No. 723,795. PATENTED MAR. 24, 1903.

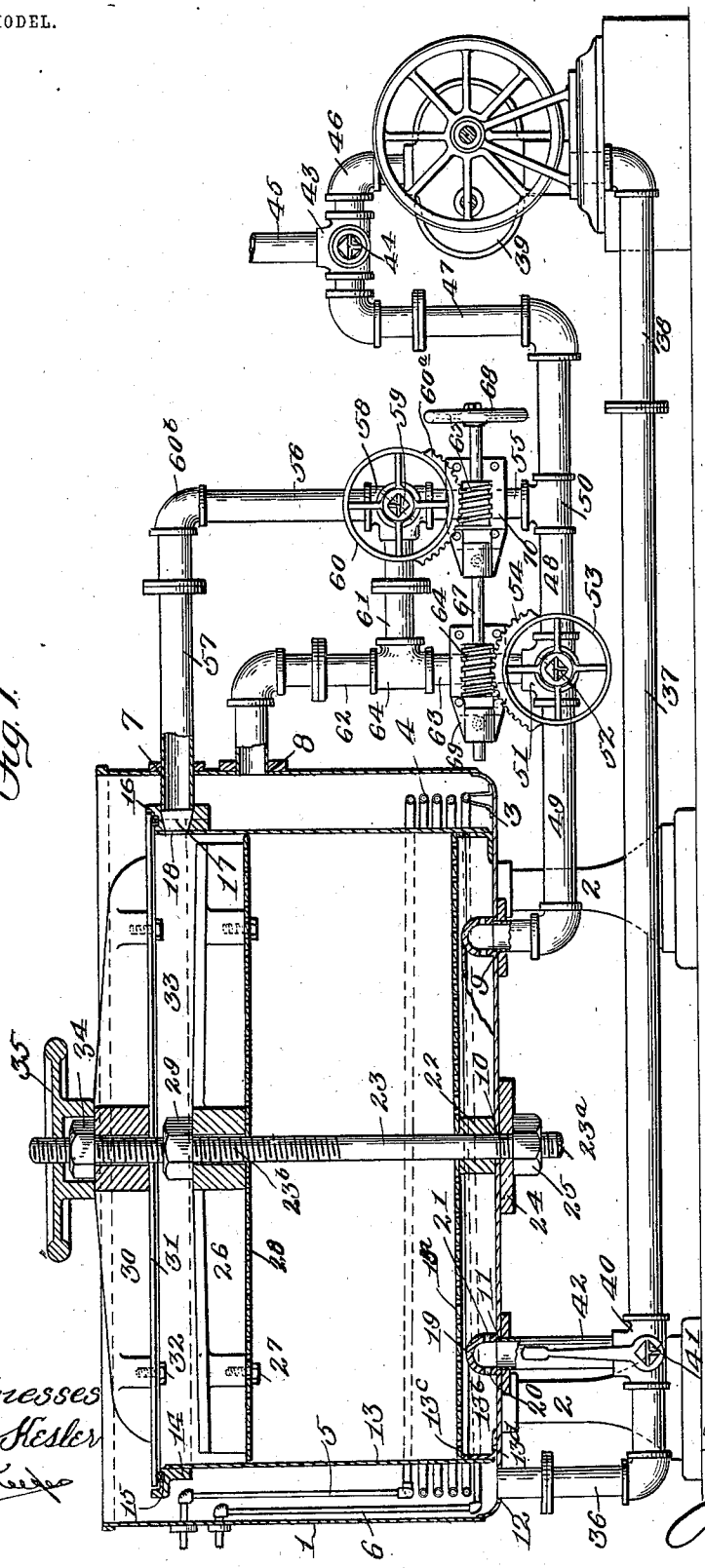
J. A. WILLARD.

APPARATUS FOR DYEING, &c.

APPLICATION FILED JULY 17, 1902.

NO MODEL. 2 SHEETS—SHEET 1.

Fig. 1.



