Oct. 22, 1974 C. A. WETHINGTON 3,843,432

METHOD TO PRODUCE A BONDED PILE FABRIC

Filed Jan. 27, 1972 4 Sheets-Sheet 1

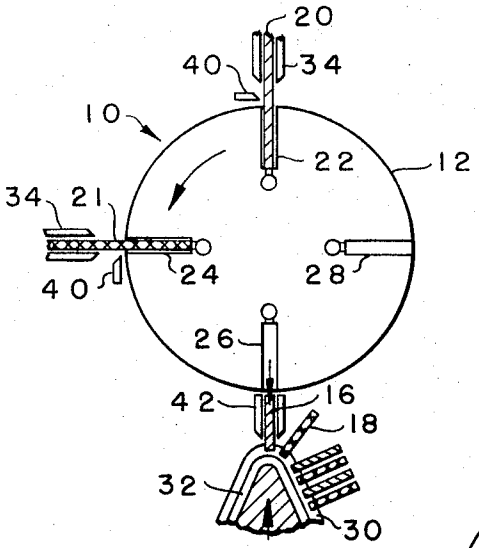


FIG. -1-

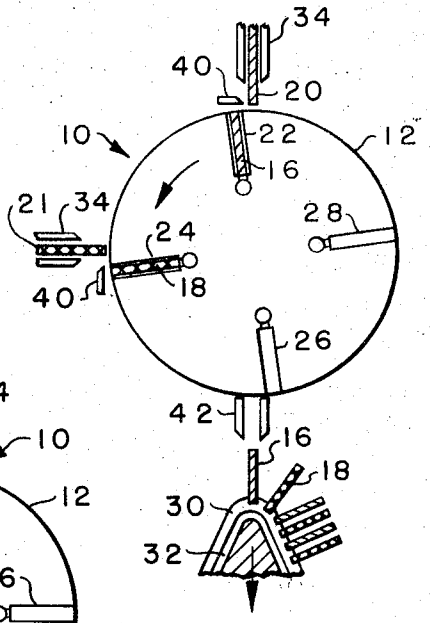


FIG. -2-

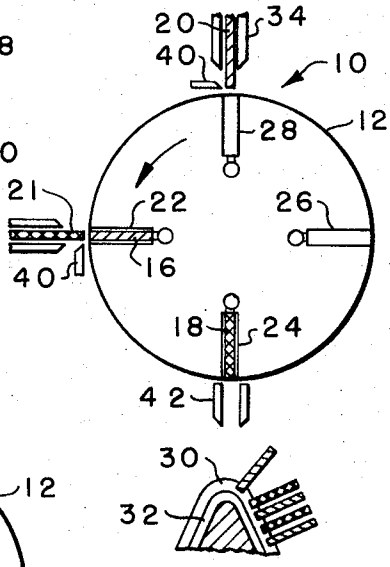


FIG. -3-

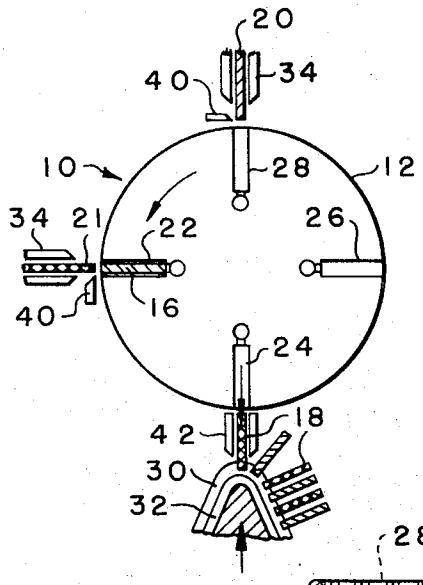


FIG. -4-

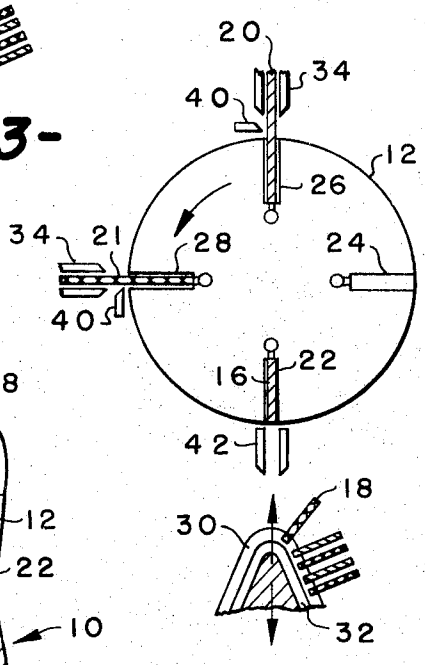


FIG. -5-

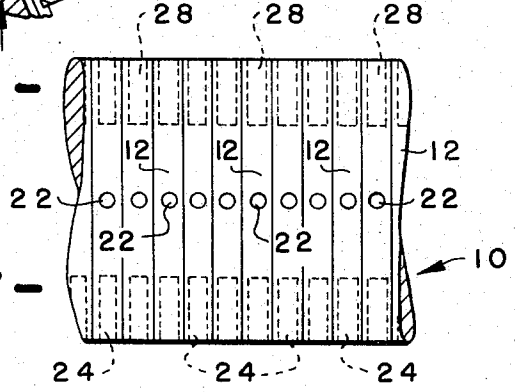


FIG. -6-

METHOD TO PRODUCE A BONDED PILE FABRIC

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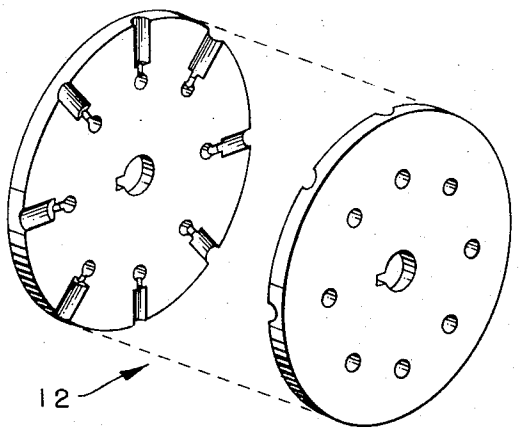


