

July 23, 1968

J. B. McELVEEN

3,393,411

PROCESS FOR DYEING PILE MATERIAL WITH VARIOUS COLORED
DYES FROM A PLURALITY OF STREAMS

Filed July 6, 1964

2 Sheets-Sheet 1

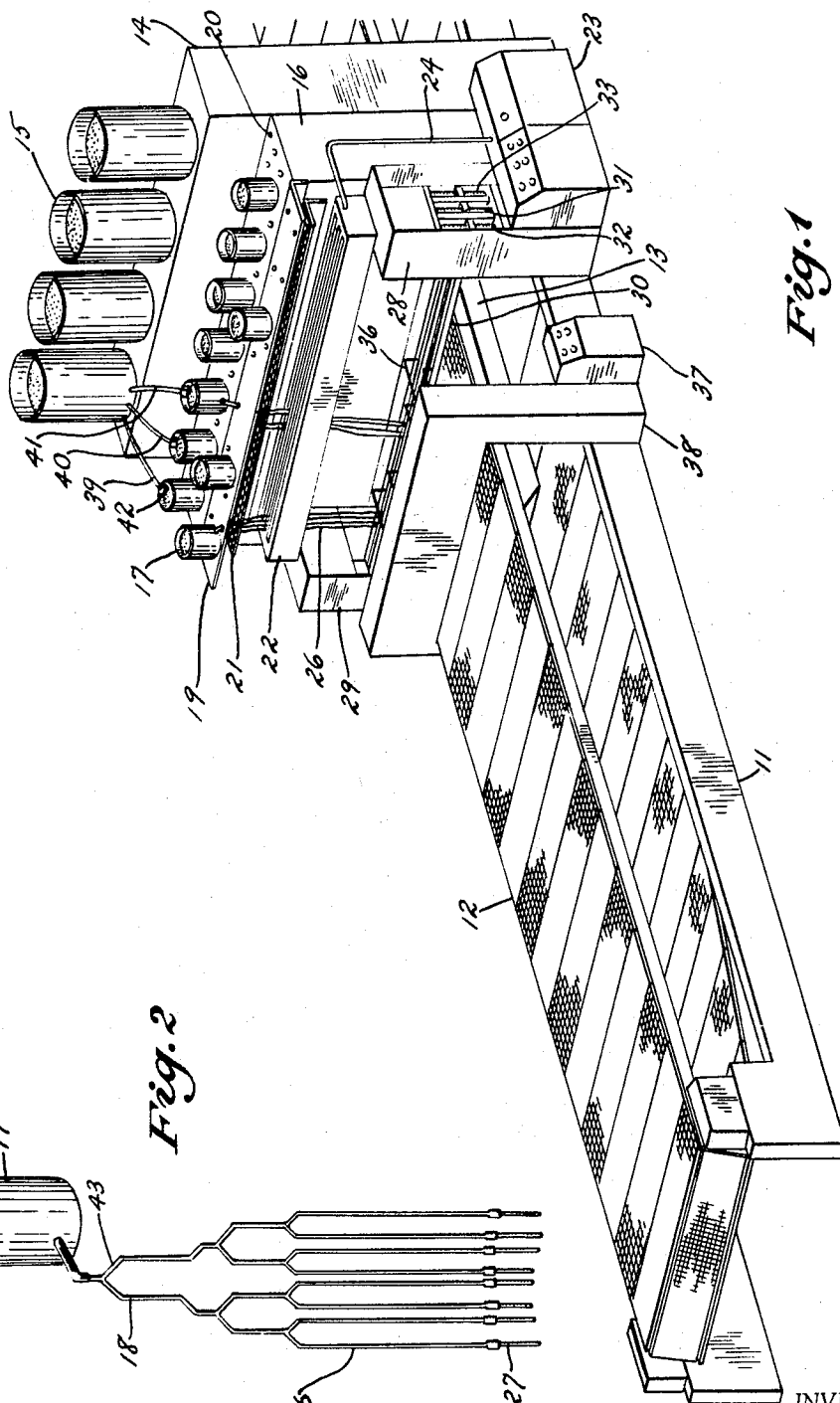


Fig. 1

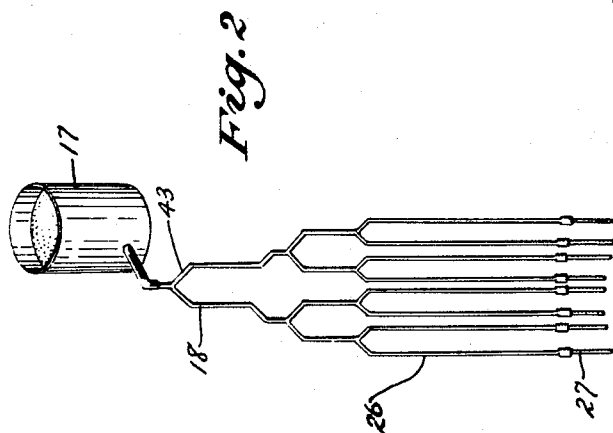


Fig. 2

INVENTOR.

