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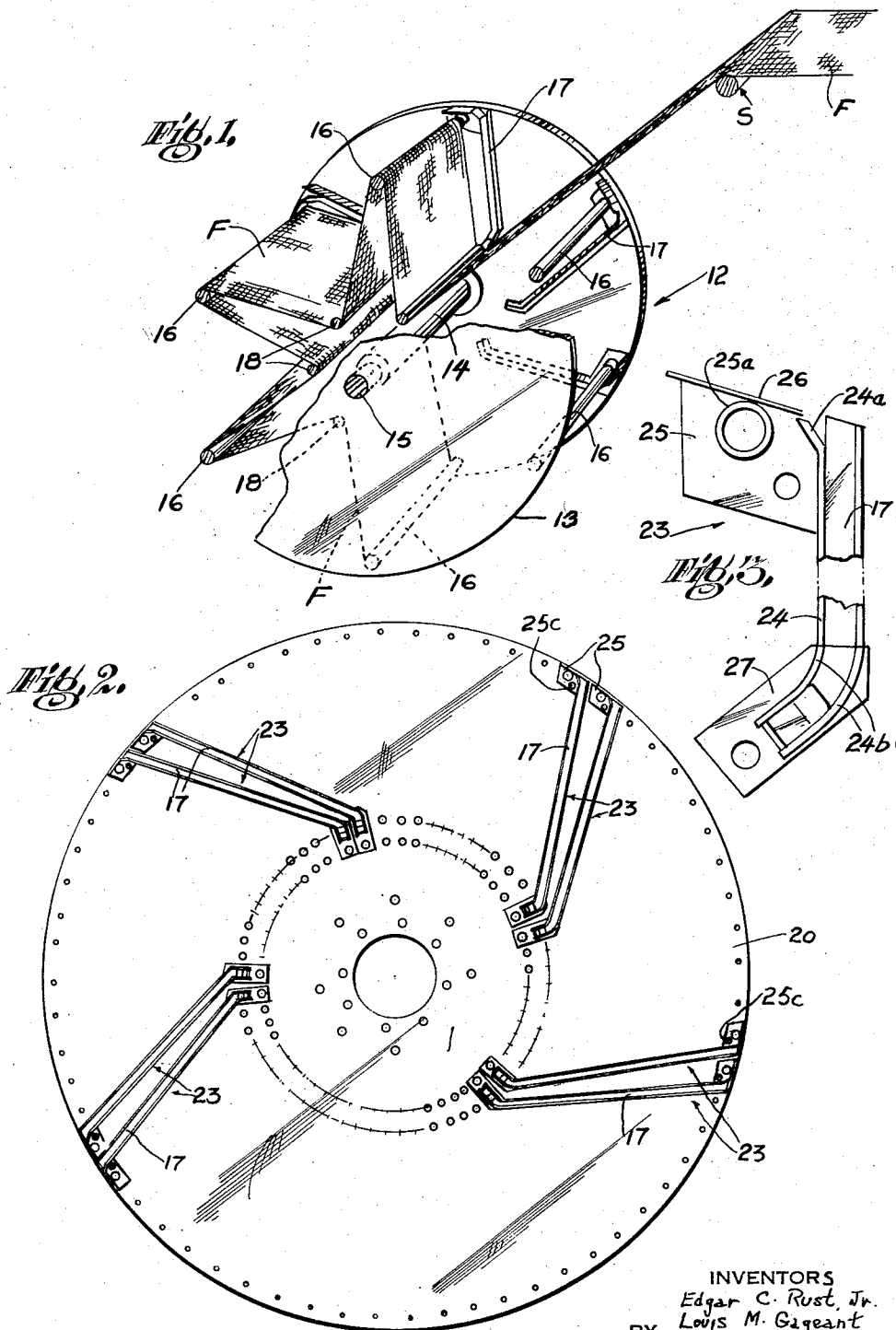
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APPARATUS FOR TREATING TEXTILES

