

# Procedure and Equipment for BLEACHING COTTON GOODS with Peroxide by the Continuous Method\*

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THERE have been many attempts to develop a continuous method for bleaching cotton goods with the objective of decreasing the processing time and the amount of handling. The development of the Gant piler, now in general use for such operations as souring and hemicking, was a definite step toward his objective. However, hypochlorite bleaching remained as a semi-continuous process because of the necessity for kier boiling the material in batches for relatively long periods of time. At least one attempt<sup>2</sup> was made to devise apparatus for the continuous treatment of cotton goods under pressure, but it appears to have attained little or no practical application in the bleaching industry.

In discussing methods for bleaching with peroxides, Weber<sup>4</sup> states that in 1888 Koechlin described a procedure for bleaching cotton goods by passing them through a weak sulfuric acid solution, washing, and then passing through a 2.4 volume hydrogen peroxide solution made alkaline by the addition of caustic soda and sodium silicate. The bath was kept at room temperature and, after saturating, the material was stored at room temperature for a sufficient time for bleaching to take place. Thus, at this early date, it appears to have been established that cotton materials could be bleached by saturating with a suitable peroxide solution and ageing the wetted goods. In some respects this is the forerunner of the present day continuous processes and of other methods that have been suggested since that time.

At a later date the same worker, Koechlin, is cited<sup>4</sup> as suggesting a method for kier bleaching cotton goods with peroxide under 2-3 atmospheres pressure. Since when many other methods have been suggested, e.g., a method of saturating with peroxide and running into a room filled with ammonia vapors<sup>1</sup>; a method of saturating with peroxide and passing continuously through a pressure chamber<sup>5</sup>; a method of saturating with hot or cold peroxide solution and storing in a tightly packed container in the presence of the

hot solution or by tightly rolling the heated cloth<sup>3</sup>.

In spite of the wealth of art directed toward continuous operation, no practical process had been evolved up to 1937. In that year a continuous process developed in du Pont laboratories was taken into the field for demonstration. Known methods and equipment were adopted, modified<sup>6, 7, 8</sup> and improved to meet the conditions necessary to produce commercially satisfactory results. By June, 1939, plant scale equipment had been built and a suitable procedure developed. Many obstacles remained to be overcome before the original methods and equipment could be developed to a point where consistent results and smooth operation were obtained on a regular production schedule. This goal was eventually reached by virtue of the patient tolerance of the plants where the first full scale installations were made.

The progress of the development has been described to the industry on several occasions<sup>9, 10, 11</sup>. Rupp<sup>12</sup> has compared the du Pont process with another process developed by the Buffalo Electro-Chemical Company. The purpose of the present paper is to report on the status of the du Pont development and to describe the process and equipment involved.

## THE BASIC PROCESS FOR PLAIN GOODS

Cotton fabrics may be processed in either rope or open width form. While the equipment differs for the two forms, the nature of the treatments is the same.

The basic process consists of two steps, the first a preliminary scour or 'boil' to prepare the goods for the second or final bleaching step. The method of handling the goods is essentially the same for both steps and consists of three operations.

1. Saturation. The cloth must be uniformly impregnated with approximately its own weight of treating solution.

2. Heating. The cloth is contacted with steam or a steam-air mixture in a controlled manner to heat to the required temperature.

3. Storage. The heated cloth must be stored in an insulated storage chamber

for the required reaction period, e.g., one hour.

In the treatment of plain goods, i.e., those which do not contain dyed patterns, the first step is a treatment with caustic soda. Fig. 1 shows the times required to render 80 x 80 cotton print cloth absorbent when heated to 212°F. and stored at that temperature after saturation with caustic soda solutions of different concentrations.

In determining the data for Fig. 1, samples of cloth were given a preliminary treatment by boiling for 15 minutes in water, then saturated in the various solutions and squeezed so they contain about their own weight of solution, heated and stored for different periods. After treating, the samples were thoroughly washed, dried, and ironed. Absorbency was determined by measuring the time required for absorption of a drop of water placed on the surface of the fabric. The surface of the fabric was kept taut by holding the fabric in a form. If the drop was absorbed in three seconds or less, the sample was considered absorbent; several check tests were made on different parts of each sample.

As indicated in Fig. 1, the times vary from 15 minutes to 2 hours with 7 per cent and 2 per cent caustic solutions, respectively. The time required rises sharply with concentrations below 3 per cent and decreases relatively slowly with higher concentrations. It must be borne in mind that the values obtained will vary with the construction of the fabrics, in that more densely woven materials will require longer treatment. Any preliminary treatments such as desizing, souring or mercerizing will also alter the results.

