(No Model.) 4 Sheets—Sheet 1.

A. GRAEMIGER & W. T. WHITEHEAD.

APPARATUS FOR DYEING, &c.

No. 511,945. Patented Jan. 2, 1894.

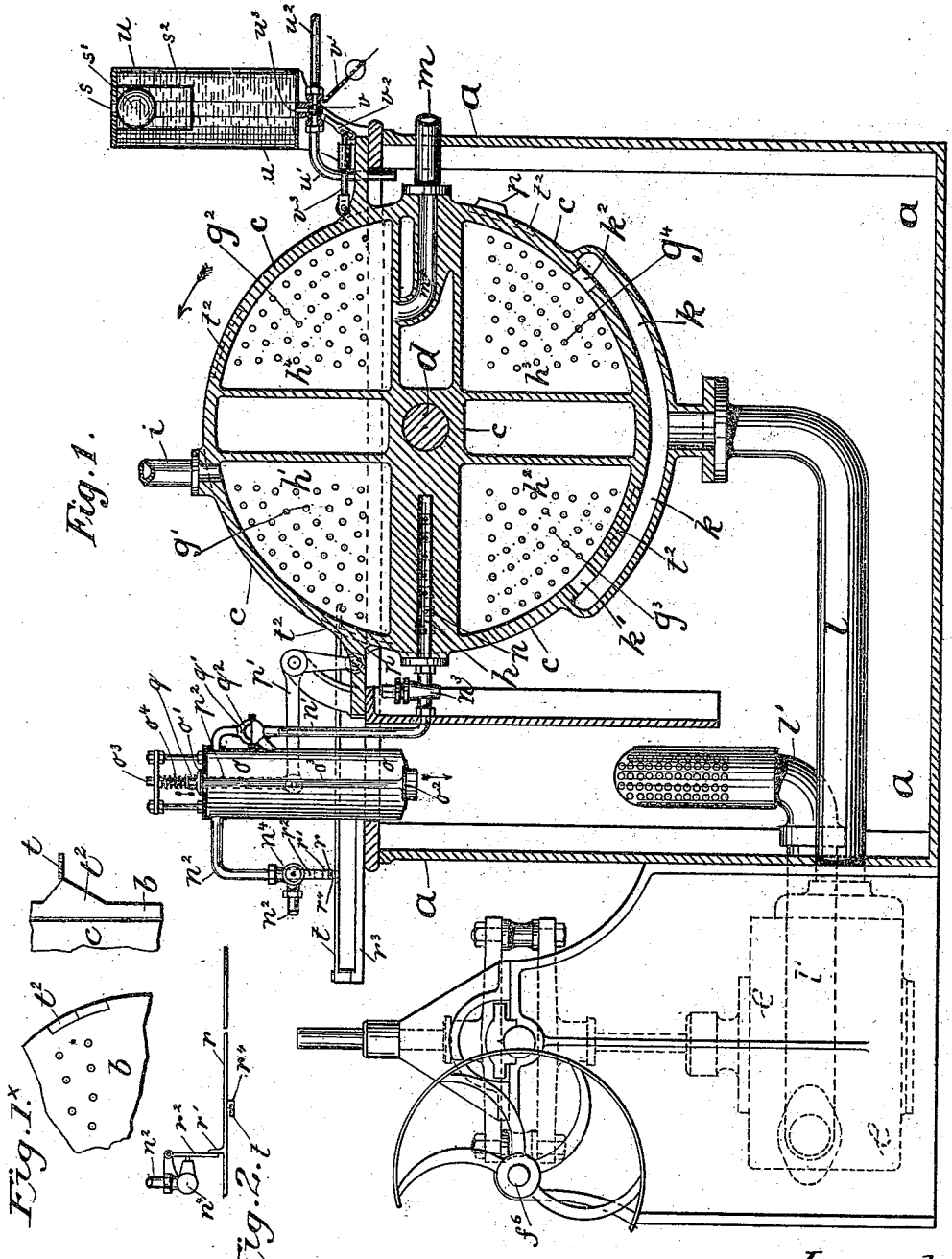


Fig. 1.

Fig. 1ˣ.

Fig. 2.

Witnesses.
Alfred Bosshardt.
Stanley Egerton Bramall.

Inventors.
August Graemiger.
William Thomas Whitehead.
per Ferdinand Bosshardt.
Attorney.

THE NATIONAL LITHOGRAPHING COMPANY.
WASHINGTON, D. C.

