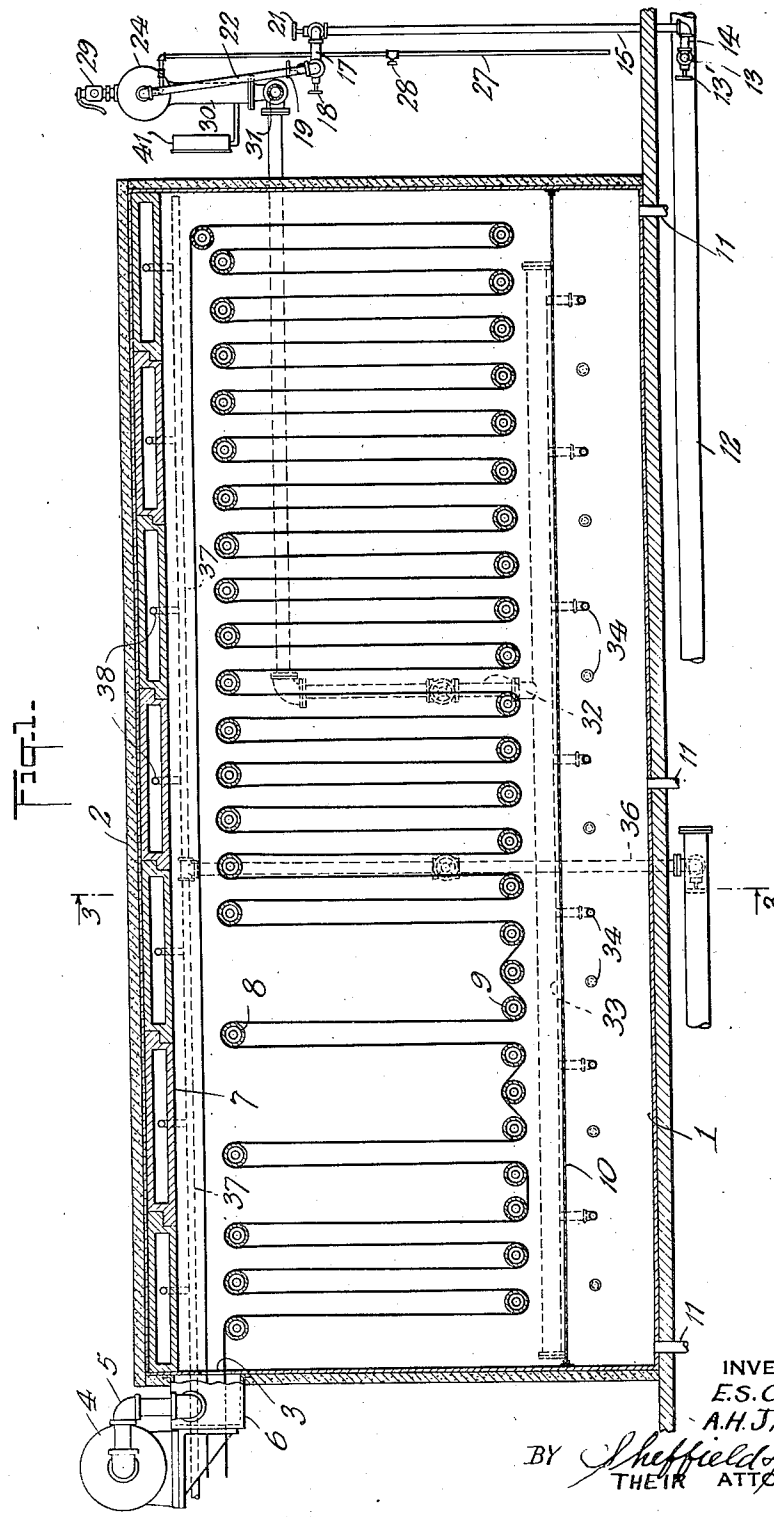
June 7, 1932. E. S. CHAPIN ET AL 1,861,623

