Sept. 14, 1965 R. J. LYONS 3,205,854

APPARATUS FOR TIP PRINTING PLEATS

Original Filed Dec. 6, 1957 4 Sheets-Sheet 1

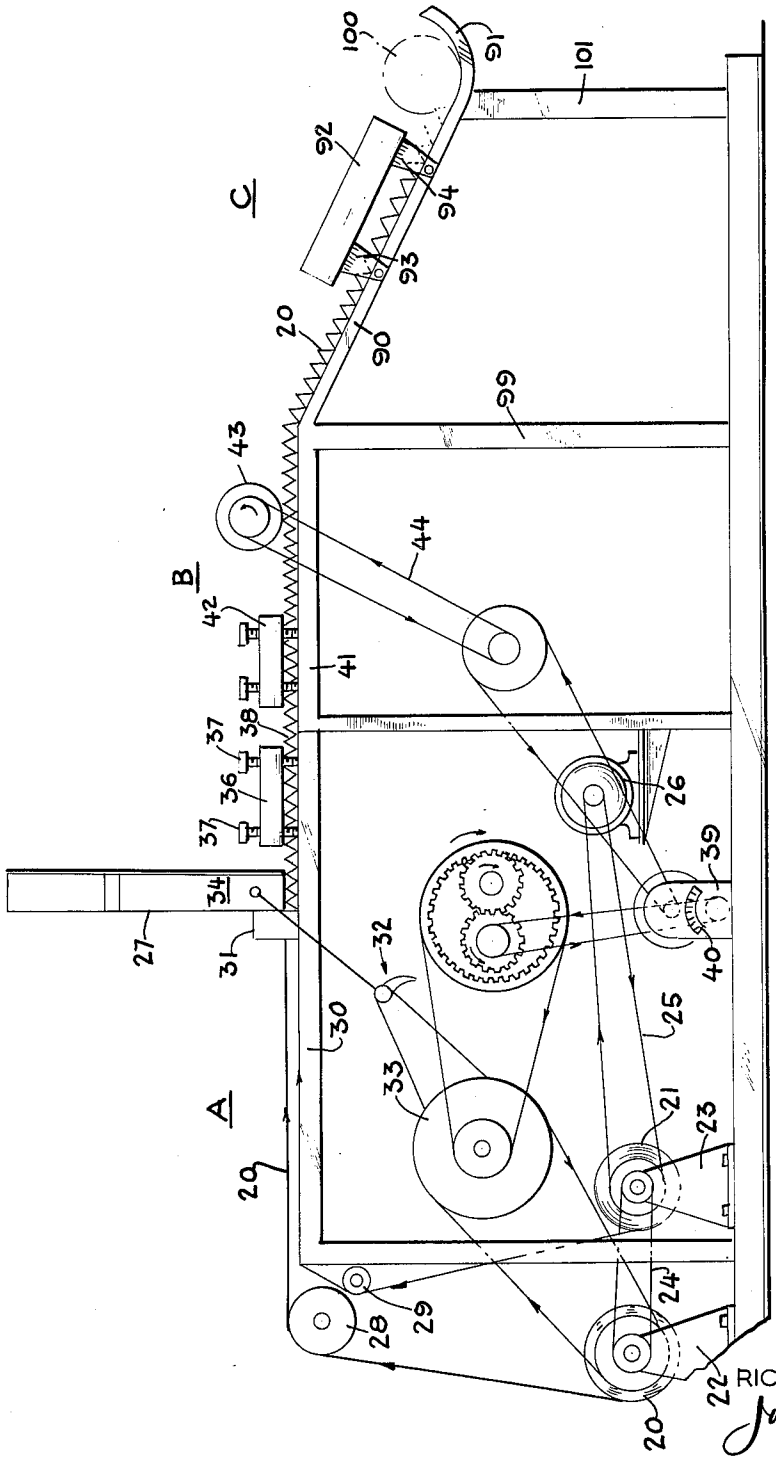


Fig. 1

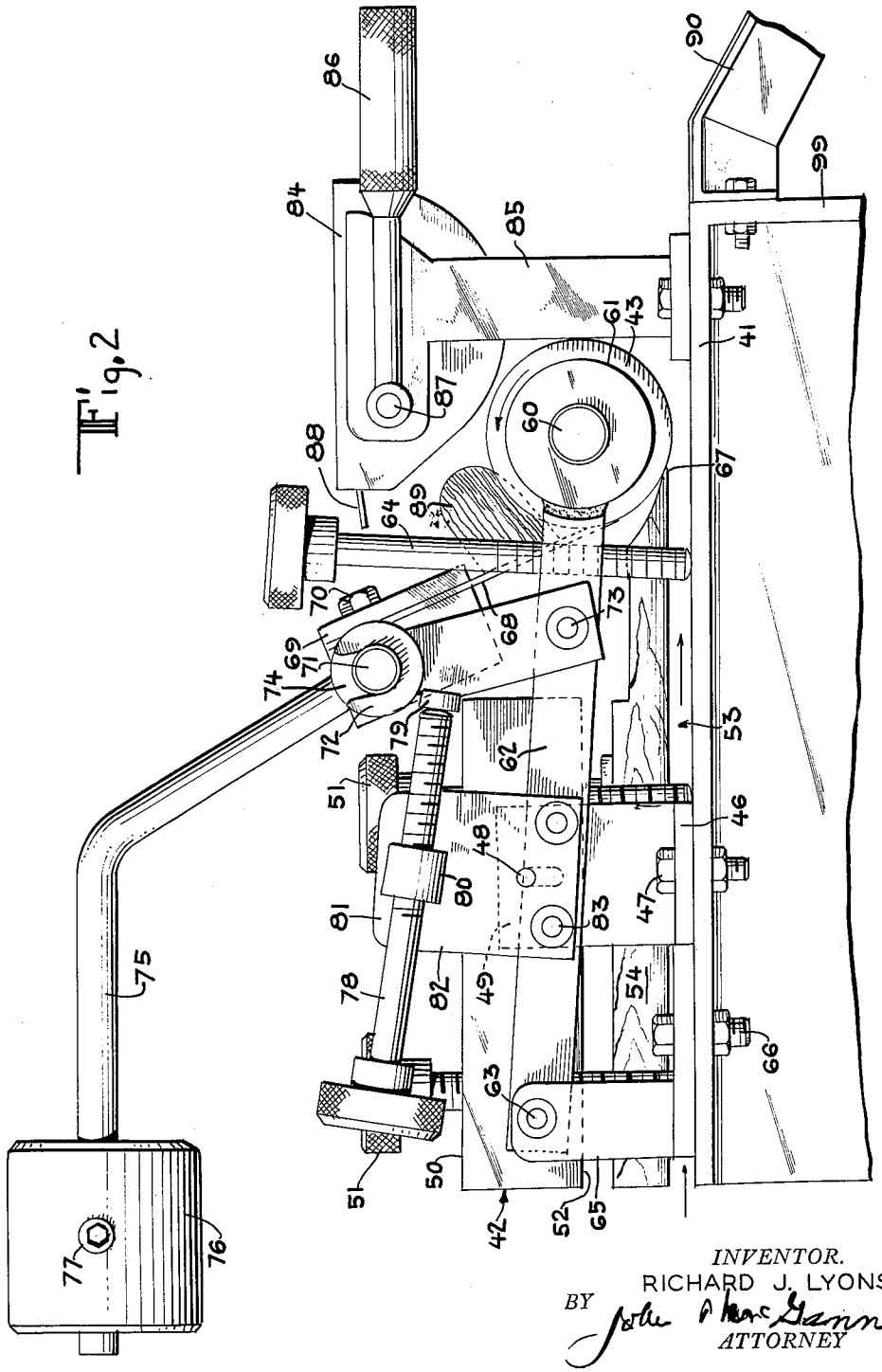
INVENTOR.
RICHARD J. LYONS
ATTORNEY

Sept. 14, 1965 R. J. LYONS 3,205,854

APPARATUS FOR TIP PRINTING PLEATS

Original Filed Dec. 6, 1957 4 Sheets-Sheet 2

Fig. 2



INVENTOR.
RICHARD J. LYONS
BY John P. MacGann
ATTORNEY