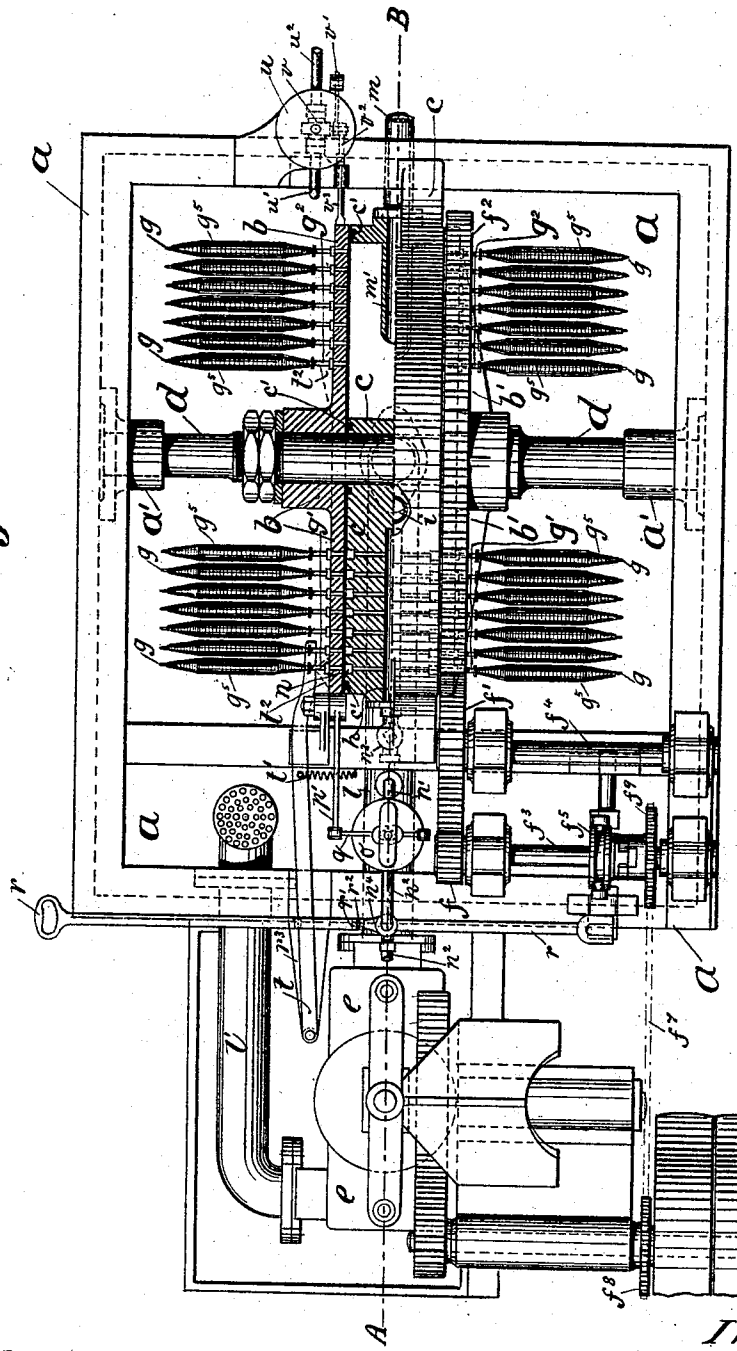
(No Model.) 4 Sheets—Sheet 2.

A. GRAEMIGER & W. T. WHITEHEAD.

APPARATUS FOR DYEING, &c.

No. 511,945. Patented Jan. 2, 1894.

Fig. 3.



Witnesses.
Alfred Bosshardt.
Stanley Egerton Bramall.

Inventors:
August Graemiger
William Thomas Whitehead
per Ferdinand Bosshardt
Attorney.

THE NATIONAL LITHOGRAPHING COMPANY,
WASHINGTON, D. C.

