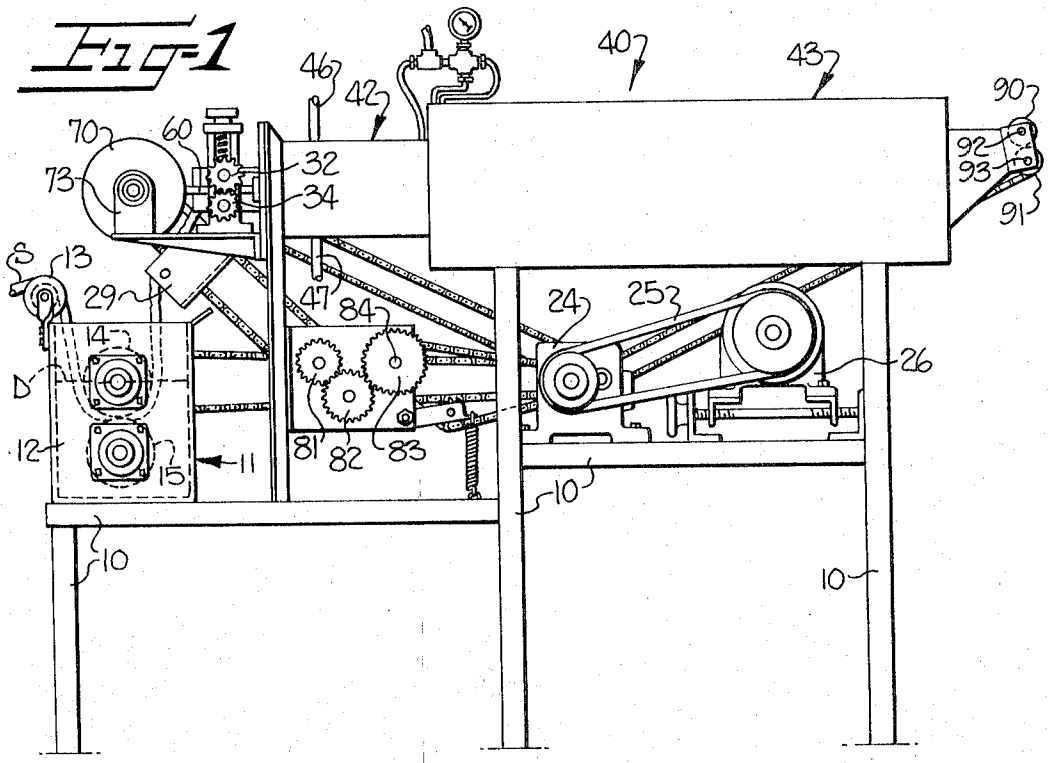
Dec. 27, 1966 D. M. WILLIS 3,293,675

APPARATUS AND METHOD FOR DYEING AND AGING TEXTILE MATERIALS

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Fig-1



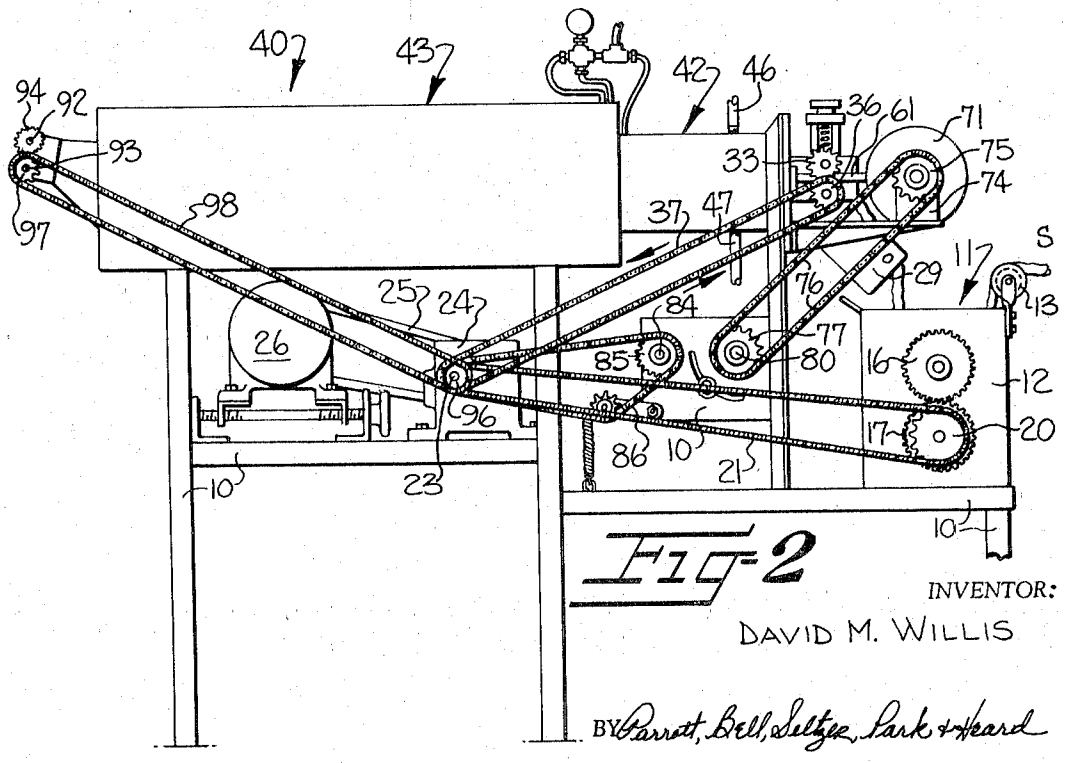