Sept. 14, 1965 R. J. LYONS 3,205,854

APPARATUS FOR TIP PRINTING PLEATS

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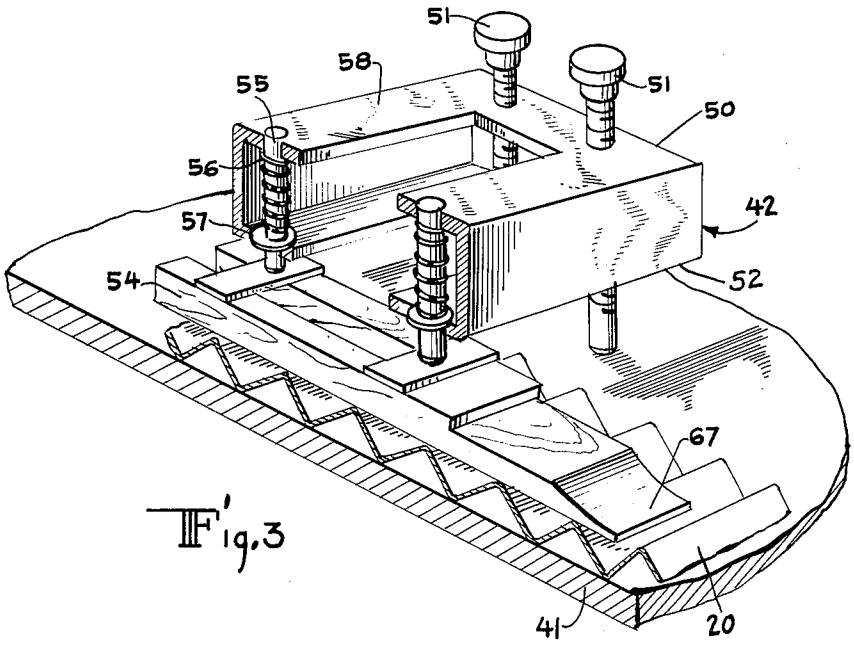


Fig. 3

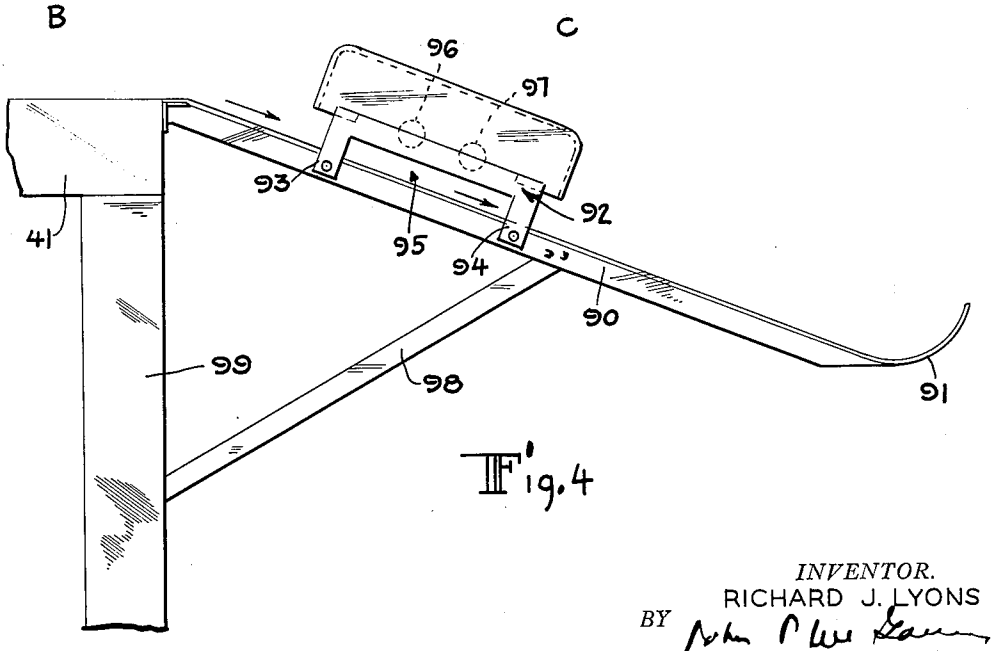


Fig. 4

INVENTOR.
RICHARD J. LYONS
BY
ATTORNEY

Sept. 14, 1965 R. J. LYONS 3,205,854

APPARATUS FOR TIP PRINTING PLEATS

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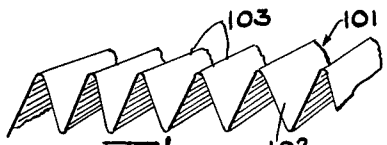