These data were developed in the laboratory, but they have been confirmed by plant work. It has been customary to use a storage period of about one hour to permit the handling of a variety of materials with a reasonably low concentration of caustic soda. The data indicate that this time might be shortened by using a higher concentration, but the consumption of caustic would be greater and there is some possibility of degrad-

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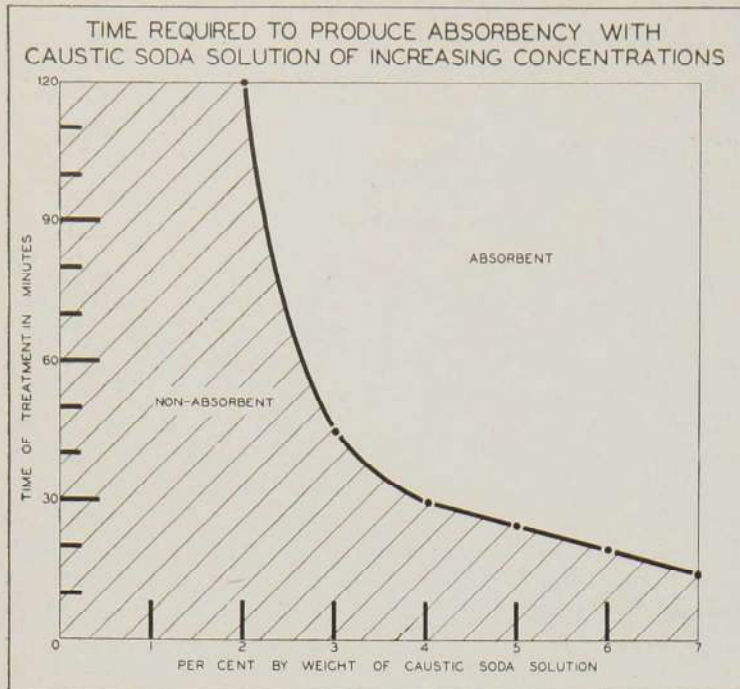


Fig. 1

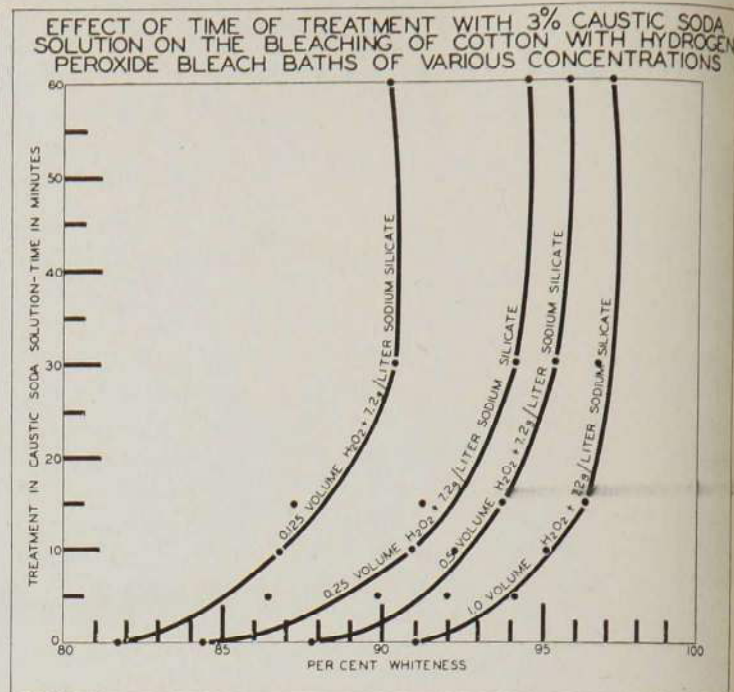


Fig. 2

ation. A 3 per cent solution is usually used, although this may vary from 2.5-4.0 per cent depending upon circumstances. As would be expected, it is desirable to avoid operating conditions on the steep slope of the curve. If the cloth is saturated with its own weight of a 3 per cent solution, the consumption is three pounds of caustic soda for one hundred pounds of material. It is interesting to note that this is in good agreement with the amounts usually employed in kier boiling. The time required is less, but this is due to the continuous method in which each yard of material receives the same treatment. In kier boiling, equilibrium may be reached in a relatively short time under ideal conditions but much longer times are needed to insure uniformity throughout the large mass of goods handled in the kier.