Fig-2

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APPARATUS AND METHOD FOR DYEING AND AGING TEXTILE MATERIALS

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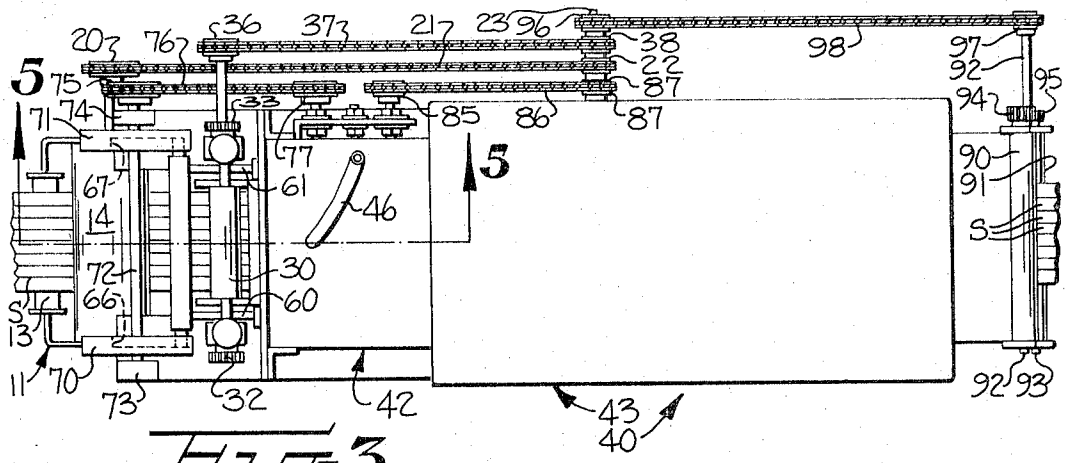


