(No Model.)

C. L. HORACK.

METHOD OF AND APPARATUS FOR COLORING YARNS.

No. 590,547. Patented Sept. 21, 1897.

Fig. 1.

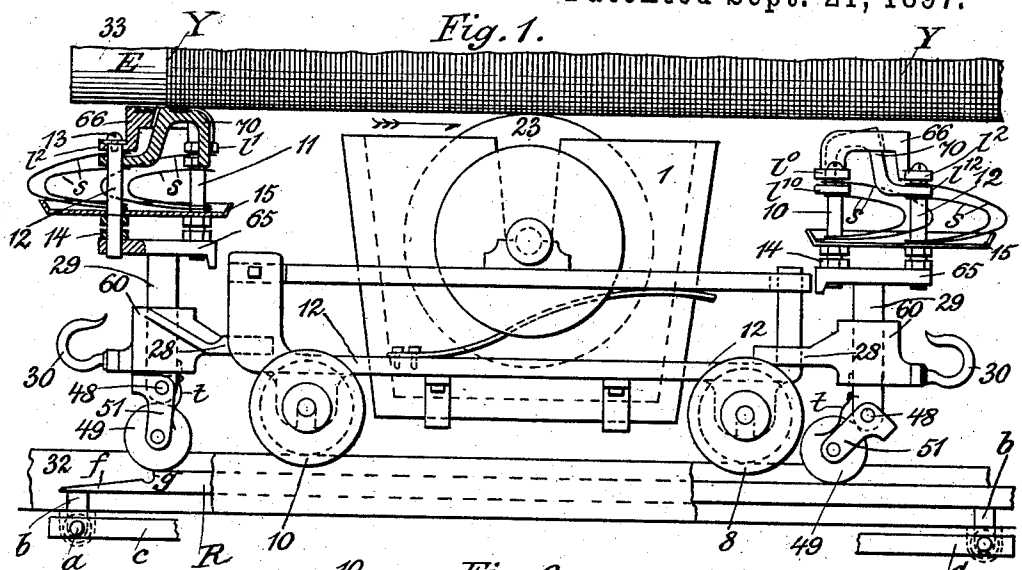


Fig. 2.

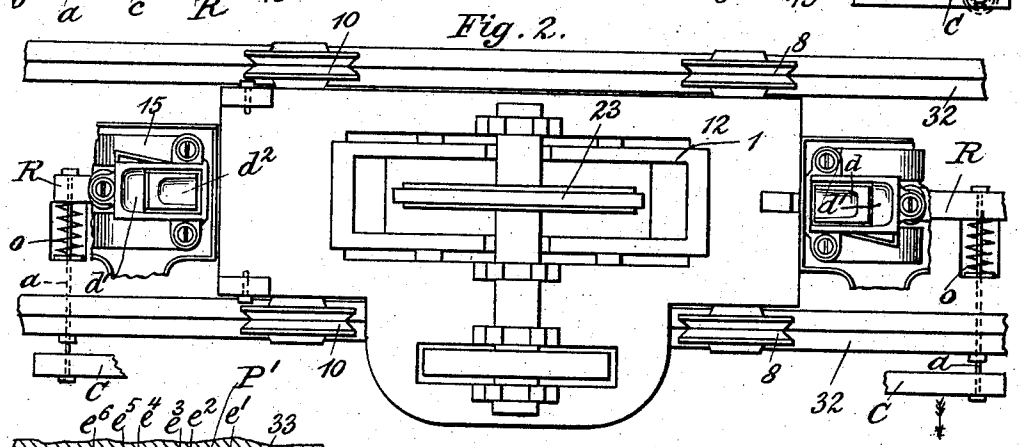


Fig. 3.

