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PROCEEDINGS

Lancashire Section

OILING OF MULE SPINDLES*

By W. S. Moore

(H.M. Inspector of Factories)

There is no necessity for me to make any comments to this audience on spinners' cancer. There has already been a great deal of publicity, and some people now suggest that publicity in the wrong place may have an adverse effect on recruitment to the trade. I should, however, like to give this talk a basis by running over one or two points in connection with the disease.

Medical opinion is agreed that the trouble is caused by contact between mineral oil and the skin of the worker, although secondary factors such as clothing worn, working temperature, methods of working, personal cleanliness and individual idiosyncrasy may have some bearing.

The oil, of course, gets on to the clothing of the worker, and so to the worker's skin, in a variety of ways. The main source is undoubtedly splash from the spindles themselves during and following lubrication. You have no doubt all seen results of holding a sheet of tissue paper vertically in front of the bolsters immediately beneath the faller rods for the first half dozen or so draws after oiling. The results give a very thick band of oil across the test paper. If the spindles are clean the quantity of oil may be reduced to one-third, but unfortunately spindles soon get dirty with " bits " and fly at the base. This leads us to consideration of the methods of oiling, and certain basic principles underlying them.

I do not want to go too deeply into the science of lubrication—apart from being hardly qualified to do so, there is no time in this short talk.

Each spindle has two bearings—the footstep at the bottom and the bolster about half way up. The bolster, of course, is the source of nearly the whole of the oil spray. It is hardly a bearing at all in my opinion, but rather something to stop the spindles falling over. Owing to the design of the spindle itself, considerable clearance has to be allowed in the bearing in manufacture—more actual clearance than is allowed in pressure fed bearings running at a fraction of the speed. After some use this clearance greatly increases. I have heard spinners say that this will not affect the spin as the spindles will have generated a good seat in the bolster through the pull being all in one direction, but the point I should like to emphasize is that owing to this fact the effective bearing surface is very rapidly reduced to under 50 per cent. Excess wear brings with it the necessity for re-aligning and reaming.

I think it is without question that the spinning mule is a precision instrument and as such deserves good treatment.

With the old established method of oiling, namely, running a can along the spindles and flooding the bearings—literally flooding in case one or two are missed—one has no guarantee that each spindle gets its quota. In fact, as long as the can clicks along the spindles the person doing the oiling may be satisfied

* A Lecture to the Lancashire Section of the Institute, Manchester, 12/7/46.

that everything is in order. I have done some tests in order to try to find out how much of the oil did any useful work. The tests, of course, had to be done on spindles running continuously: I was unable to duplicate exactly the conditions on a mule. The results gained were not entirely consistent, but they were sufficient to indicate that 90 per cent. of the oil was either thrown off the spindle, or ran through. This means, of course, that only 10 per cent. of the oil—and this in itself is by no means an accurate figure—could possibly be of any value for lubrication. These figures are really shocking. The efficiency of oiling is undoubtedly very low, apart from the waste of oil.

From the commencement of a run during the morning or afternoon power losses due to friction are rising, with the consequence that spindle speeds are dropping and bearing temperatures going up. The loss of spindle speed may be in the region of two or three per cent. only, but with spindle speeds in the region of 8,000, the actual revolutions lost are considerable. Bearing temperatures do not, of course, rise continuously. Equilibrium is eventually attained when the heat generated in the bearing is equivalent to the loss to the surrounding air. Why lubrication is even partially effective is a little difficult to say on first sight. In all probability oil is being retained only in or near the bearing by the small amount of fly on the base of the spindle, together with that entrained in the very fine grooves in the bearing surface. These fine grooves will always exist, caused by the presence of very fine particles of hard foreign matter.

With regard to the principles of lubrication, I should like to simplify these under two main headings:—

First, to have a lubricant where it is wanted, when it is wanted, and

Secondly, to maintain a correct quantity of lubricant.

In applying these principles of lubricating mule bolsters it really means that if the use of oil is continued we must find methods to use 10 per cent. or less of the present quantities (as mentioned previously, rather an arbitrary figure) to the best advantage. An obvious method is to provide a reservoir of oil and means which will feed that oil continuously and steadily to the bearing. We can consider four broad methods of attaining this object.

(1) To have bearings made of a material which is itself a lubricant, e.g. graphite.
(2) Manufacture bearings from, or modify existing bearings to contain, a porous metallic material which contains a lubricant, an example of this being the oil impregnated brasses. This method has proved entirely satisfactory.
(3) To modify existing bearings to incorporate a fixed fabric pad which can periodically be recharged with oil. This method is well established.
(4) To apply methods of feeding oil continuously from a container to the spindles by means of a mechanically-actuated traveller. The reference to the method will be familiar to you.

We might even go so far as to envisage a fifth method in the future—grease being fed from a pump.

I should like to consider the fixed fabric pad systems, which I shall call static pads, in a little more detail. This idea is by no means new, even on spinning mules. A device was manufactured nearly fifty years ago by one of the textile engineers which is still in use and proving perfectly satisfactory. It is a sobering thought that I know of three mills only where this device is fitted on any scale. Almost the whole of the production seems to have been delivered abroad.

These static pads may be fitted in a number of positions—above the bearing, below the bearing, or somewhere between the two.

The pad above the bearing will deliver its oil to the bearing mainly by gravity, and therefore it does not seem necessary, on the face of it, to have the fabric touching the spindle.

Pads fitted in the centre of the bearing must touch the spindle, and are normally fitted into a groove cut through the spindle rail into the bearing leg.

Here the oil is fed to the bearing by gravity and capillary attraction. Capillary attraction means simply that oil will rise between two surfaces which are in close contact, especially if they move relatively to one another. Pads fitted below the bearing will not, of course, be assisted by gravity at all. The oil will have to get to the bearing by capillary attraction entirely, and this brings me to a most important point which I feel I must emphasize, as unless it is appreciated it may lead to condemnation of this particular method without realising why it has failed. The static pad below the bearing must be in contact with the point at which the spindle emerges from the bearing leg. The reason I make a point of this is that a number of spindle rails are thicker than the length of the bearing leg and the timber extends up to $\frac{3}{16}$ in. below the brass.

There is a further point on these fabric pads which it may be as well to mention, and that is that a woven material seems to be more effective as an oil reservoir than a processed felt. Any woven material seems satisfactory, but wool looks as if it has a greater capacity than other materials.

As it is necessary that devices of the characteristics I have mentioned be fitted to spindles, the problem will arise as to how to arrive at the most effective method for your particular machine. Mules vary among themselves very considerably, and a method which may be suitable for one may not be entirely satisfactory for another, and vice versa. Lubrication aims at reducing friction. I think it is a fact that a mule carriage consumes over 50 per cent. of the power required to drive the mule, and the spindles obviously account for the major portion of the power used to drive the carriage. Maximum efficiency of lubrication of the spindles is therefore of prime importance, as if we can make a substantial reduction in frictional losses on the spindles it may well represent a considerable saving in horse-power in the spinning rooms.

There are several methods which we can use to give us an indication of efficiency of lubrication. It is possible to measure power consumption by means a dynamometer. To apply this method to a mule is not altogether easy. To motorise the tin roller and measure the power consumed, running the spindles continuously is the simplest way, but would not commend itself to the majority of spinners. A second method, for which I am indebted to a member of this audience, is by pulling the twist band by hand. This will give some idea as to difficulty of movement, but brings in the personal factor, and as it is not easy to remember how hard it was to pull the band from one day to the next, it may be of use only if on one day no movement could be obtained, and on the next some movement could. The two methods just mentioned would not be satisfactory unless every spindle on the particular section under test had been modified with the device whose efficiency was under consideration.

A third method that comes to mind is to measure the spindle speeds. A mechanical tachometer is not of much use in this application as it puts a load on the spindle and may itself have a greater effect on the spindle speed than any inefficiency in lubrication.

Optical methods can be used, but they require a number of safeguards as they can be effective at multiples of any given speed.

We are therefore left with having to utilise the fact that friction generates heat. This heat, of course, is produced at the point of contact between the spindle and the bolster, and will have the effect of raising the temperature of the bearing and the spindle. This temperature can be readily measured. It will not give an absolute measure of efficiency, but the temperatures obtained with the various methods of lubrication will give some idea as to their relative merits or deficiencies. This method has some disadvantages. It suffers from the defect that it does not give an average result for the whole of the mule, but only that from a few spindles, or in the case of pipe bolsters, only one spindle. It is therefore necessary to take temperatures at more than one point. Again the method will not work when the bearings are not themselves conductors of heat.

You may be interested in a method of measuring this temperature simply without elaborate apparatus. In other words, a method that can be used at once by the mill staff. An ordinary mercury-in-glass thermometer having a small cylindrical bulb and with a range of between 70 and 105 degrees F may be inserted into a hole drilled into a small block of brass brazed on to the bearing surface. The hole should first be filled with oil to give good heat contact between the bulb and the brass. The temperature indicated by the thermometer will become steady in a very short while. Other methods of measuring the temperature are, of course, available, but require more elaborate apparatus.

It is a fact that, with efficient lubrication, the reduction of bearing temperature can amount to 10° F.

There are a number of obvious practical advantages in getting efficient lubrication, and although some may not have a very marked effect, they are nevertheless present. Some of the advantages are:—

(1) Increased cleanliness, both of the worker's clothes and machines—obviously fly will not stick so easily to a dry surface.

(2) Improved cleanliness of floors, although unfortunately most wooden floors of mule rooms are already thoroughly saturated.

(3) Much less oil will be used, as already indicated. A saving of oil for the spindles themselves of 90 per cent. or more.

(4) The reduction of power required to drive the mule. I have no reliable figures on this particular aspect. Some work was done a few years ago which indicated a saving of about 5 per cent. This may well be materially increased with more efficient methods of lubrication and measurement of power.

(5) Possibility of the use of a lower viscosity oil with consequent reduction in starting load.

(6) A reduction in bearing temperature. I do not think this will have much bearing on room temperature as the mass of bearing metal is relatively small.

(7) Reduction of bearing wear resulting in less frequent attention to the bearing and lower maintenance costs.

(8) Increased production up to 2 per cent. by the saving of time in oiling.

(9) Reduction of noise. This is noticeable at the end of the run.

(10) No loss of spindle speed, resulting in a more consistent yarn.

(11) Less band slippage, which may result in less frequent band replacements.

(12) Cleaner yarn through the reduction of the possibility of oil getting on to cop bottoms.

Lastly, and of course, most important, the reduction of the exposure of the spinner himself to oil spray.

I should just like to mention one point on lubricating footstep bearings, as we have now reached the stage when we are oiling bolsters less frequently. A cup type reservoir soon empties owing to centrifugal action and dirt. A simple strip of felt laid on the surface of these cup footstep bearings, punched with holes for the spindle peg to penetrate, will itself act as an oil reservoir and probably run for a month or more without attention.

To return to the bolsters, there are now various approved types of oiling devices available which do their work very efficiently. These devices have had to conform to various standards, two of them being that the spindles should be oiled with a can not more frequently than once a week, and that splash is considerably reduced. The standards were not put so high that splash was eliminated entirely; I feel that this is unattainable, as although it may not be possible to determine the splash by ordinary methods, it nevertheless will be present in extremely fine droplets.

In closing, may I make the plea that the job of modifying the spindle bearings be completed as soon as possible. You may be interested to know that to the end of June (1946) about 1,500,000 spindles had been treated.

NOTE.—The referee asked to advise the Publications Committee with regard to this paper suggested that its value to members would be enhanced if the Interim Report of the Joint Advisory Committee of the Cotton Industry (Mule Spinners' Cancer and Automatic Wiping-down Motions) could be produced as an addendum. The permission to reproduce this report has been obtained from His Majesty's Stationery Office. The Crown Copyright is reserved.

Interim Report of the Joint Advisory Committee of the Cotton Industry

MULE SPINNERS' CANCER AND AUTOMATIC WIPING-DOWN MOTIONS

INTRODUCTION

During last year preliminary discussions with representatives of the Cotton Industry were held to consider post-war plans for improving conditions of work in both cotton spinning mills and weaving sheds, and it was decided to set up a technical advisory committee to consider and advise on practical methods of implementing certain provisions of the Factories Act, 1937, and other problems. The terms of reference were wide and some of the problems longstanding and of no mean difficulty. Two of these related particularly to mule spinning (a) the prevention as far as reasonably practicable of what is commonly termed mule spinners' cancer and (b) the provision of mechanical means of wiping down the carriage tops and roller beams of mules with a view to eliminating the awkward manual methods which necessitated entry between the fixed and traversing parts.

The opinions expressed are those of experienced technical representatives of both sides of the industry and the report is now published for the consideration of all concerned.

The gratitude of all in this section of the trade is due to the Committee for the promptitude and resource with which they have tackled these important problems.

June, 1945.

72, Bridge Street,
Manchester, 3.

To H.M. Chief Inspector of Factories

SIR,

At the first meeting of the Committee set up by you to consider and advise practical methods of implementing the Factories Act, 1937, and other cognate problems specified in our terms of reference, it was resolved to set up four separate sub-committees to deal with the various subjects, as follows:—

A. Ventilation, lighting, welfare and medical services.
B. Dust in cardrooms.
C. Spacing of machinery and the prevention of noise.
D. Prevention of mule spinners' cancer and the provision of mechanical methods of wiping down.

Technical personnel were co-opted as necessary to form these sub-committees and meetings of each have been held at least once a month.

Committee "D" after holding six meetings and visiting four factories has arrived at definite conclusions on both of the problems submitted to them and have forwarded a Report, dated 17th April, 1945, embodying their recommendations.

Since it is important that the earliest possible steps should be taken to provide improved conditions in the mills, and mill managements may be awaiting any recommendations which this Committee is able to make, it has been deemed desirable to incorporate these findings in an interim report in order that, if you so desire, the necessary publicity can be given to them without awaiting the Committee's findings on the other terms of reference.

We have carefully considered the proposals of Sub-Committee " D ", which form an Appendix to this Report, and agree (with one slight amendment in respect of wiping down motions, reference to which is made later in this Report) with their recommendations. The question of the means of implementing these recommendations has also received consideration and whilst it would appear that it is not the function of this Committee to decide whether the conclusions should be embodied in Orders or Regulations, since this is entirely a legal question, it is considered that, in view of the continued incidence of epitheliomatous ulceration amongst mule spinners, Regulations are highly desirable in so far as the Sub-Committee's conclusions deal with means of preventing this industrial disease.

We recommend, therefore, that Regulations should be made, if they can be framed, to deal with the standardisation of mule spindle oil, the provision of non-splash devices, and the periodical medical examination of mule spinners.

Regarding the question of wiping down motions, the Committee has agreed to an amendment of the recommendations of the Sub-Committee to meet certain cases where it is not necessary to enter the space between the fixed and traversing parts of self-acting mules for the purpose of wiping down. The provision of an automatic method of wiping down is clearly not necessary in such instances.

It is suggested, therefore, that No. 4 of the recommendations of the Sub-Committee should read as follows:—

> " That mechanical wiping down motions be provided on all spinning mules where it is necessary to go between the carriage and roller beam for the purpose of manual wiping or drying down, with the reservation that where paste continues to be used some latitude be given for experiment as to the type of wiper most suitable."

It is felt by the Committee that the provision of these wiping down motions is a matter which could be dealt with by voluntary agreement. The experience of the Cotton Industry has shown that voluntary agreements can be quite effective in obtaining improvements in respect of health, safety and welfare, particularly where such agreements are constantly under the review of a Joint Standing Committee, whereby advantage can be taken of modern improvements and developments. In view of this the recommendations include the establishment of such a Committee with joint representation to deal with problems arising and this would appear to be the most satisfactory arrangement. We think such a Committee might be formed from the existing Joint Standing Committee under the Cotton Spinning Agreement.

The Sub-Committee, after diligent examination of the facts with regard to the continued use of paste on mules, have not been able to recommend that its use be abolished in favour of tubes. Whilst such a prohibition would enable all mules to be fitted with wiping down motions as at present devised, we agree that it is not yet practicable. On the other hand, we feel that there should be no great difficulty in fitting a motion suitable for those cases where paste is used and strongly recommend that further experimental work, with a view to overcoming the difficulties of installing wiping down motions for mules using paste, should be expedited and so obviate the necessity for manual drying down in all cases where it is now necessary to enter the space between the carriage and roller beams for this purpose.

We discussed the difficulties in respect of the labour supply and the obtaining of material for the mechanical wiping down motions and the non-splash devices. The delay in the installation of these improvements has been due in the past to the inability of firms to obtain adequate supplies of material or to allocate labour to their manufacture. Such difficulties are likely to increase with a more general demand for these appliances unless more labour and material are made available and we recommend that every possible step be taken to obviate delays from such causes in the future.

Finally, we desire to express our very great appreciation to Mr. Hird, and all the members of his Sub-Committee, on the expeditious manner in which they have carried out their task and the concise and comprehensive expression of their findings in their Report.

We are, Sir,
Your obedient Servants,

REPRESENTING

The Federation of Master Cotton Spinners' Association Ltd.
GEORGE A. BARNES
W. M. WIGGINS

The Cotton Spinners' and Manufacturers' Association
JOHN F. C. GREY
GEO. B. FIELDING

The United Textile Factory Workers' Association
ARCHIBALD C. C. ROBERTSON
A. NAESMITH
CHAS. SCHOFIELD
J. PROCTOR

The Factory Department (Ministry of Labour and National Service)
G. P. BARNETT Chairman
T. P. THRELKELD
S. HIRD

E. K. BLACKBURN, Secretary.
17th May, 1945.

APPENDIX

72, Bridge Street,
Manchester, 3.

REPORT OF SUB-COMMITTEE "D"

G. P. BARNETT, ESQ., H. M. Deputy Chief Inspector of Factories.
Chairman of the Main Committee considering conditions of Work in the Cotton Trade.

SIR,

We have considered the questions which you referred to us, namely:—

(1) What are the most practical steps which can be taken to prevent, as far as possible, the onset of mule spinners' cancer;

(2) What are the best mechanical methods of wiping or drying down self acting mules and how far can manual methods of carrying out such operations be eliminated;

and after six meetings and four visits to factories, we beg to report as follows:—

ON THE MOST PRACTICAL STEPS TO BE TAKEN TO PREVENT, SO FAR AS POSSIBLE, THE ONSET OF MULE SPINNERS' CANCER

1. The Committee is of opinion that the most certain method of preventing the onset of Spinners' Cancer is to use only such oils for lubrication as are, so far as is known, non-cancer-producing.

2. It appears that only animal and vegetable oils come within this category, but from information supplied to the Committee these oils are not available for lubricating purposes and may not become available for some time. They are at the present time controlled by the Ministry of Food, and used for some important purposes in other ways. The Committee, however, considers that if and when such oils do become available, the matter of their suitability for lubricating purposes should be examined with a view to making them suitable and available for use in this connection. The Committee would further venture the opinion that, having regard to the importance of preventing Spinners' Cancer, and considering also the comparatively small amount of oil used on mules and the much lesser quantity likely to be used if non-splash methods are adopted, the price of such oils should not be a ruling factor against their adoption. The

Committee hopes that research will be continued which will result in the elimination of the cancer-producing constituents in mineral oils and considers that, as with non-mineral oils, they should be made suitable and available for use.

3. In view of the facts stated above as to the non-cancerous oils not being available, the Committee has considered the precautions to be taken in respect of the use of mineral oils at present available.

4. It appears from the researches carried out by Dr. Twort and his colleagues, under the direction of the Manchester Cancer Committee, that mineral oils having certain physical characteristics are found to be least carcinogenic. The oils conforming to a certain specification have now been made available by the Ministry of Fuel and Power and are actually being used by many firms. The suppliers of these oils are able to give guarantees that the oil supplied for this purposes comes within the terms of the specification and as a check on this the Committee understands that The Shirley Institute is able, and willing, to make such tests of these oils as may be found necessary from time to time.

5. The Committee, therefore, makes the following recommendation:—

> That the oils used for the lubrication of spinning mules shall conform to the specification laid down in the Appendix to this Report until such time as non-carcinogenic oils are available.

6. The Committee would further make the following observations in order that practical effect should be given to the recommendation.

7. It would be necessary that the users of the oil should take special care to ensure that they obtain the right kind of oil from their suppliers, and, when obtained, they should store and distribute it in such a way that it cannot be mixed with any other oil. It may not be possible, owing to the different conditions in different mills, to make precise directions as to how this is to be done, but it would seem that the oil should be supplied in containers so marked as to be readily identifiable, should be sealed during transit if that is possible, and when received at the mill the oil should be stored only in receptacles which are also marked distinctively and which must not be used for any other type of oil.

8. It is recommended that a copy of a certificate from the oil suppliers confirming that the oils conform to the formula given in the Appendix should be exhibited, together with a certificate from The Shirley Institute of an annual and independent test.

9. In order to see that the arrangements are properly designed and carried out it is suggested that at each mill representatives of the management and of the operatives concerned should oversee the arrangements made for storage and distribution.

NON-SPLASH METHODS FOR OILING MULE SPINDLES:

10. The Committee agrees that every effort possible should be made to prevent splashing of oil from mule spindles. It is now becoming generally recognised that the present method of oiling spindle bolsters is crude, unsatisfactory, and wasteful.

11. It must be obvious that the method of oiling a bearing by oiling a portion of the shaft (or spindle) outside it, in the hope that some of the oil will get inside the bearing, is crude. It is unsatisfactory because much of the oil, which is put on to the spindles, is thrown off during running and a substantial proportion is not effective for lubrication. It is not so much the economic waste of oil which is of importance, as the fact that the oil so wasted is thrown off in such a manner that the clothes or overalls of the operatives absorb it and transmit it to the body, resulting in the greater liability to Spinners' Cancer.

12. The Committee is, therefore, of opinion that a radical reform in the oiling of spindles is necessary, and would emphasize that the reform will also be accompanied by considerable economy and cleanliness of the surfaces round the spindle. It has been observed that where non-splash methods have been used for some time, the mule carriage and the floor have become noticeably drier.

13. The Committee have seen only one method in operation, but as that method has been in operation a long time it seems to be clearly a practicable proposition. It is a method in which the spindle bolsters are so altered as to allow of an oil pad touching the spindle. This oil pad is at present oiled once a week only, and probably does not need it even so often as that. The result is that the oil splash is reduced to a very small fraction of that involved in the ordinary method. The spindle bolsters seen were of the continuous type and could readily be converted to the oil pad system. Where individual bolsters are used this method may mean the substitution of continuous bolster plates, so made as to accommodate the oil pad.

