Oct. 29, 1968 G. S. McGEE, JR 3,407,415

METHOD AND APPARATUS FOR CONTROLLING LIQUID EXTRACTION

Filed Nov. 17, 1966

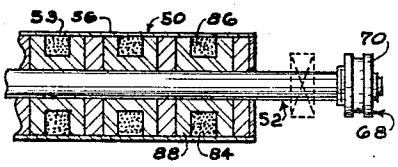

Fig. 4

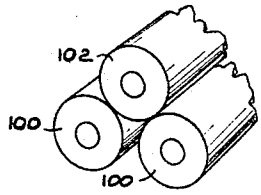

Fig. 6

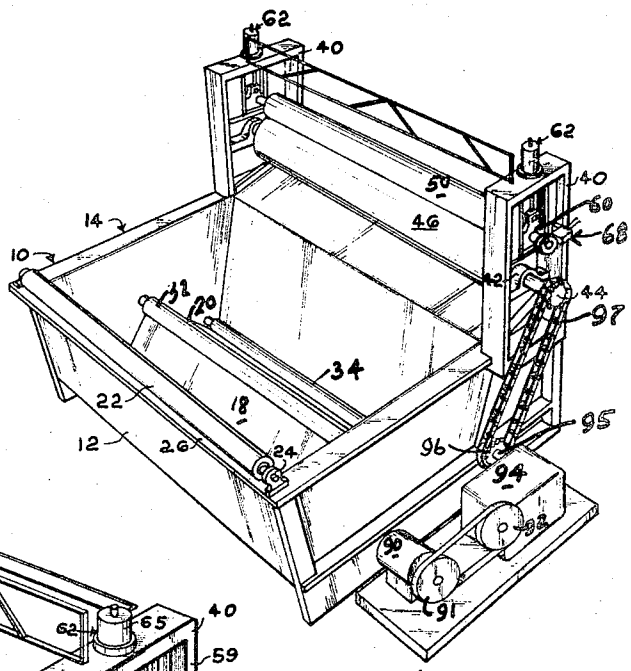

Fig. 1

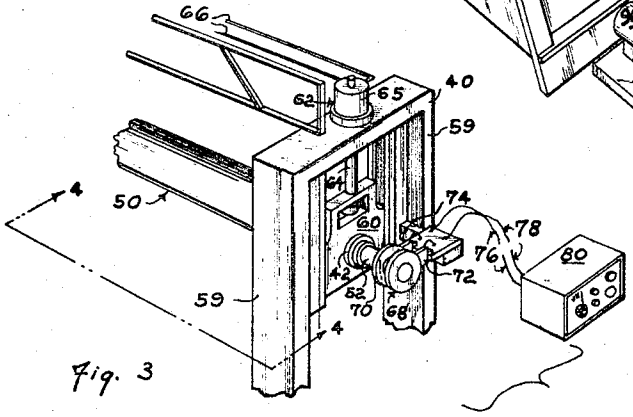

Fig. 3

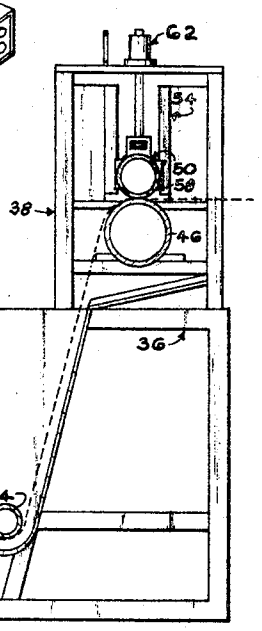

Fig. 2

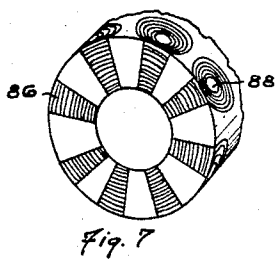

Fig. 7

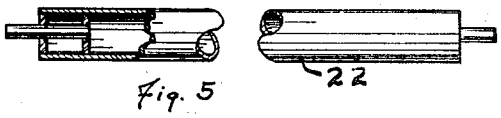

Fig. 5

INVENTOR

GEORGE S. McGEE, JR.