APPARATUS FOR TREATING AND AGING FABRICS

Filed April 29, 1929 2 Sheets-Sheet 1



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APPARATUS FOR TREATING AND AGING FABRICS

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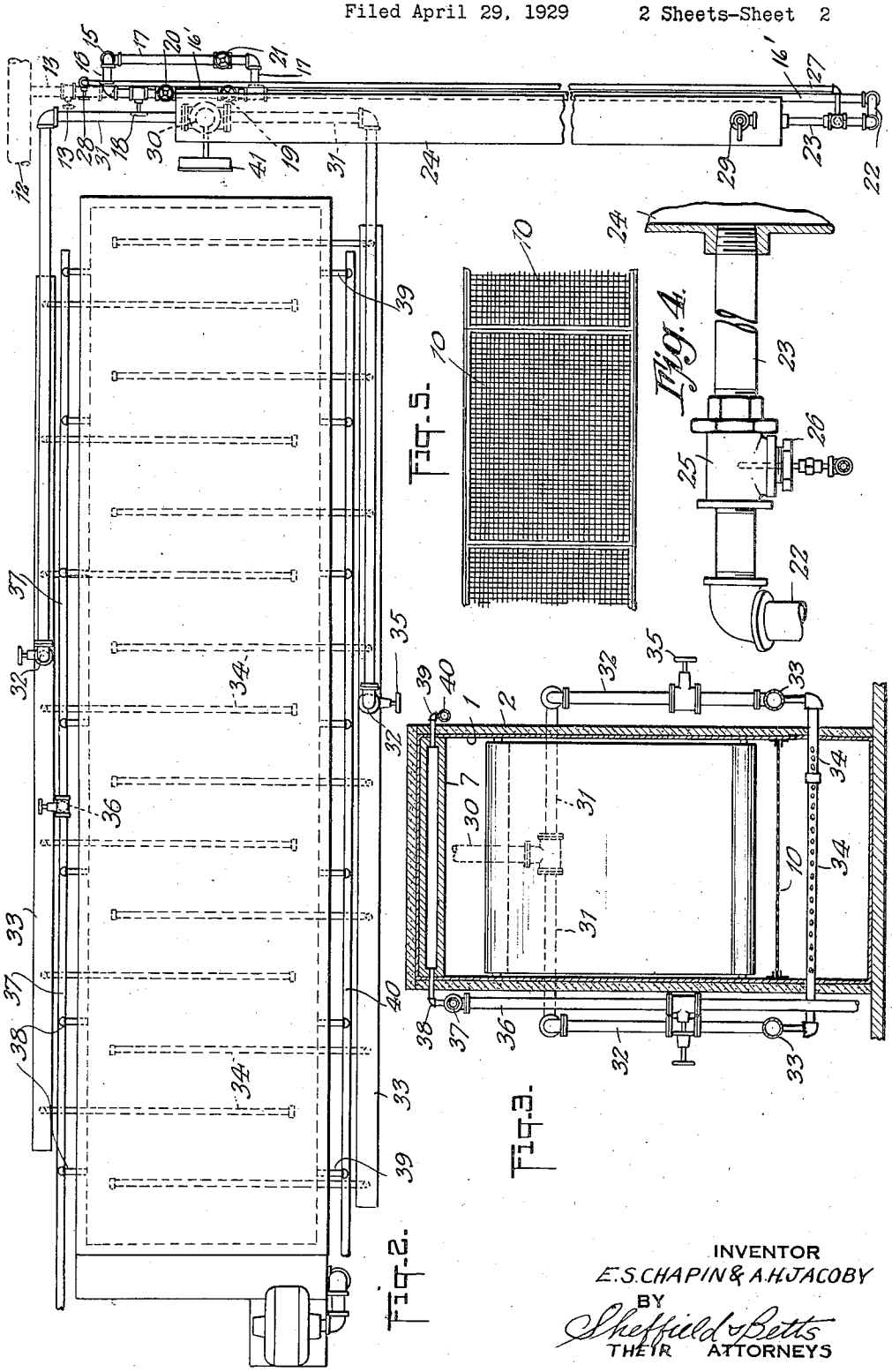


Fig. 2.