14. The oil pad method seems to be the most practicable and economic method of oiling, but the Committee has been informed of other methods which have been tried on a limited scale and found successful, though no present instances of the use of these other methods is known. The Committee have also been informed of pad oiling systems equally applicable to both continuous and single bolsters which can be readily adopted with minimum alteration to the mule. The Committee, however, is of opinion that once the need for non-splash bolsters is realised a number of satisfactory types will probably be forthcoming from which selection can be made.

15. They would, therefore, recommend that such devices as will prevent, so far as practicable, the splashing of oil from mule spindles shall be provided, maintained, and used on all spinning mules.

MEDICAL EXAMINATION:

16. The Committee has had evidence from its own members and from others as to the value of the periodic medical examination in detecting at an early stage the onset of Spinners' Cancer so that the appropriate treatment can be given.

17. They therefore recommend that there shall be periodic medical examinations of all persons engaged in mule spinning. Such examinations to take place every six months under conditions which will provide for absolute privacy for the individual and the doctor: the records of such examinations to be regarded as confidential and not accessible to any person other than the doctor: H.M. Medical Inspector of Factories shall, however, have access to these records.

WIPING DOWN DEVICES

18. The Committee has considered the second question referred to it as to the best mechanical methods of wiping or drying down self-acting mules, and of how far manual methods of wiping down can be eliminated.

19. The Committee agrees with the necessity for doing away, so far as is possible, with entry between the fixed and traversing parts of mules and they have seen a number of devices which have been designed for wiping down the carriage tops and the roller beam. These automatic devices obviate the necessity of going between fixed and traversing parts, a proceeding which is attendant with danger notwithstanding all the precautions laid down in the Self Acting Mule Regulations and the Agreement. Where a scavenger cloth extends the full length of the roller beam entry is required for its cleaning: the automatic device should avoid this.

20. Besides the danger mentioned, the present practice is attended with considerable inconvenience to the older people who are now called upon to do this work.

21. A number of automatic devices have been used for wiping down the roller beam and the back of the carriage. Those inspected by the Committee have the common characteristic that a wiper is moved automatically along the roller beam (or carriage, or both) for a distance at each draw, and provision is made for reversing when the wiper arrives at the end of the mule or at the headstock. The mechanical arrangements for effecting this movement and reversal seem to be reasonably effective on each device. It was noted, however, that the arrangements for effecting the movement in some cases involved a

certain amount of danger at the intake of a chain and sprocket or of a band and small scroll. These dangers can, however, be easily guarded, and have, in fact, been guarded in some cases.

22. There are two main methods of wiping the carriage top behind the spindles. In one method the device, mounted on the roller beam, carries a rag or scavenger which, as the carriage lets in, wipes the part up to just behind the spindles. This method seems more or less effective on the fine spinning mules on which it was seen, but it may be less effective on coarse spinning mules where more fly accumulates and where doffings are more frequent. It also seemed unlikely that this method would be effective where paste is used instead of tubes.

23. The second method of wiping down the carriage top is that where the wiper moves along the carriage. This seemed to be a very neat and effective scheme, and more likely to be successful under all conditions, whether on fine or coarse counts, or with the use of paste.

24. On some of the mules seen the device for wiping the roller beam was separate to that on the carriage, possibly involving more expense, and a later modification provides for wiping the roller beam by a brush arrangement mounted on the carriage wiper.

25. It should be noted that on the coarse spinning side of the industry the front of the roller beam is frequently wiped by a hand device which is operated from the back of the mule, and does not necessitate going under. Clearly where this is done no automatic device for wiping the front of the roller beam is necessary.

26. As previously indicated the only difficulty likely to be experienced is that which is connected with the use of paste. The paste which is deposited on that portion of the carriage top immediately behind the spindles remains wet for a certain time, and this fact may necessitate modification of the wiper, or a more frequent renewal of the wiping pad. The use of paste may tend to decrease and eventually cease. The whole question of the use of paste against tubes is bound up with considerations of cost and staffing, and there appear to be very conflicting opinions as to how far paste could be dispensed with in favour of tubes.

27. The Committee would, therefore, recommend that wiping down motions shall be provided on all spinning mules, with the reservation that where paste continues to be used some latitude be given for experiment as to the type of wiper most suitable.

28. It is further recommended that a permanent Committee be formed, representative of employers, operatives and the Factory Department, whose function shall be the consideration and approval of the various methods of meeting the recommendations and approval of the supplies of the devices concerned.

SUMMARY

Our final recommendations are:—

(1) That the oils used for the lubrication of spinning mules conform to the specification laid down in the Appendix to this Report until such time as non-carcinogenic oils are available: subject to the observations in paragraphs 7, 8 and 9 of this Report concerning the practical application of this recommendation.

(2) That such devices as will prevent, so far as practicable, the splashing of oil from mule spindles, be provided, maintained and used on all spinning mules.

(3) That there be periodic medical examination of all persons engaged in mule spinning: subject to the conditions in paragraph 17 of this Report.

(4) That wiping down motions be provided on all spinning mules, with the reservation that where paste continues to be used some latitude be given for experiment as to the type of wiper most suitable.

(5) That a permanent committee be formed representative of employers, operatives and the Factory Department, whose function shall be the con-

sideration and approval of the various methods of meeting the recommendations and approval of the suppliers of the devices concerned.

We desire to express our appreciation of the valuable services of our Secretary, Mr. N. Gregson, in organising the meetings and arranging the visits of the Committee; to Mr. Gregson and Mr. Moore for conducting enquiries and obtaining information for the use of the Committee: to Mrs. Gradwell for the painstaking care given in the preparation of the minutes which have been excellent. Their work in the above respects has greatly facilitated the work of the Committee.

We are,

Yours faithfully,

S. HIRD, *Chairman*.
K. BIDEN-STEELE.
GEORGE CLAPPERTON.
J. S. HAYDOCK.
ALBERT KNOWLES.
JOHN LINDLEY.
W. S. MOORE.
CHARLES SCHOFIELD.
J. W. WHITWORTH.

N. GREGSON, *Secretary*.
17th April, 1945.

APPENDIX

Specification for Least-Carcinogenic Mineral Oils for lubricating mule spindles.

" Mule spindle mineral lubricating oils should have a specific refractivity below 0·5539 when the specific gravity is above 0·895, or a specific refractivity below 0·5569 when the specific gravity is below 0·895. By specific gravity is meant the specific gravity at 60° F. in relation to water at 60° F. vacuo/vacuo."

" By specific refractivity is meant $\frac{n-1}{d}$ where n is the refractive index for D line sodium light, and where d is density in grammes per millitre at 20° C. The specific gravity shall be determined by the method laid down in standard methods for testing petroleum and its products, published by the Institution of Petroleum Technologists."

" The density shall be determined by means of a pyknometer or bottle having a minimum capacity of 10 millilitres or by a density hydrometer. If the latter is employed it shall conform to the British Standards Specification No. 1A or No. 2A. The thermometer employed must be accurate to within $\pm 0\cdot 1°$ C."

" The refractive index is to be determined by any recognised form of refractometer provided that it is capable of giving results to an accuracy of $\pm$ 0·0005. This instrument should be calibrated and periodically checked with liquids of known refractive index, such as carbon tetrachloride or benzene."

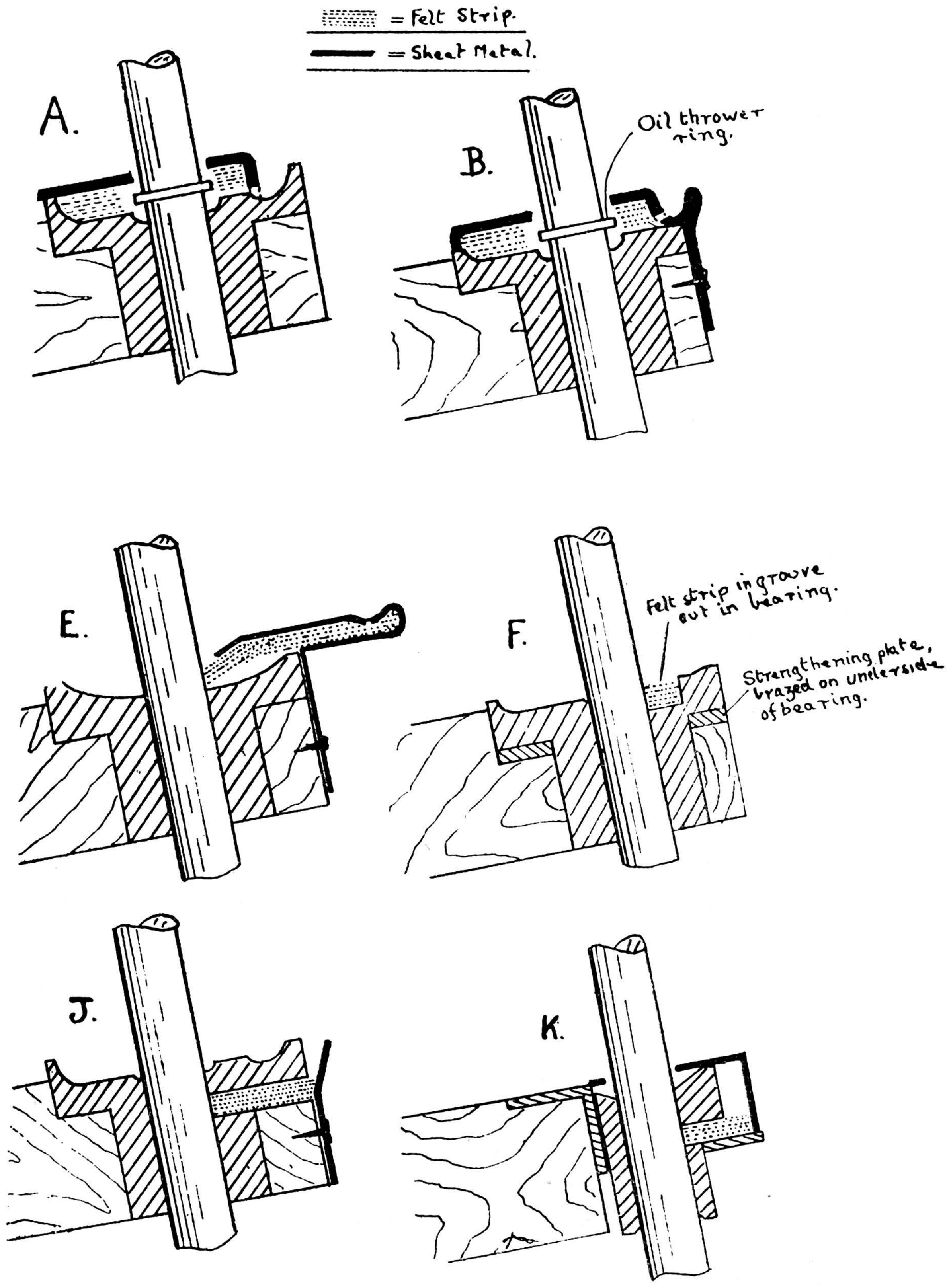
" Special care must be taken that the temperature of the sample is in equilibrium, and that of the bath controlled to $\pm$ 0·5° C."

SCHEDULE

Devices approved by the Sub-Committee for Reduction of Splash from above Top Spindle Bearings

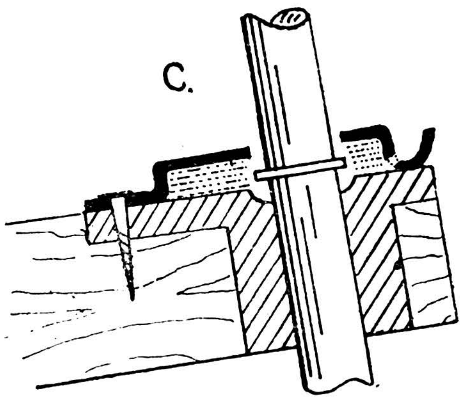
(1) Manufactured by the Farnworth Engineering Co. Ltd., Joseph Street, Farnworth.

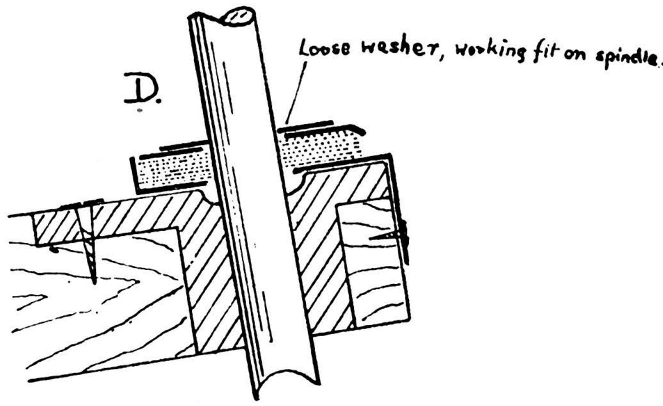
DRAWINGS ...	... A, B and C.
APPROXIMATE PRICE ...	From 2½d. per spindle (1⅛ in. gauge).
FITTING ...	... Extra. Approximately £6 3s. 0d. per mule.
COMMENTS ...	... May result in slight loss of spindle length ($\frac{3}{16}$ in. maximum) with flat-topped bolsters. Negligible loss of spindle length with contoured topped bolsters. Design shown may not be satisfactory for use with paste but modifications are being developed.
SPLASH TEST ...	... Very good.

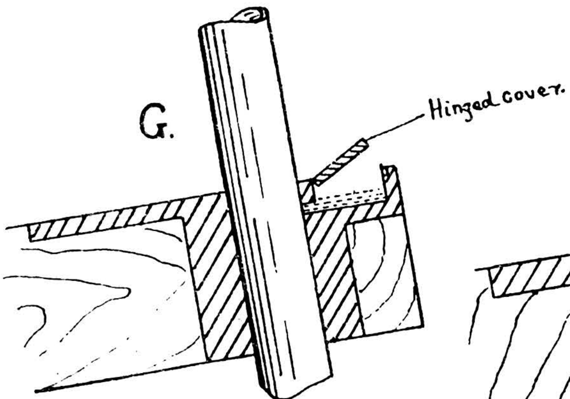


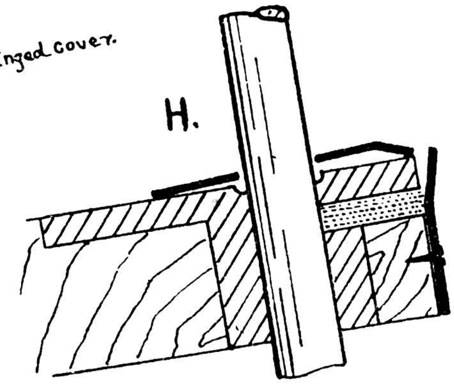
(2) Developed by Peel Mills Ltd., Bury. Manufactured by Hathershaw Sheet Metal Co. Ltd., Wellington Works, Brunswick Street, Oldham.

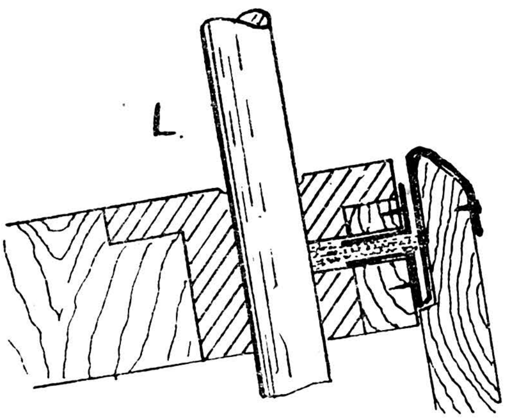
DRAWING ...	... D.
APPROXIMATE PRICE	... 2d. per spindle.
FITTING ...	... Device requires lightly screwing to front of spindle rail. Washers may require slight reamering.
COMMENTS ...	... May result in slight loss of spindle length ($\frac{3}{16}$ in. maximum). Suitable for use with paste.
SPLASH TEST ...	... Good.

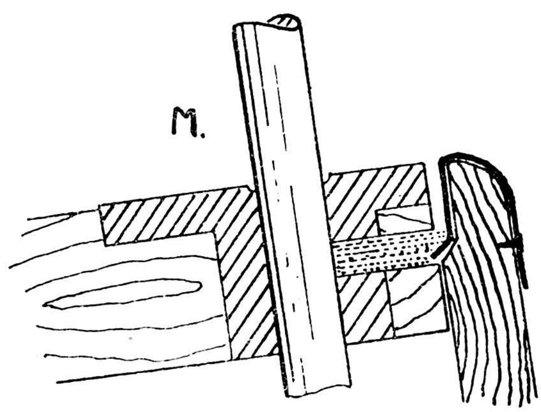












(3) Manufactured by Dobson & Barlow Ltd., Bradley Fold, Bolton. Known as the "Tonge" device.

Drawing ...	... E.
Approximate Price	... 2d. per spindle.
Fitting ...	... Device only requires lightly screwing to front of spindle rail.
Comments ...	... May cause slight loss of spindle length with flat-topped bolsters. May not be satisfactory with paste.
Splash Test ...	... Very good.

(4) Manufactured by Dobson & Barlow Ltd., Bradley Fold, Bolton. Known as the " Barnsfield Plate ".

DRAWING ... ... G.
APPROXIMATE PRICE ... 2/- per spindle.
COMMENTS ... ... Complete new spindle rail required. Suitable for use with paste.
SPLASH TEST ... ... Good.

(5) Manufactured by the Musgrave Spinning Co. Ltd., Chorley Old Road, Bolton.

DRAWING ... ... F.
APPROXIMATE PRICE ... 7d. per spindle.
COMMENTS ... ... Spindle rail may have to be recessed more deeply to accommodate strengthening section. May not be satisfactory with paste. Only applicable to mules with continuous bolsters.
SPLASH TEST ... ... Fair.

(6) Developed by Abraham Stott & Sons Ltd., Osborne Mills, Busk, Oldham. Work can be undertaken by Oldham Textile Engineering Co. Ltd., Brunswick Street, Oldham.

DRAWINGS ... ... H. and J.
APPROXIMATE PRICE ... 3½d. per spindle.
COMMENTS ... ... Suitable for use with paste.
Spindle rail may be grooved without removal from the mill. Bearings require burrs to be removed from inside after cutting. Applicable to continuous and individual bolsters.
SPLASH TEST ... ... Good.

(7) Developed by Abraham Stott & Sons Ltd., Osborne Mills, Busk, Oldham. For Asa Lees mules with individual brass journals or bearings held in a steel strip.

DRAWING ... ... K.
COMMENTS ... ... Suitable for use with paste.
SPLASH TEST ... ... Very good.

(8) Developed by (*a*) the Lancashire Cotton Corporation Ltd. at Ace Mill, Hollinwood, Nr. Oldham. (*b*) Joseph Clegg Ltd., High Crompton, Shaw, Nr. Oldham. (*b*) Work may be undertaken by Oldham Textile Engineering Co. Ltd., Brunswick Street, Oldham.

DRAWINGS ... ... (*a*) L. (*b*) M.
APPROXIMATE PRICE ... 3½d. per spindle.
COMMENTS ... ... Suitable for use with paste.
Spindle rail may be grooved without removal from the mill. Bearings require burrs to be removed from inside after cutting. Applicable to continuous or individual bolsters.
SPLASH TEST ... ... Good.

Method approved by the Sub-Committee for elimination of splash from between the top bearings and footstep bearings.

The portion of the spindle between the spindle rail and footstep should be enclosed where this is not already done (some mules are without complete lower carriage doors).

NOTE.—Splash tests must be considered only as indicating the relative merits of the devices in the matter of oil-spray immediately after oiling. It must be remembered that the frequency of oiling is reduced to less than one-tenth by using one or other of the devices.

A VISIT TO U.S.A.*

The Chairman opened the meeting by stating that Mr. H. G. Greg and Mr. A. F. W. Coulson were to give short accounts of their recent visit to the U.S.A.

Mr. Greg :

Any points that I may make this afternoon must be taken merely as observations and not necessarily my own views—I do not wish to get into any trouble with anybody, including trade unions, Government Departments, and all other interested parties.

Towards the end of the war I was feeling rather tired and weary and conscious of having been confined to my own premises during the war. The difficulties of travelling and the shortage of staff and complications of running a mill in war-time made it well nigh impossible to travel as one used to do, so I said to Mr. Coulson, when he was on leave from the Navy, that we would take the earliest opportunity of getting out of these confining circumstances. After Mr. Coulson's demobilisation we decided to visit the United States of America as we realised that the present was the time for planning and reconstruction, even if the plans could not be put into work immediately. I had a background of the United States as I had been there in 1926, when I first started in business. My father wanted me to get as wide a view of cotton spinning as possible before I settled down. Mr. Coulson had been in the United States in 1933 to 1934 as a scholarship holder. He spent a year there then, during which time he made many valuable contacts which were very useful to us on our recent trip. We put matters in hand to start soon after Easter, but the usual delays set in and we left this country in the middle of May and reached New York on the 27th May. We left New York for England on the 20th June, so we actually spent three weeks and four days on the other side. It was rather important to note the date because the O.P.A. (Office of Price Administration) was then functioning normally, and since then, of course, its powers have been considerably reduced or removed entirely, and things are different over there since we left. Before actually embarking we had considerable difficulties with Government Departments, but eventually we overcame them all and sailed from Glasgow.

We arrived at New York and there found a haven of plenty. Sweets, cigarettes, whisky, and pretty well everything that we don't see over here was in ample supply. The thing in shortest supply probably is hotel accommodation and the position as regards this really is rather difficult and needs careful watching. However, if you plan far enough ahead there should not be any real difficulty, and we didn't experience any disappointments during our stay. On landing on the other side one soon realises one is in quite different country as many things are done in what we should (in our insular way) claim to be the wrong way. Of course, they drive on the wrong side of the road, and they also write their dates differently. For instance, when we write a date we always say the day, the month and the year, and they say the month the day and the year. This may be muddling at first, but it is the way they do it and the way they like it, and the way visitors have to learn.

