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APPARATUS FOR TREATING FIBROUS MATERIALS.

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Fig. 1.

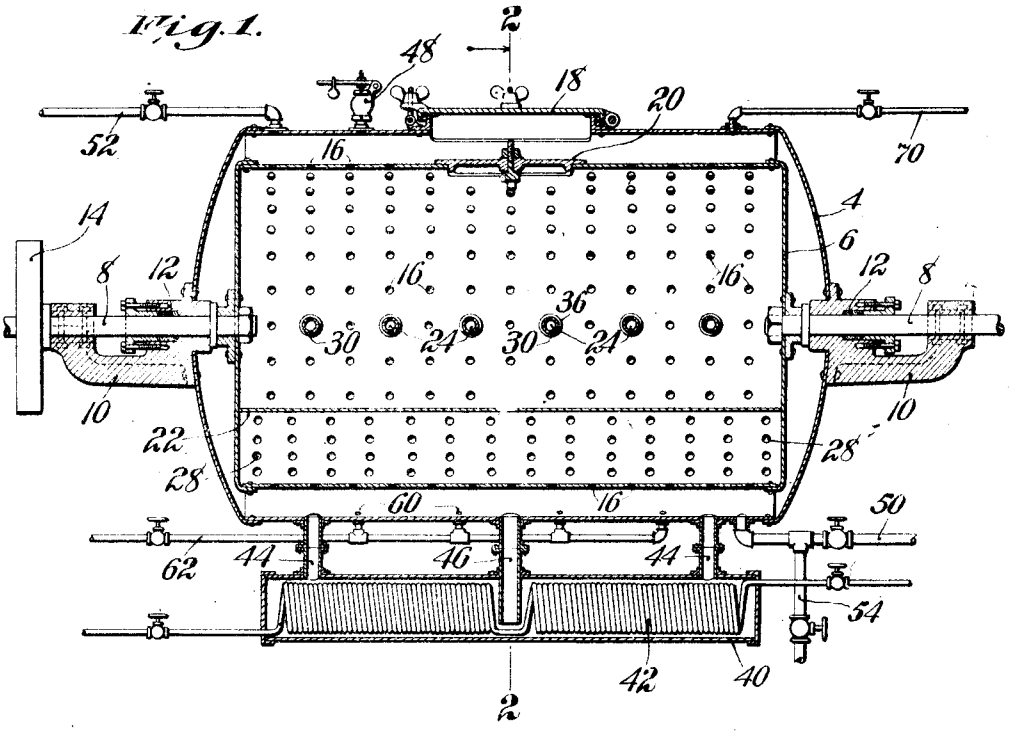
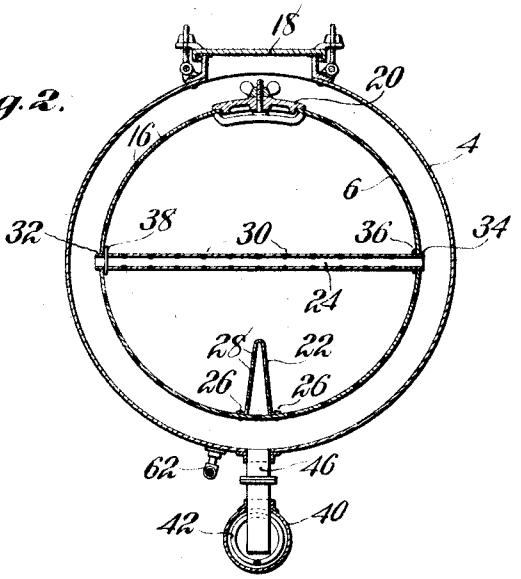


Fig. 2.



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APPARATUS FOR TREATING FIBROUS MATERIALS.

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To all whom it may concern:

Be it known that I, EUGENE D. JEFFERSON, a citizen of the United States, residing at Boston, in the county of Suffolk and State of Massachusetts, have invented certain new and useful Improvements in Apparatus for Treating Fibrous Materials; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

The present invention relates to an apparatus for treating fibrous materials and more particularly to an apparatus for boiling, bleaching or dyeing textiles, paper pulp and the like.

