Dec. 29, 1931. J. P. GAREY ET AL 1,838,385

DYEING METHOD AND APPARATUS

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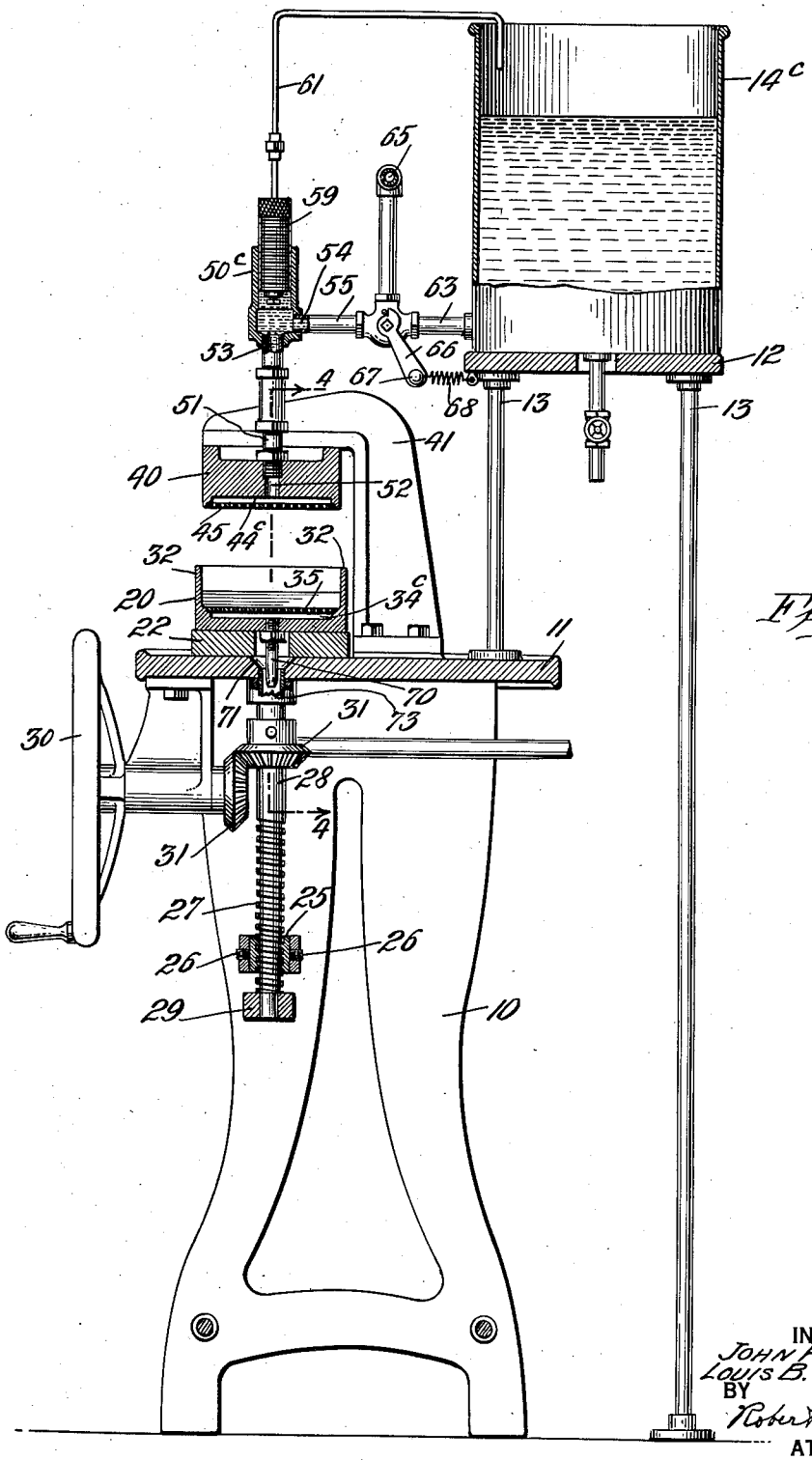

Fig. 1.

