



Proceedings

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PROCEEDINGS

INSTITUTE'S ANNUAL AUTUMN CONFERENCE.

PROCEEDINGS AT MANCHESTER AND BLACKBURN.

The Annual Autumn Conference of the Textile Institute was held on Thursday and Friday, 12th and 13th October, at Manchester and Blackburn respectively.

The proceedings on the first day opened with attendance, by special invitation, at the Exhibition of Textile Machinery and Accessories, at the City Hall, Manchester. There was an excellent gathering of Institute members from various districts, and the exhibits were viewed with considerable interest. The exhibition visualised recent progress in mill equipment in an effective manner, and, whilst the space available could not admit of anything like a complete range of exhibits of textile machinery in general, yet particular features contributed effectively towards providing a substantial indication of modern trend and practice in regard to plant and machinery equipment. A noteworthy feature was the obvious excellence of quality associated with the productions of the engineers and machinists. The wide range of exhibits with reference to driving problems formed a forceful reminder of the prevailing activities to secure advances in this important direction. The strides being accomplished in regard to the equipment of the knitted goods factory were well reflected in the exhibits in this connection. Humidifying and atmosphere-purification apparatus were much in evidence. The exhibits, as a whole, clearly demonstrated that the march of progress in regard to mechanical means of production continues to be pursued with unremitting zeal.

Luncheon was served within the exhibition hall, and the President of the Institute (Mr. John Emsley, J.P.) voiced the thanks of the members of the Institute to the promoters for their invitation.

In the afternoon, at the Institute premises, a meeting of the Council of the Institute took place, at which the principal item was the confirmation of the minutes of Committee in reference to the proposal to seek to obtain a Royal Charter for the Institute—a movement which is receiving the very heartiest support of the President, and one which, as Mr. Wm. Frost pointed out, could not be contemplated in the absence of the President's generous attitude in the matter. Another item of interest before the Council was that of the election of about fifty new members of the Institute—a result largely achieved by a personal appeal on the part of the President to existing members.

THE USES AND ADVANTAGES OF ELECTRIC POWER IN THE FACTORY.

Paper by J. F. CROWLEY, D.Sc., B.A., M.I.E.E.

In the course of this paper, the lecturer said he proposed to endeavour to present an idea of the great textile industry in India, of what electricity had done for it, and of what electricity might do for industry at home if the opportunity were afforded. It was as well to remember that the whole of the jute crop was grown within the Empire, and over two-thirds of it converted to manufactured goods within it. The splendid factories which the Scottish pioneers had planted

on the banks of the Hoogly provided over 270,000 persons with employment, and represented 800,000 spindles and 40,000 looms. The buildings themselves were such as even Lancashire might be proud of, while the driving arrangements in many cases were in advance of Lancashire or Dundee. Electricity was in general use, and the power was from central stations which were in some cases put up by associated groups of manufacturers. The individual electric drive attested the progressive character of the textile manufacturers in Calcutta, and also in Bombay, and while their enterprise and energy were to be admired their competition could not be ignored. Manufacturers in India were undoubtedly preparing to invade territory which Lancashire and Dundee had hitherto regarded as peculiarly their own. Jute fabrics previously not made outside Dundee would shortly be produced in increasing quantity by India's manufacturers, and where they considered Indian conditions unfavourable they were arranging to manufacture with Indian capital and under Indian control outside India. Therefore, it behoved the home manufacturer to do everything possible to improve the manufacturing processes, particularly from the point of view of increased productivity. More and still more productivity must be the slogan in home industrial circles. He did not mean merely increased production, but increased output from each existing factory, and to this end both finance and labour must be increasingly devoted. Speaking in London recently, Sir John Snell, the eminent engineer and chairman of the Electricity Commissioners, stated that our nation, left poor in the material sense after the Napoleonic wars, would not have made the recovery it did but for the invention of James Watt. The nation at the time did not recognise the fact. We needed recovery to-day, and Sir John Snell gave it as his opinion that electrical development was going to be an important factor in effecting the recovery. As in previous cases, the country did not recognise this as it might do. When he (Dr. Crowley) was invited to speak, that day on the subject of Electricity, it was suggested to him that textile manufacturers were tired of hearing about electric power. But he ventured to say that they could not hear too much about electricity properly applied. Electricity could improve productivity by (a) ensuring reliable running, (b) maintaining average speeds within defined limits, (c) keeping cyclic irregularity in speed within defined limits, (d) securing prompt starting and stopping of individual machines, and (e) providing for a flexible drive for machines which have inherent variations in torque. It was to be remembered that increased productivity could be secured by improved driving without any cost due to increase of building spaces, or productive machinery, or rent, rates, and taxes. The effect on profits, therefore, was consequently striking. Herein lay a solution, if not indeed the only solution, of the problem facing manufacturers to-day. Productivity was important at home because even in the best of Indian factories that particular factor was not good.

DISCUSSION.

Col. F. R. McCONNEL (Manchester) said that while most of them were anxious to keep pace with development yet cost had to be taken into serious account.

Mr. FRANK ARROWSMITH assured the lecturer that manufacturers in Lancashire were not asleep to possibilities, but the cost of current was involved. So far as getting even a 50 per cent. increase on profits by means of a comparatively small increase of percentage of production was concerned, he feared that even 50 per cent. would not amount to much in these days.

Dr. CROWLEY said he had never claimed saving in power. Any saving in that direction was not worth talking about, and even a 50 per cent. saving in the power bill was nothing compared with 1 per cent. of increased output. He left the question of saving of power to people who preferred to split hairs. There was only one claim for electricity—increase in the productivity of the machines. What was the cost of power in relation to actual turnover? If it were 5 per cent. he should be amazed. There had been far too frequent a tendency to consider the whole question as one of Steam *versus* Electricity, which formed a wrong basis for consideration and discussion.

Mr. G. B. WILLIAMSON (Preston) said that it was difficult to get true comparisons between factories owing to particular conditions. There was no impartial authority which could be appealed to, and he thought the whole subject was one for a special committee. He supposed that the extra cost of the individual electric drive would be in the neighbourhood of £25 per loom, and there was a natural hesitancy unless production were guaranteed. Instances were known where results had been disappointing. On the other hand, too often the conditions before the change to electric driving were not comparable. He was convinced that the time would come when more consideration would have to be given to these matters apart from consideration of £. s. d. and production figures. Hygienic and æsthetic considerations would assert themselves, and concentration of power in one big station would help in that direction.

Mr. F. ANDERSON (Portadown) testified to an experience of individual electric drive on a certain class of fabric yielding a result even beyond expectation.

Mr. OSCAR S. HALL (Bury) moved a vote of thanks to the lecturer, and suggested that at some future date even power might be imported. Individual electric drive was certainly best for complex looms.

Mr. J. G. CRAWFORD (Belfast) seconded, and said he thought most of those present would leave that room with better ideas of the whole matter. He agreed with Dr. Crowley as to the importance of knowing what the performances of power units were at various places.

The PRESIDENT OF THE INSTITUTE, in declaring the meeting closed, agreed that the lesson involved was that closer inspection of plants was necessary.

CONFERENCE AT BLACKBURN.

The Conference proceedings were continued at Blackburn on Friday, the 13th October, when the members attended at the Municipal Technical College. The President (Mr. John Emsley) again occupied the chair.

At the outset, Mr. F. J. Harlow, the Principal of the College, extended a hearty welcome to fellow-members of the Institute. In many respects, the Institute and the College had interests in common, both being concerned with the advancement of the great textile industry and interested in bringing men engaged practically in the industry into touch with those more particularly interested in the technical side and in scientific pursuits. They were proud of the textile department of their college and those members who took opportunity to inspect the department that day would, he hoped, be convinced that the pride was justified.

The President of the Institute acknowledged the expression of welcome and, in calling upon Mr. C. F. Cross to contribute the Mather Lecture of the Institute, said that this annual lecture represented one item in a scheme of development which the Institute had taken in hand. The next effort was to be in the direction of securing a Royal Charter for the Institute—a matter which should be of particular interest to the younger students. The aim was to raise the level of the profession of textile technology to that associated with the technology of many other industries. He noticed that at Blackburn they had a most active Textile Society. These societies exerted a great influence in the right direction and he hoped that ultimately they would all be definitely linked up with the Institute in some way or other.

