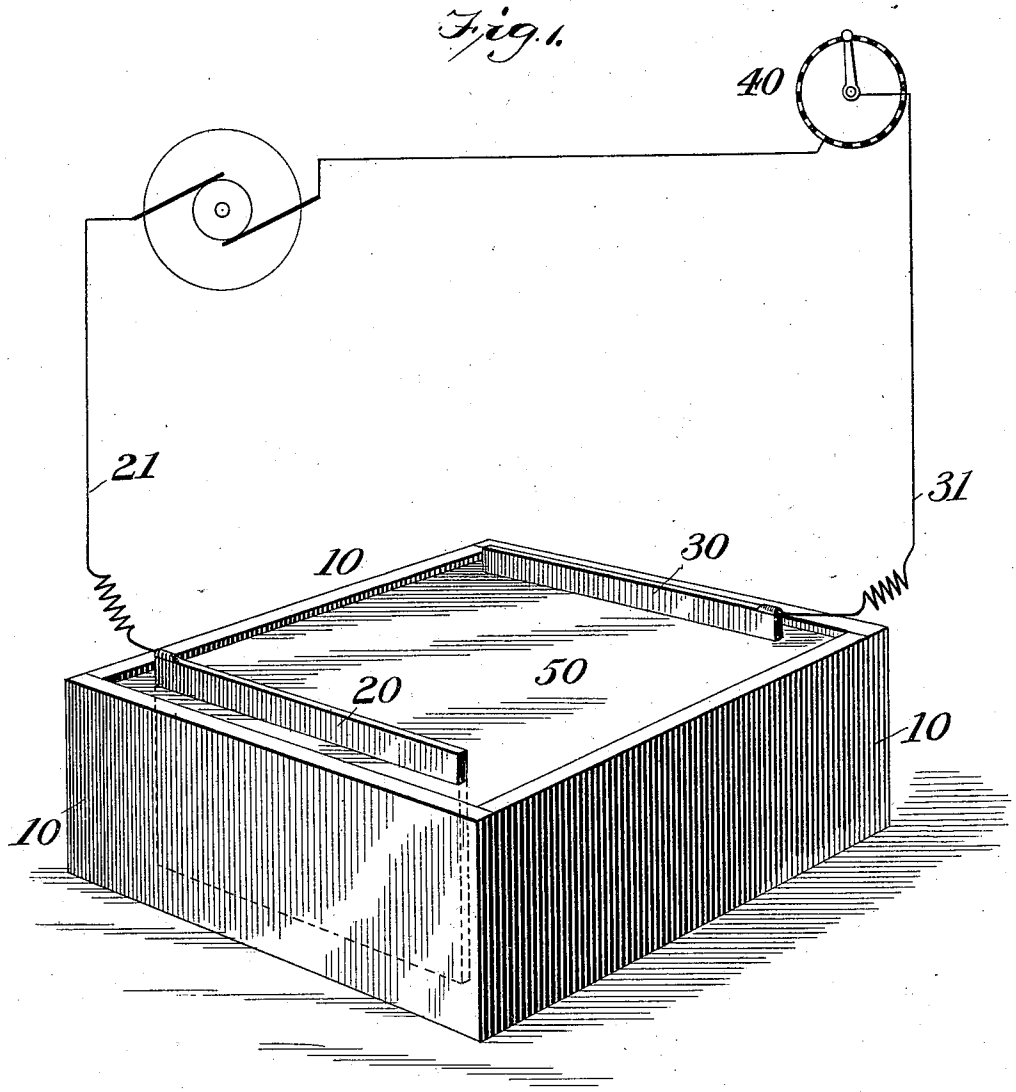
(No Model.) 2 Sheets—Sheet 1.

G. D. BURTON.

ART OF ELECTRIC DYEING.

No. 557,324. Patented Mar. 31, 1896.

Fig. 1.



Witnesses:
Edwin L. Bradford
C. A. Wood

Inventor
Geo. D. Burton
By F. C. Jones
Attorney

(No Model.) 2 Sheets—Sheet 2.

G. D. BURTON.

ART OF ELECTRIC DYEING.

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Fig. 2.

