voltmeter reading multiplied by 100.

In order to assess the ease with which the dirt deposit could be removed, the "greyness" of the patterns exposed to the weather was also measured after they had been subjected to a standardised domestic wash. The patterns exposed indoors, which were covered with a more uniform layer of dirt, were merely rubbed for half a minute with a piece of clean cotton cloth and then shaken before the "greyness" was measured.

Description of Fabrics

Series I. (Clear-finished Fabrics).

Particulars of Grey Fabrics.

Warp: 1/16's wool counts; 8 twists per in.; 58 ends per in.; reed width, 63 in.
Weft: 2/32's wool counts; 63 picks per in.
Weave: 2/2 twill.
Composition: Both warp and weft were made from the same blend of wool and "Fibro" or "Rayolanda." The blends employed are shown in Table I.

* "Fibro" and "Rayolanda" are the registered names for Courtaulds' rayon staple fibre and basified rayon staple fibre respectively.
Soiling of Union Fabrics

Table I

<table>
<thead>
<tr>
<th>Fabric No.</th>
<th>Composition of weft</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>100% wool.</td>
</tr>
<tr>
<td>B</td>
<td>62-5% wool; 37-5% &quot;Fibro.&quot;</td>
</tr>
<tr>
<td>C</td>
<td>50-0% wool; 50-0% &quot;Fibro.&quot;</td>
</tr>
<tr>
<td>D</td>
<td>25-0% wool; 75-0% &quot;Fibro.&quot;</td>
</tr>
<tr>
<td>E</td>
<td>12-5% wool; 87-5% &quot;Fibro.&quot;</td>
</tr>
<tr>
<td>F</td>
<td>100% &quot;Fibro.&quot;</td>
</tr>
<tr>
<td>G</td>
<td>100% &quot;Rayolanda.&quot;</td>
</tr>
<tr>
<td>H</td>
<td>62-5% wool; 37-5% &quot;Rayolanda.&quot;</td>
</tr>
<tr>
<td>I</td>
<td>50-0% wool; 50-0% &quot;Rayolanda.&quot;</td>
</tr>
<tr>
<td>J</td>
<td>25-0% wool; 75-0% &quot;Rayolanda.&quot;</td>
</tr>
<tr>
<td>K</td>
<td>12-5% wool; 87-5% &quot;Rayolanda.&quot;</td>
</tr>
</tbody>
</table>

Finishing Routine
Scour, hydroextract, dry, cut clear, blow and press.

Series II. (Raised Fabrics).

Particulars of Grey Fabrics.
Warp: 2/60's cotton; 56 ends per inch; reed width, 36 ins.
Weft: 120 picks per inch.
Weave: Irregular 8-end sateen.
Composition: The compositions of the various weft yarns are shown in Table II.

Table II

<table>
<thead>
<tr>
<th>Fabric No.</th>
<th>Composition of weft</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>100% &quot;Fibro&quot; (staple length 2 in.)</td>
</tr>
<tr>
<td>2</td>
<td>12-5% wool; 87-5% &quot;Fibro&quot; (21 in.)</td>
</tr>
<tr>
<td>3</td>
<td>25-0% wool; 75-0% &quot;Fibro&quot; (21 in.)</td>
</tr>
<tr>
<td>4</td>
<td>50-0% wool; 50-0% &quot;Fibro&quot; (21 in.)</td>
</tr>
<tr>
<td>5</td>
<td>75-0% wool; 25-0% &quot;Fibro&quot; (21 in.)</td>
</tr>
<tr>
<td>6</td>
<td>100% wool.</td>
</tr>
<tr>
<td>7</td>
<td>100% &quot;Fibro&quot; (staple length 6 in.)</td>
</tr>
<tr>
<td>8</td>
<td>12-5% wool; 87-5% &quot;Fibro&quot; (6 in.)</td>
</tr>
<tr>
<td>9</td>
<td>25-0% wool; 75-0% &quot;Fibro&quot; (6 in.)</td>
</tr>
<tr>
<td>10</td>
<td>50-0% wool; 50-0% &quot;Fibro&quot; (6 in.)</td>
</tr>
<tr>
<td>11</td>
<td>75-0% wool; 25-0% &quot;Fibro&quot; (6 in.)</td>
</tr>
<tr>
<td>12</td>
<td>100% &quot;Rayolanda&quot; (staple length 2 in.)</td>
</tr>
<tr>
<td>13</td>
<td>100% &quot;Rayolanda&quot; (staple length 6 in.)</td>
</tr>
</tbody>
</table>

Finishing Routine
Scour, hydroextract, dry, raise dry on teazle gig, press.

RESULTS

Values of the "greyness" of fabrics after exposure and after a domestic wash are summarised in Tables III and IV. Fabrics in Series I and II were exposed at different times.

Table III

<table>
<thead>
<tr>
<th>&quot;Greyness&quot; of Patterns after Exposing</th>
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<tr>
<td>Inside for 70 days</td>
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<tr>
<td>---------------------</td>
</tr>
<tr>
<td>A 64</td>
</tr>
<tr>
<td>B 55</td>
</tr>
<tr>
<td>C 55</td>
</tr>
<tr>
<td>D 53</td>
</tr>
<tr>
<td>E 54</td>
</tr>
<tr>
<td>F 46</td>
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<tr>
<td>G 56</td>
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<td>H 59</td>
</tr>
<tr>
<td>I 37</td>
</tr>
<tr>
<td>J 58</td>
</tr>
<tr>
<td>K 59</td>
</tr>
</tbody>
</table>
Table IV

<table>
<thead>
<tr>
<th>Fabric No.</th>
<th>&quot;Greyness&quot; of fabric after exposing outside for 72 days</th>
</tr>
</thead>
<tbody>
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<td>152</td>
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<td>135</td>
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<tr>
<td>13</td>
<td>107</td>
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</tbody>
</table>

The results indicate that in both series of fabrics the order of susceptibility to soiling is: wool, "Rayolanda," Fibro", the relative susceptibilities of the clear fabrics being 135, 94, 74, and of the raised fabrics being 183, 135, 103. As the percentage of wool in a union fabric increases, so does the ease of soiling, and the greyness of an exposed pattern bears a comparatively smooth relationship to the wool content. Fabrics containing short staple synthetic fibres soil more easily than those containing fibres of longer staple, e.g., the values for the "greyness" of fabrics which contain 2 in. and 6 in. "Rayolanda," No. 12 and No. 13, respectively, are: 135 and 107. It is also evident that the differences between the various fabrics are most marked when exposed out of doors. There are also differences in the "greyness" of the washed fabrics the wool being darker than the "Rayolanda," which in turn is darker than the "Fibro."

REFERENCE


ACKNOWLEDGMENT

The authors acknowledge the assistance provided by Mr. C. P. Atkinson, of Messrs. Courtaulds, Ltd., in supplying the materials used in the investigation.
Correspondence
To the Editor, Journal of the Textile Institute,

Dear Sir,

I would refer to page 136 in the issue of the above journal, dated November, 1944, and in particular to the last paragraph of Mr. Brown's lecture. It cannot be agreed that the use of synthetic resins in the manufacture of collars is a "glaring mistake." It is agreed that certain synthetic resins may give defective results such as "softening and the formation of lumps" when immersed in hot water, but the implication in Mr. Brown's remarks that this is an inherent defect of synthetic resins used in collar manufacture should not be allowed to pass uncorrected.

In the discussion on Mr. Brown's paper, Mr. Brassard's remark that the chlorination of woollen goods is not yet perfected sufficiently for use on the civilian market is not correct. In past years a very large amount of chlorinated wool underwear has been sold by many firms with a very high reputation and certainly the process has not rendered these garments hard, as suggested by Mr. Brassard. Also, where a very soft finish is demanded on wool rendered shrink resisting by chlorination, special softening agents have been available which have given a softer effect to the chlorinated goods than has been shown in many instances by garments of similar type and quality not subjected to the chlorination process.

Lastly, the generalisation that all research work is discontinued too soon certainly does not present a true picture of textile research as at present conducted. Sponsors of new processes and products, in some instances, carry on their research work for many years after market development has begun and it is only by this means that any firm can maintain its position in what is to-day a highly complex, competitive and progressive industry, to wit, the finishing section of the country's textile industries.

Yours faithfully,

RICHARD J. SMITH.

Imperial Chemical Industries Limited,
Dyehouse Laboratories,
Hexagon House, Blackley, Manchester, 9.

27th December, 1944.

Prize Scheme for Cotton Spinning Students

The Council of the Institute recently received particulars of a prize scheme encouraging students in the Oldham area to study textile technology. Attention is particularly drawn to the offer of a prize in connection with the Institute's examinations. For the benefit of members the details of the scheme are reproduced as follows:

"The Oldham Master Cotton Spinners' Association Ltd. offer a cash prize of £10 to every student in the direct employ of a mill in membership with the Association who secures a full First-Class Technological Certificate of the City and Guilds of London Institute, or to every student who secures a higher National Certificate with Two First-Class results in Cotton Spinning, provided always that no student shall be eligible to receive two prizes of £10.

"The Association also offer a cash prize of £10 to every student in the direct employ of a mill in membership with the Association, who passes the Associateship Examination of the Textile Institute.

"The Association reserves the right to amend or discontinue the Scheme at any time and without prior notice."
Institute Membership

The following applicants were elected to membership at a recent meeting of the Council:

Ordinary.

Ronald George Bartlett, B.Sc., Ph.D., 17, Walker Avenue, Prestwich, Manchester (Chemist, Imperial Chemical Industries Ltd., Dyestuffs Division, Blackley, Manchester 9).

T. A. Booth, Stores Branch, New South Wales Railways, 19, York Street, Sydney, Australia (Textile Inspector).


Thomas Edwards, 386, Chorley Old Road, Bolton (Manager, Hargreaves Hamilton & Co., Ltd., Thynne Street, Bolton).

H. Eldred, 36, Robin Hood Street, Nottingham (Assistant Works Manager, Windley & Co., Ltd., Nottingham).

William Emsley, c/o David Dixon & Son, Ltd., Cardigan Mills, Leeds, 4 (Buyer, Works Manager).

Percy Thomas Gale, Hon. B.Sc., M.Sc., Elderslie, Woodlands Avenue, Whitefield, Lancs. (Textile Technician—Finishing, Imperial Chemical Industries Ltd., Dyestuffs Division, Manchester, 9).

Frank Foster Goodyear, 55, Bamford Road, Didsbury, Manchester (Observer, British Cotton Industry Research Association, Didsbury, Manchester).

Ernest Groves, Durban Mill Co., Ltd., Millgate, Hollinwood (Cotton Mill Manager).

George Hasty, The Grape Mill Ltd., Crompton Street, Royton, near Oldham (Managing Director).

James C. Herschell, 83, Dickson Street, Edinburgh, 6 (Flax and Hemp Mill Overseer, British Ropes, Ltd., Bath Street, Edinburgh, 6).

Harry Holland, 876, Burnley Road, Walmersley, Bury (Manager—Cotton Spinning, Doubling and Weaving, Joshua Hoyle & Sons, Ltd., Brookbottoms Mill, Summerseat, Bury).


Wolfe Ireton, 14, The Drive, Crossgates, Leeds, Yorks. (Spinning Manager, M. P. Stonehouse, Ltd., Albion Mills, Wakefield).

James R. F. Jackson, B.Sc., 3, Sunny Drive, Prestwich, Manchester (Textile Technician, Finishing, Imperial Chemical Industries, Ltd., Dyestuffs Division, Manchester, 9).

Stephan Kann, "Park Hey," East Park Road, Blackburn, Lancs. (Company Director, Charmfyl Rayon Mills, Ltd., 11, Castle Street, Clitheroe).

Feliz Loewenstein, 34, Mauldeth Road, Withington, Manchester, 20 (Director, Helios, Ltd., Albert Mills, Bolton).

Robert Edward Lunn, 69, Cliffe Street, Keighley (Cloth Designer, Robert Clough (Keighley), Ltd., Grove Mills, Ingrow, Keighley).

Albert Packer, The Standish Co., Worthington, near Wigan (Assistant Works Manager).
Norman Hector Pomfret, 51, Douglas Street, Atherton, Manchester (Spinning Overlooker, Laburnum Spinning Co. (1920), Ltd., Atherton).

William Alan Richardson, M.Sc. (Vic.), British Cotton Industry Research Association, Shirley Institute, Didsbury, Manchester (Research Chemist).


Richard Scholfield, 36, Timbercliffe, Littleborough, Lancs. (Laboratory Research Worker, British Cotton Industry Research Association, Shirley Institute, Didsbury, Manchester).

Frank Swift, “Struan House,” Chamber Road, Shaw, Lancs. (General Manager, Lily Mills, Ltd., Shaw).


William Watkins, A.M.C.T., 9, Branksome Avenue, Prestwich, near Manchester (Director and Works Manager, Manchester Dyers (1914), Ltd., Middleton Road, Higher Crumpsall, Manchester, 8).

Frederick Harry Whyte, B.Sc. (Tech.), 30, Moss Avenue, Rochdale, Lancs. (Technical Research Assistant, Dunlop Cotton Mills, Ltd., Rochdale).

K. Soochin Yuen, A.M.I.E.E., P.O. Box 73, Chungking, Szechuen, China (Engineer, Arnhold & Co., Ltd., P.O. Box 73, Chungking, China).

Junior.


Lewis Goodman, 45, Queens Road, Manningham, Bradford, Yorks. (Student, Bradford Technical College).

Anatoliya Vareta, 181, Legrams Lane, Lidget Green, Bradford, Yorks. (Manager, Rag Business, L. Vogel & Schnurmann (Gt. Britain), Ltd., Healy, Batley).
INSTITUTE MEETINGS

LANCASHIRE SECTION


Friday, 9th February, 1945—Manchester, 1.0 p.m. Lunch-time meeting at the Institute's premises. "Natural v. Synthetic," by A. R. Knight, B.Sc., A.R.I.C., A.R.C.S. (British Bemberg Ltd.).

Tuesday, 20th February, 1945—Manchester, 7.0 p.m. Lecture: "The Electron Microscope," by Dr. D. G. Drummond (British Cotton Industry Research Association), at the Central Library, Manchester.


MIDLANDS SECTION


YORKSHIRE SECTION

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In recent investigations concerning with the alkali-sensitivity of certain types of oxycellulose the rate of flow of 0.25 per cent. acetone solutions of nitrated hydro- and oxy-celluloses was employed as an index of the average length of the chain-molecules in the nitrocelluloses and their parent modified celluloses. The change in the nitrocellulose viscosity at a standard concentration caused by the hydrolytic action of acids on cellulose is doubtless due to diminution of the average length of the molecular chains, but the corresponding change resulting from oxidation of the cellulose is probably of a composite nature, combining (a) the effect of diminished chain-length and (b) the effects of changes in chemical constitution, such as the replacement of hydroxyl by aldehyde or carboxyl groups, which may influence the degree of association and solvation of solute molecules. The general use of the rate of flow of 0.25 per cent. solutions of nitrocelluloses as an index of chain-length is thus strictly justifiable only if the effects (b) may be neglected. Evidence which suggests that the degree of association of nitrocellulose chain-molecules may be increased by periodic acid oxidation of the parent cellulose has, however, already been obtained in the observation that the nitrocelluloses derived from periodic acid oxycelluloses, although soluble in acetone when the oxidation of the cellulose is slight, become almost completely insoluble once a certain, relatively low, degree of oxidation is exceeded. The degree of association of molecules in solution decreases with the concentration and hence any effect that association may have on the viscosity of nitrocellulose solutions will be diminished by reducing the concentration. Consequently, if two nitrocelluloses that are characterized by different tendencies to association have the same viscosity at a certain concentration, their viscosities at any other concentration will be unequal; in other words, their viscosity-concentration relations will be different. The object of the present investigation was to discover whether such differences of viscosity-concentration relations do in fact occur among nitrocelluloses derived from different types of modified cellulose.

A comparison over the concentration range 0—0.25 per cent. has been made of the relations between the viscosity and the concentration of acetone solutions of nitrocelluloses derived from (1) an unmodified cellulose (purified cotton linters), (2) a series of hydrocelluloses prepared from the cotton by the action of hydrochloric acid, (3) a series of oxycelluloses prepared by
oxidation with dichromate in the presence of oxalic acid, and (4) a series of oxyccelluloses prepared by oxidation with periodic acid. The rates of flow of the nitrocellulose solutions are expressed in terms of the relative viscosity, \( \eta_r \), i.e. the viscosity relative to that of the solvent, or in terms of the specific viscosity \( \eta_s = \eta_r - 1 \). In order to describe the viscosity characteristics of a nitrocellulose independently of the concentration of the solution, use is made of the intrinsic viscosity\(^4\), \([\eta]\), which is defined by the equation

\[
[\eta] = \lim_{c \to 0} \frac{\eta_s}{c}
\]

where \( c \) is the concentration (grams per 100 c.c. of solvent). Since the intrinsic viscosity is obtained by extrapolation of the ratio \( \eta_s/c \) to zero concentration, it should not be subject to the influence of association in the way that the viscosity at a finite concentration may be. Slight oxidation with periodic acid results in only a small decrease of the intrinsic viscosity of the derived nitrocellulose and at higher degrees of oxidation the nitrocelluloses are not completely soluble in acetone, so that with this type of nitrocellulose the range of intrinsic viscosity that can be covered is very restricted.

Fig. 1 illustrates the relation between \( \eta_s/c \) and \( c \) over the concentration range 0—0.05 per cent. for the various nitrocelluloses, and it is seen that the curves approximate to straight lines at low concentrations, making possible the determination of the limiting value of \( \eta_s/c \), the intrinsic viscosity, with fair accuracy. At the higher concentrations the relation between \( \eta_s/c \) and \( c \) is no longer even approximately linear. It is evident that within a series of nitrocelluloses prepared from a given type of modified cotton the slopes of the lines in Fig. 1 decrease with decreasing intrinsic viscosity, but that the slope is substantially greater with the nitrocelluloses prepared from periodic acid oxyccelluloses than with those of equal intrinsic viscosity derived from hydroccelluloses (cf. curves \( H1 \) and \( P3 \)). The results illustrated in Fig. 1 provide little support for Staudinger’s statement that \( \eta_s/c \) becomes constant at very low concentrations\(^6\).
Numerous empirical equations have been proposed to express the relations between the viscosity and the concentration of solutions of macromolecular substances, and the applicability of some of these equations to the present data has been tested. It has been seen from Fig. 1 that two nitrocelluloses, one derived from a hydrocellulose and the other from a periodic acid oxycellulose, may have the same intrinsic viscosity and yet have different viscosities at a given concentration, and hence it follows that no equation with only one constant can adequately express the viscosity-concentration relations of all the nitrocelluloses examined. The Arrhenius equation, \((\log \eta_i)/c = \text{constant}\), does not hold for any of them, the ratio \((\log \eta_i)/c\) decreasing with increasing concentration. The two-constant equation proposed by Baker\(^7\), viz., \(\eta_i = (1 + ac)^k\), may be written in the form \(\eta_i = (1 + |\eta|c/k)^k\), and according to Philippoff and Hess\(^8\) this equation provides a satisfactory fit for data obtained with solutions of cellulose derivatives when \(k\) is assigned an invariant value of 8, thus reducing the constants to one. The simplified form of Baker's equation is satisfactory with the nitrocelluloses derived from hydrocelluloses and dichromate oxycelluloses, but less satisfactory with those derived from periodic acid oxycelluloses. The data for all the nitrocelluloses employed, over the complete concentration range studied (0—0.25 per cent.), are well fitted by the two-constant equation of Bungenberg de Jong, Kruyt, and Lens\(^8\), which may be written in the form \(\log (\eta_{sp}/c) = \log [\eta] + mc\). This is illustrated by Fig. 2, in which \(\log (\eta_{sp}/c)\) is plotted against \(c\) for a number of the nitrocelluloses, the results for the remainder being omitted to avoid confusing the figure. This equation is very suitable for the extrapolation of \(\eta_{sp}/c\) to zero concentration.

![Diagram showing viscosity versus concentration for different nitrocelluloses.](image.png)
Table I

Nitrocellulose derived from: — [η]  m

<table>
<thead>
<tr>
<th>Nitrocellulose derived from: —</th>
<th>[η]</th>
<th>m</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unmodified cotton</td>
<td>228</td>
<td>5:10</td>
</tr>
<tr>
<td>Hydrocellulose H1</td>
<td>17:6</td>
<td>3:40</td>
</tr>
<tr>
<td>&quot; H2</td>
<td>14:8</td>
<td>2:58</td>
</tr>
<tr>
<td>&quot; H3</td>
<td>12:2</td>
<td>2:16</td>
</tr>
<tr>
<td>&quot; H4</td>
<td>9:2</td>
<td>1:58</td>
</tr>
<tr>
<td>Dichromate oxycellulose D1</td>
<td>19:0</td>
<td>3:76</td>
</tr>
<tr>
<td>&quot; D2</td>
<td>16:8</td>
<td>3:45</td>
</tr>
<tr>
<td>&quot; D3</td>
<td>13:1</td>
<td>2:55</td>
</tr>
<tr>
<td>Periodic acid oxycellulose P1</td>
<td>18:4</td>
<td>4:50</td>
</tr>
<tr>
<td>&quot; P2</td>
<td>17:9</td>
<td>4:30</td>
</tr>
<tr>
<td>&quot; P3</td>
<td>17:3</td>
<td>4:14</td>
</tr>
</tbody>
</table>

Table I gives the intrinsic viscosities obtained by extrapolation in this way, together with the slopes (m) of the straight lines relating log (η_m/c) and c. In Fig. 3 the nitrocelluloses derived from the three types of modified cellulose are compared with respect to the relation between [η] and m. It is seen that there is little difference between the nitrocelluloses prepared from hydrocelluloses and dichromate oxycelluloses, respectively, but that a nitrated periodic acid oxycellulose gives a higher value of m than a nitro-
cellulose of the same intrinsic viscosity prepared from a hydrocellulose or a dichromate oxycellulose.

The differences in the viscosity-concentration relations given by different types of nitrocellulose of equal intrinsic viscosity are consistent with the suggestion that the degree of association of the nitrocellulose chain-molecules is affected by the changes in chemical constitution produced by oxidation prior to nitration. The rate of increase of nitrocellulose viscosity with concentration is greater for a cellulose oxidized with periodic acid than for a hydrocellulose of equal intrinsic viscosity and, in terms of the suggested explanation, this implies that the degree of association of the oxidized cellulose is greater than that of the hydrolysed; when dichromate is the oxidant there is a much smaller difference in degree of association between the derivatives of oxy- and hydro-celluloses. The possibility cannot be excluded that the changes of nitrocellulose viscosity produced by oxidation are also partly due to changes in the degree of solvation of the nitrocellulose chain-molecules, but the method of investigation here employed throws no light on this question. It may be significant that the best solvents for nitrocelluloses—viz., ketones and esters—contain carbonyl groups, so that the introduction of such groups into the cellulose chain-molecules by oxidation might be expected to affect association and solvation in solutions of nitrocelluloses derived from oxidized cotton.

According to the above interpretation of the viscosity-concentration relations, the two effects produced by oxidation on the chain-molecules of cellulose, viz., diminution of chain length and change in chemical constitution, influence the nitrocellulose viscosity in opposite directions, the former tending to cause a fall and the latter a rise. The change of nitrocellulose viscosity resulting from oxidation will therefore depend on which of these two factors is predominant. Hitherto, the progressive oxidation of cellulose has always been found to result in a progressive fall in the nitro-

![Fig. 4](image-url)
cellulose viscosity\(^1,2\), but it has now been observed that when a cellulose whose average chain-length has been suitably diminished by the action of acid is progressively oxidized with periodic acid, the nitrocellulose viscosity falls at first, passes through a minimum, and then increases. This is illustrated by Fig. 4, in which the relative viscosities of the nitrocelluloses at concentrations of 0.1 and 0.25 per cent, are plotted against the proportion of oxygen consumed in the preparation of the parent oxycelluloses. The shape of the curves indicates that at slight degrees of oxidation of the hydrocellulose the effect of diminution of chain-length predominates, but that as the degree of oxidation is increased the effect of the changes in chemical constitution gradually assumes predominance. The reason why similar curves are not obtained with periodic acid oxycelluloses prepared from an unmodified cotton instead of from a hydrocellulose is probably connected with the fact that incomplete solubility of the derived nitrocellulose supervenes at a considerably lower degree of oxidation with the former than with the latter.

It was found in an earlier investigation\(^2\) that the relation between the tensile strength of chemically modified cottons and the fluidity of 0.25 per cent. solutions of the derived nitrocelluloses varied with the method of modification. This observation was contrary to expectation based on the assumption that these two properties could both be taken as indices of the average chain-length of the modified cottons. The viscosity characteristics of the nitrocelluloses previously examined may be expressed in terms of the intrinsic viscosity by making use of the viscosity-concentration relations obtained in the present investigation, and when this is done it is found that there is also no unique relation between the tensile strength of the modified cottons and the intrinsic viscosity of the nitrocelluloses derived from them. Intrinsic viscosity is preferable to viscosity at a standard concentration as an index of chain-length, because it is not influenced by association, but its use probably does not avoid the effect of solvation which is presumed to be a factor in determining viscosity at a standard concentration. The assumption that the tensile strength of modified cottons of different types is determined solely by the average chain-length may also be only an approximation to the truth. This assumption implies that the cohesive forces between the molecular chains are the same whatever the method of modification, whereas they may be influenced by the changes in the chemical constitution of the chain units that result from oxidation.

**EXPERIMENTAL**

**Determination of Viscosity-Concentration Relations**

*Materials.*—The cotton used for the preparation of chemically modified celluloses was a sample of linters that had been purified by boiling under pressure with dilute sodium hydroxide solution. Hydrocelluloses (H1-4) were prepared by treatment of this cotton with hydrochloric acid (200 g./litre) at 20° C. for various times. Dichromate oxycelluloses (D1-3) were obtained by steeping the cotton in mixtures of oxalic acid and potassium dichromate solutions until the reduction of the dichromate was complete\(^11\). Periodic acid oxycelluloses (P1-3) were prepared by oxidation of the cotton with 0.005M periodic acid solution at 20° C. for various times\(^8\). The unmodified and modified cottons were characterized by means of their fluidities in cuprammonium solution, the fluidities of 0.5 per cent. solutions at 20° C. being as follows:

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Unmodified cotton:</strong></td>
<td>5.6.</td>
</tr>
<tr>
<td><strong>Hydrocelluloses:</strong></td>
<td>H1, 8.7; H2, 11.9; H3, 14.7; H4, 20.1.</td>
</tr>
<tr>
<td><strong>Dichromate oxycelluloses:</strong></td>
<td>D1, 19.8; D2, 28.8; D3, 37.3.</td>
</tr>
<tr>
<td><strong>Periodic acid oxycelluloses:</strong></td>
<td>P1, 28.9; P2, 34.5; P3, 38.5.</td>
</tr>
<tr>
<td>Sources of the nitrocelluloses</td>
<td>0-0025</td>
</tr>
<tr>
<td>--------------------------------</td>
<td>-------</td>
</tr>
<tr>
<td>Unmodified cotton</td>
<td>1-058</td>
</tr>
<tr>
<td>Hydrocellulose H1</td>
<td></td>
</tr>
<tr>
<td>H2</td>
<td></td>
</tr>
<tr>
<td>H3</td>
<td></td>
</tr>
<tr>
<td>H4</td>
<td></td>
</tr>
<tr>
<td>Dichromate oxycellulose D1</td>
<td>1-080</td>
</tr>
<tr>
<td>D2</td>
<td></td>
</tr>
<tr>
<td>D3</td>
<td></td>
</tr>
<tr>
<td>Periodic acid oxycellulose P1</td>
<td>1-047</td>
</tr>
<tr>
<td>P2</td>
<td></td>
</tr>
<tr>
<td>P3</td>
<td></td>
</tr>
</tbody>
</table>
Nitrocelluloses were prepared by nitrating the unmodified and modified cottons for four hours at 0°C. with a mixture of the following composition (by weight): \(\text{HNO}_3, 48\ \text{per cent.}; \text{H}_3\text{PO}_4, 50\ \text{per cent.}; \text{P}_2\text{O}_5, 2\ \text{per cent.}\). This procedure, when applied to unmodified cotton or to relatively slightly modified cottons such as those described above, yields nitrocelluloses containing about 13.7\ per cent. of nitrogen⁴.

The acetone used as solvent for the nitrocelluloses was dried and distilled before use. Its viscosity at 20°C. was 0.318 centipoise.

**Measurement of Viscosity of Nitrocelluloses.**—The measurements of the viscosities of the nitrocellulose solutions were made with two viscometers of the U-tube type, adapted for pipette filling. The important dimensions of these viscometers were as follows:

<table>
<thead>
<tr>
<th>Viscometer A</th>
<th>Viscometer B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capillary length</td>
<td>10 cm.</td>
</tr>
<tr>
<td>Internal diameter</td>
<td>0.085 cm.</td>
</tr>
<tr>
<td>Bulb, capacity</td>
<td>1.92 c.c.</td>
</tr>
<tr>
<td>Mean head</td>
<td>11.3 cm.</td>
</tr>
</tbody>
</table>

The viscometers were calibrated with water, \(\eta_{20°}=1.005\) centipoises, the kinetic energy correction constant being calculated in the usual way from the volume of the bulb and the length of the capillary. This calibration gave the following relations between viscosity and time of flow:

- \(\eta = \frac{n}{\rho} = 0.002079 (t - 412/t)\) for Viscometer A,
- \(\eta = \frac{n}{\rho} = 0.01325 (t - 41/t)\) for Viscometer B,

where \(\eta\) = viscosity in centipoises,
\(\rho\) = density,
\(t\) = time of flow in seconds.

Viscometer A was employed for all the nitrocellulose solutions except those with relative viscosities greater than about 4, for which viscometer B was used. With acetone in viscometer A the time of flow was 195 seconds and the kinetic energy correction was 1.1 per cent of the time of flow; the shortest time of flow measured in viscometer B was about 120 seconds, corresponding to a kinetic energy correction of 0.3 per cent.

The 0.1 per cent. and 0.25 per cent. nitrocellulose solutions were prepared by dissolving a weighed quantity (about 0.1 g.) of the dried nitrocellulose in the appropriate volume of acetone, dissolution being facilitated by attaching the tube containing the nitrocellulose and acetone to a slowly revolving wheel for about eighteen hours. More dilute solutions were prepared from the 0.1 per cent. solution by successive dilutions. The viscosity measurements were made at 20±0.05°C.

**Results.**—The experimental results are recorded in Table II, which gives the relative viscosities of the various nitrocelluloses in relation to the concentration. Figs. 1 and 2, which illustrate, respectively, the relations between \(\eta_{20°}/c\) and \(c\) and between \(\log(\eta_{20°}/c)\) and \(c\), are based on the data in Table II.

