Jan. 31, 1967 W. E. MASON ETAL 3,301,026

FABRIC DYE BECK HAVING A LIQUID FABRIC BARRIER

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FIG. 1.

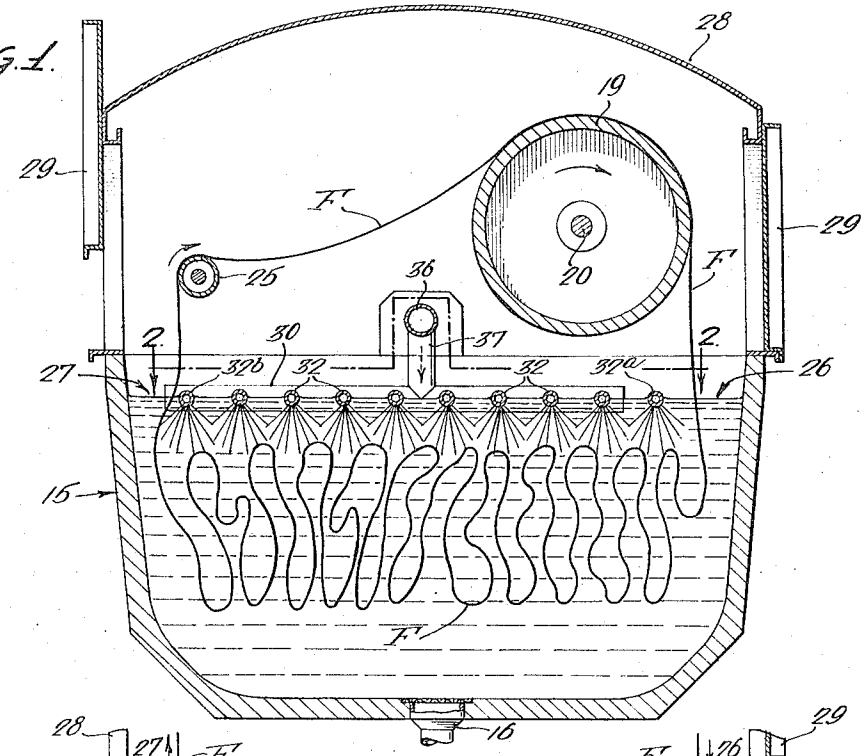


FIG. 5.

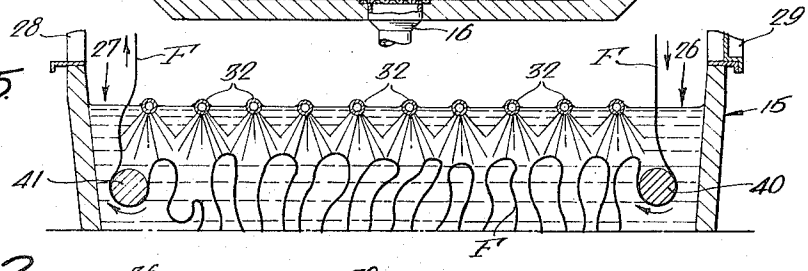


FIG. 2.

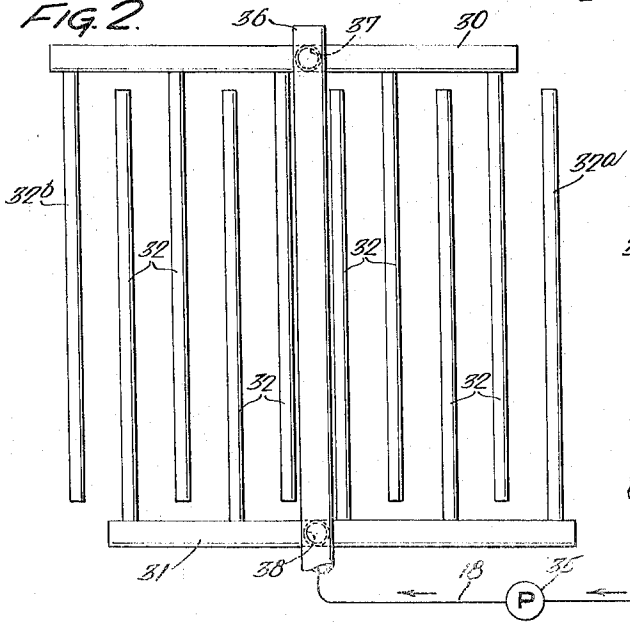


FIG. 3.