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Fig. 2.

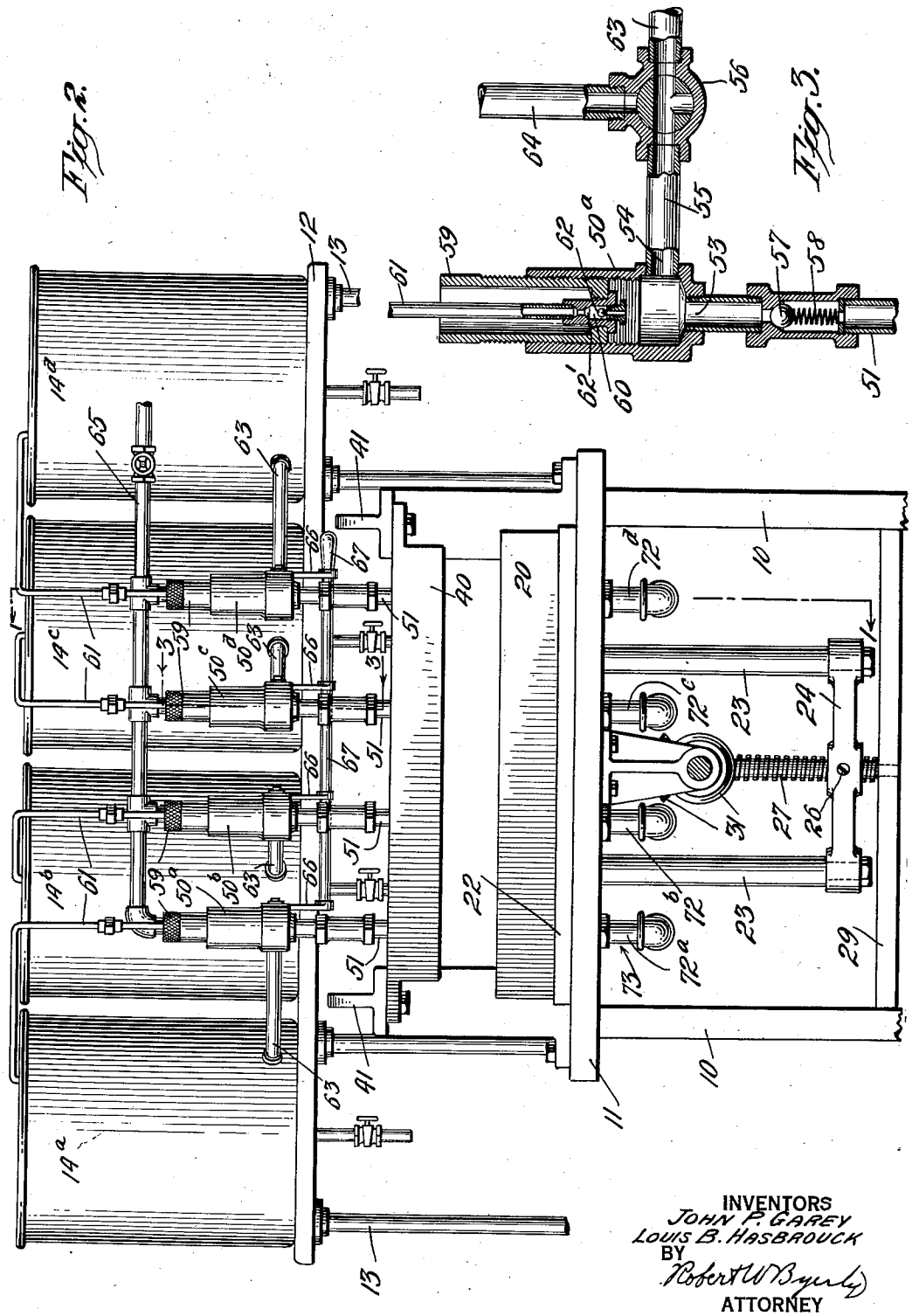

Fig. 3.