**Effect of Periodic Acid Oxidation of a Hydrocellulose on the Viscosity of the Derived Nitrocellulose.**

The hydrocellulose used was prepared from cotton linters by the action of hydrochloric acid, and it had a fluidity in cuprammonium solution of 35.7. A series of oxycelluloses was prepared by oxidizing two grams of the hydrocellulose at 20°C. for various times with 100 c.c. of 0.025M periodic acid, the oxygen consumption being calculated from the measured change in the concentration of the oxidant. Nitrocelluloses were prepared from these oxycelluloses, and their viscosities in acetone solution were determined at concentrations of 0.1 and 0.25 per cent. The relation between the relative viscosity of the nitrocelluloses and the consumption of oxygen during the preparation of the oxycelluloses is given in Table III, and shown graphically in Fig. 4.
### Table III

<table>
<thead>
<tr>
<th>Oxygen consumption during preparation of oxycellulose (atoms per glucose unit)</th>
<th>Relative viscosity of derived nitrocellulose</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1.668</td>
</tr>
<tr>
<td>0.0146</td>
<td>1.443</td>
</tr>
<tr>
<td>0.0282</td>
<td>1.439</td>
</tr>
<tr>
<td>0.0337</td>
<td>1.437</td>
</tr>
<tr>
<td>0.0426</td>
<td>1.478</td>
</tr>
<tr>
<td>0.0545</td>
<td>1.500</td>
</tr>
<tr>
<td>0.0654</td>
<td>1.513</td>
</tr>
</tbody>
</table>

**SUMMARY**

The relations between the viscosity and the concentration of acetone solutions of nitrocelluloses derived from hydrocelluloses, dichromate oxycelluloses, and periodic acid oxycelluloses, have been investigated over the concentration range 0—0.25 per cent. The viscosity-concentration relation is not the same for the derivatives of all three types of modified cotton cellulose. If, at a very low standard concentration, a nitrated hydrocellulose has the same relative viscosity as a cellulose nitrated after oxidation with periodic acid, the relative viscosities of the two products are not the same at a higher concentration, the derivative of the oxidized cellulose then having a greater viscosity than the derivative of the hydrolysed cellulose. As an explanation of this result, it is suggested that the degree of association of nitrocellulose molecules of a given average chain-length, and hence the viscosity at a finite concentration, is influenced by chemical changes—other than depolymerization—resulting from the oxidation of the cellulose with periodic acid. When dichromate is the oxidant, there is only a slight difference between the viscosity-concentration relations for the nitrated oxycelluloses and hydro-celluloses.

The relation between viscosity and concentration for all three types of nitrocellulose is satisfactorily represented by the equation \( \log (\eta_{sp}/c) = \log [\eta] + mc \), where \( \eta_{sp} \) is the specific viscosity, \( c \) is the concentration, \( [\eta] \) is the intrinsic viscosity, and \( m \) is a constant. The qualitative behaviour recorded above is expressed formally by the fact that within a series of nitrocelluloses derived from a given type of modified cellulose \( m \) increases with \( [\eta] \), but the relation between \( m \) and \( [\eta] \) varies from one type of modified cellulose to another.

In support of the suggestion that oxidation of cellulose with periodic acid leads to nitrocelluloses of relatively high degree of association in acetone solution, it is shown that under certain conditions the progressive oxidation of a cellulose material with periodic acid results in a progressive rise in the viscosity of the derived nitrocelluloses.

**REFERENCES**

2—USES AND ACCURACY OF COTTON SPINNING-TESTS ON 60-GRAM SAMPLES

By H. A. Hancock

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SUMMARY

A technique for spinning 60-gram samples on standard cotton machinery is described. The sources of variation in this two-ounce "micro spinning-test" are analysed into those arising from (a) real differences between the cotton under test, (b) spinning machine errors, and (c) variations due to imperfect sampling of the cotton. Purely spinning errors are shown to be surprisingly little affected by reducing the sample weight from a kilogram down to 60 grams. Numerical estimates are given for the unwanted errors, and for their relation to the genetic variances involved, in a few cases of general interest.

Although designed primarily for its economy in cotton, a fourfold increase in speed of working turned out to be as great an asset of the micro test. It is in fact used mainly for its advantage in speed, on samples of which there is enough cotton for a full-scale spinning. In such cases the sampling error can be made negligible, because 60 grams can be representative of a much larger bulk. Direct answer by the spinning-test now supersedes the need for inferences based on lint measurements.

An important application of the test is to commercial crop control and the elimination of deteriorated or contaminated seed. All seed-cotton intended for sowing-seed in the following crop is required by Egyptian law to be tested in advance. For the long-staple varieties, acceptance or refusal of the lots for sowing is now on the basis of lint quality. Spinnings are carried out at the Government station on mass production lines, and the method is believed to mark a big advance in crop control for quality. All the long staple cotton of Egypt is now grown directly from seed whose lint has passed the spinning standards, lot by lot.

INTRODUCTION

The amount of cotton required for a quality test is often an important question to the breeders, especially with varieties at an early stage of development. Not the least advantage of small sample testing is that quality selection can begin a year or more in advance. In common with many another research department, a good deal of time has been spent at Giza in developing a method to infer spinning quality from measurements on the lint. Economy in cotton is the chief merit of this method, but serious objections have to be counted against it. It does not meet with enough success even with a three-factor formula; and the method is tedious even when restricted to a two-factor formula, with still lower accuracy.

Spinnings-tests on 60-gram samples now give a direct answer superseding inferences formerly based on lint measurements. By the indirect method, using the characters Mean Length, Hairweight, and Hair Strength by Impact, the usual correlation obtained at Giza between inferred and actual yarn strengths from standard kilogram samples was about \( r = 0.92 \), rising to 0.96* at the best. On the other hand the correlation between 60-gram and standard yarn strengths is \( r = 0.998 \), the higher correlation being obtained with a fraction of the former effort.

* Based on duplicated spinnings and quadruplicated hair tests.
These “micro spinnings” are now carried out on all F.3 to F.6 families at Giza, and on pedigree lines at similar stages of development, before a yield figure of any significance can be obtained. Segregation is still going on and high accuracy is not called for, but there is a better chance of sorting out desirable trends before they are accidentally eliminated. Continued selection of extreme individuals in a hybrid population is also likely to help in the drive towards purity.

It was the powerful attraction of the early selection possible with small samples that first led us to develop the micro spinning-test; but when the technique was established, it was found to have the unforeseen advantage of very fast working without much loss in accuracy, under certain conditions. Some 60 or 70 samples per day could be dealt with, by the same staff and equipment formerly testing 14 to 18 larger samples. The higher speed of working has in fact turned out to be as great an asset as the economy in cotton; and, curiously enough, most micro tests are done on samples of which there would be enough cotton for a full-scale spinning.

It is important to notice that the use of a 60-gram sample for spinning need not involve appreciable increase in the sampling error if plenty of cotton is available, because there is no difficulty in drawing the 60 grams so that it is representative of a large bulk. In such cases the additional errors in the 60 gram test are those arising from spinning factors alone, and these can be reduced to normal by repeat tests if desired, still with a good saving of time compared with the large-scale test. Even without repetitions, the spinning errors are often not large compared to the other errors in field experiments. A fourfold increase in spinning output is therefore considered to be a good exchange for lower accuracy in the error component which can best afford it. At every stage in plant breeding work, the quality figure is still invariably better known than the yield figure.

This new method of testing, first tried out on a few hundred samples in 1939, has quickly come to be used for a volume of work, especially crop control work on commercial samples, in numbers hitherto out of the question for lack of time. The busy season at Giza is the five months between autumn harvestings and spring sowings. During this period upwards of five thousand micro-spinnings are carried out (representing three to four thousand samples, some with duplicate or triplicate spinnings), of which about one-third are plant breeding samples and miscellaneous experiments, and about two-thirds are commercial lots. The kilogram test formerly used, and any larger scale tests, are now reserved mainly for confirmations during the more leisurely summer season, when selections have been made and the crops are growing.

Micro Spinning Technique

The machines used in the Giza procedure are: two carding engines (for double carded preparation) of standard type except that they are fitted with Roubaix wire on doffer, cylinder, and flats; a home-made drum with traverse for making a lap out of first card sliver, and another one of bigger diameter for making drawframe laps; a drawframe of five heads; a combined slubber and intermediate frame (interchangeable) of which 12 spindles are used; a roving frame of 24 spindles in two blocks of 12; and two ring-spinning frames each of 48 spindles in four blocks of 12, creeled for double roving. All the machinery is by Messrs. Platt Brothers, of Oldham.

A staff of 17 persons is concerned with the spinning, comprising a well-qualified senior technical assistant in charge, with three junior technical assistants generally supervising and (especially) checking; and 13 laboratory boys who do the sampling and actually run the machines.

It is found possible to spin 24 leas of 60s double carded yarn from 60 grams of lint, with no more than trivial modifications to the standard
machines. The chief changes are the fitting of accurate counters, but a gear-box fitted to the drawframe for speeding up draft wheel changes is sometimes useful.

The procedure for kilogram samples described in this *Journal* some years ago, is closely followed except with regard to the counter numbers, and the number of speed frame bobbins is also halved. Essential comparisons are arranged to be within a group of twelve, all samples being so arranged in their passage through the mill. Different groups are linked when necessary by a sample or samples repeated in all groups.

From the moment of withdrawal of cotton from its bag up to the process of slubbing, the sample is accompanied by a cardboard on which it normally rests, marked with the sample reference number. No more than one bag at a time is allowed to be open even for a moment on any one table; nor is more than one sample of a group allowed to be separated, even for a moment, from its identifying cardboard. From slubbing onwards the samples are identified by their bobbin colours and numbers. Delivery and feed bobbin numbers, as well as group colours, are doubly checked at every creeling.

**Sampling.** Experience has shown that a safe procedure is to draw the working sample from about 20 sub-lots taken from all parts of the bulk, whatever its size. Increased variability in repeat tests, ascribed to insufficient sampling, has been detected in experiments where the bulk was divided into less than about 10 sub-lots. A glass-topped bench marked out by lines into divisions of equal area is found convenient for spreading the bulk into sub-lots, and an Avery balance reading in grams is used for weighing.

**Carding.** The chief departure from normal technique is in the carding. A lap of normal width would be only 8 inches long for a micro sample; and, in order to lengthen the lap, the card feed plate is blocked so that the available carding width is reduced to one-third. The first card lap is hand-made in three sections, each section being taken up by one complete revolution of the dish feed roller. There is a normal weight of cotton per unit area on the card cylinder wire, but the sliver delivered is only one-third the normal weight, because only one-third of the doffer width feeds. This fine hank sliver is hand wound into a sheet, on a drum one-third the width of the second card, the sheet being broken across and rolled up into a uniform lap for second carding.

The second card delivers sliver similarly fine, too weak for feeding to the drawframe without stretch, and it also must be made into a lap. When doing so, the opportunity of a wrapping is taken. A long spring balance reading to half grams is used for weighing the whole of the fine second card sliver, the sample being reduced to a fixed weight by pulling off the surplus after the style of a butcher weighing sausages. The fixed weight of sliver is then wound uniformly on to a drum, and the sheet broken across and rolled up forms a lap for feeding to the drawframe.

**Drawing.** Every sample is given two drawings, both first and second drawing sliver being of normal weight (0.26 hank). The procedure when making the drawlap for first drawing was effectively a control wrapping using the whole of the sample, and no further wrapping is usually necessary until the ring frame is reached. The only exceptions are certain low quality cottons which are found to run fine at the drawframe, perhaps due to stretch. These cottons are always known in advance, and for them the draft wheel is changed, the draw-frame gearbox being used so as to speed up the wheel changes.

First drawing sliver is divided into eight, controlled by a Veeder counter driven from the delivery rollers. Small boxes are used instead of cans, and second drawing proceeds as usual from the eight ends. Since there is no
Tests on 60-gram Samples—Hancock

waste due to wrappings, the quantity of cotton lost at drawings is slight—not more than six grams at the two operations. Only about 20 grams of
cotton are lost in the two cardings, thanks to the low absorption of Roubaix
card wire, so that about 34 grams out of the original 60 grams reach the
slubber.

Slubber, Inter., Rover. The 12 samples of a group are assembled and
treated simultaneously from now on. There are two doffings at each of the
three-speed frames, the roving bobbins each building to 17 layers of 8-hank
roving. The outer layer of the 24 rove bobbins in the group is run off, and
used for a wrapping on which the ring draft change is calculated. The
groups do not arrive all at the same mean hank, although they are given
identical treatments.

Spinning. Draft wheels are changed for each group of 12 samples
according to the roving wrapping alone; this is much faster than spinning
yarn for wrappings, but seems to be just as accurate in getting the counts
right. Two leas are spun, and then all bobbins are stepped up one spindle,
number 12 sample going back to the spindle vacated by number 1 sample.
This process is repeated until all 12 samples have spun two leas on all 12
spindles, thus eliminating the spindle error within groups; 24 leas of 60s
twist yarn are thus produced per sample sent for testing on four ring bobbins.
For some types of sample the number of leas is cut down to 20, stepping up
ten spindles only.

Yarn Strength Testing. The bobbins sent up, and the yarn on them,
are indistinguishable in the laboratory from the bobbins and yarn of kilogram
spinnings. For reasons not yet clearly established, micro samples tend to
be of slightly weaker yarn than normal spinnings; but the decrease is
detectable only in experiments specially laid out for the purpose, and the
established quality scale from our normal spinnings is substantially main­
tained in the micro spinnings. Two standard Goodbrand lea testers are
used, and results are quoted as “Lea Strength x Counts Products,” with the
same corrections as for kilogram samples. About 1,400 leas are broken per
day, a senior technical man and five assistants being concerned in the testings,
weighings, and calculations. There is a possibility that work in this depart­
ment can be simplified by using the ballistic type of tester2 instead of the lea
tester, and the question is at present under study.

Time per Test. When the technique was first started in 1939, the rate
of working was 24 samples per day of 6½ hours, the limiting factor being the
time for drawings. By 1942 more experience had been gained and the rate
of working was 48 samples per day. In the 1943 season the mill ran steadily
on a basis of 60 samples per day, results being reported on the fourth or fifth
day after arrival of the samples, and this output is being exceeded in the
1944 season. This rate of working is possible only with the mass production
methods suitable for a standard product, and no other yarn but 60s twist is
ever spun for micro samples.

Accuracy of Micro Spinning Tests on 60-gram Samples

Throughout this paper the spinning-test result is discussed only in terms of
the lea strength x counts product (or, shortly, the lea product) of 60s carded
ring twist yarn.

The new test has been used largely for groups of cottons straddling only
a part of the Egyptian quality range, as in comparing related strains of new
hybrids; but even over a restricted range, the accuracy cannot be determined
by reference to statistical tests alone. In a group of nominally identical
repeat spinnings, an estimate of the significance can be made in terms of
deviations from the mean lea product of the group; but such estimate of
accuracy evades the wider question of what the group mean represents.
As shown in Fig. 1, the micro test gives results very closely correlated \( r = 0.998 \) with those of the standard spinning-test used at Giza for kilogram samples, and at nearly the same strength level. This is the only standard scale we have by which to compare spinning values; but nine years’ experience with the kilogram test has shown it to give results well consistent with spinners’ evaluations, and the fact is also demonstrated by the smooth line of points on the Egyptian strength/price graph based on this spinning scale. Only if such a standard of reference is accepted, and agreement found between it and the micro test, can the estimate of error in the latter be based on analysis by the ordinary methods of statistics.

Micro spinning-test results from a series of cottons grown together in a field experiment will show variations among the lea products arising from (a) real differences of genetic origin between the cottons under test, to which are added (b) purely spinning and testing variances which are quite independent of (c) cotton sampling errors, chiefly environmental in origin and naturally of bigger magnitude when fewer plant localities are represented in the sample. The total variance is thus regarded as being made up from three components: the genetic variance and two sources of unwanted error. When the real variance (a) is appreciably larger than the total of the unwanted variances (b) and (c), significance is obtained to an extent indicated by the “Z” test or its later version the “F” test.

The error (b) of one micro spinning is usually found to be less than the error (c) incurred by taking a single ridge sample to represent a crop actually produced on many ridges. Both variances together, however, are less in magnitude than the real variance (a) found in many plant breeding populations of allied strains, and this is the conclusion that matters. For a good proportion of the work at Giza, significance at the 20:1 level is attained with 60-gram spinnings in duplicate, and the simplest possible layout in the field. It may be of interest to quote the numerical values found for these variances in one or two typical instances.

Table I shows the analysis of 47 lots of Sakel and 51 lots of Malaki grown together at Sakha in 1942. They were single-ridge crops grown in two repetitions, and two micro spinnings were done on each repetition. All the seed lots were taken at random from different ginners (except one control lot of pedigree seed in each case), and they represent the seed available to ordinary cultivators in 1942. At this date Sakel was at the end of its life, and many badly contaminated lots were to be found; Malaki was newly introduced and relatively uniform. The analysis shows the unwanted variances in the testing to be trivial compared with the magnitude of the real variance between different seed lots.

**Table I**

<table>
<thead>
<tr>
<th>Source of variance</th>
<th>Sum of squares</th>
<th>Degrees of freedom</th>
<th>Variance</th>
<th>F obtained</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>47 LOTS OF SAKEL</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between lots</td>
<td>39,450</td>
<td>46</td>
<td>858</td>
<td>9.75</td>
</tr>
<tr>
<td>Between repetitions</td>
<td>4,158</td>
<td>47</td>
<td>88</td>
<td>—</td>
</tr>
<tr>
<td>Between micro spinnings</td>
<td>2,624</td>
<td>94</td>
<td>27</td>
<td>—</td>
</tr>
<tr>
<td>Total</td>
<td>46,138</td>
<td>187</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td><strong>51 LOTS OF MALAKI</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between lots</td>
<td>14,086</td>
<td>50</td>
<td>282</td>
<td>3.53</td>
</tr>
<tr>
<td>Between repetitions</td>
<td>4,078</td>
<td>51</td>
<td>80</td>
<td>—</td>
</tr>
<tr>
<td>Between micro spinnings</td>
<td>3,377</td>
<td>102</td>
<td>33</td>
<td>—</td>
</tr>
<tr>
<td>Total</td>
<td>21,551</td>
<td>205</td>
<td>—</td>
<td>—</td>
</tr>
</tbody>
</table>

(Block variances were trivial for both varieties)
"F required" for significance at the 20:1 level is about 1.6. It will be seen that "F obtained" is far higher both for Sakel and for Malaki, therefore the significance of real variance between lots is overwhelming. Inside either variety, a difference exceeding 130 lea product units is significant, and much more than this was found. For Sakel, the highest lea product of the 47 lots was 2,920, and the lowest was 2,265—a difference of 655 units. For Malaki, the highest lea product of the 51 lots was 3,120, and the lowest 2,770—a difference of 350 units. This high significance with yarn strengths is in marked contrast to the low significance usually obtained for yield data with correspondingly simple layouts. Not only is the genetic variance of lea product usually greater, the errors in its determination are less.

As a direct check on the reality of selections, seed from the four highest and four lowest lots of both Sakel and Malaki, picked out on the 1942 crop testings, was re-grown as four composites in 1943. The second spinnings well confirmed the original placings (Table II).

### Table II

<table>
<thead>
<tr>
<th>Lea Products, without Correction for Grade.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sakel</td>
</tr>
<tr>
<td>Original 1942</td>
</tr>
<tr>
<td>Four highest lots ...</td>
</tr>
<tr>
<td>Four lowest lots ...</td>
</tr>
</tbody>
</table>

Since a clearer picture of the component variations involved is given by the Standard Deviations of Lea Product (S.D. of L.P.), the best estimates obtainable from the Table I analysis are presented in this form in Table III. The S.D. of L.P. is expressed as a percentage of the mean lea product for each variety; the total S.D. is found by adding the squares of the component S.D.'s and taking the square root.

### Table III

#### Standard Deviation of Lea Products in Commercial Lots

*(Components of the total S.D. derived from Table I)*

<table>
<thead>
<tr>
<th></th>
<th>Sakel (47 lots)</th>
<th>Malaki (61 lots)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) Genetic, between lots</td>
<td>5.7%</td>
<td>2.4%</td>
</tr>
<tr>
<td>(b) Spinning error, single spinning</td>
<td>2.2%</td>
<td>2.0%</td>
</tr>
<tr>
<td>(c) Sampling error, single ridge crop</td>
<td>2.3%</td>
<td>1.7%</td>
</tr>
<tr>
<td>Total, one micro spinning on a single ridge crop</td>
<td>6.5%</td>
<td>3.6%</td>
</tr>
<tr>
<td>Mean lea product, 60s carded twist</td>
<td>2,445</td>
<td>2,955</td>
</tr>
</tbody>
</table>

Thus with experimental errors eliminated, the isolated genetic variation between lots is represented by an S.D. of L.P. of 5.7 per cent. for Sakel, and 2.4 per cent. for Malaki, clearly demonstrating the greater contamination among Sakel lots.

At 2.2 per cent. and 2.0 per cent. the above estimates of spinning error for a single micro spinning are higher than is usually found. The best available estimate based on some hundreds of replicated tests is 1.6 per cent., representing the error due to spinning factors alone, cotton sampling errors eliminated. The corresponding value for kilogram spinnings is 1.0 per cent. Thus two or three micro spinnings give significance about equal to 1 kilogram spinning, and the purely spinning errors are surprisingly little affected by the seventeen-fold reduction in weight of sample for test.
The sampling error of a single-ridge crop (weighing usually 100 to 300 grams of lint) varies according to the size of the plot. The range of environment—soil character, water supply, insect damage, etc.—naturally tends to be less within a few ridges than over a large number. Cotton from distant ridges of a big plot may be not at all comparable because of this sampling error. But even without repetitions, quality comparisons of value can still be made so long as the series is confined within a dozen or so ridges. This is often possible (as with sister families at their first expansion), and the environmental factor is usually represented by an S.D. of L.P. less than 2 per cent. for single-ridge crops. Two per cent. was also the sampling error in the above experiments on Sakel and Malaki, even though each plot contained about a hundred ridges, and the repetitions were rather distant.

To find the average total unwanted error, the 1.6 per cent. spinning error must be added to the 2 per cent. sampling error. Thus for a single micro spinning on a single-ridge crop, the total unwanted variation is normally represented by an S.D. of L.P. equal to \(\sqrt{2.03 + 1.6^2}\), or 2.6 per cent. Apart from the chequers, the most common experimental condition at Giza is two micro spinnings on a small bulk from three or four adjacent ridges. Inside small series the total unwanted error then falls below 2 per cent., and selections for quality at 20:1 significance can be made between strains in which the genetic S.D. is not less than about 2.5 per cent.

Spinners, no less than botanists, may be surprised at the high variation in lea product found between cotton families even when they are closely related. The isolated genetic S.D. of L.P. for F.4 and F.6 sister families recently tested at Giza was 4.5 per cent. and 3 per cent. respectively, taking the crude average for all types which happened to be passing through. F.4 sisters thus vary in quality not much less than 1942 commercial Sakel lots, a degree of purity that certainly can not be described as Aryan! No data on the genetics of spinning quality appear to have been published hitherto, but it is hoped to discuss this subject in a separate paper shortly.

It is concluded that the accuracy of one or two micro spinnings is ample for selection up to F.6 within average sister families, and of course beyond F.6 within first or second cousin families. When the over-all yield-and-quality value of a new variety is in question, it is invariably the growers' problems such as the amount of seed, land, or labour available—and not the difficulties of spinning—that set a limit to the accuracy of determination.

**Micro Tests in the Control of Crop Deterioration**

The fast rate of working has made possible a very important application of spinning tests in commercial crop control.

All seed intended for sowing in the Egyptian commercial crop has to be submitted in advance to the Ministry of Agriculture, as laid down in the Seed Control Law of 1926. About 10,000 lots per year are sent for examination, of which about 1,500 lots fail to pass the steadily rising standards of seed purity and are rejected for sowing. The measure has been remarkably successful in eliminating commercial lots with off-type seeds; but it has been realised for some time that certain deteriorated elements could exist in the crop and yet be indistinguishable in the seed. Sakel was particularly unfortunate in this respect.

By a happy chance the Spinning-Test Mill at Giza is part of the Department of the Ministry (the Botanical Section), which operates the Seed Control Law. The possibilities of the new spinning-test as a crop control measure were therefore at once recognised, with administrative difficulties at a minimum, by the one Department which could put such control into

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*The sampling error for the composite sample drawn from a chequer with seven repetitions is about 0.5 per cent.
Fig. 1. Correlation between lea products from standard kilogram spinnings and 60-gram spinnings, all in 60s carded ring twist. Each point is the mean of two kilogram spinnings and four 60-gram spinnings.

Fig. 2. A 60-gram sample on its way through spinning. Starting at the top left: 60 grams of lint; 1st card sliver; lap for 2nd carding; 2nd card sliver; drawlap for 1st drawing; 1st drawframe sliver in eight divisions of its box; 2nd drawframe sliver; two slubber bobbins; two inter bobbins; two rover bobbins; and four ring bobbins holding a total of 24 leas of yarn, being two leas from each of 12 spindles.
effect. It was only necessary to have the ginners’ lots sent for testing in the form of seed-cotton instead of seed only; and a start was made in 1942–43 for long-stapled varieties only, using the spinning-test as basis of acceptance or refusal. There can be no more direct control of quality than this.

Accidents of grade or locality which do not at all reflect contamination in the seed, are liable to influence the spinning quality of the cotton submitted for test. A correction to constant grade must therefore be made, and this is always possible because the lint samples are classified for grade before receipt at the spinning mill. A precise estimate of locality effects is in process of determination, but these are already known to be small compared to the effects of even moderate seed contamination.

In the case of a long established variety like Sakel, which is badly contaminated, genetic variance between lots is four or five times as great as the variance from all other causes; elimination of a proportion of seed-cotton lots with the lowest spinning values is therefore efficient. With newly introduced varieties, on the other hand, genetic differences between different lots in circulation may be so small that they are exceeded by factors arising merely from the conditions of growth. Elimination is then inefficient but it doesn’t matter. Only trivial amounts of Karnak were rejected on the spinning-test in 1942–43; because few apparently contaminated lots were found; and even this low rate of rejection turned out to be unduly severe, because check growings the following year showed most of the rejected lots to be normal. In this newly introduced variety, it would not have mattered if nothing at all had been rejected.

The variability of lea products in the cotton from different ginners, being lots submitted for examination under the Seed Control Law, is shown in Table IV. The data represent the lint from 1942 crop seed intended for sowings in 1943, four varieties being tested. There is higher variability between lots, with increase in age of the variety.

<table>
<thead>
<tr>
<th>Variety</th>
<th>Age of variety</th>
<th>Total variation ((a, b, c))</th>
<th>Spinning error (b)</th>
<th>Genetic and environmental* (\sigma and \tau)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Karnak</td>
<td>Newest</td>
<td>2.3&quot;(a), 2.4&quot;(b), 3.2&quot;(c)</td>
<td>1.7&quot; (b)</td>
<td>4.6&quot; (\sigma)</td>
</tr>
<tr>
<td>Malaki</td>
<td>New</td>
<td>2.6&quot; (a), 1.6&quot; (b), 3.2&quot; (c)</td>
<td>2.4&quot; (b)</td>
<td>2.0&quot; (\sigma)</td>
</tr>
<tr>
<td>Sakha</td>
<td>Old</td>
<td>3.2&quot; (a), 1.8&quot; (b), 2.4&quot; (c)</td>
<td>1.6&quot; (b)</td>
<td>4.9&quot; (\sigma)</td>
</tr>
<tr>
<td>Sakel</td>
<td>Oldest</td>
<td>5.2&quot; (a), 1.6&quot; (b), 4.0&quot; (c)</td>
<td>4.9&quot; (b)</td>
<td>7.5&quot; (\sigma)</td>
</tr>
</tbody>
</table>

* By subtraction of the Spinning Error from Total Variation, subtracting as squares and taking the square root.

There is no way of separating genetic from environmental factors (in their effect upon yarn strengths) for the data of this Table. But evidently the locality factor is not large—the total variation from both causes reaches an S.D. of only 1.6 per cent, for Karnak although this variety was received from every province in the Delta; 1.6 per cent, is thus the maximum value of the locality factor for Karnak. These commercially grown cottons are samples from fields of hundreds or thousands of ridges, and the locality factor here in question is the variation between bulks from the different fields where the cotton happened to be grown. The locality sampling discussed in an earlier section of this paper was that between single-ridge crops from one plot at Sakha; and it is interesting to note that the latter, with an S.D. about 2 per cent., is greater than the variation (S.D. below 1.6 per cent.)
between well sampled bulks grown all over the Delta. To put this in other words: with uniform seed and considering only cotton of constant grade, there is more variation in spinning quality between single ridge crops grown in one plot at Sakha, than there is between well sampled crops from fields scattered all over the Egyptian Delta.

In order to check the reality of the preceding season's rejections, composites of "accepted" and "refused" seed were grown by us in 1943, and the resulting cotton tested for spinning. These testings are shown in Table V. Refused lots were of appreciably lower quality in the cases of Sakel, Malaki and Sakha 4, but not in the case of Karnak for the reasons previously given. In this the first year of testing, the standards were not quite right and should have been even easier than they were on Karnak, but more severe on Sakha 4. But the micro spinning-test seems sensitive enough to detect and eliminate contamination before it becomes serious, and there is promise that the new method marks a real advance in crop control for quality.

### Table V

**Check Testings on Growings from "Refused" Seed Lots**

<table>
<thead>
<tr>
<th></th>
<th>Karnak</th>
<th>Malaki</th>
<th>Sakha 4</th>
<th>Sakel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accepted</td>
<td>3.065</td>
<td>3.148</td>
<td>2.795</td>
<td>2.838</td>
</tr>
<tr>
<td>Refused</td>
<td>2.995</td>
<td>2.972</td>
<td>2.634</td>
<td>2.468</td>
</tr>
<tr>
<td>Difference</td>
<td>3</td>
<td>26</td>
<td>147</td>
<td>370</td>
</tr>
<tr>
<td>% Refused</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

To the growers, there are big and obvious advantages in the efficient elimination of contaminated seed. To spinners, the new method of elimination should make a strong appeal because it not only maintains the quality level of the crop, it means greater uniformity in raw cotton deliveries. From either point of view, spinners have a powerful new ally in their battle to "keep up the ends." That spinners shall be able to buy Egyptian cottons on their description alone and be able to maintain uniformity of spinning production, has been recognised as an aim of policy here for many years. This is evident by the many items of legislation introduced to that end. Egyptian growers have now adopted the spinner's own criterion of uniformity—yarn strength uniformity. No direct control of this kind has previously been attempted on the commercial supply of seed for the sowing of any cotton crop.

Cotton Research Board,
Orman, Giza, Egypt.

**REFERENCES**

LIST OF ABSTRACTORS

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

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In this Section the abstractors give digests of reports published in technical and scientific periodicals of the whole world. The opinions and claims expressed in the abstracts are those of the original authors and it must be understood that the staff of the Textile Institute do not necessarily endorse them.

1—FIBRES AND THEIR PRODUCTION

(B)—ANIMAL

South African Wool Clip. L. L. Roux. Fmg. in S. Africa, 1944, 19, 665-667. A plea for maintaining the value and prestige of the merino wool clip of the Union of South Africa by adopting a definite breeding policy. The use of non-wooled breeds to produce vigour and hardiness should be avoided as these introduce hair and coloured fibres.

Merino Wool Production in South Africa. V. Bosman. Fmg. in S. Africa, 1944, 19, 595-597. A high price per lb. of wool is not necessarily the basis for profitable fleece production, and farmers are urged to give attention to the returns per sheep rather than to a high price per lb. of wool.