After the caustic treatment, the material must be well washed with hot or cold water to remove residual caustic and solubilized impurities from the cotton. The use of apparatus on the delivery end of the storage chamber, similar to the recuperator on a mercerizing range, has some advantages. The treated cloth is not chilled by contact with the atmosphere and the alternate passages through steam and hot water are effective. In cases where the available washing equipment is limited, a neutralizing treatment in which the cloth is treated with a dilute acid may be employed. It is desirable to wash the treated fabric until the pH of the absorbed water is between pH 4.0-10.0 so that the pH of the peroxide bleach bath used in the bleaching step will not be affected substantially.

The effect of peroxide bleach baths ranging from 0.125 to 1.0 volume concentration on 80x80 cotton print cloth, previously prepared by boiling for 15 minutes in water and then treating with a 3 per cent solution of caustic soda for periods up to one hour, is shown in Fig. 2. The bleaching treatments were all continued for one hour and the whiteness was determined with a reflectance meter. The whiteness increases with rising volume concentration of peroxide, but in each case the whiteness obtained on samples treated for 30 minutes in caustic soda was approximately the same as when the caustic treatment lasted for 60 minutes.

However, whiteness is not the only measure of good bleaching, since the material must also be absorbent and free of motes. The data in Fig. 2 are replotted in Fig. 3 and, in addition, two broken lines have been included. These are lines of absorbency and mote removal; the samples above and to the right of these lines are absorbent or free of motes, respectively. Absorbency was determined as previously described; mote removal was determined by visual examination. In Fig. 1 it is shown that a 45 minute treatment is needed to produce absorbency with a 3 per cent solution. After bleaching with 0.5 and 1.0 volume peroxide baths, as indicated in Fig. 3, the samples treated for only 5 minutes in 3 per cent caustic are absorbent. With more dilute peroxide baths, a 10 minute caustic treatment produces absorbency. Thus it is shown that the bleaching treatment helps in obtaining absorbency. Mote removal is complete on all samples treated with caustic soda and bleached

with one volume peroxide solution, but when 0.5 volume peroxide is used, only the sample receiving the one hour caustic treatment is free of motes.

The data plotted were developed in the laboratory but they have been confirmed by plant work. Here again it must be borne in mind that fabric construction has an important bearing on the values obtained. Plant work has shown that with many fabrics good results are obtained with 0.5 volume baths after an hour's caustic treatment but with fabrics more difficult to bleach this must be raised to 0.75-1.0 volume. The temperature of the cloth during storage should be 205°-210°F.; plant work indicates that best results are obtained in this range. The pH of the saturating bath is maintained in the range 10.5-10.8, using about 1 per cent 42°Be. sodium silicate as stabilizing and buffering agent. In some instances it is necessary to add caustic soda to the solution to keep the bath at the proper pH, but this depends largely on the previous treatments.

#### THE BASIC PROCESS FOR DYED YARN GOODS

The basic process for fabrics containing dyed patterns is also a two-step process. However, since the dyes might be attacked by caustic the preliminary caustic soda treatment is replaced by a preliminary peroxide bleach, similar to the second stage peroxide treatment just described. The concentration of the saturating bath will vary from 0.5 to 1.0 volume; in most cases a 0.5 volume is sufficient to clean up the fabrics and