Witnesses
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THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

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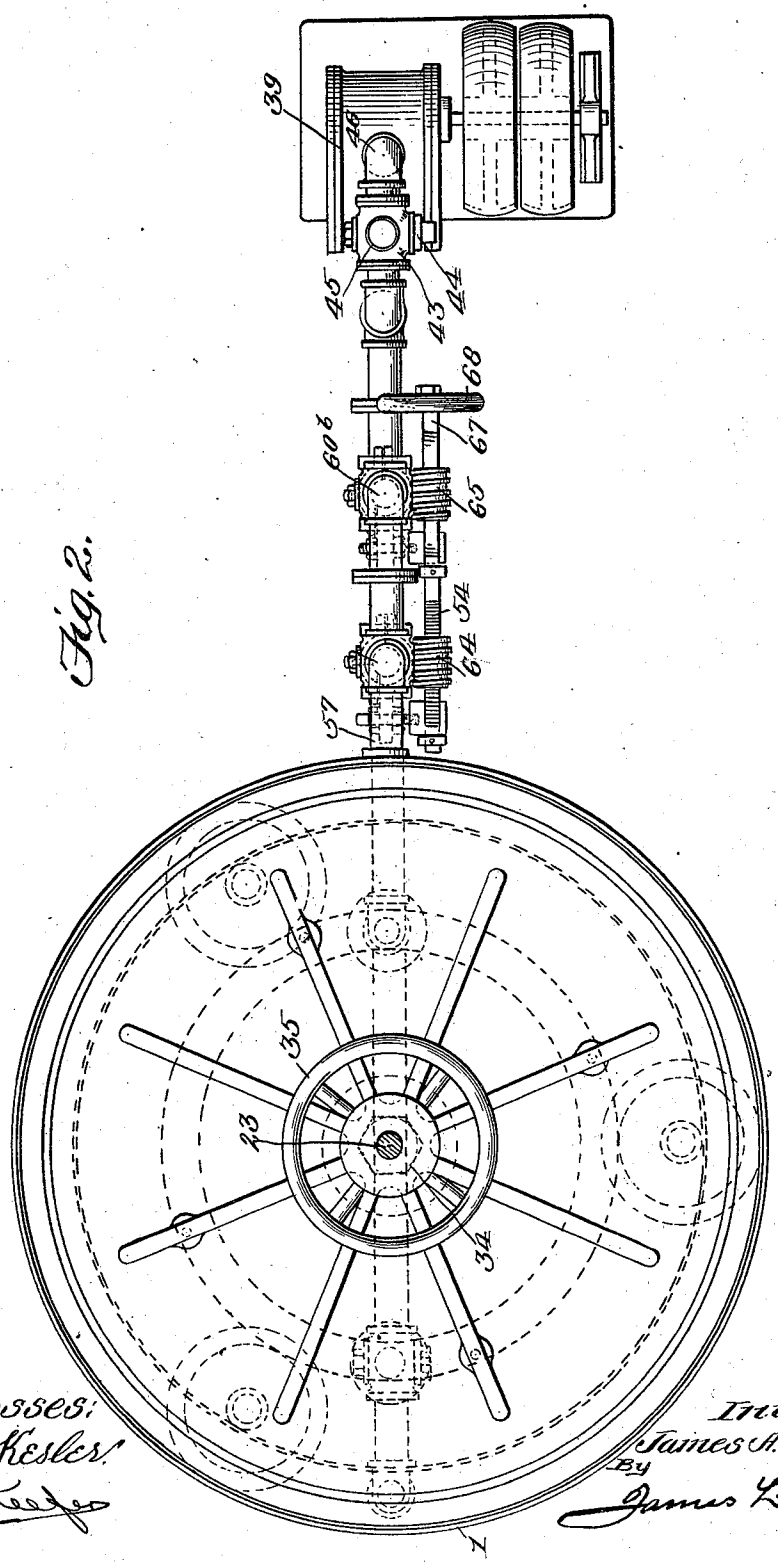
J. A. WILLARD.

APPARATUS FOR DYEING, &c.

APPLICATION FILED JULY 17, 1902.

