H. R. ANDERS.

PROCESS OF AND APPARATUS FOR TREATING FIBERS.

APPLICATION FILED DEC. 21, 1914.

1,252,986.

Patented Jan. 8, 1918.

3 SHEETS—SHEET 1.

Fig. 2

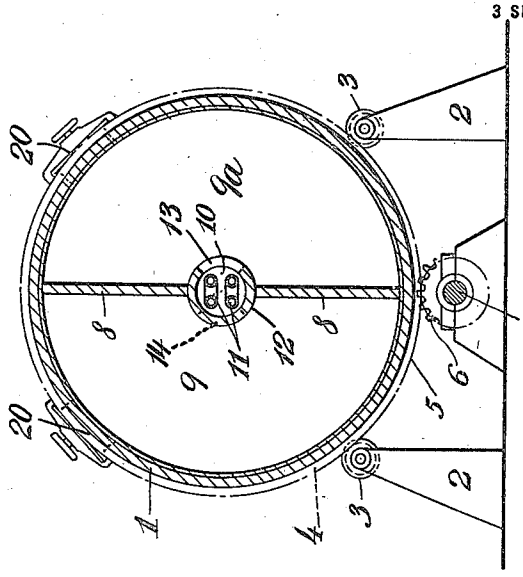
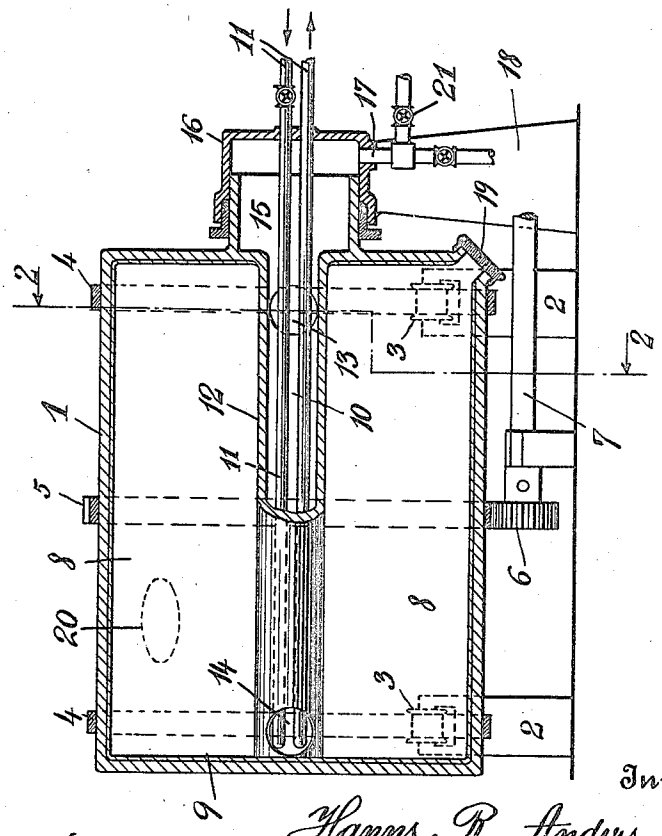