EFFECT OF BLEACHING WITH VARIOUS CONCENTRATIONS OF HYDROGEN PEROXIDE ON ABSORBENCY AND MOTE REMOVAL

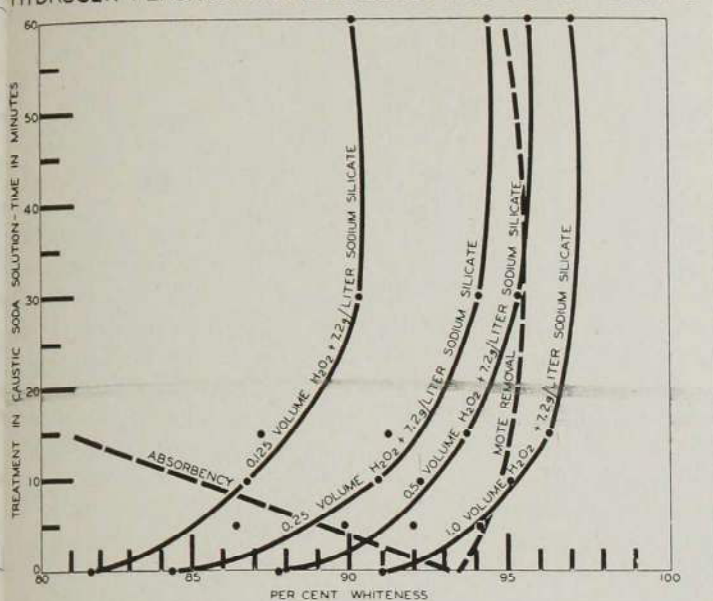


Fig. 3

RATE OF BLEACHING GRAY COTTON WITH ONE VOLUME HYDROGEN PEROXIDE AND THE RATE OF PEROXIDE CONSUMPTION

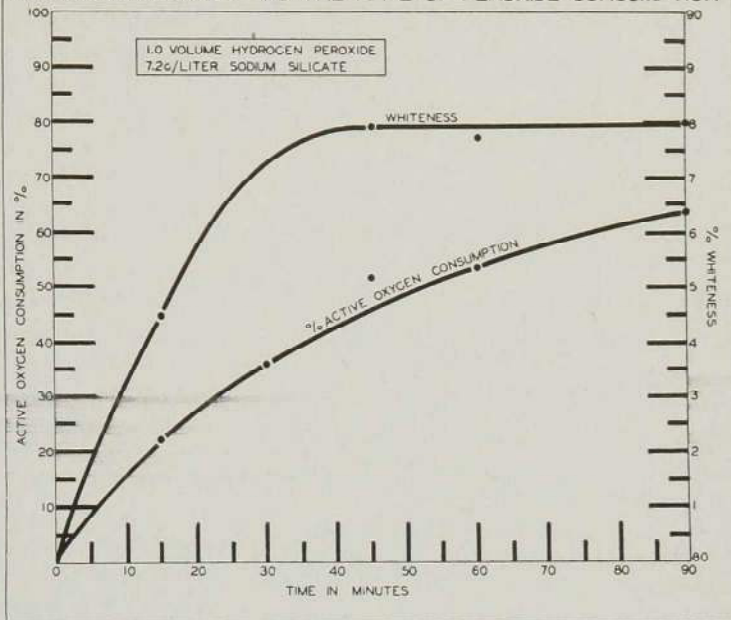


Fig. 4

partially bleach the motes so they will be eliminated in the final bleach step with 0.5-1.0 volume peroxide bath. The behavior of a 1.0 volume peroxide bath on 80 x 80 cotton print cloth prepared by boiling for 15 minutes in water is shown in Fig. 4. The temperature during the storage period was 205°F. The bleaching proceeds rapidly during the early stages and gradually slows down toward the end of the treating period. In treating goods having patterns dyed with vat colors, it is desirable to use a bath of such composition that the peroxide will persist throughout the storage period. In these tests only 60 per cent of the active oxygen was used, allowing a considerable excess. This factor can be adjusted to meet any required conditions. This figure is illustrative only and for economic reasons it is desirable to have the residual amount of active oxygen as low as is compatible with good results. In general the fastness of the vat dyes in the continuous process is the same as in peroxide kier bleaching, but somewhat higher temperatures can be used with safety. The saturating baths for both steps should be adjusted to pH 10.4-10.6 by the addition of sodium silicate and the storage temperature controlled at about 205°F. A few exceptions have been found where vat dyed patterns cause trouble under these conditions and require special handling in baths of lower pH or at lower temperatures. Since the goods are not subjected to the continuous circulation of the liquor as in kier bleaching, the clarity of the white areas is noticeably better. A number of the naphthol dyes have good fastness to these treat-

ments but it is usually desirable to use a saturating bath controlled at pH 10.0-10.4 and to keep the storage temperature at about 190°-195°F. in both steps.

VARIATION OF THE BASIC PROCESSES

In order to meet some requirements, it is desirable to include one or more additional steps. These treatments are all well known and no new techniques are suggested. The list of treatments includes the following:

1. *Singeing*. This is the first treatment given to many fabrics.
2. *Desizing*. An enzyme treatment to solubilize the sizing in the untreated goods. In some cases only a water steep is used.
3. *Washing*. In many cases when the requirements are not too rigid, a suitable preparation can be obtained with a hot or cold wash given in the conventional manner.
4. *Souring*. A hot or cold acid treatment given before the goods enter the first step is an effective treatment. A similar souring operation may be included between the two steps of the process or after the second step where it is desirable to produce fabrics with a low ash content.
5. *Mercerizing*. This treatment may precede the first step in the continuous process (grey mercerizing), come between the two steps, or follow the final bleach (white mercerizing). Grey mercerizing fits into the continuous process well and meets many requirements.