NO MODEL. 2 SHEETS—SHEET 2.

Fig. 2.



Witnesses:
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UNITED STATES PATENT OFFICE.

JAMES A. WILLARD, OF CHATTANOOGA, TENNESSEE, ASSIGNOR TO VACUUM DYEING MACHINE COMPANY, OF CHATTANOOGA, TENNESSEE, A CORPORATION OF TENNESSEE.

APPARATUS FOR DYEING, &c.

SPECIFICATION forming part of Letters Patent No. 723,795, dated March 24, 1903.

Application filed July 17, 1902. Serial No. 115,979. (No model.)

To all whom it may concern:

Be it known that I, JAMES A. WILLARD, a citizen of the United States, residing at Chattanooga, in the county of Hamilton and State of Tennessee, have invented new and useful Improvements in Apparatus for Dyeing Yarns, Hosiery, and other Materials, of which the following is a specification.

This invention relates to certain new and useful improvements in apparatus for dyeing yarns, hosiery, and other materials.

The object of the invention is to dye, wash, and fix the dyestuff on the yarns, hosiery, and other material while they are submerged at all times without coming into contact with air and until the color has been set and made fast or permanent.

The invention aims to provide an apparatus particularly adapted for use in dyeing yarns, hosiery, and other materials with sulfur-blacks, although the same is applicable for use with other characters of dyes. It is a well-known fact that sulfur-blacks have been in existence for a number of years; but there has been no practical way to use these colors, for the reason that if the material to be dyed or if the material during the dyeing operation comes in contact with air it oxidizes and becomes spotted. By the apparatus to be hereinafter described it is impossible for the air to strike the material while being dyed, as the material at all times is immersed in the liquid during the dyeing operation and also during the washing operation.

A further object of the invention is to provide an apparatus in which all the material being dyed receives the same treatment—that is to say, during the dyeing operation the dye liquor is forced alternately in opposite directions through the material. Consequently the lower portion of the material will receive the same action as well as the upper portion, thereby obtaining a uniform dyeing.

A further object of the invention is to provide an apparatus of the class referred to wherein the dyeing operation will be expedited to such an extent that a great saving of time is obtained over the method now generally employed, or, in other words, the time consumed in dyeing a quantity of yarn, hosiery, or other material by the employment of the apparatus hereinafter described is approximately one and a half hours, while the time consumed in dyeing the same quantity of yarn, hosiery, or other material by the oxidizing method now in general use is from twenty-four to forty-eight hours.

A further object of the invention is to construct an apparatus for dyeing yarns, hosiery, and other materials which shall be extremely simple in its construction, strong, durable, efficient in its operation, readily and easily set up, and comparatively inexpensive to manufacture; and to this end the invention consists of the novel combination and arrangement of parts hereinafter more specifically described, illustrated in the accompanying drawings, and particularly pointed out in the claims hereunto appended.

In describing the invention in detail reference is had to the accompanying drawings, forming a part of this specification, wherein like numerals of reference indicate corresponding parts throughout both views, and in which—

Figure 1 is a sectional elevation of my new and improved apparatus for dyeing, and Fig. 2 is a top plan view thereof.

Referring to the drawings by reference-numerals, 1 denotes an open vat or outside tank, which is preferably mounted and supported by the legs or standards 2. The vat or tank 1 is adapted to receive a body of dye liquor during the dyeing operation. Within the vat or tank 1 and arranged on the bottom thereof is a bracket 3 for supporting a steam-coil 4, which communicates with a steam-supply by the pipe 5 and is provided with a discharge-pipe 6. The steam-coil 4 is adapted to heat the body of dye liquor within the vat or tank 1 when occasion requires. One side of the vat or tank 1 is provided with an opening 7 near the top thereof and below the opening 7 with another opening 8. The function of these openings will be hereinafter referred to. The bottom of the tank or vat 1 is also provided with the openings 9, 10, 11, and 12, the function of which will be hereinafter referred to.