What is a Stud Ram? J. F. Walker. Natl. Wool Grower, 1944, 34, No. 7, 11-12. (Reprinted from the Sheepman, December, 1943.) In selecting a stud ram it is not safe to rely solely on individuality, pedigree represented by a mere list of names, or a show yard record of ancestry. In a prospective stud, the ewe flock should first be studied, and then selection made from sires that have a record of producing outstanding sheep.

Skinfolds and Development. E. N. Roberts. Merino Breeders' J., 1944, 6, No. 3, 16-19, 21-23. Development is caused by the mechanical effect on the skin of external stresses arising from congestion in the fleece. The congesting.
factors are, in order of importance, movement, size of frame, rigidity and robustness, elasticity and spring of fibre, depth of crimp, strength of fibre, density of fibre, and condition of wool. Top sires must carry desirable characteristics in excess; in the general flock any excess is to be avoided. Development can be controlled by selective and corrective breeding, or by forcing the young stock during their growing period to attain a size of body to fit the skin.

Mechanical Wool Baler. O. J. Wolff. Natl. Wool Grower, 1944, 34. No. 7, 12. The baler is operated by a truck or car, using 5 pulleys and a cable, the plunger consisting of a 50 gal. barrel with 900 lb. weight. 4, 6 or 8 fleeces can be baled at a time. The same arrangement can be used horizontally, the unweighted plunger being pushed and pulled by a truck on the ground. W.

(C)—Vegetable

Cotton Plant Variety Tests in Mississippi Hill Section, 1942. J. F. O'Kelly, E. B. Ferris and T. E. Ashley. Mississippi Sta. Bul. 386, 1943, 7 pp. (through Exp. Sta. Rec., 1944, 90, 617). Varieties leading in value of production in tests at the station and sub-stations included Acala 892, Bobshaw 1, Coker 100-5, and 100 Wilt, Delfos 531 C and 651, Deltapine 12 and 14, Miller, and Stoneville 2 B; on wilt-infested soil at the station Miller, Cleveland 54, Stoneville 2 B and 8275, and Coker 100 Wilt; and in the test of standard and new varieties at the station Delfos 651, 531 C and 6466, Deltapine 14, Miller, and Stoneville 2 B and 8275.


French (Small-seeded) West Indian Cotton: Survival. J. B. Hutchinson and S. G. Stephens. Tropical Agriculture, 1944, 21, 123-125. The indigenous perennial cottons found in the West Indies to-day and records of the cottons grown in the West Indies in the 18th century are discussed, and the conclusion is drawn that the "non-fuzzy" Marie-galante cottons of Haiti, the Grenadines, the Virgin Islands and Tobago represent the relics of the French or Small-seeded cotton which was so esteemed in the 18th century.

Cotton Root Rot Disease: Control by Varying Sowing Date. R. S. Vasudeva. Indian J. Agric. Sci., 1943, 13, 515-519. A report is given of a study, extending over a period of five years, of the effect of sowing date on the incidence of cotton root rot disease and the yield of seed cotton in the Punjab. The results show that late sowings towards the end of June and early sowings in the first week of April escape a severe attack of the disease. May sowings are most severely attacked. From infected fields remunerative yields of both desi and American varieties can be obtained by sowing about the end of June and by close plantings. Also, a reasonable outturn can be obtained from infected fields by sowing desi cotton (G. arboreum var. neglectum f. bengalensis) very early, i.e. in the first week of April. American cotton, when sown so early, may be adversely affected in certain seasons due to bad opening of the bolls.

Cotton Seedlings: Resistance to Angular Leaf Spot Disease; Testing. R. Weindling. Phytopathology, 1944, 33, 235-239 (through Rev. Appl. Mycol., 1944, 23, 299). The technique for testing the resistance of cotton seedlings to angular leaf spot (Phytoponas [Xanthomonas] malvacearum) involved the inoculation of the seed of 20 varieties in suspensions of the pathogen for periods of five minutes and three hours and growing the resultant seedlings for three weeks at 27° to 35° C., the relative disease rating being based on the severity and speed of development of the lesions. In general, the varietal reactions of the seedlings tested under these conditions agreed with those of field plants. Thus the percentages of infection in five representative varieties, viz.: S × P Egyptian (extremely susceptible), Shafter Acala (highly susceptible), Rogers' Acala (moderately susceptible), Stoneville 4-5 (tolerant), and Stoneville 4-8 (resistant), for the short and long inoculation periods were 100 and 100, 92 and 100, 48 and 86, 64 and 66, and 18 and 28, respectively, comparison of the
more susceptible varieties being facilitated by the use of a disease index. The Stoneville lines, unlike the other varieties tested, did not contract appreciably more infection after the longer inoculation period, which frequently resulted, however, in the appearance of necrotic spots on 4-8. This may point to the possession of a factor for resistance involving cotyledonary hypersensitivity, which would result in such rapid necrosis of the affected cells as to give the parasite little opportunity of producing the typical lesions. It is thought the method may serve as a rapid supplementary test in breeding disease-resistant varieties.

**Punjab-American Cottons: Weather Factors and Spread of Tirak Disease.**
R. H. Dastur and V. C. Tashna. *Indian J. Agric. Sci.*, 1943, 13, 449-467. A statistical study is made of the trends in yields of American and desi cottons in the Punjab for the period 1914-1940 and the relation of weather factors to the annual variations in yields. No direct relationship between weather factors and yield is obtained. Weather factors that cause a greater spread of *tirak* in some years (failure years) than in others are examined and it is pointed out that the *tirak* years are characterised by hot September or October. These months are marked with spells of unusually warm weather lasting for 10 days or more. Some of these years are marked by a total absence of rain in September. The following generalisations concerning the incidence of *tirak* can now be made: (1) Under given conditions of sowing time and temperature the resistance of the crop to *tirak* declines as salinity increases. (2) Under given conditions of sowing time and salinity, the resistance of the crop to *tirak* declines as the temperatures in the months of September and October rise above the normal in long spells. (3) Under given conditions of salinity and temperature the resistance of the crop to *tirak* increases as the sowings are delayed from May to the last week of June.

**Boll Weevil and Cotton Aphid: Control in the Mississippi Delta.**
R. L. McGarr and J. R. Henry. *J. Econ. Entomology*, 1943, 36, 716-718 (through Exp. Sta. Rec., 1944, 90, 368). Treatments with calcium arsenate alone and plus 2 per cent. of nicotine in alternate, and with calcium arsenate plus 1 per cent. nicotine in all, applications gave good control both in plats of about 2-3½ acres and those of 0·2 acre each. The increase in yields for the alternate applications was 415 lb. of seed cotton per acre in the large and 323 lb. in the small plats; for the second mixture the yield increases were 394 and 318 lb., respectively. With calcium arsenate minus aphicides there was a loss of 138 lb. per acre in the large and a gain of 11 lb. in the small plats. In the small-plat tests better boll weevil control was obtained with calcium arsenate alone than when mixed with sulphur (1-2) but without aphicides more aphids developed, with accompanying decreases in yield. Calcium arsenate plus nicotine and calcium arsenate-sulphur plus nicotine and Lethane 60 all gave better aphid control than calcium arsenate plus 0·5 per cent. of rotenone. The tests as a whole indicated that losses in yield from aphids following the dusting of high-yielding cotton with calcium arsenate may exceed the gains from control of light to moderate weevil infestations.

**Cotton Bales: Packing.**
I. J. Watson and V. L. Stedronskey. *U.S. Dept. Agr., Misc. Pub.*, 527, 1943, 22 pp. (through Exp. Sta. Rec., 1944, 90, 399). The author discusses first such problems of uneven packing of bales as wear and tear in gin equipment, compression difficulties, inconvenience in handling, shipping, transportation and storage. He then considers sources of uneven packing and means of elimination, such as big-ended bales and the use of the lint-flue deflector and proper care of the condenser to prevent them, heavy-sided or rolling bales and regulation of kicker speed to prevent them, and dog ridges and modification of the dog mechanism to eliminate them. Heavyweight bales as a factor in uneven packing and pressing difficulties are dealt with also.

**American Cotton Quality Statistics.**
*U.S. Dept. Agric., Food Distrib. Admin.*, 1943, CS-5, 58 pp. (through Exp. Sta. Rec., 1944, 90, 546). Data about grades and staple length are presented for the United States and each cooperating State and about the carry-overs, supplies and consumption, tenderability, etc., for the United States for 1942-43.

**Cotton Futures Statistics.**
Cotton Plant: Variety Tests. J. W. Neely and S. G. Brain. *Mississippi Sta. Bul.* 398, 1944, 8 pp. and *Miss. Farm. Res. [Mississippi Sta.]*, 1944, 7, No. 2, pp. 1, 2, 7 (through *Exp. Sta. Rec.*, 1944, 91, 29). In six variety tests conducted in 1943 at six points in the Yazoo-Mississippi Delta, the leading money value producers were Stoneville 2B, Stoneville 2C, and Deltapine 14, followed closely by Miller, Delfos 651, Rowden, and Bobshaw 1. The earliest varieties were Wilds 15, Rowden, and Deltapine 14. Outstanding in fibre strength were Wilds 15, Bobshaw 1, Bobdel and Rowden. In regard to fibre length uniformity, Rowden, Miller, Bobshaw 1, Bobdel and Deltapine 14 led the list.

Cotton Plant: Variety Tests in Georgia. R. P. Bledsoe, W. W. Ballard and A. L. Smith. *Georgia Sta. Circ.*, 144, 1944, 7 pp. (through *Exp. Sta. Rec.*, 1944, 91, 150). The results of tests at four locations in north Georgia and three locations in south Georgia during 1943 are tabulated, with averages for the period 1938-43. During the 2-year period 1942-43, strains of Empire cotton led other varieties in money value, but with relatively small differences from the five varieties of Coker cotton. In 3-year averages in south Georgia, Coker 100 wilt appeared somewhat superior in yield and money value, had a fibre length of about 1 in., under most conditions, and was thought to be an improvement over other wilt-resistant varieties. Stonewill 2, tested for only 2 years, appeared to be of about equal value. For Coastal Plain soils known to be wilt-free or lightly infested, Deltapine or Stoneville are suggested.

Cotton Plant: Variety Tests in Mississippi Hill Station. J. F. O'Kelly. *Mississippi Sta. Bul.* 396, 1944, 8 pp. (through *Exp. Sta. Rec.*, 1944, 91, 151). Yields obtained in tests at six locations in 1943 are tabulated, with averages for 1939-43. Hi-Bred led in lint percentage at all locations and in pounds of lint per acre at all locations except Holly Springs, where it was exceeded by Acala 892 and Miller on the hill soils, and by Deltapine 14 and Stoneville 2B on the valley soils. Delfos 531 and Express 11384 led in staple length with 1 1/2 in.

Cotton Plant: Manuring; Effect of Adding Sodium to Potash Fertilizer. H. P. Cooper and W. H. Garman. *Amor. Fert.*, 1944, 100, No. 1, 9-10 (through *Exp. Sta. Rec.*, 1944, 91, 18). Data are presented on the comparative yield of seed cotton at the Sandhill Sub-station on Norfolk loamy soil at different levels of potash fertilization when Na was added to the fertilizer. A progressive percentage decrease in yield of seed cotton was obtained from the use of Na coincident with the increase in rate of potash fertilization. Where no potash was applied, the addition of Na increased the yield by 215 lb. of seed cotton per acre, or 70.3 per cent.; whereas with 60 lb. of potash the increase from the use of Na was 182 lb., or 15.1 per cent.

Cotton "Topallik" Disease: Characteristics and Cause. G. Gassner. *Phytopathol. Z.*, 1943, 14, 518-521 (through *Exp. Sta. Rec.*, 1944, 91, 42). In the extensive cotton districts south of Adana and Tarsus in southern Turkey, the author observed a condition designated by the growers as Topallik disease, characterised by lack of roots and the consequent drying up of the plant. The malady is ascribed to an abnormal rise in the salt content of the soil during the summer drought.

Milkweeds: Utilisation. A. G. Whiting. *U.S. Dept. Agr., Bibliog. Bul.* 2, 1943, 41 pp. (through *Exp. Sta. Rec.*, 1944, 90, 336). The part of this summary on fibre production reviews the history, botanical characteristics, chemical and physical properties, processing and uses of floss and bast fibres of common milkweed (*Asclepias syriaca*), and culture and harvest methods, and provides similar information on bast fibre of swamp milkweed (*A. incarnata*) and notes on other species and covers 49 references. The section concerned with rubber reviews the history, botanical characteristics, rubber content, analysis and extraction, properties of rubber, and culture and harvest of common and desert milkweed (*A. subulata*) and *A. erosa* and eight other species of *Asclepias*.
Cellulose: Production, Analysis and Properties. L. Molnár. Technika
(Budapest), 1942, 25, 252-259, 288-291 (through Chem. Zentr., 1943, i, 1434
and Chem. Abstr., 1944, 38, 4127*). A discussion of the manufacture of
cellulose, methods of determining the cellulose content of raw materials,
analysis of cellulose (determinations of α-cellulose, hemicellulose, ash, pentosan,
mannan, galactan, methylfurural, pectin, lignin, resin, etc.), methods of
determining the reactivity (swelling power, and viscosity of xanthate solution)
and the degree of polymerisation of cellulose.

Trade J., 1944, 119, TAPPI, 117-119. The authors criticise the definition and
determination of α-, β- and γ-cellulose as being inadequate, at least for "pulp
for rayon." They suggest that "α-cellulose is that fraction of the pulp which
is insoluble in 17.5 per cent. sodium hydroxide at 20° C. having a degree of
polymerisation (D.P.) of 200 or more, and it is this fraction that contributes
most to the physical strength," but they feel that for pulp for rayon it
would be useful to know how much of the material falls in the lower ranges of D.P.
and how much in the higher. The effect of bleaching on the α, β and γ balance
is discussed. The following data show how the balance varies in different
grades:

<table>
<thead>
<tr>
<th>Grade</th>
<th>α (%)</th>
<th>β (%)</th>
<th>γ (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unbleached sulphite for paper</td>
<td>80</td>
<td>3</td>
<td>8</td>
</tr>
<tr>
<td>Bleached sulphite for paper</td>
<td>88</td>
<td>5</td>
<td>7</td>
</tr>
<tr>
<td>Pulp for rayon</td>
<td>92</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Pulp for Cellophane</td>
<td>88</td>
<td>9</td>
<td>3</td>
</tr>
</tbody>
</table>

Cellulose: Acetylation in a Heterogeneous Medium. Z. A. Rogovin and M.
Abstr., 1944, 38, 4126*). Cellulose is treated with 10-15 times its weight
of acetic acid to cause swelling. It is centrifuged to remove excess acetic acid
and then stirred with a mixture of 30 parts acetic anhydride and 70 parts toluene
in the ratio of 1 part cellulose to 25 parts solution at 35° for 1.5-2 hours. As
a catalyst, 0.5 per cent. perchloric acid is used. This gives a product contain-
ing 62.0-62.3 per cent. acetyl groups, completely soluble in methylene
chloride and chloroform. The cellulose acetate is washed repeatedly with
toluene to remove excess acetic anhydride. The toluene is finally removed by
steam and the cellulose acetate is dried. The acetylating mixture can be used
until it contains 20 per cent. acetic acid. It is then fractionated into acetic acid
and pure acetic anhydride.

346. The writer protests that to call nylon a "polyamide" is a misnomer.
The link is \(-\text{CO-NH}-\), an imido group, and "polyimide" would be a correct
term. The name "Polypeptide" is best reserved for the condensed amino-
acids.

Superpolyamide Filaments: Production, Properties and Applications. W.
390 and Chem. Abstr., 1944, 38, 4063*). A comprehensive report is given (in
the Dutch original) on the manufacture, structure, properties and applica-
tions of nylon, Perlon and Perluuran.

and increase of formaldehyde concentration in the tanning bath increase the
amount of combined formaldehyde in the fibre. Excessive duration of tanning
or formaldehyde concentration decreases the fibre strength. Optimum
conditions are: formaldehyde 50 g./l., sodium sulphate 150 g./l., temperature
25°, duration 8-10 hours, \(pH\) 4.5-5. A second tanning with formaldehyde
(following formaldehyde- and chrome-tanning) increases the fibre strength,
both wet and dry. For maximum strength the amount of combined chromium
sesquioxide in the fibre should be greater than 2 per cent. Alkali washing
subsequent to chrome-tanning is desirable.

Vinyon Filaments: Production, Properties and Uses. Silk & Rayon, 1944,
18, 36-40; 372-4, 437, 764-7. The development of Vinyon is traced in a review
of the patents.
Glass Fibre Yarns and Fabrics: Production. R. M. Lester. *Textile Weekly*, 1944, 34, 696. Brief mention is made of “Idaglass,” a product with staple length 8-15 inches, and of “Eutex” continuous-filament and spun yarns and filter and electrical insulation cloths. In the production of Idaglass, molten glass falls through fine holes in a platinum crucible down a hood and the filaments are blown to pieces by compressed air. The product falls “many dozens of feet” and is collected on a conveyor belt.

**Viscose: Solution State.** J. J. Stöckly. *Kolloid Z.*, 1943, 105, 190-199 (through Brit. Chem. Physiol Abstr., 1944, B II, 251). Current views of the solution state of viscose are reviewed, and a new type of state is suggested, called the cellulose chain mixed body. It is described by reference to three ideas already in use, viz., mesophases, myelin figures, and rod mixed bodies. Technical spinning solutions of cellulose are supposed to consist of bundles of esterified or etherified solvated chain molecules. The new hypothesis agrees with the more important properties of viscose solutions, e.g. the dissolution of cellulose xanthate, the process of ripening, the coagulation and decomposition of viscose, and with the properties of regenerated cellulose.

**Viscose Solutions: Viscosity.** M. Takei. *Kolloid Z.*, 1944, 106, 30-35 (through Chem. Abstr., 1944, 38, 4179). The viscosity of solutions of cellulose xanthate in solutions of caustic soda has been studied. A viscosity/concentration relation previously given is utilised to characterise the degree of solvation and the size of the dissolved units. With increasing duration of the preliminary ripening process (in a range from 1.5 to 97.5 hours) the amount of solvation increases and the particle size decreases. In this process there occurs a partial disorientation of the ordered regions in alkali cellulose. Although the unripened viscose possesses only a primary structure, a secondary one is formed in the preripened material. After-ripening for time intervals from 26 to 122 hours depresses the extent of solvation the more, the longer the period of preliminary ripening. However, only a slight effect on particle size is observed. Both variations are the smaller, the larger the amount of carbon disulphide added. However, after an uptake of a definite quantity of carbon disulphide no further changes in the state of solution are brought about by further addition. The degrees of solvation in 4 per cent. and 7 per cent. solutions of caustic soda are practically identical, but are increased in highly dilute solutions. Also the size of the micelles reaches a maximum under these conditions. It is assumed that the units of viscose in technical spinning solutions possess an ordered structure characteristic of so-called fringe micelles.

**Ethylene Polymer and Interpolymer Threads: Treatment to Reduce Heat Shrinkage.** E. I. Du Pont de Nemours & Co. and H. G. Ingersoll. B.P. 564,584 of 6/1/1943:4/10/1944. The shrinkage on heating of threads and the like made of solid polythene or solid ethylene interpolymers is reduced by a process which comprises heat-setting previously orientated threads while preventing contraction at a temperature above the desired initial shrinkage temperature, but below the melting point of the solid, until there is no further appreciable reduction in tension, and then shrinking by heating in the relaxed condition at a temperature at least as high as the desired initial shrinkage temperature, but below the temperature of the heat-setting operation. During the heat-setting operation the thread may be held at constant length or extended by drawing it to slightly less than break elongation, and this latter procedure is especially applicable in a continuous process and increases the tenacity of the thread.

**Rayon Spinning Bucket.** American Viscose Corporation. B.P.561,718 of 18/5/1943:10/10/1944 (Conv. 10/11/1942). A spinning bucket is provided with one or more openings extending through the bottom for the reception of cake-ejecting means, and a cake-supporting element, such as a disc, situated within the bucket over the openings and displaceable axially by the cake-ejecting means, which may comprise one or more pins insertable through the openings to displace the cake-supporting element axially of the bucket.

**Straw Pulp: Production.** English Cellulose Derivatives Ltd. and G. Ullman. B.P.564,833 of 2/12/1943:16/10/1944. A process for the production of pulp from fibre-bearing vegetable materials, e.g. cereal straw, comprises continuous
pre-treatment under atmospheric pressure with a weak alkaline or chlorine-containing solution by which non-cellulosic substances are dissolved, removing the excess solution, washing to remove the dissolved substances, and subjecting the washed material in an independent process to a discontinuous digestion treatment under pressure with an alkaline or acid solution. The liquor used for the pre-treatment may be the black liquor from a previous digestion treatment. Metal compounds, preferably aluminium compounds, which combine with the organic matters, silica, etc., may be added to the solutions used in the pre-treatment and/or digestion treatment. The pulp obtained is then bleached in one or more stages.

Protein Fibres: Treatment with Hardening Liquids. Courtaulds Ltd, and R. L. Wormell. B.P.555,011 of 25/11/1943:23/10/1944. A process of treating a tow of casein or the like protein fibres with a hardening liquid of greater specific gravity consists in continuously feeding the tow in convolutions on to the surface of a bath of the liquid so that the convoluted surface of the tow floats on or in the liquid, allowing the tow to accumulate in the liquid for sufficient time to produce the desired effect and thereafter continuously withdrawing the tow from the treating liquid at a rate substantially equal to the rate of feed by removing the tow from the underside of the mass of convolutions and then conducting the tow out of the liquid through guiding means so that entanglement of the tow is avoided. The guiding means may consist of a tube the entrance of which is situated below the mass of convolutions of the tow, or of pulleys, hooks or bars. The liquid bath may be contained in a cylindrical container and a slow circulatory motion imparted to the liquid. Alternatively, the liquid may be contained in a long rectangular container and a slow current of liquid maintained to float the tow along the container.

Polyamide Filaments, Bristles and Yarns: Treatment with Formaldehyde. D. McCready and Imperial Chemical Industries Ltd. B.P.555,066 of 18/11/1943:25/10/1944. A process for modifying the properties of filaments, bristles, yarns and like shaped articles derived from synthetic linear polyamides which have not been cold drawn, so that they are no longer capable of being cold drawn by more than about 75 per cent. of their original lengths comprises impregnating the filaments, bristles, yarns and like shaped articles with an aqueous solution having a pH of 3.0 or less and having dissolved therein not less than 20 per cent. by weight of formaldehyde as well as a catalyst, preferably removing the solution adhering to the surface of the articles and then baking at 100-150°C. Suitable catalysts include acids with ionization constants of not less than 1.0 x 10^{-7} at 25°C, or soluble ammonium, amine or metallic salts of these; they may be used alone, in admixture with one another, or in admixture with salts or acids with lower dissociation constants.

Cellulose Mixed Esters: Production. Hercules Powder Co. and B. T. Lamborn. B.P.555,179 of 29/11/1943:31/10/1944 (Conv. 6/10/1942). In a process for the manufacture of cellulose mixed esters, the esterification is carried out in the presence of a stable chlorofluorohydrocarbon, e.g. trichlorofluoromethane, in order to reduce the reaction temperature. The esterification may be effected with anhydrides of fatty acids with sulphuric acid as catalyst. The chlorofluorohydrocarbon acts as a solvent for the mixed ester and when completely driven off will leave a product having a desirable high viscosity.

Rayon Staple Cutting Device. American Viscose Corporation. B.P.555,250 of 18/5/1943:1/11/1944 (Conv. 22/10/1942). In a device for cutting rayon staple comprising a knife, a shear member having at least one portion adapted to serve as a cutting base in co-operation with the knife and having at least one portion not so adapted, and means for imparting continuous motion to one of the members relative to the other to effect cyclical juxtaposition of the cutting and non-cutting portions of the shear member with respect to the knife to effect intermittent cutting, means are provided for separating the knife from contact with the shear member during a substantial part of the periods of juxtaposition of the non-cutting portion of the shear member with respect to the knife.Cam means may be provided for separating the knife from contact with the shear member.

supporting square ends and radially zigzag channels. (b) The winding mechanism is claimed. (c) A group of layers of thread is disposed at spaced, radial points throughout the body of the package with a different axial arrangement from that of the layers underneath. (d) The axial length of successively formed helices is progressively decreased throughout the period in which the freshly spun thread is collected in helices on the package.

### Rayon Thread-storage Thread-advancing Device

**American Viscose Corporation. U.S.P.2,338,755.** The device consists of a pair of canted rollers, that carry an endless belt of flexible foraminous material on which are rib-like members for supporting the thread.

### Casein Filaments: Spinning

A. Ferretti (Milan; vested in the U.S. Alien Property Custodian). U.S.P.2,338,915/6/7/8/9/a0. (a) Sodium hydro sulphite or aldehyde hydro sulphite is added to the alkaline solution of casein to prevent fermentation and stabilize it. (b) The alkaline solution of casein is spun into an acid bath, and the filaments are collected as a band and passed under stretch (150 per cent.) through an alkali salt solution, and then insolubilized by passage through formaldehyde solution. (c) To harden the fresh filaments they are passed through an aluminium salt solution and then through formaldehyde solution at 25-70°C. (d) The setting bath comprises about 90 parts of a 10-12 per cent. salt (NaCl) solution and about 10 parts of perchloral formalin. (e) The acid casein is dissolved in caustic soda or potash at 14-34°C, and the progressive growth of viscosity during maturation is controlled by diluting the solution with water. (f) The coagulating bath contains sulphates of Na and Mg or Zn and NH₄, and alum as hardening agent.

### 2—CONVERSION OF FIBRES INTO FINISHED YARNS

(A)—**Preparatory Processes**

#### Rayon Staple Fibre: Carding

B. McComb. *Rayon Textile Monthly*, 1944, 25, 177-178, 227-228. (1) Practical hints are given on suitable settings and adjustments of the card for rayon staple of (a) short (1-1.5 ins.) and (b) long (1.5-3 ins.) types, including the control of static electricity, stripping and grinding, rate of production. (2) The carding of blends of rayon staple with wool on the roller top card is described.

#### Nasmith Comber: Application in “Semi-combing.”

*Textile Mercury and Argus*, 1944, III, 534-535. The writer contrasts “double carding” (i.e. slow carding) with “semi-combing” (i.e. extracting a low percentage of short fibre) as means to obtain better yarns, and stresses the advantages of the latter scheme. The “new model Nasmith comber” is claimed to be particularly suitable for semi-combing since it can be set to extract as little as 6 per cent. of short fibre and to produce 800-1000 lb. of combed sliver per week. The adjustment of the machine is explained by means of diagrams.

#### The Fancy Roller in Worsted Carding

W. H. Robinson. *Wool Rec.*, 1944, 66, 663-667. The action of the fancy is described, and its importance for carding efficiency emphasised. Unsatisfactory fancy action results in cloudy sliver, and nep and slub formation, and the origin and detection of these faults are described. The major factors for a satisfactory action are outlined, these being surface speeds, setting, wire density, and condition of the material being carded (too dry, too wet or too greasy).

#### High-production Picker

Proctor & Schwartz, Inc. *Text. World*, 1944, 94, No. 7, 93. The Super-Picker has 8 non-interchangeable bars, a cockspur type top feed roll and a fluted bottom feed roll. Feed roll speeds are varied by means of change gears. The all-steel cylinder is normally 48 in. wide, with a speed of 900 r.p.m., driven through V-belts by a 15 h.p. motor on a pivoted mounting. The stock is oil-sprayed before it passes to the feed rolls. Additional runs are given if necessary. Production is 5000-6000 lb. per hr. The fearnought has been eliminated.

(B)—**Spinning and Doubling**

#### Cotton Spinning Mill: Machinery Improvements and Spinning Costs

G. Clapperton. *Textile Weekly*, 1944, 34, 732-740. *Textile Manufacturer*, 1944, 79, 487-9, 492. A report of a lecture. The various machines of the card and spinning rooms are reviewed and improvements made during the past few decades are mentioned where possible. The wage costs of spinning 46s...
doubling weft are analysed to show how small is the scope for radical changes. The figures are, per pound of yarn: up to carding 0.345 d., combing 0.378, drawing 0.136, slubber 0.120, intermediate 0.266, rover and jack frame 0.469 (total for cardroom 1.714), mule spinning 2.279, ring spinning 2.195 (total to yarn stage, mule 3.993 d., ring 3.909 d.).

Cotton Spinning Mill: Reorganisation. J. Buckley. *Textile Manufacturer*, 1944, 79, 207-9, 253-5, 299-306. An illustrated account is given of the machinery and lay-out that are now available for the modernisation of a mill by introducing the "combined operations" of single-process lapping, lap drawing and high-draft ring spinning.

Creeled Roving: Calculation of Running Time. C. McElroy and M. Gross. *Textile World*, 1944, 94, No. 8, 93. The calculation of elapsed running time of creeled roving is facilitated by working out constants on the basis of "pounds per spindle." The "constant" is the "standard lb. per spindle" divided into the work period. A table is reproduced for a 40-hour period in spinning. One section gives the list of yarns, viz. 10, 13, 20, 25, 32 and 35s weft, 16, 20, 24, 28, 35 and 42s warp, and against the count is recorded the "standard lb. per spindle" and the "constant"; thus, for 32s weft the lb. per spindle is 0.98 and the constant is 40.0.98 = 40.82. This constant is multiplied by the weight of roving from which the yarn is drawn to give the "elapsed running time"; e.g. for 32s yarn spun two-ends up from 10 oz. roving the time would be 40.82 (2 x 10)/16 = 51.02 hours. The table gives the weights in lb. equivalent to ounces of roving from 5 to 44.

Long Rayon Staple: Processing. B. McComb. *Rayon Textile Monthly*, 1944, 25, 336-337. Practical advice is given on problems of processing long rayon staple (say 3 in.) into yarns of the woollen type. The questions raised include (1) the number of doublings and draw-frame processes, (2) the distribution of drafts, and (3) the care of the rollers, bearings and coverings.

Rayon Staple: Spinning. H. Ashton. *Textile Weekly*, 1944, 34, 559-562, 610-612. A report of a lecture on the development of rayon staple and the "Silence of staple length, denier and twist in spinning. Maximum yarn strength within a reasonable range of deniers appears to be reached with a staple of about 2\(\frac{1}{2}\) inches. On the cotton system, maximum yarn strength is secured at softer twists than for comparable cotton, e.g. at 2.6 twist-factor for 11\(\frac{1}{2}\) in., 14-den. viscose rayon staple as against 3.4-5 for cotton. The need for new machinery to cope with rayon staple in the range of 1-4 inches and 1-8 deniers is discussed, and also the possibility of blending rayon staples of different types and affinities for dyes.

Rayon Tyre Cord: Twisting. Synthetic Fabrics Inc. *Cotton (U.S.*)*, 1944, 108, No. 8, 134. Rayon for tyre cord is commonly supplied on section beams having 160 ends of 1100-den. yarn. The mill was faced with the problem of twisting this yarn on frames with only 140 spindles. A diagram is given to show how this was done by mounting two rows of 10 extra spindles on the frame and driving them from the tin roller of an old spooler which was itself driven from the front roller of the twister by means of a sprocket and chain. The bands to the extra spindles were run slack.

Whitin "Super-Draft" Roving Frame: Application in Rayon Staple Spinning. Whitin Machine Works. *Rayon Textile Monthly*, 1944, 25, 335. Illustrations are given of the Whitin "super-draft" frame as fitted to accommodate rayon staple from 1\(\frac{1}{2}\) to 3 inches in length. Advantages are claimed in the processing of blends with cut worsted top.