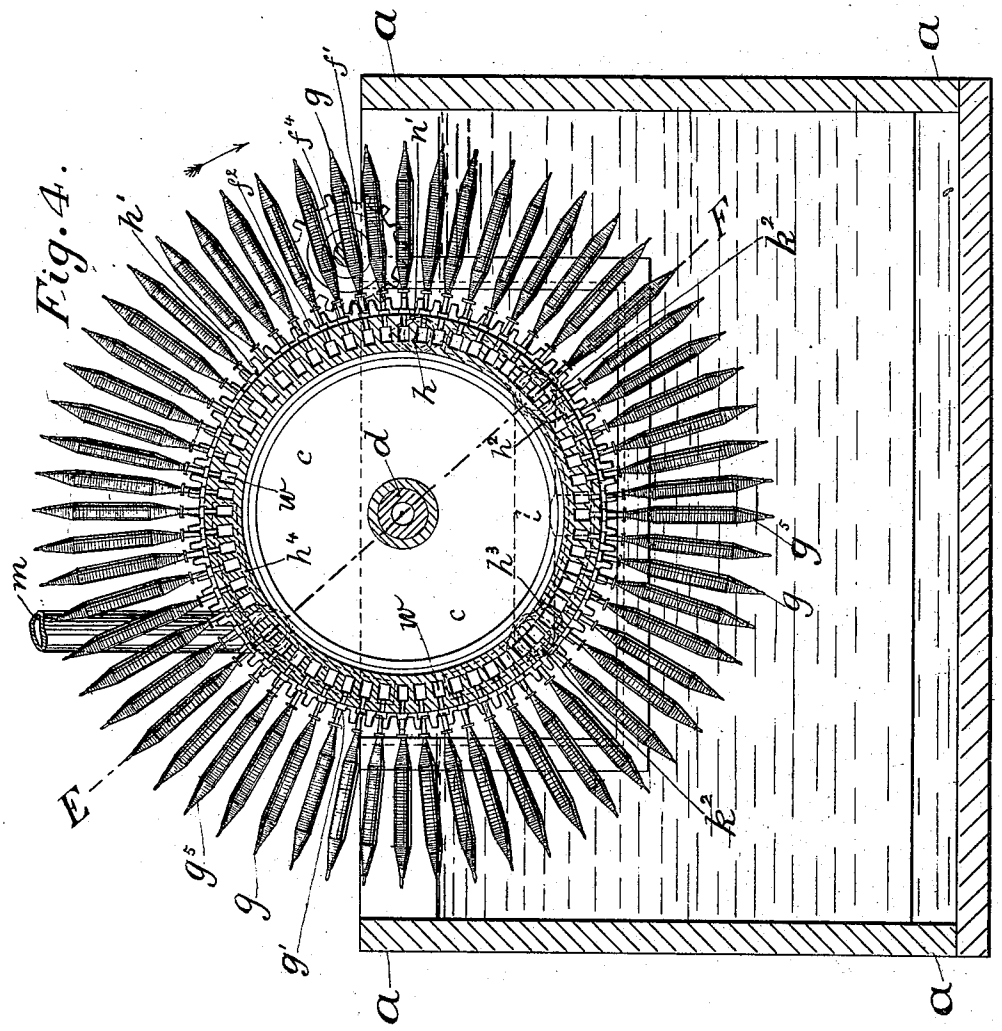
(No Model.) 4 Sheets—Sheet 3.

A. GRAEMIGER & W. T. WHITEHEAD

APPARATUS FOR DYEING, &c.

No. 511,945. Patented Jan. 2, 1894.

Fig. 4.



Witnesses.
Alfred Bosshardt.
Stanley Egerton Bramall.

Inventors.
August Graemiger.
William Thomas Whitehead
per Ferdinand Bosshardt.
Attorney.

THE NATIONAL LITHOGRAPHING COMPANY.
WASHINGTON, D. C.

(No Model.) 4 Sheets—Sheet 4.

A. GRAEMIGER & W. T. WHITEHEAD.

APPARATUS FOR DYEING, &c.

No. 511,945. Patented Jan. 2, 1894.

Fig. 6.