Filed Aug. 19, 1954

3 Sheets-Sheet 1



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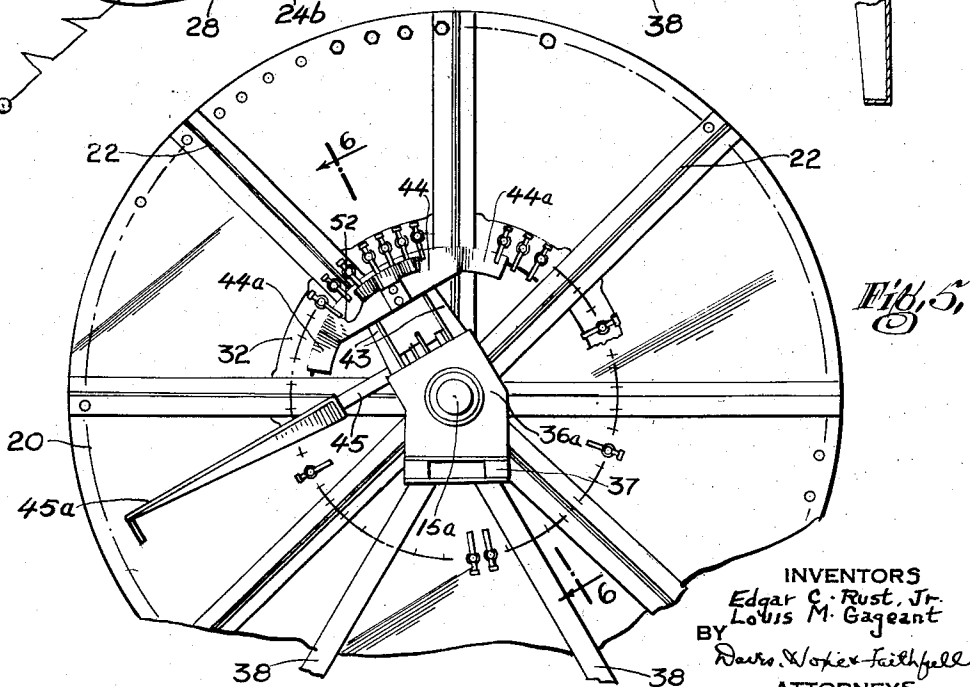
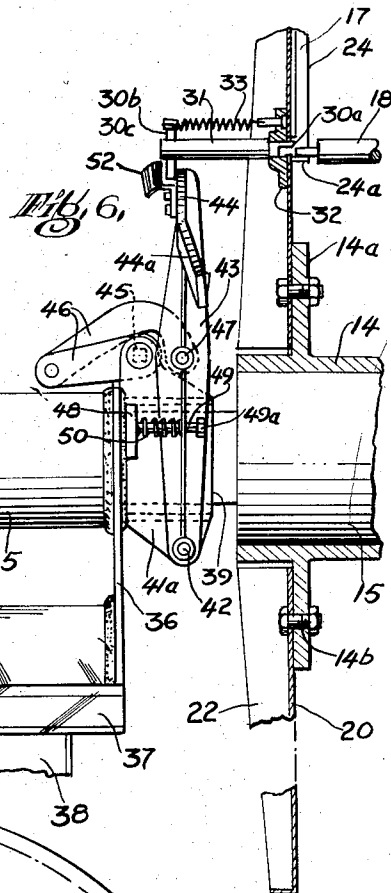
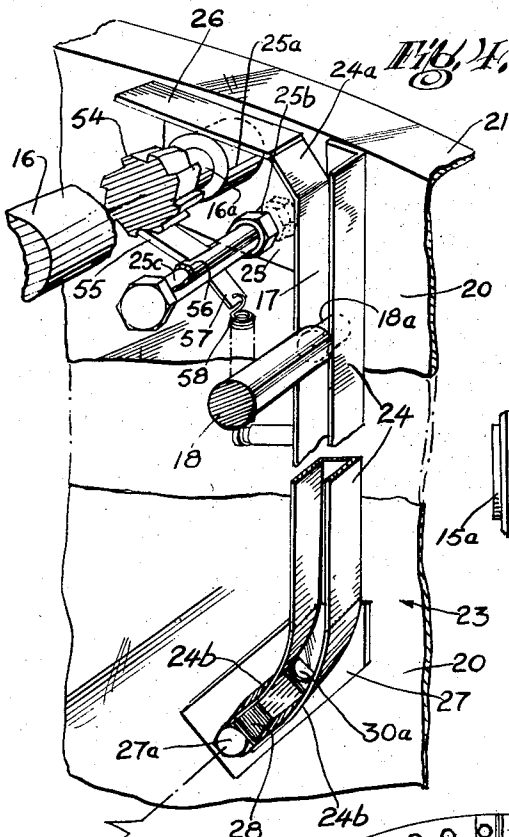
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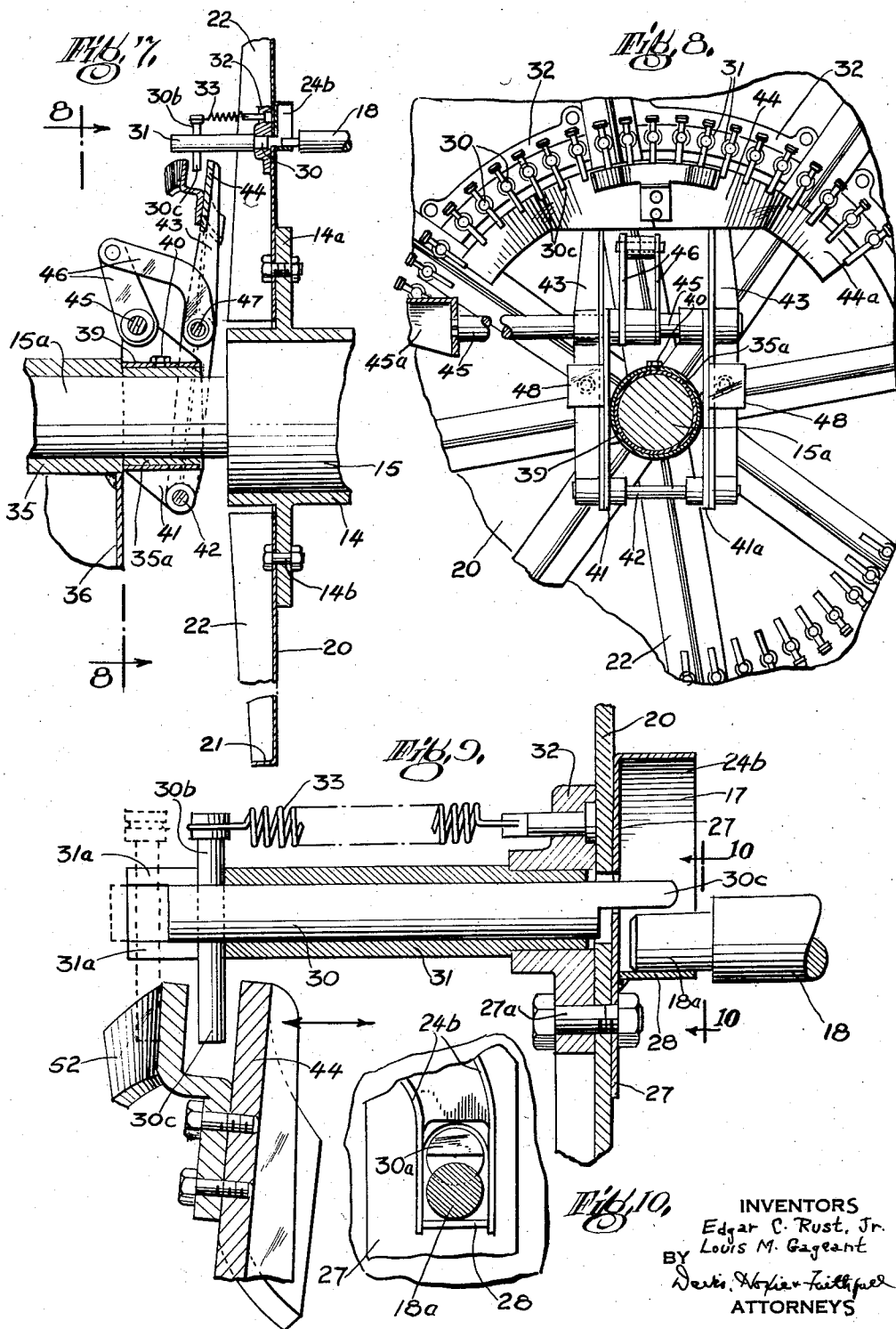
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APPARATUS FOR TREATING TEXTILES