Irregularity in Worsted Yarns. "H.D." *Text. Rec.*, 1944, 61, No. 737, 44-45, 52. Marked irregularities in worsted yarn production may be due to unsuitable drafts, excessive or inadequate fibre control, and excessively high speeds. These factors are discussed, with special reference to ratchet and carrier settings, and to the effect of twist.

(C)—Subsequent Processes

Paper Yarn: Effect of Wax Impregnation on Strength. H. W. Fiedler and E. Estel. *Textilberichte*, 1942, 23, 499-500 (through Brit. Chem. Physiol. Abstr., 1944, B II, 228). Paper yarn made from Swedish sulphate pulp (40 g. per sq. metre) was impregnated with 0.5 per cent. aqueous emulsions of
paraffin wax (pH of 5 per cent. solution 4·0 at 26°). The percentage increase in tensile strength on impregnation rose to a sharp maximum (about 24·5 per cent.) for a wax concentration (c) of about 3 per cent. for the dry yarn, and a blunter maximum (about 14·5 per cent. c=2·5 per cent.) for the wet yarn. The percentage increase in stretch was 4·5-6·0 per cent. and almost independent of c, and fell to a sharp minimum (9·5 per cent., c=3 per cent.), respectively; that of the tearing strength showed a fairly sharp maximum at 15·5 per cent. (c=about 3 per cent.) and 9 per cent. (c=2·5 per cent.), respectively. The percentage decrease in twistin strength fell sharply to a blunt maximum (—7·6 per cent., c=2·8 per cent.). The relative wet strength showed only a slight variation (viz., between 74·5 and about 80 per cent.) with wax concentration.

(D)—Yarns and Cords

Rayon Tyre Cord: Production. Industrial Rayon Corporation. Rayon Textile Monthly, 1944, 25, 232-233. A series of pictures are given to show the various stages from the spinneret to the tyre. The continuous process of rayon production provides a high-tensile filament of 1100 den. This is doubled and cabled and the "Tyron" cord is made up into 18-lb. cones. This is beamed and woven and the fabric is delivered for rubbering, etc., in 1000-yd. rolls.

Patents

Card Clothing Mounting Machine. Kardbeslag Fabriks Aktiebolaget (Norrköping, Sweden). B.P.565,126 of 5/4/1943;27/10/1944 (Conv. 27/4/1942). A machine for mounting fillets of card clothing on drums or rolls of carding or similar machines is characterised in that the braking device and the movable tension-controlling member act upon the back of the fillet exclusively. When the movable member is devised as a pivotally mounted arm that carries a roller over which the fillet passes from the braking device to the drum or roll, the external load may be produced by a slide block which is movable longitudinally of the arm, the slide block being actuated by a force, such as the tension of a spring, counteracting the tension on the fillet. The braking device preferably consists of braking rollers provided with friction coating for the fillet passing thereover, the rollers having friction material between their adjacent end faces and friction material between the other end face of one of the rollers and a stationary part of the machine, means being provided for maintaining the second friction material in contact with the stationary part of the machine at a variable pressure.

Fibre Fleeces: Impregnation and Consolidating. C. L. Nottleholn (Germany: vested in the U.S. Alien Property Custodian). U.S.P.2,338,966. Two fleeces of loose fibre are fed through angles where the outside faces receive surface films of adhesive that are dried to firm, impenetrable coatings, and a binding agent in the form of a foam is then applied to the inner faces as the two fleeces are being fed to another mangle where they are consolidated into one compact sheet.

3—CONVERSION OF YARNS INTO FABRICS

(A)—Preparatory Processes

Rayon Bobbins: Winding. S. J. Miller. Textile World, 1944, 94, No. 8, 115-117. Advice is given on hot-air drying of rayon skeins and on the winding of bobbins from skeins or prepared cones. Tables are given of the rates of production on 75, 100, 150 and 200 den. viscose rayon and of the number of machine sides (each 31 spindles) to allot to the winder, on the basis of a machine efficiency of 80 per cent.

Rayon Tyre Cord: Twist Setting by High-frequency Heating. Radio Corporation of America. Textile World, 1944, 94, No. 8, 96-97. More details are given of installations for twist-setting in large rayon cones by electronic heating. The cones are wrapped in waxed paper and placed on a conveyor belt that carries them at the rate of 3·9 ins. per minute through the heating cage which is about 8 ft. long. They pass over a solid copper plate that serves as the "cold" electrode and under a copper grid about one inch above them. The plates are 10-20 sq. ft. in area. The voltage across the load is about 10,000 and the frequency 2-10 mega-cycles; the rise in temperature is about 100° F.
The output of the 15 kw apparatus is 18,000-25,000 lb. of yarn per 24 hours.

**Rayon Warping Creels.** H. Marsden. *Textile Manufacturer*, 1943, 69, 4, 545-5. 1944, 70, 25-26, 29, 77, 119-121, 162-164, 179, 215, 261-2, 308-310, 352-4, 400-1. An illustrated account is given of bobbin and cone creels for warping rayon, with practical hints on working them, and the "cotton" and "silk" warping systems are compared. Troubles due to static electricity and their cure are described, with particular reference to the use of the Sipp-Eastwood "static eliminator."

**Whitin-Schweiter Weft Winding Machine.** *Textile World*, 1944, 94, No. 8, 88-89. The operation of the Whitin-Schweiter winder is described with a picture of one winding unit, and the advantages of the machine are pointed out. A table shows the rate of production of the machine under typical conditions on wool, worsted, cotton and rayon wefts.

** Stored and Damaged Wheats: Suitability for Starch Production.** M. M. MacMasters and G. E. Hilbert. *Cereal Chemistry*, 1944, 21, 258-266. Starch was obtained from samples of sound, stored and damaged wheat by methods involving the steeping of the wheat either in water or in a dilute solution of sulphur dioxide. Recovery, nitrogen and ash content and paste viscosity data are given. They show that wheat stored for 3 to 15 years in a cool, dry, well-ventilated place in the laboratory or in farm bins is suitable for starch production. Recovery of starch seems to decrease somewhat as the wheat ages, but the properties of the starch are not altered by ageing. Common types of damage to wheat, other than severe heating, do not render it unfit for starch production. A few types of damaged wheat yield starch having a slight off-odour. Only in badly heat-damaged wheat were the properties of starch found to be modified.

**Tape Frame: Maintenance.** T. O. Ott. *Textile World*, 1944, 94, No. 8, 105-106. Practical hints are given on good running of a tape frame with a schedule of cleaning, checking and overhauling that should be done (1) every shift, (2) every set, (3) every week-end, (4) every month and (5) every quarter or half-year.


**Loom Reeds: Maintenance and Use.** H. E. Wernich. *Rayon Textile Monthly*, 1944, 25, 229-230; 333-334. (1) Practical hints are given on the selection and maintenance of reeds, and on measures of co-operation with designers to reduce the demand for new reeds and the number of idle reeds in storage. (2) Hints are given on the repair of damaged reeds.

**Northrop Loom: Development.** C. W. Bendigo. *Textile World*, 1944, 94, No. 8, 77-87. To celebrate the fiftieth anniversary of the installation of the first Northrop bobbin-changing loom, the author traces the development of the various parts with the aid of illustrations of the early and latest models of the warp let-off, warp stop motion, heald motion, sley, magazine, cloth take-up, drive and brake, shuttles, weft bobbins, temples, and weft feelers.
Textile Factory: Organisation. A. Laszlo. *Textile Manufacturer*, 1944, 70, 290-2, 296, 336-8, 348, 384-6, 391. Hints are given on starting a new factory, or changing a factory to a new product, based on personal experiences in Czechoslovakia, the United States, Russia, Belfast, and England.

Broken Thread Defects in Fabrics: Causes. A. Sumner. *Textile Weekly*, 1944, 34, 570-574. Practical hints are given on the causes of a number of defects due to broken threads in fabrics, grouped into (1) 3- or 5-end floats, (2) defects where both warp and weft are broken over a few threads, and (3) cuts and bruises in the warp threads only.


Conlong-Worrall Shuttle Guard. R. Haistead & Sons. *Textile Weekly*, 1944, 34, 872-874. The defects in picking that lead to "flying shuttles" are discussed and an illustrated account is given of the successful application of the Conlong-Worrall shuttle guard.

"F.N.F." Warp Knitting Machine. F.N.F. Ltd. *Textile Weekly*, 1944, 34, 780-784; *Textile Manufacturer*, 1944, 70, 497. An illustrated account is given of the working parts of a warp knitting machine, developed from suggestions by Sir James Morton, that has now been working for 12 months under factory conditions at 1,000 courses per minute, without noise and vibration. The usual German machines in this field run at about 425 r.p.m.

Stocking Knitting Machines: Development. J. W. Hughes. *Cotton (U.S.)*, 1944, 108, No. 8, 145-148. The writer forecasts post-war developments in hose, particularly in the direction of knitting a complete stocking on one machine and in the saving of floor space. He expects to see twin-cylinder machines that would produce on 75 per cent. of the space as much hosiery as two separate machines.

American Army Cotton Cloths: Adaptation to Civilian Uses. T. O. Ott. *Textile World*, 1944, 94, No. 8, 94-95. Probable outlets for surplus military fabrics and yarns destined for them are reviewed. Already balloon cloth with a dot print is popular as a dress material and 6-oz. cotton twill shirtings are being made up into working shirts. Shirley cloth, the 9-oz. sateen, and the barrage-balloon cloth are likely to open up new markets.


Rayon Pile Fabrics: Production. C. H. Bever. *Rayon Textile Monthly*, 1943, 24, 595-6, 641-2; 1944, 25, 23-6, 83-4, 133, 231. An illustrated general account of the warp preparation, sizing, weft winding, selvedge construction, shearing, dyeing and finishing of rayon velvets, plushes and related pile fabrics. Combination yarn effects (e.g. mohair and rayon staple) are also discussed.

Wire Cord Tyre Fabrics: Application. J. Johnston. *Textile World*, 1944, 94, No. 8, 107. With new methods of effecting union between rubber and metal, interest has been revived in fine wire fabrics for tyres. A common type has steel wire about 0.006 in. thick, cabled 3 x 7, and then coated with brass containing a high proportion of zinc. The rubberised fabric is cut on the bias and has the bursting strength of about three plies of textile fabric. The fatigue effects are unsatisfactory, however, and it is agreed that wire fabrics cannot yet compete with textiles for tyres. Spun glass fabrics also are not sufficiently elastic. On the effects of heat in a tyre it is said that the critical temperature for textile fabrics is 250° F. and for rubber 300-350° F.

Thermoplastic Horsetail Fabric. *India-Rubber J.*, 1944, 107, 528. Mention is made of a horsetail stiffening fabric in which the common tendency for the horsetail to work out is restricted by the incorporation of cellulose acetate yarns and taking advantage of their thermoplastic properties to secure the
horsehair in position. The warp is alternately two ends of cotton and one of cellulose acetate rayon, and horsehair forms the weft. The fabric is run through an alcoholic solution of dimethoxyethyl phthalate (or other plasticizer), mangled and dried, and then hung for 6 days at 50°C and 40 per cent. R.H. to age. Excess plasticizer is then removed by running the fabric through alcohol and a further ageing follows for two days at 50°C and 55 per cent. R.H. The stiffening fabric is best fixed to the cloth by damping it and submitting the two articles to a pressure of 600 lb./sq. in. at 80-180°C. C.

Velvets: Production. T. Mellodew and Co. Ltd. Textile Weekly, 1944, 33, 918-920, 922; 34, 232-234, 568-569, 876-878. The production of velvet is reviewed: (1) history, (2) structures and weaves for velveteens and fusian cord fabrics, (3) velvet cutting, (4) dyeing and finishing of velveteens. C.

Shetland and Homespun Tweeds. "Portex." Wool Rec., 1944, 66, 742, 744. Details are given of yarn preparation and cloth construction and design. Dyeing is discussed, and the utilisation of the natural colourings of the Shetland wool. W.


PATENTS

Imitation Knitted Articles: Production on Embroidering Machines. Elsa Horler (Barcelona, Spain). B.P.564,675 of 20/7/1943:9/10/1944 (Conv. 20/7/1942). Articles resembling knitted articles, especially stockings in which "runs" are prevented, are produced on embroidering machines by "embroidering" on a support, fixed to the frame of the machine and consisting in a member which can be readily separated from the article. The support is formed by a grating of steel wires or springs which are pulled out after embroidering the article. The different needles of the machine work simultaneously and produce rows of loops. Various methods of interlacing the loops are shown. C.

Straight-bar Knitting Machine Chain Driving Mechanism. G. Blackburn & Sons Ltd. and H. W. and E. Start. B.P.564,808 of 14/1/1943:13/10/1944, and 564,844 of 25/2/1943:16/10/1944. (1) The driving mechanism for a reciprocating part or parts of a straight-bar knitting machine comprises a member continuously running during knitting and carrying a driver connected to the reciprocating part or parts of the machine, the running member being mounted so that the driver traverses a substantially rectangular part to cause the reciprocating part or parts to stand for a predetermined length of time at the end of each motion. In the preferred construction the continuously driven member comprises two endless chains mounted on a series of sprockets. (2) In chain driving mechanism for the reciprocating parts of a straight-bar knitting machine the sprockets round which the driver passes during the movement of the slide on the reciprocating parts have combined therewith means that engage with the driver and take its strain. Discs having openings that engage with the driver may be combined with the sprockets. The invention is applicable to either endless continuously running chains or to reciprocating chains, and also to an endless continuously running belt or reciprocating belt where a positive driving connection exists between the belt and its supporting rollers. C.

Circular Knitting Machine Patterning Mechanism. Wildt & Co. Ltd., H. H. Holmes and A. P. Saunders. B.P.564,894 of 8/1/1943:18/10/1944. A circular knitting machine of the type including double axially opposed needle cylinders is provided with patterning instruments that co-operate with the needles in stitch or loop formation at points removed from the knitting locations of the machine, and means adjacent to the hooks of the knitting needles at the knitting locations for holding down the old loops or stitches formed by needles upon which rib or purl stitches are produced while the same needles draw yarn for and knock over the succeeding new loops or stitches, the said means being otherwise maintained in such a position as to avoid the instruments at the aforesaid points. One combination includes (a) a device consisting of a dial or annular member having a flat radially grooved or trickled surface, with a series of independently slidable holding-down bits or web
holders in the grooves or tricks, for arrangement suchwise that the holding-
down bits or web holders can be moved radially in a plane substantially at
right angles to the axis of the needle cylinders, and (b) means for controlling
the said bits or web holders so that some of them are projected to co-operate
with the needles which produce rib or purl stitches at the knitting location, or
each of such locations when there is more than one, while the remainder of
the bits or web holders are maintained in a retracted position.

C. Winding Machine. K. J. Schärer (trading as Maschinenfabrik Schärer,
Erlenbach, Switzerland). B.P. 564,997 of 30/9/1942: 23/10/1944 (Conv.
1/12/1941). In a winding machine of the kind in which a thread guide is
reciprocated by a rotatable cam member which imparts an additional traverse
to the thread guide on account of its own axial displacement which is effected
by two coaxial gears, the two gears, together with the cam member, are
arranged coaxially on the winding spindle of the machine, from which spindle
the gears are positively driven. This arrangement gives a compact construction
of machine, whilst the positive movement provided ensures uniform laying of
the thread from the smallest up to the largest diameter of spool, with the
result that the subsequent working of spools so wound is facilitated, as a
uniform unrestrained pulling off of the thread is made possible.

C. Knitting Machine Stop Motion. Van Raalte Co. Inc. (New York). B.P.
565,182 of 25/2/1943: 31/10/1944 (Conv. 4/3/1942). A stop motion for knitting,
weaving or other textile machines comprises a pair of spaced contacts or
electrodes which are connected in an electric circuit and disposed adjacent to
a normal thread path so as to make contact with a thread when thread failure
occurs, means for applying a conducting medium to the thread so that on
making contact with the electrodes the circuit is closed, and means responsive
to the circuit closure for controlling the operation of the machine. In a pre-
ferred embodiment, one of the electrodes comprises a roller, which rotates in
a conducting liquid with the upper periphery of the roller exposed, the roller
being arranged transversely to the direction of the threads, and the other elec-
trode in the form of a bar is arranged adjacent to the exposed peripheral
surface, so that, when thread failure occurs, the thread makes contact with
the two electrodes and closes the circuit. Means may be provided whereby the
current in the circuit of the electrodes is amplified, the amplified current being
used for the control of the textile machine. Details are given of such a stop
motion applied to a tricot knitting machine.

C. Beam Flange Securing Means. F. S. Hodgson. B.P. 565,217 of 19/2/1943:
1/11/1944. Means for securing the flanges of weavers’, warpers’ and like
textile beams or rollers in position on the beams with a definite distance between
comprise at least one two-part collar adapted to fit in or having internal pro-
jections adapted to fit in a turned down or recessed part of the beam towards
each end where the flange is to be secured, the outside diameter of each collar
or of a sleeve forced on to such collar being approximately equal to the bore
of the flange boss so that the flange or sleeve hole in the two parts of the collar
together in the recessed part of the beam, and set screws for holding the flange
to the collar or to the sleeve and collar. The turned down or recessed parts of
the beam towards its end have circumferential grooves formed therein, and
the two part collars have internal projections which enter the grooves.

A sheet metal envelope is formed with a series of exterior lengthwise ribs, fitted
to a cylindrical roller, twisted at one end to make the ribs form spirals around
the roller, and the ends are then secured.

C. Cross-winding Frame Automatic Knotting Device. W. Esser, G. Kahlisch
and W. Reiners (Gladbach-Rheydt, Germany; vested in the U.S. Alien Property
Custodian). U.S.P. 2,338,914. A thread detector normally resting against the
thread as it comes from the supply bobbin, on failure of tension in the thread,
sets in motion thread catchers that draw the end from the supply and the end
from the wound package to a knotting device.

C. Stretchless Warp Knitted Fabric. Jan Just, F. Just and F. David (Bohemia;
fabric that is non-stretchable in length and width has two sets of yarns, both
united at each wale in each course, knitted so that zig-zag diagonal lines are
established, the distances along the lines from one binding point to the next being, for one of the yarns, 3 wales to the left and then 1 wale to the right, and for the other yarn 1 to the right and 3 to the left.

Corded-edged Fabric Stitching Machine. Rudolf Loeb (Jenkintown, Pa.). U.S.P.2,339,179. The claim is for a machine that folds over one edge of a fabric, inserts a cord and stitches it in.

Electric Shuttle Smash Prevention Device. M. V. Tirrell (Phillipsburg, N.J.). U.S.P.2,339,206. A switch carried by the sley opposite the binder end of the shiftable shuttle box comprises relatively movable and inter-engaging contacts normally urged towards the opposed shuttle box and means to throw one contact out of engagement when there is no shuttle at least partially in a raceway-aligned cell of the opposite shuttle box.

4—CHEMICAL AND FINISHING PROCESSES

(A)—Preparatory Processes


Sulphosuccinic Esters: Wetting Power and Structure. C. R. Caryl. Ind. Eng. Chem., 1941, 33, 731-740. Data are presented on 36 out of an almost unlimited number of possible esters of sodium sulphosuccinic acid. Several show a greater surface tension reducing effect and wetting power in more dilute solution than any wetting agents on the market or in the literature. There is a certain balance between polar and non-polar groups within the molecule that determines wetting power and reduction of surface tension, but no definite relation has been found between molecular structure and wetting power. The areas and lengths of a few of these wetting agent molecules have been calculated. The results are within the range of data on similar compounds reported in the literature.

Wetting Agents: Action. F. E. Bartell. Ind. Eng. Chem., 1941, 33, 737-740. The nature of the energy changes produced by wetting agents at various types of interfaces is discussed, and methods of measuring the energy changes are outlined. Liquid-air interfaces and liquid-liquid, solid-in-liquid and liquid-on-solid systems are considered. It is pointed out that adhesion tension serves as a measure of the degree of wetting of a solid by a liquid and that determination of adhesion tension values necessitates measurement of contact angles. Methods of measuring contact angles are briefly discussed.

Animal and Human Hairs: Suitability for Felting. L. Bonnet. Teintex, 1942, 7, 261-262 (through Chem. Zentr., 1943, I, 1015 and Chem. Abs., 1944, 38, 3483). Human hair, silk and hair from rabbits, hares and goats must be carpotted before felting. The effect of carpotting depends on an increase in the swelling power of the hair brought about by oxidation; the cystine group is attacked with the formation of cysteine and the hypothetical sulphenic acid. This acid is converted to cysteic acid and then to taurine. Serine can be formed from cysteine. The sulphur content of the hairs is considerably decreased during carpotting.

(B)—Boiling, Scouring, Degumming and Washing

"Crushing" Fabrics in Scouring. D. R. H. Williams. Text. Mfr., 1944, 70, 459; Wool Rec., 1944, 66, 618-619. Fancy worsted (26's/2 warp and 13's/1 weft, both 58s quality) for demobilized soldiers was given a firm, supple handle by treatment in a Williams-Peace combined scouring and milling machine with 15 in. wide rollers. The use of a back roller with a slightly concave surface enabled 6 pieces to be processed at a time without slipping. The times were 1 hr. for scouring, 30 min. for washing-off, 1 hr. for lathering-up and 35 min. for washing-off, with 2,000 lb. weight on the top roller for scouring and lathering-up, and 80 lb. weight on the trough for lathering-up. A bataoie was successfully treated in the same way, except that the weight on the trough for lathering-up was 120 lb. and on the top roller 1,700 lb. throughout. A tendency to curl was prevented by stitching the face of one end to the back of the other of each individual piece. Care should be taken to plan the greasy setting in relation to the finished ends and picks laid down in the specification.
(E)—Drying and Conditioning


Wool: Moisture Content. W. R. Lang. *Pastoral Rev.*, 1944, 54, 393-394. The study of the moisture content of wool may lead to a better understanding of the structure of the fibre, and may assist or hinder some important functions of the fibre as a textile. The characteristics of moisture absorption by wool are discussed. A 16 per cent. regain is somewhat high for Great Britain and for Australia 12 per cent. would be more suitable. The official values quoted for humidity conditions throughout Australia are generally too high. W.

(G)—Bleaching

Pulp: Bleaching. P. A. Forni. *Paper Trade J.*, 1944, 119, *TAPPI*, 108-116. The author has taken a spruce sulphite pulp, treated it in suspension with bleaching powder solutions containing 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90 and 100 per cent. of the total bleach demand (calculated at 80 lb. of chlorine per ton of pulp at 100 per cent. demand), and then measured the α-cellulose content, the degree of lignin chlorination, the permanganate number, the mechanical properties (pulp and sheets), and the optical properties of the products. The systematic data are tabulated. The results support the view that bleaching occurs in three phases (1) 0-20 per cent. of the chlorine demand, (2) 20-80 per cent. and (3) 80-110 (over-bleached) per cent. The characteristics of the pulps in these phases are described. It appears that degradation of the α-cellulose is slight and slow so long as the amount of bleaching agent is not above the 100 per cent. demand, but thereafter increases appreciably. The pH of the liquors was kept at above 8.

Wool Bleaching. M. H. Wilkinson. *Dyer*, 1944, 92, 257. The advantages of hydrogen peroxide for bleaching all types of woollen materials and waste are described. As a neutralising agent, sodium pyrophosphate is recommended (1-2 oz. for 100 lb. of 100 vol. hydrogen peroxide), and for even penetration the use of 1 lb. sulphated fatty alcohol for 100 gal. of peroxyd liquor. With closed steam-pipe heating, the bleaching temperature should commence at 90° F., be raised to 130° F. during the first half of processing, and allowed to fall to 90° F. before removal of the goods. pH 8-2-9-2 should be maintained throughout.

(L)—Dyeing

Aniline Black Dyeings: Production. *Rayon Textile Monthly*, 1944, 25, 247. The writer briefly describes the problems of aniline black dyeing by the ferrocyanide method and gives hints on how to avoid greenish results or reddish hues in the after-chroming.


Dyed Materials: Stripping. H. Jowett. *J. Soc. Dyers & Col.*, 1944, 60, 197-200. Reasons for stripping are discussed and factors influencing the choice of method are indicated. Methods of stripping, including (1) treatment with acids, alkalis and salts, (2) oxidation, (3) reduction, and (4) combination methods are described with special reference to their application to woollen and cotton goods, particularly rags. Removal of azoic dyes from silk, and the stripping of cellulose acetate rayon are briefly discussed.

Indanthrene Dyes: Application. K. Stierwaldt. *Deut. Färber-Ztg.*, 1943, 79, 21 (through Chem. Zentr., 1943, i, 1719 and Chem. Abstr., 1944, 38, 4133†). Indanthrene dyes are classified according to absorption velocity, migration power and levelling properties. New dyeing processes are discussed; one method is carried out at 80-90°; another involves heating in stages beginning at 16-19°, with the use of wetting agents such as Igepon T or TS, Perceral OK, Humectol CX or Setamol WS. The pigment-padding process involving the use of Eulysin A for hard-twisted yarns at elevated temperatures and gradual reduction of the dye is described. The acid vat process and various applications of the new methods are discussed.
Nylon: Dyeing and Fastness. J. G. Grundy. J. Soc. Dyers & Col., 1944, 60, 205-210. The properties of nylon and the suitability of the various classes of dyes for application to nylon are discussed. Lists of suitable dyes are given and the results of fastness tests are considered. Dispersed cellulose acetate rayon dyes give the most level effects on nylon, and many of them are much faster to washing than the dispersed cellulose acetate rayon dyes, but many of them are unsuitable for heavy and combination shades. Neolan dyes provide shades of increased fastness to washing, compared with the fastest Acid Alizarine and Cloth Fast dyes, and the shades are also fast to chlorine. Neolan dyes are unsuitable for heavy shades. Chrome Fast dyes are remarkably fast to washing, milling, light and chlorine, and can also be used for heavy shades. Basic dyes on nylon show poor fastness to rubbing, light and perspiration. Direct dyes have little affinity for nylon from a neutral-dyebath, and only a few of them can be applied satisfactorily from an organic acid dyebath. Sulphur and azoic dyes possess no affinity for nylon when applied by the methods normally associated with these classes of dyes. Vat dyes on nylon do not exhibit the high fastness properties expected from this class of dye. Better all-round fastness can be obtained with selected wool dyes. Shades on nylon are not readily attacked by reagents such as sulphur dioxide, aqueous chlorine and burnt gas fumes. The degradation of nylon on exposure to light does not appear to affect the fastness to light of dyes present on the fibre.


Substantive Dyes: After-treatment to Increase Fastness. G. Nitschke. Kunstseide u. Zellwolle, 1943, 25, 33-39 (through Chem. Zentr., 1943, i, 2244 and Chem. Abstr., 1944, 38, 41346). The methods that seek to increase fastness to substantive dyes by alteration in fibre surface or deposition of water-insoluble dyes in the interior of fibres are by far not as important as the methods involving increase in size of the dye molecule and conversion into an insoluble or difficultly soluble form. The technical dye-house methods are simpler and yield essentially better fastness to washing.

Acetoacetylamino-benzothiazoles: Substantivity. E. A. Sacks and P. Petitcolas. Chim. et Ind., 1941, 45, Suppl. to No. 3, 313-324 (through Chem. Zentr., 1943, i, 2243 and Chem. Abstr., 1944, 38, 41362). The authors have determined the adsorptivity of cotton fibre for the following benzothiazole derivatives: 2-phenyl-6-(acetoacetylamino)benzothiazole and its 5-Cl and 5-CH3O derivatives, 2-phenyl-5-(acetoacetylamino)benzothiazole, bis[(6-acetoacetylamino)-2-benzothiazolyl] and the corresponding compounds with Cl or CH3O substituted in the 5-position, bis[(5-acetoacetylamino)-2-benzothiazolyl] o-, m- and p-phenylenebis[(6-acetoacetylamino)-2-benzothiazolyl] and its 5-Cl and 5-CH3O derivatives, and m- and p-phenylenebis-[(5-acetoacetylamino)-2-benzothiazolyl]. In connection with the hypothesis of Schirm and Haller, and Haller and Ruperti, the authors establish the following points: The substantivity of acetylacetyl derivatives of primary amines is dependent on the number of conjugated double bonds in the molecule. In the same series the compound with the greater number of conjugated double bonds possesses a greater affinity for cotton fibre, when the influence of temperature on adsorption is accounted for. Of two compounds with the same number of identical chromophores and auxochromes, the one that is deeper dyed possesses the greater substantivity. The favourable influence of the addition of electrolyte to the dye solution is doubtless due to repressing the hydrolysis of Na enolate.

Azo Dyes: Substantivity; Electronic Interpretation. H. H. Hodgson and E. Marsden. J. Soc. Dyers & Col., 1944, 60, 210-214. The structure of a number of substantive azo dyes and intermediates is discussed on the basis of the resonance theory and in support of the view that two necessary conditions for substantivity are (1) co-planarity of the aromatic nuclei and (2) the presence of conjugate chains of sufficient length and facile resonance in order to provide
the necessary electron distribution for the polarities requisite for fixation of the molecule to the cellulosic material. Fulfilment of the above conditions is not sufficient to account for the substantivity of azo dyes, but a complete assessment is not attempted in this paper.

Dyes: Determination in Solution and on the Fibre. E. Waters. J. Soc. Dyers & Col., 1944, 60, 200-205. Chemical methods for the determination of dyes in solution are critically discussed and it is pointed out that these methods are not very simple or rapid and that they are not applicable to dyes in general. Optical methods are more suitable for use in technical research and are of general application to all types of dyes. Absorptiometer and colorimeter methods and apparatus are described. The direct measurement of dyes on the fibre is a difficult process which can only be carried out with colorimeters such as the Guild or Donaldson and the Lovibond Tintometer; a spectrophotometer may also be used if fitted for reflection measurements. The usual methods involve extraction of the dye with a solvent or solution of both fibre and dye, and colorimetric measurements on the solutions. Suitable solvents for various types of dyes are discussed. Reference is made to apparatus designed for continuous measurement of the rate of dyeing throughout the dyeing process. This apparatus functions in a similar manner to the photo-electric absorptiometers, the concentration of the dyebath being measured with a photocell-filter combination and recorded continuously during dyeing by a sensitive galvanometer.

Alizarates: Preparation and Application. R. Haller. Helv. Chim. Acta, 1944, 27, 344-347 (through Chem. Abstr., 1944, 38, 4447). The author refers to earlier work in which he prepared Alizarin Red from alizarin and aluminium hydroxide sol and reports that Alizarin Red can be prepared also from alcoholic solutions of alizarin and aluminium oxide and that Alizarin Red SW results from sodium dihydroxyanthraquinonemonosulphonate; the reaction occurs at pH 7 but not at pH 4-5. Alcoholic aluminium acetate and alcoholic alizarin give a deep red alizarate, which is not very stable and on standing yields a dark red precipitate; the solution is not a suitable dyeing medium for wool or cotton. Alizarin and aluminium acetate on heating give a red solution which gives a fairly satisfactory colour on wool; calcium acetate gives the same result. Qualitative observations are reported on the reaction of alizarin with calcium aluminate; the products are not suitable dyes. With sodium dihydroxyanthraquinonemonosulphonate, an aqueous solution of calcium aluminate gives a red-violet solution which dyes wool a deep red-violet, a tone which cannot be obtained with aluminium derivatives alone; a trace of zinc chloride gives a useful scarlet tone, but cannot be used with cotton.


