June 3, 1969 D. FRISHMAN ET AL 3,447,343

APPARATUS FOR KNITTING FROSTED PILE FABRIC

Filed July 11, 1966 Sheet 1 of 5

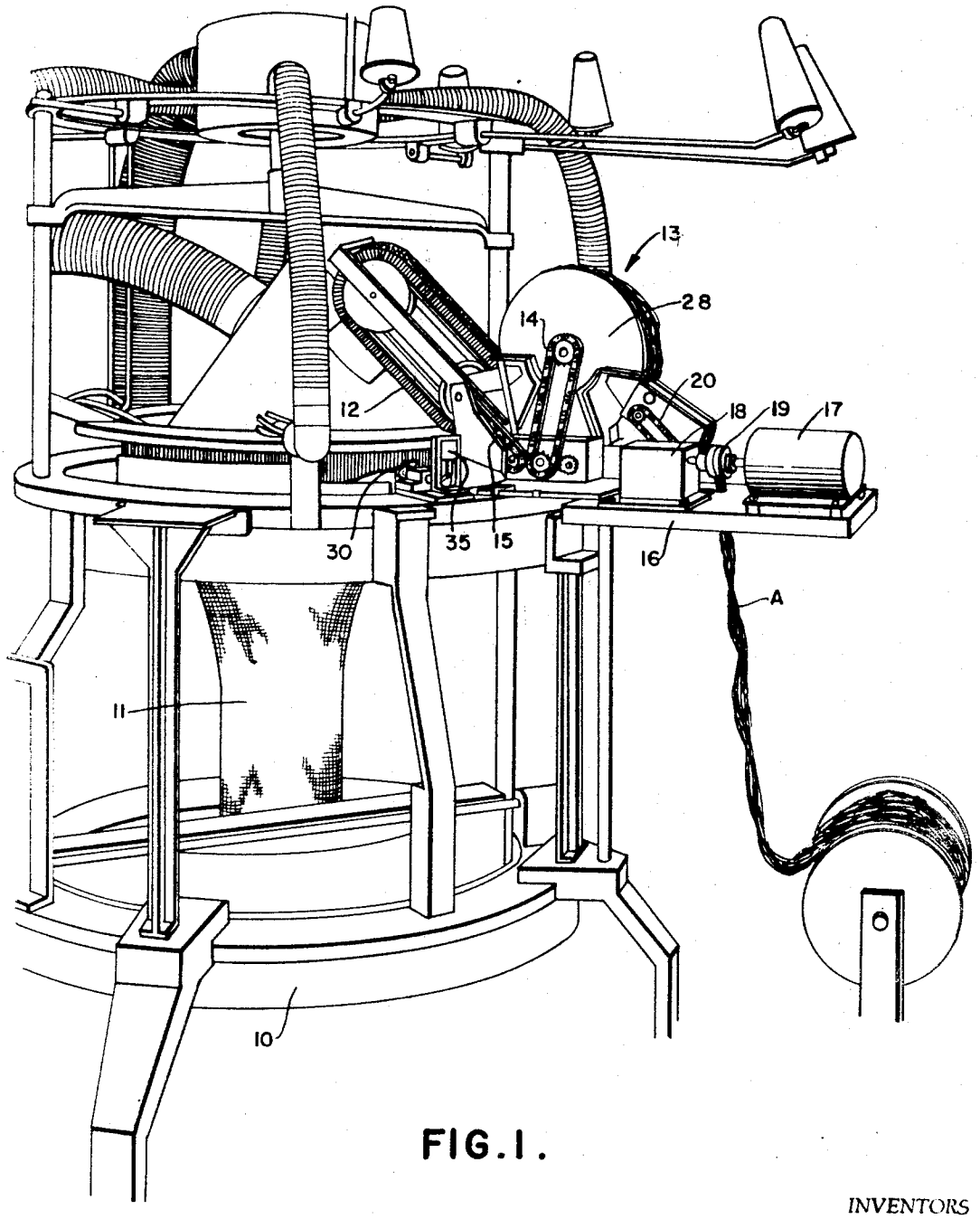


FIG. 1.