In laying out a continuous bleaching system careful consideration must be paid to the selection of the treatments needed

to supplement the basic process. The equipment should be arranged so that these treatments can be conveniently carried out and, if possible, obtain a flexible arrangement so that a variety of cloth routings can be used. Many routings are possible and the three following are offered as examples only.

A

1. Wash
2. Caustic or peroxide treatment
3. Wash
4. Peroxide treatment
5. Wash

B

1. Wash
2. Sour
3. Wash
4. Caustic or peroxide treatment
5. Wash
6. Peroxide treatment
7. Wash

C

1. Desize
2. Wash
3. Mercerize
4. Caustic treatment
5. Wash
6. Sour
7. Wash
8. Peroxide treatment
9. Wash

If the cloth is to be processed in rope form, the equipment may be arranged in a straight line or in a group. With the cloth in rope form it is quite feasible to turn one or more corners so that a great many different arrangements can be devised. If the cloth is handled in the open width it is preferable to arrange

the equipment in a straight line; corners can be turned if absolutely necessary, but are generally undesirable.

## METHOD AND CONTROL OF SATURATION

The essentials of good saturation are as follows:

1. If the cloth is wet before it reaches the saturator, the moisture content must be reduced by squeezing so that it is lower than when it leaves. The squeezing should be done in a controlled manner and as much water removed as convenient.

2. The contact between cloth and liquor must be sufficiently intimate and the time of contact long enough to insure a uniform impregnation.

3. The concentration of chemicals in the saturating bath must be properly maintained.

4. The cloth leaving the saturator should contain approximately its own weight of solution.

In rope systems the saturators used for both steps may be of the single strand slack loop type (this is the conventional pit type). In this type an amount of slack can be accumulated in the saturator so that a soaking period is provided to permit the cloth to imbibe the treating liquor. In some special cases where it is desired to handle heavy goods in rope form a double dip rope saturator may be used to provide an extra long soaking period; improved saturation can be obtained by giving an intermediate squeeze between the two dips.

Open width saturators are used for both steps in the open width system. They are also used for the first step in rope systems where the nature of the fabric or the requirements demand it. If the goods are to be dyed, open width saturation has been employed in order to insure uniformity, since the goods are not very absorbent at this point. The apparatus should be so constructed that the cloth passes through the liquor, is squeezed, immersed and squeezed a second time. The intermediate squeeze is desirable for good saturation, since no slack is accumulated and contact time is usually short. A three bowl mangle or open soaper type of apparatus is usually used.

The differential between the incoming and outgoing squeezes is recommended because the well squeezed cloth more readily takes up the treating solution and also permits the feeding of a stock solution into the saturator. The bath strength must be constantly replenished by a controlled flow of a more concentrated stock solution. The concentration of the stock solution may be 3 or 4 times

that of the saturating bath. There are many suitable methods for controlling the flow and a number of devices are made for such purposes. It is desirable that the rate of flow can be varied in order that fabrics of different constructions can be treated in the most suitable baths.

The saturating solutions should be analyzed at intervals as a check on the performance of the system. The active oxygen content of the peroxide bath can be determined with sufficient accuracy by the permanganate method<sup>13</sup>, the alkalinity by titration with standard acid solution, and either potentiometric or colorimetric methods are suitable for pH determinations<sup>14</sup>. The caustic soda solution can be analyzed with standard acid, and fair control can be maintained by hydrometer readings; conductivity instruments can also be used in some cases.

The squeezing of the cloth can be done with the conventional type of squeeze rolls. The loading mechanism should be so arranged that the loading can be controlled and reproduced at will. Several mechanical methods are available for this purpose such as levers, screws, pneumatic or hydraulic pressure devices.

## THE METHOD OF HEATING

After saturation, the cloth passes into a heating chamber. The chamber may take several different shapes to make it adaptable to different types of storage chambers. In the existing installations, it is in the form of a U tube which has an overall length of 30-40 feet. If the cloth is in rope form the vertical legs of the U are pipes generally 5-6 inches in diameter. If the cloth is in open width the vertical legs have a cross section in the form of a rectangle 6 inches on the short side and a little greater than the widest fabric to be treated on the long side.