Fig. 5.

Fig. 4.

Fig. 3.

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UNITED STATES PATENT OFFICE

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APPARATUS FOR TREATING AND AGING FABRICS

Application filed April 29, 1929. Serial No. 359,156.

This invention relates generally to the treatment of fabrics composed of various materials, such as cotton, silk, rayon, or wool, or mixtures of said materials, and is particularly applicable to the treatment of fabrics where an aging action is desired. It especially relates to the treatment of fabrics having thereon vat color prints or dyes and to discharge prints or other fabrics where the reducing of the dyes or chemicals used in printing or dyeing is necessary.

In the usual process of aging, the aging chamber is supplied with an atmosphere of steam which excludes air and particularly oxygen so that the organic dyes are reduced to the leuco bases. This treatment with steam constitutes what is known as the aging and during the aging process considerable heat is produced by various chemical and physical actions and reactions occurring within the ager. The leuco bases are water soluble and therefore can be absorbed by the fibers of the fabric. After the aging process is completed, the dyes are fixed in the fibres of the fabric by oxidation through contact with the oxygen of the air and by treatment with water solutions of soap, etc. This oxidation causes the dyes again to become insoluble and results in exceedingly fast colors.

In the use of the usual aging apparatus, it has been found impossible to maintain the temperature at sufficiently low point to carry out the aging process entirely satisfactorily because the sources of liberation of heat have not been definitely known and consequently no positive remedy has been provided.

We have found that the causes of the rise in temperature are due to various conditions resulting from the actions and reactions which occur during the aging process. These include the giving off of latent heat contained in the water vapors when they are condensed upon the fabric as it passes through the apparatus, chemical reactions resulting from the reduction of the dyes, heating coils intended to maintain the desired temperature, steam chests used to prevent condensation, and the heating of the rolls and other metallic parts which tend to absorb and then radiate heat. However, the giving off of latent heat appears to take place whether the fabric has been printed or dyed or whether it is plain, undyed or unprinted fabric, as in treating the so-called "grey goods". Consequently if it were desired to maintain an even temperature at a definite point in the vicinity of or slightly above 212° F., it has been practically impossible to do so on account of the lack of an accurate control of the heat and the maintenance of a definite degree of moisture.

The matter of the generation of surplus heat during the aging process has been generally discussed and explained in our prior Patents Nos. 1,738,946 and 1,738,947 issued December 10, 1929, for process and apparatus respectively for treating fabrics.

We have found after further practical tests and experiments, that a very important consideration in the control of the temperature within an aging apparatus is the choice of the character of steam forming the vapor in which the aging action takes place. The choice of the steam involves several factors which must be considered so that the steam will produce the aging action in the most efficient manner. These factors may be enumerated as follows: (*a*) the quantity of the steam, (*b*) the temperature of the steam, (*c*) the amount of moisture carried by the steam, and (*d*) the time during which the steam is allowed to act upon the fabric.

The latter time element is an important factor in aging. Generally up to a certain period of time the color value of the dyes is increased, while for shorter or longer time the color value is lessened. This consideration obviously involves the question of maximum production for one or more aging units and a determination of the maximum speed of the fabric through the ager consistent with high color value and minimum cost for dyes.

In most instances of the treatment of vat color prints the original organic dyes are made into a paste form by mixing with them hydrosulphite of soda, caustic soda and a thickening material, such as starch, dextrine, gum arabic, etc. After the fabric is printed by suitable engraved copper rolls or other-

wise, it is dried and passed into the chamber known as an ager comprising rolls over which the fabric passes in successive vertical runs.

Ordinarily, when the goods were finally washed after aging, the operation was usually accompanied, in different degrees, by the washing away of a considerable quantity of the dye stuff which had not become fixed in or on the fabric. This was true in some instances, to the extent that practically 50% of the dye stuff was lost through inefficient reduction and oxidation. The dye stuffs used in the printing of fabrics are, as is well known, comparatively expensive organic materials and the reduction in the cost thereof is an important factor in the total cost of treating the goods, and, naturally, when accomplished, ultimately permits a greater return on the price per yard of the finished product. One of the important results of our process is therefore a more complete and efficient use of dye stuffs so that in the final washing very little, if any, of the original dyeing material is wasted.