Knitted Goods: Cold Dyeing. S. A. Melikhov. Legkaya Prom., 1943, 3, No. 9/10, 14-15, No. 11/12, 26 (through Chem. Abstr., 1944, 38, 4449). Details are given of six methods for the cold dyeing of knitted goods. Most effective wetting agents at 20-50° are Nekal BN and Kontakt. Other wetting agents are (1) soap, (2) a mixture of sulphonated sperm whale fat 25, Leukanol 25, 20 per cent. soap 5 and water 45 per cent., (3) a composition prepared by adding to a mixture of kerosene 300, turpentine 200 and alizarin oil 150 c.c., 100 c.c. of 25 per cent. ammonium hydroxide, then alizarin oil 200 c.c. to make a homogeneous emulsion and finally turpentine 50 c.c., and diluting 1:2 with water. As further wetting agents for cold dyeing, good results were obtained with solutions of sodium tetra- or metadi-silicate, and with an emulsion containing rosin 30, ammonia 2 and water 68 per cent., prepared by adding to powdered rosin with vigorous stirring one half the quantity of ammonia and
water, heating to 50°, maintaining this temperature for approximately 3 hours, adding the rest of the ammonia and water and heating to 70° for 30 min. Either of these wetting agents is used in quantities of 10 g. per l. of bath. C.

**Mixed Fibre Fabrics: Dyeing with Vat Dyes.** O. W. Clark. *Amer. Dyes. Rept.*, 1941, 30, 300-304. A report is given of a lecture on and discussion of the use of vat dyes for dyeing fabrics containing staple fibre mixed with cotton, linen, acetate or wool fibres. The lecturer pointed out the reasons why vat dyes were used to only a small extent on such fabrics, compared the behaviour of vat dyes in hydrosulphite vats made up with (a) caustic soda, (b) tri-sodium phosphate, and (c) soda ash, and showed a large number of Kodachrome slides illustrating the wide variety of effects that can be obtained by varying the alkali of the vat, the method of preparing the goods, and the method of dyeing.

**Superpolyamides: Dye and Acid Adsorption.** E. Elöd and T. Schachowskoy. *Textilberichte*, 1942, 23, 437-440 (through *Brit. Chem. Physiol. Abstr.*, 1944, B II, 254). The adsorption of Crystal Ponceau 6R by superpolyamides increases with increasing hydrogen ion concentration and there is no maximum value as in the case of proteins. Swelling of superpolyamides in aqueous solutions of acids appears to be independent of pH. The amount of dye taken up at a fixed pH value increases with increasing liquor: fibre ratio, and different dyes are not adsorbed in equal amounts, e.g. 7:3 per cent. of Crystal Ponceau 6R and 1:6 per cent. of Palatine Fast Bordeaux BN are adsorbed under the same conditions. The tensile strengths of dyed fibres decrease with decreasing pH value of the dyebath. It is suggested that some of the combination with acids and dyes takes place through NH groups.


**Acetate Rayon Dyes: Gas Fading.** F. P. Greenspan and P. E. Spoerri. *Amer. Dyes. Rept.*, 1941, 30, 645-650, 664-665. The fading action of pure individual nitrogen oxides on 1:4-diaminoanthraquinone (violet) and Celanthrene Brilliant Blue FFS dyeings has been studied. Nitrogen oxide was without action. Nitric oxide (spectroscopically pure) caused a slow reddening, increasing with time, and strikingly similar to actual gas fadings. When the fabrics were dried to remove all moisture, a similar but slower action took place. The action of nitric oxide appears to comprise (1) a fading action caused by the gas itself, and (2) a fading action caused by the slow hydrolysis of nitric oxide by the water content of the fabric, giving rise to nitrous acid. Evidence for (2) is the continued fading of the violet dyes, approaching an orange red after several months (nitrous acid itself causes a fading to yellow via orange). This is further supported by the fact that exposure tubes containing 1:4-diaminoanthraquinone dyed fabrics (moisture present) in nitric oxide almost immediately fade to a yellow when placed in an oven at 100° C., whereas the same fabrics without moisture, similarly exposed, do not change their previously acquired reddish violet colour. The hydrolysis of nitric oxide is greatly increased by heat. Light accelerates the fading action of nitric oxide. Nitrogen tetroxide had an instantaneous and drastic fading action on aminoanthraquinone dyeings. When undyed cellulose acetate was exposed to nitrogen tetroxide, the formation of free acetic acid and cellulose nitrate was detected after a long exposure. The undyed acetate, so exposed, had no effect on benzene solutions of the blue aminoanthraquinones, but on dyeing with 1:4-diaminoanthraquinone appeared redder than a control dyeing. A blue dye, 1:4:5:8-tetraminoanthraquinone detects 1 part in 5,000,000 of nitrite. The action of nitric oxide on 1:4-diaminoanthraquinone suspended or dissolved in solvents was slight, but preliminary work indicated a markedly increased reaction when cellulose acetate was dissolved in the solvent. The action of higher oxides of nitrogen (nitric oxide and nitrogen tetroxide) on 1:4-diamino-
anthraquinone suspended in water resulted in the formation of 1-amino-4-diazonium nitrate. C.

Dyes: Fastness. R. Béha. Ind. textile, 1942, 59, 293 (through Chem. Zentr., 1943, i, 2037 and Chem. Abstr., 1944, 38, 4449*). The theory of the fading of dyes by autoxidation, and the effects of heat, of particle size of the dye, of the nature of the fibre surface, of alkali reaction, etc., are discussed. The light-fastness of rayon delustred with titanium dioxide can be increased by treatment with chromates or other chromium salts. Certain orange, yellow and red anthraquinone vat dyes have an unfavourable action. The effect of light on tannin and the losses of mordant action on basic dyes are discussed. Katanol O, in spite of decomposition, retains its mordant action.

(J)—PRINTING

Rayon Fabrics: Screen Printing. Rayon Textile Monthly, 1942, 23, 353-4, 400-1, 547-8, 666-7; 1943, 24, 89-90, 136-7, 193-4, 251-2, 421-2, 539-540, 650-1; 1944, 25, 190-1, 249-250. Practical hints are given on the detection of sizing ingredients, desizing the fabric, créping and dulling, the operation of screen printing, drying and tentering, the choice of dyes and reducing agents, the advantages of the Indigosols, the various methods for developing the colour, the choice of thickeners and the preparation of print pastes.

Screen Printing Equipment: New Developments. G. Clairmont. Rayon Textile Monthly, 1944, 25, 84-5, 141-2, 187, 248. A broad review is given of new developments in (1) equipment for pasting the fabric to a table, (2) squeegees, metal frames and metal tables, (3) high-speed agers, (4) photo-engraving and special composing machines, (5) drying equipment and (6) semi-or fully-automatic screen printing machines, and (7) the photo-mechanical process.

White Discharge Prints: Production. Textile Weekly, 1944, 34, 532-4, 702-708. Practical hints are given on methods of printing, the materials for and preparation of print pastes, precautions to be observed, and washing of the prints.

(K)—FINISHING

Cellulose: Reaction with Formaldehyde. H. Dillenius. Kunstseide u. Zellwolle, 1943, 25, 69-79 (through Chem. Abstr., 1944, 38, 41355*). The significance of the condition of the fibres for the textile properties of formaldehyde-treated fibres was investigated. The tension formed during spinning also influences the knot strength and stretch of the treated fibre. Fibres spun without tension with high initial stretch are best suited for treatment with formaldehyde. Alkaline pre-swelling can show improved knot strength and stretch only with stretched fibres which have pronounced tendency to shrink. The chemical properties of cellulose hydrate fibres are influenced during the treatment with formaldehyde only by pH, catalyst, formaldehyde concentration and drying temperature and are independent of the condition of the fibre or degree of stretch. A fibre with high resistance towards chemical effects and stable fibre strength behaves more advantageously in use than a highly stretched, strongly wet resistant fibre with slight chemical resistance which besides would again lose a part of its strength properties through alkali requirement.

Dyed Fabrics: Crease-resistant Finishing. Rayon Textile Monthly, 1944, 25, 245-246. A general review is given of the influence of the type of dye on the crease-resistant finish, with special reference to changes in shade. The process generally improves the fastness to washing.

Silk: Modification by Chemical Treatment. Silk and Rayon, 1944, 18, 873-876, 985-988, 1236-1237. The chemistry of silk fibroin and its constituent amino-acids is summarised and a review of the literature is given on the modification of silk by (1) acetylation, (2) etherification, and (3) methylation.

Fabrics: Coating. J. R. Owens. Offic. Digest Fed. Paint & Varnish Production Clubs No. 236, 261-269; Paint Ind. Mag., 1944, 59, 162, 164, 166 (through Chem. Abstr., 1944, 38, 41355*). Civilian and military uses of fabrics with protective coatings are listed. The three types of coatings used are drying oils, lacquers and rubber. Methods of application include knife spreader coating,
roller coating and dip coating. Drying is done at elevated temperatures, 180-230° F. Drying times vary from 2 to 6 hours. Fabrics for military uses are coated with oil-modified alkyd resins for gas resistance and protective devices, plasticized vinyl polymers and other thermo-plastic resins, polyvinyl butyral and other thermosetting resins and the various synthetic rubbers. C.

**Glycerin: Applications.** Georgia Leffingwell. *Rayon Textile Monthly*, 1944, 25, 244-5, 343-4. A review is given of recent suggestions for the use of glycerin in the production of rayon yarns, in delustring, dyeing and printing rayon fabrics, and in making synthetic resins. Many references are cited. C.


**Fur Pelts: Dressing.** H. Herfeld. *Ledertech. Rundschau*, 1942, 34, 73-78 (through Chem. Zentr., 1943, I, 240 and Chem. Abs., 1944, 38, 3869). Most pelts are treated not by an irreversible tanning process, but by the Leipzig method, which consists essentially in pickling the pelts with a sulphuric acid-sodium chloride solution and stuffing them lightly. This dressing is not suitable for the treatment of military pelts, because of low water resistance. Other methods developed are light chrome tanning with a preliminary tanning with aluminium salts alone or with aluminium salts followed by treatment with formaldehyde; the pelts are then mothproofed with Eulan. Ursatin dyes are used for military pelts, Ursol dyes being prohibited, because residues of free amines, diamine and aminophenol may cause skin irritation and eczema. W.

**Fine Worsted: Preventing Rubbing of Cover.** *Dyer*, 1944, 92, 373-374. To prevent excessive rubbing of light-weight fine worsteds, especially slackly-set cloths, all surplus fibres should be removed by cutting. The success of the latter operation depends also upon the methods employed in scouring and milling, and the extent to which cover is gained upon the fabric, apart from the felting properties of the cloth. The open washer, one of the newer types, is used. The finishing processes are all lighter than the ordinary dolly in their effect on the cloth, but do not give the same finish and handle. The ordinary dolly can be used if a mouthpiece is fitted through which the cloth passes, and which prevents the weight of the rollers from spreading out the cloth and the rollers touching bottom or bumping badly. The mouthpiece also assists the reduction in width before cover is gained, and the slight milling action provides only fine top cover, which is more easily removed in cutting. The normal scouring time of 45 min. is reduced to 25-30 min., washing-off being done with only a limited quantity of water, and at as high a temperature as possible without colour bleeding. W.

(L)—**PROOFING**

**Flame-, Mildew- and Water-proofed Cotton Fabrics: Production.** C. N. Rabold. *Textile World*, 1944, 94, No. 8, 90-92. War-time developments and probable post-war outlets for them are reviewed. Flame-proofing agents mentioned include chlorinated paraffin. Among mildew-proofing agents listed as having been tried in U.S. Army fabrics is cuprammonium fluoride. Limitations of various antiseptics are stated. The advantages of the newer water-repellent finishes are discussed. C.

**Ropes: Rot-proofing.** Audrie S. Tweedie and C. H. Bayley. *Textile Manufacturer*, 1944, 70, 411-412 (from Canadian Textile J., 1944, 61, 13, 31). Reference is made to Canadian government specifications for proofing cordage with copper naphthenate and to the methods of testing. Some results of tests on comparable untreated and proofed cotton, hemp, manila, sisal and "war-time" ropes, 1/4-in. diam., are tabulated. They relate to (1) weight (feet per lb.), (2) ply and ends per ply, (3) length per 10 turns, (4) increase in weight in water, (5) extractable matter, (6) copper content, before and after soaking in water, (7) breaking load of leached rope, new and after burial for 2 weeks, and (8) shrinkage after soaking in water for 24 hours. Hemp was weakened by proofing, but cotton was strengthened. The percentage loss of strength in the burial test was nil for proofed hemp and 5 per cent. for proofed cotton. Advantages are claimed for copper naphthenate against copper salts of fatty acids. C.
Fabrics: Flame-proofing. W. E. Gordon. *Amer. Dyes. Rept.*, 1941, 30, 305-308. The development of flame-proofing treatments for textile materials is briefly reviewed. The nature of fire-retardant chemicals used for such treatments and their effects on the material are discussed, and the advantages of sulphamate-type fire retardants are pointed out. Methods of application are outlined. Proportions of fire retardant needed to impart good flame-proof characteristics to different types of fibres, and the effects of fabric construction on inflammability, particularly the high fire hazard of pile fabrics, are briefly discussed.


Rayon Staple: Water-repellent Finish. A. Prévot. *Ind. Textile*, 1942, 59, 287-288 (through *Chem Zentr.*, 1943, i, 2464 and *Chem. Abstr.*, 1944, 38, 4451). Rayon staple was steeped in 3 per cent. caustic soda, centrifuged, freed from most of the water in a vacuum, and treated for 1 hour at 45° with carbon tetrachloride containing 1 per cent. (by weight of the dry rayon staple) of chloronaphthenic acid chloride. This treatment renders rayon staple water-repellent. If such material is then treated with ammonia, preferably under pressure, it acquires a good absorption power for acid dyes.

Water-repellent Pyridinium Compounds: Repellency and Structure. E. Zerner and P. I. Pollak. *Textile Research*, 1944, 14, 242-245. The use of wax-aluminium acetate emulsions and of synthetic permanent water-repellents for the production of water-repellent finishes on textile materials, and their advantages and disadvantages, are discussed. The permanent water-repellents have molecules containing a hydrophobic part (usually a fatty acid derivative) which serves as the water-repellent, combined with a polar group which attaches itself to the hydroxyl groups of cellulose, the reaction being effected by curing at about 300° F. The compounds used in the textile industry are quaternary ammonium derivatives of pyridine which are dispersible in water. At elevated temperatures, pyridine is split off and the rest of the molecule reacts with the hydroxyl groups of the cellulose to form ether-like compounds. The hydrophobic part of the molecule is usually a derivative of stearic acid. The polar group must be very reactive, a property which is present in the chloromethyl group, but not in the chloroethyl group. Numerous quaternary ammonium compounds have been synthesized, and it has been found that small differences in internal structure have great influence upon the water-repellent properties. Examples are given. In a study of pyridine compounds of chloromethylated \(N:NN'\)-distearoyl methylene, ethylene, and trimethylene diamines it was found that unsatisfactory repellencies are obtained when the chain connecting the two amide radicals contains an even number of methylene groups. This behaviour has an analogy in the variation of certain physical properties of straight chain aliphatic homologues and their derivatives. The cause of the variations is found in the steric arrangements of the chains of the molecules.

Mildew Antiseptics: Fungistatic Properties; Effect of \(pH\). C. Hoffman, T. R. Schweitzer and G. Dalby. *Ind. Eng. Chem.*, 1941, 33, 749-751. Measurements were made of the variation with \(pH\) of the minimum molar concentrations of various antiseptics and related compounds required to inhibit all visible mould growth for 48 hours at 37.5° C., in mixed cultures of common moulds, including *Aspergillus niger*, *Aspergillus glaucus*, *Rhizopus nigricans*, *Penicillium frequentans*, etc. The results show that the \(pH\) of the medium has no appreciable effect on the fungistatic properties of mercuric chloride, formaldehyde, phenol, copper sulphate and iodine which are apparently due to the inherently poisonous nature of the materials. With sodium thiosulphate, sodium sulphite and hexamine, the decomposition of the molecule at certain \(pH\) values, with the consequent liberation of toxic products, indicates an
indirect effect of pH on fungistatic properties. The pH of the medium has a significant effect on the fungistatic properties of benzoic acid, salicylic acid, acetylsalicylic acid, propionylsalicylic acid, catechol (to some extent), resorcinol and hydroquinone. The pH of the medium also has an effect on the fungistatic properties of boric acid. It is suggested that in compounds of the benzoic acid type the fungistatic power depends on the balance between the polar and non-polar groups in the molecule and that the pH of the medium affects this balance.

**Electrically-controlled Fabric Drying Machine.** Mary Dalglish, Margaret C. Cook and J. Dalglish (trading as John Dalglish & Sons) and K. S. Laurie. B.P.563,480 of 1/10/1942: 16/8/1944. In a method of controlling the drying of travelling fabrics, regulating adjustments of the drying are made in steps, the direction of each step being determined at the start of the step by the current in an electric control circuit the resistance of which varies with the moisture content of the fabric. Dryness-regulating adjustment steps are started at regularly recurring instants in the drying operation. A machine for carrying out this method has apparatus for regulating the drying of a travelling fabric, a portion of the fabric being connected in an electric control circuit and the apparatus acting to pass a control current the strength of which is dependent upon the electric resistance of the portion and at spaced instants to start dryness-regulating means in motion for a period in either the dryness-increasing or dryness-decreasing direction as determined at each of such instants by the strength of the control current above or below a predetermined datum. The invention also comprises a drying machine having apparatus that comprises parts making electric contact with the fabric embodied in a control circuit, a motor connected to a controller that regulates drying, switch means adapted to start the motor in one or other direction according to the strength of the current in the circuit as determined by the moisture content of the fabric, and a timing switch which renders the switch means effective to start the motor at intervals and to regulate the period during which the motor operates when started.

**Protein Filament Threads: Treatment to Improve Resistance to Hot Water and Acids.** Courtaulds Ltd. and R. L. Wormell. B.P.564,591 of 28/1/1943: 4/10/1944. A process for improving the resistance to attack by boiling water and hot dilute acid of artificial threads having a basis of casein or other protein comprises treating the threads with an aqueous solution containing formaldehyde and 350-750 g. of sulphuric acid per litre of solution. To this treating bath there is preferably added sodium sulphate in an amount considerably less than that necessary to react with all the sulphuric acid in the bath with the formation of sodium bisulphate. If desired, aluminium salts may also be added to the bath although it is preferred to harden the threads to some extent by means of baths containing aluminium salts before carrying out the process of the present invention.

**Hose Pipes: Impregnation with Rubber.** F. S. Zabala (San Sebastian, Spain). B.P.564,673 of 6/7/1943: 9/10/1944. In a process for impregnating hose pipes woven from natural or synthetic fibres with indiarubber latex or similar synthetic dispersions, the hose pipe is treated with a wetting agent, lodged in an inclined or vertical position in a pulverulent material that has a coagulating effect upon indiarubber latex, in such a way that the hose is completely covered externally by the coagulating agent, and then filled with stabilised indiarubber latex or synthetic dispersion to which may have been added a wetting agent and the vulcanizing agents. For this purpose the hose is closed or provided with cocks, compressed air or other gas is injected into the hose from the upper end, and the pressure is maintained until the impregnating liquid seeps through the pores in the hose. The pressure is then interrupted for a short interval of time, is established afresh, and is then interrupted again, until no liquid issues through the pores under pressure, whereupon the impregnating liquid is withdrawn from the interior of the hose, and the impregnated hose is dried, vulcanized and finished. As coagulating agents there may preferably be employed alum, citric acid or talc impregnated with acetic acid, in a pulverised form.
Composite Textile and Metal Foil Fabric.  E. V. Giles.  B.P.564,807 of 5/1/1943:13/10/1944.  An impervious fabric consists of a metal foil sandwiched between adherent sheets of heavily-milled woven or knitted woollen fabric.  Except for use at low temperatures, tin foil is suitable, but if lightness is important aluminium or an aluminium or magnesium alloy may be preferred.  The fabric may be made to adhere to the foil by a thermoplastic, flexible, liquid-resistant adhesive.  The composite fabric is suitable for the construction of fuel tanks for aircraft, diaphragms for diaphragm pumps, and damp-proof courses in building.

Anthraquinone Dyes: Production.  G. D. Buckley, H. A. Piggott and Imperial Chemical Industries Ltd.  B.P.564,859 of 12/4/1943:17/10/1944.  A process for the manufacture of acid wool dyes of the anthraquinone series comprises reacting a C-aralkylcycloaliphatic amine of the formula NH₂X(CH₂)ₙY in which X stands for a cycloaliphatic residue that may carry alkyl groups as substituents, Y stands for an aryl radical, substituted or not, and n is 1, 2 or 3, with an anthraquinone derivative which may be wholly or partly in the leuco form, which contains in the α-positions at least one substituent replaceable by an imino radical by reaction with a primary amine, and which contains in the remaining positions any substituent other than SO₂H groups, and subsequently introducing one or more SO₂H groups into the molecule of the reaction product by treating it with a sulphonating agent.  The sulphonated products dye wool in bright shades of blue or green of outstanding fastness to light and to washing.

Laminated Paper Sheets: Production.  Waxed-Papers Ltd., W. Ralston and W. T. Clout.  B.P.565,008 of 13/1/1943:23/10/1944.  In laminated sheeting of the type comprising two outer sheets of paper between which is sandwiched a reinforcing core constituted by a sheet of non-fibrous, non-metallic pliable film material bonded to the two outer sheets, the core film or one of the outer sheets is arranged to extend at one or each side near the corresponding edges of the other sheets, the projecting portion or portions being doubled over on to, and adhesively secured to, an outer sheet so as to provide an edge binding or bindings which will afford considerable resistance to tearing.  The outer sheets may be composed of Glassine paper.  The outer paper sheets may be treated before or after the laminated assembly has been consolidated, with wax, bitumen or other coating or impregnating agent.  The outer and inner sheets, each in the form of a continuous web, may be passed in assembled relationship through the nip between a pair of rollers, adhesive being applied to the opposite surfaces of the core film or to the inner surfaces of the outer webs, prior to entering the nip of the rollers.  Consolidation is effected by heat and pressure.

Cellophane and Lead Foil Compound Wrapping Material.  Waxed-Papers Ltd. and W. Ralston.  B.P.565,009 of 18/1/1943:23/10/1944.  A compound material suitable for use as wrapping material comprises a sheet of lead foil sandwiched between two sheets of transparent or translucent film adhesively secured to the foil.  The film may be of non-fibrous cellulosic material, e.g. cellulose acetate or regenerated cellulose, or of a synthetic resin composition.  The adhesive used is preferably transparent and colourless, and may contain a small proportion of caustic alkali.  The outer film sheets and inner core sheet of lead foil, each in the form of a continuous web, are passed in assembled relationship through the nip between a pair of rollers, adhesive being applied to the opposite surfaces of the lead foil or to the inner surfaces of the outer film webs, prior to entering the nip of the rollers.

Neutral Calcium Hypochlorite: Production.  Mathieson Alkali Works (New York).  B.P.565,089 of 26/1/1943:26/10/1944 (Conv. 21/1/1942).  Slurries of neutral calcium hypochlorite crystals of excellent filterability may be prepared by adding, preferably at a uniform rate, a slurry of dibasic calcium hypochlorite to a previously prepared slurry of neutral calcium hypochlorite and simultaneously injecting chlorine into the composite slurry at a rate approximately equivalent, chemically, to the rate at which the dibasic slurry is added.  The specific gravity of the liquid phase of the dibasic slurry used should not exceed 47° Twadell and preferably should be between 49 and 44° Twadell.  The free lime content of the composite slurry is advantageously maintained at
a value below 1.5 per cent., by weight, throughout the chlorination. This process can be adapted to continuous operation.

**Thermoplastic Fabrics: Modifying by Heat and Tension.** American Viscose Corporation. B.P. 565,180 of 1/2/1943:31/10/1944 (Conv. 26/2/1942). A method of modifying a fabric containing thermoplastic material comprises the steps of engaging spaced points along the boundaries of the fabric by means of holding members while continuously moving the fabric in a longitudinal path, bringing the holding members without releasing the fabric into effective separation distances defining the desired final dimensions of the fabric along a portion of its path, heating the fabric to its softening point along the said portion of the path to effect partial coalescence of the yarns at their points of crossing and to cause the fabric to attain the desired final dimensions, and subsequently setting the fabric by cooling. By variation of the longitudinal and transverse tensions the fabric can be shortened, narrowed, lengthened, widened or both shortened and narrowed or widened; or it can be modified by the heat without substantial changes in dimensions. The treatment can be applied to woven, knitted or braided fabrics and yields particularly interesting effects with open mesh fabrics.

**Napped Thermoplastic Knitted Fabric: Finishing.** Celanese Corporation of America. U.S.P. 2,338,792. A knitted fabric having a napped surface and containing thermoplastic yarns or filaments is finished by applying a softening agent for this component and passing the fabric between two heated rollers travelling at different peripheral speeds and in opposite directions, the nip being the thickness of the cloth apart from the nap. The nap is thus laid in a relatively permanent position.

**Thermo-setting Resin: Application in Finishing.** Röhmk & Haas Co. U.S.P. 2,338,983. From 1 to 6 per cent. of a thermo-setting resin is deposited in a fabric and this is then hot-pressed in a damp condition to the distended side of a heavy blanket passing over a roller, then passed with the blanket around a heated drum turning in the other direction, and the fabric and blanket are finally separated.


**Melamine Derivative: Application in Finishing.** American Cyanamid Co. U.S.P. 2,339,203. Cellulosic textiles are impregnated with 2-14 per cent. by weight of a methylated methylol-melamine, applied in aqueous solution, dried and "cured" to render the compound insoluble.


**5—ANALYSIS, TESTING, GRADING AND DEFECTS**

(A)—Fibres

**Indian Cottons: Effect of Storage on Quality.** N. Ahmad and A. N. Gulati. Indian J. Agric. Sci., 1943, 13, 494-514. Indian cottons were stored under the following conditions: (1) Bombay weather, (2) controlled humidities at room temperature, and (3) controlled humidity combined with watering of cotton. Observations were made of fibre strength, incidence of infection, and shade. Fibre length, fibre weight per inch and spinning quality were also tested. Broach Deshi 8, when stored in Bombay for 2½ years in the form of a bale, showed distinct signs of deterioration in quality. Storage at controlled humidities below 90 per cent. R.H. did not lead to any deterioration in bundle strength over a period of two years, but at saturated humidity the deterioration was so rapid that both Broach Palej and Broach Deshi 8 decayed completely in four to five months. Storage at humidities immediately above 90 per cent. R.H. resulted in loss in strength, the loss being more rapid at higher than at lower humidities. The incidence of infection was significantly lower for Broach Deshi 8 than for Broach Palej. Broach
Deshi 8 was slightly whiter in shade than Broach Palej; the shade remained unaffected in storage at 60 and 75 per cent. R.H. for a period of two years, but at 90 per cent. R.H. and higher humidities the shade of both cottons deteriorated gradually. Storage for 1½ years at different humidities and a constant temperature of 92° F. did not lead to any decrease in strength or increase in incidence of infection. Localized watering of cotton always resulted in loss in strength and change in shade in the damped region on storing. Addition of 0·5·1 per cent. of formalin to the water checked deterioration on storage.

C. 

Ramie: Chemical Composition. J. C. Medina, G. O. Jensen and J. P. Neri. Bragantia, 1942, 2, 433-447, 455-456 (through Chem. Abstr., 1944, 38, 40114). Analyses were made of ribbon taken from ramie stalks 30, 45, 60, 75, 90, 105 and 120 days old. After an initial decrease from 14·57 per cent. at 30 days to 10·33 per cent. at 60 days the ash of ramie increased as the plant grew and matured, reaching a maximum of 17·5 per cent. at 105 days. Cellulose increased regularly, reaching a maximum of 38·2 per cent. at 75 days, but declined as the plant grew older (30·15 per cent. at 120 days). After an initial increase from 9·38 per cent. at 30 days to 14·51 per cent. at 45 days, the lignin content decreased somewhat, but increased again as the plant matured. Pectin (galacturonic acid) was highest (22·9 per cent.) in the first stages and declined in a nearly regular manner as the plant developed except that in the last two stages (105 and 120 days) there was a small increase. Pentosans and reducing sugars increased regularly with the age of the plant with maxima of 5·2 and 3·8 per cent., respectively. The amount of hot water extract after a decrease in the earlier stages increased to a maximum of 24·2 per cent. at 105 days. The amount of alcohol-benzene extract decreased regularly to 4·11 per cent. at 90 days from an initial value of 8·3 per cent. at 30 days, but increased again slightly in the last stages. Crude protein (\(N \times 6·25\)) decreased from 15·2 per cent. at 30 days to 8·35 and 8·12 per cent. at 105 and 120 days, respectively.

Soybean Protein Fibre: Properties. W. von Bergen. Rayon Textile Monthly, 1944, 25, 225-226. A brief outline is given (by R. Boyer) of the process now used by the Drackett Co., U.S.A. (taken over from the Ford Motor Co.) for producing rayon staple from soybean protein. The characteristics of a recent sample are recorded, the data for fineness, strength, and effects of swelling agents being tabulated against figures for a 1939 product. The average diameter is 23 \(\mu\); breaking load in the bundle test 11,450 lb. per sq. in. dry, 4,240 lb. wet; regain at 65 per cent. R.H., 70° F., 16·1 per cent. in desorption, 12·9 per cent. in absorption; \(pH\) 2·7; per cent. swelling in water 18·7, in 0·1N caustic soda 35·1.

Man-made Fibres: Structure and Properties. W. T. Astbury. Endeavour, 1944, 3, 98-103. It is pointed out that the basis of the regenerated fibre industry is the science of isolating, controlling, and if necessary modifying, natural chain-molecules and building them into structures of the desired design, whilst the synthetic fibre industry is based on synthesis and arrangement of other chain-molecules. Regenerated fibres are produced from polysaccharides (cellulose) and from proteins. Examples of synthetic fibres are Vinyon, produced from vinyl chloride and vinyl acetate, and polyamide fibres, such as Nylon, obtained by condensation of dicarboxylic acids and diamines. The methods of production, structures and properties of these different types of fibres are briefly discussed.

Viscose Rayon: Degree of Polymerisation, Properties and Serviceability. K. Lauer and R. Döderlein. Zeitschrift, Kunstseide, Seide, 1943, 48, 123-127 (through Chem. Zentr., 1943, i, 93 and Chem. Abstr., 1944, 38, 44509). Experiments on viscose rayons which were manufactured under accurately defined conditions showed that above 220 the degree of polymerisation had no effect on tensile strength and stretch. A higher degree of polymerisation has an increasing effect on swelling but not on alkali-solubility. Serviceability tests showed no differences between viscose fibres of various degrees of polymerisation.

Wool from the North-Eastern Free State. J. C. de Klerk. Fmg. in S. Africa, 1944, 19, 623-630, 640. A study of the turn-over, value and size of the clip from the North-Eastern Free State received in Durban, with a classification of
districts according to the quality of wool produced, an analysis of the type of wool and of its fineness and length, and of the relationship between price, type and scoured yield. The figures for the 1943-1944 season are given up to and including the sales of 16 Feb., 1944.