The Office of Price Administration (O.P.A.) permeated the whole life of the U.S.A. The ceiling prices were fixed for some time in 1942/43. In all hotels and restaurants there are lists of these prices. No goods can be sold at higher prices than the ceiling prices so fixed. There is a considerable scarcity of consumer goods, though nothing like the scarcity we have over here. Then if you think that their scarcity is only half as bad as ours there would still be scarcity. As far as we could judge, a good many people were putting goods into warehouses, because they anticipated the not far distant collapse of the O.P.A. when higher prices could be obtained. After all, this is only human nature! We discussed this matter with many people whom we met while we were over there.

* Addresses at a lunch-time meeting, August 30th, 1946.

and they all told us that they anticipated a moderate rise in prices when the O.P.A. ceilings came off, but they were of the opinion that there was an adequate supply of consumer goods stored in warehouses, against the rise of prices which would be freed when ceilings came off, and these stocks would prevent prices from rising unduly high.

I am not going to try to give the relative cost of living. We stayed at hotels where we could get accommodation and not such hotels as were likely best to suit our purses. Had we remained in the country for a more extended period we could, of course, have obtained much cheaper accommodation than that which we actually did. Nevertheless, the cost of living was somewhat higher over there than in this country, but then, of course, the standard of living too was vastly higher. We had no difficulty in travelling and did almost all our journeys by rail. We always made reservations on the trains and found very little difficulty in doing so. In every case the accommodation was reserved as arranged, and was extremely comfortable. Railroad travelling seems to have settled down from its wartime peak difficulties very quickly, and pretty well completely. We did not travel by air at all, but we made one trip by long-distance bus, of about 70 or 80 miles, which, apart from being intolerably hot, was comfortable and extremely quick.

The hospitality we received over there was beyond all imagination. We had good introductions and were most cordially welcomed wherever we went. We never made any bones about our mission—which was that we were a couple of cotton spinners, wishing neither to buy nor to sell, but to investigate for our own information what was doing in the cotton industry in America, and we were given all the information that we required. On our part we did, of course, endeavour to answer any questions that our friends over there put to us as regards the conditions of trade on this side of the Atlantic. The Americans are very friendly to us, but the 3,000 mile Atlantic standing between the two countries does make for two quite different communities on each side. While a fairly large number of Americans travel over to this country, it must be realised that it is an infinitely small percentage of the total American population, and most of them are not in the least interested in what is going on on our side of the Atlantic, as they feel sure it is nothing to do with them, and in any case they have plenty of troubles of their own and things to think about. We enquired of several of our friends what the prospects were, in their opinion, of their country granting us the loan that we were then asking for. Two people replied in this strain. "Well, I don't know a thing about it" (as much as to say I don't care) "but as soon as I saw your country wanted a loan I guessed you'd get it. Whenever you ask for anything from this country you always get it." The Americans are no more interested in the starving conditions in Europe than is the 'man in the moon.' We tried to explain clothes rationing, but it was so difficult to explain and so utterly incomprehensible to the person to whom we were trying to explain it, that we had to give it up as an impossibility. Nevertheless, the Americans are always interested to talk to English people and to get their views and their reactions, and many of them are well informed.

The cotton industry in America (as many of you will know) started in the Northern states, where they engaged their labour and did their business. Labour became more and more difficult to secure in the Northern states and the industry gradually shifted from the New England district further and further south. Today there is very little of the cotton textile industry in the North and it is almost completely in the South. This has come about chiefly owing to the difficulty of getting labour in the North and the cost of that labour particularly compared with the cost of labour in the South. The same conditions seem to be operating over there which deter people from entering cotton mills. These include other places of employment where conditions are considered more attractive, and the higher wages offered in other industries. The drift of labour from cotton which almost killed the Northern industries seems to be showing signs of taking place in the South. It appears to me that the South is rapidly approaching the condition that the North was in and is, as regards labour, very similar to our own industry over here.

In Atlanta, Georgia, we found one mill which sent motor buses 30 miles out into the country to collect workers each day and take them home again after their work. We heard that General Motors Corporation were building a huge assembly plant in Atlanta, Georgia, and it will be interesting to see how the higher wages General Motors will presumably offer will react on the labour position in cotton mills.

We were rather impressed by the youthful age of many of the executives we met. These executives were young men, active and extremely well educated technically, well informed and knowledgeable. It rather struck me that a young man over there gets his opportunity while he is still young, and is very often given a more or less free hand to reorganise the mill to which he is appointed, with the latest machinery and other appliances. The technical education of potential executives is reaching a very high standard in America.

No visitor to the United States can fail to be impressed by the technical press. Most members of the Textile Institute are familiar with the American magazines "Cotton" and the "Textile World." The alertness and comprehensiveness of the technical press goes a long way in distributing technical information quickly. No detail seems to escape the editors. The members of the staffs of the technical press are able technical men, and it is quite usual for a person to leave a well paid job in industry to take up a similar job in technical journalism, and *vice versa*. It is interesting to find that the Textile Institute *Journal* is held in the very highest esteem in America as a technical publication.

Americans are, of course, very "conference minded." They hold "Conventions" or meetings on a grand scale, where not only technical matters are discussed with very great freedom, but where the social side is also very highly developed.

The trade union position is interesting. The strength of the unions is developing very rapidly. While not yet very strong in the South, very rapid progress is being made, and I think they will very soon be all powerful in the South as they are now in the North. The trade unions arrange all forms of contract for employment between employer and employee, and these contracts are most detailed and elaborate. The unions are cleverly led by strategists and place, as far as I can gather, the major emphasis on "self interest." The whole of the United States had just been badly shaken by a railway strike. This took place on the Saturday and Sunday before we landed, and its brevity caused little inconvenience, but it made the average American realise how everything could be paralysed by trade union action and most Americans now will do almost anything to avoid a repetition of such a strike. I would ask you to consider these last remarks as observations, not as opinions.

We called on the two leading makers of textile spinning machinery—the Whitin Machine Works and the Saco-Lowell. These two firms between them supply nearly all the machinery used in the spinning section and are in deadly but very friendly rivalry. Competition between them is intense, and as a consequence, each is always striving to improve its products and its service, and lessen its price. Both firms are making great improvements in the manufacture of machinery and are devoting much time and money to technical research. We also visited the Draper Corporation, makers of Northrop automatic looms, and were much impressed by their manufacturing and machining methods. Both Whitin's and Draper's have very largely mechanised their iron foundries. During the war all these plants were on munitions and just now 12 to 18 months is being quoted for delivery of new machinery.

We visited quite a number of typical mills in the South, spinning coarse to medium cotton yarns. I will not go into great detail as Mr. Coulson will deal more fully with the technical side, but a good average description of a mill would be as follows:—A number of small hopper bale breakers, sufficient in number to give not only the required production, but also ample blending of the various different bales of cotton which go to make the mixing. These hoppers are fitted with coloured light signals to show when they require feeding with more cotton. From the hoppers the stock is delivered on to a travelling apron, to aid blending, and via the apron to a hopper feeding a single process opener. The cotton is not touched by any operative from the time it enters the hopper bale breaker until it is made into a lap suitable for the card.

Cards are usually 39″ wide and produce 350 pounds per week. After carding there are two stages of drawing, one speed frame process and a spinning process, usually on a high draft ring frame. The speed frame process uses draw frame sliver and produces around 1¼ hank or 2½ hank roving. For coarse work four rollers are used in two drafting zones, without special apparatus, but for finer work (i.e. finer than 1¼ hank) two zones are used, one of which has high draft apparatus fitted. We saw no mule frames, all the spinning being done on ring frames.

We had some discussions on roller covering. We saw some leather covered rollers, many synthetic resin covered rollers, and on draw frames some metallic top rollers. The popularity of each sort of covering seemed to go in cycles, and there seemed to be insufficient evidence to point to any one type of covering being an unqualified success.

We did not see much in the way of canteens, though that is a development that is coming. Working conditions on the whole are good, and air conditioning is on the increase. One plant was installing full air conditioning apparatus, with provision for cooling, a necessary matter when outside temperatures reach 95° Fahrenheit or above. Some plants use water atomised by compressed air as a cooler. By making the air absorb water in this way, the humidity is raised and the temperature lowered. The humidity in weaving sheds is kept very high and to us was most unpleasant. In some sheds we could not see across from one side to the other as there was so much moisture in the air. However, the looms ran well under these conditions, and the workpeople seemed to welcome that state of affairs.

In conclusion, I might say that I shall be delighted to answer any questions that anyone may have to put to me, but I shall regret if they develop into a discussion. We went to the United States to make a survey of the situation as we found it there, and we think it is only fair, when we return, to put the facts, as our American friends gave them to us, in front of as many people as we can.

Mr. Coulson :

Mr. Greg has described to you conditions as we found them in America, with regard to living, travelling and visiting in that country, and more specifically in those portions of the American Textile Industry which we visited. Mine is the more prosaic task of giving you a few facts and figures which we collected as we went around from mill to mill.

First, however, I should like to remind you that there have been so many reports published on the American Textile Industry in the last 10-15 years, that anyone who has studied them all probably knows a great deal more about American textile methods than he does about our own industry in Lancashire. This is true, not only of the general structure of the two industries, and the conditions of trading, but also of such intimate matters as spindles per spinner, end breakages per 100 spindles, twist, draft, spindle speeds and so on. It follows, I think, that you should not expect to learn anything new this afternoon as a result of our three weeks visit, and the best I can hope to do is to remind you of some of the known facts and explain how various differences between the two industries have come about, in the light of some of the things we saw.

Mr. Greg mentioned in his talk that I was in America for a year in 1933 to 1934. During that time I had ample opportunity to study very carefully conditions in the American textile industry, and my chief preoccupation during the last short visit was to compare conditions then and now and to note the direction in which progress had been made.

The movement of the industry from New England to the South was well under way in 1933, and had apparently continued up to the outbreak of war. New mills had been built in Georgia and Alabama and more mills in New England had closed down. The new mills in the South are of moderate size, probably containing, on the average, 50,000 ring spinning spindles and looms to balance. Many of the plants do their own dyeing and finishing and some make up the finished article, be it a towel, sheet or handkerchief.

The biggest changes on the machinery side have taken place in the card room and winding room. Fifteen years ago the Whitin Machine Works had just introduced their single passage speed frame and one or two of these were running experimentally in the mills. Today we were led to believe that the conventional speed frame with bobbin creel was obsolete, and if any of the mills we visited had this type of frame still working, at least they did not show it to us. However, I think the truth of the matter is that the ordinary speed frame is obsolescent and is being replaced as quickly as the machinery makers can manage with the single passage type of frame.

Automatic high speed winding of either the Abbott or Barber Colman type appears to be very nearly universal. High speed warping running at 450/600 yards a minute is in general use in connection with magazine creels containing either Abbott cones or Barber Colman spools.

Package dyeing has practically replaced hank dyeing and such processes as reeling, ball warping and section warping were not seen and must be used only in very few mills in America today.

Having thus referred briefly to the principal changes in processing methods which have taken place since my last visit, may I now describe conditions as we found them in a little more detail. I should like to start off with working hours and working conditions.

Textile plants in America are working on a three-shift system. The hours most generally favoured are from 6 a.m. to 2 p.m., from 2 p.m. to 10 p.m. and from 10 p.m. to 6 a.m. However, a number of mills work from 7 a.m. to 3 p.m., 3 p.m. to 11 p.m. and 11 p.m. to 7 a.m. and report that the 7 o'clock start for the first shift is very popular with the workpeople. There is no organised break for lunch, the workpeople taking such refreshment as they can while their frames are running, some workpeople bring sandwiches from their homes, others purchase buns, cakes, sweets and cold drinks from the buffet wagon which is pushed round the plant at intervals. In general, plants appeared to be working the full two shifts and only part time on the third shift, owing to shortage of labour. The mills we visited in the South were well constructed and light and had excellent equipment for artificial lighting. Temperature and humidity were adjusted to give the best running conditions for the work, and there appeared to be very little regard for the comfort of the workpeople in this respect. In the weaving room, the humidity was often maintained at an extremely high level, stated by the management to be about 95 per cent. Such high humidity caused visible clouds of vapour to form in the upper air and the conditions were unpleasant even for the visitor who walked through the room. We saw few amenities for the workpeople in the way of canteens, rest rooms, first aid, medical, dental services, etc. On the other hand the mill villages were usually well designed and laid out and provided with concert halls, recreation rooms, swimming baths, and many other amenities for the use of the workpeople in their leisure hours.

The minimum wage for a sweeper in the textile industry is 65 cents per hour for a 40 hour shift, and time and a half for the additional 8 hours being worked at this time. The wages for the more skilled workers are considerably higher than this minimum and, indeed, it may be taken that, on average, wages are about twice as high as in this country.

Male labour is employed very generally on all processes except ring spinning and winding, and even in spinning male doffers are used. Negroes are employed in the opening room and sometimes in the blowing room, but not elsewhere in the mill. Taken as a whole, I think it is true to say that labour in textile plants in America today works harder on average than in this country, works under worse conditions and is paid nearly twice the amount the British worker is paid. There are, of course, exceptions to this general statement as I shall note later on, and it should also be remembered that the rate of pay must be considered in relation to the cost of living and average standards of living in the two countries.

The textile plants, particularly in the southern states of America are all comparatively new, and most of them were planned as complete production units. It is not surprising, therefore, to find the arrangement of processes carefully co-ordinated to facilitate the flow of production through the plant. The balance of machinery in the mills visited was extremely good, and it was quite uncommon to find frames stopped waiting for work. This state of affairs had, of course, been brought about by the mass production methods practised, with the resulting small number of changes in counts, qualities and cloth particulars. The lay-out of the individual machines is, in general, no better than in this country; alley-ways are very narrow and in the weaving room the looms are packed very close together. The general appearance of many plants was greatly improved by the absence of overhead belts and line shafts, individual motors being the common method of driving frames. In one large weaving shed visited, the looms were belt driven, but the line shaft was placed underneath the floor, the belt drive to the looms passing through small holes.

Finally, a word about machinery staffing and operative hours per 100 lb. produced. This is a very important subject, because so much was said about operative production in the Platt report and many of the figures were quoted in the Working Party Report, and held up to Lancashire as a sort of challenge. Now, my first impression on reading the Platt Report was that there must be an unbridgable gap between the working efficiency of the operative in this country and in America. However, having seen both groups of operatives at work, I could not really believe that this was so. Some little time ago, therefore, I sat down with a pencil and paper and went into the whole matter very carefully, as a result of which I became convinced of three things. First, the operative in America does not work any harder than the operative in Lancashire on certain processes such as slubbing, drawing and winding, but that on certain other processes such as beaming and roving, the operative in America does work harder than the operative in Lancashire and, indeed, as hard as our operatives on slubbers and winding frames. In other words, the energy or work output per operative in America is more consistently high, as between one process and another, than it is in this country. Secondly, in order to achieve the American O.H.P. figures on certain processes, American type high speed and automatic machinery must be used. Thirdly, if this machinery is to be used, the number of counts and qualities produced in our mills and weaving sheds must be very much reduced to enable long and steady runs to be achieved. Let me illustrate these points by referring to some figures for O.H.P. for various processes, given on page 270 of the Working Party Report. These figures were provided by the Shirley Institute and are based on other figures for P.H.M. given in the Platt Report.

Opening and Blowing

The usual system of opening and blowing in America is the single process method from bale to lap. Very large mixings are made and it is quite common to find 20, 40 or even 60 bales opened at one time and being used in one mixing. To ensure adequate blending of the cotton from all these bales a large number of blending hopper feeders are employed, all feeding on to one blending apron. For a sixty bale mixing, ten such hopper feeders might be used and six bales fed through each machine. Specialisation of labour is practised in this department as in most others. Men will be employed on opening and feeding the bale cotton. A man will be responsible for oiling and cleaning the machinery and another will be in charge of the lap heads and will be responsible for doffing and weighing the full laps and restarting the machines. I have seen one man attending to as many as ten lap heads, doffing and weighing a lap from each machine every six minutes. This is a very big job and can only be done if the work is arranged so that the machines stop for doffing in rotation and by having the weighing scales on a track running parallel with the lap heads and always near at hand. The lap man probably does not work any harder than a man minding an opener and two scutchers and doing all the work connected with them, but he does work harder than many men in this country in charge of single process machines.

The O.H.P. figures given in the Working Party Report for opening and blowing are as follows:—

Coarse Work		*Medium Work*	
British	American	British	American
0·48	0·39	0·64	0·56

The difference in favour of the American output is due, I think, to the greater prevalence of single process machinery in America and also to the tendency in this country to reduce the work load on the operative when single process machinery is installed. This point cannot be stressed too much. Whenever labour saving machinery is installed in America the worker's job is reassessed and he is given as much work to do as formerly so that output goes up. At the same time a proportion of the saving is handed on to the worker in the form of higher wages. In this country the tendency is to hand over a proportion of the effort saved to the worker so that the production does not go up by so much.

Carding

The work on carding is specialised; one man will do only stripping, another grinding, another card tending and another can doffing. In spite of this O.P.H. tends to be lower in this country than in America, and in addition I think the carding in Lancashire is, on the whole better than in America.

The figures for carding are:—

Coarse Work		*Medium Work*	
British	American	British	American
0·69	0·89	0·82	0·83

Drawframes

The O.H.P. figures for drawing are:—

Coarse Work		*Medium Work*	
British	American	British	American
0·40	0·26	0·73	0·44

The difference here is due mostly to the practice of using one or two processes in America against two or three in Lancashire. In America, men are employed on drawing and their extra energy and strength probably enables them to mind more machinery or maintain a higher machine efficiency. I have seen drawing tenters in America minding as few as 16 deliveries and as many as 84. Speeds are, on the whole, lower than in this country and hanks finer. Twelve inch diameter cans are universal.

A good average job in America would be 36 deliveries running at 300 r.p.m. of the $1\frac{3}{8}''$ front roller and producing 0·128 hank sliver.

Speed Frames

As I said earlier in this talk, the single passage speed frame is now in very general use in America and in my opinion the figures given in the Working Party Report for O.H.P., for speed frame processes in America, are out of date as they are based on the use of the slubber only, for coarse counts, and the slubber and rover for medium counts. These figures do, however, show that output per operative is similar in the two countries on the slubber, but lower in this country than in America on the roving frame. The full story, as I see it, goes rather further than this.

At the present time the aim of all American mills, is to install one process of speed frames, to convert the drawframe sliver into roving for the creel of the spinning frame. In coarse mills the speed frame may be a conventional slubber and drafts up to six will be used. In medium and fine mills the speed frame will be an inter-draft single passage frame, for drafts between 6 and 12, and a super-draft frame for drafts between twelve and thirty. The hank number of the drawframe sliver will be altered, to enable this range of drafts, on the speed frame, to produce the hank number of the roving required.

The number of frames allocated to each operative is such that the work is just the same, whether the man is minding coarse, or fine, hank frames. As an example, one man may mind one slubber of 100 spindles on 0·5 hank, two slubbers or 200 spindles on 0·76 hank, two inter-draft frames or 300 spindles on 1·25 hank and four super-draft frame or 600 spindles on 3·5 hank. In this way, the cost per pound of producing 3·5 hank is only greater than the cost per pound of producing 0·5 hank because of the more frequent doffing of the smaller package. It is the old story that all the speed frame operatives work as hard as our slubbing tenters and not as in this country, that the work per operative gets progressively lighter as the hank becomes finer.

Ring Spinning

The O.H.P. figures for ring spinning are:—

Coarse Work		*Medium Work*	
British	American	British	American
3·27	2·24	10·96	5·74

Here again you will see that the output per operative in America is higher than here and the difference is greater for the finer work than for the coarser.

The spinner in America is given a job based on the work involved and not directly on the weight spun or the number of spindles minded. Hence there is a very great incentive for the management to make the work run better so that an operative can mind more spindles. The end breakage rate per 100 spindles per hour aimed at is about 25 and many mills are achieving this result.

A typical range of jobs in America is 800 spindles per spinner on 9s; 1400 spindles per spinner on 30s and 1800 spindles per spinner on 43s. This is for the spinner who does all the work. Where specialisation of labour is worked the job per spinner in terms of spindles is greater still.

As I mentioned earlier, men doffers are normally employed and by using very large spinning packages it is possible to put these men in charge of a very large number of frames. The usual procedure is to have the doffers working in pairs, and as the spinning frames are all much shorter than ours the loss of production due to the frames being stopped for a longer period for doffing is not so serious as it would be in this country.

Typical figures for spindles per doffer are:—

9s Warp on 6 oz. bobbins	3,600 spindles per doffer
30s ,, ,, 3½ oz. ,,	4,900 ,, ,, ,,
43s Weft ,, 2½ oz. ,,	3,000 ,, ,, ,,

I believe these men work rather harder than our doffers when due allowance has been made for the larger packages, and this is probably because men have more stamina and energy than the young girls we employ.

Yarn Preparation for Weaving

In all the mills we visited, yarn was prepared for the loom on back beams and slasher sized onto weavers beams. Mill warps, cheese warps or section warps were not used and I imagine will be very exceptional in an industry organised on a vertical system where the yarn is spun and woven in the same premises.

Three principal systems of winding and warping are employed:—

(1) The Barber Coleman high speed spooler running at speeds up to 1,500 yards per minute and high speed warping at speeds up to 900 yards per minute.

(2) Abbott automatic cone winding at about 400 yards per minute and high speed magazine cone creels beaming at about 450 yards per minute.

(3) Universal or Foster cone winding and magazine cone creel beaming (these winders are also used for hosiery cones).

The O.H.P. Table I have referred to so far gives figures for processes beyond spinning and in particular shows that for winding and beaming the greatest differences occur between our productions and the American outputs.

These differences are ascribable only to two things—the size of the winding off package and the types of automatic and high speed machines used in America.

Thus in winding, the output is controlled almost entirely by the size of the spinning package and the time of the piecing cycle. By using an automatic winding machine of the Abbott or Barber Coleman type, the piecing cycle comes down from 8-12 secs. on conventional machinery to 2-3 secs. If in addition the weight of yarn on the winding off package is doubled the output per operative goes up about eight times. And this is what happens!

Typical productions on the Abbott machine per operative per 48 hours are 10,000 lb. of 12s wound from 4 oz. packages or 5,000 lb. of 30s wound from 2 oz. packages. The output on the Barber Coleman spooler is very slightly less but is offset by a slightly greater output in beaming.