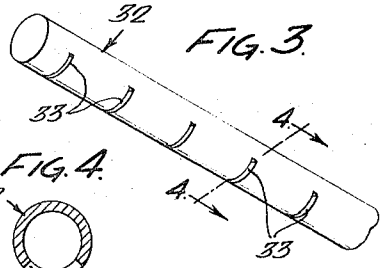
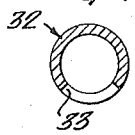
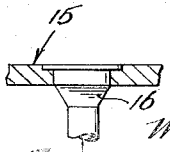


FIG. 4.





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FIG. 6.

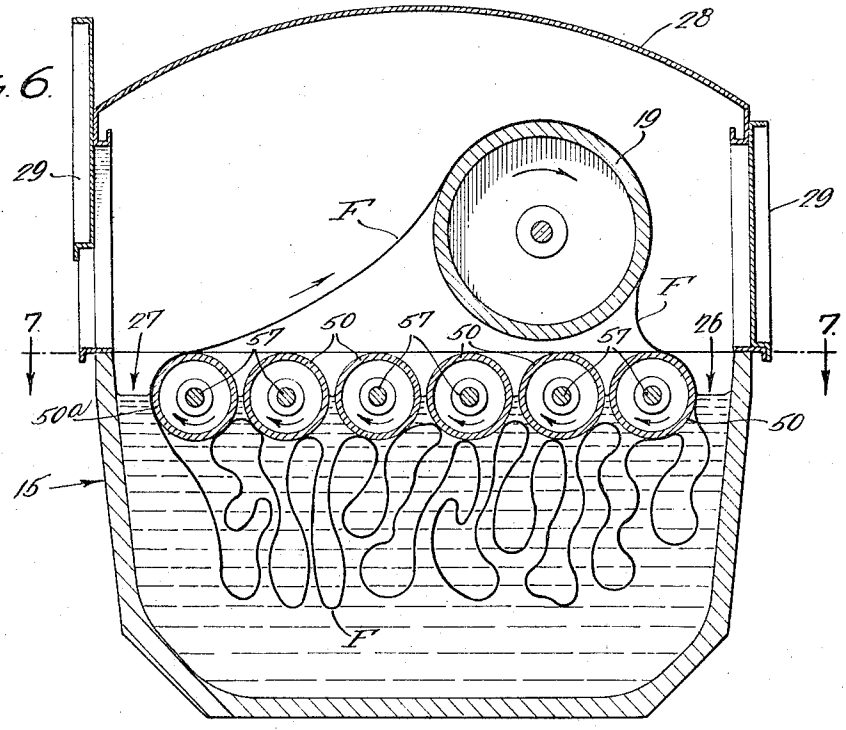
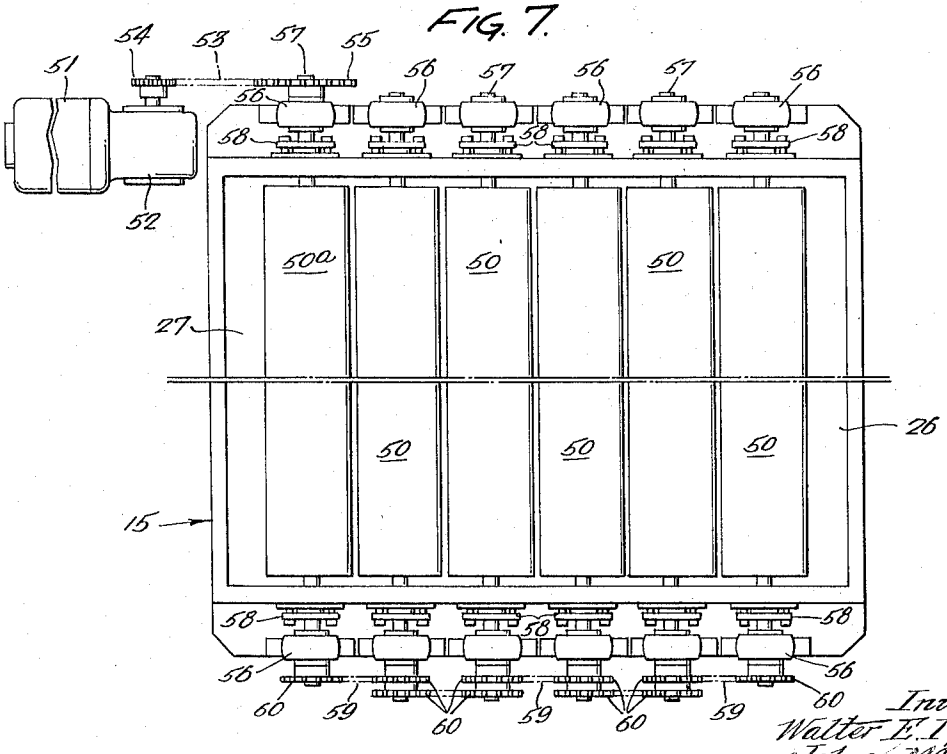