ATTORNEY Patrick D. Henry

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METHOD AND APPARATUS FOR CONTROLLING LIQUID EXTRACTION

George S. McGee, Jr., 2311 E. 28th St., Chattanooga, Tenn. 37407

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ABSTRACT OF THE DISCLOSURE

A width of continuous length fabric goods, such as tufted carpet, is directed through and submerged in a dye material. It is then directed continuously between plural extracting rollers while a magnetic force is applied between the rollers to attract one roller to the other to effect a pressure on the fabric in an even and consistent manner across the width of the fabric to remove the surplus and unwanted dye evenly therefrom.

Background of the invention

Evenness in the extraction of liquids from flexible materials very often spells a difference between an acceptable and unacceptable product. For example, in the dyeing of textile products, such as carpet, through application of a dye liquid solution, evenness and extraction of the liquid from the carpet after dyeing is a most important factor in whether the final appearance and color is acceptable. One of the biggest problems in dyeing is that of extraction of the dye from the material after the material has received the dye solution. This is particularly true in the process where the material is submerged in a controlled volume of dye chemicals and then the material is subjected to some form of extraction of the dye solution. Quality control can be a serious problem and cost of dyeing is an important factor in production considerations in order to make the goods competitive. Various methods and apparatus have been used for production dyeing including those which utilize suction means to assist in the extraction. The use of pressure rollers is well known for use in the procedure of extraction where the goods are run between the rollers and the pressure forces the liquid out. This is a good and fairly simple mechanism for extracting liquids but is totally unacceptable for a high quality dye job due to the unevenness and improper distribution of the liquid caused by the variation in the surfaces of the rollers, the pressure between the rollers, the effect of gravity, the effect of friction and other uncontrolled factors. For this reason the procedure for extracting dyes by using pressure rollers alone has been considered unacceptable. The present invention provides a method for extracting liquids from the goods which presents careful control and substantial exactness as to the evenness of the removal of the liquid from the goods. Furthermore, the method can be employed on apparatus that is production in nature because the goods can be in continuous motion.

Generally described, without restriction on the scope of my invention as defined in the appended claims, the method of the present invention comprises continuously applying a liquid solution, such as a dye solution, as by submerging the goods, such as tufted textile carpets, in a vat of dye, conveying the continuous tufted textile goods from the dye vat to the dye extraction means of the present invention which comprises an extraction roller, which is driven and a second extraction roller which is non-driven, the two rollers being in contact, then the goods are conveyed continuously between the rollers while a magnetic force is applied between opposite rollers respectively from one respective roller to attract the other whereby the rollers are applied evenly across the width

of the goods and from side to center thereby removing the surplus dye and insuring same evenly across the width of the goods.

Generally described without any limitation on the scope, reference being made to the claims, one particular form of the apparatus in the present invention comprises a dye vat having means for conveying the continuous goods, such as over a textile carpet, through the vat and through a solution of dye contained therein. It should be noted with respect to the present method and apparatus that the dye solution does not per se perform any part of the invention since dye chemicals are well known and are supplied by many leading producers. Located at position leading from the vat, there is a power driven conveyor roller. The conveying roller may be the larger roller and preferably is manufactured with a cylindrical steel shell properly machined accurately to provide a competent surface and is mounted on supports on each end. A magnetic roller of the present invention, that may be of smaller diameter than the conveying roller, is mounted on the supports. The magnetic roller has a center support shaft and is provided with electro-magnetic means. A commutator segment is mounted on the shaft on one end of the electro-magnetic roller and includes the usual brushes connected by wires to a rheostat control which allows manual variation of the pressure between the rollers by varying current to the electro-magnetic roller. A small air cylinder may be connected to the electro-magnetic roller and is operated by means of a solenoid to raise and lower the roller. Such solenoid operators are well known in the art. In operation of the apparatus, the electro-magnetic roller is brought against the conveying roller with the goods between and the initial pressure is selected according to the thickness and nature of the particular goods being run, such as the height of the pile and nature of the tufted fabric. Then, by operating the rheostat control for the electro-magnetic roller, the pressure across the length of the rollers and between the electro-magnetic roller or conveying roller may be adjusted and re-adjusted and controlled as desired until the proper dyeing job is obtained. Permanent magnet means may be used instead of the electro-magnetic means.