FIG.-7-

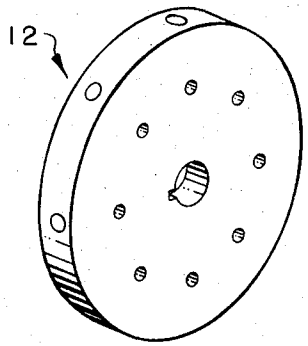


FIG.-8-

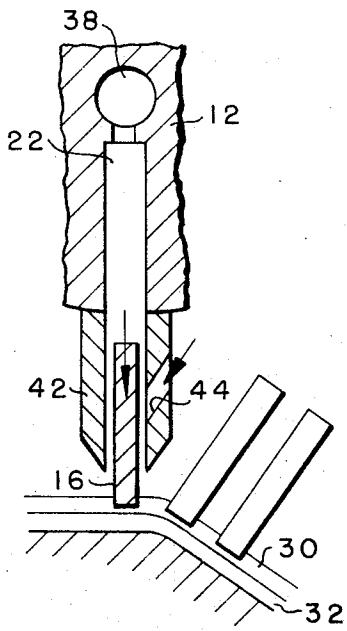


FIG.-9-

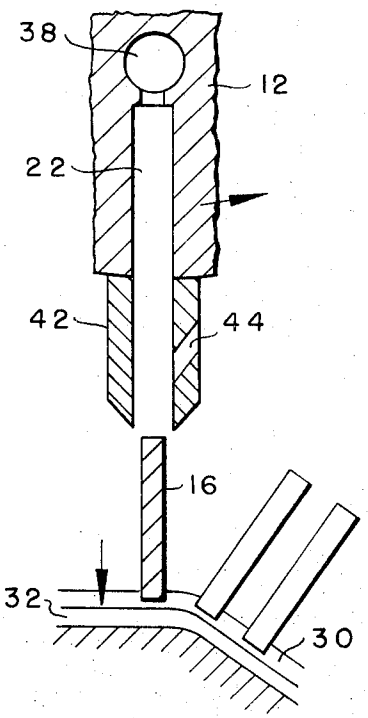


FIG.-10-

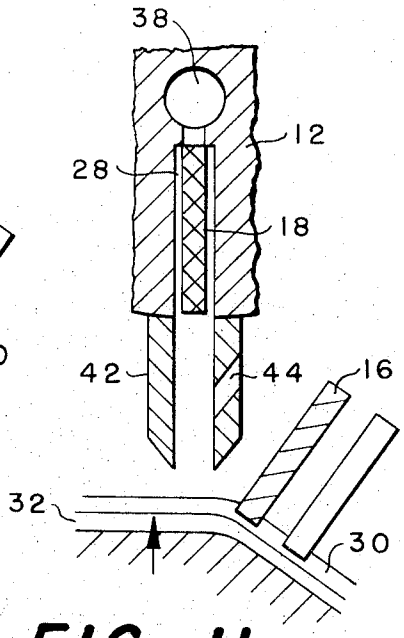


FIG.-11-

METHOD TO PRODUCE A BONDED PILE FABRIC

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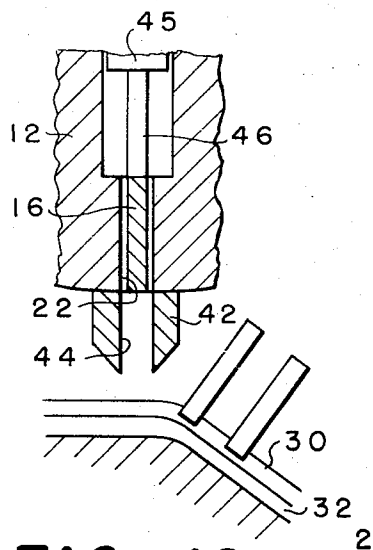