In high speed beaming one operative normally minds one or two machines and the magazine creeling is done by a creeling team of two, whilst the machine is running. The creelers work hard—as hard as our winders work on piece-rate. The beamer tenter has a full time job too, because these machines run at 450 to 900 yards per minute and a 530 lb. beam with 30 in. flanges and containing, say, 30,000 yards and 445 ends is made every 45 minutes.

As spinners and doublers we did not take any particular notice of weaving conditions, but we did see enough to confirm the very high machine and operative efficiency in this department. Indeed we were told many times that a concern will go to untold lengths to maintain the loom efficiency, since this is the most important single factor affecting cost of production. It is clear, therefore, I think, that the high figures for output per operative obtained in spinning and preparation are not obtained at the expense of the weaving shed.

Before I sit down I should like to impart one word of warning about the use of this rather popular index called O.H.P. or operative hours per 100 lb. of production. An operative hour is not an invariable unit like, say, one penny in costing. It may be a sweeper hour, a spinner hour or an overlooker hour or a director hour. In other words it may vary in usefulness and cost. In using it the fact should always be borne in mind that two firms with the same O.H.P. may yet differ in their costs of production and in efficiency of management. Other things being equal, a firm practising specialisation of labour should show a lower O.H.P. than a firm not specialising in this respect. A firm with an elaborate production planning system similarly should show a lower O.H.P. If this is not the case then the cost of time study and production specialists, all of whose time is taken into account in working out the O.H.P. will throw up the cost per lb. for such firms.

Just at present, it must be admitted, labour is so scarce that low O.H.P. becomes almost an end in itself and cost considerations become of secondary importance.

THE EXTENDING USE OF WELDING

By C. W. Brett, M.Inst.W.

(Managing Director of Barimar Ltd., Scientific Welding Engineers)

Few industries employ so wide a range of mechanical equipment as those engaged in the production of textile goods. This implies more than usual versatility in the maintenance of the plant concerned It also indicates the desirability of keeping in close touch with all applicable phases of engineering development with a view to improving quality still further and at reduced cost whenever possible.

A branch of research which has been particularly fruitful during recent years is that of scientific welding. It is used in the manufacture of factory equipment of all kinds, particularly where great strength and small weight are desirable. A special field of appeal is in the fabrication of machinery of which only one or two " off " are required, for it eliminates the cost of pattern making which is an inevitable preliminary whenever castings are employed.

In relation to general maintenance and repair work welding is in an unassailable class. This is primarily because of its complete dependability combined with the speed with which such work can be done and the modest cost. Of course, these desirable results are not accomplished without a great deal of experience on the part of the specialists employed and their operators. It is significant that a guarantee is invariably given, a procedure made possible first by the ultra care that is taken and secondly because of the strictness of inspection at each stage of the work. This includes radiographical viewing of the weld.

Within the space of a short article it is not possible to do more than touch upon a few of the applications and therefore rather better known opportunities are set aside to give room to work of a more recent nature.

It is fairly well known that practically every metal in commercial use can be handled successfully and that completely trustworthy welded unions can be made between such seemingly unlikely combinations as steel and aluminium, to name only one of many. Research in this direction has led to the increasing use of stainless steel and other alloys having corrosion-resisting properties for lining vats, pressure containers and other vessels used for scouring and dyeing.

Whilst the spraying of thin metallic coatings is practicable and carried out by passing either a powder or wire of the metal concerned through an oxy-acetylene flame, this process is apt to be costly when considerable thicknesses have to be built up over large areas, at least when compared with the welding of metal strips to form an interior lining. In this country it is more customary to make the entire vessel of non-corroding metal but if it is particularly desired to use stainless steel and certain other alloys, then the cost together with the difficulties of securing the materials required is likely to make it more profitable to follow the strip lining process.

An interesting example of lining with stainless steel arose not long ago in the case of a large cylindrical pressure container. This had become badly rusted and was causing discoloration; consequently it was decided to line it with stainless steel. The stainless steel sheet is 16 gauge and 12 inches wide. Prior to welding, each strip was pressed firmly in position by circular bands of steel fitted with turnbuckles. These bands, which were of slightly smaller width than the stainless steel, were not removed until the latter was firmly welded in position.

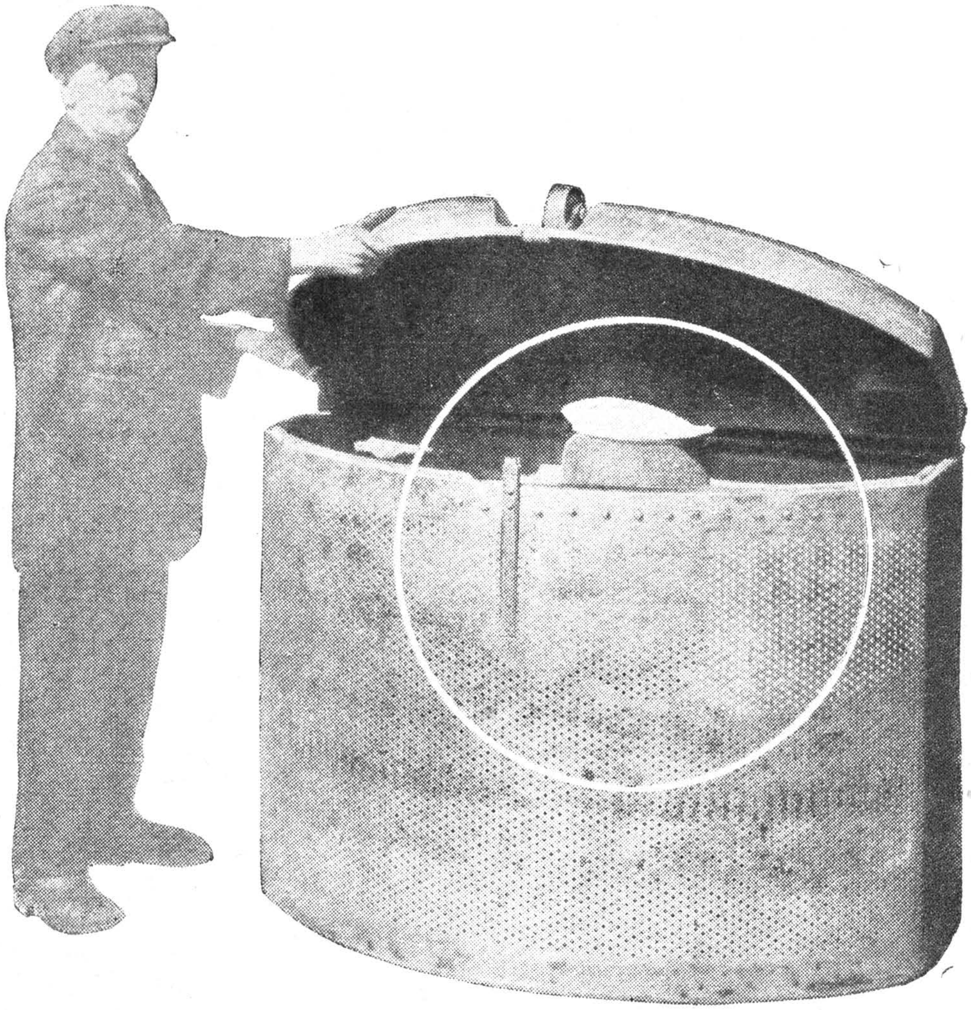


Fig. 1
This machine was made of a special corrosion resisting alloy and was broken as shown within the circle. Fortunately, by using welding rods of the same material, a perfect repair was possible and the heavy expense of a replacement avoided.

The precise methods of procedure are most important, for although electrical means are used it is impossible to avoid dilution of the non-corroding metal and that which forms the outside of the container. If only one run of welding were used then there is a likelihood of slight corrosion at the joints. One way in which this can be avoided is to weld each side of the strips leaving a gap of $\frac{1}{4}$ inch or even $\frac{3}{8}$ inch and then sealing and levelling off with a third run using the same type of stainless steel electrode.

Another way to avoid metal dilution is to lap the joints. Triple runs, however, impart great strength and satisfactorily meet the most exacting needs.

A point of further interest is that containers having dished ends or conical tops or bottom can be lined by the strip method, the size, number and position of the strips being worked out beforehand. The width of the strip is partly determined by the maximum working temperature, whilst in cases where the length is not dictated by the limited size of a vessel the average length is about 30 inches.

In some instances it is necessary to deal with coated plates, that is steel upon which other metals have been deposited by dipping or some chemical process. A great deal of experimental work has been carried out upon this class of bi-metal plate and a wealth of experience has been accumulated so that it is fair to say that even the most complex job of this type can be tackled with absolute assurance of success.

The application by welding of special hard wear-resisting steels is another aspect of bi-metal work which is used in place of case hardening. Frequently the opportunity arises to do work of this nature and save the price of a new component, delay in obtaining which is sometimes more costly than the out of pocket expenses. Similarly items that show weakness in design or by reason of long usage can be dealt with in the same way.

Of late the versatility of modern welding has been indicated as never before: It is an application of science in which this country is pre-eminent and of such aid in maintenance work that its good influence is to be noted in reduced overheads.

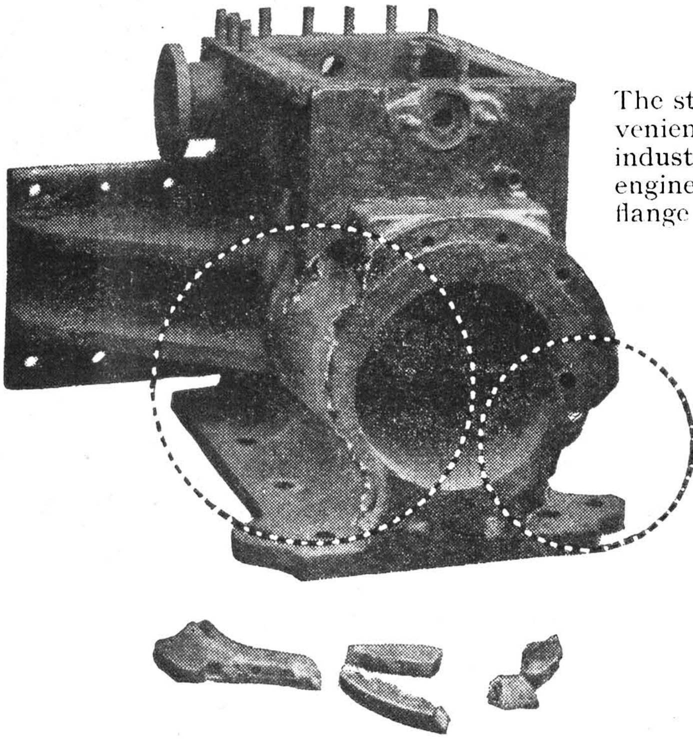


Fig. 2
The steam engine is still the most convenient form of prime mover for many industrial undertakings. This steam engine cylinder was damaged on a large flange as shown.

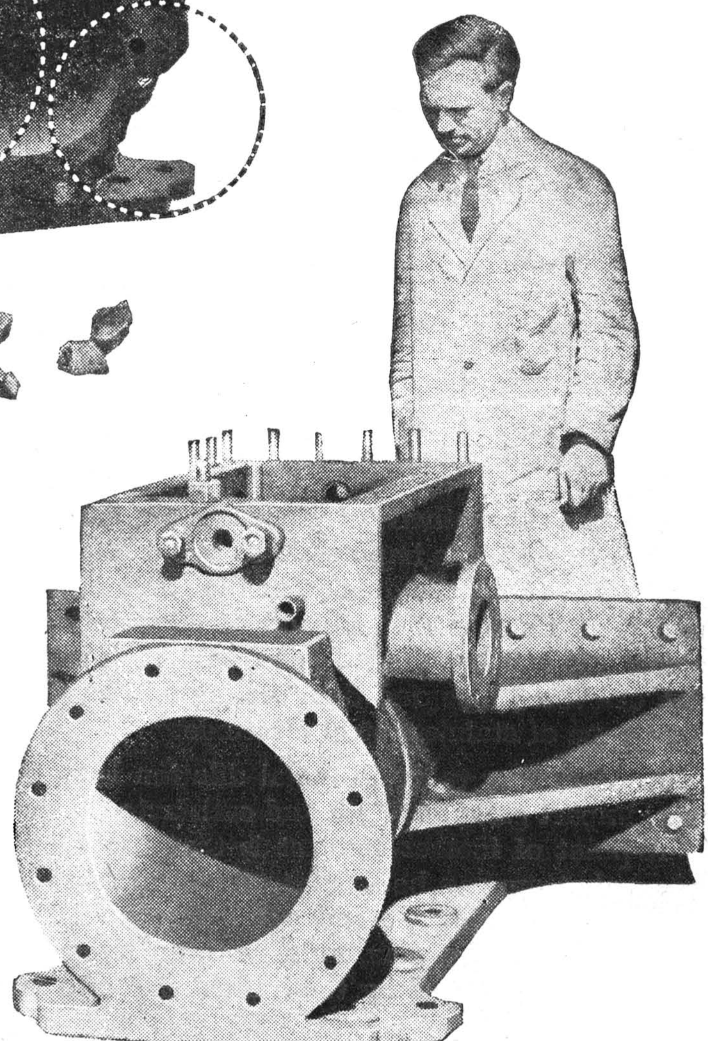


Fig. 3
This repair presented no difficulty to welding specialists as will be seen from this illustration of the repaired cylinder (Repaired in the Barimar Works).

A MECHANICAL DEVICE FOR PRODUCING ANGULAR GLASS HOOKS FOR FIBRE TESTING

By A. Johnson

During an investigation of the properties of alginate rayons, which has already been published,[1] strength and elongation tests were carried out on the Cambridge Instrument Company's Extensometer, installed in the Department of Textiles, Leeds University. In air, alginate filaments are comparable in strength with contemporary rayons but they are extremely weak when wet and it was noticed that, in this state, the weight of the lower of the two glass hooks attached to fibres being tested on this instrument caused a considerable strain on the filament. To have modified this section of the instrument so that the lower hook was supported by the pulling member would have eliminated the useful visual indication of the end point of the test which occurs when the free hook falls due to the breaking of the fibre. In the extension of strong fibres this unrecorded strain might not be significant, but in the present case it was considered necessary to reduce to a minimum the weight of the bottom hook and add this to the breaking load recorded by the spring. It should be explained that zero position the spring was taken when the spring carried the weight of the free glass hook. The shape of the hook also had an influence on the mounting of the fibre, and it was noticed that the most satisfactory type of hook was angular in form. Such hooks were difficult to make by hand from finely drawn glass and no method was known of producing them mechanically. It was, however, found possible to construct a model instrument for this purpose, a description of which follows.

Production of Glass Hooks

During the making of ordinary glass hooks by hand the glass rod was held at a certain angle close to the gas-jet and softened so that the free end swung down by gravity to form the required shape. Whilst this manipulation took place it was noticed that there was a certain order in the positions taken by the rod in relation to the flame. This sequence was all the more marked when the desired angular hooks were made similar to (*a*), as distinct from (*b*) in Fig. 1.

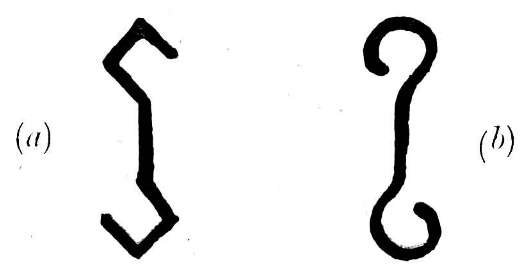


Fig. 1

The first type has rather more utility than (*b*) as, owing to the well-defined centres, it presents far less opportunity for the fibre to be misplaced, a condition which is liable to swing the hook out of alignment when on the extensometer. The positions taken up by the rod and gas-jet were tabulated as shown in Fig. 2, the dotted line indicating the position of the rod being moulded before the application of the flame denoted by the black dot. It is apparent that six positions of the rod complete the cycle in the manufacture of a hook and these are conveniently spaced at 90° to each other. Such an arrangement is mechanically easy to reproduce when the centre of the rod works about the point A in Fig. 2. On the other hand, if this centre is constant, then the flame must move in relation to the rod. There are three points at which the flame must be applied and, for each of these, two positions must be taken up by the glass rod. The three points are illustrated by the large black dots in Fig. 3 and, at first sight, appear to arrange themselves at three of the corners of a square, indicated by a broken line. Such an angular movement, if made by slipping the nozzle into

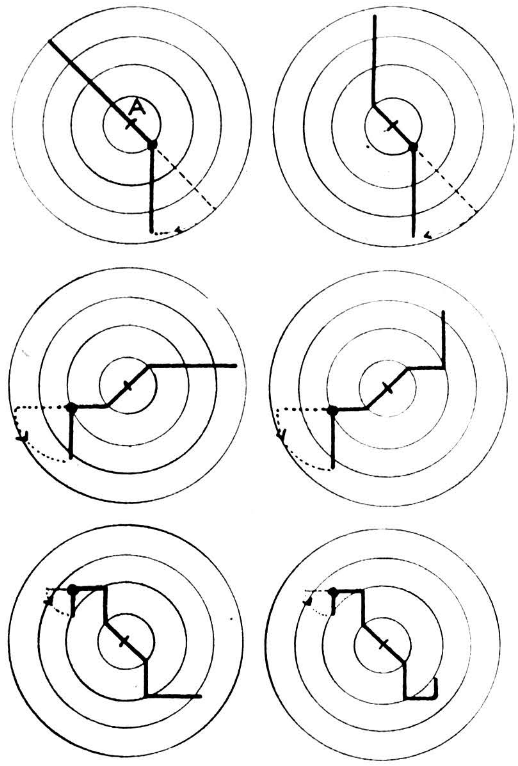


Fig. 2

slots, is cumbersome and the obvious mechanical solution is to substitute a rotary movement. This is possible because the three positions assumed by the flame conform to three points, 90° apart, on the circumference of the heavily defined circle in Fig. 3. Thus the relative centres of glass rod and flame fall in

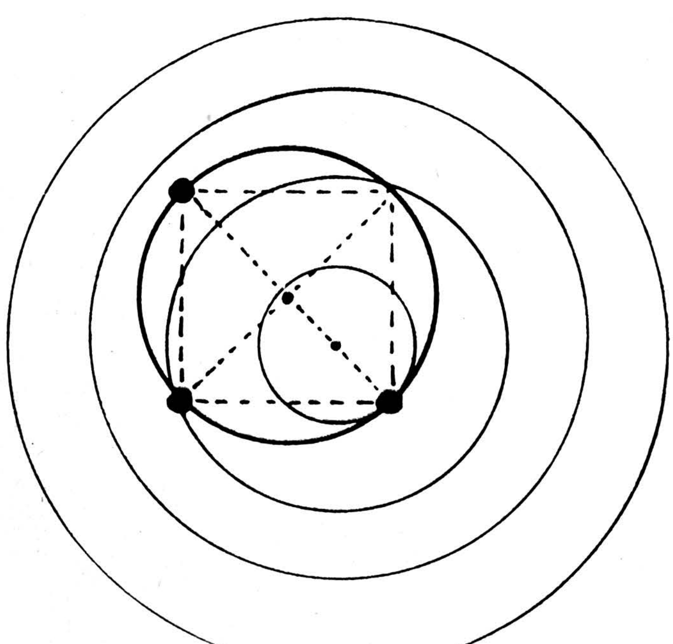


Fig. 3

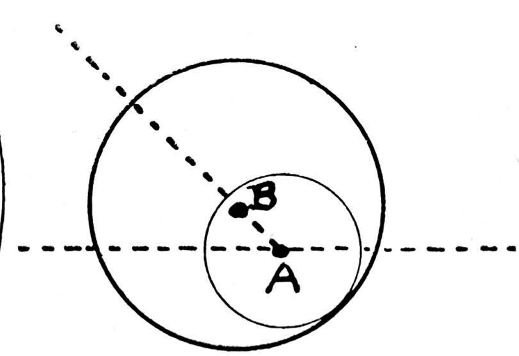


Fig. 4

a line running at 45° to the horizontal as shown at A and B respectively in Fig 4. Working on the foregoing assumptions, a model was built on the lines indicated in Fig. 5. The nozzle A forming the pin-point flame was made from

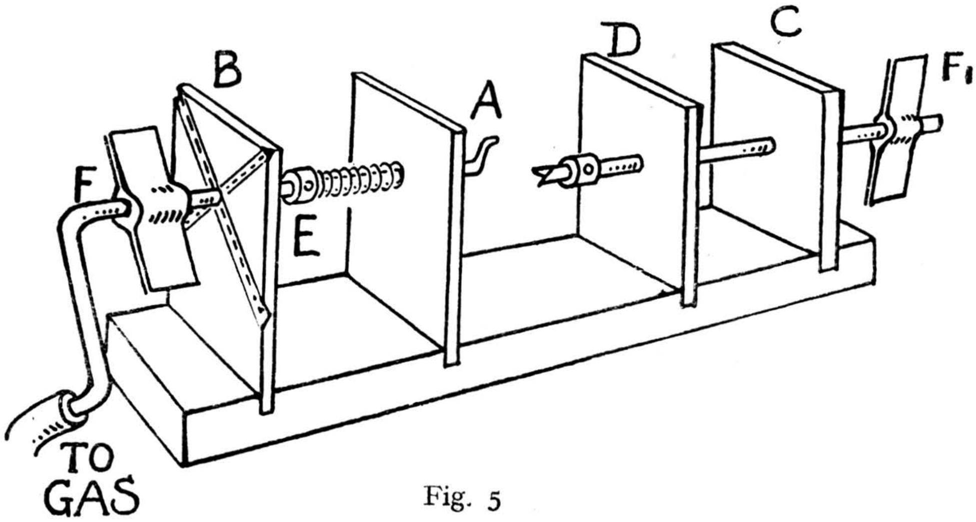


Fig. 5

tubular glass and could, in modified models, be adjusted in order to make hooks with varying lengths of shaft. A V-shaped notch on the end of the rod D held the glass rod in position during the operation. The relative positions of jet and rod were determined by slots in the upright sections B and C into which the wings F and F1 attached to rod and gas-jet could be fitted with certainty. The metal rod D can be withdrawn from the flame when inserting a length of glass rod. Similarly, when the flame is not in use, it is moved to its farthest extremity away from the glass, by the expanding spring E.

It was, therefore, possible to make very fine hooks of standard form which swung in perfect alignment with the fibres on the extensometer and thereby assisted in obtaining a greater degree of accuracy in the results.