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3 Sheets-Sheet 3



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APPARATUS FOR TREATING TEXTILES

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15 Claims. (Cl. 242-1)

This invention relates to textile-treating apparatus of the type in which the textile undergoes a dyeing operation or other liquid treatment while mounted in open width on a revolving creel or rotor.

A recent development in the dyeing of textile fabrics is the so-called Barotor promoted by E. I. du Pont de Nemours and Co., Inc. of Wilmington, Delaware, and disclosed in its Primary Bulletin CSB-X-7 of April 1954. The Barotor is essentially a rotor revolving on a horizontal axis and having a series of outer bars extending between opposed heads of the rotor and alternating around the rotor axis with inner bars each mounted in a pair of opposed tracks leading from the peripheral to the central portions of the heads. The fabric to be dyed is loaded on the rotor by inserting the inner bars one by one into the outer ends of their respective tracks from a loading station at the upper part of the rotor, so that each inner bar overlies the fabric which, in turn, overlies an adjacent outer bar. Each inner bar, when so inserted, moves by gravity to the inner ends of its tracks so as to draw a length of fabric from the loading station into the rotor. The rotor is then revolved in one direction to bring the next outer bar and pair of tracks opposite the loading station, whereupon another inner bar is placed over the fabric and allowed to drop to the inner ends of its tracks so as to draw another length of fabric into the rotor. The loading operation is completed when these loading steps have been repeated through one revolution of the rotor and the latter supports the fabric in a closed loop extending alternately over one outer bar and under the next inner bar thus forming sub-loops extending in zig-zag fashion around the rotor axis.

The dyeing operation is performed by revolving the loaded rotor in a horizontal autoclave partly filled with the dye liquor, which causes the fabric loop to progress forward relative to the rotor as it rotates through the dye bath. The rotor is then removed from the autoclave and unloaded by the reverse of the loading steps previously described. This dyeing procedure affords numerous advantages which will be apparent to those skilled in the art.

A difficulty encountered in the use of the Barotor arises from the manner of retaining the inner bars at the inner ends of their tracks as the rotor revolves. Heretofore, these tracks have been arranged so that their inner ends turn back toward the rotor periphery, forming J-shaped tracks which trap these bars in the short reversely-turned inner parts of the tracks as the rotor revolves in one direction. Rotation of the rotor in the opposite direction releases the bars automatically one-by-one from these inner parts of their tracks, for unloading purposes. This arrangement is unsatisfactory for several reasons. The inner bars cannot be relied upon to stay trapped in the J-shaped tracks or slots, due to cloth shrinkage and uneven progression of the cloth loop relative to the rotor at different parts of

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the rotor. Any accidental release of an inner bar would have serious consequences in spoiling the cloth and damaging the machine. Furthermore, the J-shaped tracks require too much space at the central portions of the rotor heads, thereby limiting the number of bars which can be accommodated by the rotor and therefore the fabric length which can be loaded. Also, the inner bars can undergo considerable movement even when they remain trapped in their J-shaped tracks, which tends to crease certain fabrics and retard the desired progression of the cloth relative to the bars during the dyeing operation.

The present invention has for its principal object the provision of an apparatus of the character described which overcomes the above-noted disadvantages.