FIG.-12-

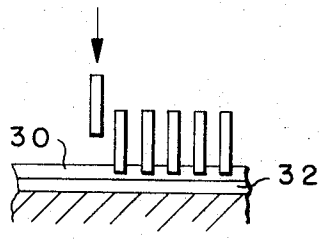


FIG.-14-

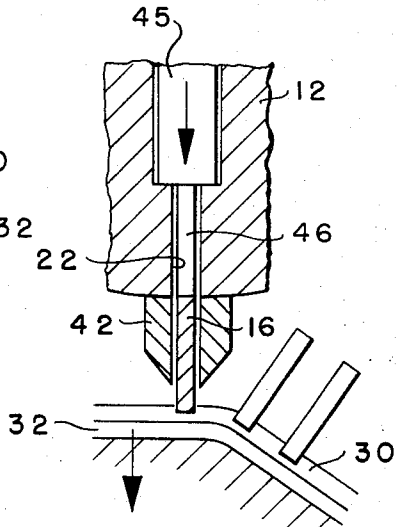


FIG.-13-

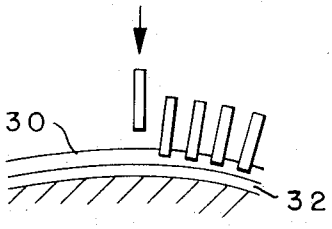


FIG.-15-

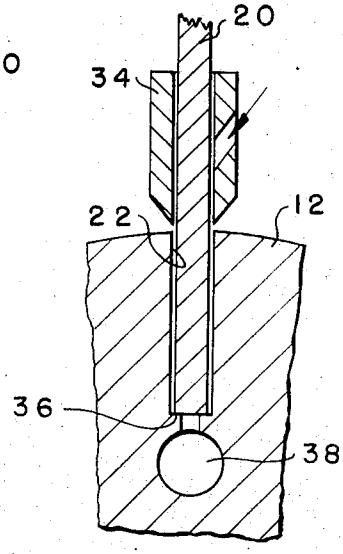


FIG.-17-

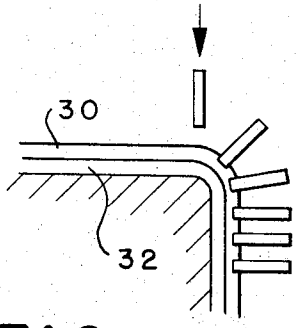


FIG.-16-

METHOD TO PRODUCE A BONDED PILE FABRIC