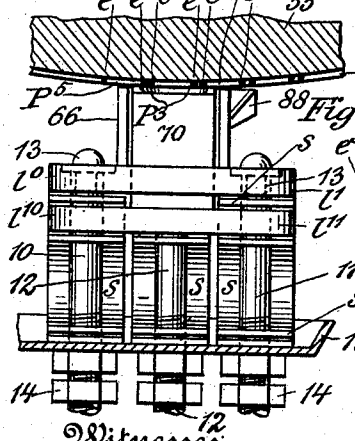
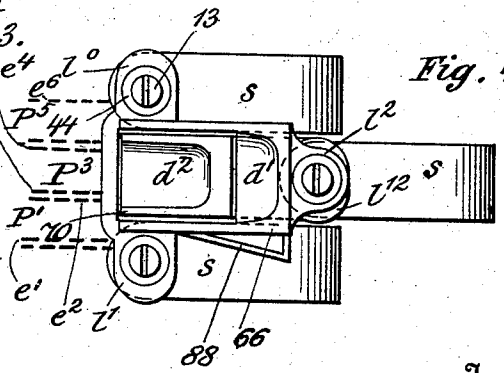


Fig. 4.



Witnesses
M. S. Airy.
A. M. Pierce.

Inventor
Charles L. Horack

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

UNITED STATES PATENT OFFICE.

CHARLES L. HORACK, OF BROOKLYN, NEW YORK.

METHOD OF AND APPARATUS FOR COLORING YARNS.

SPECIFICATION forming part of Letters Patent No. 590,547, dated September 21, 1897.

Application filed April 15, 1897. Serial No. 632,195. (No model.)

To all whom it may concern:

Be it known that I, CHARLES L. HORACK, a citizen of the United States, and a resident of Brooklyn, in the county of Kings and State of New York, have invented certain new and useful Improvements in Methods of and Apparatus for Coloring Yarns, of which the following is a specification.

My invention refers to methods of and apparatus for coloring yarns, and more particularly yarns used in the manufacture of tapestry and velvet carpets.

My improved method is capable of being carried out wholly or partly by means of appliances actuated directly by the hands of the operators or by mechanical and automatic means superintended and directed in general only by the operator. In the latter case I prefer to employ an apparatus as now commonly used in printing such carpet-yarns, which consists of a drum around which the yarn is wound and a color-carriage with color-wheel adapted to apply streaks of color to the yarn side by side while traveling underneath the drum and to apply thereto the structural improvements above referred to.

The objects of my invention are to provide a suitable method for applying coloring-matter to yarn and for spreading and forcing such coloring-matter along, into, and through the yarn, and to thereby distribute such coloring-matter in approximately uniform manner, whereby, particularly also after the yarn shall have been subjected to the usual steaming or scouring process and after having been woven into a fabric, portions of threads of the same shade may be made to appear substantially uniform.

Further objects are to provide against the difficulty sometimes encountered that the color-wheels deposit colors of various shades around the ends of the cylindrical surface of the drum, which ends generally are not covered by yarn, that in revolving the drum such color flows around such edges and becomes mixed and is then picked up by the mechanical spreading devices as they pass underneath the drum and is carried along by the same and deposited upon the yarn, thus producing stains and smearing; also to provide proper means for moving the spreading devices toward the drum and for applying the same to the yarn thereon, and also for moving the same away from the drum and for detaching the same from the yarn, and to connect and suitably combine said means with appliances for confining the spreading devices out of operative contact with the yarn while traveling along the drum in either direction.

