April 24, 1962 M. BROWN ET AL 3,030,791

PIECE DYEING MACHINE

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Fig.1

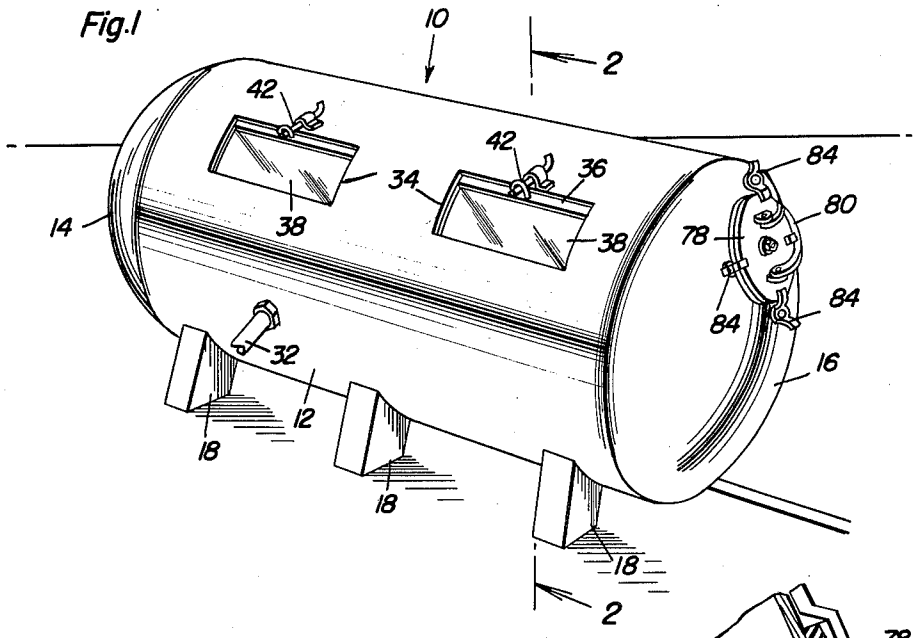


Fig.2

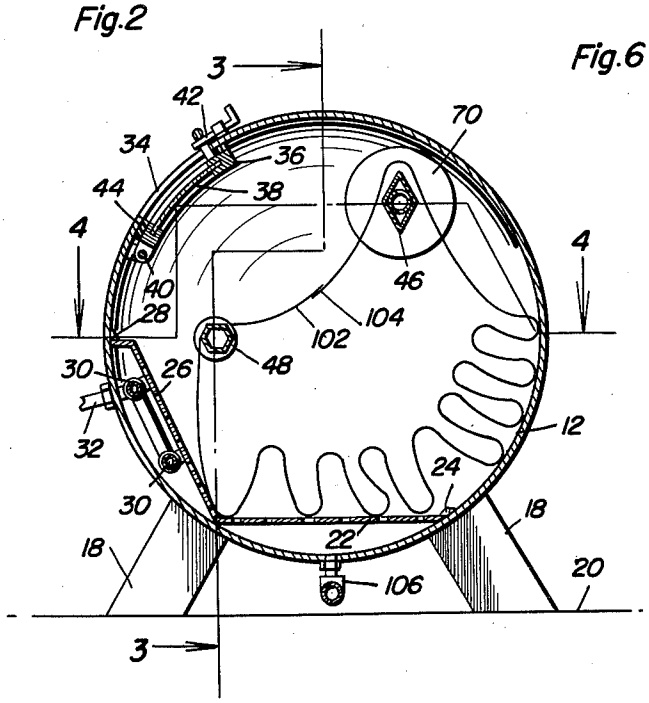
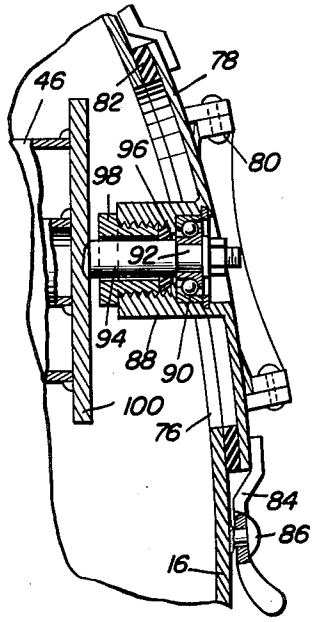