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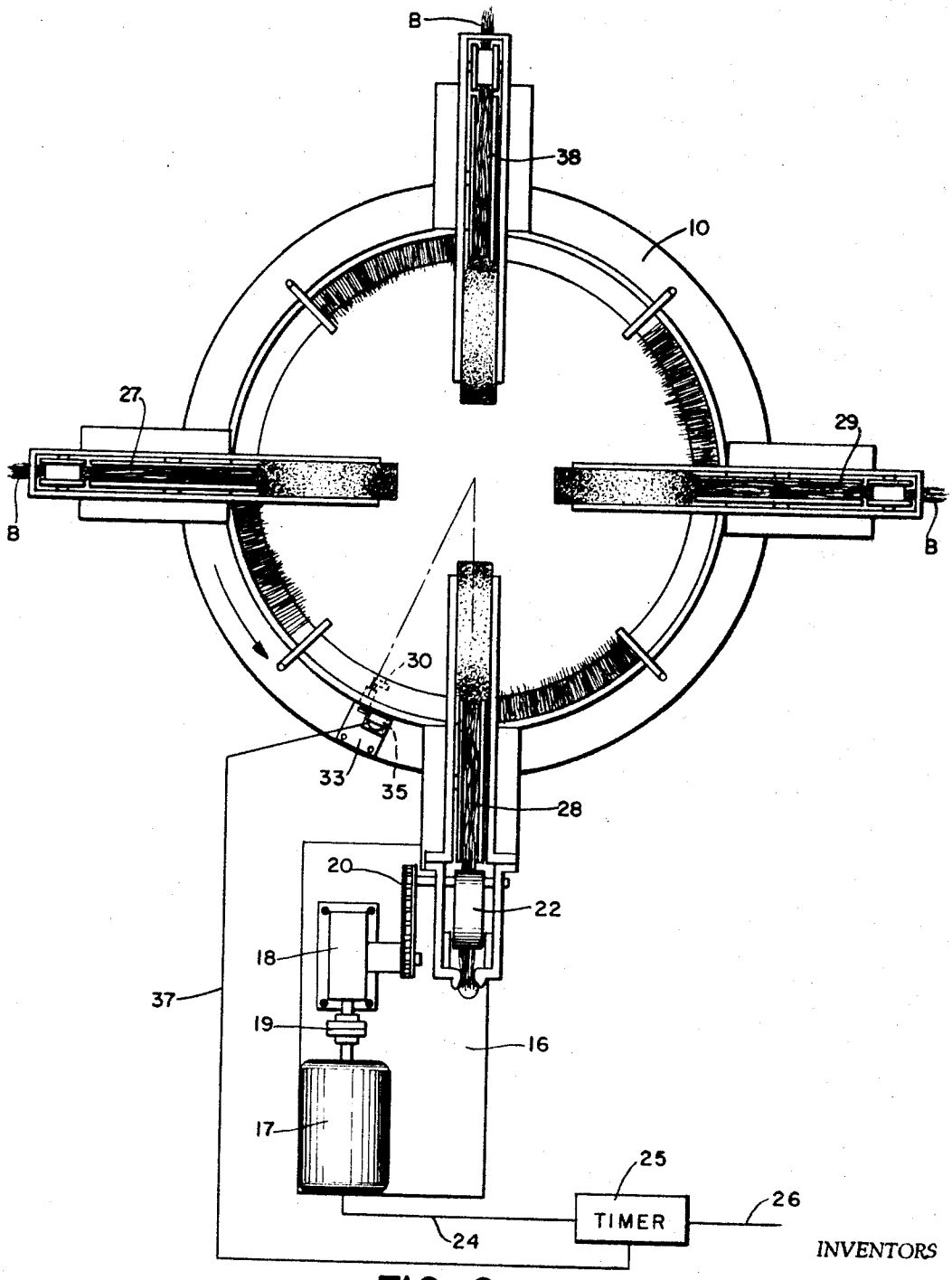


FIG. 2.