Fig. 1



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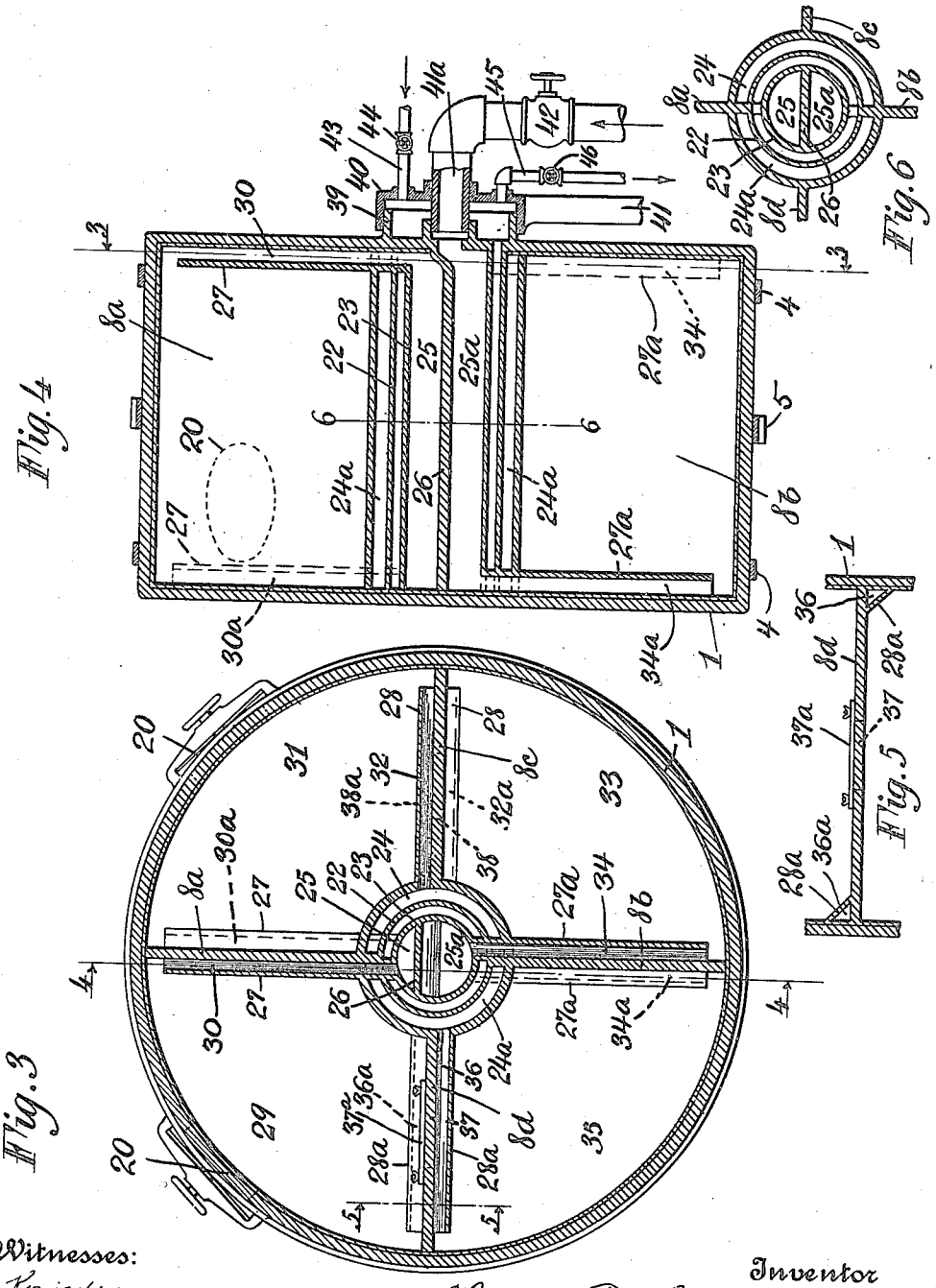


Fig. 4

Fig. 3

Fig. 6

Fig. 5

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3 SHEETS—SHEET 3.