Fig-3

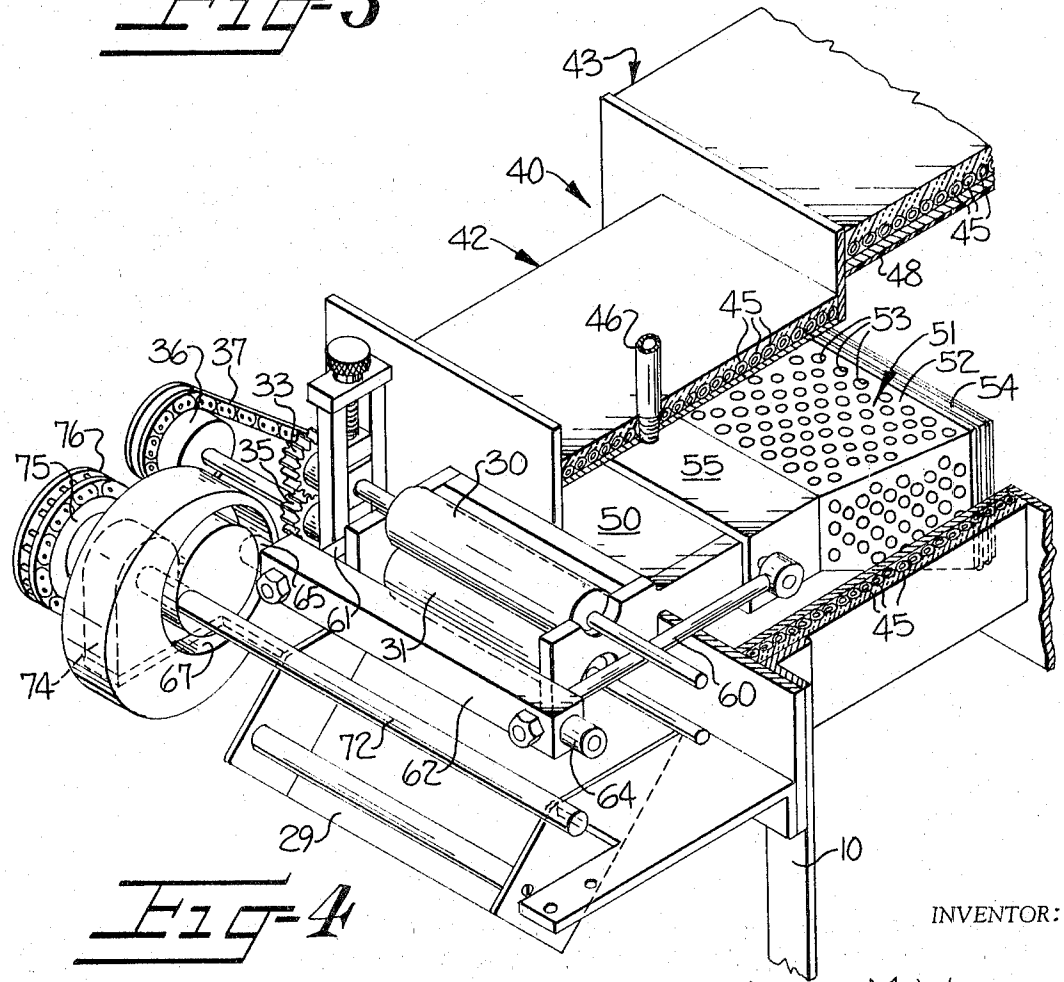


Fig-4

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APPARATUS AND METHOD FOR DYEING AND AGING TEXTILE MATERIALS

Filed Feb. 2, 1965 3 Sheets-Sheet 3

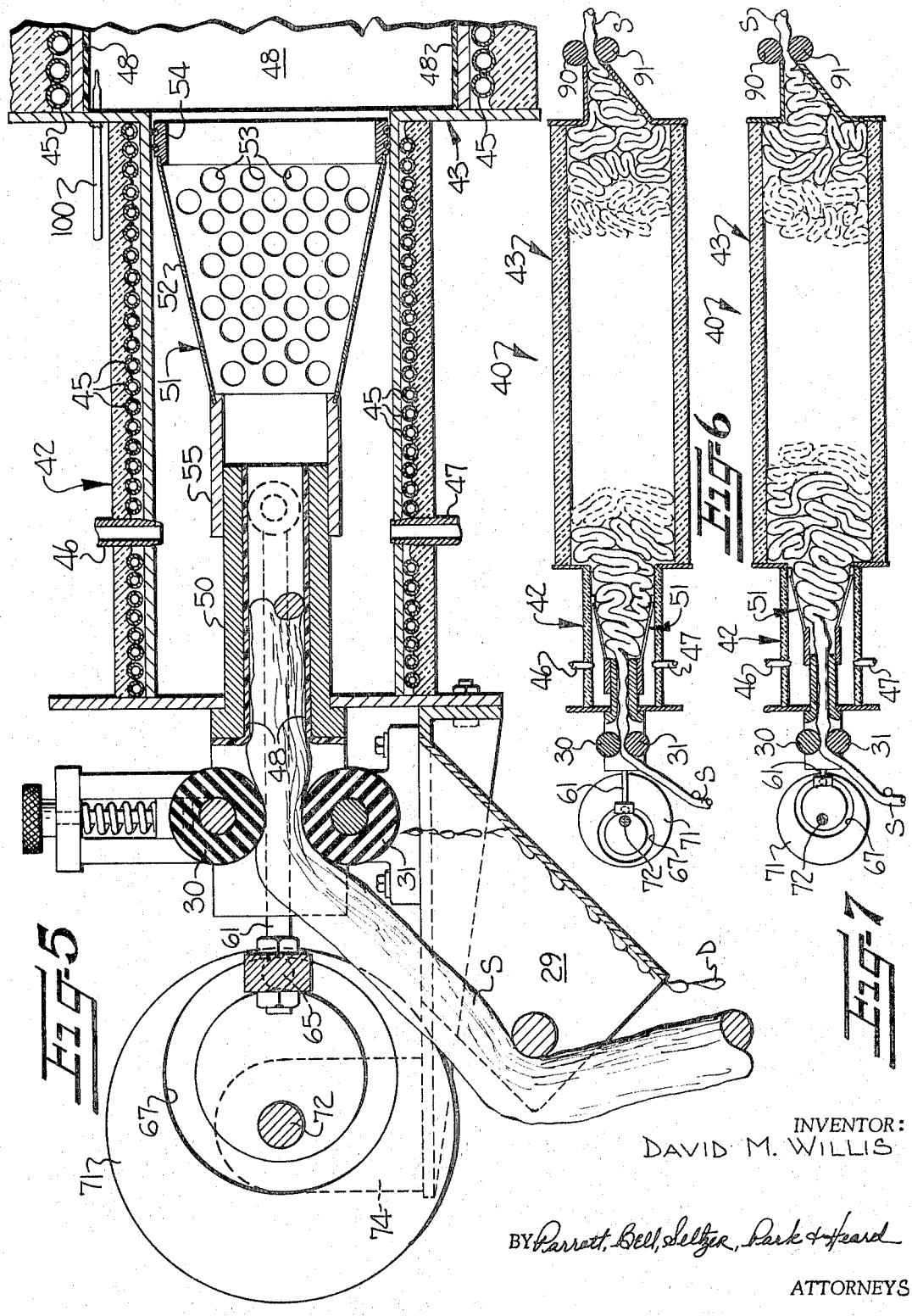


FIG-5

FIG-6

FIG-7

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APPARATUS AND METHOD FOR DYEING AND AGING TEXTILE MATERIALS

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13 Claims. (Cl. 8—149.1)

This invention relates to apparatus and method for dyeing and aging textile materials and more specifically for continuously dyeing and aging strands of textile fibers in sliver form.

It is often desirable in certain textile manufacturing operations to dye the textile fibers before they are spun into yarn, as for example, in the form of raw stock or sliver. As is well known in the art, the raw stock form does not readily lend itself to the use of a continuous dyeing and aging process. On the other hand, the sliver form presents the fibers in continuous lengths, and as such, is more readily utilized in a continuous process.

Wool is one of the more difficult fibers to dye and accordingly the developments in continuous wool dyeing and aging have not kept pace with developments in continuous dyeing and aging of other fibers. However, with the advent of certain relatively new dyeing auxiliaries or assistants, such as those sold under the trademarks "Cibaphasol" and "Irgapadol," continuous wool dyeing and aging has become more practical. To this end, it has been suggested that slivers of wool fibers are continuously dyeable by padding a dyestuff solution (containing an assistant) onto the sliver and then running such slivers into a J-box arrangement wherein they are aged, or more sepcifically, subjected to heat and moisture for a period of time necessary to properly set the dyestuff.