In the coloring of tapestry-carpet yarns as practiced heretofore very generally the yarn, having been wound around a drum in a very thin and uniform layer—say of the thickness of one thread—had liquid coloring-matter more or less thickened by the addition of flour, paste, or the like applied to it by the color-wheel, which during its travel along the yarn would constantly bring up a supply of such coloring-matter from the color-box underneath it, the color-box and color-wheel being superseded by others whenever all the streaks of a given shade called for by the pattern had been applied to the yarn and streaks of a different shade were to be applied next, contact of the color-wheel with the yarn during the printing operations being enforced by powerful springs. These operations would be continued until the entire outer surface of the yarn would be covered with streaks, when generally a different set of operators would take charge of the drum and by means of hand-scrapers, made usually of hard rubber, would rub along the streaks of coloring-matter forward and backward and with great force, rubbing the color into the yarn as far as practicable and also removing surplus coloring-matter, which would attach itself to the scrapers. As soon as practicable afterward the yarn would be put in a steam-room and brought in contact with steam under, say, five pounds pressure and would be maintained therein for about twenty minutes, being afterward exposed to the atmosphere for about an hour and then scoured in cold water to remove the flour or paste still adhering to it and any free surplus coloring-matter. After drying it it would then be in proper condition for the weaving operation. Such exposure of the yarn to the action of steam serves not only to fix or set the color, but also to further equalize the color on the yarn by causing color still deposited too thickly upon or

within portions of the yarn to spread over and into adjoining portions, and it is this feature which permits of leaving single streaks or the outer streaks of a series of adjoining streaks or the outer portions of such outer streaks unrubbed. The above-described manipulations are of course subject to variations in accordance with the general nature of the coloring substances employed, the moisture in the atmosphere, the climate, and other surrounding conditions.

In equalizing the coloring-matter by means of automatic appliances substantially the same operations are generally gone through with at present except as far as the rubbing of the yarn by hand-scrapers is concerned, the coloring substance, however, generally containing a much smaller amount of thickening substance. Adding of large amounts of flour or paste to the liquid color, while detrimental to the prompt and thorough impregnation of the yarn, is resorted to to prevent "bleeding" or running of the color from one streak into an adjoining streak or into the space to be occupied by such a streak, which is apt to proceed along the threads of the yarn running at right angles to the streaks during the interval which must necessarily elapse between the printing of the streaks by the color-wheel and their being scraped by hand, the printing of the entire surface of a drum of average diameter and length requiring approximately twenty minutes and that of larger drums requiring more time in proportion before hand-scraping is undertaken. The color having further thickened by this time, proportionately greater pressure is required to rub the same into and through the yarn than would have been required if done substantially simultaneously with the printing operation by the color-wheel, and the yarn is therefore much more apt to be injured and destroyed by the system of deferred hand-scraping, as described above, than by scraping or rubbing applied promptly after the printing, and it is one of the great advantages of automatic scraping as practiced within the last few years and as exemplified particularly in the appliances described in William Shaw's United States Patent No. 514,282 that it has been possible to employ in connection therewith liquid coloring substances containing comparatively little flour or paste; but even these appliances must be applied to the printed yarn twice under heavy spring-pressure to secure the desired results, particularly as the condition of the yarn (it being stretched rather tightly on the drum) favors the spreading of the color along the threads of the yarn much more than the thorough entry of the color into interior and to that portion of its surface which faces the drum. In subjecting the streaks on the yarn to rubbing immediately after the printing operation the yarn may reach the steam-room much quicker.

In my improved method, as exemplified more fully hereinafter, I avail myself of the tendency of the liquid color to spread laterally beyond the streak then in course of application, so as to moisten adjoining unprinted portions of the yarn, and applying to the same in doing so color under proper pressure, whereby such portions are made more receptive with reference to the color to be subsequently applied to them by the color-wheels. I have found that this sidewise displacement of the color under pressure carried to the extent of substantially half the width of a streak, in view of the constant tendency of this color to spread farther laterally into portions of the yarn less saturated, particularly with the aid of pressure subsequently applied thereto, and also in view of a subsequent steaming process, can be depended upon to give very satisfactory results as far as uniformity of shading is concerned.

My method consists in applying streaks of coloring-matter to yarn side by side and successively and after the printing of the first streak of a series of streaks and during the printing of the second one subjecting the first and the second streaks to pressure and rubbing, the former to the extent of approximately one-half of its width, forcing from such second streak coloring-matter into the space to be subsequently occupied by a third streak to the extent of approximately one-half of the width of a streak, subjecting the color so forced over simultaneously to pressure, and afterward printing a streak upon the unprinted adjoining space which has received such coloring-matter.