JOHN BETHEA McELVEEN

BY *Thomas M. Lemon*

ATTORNEY

July 23, 1968

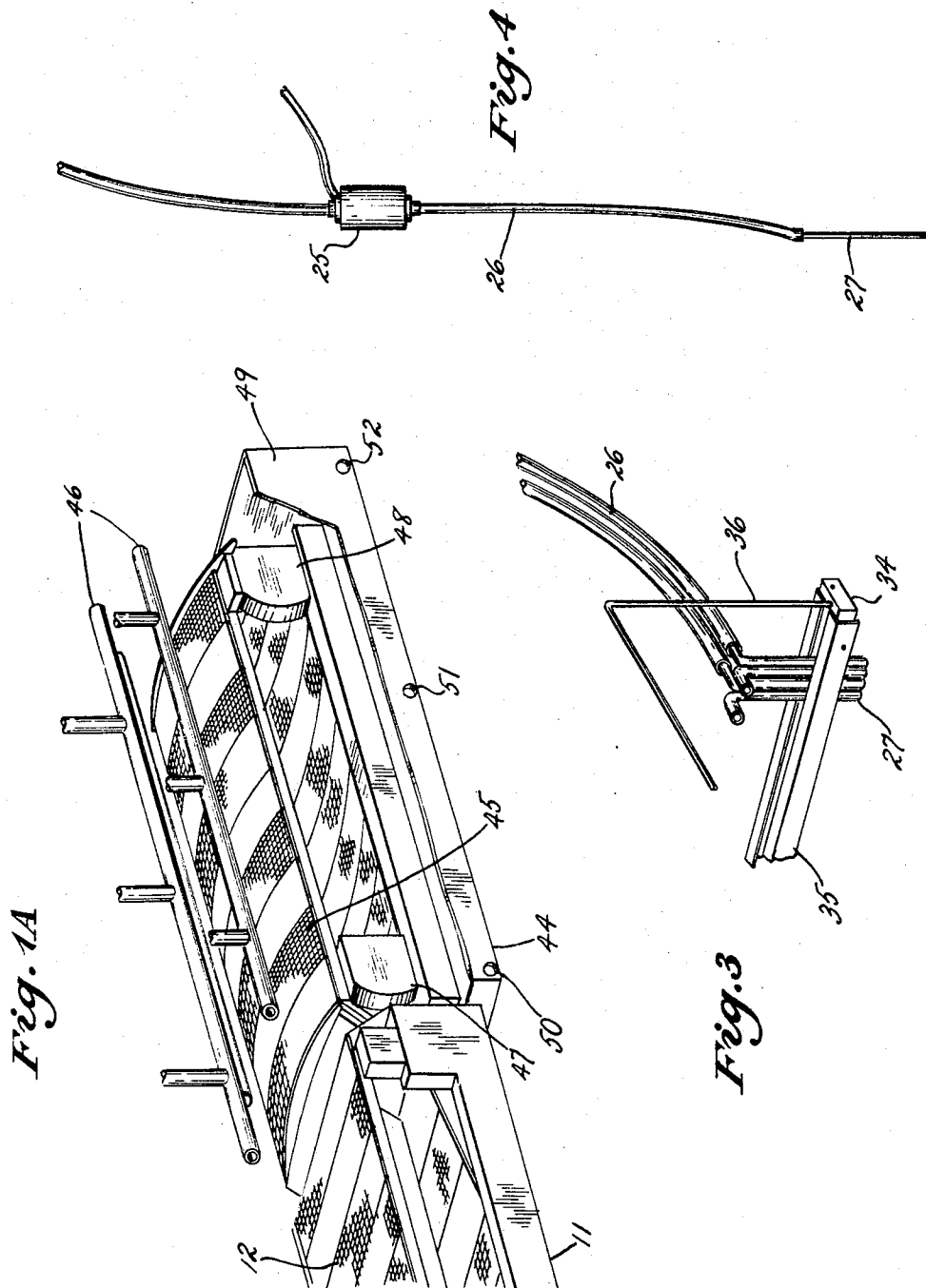
J. B. McELVEEN

3,393,411

PROCESS FOR DYEING PILE MATERIAL WITH VARIOUS COLORED
DYES FROM A PLURALITY OF STREAMS

Filed July 6, 1964

2 Sheets-Sheet 2



INVENTOR.
JOHN BETHEA McELVEEN
BY *Thomas M. Hammond*
ATTORNEY

1

3,393,411

PROCESS FOR DYEING PILE MATERIAL WITH VARIOUS COLORED DYES FROM A PLURALITY OF STREAMS

John Bethea McElveen, Rutherford, N.J., assignor to J. P. Stevens & Co., Inc., New York, N.Y., a corporation of Delaware

Filed July 6, 1964, Ser. No. 380,280

2 Claims. (Cl. 8—151)

ABSTRACT OF THE DISCLOSURE

An apparatus and process whereby a plurality of dye streams are applied to a material in an amount sufficient to penetrate the material at least partially but less than sufficient to saturate it thereby avoiding dissipation of the various dyes into the surrounding areas of the material. This process results in the formation of a variegated color patterned surface in which the differences in color are emphasized by substantially complete change in color from one area of the surface to another.

This invention relates to dyeing. More particularly, the invention deals with a process for dyeing pile material and an apparatus for carrying out the process.

Application of color to pile material in order to completely dye the material or to produce a dyed pattern is useful in the preparation of many items, such as articles of clothing and household items including carpets, doilies, towels, seat covers, and the like. Presently known methods and apparatus for accomplishing the application of color to pile materials are often too complicated or expensive, and generally show poor color fastness. Accordingly, there exists a need for a process which will result in the dyeing of pile materials in which the above disadvantages are overcome. In accordance with the present invention there is provided a process and apparatus for carrying out the process which permits complete or patterned application of color to pile materials in a relatively simple and inexpensive manner to produce dyed pile type materials wherein the color is of good quality, is substantially permanent, and which process and/or apparatus can be utilized with a wide variety of pile materials and dyes.