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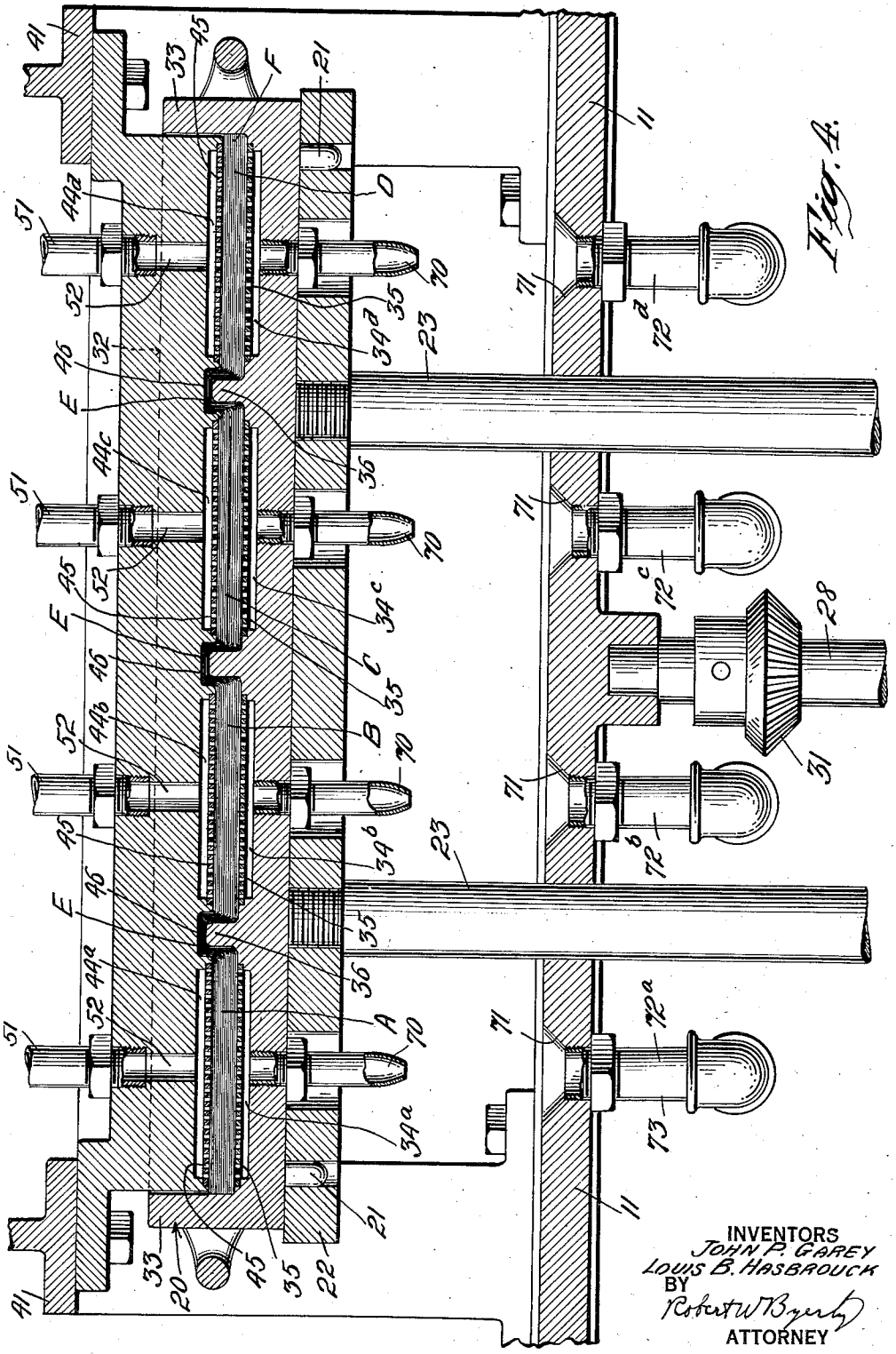

Fig. 4.