In treating textiles or paper pulp it is usual to boil the material in an alkali previous to the bleaching operation in order to discharge as much of the coloring material as possible before bleaching, to remove the greases and to soften the fiber. To secure the most efficient and rapid chemical action of the alkali on the materials, the materials should be alternately exposed to a boiling hot alkaline solution and to live steam. The chemical action due to alternately and repeatedly exposing the materials to the hot alkaline solution and to the steam is not perfectly understood, but I have found that such treatment removes the color and grease from the materials much more rapidly than boiling the materials in the alkaline solution without withdrawing the materials from the liquor and exposing them to the steam during the boiling operation. Similarly, to promote the most advantageous and rapid action of bleaching with a solution of chlorid of lime, commonly known in the bleaching industry as chemic, the materials should be alternately and repeatedly saturated in the chemic and exposed to the air to aerate them. Moreover, the bleaching liquor itself acts to bleach more rapidly if air is blown through the liquor to aerate it.

In the use of certain dyes, particularly the indanthrin dye, the materials must be impregnated with the dye and the color must be set in a vacuum as the presence of oxygen prohibits the proper chemical action.

The object of the present invention is to produce an apparatus for treating fibrous substances such as textiles, paper pulp and the like.

With the above object in view, one feature of the present invention relates to an apparatus in which the materials are alternately and repeatedly immersed in and withdrawn from a boiling alkaline solution so as to alternately and repeatedly expose the materials to the action of the solution and to the action of live steam.

Another feature of the present invention relates to an apparatus in which the materials may be alternately and repeatedly immersed in and withdrawn from the bleaching liquor to alternately and repeatedly expose the materials to the action of the bleaching liquor and to the action of the air.

Another feature of the present invention relates to an apparatus in which the materials may be thoroughly saturated in a dye in a vacuum.

Still another feature of the present invention relates to the production of an apparatus in which the operation of boiling in alkali, of bleaching, and of dyeing may be carried on sequentially in the same apparatus.

Other features of the present invention relate to certain constructions, arrangements and combinations of parts hereinafter described, the advantages of which will be apparent to those skilled in the art from the following description.

Referring to the drawings in which is illustrated the preferred embodiment of the present invention; Figure 1 is a side view taken partly in vertical section of the apparatus; and Fig. 2 is a vertical section along the line 2—2 of Fig. 1.

As illustrated in the drawings the apparatus comprises a tank which is adapted to be partially filled with liquor, a drum for holding the materials rotatably mounted in the tank, retainers for keeping the mass of materials from turning in the drum as the drum is rotated and various auxiliary devices such as a heater for boiling an alkaline solution in the tank, ports for blowing air under pressure into the tank when bleaching is being carried on, and a connection to a vacuum pump for creating a vacuum for dyeing.

The illustrated apparatus is described as follows: The tank 4 is a gas-tight horizontally disposed cylindrical receptacle having crowned ends. Within the tank is a cylindrical drum 6 which is rotatably mounted by means of shafts 8 which are journaled in brackets 10. The bearings of the shafts 8

are provided with stuffing boxes 12 to provide a steam- and air-tight bearing. A pulley 14 is mounted on one of the shafts 8 for rotating the drum 6. A large number of perforations 16 are formed in the drum 6 so that the liquor has free access to the fibrous material which is packed in the drum. The tank 4 has a manhole provided with a steam- and air-tight cover 18 and the drum 6 has a similar manhole which is closed by a cover 20 so that access may be had to the interior of the drum 6 to pack and remove the materials to be treated. After the drum is packed with the material to be treated, the tank is filled about half full of liquor. Retainers are provided inside the drum to hold the mass of materials from turning about inside the drum under the action of gravity as the drum is rotated so that as the drum rotates the mass of materials is rotated with the drum and the different parts of the mass are alternately immersed in and withdrawn from the liquor in the lower half of the tank. These retainers include a hollow inwardly projecting fin 22 and a number of pipes 24 extending across the interior of the drum. The fin 22 consists of a substantially V-shaped sheet of metal, the edges of which are flanged and secured to the drum 6 by means of rivets 26. The fin 22 is provided with a large number of perforations 28, and, as the base of the fin spans one horizontal row of the perforations 16, a free passage is provided for the liquor through the interior of the fin 22 into the material surrounding the fin. The fin 22 therefore not only acts to prevent the materials from turning in the drum as the drum is rotated but also assists in a more thorough penetration of the mass of materials by the liquor. The pipes 24 perform a similar function in preventing the materials from turning about in the drum and assisting in a more thorough impregnation of the materials with the liquor. The pipes 24 have open ends extending outside of the drum and are provided with a large number of perforations 30. In packing the drum, the drum is turned to the position shown in Fig. 2 and the manholes are open and the material is packed in until the drum is half full and then the pipes 24 are put in place. In putting a pipe in place one end of the pipe is pushed out through the pipe receiving hole 32 and the other end of the pipe is brought opposite the pipe receiving hole 34 in which it is placed. A collar 36 prevents the pipe from being pushed too far out through the hole 34. After the pipe is thus pushed in the hole 34, a cotter pin 38 is placed through a hole in the pipe to hold it in place. A heating chamber 40 is provided beneath the tank 4 to heat the liquor in the tank when the materials are to be boiled. The heating chamber 40 is a closed cylindrical receptacle containing a steam coil 42. The heating chamber 40 is connected with the bottom of the tank 4 by means of connecting pipes 44 and 46. There are two connecting pipes 44 which extend from the bottom of the tank 4 to the top of the heating chamber. A single pipe 46 extends from the bottom of the tank 4 to near the bottom of the heating chamber. The heated liquor rises through the pipes 44 and is displaced by the colder liquor coming downward through the pipe 46. A safety valve 48 is provided to guard against excessive steam pressures when the liquor in the tank 4 is boiled by means of steam coil 42. A pipe 50 is provided through which the different treating liquors may be run into the tank. A pipe 52 is provided for the admission of wash water and a pipe 54 is provided for draining off the wash water.