FIG. 7.



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FIG. 8.

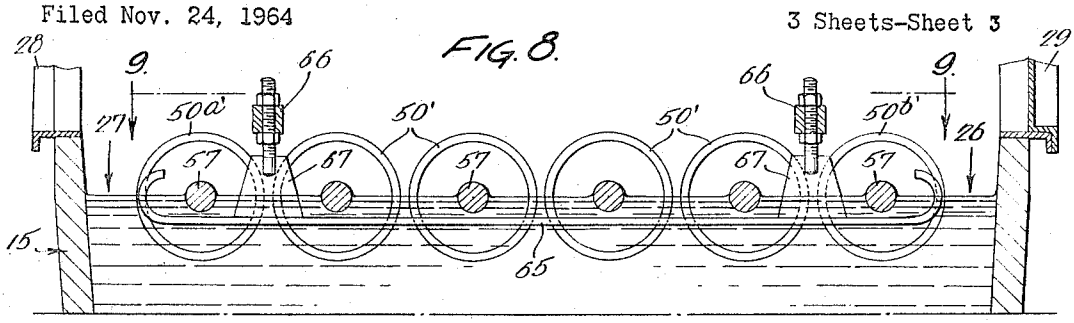


FIG. 9.

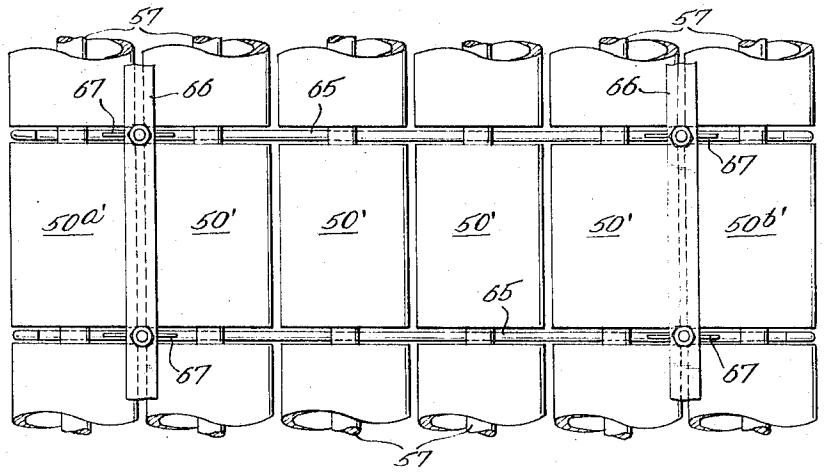
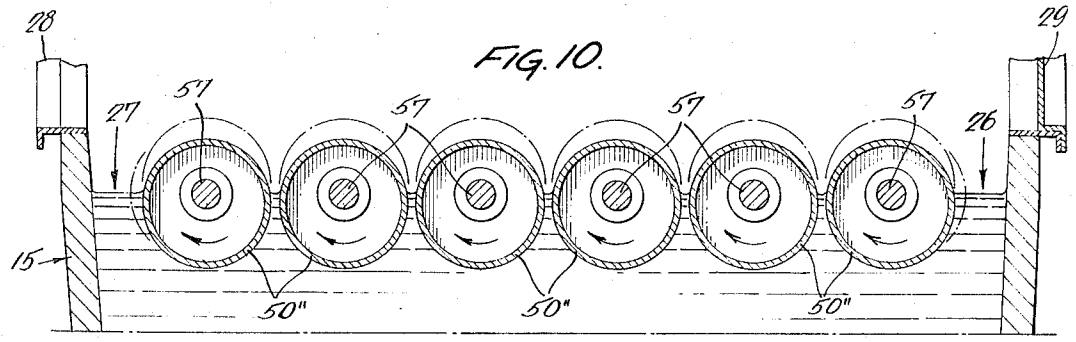