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UNITED STATES PATENT OFFICE

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DYEING METHOD AND APPARATUS

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This invention relates to dyeing methods and apparatus. An important object of the invention is to provide for the random-dyeing of artificial silk thread in skein form, but many features of the invention are of general application in the dyeing of absorbent masses.

Standard methods of random-dyeing in the mass, such as that of Van Ness Patent No. 1,456,344, cannot be applied economically to artificial silk thread, owing to the fact that such thread is ordinarily packaged in the form of loose skeins instead of as a wound mass. Prior to our invention, attempts had been made to random-dye such skeins by covering portions of them and then immersing them in a tank of dye. Such expedients have proved unsatisfactory owing to the difficulty of coloring evenly the portion to be dyed, and have proved uneconomical because of the large excess quantity of dye necessary. By means of the present invention these difficulties are overcome and a practical and economical way of random-dyeing such skeins is provided.

In an approved form of apparatus embodying our invention, spaced portions of one or more skeins are compressed between perforated plates, while the intermediate parts of the skein or skeins not to be colored are tightly clamped between imperforate members. The portions of the skein or skeins clamped between the perforated plates are then dyed by passing dye through each of them from one plate to the other. Different colored dyes may be applied to the parts of the skein or skeins held between different pairs of perforated plates.

An important feature of the invention, which is of general application, consists in passing through the portion of the mass to be dyed, a limited quantity of dye only slightly in excess of that necessary to color this portion and immediately removing all excess dye from this portion of the mass. This is accomplished by applying a limited quantity of dye to the upper surface of the part of the mass to be colored and then applying air or gas pressure to the limited quantity of dye, so that the air or gas forces the dye into and through the mass, and then follows the dye through the mass, removing any surplus dye therefrom.

The invention may be best understood from a detailed description of a practical skein dyeing machine which is shown in the accompany drawings, in which:

Fig. 1 is an end elevation of the machine sectioned on the line 1—1 of Fig. 2;

Fig. 2 is a front elevation of the machine;

Fig. 3 is an enlarged fragmentary vertical section, taken on the line 3—3 of Fig. 2, and showing one of the measuring cups and the valves associated therewith; and

Fig. 4 is an enlarged fragmentary front elevation sectioned on the line 4—4 of Fig. 1.

The machine illustrated has a frame 10 supporting a table 11. Behind and above the table 11 is a raised platform 12 mounted on standards 13 and supporting a plurality of dye reservoirs 14*a*, 14*b*, 14*c*, 14*d*.

Means for supporting and clamping skeins are mounted on the table 11. They include a movable lower clamping block 20 and a fixed upper clamping block 40.

The lower clamping block 20 is removably mounted by means of dowel pins 21, on a plate 22 which normally lies on the table top 11 as shown in Figs. 1 and 2, but may be moved vertically upward by any convenient form of mechanism. The mechanism for this purpose, which was shown in the drawings, includes two vertical slide rods 23 passing through holes in the table 11 and carrying the plate 22 at their upper ends. The rods are connected by a cross bar 24 which has at its middle a nut 25, held against rotation by set screws 26, and engaging a threaded part 27 on a vertical shaft 28, having an upper bearing in the bottom of the table and a lower bearing in the cross bar 29 of the frame 10, which hold it against vertical movement. A hand wheel 30, connected with the shaft 28 by beveled gears 31, provides means for turning the shaft 28, and thus forcibly raising the plate 22 and the block 20.

The upper clamping block 40 is carried by two brackets 41, rising from the table 11.