THE TEXTILE INSTITUTE ANNUAL MATHER LECTURE.

THE DEVELOPMENT AND FUTURE OF THE PRODUCTION OF ARTIFICIAL FILAMENTS FOR THE TEXTILE INDUSTRY.

By C. F. CROSS, F.R.S.

Before accepting the invitation of the Institute to discourse on "Artificial Silk," I hesitated under the consciousness of superficial knowledge and experience of the primary textile industries. As a "Mather" lecture, however, a treatment of the subject is suggested independent of any qualifications of textile specialist, which I

formally disclaim. I was associated with William Mather in a campaign of technical progress in the methods of bleaching cotton and flax textiles in the period of 1885–1890, which ante-dated the discovery of viscose (1892); and the systematic work which led up to this was incidental to the general investigation of the relationship of cotton cellulose to alkalis, which underlies the chemical-mechanical processes of bleaching and finishing.

The "Mather" kier and process arose out of a demonstration to William Mather of the effect of steaming cotton goods saturated with a 2% NaOH lye—devised as an improved preparation of cloth to be bleached on the continuous system which he had designed to carry out the Thompson chemicking process (*J. Soc. Chem. Ind.*, 1884: E. Patent 595/83.)

As a personal reminiscence and tribute to William Mather's technical perceptiveness—in fact, genius—it may be recorded that the design of the kier to carry out the systematised process followed within a day or two, and the records of Mather and Platt would no doubt confirm my estimate of the design as originally perfect.

These records, if and when brought to light would give technologists an interesting example of evolution of a process in technical and economic detail through the stages of Market and Printers' Bleach (cotton piece goods), Bump Yarn and Paper-makers' rag bleach, Flax damask, and, lastly, the fine linen Bleach. While this development involved no novel principle or process in regard to the chemistry of cellulose purification, it administered a critical "shake up" to important sections of the cellulose industry. It synchronises with another development involving the relationship of cellulose to alkalis, the re-investigation of John Mercer's neglected and then almost forgotten transformation of cotton goods under the action of the alkaline hydrates. The story of "Mercerisation" deserves a brief mention in this connection, not only for its intrinsic interest and many paradoxical features, but by reason of its influence on the development of artificial silk. It would be obvious to any student reading the life of John Mercer, in the interesting setting which we owe to E. A. Parnell, that his investigations, while exhaustive, or the level of the science and technology of his day, were eloquent of unexhausted possibility. In the one direction, these were realised by the pioneers of the modern methods of mercerization; but, on the side of pure chemistry, there were indications of a general reactivity of Mercer's "Alkali Cellulose," and it was through a study of its interaction with benzoyl chloride, that it became obvious that the Alkali Cellulose would react with carbon bisulphide; and so much so that the first preparation of the Cellulose-Sodium Xanthogenate (April, 1892) was made under the quantitative conditions of the present-day industrial Viscose process.

On a retrospect, it appears that this discovery was implicitly patent to many earlier investigators: thus, in the *Ber.*, 1875, 8, 802 and 955, Zoeller & Grete deal with the special application of alcoholic xanthates in vine-culture, for the destruction of the phylloxera. To overcome certain defects of the methyl and ethyl salts, they worked through a series of alcohols of higher molecular weight to find that the amyl-xanthate fulfils all the conditions of the chemical-biological-industrial specification. That these workers did not extend their generalization to the carbohydrates and cellulose as "alcohols" is, therefore rather a psychological accident. As it was, Viscose waited 20 years and a series of incidents for its debut; "Mercerization" waited 20 years for full industrial realization, but after a specific "discovery" of effects, and a categorical investigation of immediate causes. So it is in the textile world: with a necessary tide of evolution, *i.e.*, of technical progress, there are counter streams, and eddies of routine, convention, and polarised thought, which require to be broken by some incursion from without to liberate an idea for its normal movement towards realization.

The year 1892 has been mentioned as the date of appearance of the actual Viscose; but in regard to our main theme other dates are of greater moment. In my personal view of this field, the date 1833 is prominent as marking the awakening of the technical world to the possibility of an artificial silk. In the order of time, we shall no doubt possess a complete history of Hilaire de Chardonnet's invention—invention in the full and true sense of the word—the "genial" idea, the flash of

conception, the early realization in the laboratory in the concrete form of thread, to be followed by the long, drawn-out threads and complex tissue of technical-financial evolution. On a retrospect, it again appears that there intervened an incubation period of some 20 years, which, by the way, is quite a usual if not the normal average for inventions, in this field, of "great pith and moment." In view of the complexities of the cycle—Cellulose—Nitric Ester—Cellulose—and of the problems of chemical engineering involved; and, next in order, of the textile conditions to be fulfilled in regard to production and application of the thread; and, lastly, of the psychology of the world of promoters, adventurers, and an inarticulate public through whom the ultimate realization of the industry requires to be worked, the period of incubation in this memorable case is not inordinate.

On personal memory, the next prominent date is 1900, which marks a Paris Exhibition, the triumphant exposition of the "Soie Artificielle Chardonnet," in the convincing form of "*toiles de luxe*," high selling prices of the yarn, and a feverish market in the shares of the parent industrial company.

A development of this "Collodion Silk," of secondary importance, was associated with the name and work of Lehner, who elaborated a simplified method of spinning or drawing the collodion to thread. The Chardonnet process of forming the solidified thread (of cellulose nitrate) by evaporation of the volatile solvents, was replaced by the method of precipitation or coagulation by the action of water, the water of the spinning bath taking up the alcohol, and, in part, the ether of the collodion, to be afterwards recovered by distillation. Both Lehner and du Vivier appear to have exercised ingenuity in the unpromising field of compound colloids as the basis of a textile thread—mixtures of nitro-cellulose with protein-colloids, oxidised derivatives of drying-oils, and the like, to use the terminology of patent specifications.

But in the period 1890—1892, during which the Lehner process was demonstrated at Bradford, these complications had already been shed—tried and found wanting—in favour of simple and specific variants of the Chardonnet technique, which had been set forth in his communications to the "Académie des Sciences" (1884-7)—"Sur une Matière Textile Artificielle ressemblant à la Soie."

Lehner's activity in this field, and the development of an industrial production, is probably connected with the initiation of the "Glanzstoff" undertaking which developed the alternative process—the third of the major cellulose methods—based on the cuprammonium solution of cotton cellulose.

The perfected industrial and highly successful system, is a resumé of the labours of Pauly, Frémery and Urban, and Bronnert.

The evolutionary struggle between these three major systems is a matter of history; the conditions which have limited the dominance of the nitro-cellulose process to an episode—albeit of exceptional brilliance—and the cuprammonium process to a partial permanent survival, on the basis of technical superiority of certain products, are generally known in the textile world.

At the present day the dominant position has passed to the viscose process, and this opportunity offers to put on record some features of its developments which are not generally known. The following points are selected with regard to the limitations of a lecture as distinguished from a closely reasoned, scientific-technical communication.

To develop the new cellulose derivative in its many industrial applications, there was formed a proprietary syndicate—The Viscose Syndicate Limited—with a cash capital of £4,000 contributed by the late Alfred Nobel and Andrew Pears. In due course, the syndicate was approached by the late C. H. Stearn, who was well-known in connection with the highly technical industry of incandescence lamps, for a licence for spinning cellulose filament to be carbonised for use in this industry. The study of the technique of the process by Stearn and his assistant, C. Topham, resulted in the undertaking of the extension to textile filaments. To deal with this matter, there was formed the Viscose Spinning Syndicate, again with a cash capital of £4,000. This was formed jointly with the Continental Viscose Company, which had been formed for parallel developments in Continental countries. The success of the new venture, in the hands of Messrs. Stearn and Topham, is, on retrospect, quite

remarkable, and those who now work the industrial process yield generous tribute to the work of these two men. In view of the extreme complexity of the technical problems involved, firstly in the viscose preparation, secondly in the process of conversion into thread, and thirdly in the evolution of a manufacturing plant at Kew to an effective industrial unit, it is one of the most extraordinary cases in technical history. In evidence, the subjoined note which covers quite a number of fundamental technical points, has been prepared as a resumé of the experience of those who have been carrying on the work of technical control and research in the factories of the various Viscose companies. It is only necessary to add to this note that the evolution of the matter at the Kew works passed through the stage of parallel drawing to the integrated centrifuge system, and it was no doubt this very important simplification and condition of large output which gave great advantage in a competition which on the system of parallel drawing would have been more severe.