Vegetable Matter Content of Wool: Determination. H. J. Wollner, L. Tanner and J. Michelson. Amer. Dyes. Rep., 1944, 33, 375-379. The hand picking, sodium hydroxide, peroxide-carbonate and carbonising methods of determining the vegetable matter content of wool have disadvantages as regards accuracy and speed. A laboratory method for the rapid quantitative estimation of vegetable matter in scoured wool, without loss or damage, consists in immersing the wool fibres in a liquid having the same refractive index (1.555), e.g. monochlor-naphthalene and a petroleum distillate. A laboratory method for the rapid quantitative estimation of vegetable matter. A relatively small number of standards suffices for routine work. As compared with hand picking, the method is accurate to 0.1 per cent. The question of sampling is discussed. The method can be applied to any substance for which a suitable liquid having the same optical properties is available.

(B)—YARNS
Rayon Candle Wicks: Properties. J. Chłosta. Chem. Ztg., 1944, 68, 7-9 (through Brit. Chem. Physiol. Abstr., 1944, B II, 251). Investigations of the burning properties and, especially, capillarity of rayon and cotton candle wicks indicates that the staple length of the fibre and nature of the wax are unimportant factors, whilst fineness of filament and yarn strength have some, and ash content, type of spinning, and fibre characteristics a pronounced, influence on wick quality. Delustred fibres are useless, but bright, stretch-spun fibres with wool-like properties are suitable raw material, such fibre when given an alkaline treatment (which produces a shrinkage of 2.5-6.0 per cent.) yielding a wick which burns more slowly than cotton wicks.

(C)—FABRICS
"Fludlite" Cloth Examination Glass. Stanley Electric Tool Division. Rayon Textile Monthly, 1944, 25, 253. An illustrated note is given of a glass for fibre and cloth inspection that has a 5-in. lens of focal length 13 ins., at the rim of which is housed a small fluorescent daylight lamp. There is a hand model with a length of flex attached, and a bench model with jointed arm.

Bags: Testing. R. W. Lahey. Chem. & Eng. News, 1944, 22, 1191-1192. The selection of bags for various types of materials is discussed and the advantages of a laboratory test that would indicate the ability of bags to withstand transportation and handling abuses are pointed out. A test is proposed in which packed bags are dropped mechanically by drop table or other apparatus on to a concrete floor in accordance with the following cycle: (a) Drop on one face; (b) drop on opposite face across 4 x 8 inch timber baffle; (c) drop on one edge; (d) drop on opposite edge across baffle; (e) drop on one end; (f) drop on opposite end across baffle. After successful completion of each cycle, the height of drop is increased by 1 foot until the bag fails. Drops are so arranged that the drops in the second cycle across the baffle will be made on the opposite face, edge and end to those of the first cycle, and this alternation continues throughout the test.

Belting Ducks: Warp-way Strength Testing. W. Lord. Textile Manufacturer, 1944, 79, 395-397. The author presents a critical analysis of the ravelled-strip test and the standard grab test (specimens about 4 ins. wide, upper grip 1 in. wide, lower grip at least 2 ins. wide), his criterion being the closeness of the breaking load figure to the "aggregate single-thread strength," that is the breaking load of one end of the warp multiplied by the number of ends in the width of the test specimen. The ravelled-strip test gives low results, especially with hard fabrics, and it is seen on inspection of the specimen that at the approach of rupture several warp threads lie loose in the weft fringes and the strain is taken by fewer ends than arranged. The grab test gives high results especially with soft fabrics, and the results do not provide any true basis for comparing different weights and textures. A new test is
described, called the "Adagrab" (adapted grab test) in which one inch of fabric is gripped between the jaws and the specimens are pulled down to within 4 ends on each side of the gripped inch. The distance between the jaws is 7 inches. The results are always within 4 per cent. of the "aggregate single-thread strength." Typical results are recorded. C.

Balloon Fabrics: Permeability to Hydrogen. H. L. Van Nouhuys. Textilberichte, 1943, 24, 507-511 (through Brit. Chem. Physiol. Abstr., 1944, B II, 227). A modified method of measuring the permeability of balloon fabrics (a rubber layer between two strong cotton layers, the outer layer of which is also rubber surface-coated) is described; results are reproducible to within 10 per cent. The permeability increases by about 5 per cent. per degree C. between 20° and 30°, and by about 8 per cent. for an excess hydrogen pressure of 0-30 mm.; these differences, however, approach the analytical limit of the method. Variations in air velocity have little influence on the permeability between 3 and 10 l./hour, and the permeability is approximately proportional to 1/thickness of rubber layer. The permeability per unit thickness of a natural rubber is 4-6 times that of a neoprene type synthetic rubber. Accelerated ageing for 7 days at 70° in the dark in circulating air, or for 3 days at 70° in oxygen at 1 atm. had little effect on the permeability of fabric containing natural or synthetic rubber. Artificial weathering by wetting for 14 days under natural midsummer conditions increased considerably the permeability of one sample of natural rubber, decreased considerably that of another, and increased slightly the permeability of synthetic rubber coated with aluminium powder.

C.

Cotton and Rayon Curtain Fabrics: Quality and Durability. F. E. Petzel. Ohio Sta. Bul. No. 645, 1943, 30 pp. (through Exp. Sta. Rec., 1944, 90, 573). The fabrics studied included cotton voiles, scrim, marquisettes, bobbinets and filets and rayon marquisettes, voiles and ninons of ecru or closely related colour. The relationship between breaking load and price per square yard varied for different types of fabrics. Price was not closely related to shrinkage or to colour fastness to light or washing. In the relation of fibre content to durability, cotton voiles (except the lowest priced) were stronger than rayon voiles and ninons. Among the rayon plain-weave fabrics, cuprammonium voile was the strongest and ninon the weakest, with viscose voile in an intermediate position. Among the light-weight marquisettes, those of cotton were stronger than similar ones of rayon in the warp direction but weaker in the weft direction. The heavy viscose marquisette was weaker in the warp than the two heavy cotton marquisettes and intermediate in strength in the weft direction. Exposure to light did not affect the relationships between fabrics. The wet strength of the rayon voiles, ninons and marquisettes was less than that of cotton voiles and marquisettes. There was no consistent relationship between fibre content and colour fastness to light. In the relation of yarn and fabric construction to durability, the cottons in descending order of strength were scrim, heavy marquisette, cotton voile, light-weight cotton marquisette, filet and bobbinet. The rayons ranked as follows: heavy viscose marquisette, cuprammonium voile, viscose voile, light-weight viscose marquisette, ninon, and cellulose acetate marquisette. Shrinkage was related to yarn and fabric construction, tending to be highest in marquisette and bobbinet. Warwise allowances for shrinkage, assuming the fabrics to be ironed rather than stretched after washing, are given in inches per yard for the different types of fabric. Certain laundering precautions are noted. C.

Full-fashioned Hose Defects. Textile World, 1944, 94, No. 8, 125. Illustrations are given of (1) and (2) hole cuts in the leg and welt, (3) a rough selvedge, and (4) 'a narrowing hole and causes and cures are suggested. C.

Rubberised Rayon Raincoats: Defects. — Kehren. Textilberichte, 1943, 24, 502-507 (through Brit. Chem. Physiol. Abstr., 1944, B II, 230). Under normal wear-and-tear conditions satisfactory raincoats made from rubberised rayon or staple fibre should last for 2-5 years. Defects which reduce this period arise from the following: (a) "Haloes" due to the action of water on the rayon; they can be prevented by pretreating the rayon with agents which render it more water-resistant. (b) Loosening of the rubber layer. A test for this weakness is to soak a sample in water, and to look for blisters. It is particularly prevalent between a staple fibre topside and a rayon underside, and is often due to the presence of too much filler, e.g., in presence of about 33 and 21 per cent. of ash, respectively,
the rubber layer parted immediately and was intact for more than 24 hours after immersion in water. (c) Tearing may be due to mechanical weakness, and data are presented showing that high dry strength may accompany low wet strength. It may also arise from chemical decomposition of the fibre, e.g. from the action on cloth of decomposition products of substances (e.g. urea resins) used to render it creaseproof. Even relatively small quantities of weak organic acids (e.g. formic acid) may act in this way at a vulcanising temperature of 120-130°C.

(d) Low water-resistance of the cloth itself; this may arise from causes as with (c), and may be partly offset by the use of close weaves or a combination of rayon and cotton webs. (e) Development of stickiness in the rubber followed by loss of elasticity, and the formation of hard and brittle lumps which adhere to the clothing. These changes are often accompanied by a characteristic odour, and are usually due to catalytic decomposition of the rubber by metals, especially copper and manganese. If after extraction of the rubber from the specimen in a suitable solvent the concentration of copper + manganese of the residual cloth is greater than 0.005 per cent., this fault is likely to occur.

C. Cotton Corduroy: Physical Properties. Gladys White. Amer. Dyes. Rept., 1944, 30, 315-316. A report is given of an examination of 12 cotton corduroy fabrics representing three different types of construction of ground weave. The fabrics were tested for breaking strength, weight, durability, as measured by resistance to abrasion, colour-fastness to light and to washing, changes produced by laundering, and other physical properties. The methods of testing are outlined and the results are tabulated and discussed. The results of a statistical analysis of the data are also presented. On the basis of the results of this work, specifications are proposed to define the minimum quality of medium weight cotton corduroy for boys' wear.

"Planoflex" Fabric Pliability Tester: Application. E. C. Dreby. Amer. Dyes. Rept., 1944, 30, 561-564. 665-666. The Planoflex, a simple device for measuring the extent to which a fabric can be distorted in its own plane without producing wrinkles on its surface, has been developed to evaluate the pliability of woven fabrics. It consists of a metal base plate, supported by a wooden frame, to which are fastened a movable clamp, a fixed clamp and a hinged shelf. The movable clamp is constrained by two connecting strips to move in an arc of six inches radius in such a way that it remains parallel to the fixed clamp. A weight clamp, supported by the hinged shelf, is used to put the test specimen under a two-pound tension when it is mounted. A specimen, three inches wide and ten inches long, cut with the long dimension either parallel or perpendicular to the warp yarns of the fabric, is used for the test and is mounted in the clamps. The movable clamp is moved slowly, first to the left and then to the right, to the angles at which longitudinal wrinkles first appear on the surface of the specimen. The angles are read on a scale below a pointer on the movable clamp. The total angle through which the fabric can be distorted is the sum of the readings obtained on the left and right of the centre. Results of measurements on a series of cotton percales show an 88 per cent. correlation with their actual pliability ratings. Comparison of the Planoflex with the Schiefer Flexometer and the Peirce Hanging-heart Loop methods for evaluating pliability showed the Planoflex method to be as good as or better than the other two methods with respect to the extent of the correlation between measured values and actual pliability ratings, sensitivity to small differences in pliability, and ease of operation. The Planoflex may be used for testing a wide variety of fabrics, with the exception of heavily starched fabrics, and for evaluating the effects of different finishing agents and treatments.

(D)—Other Materials

Coloured Rubber: Light Fastness Tests. W. H. Willott. J. Rubber Research, 1944, 13, 89-97. A range of samples of rubber containing organic pigments and other ingredients liable to lead to change on exposure to light were tested for fastness to (1) daylight, the light of (2) the "Fad Outfit," (3, 4, and 5), the Fugitometer, types A, B and C, (6) the high-intensity arc and (7) the incandescent cathode mercury vapour lamp. The effects are described. It appears that the temperature of the air near the test specimens should be kept below 30°C. and that the humidity influences the shade to which the colour changes but not the rate of fading. The high-intensity arc reproduced the effects of sun-
light in the early stages. Results by the Fugitometer may be correlated with the effects of sunlight provided the humidity is high and the temperature low. The mercury lamp displays a very strong line spectrum so that its radiation may give erroneous effects with particular colours.

**Paper and Paper-board: Testing; Standard Conditions.** Technical Association of the Pulp and Paper Industry. *Paper Trade J.*, 1944, 119, TAPPI, 142. Details are given of a revision of TAPPI official Standard T402 m.-41 which prescribes 50 ± 2 per cent. R.H. and 73 ± 3 °F. as the atmospheric conditions for testing paper and paper-board. Samples should be conditioned until of constant weight, equilibrium being approached from a point well on the dry side.

**Resin Finishes: Analysis.** F. P. Brennan. *Rayon Textile Monthly*, 1944, 25, 339-341. A list is given of agents that have to be analysed in finished fabrics and the methods for testing resin finishes put forward by the American Society for Testing Materials are reproduced.

### 7—LAUNDERING AND DRY-CLEANING

(A)—CLEANING

**Soda-Soap Solutions: pH Measurements.** L. R. Bacon, J. W. Hensley and T. H. Vaughn. *Ind. Eng. Chem.*, 1941, 33, 723-730. Measurements of pH have been made in modified soda-water and modified soda-soap-water systems by means of the hydrogen electrode, the glass electrode, and two colorimetric methods. Details of the methods and equipment are given. The electrometric measurements were made at 25°, 40°, 60° and 80° C., and the colorimetric measurements at 25° C. The modified soda contained 40-94 per cent. sodium carbonate and 45-15 per cent. sodium bicarbonate and was used in concentrations covering the full range of detergent interest (up to 1-2 per cent.); soap concentration was 0-1 per cent. Results are shown in tables and curves, and compared with results of other investigators. The modified soda solutions were found to be characterised by flat pH maxima at concentrations between 0-5 and 1-0 g. per litre at 25-60° C. In the presence of soap, the pH values closely approximated to those of soap solutions at very low soda concentrations whilst at high soda concentrations the behaviour was practically that of the builder alone. At 25° C. the pH of soap solutions was reduced by modified soda. At 40° C. the behaviour was similar, but less marked. At 60° C., all concentrations of modified soda increased the pH of soap solutions and at 80° the increases were greater. At a soap concentration of 0-1 per cent. the practical laundry builder range of modified soda concentration is about 0-03 to 0-3 per cent. For this range the pH difference would be 0-04 at 40° and 0-10 at 60° C., yet great differences in effective washing capacity result from the use of various compositions within this range. Such conditions do not permit practical control of detergent solutions by any form of pH measurement. Colorimetric measurements are misleading at the lower builder concentrations of laundry interest because of inaccuracity and because of inability to relate the values to those prevailing under washing conditions.

**Washing Agents: Detergency Determination.** E. Jaag. *Tech.-Ind. schweiz. Chem. Ztg.*, 1942, 25, 331-336 (through Chem. Zentr., 1943, i, 2254-2255 and Chem. Abstr., 1944, 38, 4339). A new method is reported for the laboratory determination of the detergent value of a washing preparation. Pieces of cloth soiled with India ink, with India ink and mineral oil and with India ink and vegetable oil were washed with various detergents. The washing efficiency of almost all the synthetic products tested was improved by the addition of soda. Although soap without soda shows a maximum detergent effect, soda can be added to the soap solution to bring the pH to 10-7, at which value the detergent action of the soap is at a maximum. Soda alone shows considerable detergent action. Sulphonates of the aliphatic alcohols showed essentially better wetting properties than a condensation product of the aliphatic acids. The addition of a slight amount of a protective colloid (a cellulose derivative) to the aliphatic alcohol sulphonate increased the detergent strength 20 per cent. Saponins showed no detergent action. The different detergents behaved differently toward the various types of soil, so that laboratory results can be used to determine the best detergent for a particular purpose.
Stoddard Dry Cleaning Solvent: Recovery. C. S. Lowe and A. C. Smith. *Ind. Eng. Chem.*, 1941, 33, 762-768. Laboratory and plant tests carried out under controlled conditions have shown that the use of adsorbent powders retards accumulation of fatty acids in Stoddard dry cleaning solvent, and will remove odorous impurities to some extent. Of the adsorbing agents studied activated carbon ranked first in this respect, followed by magnesium silicate and activated fullers' earth. The source of fatty acid accumulation above that derived from the garments being cleaned is discussed. It is suggested that water present in the soap and garments causes hydrolysis of soap and that the resulting alkaline products are adsorbed by protein fibres whilst the acid accumulates in the solvent. Displacement of the fatty acid combined in the soap by mineral acids held on the garments and insoluble in dry cleaning solvent also results in accumulation of fatty acid in the solvent. Soap prevents the removal of acid by adsorbent powder when the proportion of the latter is below a certain value. In the presence of garments the action of the soap in preventing adsorption of acid by the powder is greatly diminished.

Rayon Fabrics: Shrinkage in Laundering. Alice C. Gaston and Hazel M. Fletcher. *Rayon Textile Monthly*, 1944, 25, 238-239. The influence on shrinkage of the type of fibre and yarn and of the tension under which ironing is performed has been studied on a series of dress and underwear fabrics in plain weave, from (1) continuous filament viscose rayon, (2) continuous filament cellulose acetate rayon, and (3) spun viscose rayon. The materials (five in each group) were laundered up to five times and ironed under 0, ½, 1, 3 and 4 lb. tension. Particulars of the fabrics and the tests are tabulated. Both sets of continuous filament fabrics behaved alike in shrinking by a small amount which was decreased as the tension in ironing was increased. The spun viscose rayon materials shrank much more (e.g. 4.4 per cent. in one wash as against 0.5-0.7 per cent.) and the decrease due to ironing under tension (e.g. 2.6 per cent. shrinkage under 4 lb. tension) was more marked. All the materials shrank more in the warp than in the weft.


**PATENTS**

Wetting, Sudsing and Detergent Agents: Preparation. Procter and Gamble Co. (Assignees of N. B. Tucker). B.P.564,837 of 28/1/1943:16/10/1944 (Conv. 29/12/1941). A higher fatty acid salt having eight to twenty-two carbon atoms is condensed with a halogen substituted sulphonate of the general formula X.Rj.SOjMe in the presence of formyl morpholine to produce a wetting, sudsing and detergent agent of the general formula R.CO.ORj.SOjMe where R is an alkylene or hydroxy alkylene radical having two to four carbon atoms and Me is a metal forming a water-soluble salt.

Ironing Machines. J. W. S. Lane. B.P.565,273 of 13/1/1943:3/11/1944. In multiroll ironing machines tapes are used to ensure that the work passes from one roll to the next. They do not always work satisfactorily, however, and this specification describes a device for eliminating them. A hollow body is placed between the rollers and is shaped so that with the adjacent part of the bed it forms a guide for the work passing through the machine. The under face of this body is perforated so that air can be blown through to assist the passage of the work from one section to the next.

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8—BUILDING AND ENGINEERING

(A)—CONSTRUCTION AND MAINTENANCE OF BUILDINGS AND PLANT


Compressed and Impregnated Laminated Wood: Fatigue Tests. A. G. H. Dietz and H. Grinsfelder. *A.S.T.M. Bull.*, 1944, No. 129, 31-34. Modulus of rupture, modulus of elasticity, and specific gravity have been determined, and rotating-beam tests carried out on high-density materials made by compressing wood veneers interleaved with phenolic resin films, veneers spread with medium polymer liquid resin adhesives, and veneers impregnated with low polymer phenolic resin. Details of the apparatus, methods and results are given. Both impregnated and unimpregnated materials, when laminated and not cross-banded, had fatigue limits about 30 per cent. of the modulus of rupture. Material impregnated with one low-polymer resin had a fatigue limit as high as 38 per cent. of the modulus of rupture. Cross-banded unimpregnated material had a fatigue limit approximately 25 per cent. of the modulus of rupture. Unimpregnated laminated material was improved in its characteristics by employing veneers 1/28th in. thick, rather than thinner ones. Differences as great as 25 per cent. were observed between panels made up under nearly identical conditions. No consistent conclusions could be drawn respecting the effect of pressure.

**Masonite Wood Products: Application.** R. M. Borland. *Chem. and Eng. News*, 1944, 22, 1352-1356. The Masonite process consists in feeding wood chips into a cylindrical steel vessel of 25 c. ft. capacity, fitted with a quick-opening hydraulic valve at the bottom, admitting steam during about 30 seconds until the pressure reaches 600 lb., then quickly increasing the pressure to 1000 lb. for 1-2 seconds, and suddenly opening the valve so that the contents of the cylinder are explosively discharged into a cyclone separator as a mass of fibre. This fibre is then washed, refined, screened and formed into sheets on a machine of the Fourdriner type. The wet sheets are fed, 20 at a time, to a hot press (about 200° C.) and converted into "Preswood" products, the variety of which depends on the pressure. The lignin set free by the hydrolysis of the lignocellulose is said to be the agent that binds the fibre together. "Tempred Preswood" is obtained by impregnating ordinary Preswood with oils which are then polymerised by heat. A sheet 1/4-in. thick has sp. g. 1.08, breaking load about 10,000 lb. per sq. in., and increases only 6 per cent. in weight when immersed in water. Other products known as "S-2-S" are obtained by the hot pressing of the original Masonite sheets in a substantially dry condition. An illustrated account is given of war-time applications. The output in 1943 was more than 500 million feet.

**Interconnecting Services.** *Power and Works Engineer*, 1944, 39, 232-4. Notes on the interconnecting of adjacent plants in respect of engineering services, e.g. steam, power, compressed air, etc.


**Careless Electrical Maintenance Spells Fire.** *Industrial Heating Engineer*, 1944, 6, 147-8. Notes on how to eliminate the fire hazard arising from unsatisfactory servicing of electrical plant.

**Flue Gas Analysis.** R. H. Parsons. *Power and Works Engineer*, 1944, 39, 229-30. It is shown that readings from an Orsat apparatus can often be used to provide information on quantity of excess air, theoretical maximum CO₂ per cent. obtainable from the fuel in use, the amount of water vapour in the flue gases, etc.

**Electric Motors: Application in Textile Mills.** *Silk and Rayon*, 1942, 16, 688-692, 748-752; 1943, 17, 44-48, 52, 106-110, 122, 182-188, 246-250, 310-312, 378-380, 438-440, 448, 507-509, 582-584, 692, 698, 800; 1944, 18, 106-109, 222-224. The electrical engineering aspects of motor drives for textile mills are explained under the main chapter headings (1) Choice of motors; (2) Characteristics of d.c. motors; (3) Characteristics of a.c. motors; (4) A.C. supply, power factor and improvement of power factor; (5) Electrical installa-
tions and safety regulations; (6) and (7) Protective devices for electrical plant; (8) and (9) Private generating plant; (10) Operation of dynamos; (11) and (12) Causes of electrical plant failures; (13) Excessive heating of motors; (14) and (15) Plant for converting a.c. to d.c.


Spindle Driving Tapes: Joining. Clipper Belt Lacer Co. *Textile World*, 1944, 94, No. 8, 123. A hand machine is shown for joining thick spindle tapes by means of hooks and a raw-hide pin. The devices are supplied in widths ranging from $\frac{1}{4}$ to 2 inches. The ends of the tapes are cut square and sealed with a binding fluid that dries hard. It is claimed that a $\frac{1}{4}$-in. thick tape joined by these hooks rides with less vibration than an ordinary stitched tape.

(E)—Transport

Knitting Factory Overhead Conveying System. American Monorail Co. *Textile World*, 1944, 94, No. 8, 119-121. An illustrated account is given of an automatic system for conveying 12 bags of hose, each containing 20 doz., from the knitting room to the store of the dyeing department, and another system for taking 100-150 lb. of hose from the grey room to the dyehouse, at the Union Manufacturing Co.'s factory, Union Point, Georgia, the output of which is about 5,000 dozen per 16-hr. day.

(F)—Lighting


(G)—Heating, Ventilation and Humidification

Humidification Plant: Developments. H. Miedendorp. *Rayon Textile Monthly*, 1944, 25, 251-253. In a general article on the value of controlled humidification in the textile industry, the following recent developments are briefly described. (1) The Bahnson "centri-spray central station air-conditioning unit, with centrifugal device for atomizing the water. (2) The "humiduct-precipitron" unit in which the Bahnson thermostatically-controlled humidist is combined with the Westinghouse electrostatic air filter. (3) The Sturtevant "vap-air blender" which achieves complete absorption of the moisture from the spray heads.

(H)—Water Purification

Ion Exchange Resins: Application. E. R. Mueller. *Paper Trade J.*, 1944, 119, TAPPI, 120-123. A report of a lecture on the action of zeolites and of artificial resins with similar properties. It is pointed out the effectiveness of a combination of cationic and anionic resins for removing ions depends on the extent to which the cationic member ionises the electrolytes to their component acids and bases. Thus, carbonaceous cation exchangers do not completely ionise sodium salts. On the other hand, ionic exchange is a more effective means for removing heavy metals than is distillation in a Pyrex still. A spectrographic analysis of a treated river water is recorded.

"Ionac" Ion-exchange Resins: Application. W. E. Mannring. *Paper Trade J.*, 1944, 119, TAPPI, 123-126. Ionac C-284 is a black, vitreous cationic resin in which bound sulphonic acid groups are the active nuclei and Ionac A-293 is a white, vitreous amine resin insolubilised by melamine. The author describes their performance in a four-bed system, comprised of alternate beds of C and A, for the complete removal of mineral salts from water. Details are given of (1) the treatment of a brackish water, (2) a portable cartridge unit (known as "Filt-R-Stil") and (3) a self-contained laboratory unit with an output of 30 gallons per hour.
Ion Exchange Resins: Application in Water Treatment. E. Nordell. *Paper Trade J.*, 1944, 119, TAPPI, 141-144. The chemistry of cationic exchangers of the type of sulphonate coal ("Zeo-Karb") and resins, and of the amine resin anionic exchangers is reviewed and analyses are given to show their effectiveness in joint use for removing mineral salts from water. Operating costs are also recorded; they vary from $0.03-0.16 per 1,000 gallons, compared with $0.60 for the most efficient quadruple-effect stills.


Selective Calcium Softening for Industrial Water Supplies. R. T. Sheen and E. B. Woodruff. *Industrial and Engineering Chemistry*, 1944, 36, 971. Many industrial water requirements can be satisfied by softening the raw water to reduce the calcium hardness only, and leave the magnesium hardness in solution. This is particularly applicable to process water used for cooling purposes, and where reduction of calcium hardness and alkalinity will establish a balanced water that will not deposit calcium carbonate on heat exchange surfaces with rise in temperature. The chemical cost of reducing calcium hardness is materially less than the cost of reducing both calcium and magnesium hardness. Lime and soda softening for reduction of calcium hardness only can be controlled by pH value of the process; the pH is normally held between 9.6 and 10.2, and the exact control point is determined for the individual water. The softening process is followed by partial neutralization, either with acid or with scrubbed and purified flue gas to a controlled pH point, designed for a stable water as determined by the Langelier Index or by marble tests, or it may be further stabilized by the application of polyphosphates.


Wool Wax Alcohols. E. S. Lower. *Ind. Chem.*, June, July and August, 1944. The production of wool wax alcohols from wool grease, especially the saponification, is described. Details are given of the general properties and industrial applications of the component alcohols, including two cholesterol-rich fractions now available on the British market.

Textile Air Filters. C. C. Marston. B.P.564,921 of 12/1/1943;18/10/1944. A hollow textile member (e.g. a sleeve) through which dust-laden air or gas passes for filtering, associated with means by which it can be mechanically shaken is characterised in that the sleeve is constructed of a resilient material such as elastic webbing or other elastic fabric throughout its whole length. The sleeve may be secured by one end to a vibratory platform forming one wall of a substantially air-tight chamber.

Combined Dust Extractor and Filter Devices. C. G. Vokes. B.P.564,932 of 15/4/1943;19/10/1944. Means for pre-cleaning and filtering the intake air of engines include a filtering screen, means for causing air to flow at considerable velocity along a path adjacent to the screen carrying heavier dust particles with it beyond the screen, a series of louvres or equivalent means to define openings between the path and the screen and so formed as to enforce a sharp backward turn of all the intake air as it passes to the filter screen and a duct leading from the clean side of the filter screen to the engine intake. The means for imparting velocity to the outside air may include blades blowing the air along the screen.

raw rubber in an amount between 0.8 and 2.0 per cent. by weight of the total composition. The composition may also contain a colouring material such as a pigment or dye. When this composition is applied by standard spraying procedures to a bare metal or other suitable base and baked for one hour at 250-275°F., a smooth, high-class hammered metal effect finish is obtained with a single coating.

### Pipe Couplings

**T. C. Enstone & Co. Ltd. and W. A. Crook. B.P.564,182 of 12/6/1943:15/9/1944.** This invention consists of a pipe coupling wherein the mechanical arrangement between the nut and the ring is formed by providing the ring with a flange which is not screw threaded, but may be complete or interrupted, this flange, having a periphery or peripheral portion of slightly larger diameter than the internal diameter across the ridges of the thread in the nut, but less than the internal diameter across the bases of the groove of the said thread. The object of the invention is to provide an improved form of mechanical engagement between the nut and the ring, whereby these two parts will normally be retained together as a unit, but in cases in which the ring has become firmly fixed between the union and the pipe, to allow the nut to be removed by screwing it off from the union leaving the ring in position.

**Pipe Couplings.** T. C. Enstone & Co. Ltd. and W. A. Crook. B.P.564,183 of 12/6/1943:15/9/1944. In this invention a pipe coupling is made wherein the mechanical engagement between the nut and the ring is formed by a non-positive retaining member which engages both the nut and the ring and normally retains them together, but is self releasing from one of the two members when a moderate force causing no damage to any of the parts, is applied in an axial direction between the nut and the ring.

### Wool Grease: Purification

**American Cholesterol Products Inc. Australian P.117,961 (through Text. J. Australia, 1944, 19, 104).** The grease is treated with barium hydroxide in an aqueous medium and the water-insoluble residue extracted with an inorganic solvent to separate the unsaponified matter, including the sterols, from the resulting soap. To prevent the destruction of the sterols, the temperature should not exceed 100°C.

### 9—Pure Science

#### Potato and Corn Amylopectin: Colloidal Behaviour

**M. Samec and L. Zagar. Wien. Chem. Ztg., 1943, 46, 25-31 (through Chem. Abstr., 1944, 38, 3868a).** The authors review the history of the work on corn and potato starch leading to the theory that the phosphorus content of the amylopectin fractions is responsible for much of the difference in physical properties of the two starches. The preparation of a sample of potato amylopectin with 0.1 of its normal phosphorus pentoxide content is described. The dephosphorized product was much less fluid than a sample of potato amylopectin prepared after cooking for half an hour, and was more opaque, and in every way much closer to corn amylopectin. The phosphorus pentoxide content of corn amylopectin, approximately 0.045 per cent. as against 0.175 per cent. in potato amylopectin, is largely in the form of phosphatides, and little change was noted upon its removal. A method of bringing the phosphorus content of corn starch up to and above that of potato starch is described. The product is much higher in consistancy than the original material, and is white and cloudy. It appears that the electric properties and phosphorus content are related to the gel strength and viscosity of the starches, but not to the difference in clarity and stringiness. The addition of caustic soda up to 0.5N. renders corn amylopectin clear and semi-fluid. Additional factors are the less branched nature of corn amylopectin, as shown by end-group studies, and the likelihood that the molecule of potato amylopectin is larger, and hence has less tendency to crystallise.