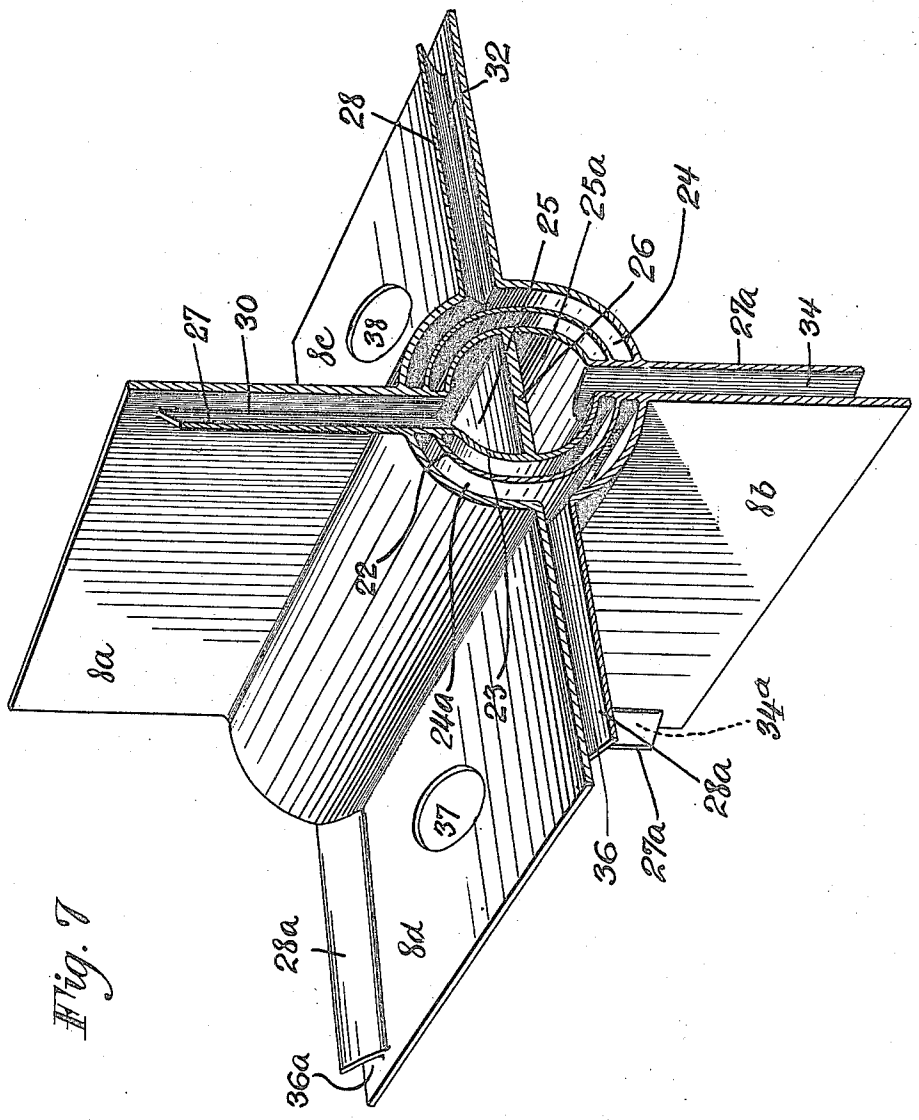


Fig. 7

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UNITED STATES PATENT OFFICE.

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PROCESS OF AND APPARATUS FOR TREATING FIBERS.

1,252,986. Specification of Letters Patent. Patented Jan. 8, 1918.

Application filed December 21, 1914. Serial No. 878,246.

To all whom it may concern:

Be it known that I, HANNS R. ANDERS, a subject of the Emperor of Austria, and resident of Perth Amboy, county of Middlesex, State of New Jersey, have invented certain new and useful Improvements in Processes of and Apparatus for Treating Fibers, of which the following is a specification.

My invention relates generally to processes for treating fibers by means of solutions, as for instance in bleaching processes with solutions containing active oxygen, and to apparatus for carrying said processes into effect. One of the principal objects of this invention is the provision of an improved process wherein a great saving in time is achieved owing to certain ways of circulating the bleaching liquor and the like through the goods. A further object is to very considerably reduce the volume of bleaching liquors necessary to be used, whereby great economy in the process is effected. These, together with such other objects as may hereinafter appear, or are incident to my invention, I attain by certain means a preferred form of which is illustrated in the accompanying drawings, wherein:

Figure 1 is a transverse section, parts being shown in full lines and parts being broken away of one form of apparatus embodying my invention and by which my process may be practised.

Fig. 2 is a sectional view through the apparatus on the line 2—2 of Fig. 1.

Fig. 3 is a cross section through another form of apparatus on line 3—3 of Fig. 4.

Fig. 4 is a transverse section of the apparatus shown in Fig. 3 on the line 4—4 of Fig. 3.

Fig. 5 is a detail sectional view on the line 5—5 of Fig. 3.

Fig. 6 is a detail sectional view on the line 6—6 of Fig. 4.

Fig. 7 is a perspective view of the interior arrangement of the apparatus shown in Fig. 3.