My improved method can be applied in manner as hereinafter described; and the objects of my invention can be accomplished by the means hereinafter specified, and set forth more particularly in the claims.

In the accompanying drawings, forming part of this specification, Figure 1 is a side elevation, partly in section, of a color-carriage and part of the yarn-drum fitted up according to my invention, while Fig. 2 is a ground plan of Fig. 1, the drum, however, not being shown therein. Fig. 3 is a front elevation of a spreading device shown in operative engagement with the yarn on the drum, and Fig. 4 a ground plan of the spreading device illustrated in Fig. 3. Said Figs. 3 and 4, in conjunction with the following description, serve more particularly to illustrate my method of procedure in applying the color to the yarn and forcing it into the yarn and indicate relative positions of paths traversed and to be traversed by the color-wheel and of spreaders which may be employed in carrying out my method for coloring the yarn. Figs. 3 and 4 are drawn to an enlarged scale.

Corresponding letters and figures of reference throughout the different views refer to corresponding parts.

12 is the color-carriage, mounted on wheels 8 8 and 10 10, on which color-box 1 and color-wheel 23 are supported, and which is drawn by means of a cord attached to hooks 30 for-

ward and backward along rails 32, placed underneath and parallel with drum 33, carrying the yarn Y.

28 28 are brackets attached to the main body of the carriage and carrying a vertical arm 60, which forms a bearing within which a post 29, made of rectangular cross-section, is made to slide.

48 48 are pivots passing through the lower extremities of posts 29, to which are hinged levers 51, carrying at their lower ends rollers 49 49, posts 29, together with levers 51 and pivots 48, forming a toggle-jointed support for rubbing appliances, more fully referred to hereinafter.

All these parts substantially correspond in their construction and in their mutual relations and functions with the parts bearing corresponding letters of reference in William Shaw's United States Letters Patent No. 543,512.

65 is a platform at the upper extremity of post 29. 10, 11, and 12 are cylindrical studs screwed into said platform, and 14 14 jam-nuts for holding said studs in position.

15 is a pan for catching and carrying off the drippings of coloring-matter from the equalizer 66 and the rubber 70, mounted at the upper ends of said studs in manner hereinafter described. This equalizer 66, to which may be attached an auxiliary rubber 88, and the main rubber 70 correspond as to their functions with the equalizers 66 and the rubbers 70 of aforesaid United States patents and resemble the same also as far as their general configuration is concerned. Equalizer 66 is provided near its forward end with side lugs 1^0 and 1′ and with a rear lug 1^2 and rubber 70 with side lugs 1^{10} and 1^{11} and with a rear lug 1^{12} in such manner that the upper end of stud 10 freely passes through lugs 1^0 and 1^{10}, that of stud 11 through lugs 1′ and 1^{11}, and that of stud 12 through lugs 1^2 and 1^{12}, so as to allow the equalizer and the rubber to freely play upward and downward along said studs. 13 13 are screws entering the heads of said studs and serving by means of washers 14 to prevent the equalizer and the rubber from leaving said studs. S S are springs yieldingly supporting said lugs. Their lower holes are of sufficient size to permit the same to pass over the lower screw-threaded portions of studs 10, 11, and 12, while the perforations in the upper ends of said springs are of sufficient size to allow of the free play up and down of these ends along the studs.

d′ d′ are shallow depressions on the upper surfaces of equalizers 66, and d^2 d^2 such depressions on the upper surfaces of rubbers 70, said depressions in each case being shown on the portions of such surfaces nearest to the color-wheel and to be of such sizes and proportions as to leave at their sides and in the rear of them U-shaped flat portions which are adapted to come in direct contact with the yarn when the rubbing devices are being pressed upward while occupying positions underneath the drum. Rollers 49 are adapted to travel on rail R, placed between track-rails 32 32.