A steam chest is located at the top of the second leg of the U, farthest from the entrance. The inner wall of this chest is perforated so that the steam is distributed on all sides of the cloth. A supply of properly conditioned steam is admitted through this chest. A large portion of this steam travels counter to the cloth toward the cloth entrance. The tube is made long enough to permit the uniform heating of cloth at high speeds; in this way each yard of cloth is properly heated and there is no chance for uneven heating.

The steam supplied to the cloth heater must be dry, saturated steam at atmospheric pressure. The conditioning of the steam supply is of prime importance.

To meet these requirements the steam drawn from the mill supply must be expanded to atmospheric pressure by passing into an expansion chamber, which is simply a pipe of suitable length (usually about 15 feet) and larger than the steam supply line. Superheat can be removed by spraying water into the expanded steam. The use of superheated steam may create a drying atmosphere in the heater and storage chamber or the atmosphere may fluctuate between a drying and non-drying atmosphere. It is essential that the treatments be carried out in a non-drying atmosphere. After desuperheating, the steam may pass through a purifier to remove impurities and entrained water.

The temperature of the cloth is controlled by limiting the amount of steam entering the cloth heater and in some cases using a steam-air mixture. The flow of steam may be regulated automatically by a suitably located temperature control instrument. In comparison with kier processing the steam requirements are very low, since only 100 lbs. of water per 100 lbs. of goods are heated in each step, whereas about 400 lbs. of water are needed in kier work. Steam savings of 50 per cent and upwards have been realized with the du Pont process.

## STORAGE CHAMBERS

The storage chambers used have been of the J piler type of more or less conventional shape, built in different sizes to accommodate different production rates. They have been built of 18-8 stainless steel sheets with the surfaces on which the cloth slides made from metal finished with a high polish. The pilers should be insulated to prevent heat loss; this may be done with glass wool, magnesia block or the equivalent. The cloth must be piled in the storage chambers in a regular manner so that it will pull out smoothly and evenly.

This part of the equipment functions as a conveyor to obtain the needed storage period of one hour for each step. There are other types of conveyors that can be used with equally good results, e.g., belt conveyors.

## SUMMARY

The process consists of two basic steps supplemented by certain other auxiliary steps that may be incorporated in the process for certain fabrics or to meet certain production requirements. The method used for each of the two steps consists of saturating the cloth uniformly with its own weight of treating solution, heating to a predetermined reaction temperature in a chamber wherein all

faces of the cloth are exposed to an atmosphere of conditioned steam and ring or ageing the heated cloth without heat loss for a one hour reaction period.

The development has created wide interest and its use has been limited only by the difficulties attendant to the installation of new equipment under wartime conditions. However, there are now several ranges in operation, eight for treatment of the cloth in rope form and one for open width. There are probably six million yards of cloth bleached by this process every week and the volume is actually rising as the cloth speed is increased. Operating speeds have increased from 100 yards per minute to 100-190 yards in some of the later installations and there is no indication that the limit has been reached.

The steam consumption is less than with other bleaching processes and is closely approaching the theoretical amount required to heat the saturated cloth. The total cost of chemicals used in the process is lower than any other method of peroxide bleaching and is well in line with the lowest figures for hypochlorite bleaching. The overall cost picture is favorable. The quality of the processed fabrics has been good and the percentage of seconds has shown a profitable decrease as compared to older processes. While there are still some problems to be solved and improvements to be made, there is every reason to believe that the process will exert an important influence on cotton bleaching in the future.

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#### DISCUSSION

*Chairman:* We have a lot of bleachers here this evening; I know that we will have a very interesting question period

following this paper. As a matter of fact, I recall an experience I had with peroxide a few years ago in connection with handling some goods which had been desized. I knew that when the goods hit the peroxide, my bleaching liquor completely exhausted and no bleaching took place; on giving the goods a second treatment considerable tendering had resulted. You mentioned handling goods, that had been malted or desized, through the continuous process—I was wondering if you had run into any difficulty with incomplete removal of converted starches.

*A.* No, we haven't. Both treatments are alkaline. If they weren't you might have trouble if there were starch present to form enough acidic products. You could tender cloth if the alkalinity was not sufficient to keep the goods alkaline all the way through the high temperature treatment.

*Q.* Do you use wetting agents?

*A.* We have used wetting agents and still use them in some of the installations. As far as the caustic treatment is concerned, I think caustic soda is about as good as anything you can use.