In general, the process comprises applying dye in a stream to a pile material in an amount sufficient to penetrate the pile lengthwise at least partially and stabilizing the dye in situ with substantially no dissipation, that is, bleeding or running of the dye, to the surrounding areas. The amount of dye necessary to penetrate the pile to the desired extent in any particular case can be determined by calculation and routine testing and the total amount of dye employed on a pile material will vary depending on whether all of the pile material is to be dyed or only part thereof is to be contacted by such dye.

In carrying out the practice of this invention a preferred manner of applying dye to a pile material is to direct a stream or streams of the dye onto the surface of the pile material in an amount sufficient to penetrate the pile lengthwise substantially completely. The stream of dye being directed on the fabric to be dyed can be applied thereto by positive pressure or simply by gravitational forces. Accordingly, in the practice of the invention, the material to be dyed and the stream of dye generally assume a spatial relationship such that the dye streams into contact with the material to be dyed. Such a process of application suits itself admirably well to the random dyeing of the pile material, or if desirable, to applying dye in a definite pattern. In this connection, it is to be

2

noted that an excess of dye applied to the pile material is avoided in carrying out the practice of the invention. Consequently, oversaturation of the pile material which is contacted by the dye is avoided and bleeding or running of the dye into the surrounding area is thereby eliminated.

Application of the dye to the pile material can take place at widely varying temperatures and the temperature range most suited for any particular system will depend upon the dye being utilized as well as the pile material which is being dyed therewith. For example, in utilizing a reduced vat dye on cellulosic pile material application of the dye can take place at temperatures in a range of about 20° C. to 95° C. and preferably takes place at a temperature in a range of about 50° C. to 70° C.

After the pile material has been contacted by the dye, the dye is stabilized or fixed by known procedures. These procedures vary depending upon the particular dye being used as well as the particular pile fabric which is being dyed. For example, when vat dyes are being used with cellulose they are stabilized or fixed by air oxidation or by immersing the dyed pile material in cold water for a period of time sufficient to bring about substantially complete stabilization of the dye.