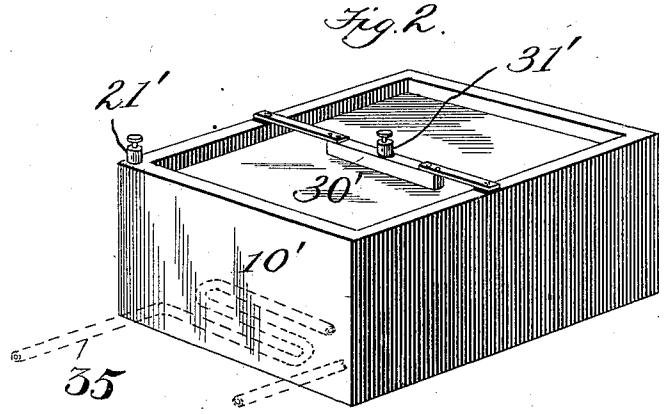
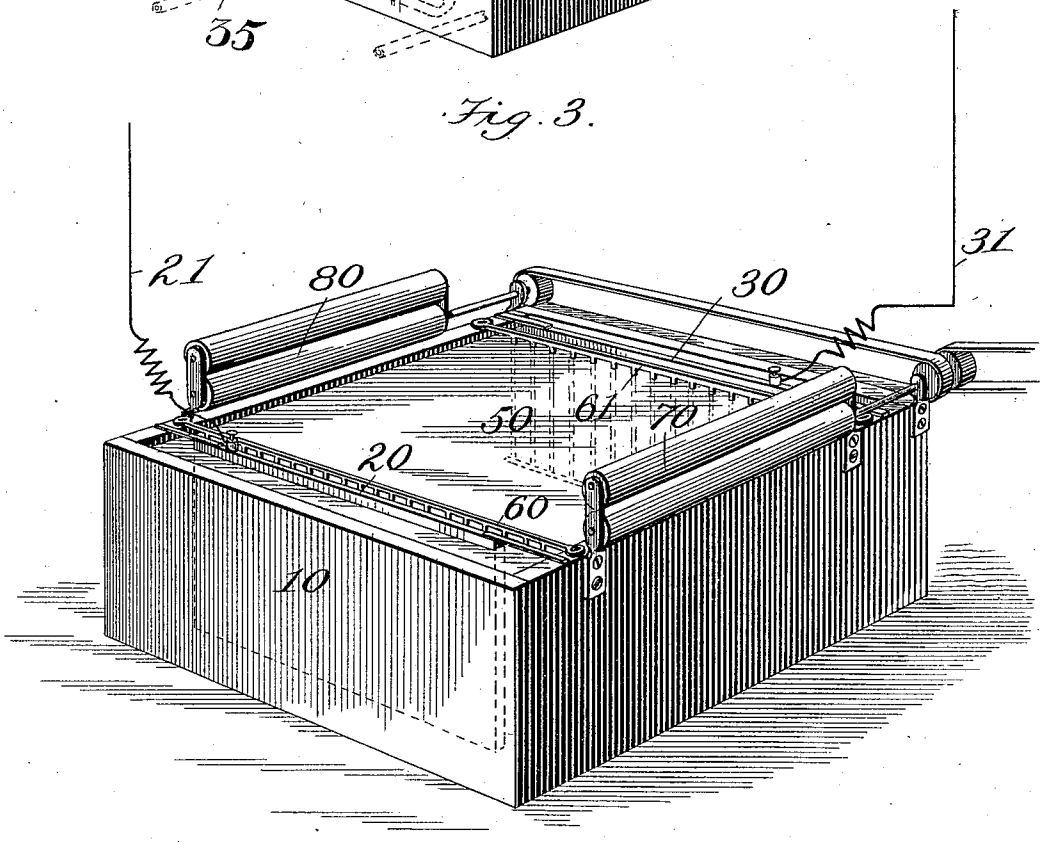


Fig. 3.



WITNESSES:

L. M. Dorsett.

H. Reed.

INVENTOR

Geo. D. Burton

BY

R. F. B. Lomax,

ATTORNEY.

UNITED STATES PATENT OFFICE.

GEORGE D. BURTON, OF BOSTON, MASSACHUSETTS, ASSIGNOR TO JOHN J. MOORE, OF SPRINGFIELD, MASSACHUSETTS, AND JAMES S. McCABE AND WALTER A. BYRNE, OF AUBURN, NEW YORK.

ART OF ELECTRIC DYEING.

SPECIFICATION forming part of Letters Patent No. 557,324, dated March 31, 1896.

Application filed September 25, 1894. Serial No. 524,090. (No model.)

To all whom it may concern:

Be it known that I, GEORGE DEXTER BURTON, a citizen of the United States of America, residing at Boston, in the county of Suffolk, in the State of Massachusetts, have invented an Improvement in the Art of Electric Dyeing, of which the following is a specification.