*Q.* Have you used silicate and caustic?

*A.* No, we haven't.

*Q.* There is some residual caustic in the first treatment carried over from washing, isn't there?

*A.* Well, that depends. You have to have sufficient washing so that you can control the amount of caustic going into the peroxide saturator. There is a limit to how much caustic you can carry in there. Sometimes in peroxide kier bleaching we bleach in baths of very high pH; but in the continuous system we find it desirable to keep the pH just about 10.6-11.0, this should go down to 10-10.4 for naphthols, and 10-10.6 for vat colors.

*Q.* What about the peroxide? Is the bath stronger or more detrimental to colors?

*A.* Fundamentally, what we are doing in the continuous process is eliminating water. The bath may be a little bit stronger but not very much so. Essentially, the hydrogen peroxide concentration is about 1/2 vol. where there are only a few motes, and from 3/4—1 vol. in dirtier grades. It is the liquor ratio which has dropped from 1:8 down to 1:1, which is responsible for the savings.

*Q.* Hasn't this process evolved with the general improvement in the stability of the hydrogen peroxide as it is manufactured today?

*A.* Yes, it certainly has.

*Q.* How about tensile strength?

*A.* Tensile strength and fluidity in

cuprammonium solution are excellent, the latter being about 4-5 rhes and falls in the range of well-bleached cotton.

*Q.* What is the comparative whiteness of the finished goods?

*A.* You can get any degree of whiteness you want. That is a function of the amount of peroxide used.

*Q.* How about mercerizing?

*A.* Mercerizing can be done at any point in the process where it is convenient, but most commonly in the grey stage before this process.

*Q.* Do fabrics like wool or acetate go through?

*A.* Well, of course the process is designed for high temperature operation which usually is not very good for wool. There are methods of bleaching wool by saturating with peroxide and storing where the cloth is heated by passing through a warm or hot solution.

*Q.* I should think you could bleach wool with an acidulated peroxide and get it down to a pH of 3.5 or 4.

*A.* So far there has been no practical application of anything like that.

*Q.* Is the conditioned steam of which you spoke removed at the discharge end of the roller?

*A.* The temperature is controlled by limiting the amount of steam which enters the heating chamber. You can do that automatically by placing a controlling thermometer bulb near the entrance of the heating tube. We have gradually increased the length of the heating tube to increase efficiency until we have approached the theoretical amount of steam required to heat the wet fabric. Very little steam escapes.

*Q.* You bring your fabric practically up to steam temperature?

*A.* Not always. For white goods the temperature in the peroxide treatment may be 205° to 210°F. Our plant work indicates that is the best temperature range to use. When we are bleaching dyed yarn fabrics and the yarn is vat dyed, the temperature is controlled about 205°F. If you have a pattern with naphthol colors in it, it is desirable to keep the temperature down around 190° to 195°F. We have done that by limiting the amount of steam or using a mixture of steam and air. On colors you also have to exercise good control over the pH of the saturating bath.

*Q.* What kind of heating unit do you have for open width goods?

*A.* The open width heater is only 6" deep and a little wider than the widest fabric handled. The over-all length and other details are similar to the heater used for rope work.

Q. Do the J boxes maintain their heat?

A. Quite well, as they are insulated with 2" magnesia block or 1-1/2" of glass fiber insulation.

Q. What kind of metal do you use?

A. The storage chambers are built of stainless steel, about 16-gauge metal, and the heating tubes are a little bit heavier. The sliding surfaces are given a mirror finish.

Q. Why is stainless steel necessary?

A. The storage chambers run without any conveyor and you have to select a metal with a low coefficient of friction so that the cloth will slide. There are other metals which might be used but stainless is the best. Actually none of this equipment has been built of anything but stainless.

Q. May I ask about scale formation?

A. That is pretty much a matter of housekeeping. There have been one or two instances where scale has formed, particularly if the units weren't cleaned out after using.

Q. Do you have any trouble with friction marks?

A. That may be traceable either to the scale formation of which we spoke but most probably to the mechanics of handling the cloth as it passes through the range.

Q. In that J-piler have you some kind of conveyance so that there will be no drag on the fabric when it comes out?

A. No, it does quite well. Actually the cloth is being pulled from the low joint in the J.

Q. What do you use for squeeze rolls?

A. Rubber. And it is desirable to load these squeeze rolls in such a manner that the squeeze can be reproduced. A rubber-stainless steel combination could also be used.