NOTE OF CRITICAL RETROSPECT: AGREED WITH TECHNICAL STAFFS
OF REPRESENTATIVE VISCOSE-SILK FACTORIES, 1922.

The experimental plant for the manufacture of viscose silk, designed and erected at Kew by Stearn and Topham, and its rapid improvement to the stage of actual production of a merchantable "silk," was a marvellous example of technical insight and grasp of principle, for it comprised the use of the pump for controlling the viscose delivery for the unit multiple thread, metallic spinning nozzles with multiple perforations of minute diameter, and the centrifuge-box for collecting and laying the thread and imparting the required twist, which are employed to this day in producing what is probably the larger portion of artificial silk. These have been modified in detail by many workers, particularly by J. Clayton, and the number of variations patented is now considerable. The principle of parallel spinning directly on bobbins and twisting afterwards, which was developed at an early date in the viscose factories of Germany and Italy, has survived, and is turning out the "silk" in large quantities, but experts cannot agree as to the relative merits of these two processes. The very desirable method of rotating the spinning jet itself, so as to twist the thread before winding it on to a bobbin, has attracted much inventive ingenuity, but the considerable difficulties which arise in practice are still to be overcome.

With regard to secondary details, an enormous number of variations have been proposed, but most of these show more ingenuity than knowledge of the practical problems of artificial-silk manufacture. On the chemical side, almost every possible and many quite impossible substances have been proposed as additions to the viscose and to the spinning bath.

Substances have been added to the viscose with the purpose of modifying the cellulose to a thread of greater softness and resistance to water, also for reducing the rate of ripening of the viscose so as to obtain a more stable product. For these and other purposes, the addition of the following have been proposed:—Sodium silicate, sodium aluminate, soap, sodium thiosulphate, glycerine, glucose, urea, salts of resinic acid, phenol-formaldehyde condensation products, albumen, turpentine, and naphthenic acids.

The chemist has a greater latitude with regard to the possible components of the spinning bath and this has resulted in the following list of substances proposed for this purpose:—Sulphuric, hydrochloric, formic, acetic, lactic, citric, tartaric, glycollic, and aromatic sulphonic acids; sulphates of ammonium, sodium, magnesium, iron and zinc; chlorides of sodium and ammonium; sodium sulphite, bisulphite, and thiosulphates; alcohols, starch, sugars, molasses, aniline, glycerine, aldehydes, ketones, and lignone-sulphonic lyes.

The principal development in this respect, which was foreshadowed by Stearn and Woodley in E.P. 2529 of 1902 for spinning a purified viscose, has been the use of acid solutions for spinning so as to get a cellulose thread directly instead of a cellulose xanthate thread which has to be subjected to further treatment to regenerate the cellulose. Since then, the value of both salts and acids has been fully appreciated, and various mixtures of these two classes of substances have held the field, the

use of organic substances such as glucose having proved valuable on account of their effect in modifying and softening the action of the acid constituent.

So far, viscose, in spite of its undoubted merits has not shown the facility possessed by cuprammonium solutions of being spun into very fine filaments, as is being done by Bemberg and Holken. One looks forward with interest to the working of recent patents of R. Bronnert in this connection, which claim to produce the thread in a range of 5—2 deniers and to extend the industry in the direction of substituting silk (*J. Soc. Dyers and Colorists*, June, 1922).

A certain amount of confusion exists in the literature on this branch of the subject, particularly in patent specifications, where it may be not altogether accidental. A typical example is in a German application of W. Vieweg, which states that, while it has been proposed to draw out in order to obtain fine filaments, the inventor spins filaments of 1—3 denier direct from jet openings of 0.09 mm. diameter, it being quite obvious that, other conditions being constant, with a given aperture the sole condition which governs the fineness of the filament is the extent to which it is possible to draw it down in diameter.

The scientific control required in this industry is necessarily very elaborate and has necessitated the working out of new and special analytical processes suited to the examination of substances about which very little has been published. The control of the composition of the wood-cellulose raw material, alkali-cellulose, cellulose-xanthate (viscose), spinning baths, etc., calls for a considerable chemical staff. The number of samples tested weekly at one of the factories, as far back as 1914, was 1,700, and the number of separate examinations made was 3,300.

The qualities of the finished product also require careful study; the regularity of its chemical composition, lustre, extensibility, tensile strength both dry and in the wet state, affinity for dye-stuffs, etc., must be carefully controlled. An interesting point is the influence of the contour of the filament on its textile qualities. This factor is largely dependent on the composition of the spinning bath, and variations in this respect show themselves in alterations of lustre and covering power. In the early days of the industry, this was considered by the textile consumers to result from variations of specific gravity.

In the control of contour, the filament is examined in cross-section and the microscope mounts are photographed for actual measurement and for permanent records. The cross-section also affords useful though not absolutely conclusive evidence as to the method of manufacture of a given sample, and in some cases even has enabled one to identify the factory in which it was made.

The contour is governed by the manner in which the original cylinder of cellulose solution contracts during the operations of coagulation and dehydration. Three broad classes of section may be distinguished:—

- (1) The whole filament contracts slowly and evenly, giving a fairly regular section.
- (2) The outline remains smooth while the walls contract inwards, giving an irregular shape with a smooth surface.
- (3) The walls become corrugated in an attempt to adjust the original circumference to a diminished sectional area.

These three classes correspond approximately to:—

- (1) Cuprammonium and early viscose silk.
- (2) Nitro and acetate silk.
- (3) Modern viscose silk.

A striking demonstration of these differentiations of form and surface is submitted in the convincing form of photo-micrographs of sections of typical specimens. The photo-micrographs also illustrate the advanced technique of the routine control of the processes involved in the production of artificial silk.

A note may be added of the actual factors of the processes or manufacturing operations requiring control:—

1—RAW MATERIAL: Cellulose of "standard" quality; composition in terms of α - and β -cellulose (resin and ash); viscosity of 7% (cellulose) solution. Condition, at moment of treatment for

2—ALKALI CELLULOSE : NaOH % of lye; temperature; ratio cellulose-NaOH-water in finished product—Apparent volume of alkali cellulose. Ageing process : Closed vessels—constant temperature—variable time.

3—VISCOSE PROCESS : Temperature and duration of reaction (CS_2) to reach optimum condition for solution of Xanthate; followed by filtration and ageing or ripening.

4—DRAWING OR SPINNING : Perforation of spinning nozzles to orifices of 0.1 mm.; composition of precipitating bath; temperature; speed of drawing adjusted to supply of viscose (control of denier of yarn).

5—WINDING OF THREAD (hydrated cellulose with sulphur by-product of reaction, and absorbed liquor from spinning bath) followed by operations of washing, de-sulphuring, bleaching, and drying.

The yarns are finally handled by experts and sorted into grades or qualities. A well-controlled manufacture will give 60% first quality "silk" and a total yield of saleable silk 75% of the cellulose (wood-cellulose of 90% α cellulose). The losses are made up of the cellulose de-graded to soluble forms, and of viscose in the stages of filtration, distribution, and in the spinning bath.

Resuming the thread of history, it must be very briefly recorded that the Spinning Syndicate early arranged for the cession of German patents and rights to Prince H. von Donnersmarck. Almost simultaneously, and following the Paris Exhibition, a financial industrial group was attracted to the French industry. The Société Française de la Viscose was formed, and for the early development a favourable location was found at Arques-la-Bataille, near Dieppe. A tribute is due to the French group and their spirit of adventure; they not only took up the spinning of "silk" but the whole of the possible applications of the new derivative, which they studied systematically and brought at least four other industrial developments to a successful realisation. Of these, we must mention the "Crin," which is a flat filament of high lustre used in millinery and other decorative arts; and next in order the film fabric known as Cellophane, which is also a development of the artificial silk process, being in essential particulars an identical treatment of cellulose. This fabric, which is drawn through a fine orifice, solidified as a hydrated cellulose, as a web of 1.5 metre breadth, is drawn forward and treated on continuous machinery to finish as a web of 1 metre width at the end of the machine. This, again, is a case of industrial realisation through phases of excessive difficulty for reasons evident to all technologists. It should thus be recognised that the Société Française has been the effective pioneer of Viscose from the industrial point of view. The English textile enterprise, now Anglo-American, in the hands of Messrs. Courtaulds and pioneered through its more difficult phases by the late Mr. H. G. Tetley and his co-director Sir Thomas Latham, presents on retrospect many arresting features of industrial pioneer work. Success is its own exponent, and the exceptional causes of the success of this enterprise are perhaps well known to the textile world.