Filed Jan. 27, 1972 4 Sheets-Sheet 4

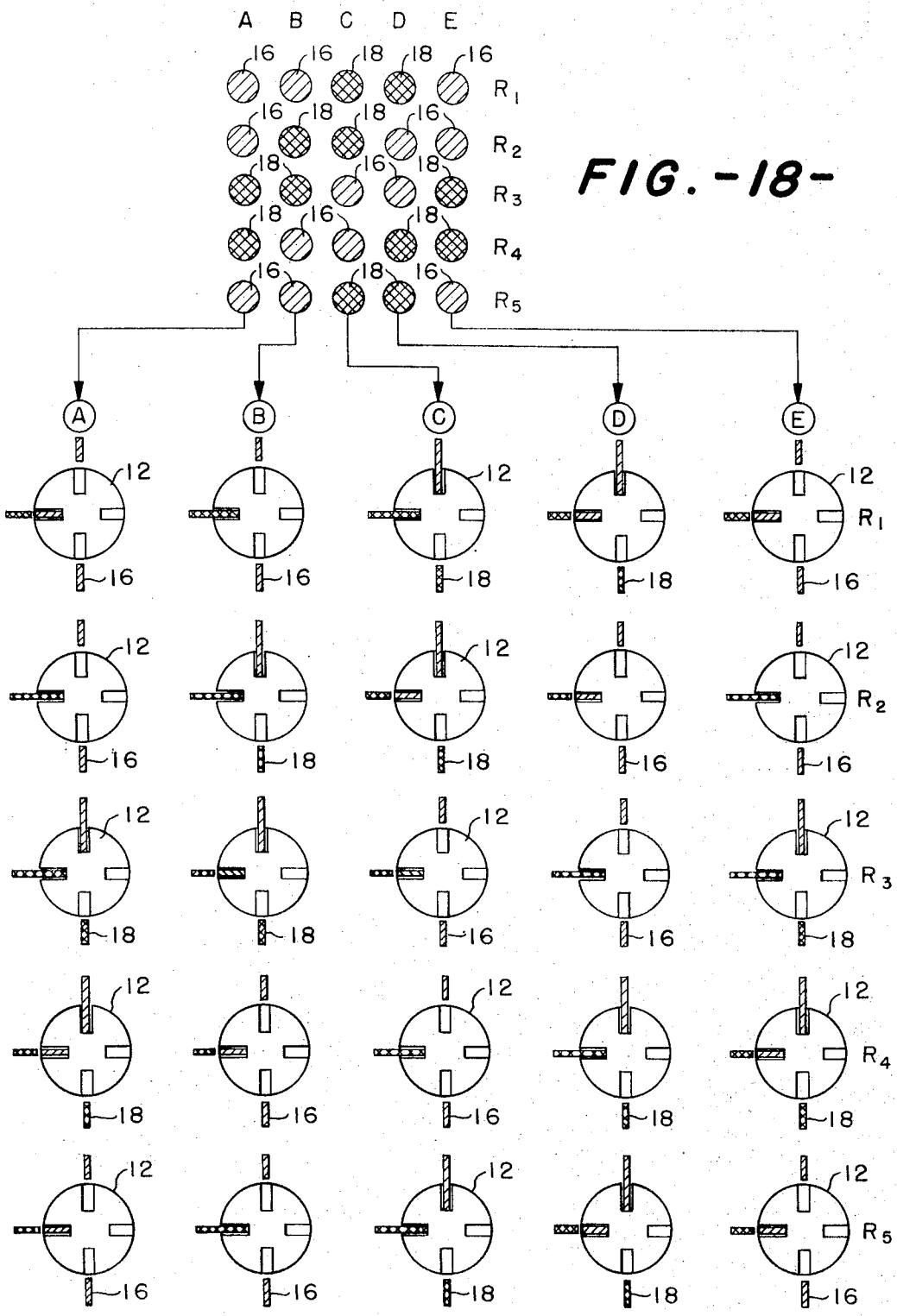


FIG. -18-

United States Patent Office 3,843,432 Patented Oct. 22, 1974

3,843,432

METHOD TO PRODUCE A BONDED PILE FABRIC

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Int. Cl. B32b 5/02, 31/00; D05c 17/02
U.S. Cl. 156—72 2 Claims