An apparatus made according to the invention comprises bar-retaining devices mounted on each head of the rotor at the inner portions of the respective tracks for the inner bars. These retaining devices are movable with the head along a closed path as the rotor revolves, and each retaining device is also movable relative to the head between a closed position for locking one end of an inner bar at the inner portion of the respective track and an open position for permitting passage of the bar end to and from this inner portion of the track. The apparatus also includes means responsive to movement of these retaining devices to a predetermined portion of their path (corresponding to a loading station) for shifting the devices from their closed to their open positions, and means for returning each retaining device to its closed position when the rotor carries it away from this predetermined portion of the path. The apparatus is further provided with mechanism for rendering the shifting means inoperative, so that the bar-retaining devices will remain in their closed positions throughout the path through which they move as the rotor revolves.

With this construction, the bar-retaining devices can be made to open automatically as the corresponding tracks approach the loading station and to close automatically to lock the inner bars in their tracks as they leave the loading station (as in the loading operation), or the retaining devices can be held closed to lock the inner bars in position throughout the rotation of the rotor (as in the dyeing operation), depending on whether the shifting means are in their operative or inoperative condition.

A further feature of the invention resides in an improved construction of the rotor heads, wherein each head is provided with a series of bar-supporting units separately attached to a main plate of the head, each unit forming a track for one end of an inner bar and a support in which one end of an outer bar is rotatably mounted.

Still another feature of the invention resides in the provision of an improved apparatus of the character described which facilitates forward progression of the fabric loop relative to the rotor as the latter rotates through the dye bath, thereby preventing bar marks on the fabric. It is known that such progression will occur when the fabric is loaded so as to provide some slack in the loop, apparently because of an unbalanced tension created by the pools of liquid which are scooped from the dye bath by the fabric as the outer bars emerge from the bath. We have found, however, that the fabric actually undergoes both forward and backward movement relative to the rotor during its rotation in the bath, although the backward movement is to a lesser degree over-all. According to this further feature of the invention, some of the bars are provided with means for preventing their rotation in one direction so that they can rotate only in the direction which permits the forward movement of the fabric, such means being preferably

a pawl and ratchet mechanism associated with each outer bar.

For a better understanding of the invention, reference may be had to the following detailed description and the accompanying drawings illustrating a preferred form of the apparatus. In the drawings:

Fig. 1 is a perspective view of the rotor showing the manner of loading the fabric on the rotor bars, certain parts of the rotor being broken away or omitted to simplify the illustration;

Fig. 2 is more detailed view (on a larger scale) of the inner face of one of the rotor heads, showing some of the bar-supporting units;

Fig. 3 is an enlarged face view of one of the bar-supporting units illustrated in Fig. 2;

Fig. 4 is an enlarged perspective view of part of the rotor head illustrated in Fig. 2, showing the manner in which one of its units supports the adjacent ends of two bars;

Fig. 5 is an end view of the apparatus, showing the support for one end of the rotor and the cam for actuating the retaining devices for the inner bars;

Fig. 6 is a partial sectional view on the line 6—6 in Fig. 5, the rotor support and cam being shown in elevation with the cam in its operating position;

Fig. 7 is a sectional view on the line 6—6 in Fig. 5, but showing the cam in its inoperative position;

Fig. 8 is a view on the line 8—8 in Fig. 7;

Fig. 9 is a detailed sectional view of part of the apparatus, showing one of the inner bar retaining devices in its closed position and the cam in its inoperative position, and

Fig. 10 is a view on the line 10—10 in Fig. 9.

Referring to Fig. 1, the rotor there shown comprises opposed heads 12 and 13 connected at their central portions to a sleeve 14. This sleeve is secured to a central shaft 15 by a tight fit around the latter, and the shaft projects from the ends of the sleeve so as to form trunnions. The projecting ends of the shaft 15 are mounted for rotation on bearing supports (which will be described in detail presently) and the shaft is adapted to be rotated from one end by a suitable motor (not shown) so that the heads 12—13 and sleeve 14 rotate as a unit.

The rotor is provided with a set of outer bars 16 extending between the heads 12—13 parallel to the axis of rotation formed by the shaft 15. The bars 16 are spaced circumferentially around the heads near their peripheries, each bar having its ends rotatably mounted in the heads. The opposing faces of the two heads each have a series of grooves 17 forming tracks extending inward toward the central portion of the head but tangentially of this central portion, except for a short inner section of the groove which extends toward the rotation axis. Each groove 17 leads inward from the peripheral part of the head adjacent one of the outer bars 16, so that the grooves 17 alternate with the bars 16 around each head. The arrangement of the grooves 17 on each head is a mirror image of the groove arrangement on the other head, whereby each groove on one head is opposed to a similar groove on the other head. Each pair of opposed grooves on the respective heads is adapted to receive the ends of an inner bar 18 which is rotatable in the grooves. The grooves 17 are open at their outer ends to permit the bars to be inserted in the grooves and moved to the inner ends of the latter, where they are adapted to be held by retaining devices to be described presently.

In Fig. 1, we have shown six outer bars 16 and grooves 17 for six inner bars 18. However, the number of bars in each of the inner and outer sets is preferably substantially greater than this, there being sixty-four bars in each set in the embodiment of the invention which is illustrated in more detail in Figs. 2 through 10. The

omission of certain bars and grooves in Fig. 1 is for the purpose of simplifying this general illustration so as to enable a better understanding of the over-all operation of the apparatus before proceeding with a description of the details.