The J-box is well known to the textile wet processing art and generally comprises a J-shaped treating chamber having an inlet at the top of the long edge of the J and an outlet at the top of the hook of the J. In use, the goods to be treated are fed by gravity downwardly into the J-box where they are stacked in a loose, randomly sinuous manner and ultimately pulled from the outlet. Because of the transformation of the goods from a straight line (upon entry) into a sinuous path (during storage) and back into a straight line (upon exit), the goods are subjected to an unusually long period of treatment (for a continuous process) in a relatively short length of space. The use of a J-box, however, does present space problems in the usual dyeing plant, because its high silhouette takes up space in the vertical rather than the horizontal direction. Thus, it is often necessary to use two floors of a plant when a J-box is incorporated in a continuous line of processing machinery in order to accommodate the height of the J-box. Moreover, because of the necessity for raising the goods from the level of the previous wet processing machinery to a level necessary to drop them into the J-box or raising the goods back to the level of subsequent processing machinery (as the case may be) great care must be taken with the loose strands of sliver to prevent strand breakage through excessive tension.

The present invention is directed, inter alia, to a solution to many of the problems encountered with a J-box type continuous dyeing apparatus and has for its primary object, the provision of a continuous dyeing and aging apparatus and method, particularly suitable for dyeing and aging strands of sliver.

It is another object of the present invention to provide an apparatus and method for continuously dyeing and aging strands of sliver wherein dyestuff is applied to such strands by means of a padder and then such strands are drawn from the padder and intermittently forced into an elongate horizontal aging chamber where they are stored in a randomly sinuous manner for a predetermined period of time necessary to age or set the dyestuff and then withdrawn from the chamber.