Fig.6



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PIECE DYEING MACHINE

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Fig.3

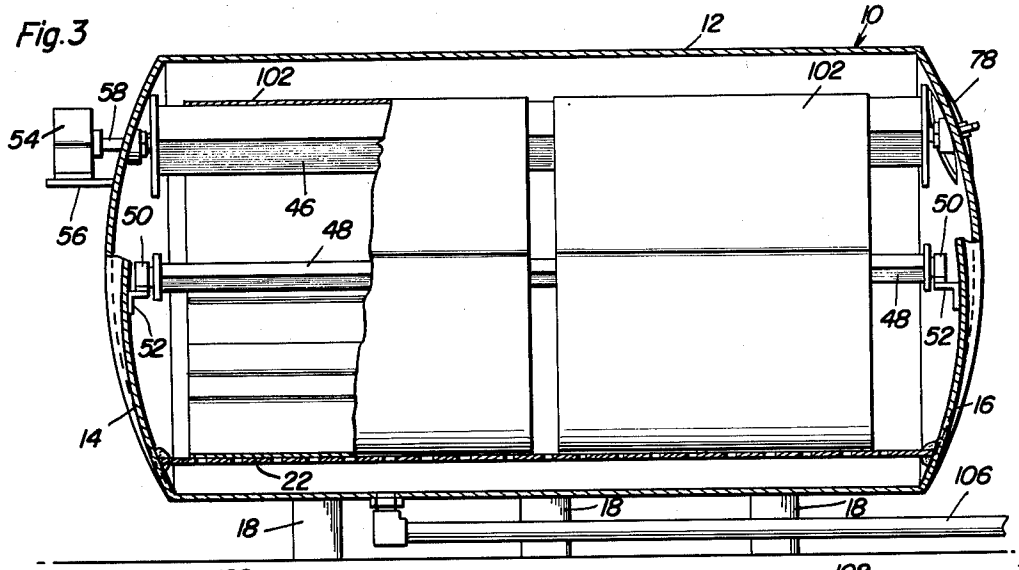


Fig.4

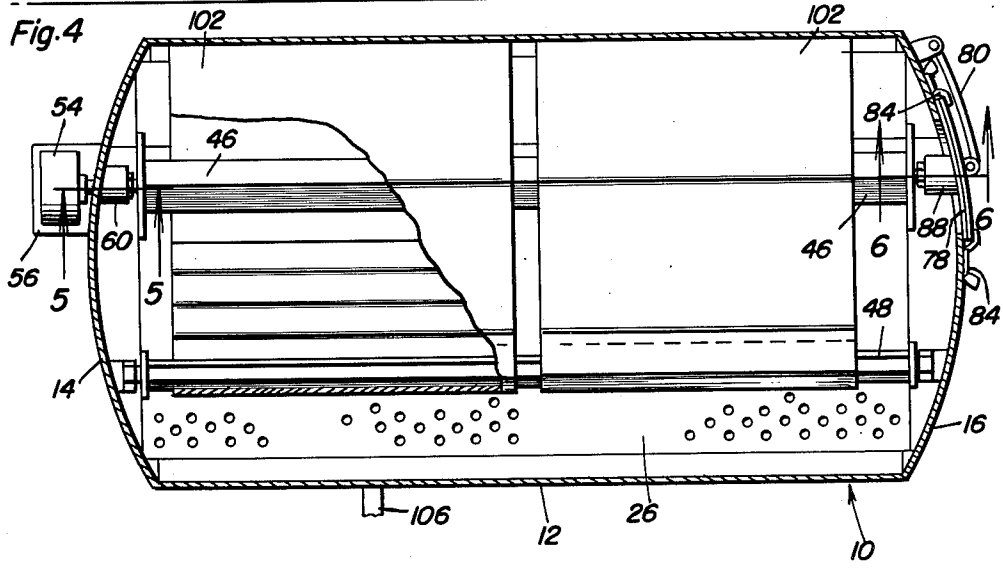
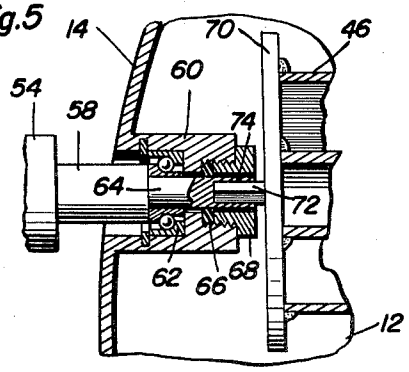