The reference-numeral 13 denotes a hollow

cylinder or drum forming a receptacle to receive the material to be compressed and dyed and which is adapted to be mounted within the tank or vat 1, the cylinder or drum 13 being of a diameter to form a suitable space between it and the inner face of the tank or vat 1 and is provided with a perforated bottom plate 13^a, arranged a suitable distance above the bottom edges of the side thereof and forms an auxiliary chamber 13^b for the dye liquor before it is passed upwardly through the material within the cylinder or drum. The plate 13^a is supported and secured in position by means of the concentric annular flange 13^c, formed integral therewith and which is secured to the inner face of the cylinder or drum 13 in any suitable manner.

The reference-numeral 13^d denotes a concentric angle-bar secured to the inner face of the drum or cylinder in any suitable manner at the bottom thereof for reinforcing the lower end of the cylinder or drum, as well as forming a support therefor. The cylinder or drum 13 has connected thereto an annular band 14. The latter circumferentially extends around the periphery of the cylinder or drum at the top thereof and has formed in its top face an annular groove, in which is seated a strip of suitable packing material 15, the latter projecting above the top of the band 14. The band 14 is also provided on its top face near its outer edge with a ridge 16, the function of which will be hereinafter set forth. The band 14 is also formed with an opening 17, which extends transversely therethrough and registers with an opening 18 in the side of the cylinder or drum.

Arranged within the chamber 13^b is a dye-liquor-distributing pipe 19, concentric in contour and of inverted-U shape and provided throughout its inner and outer sides with the outlet-ports 20 21, respectively. The function of the pipe 19 is to provide means for properly distributing the dye liquor and to prevent the force of the pump, hereinafter referred to, from throwing the dye liquor against any one given point of the material. The pipe 19 rests upon as well as being secured in any suitable manner to the upper face of the bottom of the vat or tank 1, which forms the bottom of said pipe. The pipe 19 communicates with the openings 9 and 11 in the bottom of the tank or vat 1. The dye liquor is fed to the pipe 19 through the opening 9, and when occasion requires the dye liquor is exhausted from the pipe 19, as well as the chamber 13^b, through the opening 11. Centrally arranged within the chamber 13^b is a sleeve or collar 22, which engages at its top the plate 13^a and rests at its bottom upon the upper face of the bottom of the tank or vat 1. The opening through the sleeve or collar 22 is of such diameter that the walls thereof register with the edge of the opening 10 in the bottom of the vat or tank 1 and with the edges of a centrally-arranged opening in the perforated plate 13^a.

The reference-numeral 23 denotes a supporting-rod which extends through the cylinder or drum 13 and through the opening in the perforated plate 13^a, the sleeve or collar 22, the opening 10, and projects at its lower end below the vat or tank 1. The rod is screw-threaded at 23^a and at 23^b. The screw-threaded portion 23^a of the rod 23 carries a washer 24 and a nut 25, the washer 24 being interposed between the nut 25 and the lower face of the bottom of the tank or vat 1. Mounted upon the screw-threaded portion 23^b of the rod 23 is a vertically-adjustable eight-arm spider 26, to which is removably connected, by means of the screws 27, a perforated compression-plate 28, the latter being of such diameter as to fit closely within the cylinder or drum 13, but at the same time to permit of the vertical adjustment thereof. Mounted upon the rod 23 and engaging the spindle 26 is a fastening-nut 29 therefor. Mounted upon the screw-threaded portion 23^b of the rod 23 and above the nut 29 is a vertically-adjustable spider 30, carrying the removable cover-plate 31 for the drum or cylinder 13. The cover-plate 31 is of such diameter as to engage the top face of the band 14, with its edge fitting closely the ridge 16. The cover-plate 31 is not perforated and is removably secured to the spider 30 by means of the screws 32. The cover-plate 31 is arranged a suitable distance above the perforated plate 28 to form an auxiliary chamber 33 for the dye liquor before or after passing through the material and when entering and leaving the cylinder or drum 13.

The reference-numeral 34 denotes a fastening-nut for the spider 30, and the reference-numeral 35 denotes a wheel-wrench for loosening or tightening the nuts 29 and 34.