REFERENCE

[1] *J. Soc. Dyers & Colourists*, 1945, **61**, 13-20.

Courtaulds, Ltd.

*THE EFFECT OF MOISTURE ON NYLON YARNS AND FABRICS

By G. LOASBY and H. O. PULS

Introduction

The literature dealing with the general subject of nylon polymers and nylon yarns is already extensive, and the history of the original polymer development and the general physical and chemical properties of nylon yarn are well known.

In this paper it is intended to deal with the particular question of moisture and its relation to the physical properties of nylon yarns and fabrics. Particular emphasis will be laid on the practical applications rather than on the theoretical studies. The effect of moisture on the physical properties calls for close attention during processing from yarn to finished fabric. Intelligent interpretation of some of the yarn properties, besides easing the manufacturing processes, will lead to more satisfactory finished products.

Moisture Relationship

Most textile fibres are hygroscopic, i.e., they are capable of taking up or releasing moisture so as to reach equilibrium with the ambient atmospheric conditions. The comparable position of nylon with some of the other textiles is demonstrated by Table I. The values of the regain are given in whole numbers only as values of the regains of many of the substances cover considerable ranges.

Table I
Moisture Regain of Various Textiles at 65 per cent. Relative Humidity and 25° C.

Yarn	Moisture Regain %
Polystyrene	Nil.
Vinyon	Nil.
Cotopa (esterified cotton) ...	3
Nylon	4
Acetate rayon	6
Cotton	8
Linen	8
Celanese F.S. rayon	9
Silk	10
Rayolanda X rayon	10
Mercerised cotton	11
Casein rayon	13
Viscose rayon	14
Wool	16
Alginate rayon	20 to 30 (dependent upon combined metal.)

Usually the moisture regains of textiles depend on the previous treatment of the materials; those previously exposed to a dry atmosphere will contain less moisture when in equilibrium at any given atmospheric humidity than those which were exposed to an atmosphere more moist than the given one. This phenomenon, known as moisture hysteresis, is not exhibited by nylon textiles. Fig. 1 by Speakman and Saville[1] shows the coincidence of the absorption and desorption curves for a 35 denier/17 fil. yarn determined at a dry bulb temperature of 25° C.

Fig. 2 exhibits some of Speakman's determinations of regain at 20° C., 25° C., 30° C. and 35° C. This shows that nylon is one of the less hygroscopic textiles. This can have many practical advantages. Subsequent to all wet processing, including the domestic wash, nylon dries out very readily. Precise details of drying times for all fabrications of nylon materials cannot be given but results of laboratory tests on the absorption and desorption times of nylon in the form of (i) skein of yarn (ii) woven fabric and (iii) knitted fabric are available. One batch of

* A Lecture to the Lancashire Section of the Institute, in Manchester, 13/9/46.

samples was dried in an oven at 105° C., to constant weight and the other was immersed in distilled water for 16 hours. All samples were then exposed to an atmosphere of relative humidity 65 per cent. and temperature 70° F. (21·1° C.) and weighed at frequent intervals. Each test specimen weighed approximately 3 grams, and was freely suspended in a well-circulated conditioned atmosphere.

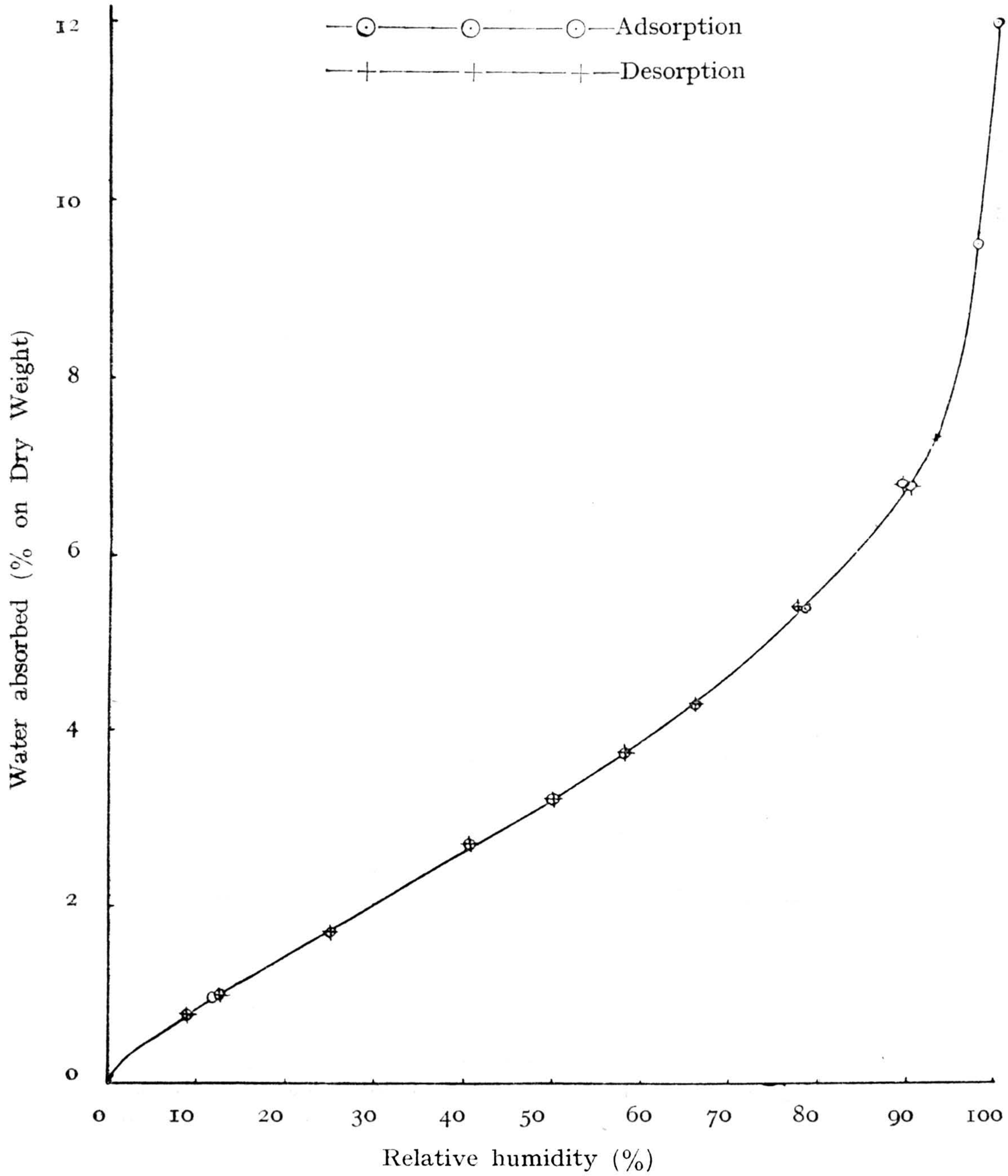


Fig. 1. Adsorption and desorption curves at 25° C.

The desorption curves only, which are of greater interest from a wet processing standpoint, are given in Fig. 3. They show that even after soaking for 16 hours in water the three particular samples became " air-dry " within 3 hours of being placed in the standard atmosphere ; the knitted fabric took only 1½ hours. If most of the moisture is removed by centrifuging the times are reduced well below these values. The absorption tests showed that the materials reached equilibrium with the standard atmosphere in ½ and 1 hour after removal from their moisture-free surroundings.

Effect of moisture on physical properties.

To provide a general background, Table II has been compiled from published data[2, 3].

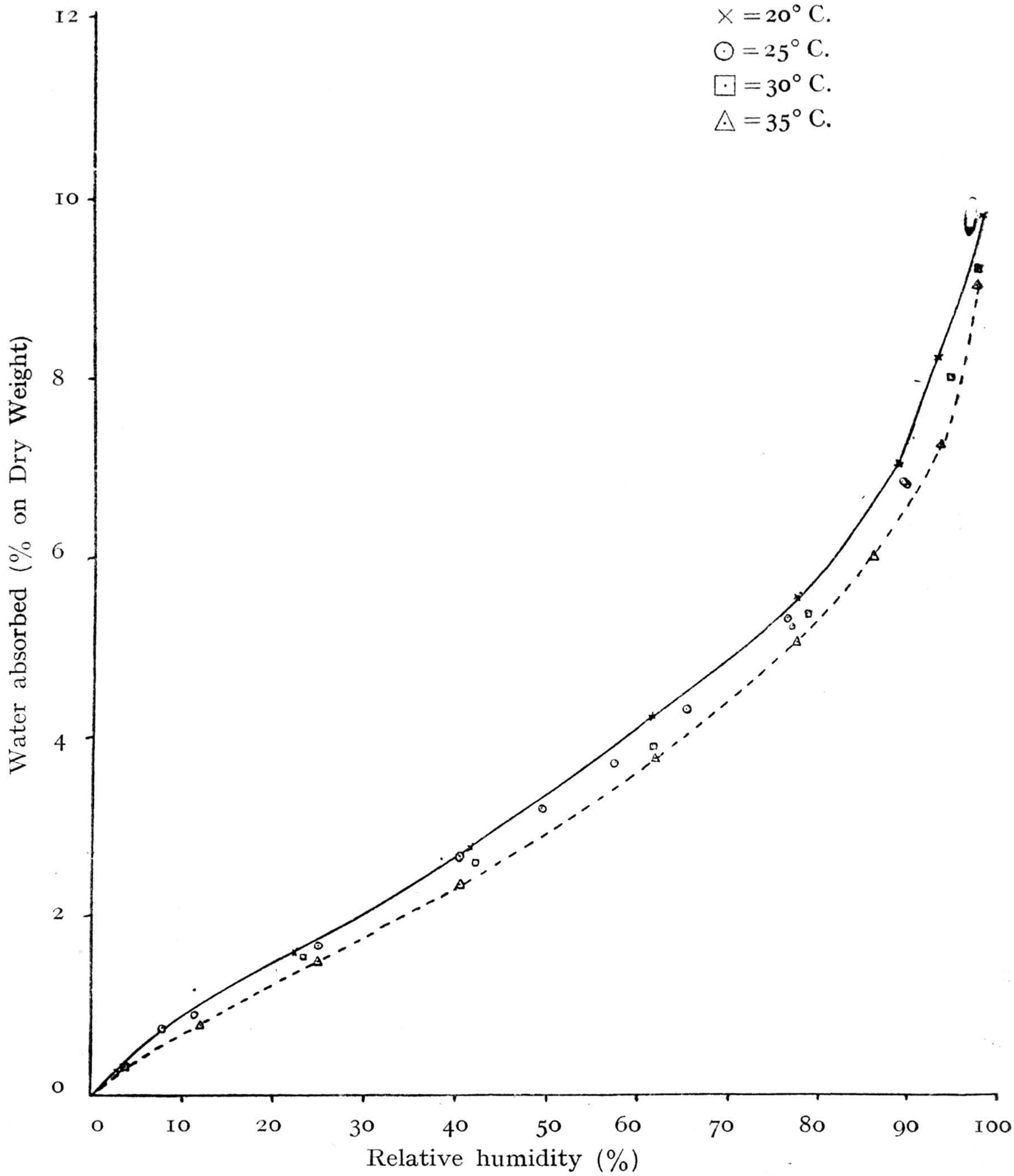


Fig. 2. Effect of temperature on water adsorption.

Table II

Effect of Moisture on the Strength of Some Textile Fibres

Fibre	Wet Breaking Load (per cent. of value at 65% R.H.)
Calcium alginate rayon	25
Viscose rayon (ordinary)	45 to 55
Acetate ,, ,, ...	65 to 70
Chromium, or beryllium, alginate rayon ...	70
Silk	75 to 85
Wool	80 to 90
Nylon	85 to 90
Vinyon	100
Cotton	110 to 120

During textile processing, and later in ordinary use, these strength changes on wetting the material might result in serious inconvenience. However, it is not often that a material is taken to its ultimate breaking load during use ;

therefore, for practical purposes the effect of moisture on the extensibility of a material at tensions employed in processing is of greater importance. This applies especially where a material has a low elastic modulus. The question of ease of stretching and possible elastic recovery at some later processing stage will be covered later.

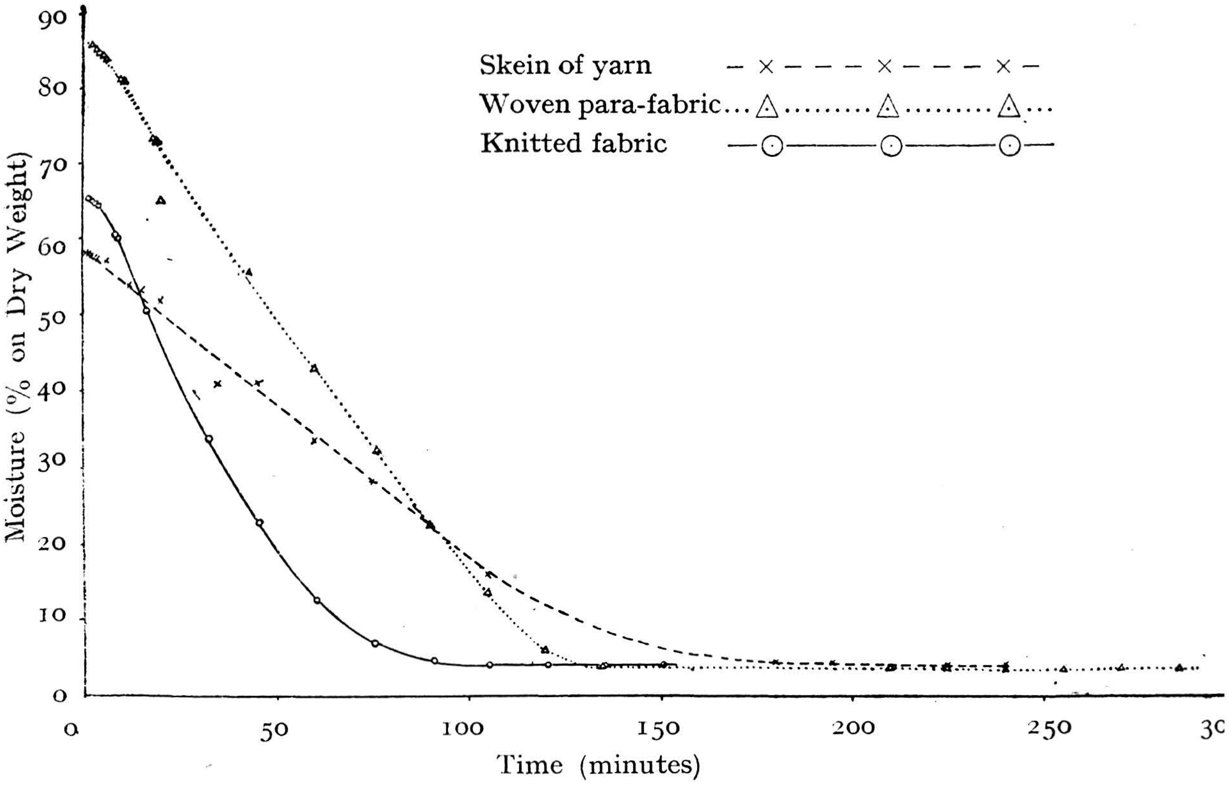


Fig. 3. Desorption curves.

Atmospheric conditions throughout test 65% R.H. and 70° F.
Samples soaked in water, at 70° F., for 16 hours before test.

Some interesting comparisons, similar to those of Table II but dealing with extension changes are given in Table III. The data have been abstracted from the work of Hindman and Fox [4], and it is suggested that a close study of the original will amply repay all who have to process man-made materials.

Table III

Fibre	Load (as a per cent. of the breaking load as determined at 65% R.H.)	Resultant Extension at		
		0% R.H.	65% R.H.	100% R.H.
Viscose rayon (125 den.)	10	0·2	0·3	4·0
	50	1·2	5·8	Broken
"Cordura" (Stretch-spun regenerated cellulose, 50 den.)	10	0·1	0·3	2·8
	50	0·8	7·8	11·2
Acetate rayon (100 den.)	10	0·4	0·4	0·4
	50	2·4	2·4	19·4
"Fortisan" (Stretch-spun saponified acetate, 30 den.)	10	0·2	0·2	0·6
	50	1·1	2·5	3·2
Cuprammonium rayon (30 den.)	10	0·1	0·2	0·9
	50	0·6	2·8	5·7
Nylon (30 den.)	10	0·9	1·5	2·0
	50	6·3	6·9	7·3

These figures indicate that the load-extension properties on nylon are less affected by changes in atmospheric humidity than other materials, but at low loads the magnitude of its extension at all humidities should be noted.

For testing purposes and for general knowledge of the effects of humidity on nylon yarns a long series of tests to obtain detailed knowledge of their humidity/strength and humidity/extension relationship has recently been completed. Besides acceptance tests made at fully-equipped test-houses a large number of process control tests are often made on the manufacturer's own premises. If for any reason the tests cannot be made in a controlled atmosphere under standard conditions, some correction factor must be applied if the tests are to be comparable over a period of time. Much work of this nature has already been published on most of the natural fibres [5-8] and on certain rayon materials.

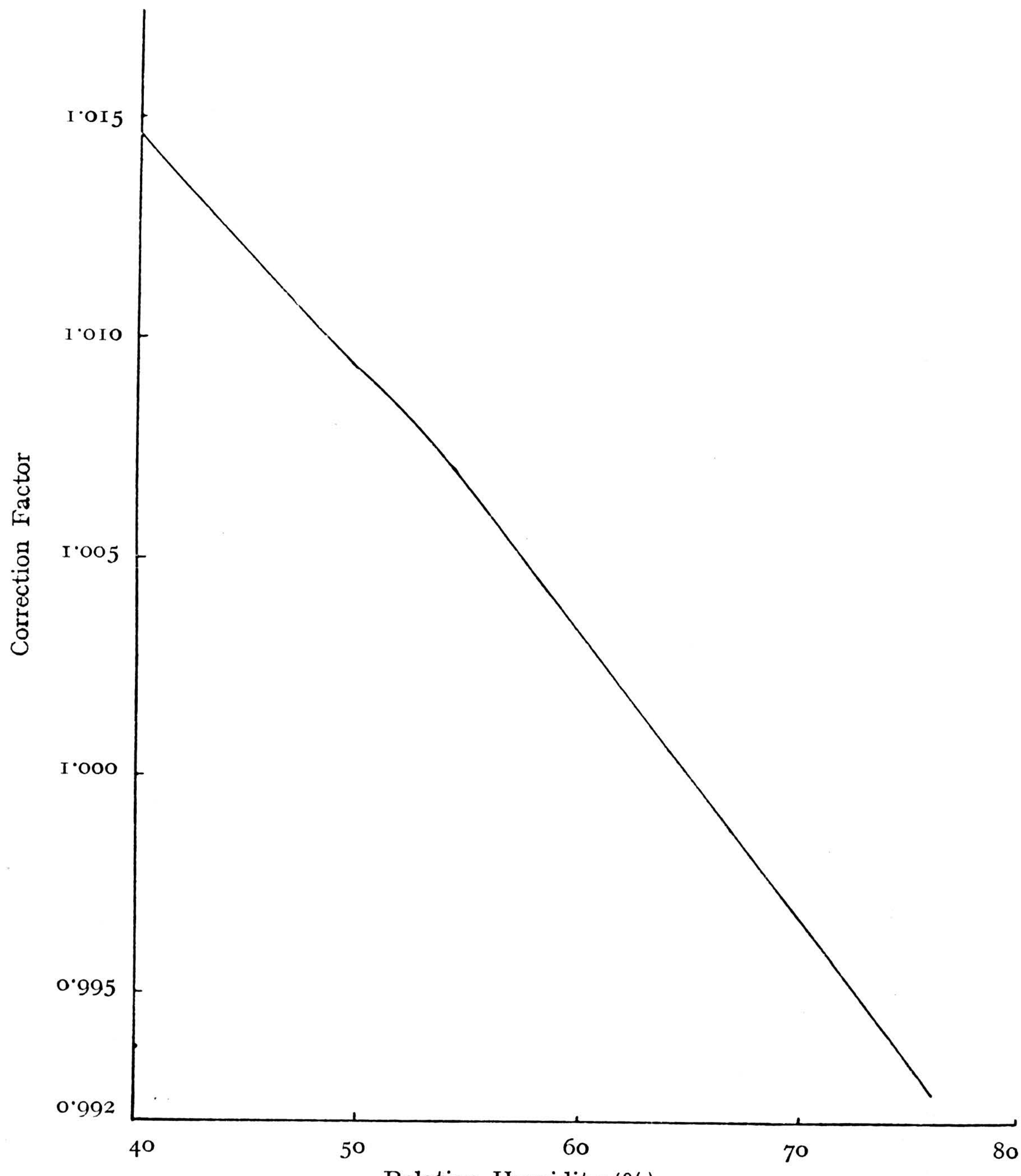


Fig. 4. Denier correction factor variation with relative humidity.

Breaking load and extensibility tests were made on a large number of specimens taken from three batches of 45 den/15 fil. delustred nylon yarn. Skeins of several thousand metres were made from each sample and cut. It was then possible to choose 100 test lengths at random from each skein for testing purposes. The tests were made on a gear-driven pendulum-loaded constant rate of traverse single thread testing machine ; the speed of the straining grip was 760 mm/min., both loaded and unloaded, and the initial test length was 50 cm. The atmospheric conditions of the test room could be varied at will and any particular condition was maintained constant to ± 0·4 per cent. relative humidity and ± 0·2° C. dry bulb. The skeins were conditioned for at least 24 hours before testing. Small supplementary skeins were found to have assumed a constant weight by this time. These skeins were used for checking the moisture absorption variation for the range of relative humidities employed in the experiments.

It has been found that the above factors apply to all types of current nylon yarns made from polyhexamethylene adipamide

Denier For many practical purposes, a correction will be required for the specific strength (tenacity) of a yarn rather than its breaking load. This involves, the denier/relative humidity relationship, details of which are given in Fig. 4. The effect of dry bulb temperature, between 20° C. and 26° C. was so slight that it was neglected.

See Fig. 4.

Tenacity. Combination of the data of Table IV and Fig. 4 gives a correction factor of tenacity. Table V will be found to contain all the necessary information to permit experimental values to be readily corrected.