Fig. 5

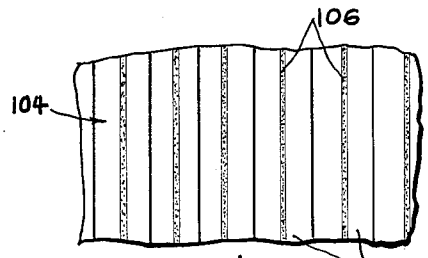


Fig. 6

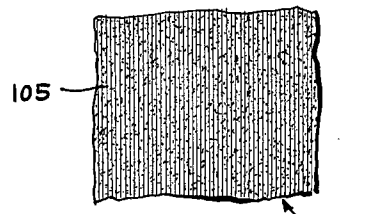


Fig. 7

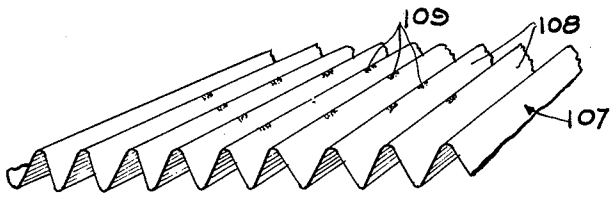


Fig. 8

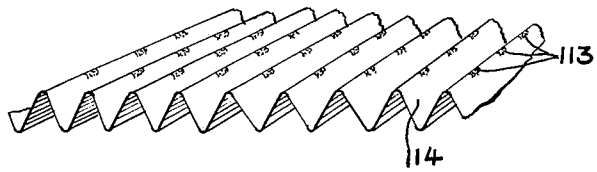


Fig. 9

INVENTOR.
RICHARD J. LYONS
BY John P. McGowan
ATTORNEY

United States Patent Office 3,205,854 Patented Sept. 14, 1965

3,205,854

APPARATUS FOR TIP PRINTING PLEATS

Richard J. Lyons, Swannanoa, N.C., assignor to United Merchants and Manufacturers, Inc., New York, N.Y., a corporation of Delaware

Original application Dec. 6, 1957, Ser. No. 701,221. Divided and this application June 15, 1962, Ser. No. 207,845

1 Claim. (Cl. 118—32)

This is a division of application Serial No. 701,221, filed December 6, 1957, now abandoned.

This invention relates to the application of color to restricted portions of fabrics or the like.

More particularly, the invention contemplates the preparation and application of coloring compositions of various kinds and descriptions in the form of a printing paste or otherwise, only to certain areas of a continuous length of cloth or similar material in the form of piece goods or the like.

Basically, of course, the application of color to piece goods material is divided into two broad classes, namely, dyeing and printing. The present application has to do with the latter wherein the coloring composition is not applied all over the cloth as in dyeing, but merely to restricted portions thereof, whereby an ornamental or functional design, pattern or motif is formed, and only parts or certain portions of the goods received the color impressions.

More particularly still, the present invention especially contemplates the application of color, as by a printing operation, to raised surfaces of a fabric or the like. In the patent to Cady and Horton, U.S. No. 2,741,215, there was disclosed a roller assembly for the production of permanent localized tipping color effects primarily to the upper or exposed surface of raised portions of a continuous length of piece goods; that is to say, the color was applied only to the embossed portions of the moving fabric lying in a horizontal plane, such embossed portions, of course, being elevated out of the normal plane of such fabrics.

In the patent to Davis, U.S. No. 2,667,426, a method and apparatus were disclosed for virtually simultaneously embossing and tipping of fabrics. The invention forming the subject matter of that patent was characterized, in particular, by the application of color, in a so-called tipping operation, to portions of an embossed fabric web while that web is still carried on the backing surface incident to the embossing operation, whereby such backing surface may be employed not only for the embossing step, but also for the coloring operation.

In the case of the present invention there is contemplated the application of color in a tipping or printing operation, or both, to localized portions only of a pleated fabric. By pleating is meant a double fold of material folded over and held in place as by pressing or otherwise. Pleats are formed in various widths and are sometimes stitched to hold them in place. In other instances, immediately after the pleats are formed, they are subjected to a heat treatment, as by steam, for example, or other elevated temperatures to render the pleat formations permanent or semi-permanent. It is also the practice in certain cases to pre-treat the goods intended to be pleated by impregnating the same prior to pleat formation with one or more synthetic resinous materials, such as urea formaldehyde, melamine formaldehyde, ethylene urea formaldehyde, or

mixtures, or other combinations thereof, for the purpose of rendering the fabric pleats washfast after the production thereof has been completed.

Broadly speaking, it may, with some accuracy, be said that pleated fabrics are distinguishable from other fabrics in that they are characterized by the formation of a series of individual fold-like formations, usually symmetrically arranged, to enhance the ornamental and functional properties of the materials in which they are formed. The present invention, as already indicated, is concerned with the application of coloring matter to fabrics, and especially to pleated fabrics, as for example, fabrics made of or containing accordion pleats. In its preferred form, however, the present invention proposes the application in a tipping operation or a printing method of color to the topmost portions of accordion pleats. In referring to the topmost portions, it is intended to indicate that color is applied only to the upper part of the accordion pleat. In other words, if one may suggest that a single accordion pleat visually represents a valley or depression and mound in contiguous relation, it is a purpose and object of the invention to apply color only to the mound portion, and especially the upper part thereof, and not to the valley portion of that particular pleat, and preferably, but not necessarily to all the other pleats assembled in a length of cloth fabric or the like.

It is further contemplated herein that color may be applied to the upper portions or elevated surfaces of pleated fabrics made from or containing natural or synthetic, and/or man-made fibers, such as fibers of cotton, nylon, regenerated cellulose, cellulose acetate, the polyester fiber sold under the trade mark "Dacron," copolymers of vinyl chloride and acrylonitrile and/or vinyl acetate, orlon, and other natural and synthetic fibers, or man-made fibers, or combinations thereof, such as linen and silk.

It is a further object of the present invention to apply a pigmented carrier such as a typical textile printing ink to the apex, or raised portion, or knife edge of accordian pleated fabrics.

It is further within the contemplation of the present invention to apply such pigmented carrier or coloring composition to the raised portions of the several pleats transversely over the whole width of the goods or cloth or, as an alternative, to apply the color only to spaced or isolated parts of each raised portion transversely thereof, so as to form, in fact, a printed design wherein the color is not actually applied all across the width of the fabric, but only to restricted and separated portions thereof.

It is a still further object to apply a pigmented carrier to pleated fabrics by a process which includes the application of a plurality of colors thereto in harmonious relation or otherwise. That is to say, it is here proposed not to merely apply one color to the raised surfaces of pleats, but a series of two or more colors or varying shades, as may be desired.