The rotor as shown in Fig. 1 is partly loaded with a textile F, which may be a synthetic fabric such as nylon, Dacron or Orlon. The fabric is loaded from a loading station designated generally at S, which is located approximately 45° above the horizontal at one side of the rotor. One way of loading the fabric is to secure one end of the web temporarily to an outer bar 16 adjacent the loading station S. A bar 18 is then inserted in the pair of opposed grooves 17 nearest to this bar 16 in the clockwise direction. Under the action of gravity, the bar 18 thus inserted will drop to the lower ends of its grooves 17 and thereby draw a length of fabric from the feeding station S. The rotor is then rotated counter-clockwise to bring the next outer bar 16 to the loading station S, and another inner bar 18 is inserted in the adjacent pair of opposed grooves 17 in the heads, the latter bar dropping to the lower ends of its grooves and thereby drawing another length of fabric F from the loading station. This procedure is continued until the rotor has made a complete revolution in the counter-clockwise direction; and it is pointed out here that as the step-wise rotation of the rotor carries each inner bar 18 away from the loading station the inner bar is locked at the inner ends of its grooves 17 (as will be described in detail hereinafter) so that it cannot return by gravity to the outer or peripheral portion of the rotor when this inner bar reaches a position below the horizontal. When the outer bar 16 to which the leading end of the web F was attached (the lowermost bar in Fig. 1) returns to the loading station S, this leading end of the web is detached from the outer bar and attached to the trailing end of the web, as by stitching. Thus, with the rotor fully loaded, the fabric web F extends in open width alternately over each outer bar 16 and under the next inner bar 18, in zig-zag fashion about the rotor axis, as partly indicated in Fig. 1.

According to the principle of the so-called Barotor, previously mentioned, the rotor 12—13 thus loaded is placed in a horizontal autoclave (not shown) and rotated slowly on its horizontal axis formed by shaft 15, the dye liquor having first been introduced into the autoclave to the desired depth (usually about one-quarter of the diameter of the autoclave). Due to the rotation of the rotor in the autoclave, all portions of the fabric F have equal contact with the liquor regardless of how shallow the bath may be. The rotor speed may be such as to pass the fabric through the bath several times a minute, which enables rapid and continuous "leveling" and allows the dyeing to be carried out in a short period of time. Shrinkage of the fabric during the dyeing operation can be accommodated by providing a certain amount of slack in the fabric when loading it on the rotor as previously described. Since the rotor supports the fabric in an endless configurated loop, the fabric is caused to progress forward relative to the rotor as the latter revolves, this progressing action being apparently due to the weight of the liquor picked up by the fabric as it moves through the bath in the bottom portion of the autoclave, it being understood that the bars 16 and 18 are rotatable relative to the heads to facilitate this progressing of the fabric. The progression of the fabric relative to the rotor has certain advantages, among which is the avoidance of bar marks on the dyed fabric.

When the dyeing operation has been completed, the rotor is removed from the autoclave and unloaded. To unload the rotor, the leading and trailing ends of the web are detached from each other at the loading station S, and one end is drawn out from the rotor so as to lift the adjacent inner bar 18 in its grooves 17, whereby this inner

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bar can be removed from the rotor through the open outer ends of the grooves. The rotor is then revolved sufficiently to bring the next inner bar 18 adjacent the station S, and a further length of the fabric is drawn from the rotor and this next bar removed in the same manner, it being understood that the retaining device for each inner bar 18 is released when the bar arrives at the unloading position at S. The rotor will be completely unloaded when this procedure has been followed through a complete revolution. In some cases, it may be desirable to unload the rotor at a station located below a horizontal plane through the rotor axis, so that the inner bars 18 can be removed from the rotor by gravity.

As previously mentioned, each rotor head 12—13 is a mirror image of the other head. Accordingly, a description of the details of one head will suffice. The head 12 shown in Fig. 2 comprises a circular plate 20 having a central opening through which the corresponding end of the sleeve 14 extends (Figs. 6 and 7). This end portion of the sleeve 14 has a radial flange 14a secured to the plate by bolts 14b. A flange 21 is provided around the periphery of the plate and extends away from the opposing head 13. The plate 20 is stiffened by means of radial ribs 22 on its outer face (Fig. 5).

The plate 20 has on its inner face a series of bar supporting units 23. Each unit 23 (Figs. 3 and 4) comprises a channel member 24 forming a groove or track 17. Each channel member 24 is open at its outer end, which is located at the periphery of the plate, and extends inward toward the central portion of the plate but tangentially to the latter. At its outer portion, the channel member 24 has one of its side walls bent in the counter-clockwise direction, as shown at 24a. This bent portion and the adjacent part of the channel member are welded or otherwise secured to a sub-plate 25, the latter being secured to the main plate 20 by connecting means in the form of a bolt 25c extending through aligned openings in these two plates, and nuts 25b screwed on the bolts. The sub-plate 25 carries a bearing support 25a which receives the reduced end portion 16a of an outer bar 16. A flange 26 is secured to the sub-plate 25 over the bearing support 25a and leads to the end of the bent portion 24a of the channel member. At its inner end, the channel member 24 is connected by welding, or the like, to a second sub-plate 27 which is secured to the main plate 20 by a bolt 27a. The sub-plate 27 has curved walls 24b forming continuations of the side walls of channel member 24, the walls 24b curving inwardly toward the rotation axis (Fig. 2). At its inner end, the groove or track 17 formed by the members 24 and 24b is closed by a bar stop 28.