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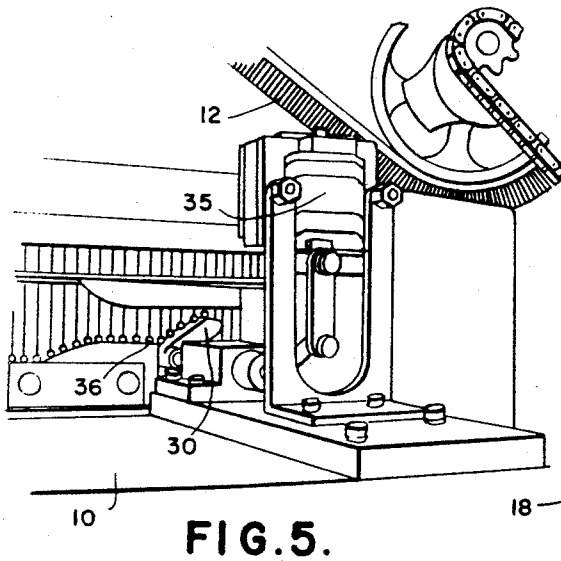


FIG. 5.

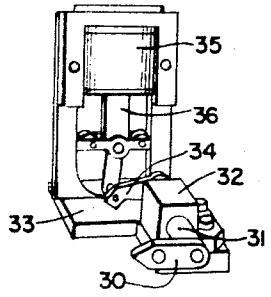


FIG. 6.

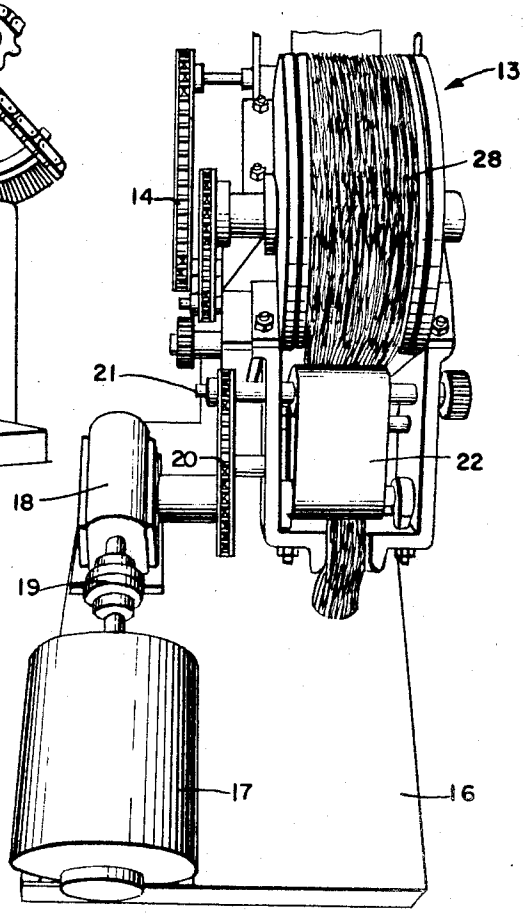


FIG. 3.

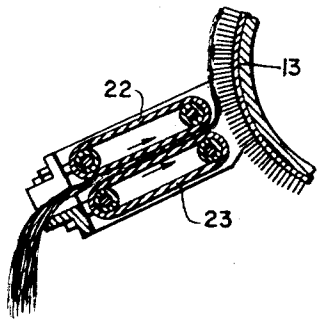


FIG. 4.