ABSTRACT OF THE DISCLOSURE

A machine and process with colored yarn patterning capability to produce a bonded, cut pile carpet. A series of hollow needle bars are used to supply yarn to a rotary carrier which carries the individual cut fibers into a position where they are selectively ejected into the surface of an adhesive material.

Prior to this invention the carpet industry has attempted to develop a relatively simple machine to produce a bonded, cut pile carpet which has the appearance of an Axminster carpet.

Therefore, it is an object of this invention to produce a bonded, cut pile carpet by a machine and process which has colored yarn patterning capability.

Other objects and advantages of the invention will become clearly apparent as the specification proceeds to describe the invention with reference to the accompanying drawings, in which:

FIGS. 1–5 represent schematically the basic concept of the invention;

FIG. 6 is a partial view of the yarn collector and distributor cylinder;

FIGS. 7 and 8 are schematic representations of two forms of the individual discs used in the yarn collector and distributor cylinder;

FIGS. 9–11 are blown-up views of the yarn collector and distributor cylinder to show the yarn ejection cycle;

FIGS. 12 and 13 show an alternative method of ejecting the yarn into the adhesive surface;

FIGS. 14–16 show various forms of the adhesive surface;

FIG. 17 illustrates one type of yarn feed device; and

FIG. 18 represents a modification of the invention shown in FIGS. 1–5.

Looking now to FIGS. 1–6, the basic concepts of the invention will be explained. The yarn collector and distributor cylinder **10** consists of a plurality of discs **12** which have a plurality of radial openings therein to accommodate bits of yarn **16** and **18** cut off from the respective yarn supplies **20** and **21**. For the sake of illustration four radial holes **22**, **24**, **26** and **28** are shown in each of the discs **12**. The discs are secured together in any suitable manner to provide an elongated right circular cylinder which is mounted on a horizontal axis to supply bits of yarn **16** and **18** in a substantially perpendicular direction into the adhesive surface **30**.

The adhesive surface **30** can be applied to a backing material or, depending on the adhesive, can be applied directly to the conveying surface **32**. The particular adhesive could be liquid at the point of yarn insertion requiring heat or time to become a permanent bonding vehicle or could be a hot melt requiring only cooling. The adhesive surface **30** can be planar at the point of yarn insertion as shown in FIGS. 14 and 16 or can be curved at the point of insertion as shown in FIGS. 1–6 and 15.

Looking at FIG. 17 a typical yarn feed is illustrated in that air is aspirated into the needle **34** to suck the yarn **20** into the radial opening **22** until it bottoms on the

bottom **36** of the opening. If desired, the passage **38** can be vented to atmosphere to allow the yarn to be more readily fed into the opening **22**. In the desired form of the invention the length of the yarn **20** to be cut is determined by the depth of the opening **22** but other devices, such as a solenoid controlled stepping motor, can be used to deliver a desired length of yarn into the opening **22**. As shown in FIGS. 1–5 the yarn bits are cut from the yarn supplies **20** and **21** by a fixed knife blade **40**, or other suitable means such as a shear, band knife or sickle bar cutter, located adjacent the yarn supply so that it engages the yarn as the yarn distributor rotates to sever the bits from the yarn supply.

FIGS. 9–11 show the preferred yarn release and bit inserter device and FIGS. 12 and 13 show an alternative device. In FIGS. 9–11 when the cyliner **12** rotates to a position where one of the radial holes, such as **22**, is lined up with the hollow needle **42** and it is desired to insert the bit of yarn **16** into the adhesive layer **30**, the passage **38** is vented to atmosphere and air is aspirated into the needle **42** through opening **44** to insert the yarn bit **16** into the adhesive layer **30**. Then the conveying surface **32** is moved downward (FIG. 10) so that the yarn bit **16** clears the bottom of the needle **42**. Then the conveying surface is moved downstream from the needle and upward for receipt of another row of yarn bits if the row of yarn is complete with the proper colors. At the same time the cylinder **12** has rotated counterclockwise to place another radial opening, such as **28**, into communication with the hollow needle **42**.