As will be appreciated by those familiar with the art of aging fabrics, the aging process is carried out upon a great variety of goods, particularly as to the weight of the fabric and the amount of the dye applied thereto. The heavier fabrics having the coloring dyes applied thereto in considerable quantity or in relatively heavy coatings, naturally develop considerably more heat in the aging process than do lighter fabrics having lighter coatings of the dyeing material applied thereto.

Furthermore, different coloring matters in materials produce different amounts of heat which are generated during the aging process. It thus becomes necessary in the aging of various fabrics to control the action of the heat generated so that it will not become so high as to interfere with the subsequent actions as the process proceeds.

Not only should the heat generated be removed from the vicinity of the fabric as rapidly as possible, but the steam subsequently supplied to act further upon the dyes and the fabric to continue the reactions should be so provided as to quantity and quality that the conditions within the ager may be maintained under the best conditions to produce the desired result.

One of the objects of the present invention is, therefore, to produce an improved process by means of which the fabric being aged may be treated uniformly and efficiently without involving the usual disadvantages heretofore experienced resulting from the presence of an undesirable amount of heat or too great or too small an amount of moisture. We have found in most instanes that when steam is supplied to the aging apparatus thorugh the usual means, such as taking directly from a boiler or other steam generator used for driving a steam engine or turbine, the reduction of the pressure by reducing valves before entering the ager causes the steam to enter the ager in too dry a condition, and its quantity and quality are not such as are suitable to give uniform and efficient results because of the superheated condition of the steam.

This is also true of steam which has been taken from a boiler such as above mentioned and allowed to expand in an expansion chamber, although owing to the radiation from such an expansion chamber the amount of moisture contained in the steam may be greater than that when direct steam is used. This method, in certain instances, has, however, been found to produce better results in the ager than the use of steam direct from a boiler.

A third source of steam is the exhaust from a steam power generator, such as a steam turbine. In this case, some of the heat has been extracted from the steam by reason of the power developed in the generator or turbine; therefore, for a given amount of steam, the pressure is somewhat lower and the steam more moist.

It is clear, however, that the steam which is introduced into the ager must be of the right quantity as well as of the right quality as regards temperature and degree of moisture to produce the best effects in any particular ager, depending upon the kind of goods being treated or the amount of dye materials thereon.

As a result of our researches and experiments, we have found that the steam when passed through an ager in comparatively larger quantities than formerly used from a source having a low pressure is best adapted to produce the desired results.

This is particularly true if the action of the steam be permitted to continue for a considerable time beyond that usually considered necessary under the conditions formerly existing.

The quantity of such steam has been determined by flow meters and thereby, it has been found that 1800–2000 lbs. of steam per hour has often been required.

As far as we are at present advised, no apparatus has yet been devised to determine through any form of indicator the amount of moisture which may be present in steam after it has been introduced into an aging apparatus and the best available indicator for the conditions of the heat existing within the aging apparatus is the thermometer, these thermometers being placed at various places so as to indicate the temperatures at a plurality of points. We have found, contrary to the usual practice, that it is necessary and essential so to locate thermometers that the temperatures between the runs of the fabric

at various points within the apparatus may be accurately determined, particularly in the central longitudinal zone where the highest temperatures usually occur. We have found that when the quantity and quality of the steam have been correctly adjusted by controlling the supply, the temperature within the ager at such points should be between about 215° and 225° F., although in some cases, depending upon the nature of the fabric and the printing, it may be somewhat higher or lower than those temperatures.

We have also found that the initial reactions at the forward end of the aging apparatus produce the greater amount of heat, and, therefore, especial attention is necessary to prevent abnormal rising in temperature at that part of the aging apparatus.