With the above and other objects in view, as will be apparent, this invention consists in the construction, combination, and arrangement of parts, all as hereinafter more fully described, claimed, and illustrated in the accompanying drawings, wherein:

FIG. 1 illustrates, in a schematic arrangement, an assembly or range of apparatus adapted for the production of tip printed pleats according to at least one embodiment of the present invention where three separate zones, respectively lettered A, B, and C, are illustrated and in-

tended to represent the successive steps of A pleat formation, B tip printing, and C color drying and/or resin curing and take-up. Zone A, of course, constitutes the entrance end for the unpleated fabric; zone B is a color applying station, and zone C includes the take-up station and is the delivery end for the pleated and tip printed goods. FIG. 1 also includes means for driving the combined pleating and tip printing assembly, and for conveying a work-piece, that is the cloth, therethrough;

FIG. 2 is an end elevation of the tip printing apparatus proper, which shows the direction of movement of the cloth from the time it leaves the pleating zone A until it has completed its passage through the tipping zone B; including a plurality of means for adjusting the disposition of the tipping or printing roller and its placement in relation to the pleated cloth which is being tipped. Tilting means are also shown herein for applying a pigmented carrier or coloring composition through the tipping roller;

FIG. 3 is a detail view, partially in section, of a portion of a tensioning device or tension bracket incorporated in FIG. 2, under which the pleated cloth passes from the pleating station A to the tipping roller or printing roller in zone B;

FIG. 4 is a side view of a sloping delivery pan or chute placed in the curing end or drying zone C of FIG. 1 where the pleated and tipped printed cloth is received at or prior to final wind-up, and where heat or elevated temperatures may be applied to the upper surface of the pleated and colored cloth as it passes therethrough. Alternatively, in these days of fast drying coloring inks, no drying interval may be necessary, and instead, the pleated and printed cloth may be simply cured by means of such heaters, which is to say, that if such cloth has been pre-treated by impregnation thereof with synthetic resins to render the pleat formations subsequently applied thereto permanent, then in such case the provision of the heating elements in zone C hereof may partially or entirely set such resinous materials. In practice, however, it has been found generally desirable to eliminate the heating elements altogether and utilize zone C as and for a delivery or wind-up station only. If the goods have been previously impregnated with a resin for the purpose of rendering the pleats washfast, it is generally better practice to cure the same and set the resin in the pleated material in a long-range curing box or oven after the pleated and tip printed cloth has been removed entirely from the present combination pleating and tipping assembly;

FIGS. 5 to 9 inclusive are intended to illustrate representative types of pleat tipping which may be employed or incorporated in practising the present invention, as follows;

FIG. 5 is a perspective section, untipped, of a small portion of accordion pleated material shown for reference only, and before the application of coloring composition as contemplated herein;

FIG. 6 is a plan view of accordion pleated goods that have been tipped as by means of the apparatus illustrated in FIGS. 1 to 4 inclusive, the accordion pleated formations being expanded;

FIG. 7 is a compressed plan view of the fabric shown in FIG. 6, which is to say that the several pleat formations therein are pressed together and subjected to compression, rather than being opened out in expanded form as in FIG. 6;

FIG. 8 is a perspective view of another portion of tip printed fabric in which the color has been applied only to the top portions of the pleats and only in isolated sections thereof in relation to the transverse dimension or widthwise of the pleated cloth, the arrangement of tipping material being such as to form a diamond design or motif;

FIG. 9 is a perspective view of pleated goods which have been tip printed in a plurality of multi-color parallel stripes. This type of multi-color printing may be obtained by the substitution of at least two printing rollers, each of which is furnished with a color distinct from that of the other or others, in place and stead of the tipping roller of FIG. 2.

According to the instant invention, an accordion pleater for putting folds in the shape of accordion folds in a textile fabric may be combined in an assembly which also includes means for applying color to the upper portions only of the several pleats in such goods. Both the pleater and the tipping or tip printing apparatus may be driven by the same means, and a series of reduction gears may be utilized to modify the main pleating machine drive so as to drive, in turn, a knurled steel tipping roll, or an engraved steel printing roll, or a plurality of printing rolls, at a speed slightly greater than, or approximately equal to, the delivery rate of the formed pleated material as it is pushed out of the pleater. The engraved or knurled roll may be serviced with a thickened pigmented textile emulsion such as a water-in-oil system, and the excess portion of coloring composition may be wiped clean by a steel doctor blade constructed and arranged to coact with the knurled tipping or engraved printing steel roller or rollers. By carefully adjusting the distance of the driven roll which applies the coloring composition to the raised portions of the several pleats, the textile emulsion may be applied to these portions exclusively without inking any other portion of the cloth during the operation which follows delivery of the pleated goods from the pleater to the tipping or tip printing or printing zone.

One example, with detailed data, showing the mode of operation of the present apparatus, and how the present process is carried out so as to produce tip printed pleats as contemplated herein and described above, is as follows.

A bleached 80 x 80, 4.00 yards/pound cotton print cloth is initially impregnated through a mangle, with suitable thermosetting resinous materials and catalysts, and dried on a tenter frame to a residual moisture content of 6½ to 8%. These resinous materials can be those extensively used in the textile finishing art, and can be of the urea or modified urea-formaldehyde precondensate type, dimethylol ethylene urea fiber reactants, or melamine formaldehyde. A typical formula would be as follows:

	Lbs.
Rhonite R–1 (ethylene urea formaldehyde—Rohm & Haas)	100
Catalyst AC (2-amino 2-methyl 1-propanol hydrochloride—Rohm & Haas)	15
Ahcovel R. (anionic fatty carbamide salt—Arnold, Hoffman)	2
Igepal CA (ethylene oxide-alkyl phenol condensate—General Dyestuff)	½

Made up to 100 gallons with water.

Following drying to the previously mentioned 6½ to 8% residual moisture content, the impregnated material is threaded into a Chandler Accordion Pleater model 04, of the type schematically illustrated or intended to be represented in zone A of FIG. 1 of the drawings hereof, operating in a temperature range of 150° F. to 300° F. and at a speed of 20 to 160 pleats per minute. As the material leaves the compression rack of the pleater following pleat formation, it is engaged by the reduction driven knurled or engraved roller previously outlined. This roller extends the length of the pleated compression rack and is immediately adjacent and parallel to it. The speed of this roller must be controlled so that its peripheral speed is nearly equal to the linear delivery rate of the pleated materials leaving the machine. Preferably, although not necessarily, the knurled tipping roll may be rotated at a rate of speed slightly faster than the rate of feed of the pleated fabric thereto. With this arrangement it has been found that the tipping roller imparts a brushing action to the portions of the pleats which receive the coloring composition. The speed of this knurled roller is controlled by incorporating on it a typical gear reduction drive, connected to a variable speed pulley device, such as a positively infinitely variable system (PIV) with a 4/1 ratio, model V–1/2–50, 1.35 horse power,