The primary object of this invention is to provide a method for controlling the extraction of liquids from goods such as continuous length fabrics, especially tufted carpets and the like.

Another object of this invention is to provide a method for extracting dye from continuous textile goods such as tufted carpet by continuous extraction between rollers while applying an electro-magnetic force between the rollers.

Still another object of this invention resides in the use of magnetism to attract one roller to another evenly across the length thereof and to extract liquids between the rollers by controlling the force therebetween.

An additional object of this invention resides in the method of extracting dyes from continuous fabric goods such as tufted textile carpets by applying a magnetic force between at least one roller and at least one magnetically attracted second roller and varying said force by varying the magnetic force between the rollers thereby providing an adjustment whereby visually upon inspection the liquid extraction may be controlled.

Still another object of this invention resides in the method mentioned in the preceding paragraph wherein one of the rollers is provided with an electro-magnetic force controlled electrically to provide an adjustment of the pressure.

An additional object resides in the apparatus and the magnetic means for controlled, equal extraction.

Other and further objects and advantages of my inven-

tion will become apparent upon reading the following specifications taken in conjunction with the accompanying drawings, in which:

FIG. 1 is a perspective view of a typical carpet dyeing apparatus which may be employed to practice the present method.

FIG. 2 is an elevation cross-sectional view taken substantially along lines 2—2 in FIG. 1.

FIG. 3 is a perspective view of one end of an electromagnetic roller arrangement for the present apparatus.

FIG. 4 is a cross-sectional view taken substantially along lines 4—4 in FIG. 3.

FIG. 5 is a plan view of one form of roller with portions broken away.

FIG. 6 is a diagrammatic view of an alternative magnetic roller arrangement using two magnetic rollers.

FIG. 7 is a partial perspective view of the magnetic roller shown in FIG. 4.

Referring initially to FIGS. 1 and 2 and thence to the other figures of the drawings as the specification unfolds and as the various details are pursued, the apparatus of the present invention, which may be used to practice the method of the present invention which is disclosed as the apparatus and its operation is described, is designated generally by reference numeral **10** and comprises a closed tank or vat **12** having an open top **14** and being provided with an inverted V-shaped bottom **16** of convex arrangement which provides a forwardly sloping surface **18** and a rearwardly sloping surface **20**. The bottom, and in fact any depth, of the inside of tank **12** may be filled with any solution such as conventional carpet dye or other textile fabric dye solution selected according to the suitability of that dye for the particular fabric, color and the like. The chemicals, dyes and the processes of dyeing, as relates to the chemical and physical relationship between the dye and the fabric itself does not per se form any part of this invention since this is a well developed subject that may be pursued with any one of the many established dye houses. The dye is selected for the particular goods being dyed. The present invention relates to the extraction or removal of any surplus or unwanted part of the dye or other chemical after it has been applied to the material and to the even distribution of the dye solution in the goods to give an even dye job.

Tank **12** is provided along one edge with a support roller **22** mounted on respective end bearings **24** on the top edge of the tank **26**. A first roller **28** at the forward part of the tank has the material or fabric, such as carpet goods **30**, passing thereunder and the carpet goods **30** then pass across the top of a roller **32** mounted inside the tank above the bottom near the middle and from which the goods **30** pass beneath another roller **34**, receiving dye during this motion while the carpet **30** is submerged within the tank **12**.