Table IV

Breaking Load Correction Factor

Temp. °F.	Relative Humidity								
	40%	45%	50%	55%	60%	65%	70%	75%	80%
55	0·86	0·87	0·89	0·91	0·93	0·94	0·96	0·98	1·01
56	0·86	0·88	0·89	0·91	0·93	0·95	0·97	0·98	1·01
57	0·87	0·88	0·90	0·92	0·93	0·95	0·97	0·99	1·01
58	0·87	0·88	0·90	0·92	0·94	0·95	0·97	0·99	1·02
59	0·88	0·89	0·91	0·92	0·94	0·96	0·98	1·00	1·02
60	0·88	0·90	0·91	0·93	0·94	0·96	0·98	1·00	1·02
61	0·88	0·90	0·92	0·93	0·95	0·96	0·99	1·00	1·02
62	0·89	0·90	0·92	0·94	0·95	0·97	0·99	1·01	1·03
63	0·89	0·91	0·92	0·94	0·96	0·97	0·99	1·01	1·03
64	0·90	0·91	0·93	0·94	0·96	0·98	0·99	1·01	1·03
65	0·90	0·92	0·93	0·95	0·96	0·98	1·00	1·02	1·04
66	0·90	0·92	0·94	0·95	0·97	0·98	1·00	1·02	1·04
67	0·91	0·92	0·94	0·96	0·97	0·99	1·01	1·02	1·04
68	0·91	0·93	0·94	0·96	0·98	0·99	1·01	1·03	1·05
69	0·92	0·93	0·95	0·96	0·98	1·00	1·01	1·03	1·05
70	0·92	0·93	0·95	0·97	0·98	1·00	1·02	1·04	1·06
71	0·92	0·94	0·96	0·97	0·99	1·00	1·02	1·04	1·06
72	0·93	0·94	0·96	0·97	0·99	1·01	1·03	1·04	1·06
73	0·93	0·94	0·96	0·98	1·00	1·01	1·03	1·05	1·07
74	0·93	0·95	0·97	0·98	1·00	1·02	1·04	1·06	1·07
75	0·94	0·95	0·97	0·98	1·00	1·02	1·04	1·06	1·08
76	0·94	0·96	0·97	0·99	1·01	1·03	1·04	1·06	1·08
77	0·94	0·96	0·98	0·99	1·01	1·03	1·05	1·07	1·09
78	0·94	0·96	0·98	1·00	1·02	1·04	1·06	1·08	1·10
79	0·95	0·96	0·98	1·00	1·02	1·04	1·06	1·08	1·10
80	0·95	0·97	0·98	1·00	1·02	1·05	1·07	1·09	1·11
81	0·95	0·97	0·99	1·01	1·03	1·05	1·07	1·10	1·12
82	0·95	0·97	0·99	1·01	1·03	1·06	1·08	1·10	1·12
83	0·96	0·97	0·99	1·01	1·04	1·06	1·08	1·11	1·13
84	0·96	0·98	1·00	1·02	1·04	1·07	1·09	1·12	1·14
85	0·96	0·98	1·00	1·02	1·05	1·07	1·10	1·12	1·15
86	0·96	0·98	1·00	1·02	1·05	1·08	1·11	1·13	1·16

Table V
Tenacity Correction Factors for Nylon Yarns at various Relative Humidities and Temperatures

Temp. °F.	Relative Humidity								
	40%	45%	50%	55%	60%	65%	70%	75%	80%
55	0·85	0·87	0·89	0·91	0·93	0·95	0·97	1·00	1·02
56	0·86	0·87	0·89	0·91	0·93	0·95	0·98	1·00	1·02
57	0·86	0·88	0·90	0·92	0·94	0·96	0·98	1·00	1·02
58	0·86	0·88	0·90	0·92	0·94	0·96	0·98	1·00	1·03
59	0·87	0·89	0·90	0·92	0·94	0·96	0·98	1·01	1·03
60	0·87	0·89	0·91	0·93	0·95	0·97	0·99	1·01	1·03
61	0·87	0·89	0·91	0·93	0·95	0·97	0·99	1·01	1·03
62	0·88	0·90	0·91	0·93	0·95	0·97	0·99	1·01	1·04
63	0·88	0·90	0·92	0·94	0·96	0·97	1·00	1·02	1·04
64	0·89	0·90	0·92	0·94	0·96	0·98	1·00	1·02	1·04
65	0·89	0·91	0·93	0·94	0·96	0·98	1·00	1·02	1·05
66	0·89	0·91	0·93	0·95	0·97	0·98	1·01	1·03	1·05
67	0·90	0·91	0·93	0·95	0·97	0·99	1·01	1·03	1·05
68	0·90	0·92	0·94	0·96	0·97	0·99	1·01	1·03	1·06
69	0·90	0·92	0·94	0·96	0·98	1·00	1·02	1·04	1·06
70	0·91	0·93	0·94	0·96	0·98	1·00	1·02	1·04	1·07
71	0·91	0·93	0·95	0·97	0·99	1·00	1·02	1·05	1·07
72	0·91	0·93	0·95	0·97	0·99	1·01	1·03	1·05	1·08
73	0·92	0·94	0·95	0·97	0·99	1·01	1·03	1·06	1·08
74	0·92	0·94	0·96	0·98	1·00	1·02	1·04	1·06	1·09
75	0·93	0·94	0·96	0·98	1·00	1·02	1·04	1·07	1·10
76	0·93	0·95	0·97	0·99	1·00	1·03	1·05	1·07	1·10
77	0·93	0·95	0·97	0·99	1·01	1·03	1·05	1·08	1·11
78	0·94	0·95	0·97	0·99	1·01	1·04	1·06	1·09	1·12
79	0·94	0·96	0·98	1·00	1·02	1·04	1·07	1·09	1·13
80	0·94	0·96	0·98	1·00	1·02	1·05	1·07	1·10	1·14
81	0·95	0·96	0·98	1·00	1·03	1·05	1·08	1·11	1·15
82	0·95	0·97	0·99	1·01	1·03	1·06	1·09	1·12	1·16

Extensibility or extension at break. So far as the extensibility/relative humidity relationship is concerned no general correction factor can be given but, in general, the variations were small in the range of 55 per cent. to 80 per cent. relative humidity and no correction is thought necessary. The variation of extensibility with dry bulb temperature at constant humidities was uniform over a range of 16° C. to 26° C. (61° F. to 79° F.).

The factor was constant between 55 per cent. and 80 per cent. relative humidity so that Table VI contains only a single set of figures.

Table VI
Extension Correction Factor

Variation with temperature for all relative humidities between 55% and 80%	
Temperature (° F.)	Correction Factor
58	1·15
60	1·12
62	1·09
64	1·06
66	1·04
68	1·02
70	1·00
72	0·98
74	0·96
76	0·95
78	0·93
80	0·92
82	0·91

By the use of the appropriate factors it is now possible to correct test results for denier, breaking load, breaking extension and tenacity for departures from the standard conditions of 65 per cent relative humidity and temperature 70° F.

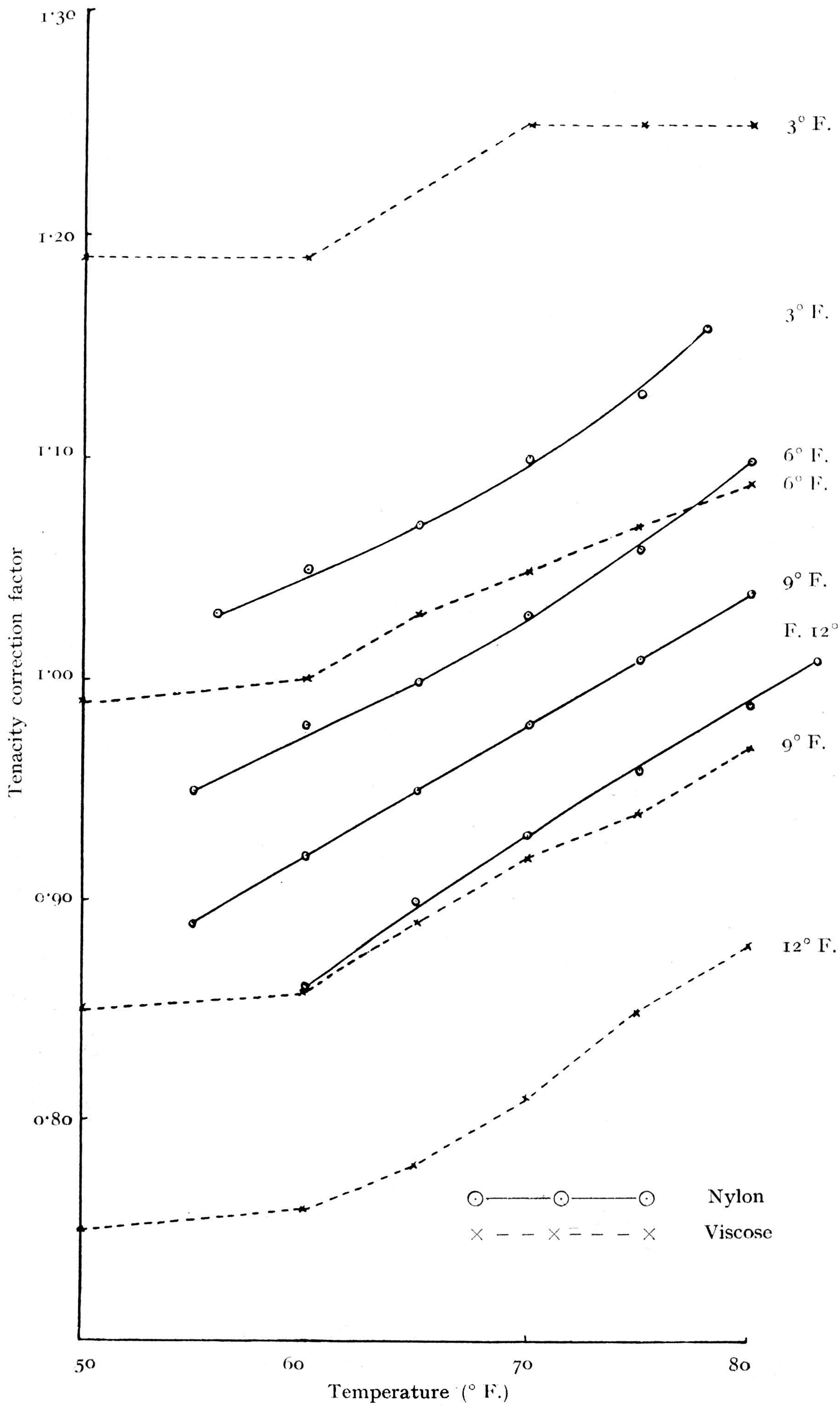


Fig. 5. Tenacity correction factors : comparison with viscose.

Previous reference has been made to the comparatively small change in strength which occurs when nylon is subjected to wide changes in atmospheric conditions. To emphasize this point, Fig. 5 compares tenacity correction factors for viscose rayon and nylon. From the curves, taken between dry bulb temperatures at 60° F. and 80° F. it will be seen that, whereas the nylon factors range from 0·86 to approximately 1·20, those for viscose range from 0·76 to 1·25.

In the processing of nylon yarns, one is often concerned with the deformation, or length change, caused by low loads. Information based on load/elongation curves obtained on variously conditioned yarn indicates how such length changes are likely to be affected by the atmospheric conditions. Details of the tensions necessary to cause nylon and many other yarns to stretch 1 per cent are contained in the booklet " Nylon yarn : its properties and its processing "[9]. Table VII shows how this modulus, expressed as load in grams/denier necessary to cause 1 per cent. extension, varies in the case of nylon yarn.

Table VII
Modulus (grams/denier, per 1% stretch) at 26°C.

Relative Humidity	Tension to Stretch 1% (gram/denier)
100	0·123
72	0·234
63	0·283
60	0·275
57½	0·306
44	0·421

Manufacturers who wind and weave nylon yarns will need to bear these facts in mind. It cannot be stressed too strongly that it is advisable to avoid processing tensions which fluctuate violently or which are consistently high. The reduction of atmospheric humidity to make use of the increased modulus may result in other disadvantages, such as the development of excessive electrification.

Dimensional Changes caused by Moisture and Water

Since nylon is not greatly affected by variation of humidity, it is not surprising that it exhibits only small dimensional changes as a single filament. At 22·2° C. Speakman[1] has shown that in moving from 0 per cent. to 100 per cent. relative humidity a single filament of nylon will increase in length less than 1·2 per cent. and increase in diameter 4·8 per cent.

The behaviour of nylon yarns naturally depends upon their type and make-up. The amount of twist will determine whether the foregoing longitudinal and lateral dimensional increases in filament size are transferred to the yarn—in circumstances of high twist it is possible to visualise a shortening of the yarn—and the make-up, viz., hard-wound cone, soft-wound bobbin or loosely-twisted skein, will control the rate at which either moisture vapour or water can penetrate the package. Previous periods of relaxation, and any shrinkage treatment which the yarn may have received are liable to affect the dimensional changes. In general, it can be said that yarn wetted out in cold water will show a shrinkage after drying of 2 to 3 per cent. compared with its original air-dry (65 per cent R.H.) dimensions and a boiling water shrinkage of 6 to 8 per cent. These figures apply to yarn which has not been twist-set. Some comparisons with German products recently brought to the U.K. illustrate this feature and they are given in Table VIII.

Twist-set yarns will also show some shrinkage. Its magnitude is not so great but available evidence indicates that, for shrinkage purposes, boiling water is more effective than steam at atmospheric pressure. Increase of steam pressure

Table VIII
Shrinkage of Caprolactam and Polyamide Yarns

	Shrinkage per cent. in water Hot	Cold
Perlon L. 40 denier, 12 filaments	5·0	0·4
Perlon L. 40 denier, 15 filaments	4·3	0·4
Perlon L. 268 denier, 80 filaments	7·0	0·4
British Nylon Spinners, 45 denier, nylon	6·5	2·4
British Nylon Spinners, 70 denier, nylon	5·4	3·4

naturally results in greater shrinkage. These effects, on a yarn which had been twist-set for 90 minutes in an atmosphere corresponding to 77° C. dry bulb and 71° C. wet bulb, are illustrated by the figures in Table IX.

Table IX
Twist-set Yarn : Resultant Shrinkages after Various Wet Treatments

Treatment	Shrinkage (per cent.)
25°C. in water for 3 minutes	0
50°C. ,, ,, ,, 3 ,, ...	0·2
75°C. ,, ,, ,, 3 ,, ...	0·5
100°C. ,, ,, ,, 3 ,, ...	2·8
100°C. in steam for 3 minutes	0·2
120°C. ,, ,, ,, 3 ,, ...	2·4
100°C. ,, ,, ,, 10 ,, ...	0·5
120°C. ,, ,, ,, 10 ,, ...	2·5
100°C. ,, ,, ,, 30 ,, ...	1·4

In general nylon yarns having more than 10 t.p.i. twist will require twist-setting. Therefore, for yarns of this type the above figures should be borne in mind in use and in processing, rather than the shrinkage figures given earlier.

With reference to fabric shrinkage it will be obvious that, apart from relaxation of any strain imposed during processing, the dimensional changes will be of the same order as those shown by the yarn. Weaving tensions and the degree of balance between warp and weft are so dependent upon the type of fabric that the amount of strain relaxation cannot be generalised. To give an indication of the order of shrinkage likely to be encountered our general experience has been for unset fabric to show a maximum shrinkage of 4 per cent. when immersed in cold water, and 8 per cent. when immersed in boiling water for 10 minutes.

Before leaving this subject of dimensional change caused by water, some figures will illustrate typical changes recorded in laboratory wash tests on full-fashioned stockings may be of interest. Before test, the hosiery were in the finished state, i.e., they had been set in a steam pressure chamber at 25 lb/sq. in. for 3 minutes, dyed and finished.

Table X
Dimensional Changes of Some Typical Full-fashioned Nylon Stockings

(*a*) Washed seven times in 0·3 per cent. soap solution for 10 minutes, each time at a temperature of 40°C., then rinsed, dried and hung for an hour before measuring.
(*b*) Boiled once in water for 10 minutes.

	Dimensional change (expressed as a percentage of the original size)					
	Test method (*a*)				Test method (*b*)	
	Stocking 1	Stocking 2	Stocking 3	Average	Stocking 4	Stocking 5
Length of leg ...	+3·3	+1·8	+3·7	+2·9	−1·0	nil
Width of thigh	−3·5	−2·9	−2·1	−2·8	−4·0	−2·8
Width of calf ...	−2·3	−3·4	−4·6	−3·4	−5·5	nil

The Effect of High Temperature and Moisture

The first part of this paper has been concerned chiefly with the effect of moisture under ordinary atmospheric conditions. By a combination of high temperature and moisture use can be made of a unique and valuable property of nylon, namely its capability of being set under such conditions. The theories of molecular orientation, or of readjustment into less strained positions, which are involved will not be dealt with, but reference should be made to the more practical aspects of this remarkable property.

Usually, setting is accomplished by subjecting nylon to boiling water or to saturated steam under pressure. Setting can also be achieved with dry heat at elevated temperatures but proper processing conditions are less easy to realize.

The permanency of the setting process can be assured only by choosing setting conditions such that the temperature will be in excess of any subsequent treatment the material may receive throughout its useful life. For example, nylon set by boiling water would have to be treated with steam at about 107° C. before the setting could be undone in a practical time. On the other hand, temperatures up to 82° C. could be used without any fear of removal of set. It is, of course vital to ensure in this process that the material does not contain fortuitous wrinkles or creases since these too will be set in position. A further important point is that a dimensionally stable set cannot be expected if the nylon is under extreme tension during the setting process. Apart from partial reversion to the unstrained dimensions, Speakman has shown that the mechanical properties, when compared with those of set unstrained nylon, may be lowered.

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AUTOMATIC WEAVING*

Mr. Sharpe, in opening his address, said that the subject chosen for him, automatic weaving, was from some points of view rather dangerous. He considered that the man who knew most about it was the least inclined to talk. He would begin by assuming that the members of his audience were all anxious to have a better textile industry and that they had therefore already decided on the use of automatic looms rather than non-automatics.

The first requirement was that the operatives should be automatic-loom minded and that they should be as free as possible from prejudice against automatic weaving. Next he regarded as essential the optimum atmospheric conditions. Temperature and relative humidity were important and should be under constant control.

As for weaving with non-automatic looms, the preparation of the warps should be perfect. No looms could be expected to produce perfect cloth from faulty warps. Similarly with regard to the winding of the weft, it was useless to expect good weaving unless the yarn left the shuttles in a perfectly satisfactory manner.

At this stage arose the question of the type of automatic loom, bobbin change or shuttle change, to be employed. Each type had its enthusiastic advocates, but the plain fact was that both types possessed disadvantages as well as advantages. His own preference was for the bobbin change type. In the matter of British or foreign looms he was anxious not to offend susceptibilities and yet to be as helpful as possible. He was strongly of the opinion that the automatic looms had not been sufficiently well made and that this had prevented to a considerable extent their adoption. In the looms made since the war and delivered in 1945/6, there were numerous minor faults. He regarded this, not as a legacy of the 1939 war, but as having existed since the 1914 war. Further, he was alarmed to find defects in new looms which were not present in pre-war machines. As an instance, he cited the slipping of shedding tappets and the difficulty in re-setting.

In the bobbin change loom the difficulty was in controlling the weft at the bobbin change, which was the cause of much faulty cloth. The shuttle and the shuttle eye could be radically improved. In his view fabrics of the highest quality could be made on automatic looms. Where this was being done the manufacturer had improved the looms himself and so enabled them to produce cloth of quality equal to that from non-automatic looms. He appealed for an organisation, endowed with authority to implement its findings, of machine makers, users, engineers and scientists to investigate and improve automatic looms, and he thought the matter was very urgent, if the British textile industry is to regain its pre-eminence. He considered that a textile machine when delivered should not require adjustment before it becomes a producer. No one expects or needs to adjust a motor car, a clock or a wireless set before it will work. Forty years ago looms were delivered in running condition. The present trouble was fundamentally one due to lack of co-ordination. He went so far as to say that machine makers should not be allowed to produce machines except of the best and highest class. The machine shop people could do the work and their efforts were being wasted if they were not allowed to make perfect plant.

Discussion

The Chairman, in throwing the meeting open to discussion, referred to the need to define the spheres of the automatic and the plain looms. He thanked Mr. Sharpe for his forthright address and his fearless expression of what he had to say, as a practical man who really knew what he wanted. If all concerned took up the subject as Mr. Sharpe had done there would soon be something done to remedy the present ills of the industry.

*Abstract of a paper by Mr. F. I. Sharpe and discussion on Automatic Weaving at at a meeting on Friday, October 18th, 1946.

Question: Was the delivery of machines not ready to produce due to the employment of "green" labour?

Reply: The labour is not "green". It is skilled and paid for at a high rate.

Question: How would Mr. Sharpe's proposed commissioners do the work he desired? Was simplification of the automatic loom necessary?

Reply: Research in progress at the Shirley Institute revealed many surprising things about looms. He thought such research should proceed at the rate of 24 hours per day.

Question: Was Mr. Sharpe not hard on the makers of automatic looms? There were firms who employed good men and made a success of the automatic loom installations.

Reply: Mr. Sharpe denied that he condemned loom makers. He praised the efforts of the Northrop Company to train men as skilled fitters by means of special courses of instruction.

Question: Did Mr. Sharpe advocate standardisation of mechanism and loom parts?

Reply: Without standardisation Messrs Tootal Broadhurst Lee Co., Ltd. had successfully produced fine quality cloths on automatic looms and were to be congratulated on their success.

Question: Was the industry prepared to pay for an ideal loom if it could be made?

Reply: There was little incentive to look for the ideal loom when the manufacturer could readily sell all the cloth he could make.

Question: Was not the export drive, which has the blessing of the Government, self-destructive of the machine making and the cloth producing industries?

Reply: Engineers, other than textile machinery makers, could make new looms.

Mr. Asworth proposing a vote of thanks thought much depended on the skill of the operative, and suggested considerable up-grading of labour.

*PUBLIC ELECTRICITY SUPPLY AND THE TEXTILE INDUSTRY

That 750,000 tons of coal would be saved annually if all the power now produced in Lancashire's cotton mills by steam engines were provided by electrical power from public supply was claimed by Mr. W. E. Swale, M.I.E.E., Assoc.M.Inst.C.E., speaking on behalf of the British Electrical Development Association at a lunch-time meeting of the Lancashire Section of the Textile Institute in Manchester on Friday, January 10th.