manufactured by the Link Belt Company. The main drive for both the tip-printing knurled roller and the pleating machine is the same and can be a 110 volt, ⅓ or ½ H.P. electric motor. However, since the pleated material is delivered from the machine at a rate considerably slower than the drive speed, the speed of the knurled tipping roller must be reduced, as described above, to substantially equal the cloth delivery rate. During the tip-printing process, the knurled roller is continuously supplied with the previously discussed water-in-oil emulsion, such as an Aridye pigmented clear manufactured by Interchemical Corporation. This emulsion is allowed to "well" in a doctor blade attachment servicing the knurled roll. This blade allows the color to penetrate only in the depressed or engraved areas of the roller, as the roller turns against the blade, and the blade wipes off the excess color. The height of the knurled roller is then adjusted with metering screws so that its parallel distance from the knife edges of the delivered accordion pleated material is nearly equal. This is variable within limits, and application technique may require that a pleat with a filling knife edge height of 7/32", may be need an inking roll height of 3/16", 7/32" or ¼", depending on the thickness of the color deposit required. As the pleated fabric passes beneath the driven, inked, engraved roller, the color is transferred from the roll to the knife edges of the pleat, producing a novel two-toned effect. Following inking, the goods are rolled up or tubed and then "cured" in a typical textile finishing manner, at temperatures in the range of 280° to 360° F. for periods of time from 3 minutes to 1 minute and 45 seconds. This "curing" will "set" both the pleated material and the color applied to the knife edges of the individual pleats.

FIG. 1 of the drawings hereof illustrates schematically a range or assembly adapted for carrying out at least one embodiment of the present invention, viz.: the application of coloring composition to certain portions only of the pleat formations in a pleated fabric or the like. As there seen, the assembly may comprise a zone or station A in which the work-piece or material to be pleated together with an underlying paper backing may be simultaneously fed into the jaws or nip of a pleating machine. Following the application of pleats to the continuous length of cloth and also to its underlying and accompanying paper backing, the two pleated materials may be pushed, as by compression, out of zone A and into zone B, where the coloring composition is applied to the upper or top portions of the pleat formations in the cloth only. It will be understood, of course, that the underlying paper which merely serves as a convenient backing component for the pleated cloth does not receive any coloring composition. After the color has been applied to the top portions of the accordion pleats in a tipping operation of the character previously described and hereinafter referred to again, the pleated and tipped or printed cloth may be fed or pushed or otherwise passed on to the top of an inclined table situated in the take-up or delivery zone C. This take-up station C may also conveniently comprise suitable heating elements or heating means for drying or assisting in the drying of the coloring composition previously applied to the tops of the pleat folds in tipping station B. Another function of the heating elements of take-up zone C may be to at least partially polymerize or insolubilize a synthetic resin or a combination of synthetic resins if such have been previously applied to the cloth before the pleats have been made therein. The purpose of the resin application is to make the pleats washfast or permanent so that they will not be lost after the cloth is subsequently made into a garment or otherwise, worn and washed.

It is to be noted, however, that as a matter of practice, so-called quick drying pigment carriers or compositions may be applied in the tipping or printing operation to the top portions of the pleat folds, and in such cases the coloring composition will already be substantially dry before it reaches the terminal portion of the take-up table in delivery station C. Thus the drying function of the heating elements provided in the same zone becomes unnecessary. Moreover, where the cloth has been preliminarily impregnated with crease-resistant synthetic resins to make the pleat formations washfast, it is often found desirable not to try to cure or insolubilize these resins in the fabric at the take-up zone, but rather to run the pleated goods through a separate curing oven not physically or integrally connected with the present combination pleating and tipping or printing assembly.

The apparatus comprised generally and including belts and pulleys within zone A of FIG. 1 is intended to represent a conventional accordion pleater machine, together with drive therefor, and for this reason it is considered that no extended description or recital of the several component parts thereof is necessary, since this part of the present assembly, per se, is not claimed as novel. It should be said, however, that the pleating portion A of the present tip printing apparatus is intended to accommodate a supply of cloth or other fabric 20 and a supply roll 21 of paper, both of which are adapted to be unwound from their respective stands or supports 22 and 23 as by means of the link belts 24 and 25 driven by any suitable means such as from a common motor 26 whereby both the fabric roll 20 and paper 21 are rotated in the same direction at the same speed and simultaneously so as to supply the accordion pleater 27 with cloth and paper materials to be pleated in unison. To that end the fabric 20 and underlying paper 21 are passed over their respective tensioning rolls 28 and 29 and then pulled over the top of the pleating table 30 and subsequently into contact with a reciprocating pinch bar 31 which is intermittently moved as by a cam action 32 driven from a sprocket 33 so as to reciprocate in timed relation about midway of the table top 30 of the pleating machine 27. The function of the pinch bar 31 is to intermittently push the fabric 20 into the pleating zone proper 34 (which is usually heated) where a plurality of pleats of the accordion type are pressed into being and heated as the cloth 20 passes therethrough.

In accordance with customary practice, at or about the time the pleat formations or folds are made in the cloth 20 at the pleating zone proper 34, the folded cloth is subjected to the action of the heating element such as by steam or otherwise (not shown) to help set the pleat formations. Preferably the heating elements are contained in a pressure frame or rack 36 provided on each end with a pair of leveling, or height-adjusting, screws 37. After the pleats 38 have been actually formed at the pleating station 34, the pinch bar 31, continuing its reciprocation according to a pre-determined and timed relation, causes the pleat containing fabric to be pushed forward so as to continue in its travel past the pleating station 34 and under the compression frame 36. The function of the frame 36 is to control the pleat formations 38 recently formed in the fabric 20 while the pleats 38 are at least preliminarily set by heat during passage of the pleated cloth 20 underneath the frame 36. As each motion of the reciprocating bar 31 pushes another small portion of the unpleated fabric 20 into the pleating station 34, the pleated portions of the cloth 20 which are now outside the pleating station 34 are bodily moved or pushed as by compression underneath the frame or rack 36 until each pleat successively emerges from underneath the frame 36. At that point the fabric 20 now in pleat formation 38 enters the tip printing range B proper, as will be explained hereinafter. With regard to the motor 26 supplying the drive for operating the system of links and belts shown in FIG. 1 whereby the unpleated cloth 20 and underlying paper 21 move in unison into and through the pleating station 34, and under and through the compression frame 36, it has been found that a constant speed, 3 phase, 760 r.p.m. ⅓ or ½ H.P. motor is satisfactory. In adjusting the leveling screws 37 on both sides of the

frame 36, care must be taken to have the frame 36 at a height from the table 30 sufficiently great so as not to halt passage or interfere with the movement of the pleated goods 38 thereunder. At the same time the height of the frame 36 or its distance from the table 30 must not be so great as to prevent effective control of the pleat formations 38 in the pleated cloth 20 after its emergence from the pleating zone proper 34.