Similar numerals of reference indicate similar parts throughout the various views.

In the drawings 1 indicates a vessel, preferably of cylindrical form, made of wood, steel or other suitable material, mounted on suitable bases 2, 2 carrying supporting rollers, 3, 3, engaging tracks 4, 4 on the circumference of vessel 1. The vessel may be rotated by means of rack 5, engaging pinion 6 on shaft 7 in the usual way. The nature of the liquors with which the fibers are to be treated may of course be of the most varied character and as the weights of the material are also very considerable both factors must be taken into consideration. It is therefore sometimes necessary to use a certain material for vessel 1 and to protect the inside thereof with a coat of paint, bakelite or other suitable material resistant to the effects of the bleaching liquor, or to use other material for said vessel exhibiting the same resistance but without the necessity of such interior protecting coating, as for instance wood, soapstone, porcelain, earthen-ware and the like substances.

The interior of the vessel may be divided into a plurality of preferably equal spaces by suitable partition 8, the partitions being made of material corresponding with that of the vessel or the vessel and its interior coating as the case may be.

For the better understanding of the process I shall first describe by way of example the construction of the apparatus shown in Figs. 1 and 2 wherein the interior of the vessel 1 is divided into two substantially equal chambers 9 and 9^a, and after having shown the operation of the process by means of this apparatus I shall further describe a modified form of the apparatus in which the interior of the vessel 1 is divided into four chambers.

In the modification showing two substantially equal chambers (Figs. 1 and 2), it is evident from Fig. 2 that the partitions 8 do not meet each other at their inner edges but leave an open center space 10 to receive a heating coil 11 of lead, tin or like suitable material.

The coil is incased in the central space 10 by means of a suitable shell 12 also made of resistant material and secured to partitions 8. The space or channel thus formed is provided with two openings 13 and 14 serving as an entrance and an exit and placed diagonally opposite each other at opposite ends of the shell. Space or channel 10 opens into a chamber 15 closed by a cap 16, at the lower end of which there is pipe 17 provided with suitable valves per-

mitting admission of liquor, water, etc., into said chamber 15; heating coil 11 passes through suitable stuffing boxes in the head of cap 16; the walls of chamber 15 are preferably integral with vessel 1 and rotate therewith, suitable liquid tight connection being made between said chamber and cap 16, which latter is mounted upon standard or base 18.

An outlet 19, closed by a suitable cover, and a man-hole 20, closed by a detachable cover, is provided for each of chambers 9 and 9a.

The operation of the apparatus set forth, as for instance when used in carrying out bleaching processes, will now be described.

The material to be bleached is packed into the two chambers 9 and 9a as uniformly as possible. The man-holes are then closed, and the vessel started to rotate. Bleaching liquor is then permitted to flow from a reservoir (not shown) through pipe 17, channel 10 and openings 13 and 14 into chambers 9 and 9a until the liquor has risen to the proper height in the vessel, filling the same to about half its height. In whatever direction the latter is rotating the bleaching liquor will be drawn from the ascending chamber, for instance 9, into the descending chamber 9a by passing through opening 14, channel 10, and opening 13, or vice versa. Thus the bleaching liquor travels continuously from one chamber to the other during the process and as the liquor always passes along coil 11 as it goes through channel 10 its temperature may conveniently be regulated by passing steam through coil 11. In the majority of cases heating by indirect steam will be the more preferable course, though heating by direct steam will be a necessity in many other cases.

In order to meet this exigency a valve 21 is provided in pipe 17 so that direct steam may be admitted whenever necessary. As soon as the process is finished the bleaching liquor is run off through opening 19 and washing water is admitted through pipe 17. After the finished goods are sufficiently rinsed in the same way that the bleaching liquor passes over the goods during the bleaching process, the water is also run off through opening 19, whereupon the vessel is emptied and refilled for a new operation.

Having described the principle of the process and one way of carrying it out in actual work, I shall now describe a modification of the apparatus showing a way of practising the process in connection with a greater number of chambers than two, for instance, four, as used when great quantities of goods are to be treated. Such an arrangement is illustrated in Figs. 3 to 7 inclusive.