Fig.5



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PIECE DYEING MACHINE

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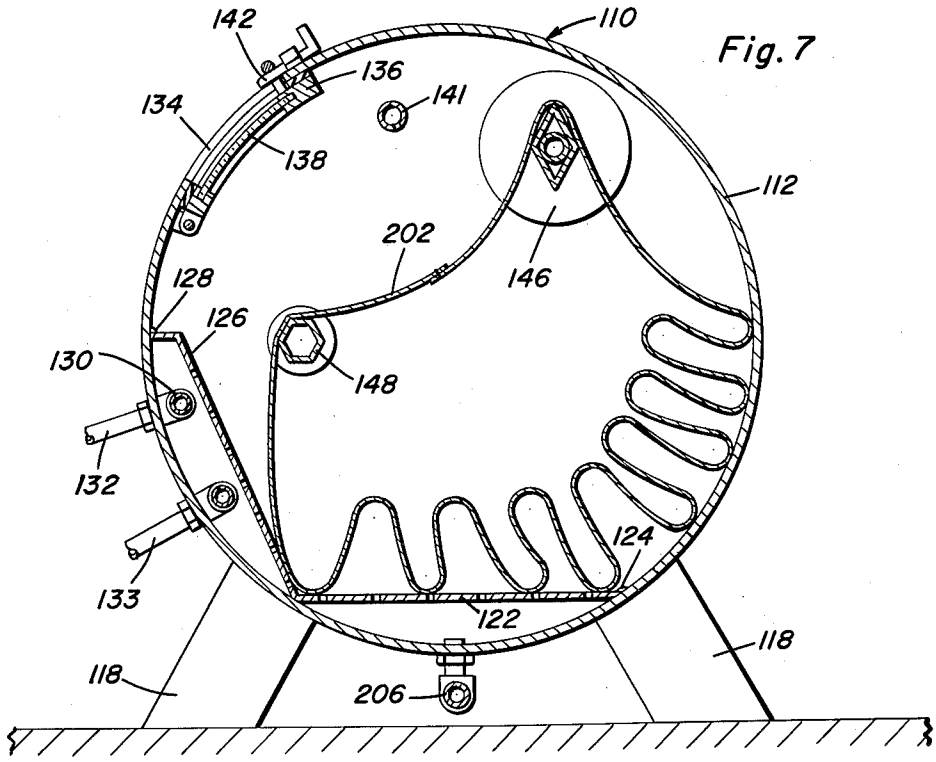