The bottom of the tank 4 is provided with a number of ports 60 for the introduction of compressed air which is supplied through a pipe 62 for use in aerating the liquor and the materials in bleaching. The safety valve 48 furnishes a convenient device for maintaining the pressure in the tank while the compressed air is being blown through it. At the top of the tank 4 a pipe 70 leads to a vacuum pump to create a vacuum in the tank when it is used for dyeing.

The apparatus having been specifically described, the operation will now be set forth as a series of steps including boiling with alkali, bleaching with chemic, and dyeing. The manholes 18 and 20 are opened and the drum 6 is packed with the material to be treated such as textiles, rags, paper pulp or the like. The alkaline solution is run through the pipe 50 until the tank 4 is about half full, after which the manholes are closed and the drum 6 is rotated. Live steam is admitted into the coil 40 to boil the alkaline solution in the tank. The alkali in the tank is kept boiling and the drum is slowly rotated until the color has been discharged and the grease has been removed from the materials. During this boiling operation the materials are alternately exposed to the boiling alkaline solution and to the live steam which is boiled off from the solution and fills the upper half of the tank 4. The alternate and repeated action of liquor and steam on the materials gives the proper chemical reactions to quickly start and remove the color and grease from materials.

After the alkaline boiling is completed, the alkali is drawn off and wash water is run through the tank 4 by means of pipes 52 and 54 and the drum 6 is rotated to wash alkali from materials. Then the water is shut off and chemic is run into the tank 4 through the pipe 50 until the tank is about half full. After the chemic is run into the tank the compressed air is admitted through the pipe 62 and ports 60 into the bottom of

the tank 4 and bubbles up through the chemic and around the drum 6, escaping through the safety valve 48. The drum 6 is, of course, slowly rotated during the bleaching operation. Since the materials are alternately immersed and withdrawn from the chemic, as the drum is rotated, a thorough and repeated saturation and aeration of materials takes place. Moreover, since the aeration takes place under pressure, the chemical reaction due to the presence of air is accentuated since compressed air has a greater chemical reaction on the saturated material than air at atmospheric pressure. The compressed air, as it bubbles through the chemic bath also acts to thoroughly aerate the chemic itself which also assists its action in bleaching. After the materials are bleached, they are washed by water circulating through the tank 4 from the pipe 50 to the pipe 54 until the chemic is thoroughly washed from materials. With the ordinary sorts of materials such as white cloth, rags or paper pulp, the materials will be removed from the drum after the bleach. However, if the material is to be dyed and particularly is to be dyed with the indanthrin dye, it is left in the drum 6. The water is drained from the tank and the valves closed so that the tank 4 is air-tight. Then the valve in the pipe 70 leading to the vacuum pump is opened and the tank 4 is exhausted to a high vacuum, after which the indanthrin dye is run in through the pipe 50 and the materials are thoroughly saturated with the dye by the rotation of the drum 6 which acts to alternately immerse and withdraw the materials from the dye. Since the tank is air-tight, this dyeing operation can be carried on in a high vacuum and the dye be set under the most advantageous conditions.