It is evident from a comparison of Figs. 3 to 7 with Figs. 1 and 2, that the apparatus having four chambers is constructed on the same principles as that in which two chambers are employed.

The inner space of the vessel in Figs. 3–7 is divided by partitions 8a, 8b, 8c and 8d into four substantially equal chambers. As is obvious from Fig. 4, these partitions do not meet in the center, but leave a free space surrounded by a cylindrical steam jacket formed between suitable walls or shells 22 and 23.

This jacket is made of suitable material, as for instance, tin, lead or any other suitable material resistant to the action of the liquor; it serves as a heating device by means of steam passed through the same while the liquors pass along both its inner and outer walls, as hereinafter set forth.

In order to cause an efficient and well regulated heating of the liquor, semi-circular spaces or channels 24 and 24a are provided around outer wall 22 of the steam jacket by means of suitably bent or curved shells made of material corresponding in its properties with that of the partitions. The shells forming the outer wall of channels 24 and 24a, are mounted on the partitions as shown in Figs. 3 and 7, and as hereinafter more particularly described. The central space, within the steam jacket, is divided into two substantially equal longitudinal channels 25, 25a, by means of partition 26.

In order to effect communication between the various chambers and the channels 24 and 24a and 25 and 25a, respectively, the steam jacket is provided with various openings permitting the passage of the liquor from chamber to chamber during the rotation of the vessel. In order to insure the accurate flow of the liquor to bring about the desired result, I have provided sub-partitions 27, 27a and 28, 28a corresponding in material to the partitions 8a, 8b, etc.; it will be noted that the sub-partitions 27 and 27a, and 28 and 28a are arranged one at each end, but on opposite sides, of the respective partitions 8a, 8b, 8c and 8d, and that the lines of intersection of each pair of sub-partitions with the partition on which they are mounted are parallel to each other; that is, the two sub-partitions 28a for example, at opposite sides of partition 8d extend in planes parallel to each other (Fig. 7). The sub-partitions are preferably arranged at an angle of about 45° to the main partitions, one edge of each of the respective sub-partitions having a liquid-tight joint with its co-operating main partition and the other edge a similar connection against the end wall of vessel 1. As the sub-partitions do not reach quite to the wall forming the periphery of vessel 1, channels are thus formed between the end walls of vessel 1 and the partitions with an opening at one end adjacent the peripheral wall of the vessel.

Partitions 8a and 8b extend from the walls

of vessel 1 inwardly to the channels 25 and 25[a] respectively, thus forming a portion of the walls of circumferential channels 24 and 24[a] respectively. Subpartitions 27, 27 (diagonally opposite each other, but on opposite sides of partition 8[a]) and subpartitions 27[a], 27[a] (diagonally opposite each other, but on opposite sides of partition 8[b]) also extend inwardly to channels 25 and 25[a] respectively.

Partitions 8[c] and 8[d] extend from the walls of vessel 1 inwardly to the channels 24 and 24[a] respectively. Sub-partitions 28, 28, (diagonally opposite each other but on opposite sides of partition 8[c]) and sub-partitions 28[a], 28[a] (diagonally opposite each other but on opposite sides of partition 8[d]) extend inwardly to channels 24 and 24[a] respectively.

Inasmuch as the sub-partitions 27, 27, 27[a], 27[a], 28, 28, 28[a] and 28[a] end a short distance from the walls of vessel 1, it is evident that they form, in connection with the respective partitions, a net of channels which permit the liquid, if the vessel rotates, to pass in a cycle through the various chambers of said vessel. Thus, if the vessel rotates in a clockwise direction, the liquid runs from—say chamber 29—through channel 36[a] into channel 24[a], thence through channel 24[a] and out through the corresponding channel 36, at the opposite end of channel 24[a] from the entrance of channel 36[a] thereinto, into chamber 35. From the latter chamber the liquid passes through channel 34[a] into channel 25[a], thence through channel 25[a] and out through the corresponding channed 34, at the opposite end of channel 25[a] from the entrance of channel 34[a] (chamber 35) thereinto, into chamber 33. Similarly the liquid may pass from chamber 33 through channel 32[a] into channel 24, thence through 24 and out through the corresponding channel 32, at the opposite end of channel 24 from the entrance of channel 32[a] thereinto, into chamber 31. Finally the liquid travels from chamber 31, through channel 30[a] into channel 25, thence through channel 25 and out through channel 30, at the opposite end of channel 25 from the entrance of channel 30[a] thereinto, back into chamber 29.