Communicating with the opening 12 in the bottom of the tank or vat 1 is a suction-pipe for the dye liquor. This pipe is adapted to carry the dye liquor which has been supplied to the tank or vat 1 to the pump, hereinafter referred to, and through the action of the pump and intermediate pipes the dye liquor is forced alternately and in opposite directions through the material to dye it. The suction-pipe is formed of sections 36 37 38, the section 36 communicating with the opening 12 and the section 38 communicating with the pump 39. The sections 36 and 37 are connected together by means of the T-coupling 40, in which is arranged a three-way valve 41. Connected to the T-coupling 40 and communicating with the opening 11 and with the circulating-pipe 19 is an auxiliary suction-pipe 42, which is normally closed by means of the valve 41. The suction-pipe 42 is opened when it is desired to remove all of the dye liquor from the tank or vat 1, the cylinder or drum 13, and the circulating-pipe 19 after the dyeing operation or before the washing operation.

The reference-numeral 43 denotes a T-coupling carrying a three-way valve 44. To the top of the coupling 43 is connected a pipe 45, lead-

ing to a suitable reservoir for the dye liquor. (Not shown.) To one side of the coupling 43 is attached a pipe connection 46, which communicates with the pump 39, and to the other side of the coupling 43 is attached the lower feed-pipe for the dye liquor, which communicates with the opening 9 and consists of the sections 47, 48, and 49. The section 47 is attached to the coupling 43 and by means of the T-coupling 50 to the section 48. The latter is connected by the T-coupling 51 to the section 47. Within the coupling 51 is arranged a three-way valve 52, the stem of which carries an operating-wheel 53, provided with a toothed rack 54. Attached to the top of the coupling 50 is the upper feed-pipe for the dye liquor and which consists of the sections 55 56 57. The sections 55 and 56 are connected together by the T-coupling 58, within which is arranged a three-way valve 59, the stem of which carries an operating-wheel 60, provided with a toothed rack 60^a. The sections 56 and 57 of the upper feed-pipe are connected together by the elbow 60^b. The free end of the section 57 extends through the opening 7 in the tank or vat 1 and into the opening 17, formed in the band 14. Connected to the T-coupling 58 is one section 61 of the dye-liquor-return pipe for the tank or vat 1, and the reference-numerals 62 and 63 denote the other sections of the said return-pipe. The sections 61 62 63 are connected together by the T-coupling 64, and the section 63 is also connected to the top of the T-coupling 51.

The valves 52 and 59 are operated simultaneously by means of a pair of worm-screws 64 65, carried by an operating-rod 67, provided with a hand-wheel 68. The rod is supported in the bearing-brackets 69 70. The worm-screw 64 meshes with the rack 54, and the worm-screw 65 meshes with the rack 60^a. It will be evident that when the rod 67 is operated it will cause the simultaneous operation of the valves 52 and 59.