It is a more specific object of the present invention to provide an apparatus and method of the type described wherein such strands are pulled out of the padder by a pair of nip rolls which squeeze the excess dye liquor therefrom and at the same time convey such strands into and through an injection tube mounted in the inlet end of a horizontal ager whereupon such strands enter a horizontally reciprocating feeding member in which the strands are transformed into a randomly sinuous configuration and then pushed into the body of the ager where they are stored for a predetermined period of time sufficient to age or set the dyestuff.

Some of the objects of the invention having been stated, other objects will appear as the description proceeds, when taken in connection with the accompanying drawings, in which—

FIGURE 1 is a side elevational view of the apparatus of this invention;

FIGURE 2 is a side elevational view of the other side of the apparatus of this invention;

FIGURE 3 is a top plan view of the apparatus of this invention;

FIGURE 4 is an enlarged partial perspective view with parts broken away of the apparatus of this invention;

FIGURE 5 is an enlarged sectional view taken substantially along the lines 5—5 of FIGURE 3;

FIGURE 6 is a fragmentary vertical sectional view of the apparatus shown in FIGURE 1 showing the horizontally reciprocating feeding means in a retracted position; and

FIGURE 7 is a view similar to FIGURE 6 but showing the horizontally reciprocating feeding means in an extended position.

Referring now to the drawings, the apparatus of this invention is mounted on a frame, generally indicated by the reference numeral 10.

Padding means shown in the form of a dye padder, generally indicated by the reference numeral 11, are mounted on the frame 10. The padder 11 comprises a tank 12 adapted to contain dyestuff D, a guide roll 13 for guiding textile material, preferably in the form of a plurality of juxtapositioned strands S into the dye bath, a pair of immersion rolls or padding rolls 14, 15 disposed within the housing 12 and drivingly mounted in bearings carried in the walls of tank 12. The shafts of the rolls 14 and 15 extend through the outer wall of the tank 12 and having intermeshing gears 16 and 17 disposed on one of the outer ends thereof. The shaft of the roll 15 also has a sprocket 20 disposed thereon outwardly of the gear 17. The sprocket 20 and therefore the gears 16 and 17 and the rolls 14 and 15 are driven by a chain 21 which extends around sprocket 20 and around a sprocket 22 disposed on a shaft 23 from a speed reduction gear 24. The speed reduction gear 24 is driven by a belt 25 from the motor 26 of the apparatus.

The strands S pass over guide roll 13 and between immersion or padding rolls 14 and 15 where the dyestuff D is padded thereon. The strands S are then pulled from the padder 11 by a pair of driven nip squeeze rolls 30 and 31 which squeeze the excess dyestuff D from the strands S, as indicated in FIGURE 5. This excess dyestuff falls onto trough 29 which directs such excess dyestuff back into the tank 12. The rolls 30 and 31 are adjustably mounted in bearings carried by the stationary frame 10. The outer ends of the shafts of the rollers 30 and 31 carry intermeshing gears 32, 33 and 34, 35, respectively. The

shaft of roll 31 extends beyond the gear 35 and has a sprocket 36 secured thereto. A chain 37 passes around sprocket 36 and around a sprocket 38 disposed on the shaft 23 of the speed reduction gear 24. Therefore, the motor 26 continuously rotates the rolls 30 and 31 by the belt 25, speed reduction gear 24, sprockets and chain 23, 37, 36, gears 33, 32, 34 and 35.

The strands S are pulled from the padder 11 by the squeeze rolls 30 and 31 and fed into an ager in the form of a substantially enclosed elongate horizontal chamber, generally indicated by the reference numeral 40. The ager is positioned adjacent the padder and has a reduced inlet end 42 and a somewhat enlarged outlet end 43 of greater cross-sectional area than the inlet end.

The chamber 40 has heating coils 45 disposed therein and secured to the interior surface thereof for maintaining a heated atmosphere within the chamber. The chamber 40 also includes a steam inlet 46, preferably disposed in the inlet end 42 for the admission of steam into chamber from any suitable source (not shown) and also includes a drain 47 for draining any moisture which might have collected in the chamber due to condensation of the steam. Preferably, a coating of friction and heat resistant material 48, such as "Teflon," is secured to the interior of the chamber 40 and extends over the heating coils 45 to insulate the heating coils from possible contact with the strands S and to provide a bearing surface, for purposes to be hereinafter described.

Disposed within the inlet end 42 of the ager chamber 40 is an elongate generally rectangular injection tube 50 which communicates with the interior of the ager and is adapted to receive and pass therethrough the strands S from the nip rolls 30 and 31.