Mr. Swale, whose subject was "Public Electricity Supply and the Textile Industry," said that the differences in the historical and economic backgrounds of the two industries had no doubt delayed the general acceptance of electric driving as a vital factor in increased production.

Power costs form only a small proportion of the total cost of manufacture; for example, only about 2 per cent. of the value of the yarn in spinning 35s count from the raw cotton stage, and in plain weaving only 0·75 per cent. of the value of the cloth. As a large proportion of the steam drives in Lancashire were written off, and therefore operating debt free, it was not surprising that they had been kept in operation until there were more compelling reasons for a change to electric driving than those which had obtained in the last few decades.

Since the conclusion of the war the vital need to conserve the country's coal resources had become manifest. The obsolescence of steam engines and boiler plant, and the increasing difficulty of achieving rapid repairs in the event of a breakdown, together with the imperative need for greater output, and for respacing and improved working conditions in mills had considerably stimulated thought in the direction of change to electric driving.

*Abstract of a lunch-time lecture at the Institute Friday, 10th January, 1947.

The recommendations of the Cotton Working Party for the replacement of 9 million mule spindles by 3 million ring spindles and the modernising of 8 million existing ring spindles might lead to the installation of 240,000 h.p. of new motors. The problem of applying this very considerable amount of plant called for the closest co-operation of all concerned.

In 1945 only about 30 per cent. of the power used in textile mills was furnished by public electricity supply concerns, but it was obvious that the rate of conversion would be greatly accelerated in the next few years.

The Electrical Development Association had appointed a Textile Sub-Committee, whose immediate programme included a series of lectures to textile associations, publication of information booklets, formulation of a programme of agreed electrical performance and production tests, and an offer to collaborate with the Textile Institute in the preparation of a students' textbook on electrical practice in the textile industry.

It was only by careful planning that the textile industry could hope to obtain what it requires in a reasonable time. The Electrical Development Association offered the fullest co-operation in the tasks which lay ahead.

Yorkshire Section

*GLASS FIBRES, YARNS AND CLOTHS

Mr. Robertson dealt first with historical references apart from those which are purely mythical. Glass fibre was produced for lamp wicks in 1858 and in 1873 Michael Owens in the United States made lamp shades from materials with a silk warp and glass yarn weft. As early as 1893 dresses were made from materials containing glass.

Mr. Robertson stressed the fact that glass should not be regarded as a competitor of the natural or the man-made textile fibres. He observed that the technical application really began about 1904, when the virtues of glass fibre for heat insulation had begun to be appreciated.

The British blockade of Germany in 1914 stimulated the vigorous development in the production of glass fibres in Germany, but between the end of the 1914 war and 1931, very little advance was made. In 1931 the modern high speed bulk production was set afoot. Work had begun in Glasgow two years previously, using methods developed in America and operated under licence.

Mr. Robertson then dealt briefly with the compositions of glasses and the way their properties in the molten state depended on composition. He gave the sizes of fibres normally produced and intimated that finer fibres are now becoming available. He observed that glass fibre is still glass rod and as such will naturally fail when a knot is tied in it; hence he did not consider glass fibres as rivals of the orthodox textile fibres in the ordinary way. The proper sphere for glass textiles is in industry. It makes excellent retaining material for the paste in electrical storage batteries and the cloths woven from continuous filaments are very good for filtering liquids which are not alkaline. An alkali-resistant glass for textiles has not yet been produced.

A few textiles, such as curtains, might advantageously use glass yarns and fibres, because of the long time they could hang without becoming soiled. Narrow fabrics produced from glass yarns find extensive application in the electrical industry where they permit dynamos and motors to operate under heavy loads, and at higher temperatures than would be permissible with cotton or rayon insulating tapes. The bulk of glass fibre goes into insulating material for thermal insulation and sound proofing, and for the lagging of steam pipes, etc.

A vote of thanks was proposed by Mr. Roberts, and this was put to the meeting and seconded by the Chairman, Mr. Halliday. There was a spirited discussion in which questions were asked concerning widely different applications of glass fibres ranging from modern surgery, ink erasers to theatre safety curtains.

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*The substance of a lecture by A. M. Robertson Esq., Fibreglass Limited, Glasgow.

Macclesfield, Leek and District Section

SOME IMPRESSIONS OF AN AMERICAN TOUR

On Wednesday, 15th January, 1947, the Macclesfield, Leek and District Section met at the Nicholson Institute, Leek, to hear Dr. F. C. Toy, C.B.E., Director of the British Cotton Industry Research Association giving an account of his visit to America early in 1946. In the absence of Alderman Birch through indisposition, Mr. Wadsworth presided.

Dr. Toy stated that his visit covered a period of nearly ten weeks. It was not his intention to dwell unduly on cotton problems in his talk.

Landing at Halifax, Nova Scotia, he proceeded to Washington, where he saw the work of the Quarter-Master's Department on behalf of the United States Forces. He then went South to Memphis and New Orleans, through the Southern States and back to New York. From there he proceeded to Canada to see the main textile centres. In his tour he covered approximately 7,000 miles.

He considered one of the main differences between the American textile industry and the British textile industry was that the American was vertically organised, whilst the British was mainly horizontally organised. In the States there are many large combines concerned with all processes from raw material to finished goods, and many organisations do their own merchanting. There are cases of big merchant houses buying up production factories in order to make their organisation vertical and be assured of supplies for their own demands.

Dr. Toy considered a vertical organisation to have some advantages from the point of view of research. In this connection he discussed an activity in the States not yet very common in this country; this was the employment of trained men to look into questions of labour utilisation, load assessment, the general efficiency of the organisation, and the planning of production. On their recommendations wage rates were altered when old machines were scrapped in favour of new equipment. In this respect the States were considerably ahead of England. As a matter of interest, Dr. Toy noted that in the Southern States, where there was a definite tendency for industry to drift from the North, trade unionism was not nearly so strongly entrenched as in the Northern States.

In the matter of mechanisation the United States were undoubtedly ahead of this country. Dr. Toy gave two interesting examples of "mass mechanisation"—one a foundry, and the other a huge weaving shed with more than 2,300 looms. In the latter, two counts of yarn only were used, and the same cloth was produced year in and year out. The production engineers were consistently on the look out for means of eliminating labour and maintaining or increasing production by additional mechanisation. The production engineering staff in one concern grew to 19 members in 12 months. The weaving is practically all automatic with bobbin changers becoming more popular than shuttle changers.

In New York, Dr. Toy saw the representatives of many large concerns, and in particular the educational institutions. The out-put of qualified textile technologists from the schools was far greater than in this country, and would certainly have a great influence on the American industry within the next ten years. He considered that at present the British textile industry was more research minded than the American, but that they would make rapid progress in this respect. They were great believers in the possibilities of mixed fabrics.

Dr. Toy's observations on the Good Housekeeping Institution were very interesting, particularly the close connection between quality control and advertising. At the moment he admitted that he found less research than he expected, but these conditions should change rapidly. People in the States impressed upon him the necessity for Britain to keep up her standards of quality. America and this country had much to learn from each other.

In opening the meeting to discussion, the Chairman observed that Dr. Toy had not stressed the gloomy side of the textile industry in this country. Dr. Toy replied to a number of questions on the advantage of vertical organisation, the standard of the textile colleges, female labour, standards of living, and the relative quality of fabrics in this Country and the States.

A vote of thanks was ably proposed by Mr. Pegg and Dr. Toy replied.

Reviews

Definition and Measurement of Gloss. A Survey of Published Literature. By V. G. W. Harrison, Ph.D., F.Inst.P., A.R.P.S. (London. The Printing and Allied Trades Research Association, pp. vi+145. Illustrations 28. Price 10/- net).

Dr. Harrison and the Printing and Allied Trades Research Association are to be congratulated and thanked for making available to all interested the results of their critical study of the literature of this somewhat difficult subject; no less than 180 papers are referred to and most of these are said to have been consulted in the original publications.

The author is a physicist but his extensive knowledge of the subject makes him declare emphatically that the physical approach is insufficient. Indeed he would probably say that it is putting the cart before the horse, since gloss or lustre is a sensation which is obviously real but its analysis in physical terms is still unaccomplished.

The monograph is divided into four parts. In Part I, the physical basis of gloss, i.e. the reflection of light from surfaces, is adequately discussed. The theory covers surfaces which are plane, curved and irregular—a full treatment being given of wavy surfaces—diffusing and semi-glossy surfaces. A discussion is given of polar curves which define satisfactorily the reflection properties of a surface but they are tedious to determine and difficult to interpret.

Part II brings the reader to the study of lustre as a sensation experienced by normal observers. In the words of the author ". . it is an effect which we all recognise easily enough, but which we find it very difficult to describe in words . . . . . in the underlying idea of lustre there is a feeling of looking through two competing surfaces, too close together to be clearly distinguished."

This section is perhaps somewhat more difficult than the others to understand, dealing as it does with phenomena in the border region between physics and psychology. Nevertheless the matter is expressed clearly and the reader's interest is fully held.

In Part III, which occupies about one-third of the monograph, the author discusses six basic ways in which the practical determination of gloss has been attempted, viz., the simple Ostwald-Klughardt method, the polarisation method, the "objective" glossmeter, the "subjective" glossmeter, the goniophotometer and distinctness of image methods. The existence of so many methods is in itself a confession of the inadequacy of our knowledge, for each measures a different optical property of the material, although "none of these is related in a one-to-one manner with our sensations." The critical study which the author makes in this section is of great value in enabling the reader to assess the merits of each of the methods.

In the final section the author holds a discussion on our present state of knowledge. To those who already have some acquaintance with the subject of gloss this is perhaps the most interesting, with its philosophical approach, its plea for further investigation of the physico-psychological region, and its valuable summary. Not the least important information given in this section is that an extensive programme of work has been initiated by the Printing and Allied Trades Research Association on the correlation of measurements made by different methods with one another and with visual estimations. Publication is promised as soon as the results are available and many will await them with interest.

Dr. Harrison has a very pleasing and easy style and as he writes in the first person singular the many homely analogies which he uses make us feel that we are sharing his obviously wide interests within and without the realm of science. What therefore might have appeared as dry bones from a less gifted author is presented by Dr. Harrison in attractive raiment.

P. W. Cunliffe.

Les Textiles Artificiels et Synthétiques en France. By Bernard Pierre, with a preface by H. Laufenburger. (Paris, Société Privée d'Imprimerie et d'Édition. pp. 273. No price quoted.)

Every aspect of the man-made fibre industry in France is covered by this book. It tells vividly the story of the pioneer work of Count Hilaire de Chardonnet, follows the subsequent research and development in various countries which have led to the present-day products, and discusses the uses and applications of the finished articles made from the different fibres.

The raw materials used and the methods of manufacture of continuous filament rayon yarn and rayon staple fibre are described briefly. Much fuller treatment, however, is given to the commercial and economic aspects of the industry, questions of man-power, efficiency in administration, cost of equipment, investment of capital, and the position of the home and export markets; and it would appear that the book is likely to be of more interest to those concerned with administration and market research than to chemists or technologists.

A very interesting section, well illustrated by maps, is devoted to the reasons for the present geographical distribution of the rayon industry in France. It deals with the location of chemical manufacturers, rayon producers —there are 29 of them in France—weavers and makers-up. It brings out their inter-relationship and shows how their plants have been located with an eye to such factors as the availability of skilled and specialised labour, and transport services.

Other matters discussed are the quantities of rayon produced by France compared with other countries, and the organisation of her domestic and foreign markets; there is a wealth of statistical information relating to these subjects. The book further describes the conditions which led to the formation some years ago of various federations designed to safeguard the interests of producers and consumers alike in all branches of the industry, and the development and organisation of present methods of government control and regulation.

The author is enthusiastic about the possibilities of this young industry, and rightly stresses the importance of regarding the new fibres as materials with attributes of their own and in no way as substitutes for anything else.

The Dyeing of Textile Fibres. By R. S. Horsfall and L. G. Lawrie. (London, Chapman & Hall Ltd., 1946, 2nd. Edition. pp. 438. Price 25/- net.)

The second edition of this well-known text book follows closely in arrangement that of the first edition of 1927. The volume is now only about one half the thickness of the original but actually contains slightly more pages. The type is pleasing and the many italicised headings of the original edition give way to a more legible heavy type. The wording remains the same in many places but drastic re-writing has been carried out where new knowledge is available. As in the first edition there are no diagrams or illustrations.

In the Preface to the new edition the authors acknowledge their indebtedness to fourteen collaborators each of whom is an authority in his own sphere. In passing it may be noted that the date given in the Preface is August, 1944, and it is no doubt a sign of the times that publication was not effected until December, 1946. It may be regarded as an accomplishment that the price of the book is less by a few shillings than that of the first edition.

In the Preface to the first edition it is clearly stated that the approach to the subject is made from that of the material to be dyed, so that considerable portions of the book are devoted to a description of the properties of the fibres themselves and of their preparation for dyeing. Although these sections summarise the latest information it may be doubted whether such an approach is now satisfactory in the light of the extensive knowledge which exists as a result of research carried out in recent years by the research associations, the universities and industrial laboratories. Moreover, the information which is given does not appear to be drawn upon in the succeeding chapters on dyeing, which remain a description of an art rather than a science. One would have thought that the "omnibus" text-book belonged to the more mentally comfortable days of the pre-scientific era of textile technology.

The book is well written although the following sentence from p. 28 requires clarification: "Below 50 per cent. R.H., the effect of humidity in increasing the breaking load of cotton hairs is considerable and fully accounts for the well-known increase in strength of cotton yarns in a moist atmosphere, but above 60 per cent. R.H. humidity has little effect on hair strength."

In Chapter I after an historical survey of dyeing and dyestuffs, we find an up-to-date though brief description of modern methods of colour measurement including the C.I.E. system. As a short introduction to the subject this section may have some merit but it is scarcely sufficient to give the reader an indication of the complexity and the extensive literature of this subject. This section and another on "Theory of Dyeing" have been entirely re-written and illustrate the great advance in our knowledge of these subjects during the last twenty years.

Chapter II by comparison with the first edition again shows the great advance in our knowledge of the chemistry and physics of cotton fibres which has resulted from the publication of investigations which have been carried out in recent years. The section in the first edition on "Organdie Finishes and Immunisation" is replaced by one on the assessment of damage, action of oxidising agents, etc., on cotton.

Chapter III which deals with the treatment of cotton before dyeing has been brought up-to-date but one wonders why it is necessary to give twice (pages 46 and 53) the method of dressing the interior surface of a kier, with Portland cement and silicate, useful though it is.

Chapter IV deals with the dyeing of cotton, giving first an outline of the various types of dye followed by methods of their application. This chapter also includes a brief description of the newer finishing processes such as Trubenising, vulcanising, water-proofing and the anti-crease process.

Following a short chapter on the bast fibres we come to the dyeing of rayon and the newer synthetic fibres. One must reluctantly doubt the statement of the author on p. 151 that "the term 'rayon' is now almost universally adopted although its general acceptance was slow in materialising." The process is so slow that it is by no means uncommon to hear the word "silk"—without even the "artificial"—used in dyehouses when referring to rayon.

Reference is made to and brief descriptions are given of the machinery which is used in dyeing textile materials in their many forms from the loose fibres to the piece. These descriptions are given as required in the chapters on the dyeing of cotton, wool, etc. This leads to some difficulties; for example, under the dyeing of cotton the Hussong and Klauder-Weldon are referred to but only by name, the description being reserved for a later chapter on the dyeing of wool. Even here mention is first made of the machine four pages before the description is given. Presumably the authors have had in mind to produce self-contained chapters but it appears to the reviewer that a separate section on machinery would be more convenient for the reader.

Subsequent chapters in the book follow the lines already indicated for cotton and rayon and deal with wool, silk and union materials. Under wool one notes recent work on the application of vat colours to that fibre. Judging by the statements made in the first edition this branch of dyeing has passed from the experimental to the practical stage.

In a section on sundry finishing processes less than one page is devoted to the unshrinkable finish and this again demonstrates the impracticability of producing a general text-book on properties, processes and dyeing of textiles.

Chapter XI on indigo, Indigosols and Soledon dyestuffs has been extended to include recent advances. Chapter XV on auxiliary products perhaps shows the greatest change from the first edition due to the more extensive knowledge, production and use of the products.

The lack of modern text-books on textile processes is gradually being rectified and there is an assured place with the practical dyer for a book of an authoritative nature such as the present one. P. W. CUNLIFFE.

Wool: From the Raw Material to the Finished Product. By S. Kershaw, F.T.I. 6th Edition. (London, Sir Isaac Pitman & Sons Ltd., 1945, pp. vii+127, 6/- net.)

The appearance of the sixth edition of a book on textiles must create a record, particularly when eight years only separate the fifth and sixth editions and for more than half of this period the world was at war. The author evidently saw little reason for modification. The changes are practically restricted to the addition of a short chapter "Wool in War-time" and the replacement of the figures in Appendix I by data covering the years 1939-1942.

Apart from the quality of the paper the high standard of the production has been maintained. The persistent call for the book is all the testimonial it needs. T.

Additions to Library

Studier I Svenska Textila Industriers Struktur. By Folke Kristensson. The Swedish Institute for Industrial Research, Stockholm, Sweden, 1946. This work consists of economic studies of the structure of the textile industry in Sweden, made presumably on behalf of the Swedish Institute for Industrial Research. The text is in Swedish and is copiously illustrated with diagrams produced in many cases in more than one colour. There is an English summary incorporated in the volume which is a very fine production.

Room Temperature Vulcanisation: Vulcafor ZIX + Vulcafor DDCN. Report R-52. Imperial Chemical Industries Limited, London.

Ahmedabad. Published by The Rotary Club of Ahmedabad. Price 2/-. This book has been presented to the Institute's library by Mr. N. S. Rowe.

General Items

New Year Honours

The Institute records with pleasure the following awards which appeared in the New Year Honours List to two of its members who hold the Fellowship of the Institute.

C.M.G. Geoffrey Parkes, Esq., lately Deputy Chief (Executive), Trade and Industry Division, British Element, Control Commission for Germany.

C.B.E. Francis Carter Toy, Esq., D.Sc., Director of the British Cotton Industry Research Association.

Members will be interested in the award of Knighthood to Professor Walter Norman Haworth, Sc.D., F.R.S., Director of the Department of Chemistry in the University of Birmingham, as he has accepted the invitation of the Council to deliver the Mather Lecture on the occasion of the Annual General meeting in April.

STANDARDIZATION OF THE NOMENCLATURE OF DYESTUFFS

Report of Conference convened by the British Standards Institution and held at the Midland Hotel, Manchester, on Friday, November 29th, 1946, at 2.30 p.m.

The following organisations, Government Departments, etc., were represented:—

Association of British Chemical Manufacturers.
Board of Trade.
British Rayon Federation.
British Standards Institution.
City of Bradford Conditioning House.
Commonwealth Interservice Technical Committee on Textiles.
Cotton Board.
Cotton Industry Committee.
Manchester Chamber of Commerce Testing House and Laboratory.
Ministry of Supply.
Society of Dyers & Colourists.
The Textile Institute.
Wool Industries Research Assocn.
Wool Textile Delegation.

It was unanimously agreed that Mr. Bowen should be Chairman of the Conference.

Mr. Good said that the Conference had been called in accordance with the general policy of the B.S.I. to consider the proposal that some attempt should be made to standardize dyestuff nomenclature. He explained that when a proposal for standardization was received it was referred to the relevant

Industry Committee of the B.S.I. in whose field the subject came and if they were satisfied as to the need for the work to be undertaken they could authorise the setting up of a Committee to carry out the work. If, however, they were in any doubt about the matter they could authorise a Conference of all those interested to be convened to discuss the proposition and to decide whether or not any action should be taken. In this case the proposal for standardization of the nomenclature of dyestuffs had been brought before the three Industry Standards Committees in the Textile Section, viz., Cotton, Linen and Rayon, and they had all agreed that a conference should be held at which the subject could be discussed.

The Chairman then invited representatives to express their views and in the course of the discussion attention was drawn to the work which is being done by a Committee of the Society of Dyers and Colourists in the preparation of a revision of their Colour Index. It was explained that this revision would be a considerable amplification of the present edition and would group together all the relevant dyes on the market which were appropriate to any particular colour and a number would be allocated to each colour group. In this work account was being taken of the position in America and also on the Continent.

Mr. Good said that he had not previously been aware of the work which the Committee of the Society of Dyers and Colourists were carrying out, nor had it been mentioned at any of the Industry Committees refrerred to above on all of which the Society was represented. If it was felt that what they were doing would adequately meet the position there would be no need for the B.S.I. to take further action in the matter as the last thing which the B.S.I. wished to do was to duplicate activities which were being effectively carried out elsewhere. If the B.S.I. could in any way assist the Dyers and Colourists in their work they would of course be happy to do so, but that was another matter which was for the Society and the B.S.I. themselves.

It was generally agreed that the Committee of the Society of Dyers and Colourists were adequately handling the position and that no further action on the part of the B.S.I. was required.

The Conference then terminated.

The Science Museum, South Kensington. Re-opening of the Textile Gallery.

The Textile Gallery of the Science Museum was re-opened to the public on Saturday January 4th. This Gallery was most popular among students before the war as the range of exhibits provides a wide insight into the many different processes of the textile industry.

The art of spinning is demonstrated by working exhibits from the early spinning wheel to the modern ring-frame. Various forms of weaving are shown including a simple power loom and a Jacquard loom for the making of patterned fabrics.

Another section shows the development of the sewing machine. It is just 100 years since Elias Howe constructed his first practical machine and there are exhibits to show the many developments which have resulted in the all-electric domestic machine of to-day.

A Tribute to the late Mr. J. H. Lester.

It was my good fortune to grow into a knowledge of the late Mr. J. H. Lester some time before the Textile Institute was thought of. He was then at the Testing Laboratories of the Manchester Chamber of Commerce and, as my position in Bradford frequently involved tests in which we were both interested and concerned, we were frequently pulling together in the interests of the textile industries, although I was primarily concerned with wool while Mr. Lester was specially interested in cotton. It was in 1907 that, stimulated by Mr. G. Moores, the thought that the time had come for the launching of the Textile Institute, mooted some years earlier by Mr. B. H. Thwaite, really gripped Mr. Lester. It had been my privilege to be concerned in the formation of Textile Societies since the year 1887 and Leeds, Shipley, Bradford and Huddersfield were working to marked advantage about this time. It was not surprising, then, that Mr. Lester and Mr. Moores should visit me in Bradford with the idea of obtaining my collaboration in the great move which they already had in mind. I would state straight away, however, that they were the living strings in the movement. I simply backed up activities which I felt were going to help forward the institution of the Textile Institute on right lines.