It will be noted that the liquid in its passage through the apparatus and through the respective chambers thereof is caused to take a successive series of diagonal paths, thus exposing the contents of the respective chambers to an exceedingly efficient wetting process.

Man-holes 37 and 38 respectively are provided in about the center of partition 8[d] and 8[c], in order to permit the proper packing of the chambers. The man-holes are adapted to be closed by detachable covers 37[a], 38[a], respectively.

The vessel 1, in this modification is provided with a cylindrical rim 39 which carries a tightly fitting cap 40, which is held stationary by a suitable arm 41 while vessel 1 is rotating.

A pipe 41[a] passes through the center of cap 40 and is provided with a valve 42 admitting liquor into the lower channel 25[a], partition 26 being upwardly bent to prevent the liquor from entering the upper channel 25, thus regulating the flow of the liquor in the desired way. Cap 40 also carries a pipe 43 having a valve 44 for admitting steam into the steam jacket between walls 22 and 23, as well as an exhaust pipe 45 with valve 46.

The operation of this four-chamber vessel is practically the same in every respect as that of the two-chamber vessel. As soon as all the chambers are properly packed with the goods, the vessel is caused to rotate clockwise and sufficient liquor is admitted so as to thoroughly wet the goods. As soon as this is effected the vessel is stopped and more liquor is added so as to just fill one chamber, for instance chamber 29.

The vessel is then started again for the operation of the process. Suppose chamber 35 to be completely filled; then owing to the continuous, though very slow rotation, the liquor is caused to pass through the channel 34[a] into channel 25[a], thence along the walls of the heating jacket toward the opposite wall of the vessel and to descend through channel 34[a] into chamber 33 gradually filling the same. When partition 8[b] has assumed a horizontal position all the liquor has passed completely in the manner described into chamber 33 whence as partition 8[b] ascends, it leaves at the rear of chamber 33 through channel 32[a] into channel 24 and flows toward the front wall of the vessel being simultaneously heated while passing along the walls of the steam jacket and finally entering chamber 31 through channel 32 formed in the front of the vessel. The further course of the liquor is similar to the manner described above, up to the end of the process; the further steps for rinsing the goods with water and subsequently treating the same with other liquors, for instance with sizing liquors or with dyeing baths, etc., as the case may be, for finishing the operation are also performed in the same way.

Bleaching apparatus preferred up to now has consisted usually of a container with a false bottom and partitions having perforations, to receive the goods, the bleaching liquor filling the container and being usually circulated through the goods by means of a pump or like means.

In this type of apparatus the proportion of liquor to the wetted out goods is about four to ten times by weight of the former to one by weight of the latter. The use of a pump of course always guarantees a certain circulation, but there are certain short-

comings which greatly reduce the beneficial action of the circulation as it is always found that channels are formed owing to the force of the liquor, especially when the goods are tightly packed. As soon as such channels are formed, and their formation cannot be completely prevented even with the greatest care, the action of the liquor on the goods is practically next to *nil* because the goods remote from the channels meet only a little or no supply of liquor whereas the goods adjoining the channels are too much exposed to it and thus consequently suffer in strength and appearance.

There is another type of bleaching machine in which the goods are put into a frame work or in a perforated container, either of which are rotated in another container filled with the bleaching liquor, so that the rotating part of the machine is immersed up to or a little over the axis. It is obvious that in such a type of machine a considerable dead space is left between the outside container and the rotating part of the machine. The resulting drawbacks are considerable, for an unnecessarily large amount of the liquor decomposes prematurely without any beneficial effect and thus stamps this type of apparatus as extremely wasteful for solution containing active oxygen for instance.