It is, therefore, particularly desirable to produce a more rapid circulation of the vapors at certain points and then to remove or exhaust them so that vapor containing the excess heat developed may be rapidly displaced and its place taken by more moist vapors, as set forth in our prior patents above mentioned.

In the general commercial use of former agers, as employed in the cloth printing industry, it has been found that the depth of the color produced varies to a considerable extent. Thus when the ager was first started, the resultant color was considerably deeper than that secured after the ager had been run for several hours. Not only this, but in the course of a day's run the color value would go off and this might even occur during the course of a single run.

The definite cause of such conditions was practically unknown prior to our researches and the result was that a comparatively large percentage of the finished goods had to be discarded or sold as an inferior product or "seconds".

Through the use of our improved apparatus, the certainty in the color value of the printed fabric produced has been greatly increased and we have been enabled to produce a fabric in which any defects that may occur do not result from the treatment during aging, but are due to other conditions which may have existed during the actual printing or during other treatments not connected with the aging process or apparatus.

Owing to this fact, which results from the definite condition of the quantity and quality of the steam which is present within the ager, we have been able to produce great regularity in the process so that continual variations of the conditions within the ager are effectively eliminated.

Furthermore, the product is practically uniform and of greater depth of color per unit of dye or other coloring substance than has heretofore been possible to obtain.

In addition to these results as to uniformity and depth of color, and the reduction in the amount of defective goods, we have been able to accomplish another result which is of great importance in the practical industry of printing and producing vat color prints—that is, the reduction in the quantity of dye stuffs employed.

Some of the advantages above stated may be accomplished by the use of our inventions without any substantial increase in the time required for treating the fabrics, as we have found that material may be aged, if desired, in substantially the same time as required in the old or previous aging apparatus, and with greatly improved results.

A preferred form of apparatus adapted to carry out the process of the present invention is shown in the accompanying drawings in which

Fig. 1 is a vertical longitudinal sectional view of the aging apparatus showing the piping connections thereto through which steam is supplied to the interior of the ager;

Fig. 2 is a plan view of the apparatus shown in Fig. 1.

Fig. 3 is a vertical cross-sectional view taken substantially along the line 3—3 of Fig. 1;

Fig. 4 is an enlarged partial view of the piping system adjacent the mixing chamber, and

Fig. 5 is a partial view of the screen positioned in the ager for the purpose hereinafter described.

The construction of the ager will be described first. Referring to the drawings, the numeral 1 indicates a casing of sheet material which forms the body of the ager and which is covered with suitable heat insulating material 2, to prevent the escape of heat from the ager. At the upper left hand side of the ager an outlet 3 is provided through which the cloth to be aged enters and emerges from the interior of the ager. The opening 3 is provided with means to suck away the steam which would tend to be discharged through said opening, said means preferably comprising a fan or other form of suction device 4 having a pipe 5 leading from the interior of a horizontal hood 6 adjacent the opening 3 and through which the cloth passes in entering and emerging from the ager.

The top surface of the ager is provided with a plurality of hollow heating plates 7 which are provided with steam as hereinafter described so as to maintain the top surface of the ager at such a temperature as to prevent condensation of moisture from the steam in the ager so the drops of water will not fall on the fabric being treated.

The interior of the ager is provided with two series of rolls 8 and 9 over which the cloth to be aged passes successively in parallel vertical runs as indicated in Fig. 1.

A screen 10 having substantially the same length and width as the interior of the ager is positioned slightly below the lower series of rolls 9 so as to prevent the goods being treated in the ager from being spattered with moisture produced in the interior of the ager by the inflowing steam. The screen 10 also serves to distribute the inflowing steam evenly throughout the ager.

The bottom of the ager is provided with a plurality of drain pipes 11 as shown, through which the moisture condensing in the ager will flow therefrom.