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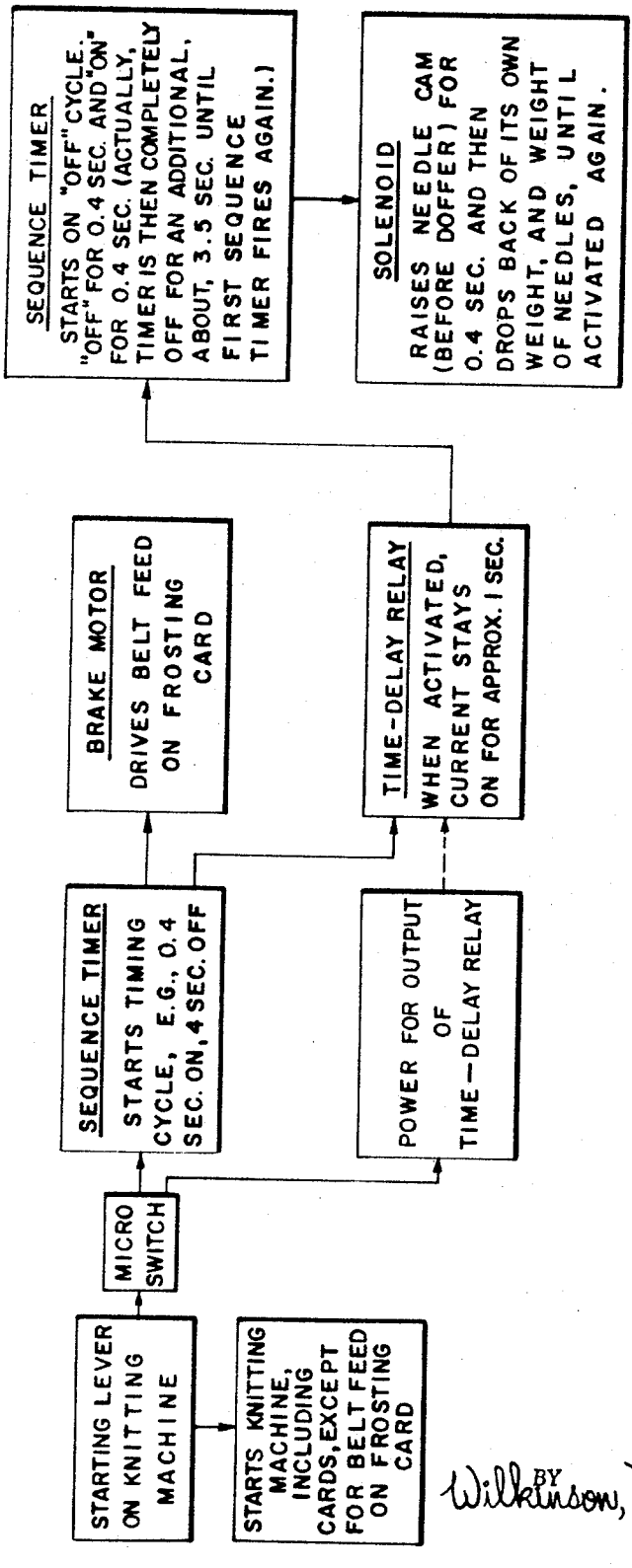


FIG. 7.

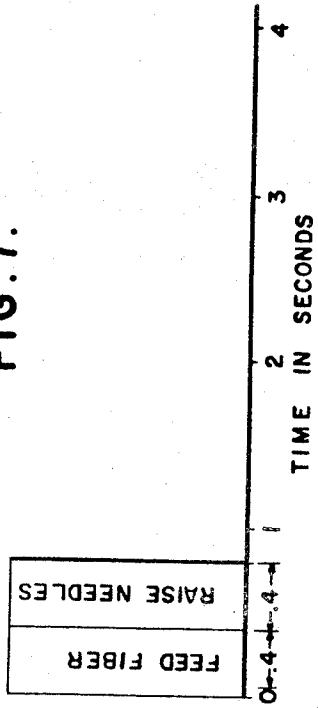


FIG. 8.

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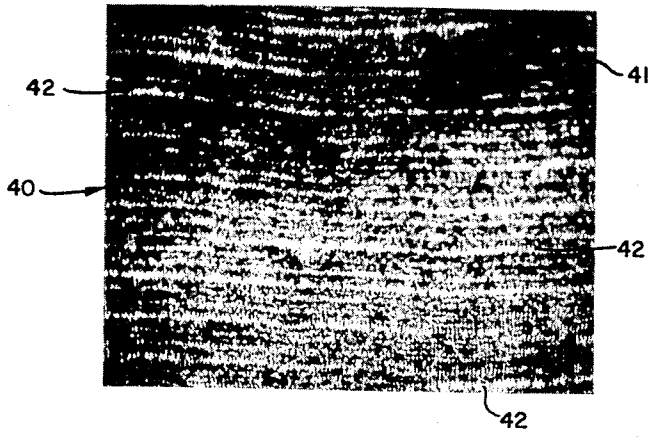


FIG. 9.