The operation of the apparatus is as follows: The nut 34 is unscrewed from the rod 23 by means of the wrench-wheel 35, which will permit of the removal of the spider 30 and cover-plate 31. The nut 29 is then run off of the rod 23 and the spider 26 and perforated compression-plate 28 removed. This opens the top of the cylinder or drum 13, so that the material to be dyed can be placed therein. The material is then packed in the cylinder or drum 13. The perforated plate 28 and spider 26 are then mounted on the rod 23 and the material within the cylinder or drum 13 compressed to substantially a solid mass by the screwing down of the nut 29, which has been mounted on the rod 23. The spider 30 and the plate 31 are then placed on the rod 23 and screwed down thereon by means of the nut 34 until a water-tight joint is made between the band 14, packing 15, ridge 16, and the plate 31. This makes the cylinder or drum 13 water-tight. The dyestuff having previously been dissolved, the liquor is now run into the vat or tank 1 in such a quantity until it reaches the height of several inches above the plate 31. It is then brought to boil by the admission of steam to the coil 4, which is arranged between the vat 1 and cylinder or drum 13. The body of dye liquor is of such quantity that it completely submerges the cylinder or drum 13, so that when the liquor is drawn from the tank or vat 1 and forced through the material in the cylinder or drum a sufficient quantity of dye liquor will remain in the tank or vat 1 as to still submerge the cylinder or drum 13, or, in other words, the quantity of dye liquor is such that during the entire dyeing operation the cylinder or drum 13, containing the material, will be submerged. The pump 39 is then started, the pump sucking the dye liquor from the tank or vat 1 through the opening 12, the dye liquor passing down the pipe 36, through the valve 41 into the sections 37 and 38, and thence into the pump 39. The dye liquor is driven by the pressure of the pump 39 into the sections 47 and 48, through the valve 52 into the section 49, and thence into the circulating-pipe 19, passing out through the perforations 20 21 in the said pipe, then through the perforated bottom plate 13^a, through the material, thence through the perforated compression-plate 28, out through the opening 17 into the sections 57 and 56, through the valve 59 into the section 61, through the coupling 64 and section 62, and thence discharging into the tank or vat 1 at the opening 8. This operation is continued for a few minutes, when the three-way valves 52 and 59 are reversed by means of the worm-screws 64 65, which are operated by the rod 67 and wheel 68 and engage with the racks 54 60^a. This changes the course of circulation and sets the valves in such a manner that the dye liquor enters at the top through the opening 17 as follows, (the suction of the pump remaining the same:) The dye liquor is forced by the pressure of the pump 39 through the pipe connection 46, the three-way valve 48 into section 47, up through the T-coupling 50 into section 55, through the valve 59 into sections 56 57, and entering the top of the cylinder or drum 13 at the opening 17. The dye liquor then passes down through the perforated compression-plate 28 through the material, escaping into the circulator 19 through the perforations 20 21 into section 49, up and through the valve 52 into section 63, through the coupling 64, section 62, and discharging into the tank or vat 1 at the opening 8.

It will be observed by the foregoing operation that the liquor is forced to circulate in both directions—for example, starting at the top and passing down through the material or starting at the bottom and passing up through the material. The course of the circulation can be reversed as many times as it is necessary during the process of dyeing. The direct dyeing is continued for about an hour, when the dye liquor is drawn off from

the cylinder or tank 1 and discharged into a suitable receptacle, passing out through the three-way valve 44 and pipe 45. The tank or vat 1 is then filled with water and the material thoroughly washed by circulating water in alternate directions through the material until it becomes clean. It will be noted that after the finishing of the dyeing the drum or cylinder 13 is full of dye liquor up to the bottom of the opening 17. The suction-pipe 42 is then connected with the cylinder or drum 13 by means of the three-way valve 40, and the liquor is then drawn from the inner cylinder. It will also be evident that after the washing operation the cylinder or drum 18 is full of water up to the bottom of the opening 17. In this instance the suction-pipe 42 is again connected with the cylinder or drum 13 by means of the three-way valve 40, and the water is drawn from the said cylinder or drum 13 and the goods are ready to be removed.

It will be evident that owing to the compression of the material to be dyed the same will form a substantially solid mass and will also give a certain amount of resistance to the pump. It also insures a more uniform dyeing, as each and every portion of the material offers the same resistance to the dye liquor. It will also be evident that if the material was placed in a loose condition within the dyeing-cylinder the liquor would have a tendency to pass around the material and not directly through the material, as would be the case when it is compressed, or, in other words, the loose placing of the material within the cylinder will form passages through which the dye liquor will be forced, whereas if the material is compressed the same will be substantially a solid mass, so that, as above stated, a uniform dyeing is obtained, as each and every portion of the material offers the same resistance to the dye liquor, or, in other words, the dye liquor passes through the material in a uniform manner. It is well understood by every dyer that cotton yarn will not take up the dye matter readily; but by the operation of the apparatus hereinbefore set forth the dye liquor is forced through the material, leaving the dye-stuff on the same, and the water passes out. This is continued until the bath is exhausted and it is to be replenished to dye the second lot. It will also be evident that by the employment of the apparatus the dye liquor is saved and can be used over again.