One side of the tank, which for the sake of reference herein is designated as the outlet or backside, is designated generally by reference numeral **36** and on this side is mounted the extraction apparatus of the present invention designated generally by reference numeral **38**. A pair of rigid rectangular, upwardly extending support frames **40**, there being one on each side of the tank at the rear portion **36**, supports, in respective journals **42**, the center shaft **44** of a conveying or transport roller **46** which conveys the carpet **30** from the tank **12**. Conveying roller **46** is preferably constructed in cylindrical formation with a peripheral surface which may be chrome plated and according to the present invention the cylindrical conveying roller **46** should be constructed from a magnetically attracted material such as steel or an alloy having a homogeneous amount of iron (Fe) therein. Supported above the surface of conveying roller **46** and arranged to be brought into contact therewith is a second magnetic roller **50**, one form of which is shown in the cross-sectional view in FIG. 4. Roller **50** is constructed with a solid center shaft or rod **52** on which is mounted the cylindrical housing or roller shell **53** preferably manufactured of plated construction with a proper surface **56** thereon. The end of shaft **52** of roller **50** extends respectively beyond the end of the shell or housing **53** and is supported in a respective journal bearing support **58** on each respective side and in the respective frame **40** in the respective journal support **42**. Each frame **40** comprises a pair of spaced members **59** having a rectangular bearing box **60** slidably supported therein. By this arrangement, the magnetic roller **50** is moved and adjusted by the sliding action of the bearing box **60** inside the frame **40**. As seen in FIG. 3, movement of the magnetic roller **50** may be accomplished by means of a solenoid operated air valve **62** (a common article of commerce) which comprises the piston rod or armature portion **64** that is actuated from a cylindrical housing **65** operated by means of a switch controlled through wires **66**. Actuation by switch **66** from any remote point causes the rod **64** to move the box **60** up and down in the respective frame **40** bringing the surface **56** of roller **50** into engagement with the surface of roller **46**.

The particular roller construction of magnetic roller **50** shown in FIG. 4 has a commutator arrangement **68** employing a brush slip ring **70** of copper or the like contacted by respective brushes **72, 74** each connected to a respective wire **76, 78** leading to a control box **80** having a rheostat, volt meter, air control, AC and DC switches, and the like (not shown) in the panel and having the rheostat (not shown) connected to the wire **76, 78** to control the voltage thereto thereby varying the amount of the electro-magnetism in the electro-magnets **84** which is seen in FIG. 4 are mounted within the housing **53** along the shaft **52**. Electro-magnets and the control thereof and the effect per se are well known and in one form comprise coils of wire **85** wound around a core or armature **86** which create an electric-magnetic force when energized through the core by electro energy. The electromagnets **84** may be selected across the length of roller **50** to provide an even electro-magnetic force thereacross which when in operation will be applied to the surface of the roller **46** in the amount corresponding to the amount of voltage and current in the respective electromagnets **84** controlled by the rheostat on the box **80**. According to the properties of magnets, like poles repel and opposite poles attract. Also magnets attract metals having iron in them.

Roller **46** is power driven from an electric motor **90** driving a pulley **91** which drives a second pulley **92** on input shaft **93** of a transmission **94** having an output shaft **95** with sprocket **96** connected by chain **97** to drive sprocket **98** on shaft **44** which turns roller **46**.

In one alternative form shown diagrammatically in FIG. 6, a pair of magnetic rollers **100** are supported in an assembly of rollers including a non-magnetic roller **102** which is attracted to rollers **100**. Rollers **100** are controlled and operated and energized in the same manner as roller **50** to attract roller **102** along the length thereof.

The polarity of permanent or electro-magnets may be predetermined in advance. Therefore, any roller surface may be made a north or a south pole to attract or repel another roller surface as selected.