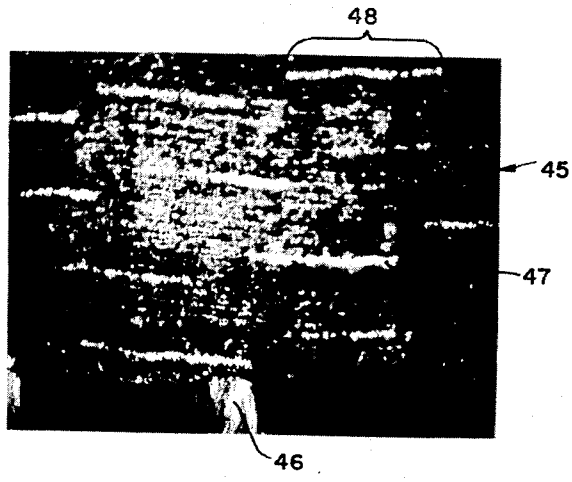


FIG. 10.

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3,447,343

APPARATUS FOR KNITTING FROSTED PILE FABRIC

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Int. Cl. D04b 9/12, 9/44
U.S. Cl. 66—9
6 Claims

ABSTRACT OF THE DISCLOSURE

The apparatus of the present disclosure is directed to knitting a frosted deep pile fabric for making wigs or other textile products on a circular knitting machine having at least two cards in which one of the cards is fed with a sliver continuously and the second card is fed with a sliver of a color different from the first sliver and the feed of the second card is done on an intermittent basis. Means is provided circumferentially in advance of the intermittently fed card to raise the needles in timed relation to the intermittent feed.

The present invention relates to frosted fabric, method and apparatus for knitting same, and has for an object the provision of a method of color streaking a fabric during its formation by introducing into the fabric as it is being knit a predominant group of dark filaments and dispersing through the fabric without interrupting the knitting process, filaments lighter in color to provide a frosted effect on the finished fabric. This fabric then is capable of being cut and formed into wigs in the manner described in United States Letters Patent No. 3,139,093, issued June 30, 1964, and United States Letters Patent No. 3,199,516, granted Aug. 10, 1965.

Another object of the present invention is to provide an apparatus for making a frosted fabric, which apparatus can be automatically operated intermittently without the attention of an operator through a timing mechanism for providing energy to the driving medium intermittently and which is normally driven from the main card mechanism.

A further object of the present invention is to provide a compact modified card assembly which may be converted readily from a conventional drive, as shown in United States Letters Patent No. 3,199,516 to the embodiment illustrated and described herein with a minimum of shutdown time necessary to make the modification.

The principal improvement of the present invention over the above resides in modifying the sliver feed techniques as well as the machine needle control techniques in the doffing zone where a sliver of different color from the sliver fed by the other cards on the machine is introduced.

Principally the frosting sliver is pulse fed to the card unit by an independently controlled feed separate from the other cards feeding the main or dominant sliver color and separate from the circular knitting machine drive.

With the foregoing and other objects in view, the invention will be more fully described hereinafter, and will be more particularly pointed out in the claims appended hereto.

In the drawings, wherein like symbols refer to like or corresponding parts throughout the several views:

FIGURE 1 is a perspective view of a Wildman jacquard machine having the modified card and needle control mechanism of the present invention attached thereon.

FIGURE 2 is a top plan view of a Wildman jacquard machine showing two normal card feeds and two modified card feeds in accordance with the present invention.

FIGURE 3 is a perspective view of the card mechanism constructed in accordance with the present invention.

FIGURE 4 is a cross sectional view taken through the endless belt sliver feed mechanism of the present invention.

FIGURE 5 is a fragmentary perspective view of the needle control mechanism employed with the present invention.

FIGURE 6 is a perspective view of the needle control cam and its operating solenoid in accordance with the present invention.

FIGURE 7 is a schematic of the cycle of driving the frosting card and needle control.