This invention relates to the art of dyeing, and is applicable to the dyeing of wool, cotton, silk, and other fibrous substances, either in the form of raw materials or manufactured products. It is useful in the dyeing of hats, textile and felt fabrics, furs, and other analogous articles, also including leather.

The invention consists principally in the art of electric dyeing, which comprises the intermixing of a dyeable fibrous substance with a dye liquor and passing an electric current of forty or more volts through that part of the dye liquor with which said fibrous substance is intermingled, whereby the fibers thereof are forced apart and thoroughly exposed to the action of the dye liquor in the dyeing operation.

In carrying out this invention any suitable dye liquor is employed.

In the accompanying drawings, Figure 1 represents a perspective view of one form of apparatus for practising this art. Fig. 2 represents a perspective view of a metallic vat for constituting a part of an apparatus for this purpose and adapted to serve as one electrode. Fig. 3 represents a vat adapted to constitute a part of an apparatus for this purpose provided with non-conducting screens for shielding the object to be dyed from contact with the electrodes and with mechanical means for passing cloth through the bath.

Any suitable vat, as 10, constitutes a part of the apparatus. This vat is constructed of wood, earthenware, or other non-conducting material.

Any suitable receptacle for the dye liquor, provided or not with a common or suitable mechanical means for immersing the material to be dyed or for submerging and withdrawing said material from the dye liquor, may be substituted for the tank 10 herein illustrated.

An electrode 20, which may serve as the anode, is disposed in the tank, preferably at one end or one side thereof, and another electrode 30, which may constitute the cathode, is also disposed in the tank, preferably at the other end or other side thereof. Both of these electrodes are preferably composed of copper, but they may consist of zinc, lead, or other metal. A wire 21 connects the anode 20 with a dynamo, electric service-wires, or any suitable source of electricity, and a conductor 31 connects the cathode 30 with the negative pole of said electric source or with a negative service-wire.

A rheostat 40 is preferably inserted in the circuit on either side of the tank.

In carrying out this process I use a dye liquor 50 of any suitable character—as, for instance, a solution composed of salt, vitriol, and water. The proportions may be thirty pounds of salt, twelve ounces of vitriol, to thirty gallons of water, to which is added any desired coloring-matter. These proportions may be varied. The specific gravity of the liquor should be about 1.000° to 1.025°. In the use of this process the material to be dyed is dipped into the dye liquor 50 in the tank 10 and the current of electricity is switched on. The current passes from the electrode 20 through the liquor to the electrode 30 and agitates the fibers of the material to be dyed, as well as the liquor, and causes a very rapid absorption of the dyeing material by the fiber. An electrolytic action takes place which also hastens the dyeing operation. The material to be dyed may be dipped into the vat or passed over rolls or plunged into the bath in any manner. The current may be regulated, as desired, by the rheostat 40 or by varying the distance between the electrodes in the bath. I have used a direct current of five hundred volts and sixty amperes on a bath having a bulk of about two barrels, and the action of this current raises the temperature of the bath to 210° Fahrenheit, the proper dyeing temperature for the dye liquor above specified, in a few minutes. For a tank six feet long, three feet wide, and one foot deep I provide means for supplying a current of two hundred and twenty volts and one hundred amperes.

I have also used a current of six volts and four hundred amperes with good results for some work.

By the rheostat the temperature of the bath may be regulated to suit the requirements of the bath and of different dye liquors.

When copper plates are used, some benefit is derived from the electrolytic action on the copper. I prefer to use electrodes of the same material, as there is less deposit in that case from one to the other.

In Fig. 2 the vat 10′ is constructed of metal, preferably copper, and the wire 20′ connects it directly with one pole of the electric source, whereby it serves as one of the electrodes. It is provided with a plate 30′, connected by wire 31′ with the other pole of the electric source.

In Fig. 3 I have shown screens 60 and 61, of non-conducting material, which are preferably disposed in the tank in front of the electrodes to prevent contact therewith of the object being dyed. This vat is also provided with a pair of rolls 70 for feeding a web of fabric to be dyed to the bath and with a pair of delivery-rolls 80 for discharging the fabric.

In dyeing in those cases where heat is necessary the dye liquor may be heated to the required temperature either by the electric current or by any known means of heating, as a steam-pipe 35, and after the liquor is heated to the dyeing-point the object to be dyed is inserted therein, and the bath is subjected to an electric current during the dyeing operation. The electric current is of such a strength as to cause the fibers of the material in the dye liquor to separate, whereby they are exposed thoroughly to the action of said liquor, so that the dyeing operation is effected very rapidly. The current may also be such as to maintain the dye liquor at the proper temperature during the dyeing operation.