The lower clamping block 20 has side walls 32 and end walls 33, so that it forms a box

or trough for the reception of the skeins to be dyed. The upper surface of the bottom of the block 20, contains a plurality of spaced recesses 34*a*, 34*b*, 34*c*, 34*d*, each of which is covered by a perforated plate 35. Between the recesses 34*a*, 34*b*, the recesses 34*b*, 34*c*, and the recesses 34*c*, 34*d*, the block 20 is provided with transverse ribs 36 which project above the upper surfaces of the perforated plates 35.

The upper block 40 is of such size that it may enter between the side and end walls 32, 33 of the block 20 as a plunger when the block 20 is raised. The lower surface of the block 40, is provided with spaced recesses 44*a*, 44*b*, 44*c*, 44*d*, registering with the recesses 34*a*, 34*b*, 34*c*, 34*d*, of the lower block 20. Each of the recesses of the upper block 40, is covered by a flat perforated plate 45. Between the recesses 44*a*, 44*b*, the recesses 44*b*, 44*c*, and the recesses 44*c*, 44*d*, the block 40 is provided with transverse grooves 46.

In preparing skeins for dyeing in the machine, the skeins are spread out lengthwise in the box-like lower block 20, while this block is down against the table 11, as shown in Fig. 1, and the block 20 is then raised to clamp these skeins between the blocks 20 and 40. As clearly shown in Fig. 4, four spaced portions A, B, C, D, of the skeins are compressed between the pairs of perforated plates 35, 45. The intermediate parts E of the skeins are tightly clamped between the ribs 36 and the grooves 46, while the ends F of the skeins are clamped between the extreme end portions of the blocks. This has the effect of forming the skeins into a plurality of compressed masses separated by packings provided by the still more compressed intermediate parts of the skeins themselves.

The machine includes means for passing limited quantities of different colored dyes through the compressed masses A, B, C, D, and for removing all surplus dye from these masses. The parts of the machine for accomplishing these purposes, will next be described.

The recesses 44*a*, 44*b*, 44*c*, 44*d* of the upper block, are connected with measuring cups 50*a*, 50*b*, 50*c*, 50*d*, by means of fixed conduits 51, communicating with bores 52 in the block 40. Each of the measuring cups has at its bottom, an outlet opening 53, communicating with one of the conduits 51, and a lateral intake opening 54, connected by a pipe 55 with a three-way valve 56. The outlet opening 53 is controlled by an outwardly opening valve 57 normally closed by a spring 58. The capacity of each measuring cup may be varied by means of an adjustable closure 59, screwed into the upper end of the cup. In the closure of each cup 59 is an air vent opening 60, to which is connected a small splash pipe 61, extending into the top of the dye reservoir which is associated with this measuring cup. In the air vent opening 60 is a small inwardly opening ball valve 62. Each of the three-way valves 56, is connected by a pipe 63 with the lower part of one of the dye reservoirs 14*a*, 14*b*, 14*c*, 14*d*, and, by a branch pipe 64, with a conduit 65 leading from a supply of compressed air or other gas. The operating arms 66 of the four three-way valves are connected to a common handle rod 67, which is normally held by means of a spring 68 in position to connect the intake openings of all the measuring cups with their dye reservoirs.

When the three-way valves are in their normal position dye flows from the reservoirs 14*a*, 14*b*, 14*c*, 14*d*, into the measuring cups 50*a*, 50*b*, 50*c*, 50*d*, filling each cup with the dye provided in its reservoir. The springs 58 of the valves 57, have sufficient strength to keep these valves closed against the hydrostatic head of the dye in the reservoirs, so that no dye passes through the conduits 51 during the filling operation. The air with which the cups were filled when the dye was admitted to them, passes out through the air vent openings 60. The rate of flow of this air is not sufficient to raise the balls 62 against their seats 62′. Any dye which may pass through the air vent openings stands in the pipes 61.