a a are rods attached to lugs *b* on rail R and connected to a beam C in such manner that by moving said beam in the direction of the arrow in Fig. 2 said rail will be withdrawn laterally from contact with rollers 49, springs *o o* forcing said rail back into its original position when the sideward thrust on beam C ceases. Any other means—for instance, such as shown for a like purpose in William Shaw's United States Patent No. 514,282—may be substituted for those above described, whereby rollers 49 may be temporarily deprived of their support, so as to cause the weight of the spreading devices and of their movable supports to drop to elevations below the drum, thereby keeping the same from contact with the yarn. Thus the passage of the rubbing appliances over the outer ridges of outer streaks in a series of streaks of the same shade can be prevented and the forcing of coloring-matter into an adjoining streak of different shade can be guarded against.

For the purpose of thoroughly impregnating the yarn with coloring-matter and for properly forcing the same into the yarn I avail myself of the method pointed out by William Shaw in his United States Patent No. 514,282 of successively rubbing the interior streaks of a series of streaks twice and in opposite directions, which is accomplished by making the spreading devices of substantially double the width of the color-wheel and by placing said spreading devices substantially in line with each other. The drum during the printing of such a series of streaks is being revolved step by step in usual manner. As the coloring-matter is generally forced outward and deposited in pairs of ridges, as *e′ e²* and *e³ e⁴*, &c., with coloring-matter thinly spread between such ridges of the same streak, along the paths P′ P^3, &c., of the color-wheel, the mechanism for turning the drum is arranged in usual manner so as to leave a space between the paths of the two color-wheels where two such ridges may be deposited and may unite into one if the coloring substance is sufficiently liquid, the peripheral travel of the drum at each step, therefore, being greater than the width of the color-wheel employed. Said Patent No. 514,282 illustrates such positions of the spreading devices as to bring their edges on one side of the central longitudinal planes of the color-wheel approximately in line with an outer operative edge of the distributing-wheel, whereby the coloring-matter of two entire successive streaks is equalized simultaneously.

I have found that very good results can be obtained by using spreading devices of widths equal to or greater than the peripheral travel of the drum during two successive steps and

placing the same in line with each other, but in such positions with reference to the color-wheel that such spreading and rubbing devices will not only cover streaks already applied to the yarn or which are in course of being applied by the color-wheel, but will also materially extend into the next adjoining path which the color-wheel is to take subsequently, as thereby the spreading and rubbing devices will promptly after the deposition of the coloring-matter by the color-wheel spread the same laterally onto the portion of the yarn to be covered by the color-wheel during its next travel, thus imparting to the yarn which has not yet been traversed by the color-wheel such color, thereby moistening it and forcing color to enter into the yarn under pressure substantially corresponding with that simultaneously applied to yarn in line with the color-wheel and preparing it to receive and absorb additional color when the color-wheel afterward passes over it. For such purpose I place the central portions of the spreading device as it follows the color-wheel directly in the rear of such wheel, as shown in Fig. 2, whereby a portion of a streak, as P′, previously made and all of streak P^3 which is in course of being applied to the yarn and part of the path next to be covered by the distributing-wheel can be covered by said spreading device, while during the return travel of the color-wheel one-half of streak P^3 and all of the subsequent streak P^5 are acted upon by the other spreading device in opposite directions and the yarn which is to be covered by a neighboring and successive streak is being moistened under pressure and covered with color in part or in whole. I prefer to make depressions d' and d^2 of sufficient widths to cover the three ridges previously made by the color-wheel over which the spreading device is passing, so as to temporarily receive surplus coloring-matter therefrom and supply the same to a portion of the surface of the yarn not yet traversed by the color-wheel.