This is a brief and, in fact, scrappy note of technical history. Our present-day workers, although no doubt more interested in the future, will be aware that the past has a determining influence which should not be neglected on any enquiry, whatever its purpose, and that in regard to the future it is necessary, for progress, to take the widest possible view of the industry, such width of view requiring a certain detachment—to be in the industry, perhaps, and yet not of it. This is the more important function of the individual, with the growing complexity of science and technology. From the foregoing Note of Critical Retrospect, which represents, in appreciative review, the results of many years of work and experience, we may conclude that in the viscose section of the industry there has been little progress affecting primary factors. Some secondary variations, studied by exact method and then controlled, have developed textile quality and value; but the literature of patented inventions bearing on the industry is evidence of competitive activity rather than of grasp of method and fundamental perspective.

This statement probably holds for the rival processes, the Nitro-Cellulose and Cuprammonium variations : the period 1900—1922 has been one of technical-industrial

and consequent commercial development of the position fundamentally established 20 years ago.

In the meantime, a new competitor has taken the field as an industrial *fait accompli*: the Cellulose Acetate thread arrives, again after an incubation period of 20—30 years. As an abstract proposition, this has been present to the scientific-technical world since the acetate was produced on the manufacturing scale in the period 1890-92 (Cross & Bevan—C. O. Weber).

In the later development of the product and its applications, a number of distinguished workers and corporations have taken part, e.g., Lederer—Donnersmarck, Knoevenagel—Knoll, Eichengrün—Bayer—and, latterly C. & H. Drefus—British Cellulose Company. This last named undertaking, as representing the *fait accompli* referred to, claims the serious critical notice of the technical world, as it has secured the interested attention of the general public and considerable support from the investing public.

We are, therefore, at this date, interested spectators of a highly complex, evolutionary struggle, involving many dramatic elements. It is all the more important to use the present opportunity to insist on the fundamental factors of science and their determining influence on the struggle, and to remind the individual that, in forming his critical estimate of the industrial future, he should be able to apply the criteria of science with the detachment of the student.

As an illustration and vindication of "detachment," I would like to point out to this audience that Stearn and Topham accomplished a revolution in the textile industry in two years' work, starting from the zero of experience, or inexperience, and perhaps the popular level of knowledge of the arts of spinning and weaving upon which "cotton" and "linen" are interchangeable terms! Such knowledge, or ignorance, would be regarded in Lancashire as pitiable, and the epithet need not be qualified, save by reminding ourselves of our own sectional ignorance and of what is in fact a universal experience—the greater the light, the deeper the shadows. In the special instance, to put the matter more logically, the positive working basis of invention was (1) The command of experimental method, (2) the fore-reaching grasp, which is faith, (3) the moral discipline which rejects the imperfect and ineffective, *sans phrase*, as steps to the final realisation and takes the pleasure of the craftsman in handing it over as good value to the ultimate purchaser. Ignorance of a particular industry, in this and other cases, is overborne in objective effort based on the very essence of science—*ab uno disce omnes*—with its message of consolation to the worker conscious of his many-sided ignorance.

This is only a parenthesis, by way of introduction to a general case or problem which may be formulated in the terms:—What is the maximum technical effect to be realised with a given weight of cellulose? In the endeavour to solve this major or general problem, the student will find that most of the problems in this field are implicitly involved. He may be a shareholder in Courtaulds, or the British Cellulose Company; he may be a spinner, dyer and finisher, textile manufacturer, or merchant; he may be eager for knowledge or a curious enquirer. In the prospective enquiry, which is disinterested and unprejudiced, he must subordinate any personal interest to its objective, which, in the main, is one of science. This is another aspect of the discipline of detachment.

After some consideration, I find that the following typical industries may be compared in regard to the solution of the problem:—

- (1) Cotton Spinning—The production of 100's combed weft yarn.
- (2) Paper-making—The production of a tissue paper of 15 grms. per square metre.
- (3) Artificial Silk—of 9×7 deniers, i.e., 60—70 den.

The next section of the Lecture, devoted to the elucidation of the comparison, in terms of the following data, may be put on record in the shortest possible terms.

COTTON YARN MANUFACTURES—GENERAL DATA—SPINNING OF 100's COMBED WEFT.

Taking four more or less typical cottons to give the figures in the accompanying table, the cottons are:—

(1) **SUPER SEA ISLAND**, a high grade pedigree cotton isolated by Harland. Although the values it gives are comparable with the best commercial St. Vincent, which is the finest cotton found on the market, it is definitely superior to the commercial supply and is undoubtedly the prize cotton of the world.

(2) **EGYPTIAN**: This is a typical high grade Sakel.

(3) **AMERICAN**: This is the average of a number of good quality, medium staple, Upland cottons.

(4) **ROUGH PERUVIAN**: A typical commercial sample.

	TABLE.				
	I.	II.	III.	IV.	
	Super Sea Island.	Egyptian.	American.	Rough Peruvian.	Average.
Commonest Length (in inches)	2	1½	1	1½	—
Approx. staple length (in inches)	2½	1½	Bare ¾	1½	—
¹ "Ribbon width" (mms. × 10 ⁻⁴)	154	194	202	215	191
* Weight per cm. of hair (mgs. × 10 ⁻³)	97	136	171	255	165
Hair break (grms.)	3.92	4.70	5.04	7.00	5.16
Tenacity; Beaking strain: Length. Average 3.1 grms. per M. denier, or 31,000 M. Br.					

¹ Note that "Ribbon width" is *not the diameter*, but is the major axis of the ellipsoid in cross section: the minor axis runs round about half of this.

* Hair weight per cm. is taken in the middle of the hair, and is subjected to a dubious correction for the whole length of the hair.

(The above data are from the Research Records of the Fine Cotton Spinners and D.A., Ltd., and were prepared by Dr. W. Lawrence Balls).

Some calculations from data of dimensions, etc., for wt./length. Single hair: average den. 2 Tenacity 2.0—3.5 grms. per den. (similar to boiled-off silk).

Taking the filament of cotton as a cylinder (mean diam. as indicated).

0.2 mgr. — 1 metre length = 0.315 mm.³

Taking cotton substance at 1.53 sp. gr.

Vol. of 0.2 mgr. 0.130 40%

Air space 0.185 60%

Total 0.315

For the Yarn:—

100's—diameter of thread (approx.) 0.1 mm.

Vol. per 10 metres 78.6 mm.³

Weight per 10 metres 60.0 mgr.

The Vol. of Yarn Cylinder represents approximately:—

50% Cotton substance; 50% Air space.

Apparent surface of Yarn Cylinder: Approximately 550 cm.²

The figures for commercial production (1922) on the basis of 15 tons per week, are:—

100's COMBED DOUBLING WEFT: A weight of 33,600 lbs. per week would require 186,000 spindles, which at £4 a spindle for cost and working capital would equal £744,000 total cost.

The charges to be considered weekly in producing this weight would be:—

Cotton £3,800; Wages £1,290; Coal and Power £215/250; Interest on Capital (say 10%) £1,490.

Approx. cost 4/- lb.

60's COMBED DOUBLING WEFT: A weight of 33,600 lbs. per week would require 93,000 spindles, at a cost including capital of say £384,000. The weekly charges would be:—

Cotton £3,100; Wages £730; Coal £110/130; *10% of Capital £760.

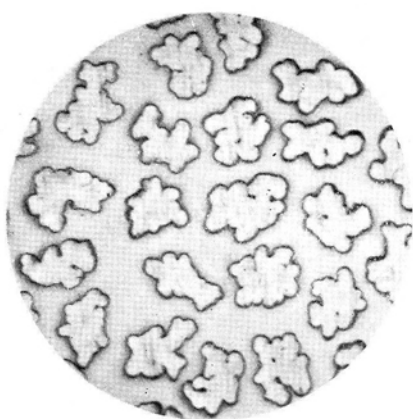
The hours run each week would be 48.