FIGS. 12 and 13 illustrate another type of yarn inserter which may be employed to implant yarn bits **16** into the adhesive layer **30**. The yarn inserter of FIGS. 12 and 13 is a mechanical type which uses a plunger **45** and plunger rod **46** to mechanically push the yarn bit **16** into the adhesive surface **30**. The plunger **46** can be actuated by any suitable means such as a cam, solenoid, etc.

It is understood that there are a series of yarn supply devices and yarn delivery devices lined up in a substantially parallel position to supply a multiplicity of yarn bits into the adhesive surface **30** at one time to produce a row of yarn bits.

FIGS. 1–5 represent schematically the operation of one disc of one cylinder **10**. For the sake of discussion, let us assume it is desired to provide a carpet with a two color yarn effect. The control of the yarn into and out of the radial opening, as well as the rotation of the cylinder **10**, is automatic and preselected to provide the desired effect in the finished product. If N represents the number of yarn colors required, the discs **12** will have 2N openings therein as indicated by the openings **22**, **24**, **26** and **28** since a two color yarn effect is desired. The number of openings in the disc **12** for any N is such that there will be N openings in a position to be fed yarn. $N-1$ openings empty or idle and one opening in a position to release yarn into the adhesive layer. The control is so selected that only one color yarn is released at any one time so each indexing rotation of the cylinder **10** is π/N radians. Thus the maximum number of indexes necessary for a given yarn color to become available at the release station at a given place in the pattern also will be N. To express it another way, if it is desired that all colors are to be placed in a single row in the adhesive, the cylinder **10** will be rotated or indexed N times before the backing **32** is moved to make another row in the carpet.

As shown in FIGS 1–5, one color yarn is supplied only to openings **22** and **26** while the other color yarn is supplied to openings **24** and **28**. Looking now to FIG. 1 and assuming that the controls are programmed to do so, one color yarn **20** is being supplied to opening **22** while another color yarn **21** is being supplied to the opening **24**.

At the same time, yarn bit **16** which has been cut from the yarn supply **20** is being released into the adhesive layer **30**. Then, as shown in FIG. 2, the conveying surface **32** is moved downward so that the yarn bit **16** clears the needle **42** and the cylinder **10** starts to rotate to the position shown in FIG. 3. As the cylinder **10** rotates, yarn bits **16** and **18** will be severed from their respective yarn supplies **20** and **21** by the knives **40** apppropriately located in the path of travel of the cylinder **10**. Then the cylinder **10** reaches the position shown in FIGS. 3 and 4. When the cylinder reaches the position shown in FIG. 3, the conveying surface **32** is moved upward so that the yarn bit **18** can be released into the adhesive surface **30** as shown in FIG. 4. Since yarn bit **16** is located in opening **22** no yarn is supplied from yarn supply **21** and no yarn is supplied from yarn supply **20** into the opening **28**. Then, as shown in FIG. 5, the conveying surface **32** is moved downward, indexed one space to receive another row of yarn bits and moved back up into yarn receiving position. At the same time, yarn supply **20** is supplying yarn into opening **26** and yarn supply **21** is supplying yarn into opening **28**. Then the procedure is repeated to provide another row of yarn bits.

In the above-described type of system a complicated array of actuating devices is necessary for each disc **12** since each disc has to have actuation at each of $N+1$ stations since there is selective release of only one color yarn at the release station, thereby requiring a number of actuation devices equal to $(N+1)$ x number of discs 12 for the cylinder **10**. The schematic representation of FIG. 18 reduces this number to (N x number of discs 12+1) since all the bottom holes release yarn on each index of the discs, thereby requiring only one release mechanism for all the discs in the cylinder **10**. Also the number of indexes of cylinder per row of yarn is reduced to one index per row.