Fig. 7

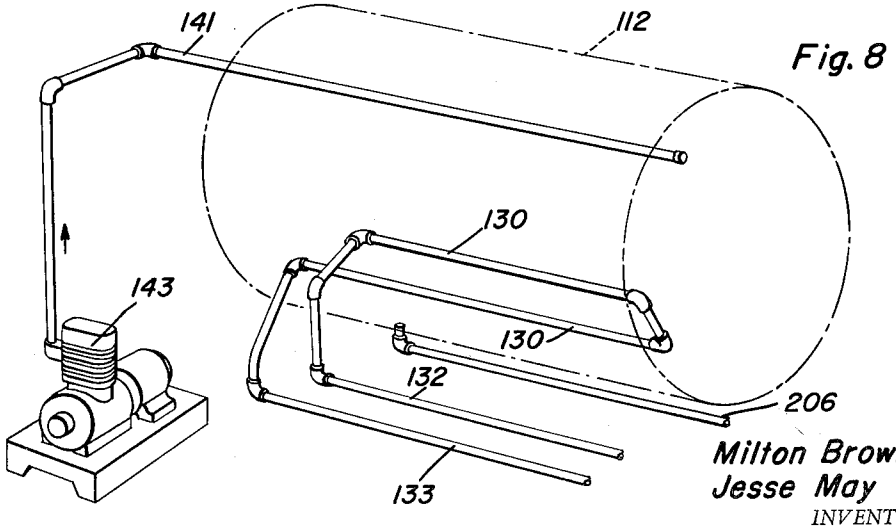


Fig. 8

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PIECE DYEING MACHINE

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1 Claim. (Cl. 68—177)

This is an improvement over and a continuation-in-part of my prior co-pending application Serial No. 770,-951, for Piece Dyeing Machine filed October 31, 1958, now abandoned.

This invention relates in general to new and useful improvements in cloth treating equipment, and more specifically to a piece dyeing machine.

Herebefore when synthetic fibers were dyed the synthetic fibers were passed through hot dye baths. However, it has been found that this method of dyeing the more recently developed synthetic fibers is not the most effective since the newer synthetic fibers are not readily penetrated by dyeing fluids or bath unless the fibers are heated to temperatures in excess of 212° F. at which temperatures these fibers begin to soften and will quite readily be penetrated by dyeing fluids.

In order to maintain cloth or material made of these synthetic fibers, which are more commonly referred to as "high temperature synthetics," the vessel in which the fabric is being dyed must be heated as well as the dyeing fluids themselves. However, when the dyeing fluids are mixed, a certain amount of dyeing agent is mixed with the fluid base used in order to enable the fabric to pass through the dyeing fluids an approximate number of predetermined times to obtain the desired color. Therefore, vapor from the dyeing fluids must not be allowed to escape from the dyeing vessel in any quantity since the result would be a stronger dyeing bath. Further, in order to obtain a dyeing bath temperature in excess of 212° F. the vessel in which the fabric is being dyed must be pressurized.

It is therefore the primary object of this invention to provide a piece dyeing machine which is in the form of an enclosed chamber whereby the temperature and pressure within the chamber may be controlled to that desired and the synthetic fibers dyed under these controlled conditions.

Another object of this invention is to provide a piece dyeing machine which includes a closed chamber, the chamber having extending longitudinally thereof a drive reel and an idler reel whereby the piece of synthetic fiber being dyed may be continuously moved through the lower part of the machine, the machine being so constructed whereby the dye disposed therein may be heated to the desired temperature, which when dyeing high temperature synthetics is above 212° F., pressurized an amount sufficient to eliminate boiling of the entire dyeing bath.

Another object of this invention is to provide a piece dyeing machine which includes an elongated chamber having end walls, there being positioned within the chamber and extending between the end walls a pair of reels, one of the reels being a drive reel and the other being an idler reel, the reels being placed above the bottom of the chamber and in offset relation both vertically and transversely of the chamber whereby as the piece being dyed passes over the main drive reel it will drop down into the bottom of the chamber in a generally folded condition and then move through the bottom of the chamber after which it is drawn up over the idler reel.

A further object of this invention is to provide a piece dyeing machine for synthetic fibers and the like, the piece dyeing machine including a sealed chamber in which the synthetic fibers to be dyed may be positioned, the chamber to be provided with the necessary dye materials and additionally have steam lines mounted therein whereby

the steam may be used both for the purpose of heating the interior of the chamber and the dye material and pressurizing the interior of the chamber.

Still another object of this invention is to provide a piece dyeing machine including a sealed chamber in which the synthetic fibers to be dyed may be positioned, the chamber being provided with the necessary dye materials and additionally having closed steam lines mounted therein whereby steam may be used for heating the chamber and the dye materials contained therein without effect upon the pressure within the vessel, a compressed air system being provided for regulating the pressure within the chamber.