For forcing the strands S from the reduced inlet end 42 into the outlet end 43, there is provided a hollow reciprocating elongate feeding member, generally indicated by the reference numeral 51, disposed within the reduced inlet end 42 of the chamber 40. The feeding member 51 comprises an outer flared end portion 52 that has substantially the same cross-sectional area as the reduced inlet end 42 of the chamber 40. The outer flared end portion 52 is truncated pyramid-like in configuration and is perforated by apertures 53 for the passage of steam and heat therethrough so that the strands S are subjected to steam treatment while positioned herein. The feeding member 51 also has an outer bearing surface 54 for reciprocating sliding engagement with the bearing surface formed by the coating of friction resistant material 50 on the interior surface of the inlet end 42 of the chamber 40. The flared end portion 52 is secured to a generally rectangular sleeve portion 55 which is slidably mounted on the injection tube 50 for horizontal reciprocation of the feeding member 51 between a retracted position (shown in FIGURE 6) and an extended position (shown in FIGURE 7).

For reciprocating the feeding member 51, there is provided a pair of actuating rods 60 and 61, which are connected at one end thereof to the sleeve portion 55 of the feeding member 51 and are connected at the other ends thereof to a connecting member 62 which interconnects the two actuating rods. The connecting member 62 has cam followers 64 and 65 disposed on the outer ends thereof. The cam followers 64 and 65 are in engagement with eccentrically disposed cam grooves 66 and 67 in cams 70 and 71, respectively. The cams 70 and 71 are disposed on a shaft 72 mounted in bearings 73 and 74 on the machine frame 10. The shaft 72 extends beyond the bearing 74 and has a sprocket 75 secured on the outer end thereof. The sprocket 75 is rotated by a chain 76 which is disposed therearound and extends around a sprocket 77 mounted on a shaft 80. The shaft 80 is mounted in suitable bearings carried by the machine frame 10 and has disposed on the other end thereof a gear 81 which meshes with an idler gear 82 which in turn meshes with a driven gear 83. The gear 83 is mounted on one end of a shaft 84 which is also secured in suitable bearings on the machine frame 10 and has on the other end thereof a sprocket 85 which is driven by a chain 86 which passes around a sprocket 87 mounted on the shaft 23 of the speed reduction gear 24. Thus, it may be seen that cams 70 and 71 are continuously rotated, such as that cam followers 64 and 65 will pass around the eccentrically disposed grooves 66 and 67 to reciprocate actuating rods 60 and 61 and thus, feeding member 51. The size of these sprockets are selected so that the speed or reciprocation of the feeding member 51 is less than the speed of rotation of the nip rolls 30 and 31, for a purpose to be hereinafter described.

As may be seen in FIGURE 5, the sliver S passes from the nip rolls 30 and 31, through the injection tube 50 and into the feeding member 51. The nip rolls 30 and 31 are conveying the strands S faster than the feeding member 51; therefore, the strands S are overfed into the flared end 52 of the feeding member 51 is a randomly sinuous manner as the feeding member moves toward and reaches its retracted position (FIGURE 6) and are intermittently forced into the outlet end 43 of the ager chamber 40 in the randomly sinuous configuration for aging upon movement of the feeding member 51 to its extended position (FIGURE 7). The ratio of feed of the nip rolls 30 and 31 to the feeding member 51 is preferably about two to one. While the strands S are disposed in the feeding member 51 and the ager chamber 40, they are subjected to a steam heated atmosphere for proper setting of the dyestuff. This atmosphere causes the strands S to expand somewhat as they are fed from the injection tube 50 into the feeding member 51, thus aiding the formation of the randomly sinuous configuration.

The apparatus further includes driven feeding rolls 90 and 91 mounted on shafts 92 and 93 disposed in suitable bearings carried by the machine frame 10. The rolls are adapted to pull the strands S from the outlet end 43 of the ager chamber 40 in time relationship to the feeding rolls 30 and 31 so that the strands are maintained in the chamber for a predetermined amount of time sufficient for the setting of the dyestuff on the sliver.

For driving the feed rolls 90 and 91, intermeshing gears 94 and 95 are provided on the shafts 92 and 93, respectively. A sprocket 96 is provided on the shaft 23 from the speed reduction gear 24 and a sprocket 97 is provided on the shaft 92. The sprockets 96 and 97 are drivingly interconnected by a chain 98 passing thereabout so that the rolls 90 and 91 will be driven from the shaft 23 at the same speed as rolls 30 and 31 which are also driven from shaft 23.

The aging mechanism 41 is also provided with a thermometer 100 which extends into the enlarged outlet end 43 of the ager chamber 40 so that the temperature of the heated atmosphere within the chamber may be readily determined by view of an operator.