The method of the present invention, which is disclosed in connection with and may be practiced by the apparatus previously described, comprises continuously directing a width of continuous length fabric goods such as the tufted carpet **30** through and submerged in a dye material, then directing the fabric continuously with the width thereof across a conveying roller, applying a pressure across the width of the fabric on the other side from said conveying roller and while said continuous goods is moving between the rollers applying a magnetic force between the rollers in an even and consistent manner across the width of the fabric to remove the surplus and unwanted dye evenly therefrom.

While I have shown and described the particular embodiment of my invention together with one form of the

method and one form of the apparatus for the purpose of illustration, this is not to be construed in any way as any sort of limitation on the scope of my invention since there is alterations, changes, deviations, ramifications, eliminations, additions, substitutions, changes, omissions, additions, alterations and departures may be made in the method and apparatus shown without departing from the scope of my invention as defined in the appended claims.

What is claimed is:

1. In a method for evenly distributing and extracting any surplus liquid from a continuous goods such as distributing and extracting surplus dye from a continuous length of a tufted carpet fabric by applying pressure across the width thereof, the steps comprising:

(a) directing the continuous goods, such as a tufted carpet, and continuously applying the liquid such as the dye solution,

(b) continuously directing the continuous goods with the width thereof across a first wide continuously moving surface which extends coextensively with the width of the goods,

(c) engaging the goods as it is moved continuously along and against said first surface with a second continuously moving surface applied from the other side of the goods from said first surface said goods moving between said continuously moving surfaces,

(d) applying a magnetic force across the width of the fabric and along the corresponding width of both of the moving surfaces to attract said first and second surfaces to each other and forcing said goods between said surfaces and thereby evenly to remove any surplus dye solution and to distribute the dye solution evenly across the width of the goods.

2. The method claimed in claim 1, wherein said continuously moving fabric is moved by said extraction rollers.

3. The method in claim 1:

(e) magnetizing one of the said first and second surfaces with a magnetic force that attracts said other of said first and second surfaces.

4. The method in claim 3: applying said magnetic force along all of the width of said surface that corresponds with the width of the fabric thereby attracting the first and second surfaces to each other across the width of the fabric to force the solution out of the fabric evenly and to distribute the dye evenly in this manner.

5. The method in claim 4: applying an electro-magnetic force along one of said surfaces which is opposite to the said other surface and magnetically attracts same.

6. The method of claim 4 wherein said first and second surfaces are rollers: magnetizing one of said rollers along the length thereof to attract the other roller thereto, passing the goods between the rollers while the magnetic force is applied between said rollers.

7. In an apparatus for evenly distributing and extracting any surplus liquid from a continuous goods such as distributing and extracting surplus dye from a continuous length of a tufted carpet fabric by applying pressure across the width thereof, comprising:

(a) roller support means,

(b) at least two opposed moving rollers, one of which is magnetized across the length thereof and the other of which is constructed from a material that is magnetically attracted whereby said moving magnetized roller attracts said other moving roller across the length, said goods being moved between said rollers.

8. The apparatus in claim 7 wherein said magnetized roller has electro-magnets therein.

9. The apparatus in claim 8 wherein there is a container in which the goods is transported.

10. The apparatus in claim 7 wherein said magnetized roller is magnetized by permanent magnetic means therein.

11. The apparatus in claim 9 wherein one of said rollers is supported to be moved with respect to the other and there is a means for shifting said movable roller.

12. In a method for extracting any surplus liquid such as dye from a continuously moving goods such as distributing and extracting surplus dye from a continuous length of continuously moving tufted carpet fabric by applying pressure across the width thereof, continuously moving said fabric between a pair of continuously moving extraction rollers and simultaneously therewith continuously applying a magnetic force between said rollers to attract one roller to the other and across the length of said rollers corresponding to the entire width of the fabric to be treated.

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WILLIAM I. PRICE, *Primary Examiner.*