These together with other objects and advantages which will become subsequently apparent reside in the details of construction and operation as more fully hereinafter described and claimed, reference being had to the accompanying drawings forming a part hereof, wherein like numerals refer to like parts throughout, and in which:

FIGURE 1 is a perspective view of the piece dyeing machine and shows the general outline of one form thereof;

FIGURE 2 is an enlarged transverse sectional view taken substantially upon the plane indicated by the section line 2—2 of FIGURE 1 and shows the specific details of the construction of the piece dyeing machine;

FIGURE 3 is an enlarged longitudinal sectional view taken substantially upon the plane indicated by the section line 3—3 of FIGURE 2 and shows further the details of the interior of the piece dyeing machine;

FIGURE 4 is a generally horizontal sectional view taken substantially upon the plane indicated by the section line 4—4 of FIGURE 2 and shows further the details of the internal construction of the piece dyeing machine, the view also being on an enlarged scale;

FIGURE 5 is an enlarged fragmentary sectional view taken substantially upon the plane indicated by the section line 5—5 of FIGURE 4 and shows the manner in which the main drive reel is releasably connected to a motor driven drive shaft;

FIGURE 6 is an enlarged fragmentary sectional view taken substantially upon the plane indicated by the section line 6—6 of FIGURE 4 and shows the manner in which the opposite end of the main drive reel is mounted, there also being shown the details of a removable plate to facilitate the repair of the drive reel and the idler reel;

FIGURE 7 is an enlarged transverse sectional view similar to FIGURE 2 but showing a modified form of the invention which utilizes closed steam lines for heat and a compressed air system for pressurizing the chamber; and

FIGURE 8 is a diagrammatic view in persective showing the modified form of pressure and heating system.

Referring now to FIGURES 1–6 in the drawings in detail, it will be seen that there is illustrated one form of the piece dyeing machine which is the subject of this invention, the piece dyeing machine being referred to in general by the reference numeral 10. The piece dyeing machine 10 includes a generally cylindrical chamber 12 having outwardly dished ends 14 and 16. The cylindrical chamber 12 is mounted on suitable foundation members 18 so that it may be supported above the floor of the building in which it is mounted, the floor line being indicated by the reference numeral 20.

Referring now to FIGURE 2 in particular, it will be seen that the interior of the chamber 12 is provided with a baffle plate 22 which extends across the bottom thereof. The baffle plate 22 is perforated and may be mounted in any desired manner including the direct welding thereof as at 24. The baffle plate 22 also includes an upwardly sloping end portion 26 which is suitably secured to

the interior of the cylindrical chamber **12** as at **28**. The extension **26** is also perforated.

Secured to the baffle plate extension **26** on that face thereof opposing the interior surface of the cylindrical chamber **12** are suitable steam lines **30**. The steam lines **30** are coupled to a steam supply line **32** which opens through the exterior of the cylindrical chamber **12**, as is best shown in FIGURE 1.

It is the intention of this invention that the necessary dye liquid be disposed in the bottom of the cylindrical chamber **12**. This dye liquid will best operate on synthetic fabrics at a temperature in excess of 212° F. and at a relatively high pressure of 15 pounds or more. For that reason, the steam lines **30** are provided to heat the interior of the cylindrical chamber **12** and the dye liquid contained therein. Additionally, the interior of the cylindrical chamber **12** may be pressurized by opening the steam lines **30** directly into the interior of the cylindrical chamber **12** by means of perforations (not shown) so that the steam may both heat and pressurize the interior of the cylindrical chamber **12**.

In order that access to the interior of the cylindrical chamber **12** may be had for the purpose of positioning and removing pieces of synthetic fibers to be dyed, the cylindrical chamber **12** is provided with suitable access openings **34** which are best illustrated in FIGURE 1. The access openings **34** are closed by means of doors **36** having windows **38**. The doors **36** are positioned within the cylindrical chamber **12** and are mounted by means of hinges **40**. Suitable latches **42** are provided to retain the doors **36** in their closed positions and sealing strips **44** form a seal between the doors **36** and the cylindrical chamber **12**. Because the individual doors **36** are provided with windows **38**, the operation of the piece dyeing machine **10** may be observed.