As further shown in FIG. 1, a variable speed drive 39 may be connected as by any convenient system of pulleys and/or sprockets to the motor drive 26 and connected also by similar devices so as to control the rotation and speed of rotation of the tip printing roller whereby any coloring composition that may be desired is applied to the tips of the pleats 38 of the fabric 20. Furthermore, the variable speed control unit 39 may be provided with a speed adjusting arm and indicator 40 to alter the ratio of speed between the motor drive 26 controlling unwinding of the cloth and paper rolls 20–21, and the speed of rotation of the tipping roll. The system of driving and driven motors schematically illustrated in FIG. 1 of the drawings is intended to represent any suitable means for controlling the rate of feed of the cloth 20 and paper 21 into the pleater 27 in relation to the speed of rotation of the cloth tip printing roller which will be presently described.

Upon emerging from the pleating zone A the pleated fabric 20, with its accordion pleats substantially compressed rather than expanded, is pushed on lengthwise into the tipping zone B which comprises an auxiliary flat table or bed plate 41, a secondary pleat controller device 42, the tipping roller 43, and suitable driving means for rotating the roll 43 such as a belt and pulley system 44 (FIG. 1).

In FIG. 2 are shown the details of a tipping assembly of the type schematically illustrated in FIG. 1. Such assembly may include the flat metal table 41 on which pleat controller 42 and tip-printing roller 43 are both mounted in coacting relation.

The function of the controller device 42 is to control and maintain the pleat formations in the cloth 20 after it leaves the pleating zone A until it reaches the tipping roll 43 in the printing zone B. In effect, the controller 42 provides a corridor which permits controlled passage of the pleated fabric 20 from the pleater A to the printing station B. It is observed that not only are the pleats controlled but, in addition, movement of the cloth itself, at least vertically, is restricted and governed by means of this relatively narrow corridor which is constructed and arranged to span the full width of the table 41, and which runs lengthwise thereof up to the point at which the pleated fabric 20 is subjected to the printing action of the tipping roll 43.

The controller device bracket 42 may be conveniently and releasably fixed to the top of the stationary table 41 at its forward end as by means of an adjustable angle or mounting bracket 46. Bracket 46 itself may be fixed against movement to the table-top 41 as by means of the bolt 47, it being understood, of course, that two mounting brackets 46 are preferably employed, one for each end of the controller 42. A pin 48 is fitted through coacting apertures in registration on each end of the controller 42, and centrally of the upstanding portion 49 of angle 46. By this means lateral movement of the device 42 lengthwise of the supporting table 41 is prevented during the tipping operation. The controller 42 may comprise a rectangularly shaped frame 50 of U-shaped cross section (see FIG. 3) having two height adjusting screws 51 at each end whereby sufficient space may be allowed between the top of the table 41 and the under side 52 of the frame 50 to permit passage of the pleated cloth 20 through the corridor 53 defined by the top of the table 41 and the under surfaces of a series of spaced elongated hardwood pressure feet 54 that are suspended from the bracket frame 50 by means of the wood screws 55.

To permit limited vertical movement of the controller 42 with respect to the fixed position of the table-top 41, each of the pins or screws 55 accommodates a small encircling tension spring 56 held in place by flat washers 57 or by any other suitable means.

The controller device 42 thus described provides a corridor, a tunnel, or controlled passageway 53 for the pleated cloth 20 to move from the pleater A to the tipping roll 43. The length of the longer sides 58 of the rectangular frame 50 is such as to span substantially the full width of the table 41 and thereby permit goods of almost any width to be processed, or at least goods of any size width up to the width of the table 41 itself. The space or distance 53 between the pressure feet 54 and the table-top 41 may be varied at will, or as necessary, to fit different heights of pleat formations by adjusting the turn-screws 51 at both sides of the frame bracket 50. Thus, as noted in FIG. 2, the pleated cloth 20 may pass through the corridor 53 according to a predetermined degree or pattern of control, such that, on the one hand, the gap 53 will not be so great as to result in the loss of the pleat formations, and on the other hand, will not be so small as to prevent or interfere with passage, that is, movement of the pleated cloth 20 from the pleater A to the tipping station B.

It should be understood, of course, as clearly shown in FIGS. 2 and 3 of the drawings hereof, that the rectangular frame 50 of device 42 is held in position suspended over, but spaced from, the table-top 41 by means of the adjustable turn screws 51, and that by means of this adjustment the pleated fabric 20 is free to move within the gap 53 formed by the under surface of the frame 50 and the upper surface of the table 41. This gap or distance 53 may be increased or decreased at will, or as required by the height of the pleats in the fabric 20, simply by turning the end screws 51 on either end of the frame bracket 50. In short, the controller 42 is held out of contact with the table-top 41, but notwithstanding is supported thereby as by means of the adjusting screws 51.

It will also be noted by reference to FIG. 1 and the schematic arrangement shown therein that the controller 42 in zone B thereof, that is the tipping zone, is a substantial duplicate of the compression rack assembly 36–37 in zone A thereof, which is placed immediately in back of the pleating area 34. Theoretically, at least, it would seem possible to dispense with the secondary or auxiliary controller 42 in zone B and to rely entirely upon the counterpart thereof 36–37 in zone A. In practice, however, it has been found desirable to extend the compression corridor interval or period, and to provide the auxiliary or secondary controller 42 in zone B, that is the tipping zone, as described above.

The tipping means proper for applying a deposit of color to the tops or tips of the accordion pleat formations in the fabric 20 that is being processed are located immediately in back of the frame 50, and may comprise a rotatable knurled stainless steel tipping roll 43 journaled as at 60 in the free end 61 of a movable arm 62 pivoted at at 63. Just as the controller 42 is held suspended over the table 41 and spaced therefrom by means of the height adjusting screws 51, so also the distance of the outside periphery or working surface of the knurled tipping roller 43 from the table-top 41 may be altered as desired by means of the height adjusting screw 64 which threadedly engages the free end 61 of the pivoted tipping roll arm 62. The pivoted end 63 of arm 62 is fixed against lateral movement by the bracket 65 which is fastened as at 66 to the side of the table 41. It will be observed at this point that the fingertip edges 67 of the series of elongated pressure feet 54 are in surface contact with the rotating surface of the tipping roll 43. This

arrangement helps to facilitate an even distribution and deposit of coloring matter to the tips of the pleats in cloth 20 as it passes through the gap 53 between the tipping roll 43 and the table-top 41, the extent of said gap being predetermined or fixed by means of the tipping roller adjusting screw 64. The color deposit and distribution is further governed and controlled as by a tempered steel doctor blade 68 having its lower or free edge in contact with one side of the tip-printing roll 43 which is clampingly held by a doctor blade holder block 69 which may be made of aluminum or other suitable material. The blade 68 may be fixed to the block 69 with bolts 70 as seen in FIG. 2.