Looking now to FIG 18, a modification of the system shown in FIGS. 1–5 is schematically represented. For the sake of discussion let us assume a two yarn pattern is required and the pattern is to repeat every four rows. As in FIGS. 1–5, the reference number **16** represents one color yarn and the reference number **18** represents another color yarn. The letters A–E represent discs **12** in the cylinder **10** and the letters R_1, R_2, R_3, R_4 and R_5 represent rows of yarn bits. The yarn bits are supplied and released in the manner previously disclosed. Preferably the supply and release actuation devices are programmed on a computer which, at the predetermined time for the particular desired pattern, actuates the actuators. As pointed out above, FIG. 18 represents a two color repeat pattern but obviously any number of yarns and patterns can be employed within the physical capabilities of the apparatus.

R_1 represents the first row in the carpet being produced and bottom openings of A, B and E are supplying yarn bits **16** and bottom openings of C and D are supplying yarn bits **18**. At the same time yarn for bits **16** to be released at row R_3 are being supplied to C and D while yarn for bits **18** are being supplied to B and C for release at row R_2.

Then the discs **12** are rotated to the R_2 position where A, D and E release yarn bits **16** and B and C release yarn bits **18**. At the same time yarn for bits **16** are being supplied to B and C for release at row R_4 while yarn is being supplied to A, B and E for release at row R_3.

Once again the discs are rotated to row R_3 where A, B and E release yarn bits **18** and C and D release yarn bits **16**. At the same time yarn for bits **16** is being supplied to A, B and E for release at row R_5, which is identical to R_1, and yarn for bits **18** to be released at row R_4 is being supplied to discs A, D and E for release at row R_4.

The discs **12** are rotated to release yarn bits for row R_4 where A, D and E release yarn bits **18** while B and C release yarns bits **16**. At the same time discs A, D and E are receiving yarn for yarn bits **16** to be released on the repeat of row R_2 while yarn for yarn bits **18** is being supplied to C and D to be released at row R_5. Then the discs are rotated to row R_5 position and the above-described pattern is repeated.

As noted, the above-described operation is for a repeat pattern but obviously yarn bits can be supplied by a programmer which does not repeat the pattern.

As described, the herein-disclosed invention provides apparatus and methods which can be computer controlled for manufacturing bonded, cut pile carpets with colored yarn patterning capability.

Although I have described in detail the preferred embodiments of my invention, I contemplate that many changes may be made without departing from the scope or spirit of my invention and I desire to be limited only by the claims.

That which is claimed is:

1. A method of manufacturing a cut, pile fabric on a machine having an elongated rotably mounted rotor member having a plurality of rows of apertures therein with the rows of apertures extending in the axial direction of the rotor member comprising the steps of: providing a plurality of yarn supplies of a first color adjacent the rotor member, providing a plurality of yarn supplies of a second color at an angle to the yarns of a first color adjacent the rotor member, supplying certain selected yarns of the first color into certain apertures of one row of the rotor member, severing the certain selected yarns of said first color from its supply, rotating the rotor to a position whereat the apertures of the one row are adjacent the yarns of a second color, supplying certain selected yarns of the second color into other apertures of the one row of apertures of the rotor member, severing the certain selected yarns of said second color from its supply, rotating the rotor member to a position where the one row of apertures is adjacent a yarn receiving adhesive member and simultaneously inserting said first color yarn and said second color yarn from the one row of apertures into the adhesive member.

2. The method of Claim **1** wherein yarn of said first color and said second color is being supplied to other apertures in other rows of apertures while yarn is being inserted into said adhesive member.

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CHARLES E. VAN HORN, Primary Examiner

T. E. BOKAN, Assistant Examiner

U.S. Cl. X.R.

156—265, 298

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,843,432 Dated October 22, 1974

Inventor(s) Charles A. Wethington

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 2, line 16, the word "cyliner" should read --cylinder--.

Column 2, line 54, the "." after the word yarn should be a --,--.

Signed and sealed this 17th day of December 1974.

(SEAL)
Attest:

McCOY M. GIBSON JR.
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents

FORM PO-1050 (10-69)

USCOMM-DC 60376-P69
* U.S. GOVERNMENT PRINTING OFFICE : 1969 O—366-334.