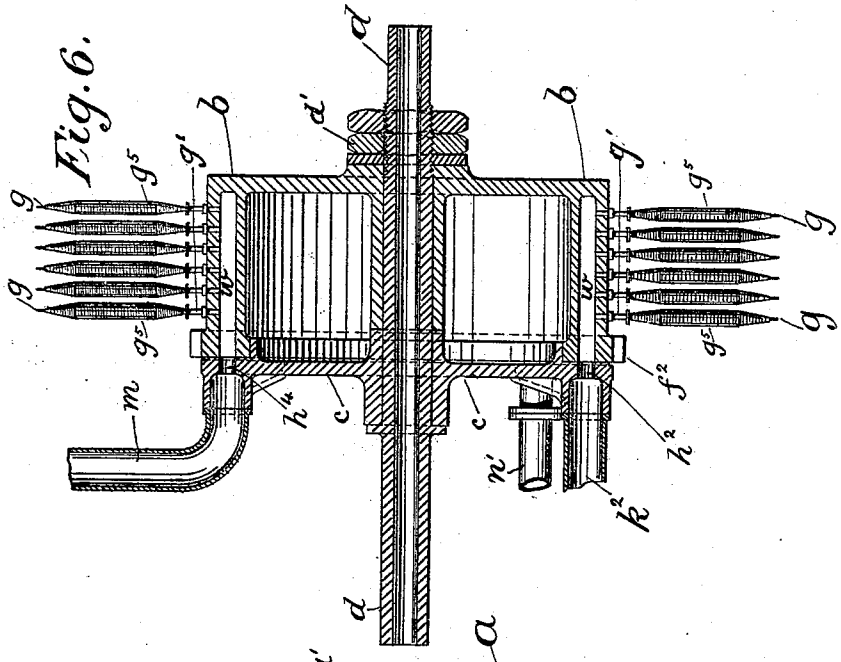
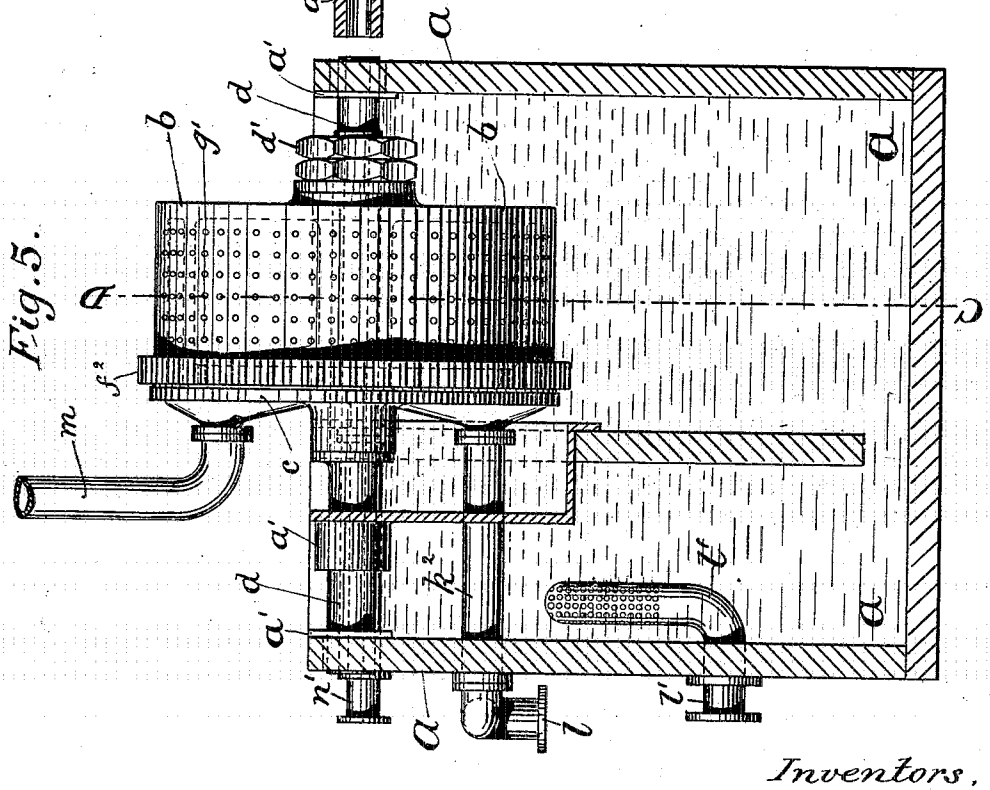


Fig. 5.



Witnesses.
Alfred Bosshardt.
Stanley Egerton Bramall.

Inventors,
August Graemiger.
William Thomas Whitehead.
per Ferdinand Bosshardt
Attorney.

THE NATIONAL LITHOGRAPHING COMPANY,
WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

AUGUST GRAEMIGER AND WILLIAM THOMAS WHITEHEAD, OF MANCHESTER, ENGLAND.

APPARATUS FOR DYEING, &c.

SPECIFICATION forming part of Letters Patent No. 511,945, dated January 2, 1894.

Application filed January 2, 1890. Serial No. 335,704. (No model.) Patented in England June 12, 1889, No. 9,692.

To all whom it may concern:

Be it known that we, AUGUST GRAEMIGER, a citizen of the Republic of Switzerland, and a resident of Cheetham, and WILLIAM THOMAS WHITEHEAD, a subject of the Queen of Great Britain, and a resident of Radcliffe, Manchester, in the county of Lancaster, England, have invented new and useful improvements in machines for dyeing, bleaching, and otherwise treating yarn in cop or other compact form, of which the following is a specification.

The invention has been patented in England to ourselves and others, No. 9,692, dated June 12, 1889.