In dyeing the masses A, B, C, D, after the lower block has been raised to compress them and the measuring cups have been filled, the handle rod 67 is pulled forward so that the three-way valves 56, connect to inlet opening 54 of each measuring cup with air pipe 65. The air flowing into the measuring cups under pressure, starts to flow out through the air vent openings 60 so rapidly that it raises the balls 62 against their seats 62′ and cuts off these openings. The air forces the dye in each measuring cup against the valve 57 with sufficient force to open this valve. The dye from the measuring cups 50*a*, 50*b*, 50*c*, 50*d*, therefore falls into and fills the recesses 44*a*, 44*b*, 44*c*, 44*d* in the upper block 40, and comes into contact with the upper surface of the compressed masses A, B, C, D, through the perforations in the plates 45. The air forces the dye from each of the recesses of the block 40, into and through the compressed mass below that recess, and then follows the dye through the mass, removing any excess dye.

The excess dye and the air, passes out of the compressed masses through the plates 35, into the recesses 34*a*, 34*b*, 34*c*, 34*d*, of the lower block 20, from which the excess dye and air escape through discharge nipples 70, extending through the bottom of the block 20 and through the plate 22. The excess dye falling from the nipples 70 is caught in conical cups 71, formed in the table 11. These cups are connected by four separate drain pipes 72*a*, 72*b*, 72*c*, 72*d*, with separate receptacles (not

shown) in which the excess dye is preserved for re-use. It should be noted that although the nipples 70 extend below the lower surface of the plate 22, they do not prevent lowering this plate against the table 11, as when the plate is lowered they enter and lie within the cups 71 and vertical portions 73 of the drain pipes.

After the flow of air has removed the excess dye from the compressed masses, which takes only a few moments, the handle 67 is allowed to return to its normal position, cutting off the flow of air to the measuring cups, and allowing them again to fill up with dye. The lower block 20 and plate 22 are then brought down against the table 11 by turning the hand wheel 30 so that the dyed skeins may be removed from the block 20 and replaced by skeins to be dyed.

It will be understood that when desired, the dye reservoirs 14*a*, 14*b*, 14*c*, 14*d*, may be filled with dyes of different colors. The operation of the machine then results in giving each of the portions A, B, C, D, of the skeins a different color. The packing provided by the tightly clamped portions E of the skeins prevent any mixing of the colors during the dyeing operation, and the removal of the excess dye by the air prevents a mixing of the colors after the pressure has been removed from the skeins by lowering the block 20.

The dyeing of each part of the skeins has been found to be very even. This is due in part to the compression of the skeins and due to a considerable extent to the fact that the dye is forced through slowly by the evenly distributed pressure applied to it by the compressed air. The best results are obtained by using a low air pressure—of the order of five pounds per square inch.

What is claimed is:

1. The method of dyeing an absorbent mass, which comprises placing a limited quantity of dye in contact with the upper surface of the mass, and applying gas pressure to said limited quantity of dye to force the dye and air through the mass.

2. The method of dyeing an absorbent mass, which comprises placing a chamber with an open bottom against the upper surface of the mass, placing a limited quantity of dye in the chamber, and introducing air under pressure into the chamber so that the air forces the dye through the mass and then follows through the mass after the dye, removing the surplus dye therefrom.

3. Apparatus for dyeing an absorbent mass, comprising a holder for the mass, a receptacle having an open bottom, means for bringing said receptacle into contact with the upper surface of the mass in the holder, and means for connecting said receptacle alternately with a source of dye and with a source of compressed gas.

4. Dyeing apparatus, comprising a receptacle having an open bottom, means for placing the upper surface of a mass to be dyed across the bottom of the receptacle, a measuring cup having an outlet opening in its bottom and vent opening in its top and an inlet opening, a conduit connecting the measuring cup with the receptacle, an outwardly-opening valve in said outlet opening, a spring tending to close said valve, an inwardly-opening valve in the vent opening, a three-way valve connected with the inlet opening of the measuring cup, a dye reservoir connected with said three-way valve, and a conduit connecting the three-way valve with a supply of gas under sufficient pressure to open the outlet valve of the measuring cup and to close the vent valve thereof when the air conduit is connected with the measuring cup through the three-way valve.