Projecting beyond the opposed ends of the block 69 and associated therewith are a pair of journals 71 constructed and arranged to be supported for axial movement or rotation in a pair of bearing brackets 72 pivotally fixed as at 73 to the movable arms 62 on either side of the table 41. A bronze bushing 74 formed as the inner end of a doctor blade weight arm 75 may be fixed to the journal 71 of the blade 68, and by this means the extent of pressure of the blade 68 against the working surface of the tipping roll 43 may be modified or adjusted as by a mechanical lever motion or action. The mass or weight 76 and its relative position on the projecting and horizontally disposed portion of the arm 75 may be adjusted as required by means of allen set screws 77 or any other suitable fastener device.

An obliquely disposed adjusting screw 78 may also be provided to move the blade 68 bodily toward the print roll 43 and to alter the pitch of the doctor blade 68 in relation thereto. To that end, the movable bracket 72 incorporates a boss or stop 79 medially of its length and the free end of the oblique doctor blade adjusting screw 78 may bear against the stop 79. The screw 78 itself is threaded at one end to engage a supporting interiorly threaded bushing 80 which is fixed to the outer face 81 of a screw bracket 82, which itself is fixedly united to the movable arm 62 by the fasteners 83.

Thus it is seen that the present tipping assembly, and in particular, the relation of its tipping roll 43 and the doctor blade 68 components feature three different adjustments, viz.: the vertical screw 64 for altering the height of the corridor 53 through which the pleated goods 20 pass under the print roll 43; the obliquely disposed adjusting screw 78 for moving the blade 68 bodily in a generally horizontal plane, and simultaneously altering its pitch; and the weight arm 75 which controls firm contact of the blade 68 against the working surface of the tip-printing roll 43.

It is to be understood, of course, that while for convenience only one side of the tipping assembly as shown in FIG. 2 has been described, actually the far side or other side of the work table 41 is a duplicate thereof, so that for example the assembly comprises not merely one, but two vertical screws 64, one on each side of the table 41; not one, but two oblique screws 78; and not one, but two weight arms 75; and two complementary sets of the respective coacting components of the elements thus described in the singular, excluding, of course, the tipping roller 43 and the doctor blade 68, of which there is only one of each.

The coloring composition that is to be applied in the present tip printing operation to the tops or tips of the pleat formations in the fabric 20 being processed may be applied to the nip formed by the bottom edge of the doctor blade 68 and the working surface of the tipping roller 43 in contact therewith, as shown in FIG. 2 hereof. As the printing roll 43 rotates in the direction of the arrow as shown, the deposit of color is applied to the cloth 20. In order to furnish a supply of coloring composition to the nip of the blade 68 and the tipping roller 43, a tiltable pan or other container 84 may be mounted as seen in FIG. 2, immediately to the rear of the knurled roll 43. The pan 84 containing the coloring composition (not shown) may be tiltably mounted as by means of the upstanding bracket 85 and may also be provided with a tilting lever 86 pivoted as at 87. When the lever 86 is moved upwardly so as to reciprocate about its pivot point 87, the coloring composition within the pan or bucket 84 will escape and flow over the lip 88 of the pan 84. It will be understood that when the pan 84 is tilted upwardly so as to deposit the coloring composition in the trough or nip formed by the blade 68 and the tipping roller 43, the lip 88 of the tilted pan 84 will be trained over or directly above the nip of these components so that the coloring composition will not spill out elsewhere. To prevent coloring composition from escaping from either side of the nip or trough formed by the doctor blade 68 and the tipping roller 43, a pair of felt blocks or color retainers 89 may be placed in position at either side or at either end of the trough so as to provide in effect a color composition dam at both ends of the knurled tipping roll 43 and doctor blade 68. By this means, all of the coloring composition that is dumped into the trough will be applied to the tips of the pleat formations in the cloth 20 as the latter proceeds through the corridor or free space 53 intermediate the under surface of the pressure feet 54 and the table top 41.

In practice it has been found perfectly feasible to eliminate entirely the color pan 84 and its mounting bracket 85 and tilting lever 86. In this embodiment or modification of the present invention the color is applied directly to the same place, that is to the nip formed by the doctor blade 68 and the tipping roll 43 by pouring the coloring composition directly therein from the can or other container in which the coloring composition is furnished by the supplier thereof.

After passing through the tipping zone B, as shown in FIG. 1 and FIG. 2, the pleated and tipped cloth 20 is fed into the curing and/or take-up and/or drying zone C (cf. FIG. 1). If such goods 20 have been previously impregnated with a synthetic resin for the purpose of maintaining or helping to maintain washfast the pleat formations therein, then take-up zone C may also be utilized to impart at least a partial curing moment or interval as by the application of heat therein to the pleated cloth 20.

Referring now more specifically to FIGS. 1 to 4 of the drawings, the present tip printing assembly for pleated fabrics may also incorporate, as previously stated, a curing-drying-take-up zone C as by means of the sloping table or platform 90 which may be made of metal or any other suitable material bolted or otherwise fastened at its forward end to the delivery end of the table 41 at the end of zone B. At the far end of the delivery table 90 there may be placed as an integral part thereof a curved stop member 91 and the operator in charge of the present apparatus may from time to time take up a position immediately in back of the stop member 91 and from that place roll up that portion of the pleated and tipped fabrics 20 which may have accumulated on the take-up slope 90.

Means for the application of heat, at least to the upper surface of the pleated fabric 20 while it is passing over the delivery pan 90, may consist of a heating element or member 92 fastened as at 93 and 94 at both sides of the delivery end 90 of the table 41, the arrangement being such as to provide a free space 95 for passage of the cloth 20 thereunder. The heating member 92 also comprises heating coils 96 and 97 which conveniently may span the width of the delivery end 90 of the table 41 so as to apply heat transversely over the whole width of the cloth 20 as it passes over through free space 95. A pair of support bars 98 fixed at one end to the sides of the delivery portion 90 of the table 41 and fastened at their other end to the uprights 99 of table 41 serve to keep the delivery station 90 in constant contact and proper position so as to receive the accumulating cloth 20 as it passes out of the tipping zone B into the delivery zone C.

It may also be noted here that as an auxiliary means for governing and controlling the pleat formations in the cloth **20**, it has been found desirable to keep the pleated paper **21** underlying the pleated cloth **20** and in contact therewith so that both simultaneously and in registration with each other pass through the entire opening range A, B, and C. Thus, even at the final step in the operation, when the goods form the take-up roll **100**, they comprise not merely the pleated cloth **20** but also the accompanying pleated paper **21**.

Instead of fastening the take-up station **90** to the upright of table **41**, as shown in FIGS. 2 and 4, there may be substituted an independent upright **101** constructed and arranged to support the take-up station **90** at its terminus **91**, as seen in FIG. 1.