As shown in Fig. 2, the bar-supporting units 23 are closer together at their inner ends than at their outer ends, so that these units converge toward the central portion of the plate. Each unit 23 supports one end of an outer bar 16 in its bearing support 25a and is adapted to receive one end of an inner bar 18 in the track or groove 17. The flange 26 of each unit facilitates insertion of the inner bar into the track 17, since the reduced end portion 18a (Fig. 4) of the inner bar may be placed on the flange 26 and the bar rolled along this flange to the slanting side wall 24a, which guides the bar into the track 17. The bar 18 will then move downward in the track by gravity, as shown in Fig. 4, until it reaches the bar stop 28 at the lower end of the track. It will be apparent that each bar-supporting unit 23 can be made up separately and the various units assembled on the plate 20 by the simple expedient of attaching the bolts 25c and 27a.

In order to lock the bars 18 at the inner ends of their respective tracks 17, we provide bar-retaining devices which will now be described. Referring to Figs. 6—10, each bar-retaining device is in the form of a bolt 30 slidably mounted in a cylindrical housing 31 extending parallel to the rotation axis of the rotor. Each track 17 has its own bolt 30 and housing 31. The housings 31 are

secured to the outer face of the plate 20 by means of ring segments 32 connected to the plate between the radial stiffening ribs 22 (Figs. 5 and 8), the inner ends of the bolt housings fitting closely into the ring segments. Where the ring segments are interrupted by the stiffening ribs 22, the bolt housings 31 are secured directly to the ribs themselves. Each bolt 30 has a bar-retaining portion 30a at its inner end (Fig. 9), this inner portion 30a being of reduced cross-section and extending through aligned holes in the plate 20 and the corresponding sub-plate 27, so that in the inner or closed position of the bolt 30 its end portion 30a extends a substantial distance into the track groove 17. Accordingly, when the reduced end portion 18a of an inner bar is dropped to the inner end of its track 17, movement of the locking bolt 30 to its closed position will cause its bar-retaining portion 30a to hold the adjacent end of the bar at the stop 28, as shown in Figs. 9 and 10. At its outer end portion, each locking bolt 30 has a transverse pin 30b slidable in diametrically opposed slots 31a in the bolt housing 31. A biasing element in the form of a tension spring 33 connects each bolt pin 30b to the plate 20 by way of the adjacent ring segment 32. The spring 33 urges the bolt 30 toward its closed position (Fig. 9) but is yieldable to permit retraction of the bolt to its open position (Fig. 6) wherein the inner portion 30a of the bolt is withdrawn from the corresponding track 17 to permit the adjacent end of an inner bar 18 to pass to or from the inner end of the track. This retraction of the bolt 30 is effected by the action of a cam on the end 30c of the transverse pin, as will be described presently. Thus, the end 30c of the pin constitutes a cam engaging portion of the bolt.

The rotor shaft 15 extends beyond the end of the surrounding sleeve 14, where it is provided with a reduced portion or trunnion 15a. The trunnion 15a is rotatably mounted in a fixed bearing or bushing 35 (Figs. 6 and 7). The bearing 35 is supported on vertical plates 36 and 36a connected to a horizontal plate 37 which, in turn, is supported by legs 38 (Figs. 5 and 6). It will be understood that a similar bearing support is provided at the other end of the rotor adjacent the opposed head 13. The supporting legs 38 may be mounted on a carriage (not shown) so that the rotor and its mount may be wheeled into and out of the autoclave previously mentioned. It will be further understood that a suitable motor (not shown) is provided to drive the rotor through a connection to one end of the shaft 15, although the manner of driving the rotor and supporting its bearings 35 forms no part of the present invention.

The bearing or bushing 35 has an inner extension 35a (Fig. 7) on which a collar 39 is mounted. This collar can be set in any desired angular position on the bearing extension 35a by means of a set screw 40. Two frame plates 41—41a are welded or otherwise secured to the collar 39 in diametrically opposed relation. A transverse shaft 42 is journaled in the plates 41—41a below the rotor shaft extension 15a, and two cam supporting arms 43 are mounted at their lower ends on the transverse shaft 42 so that these arms straddle the extension 15a of the rotor shaft outside the frame plates 41—41a. An arcuate cam 44 is connected to the arms 43 at their upper ends and is positioned between the head plate 20 and the closed path circumscribed by the cam-engaging portions 30c of the locking bolts as the rotor operates. As shown in Figs. 5 and 6, the cam 44 extends through a certain arc of the rotation and has end portions 44a which are inclined inward toward the adjacent rotor head 20.

A toggle shaft 45 is rotatably mounted in the upper portions of the frame plates 41—41a and is connected through toggle linkage 46 to a transverse shaft 47 spanning the cam arms 43 intermediate their ends. The toggle shaft 45 projects radially outward at one end toward the periphery of the plate 20 and is provided with a handle 45a which is readily accessible to the operator

of the apparatus. By turning the toggle shaft 45 counter-clockwise by means of the handle or operating member 45a, the toggle linkage 46 is set to hold the cam arms 43 to the left (Figs. 6 and 7), whereby the cam 44 is held in its operating position, as shown in Fig. 6. In this position, rotation of the rotor causes the cam-engaging portions 30c of the retaining bolts to engage the slanted portion 44a of the cam one-by-one and move along this slanted portion to the main central portion 44 of the cam. As a result, the cam retracts the locking bolts 30 one-by-one against their springs 33 and holds them retracted through that part of the arc traversed by the main cam portion 44. As the rotor carries each locking bolt along the inclined cam portion 44a beyond the main portion 44, the corresponding spring 33 will return the bolt to its closed position in the adjacent track 17.