Our invention relates to improvements in machines for dyeing, bleaching or otherwise treating yarn in cop or other compact form and is of general applicability to machines in which an intermittent rotary cop carrier in conjunction with a carrier body is employed in a liquor tank, and in which the cops to be dyed or otherwise treated are placed on perforated injection tubes or spindles and the liquor is drawn or forced through the same by suitable means; and the objects of our improvements are, first, to reduce friction between the cop carrier and carrier body and to increase the capacity of the machine; second, to provide means whereby the liquor left in the cops from boiling or mordanting can be extracted; third, to separate the air and liquor extracted from the cops by the preliminary exhaustion chamber so as to prevent the liquor from entering the air pump and to effect the return of the same into the tank free of air; fourth, to provide means whereby the machine, on being set in motion by the attendant, automatically opens the vacuum valve in connection with the preliminary exhaustion chamber and air pump, closes the same and stops the machine to permit the substitution and desired treatment of the cops; fifth, to provide means whereby the liquor is automatically supplied to the tank in certain quantities according to the number or weight of cops to be treated. We attain these objects by the mechanism illustrated in the accompanying four sheets of drawings, in which—

Figure 1, Sheet I., is a vertical section through A—B Fig. 3, Sheet II. Fig. $1^{\times}$ is a detached side and front view of one of the cams on the cop carrier operating the lever arm in connection with the vacuum valve mechanism; Fig. 2, a side view of the vacuum valve detached and Fig. 3, Sheet II., a plan partly in section of a machine with a double disk cop carrier. Fig. 4, Sheet III., is a section through C—D Fig. 5, Sheet IV., and the latter a side view with liquor tank in section, and Fig. 6, Sheet IV, a longitudinal section through E—F Fig. 4, Sheet III., of a machine with a cylindrical cop carrier.

Similar letters refer to similar parts throughout the several views.

Referring to Figs. 1, 2 and 3, Sheets I and II, a is the liquor tank, b, b' the cop carrier, c the carrier body, d the cop carrier axis, e the liquor pump of the machine.

In the tank a is employed a cop carrier, consisting of two disks b, b', suitably fixed on the axis d mounted in bearings a' and intermittently rotated by means of spur wheel gearing f, f', f^2, shafts f^3 and f^4 and clutch f^5, from the driving shaft f^6 through chain f^7, sprocket wheels f^8 and f^9. In conjunction with the said two carrier disks b, b', a central stationary carrier body c, bolted to the liquor tank a, is ground or by means of rubber rings c' fitted air tight between the inner faces of the disks b, b'. The outer faces of the carrier disks b, b' are respectively formed with four cop tube hole or nipple groups g', g^2, g^3, and g^4, which serve to receive the perforated injection tubes g on which the cops g^5 to be treated are placed.

The carrier body c is formed with four chambers h', h^2, h^3, h^4, which on the intermittent rotation of the cop carrier b, b', come successively into communication with each of the four groups of cop tube holes or nipples g', g^2, g^3, and g^4, so as to permit in chamber h' substitution and liquor (from boiling or mordanting) extraction, chambers h^2 and h^3, saturation and impregnation, and chamber h^4 liquor extraction of the cops.

To the top of the carrier body c is connected a pipe i, which is in connection with a pump and communicates with the chamber h', by means of which the liquor left in the cops from boiling or mordanting, (which hereto-

fore had to be recovered) can be removed in the same machine in which they are dyed, the chamber h' thus serving as a primary liquor exhaustion chamber. The carrier body c, below the liquor level in the tank a, is formed with a cavity k, having two ports k', k^2 leading respectively to the saturation and impregnation chambers h^2 and h^3 and the pipe l connected thereto leading to the liquor pump e so as to subject four cop groups simultaneously to saturation and impregnation, the liquor being returned into the tank a by the pump e through the pipe l'.

Between the saturation and impregnation chamber h^3 and the liquor extraction chamber h^4, an inlet pipe m connected to a pump, not shown, is fitted thereto, which communicates with a port m' leading to the liquor extraction chamber h^4.

Between the primary liquor extraction chamber h' and the saturation and impregnation chamber h^2, the preliminary or air exhaustion chamber h having ports n, is formed, which are equal in number to and in communication with the circular rows of cop tube holes or nipples in the carrier disks b, b'. To the said preliminary or air exhaustion chamber h, is connected an inlet pipe n', n^2 furnished with a tap n^3 leading to an air pump, not shown, which tap n^3 serves to cut off the respective connection as desired for certain colors. Into this pipe n' and n^2 we insert an air and liquor separator, consisting of a cylinder or casing o provided at the top and bottom respectively with air and liquor valves o' and o^2 formed on the rod o^3 and held against their seatings by means of a spring o^4. These valves o', o^2 are automatically opened, the moment before the preliminary extraction of liquor or air exhaustion from the cops takes place, by means of one or more cams p fixed to the carrier disk b operating a bell crank lever p' connected by means of a rod p^2 to the forked lever q pivoted to the cylinder or casing o and embracing the valve rod o^3.