It is the intention of this invention that the synthetic fibers being dyed be repeatedly passed through the dye liquid. In order to accomplish this, there is mounted within the cylindrical chamber two reels. One of these reels is in the form of a main drive reel **46** and the other reel is in the form of an idler reel **48**. The idler reel **48** is preferably hexagonal in cross section, as is best shown in FIGURE 2 and is rotatably journaled in suitable bearings **50** carried by mounting brackets **52** secured to the interior surfaces of the dished ends **14** and **16**, as is best shown in FIGURE 3.

Although the main drive reel **46** also extends between the dished ends **14** and **16** of the cylindrical chamber **12**, inasmuch as the main drive reel **46** is driven, the mounting thereof is quite different from that of the idler reel **48**. Mounted on the dished end **14** in alignment with the main drive reel **46** is a suitable power unit **54** which is preferably in the form of an electric motor. The power unit **54** is seated on a platform **56** secured to the end **14**, and has a drive shaft **58**.

Referring now to FIGURE 5 in particular, it will be seen that the dished end **14** is provided with an internally projecting boss **60** which has seated in the outer portion thereof a suitable thrust bearing **62**. The thrust bearing **62** is engaged with a reduced portion **64** of the shaft **58**. Further, the innermost portion of the boss **60** has positioned therein suitable packing **66** and a packing nut **68** so as to form a stuffing box and thus prevent the escape of the dye liquid through the dished end **14**.

The drive reel **46** is provided at the left end thereof with an end plate **70**. Projecting from the plate **70** is a non-circular cross sectional stub shaft **72** which is received in a similar cross sectional opening **74** in the end of the drive shaft **58**. Thus the main drive reel **46** is releasably drivingly connected to the drive shaft **58** to be driven from the externally mounted power unit **54**.

Alined with the opposite end of the drive reel **46** is an opening **76** in the dished end **16**. The opening **76** is provided so that repairs to the reels **46** and **48** may be accomplished. Also, the reels **46** and **48** may be removed through the opening **76**. The opening **76** is normally closed by means of a closure plate **78** which is supported by a hinge unit **80**. The closure plate **78** is sealed with respect to the dished end **16** by means of a sealing strip **82** and is held in its closing position by means of dogs **84** which are pivotally mounted on pins **86**.

The closure plate **78** is provided with an internally projecting boss **88**. The boss **88** having mounted in the outer part thereof a thrust bearing **90** in which there is received a reduced portion **92** of a shaft **94**. Surrounding the shaft **94** is a suitable packing ring **96** which is held in place by means of a packing nut **98** to form a stuffing box for the shaft **94**.

The right hand end of the drive reel **46** is also provided with a plate **100**. The shaft **94** is illustrated as being directly secured to the plate **100** for supporting the right hand end of the drive reel **46**. However, if desired, a two piece shaft could be used here also.

As is best shown in FIGURE 2, the drive reel **46** is generally diamond shaped in cross section. The shape and proportion of the drive reel **46** is such that as a piece of material being dyed passes thereover, it will be folded and dropped in folds to the bottom portion of the cylindrical chamber **12** therebeneath, as is best illustrated in FIGURE 2. The piece of synthetic fiber being dyed is referred to by the reference numeral **102**. The piece of material **102** will be passed into the interior of the cylindrical chamber **12** through one of the openings **34** and will have the major portion thereof seated in the bottom part of the cylindrical chamber **12**. The ends of the piece of material will be passed over the drive reel **46** and the idler reel **48**, respectively, and suitably temporarily connected together as at **104**.

After the piece dyeing machine **10** has been loaded, the drive reel **46** is driven. The drive reel **46** will serve to pull the piece of material **102** up over the idler reel **48** and then up over itself after which the piece of material **102** is dropped down into the lower part of the cylindrical chamber **12** in folds, as is shown in FIGURE 2. Inasmuch as the bottom part of the cylindrical chamber **12** is filled with the dye liquid, it will be seen that as the piece of material **102** passes through the lower part of the cylindrical chamber **12**, the necessary dyeing operation will take place.