It is thought the many advantages of my improved apparatus for dyeing yarns, hosiery, and other materials can be readily understood from the foregoing description, taken in connection with the accompanying drawings, and it will also be noted that minor changes may be made in the details of construction and arrangement of the various parts without departing from the general spirit of my invention.

Having thus fully described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In an apparatus for dyeing, an outer tank, a receptacle for the material arranged therein and forming at its bottom in connection with the bottom of the outer tank an auxiliary chamber, said receptacle adapted to receive the material to be dyed, means for compressing the material within said receptacle, means for supporting the said compression means, said supporting means extending through the said receptacle and connected with the bottom of said tank, a closure-plate for the said receptacle carried by the said supporting means and forming an auxiliary chamber between the said compression means and the said closure-plate, and means for distributing dye liquor in alternate directions through the said receptacle.

2. In an apparatus for dyeing, a tank, a receptacle for the material arranged therein, and a perforated distributing-pipe having its bottom wall formed by the bottom of said tank, said distributing-pipe arranged below the bottom of the said receptacle.

3. In an apparatus for dyeing, a tank, a receptacle for the material arranged therein, and a concentric perforated distributing-pipe having its bottom wall formed by the bottom of said tank, said pipe arranged below the bottom of the said receptacle.

4. In an apparatus for dyeing, a tank, a suction-pipe in communication therewith, a receptacle, feed-pipes for the dye liquor communicating therewith, valves in the said feed-pipes, means for simultaneously operating said valves to reverse the circulation of the dye liquor, and a perforated distributing-pipe having its bottom wall formed by the bottom of said tank and arranged below the bottom of said receptacle.

5. In an apparatus for dyeing, a tank, a cylinder, a band carrying a suitable packing secured to said cylinder, a vertically-adjustable closure-plate for said cylinder adapted to engage said band and packing to form a watertight closure, and a perforated dye-liquor-distributing pipe interposed between the bottom of said tank and cylinder.

6. In an apparatus for dyeing, a tank, a cylinder, a band carrying a suitable packing secured to said cylinder, a vertically-adjustable closure-plate for said cylinder adapted to engage said band and packing to form a watertight closure, a perforated dye-liquor-distributing pipe interposed between the bottom of said tank and cylinder, a suction-pipe in communication with said tank, feed-pipes for the dye liquor communicating with the cylinder, valves in the said feed-pipes, and means for simultaneously operating said valves to reverse the circulation of the dye liquor.

7. In an apparatus for dyeing, a tank, a cylinder, a band carrying a suitable packing secured to said cylinder, a vertically-adjustable closure-plate for said cylinder adapted to en-

gage said band and packing to form a water-tight closure, a suction-pipe communicating with said tank, feed-pipes for the dye liquor communicating with the said cylinder, valves in the said feed-pipes, and means for simultaneously operating said valves to reverse the circulation of the dye liquor.

8. In an apparatus for dyeing, a tank, a cylinder arranged therein and provided with a perforated bottom, a rod extending through said tank and cylinder, a vertically-adjustable perforated compression-plate carried by the rod and arranged within the cylinder, a vertically-adjustable cover-plate carried by the rod and adapted to engage the top of said cylinder to form a water-tight closure, a suction-pipe communicating with said tank, a lower feed and an upper feed pipe for supplying dye liquor to said cylinder, a return-pipe for the dye liquor communicating with said tank, a pump communicating with said feed and suction pipes, valves in the feed-pipes, and means for simultaneously operating the valves to reverse the circulation of the dye liquor through the cylinder.

9. In an apparatus for dyeing, a tank, a cylinder arranged therein and provided with a perforated bottom, a rod extending through said tank and cylinder, a vertically-adjustable perforated compression-plate carried by the rod and arranged within the cylinder, a vertically-adjustable cover-plate carried by the rod and adapted to engage the top of said cylinder to form a water-tight closure, a suction-pipe communicating with said tank, a lower feed and an upper feed pipe for supplying dye liquor to said cylinder, a return-pipe for the dye liquor communicating with said tank, a pump communicating with said feed and suction pipes, valves in the feed-pipes, toothed racks connected with said valves, worm-screws adapted to mesh with the said racks, and means for operating said screws, causing thereby the operation of the valves to reverse the circulation of the dye liquor through the cylinder.