FIG. 10.



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3,301,026

FABRIC DYE BECK HAVING A LIQUID FABRIC BARRIER

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Filed Nov. 24, 1964, Ser. No. 413,507
12 Claims. (Cl. 68—177)

This invention relates to dye becks and more particularly to improvements in the type of dye beck used in piece dyeing lengths of pile fabric such as soft floor coverings.

The fabrics that are piece dyed in large dye becks or kettles may be either woven, tufted or knitted. The ability to produce substantial quantities of pile fabric in the greige and then dye given quantities in accordance with style demands has been the cause for the widespread manufacture of stufferless Wilton and velvet woven carpeting, usually of a one-shot construction, which is piece dyed and then secured to a secondary backing material by means of suitable adhesives. This change in the well-known and long standing method of producing woven carpeting has in part been the result of procedures in the tufted carpet industry which today almost without exception apply a secondary backing to the primary fabric through which the pile yarns are tufted in order to insure sufficient dimensional stability and adequate strength for handling and installation. Consequently the trend towards piece dyed fabrics as distinguished from skein or stock dyed goods has introduced dyeing problems because these fabrics in the greige are made with constantly decreasing specific gravity. Unless the fabric can be maintained beneath the dye liquor in the dye beck during the immersion portion of the cycle, nonlevel dyeing occurs. The use of synthetic materials in the fabrics either as pile yarn or as primary backing has so decreased the specific gravity of the fabric that floatation in the dye beck has caused serious problems in obtaining proper dye results. Acrylic and olefin yarns now coming into general use aggravate the tendency of the fabric to float. On the other hand the problem is complicated by the fact that some of the synthetic fibers, particularly the olefins, are so fragile at normal dyeing temperatures that mechanical contact with any part of the dye equipment while submerged may cause serious damage and result in substantial seconds.

To overcome these serious disadvantages of piece dyeing, the present invention has for its primary object the modification of a carpet dye beck which insures that the fabric is completely immersed in the dye bath at all times during the immersion portion of the dyeing cycle.

A further object of the invention is to provide various modifications for a dye beck which can be utilized to maintain fabric immersion without mechanical contact with the fabric.

A further object of the invention is to provide driven means in a dye beck for maintaining immersion of a fabric where limited mechanical contact with the fabric in the dye bath is permissible.

A still further object of the invention is to provide means in a piece dye fabric kettle for preventing fabric gathering at the entrance zone of the dye bath and means for assisting fabric removal at the exist zone thereby preventing damage and distortion of the fabric.

Further objects will be apparent from the specification and drawings in which

FIGURE 1 is a transverse section through a dye beck equipped with a preferred form of the present invention that utilizes no mechanical contact with the fabric,

FIGURE 2 is a section as seen at 2—2 of FIGURE 1,

FIGURE 3 is a perspective of one of the spray headers shown in FIGURES 1 and 2,

FIGURE 4 is a sectional detail as seen at 4—4 of FIGURE 3,

FIGURE 5 is a fragmentary section similar to FIGURE 1 but showing a modification at the inlet and outlet zones,

FIGURE 6 is a transverse section through a piece dye kettle showing a different embodiment for maintaining the fabric immersed in the dye bath,

FIGURE 7 is a section as seen at 7—7 of FIGURE 6,

FIGURE 8 is a fragmentary sectional view similar to FIGURE 6 but using a modification in the form of stationary rails,

FIGURE 9 is a fragmentary section as seen at 9—9 of FIGURE 8, and

FIGURE 10 is a view similar to FIGURE 8 in which the rollers are mounted eccentrically instead of concentrically.