Approx. cost 2s. 9½d. per lb.

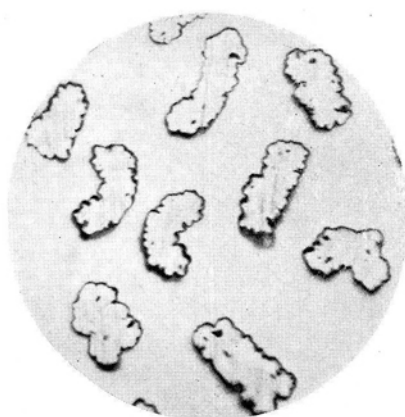
(These figures are from the statistical records of the Fine Cotton Spinners & D. A. Ltd.—II. Stowell.)

PAPER, of substance 15 grms. per square metre, represents 666 cm² of paper surface per 1 gm. (of cotton cellulose) and obviously twice this of apparent web surface.

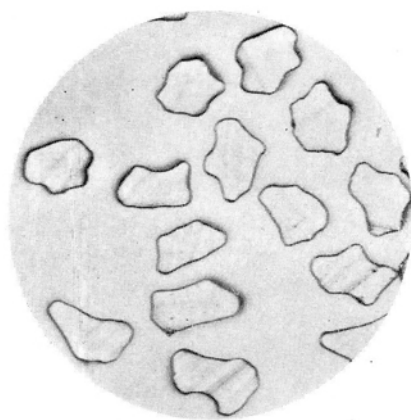
A "cigarette tissue" of this substance has an apparent gravity of 0.6 and, allowing for the vol./wt. of the mineral matter, the paper represents a web or tissue



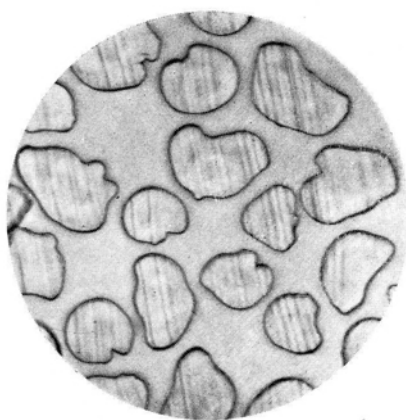
Modern Viscose Silk I.



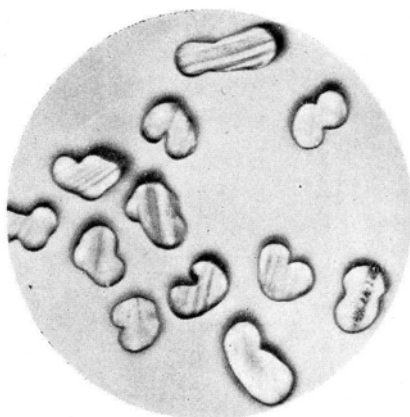
Modern Viscose Silk II.



Viscose Silk, 1905.



Cuprammonium Silk.



Nitro-cellulose Silk.



Cellulose Acetate Silk.

of approximately 50% fibre substance (cellulose), 50% air space. This paper converted into a paper yarn by slitting, rolling to a cylinder, and twisting, would represent a yarn of 150 den. (metrical) per 1 mm. of width or original web.

TISSUE PAPER MANUFACTURE: Fifteen tons per week of "substance" 15 grms. per square metre from cotton rag cellulose.

The cost for full Mill equipment works out to, say	£80,000
To this would require to be added, say	£15,000

For working capital, approximating three months' output, making a total capital of, say	£95,000
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With the raw materials (including chemicals for treatment) for one ton of finished paper costing	£53 17 6
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Power costing	£5 0 0
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Labour costing, say, per ton	£12 8 0
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The total cost of raw material, power and labour, would be	£71 5 6
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In addition to this, depreciation on the plant, exclusive of buildings at 7½% per annum = £4,750, which works out to, per ton	£6 6 8
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Felts, oil, etc., per ton, say	£1 0 0
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Approximately	£78 12 2
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Add 10% interest on the capital invested, viz., £95,000, we get £9,500 which works out to, per ton	£12 13 4
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	£91 5 6
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Which works out to 9½d. per lb.—a low figure for this quality of paper, for which the raw material costs £50 10s. 0d. per ton of finished paper, using new, unbleached cotton rags.

(The above figures are the approximate estimates of Messrs. Bertram's, Ltd., Edinburgh, a leading firm of paper makers' engineers and specialists.)

VISCOSE ARTIFICIAL SILK AND FILAMENTS: Viscose, drawn from an orifice of 0·1 mm. and solidified, represents a volume (viscose) of 7·85 mm³ per metre of length: and at 7–8% cellulose content, this conditions the average unit "fil" of 6–7 metric deniers, i.e., without reduction of volume by drawing out or drawing down.

For a technical-scientific study of this problem refer to the recent publication of Dr. R. Bonnert, *Jk. Soc. Dyers and Colourists*, June, 1922.

The Viscose unit filament (cellulose) of approximately cylindrical form (as at date 1905) has a surface (length or lateral surface) of 930–950 cm² per 1 grm. of substance. Technical progress in changing the form of the filament (as demonstrated by photo-micrographs of sections) has increased this surface by 40–80%, with proportionate appreciation of textile quality (covering power, adhesion of filaments in warp yarns of high twist).

With this feature of progress, there is another of equal importance—the increase of specific tenacity (breaking weight) both dry and wet, from the 1·2–0·5 grms. of 1905 to 1·6–0·75 grms. per denier of the present-day product.

FACTORY PRODUCTION: It would be interesting to complete the comparison of the three industrial treatments of Cellulose by statistics of the Artificial Silks parallel with those of Cotton Spinning and Paper Manufacture. The latter, as long established industries, are on the basis of open competitive costs and values. The Artificial Silk and Filaments are in a different position, not only in regard to the general conditions of economic production, but specially in regard to the particular changes of values fundamental to the industry, i.e., of raw materials (including chemicals), labour, and power. Lastly, the capital charges involved are not comparable with those of long-established industries, and the costs of technical control and research are on a different scale.

The comparison can only be completed, and that approximately, by those who have the very special knowledge for laying out a factory construction, and capital scheme, embodying the results of the experience, positive and negative, of the 20 years of technical progress of the several systems and an estimate of the past and future of their competitive evolutionary struggle.

To return to the question of a critical estimate of the future of the industry in artificial filaments. In the developments of the last thirty years, the matter has passed out of the region of "pure" science: the world has adopted the products, and the present consumption is in excess of 100 tons a day. As to competition with and displacements of silk, this is less marked than creation of textile novelties, applications of the products *sui generis*, based on qualities and prices and the conventional estimates of value.

As a psychological point, the fateful term "Artificial Silk" from which there appears to be no escape—though a bar sinister, and a prejudice, has hardly been operative. It probably influences the superior shop assistant in advising customers that an article which tempts them is "only wood"; and it is evident in inter-feminine conversations on wearing and other qualities of textiles.

To put the matter briefly: *La sole est parvenue, enfin arrivée, malgré soi!*

It is the depressing function of exact science to recognise certain fundamental facts which at first sight appear to confirm the prejudiced estimate of value. The three cellulose silks represent de-graded celluloses.

One hesitates to use the proper terms in these days of journalistic inexactitudes, for it will certainly be rendered "degraded," and even a specialist audience may not correctly evaluate its significance. But they will understand being referred to the Textbooks in respect of a definition of cellulose as a chemical individual and structural colloid, with regard to:—(a) The Natural Normal, (b) The Normal Pure or Bleached, and (c) The infinite number of de-grades, natural grades of inferior differentiation, and modifications determined by industrial treatment, generally with lowering of quality.