Q. What is the minimum floor space and head room necessary?

A. The storage chambers are about twenty-two feet high overall. The minimum head room would be about twenty-five feet. The floor space depends on how the equipment is arranged. The straight line arrangements are about 100 to 125 feet long and 25 feet wide. A 65-foot square can be used for a compact group arrangement.

Q. What is the relative speed of the rope bleach and open width?

A. The speed of the rope systems originally was 100 yards a minute and it is now up to 190 yards a minute. The open width speed has gone as high as 100 yards a minute, depending on the weight of the fabrics. We have not yet reached the limit.

Q. What are the heaviest goods you have handled?

A. About one yard or one and one-half yards per pound in open width equipment.

Q. What are the lightest goods you recommend for this process?

A. The lightest goods which have been handled are in the neighborhood of 5 1/2 to 6 yards per pound. I don't know that there is any limit. I think we will be able to handle goods of practically any weight provided the mechanics of the system are such that you don't distort them.

Q. What is the overall time required?

A. About two hours and twenty minutes for complete processing.

Q. Does that time apply to all fabrics?

A. The length of time would be just about the same.

Q. In a unit such as you describe, how many men are required?

A. The ranges now in operation run all the way from one and one-half men to about three and they turn out up to a couple of hundred tons of cloth a week.

Q. How much do these units cost?

A. About \$6000 to \$8000 for the heaters and storage chambers; the washing equipment, etc., is standard.

Q. When you change from one kind of bleaching to another, do you shut down the plant?

A. No, we haven't had to shut down any plants to change bleaching processes.

Q. Do you think the conventional kier will become obsolete in time?

A. Of course I think it will, except for specialties.

#### MEETING, NEW YORK SECTION

THE Annual Business Meeting of the New York Section was held on June 9th at the Downtown Athletic Club, 19 West Street, New York City, Patrick J. Kennedy, chairman, presiding.

A letter from the chairman of the Philadelphia Section, Boyce C. Bond, was read. This referred to the Annual Meeting to be held in Atlantic City on October 12th, 13th and 14th, under the auspices of the Philadelphia Section.

The treasurer, Edward H. Schmidt, reported a cash balance of \$1,207.78. He pointed out that it had not been necessary to call on the national body for funds.

It was voted that the New York Section apply for corporate membership in the national association. The sum of \$500 was appropriated for this, to be prorated \$100 annually.

The secretary, Norman A. Johnson, reported that minutes of all meetings had been published in the Proceedings.

Kenneth H. Barnard submitted for the councilors a report prepared by J. Robert Bonnar. This report pointed out that,

during the last three or four years, attendance at the council meetings had been practically 100% on the part of the New York Section representatives. It also reviewed the activities of the Council during the past two years.

Mr. Barnard also referred to the Inter-sectional Contest to be held at the Annual Meeting. He stated that all eight sections will be represented this year.

P. J. Wood reported for the New York Section committee for the Inter-sectional Contest and stated that progress was being made.

The chairman of the technical program committee, Dr. Herman E. Hager, reported on the programs that his committee had arranged for the past season.

The chairman of the membership committee, Thomas F. O'Brien, reported that the New York Section had gained a total of 166 new members during the past two years.

The chairman of the registration committee, Paul J. Luck, reported that by means of registration it had been possible to determine the number of non-members attending meetings. This information was turned over to the membership committee with results as noted above.

The chairman of the corporate membership committee, Leonard S. Little, reported that his committee had had a number of meetings and was now actively engaged in raising the New York Section quota. He expressed the belief that the Section would raise more than its quota of \$12,000.

It was announced that a report on promotion and publicity of the New York Section, prepared by Winn Chase, had been turned over to President William D. Appel for study.

The chairman of the nominating committee, P. J. Wood, presented the committee's slate of officers for the 1944-45 season. These officers, whose names appeared in the June 19th issue, were unanimously elected.

At this point the meeting was turned over to the chairman-elect, Emmett Driscoll, who presented Henry E. Hird, vice-president and secretary of Samuel Hird & Sons, Inc., Garfield, New Jersey. Mr. Hird spoke briefly on "The Value of a Hobby" and then presented three colored motion pictures entitled: "Desert Life," "Packhorse Trip in the Canadian Rockies" and "Fishing and Hunting." These remarkable pictures were thoroughly enjoyed by the audience.

The attendance was approximately 120.

Respectfully submitted,

NORMAN A. JOHNSON,

Secretary