In the preferred form of the present invention a conventional dye kettle **15** has dye liquor sump **16** connected to conduits **17**, **18** and is provided with a relatively large driven cylinder or drum **19** mounted on shaft **20** which carries the fabric F from a smaller guide roller **25** and deposits the fabric into the dye bath or liquor at what is referred to herein as the entrance or entering zone **26** generally adjacent the back of the dye beck. The fabric F leaves the dye bath at the exit zone designated at **27** where it is drawn upwardly over roller **25**. The lid **28** is provided with doors or closures **29** which are opened when the fabric is initially placed around rollers **19** and **25** and then removed after the dyeing has been completed. When dyeing in such a kettle a long roll of goods is stitched together after lacing over rollers **19** and **25** so that it is in the form of an endless length during the dyeing process.

At approximately the height of the liquid level in kettle **15** we provide a pair of manifolds **30** and **31** (FIGURE 2) from which extend a series of interdigitated headers **32**, **32** across substantially the width of the dye beck. Each header is provided with elongated slots **33**, **33** as shown in FIGURES 3 and 4 to achieve optimum spray effect. The dye liquor is drawn from the bottom of the dye beck through conduits **17**, **18** by means of a pump **35** and discharged into the main header **36** which is connected to manifolds **30** and **31** through vertical conduits **37** and **38**. This construction provides relatively even distribution for the discharge of the dye liquor at or near the surface of the dye bath in the kettle. The discharge orifices or slots **33** are directed to maintain a liquid current barrier through which the loose folds of the fabric F in the dye bath cannot pass during fabric travel through the bath to the exit area **27**. The first header **32***a* is of particular importance and may be provided with somewhat different liquid discharge characteristics than the remaining headers. It is primarily the function of header **32***a* to prevent gathering or folding of the fabric on the surface of a dye bath in zone **26** and to maintain the fabric in a submerged condition until it has passed under control of one or more of the remaining headers. Conversely, the direction of the slots **33**, **33** in the last header **32***b* may be so aligned or adjusted that they assist in breaking the surface tension in the exit zone **27** and likewise eliminate contact between the fabric and either the side of the dye kettle or the header itself. In this form there is little or no mechanical contact between the fabric and any structure beneath the level of the dye liquor so that the possibility of damage to the fabric during the dyeing procedure is minimized.

Depending upon the stability of the fabric, the material, and the temperature of the dye bath, a modified form of dye kettle may be used in which the kettle **15** is provided with a driven roller **40** (FIGURE 5) mounted transversely in the kettle below the liquid level in zone

26. A similar driven roller 41 may be used in zone 27 either with or without the roller 40. The function of roller 40 is to prevent lapping or gathering of the fabric in area 26 at the surface of the liquor and to insure complete immersion in this area. Similarly roller 41 may be used to assist in the lifting of the fabric from the dye bath in area 27 to prevent or reduce any tendency for the fabric to stretch or distort at this point. The peripheral speed of rollers 40 and 41 is regulated so that contact with the fabric does not resut in damage thereto. Under some circumstances the peripheral speed may be such that a water barrier can be created to control the fabric movement without actual contact.

Referring now to FIGURES 6 and 7 a modified form of immersion control is shown in which a series of driven rollers 50, 50 is mounted in the dye beck 15 at approximately the level of the dye liquor. All of the rollers 50 are driven in a clockwise direction as seen in FIGURE 6 so that the lower portions of their peripheries conduct the folds of the fabric F through the dye bath from zone 26 to zone 27. The rollers are spaced closely enough together so that the fabric will not be carried up in between any two of the rollers and out of the bath. In this form there may be some contact between the fabric and the rollers although the turbulence in the bath created by the rollers can be used to minimize contact. The fabric emerges from the bath in zone 27 over the last roller 50*a* from which it passes directly to the driven cylinder 19.