The side of the cylinder or casing o near the tap n^3 of the preliminary exhaustion chamber h, is furnished with a chamber q' which is in communication therewith and the pipe n' and furnished with a perforated division plate q^2, preferably concave, against which the air on rushing from the preliminary exhaustion chamber h strikes, so as to cause any liquor which it may contain to separate therefrom and descend into the lower part and the air to ascend into the upper part of the said cylinder o, from which the air is permitted to escape, and the liquor returned into the tank a on the valves o', o^2 being opened as aforesaid.

The pipe n^2 between the cylinder or casing o is provided with the vacuum valve n^4 by means of which communication is established and cut off as required between the air pump and preliminary extractor h, automatically as follows: In connection with the clutch f^5 a shipping rod r is employed which when pushed forward by the attendant throws the clutch f^5 in gear and sets the machine in motion, the part of the clutch f^5 which otherwise revolves loosely on the shaft f^3 being formed with a sprocket wheel f^9 to which motion is transmitted from the sprocket wheel f^8 on the shaft f^6 by means of the chain f^7.

The shipping rod r is furnished on its upper side with a projection r' bearing against a lever r^2 suspended from the casing of the vacuum valve n^4 and bearing against the stem of the latter. Below the shipping rod r is positioned a lever arm t, pivoted to a bracket r^3, bolted to the tank a, which lever arm t is under the influence of a spring t' Fig. 3 and operated upon intermittently by four cams t^2 which operate respectively in connection with each cop group g', g^2, g^3, g^4. When the carrier disks b, b' are at rest, the vacuum valve n^4 is closed and the free end of the lever arm t, on the point of the cam t^2 belonging to the cop group next thereto, while a projection r^4, provided on the under side of the shipping rod r, bears against the front edge of the lever arm t.

When it is desired to commence the rotation of the carrier disks b, b', the free end of the shipping rod r is raised a little, so as to free the lever arm t from the projection r^4 and afterward pushed forward causing the projection r' to depress the lever r^2 and the latter the stem of the vacuum valve n^4 thus opening the valve n^4 and the shipping rod r at the same time throws the clutch f^5 in gear. The free end of the lever arm t is then caused to move down the incline of the respective cam t^2 toward the disk b, which causes the projection r^4 to leave the upper side of the lever arm t, drop and position itself again against the front edge of the latter. During the rotation of the carrier disks b b', the vacuum valve n^4 remains open until one of the series of cop groups has passed the preliminary exhaustion chamber h. The cam t^2 of the next cop group then comes into contact with the arm t, moves it outward and causes the latter to draw with it the shipping rod r and thus close the vacuum valve n^4, throw the clutch f^5 out of gear and thereby stop the machine.

The liquor in the tank a is automatically replenished by means of a charging vessel u which is in communication with the same, by means of the pipe u' and with a liquor reservoir not shown, by means of the pipe u^2. The charging vessel u at its lower extremity is formed with a port u^3 which is in communication with a two way tap v having attached to its spindle a weighted lever v' and slot lever v^2 the latter being connected to a sliding rod v^3 which is acted upon by one or more cams p fixed to the cop carrier disk b and establishes communication between the charging vessel u and the liquor tank a. The cam p may be made adjustable in length so as to retain the communication, between the liquor tank a and the charging vessel u, open any desired period, thus supplying more or

less liquor to the tank a as may be required for the number or weight of cops to be treated and to keep the liquor in the tank a always at the same level. When the cam p leaves the rod v^3 the weighted lever v' turns the tap v and establishes communication between the liquor reservoir and the charging vessel u, which latter is formed at the top with an air hole s and ball valve s' which floats in a cage s^2 on the liquor and closes the air hole s when the charging vessel u is full.

In order to diminish friction and insure always a good joint between the cop carrier b and its body c in a cylindrical machine, see Figs. 4, 5, and 6, Sheets III and IV, we form the carrier body c so as to constitute one end of the cop carrier b, against which the latter rotates, in lieu of inside the same. This carrier body c is formed with segmental chambers h, h^2, h^3, h^4 for effecting substitution, preliminary extraction, saturation, impregnation and liquor extraction of cops similar as hereinbefore described, each chamber being respectively in communication with the conduits n', k^2, m.