#### Cellulose and Cellulose Derivatives: Sedimentation and Diffusion Measurements

**N. Graelen. Thesis, Uppsala, 1944, 115 pp. (through Brit. Chem. Physiol. Abstr., 1944, A I, 153).** The principles of sedimentation in the ultracentrifuge are described, and an empirical relation between rate of sedimentation and concentration is given. Taking this into account the shape of the sedimentation curve for polydisperse systems is analysed mathematically. The width of the curve is regarded as a measure of the polydispersity. Sedimentation experiments on cellulose in cuprammonium solution, nitrocellulose in...
acetate, Na cellulose xanthate, and Na cellulose glycollate in water, are described. Data are given for native fibre celluloses (unbleached and bleached) and for several wood celluloses. The effects of different chemical treatments in reducing the sedimentation constants are evident; in general a reduction in sedimentation constant is accompanied by an increase in polydispersity. Apparatus for diffusion measurements is described and measurements on the above materials are recorded. The skewness of diffusion curves arises from the dependence of the diffusion constant on concentration. Diffusion of a polydisperse substance is treated mathematically, and a method for determining the polydispersity suggested. For cellulose the diffusion process reaches its true velocity only after the lapse of some time. The derivatives of cellulose behave normally. A formula is derived for determining molecular weights from sedimentation equilibrium. Equilibrium is reached in a reasonable time only for cellulose of fairly low molecular weight. The partial specific volume of cellulose was found to be 0.664. Molecular weights of cellulose and its derivatives determined by sedimentation and diffusion are reviewed, and shown to differ from those obtained by viscosity measurements, using Staudinger's relation. The relation between intrinsic viscosity and molecular weight is not linear. Comparison of molecular weights of cellulose and nitrocellulose shows that some depolymerisation takes place in nitration (about 3 bonds per 10,000 ruptured). Na cellulose xanthate and Na cellulose glycollate have relatively low molecular weights. Approximate data for the shape of molecules are given; cellulose molecules are less fully extended than nitrocellulose molecules. The polydispersity of each substance tends to increase with decreasing molecular weight, but nitrocellulose has rather lower polydispersity than the corresponding cellulose, indicating that the larger molecules are preferentially degraded during nitration. Results from sedimentation and diffusion are not usually in good agreement, but the experimental errors and approximations involved are considerable.

**Macromolecular Solutions: Viscosity.** J. J. Hermans. *Kolloid Z.*, 1944, 106, 22-29 (through Chem. Abstr., 1944, 38, 2533). Viscosities of various macromolecular substances (paraffin, polystyrene, cellulose, cellulose nitrate, Cellite, cellulose triacetate, methylcellulose) were determined in various solvents (benzene, cuprammonium, acetone, butyl acetate, chloroform, m-cresol, water). The dissolved macromolecules are considered as flexible coils which are deformed by the velocity of falling through the streaming field. The shearing modulus X is calculated from the deformation by the Kuhn statistical method. The deformed molecules require a definite relaxation time, τ, to return to their original shapes. The product Xτ establishes the contribution of the dissolved molecules to the viscosity. This simple theory agrees with the Staudinger viscosity concept. The final viscosity formula contains a factor varying with the "degree of stretch" of the convoluted molecule. The degree of stretch calculated from the formula gave reasonable values in all of the cases investigated. The formula presents a possibility of determining the relation of the degree of stretch with the solvent and with the temperature.

**High-speed Cinematograph Camera.** P. S. H. Henry. *J. Sci. Instruments*, 1944, 21, 135-141. A camera is described that can take 120 pictures at rates up to 1,500 per sec. The photographs are taken on standard 35 mm film carried on a rotating drum, and the illumination is provided by a series of sparks in air. The sparks are obtained by the discharge of 0.1 μF condensers at a potential difference of about 20,000 V. The pictures provide their own accurate time base. Photographs, diagrams and details of the apparatus are given. They include (a) a loom weft-stop motion, (b) a shuttle being accelerated in a loom, and (c) a pirn being unwound in a shuttle.

**Small Colour Differences: Discrimination.** N. Macbeth. *Amer. Dyes. Rept.*, 1944, 33, 287-292. The importance of the use of a constant and standard illuminant in the discrimination of small colour differences is pointed out and reference is made to specifications for illumination in colour matching adopted by the American Association of Textile Chemists and Colorists. Large textile groups are not entirely satisfied that the 7500° K specification recommended for artificial day-lighting is high enough in colour temperature. An attempt is therefore being made to assemble data on what mill colour matchers have and what they prefer in natural and artificial day-lighting. A report is given of a discussion of various papers on small colour differences.
Macromolecular Substances: Microscopic and Electron-microscopic Investigations. (Frl.) M. Staudinger. *Chem. Ztg.*, 1943, 67, 316-320 (through Brit. Chem. Physiol. Abstr., 1944, A I, 146). The study of synthetic polymers of known structure, e.g. polyoxymethylene and polyethylene oxides, as a preliminary to investigation of natural polymers, e.g. cellulose, is discussed. With linear macromolecular substances the capacity for fibre formation runs parallel with the chain length. Photomicrographs are shown (in the original) of polyoxymethylene crystals degraded by acids and alkalis. Cellulose fibrils are more stable towards chemical degradation, but its effect becomes apparent after swelling or mechanical treatment. Bacterially degraded fibres are attacked only locally, and the average degree of polymerisation is not much reduced. The possible arrangements of macromolecules in the cell-wall are considered. C.

Starches: X-Ray Diffraction Spectra and Swelling. R. Sutra. *Bull. soc. chim.*, 1942, 9, 795-797, 797-801 (through Chem. Abstr., 1944, 38, 3546e). The diffraction spectra for copper Kα radiation of many starches are classifiable into the wheat type and the potato type. To the first type belong the spectra of those starches formed in the above-ground portions of plants; subterranean starches give the second type. The spectra differ in the relative intensities of certain lines. The swelling of starch takes place in two distinct stages (1) simple swelling with no change in properties, (2) gelation in which the colloidal properties change. During the second stage a spectrum of wheat starch type changes to that of the potato type.


Cotton Seed: Respiration; Effect of Humidity. C. M. Franco. *Bragantia*, 1943, 3, 137-149 (through Exp. Sta. Rec., 1944, 91, 139). Respiration of cotton seed was appreciable in atmospheres with R.H. above 80 per cent. When stored at 0-90 per cent. R.H. the moisture content of the seed ranged from 11% to 20.97 per cent.


Normal and Jaundiced Silkworm Blood: Behaviour in the Ultracentrifuge. M. A. Lauffer. *Soc. Exp. Biol. and Med. Proc.*, 1943, 52, 330-332 (through Exp. Sta. Rec., 1944, 90, 668). When the bloods of normal and jaundiced silkworms and a highly infectious purified material isolated by Glaser and Stanley from the blood of diseased worms were studied in the ultracentrifuge, no difference was observed between those of the healthy and the diseased insects. Both contained a homogeneous compound with a corrected sedimentation constant of 16 or 17S and a very inhomogeneous, more slowly sedimentating component. The only component present in an optically detectable amount in the highly infectious purified material was found to have a corrected sedimentation constant of about 17S.

Silkworm Jaundice Virus and Inclusion Bodies: Biochemistry. R. W. Glaser and W. M. Stanley. *J. Exp. Med.*, 1943, 77, 451-466; *Rochefeller Inst. Med. Res. Studies*, 1943, 124, 471-486 (through Exp. Sta. Rec., 1944, 90, 668). Silkworm jaundice virus was found stable only at pH 5 to about 9. The fact that polyhedral bodies retained virus activity after exposure to pH 2 is regarded as due to the protection of virus occluded within these bodies. Further evidence on this point was furnished by experiments on the activity of polyhedra when treated with antiformin-formalin and with 1 per cent. sodium dodecyl sulphate. Free virus was inactivated by 36 per cent. urea or guanidine and 1 per cent. sodium dodecyl sulphate. A purified preparation
consisting essentially of a nucleoprotein component with sedimentation constant of 17S, particle diameter of 10nm, and molecular weight of about 300,000 was obtained from the polyhedral-free blood of jaundiced worms. However a component with sedimentation constant of 16S was demonstrated in the blood of normal worms. This component, the material from diseased blood, and the polyhedral bodies were found to contain serologically related material. Absorption of material from diseased blood with antiserum induced by a preparation from normal blood yielded a substance with a sedimentation constant of 17S, which reacted strongly only with antiserum to material from diseased blood. This, and especially the fact that inoculation of normal blood did not induce jaundice, demonstrates that a difference must exist between the purified materials from diseased and normal worms. Chemical analysis of the purified virus material and of the polyhedral bodies also showed certain differences, although both probably represent nucleoproteins. Electron microscopy signified further differences.

Starch Cleavage Products: Analytical Separation. A. Tiselius and L. Hahn. Kolloid Z., 1943, 105, 177-182 (through Chem. Abstr., 1944, 38, 3921*). Adsorption methods are applied to the separation of the cleavage products obtained by the fermentation of the starches. Mono- to tetra-saccharides can be adsorbed on charcoal and removed selectively with the aid of ephedrine. Losses during the processes are prevented by treating the charcoal 2-10 times with the dilute displacement solution of ephedrine before attempting to adsorb the desired compounds. In this way, the differences in adsorption tendencies of the various products become more pronounced and their separation from mixtures is facilitated. The dextrins from wheat and potato starches were analysed by the adsorption method. Tri- to hexa-saccharides were detected and separated from one another.

Cellulose: Action of Sulphuric Acid on. G. Champaetier and Jeanne Bonnet. Bull. soc. chim., 1943, 10, 585-586 (through Chem. Abstr., 1944, 38, 4127*). Depending upon the concentration of sulphuric acid, its interaction with cellulose may give rise to either addition or substitution products. When the concentration is below 770 g./l., simple addition takes place and the amount of acid taken up by the cellulose increases with rising acid concentration. On washing with water, the original cellulose is regenerated. Sulphuric acid esters are formed when the concentration is in the range 770-930 g./l., the degree of esterification increasing with rising acid concentration. At a concentration of 900 g./l., a cellulose sulphonate corresponding approximately to C₆H₈O₃SO₂H is formed.

Lacquers of Low-viscosity Nitrocellulose: Property. W. Koch. Ind. Eng. Chem., 1944, 36, 756-758. Lacquers were prepared with low-viscosity nitrocelluloses (below RS₁-second type), having viscosities of 10, 27, 33 and 40 centipoises, and four commercial non-oxidising alkyl resins, together with plasticizers and pigments, and were applied by spraying to steel panels. Sward rocker hardness tests were made on the panels, and temperature-change resistance was measured after six months of weathering in Florida. Observations were also made of chalking, dirt collection, rusting, cracking, etc., on outdoor exposure for three months at Miami followed by three years at Wilmington. Results are tabulated and discussed. They show that satisfactory lacquers of the automobile finishing type can be made by combining nitrocelluloses having viscosities as low as 27 centipoises with non-oxidising alkyl resins. Nitrocelluloses of still lower viscosities can be used with resin of the drying-oil type.

Binary and Commercial Soap Systems: Crystallisation. R. H. Ferguson and H. Nordieck. Ind. Eng. Chem., 1944, 36, 748-752. A study of the long spacings of X-ray diffraction patterns shows that fractional crystallisation into the single-constituent soaps does not occur when either anhydrous binary soap systems or the more complicated commercial soap systems crystallise. Fractional crystallisation into different solid solution phases can occur in certain restricted composition ranges, as in binary systems, but only one solid solution phase has been found in typical unbuilt commercial soap systems. In the typical anhydrous binary system sodium myristate-sodium palmitate, where the components are even-numbered adjacent homologues, a continuous series of solid solutions occurs, with nearly linear variation of the long spacing with composition. Where the components differ by four CH₂ groups, as in the system sodium laurate-sodium...
palmitate, the behaviour is more complex. A laurate-rich solid solution separates at the laurate end and a palmitate rich solid solution separates at the palmitate end of the system. In a system in which the components are even further separated by six CH₂ groups, as in the system sodium laurate-sodium stearate, a still more involved behaviour is found. Here three different solid solutions are able to exist. The short-spacings of the X-ray patterns of the binary mixtures are essentially independent of composition and are useful in detecting changes in crystal modification over wide ranges of fatty composition.

Collagen: Large Fibre-axis Period. R. S. Bear. *J. Amer. Chem. Soc.*, 1944, 66, 1297-1305. The results are presented of a survey of the small-angle diffractions obtained from a variety of collagenous tissues of a number of vertebrate animals. A characteristic large fibre-axis period is possessed by all of these materials, similarities extending from the magnitude of the macro-period to the relative intensities of the diffraction orders exhibited. The collagen large period is 640 A. long, as measured from photographs of normal dry material. Variations from 680 to 615 A. are introduced by appropriate treatment involving wetting at the upper limit and treatments resembling tanning at the lower. Relative diffraction order intensities differ remarkably between moistened and dried samples, the wet preparations showing a striking alternation of intensities, with odd orders predominant. The order intensities suggest that normally the electron density distribution along a collagen fibril consists of a primary, slowly changing, nearly cosinusoidal variation in density, having a period of 640-680 A. Superimposed thereon are secondary fluctuations, prominent among these being sub-periods which are 70 to 110 A. in extension along the fibril. For dry samples the orders extend out to angles corresponding to about the thirtieth order, indicating a considerable regularity in the structure. Physical and chemical manipulations which destroy this regularity abolish the possibility of observing the small-angle diffractions by means of X-rays. The maximum spacing alteration which has been observed with X-ray techniques (reduction of the period to 550 A.) was secured with a formalin-treated preparation which had been nearly reversibly shortened and re-extended by a heating and cooling cycle. Throughout all manipulations that have been tried there is no apparent relation between variations in the large period and the diffractions observed at wider angles. This is interpreted to mean that the wide-angle (short) spacings are related to but a portion or portions of the entire matter constituting the macroperiod. Correlation is excellent between the X-ray information and electron microscope results regarding the large period of collagen.


Metal Resinates: Preparation and Properties. J. N. Borglin, P. R. Mosher and H. A. Elliott. *Ind. Eng. Chem.*, 1944, 36, 752-756. Homogeneous metal resinates, prepared by the fusion of refined wood rosin disproportionated wood rosin, commercial hydrogenated rosin, and commercial polymerised rosin with metal diacetates, were found to have the following maximum metal contents: 6 per cent. Ca, 19 per cent. Co., 8-9 per cent. Cu, 29-40 per cent. Pb, 6-8 per cent. Mn, or 18-23 per cent. Zn. The pronounced "blocking" (crystallisation) tendency of Co, Mn, and Zn resinates during preparation was overcome by using temperatures as high as 285-330° C. to keep the resinate molten and by adding enough calcium acetate to supply about 0.5-2 per cent. Ca in the resinate. No blocking was encountered with the resinates of polymerised rosin. Co, Pb and Zn resinates were prepared with higher metal contents than their corresponding metal diacetates, possibly due to the formation of salts of the metal acetate-type. The homogenous resinates were amorphous resins and had higher melting points than the original rosin. Ca resinates increased in melting point 20-32° C. for each 1 per cent. Ca; Pb and Cu resinates increased only 2-4° C. for each 1 per cent. metal. Co, Pb and Mn resinates showed intermediate melting point increases with metal content. At metal contents which approached the theoretical value, based on acid number of rosin, most of the resinates were completely soluble in organic solvents. Zn resinates were soluble at metal contents of approximately twice this theoretical value.
Redwood Bark: Chemical Composition. H. F. Lewis, F. E. Brauns, M. A. Buchanan and E. F. Kurth. Ind. Eng. Chem., 1944, 36, 759-764. Redwood bark is separated commercially into two fractions, bark fibre and bark dust. The former is used for insulation and is blended with various fibres for textile and related purposes. Bark fibre is inherently a cellulose fibre. After delignification it swells with cuprammonium solution as does wood fibre. In its raw state the cellulose appears to be combined with lignin by a linkage which is resistant to splitting by caustic soda or by phenol and acid. Part of the lignin appears to be closely related structurally to sprucewood lignin. One other compound appears to be associated with the fibre in its raw state, a low methoxyl phenolic acid; a second may be present, which resembles lignin but contains a definite percentage of carboxyl groups. The first of these is readily soluble in alkalii; the second is somewhat more difficultly soluble. Small amounts of catechol-type tannins and phlobaphenes and a carbohydrate gum are also present in the fibre. Bark dust represents a heterogeneous mixture of broken fibres and parenchyma cells, together with a large amount of the low-methoxyl phenolic acid found in the fibre. This substance probably makes up 70-80 per cent. of the bark dust. The carbohydrate gum present in the fibre is also present in the dust to the extent of 8-9 per cent. It is soluble in hot water and precipitated with alcohol, and at least half of it is peptic acid. Small amounts of catechol-type tannins and phlobaphenes are likewise present in the dust.

Wheat Proteins: Recovery with Sulphite Waste Liquor. J. S. Wallerstein, E. Farber, Gertrude D. Maengwyn-Davies and A. L. Schade. Ind. Eng. Chem., 1944, 36, 772-774. A method is described for the recovery of protein by the addition of sulphite waste liquor to hot, acidified wheat mashs. By this method 85-90 per cent. of the protein is readily recovered and filtration of the mash is improved. Studies with two different sulphite waste liquor samples indicate that the protein-precipitating action is a function of lignin (lignosulphonic acid) content. For the precipitation of soluble wheat proteins, the optimum ratio of lignin to protein is 1 to 4. Lignosulphonic acid is more than 10 times as effective as sulphisalicylic acid for the precipitation of soluble wheat protein and gives considerably higher maximum percentages of precipitated protein. The optimum range of acidity for maximum precipitation of soluble protein is pH 2 to 4. With fermentation mashs containing both soluble and insoluble protein, approximately two parts of sulphite waste liquor, calculated on the basis of its lignin content, are required to recover five parts of protein. The optimum pH range for this precipitation is 1.5 to 2.5. Preliminary tests indicate that the recovered protein is suitable for feed purposes, when properly supplemented.

Zein: Fractionation. R. A. Gortner and R. T. MacDonald. Cereal Chemistry, 1944, 21, 324-333. An account is given of a method of fractionating zein in methyl-cellosolve solution by the addition of water, and of a study of fractions obtained by this method. Precipitation studies on the various fractions indicated that two types of protein are present in zein: Type I, which is hydrophobic, is precipitated as a compact coagulum, whereas Type II, which is hydrophilic, is not precipitable by water but forms a stable suspension when thrown out of clear solution. These two types of zein protein were found to differ markedly in their total nitrogen content. Optical rotation studies pointed to the existence of at least three components. Osmotic pressure studies indicated considerable variation in the molecular weights of the zein fractions. These results, together with information obtained from peptization studies, and from the weights of individual fractions, lead to the conclusion that zein contains components which fall roughly into three groups: (1) 65 per cent. of the total protein consists of a fraction of molecular weight 45,000; (2) 25 per cent. of the total protein is a fraction of molecular weight 30,000; (3) 10 per cent. of the total protein is a fraction of molecular weight 23,350. The third protein fraction is of Type II, whereas the others are of Type I. C.

Water: Rate of Rise in Capillary Tubes. G. Pickett. J. Applied Physics, 1944, 15, 623. The author disagrees with the conclusion reached by Rense that the rise of water in capillary tubes produced turbulent flow, and shows that the experimental results can be accounted for without assuming turbulent flow if all the forces acting on the water are taken into account. He concludes that the rise of water in a capillary tube is in agreement with a theory that
takes into account surface tension, viscosity, and density of the fluid, and the corresponding capillary, viscous, gravitation, and inertia forces, and points out that turbulent flow cannot play a part because the Reynolds' number is far too low.

**Sonic and Ultrasonic Waves: Application in Colloid Chemistry.** K. Solnner. Chemical Reviews, 1944, 34, 371-391. Piezoelectric, magnetostrictive, and electromagnetic sound generators and the gas current vibration generator are briefly described. Emulsification, the formation of fogs, peptization of gels, precipitates, etc., changes in anomalous viscosity, the splitting of macromolecules, coagulation of aerosols, accumulation in liquid systems, coagulation in liquid systems with visible or microscopic particles, coagulation in colloidal solutions, and other effects of sound waves are reviewed and practical applications discussed.

**Oil: Separation from Water Surface.** G. Antonoff. J. Phys. Chem., 1944, 48, 173-174. An electrically-driven stirrer with its blades bent so as to give a gentle pull inward was inserted in water having oil spread over its surface in the form of a thin layer. At moderate stirring speed the oil collected round the axis in the form of a planetary body. With increase in speed the sphere began to flatten out and showed a tendency to form a Saturnian ring. Further increase in speed resulted in the formation of moons, and finally in the disintegration of the system. Oil collected into a planetary body could be sucked off by means of a pipette.

**Foams: Stability.** A. P. Brady and S. Ross. J. Amer. Chem. Soc., 1944, 66, 1348-1356. Methods of producing foams are briefly discussed and a static meter for the measurement of foam stability is described in which the foam is produced by bubbling gas through the liquid. The determination of \( L_t \), the average lifetime of the foam in minutes, and \( L_o \) and \( L_v \), the average lifetimes in minutes of liquid and gas in the foam, is explained. Results of measurements of foams of hydrocarbon oils and a solution of Aerosol OT in triethanolamine are presented and discussed. An analysis is made of the various factors that influence, \( L_t \), \( L_o \) and \( L_v \), and mathematical equations are deduced. It is shown that the average life of the gas in the foam, \( L_v \), is proportional to the kinematic viscosity and to the height of the foam column. The proportionality constant is independent of the temperature, the dimensions of the apparatus and the amount of liquid charged, and is the same whether the beating or bubbling method of foam production is used. The relation between dynamic and static methods of foam measurement is discussed.

**Saponins: Foaming Power.** R. G. Ruyssen and E. O. K. Verstraete. Meded. Kon. Vlaamsche Acad. Wetensch., Letteren schoone Kunsten Belgid, Klasse Wetensch., 1943, 4. No. 6, 39 pp. (through Chem. Zentr., 1943, ii, 11 and Chem. Abstr., 1944, 38, 3892). The foaming power of saponins was studied in two ways: (1) The duration of a single bubble of foam was observed as a function of concentration of saponin. (2) Nitrogen was bubbled through the solution under controlled conditions and the limiting concentration necessary to attain arbitrary relations was measured. In method (2) a stable layer of foam with completely spherical bubbles was always formed above a certain concentration. Observations were made of the effects of age, concentration, \( \rho H \), temperature, additions of glycerol, glucose, tannin and electrolytes, and of the effect of the kind of gas used to produce the foam. The saponins can be arranged according to the concentration necessary to produce in 15 min. under arbitrary conditions a stable layer of foam 45 mm. high. The order is: senegin, guaiacin, saporubrin, sapoalbin, quillosiacin, digitonin, Na sapogenate.

**Ion Exchangers: Reaction Rates.** F. C. Nachod and W. Wood. J. Amer. Chem. Soc., 1944, 66, 1380-1384. The reaction rates of various cation and anion exchangers were measured at various temperatures. The reactions were second-order, bimolecular reactions and the values could be calculated by using concentrations instead of activities. The rate of anion exchange or acid absorption is very much slower than the rate of cation exchange reactions, suggesting a different reaction mechanism for this class of exchangers. Various commercial ion exchangers display differing reaction rates under the same experimental conditions. Factors determining the reaction rate are discussed.
Plastic Suspension Consistency Measuring Apparatus. F. G. van Selms and H. R. Kruyt. Rec. Trav. Chim., 1943, 62, 398-406 (through Chem. Abstr., 1944, 38, 3890*). The disadvantages of Roder's apparatus in which a sphere attached to a thin rod is pulled through the liquid by a car which is pulled over a set of rails, are pointed out. A new apparatus consisted of a glass tube 50 cm. long and 9.6 mm. inside diameter mounted on a goniometer. The angle of tilt could be read to one minute of arc. The tube was fitted with ground glass stoppers, one of which had a capillary to aid in eliminating air bubbles. The tube was water-jacketed. An 8 mm. steel ball bearing was introduced with the liquid to be tested and the velocity of roll determined with the tube tilted at increasing angles. Too great an angle gave a slipping instead of a rolling motion with the more viscous liquids and turbulence with the less viscous ones. With lubricating oils the velocity of roll plotted against the sine of the angle of slope gave a straight line passing through the origin. Relative yield values were measured on three suspensions of rice starch in carbon tetrachloride with 8-o- and 6.3-mm. balls. Agreement was good at low yield values but marked deviations occurred at high ones. Yield values were calculated by the equation

\[ \sin \theta = \frac{w - u}{c} \]

where \( w \) is the weight and \( c \) the cross section of the ball, \( u \) the upwards pressure due to the liquid and \( \theta \) the angle of slope of the tube. The motion of the sphere is so complex that only relative viscosities and yield values can be calculated at present.

Plasticized Cellulose Derivatives: Relaxation Theory of Viscosity. (1) R. E. Powell and H. Eyring. Nature, 1944, 154, 427-428. (1) The place-exchange theory of plastic flow is reconciled with deviations at high stresses, as reported by Eley and Pepper, by postulating that flow (or place exchange) involves the rupture of at least two types of bond. Type 1 consists of strong bonds so that they flow according to a non-Newtonian law (at moderate stresses, the exponential law) and Type 2 are weak and flow is proportional to stress (i.e., Newtonian). An equation is derived that accounts for both types of bond yielding at the same rate, and this is fitted to published data on a lime-base grease and shown to reflect accurately the rate of shear at both small and large stresses. (2) Eley and Pepper reply that they do not reject a two-bond mechanism for plasticized cellulose derivatives, but prefer to test all possible one-bond mechanisms.

Starch and Quartz Suspensions: Plasticity. H. R. Kruyt and F. G. van Selms. Rec. Trav. Chim., 1943, 62, 407-414 (through Chem. Abstr., 1944, 38, 3890*). Rice starch suspended in a mixture of 45 c.c. carbon tetrachloride to 6 c.c. paraffin oil showed plasticity only if water was present. The starch was vacuum-dried over calcium chloride, and suspensions of 15 g. in 50 c.c. of liquid mixture were prepared with a water content ranging up to 14 per cent. on the dry weight of starch. Water content plotted as abscissae against yield values as ordinates gave a line which rapidly curved upward. Suspensions containing 10 and 15 g. of dry quartz in 120 c.c. of a 100 to 300 c.c. mixture of tetrabromo and tetrachloro-ethane were tested. Yield values increased rapidly up to 3 per cent. water content, remained constant to about 12 per cent. and then dropped slowly. Repeat experiments using quartz fractionated into sizes ranging from 1 to 5 and 10 to 15 were made. Results were similar except that no decrease in yield values occurred after the maximum was reached. Yield values vary with concentration and are inversely proportional to particle size. Dipole moment and other electric phenomena play no part here. Starch and quartz cohere only when flowing together, hence boundary and surface tensions are the dominant factors. The appearance of "wet" and "dry" suspensions was quite different; "wet" ones tended to clump together whereas "dry" ones were fairly evenly distributed.

Water: Viscosity. J. R. Coe, Jr., and T. B. Godfrey. J. Applied Physics, 1944, 15, 625-626. The following values have been obtained: Absolute viscosity of water at 20° C., 1.002 centipoise. Viscosity of water at 25°, 30° and 40° C., relative to its viscosity at 20° C., 0.8885, 0.7960 and 0.6518, respectively. These values are compared with the figures given by other workers. Notes are given on the method and apparatus used.
Hydroxy Azo Dyes: Absorption Spectra and Structure. Pauline Ramart-Lucas. *C. r. Acad. Sci.*, 1942, 215, 468-470 (through *Chem. Abstr.*, 1944, 38, 3907). Numerous investigations over a period of nearly a half century have failed to establish clearly the structure of azo dyes and their acyl derivatives. It has been a matter of controversy whether an o-hydroxyazo compound has the structure of azophenol or that of the isomeric compound, quinone hydrazone. A study of the absorption spectra of the acyl derivatives has been undertaken because it is expected that the absorption spectrum shown by an aromatic radical attached to an azo group should resemble that of an azo hydrocarbon, quite different from that of the isomer, quinone acylhydrazone. This has been demonstrated. Absorption curves of representative compounds are shown. In every instance the spectrum of the acyl derivatives closely resembles that of azobenzene.

Color Harmony: Colorimetric Specification. W. C. Granville and E. Jacobson. *J. Optical Soc. America*, 1944, 34, 382-395. Basic colorimetric specifications in terms of the 1931 I.C.I. standard observer and Illuminant C have been computed from spectral apparent reflectance curves for the 680 chips in the handbooks of the Colour Harmony Manual. Tables and diagrams are given. Comparisons are made with other productions of the abridged Ostwald system and with theoretical data, and it is concluded that the chips in the Colour Harmony Manual represent the closest approach to date to the ideal abridged Ostwald system.

Ostwald Colour System: Analysis. C. E. Foss, D. Nickerson and W. C. Granville. *J. Optical Soc. America*, 1944, 34, 361-381. The authors explain some of the Ostwald concepts, show how the ideal Ostwald colour solid may be developed in terms of modern colorimetry, and indicate how material representations of the system relate to the ideal.


Fibre Molecules: Migration Double Refraction in an Electric Field. W. and H. Kuhn. *Helv. Chim. Acta*, 1944, 27, 493-499 (through *Brit. Chem. Physiol. Abstr.*, 1944, A I, 166). Methylcellulose degraded to an about 60-fold polymer and oxidised by iodine to methylcellulosemonocarboxylic acid shows strong double refraction when its aqueous solutions are placed in electric fields of 450-1200 v. per cm. The double refraction constant is $1.1 \times 10^{-9}$, in qualitative accord with the value deduced from consideration of the orientation of the molecules in the electric field.

Keratin Film: Permeability to Water Vapour. G. King. *Nature*, 1944, 154, 575. The suggestion due to Barrer ("*Diffusion in and through solids,*" 1941), that the diffusion of vapours through media in which sorption and swelling are dependent on the vapour concentration in the specimen, is verified by measurements on a film of horn that was set up to separate an evacuated space (B) from one containing water vapour (A). Diffusion was slow until the film reached a water content of about 6 per cent. throughout and then a rapid increase in transport occurred in spite of the decreasing pressure difference across the membrane. When equilibrium was reached, the vapour in (A) was removed. Diffusion from (B) to (A) began briskly but soon the surface of the membrane on the (A) face dried down to less than 6 per cent. moisture and diffusion then became very sluggish.

Montmorillonite Clays: X-ray Identification. D. M. C. MacEwan. *Nature*, 1944, 154, 577-578. Minerals of the montmorillonite type in clays (e.g. fuller's earth and bentonite) can be readily detected by the fact that when dried with glycerol they give a very sharp and intense first-order basal reflexion at about 17.7\AA. It is possible to detect 1 per cent. of montmorillonite in kaolin by this means.
Rubber: Infra-red Absorption; Effect of Stretching. D. Williams and B. Dale. *J. Applied Physics*, 1944, 15, 585-591. The transmission spectrum of natural rubber has been studied in the region between 1μ and 15μ and the effects of linear and radial extension have been observed. Linear extension greater than 400 per cent. of the original length produces an increase in the C–C vibrational frequency. Both linear and radial extension produce an increase in absorption coefficient and a decrease in reflection coefficient. The changes in absorption and reflection coefficients are greatest at short wave lengths.