10. In an apparatus for dyeing, a tank, a suction-pipe in communication therewith, a cylinder, an auxiliary suction-pipe in communication therewith, feed-pipes for the dye liquor communicating with the cylinder, a return-pipe communicating with the tank, and means for causing the circulation of the dye liquor through the said pipes.

11. In an apparatus for dyeing, a tank, a suction-pipe in communication therewith, a cylinder, an auxiliary suction-pipe in communication therewith, feed-pipes for the dye liquor communicating with the cylinder, a return-pipe communicating with the tank, valves in the said feed-pipes, a perforated distributing-pipe having its bottom formed by the bottom of the said tank and communicating with the said pipes for distributing a dye liquor, said distributing-pipe arranged below the bottom of said cylinder, and means for simultaneously operating the valves to reverse the circulation of the dye liquor through the feed-pipes.

12. In an apparatus for dyeing, a tank, a cylinder mounted therein and provided with a perforated bottom plate forming an auxiliary chamber between the same and the bottom of the tank, a distributing-pipe arranged in said auxiliary chamber, a feed-pipe for the dye liquor communicating therewith, a suction-pipe communicating with the tank, a compression-plate arranged in the said cylinder, a closure-plate for the said cylinder, said closure and compression plates forming an auxiliary chamber between them near the top of the cylinder, a feed-pipe for the dye liquor communicating with the said auxiliary chamber, and a pump communicating with the said pipes for circulating a dye liquor therethrough.

13. In an apparatus for dyeing, a tank, a cylinder mounted therein and provided with a perforated bottom plate forming an auxiliary chamber between the same and the bottom of the tank, a distributing-pipe arranged in said auxiliary chamber, a feed-pipe for the dye liquor communicating therewith, a suction-pipe communicating with the tank, a compression-plate arranged in the said cylinder, a closure-plate for the said cylinder, said closure and compression plates forming an auxiliary chamber between them near the top of the cylinder, a feed-pipe for the dye liquor communicating with the said auxiliary chamber, a pump communicating with the said pipes for circulating a dye liquor therethrough, valves in the said feed-pipes, and means for simultaneously operating the said valves to reverse the flow of the dye liquor therethrough.

14. In an apparatus for dyeing, a receptacle adapted to contain the material to be dyed, a perforated bottom for the said receptacle, a perforated compression-plate arranged in the said receptacle, a band connected to the periphery of the top of the said receptacle, a packing-strip carried by the band, and a closure-plate for the said receptacle adapted to engage the band and the packing for forming a water-tight closure.

15. In an apparatus for dyeing, a receptacle adapted to contain the material to be dyed, a perforated bottom for the said receptacle, a perforated compression-plate arranged in the said receptacle, a band connected to the periphery of the top of the said receptacle, a packing-strip carried by the band, a closure-plate for the said receptacle adapted to engage the band and the packing for forming a water-tight closure, a tank in which said receptacle is mounted, and a rod connected with said tank and adapted to support the said compression and closure plates.

16. In an apparatus for dyeing, a receptacle adapted to contain the material to be dyed, a perforated bottom for the said recep-

tacle, a perforated compression-plate arranged in the said receptacle, a band connected to the periphery of the top of the said receptacle, a packing-strip carried by the band, a closure-plate for the said receptacle adapted to engage the band and the packing for forming a water-tight closure, a tank in which said receptacle is mounted, a rod connected with said tank and adapted to support the said compression and closure plates, and a steam-coil interposed between said receptacle and tank.

In testimony whereof I have hereunto set my hand in presence of two subscribing witnesses.

JAMES A. WILLARD.

Witnesses:
R. H. WILLIAMS,
BATTLE MCLESTER.