The first meeting of the promoters of the scheme was called at Manchester on 20th July, 1909. I remember entering the room rather late, as my train had been delayed, and I was somewhat surprised when it was proposed that I should take the chair. However, to facilitate the business we had in hand, I presided at this meeting and acted as Chairman of the Institute until I felt that others ought to be invited to take responsibilities. In 1915 I vacated the position of Chairman and Mr. George Garnett succeeded to the office. I would candidly state, however, that I was little more than a figurehead. Mr. Lester was the inspirer and Mr. Moores did the work. Those who are working the Textile Institute and the textile societies today can have little knowledge of the difficulties with which we had to contend. Our first difficulty, for example, was that the Lord Mayor of Manchester refused to back us up by attending our first dinner. Fortunately one of our Bradford friends was acting in Government circles and as he was successful in persuading Mr. Sydney Buxton, Postmaster-General to grace our meeting, the Lord Mayor ultimately consented to attend. Then we were in difficulties with reference to our Autumnal Meeting and here again it was Bradford to the rescue, the Lord Mayor (Mr. Lund) doing everything possible to ensure the success of this conference in Bradford. But none of the early successes which we scored would have been possible or for that matter attempted without the active inspiration of Mr. Lester continually stimulating us to further endeavours.

When Mr. Lester left the Manchester Testing House for industry he naturally could not give the time to the Institute which he unstintingly had given up to then, but he was still the driving force behind the scenes and as one who worked with him I would like to bear testimony to the major part which he played not only in the inauguration of the Institute—a comparatively simple and easy matter—but more particularly in the way in which he ensured the success of the movement through the many vicissitudes which enveloped its activities until it gained its Royal Charter in 1925.

ALDRED F. BARKER.

Notices and Announcements

Annual Subscriptions

Members are reminded that subscriptions fall due on 1st January each year. Prompt payment will greatly facilitate the work of the Institute's staff and will ensure that the *Journal* and other publications and notices are sent out promptly.

List of Members

In pre-war days a list of members of the Institute was published annually and was widely regarded as a most useful index of those qualified as Textile Technologists and of those interested in promoting textile technology. It is proposed to renew the publication of this list as soon as possible.

To ensure that the details given in the list are accurate, all members are being requested to provide certain information. A card for this purpose is being sent to each member. The prompt return of this card will be most valuable co-operation in ensuring the early publication of the list.

Development Fund

The Institute's £50,000 Development Fund has now reached a total of almost £20,000. It is hoped that the balance will be forthcoming during the present year. Already considerable progress has been made in the development of the Institute's activities, and full consideration is at present being given by the Institute's Council to the utilisation of the money so far received.

It is thought that those members who have not yet contributed to the Development Fund would like to take the opportunity of doing so when they renew their annual subscription.

The total on January 17th was £19,868 12s. 6d. £18,067 5s. 0d. has been contributed by 268 firms and £1,801 7s. 6d. by 362 members and friends.

Recent contributions include:—

£50—W. & H. Foster Ltd., Denholme.

£25—J. Mandleberg & Co. Ltd., Salford.

Members—

£5 5s. 0d. each—C. W. Bancroft, Esq.; F. Courtney Harwood, Esq.

£5—John S. Dodd, Esq.

Institute Diplomas

Elections to Associateship have been completed as follows since the appearance of the previous list (December issue of the *Journal*):—

ASSOCIATESHIP

BERNARD COOPER,
Fabric Stylist, Yorkshire Worsted Mills, New York, U.S.A.

NORMAN SAMUEL ANTCLIFF HUMPHRIES, B.Sc.Tech., M.Sc.Tech.,
Senior Assistant, Tootal Broadhurst Lee Co. Ltd.

ERIC SMITH,
Experimental Officer, Linen Industry Research Association.

Obituary

The Institute regrets to announce the death of the following member:

H. MEIER, Peru.

Institute Membership

The Textile Institute begins 1947 with a record membership of over 3,000, a figure which still continues to increase rapidly. 750 new members joined the Institute during 1946, an increase of 30 per cent. in twelve months. The present total of 3,069 members compares with 1,831 at the end of 1943, so that there has been an increase of 66 per cent. in three years.

A welcome sign is that the number of junior and student members has almost doubled during the past twelve months: they comprise one-sixth of the new members. Nearly half the new members are men engaged on the practical side of industry—managers, designers, technologists and directors. One-third of the new members are drawn from the cotton trade; a quarter from the wool trade; the rest are connected with silk, rayon, hosiery, flax and other branches of the industry.

Every part of the British Isles is represented, and there has also been a marked increase in the number of new overseas members enrolled.

The number of New Associates elected during the year, 61, is also a record, and the total now stands at 596. The election of 15 new Fellows brings the total in this section to 266.

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

Ordinary.

Adamson, G. A.; 147, Oldham Road, Middleton, Manchester (Assistant Chemist, I.C.I. Dyestuffs Division, Hexagon House, Blackley, Manchester, 9).

Adnett, Eric John; 21, Walker Road, Birstall, Leicester (Manager, Textile Speciality Co., Reptow Street, Leicester).

Allt, Francis Greenhouse; C.A., A.M.I.I.A.; c/o Messrs. Brocklehurst-Whiston Amal. Ltd., Hurdsfield Mills, Macclesfield (Company Director).

Banner, Albert Victor; "Heathlands," Blakedown, Kidderminster, Worcs. (Time Study Engineer, Brintons Ltd., Kidderminster).

Batley, Fred; c/o Mrs. Dumphy, 1, Talbot Inch, Kilkenny, Eire (Assistant Designer, Kilkenny Woollen Mills Ltd., Kilkenny).

Bayley, Colin Hahnemann; B.A.Sc., M.A.Sc., M.A.; c/o National Research Council, Ottawa, Canada (Research Chemist).

Beton, Ernest Sutcliffe; B.Sc., F.R.I.C.; "Withens," Walker Lane, Sutton, Macclesfield (Chemist, Messrs. Brocklehurst-Whiston Amal. Ltd., Langley Print Works, Nr. Macclesfield).

Boag, William Maxwell; Manilla House, Clackmannan Road, Alloa (Wool Blender, Patons & Baldwins Ltd., Kilncraigs, Alloa).

Bonser, Arthur; 51, Roger Lane, Newsome, Huddersfield (Carding Overlooker, c/o W. E. Yates, Wellington Mills, Bramley, Leeds).

Bowden, Wilfred; 59, Lodge Lane, Hyde, Cheshire (Teacher of Weaving, Ashton Bros. & Co. Ltd., Carrfield Mills, Hyde).

Briggs, Herbert Bradley; M.Sc., A.R.I.C.; 44, Park Lane, Whitefield, Manchester (Chemist, I.C.I. Ltd., Hexagon House, Blackley, Manchester).

Broadbent, John Basil Woodward; Gatesgarth, Lindley, Hudderfield (Student).

Buck, William J.; Belding Corticelli Ltd., P.O. Box No. 9., Montreal, Quebec, Canada (Manager, Thread Department).

Cassie, Arnold Blatchford David; M.A., Ph.D., D.Sc., F.Inst.P.; Wool Industries Research Association, Torridon, Headingley, Leeds (Physicist).

Conderson, Wilfred; 152, Highroadwell Lane, Halifax (Head Designer, Messrs. British Furtex Ltd., Luddendenfoot, Nr. Halifax).

Cooper, Ernest; 151, Hughes Street, Bolton (Salesman, Duncan Doubling Co., Ashton-under-Lyne, Lancs.).

Costelloe, Kevin Joseph; "St. Anthony's," 21, Glasnevin Hill, Dublin, Eire [Sales Manager, John Barran & Sons (Dublin) Ltd., 7, St. Augustine Street, Cornmarket, Dublin].

Cowgill, Allen; 22, Kensington Street, Nelson (Wages Clerk, Taylor & Clarkson Ltd., Fraser St. Manufacturing Co., Brannand Mill, Burnley).

Czubaj, Czestaw Dominik; c/o Mrs. Friebe, 268, Bath Street, Glasgow, C.2 (Student, Royal Technical College, Glasgow).

Davis, Frederick Victor; B.Sc., A.R.I.C.; "Lytham View," Chorley Old Road, Whittle-le-Woods, Nr. Chorley (Chemist in charge, Chemical Inspection Dept., Ministry of Supply, R.O.F., Chorley).

Dobson, Charles Geoffrey; Messrs. Selectus Ltd., Biddulph, Stoke-on-Trent (Sales Manager).

Giovanoli, Adolphe; Societe Industrielle pour la Schappe, Basle 21, Switzerland (Manager).

Glasman, Ismar; c/o Textile Department, The University, Leeds (Student).

Hasler, Eckart; 73B, Belgrave Road, Keighley (Under Manager, Driver, Hartley & Co. Ltd., Dryart Mills, Keighley).

Helm, Harry Earnshaw, c/o H. o. Bennett, Crafton Street, Leicester (Factory Manager, H. o. Bennett, Crafton Street, Leicester).

Hill, Thomas; B.Sc.Hons.; Rosebank, 15, Woodcroft Avenue, Leek, Staffs. (Textile Dye Chemist and Works Manager, Joshua Wardle Ltd., Leekbrook Dyeworks, Leekbrook).

Holgate, John; Westholme, West Bradford, Nr. Clitheroe (Weaving Manager, John Holgate & Sons Ltd., Bradford Mill, Clitheroe).

Horrocks, Frederick W.; "Marada," Bog Height Road, Darwen (Manager, India Mills (Darwen) Ltd., Darwen).

Kerr-Muir; O.B.E., M.A.(Oxon), B.Sc.; Lustre Fibres Ltd., 7315, Empire State Building, New York, U.S.A. (Technical Representative).

Lawrie, Leslie Gordon; I.C.I. Ltd., Dyestuffs Division, Blackley, Manchester (Chemist).

Levers, William Hague; 41, Lammack Road, Blackburn (Technical Textile Representative).

Liptak, Jan; c/o Mrs. Conway; 46, Lawrence Street, Glasgow, W.1 (Student, Royal Technical College, Glasgow).

Meitner, Walter; Ph.D.; 1198, Wilmslow Road, Manchester, 20 (Manager, 12, Blackfriars Street, Manchester, 3).

Mills, Sidney; Cornerways, 30, Gorsey Road, Wilmslow, Cheshire (Area Manager, Tufnol Ltd., 21, Spring Gardens, Manchester, 2).

Mirfield, William; 5, Branksome Crescent, Heaton, Bradford (Weaving Department-Director, Lumb Lane Mills, Bradford).

Monks, Arthur; Crolt Engineering Ltd., Waterloo Street, Bolton (Director).

Morson, Frank; "Ivanhoe," Bennetts Road, Keresley, Nr. Coventry (Senior Clerk, Courtaulds Ltd., Foleshill Road, Coventry).

Narasimhan, Kasthur Iyengar; B.Sc., B.Sc.(Tech.), Ph.D.; College of Technology, Manchester (Research Scholar of Government of India).

Nelson, Frank; 1, Grange Avenue, Heaton Chapel, Stockport (Assistant, Production and Labour Departments, Messrs. Kirkless Ltd., Bury).

Park, John William; 19, Prospect Hill, Bromley Cross, Nr. Bolton (Assistant Dyer, The 'Know Mill' Printing Co. Ltd., Bevis Green Works, Walmersley, Nr. Bury).

Partt, Robert; 41, Egerton Road, Chorlton cum Hardy, Manchester, 21 (Assistant Buyer, Hodgson & Norem Ltd., 52, Princess Street, Manchester).

Pfeffer, Edward C.; B.S.; Messrs. Cluett Peabody & Co., Inc., 433, River Street, Troy, New York, U.S.A. (Research Director).

Pinkstone, Fred; 22, Adbolton Grove, West Bridgford, Nottingham (Assistant Factory Manager, Cooper & Roe Ltd., Carlton Road, Nottingham).

Potter, Harry; B.Sc., M.Sc., A.Inst.P.; 9, Hermon Avenue, Oldham (Research Physicist, Messrs. Tootal Broadhurst Lee Co. Ltd., Oxford Street, Manchester).

Rowan, Samuel Noel; 2, Mountainview Terrace, Newry Road, Bambridge, Co. Down (Under Manager, Thos, Ferguson & Co. Ltd., Edenderry Factory, Bambridge, Co. Down).

Scholes, Thomas; 4, Ruskin Street, Oldham (Ring Spinning Overlooker, Jas. Stott Ltd., Hartford Mill, Oldham).

Scott, Andrew, 28, Myrtlefield Park, Belfast, N. Ireland (Engineer, 18, Scottish Temperance Buildings, Belfast).

Selka, Michael; 68A, Emm Lane, Bradford (Director, James Drummond & Sons Ltd., Lumb Lane Mills, Bradford).

Sellers, Robert; 10, Whitehall Lodge, Pages Lane, London, N.10 (Export Manager, City Export Ltd., 44, South Molton Street, London, W.1).

Simm, Walter Martin; 46, Livesey Branch Road, Feniscowles, Nr. Blackburn (Salesman, Birtwistle & Fielding Ltd., Grange Mill, Blackburn).

Sleath, Leslie Thomas; 38, Wand Street, Belgrave Road, Leicester (Textile Mechanic, Hall & Earl Ltd., Baxter Gate, Loughborough).

Spencer, Herbert Colin; 5, Spring Terrace, Thwaites Brow, Keighley, Yorks (Student, Leeds University).

Swales, John Norman; 49, Barton Road, Swinton, Manchester (Lecturer, Royal Technical College, Salford).

Truslow, James Linklater; S.B.; American Viscose Corporation, 19, Sackville Street, London, W.1 (Overseas Representative).

Woolley, John Wynee; 30, Chelford Road, Macclesfield (Sales Engineer Tufnol Ltd., 21, Spring Gardens, Manchester, 2).

Junior.

Dewoolkar, Vasantrao Kamalnath; B.Sc.; "Pulee Villa," 20, Laburnum Road, Bombay 7, India (Apprentice, Bleach House, c/o Finlay Mills Ltd., Government Gate Road, Parel, Bombay).

Turnbull, Gerald Michael; "Town Head," Bradley, Via Keighley (Student, Textile Dept., University, Leeds).

Wilkinson, Derek; 4, Hudcar Lane, Bury, Lancs. (Assistant to Works Manager, Bury Felt Manufacturing Co. Ltd., Hudcar Mills, Bury).

Wilkinson, Frank Howard; 59, Allerton Road, Bradford (Textile Student, Technical College, Bradford).

Junior (Student).

Pearce, William Ronald; 276, Golden Hill Lane, Leyland [Textile Trainee, Brook Mill (Leyland) Ltd., Leyland].

Pinder, Kathleen Mary; 15, Sunnydale Road, Nottingham (Laboratory Assistant, Wool Industries Research Association, Hosiery Branch Laboratory, Nottingham).

Radford, Rita Joyce; "Wayside," Adbolton Grove, West Bridgford, Nottingham (Laboratory Assistant, Wool Industries Research Association, Sherwood Rise, Nottingham).

Appointments Register

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

No. 284—Member, 38 years of age desires position. Experience in Textile Designing on Cotton and Rayon Shirtings, and Dress Fabrics. Previously employed on Inspection of Stores, Ministry of Supply, as Superintendent. Associateship of Salford Royal Technical College.

No. 285—Member, 31 years of age, desires position. Previously Assistant Manager of Weaving Factory. Recently demobilised from Royal Air Force.

No. 286—Member, 38 years of age, 14 years as overlooker on fine yarns and cloths. Full Technological Certificate of City and Guilds of London Institute in Plain and Fancy Weaving. Conversant with principle and practice of time and motion study in Cotton Manufacture. Desires post as Manager or Assistant Manager at home or abroad.

No. 287—Member desires position as Designer for Men's and Ladies' Wear. Aged 29 years. City and Guilds Certificates in Woollen and Worsted Weaving, Cloth Analysis and Testing of Yarns and Fabrics, Design and Colour as applied to Woven Fabrics for Producers. Practical experience in Yarn Spinning and Weaving, and as Assistant in Designing and Costing Office.

No. 288—A.T.I., 36 years of age, desires position as Manufacturer's representative. Bradford Diploma in Cloth Manufacture. Nine years experience as Rayon Weaver. Six years experience as Technical Representative and Salesman. City and Guilds Certificates in Cotton, and Silk and Rayon Weaving.

No. 289—Textile Technologist, 34 years of age, desires position of responsibility. Practical experience of weaving. Good knowledge of the fabric problems met in Bleaching, Dyeing, Printing and Finishing of cotton and rayon fabrics. Sound knowledge of fabric analysis and construction. Several years experience of research testing. A.M.C.T., A.T.I.

No. 290—Young member, 20 years of age, desires position as Junior or Assistant Managerial position in the commercial, administrative or technical field of the textile industry. Bradford Diploma in Preparing, Combing and Spinning. City and Guilds Full Technological Certificates in Woollen and Worsted Spinning.

INSTITUTE MEETINGS

IRISH SECTION—BELFAST BRANCH

Thursday, 20th February, 1947—*Belfast*. Lecture, 7.30 p.m. at the College of Technology: "Some Recent Developments in Cellulose and Wool Science and Technology"—Dr. F. C. Wood, Ph.D., M.Sc., F.R.I.C., F.T.I. (Messrs. Tootal Broadhurst Lee Co. Ltd.). Chairman: E. Butterworth, M.Sc.

IRISH SECTION—DUBLIN BRANCH

Friday, 7th February, 1947—*Dublin*. Lecture, 7.30 p.m. at the Mansion House, Dawson Street: "Nylon Textiles—Their Properties and Processing"—E. Waters, B.Sc. (Imperial Chemical Industries Ltd.).

Friday, 21st February, 1947—*Dublin*. Lecture, 7.30 p.m. at the Mansion House, Dawson Street: "Some Recent Developments in Cellulose and Wool Science and Technology"—Dr. F. C. Wood, Ph.D., M.Sc., F.R.I.C., F.T.I. (Tootal Broadhurst Lee Co. Ltd.).

Friday, 7th March, 1947—*Dublin*. 7.30 p.m. at the Mansion House, Dawson Street: Works Films (details to be given later)—Samuel Law & Sons, Cleckheaton.

LANCASHIRE SECTION

Friday, 14th February, 1947—*Manchester*. Lunch-time meeting, 1.0 p.m. at the Institute: "Lubrication—Its Application and Control in the Textile Industry"—P. R. Masheder (Tecalemit Industrial Ltd.)

Friday, 21st February, 1947—*Manchester*. Lecture, 7.0 p.m. at the Institute: "Researches in Spinning and Doubling"—G. Dakin, B.Sc. (British Cotton Industry Research Association).

Wednesday, 5th March, 1947—*Manchester*. 2.30 p.m. Visit to Messrs. Montague Burton Ltd., Burtonville Clothing Works, East Lancashire Road, Worsley.

Friday, 14th March, 1947—*Manchester*. Lunch-time meeting, 1.0 p.m. at the Institute: "Some Recent Trends in Ribbon Manufacture"—L. J. Clarke, B.Com. (Wm. Franklin & Son Ltd.).

LANCASHIRE SECTION—BLACKBURN BRANCH

Thursday, 6th February, 1947—*Blackburn*. Lecture, 7.15 p.m. at the Chamber of Commerce: "Current Developments in Rayon Staple Spinning"—H. Ashton, F.T.I. (Courtaulds Ltd., Arrow Mill, Rochdale).

Thursday, 6th March, 1947—*Blackburn*. Lecture, 7.15 p.m. at the Chamber of Commerce: "Thoughts on a Modern Loom"—L. Armstrong (Messrs. Tootal Broadhurst Lee Co. Ltd.).

LANCASHIRE SECTION—BOLTON BRANCH

Friday, 14th February, 1947—*Bolton.* Lecture, 7.30 p.m. at the Municipal Technical College: "A Service by the Dyer to the Manufacturers"—F. Scholefield, M.Sc., F.R.I.C., F.T.I. (Manchester College of Technology).

Friday, 14th March, 1947.—*Bolton.* 7.30 p.m. at the Municipal Technical College—General Meeting and Open Meeting.

MACCLESFIELD, LEEK AND DISTRICT SECTION

Saturday, 15th February, 1947—Visit to Messrs. Imperial Chemical Industries Ltd., Blackley, Manchester.

Wed., 26th February, 1947—*Leek.* Lecture, 8.0 p.m. at the Nicholson Institute: "Fancy Yarns—Their Production and Use"—H. G. Greg (R. Greg & Co. Ltd.) Chairman: Col. L. J. Worthington, T.D., J.P.

Tuesday, 11th March, 1947—*Macclesfield.* Lecture, 8.0 p.m. at the Memorial Hall: "Costing in Relation to Management"—A. N. Sidebottom, A.M.C.T. (Ashton Bros. & Co. Ltd.). Chairman: F. G. Allt, C.A.

MIDLANDS SECTION

Friday, 21st February, 1947—*Leicester.* Lecture, 7.0 p.m. at the College of Technology (Room 104): "Hosiery Yarn Preparation"—E. Brierley, F.T.I. (Messrs. Thos. Holt Ltd., Rochdale).

Tuesday, 11th March, 1947—*Loughborough.* Lecture, 6.45 p.m. at the Technical College: "The Finishing of Knitted Garments and Fabrics"—Dr. E. R. Trotman.

YORKSHIRE SECTION

Tuesday, 18th February, 1947—*Dewsbury.* Lecture, 7.0 p.m. at the Technical College: "Comparison of Continental and English Systems of Woollen Yarn Manufacture"—G. Marshall.

Thursday, 20th February, 1947—*Bradford.* Lecture, 7.0 p.m. at the Midland Hotel: "Proteins and Plastics"—Professor J. B. Speakman, D.Sc., F.R.I.C., F.T.I. (Leeds University).

Thursday, 13th March, 1947—*Keighley.* Lecture, 7.0 p.m. at the Technical College: "Textile Machinery"—A Poncelet (Prince, Smith and Stells Ltd).