When the toggle shaft 45 is rotated clockwise (Figs. 6 and 7), the toggle linkage 46 releases the cam arms 43 so as to allow these arms to swing clockwise about the shaft 42 on their lower ends, whereby the cam 44 is moved to its inoperative position shown in Fig. 7. To facilitate this movement of the cam, we provide a biasing means mounted on ears 48 extending outward from the frame plates 41—41a. Each ear 48 supports a pin 49 extending through the opposed cam arm 43 and having a head 49a for limiting movement of the cam arms toward the head plate 20. A compression spring 50 is coiled around each pin 49 between the ear 48 and the opposed cam arm 43. Accordingly, when the toggle linkage 46 is released, each spring 50 acts to force the cam 44 to its inoperative position shown in Fig. 7, which is determined by the heads 49a of the pins 49. When the cam 44 is in its inoperative position (Fig. 7) it is located inward toward the head plate 20 from the path of the cam-engaging portions 30c on the locking bolts 30, so that the latter are held by their springs 33 in their closed positions throughout the rotation of the rotor.

It will be apparent from the foregoing that as each track 17 approaches the station S (Fig. 1), in a loading operation, the cam-engaging portion 30c of the corresponding locking bolt 30 will ride along the slanting portion 44a to the main portion 44 of the cam (assuming the latter to be in its operating position shown in Fig. 6) thereby retracting the locking bolt from the corresponding track 17. After an inner bar 18 has been inserted in the track 17 at the loading station and has seated against the corresponding bar stop 28, further rotation of the rotor for the next loading step will cause this inner bar to be locked in the lower end of its track by return of the corresponding bolt or retaining device 30 to its closed position under the action of its spring 33 as the cam engaging portion 30c of the bolt rides away from the main cam portion 44. In other words, the cam 44 in its operating position constitutes a means responsive to movement of the bar-retaining devices 30 to a predetermined portion of their closed path for shifting the retaining devices from their closed to their open positions; and the springs 33 constitute means for returning each retaining device 30 to its closed position when the rotor carries the device away from this portion of the path occupied by the cam 44. The handle 45a and the toggle linkage 46 for the pivoted arms 43 constitute a mechanism for rendering the shifting means 44 inoperative so that the retaining devices 30 will be in their closed positions through the rotation of the rotor, as when the latter is being revolved in the autoclave. By releasing the set screw 40 (Fig. 7), the cam 44 and its associated actuating mechanism can be adjusted to any desired angular position on the bearing extension 35a, in case it may be desired to change the position of the loading station or to unload the rotor from a different station than the loading station. The angularly adjustable mount 39—41—41a for

the cam can be omitted, of course, in cases where there is no necessity for ever changing the location of the station S at which the rotor is loaded and unloaded.

As a safety measure, it may be desirable to provide an auxiliary cam 52 on the main cam 44, as shown in Figs. 5—8. This auxiliary cam functions only when the main cam 44 is in its inoperative position (Fig. 7). In the latter position of the cam, if the springs 33 have failed to return any of the locking bolts 30 to its closed position, the cam 52 will engage the bolt part 30c so as to press the bolt inward. In other words, if one or more of the springs 33 should fail, the auxiliary cam 52 will take over the spring function when the main cam 44 has been moved to its inoperative position, the auxiliary cam then acting to push the open bolt or bolts into closed position once every revolution of the rotor.

In order to facilitate the progression of the fabric loop in the forward direction relative to rotor 12 as the latter rotates in the autoclave, we provide means for preventing rotation of some of the bars 16—18 in the reverse direction. As shown in Fig. 4, such means comprise a ratchet 54 on one end of each outer bar 16, between the main section of this bar and its corresponding reduced end portion 16a, and a pawl 55 coacting with the ratchet. The pawl 55 is secured to a sleeve 56 rotatably mounted on an extension of the bolt 25c, the sleeve being located between the head of the bolt and the nut 25b. Diametrically opposite the pawl, the sleeve 56 has a projection 57 connected to one end of a tension spring 58, the other end of which is fixed to the head plate 20. Thus, the spring 58 urges the pawl against the ratchet 54 to prevent rotation of the outer bar 16 in the counter-clockwise direction (Fig. 4), while permitting the outer bar to rotate clockwise to accommodate the forward progression of the fabric relative to the rotor. While the inner bars 18 are rotatable in both directions as shown, movement of the fabric F in the reverse direction relative to the rotor 12 during the dyeing operation will be substantially prevented by the action of the pawl and ratchet mechanisms on the outer bars 16.