Cellulose Esters: Acyl Content Determination by Saponification in Solution. C. J. Malm, L. B. Genung, R. F. Williams, Jr., and Mary A. Pile. *Ind. Eng. Chem., Anal. Edn.*, 1944, 16, 501-504. A method for the determination of the total acyl content of cellulose esters involves additions of alkali and water to a solution of the ester under conditions such that the ester remains in solution until saponification is almost complete. The regenerated or only slightly esterified cellulose finally precipitates in a soft finely divided form which does not interfere with completion of the reaction or the back-titration. This method has been applied to soluble cellulose acetates (containing 15-44 per cent. acetyl), cellulose acetate-propionates and acetate-butyrates, and cellulose propionates and butyrates up to and including tributyrates. These cellulose esters have been divided into four groups based on composition and solubility, and variations made in the procedure to meet the requirements of each. The effects of time, temperature and alkalinity have been studied and optimum conditions established. The limits of uncertainty (maximum range within which nearly all carefully determined values should fall) are ±0.1 to ±0.2 per cent. acetyl, depending on the type of ester being analysed. A measure of the accuracy of the method was obtained by analysing samples of cellulose mixed esters for free hydroxyl and for acetyl or apparent acetyl (saponification value calculated as acetyl) and complete acyl. The observed acetyl or apparent acetyl values were compared by difference from observed free hydroxyl contents and molar ratios of the acyl groups on the assumption of three hydroxyls per glucose unit of cellulose. The agreement was well within experimental error.

Formaldehyde: Polarographic Determination. G. C. Whitnack and R. W. Mosher. *Ind. Eng. Chem., Anal. Edn.*, 1944, 16, 496-498. Formaldehyde can be rapidly determined in the presence of acrolein and acetaldehyde by the polarographic method with an accuracy of ±2 per cent. The propionaldehyde wave does not overlap that of formaldehyde, but its presence tends to cause low results unless determinations are made immediately after addition of the sample to the base solution. The most satisfactory results are obtained in 0.1N. lithium hydroxide containing 0.01N. lithium chloride, at constant temperature and constant pH, without removal of dissolved oxygen. The determination is limited by the ratio of the quantities present in the aliquot taken for analysis. With 6 mg. of formaldehyde, no more than 0.75 mg. of acrolein may be present. However, with 1.2 mg. of formaldehyde, 2.2 mg. of acrolein do not interfere. Acetaldehyde may be present up to 2.74 mg. Some typical results are given.

Glucose and Maltose: Micro-determination in Mixtures. D. L. Morris. *J. Biol. Chem.*, 1944, 154, 561-567. Glucose and maltose have different relative reducing powers when determined with different reagents. If the total reduction of a mixture of the two is determined with an alkaline copper and an alkaline ferricyanide reagent, it is possible to calculate the concentration of each in the mixture by the solution of a pair of simultaneous equations. Results obtained in this way are satisfactory, though errors may be as large as 0.03 mg. on a mixture containing about 0.4 mg. of each sugar. The causes of error are discussed. Some typical results are given. A modification of Somogyi's 'high alkalinity' copper reagent is described, which gives linear proportionality between glucose taken and thiosulphate used over the range 0 to 1 mg.

Linseed Oil: Analysis by Various Collaborators. R. F. Bowles and H. W. Keenan. *J. Oil & Colour Chemists' Assoc.*, 1944, 27, 119-121. Fifty-five sample bottles containing approximately 15 g. of polymerised linseed oil,
drawn from a master sample, were distributed to members of the Oil & Colour Chemists' Association for determination of acid value and saponification number by members' own methods. Results are tabulated, with notes on the methods used. The unexpectedly wide spread of results, especially for acid value, demonstrates the need for co-operative practical work. Members' desire for such work and willingness to co-operative are briefly discussed. C.

**Pectin: Zeisel Methoxyl Values; Errors Due to Retained Alcohol.** E. F. Jansen, S. W. Waisbrot and E. Rietz. *Ind. Eng. Chem., Anal. Edn.*, 1944, 16, 523-524. Retained ethanol causes the methoxyl content of pectins, as measured by the Zeisel method, to be as much as 20 per cent. higher than saponification values. The ethanol cannot be removed by the usual drying techniques but can be removed by humidification followed by drying. Acetone rather than ethanol precipitation results in good agreement between the two methods of analysis. Retained isopropyl alcohol can be removed by drying at 100°C. C.

**Chlorine: Solubility in Water.** R. P. Whitney and J. E. Vivian. *Ind. Eng. Chem.*, 1941, 33, 741-744. The solubility of chlorine in water was determined experimentally by passing various chlorine-nitrogen gas mixtures through an equilibrium cell contained in a thermostat. Measurements were made at 10°, 15°, 20° and 25°C, using partial pressures of chlorine from 0.06 to 1.0 atm. Details of the apparatus and method are given. The results agree well with other published values. Hydrolysis constants were calculated from the solubility data, assuming Henry's law to apply to the unhydrolysed chlorine in solution. The hydrolysis constants have one half to three quarters the values reported by Yakovkin. An equation for extrapolating the solubility to partial pressures of chlorine in excess of 1 atm. is presented. C.

**Disaccharides and Dextrins: Oxidation by Lead Acetate and Periodic Acid.** K. Ahlborg. *Svensk. Kem. Tid.*, 1942, 54, 205-217 (through *Chem. Zentr.*, 1943, 1, 279-280 and *Chem. Abstr.*, 1944, 38, 4254). On oxidation with lead acetate, the oxidation curves of disaccharides containing 1:4-bonds and the corresponding disaccharides containing 1:6-bonds show fundamental differences, and serve to distinguish in a qualitative way the type of bond. Oxidation with periodic acid is suitable for both the qualitative and quantitative determination of 1:4- and 1:6-bonds. Under the conditions specified, disaccharides with 1:4-bonds and two carbon atoms with free primary OH groups yield two molecules of formaldehyde, whereas disaccharides with 1:6-bonds and only one free primary OH group yield no formaldehyde. In the oxidation of sugars containing 1:4-bonds by periodic acid, free iodine is liberated stoichiometrically, and this serves as a method for the quantitative determination of disaccharides with 1:4-bonds, even in the presence of other types of sugars, such as glucose, fructose, etc. With dextrins containing only 1:4-bonds (lichenin dextrin) the liberation of one atom of iodine per molecule is as much greater than that from maltose as the number of bonds in dextrin exceeds the number in maltose. By means of periodic acid it is possible to distinguish disaccharides containing 1:4-bonds from those with 1:6-bonds. Furthermore, from the consumption of oxygen it is possible to calculate whether a disaccharide or a dextrin containing a known number of glucose residues contains only 1:4-bonds, or whether, and in what position, 1:6-bonds also are present. The probable oxidation mechanisms are discussed. C.

**Nitrocellulose: Gelatinisation by Methyl and Ethyl Nitrites.** Jeanne Coutelle and E. Calvet. *C. r. Acad. Sci.*, 1942, 215, 138-139 (through *Chem. Abstr.*, 1944, 38, 4437). A study has been undertaken to determine the difference between the effect of an agent of similar constitution (nitrate on nitrocellulose) and of a complementary agent (basic oxygen of acetone on acid glucosidic oxygen). Plots of the heat liberated as a function of the number (n) of molecules of methyl nitrate per chain member of the high polymers are presented. The dinitro compound is very much changed, when n is less than 6, becoming elastic and translucent in contradistinction to the behaviour of the trinitro compound. The heat liberated is 34.9 kg.-cal. per gm. of fixed agent in the beginning of the fixation of methyl nitrate by trinitrocellulose, 81 for dinitrocellulose, and 110 for non-nitratuated cotton. This indicates a decrease of the
magnitude of the thermal effect with increasing nitration. The speed of fixation increases with the degree of nitration. The thermal effect of ethyl nitrate is identical with that of methyl nitrate. These results differ from those previously obtained with acetone.

**Gelatin: Preparation; Preliminary Soaking.** W. M. Ames. *J. Soc. Chem. Ind.*, 1944, 63, 234-241. An account is given of investigations of possible methods of shortening the soaking period in the alkaline method of preparing gelatin. Experiments were made with various precursors. The data show that caustic soda is a much less efficient soaking agent than lime. The use of 0.5 per cent. soda ash solution, in conjunction with lime, at suitable temperatures shortens the time of soak. The lime soak may be shortened by raising the temperature up to 22° C. Use of caustic soda at such temperatures is not to be recommended on account of the danger of destruction of the precursor and of dullness in the gelatin. At low temperatures, caustic soda may usefully be used. Higher temperatures (e.g. 30° and 40°) are unsatisfactory. Preheating of the precursor should be avoided. The presence of neutral salts in the soaking bath leads to unsatisfactory results. Under certain conditions digestion with trypsin enables good gelatin to be prepared from a lightly limed precursor. The importance of the pH of extraction is briefly discussed and it is pointed out that collagen at its isoelectric point is less easily hydrolysed than in any other condition. Gelatin may be extracted at any pH sufficiently far removed from the isoelectric point, but not sufficiently acid or alkaline to cause rapid hydrolysis of the gelatin produced.

**Wool, Silk Fibroin, Collagen and Gelatin: Methylation and Acetylation.** S. Blackburn and H. Phillips. *Biochem. J.*, 1944, 38, 171-178. When collagen and gelatin are methylated with methyl sulphate, peptide methylation as well as esterification of free carboxyl groups takes place. During peptide methylation, sulphuric acid becomes covalently linked to proteins. When exposed to methyl iodide or methyl bromide, the free carboxyl groups are esterified, but peptide methylation only occurs slowly if at all. Neither the peptide methylation nor the esterification of the free carboxyl groups of wool is prevented by treating it before methylation with dilute alkali, nitric acid or formaldehyde. Removal of amide groups by acid hydrolysis leads to increased esterification. When wool is acetylated with acetic anhydride, the subsequent methylation of free carboxyl groups by either methyl sulphate or methyl halides is restricted. Treatment of wool and silk fibroin with acetic anhydride in methanol leads to N- and O-acetylation, simultaneously with the methylation of free carboxyl groups.

**Linseed Oil: Drying; Influence of Metallic Salts.** H. W. Rudd. *J. Oil & Colour Chemists' Assoc.*, 1944, 27, 111-118. The author describes the influence of sodium phosphate, sulphate, silicate and borate and potassium chromate on the drying of aqueous emulsions of linseed oil, stabilised with gelatin and ammonium oleate and containing as driers cobalt, manganese and lead linoleates. The results show that the general effect of metallic salts on the drying of linseed oil is a prolonging of the induction period and a decrease in the rate of oxygen absorption. In some cases the effect is equivalent to the removal of drier from the oil which dries as though no metal were present. In most cases the net weight increase is less than with an oil which has not been treated with a salt. The effect is not due to a permanent irreversible poisoning of the metal drier, and oil recovered from an emulsion dries normally. Sodium sulphate and sodium phosphate have no effect on linseed oil in the absence of drier, the oil then drying normally. Chromates and other oxidising agents accelerate drying. It is pointed out that inhibition or retardation of drying only occurs when the molecules of oil-glyceride, metal drier and salt are in a state of intimate contact of the kind provided in the emulsion state and that the phenomenon depends on surface action. Observations of the effects of the salts on the metal soaps in thin films are discussed and it is suggested that complex formation between metal soap and salt explains the formation of stable interfacial films between, for example, manganese linoleate and sodium phosphate, and that such complexes are sufficiently stable to prevent the manganese soap from catalysing the oxidation of linseed oil.
Melamine-Formaldehyde Film-forming Compositions: Properties. T. S. Hodgins, A. G. Hovey, S. Hewett, W. R. Barrett and C. J. Meeske. \textit{Ind. Eng. Chem.}, 1941, 33, 769-779. Structural formulae are suggested for the deamination products of melamine. Resinification of methylolmelamines is postulated as proceeding through either the methylene or the ether linkage. The properties of hydrocarbon-soluble melamine-aldehyde-alcohol resins are discussed and it is pointed out that the wide range of properties can be explained by etherification as the mechanism whereby the final resins are formed from the methylolmelamines. Heat stability of melamine resins, as compared with urea resins, may be due to the absence of carbonyl groups. Acidity of the resulting etherified melamine resin is a major factor in low-temperature conversion and as proceeding through either the methylene or the ether linkage. The properties of hydrocarbon-soluble melamine-aldehyde-alcohol resins are discussed and compared with those of urea-alkyd compositions. C.

High Polymer Films and Precipitates: Spontaneous Movements. F. H. Muller. \textit{Kolloid Z.}, 1943, 103, 144-145 (through Mark & Proskauer's \textit{Resins, Rubbers, Plastics Abstr.}, 1944, 162). When a drop of a dilute solution of polystyrene in amyl acetate is spread on water, the film obtained shows whirling movements. In the case of very thin films, a sudden contraction is observed, after which the film remains still. With more concentrated solutions and thicker layers, the curling proceeds at a much slower rate, and no contraction occurs; the surface of the resulting film is corrugated and ruffled. It is assumed that the 3-dimensionally arranged polystyrene chains are compressed rather suddenly to a planar arrangement. This rearrangement is due to the diffusion of amyl acetate into the water. Since the osmotic forces act preponderantly on the water interface, a one-sided strengthening occurs. When the resulting strain exceeds the yield value, the whirling movement and finally the contraction relieve the strain. On glass the strain cannot be relieved and is frozen in so that movements are not observed on glass surfaces. On heating above the softening temperature, films with frozen in strains exhibit shrinking. Similarly, rubber or polyisobutylene films on glass or metal curl up as soon as they are lifted from their bases. When dilute solutions of nitro- or benzylcellulose in acetone are poured into a mixture of water and acetone, the cellulose derivatives are precipitated as fine flakes. Up to about 1 hour after precipitation, characteristic whirling movements are observed, which are probably due to sudden and somewhat discontinuous shrinkage processes. The osmotic effect of the water produces anisotropic arrangements of the chains. Rearrangements or crystallisation processes produce a stirring-up effect which promotes the shrinkage of neighbour elements, thus causing the propagation of the visible movement. The effects may be considered as visible manifestation of a micro-Brownian movement of chain molecules. C.

High-polymer Solutions: Osmometry. R. H. Wagner. \textit{Ind. Eng. Chem., Anal. Edn.}, 1944, 16, 520-523. A glass osmometer of simple design is described which is especially useful for osmotic pressure measurements of high-polymer solutions that tend to form a stable foam. A diagram and details of the assembly and operation of the instrument are given. Results of measurements on solutions of gelatin and various cellulose and polyvinyl derivatives are presented and the reproducibility of the results is discussed. C.

Methylcellulose: Water-holding Effect in Soils. I. M. Felber and V. R. Gardner. \textit{Michigan Sta. Tech. Bul.} 189, 1944, 30 pp. (through Exp. Sta. Rec., 1944, 91, 16). The authors report on a laboratory and greenhouse investigation of the effect of methylcellulose on evaporation losses from the soil, its effect on transpiration losses from the plant, and the effect on rate of growth and water requirement. Methylcellulose added to the soil surface or mixed with the soil influenced significantly the rate of evaporation, transpiration, water requirement, and wilting without any harmful effects being noted. The effects remained unaltered for more than 3 months. Methylcellulose restricts the water loss from soils so appreciably that soil moisture is still available to plants when it would be exhausted in untreated soils under the same atmospheric
conditions. In soils rich in organic matter, the treatment may cause a slight retardation of growth when the moisture content is high, but in sandy soils growth is accelerated and remarkably benefited under drying conditions. Methylcellulose in culture solution effected a reduction of the water requirement of bean and corn plants amounting to about 30 per cent. during one month of growth.

**Functional Viscosity Scales.** E. P. Irany. *Rheol. Bull.*, 1943, 14, 23-26 (through Mark & Proskauer’s *Resins, Rubbers, Plastics Abstr.*, 1944, 163). The two postulates on which a rigorous solution of the viscosity problem must be based are: (1) Proof that a unique and general viscosity law exists which is not subject to individual factors. (2) The determination of viscosity functions relative to volume (ideal mixtures), temperature, and pressure which are additive throughout the whole range of liquid viscosities. For the viscosity-temperature function, a diagram is assumed in which the viscosity function appears linear against proportionate units of temperature. The measured viscosities provide fixed points of a scale which is completed by interpolation. This scale represents graphically the temperature function. It is shown that, with only a few obvious exceptions, all liquids yield the identical scale or plot as straight lines in that scale. The same method applied to the viscosity-volume function yields a generally valid viscosity scale, and application to the viscosity-pressure function gives a third scale. With regard to the viscosity of liquid mixtures and solutions, it is very important that composition be expressed in terms of component volumes. The results prove the existence of a unique and general viscosity law which, in its graphical form, can be stated independent of material factors (Postulate 1). The examination of a great number of experimental data appears to indicate that Postulate 2 is also satisfied. It is claimed that the three functional scales are the best possible approximation to the unique viscosity functions.

**Trichromatic Photopometer: Application.** R. Jonnard. *Instruments*, 1944, 17, 474 and 506. A brief discussion of some important features and uses of the large trichromatic Photopometer of Jonnard and Escher-Desrivières. This instrument is primarily intended as a colour mixer. The simpler three-colour mixer of Grether is almost identical in principle.

**Cellulose Film: Optical Anisotropy.** R. C. Gray. *J. Soc. Chem. Ind.*, 1944, 63, 241-245. The birefringence of cellulose film is influenced by the pressure in the viscose at the moment of extrusion, by the rate of coagulation and by the machine direction forces and the transverse frictional forces exerted on the film during the casting process; the relative retardation is unaffected by change of water content, but since increase of water content causes increase of thickness, it causes a corresponding reduction in birefringence. The birefringence has a minimum value $B_0$ at the middle of the web, and rises towards the selvedges in accordance with the law

$$B = B_0 + bx^4,$$

where $x$ is the distance from the middle of the web, and $b$ is a positive constant that depends on the transverse forces acting on the film during contraction. The dispersion of the birefringence follows the law

$$B = a - b/x^2 + c/x^4,$$

where $a$, $b$, $c$ are positive constants; $B$ has a minimum value in the extreme red. For the same grade of film, the tensile strength in the machine direction, or in the transverse direction, is greater when the birefringence is greater. Stress in the machine direction can increase the permanent birefringence by 50 per cent. Stress in the transverse direction can reduce the permanent birefringence to zero, and can reverse its sign; the final birefringence may be numerically as great as the initial birefringence. All commercial dyed cellulose films are dichroic, the effect being most pronounced in the chocolates and mauves.

**Water Drops: Light Transmission.** R. Ruedy. *Canadian J. Res.*, 1944, 22 A, 53-66. The size of the drops formed when water vapour condenses is related to the work performed against the surface tension. For the determination of the size by optical methods, Mie's solution of the electromagnetic equations for the propagation of light of wave length $\lambda$ in a medium containing small spherical drops of radius $a$ indicates that as the ratio $a=2na/\lambda$ increases from 0 to 20, the intensity of the light received in the prolongation of the incident beam passes alternately through maximum and minimum values. At distances from the drops greatly exceeding $\lambda$, the first maximum lies close to
\( a = 2\pi \), the second is near \( a = 8.6 \), and the subsequent peaks are less distinct and tend to repeat themselves at \( a = (m + 3/4)\pi \). As a result of these fluctuations the light seen through a cloud of particles with diameters greater than about 1\( \mu \) is coloured. The theory accounts for the cycles in the changes of colour observed when the diameter increases, and enables a determination of the radius of growing drops. With increasing radius, the influence of the index of refraction \( m \) decreases; for \( m = \infty \) the positions and values of the peaks differ only slightly from those obtained with water.

**Electronic Temperature Measuring Instruments.** C. O. Fairchild. *Instruments*, 1944, 17, 468-472, 496. Industrial instruments for measuring and controlling temperature which employ electronic methods and devices are discussed, and details are given of circuits combining a vacuum phototube and its accompanying amplifier tube for detecting (for example) the light reflected from a mirror-galvanometer and thereby operating a relay or motor, instruments using a galvanometer, instruments using a synchronous vibrator, an electronically-balanced a-c. bridge used with a resistance thermometer, and equipment for high-speed radiation pyrometry.

**Adsorption of Water Vapour by Proteins.** H. B. Bull. *J. Amer. Chem. Soc.*, 1944, 66, 1499-1507. The results are given of investigations on the weight of water vapour adsorbed by a series of purified proteins studied as a function of the aqueous vapour pressure at 25° and at 40° C., and also of the free energy changes and the heat changes. The theory of multilayer adsorption as proposed by Brunauer, Emmett and Teller (J. Amer. Chem. Soc., 1938, 60, 309) satisfactorily describes water adsorption by proteins. The present results are consistent with the view that protein molecules in the solid state are linked together to form coherent planes whose exposed surfaces are hydrophilic, water being adsorbed between these planes.

**Chemical Studies on Powdered Keratins.** B. Edwards and J. I. Routh. *J. Biol. Chem.*, 1944, 154, 593-596. Keratins of human hair, turkey, duck and chicken feathers, and porcupine quill were ground in a steel ball mill. The cystine content decreased markedly, but the nitrogen and sulphur contents were not appreciably affected. Aqueous extracts contained increasing amounts of nitrogen, cystine, inorganic sulphates, and partially-oxidised sulphur compounds. With the exception of human hair, a larger fraction of the original keratin was soluble in water than from wool. Mechanical degradation of these keratins was apparently accompanied by oxidation, as evidenced by the decrease in cystine sulphur and the presence of one-fourth to one-half of the water-soluble sulphur in the form of inorganic sulphates.

**Carboxyethyl Starch Ethers Soluble in Water: Production.** Röhm & Haas Co. (Philadelphia). B.P.546,585 of 7/1/1943:4/10/1944 (Conv. 2/1/1942). A water-soluble β-carboxyethyl ether of starch is prepared by mixing starch, an aqueous solution of 1 per cent. to 10 per cent. of water-soluble, strongly basic hydroxide, and acrylonitrile, and maintaining the mixture between 0° and 60° C. until the product is soluble in water. The starch may be of root or grain origin and may be in a raw, gelatinized or solubilized state. Products obtained in this way are useful as sizing agents for textiles and paper, protective colloids, and spreading and depositing agents in insecticidal and fungicidal sprays.

**Pyrrrolidinium Hydroxide Cellulose Solution.** Otto Hecht and E. Gassemeier (Germany; vested in U.S. Alien Property Custodian). U.S.P.2,339,012. The claim is for a solution of cellulose in a 1 to 4N solution of pyrrrolidinium hydroxide in water, alcohol or aqueous alcohol.

**American, Cotton: Promoting Consumption.** *Cotton (M/cr.),* 1944, 50, No. 2341, p. 5. It is reported that the consumption of cotton in the United States, which averaged 64 million bales in 1935-39, has reached 11 million bales in the past two crop years. A domestic consumption of 10 million bales could be maintained if the normal consumption could be raised from 25 lb. to 37 lb. per head per annum and reference is made to research designed to this end at the Southern Research Laboratory, U.S. Department of Agriculture.
Cotton Textile Mission to the United States: Recommendations. (1) *Textile Manufacturer*, 1944, 70, 472-475; (2) *Textile Weekly*, 1944, 34, 686-688; (3) *Ibid.*, 811-814. (1) and (2) The salient features of the official report of the Cotton Textile Mission (1944) are summarised. Reasons for the generally higher "Production per Man-Hour" in the United States are enumerated and immediate and long-term suggestions are given for increasing the productivity in Lancashire mills. (3) Various press comments on the Report are summarised. C.

British Cotton and Rayon Export Trade: Prospects. W. H. Slater. *Textile Weekly*, 1944, 34, 642-6, 691-4. The post-war outlook for the Lancashire export trade is discussed with the help of the Cotton Board estimates of home and export market requirements, costs of production, and plant and labour needs. C.

Indian "Cotton Textiles Fund Ordinance," 1944. *Indian Textile J.*, 1944, 54, 425. The text is given of an Ordinance set up "to establish a fund for supervising the exports of cotton cloth and yarn, and for the development of technical education, research and other matters" in relation the cotton textiles industry of India. It is proposed to levy a duty of 3 per cent. of the price, ex-factory, on cloth and yarn manufactured in India and exported. C.

America and the Wool Problem. G. Blau. *Wool Rec.*, 1944, 66, 654-655, 669. American questions discussed in connection with future problems of world wool disposal are the Wool Products Labelling Act, position as regards stockpiles, increased costs of producing the domestic clip, financing of promotion and publicity, and prospects of future consumption. W.

The Wool Trade: Importance and Future. I. C. Ross. *New Zealand Farmer Weekly*, 1944, 65, No. 13, 7. Address given at Canterbury Agricultural College, Lincoln, N.Z., to students and farmers. Emphasis is laid on the great necessity of the wool industry both to Australia and New Zealand and on the necessity of taking active measures to meet the competition from synthetic fibres of all kinds. W.

Wool in the Post-war World. J. F. Wilson. *Natn. Wool Grower*, 1944, 34, No. 8, 27-28, 34-37. Types of fibre competitive with wool are briefly described. Any attempt to protect the American wool market by legislation aimed at other domestic products (casein, soybeans and wood pulp) would be unsuccessful. Very little has been spent on advertising wool, although it lends itself to truthful advertising. The findings of science should be utilised, especially shrinkproofing and mothproofing processes. Funds for advertising and research could be raised in America by a self-imposed tax of $ of 1 per cent., collected from the industry as a whole. W.

11—INDUSTRIAL WELFARE, INDUSTRIAL PSYCHOLOGY, AND EDUCATION

Caustic Soda: Handling. *Chem. & Eng. News*, 1944, 22, 1164-1166. A general account is given of safety devices and precautions necessary for the unloading of caustic soda solutions from tank cars, suitable storage tanks, pipes and pumps for caustic soda solutions, methods of removing solid and flake caustic soda from drums and dissolving for use, and protective clothing and first-aid kit. C.

Cotton Operatives: Training. *Textile Manufacturer*, 1944, 70, 378-381, 391. Particulars are given, with illustrations of wall charts, etc., of schemes for the training of young persons at (1) Messrs. John Duckworth & Son Ltd., Roe Lee Mills, Blackburn (weaving), (2) Thomas Moss & Sons Ltd., Lostock Hall, Preston (weaving), and (3) Abraham Stott & Sons Ltd., Osborne Mills, Busk, Oldham (spinning). C.

Dichloromethane: Toxicity. L. A. Heppel, P. A. Neal, T. L. Perrin, M. L. Orr and V. T. Porterfield. *J. Ind. Hyg. & Toxicol.*, 1944, 26, No. 1, 8-16 (through *Bull. Hygiene*, 1944, 19, 629). Experiments on animals are described that suggest that the toxicity of dichloromethane (=methylene chloride) is relatively low. When used as a solvent for cellulose esters, fats, oils, resins and rubber the maximum allowable concentration in the atmosphere, for 8 hours daily exposure, might be permitted to reach 500 parts per million. C.
Hospital Bedclothes: Treatment to Reduce Dust-borne Infection. (1) M. Van den Ende and others; Lancet, 1941, June and December, pp 716-8, 751-2, 755-9; Brit. Med. J., 1941, June 28, 953-8. (2) Joyce Wright, R. Cruickshank and W. Gunn; Brit. Med. J., 1944, May 6, 611-4. (3) F. C. Harwood, J. Powney and C. W. Edwards; Brit. Med. J., 1944, May 6, 615-6 (through Bull. Hygiene, 1944, 19, 572-575). These reports call attention to the risk of spreading infection in hospital wards by the dust created in bed making and describe promising experiments to reduce the risk by oiling, not only the floor, but the bedclothes as well. Contribution No. 3 describes the process devised by the British Launderers’ Research Association. Technical white oil emulsions are applied in the laundry (every four weeks), under laboratory control to ensure that the clothes do not become over-oiled. A cationic agent is used in the emulsion for wool and an anionic agent for cotton goods or common wool/cotton mixtures, to ensure complete deposition of the oil on the fibre.

Human Body: Reactions to Atmospheric Conditions. D. Brunt. Endeavour, 1944, 3, 87-97. Reactions of the human body to atmospheric conditions are discussed and the heat economy of the body indoors is studied. Curves are given showing the variation of metabolic rate, storage rate, joint loss by radiation and convection, wetted area of skin, conductance, and mean temperature of skin with operative temperature. Out-of-door conditions and the effects of air humidity, wind-speed, clothing and physical effort are also discussed. The limits of evaporative regulation are considered and curves are given showing the limits of tolerable conditions for various degrees of activity and the effect of ventilation on heat-stroke conditions. Conditions for comfort, health and efficiency are outlined and a tentative classification of climates is made. The characteristics of an ideal climate are indicated and the possible influence of climate on the development of early civilisations is noted.

Rubber Solutions: Toxic Effects. J. L. Hamilton-Paterson and Ethel Browning. Brit. Med. J., 1944, 349-352 (through Bull. Hygiene, 1944, 19, 450). Clinical and haematological examinations were made of 200 women using rubber solutions containing aromatic hydrocarbons in the proportion of 5-20 per cent., of which some proportion was benzene. The results of blood examinations were compared statistically with those of 200 women not exposed to rubber solutions, and the effects of rest periods on the blood picture were observed in 18 women. The most striking change in the blood counts of the exposed women was a fall in the total white cell count, and especially in the polymorphonuclear leucocytes; this neutropenia is regarded as the primary and essential change before there is definite evidence of benzene poisoning. The changes in the red cells and haemoglobin did not suggest that anaemia was an early feature. No consistent relationship was found between the incidence of neutropenia and symptoms suggestive of benzene poisoning. Rest periods up to three months were followed by a rise in total white and polymorphonuclear counts, while in three women re-exposure was followed by a further fall. Urinary sulphates were estimated in 17 women with neutropenia; the partition of organic and inorganic sulphates was in all cases within normal limits. Regular blood counts and rest periods may provide a method of controlling benzene absorption and preventing the onset of chronic poisoning.

Woollen Military Clothing Dermatitis: Occurrence and Treatment. Brit. J. Dermat. & Syph., 1944, 56, No. 2, 33-43 (through Bull. Hygiene, 1944, 19, 441). Out of 670 admissions to the skin wards of a large military hospital, 110 concerned dermatoses proved, by patch tests and the observed effect of resuming khaki clothing, to be wholly or partly due to intolerance by the skin of contact with woollen textiles. The cases can be roughly divided into classes showing the dominance of pruritus alone, erythema, erythematous dermatitis, eczematoid dermatitis, circumscribed or diffuse lichenification, facial eczema, prurigo simplex and prurigo simulating scabies. Sensitization may occur spontaneously or as the result of friction by garments in association with sweating, but most often the onset is determined by an antecedent dermatitis. Scabies is the most common of such factors, but arsenical dermatitis, therapeutic accidents and infective skin conditions have also been detected. The subsequent reaction to woollen materials tends to simulate the original skin condition. Treatment consists primarily in removal of the irritant. The
patient sleeps between sheets, has a cotton or linen shirt, and wears cotton pyjamas by day under his hospital blues. Simples remedies, such as calamine liniment or lotion, are as effective as elaborate ones. Cases of long standing, with strong positive patch-tests, especially those who give positive reactions to several kinds of woollen material and to other substances, must be regarded as incurable. Mild cases of the pseudoscarious prurigo type recover slowly when protected by cotton and excused heavy physical exertion, even if they leave hospital with the eruption still active. Moderately severe cases do not lose their symptoms or rash completely, but if protected by cotton they may be returned to duty without necessarily becoming worse. Unfortunately, as a general rule, they relapse and have to be invalided. C.
Telling the World about Wool

The world needs wool. The British Empire will have wool in plenty to keep pace with every demand and a vast propaganda drive is now educating world opinion as to the infinite possibilities of British and Empire wool in the post-war years for all branches of industry. This campaign will assist all makers and distributors of wool products, who it is hoped will use this publicity to their own advantage and so further the cause of wool everywhere.

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