In lieu of forming the cop tube holes or nipples in the cop carrier b in groups, we form the same in rows, at equal distances apart, all round the periphery of the cop carrier b, a separate segmental cavity w being formed in the carrier body c for each row instead of for a series thereof, which greatly increases the capacity of the machine and causes the cops to be treated more effectually and uniformly.

The cop carrier b and its body c are suitably fixed onto the axis d and made adjustable thereon against each other by means of nuts d' and to insure an air tight fit between the same, the respective surfaces are ground together or furnished with rubber rings.

Referring more particularly to Figs. 1 and 2, the operation of the machine is as follows: After the tank a has been supplied with liquor, and assuming the nipple groups g', g^2, g^3, g^4, on the carrier b, b' are positioned respectively opposite the chambers h', h^2, h^3, h^4, in the carrier body c, the nipple groups g' are supplied with cops g^5 previously mordanted, and the superfluous mordant extracted from the respective cops g^5 by means of a suction pump (not shown) and the pipe i connected thereto and the chamber h', which latter then communicates with the nipple and cop groups g'. After the extraction of the mordant, as described, the cop carrier b, b', is set in rotation, by pushing the lever r forward which throws in gear the clutch f^5. Power is transmitted through the chain f^7, wheels f^8, f^9 and gears f, f', to the disks b and b', until the cam t^2 of the nipple and cop groups g', comes into contact with and moves the lever t and the latter the shipping rod r outward, so as to throw the clutch f^5 out of gear and thus limit the rotation of the cop carrier b, b' to a quarter of a revolution. At the commencement of the rotation of the cop carrier b, b' the valve n^4, which when the machine is at rest is closed, is opened through the mediums r', r^2 and thereby communication established, by way of tap n^3, pipes n', n^2 and vessel o, between the vacuum pump (not shown) and the preliminary extraction chamber h. During this first quarter of a revolution of the cop carrier b, b', each radial row of its perforations is successively brought in communication with the ports n leading to the preliminary exhaustion chamber h and thus the nipple and cop groups g', for a short period subjected to the action of a vacuum pump (not shown) for the purpose of emptying the same of air previous to being saturated and impregnated. On the completion of the first quarter of a revolution of the cop carrier b, b' which takes place automatically as described, its nipple groups g^2, will be positioned opposite the mordant extraction chamber h' and its nipple and cop groups g' opposite the saturation and impregnation chamber h^2. The nipple groups g^2 are then supplied with mordanted cops g^5 and the superfluous mordant extracted therefrom as described, while the cops g^5 of the nipple group g' are subjected to the action of the liquor pump e, which draws the liquor from the tank a through the same into the saturation and impregnation chamber h^2, and through port k', cavity k, pipes l and l' back into the tank a. After a sufficient period the cop carrier b, b' is rotated for a second quarter of a revolution during which the cops g^5 of the nipple groups g^2 are subjected to the action of the vacuum pump (not shown) in the manner as hereinbefore described. On the completion of the second quarter of a revolution of the cop carrier b, b' the nipple groups g^4 and nipple and cop groups g^2 and g' are respectively positioned opposite the mordant extraction chamber h', saturation and impregnation chambers h^2 and h^3. The nipple groups g^3 are then supplied with mordanted cops g^5 and the superfluous mordant extracted therefrom, while the cops g^5 of the nipple groups g^2 and g' are subjected to the action of the liquor pump e, as previously described, the cops g^5 of the nipple groups g' thus receiving a second saturation and impregnation. After a second period the rotation of the cop carrier b, b' is continued for a third quarter of a revolution, during which the cops g^5 of the nipple groups g^4 are subjected to the action of the vacuum pump (not shown) in the manner described. On the completion of the third quarter of a revolution of the cop carrier b, b' the nipple groups g^3 and nipple and cop groups g^4, g^2 and g' are respectively positioned opposite the mordant extraction chamber h', saturation and impregnation chambers h^2 and h^3, and dye liquor extraction chamber h^4. The nipple groups g^3 are then supplied with mordanted cops g^5 and the superfluous mordant extracted therefrom, while the cops g^5 of the nipple groups g^4 and g^2 are subjected to the action of the liquor pump e, as previously described, the cops g^5 of the