While the apparatus illustrated in the drawing is capable of use for the three operations of alkaline boiling, of bleaching, and of dyeing, it will be evident that by omitting or not using some of the accessory parts such as the vacuum pump, the heating chamber or the compressed air supply, the apparatus may be used to perform a single one of the above operations or two of them without the third.

While the preferred embodiment of the invention has been specifically illustrated and described, the present invention is not, however, limited to the illustrated construction but may be embodied in other structures within the scope of the invention as defined in the following claims:

I claim—

1. An apparatus for treating fibrous materials, having, in combination, a closed gas-tight tank adapted to be partially filled with a treating liquor, and means for alternately immersing the materials in the treating liquor and withdrawing them from the liquor comprising a drum for holding the materials rotatably mounted in the tank and adapted to be partially immersed in the liquor, and means for preventing the mass of material from turning in the drum as it rotates and for assisting the penetration of the materials by the liquor comprising perforated pipes extending across the drum and having open ends for leading the liquor into the mass of the materials, and mechanism for rotating the drum.

2. An apparatus for treating fibrous materials, having, in combination, a gas-tight tank adapted to be partially filled with treating liquor, and means for alternately immersing the materials in the treating liquor and withdrawing them from the liquor comprising a drum for holding the materials rotatably mounted in the tank and adapted to be partially immersed in the liquor, and means for preventing the mass of materials from turning in the drum as it rotates and for securing the penetration of the liquor into the materials comprising a perforated member extending into the mass of the materials and open to allow the passage of the liquor into the member and through the perforations into the materials.

3. An apparatus for treating fibrous materials having, in combination, a closed tank adapted to be partially filled with a treating liquor, means for alternately immersing the materials in the treating liquor and withdrawing them from the liquor comprising a drum for holding the materials rotatably mounted in the tank and adapted to be partially immersed in the liquor, and means for assisting the penetration of the materials by the liquor including a perforated pipe extending into the mass of materials in the drum.

4. An apparatus for treating fibrous materials having, in combination, a closed gas-tight tank adapted to be partially filled with a treating liquor, means for boiling the liquor in the tank to drive out the air so that the tank is filled with boiling liquor and with live steam, a valve for preventing the free escape of steam from the tank so that the steam in the tank is maintained under pressure, and means for alternately subjecting the materials to the repeated and successive action of the boiling liquor at the bottom of the tank and of the live steam at the top of the tank comprising a drum for holding the materials, rotatably mounted in the tank and adapted to be partially immersed in the boiling liquor and mechanism for rotating the drum.

5. An apparatus for treating fibrous materials having, in combination, a closed gas-tight tank adapted to be partially filled with a treating liquor, means for boiling the liquor in the tank to drive out the air so that

the tank is filled with boiling liquor and with live steam, and means for subjecting the materials to the repeated and successive action of the boiling liquor at the bottom of the tank and of the live steam at the top of the tank comprising a drum for holding the materials, rotatably mounted in the tank and adapted to be partially immersed in the boiling liquor and mechanism for rotating the drum.

6. An apparatus for bleaching fibrous materials having, in combination, a closed gastight tank adapted to be partially filled with a bleaching liquor, means for maintaining a circulation of air under pressure through the tank during a part of the bleaching operation, and means for subjecting the materials to the repeated and successive action of the bleaching liquor and the compressed air comprising a drum for holding the materials, rotatably mounted in the tank and adapted to be partially immersed in the liquor and mechanism for rotating the drum.

7. An apparatus for bleaching fibrous materials having, in combination, a closed gastight tank adapted to be partially filled with a bleaching liquor, means for maintaining a circulation of air under pressure through the tank during a part of the bleaching operation including an air port beneath the liquor level so that the bleaching liquor is aerated with compressed air, and means for subjecting the materials to the repeated and successive action of the bleaching liquor and the compressed air comprising a drum for holding the materials, rotatably mounted in the casing and adapted to be partially immersed in the liquor and mechanism for rotating the drum.

8. An apparatus for bleaching fibrous materials having, in combination, a closed gastight tank adapted to be partially filled with a bleaching liquor, means for maintaining a circulation of air under pressure through the tank during a part of the bleaching operation including an inlet for compressed air and an air outlet having a valve for preventing the free escape of air from the tank so that the air in the tank is maintained under pressure, and means for subjecting the materials to the repeated and successive action of the bleaching liquor and compressed air comprising a drum for holding the materials rotatably mounted in the tank and adapted to be partially immersed in the liquor, and mechanism for rotating the drum.

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