The arrangement of piping for supplying steam under the proper conditions of temperature, pressure and moisture content will now be described. In the drawings the numeral 12 indicates the main steam supply pipe through which steam from a suitable source of supply flows. The pipe 13 is connected to the supply pipe 12 and has associated with it a suitable valve 13′ to control the admission of steam to the aging apparatus. The pipe 13 communicates with a pipe 14 (see Fig. 1) which in turn connects with a vertical pipe 15 shown more clearly in Fig. 1. From the vertical pipe 15 two horizontal branch pipes 16 and 17 extend as shown in Fig. 2. The pipe 16 has connected thereto the pipe 16′ and the valves 18 and 19 which are adapted to stop the flow of steam therethrough. An automatic regulating valve 20 is also provided in the pipe 16′ to reduce the pressure of the steam flowing through the pipe 16′ to any desirable pressure below the pressure of the steam supply from the main pipe 12 and this valve is made inoperative by the valves 18 and 19. The pipe 17 is connected to pipe 16′ beyond the valve 19, thus constituting a by-pass. A valve 21 is inserted in the pipe 17 and it will be readily understood that by closing the valves 18 or 19 in the pipe 16 and opening the valve 21 in the pipe 17, the steam may be caused to flow through the by-pass 17 instead of flowing through the pipe 16 and regulating valve 20, thereby permitting repair or adjustment of the latter.

The opposite end of the pipe 16 is connected to a riser 22 which in turn communicates with a horizontal pipe 23 connected to a mixing chamber 24, as clearly illustrated in Fig. 4. Referring now to Fig. 4 it will be seen that the pipe 23 is provided with a T 25 having a reducing plug 26 screwed into one opening. Water is supplied to the interior of the mixing chamber 24 through the pipe 27 which is connected to the T 25 through the reducing plug 26, as shown more clearly in Fig. 4. A valve 28 in the pipe line 27 controls the admission of water to the mixing chamber 24.

In the mixing chamber 24 the steam flowing through the pipe 23 and the water flowing through the pipe 27 are caused to be thoroughly mixed, and by proper manipulation of the steam and water control valves described above, steam of proper pressure, temperature and water content can be prepared for use in the ager as specified above in this specification. The mixing chamber 24 is provided with a suitable safety valve 29 to prevent the pressure of the steam chamber 24 rising beyond safe limits.

From the mixing chamber 24 the steam flows through an outlet pipe 30 which communicates with the branch pipes 31 extending across the width of the ager and slightly beyond. The branch pipes 31 communicate with vertical pipes 32 which are connected at their lower ends with the steam manifolds 33 extending along the length of the lower portion of the ager as shown in Fig. 3. From the manifolds 33 the steam flows through pipes 34 which extend into the ager and are perforated as shown. The arrangement of the perforated pipes 34 is clearly indicated in Fig. 2. It will be observed from Fig. 1 that the screen 10, being positioned between the perforated pipes 34 and the lower series of rolls 9, prevents water spattering on the goods being treated. Pipes 32 are provided with valves 35 for controlling the supply of steam to the manifolds 33.

Steam is supplied to the steam plates 7 located at the top of the ager through the pipe 36 which connects with a horizontal manifold 37 extending along one side of the ager as shown in Fig. 3. From the manifold 37 pipes 38 convey steam to the interior of the steam plates. The drains 39 communicate with the interior of the steam plates 7 and and lead into a horizontal manifold 40 through which the exhaust steam and moisture from the steam plates flow.

A temperature recording device 41 may be associated with the outlet pipe 30 from the mixing chamber 24 so that a permanent record of the temperature of the steam supplied to the ager may be kept. Flow meters and other devices measuring the quantity, pressure and temperature of the steam may be located in desirable portions of the piping system so that an accurate record of the quantity and quality of the steam supplied to the ager may be kept.

As indicated by the use of the above described apparatus, our invention comprises a correct selection of the source of steam as to quantity and quality, particularly as regards temperature and moisture in the main portion of the ager. This is preferably accomplished by the use of steam which is comparatively wet, that is, steam from which some of the normal heat content has been abstracted either by radiation, or by adding water to steam whose pressure has been reduced, as above described or by other similar means. We have found generally that exhaust steam in comparatively large quantities when passed through the ager from a source

having a steam pressure of from 10 to 15 lbs. produces good results, but the supply thereof being unreliable and variable in quantity and quality it has been found necessary to use such apparatus as above described in order to insure exact characteristics of the steam.