Perhaps it will be assumed as *a priori* evident that the prototypes of nature, such structural materials as silk and cotton, are the ideals of perfection whether estimated on the basis of convention or in the terms of exact science. Science certainly confirms the world's estimate of quality and value. Those of silk quality expressed in low specific weight, tenacity, elasticity, resistance to destructive influences, whether of atmosphere or of treatments incidental to preparation and use (chemical) or wear and tear (mechanical) are inimitable. Nor must we forget that it is also, a manufactured product, not an original or primary structural material. Of Cotton, as a chemical individual (cellulose) and a structural colloid of highly specialised form, with properties and qualities similarly expressed in the exact terms of laboratory language, we can merely state that it is its own standard of super-excellence.

From these we descend to the now familiar "artificial" products. We note that it is only the familiar *form* which is artificial. To produce this, the cellulose in each case passes through a chemical cycle, but with resulting de-grading effects—that is, instead of a cycle, a cycloid, with the reverted or regenerated cellulose on another and lower plane defined in the essential terms of constitution or properties, this notwithstanding the fact that the cellulose may be recovered without loss. On this important aspect, it may be pointed out that each cycle has its special chemistry and danger points.

In the original nitro-cellulose process there are the two defects readily appreciated by chemists—the presence of sulphuric groups (SO_3H) in the ester product, and not wholly removed in the denitration treatment. This treatment is not a simple saponification of the nitrate, and it does not appear to be possible to effect the simple reversal in the case of the nitrates. The treatment with alkali for such purpose determines changes in the nitric residues, with destructive action on the cellulose complex. The process devised to avoid this is one of de-oxidation of the acid residues and combination with bases to soluble forms. But it is evident from the properties of the regenerated cellulose that it has been de-graded.

The cuprammonium solution of cellulose is extremely sensitive to the action of oxygen, and to light; the cellulose complex in solution is de-graded and the change is evidenced by loss of viscosity of the solution. (Gibson, *Jl. Chem. Soc.*, 1918.)

The industrial process involving this phase obviously depends upon a controlled limitation of this down-grade change.

The viscose process is, to the chemist, a violent treatment of cellulose, but the severe treatment with caustic alkali determines changes which, if destructive in a limited sense, are compatible with the special characteristic of the cellulose in the xanthate or viscose phase, the property of spontaneously reverting to insoluble form. On reflection, chemists will recognise in this property an important factor of the technical progress of the industry from its earlier stages as set forth in our preceding notes. A further point to be noted is that the reverted cellulose, in its various forms of thread, film and solid, has been kept under observation for 20 years, and this evidence of permanence is unassailable.

In regard to the actual constitution of the cellulose in the three artificial modifications, no one appears to have undertaken a methodical investigation such as would afford a measure of the kind and degree of differentiation from the normal. Taking, as an integral measure, the tenacity of the artificial silks, we see that the inferiority to the natural prototype is large; so, also, the degree of resistance to water and generally to solutions of active hydrolytic agents, notably acids and alkalis.

Cotton, moreover, has the advantage of its form or structure, which conditions a number of effects not realisable with a structureless solid form of matter.

In contrast with the three forms of cellulose, the acetate, *i.e.*, the normal acetate, presents characteristics which it has been hoped to realise in a superior "artificial silk."

- (1) It is of notably lower specific weight, and approximately that of the silk-worm product.
- (2) As an ester derivative, it has a resistance to water much greater than even the normal cellulose.
- (3) As an ester, it represents a considerable increase of weight in relation to the parent substance or industrial raw material, whereas all forms of "cellulose" silk represent a lesser weight. And, moreover, the thread or silk once formed is in its saleable form, requiring only the mechanical treatments incidental to finish.

These are strong points of claim; but there is the other side.

The Acetate fulfilling the requirements of a spinning, *i.e.*, a drawing process, is a considerable departure from the normal. In regard to colloid-structural characteristics, it is inferior to its analogue, the nitric ester; and the "silk" fails to show superiority to the "cellulose" silks in tenacity in the dry or wet state.

In regard to the important question of cost of production, it is difficult to estimate this on the present and prospective basis of industrial values. In the period 1900—1914, when acetic acid and anhydride were on the low level of selling values, it was possible to produce the cellulose in solution as acetate at approximately the cost of the viscose form. At this period of violently alternating industrial values, it is impossible to make a comparative estimate. Further, the process actually adopted involves the separation of the acetate from its original solution, and redissolving in organic solvents to the solution to be utilised in the process. The problem must, therefore, be left unresolved, and the issue to the factors of industrial evolution and survival.

In regard to present progress there is considerable achievement in the production of fine denier yarns—5 denier, 3 denier, even down to 2 denier. This no doubt arises from a certain positive competition with silk and a certain displacement of natural silk. Progress and evolution here is very much a matter of convention and demand based upon conventional estimate of textile quality.

The long future, I should point out, is certainly a matter of science. Our present knowledge of cellulose, which appears to be considerable, is in important respects superficial; actually, we have very little control of cellulose reaction, and the control we have is on proximate lines. We have no control of ultimate factors which may be of first importance. The outlook here involves research and systematic study of cellulose. We have endeavoured to give indications on broad

lines upon which such problems are to be attacked and perhaps resolved in our Volume IV "Researches on Cellulose" (C. F. Cross and C. Dorée) just published.

Anything I should say on this matter would be a diffuse repetition of the matter of that volume, and I propose to leave this side of the problem with merely the indication of the directions in which research should contribute to progress—at first, progress of science, and, in due course, progress of industry. These main directions of more profound study of cellulose are the *via aspera* of physics and physiology.

As should have appeared from this present treatment of the subject matter, the incubation period in textile progress is a long one, and this may discourage workers other than those who are prepared to take the longest views of art and life. It is a consoling reflection that these long views are only the intellectual framework: the animating principle and experience of the research worker is that "Joy's soul lies in the doing."

The lecture was illustrated by exhibits of yarns, woven and knitted fabrics, specially selected in demonstration of technical progress, and contributed by Messrs. Courtaulds Limited and Société Française de la Viscose (viscose textiles); and The British Cellulose and Chemical Manufacturing Company, Ltd. (Textile, Films, and Solids, of Cellulose Acetate); also with photo-micrographs and technical data. To these firms, and on behalf of the Institute, I wish to record an expression of thanks, as also to the Fine Cotton Spinners' Association (Dr. W. L. Balls and Mr. Stowell) and Messrs. Bertrams Limited (Mr. S. Milne) for their contributions of technical matter.

DISCUSSION.

Mr. J. H. LESTER (Manchester), proposing a vote of thanks to the lecturer, said that not only was Mr. Cross the originator of the viscose process but the history of the constitution of cellulose had been a subject which he had made his own in association with Mr. Bevan. It was because he started out with an ideal above and beyond him that many industrial results had arisen. It was a case of the higher the ideals the more numerous the bye-products. The constitution of cellulose was still a matter for considerable argument and discussion. Possession of the complete knowledge would be the means of advancing industry, but even if the achievement were not complete there would be a return of reward on the way. Mr. Cross represented a type of individual to be brought along in greater number for the benefit of industry. To-day, the profession of textile technology hardly existed, but it had got to be recognised in the future and that was why the Textile Institute was anxious to secure a Royal Charter.

Professor A. J. TURNER (Manchester) seconded, and said that the Lecturer's generous offer that day to give advice and information indicated how it came about that Mr. Cross had been concerned in so much of important work in the past. His attitude had been a stimulus to other workers, and that stimulus had resulted in the enrichment of the pages of the works on cellulose by the lecturer. The developments in regard to artificial filaments in so short a time was astonishing. It was commonly said that there had not been great achievements in the textile industry during the last fifty years, with the exception of automatic looms, but it was often overlooked that mechanism was not the only concern of the industry. New raw material was a matter of the greatest moment. Jute was not yet 100 years old in its great commercial exploitation, whilst cotton was only about 150 years old so far as widespread commercial and special applications were concerned. A description had just been given of the introduction of the raw material for "artificial silk." He did not think there was any fear that the cotton industry would be displaced by the development of production of artificial fibres, but it must be remembered that this raw material was new and we had not yet seen the limits of its possibilities.

The vote was heartily accorded, and

The LECTURER, in response, said he had never for a moment suggested that the artificial would displace the natural fibres. Cotton was an extraordinary structure and there was not the slightest idea of approximating to it by artificial fibre. As to natural silk, it was so enormously superior in chemical structure that he had no expectations in that quarter. Artificial silk had not displaced silk to more than a fractional amount. "The great problem for the chemist," he added, "is: Can he carry out an up-grade process in the interior of the cotton substances in place of a de-grading process? I look to the young men of to-day to put energy into this problem and give us an undegraded product."