5. Dyeing apparatus, comprising a receptacle having an open bottom, means for placing the upper surface of a mass to be dyed across the bottom of the receptacle, a measuring cup connected to the receptacle, means for alternately supplying dye and compressed gas to the measuring cup, and means for closing the connection between the measuring cup and the receptacle while dye is being admitted to the measuring cup and for opening this connection when compressed gas is admitted to the measuring cup.

6. In dyeing apparatus, a closed measuring cup having a vent opening, an outlet opening and an inlet opening, means for alternately connecting the inlet opening of the measuring cup with a source of dye and a source of compressed gas, means for closing the outlet opening when the inlet opening is connected with the source of dye, and means for closing the vent opening when the inlet opening is connected with the source of compressed gas.

7. Apparatus for dyeing a loose mass, comprising a pair of opposed foraminous plates at opposite sides of the mass, means for causing an approaching movement between said plates to compress the mass between them, means for supplying dye to one of the plates, and means for causing it to pass from one plate to the other through the compressed mass between them.

8. Apparatus for partially dyeing a loose mass, comprising a plurality of spaced pairs of foraminous plates at opposite sides of the mass, means for compressing portions of the mass between said plates, pairs of imperforate members between the pairs of plates, means for tightly clamping intermediate parts of the mass between said imperforate members, means for supplying dye to one of the plates of each pair, and means for causing it to pass from one plate to the other through the compressed mass between them.

9. In a dyeing machine, fixed and movable clamping blocks having registering spaced

recesses in their opposed faces and conduits extending from their recesses to their back faces, and foraminous plates covering the recesses of each block and spaced apart farther than the clamping portions of the blocks.

10. In a dyeing machine, fixed and movable clamping blocks having registering spaced recesses in their opposed faces and conduits extending from their recesses to their back faces, and foraminous plates covering the recesses of each block, the portions of the opposed faces of the blocks between their recesses being closer together than are the corresponding plates of the two blocks.

11. In a dyeing machine, two cooperating clamping blocks having registering recesses in their opposed faces and registering transverse ribs and grooves between such recesses and passages communicating with their recesses and extending to their back surfaces, and perforated plates covering the recesses of each block.

12. A skein dyeing machine having perforate upper and lower clamping members, of which the upper member is fixed and the lower is vertically movable, fixed pipes communicating with the perforations of the upper member, downwardly directed drain nozzles in the lower member communicating with the perforations thereof, and fixed drain pipes with openings located directly under said nozzles.

13. In a dyeing machine, a fixed table containing drain cups, drain pipes extending vertically downward from said drain cups, an upper clamping block fixed above said table and containing passages for passing dye therethrough, a lower clamping block containing passages for passing dye therethrough, means for raising and lowering said block betwen the table and the upper block, and drain nipples extending downwardly from the passages of the lower block and adapted to enter the drain cups and drain pipes of the table when the lower block is lowered.

14. Apparatus for dyeing parts of skeins in different colors, comprising a plurality of spaced pairs of foraminous plates at opposite sides of the skeins, pairs of imperforate members between the pairs of plates, means for compressing portions of the skeins between said plates and for tightly clamping intermediate parts of the skeins between said imperforate members, and means for supplying different colored dyes to the portions of the mass between the pairs of foraminous plates.

15. Multi-color dyeing apparatus, comprising a shallow trough having upstanding ridges dividing it into a plurality of compartments and provided with a drain opening in the bottom of each compartment, a foraminous plate in each compartment spaced from the bottom of the compartment, movable foraminous plates located one above each compartment in the trough, means for clamping against said ridges intermediate portions of skeins laid in the trough and for moving said plates toward the plates in the compartments, and means for supplying different colored dyes to the different compartments in the trough.

In testimony whereof we have hereunto set our hands.

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