As mentioned hereinbelow, a wide variety of pile materials and dyes are available for carrying out the practice of the present invention. The individual piles of the pile material can be in the form of fibers, yarns, tufts or any other convenient form. Suitable pile materials include cellulose, polyamides, wool, acrylics, and others. Suitable dyes for use with the cellulose include vat dyes, sulfur dyes, azoic dyes, reactive dyes, and the like. Dyes suitable for use with the polyamides include acid dyes, reactive dyes, vat dyes, and the like. Dyes suitable for use on wool include vat dyes, reactive dyes, acid dyes, direct dyes, and the like. It is to be understood that these examples are illustrative and not limitative and other types of pile materials may be utilized with suitable dyes in carrying out the practice of this invention.

The process of this invention provides a means of application of dye to at least some of the individual piles of pile material by applying the dye by gravitational or pressure induced stream onto the surface of the individual piles in a controlled amount sufficient to penetrate the piles but less than sufficient to saturate them thereby avoiding dissipation of dye to the surrounding areas. Accordingly, the process results in the formation of a variegated dyed pile surface in which the color differences are emphasized by substantially complete change in color from one area of pile material to another. In other words, utilization of this instant process results in a color pattern on pile material such as might be achieved on flat goods by printing, since dye penetration of individual piles without subsequent dissipation or bleeding results. Such penetration permits the achievement of abrupt contrast of colored areas and/or colored and noncolored areas.

Apparatus suitable for carrying out the process of this invention generally includes a dye source, means for conveying pile material to the vicinity of the dye source, dye delivery means for delivering dye in a stream to the pile material in controlled amounts and stabilizing means located in a post dyeing position.

In order to more completely understand the process and apparatus useful in the practice of the invention reference is made to the attached drawings wherein:

FIGURE 1 is a view in perspective of an apparatus capable of carrying out the process of this invention;

FIGURE 1a is a view in perspective of a cascade drenching arrangement used to stabilize color on a dyed material;

3

FIGURE 2 is a schematic detail of the constant level feeder tank, flexible tubing and dye delivery tube;

FIGURE 3 is a sectional view in perspective showing in detail dye delivery tubes, the delivery tubes holder, the holder track therefor, and the traversing bar; and

FIGURE 4 is a detailed view in elevation of one dye delivery tube including an electric valve for control of the flow of dye through the dye delivery tube.

Referring more particularly to the drawings, the apparatus illustrated in FIGURE 1 includes a support means 11, such as a frame or the like made of metal, such as steel, or any other suitable material, metallic or non-metallic. Attached at either end of the support means are rollers (not shown), at least one of which is connected to a source of power (not shown). Disposed over the rollers is an endless perforated conveyor or other suitable, similar means 12. The conveyor is perforated in order that excess dye may pass through into drainage tray 13 located under the conveyor at the site of dye application. The conveyor 12 can be constructed of any suitable material which provides substantial support to pile material being conveyed thereon. Generally, it is preferred that the conveyor be manufactured from metal in an open mesh design in order to facilitate drainage of any excess dye into the drainage tray 13 mentioned hereinbefore. The conveyor is generally operated at a speed calculated to allow the required amount of dyestuff to be delivered to the material being dyed. The necessary speed in any particular case is calculable in a routine manner.

The support means 11 is equipped with an inverted U-shaped member 14 which supports the dye source, that is, the supply tanks 15 in a position above the conveyor. A similar structure 16 disposed in like fashion over the surface of the conveyor but having a height somewhat less than member 14 is located next to member 14 and forms a shelf having disposed thereon constant level feeder tanks 17 which supply dye to the dye delivery means 18 which is discussed more fully hereinafter. Member 16 forms a support for shelf 19 which increases the amount of area suitable for supporting the constant level feeder tanks 17. Both shelf 19 and that portion of member 16 which supports the constant level feeder tanks have a series of openings 20 through which the dye delivery tubes 26 pass. Below shelf 19 there may be disposed a grid or screen 21 connected to member 16 which aids in positioning of the dye delivery means with respect to material carried by the conveyor. Beneath screen 21 is flow control means generally designated by 22 which consists of one or more pinching bars or solenoid valves, electrically operated to control the flow of dye through the tubes of the dye delivery means 18. In order to actuate the flow control means, such as, solenoid valves or pinching bars, a control panel 23 is connected thereto through electrical conduit 24. The control panel can, of course, be designed, if desirable, so that it can be programmed to open or close any one or more dye delivery tubes automatically and in any desirable sequence. Such an arrangement permits a great variety of pattern effects on materials being dyed in accordance with the invention.