The predetermined period of time in which the strands S are maintained in the ager chamber is determined by the initial amount of strands disposed therein during threading of the mechanism when compared with the speed of the feed rolls 30, 31, 90 and 91 and the comparative speeds of feed of the feed rolls 30, 31, the feeding member 51, and the feed rolls 90 and 91. This period of time may be varied as desired.

Thus, it may be seen that an apparatus and method is provided for continuously dyeing and aging strands of textile fibers which eliminates the problems heretofore encountered in this type of operation.

In the drawings and specification there has been set forth a preferred embodiment of the invention and, although specific terms are employed, they are used in a generic and descriptive sense only and not for purposes of limitation, the scope of the invention being defined in the claims.

I claim:

1. Apparatus for continuously dyeing strands of textile fibers in silver form comprising

(a) means for applying dyestuff onto a moving length of such strands,

(b) an ager having an elongate horizontal chamber positioned adjacent said dyestuff applying means, said ager having inlet and outlet ends and being provided with heating means and a steam inlet for maintaining predetermined conditions of heat and moisture in said chamber to properly set the dyestuff applied to the strands,

(c) conveying means positioned between said dyestuff applying means and said ager for pulling the strands from said padding means and conveying said strands into the inlet end of said ager,

(d) horizontally reciprocating feeding means mounted in said ager adajcent the inlet end thereof for receiving the strands and forcing the same into said chamber in a randomly sinuous manner, and

(e) means positioned adjacent the outlet end of said ager for pulling the strands from said chamber in timed relation to said conveying means whereby the strands are maintained in said chamber for a predetermined period of time sufficient for the setting of the dyestuff on the strands.

2. Apparatus for continuously dyeing strands of textile fibers in sliver form comprising

(a) means for applying dyestuff onto a moving length of such strands,

(b) an ager having an elongate horizontal chamber positioned adjacent said dyestuff applying means, said ager having inlet and outlet ends and being provided with heating means and a steam inlet for maintaining predetermined conditions of heat and moisture in said chamber to properly set the dyestuff applied to the strands,

(c) an elongate injection tube mounted in the inlet end of said ager and communicating with said chamber,

(d) conveying means mounted adjacent the inlet end of said ager for pulling the strands from said dyestuff applying means an conveying such strands into and through said injection tube,

(e) horizontally reciprocating feeding means mounted in said ager adjacent said inlet end for receiving the strands from said injection tube and forcing the same into said chamber in a randomly sinuous manner, and

(f) means positioned adjacent the outlet portion of said ager for pulling the strands from said chamber in timed relation to said conveying means whereby the strands are maintained in said chamber for a predetermined period of time sufficient for the setting of the dyestuff on the strands.

3. Apparatus according to Claim 2 wherein said horizontal reciprocating feeding means comprises

(a) a hollow elongate feeding member, one end of said member being slidably mounted on said injection tube for horizontal reciprocation of said feeding member between retracted and extended positions and the other end thereof being flared and having a cross-sectional area substantially larger than the cross-sectional area of said injection tube, and

(b) means connected to said feeding member for driving the same in timed relation to said conveying means and at a rate of speed less than the rate of speed at which said conveying means conveys the strands through said injection tube,

whereby the strands are overfed into the flared end of said member in a randomly sinuous manner as said feeding member moves toward and reaches its retracted position and are forced into said chamber in such randomly sinuous configuration upon movement of said member to said extended position.

4. Apparatus according to claim 3 wherein said steam inlet is positioned near the inlet end of said ager and the flared end of said hollow, elongate member is perforated whereby the strands are subjected to steam treatment while positioned in said hollow, elongate member.

5. Apparatus for continuously dyeing strands of textile fibers in sliver form comprising

(a) padding means for applying dyestuff onto a moving length of such strands,

(b) an ager having an elongate horizontal chamber positioned adjacent said padding means, said ager having inlet and outlet ends and being provided with heating means and a steam inlet for maintaining predetermined conditions of heat and moisture in said chamber to properly set the dyestuff applied to the strands,

(c) an elongate injection tube mounted in the inlet end of said ager and communicating with said chamber,

(d) a pair of nip rolls mounted adjacent the inlet end of said ager for squeezing excess dyestuff from the strands while pulling such strands from said padding means and conveying them into and through said injection tube,

(e) horizontally reciprocating feeding means mounted in said ager adjacent said inlet end for receiving the strands from said injection tube and forcing the same into said chamber in a randomly sinuous manner, and

(f) means positioned adjacent the outlet portion of said ager for pulling the strands from said chamber in timed relation to said pair of nip rolls whereby the strands are maintained in said chamber for a predetermined period of time sufficient for the setting of the dyestuff on the strands.