BLACKBURN AND DISTRICT COTTON EMPLOYERS' ASSOCIATION

Following the delivery of the Mather Lecture, the visiting members were entertained to luncheon, in the King George's Hall, by the above-named Association. Mr. James Smith, as Chairman of the Association, presided over the assembly and representatives of many phases of municipal, commercial, and industrial life in Blackburn were present.

The toast of "Our Guests" was proposed by the Chairman, who said that as to the future of the cotton trade he supposed the optimists would be correct some day, but, for the moment, he, at any rate, felt none too sanguine. It behoved them to encourage all forms of education leading to developments of the technical and scientific aspects of the industry. He believed they would have to look more and more to organisations like the Textile Institute, research associations and technical colleges, for that assistance which the problems of the industry demanded.

The PRESIDENT OF THE INSTITUTE responded and thanked the Chairman for the hospitality so generously accorded by the Cotton Employers' Association. It seemed to him, he said, that in the matter of trade this country must produce articles which the world requires at prices the world can pay. India had begun to impose a tariff against Lancashire goods. If India produced the coarser goods then this country would have to endeavour to produce that which India would be obliged to take in spite of the duties. Bradford had been in a somewhat similar position with reference to America. The textile industries in this country must keep on progressing and all the help which could be got from the scientist must be taken advantage of. This country had gone through a big crisis, but it had weathered it better than many other countries. He was hopeful that greater interest would be taken in the Textile Institute as an organisation embracing all sections of the industry and bringing the various interests into closer contact and relationship. The Institute hoped to succeed in an application for a Royal Charter so that it could set up recognised qualifications or degrees and in this way something definite could be done for the benefit of the whole industry.

Mr. JOHN CROMPTON, Chairman of Council of the Institute, also responded and complimented Blackburn on the rapid advances made at the local Technical College. He looked upon that institution as a pioneer in respect of technical education, particularly on the textile side. He was delighted to know that the trade unions were in full sympathy with the work and that it was practically a condition that entry to the position of overlooker involved attendance, as apprentices, at the textile classes. The Textile Institute would like to see a large accession of members from the Blackburn district and he desired to take that opportunity of saying that they had no interest to serve beyond that of the well-being of the textile industry generally.

Mr. FRED HARGREAVES also spoke and referred to the present state of trade. A more normal condition of trade could only be expected when goods were produced at a price which customers could afford to pay. Industrial harmony was essential to industrial prosperity. It was necessary that commercial intercourse should be fully restored, with confidence that business obligations would be fully respected so that the industry in which so much capital was invested and so many workpeople employed might be preserved and extended. This could only be effected by the closest co-operation on the part of all sections of the industry and allied trades,

and it was therefore with much pleasure that he bore testimony to the importance of the work being carried on by the Textile Institute, and he wished the greatest possible success for the institution. He had every confidence that by co-operation of effort existing difficulties would be overcome. It had been suggested that the bankers had not done all they might have done of late, but, as a chartered accountant with special knowledge of the facilities given, he could not in the least degree agree with the suggestion.

Mr. J. JOHNSON (secretary to the Blackburn Operative Spinners' Association) also responded and claimed that this country possessed the finest workpeople in the world. The aim should be to advance the quality of their productions along with the advancing skill of the workers.

A hearty vote of thanks to the Chairman and the Cotton Employers' Association concluded this part of the proceedings.

Subsequently, the visitors motored to Daisyfield and inspected the works of the British Northrop Loom Co., Ltd. The inspection was carried out under the personal direction of the Manager (Mr. D. M. Hollins). The party was formed into groups and conducted over the various departments, the inspection occupying practically the whole afternoon and exciting the keenest interest on the part of the visitors.

In the evening, several members attended a lecture under the auspices of the Blackburn Textile Society, when Dr. A. W. Crossley, Director of Research at the Shirley Institute of the British Research Association for the Cotton Industry, gave an account of the Shirley Institute and its work, whilst Dr. A. E. Oxley described a research for which he had been responsible at the Institute.

NOTES AND NOTICES

A LONDON SECTION OF THE INSTITUTE.

The oft-repeated suggestion in favour of the formation of a London Section of our Institute has this year come forward again in a manner which gives promise of the establishment of a really useful organisation. Sir Frank Warner, K.B.E., the esteemed Past President of the Institute, has entered into the movement with characteristic energy, and, after the formation of the Section by existing members in the Metropolitan area—a meeting for this purpose having been called for the 13th November, at the hall of the Clothworkers' Company, kindly granted for the occasion—there is to be a further meeting, on a larger scale, with a view to the launching of the Section's work and enlisting widespread interest in it. Proposals as to activities have already received substantial consideration, both in London and at the Institute in Manchester, and there appears to be every reason for the assumption that the movement will be successful.

DESIGN AND STRUCTURE OF WOVEN FABRICS.

The Committee of the Institute which carries out the work connected with the annual competition under the Crompton Prize Fund Scheme, has this year experienced an arduous task in the matter of adjudication, notwithstanding the fact that the number of competitors is rather less than was the case in the previous year. The competition has demanded several meetings and the devotion of a great amount of time to consideration of the merits of the competitive albums of specimens. At time of writing this note, the date for the presentation of the prizes has not been definitely fixed, though the event will doubtless take place on a Saturday afternoon late in the present month or the early part of December. The specimen albums issued annually by the Institute to the various subscribing technical institutions are now in preparation and will be issued shortly. This year, more than average difficulty has been experienced in compiling these albums. It is in the natural order of things that in each succeeding year the selection imposes more and more effort on the part of those responsible for the collection, as repetition has to be

avoided. The institutions possessed of the complete series, however, secure an increasingly useful collection of samples of woven fabrics as the years advance. Not only are the specimens of somewhat special interest, but the respective issues provide a valuable record of the class of materials available on the retail market in the different years covered.

RETAIL TRADE "BAROMETERS."

When trade is more or less generally associated with "slump" conditions, the keener is the alertness of all concerned for the appearance of any sign which may possibly be regarded as pointing to a turn of the tide. A correspondent calls attention to a recent statement in "The Textile World" to the effect that improving conditions in the sales of carpets by auction provide "a barometer of clearing skies in the commercial field!" The reference does not appear to offer any suggestion as to the reliability or otherwise of this remarkable barometer. The suggestion presented, however, does appear to open up a fairly big field for enterprise on the part of individuals who claim to be specially well-informed, and even gifted in the prophetic sense, with regard to the "swing of the pendulum" in the matter of trade. Some day, perhaps, phenomena which are supposed to point the way of trade may be tabulated in order of importance and tendencies indicated by them may be broadcasted after the manner of weather-forecasting. It is conceivable, however, that study of these trade barometric readings might, in some cases, prove so overwhelmingly engrossing that some measure of the elusive trade would be lost in the process. Our correspondent adds another "barometer," in calling attention to the one already described. It is asserted that the measure of the sales of the twine manufacturer forms the best indicator of activity in retail trading, and the suggestion is added that the whole subject involved might well be investigated by the economists. The economists deserve great sympathy.

INFORMATION INQUIRIES.

Inquiries and effort to secure adequate and useful information thereon demand a good deal of attention on the part of the Institute staff. In a large number of cases, members of the Institute concede valuable assistance in this connection. An inquiry at present in hand refers to the manufacture of cotton powder for plastic compounds, the correspondent desiring to get into touch with a firm who would be interested in a process for the manufacture of the powder, for which, it is stated, there is an immediate market. The correspondent states that the raw material required is short fibre waste. Another correspondent desires information as to a fibre described as "Ghazi."

NEW PUBLICATIONS ON DESIGN.

Impending publication of a number of novel and interesting works on textile design is announced by Messrs. B. T. Batsford, Ltd. (London). The first of Mr. W. G. Paulson Townsend's Series of five volumes on "Modern Decorative Art in England" is devoted to illustrations from the time of William Morris to the present day of Woven and Printed Fabrics, Wallpapers, Embroidery, Lace, Tapestry, Batik, and Stencil Work. A concise but comprehensive manual on "Historic Textile Fabrics," by Mr. Richard Glazier, Hon. A.R.C.A., late headmaster of the Manchester School of Art, will add materially to that author's contributions to literature.