It is, therefore, our desire to protect the improvements in the process of aging fabrics in which the use of steam in an aging apparatus is at a comparatively lower pressure and in larger quantities than has heretofore been deemed practicable and the use of steam of such characteristics as to temperature and moisture and for such a period of time with the necessary amount of circulation as will produce the maximum reduction and absorption of the dyes within and upon the fibers of the fabric so that the greatest and most uniform depth of color may be developed with a minimum amount of dye stuffs.

Having thus described this form of our invention, we do not desire to be limited to the details of the process as above pointed out for various changes may be made in the practical employment of our invention without departing from the spirit and scope thereof as pointed out in the following claims:

What we claim and desire to protect by Letters Patent is:

1. In combination with apparatus for treating or aging fabrics including an aging box or casing, and a steam supply device therefor, the improvement which comprises, an expansion and mixing chamber, a steam supply pipe connected therewith, means for introducing additional moisture into said expansion chamber, and pipes between said expansion chamber and said aging box whereby steam is supplied to the latter at the desired temperature and pressure and with the desired moisture content.

2. In combination with apparatus for treating or aging fabric, including an aging box or casing, and a steam supply pipe therefor, the improvement which comprises, an expansion and mixing chamber, means for introducing water into the steam entering said chamber, and pipes between said chamber and said aging box whereby steam is supplied to the latter at the desired temperature and pressure and with the desired moisture content.

3. In combination with apparatus for treating or aging fabric, including an aging box or casing, and a steam supply pipe therefor, the improvement which comprises, an expansion and mixing chamber, means connected with said supply pipe for introducing water into the steam entering said chamber, and pipes between said chamber and said aging box whereby steam is supplied to the latter at the desired temperature and pressure and with the desired moisture content.

4. In combination with apparatus for treating or aging fabric including an aging box or casing, a main steam supply pipe having an automatic pressure regulating valve therein, the improvement which comprises, an expansion and mixing chamber with which said steam supply pipe is connected, means for introducing water into the steam supply pipe entering said chamber, and pipes between said chamber and said aging box, for the purposes set forth.

5. In combination with apparatus for treating or aging fabric, including an aging box or casing, a main steam supply pipe having an automatic pressure regulating valve therein, means for making said regulating valve inactive, and perforated pipes in said aging box, the improvement which comprises, an expansion and mixing chamber with which said steam supply pipe is connected, means for introducing water into the steam entering said chamber, and pipes between said mixing chamber and said perforated pipes, whereby steam is supplied to said box at the desired temperature and pressure and with the desired moisture content.

6. In combination with apparatus for treating or aging fabric including an aging box or casing, perforated pipes in the lower portion thereof, drains for preventing the accumulation of water in said aging box, an expansion and mixing chamber, a steam supply pipe connected therewith, a pressure regulating valve in said pipe, means for introducing water into the steam within said chamber, and pipes between said chamber and said perforated pipes, whereby steam is supplied to the latter at the desired temperature and pressure and with the desired moisture content.

7. In combination with apparatus for treating or aging fabric including an aging box or casing, a reticulated screen in the lower portion thereof, perforated pipes below said screen, drains for preventing the accumulation of water in said aging box, an expansion and mixing chamber, a steam supply pipe connected therewith, a pressure regulating valve in said pipe, means for introducing water into the steam within said chamber, and pipes between said chamber and said perforated pipes, whereby steam is supplied to the latter at the desired temperature and pressure and with the desired moisture content.

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CERTIFICATE OF CORRECTION.

Patent No. 1,861,623. June 7, 1932.

EDWARD S. CHAPIN ET AL.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 2, line 63, for the mispelled word "instanes" read instances; and line 65, for "thorugh" read through; page 4, lines 43 and 49, for "16" read 16'; and line 102, strike out the word "and" second occurrence; and that the said Letters Patent should be read with these corrections therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 30th day of August, A. D. 1932.

M. J. Moore,
Acting Commissioner of Patents.

(Seal)