As previously pointed out, it is necessary to guard against smearing the yarn by the carrying of color from the ends of the drum not covered with yarn, and indicated by E, to the yarn itself. For such purpose I construct the center rail R as follows: I provide its ends with slopes *f* in general manner as indicated in said United States Patent No. 514,282, whereby as the carriage travels toward the drum the lever 51 first approaching the drum will be tripped and, together with the spreading appliances above it, will assume the positions illustrated in the right-hand portion of Fig. 1, while rear lever 51 will be brought into a substantially vertical position as it passes over such slope. Rubber 70 I allow to project above the equalizer in manner shown in Patent No. 543,512. The same will therefore come in contact with the yarn earlier than equalizer 56. The left-hand portion of Fig. 1 shows its position at the time it first touches the yarn and the drum, its depressed portion being placed underneath the yarn and its flat portion under the free portion of the drum directly adjoining the yarn. In order to guard against its striking the drum earlier with any considerable force, I provide a shoulder, as *g*, near the upper end of slope *f*, so that roller 49 after traveling upward along said slope will strike said shoulder and will thereby be carried upward abruptly.

At the other end of the rail the corresponding shoulder will serve to permit of abruptly lowering the supports of the spreading device. This is valuable and important, as operators are generally in a great hurry to swing the drum as soon as possible after the color-wheel has passed from underneath the same, and the prompt detachment of the spreading devices from the yarn at this point will guard against their pulling, displacing, and breaking the yarn. Withdrawing the spreaders from the drum or from contact with the yarn in directions substantially at right angles to the drum where appliances are used for continuously confining said spreaders out of action while the carriage travels along the drum in either direction therefore tends toward preserving the yarn and saving time in operating the apparatus.

As the central portion of rail R is not always perfectly level and parallel with the drum and coloring-matter is apt to lodge on it and make it slippery, it will sometimes occur that the roller underneath the operative spreading device will roll forward beyond its post 29, thereby shortening the toggle-joint and detaching its spreading devices from the yarn. Leaf-springs *t*, applied to post 29 and resting against lever 51, as shown, will tend to guard against this, these springs being made comparatively weak, so as not to force post 29 upward when the same is intended to occupy the position shown in the right hand portion of Fig. 1. A counterweight attached to that side of lever 51 which faces toward the color-wheel would accomplish the same result.

It will readily be seen that many modifications might be made in the construction illustrated by me. Thus any suitable form of single or compound spreaders with or without depressions on their faces may be employed, and instead of having spreading devices in front and in the rear of the color-wheel one such device might be made to serve at all times in the rear of the color-wheel, no matter in which direction the same may be traveling, by providing a proper shifting-lever which may upon the end of the travel of the wheel in one direction place such spreading device in the rear of the color-wheel.

I claim as new and desire to secure by Letters Patent—

1. The improvement in the art of coloring carpet-yarns, which consists in successively

printing streaks of color of given widths upon the yarn side by side, subjecting the entire width of the color-streak in course of application to a rubbing action and simultaneously subjecting approximately one-half of the width of the adjoining streak previously printed to such action while also spreading color from the streak in course of application over the adjoining unprinted portion of the yarn on its other side to the extent of substantially one-half of the width of a streak and there rubbing it into the yarn simultaneously, and then printing a streak upon the adjoining unprinted portion of yarn upon which coloring-matter has been so spread from the streak in course of application, substantially as set forth.

2. In an apparatus for coloring yarns, the combination with a yarn-drum, a color-carriage and a color-wheel, a spreading device, a movable support for it in the rear of the color-wheel, and a rail on which said support rides, such rail being provided with a slope adapted to conduct the support toward the drum, such slope becoming more abrupt where it approaches the drum, substantially as set forth.

3. In an apparatus for coloring yarns, the combination with the drum, the color-carriage and the color-wheel, of a spreader mounted on said carriage and adjusted to travel in the rear of the color-wheel, means adapted to conduct the operative portion of said spreader in a direction substantially at right angles away from the drum, and mechanism for continuously confining the spreader out of operative contact with the yarn while traveling along the drum in either direction, said mechanism being adapted to be actuated during said travel of the spreader away from the drum, substantially as set forth.

In testimony that I claim the foregoing as my invention I have signed my name, in presence of two witnesses, this 14th day of April, 1897.

CHARLES L. HORACK.

Witnesses:
M. S. AVERY,
A. M. PIERCE.