In addition will be issued a series of plates showing textile treatment of various flowers in Oriental and European work, under the title of "Floral Forms in Historic Design." The drawings of these have been prepared by Mr. Lindsay P. Butterfield, the well-known designer, and Mr. W. G. Paulson Townsend contributes the Introduction and Notes. The same publishers announce an English edition, condensed into one volume, of Otto Von Falke's great work on "A History of Design in Silk Fabrics" with 10 plates in colour and 500 specimens of all periods and countries. At the same time, an issue is taking place in England of three uniform volumes, with plates in colour by a special artistic facsimile process, of Chinese Embroideries

and Textile Fabrics; Coptic Textiles, Tapestries and Embroidery; Peasant Art in Czecho-Slovakia, each containing about 40 plates and illustrating about 100 typical designs.

REVIEWS

COLOR INDEX. Published by the Society of Dyers and Colorists, 38, Wall Street, Bradford. Edited by Dr. F. M. Rowe.

Those who know the difficulties surrounding the preparation of so complicated a work of reference must pay a tribute to the courage and enterprise shown by the Society of Dyers and Colorists. The object of the compilation is, in the words of its editor, "to produce as accurate and comprehensive a work as possible dealing in tabular form with all dyes of known constitution which have received commercial names"—in other words, an English work to take the place of "Schulz" and to improve upon it.

The Society knows something of the art of publicity. The index has been loudly heralded in the daily Press—so loudly that we have awaited the first number with considerable interest to see what form it would take. Let us say at once that the Color Index Committee has done its work well. The form of tabulation, with one unimportant reservation, could hardly be improved upon. The headings under which the information is grouped are:—(1) Commercial Name; (2) Scientific Name, Components, Formula; (3) Preparation; (4) Discoverer, Literature; (5) Description, Properties, Mode of Application. Ample space is allowed for individual notes.

The order in which the dyestuffs are tabulated conforms to well known lines. Part I includes the Nitroso, Nitro, and a number of the Monazo coloring matters following each other in chemical sequence.

It is clearly impossible to review a work on the strength of Part I, all of which deals necessarily with the simplest of synthetic dyestuffs, but, whilst the editor is probably right that in order to make the work complete it is desirable to include some dyes now of historical or scientific interest only, it is surely unnecessary to include in detail so many obsolete coloring matters. Too many dyestuffs enumerated in this issue might come with advantage within the scope of the editor's remarks that "in certain cases types of groups of dyes are described rather than individual products." Three Chrysoidines, for instance, are detailed and again three Cochineal Scarlets made respectively from aniline, toluidine, and xylydine, occupy three separate places in the tables.

It is not yet quite clear what form the preparation column is finally going to take. Some of the processes described so far are perhaps too elementary. Much of the information given for the preparation of quite ordinary organic compounds, process for simple sulphonation, acetylation, etc., can be obtained elsewhere in quite trustworthy form.

The inclusion of a set of fastness tables the better to illustrate a dyestuff's properties is an excellent system. The tables are adequate with the exception of the standard-to-light which might be stiffened in accordance with more recent German practice. So far, they have been applied only spasmodically—a fact which may be accounted for by the number of dyestuffs dealt with in Part I which are rarely used. Such notes on dyestuff behaviour which belong more properly to a description of the color than to a textbook on dyeing are of the utmost importance not only to the user but also to the manufacturer and the student. It will be interesting to see how this question is treated when the index deals with more modern dyestuffs the properties of which have been searchingly tested and tabulated by the manufacturers.

The index deals capably with the dyestuff's appearance, solution, behaviour towards the usual reagents, and, in many cases, gives the spectrum in water. References to the literature on the subject appear to have been very carefully assembled and verified whilst for further information on the technical side of a

color's application, the reader is freely referred to that excellent "Manual of Dyeing" by Knecht, Rawson, and Loewenthal.

Where we have criticised, it has not been so much in the spirit of criticism as in the desire to see this English work well ahead of its foreign predecessors and, above all, moving with the times. It is not wise to overload a modern color index with colors of the past. Within that definition come many which achieved a temporary war-time prominence.

We intend to refer to the work again at a later date when some further numbers will have appeared.

—C. S. P.

RESEARCHES ON CELLULOSE (1910-1921)—IV. By C. F. Cross and C. Dorée. (Longmans, Green & Co. 15/- net.)

In the introduction to this valuable book the authors mention the recent developments in research relating to the textile industry, and refer to the Textile Institute, the Cotton Research Association, and the Fine Cotton Spinners' Association. A selection of a few names by eminent experts unavoidably gives an impression to the lay reader that research is limited to the institutions mentioned. Quite a number of trade associations and companies are carrying out research to-day, some of them having done so for quite a long time.

In Chapter 1, a general account is given of developments, particularly on the questions of constitution, due emphasis being laid on the fact that the graphic formulæ already proposed are quite insufficient to explain the properties of cellulose as found in nature. Chapter 2 deals with the physical properties of cellulose, the importance of which is gradually being realised by those engaged in industry. Recent work on the internal stresses in cotton, the presence of growth rings in natural cotton fibres, and the modifications in properties produced by mechanical disintegration is described. It is pleasing to note that a paper on surface films finds its place in a book of this kind, illustrating fully the growing importance of physics—a subject sadly neglected by chemists preparing for service in the great textile industries of this country. Recent investigations on the fluorescence of cellulose and on the solubility of cellulose in solutions of inorganic salts are described in detail. The crystalline structure of cellulose as determined by X-ray analysis is mentioned.

Chapter 3 deals with the chemistry of cellulose and gives an account of most of the recent work on the hydrolysis of cellulose and its methylation products. The more recent constitutional formulæ of Hess, Hibbert, Irvine, and others, are discussed, due criticism being made of their disadvantages.

In Chapter 4, the remarkable effects produced in cotton by partial xanthogenation are fully described. Chapter 5 deals with oxycellulose and hydrocellulose, and gives an account of the recent work on the subject. The authors arrive at the conclusion that there is no distinct line of demarcation between oxycellulose and hydrocellulose, and might with advantage have included cellulose itself in the remarks.

An account of most of the recent work of lignocelluloses, a subject which seems as complex if not more so than that of cellulose itself, appears in Chapter 6, whilst Chapter 7 relates to cellulose industries and technology, and forms a valuable and interesting section. The importance of the questions discussed in Chapter 4 to the paper-making industry is indicated. The properties of arghan and kapok are mentioned, and an account is given of the effect of sea water, of storage, and of bacteria on cellulosic fibres.

The book concludes with remarks on the narrow and empirical basis on which most of the technical literature on cellulose exists, without discussing the causes of this defect or its remedies. A deeper study of physics will do much to meet this criticism.

The book would have gained considerably in value if artificial silk had been included. There is much literature available on this subject which might have been described. It is hoped that this will not be neglected in the next volume, which chemists will expect.

The book should be in the hands of all interested in the chemistry, physics, and technology of cellulose, and textile men generally would do well to find a prominent place for it on their bookshelves, and to read it systematically. —W. HARRISON.

DYES CLASSIFIED AS INTERMEDIATES. By R. Norris Shreve, in collaboration with W. N. Watson and A. R. Willis. (Chemical Catalogue Company, Inc., New York, 1922. Price \$10.00 net.)

This book is designed to fill the rôle of a work of reference to which those dealing with both intermediates and dyestuffs can profitably turn, since it shows in tabular form the commercial dyes which are manufactured from each important intermediate. The book may therefore be said to be complementary to Lange's "Zwischen Produkte," and is likely to prove useful to chemical manufacturers owing to the fact that it is a work from which suggestions can be obtained as to the best possible methods of utilizing their intermediate products.

The arrangement of names is alphabetical. Under each principal name is given the synonyme (both being cross-indexed in their alphabetical order) the empirical and structural formulæ, molecular weight, a very brief description of the methods of formation, and the principal literature references, which latter, although quite up to date, could with advantage be amplified in future editions.

Included in the book is also a formula index and an alphabetical list of the names of dyes referring to their Schultz Numbers, which greatly facilitate the work of those seeking information.

The work represents an immense amount of well-directed labour.

T. K. WALKER.