The rollers 50, 50 in the form of FIGURES 6 and 7 are driven by means of a motor 51 connected to a speed reducer and controller 52 which drives roller 50*a* through chain 53 and sprockets 54 and 55. Each roller is mounted on a suitable support by means of pillow blocks 56, 56 and the shafts 57 for each roller are provided with stuffing boxes 58, 58. The drive from roller 50*a* is transmited to the other rollers by means of chains and sprockets 59, 59 and 60, 60 as shown clearly in FIGURE 7.

A still further modification which may be utilized under some circumstances to insure complete fabric immersion is shown in FIGURES 8 and 9. In this version the rollers 50′, 50′ of FIGURES 6 and 7 are grooved or sectionalized to permit the mounting of baffle plates or bars 65, 65 across the dye kettle. The bars 65 are supported by means of transverse rails 66, 66 from which they are adjustably suspended by means of hangers 67, 67 as shown in FIGURE 8. In this form the peripheral speed of the rollers may be substantially reduced since the fabric cannot pass upwardly between the rollers, and if desired the intermediate rollers between the entering roller 50*b* and the exit roller 50*a* may be eliminated entirely.

A further modification which may be used to increase turbulence is shown in FIGURE 10 in which the rollers 50″, 50″ are mounted eccentrically on their respective shafts 57, 57. With all of the rollers substantially in phase, a circulating current is up at the surface of the dye bath which acts as a combined barrier and conveying means inducing the fabric to travel through the bath from zone 26 to the zone 27 at all times below the liquid surface and with a minimum of mechanical contact.

We have thus described an improved dye beck for the piece dyeing of pile fabrics such as floor coverings and the like in which the fabric regardless of its tendency to float or to become damaged during the dyeing procedure can be maintained beneath the level of the dye liquor. Depending upon the particular conditions encountered and the nature of the fabric, the dye beck may be constructed to provide no physical contact with the fabric or a limited physical contact. The turbulence and direction of current flow at the surface of the dye bath particularly

at the entrance and exit zones may be so regulated that the fabric is instantly and completely immersed at the entrance zone and is assisted when drawn out of the dye bath at the exit zone. The fabric controlling and deflecting means forming the essence of the present invention provides completely level dyeing for fabrics of low specific gravity and avoids physical damage to the fabric when in a softened condition due to elevated temperatures of the dye bath.

Having thus described our invention we claim:

1. In a dye beck assembly for piece dyeing endless lengths of fabric having a dye liquor kettle and means for circulating dye liquor into and out of the dye liquor kettle, the improvement which comprises means positioned adjacent the surface of the dye liquor for generating a liquid current barrier in the dye liquor adjacent the surface thereof and extending substantially over the area of the dye liquor between the entrance and exit zones of the fabric for maintaining a selected length of the fabric immersed in the dye liquor.

2. A dye beck assembly in accordance with claim 1 in which the liquid current barrier generating means comprises manifold means and a plurality of discharge orifices in said manifold means for discharging dye liquor into the dye bath under pressure.

3. A dye beck in accordance with claim 1 in which the liquid current barrier generating means comprises a plurality of driven rollers mounted transversely in the kettle over the area of the dye liquor between the entrance and exit zones of the fabric.

4. Apparatus in accordance with claim 2 including at least one driven roller in the zone of fabric entrance into the dye liquor.

5. Apparatus in accordance with claim 2 including at least one driven roller in the zone of fabric exit from the dye liquor.

6. Apparatus in accordance with claim 2 in which the manifold comprises two interdigitating headers extending transversely across the dye kettle.

7. Apparatus in accordance with claim 5 in which the headers have elongated discharge orifices for the dye liquor.

8. Apparatus in accordance with claim 3 in which the rollers are in the same horizontal plane.

9. Apparatus in accordance with claim 3 in which the rollers are mounted concentrically.

10. Apparatus in accordance with claim 3 in which the rollers are mounted eccentrically.

11. Apparatus in accordance with claim 3 in which the rollers are journaled in the sides of the dye kettle and have a single external motor and driving connections between each of the rollers.

12. A dye beck in accordance with claim 3 having a series of bars suspended beneath the surface of the dye liquor and extending from the entrance zone to the exit zone.

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