A solenoid valve control is shown more completely in FIGURE 4 and designated generally as 25. When such valves are utilized in an apparatus according to the invention the delivery tubes 26 can be of rigid construction such as stainless steel or the like, if lateral and vertical mobility is not required. If lateral and vertical mobility is required, it is necessary for the tubes to be flexible between the point of flow control and the point of connection with the delivery outlet 27. Regardless of the requirements of mobility, delivery outlet 27 is generally of rigid construction, either metallic or non-metallic. In cases where pinching bars are utilized, that portion of the delivery tubes subject to pinching must be made of flexible material such as rubber, plastic, or any other suitable material regardless of the mobility requirements.

Upright members 28 and 29 are disposed on each side

4

of the support means 11 and below the flow control means 22. Tracks generally designated by 30 and 31 extend transversely across the width of the conveyor 12 and are anchored at each end on adjusting screws 32 and 33 located in upright members 28 and 29. Accordingly, the tracks can be raised and lowered with respect to the distance between them and the conveyor 12. The delivery end of the dye tubes 27 as shown more completely in FIGURE 3, are suitably secured in a convenient manner to tube holder 34, held in place by holder track member 35. The number of pairs of holder tracks and tube holders on any particular apparatus being utilized can vary, and the number of tubes in each tube holder may be as few as one or as many as can conveniently be secured by a tube holder according to its capacity for performing the tube carrying function. Each pair of holder tracks not only provides support for a tube holder but also serves as a guide for the tube holder during lateral movement. Traversing bars 36 actuated through a control panel 37 by way of a mechanism not shown but located in inverted U-shaped member 38 are associated with each track and when in operative position move the tube holders in a lateral direction. The traversing bars are connected in any convenient manner to the tube holders.

As pointed out hereinbefore, the constant level feeder tanks 17 are supplied with dye from the supply tanks 15. The supply tanks may be equipped with one or more lines such as 39, 40, and 41 which lead to the constant level feeder tanks 17. In order to maintain a constant level of dye in the feeder tanks, each feeder tank is equipped with an automatic valve 42 which is actuated to maintain the dye in the tank at a certain level. Each feeder tank 17 as shown in detail in FIGURE 2 is connected to one or more dye delivery tubes 26.

The dye delivery means 18 can vary in arrangement, and can be made up of a number of tubes, such as 26. For example, as shown in FIGURE 2, it can consist of one or more dispersing Y's 43 connected to dye delivery tubes 26 which are flexible and which have at the opposite ends outlet tubes 27 of an interior size to allow capillary action to take place. Outlet tubes 27 may be made of glass, metal, or any other suitable material, and one feeder tank may supply dye to one or a large number of outlet tubes.

In FIGURE 4 there is illustrated, as mentioned hereinbefore, a flexible dye delivery tube 26 having a solenoid valve 25 to control the flow of dye through the tube. The outlet end of the tube, that is, the stainless steel member 27 may vary in size so long as that when the flow control means is actuated, dye flowing through the tube is immediately shut off and that portion of dye above the opening in the end of the tube 27 is held therein by capillary attraction.

Located in a post dyeing position is a stabilizing means. Referring to FIGURE 1a, a suitable such means is a cascade drenching arrangement 44 which serves to stabilize the color on a dyed material. This drenching arrangement consists of a perforated convex conveyor 45 which serves to carry dyed material underneath one or more perforated pipes 46 from which water or other suitable liquid is cascaded in large quantities. The conveyor 45 is advanced by a sprocket and chain drive (not shown) or any other suitable drive arrangement located in housings 47 and 48. The entire cascade arrangement is situated within a retaining basin 49 equipped with drains 50, 51, and 52. Other means of color stabilization can be employed and can be substituted for or interposed before or after the cascade arrangement. Illustrative of such color stabilization means suitable for introducing heat to the treated material, such as our own or the like.