The proportion of liquor to the goods in such apparatus is unusually high, for instance it often takes from eleven to sixteen times the weight of liquor to one part by weight of the goods and very often the proportion is even more disadvantageous, and yet there is in these apparatus a poor percolation of the goods by the liquor inasmuch as the liquor follows the line of the least resistance during the circulation.

The well known type of machines for bleaching piece goods, having one reel above and one under the liquor, are also poor in economy as the proportion of liquor to the goods is about 6 or more : 1. All such shortcomings as unnecessarily great volumes of liquid, dead corners, channels, etc., are avoided by my new process of bleaching. Owing to the very slow rotations of the container, making about one to two revolutions per minute, a motion of the bleaching liquor is induced which is different from that achieved in any other bleaching apparatus used up to now. It is evident that, as a chamber ascends the bleaching liquor is inclined to follow the motion of the wall, but subsequently falls back and cascades evenly all through the goods toward the center of the vessel, in the modification shown in Fig. 2, entering the channel 10 through opening 14 and leaving on the other side through the opening 13, spreading through the goods in the descending chamber and penetrating the same from the top (*i. e.* from the middle axis) toward the bottom. In the modification shown in Figs. 3–7, as soon as the partitions 8^a and 8^b, for example, are in the horizontal position, chamber 29 is practically empty of bleaching liquor and is descending, whereas chamber 31 is now ascending. It is obvious that at this point chamber 31 is completely filled with the bleaching liquor and that when the latter has entered chamber 29, (in the manner heretofore described) each particle of goods in chamber 31 has already actually been exposed to the bleaching liquor under the same conditions, and to the same extent as every other particle.

Should air accumulate in the apparatus it may be discharged and the pressure relieved by any suitable means, such as a valve controlled opening in the walls of the vessel (not shown).

Owing to the laws of gravity the bleaching liquor has to force its own way through the goods and as this is effected in a gentle way as compared with the pressure exerted by pumps, the liquor filters evenly through the goods. The rotation of the containing vessel is usually caused to go in one direction, but it may be changed at will to go in the opposite direction so that the flow of the liquor may thus be reversed, although, as is obvious, even with the rotation in one direction the course of the liquor is periodically changed in a diagonally opposite direction thereby alternately fully immerging, during such interval, all the fibers in any one of the chambers, thus exposing each and every particle of the goods to the bleaching action under like conditions, the result being a most desirable uniform whiteness of the goods, preserving at the same time the original strength of the fibers practically unaltered. Further and quite material factors in the new process are the certainty with which the operator can rely on the positive outcome of the desired result, the considerable reduction of the time in the operation of other processes, the enormous reduction of the volume of bleaching liquor applied and the perfect utilization of the available oxygen of the bleaching liquor as well as the considerably lower cost of installation.

The very considerable increase in economy in my new process as compared with the processes of the prior art resulting from the enormous reduction in the volume of liquor necessary for the operation of the process is especially to be noted. Whereas the old processes needed a plurality of volumes of liquor in proportion to the volume of goods, my process reduces such proportion to only a fraction of that of the volume of the goods. For instance in the two chamber apparatus illustrated in Fig. 2, I need liquor only to the amount of about one-half the volume of the goods and when there is a

sufficient mass of goods to necessitate the operation of a large four chamber apparatus I need an amount of liquor which is approximately only one-fourth of the volume of the goods.

While the machine can also be built on a plan providing more than four chambers I do not describe such further analogous constructions as a four chamber apparatus will be large enough to satisfy all practical requirements. It is of course understood that various changes in the construction of the apparatus as well as in the operation of the process can be made without departing from the spirit of the invention or sacrificing the advantages thereof and such deviations, as for instance varying the means for heating the liquor so as to use other means than heating with steam, and using the apparatus for washing or treating fibers with dyestuffs or for treating the same with liquors for any other purpose whatever, are claimed as part of my invention as coming within the scope of the claims annexed thereto.

I claim:

1. The process of treating fibers with liquids consisting in completely packing the interior of a given space with fibers, filling a part only of the space with liquid, submitting the fibers to a rotating motion and filtering the liquid through the fibers during said rotation.