nipple groups g^2 thus receiving a second saturation and impregnation. The cops g^5 of the nipple groups g' in the meantime are subjected to the action of a suction pump (not shown), which is in communication with the chamber h^4 by means of the pipe m and port m', for the purpose of extracting therefrom the superfluous dye, which completes the dyeing of the cop groups g'. After a third period, the rotation of the cop carrier b, b' is continued for the remaining quarter of a revolution, during which the cops g^5 of the nipple group g^3 are subjected to the action of the vacuum pump (not shown) in the manner described. On the completion of the fourth quarter of a revolution of the cop carrier b, b', the nipple and cop groups g' have arrived at their starting point, viz., the mordant extraction chamber h', where the dyed cops g^5, are substituted for mordanted ones, while the nipple and cop groups g^3, g^4 and g^2 are respectively positioned opposite the saturation and impregnation chambers h^2 and h^3 and dye extraction chamber h^4, and the cops g' thereof are subjected to the action of pumps as hereinbefore described.

What we claim as our invention, and desire to secure by Letters Patent, is—

1. In machines for dyeing, bleaching, and otherwise treating yarn in cop or other compact form, a central carrier body c fixed to a liquor tank and having chambers h, h', h^2, h^3, h^4, each communicating with a suitable pump, in combination with a cop carrier, consisting of two disks b, b' formed respectively with four groups of cop tube holes or nipples g', g^2, g^3, g^4, adapted to receive cops g^5 and to be intermittently rotated, by suitable means, hermetically against each side of the central body C, so as to subject by means of the said pumps, the cops g^5 of the said groups, on passing over the ports n in the chamber h to air exhaustion and when positioned opposite the chambers h', h^2, h^3, h^4, respectively, to mordant extraction, saturation and impregnation, and liquor extraction, all substantially as set forth.

2. In machines for dyeing, bleaching, and otherwise treating yarn in cop or other compact form, the combination with the tank, the cop carrier the air exhaustion chamber h in the carrier body c and the automatically operated vacuum valve n^4 of an air and liquor separator consisting of a cylinder or casing o furnished with upper and lower valves o' and o^2 and having a chamber q at its side, which contains a perforated division plate q^2 pipes in communication with the upper portion of the cylinder or casing o and the air exhaustion chamber h the said lower valve controlling the opening from the cylinder to the tank and the said upper valve controlling the port leading to the outside air and suitable means for operating the valves, substantially as described.

3. In combination, in a dyeing and bleaching machine the combination of the cop carrier b having cams t^2 projecting therefrom, the means for turning the cop carrier, the clutch f^5, the vacuum valve n^4 with the pipe leading therefrom to the cop carrier, the lever arm t, the spring t' therefor, the shipper rod having the projection r' to operate the stem of the vacuum valve and having also the projection r^4 to engage the lever arm t, said arm t being arranged in the path of the cams on the cop carrier whereby the movement of the said arm t under the action of the cam will operate the shipper rod by engaging the projection r^4 to release the clutch and to close the vacuum valve, substantially as described.

4. In a machine for dyeing, bleaching, and otherwise treating yarn in cop or other compact form, the liquor charging vessel u fixed to the liquor tank a and having at its upper end an air valve s, s', s^2 and at its lower end a port u^3 and a two way tap n^3 adapted to alternately establish and cut off communication between the liquor charging vessel u, and the liquor tank a and having attached a weighted lever v' and slotted lever v^2, which latter is connected to a sliding rod v^3 suitably guided, in combination with an intermittently rotated cop carrier b, having cams p which are adapted to push the rod v^3 and the latter by means of the lever v^2 to turn the tap n^3 and thereby establish communication between the liquor charging vessel u and tank a, while on the cam p leaving the rod v^3 the weighted lever arm v' reverses the movement of the tap n^3 and thereby cuts off the aforesaid communication, all substantially as and for the purpose specified.

5. In a machine for dyeing, bleaching and otherwise treating yarn in cop or other compact form, the cop carrier b formed with cop tube hole or nipple rows g' all round its periphery and with a separate cavity w for each row in combination with a carrier body c stationary on the axis d and bearing hermetically against the end of the cop carrier b, and having the chambers h, h^2, h^3, h^4, means for rotating the carrier to successively bring the mouth of the cavities w in communication with the segmental chambers h, h^2, h^3, h^4 of the body c, and suitable pumping means connected with the chambers adapted to subject the cop rows g' to preliminary or air exhaustion, saturation and impregnation, liquor extraction and substitution as said rows are moved over said chambers, substantially as and for the purpose set forth.

AUGUST GRAEMIGER.
WILLIAM THOMAS WHITEHEAD.

Witnesses:
ALFRED BOSSHARDT,
STANLEY EGERTON BRAMALL.