The illustrated apparatus operates as follows. A pile material is disposed on the conveyor 12 and carried thereby to the vicinity of the dye delivery outlets 27 where dye is directed in streams from the delivery outlets 27 onto the material being dyed. The amount of dye being

5

applied can be controlled within fine limits due to the capillarity of the dye delivery tubes and to the precise control mechanism operated through a control means such as the solenoid valve 25 with which each tube is equipped and which is programmed through control panel 23. If it is desired, while the material is passing underneath the dye delivery tubes, the tubes may be moved laterally by means of the traversing bars on the holder tracks 30 and 31. Such lateral movement is controlled through control panel 37. After dyeing, the material is then conveyed to the cascade drenching arrangement 44 where the color is stabilized. Further in illustration of the process and apparatus of this invention, an excellently dyed pile material is obtained in accordance with the procedure set forth below.

A tufted cellulose, rayon rug, 21" wide and 36" long with $\frac{7}{8}$ " pile, is dyed with reduced solutions of four vat dyestuffs at a temperature of 60° C. The dyestuffs are applied simultaneously through a series of $\frac{1}{8}$ " inside diameter delivery tubes so as to obtain a multicolored stripe pattern. Dyestuff delivery is effected, from a height 28" above the pile material being dyed, through flexible tubing attached to the $\frac{1}{8}$ " inside diameter delivery tubes. The discharge of dyeing liquor from these tubes is such that a coordinated speed of fifteen yards per minute is used to effect the movement of the pile material underneath the delivery tubes in order that a desirable amount of dye liquor might be delivered thereto. Dyestuffs used are C.I. Vat Green 3, C.I. 69500, C.I. Vat Black 25, C.I. 69525, C.I. Vat Yellow 2, C.I. 67300 and C.I. Vat Brown 1, C.I. 70800. The flow of liquor is controlled by pinching the flexible tubing between a flat and an angled surface with weights applied to the angled piece to obtain pinching force.

The instant process and apparatus are particularly adapted for continuous and semi-continuous operation. However, it is to be understood that both the process and apparatus are also suitable for use in a batch operation, that is, an operation wherein one unit of a suitable pile material is processed in accordance with the present invention and on the present apparatus.

While the invention has been illustrated and described in but one embodiment, it is to be understood that those skilled in the art may modify certain details thereof

6

without departing from the spirit or scope of the invention as defined in the appended claims.

What is claimed is:

1. A process for dyeing pile material comprising causing various colored dyes to flow in a plurality of streams, selectively controlling the amount of dye in each of said streams reaching the surface of said pile material so as to completely penetrate the pile lengthwise before oversaturation of said pile, causing a relative movement between said streams and said pile material to be dyed, and selectively controlling the flow of said streams during said relative movement between said streams and said pile material to dye said pile material in a predetermined pattern wherein there is substantially no dissipation of said dyes to the surrounding areas thereby providing a sharp definition of a variegated colored pattern in said dyed pile material.

2. A process for dyeing pile material comprising causing various colored dyes to flow in a plurality of streams, selectively controlling the amount of dye in each of said streams to completely penetrate the pile lengthwise before oversaturation of said pile, causing a relative movement between said streams and said pile material to be dyed, selectively controlling the flow of said streams during said relative movement between said streams and said pile material to dye said material in a predetermined pattern and stabilizing the dye on said pile material wherein there is substantially no dissipation of said dyes to the surrounding areas thereby providing a sharp definition of a variegated colored pattern in said dyed pile material.

References Cited

UNITED STATES PATENTS

1,253,050	1/1918	Kitsee	8—14 X
1,470,535	10/1923	Kolb	8—14 X
1,726,055	8/1929	Campbell	8—14 X
1,873,000	8/1932	McCarthy	8—14 X
2,318,133	5/1943	Wentz	8—34
3,102,771	9/1963	Neale	8—14
3,271,102	9/1966	Morgan	8—151

NORMAN G. TORCHIN, *Primary Examiner.*

T. J. HERBERT, *Assistant Examiner.*

Dedication

3,393,411.—*John Bethea McElveen*, Rutherford, N.J. PROCESS FOR DYE-
ING PILE MATERIAL WITH VARIOUS COLORED DYES
FROM A PLURALITY OF STREAMS. Patent dated July 23, 1968.
Dedication filed Oct. 13, 1977, by the assignee, *Milliken Research
Corporation*.

Hereby dedicates to the Public the entire term of said patent.

[*Official Gazette January 17, 1978.*]