6. Apparatus for continuously dyeing strands of textile fibers in sliver form comprising

(a) padding means for applying dyestuff onto a moving length of such strands,

(b) an ager having an elongate horizontal chamber positioned adjacent said padding means, said ager having inlet and outlet ends and being provided with heating means and a steam inlet for maintaining predetermined conditions of heat and moisture in said chamber to properly set the dyestuff applied to the strands,

(c) an elongate injection tube mounted in the inlet end of said ager and communicating with said chamber,

(d) a pair of nip rolls mounted adjacent the inlet end of said ager for squeezing excess dyestuff from the strands while pulling such strands from said padding means and conveying them into and through said injection tube,

(e) a hollow elongate feeding member, one end of said member being slidably mounted on said injection tube for horizontal reciprocation of said member between retracted and extended positions and the other end thereof being flared and having a cross-sectional area substantially larger than the cross-sectional area of said injection tube,

(f) means connected to said feeding member for driving the same in timed relation to said nip rolls and at a rate of speed less than the rate of speed at which said nip rolls convey the strands through said injection tube whereby the strands are overfed into the flared end of said feeding member in a randomly sinuous manner as said feeding member moves toward and reaches its retracted position and are forced into said chamber in such randomly sinuous configuration upon movement of said feeding member to its extended position, and

(g) means positioned adjacent the outlet portion of said ager for pulling the strands from said chamber in timed relation to said nip rolls whereby the strands are maintained in said chamber for a predetermined

period of time sufficient for the setting of the dyestuff on the strands.

7. Apparatus for aging strands of textile fibers in sliver form comprising

(a) an elongate aging chamber having inlet and outlet ends and being provided with heating means and a steam inlet for maintaining predetermined conditions of heat and moisture in said chamber for properly aging the strands of textile fibers,

(b) reciprocating feeding means adapted to reciprocate between extended and retracted positions and disposed at least partially within said inlet end of said chamber for receiving the strands of textile fibers therein and intermittently forcing the same into said aging chamber in a randomly sinuous manner, and

(c) means positioned substantially adjacent said outlet end of said chamber for pulling the strands of textile fibers from said chamber in timed relationship to said feeding member whereby the strands of textile fibers are maintained in said chamber for a predetermined period of time sufficient for proper aging.

8. Apparatus according to claim 7 including

(a) conveying means mounted adjacent said reciprocating feeding means for continuously conveying the strands of textile sliver within said reciprocating feeding means so that the strands will form a randomly sinuous configuration therein during movement of said feeding means from its extended position to its retracted position.

9. A method of aging strands of textile fibers in sliver form comprising

(a) conveying the strands of textile fibers into a reciprocating feeding means while arranging the strands therein a randomly sinuous configuration,

(b) intermittently forcing the randomly sinuously arranged strands into an elongate aging chamber while continuing to convey the strands into the reciprocating feeding means,

(c) aging the strands of textile fibers in said aging chamber by subjecting the strands to desired conditions of heat and moisture within said chamber, and

(d) pulling the strands of textile fibers from said aging chamber in timed relationship to said feeding means so that the strands are maintained within said chamber for a desired predetermined period of time.

10. A method according to claim 9 including

(a) subjecting the strands of textile fibers to the desired conditions of heat and moisture while positioned in said reciprocating feeding means to aid in the formation of the randomly sinuous configuration of the strands therein.

11. A method according to claim 9 including

(a) maintaining the strands of textile fibers in a substantially horizontal flow path throughout the aging method to minimize tension and substantially prevent strand breakage.

12. A method for continuously dyeing strands of textile fibers in silver form comprising

(a) applying dyestuff onto the strands of textile fibers,

(b) conveying the dyed strands of textile fibers into a reciprocating feeding means while arranging the strands therein in a randomly sinuous configuration,

(c) intermittently forcing the randomly sinuously arranged strands into an elongate aging chamber while continuing to convey the strands into the reciprocating feeding means,

(d) aging the strands of textile fibers in said aging chamber by subjecting the strands to desired conditions of heat and moisture within said chamber, and

(e) pulling the strands of textile fibers from said aging chamber in timed relationship to said feeding means so that the strands are maintained within said chamber for a predetermined period of time.

13. A method according to claim 12 including

(a) maintaining the strands of textile fibers in a substantially horizontal flow path throughout the again process to minimize tension and substantially prevent strand breakage.

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