This process is very useful in dyeing felt or fur hats of any pattern. The hat treated by this electric-bath process has a lively snap when indented and a fine finish is imparted thereto. A greater number of hats or other fibrous substances to be dyed can be put in the tank or vat at the same time than was heretofore customary. The dye liquor when heated by an electric current is equally as efficient at a lower temperature as at a high temperature when heated by steam, and it is therefore less irksome upon the workmen, who are not obliged to stand over hot steam. One workman can attend to two or more vats and the dyeing process is completed in much less time than by the old method.

The following is another instance of a dye liquor which I have used—to wit, two pounds of vitriol, one and one-half pounds of Boston and New York Dye Wood and Chemical Company's "Fast Black," known as "3 B," and twenty gallons of water. In this bath I have dyed twenty-five pounds of wool at a time. The bath was subjected to a current of from fifty-five to seventy amperes at a voltage of from two hundred and fifteen to two hundred and twenty. The gravity of the liquid was 1.030° to 1.037°. The temperature of the liquid at starting was 40° Fahrenheit and gradually increased to the point of boiling—212°. The time required to heat the twenty gallons of liquid to a milk-warm or blood heat with sixty amperes and two hundred and twenty volts was three minutes, time to boiling-point thirteen minutes. As the temperature of the liquor increased the amperage increased to sixty-seven and fluctuated between sixty-seven and sixty-four. When the temperature was 210° Fahrenheit, the voltage was two hundred and fifteen and the gravity 1.040° and the amperage sixty-eight. The wool was dyed in thirty-five minutes. The usual time of dyeing by this bath in the ordinary manner without electricity is one hour and forty minutes. I used a current of from sixty-five to eighty amperes at two hundred and seventy to five hundred volts.

Another dye liquor for a blue-black color especially adapted for hats is fifteen gallons of water, three ounces of "Hatter's Concentrated Black" from Beach & Co., of Hartford, Connecticut, to eight ounces of Glauber salt and three-fourths of an ounce of oil of vitriol. The current used is similar to that heretofore described.

Another dye liquor for a jet-black, also for hats, consists of the ingredients named in the preceding paragraph, with the addition of one-half an ounce of "Green B," a manufactured article known in the dye trade, the composition thereof being undisclosed. In the use of this dye liquor for a hat the dyeing process usually takes four hours, when performed in the ordinary manner, for a heavy nine-ounce-weight hat; but by electricity it is done in one hour. Lighter-weight hats are dyed in less time.

Another dye liquor for an orange color, also for hats, is fifteen gallons of water, twenty ounces of Glauber salt, three-fourths of an ounce of the oil of vitriol, and four ounces of acid-orange. With a current of sixty amperes and two hundred and twenty volts the dyeing is performed in forty-five minutes against three hours by the usual process.

Another dye liquor for a nutria color, a kind of slate-brown, for hats, is eight ounces of alizarin-brown in fifteen gallons of water. The time by this process for dyeing a hat in this liquor is fifteen minutes, while by the old boiling process it took one hour and a half.

The colors may be put into the water at a boiling heat and then the current passed through, the water having been first heated by steam or by electricity.

For the dyeing of leather a high voltage and low amperage current is used. The amperage is made comparatively low, so as not to produce too high a heat in the liquor for leather, and a large voltage is required to

cause the dye liquor to penetrate through the fibers of the leather.

I claim as my invention—

1. The art of electric dyeing, which consists in intermingling a dyeable fibrous substance with a dye liquor and passing an electric current of forty or more volts through that part of the dye liquor with which said fibrous substance is intermingled, whereby the fibers thereof are forced apart and thoroughly exposed to the action of the dye liquor, substantially as set forth.

2. The art of electric dyeing, which consists in intermingling a dyeable fibrous substance with a dye liquor, and passing an electric current of forty or more volts and of sufficient volume to maintain the liquor considerably above the normal temperature, through that part of the dye liquor with which said fibrous substance is intermingled, substantially as set forth.

3. In a dyeing apparatus the combination of a vat or receptacle of non-conducting material, two electrodes composed of copper disposed in said receptacle, a dye liquor also disposed in said receptacle, and conductors connecting said electrodes with opposite electric poles.

GEO. D. BURTON.

Witnesses:
GEO. S. EVANS,
F. C. SOMES.