FIGS. 5 to 9 illustrate the product obtained by the assemblies of FIGS. 1 to 4 inclusive and modifications of such product, as will be explained.

The perspective view of a fragment or portion only of a fabric **101** having pleat formations therein **102** is shown in FIG. 5. This pleated fabric **101** has its pleat formations expanded rather than compressed for illustrative purposes only, and it is to be understood that the top or tips **103** of the pleats **102** have not received the tipping or printed deposit of color as contemplated herein.

On the other hand, FIG. 6, which is a plan view of a pleated fabric **104**, has its pleats **105** expanded, the upper portions **106** of which have already been tipped or printed with a coloring composition of any desired nature or make-up.

The pleated and tipped fabric **104** shown in expanded form in FIG. 6 is illustrated in the compressed state in FIG. 7, and as there seen each of the pleats **105** is compressed so as to be closely adjacent each other.

As previously indicated, and as shown in FIG. 8, the present invention also contemplates the application of a coloring composition only to isolated portions or certain areas only of the tips of a pleated fabric. There, the pleated fabric **107** in which the pleat folds **108** are in expanded formation, a deposit of color **109** may be applied according to a predetermined design, such as a diamond. It will be understood, of course, that if pleat formations of the fabric **107** are pressed together after the tipping composition has been applied only in the form of a design such as a diamond so that all of the pleats are closely adjacent, as indicated in FIG. 7, then each of the dots **109** or printed portions shown at the top of each of the pleats in the expanded fabric **107** of FIG. 8 would not be spaced from its neighboring pleats and dots whereby the design of a diamond would be clearer. In other words, if the fabric **107** of FIG. 8, having first been printed in its tipped portions in the form of a diamond, is compressed together, or if its pleat formations are pressed together, the diamond design is more apparent than it would be when the pleats are expanded as per FIG. 8.

FIG. 9 is intended to indicate another modification of the present invention whereby the application of color is made in the form of spaced stripes that are applied to the tips or topmost portions of each successive pleat, especially pleats of the accordion type. Here may be mentioned also that it is contemplated, if desired, that each of the several stripes **113** in the pleated fabric **114** shall be of a color such as to contrast with the colors of the other stripes therein. In short, FIG. 9 illustrates the application of the present invention to the production of multi-color spaced stripes lengthwise of a moving pleated fabric so that the stripe formations run lengthwise, that is, in the same direction as the longer dimension of the cloth **114** and/or at right angles to the pleat formations therein. Just as the diamond pattern of FIG. 8, there shown with the pleat formations expanded, becomes more emphasized if the pleats are contracted or compressed, as in FIG. 7, so it is with the stripe formations seen in the expanded pleats of the fabric **114** in FIG. 9: which is to say that if these expanded pleats be contracted or compressed, the multi-color stripe effect therein becomes more pronounced.

To obtain the special effects mentioned above, such as the diamond shape of FIG. 8, it is advisable to substitute in practising the present invention for the knurled tipping roller **43** of FIG. 2 an engraved printing roll (not shown) having an engraved or cut-out portion corresponding to the diamond design or whatever other design is specified.

To obtain the striped multi-color effect of FIG. 9, it is recommended that quick drying inks be used, and that a plurality of engraved striped printing rolls, one in back of the other (not shown), be substituted in place of the knurled tip-printing roll **43**. In such an arrangement, of course, it is contemplated that each successive printing roll involved in a substitution of that character will apply a deposit of different color to the tips of the pleated fabric passing thereunder, and before the cloth to which a stripe in one color has been applied advances toward and reaches the next roller at which a contrasting color will be applied, the ink deposited thereon at the first roller will have dried so that there will be no ink smearing problem involved in the application of multi-color stripes to the fabrics **114** as described.

It must also be understood, of course, that one is not confined, in the matter of special effects or design printing, to the diamond shape motif or pattern illustrated in FIG. 8 of the drawings hereof.

With regard to using a plurality of engraved rollers for multi-color tipping or printing, as suggested above, it has been found unnecessary to use more than one tipping roll where it is desired to apply the coloring material all over, that is, along the whole width of the tips of all the pleat formations.

As a general rule, it has also been found advisable to cure the pleated and tipped cloth in a curing oven or box, separate and apart from the present pleating and tipping assembly.

What is claimed is:

The combination in an assembly for continuously applying color only to the tips of the pleats in a pleated fabric, of a work table for receiving a length of the fabric in open width pleated form, means for moving the open width pleated fabric lengthwise across the top of the work table, a pleat controller mounted over the table and defining therewith a controlled passage for receiving the moving length of pleated fabric and guiding its movement lengthwise of the table without distorting its pleated form, said controller comprising a rectangular frame suspended over the table by means of legs at the corners of said frame, and held against movement widthwise of the table by mounting brackets secured to the sides of the table, and held against movement lengthwise of the table by pins projecting from the sides of the frame engaging with slots on the sides of said mounting brackets, means for adjusting the distance between the table top and the frame suspended thereover to permit passage therethrough of fabrics having pleats of various heights, a series of spaced pressure feet running lengthwise of the table and yieldingly suspended from the under side of said frame to thereby define a variable distance gap through which the pleated fabric may be passed along the top of the table, each of said pressure feet including an extended portion projecting beyond said frame to coact with applicator means for applying a coloring composition only to the tips of the pleats in said fabric after its emergence from the exit end of such passage, said applicator means comprising a rotatable tipping roll mounted for limited vertical movement on the free ends of a pair of moveable arms pivoted at their other ends to spaced brackets fixed to the sides of the table top, the peripheral surface of said tipping roll being out of contact with said table and in surface contact with the extended portions of each of said pressure feet to facilitate the deposit and distribution of the color-

ing composition from said applicator roll to the tips of said pleats as the pleated fabric passes between the applicator roll and the table top, and means on said movable arms coacting therewith for adjusting the relative distance of the applicator roll from the table top to correspond with adjustments of the distance of said controller frame from the table top.

References Cited by the Examiner

UNITED STATES PATENTS

671,790 4/01 Chandler ---------- 223—30
2,213,117 8/40 Blackmore ---------- 118—259 X
2,534,320 12/50 Taylor ---------- 118—413 X
2,659,340 11/53 Zinn ---------- 117—111 X
2,741,215 4/56 Cady et al.
2,747,541 5/56 Chew ---------- 118—259 X
2,785,081 3/57 Babiarz et al. ---------- 118—44 X
2,874,754 2/59 Yost et al. ---------- 223—30 X

CHARLES A. WILLMUTH, *Primary Examiner.*
RICHARD D. NEVIUS, *Examiner.*