The cylindrical chamber **12** is also provided with a bottom drain **106**. The drain **106** is for the purpose of draining the dye liquid from the cylindrical chamber **12** either when it is desired to change colors of dyes or when the usefulness of the dye liquid has ended.

Referring now more specifically to FIGURES 7 and 8 wherein there is illustrated a preferred modification of the dyeing machine generally designated by the reference numeral **110**. The piece dyeing machine **110** is similar in most respects to the machine **10** and includes a cylindrical chamber **112** mounted on suitable foundation members **118**. The chamber **11** further includes a perforated baffle plate **122** having an upwardly sloping portion **126** which are suitably secured to the chamber **112** as at **124** and **128** respectively.

The operation of the machine **110** is identical with that of the machine **10**, that is to say, the synthetic material **202** is disposed within the chamber **112** and over the drive and idler reels **146** and **148** to pass through the dyeing materials which may be drained from the chamber **112** through drain **206**.

The material **202** is loaded through the access openings **134** after the doors **136** having windows **138** have been opened. The doors **136** are then closed and retained in their closed position by means of suitable latches **142**.

To heat the chamber **112** suitable closed steam lines **130** are provided which are coupled at one end to a steam supply line **132** and at the other end to a return line **133**, which lines **132** and **133** are connected to a steam source (not shown). The temperature within

the chamber **112** and the dyeing both may thus be controlled by the steam passing through lines **132**.

Inasmuch as the temperature desired to aid the dyeing of the "high temperature synthetics" in popular use today is in the neighborhood of 240° F., the chamber is pressurized to enable temperatures in this range of both the chamber and the dyeing bath.

To pressurize the chamber **112** a pressure line **141** is provided which communicates with the interior of the chamber at one end and is connected to a suitable compressed air supply at the other end, which supply may be in the form of air compressor **143**.

With means for separately controlling both the pressure and temperature within the chamber **112** the most advantageous conditions can be attained for the process of dyeing the different "high temperature synthetics."

It is to be noted that although the degree of pressurizing has been mentioned herein to be in the neighborhood of 15 pounds or more, the pressure within the chamber for the most part will be at least sufficient to eliminate boiling of the entire dyeing bath and that the temperature therein will be sufficient to soften the fibers to the extent whereby they will, in a relatively short time, absorb the desired quantity of dye and not be just coated by the dye, which temperature could conceivably be in the neighborhood of 300° F.

Further, it is to be understood that any suitable separate means may be used to pressurizing and heating the interior of the chamber in the preferred form of the invention.

From the foregoing, it will be readily apparent that there has been devised a very simple piece dyeing machine which, although simple, is of such a nature whereby synthetic fibers may be dyed at both a relatively high temperature and a high pressure. This is accomplished by forming the chamber of the piece dyeing machine so as to be pressurized and both pressurizing and heating the interior thereof. Because of the simple arrangement of the reels, both the drive reel and the idler reel, the piece of material to be dyed is effectively moved through the dye liquid to accomplish the desired dyeing operation.

The foregoing is considered as illustrative only of the principles of the invention. Further, since numerous modifications and changes will readily occur to those skilled in the art, it is not desired to limit the invention to the exact construction and operation shown and described, and accordingly all suitable modifications and equivalents may be resorted to, falling within the scope of the invention as claimed.

What is claimed as new is as follows:

A piece dyeing machine comprising a chamber having ends, a drive reel extending between said ends, an idler reel extending between said ends, said chamber being sealed, and a steam line opening into said chamber for heating the interior of said chamber and for raising the pressure therein sufficient to eliminate all boiling of the dyeing fluid contained therein when the temperature of the latter has been raised to close to 240° F., an access opening in one of said ends, a cover plate for said access opening, one end of said drive reel being supported by said cover plate.

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