2. The process of treating fibers with liquids consisting in completely packing the interior of a given space with fibers, filling the space with liquid varying in volume up to approximately half the volume of the space, submitting the fibers to a rotating motion and filtering the liquid through the fibers during said rotation.

3. The process of treating fibers with liquids consisting in completely packing the interior of a given space with fibers, preliminarily wetting the fibers with liquid, filling a part only of the space with the liquid to which the fibers are to be finally submitted, submitting the fibers to a rotating motion and filtering said last named liquid through the fibers during rotation.

4. The process of treating fibers with liquid consisting in dividing a suitable vessel into preferably substantially equal subdivisions maintaining a suitable communication betwen the adjoining subdivisions, packing each subdivision with fibers to be treated, preliminarily wetting the fibers with the liquid, filling a part only of the space with liquid, submitting the fibers to a rotating motion and filtering the liquid through the fibers during said rotation.

5. The process of treating fibers with liquids consisting in dividing a suitable vessel into preferably substantially equal subdivisions, maintaining a suitable communication between the adjoining subdivisions, filling the subdivisions with fibers, preliminarily wetting the fibers with the liquid, filling but a single subdivision of the space with liquid, submitting the fibers to a rotating motion and filtering the liquid through the fibers during said rotation.

6. The process of treating fibers with liquids consisting in dividing a suitable vessel into preferably substantially equal subdivisions, maintaining a suitable communication between the adjoining subdivisions, filling the subdivisions with fibers, preliminarily wetting the fibers with the liquid, filling the vessel with liquid varying up to approximately half the volume of the vessel, submitting the fibers to a rotating motion, passing the liquid from one to the other of said subdivisions and filtering the same through the fibers during said rotation.

7. The process of treating fibers with liquids consisting in dividing a suitable vessel into preferably substantially equal subdivisions, maintaining suitable communication between the adjoining subdivisions, packing said subdivisions with fibers, preliminarily wetting the fibers with the liquid, filling one subdivision with liquid, submitting the vessel to a rotating motion, passing the liquid from each subdivision to the adjacent one and filtering it consecutively through the goods in the other subdivisions.

8. The process of treating fibers with liquids consisting in dividing a suitable vessel into preferably substantially equal subdivisions, maintaining suitable communication between the adjoining subdivisions, packing said subdivisions with fibers, preliminarily wetting the fibers with the liquids, filling but one subdivision with liquid, passing the liquid through said subdivision in diagonally opposite directions and filtering it consecutively through the goods in each subdivision.

9. The process of treating fibers with liquids consisting in dividing a suitable vessel into preferably substantially equal subdivisions, maintaining suitable communication between the adjoining subdivisions, filling each subdivision with fibers, preliminarily wetting the fibers with the liquid, filling the vessel with liquid varying up to approximately half the volume of the vessel, submitting the fibers to a rotating motion, passing the liquid from each subdivision to the adjacent one, regulating the temperature of the liquid during this latter passage, and filtering the same consecutively through the goods in each subdivision.

10. An apparatus for treating fibers with liquids comprising a container capable of being rotated, partitions subdividing the inside of the container into a plurality of substantially equal chambers, heating means located approximately in the center of the container, means incasing the heating means, a

channel establishing communication between the adjacent chamber through the heating incasing means and means to impart a rotating motion to the container.

11. An apparatus for treating fibers with liquids comprising a container capable of being rotated, partitions subdividing the inside of the container into a plurality of substantially equal chambers, a heating device located approximately in the center of the container, a shell incasing the heating device, openings from said shell into said chambers in diagonally opposite sides, a channel establishing communication between the chambers through said shell, and means to impart rotating motion to the container.

12. An apparatus for treating fibers with liquids comprising a container having its interior subdivided into a plurality of substantially equal chambers, means for liquid communication from each chamber to the adjoining one, means for heating the liquid while passing from one to the other of said chambers, and means for rotating said container.

In testimony whereof I have signed this specification in the presence of two subscribing witnesses.

HANNS R. ANDERS.

Witnesses:
FRED'K W. WEBER,
OTTO K. ZWINGENBERGER.