We claim:

1. In a textile-treating apparatus of the character described which includes a rotor having opposed heads rotatable about a common axis, a set of outer bars extending between the heads substantially parallel to said axis and spaced circumferentially around the heads, each head having a series of tracks extending inward toward the central portion of the head and opposed to a corresponding series of tracks on the other head, the tracks of each head alternating with said bars, and a set of inner bars adapted, respectively, to be mounted at their ends on a pair of opposed tracks on the heads and to move inward along the tracks away from the outer bars, whereby the textile can be loaded in open width on the rotor so as to extend alternately over each outer bar and under the next inner bar, in zig-zag fashion about said axis, the improvement which comprises bar-retaining devices mounted on each head at the inner portions of the respective tracks and movable with the head along a closed path as the rotor rotates, each device being also movable relative to the head between a closed position for locking one end of an inner bar at said inner portion of the respective track and an open position for permitting passage of said end to and from said inner portion of the track, means responsive to movement of said devices to a predetermined portion of said path for shifting the retaining devices from their closed to their open positions, means for returning each device to its closed position when the rotor carries the device away from said path portion, and mechanism for rendering said shifting means inoperative, whereby the retaining devices are in their closed positions throughout said path.

2. The improvement according to claim 1, in which

said shifting means comprise a cam, said mechanism comprising a movable member connected to the cam and operable to move the cam to and from an operating position for engaging the retaining devices in sequence as the rotor rotates.

3. The improvement according to claim 1, in which said shifting means comprise a cam having an operating position wherein it is engageable with the retaining devices in sequence as the rotor rotates, to move said devices to their open positions, said returning means including a biasing element operatively connected to each device for urging it toward its closed position.

4. The improvement according to claim 1, in which said shifting means comprise a cam having an operating position wherein it is engageable with the retaining devices in sequence as the rotor rotates, to move said devices to their open positions, said returning means including a biasing element operatively connected to each device for urging it toward its closed position, said mechanism comprising a movable member connected to the cam and operable to move the cam to and from said operating position.

5. The improvement according to claim 1, comprising also a movable mount on which said shifting means are adjustable about said axis to vary the position of said path portion.

6. The improvement according to claim 1, in which said shifting means comprise a cam, said mechanism comprising a movable member connected to the cam and operable to move the cam to and from an operating position for engaging the retaining devices in sequence as the rotor rotates, the improvement comprising also a movable mount on which the cam is adjustable about said axis to vary the position of said path portion.

7. The improvement according to claim 1, in which each retaining device is a bolt slidable in the head in a direction generally parallel to said axis and having a bar-retaining portion at one end, the bolt extending through the head and having a cam-engaging portion at the other end, said shifting means comprising a cam engageable with said last portions of the respective bolts in sequence as the rotor rotates.

8. The improvement according to claim 1, in which each retaining device is a bolt slidable in the head in a direction generally parallel to said axis and having a bar-retaining portion at one end, the bolt extending through the head and having a transverse pin at the other end, said shifting means comprising a cam engageable with one end of the pins of the respective bolts in sequence as the rotor rotates, said returning means including a spring connecting the other end of each pin to the adjacent head.

9. The improvement according to claim 1, in which said shifting means comprise a cam having an operating position wherein it is engageable with the retaining devices in sequence as the rotor rotates, to move said devices to their open positions, the cam also having an inoperative position wherein the retaining devices are held in their closed positions throughout said path, said mechanism including a toggle connected to the cam for holding the cam in its operating position, and a movable member connected to the toggle for releasing the same to permit movement of the cam to its inoperative position.

10. The improvement according to claim 9, comprising also a movable mount on which the cam and toggle

are adjustable about said axis to vary the position of said path portion.

11. The improvement according to claim 1, in which said shifting means comprise a cam having an operating position wherein it is engageable with the retaining devices in sequence as the rotor rotates, to move said devices to their open positions, the cam also having an inoperative position wherein the retaining devices are held in their closed positions throughout said path, said mechanism comprising a movable member connected to the cam for moving the cam between its operating and inoperative positions, the improvement comprising also an auxiliary cam movable by said member with the first cam and operable in said inoperative position of the first cam to return said devices to their closed positions independently of said returning means.

12. The improvement according to claim 1, in which each head includes a generally circular plate and a series of bar-supporting units secured to the side of the plate facing the opposing head, each unit including a bearing support for one end of an outer bar and a channel-shaped member adapted to receive one end of an inner bar and forming one of said tracks, each bar-retaining device being a bolt extending through the plate into one of the channel-shaped members near the inner end thereof and being slidable in the plate to retract the bolt from said last member.

13. A textile-treating apparatus of the character described which comprises a rotor having opposed heads rotatable about a common axis, a set of outer bars rotatably mounted on the heads substantially parallel to said axis and spaced circumferentially around the heads, each head having a series of tracks extending inward toward the central portion of the head and opposed to a corresponding series of tracks on the other head, the tracks on each head alternating with said bars, a set of inner bars adapted, respectively, to be rotatably mounted at their ends on a pair of opposed tracks on the heads and to move inward along the tracks away from the rotor periphery, whereby the textile can be loaded in open width on the rotor so as to extend alternately over each outer bar and under the next inner bar, in zig-zag fashion about said axis, means for releasably retaining the inner bars at the inner ends of their respective tracks while permitting rotation of the inner bars relative to the heads, and means for preventing rotation of some of said bars in one direction relative to the rotor heads while permitting rotation of said last bars in the opposite direction.

14. Apparatus according to claim 13, in which said rotation-preventing means are associated with only the outer bars.

15. Apparatus according to claim 13, in which said rotation-preventing means include a pawl and ratchet mechanism associated with each outer bar.

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