FIGURE 8 is a time graph of the cycle of FIGURE 7.

FIGURE 9 is a photograph of the fabric of the present invention when only the card feed is modified in accordance with the present invention.

FIGURE 10 is a photograph of the fabric when both the card feed and needle control have been coordinated in accordance with the present invention.

Referring more particularly to the drawings, **10** designates generally a conventionally Wildman jacquard circular knitting machine which knits a tubular fabric **11**, which fabric has interknit simultaneously with its formation filaments extending from one side of the fabric, which filaments are doffed to the needles of the circular knitting machine by a doffing belt **12** which strips the filaments from a conventional card cylinder **13**. The carding cylinder **13** and belt doffer **12** are driven through chains **14** and **15** which are themselves driven from the circular knitting machine in a known and conventional manner.

Extending radially outwardly from the circular knitting machine **10** is a platform **16**, which platform supports a motor **17** which drives a reducer **18** through a coupling **19**. The output of the reducer **18** drives a chain **20**, which chain drives a shaft **21**, which in turn drives a pair of endless feed belts **22**, **23** for supplying filaments from the sliver A to the main card cylinder **13**.

The motor **17** is a three-phase electric motor supplied by a power line **24** having a timing device **25** in circuit therewith before being connected into the main source of power **26**. The timer is an ordinary electric clock type timer which may be set to close a circuit so many seconds out of a minute and, by way of example here, 0.4 out of 4.25 seconds is an example of the timing that could be employed with the clock timer.

When the timing circuit is energized, putting voltage on the motor **17** through the line **26**, **24**, the motor **17** drives the reducer **18** causing the chain **20** to drive the endless belts **22**, **23** which supplies filaments from the sliver A to the needles on the card cylinder **13**, which filaments are then transferred to the doffer belt **12** and which filaments are then doffed onto the needles of the circular knitting machine in the manner shown and described in the above-identified U.S. Patent No. 3,199,516.

Each card is followed by a knitting yarn and a knitting station where a jersey stitch is formed, i.e., number four cards, four courses, two cards, two courses, etc. At least one or more cards feed sliver continuously and at least one or more cards pulse feeds sliver as indicated above and yarn is fed following each card station to form a jersey stitch as is well known in the Wildman jacquard circular knitting machine. While the needles progress through the card, they are in the raised position thereafter but before reaching the next card they are raised to a full clear position; then they are lowered to form a knit stitch in a manner well known to the art. They do not have to be fully clear. They may be at either a tuck or clear height to receive sliver. In the case where the needles are continu-

ously raised while passing through the doffing zone the desired effect of FIGURE 9 may be obtained by simple intermittent pulse feeding of the frosting sliver to its card.

The cards **27** and **29**, as shown in FIGURE 2, supply sliver B of a dark color, the filaments of which are doffed onto the needles of the circular knitting machine and which by reason of there being more than one in number will produce a fabric having a hairy face of predominantly a dark color, while the cards **28** and **38** being the subject of the instant invention will be feeding filaments from the sliver A, which filaments are of a lighter color and which filaments will produce a fabric having streaks of lighter filaments intermittently therethrough due to the intermittent operation of the motor for driving the endless belt feed **22, 23** supplying filaments to the cards **28** and **38**. Cards feeding like filaments are circumferentially opposed to one another as in FIGURE 2.

Referring now to FIGURES 2, 5 and 6, in addition to pulse feeding sliver to the frost card, as described above, needle control techniques in accordance with the present invention are provided which employ a cam **30** secured to a rock shaft **31** carried in a bearing **32** mounted on a platform **33**. A lever arm **34** is connected to rock the shaft **31** and hence the cam **30**. The arm **34** is actuated by a solenoid **35** having armature **36** which has a movement up and down dependent upon energization of the solenoid coil. It will be noted from the top plan view in FIGURE 2 that the solenoid **35** carried on its platform **33** is positioned immediately circumferentially in advance of the frosting card. The solenoid is connected in electrical circuitry with the timer **25** over line **37** and as shown in FIGURE 7 the timing of the pulsing of solenoid **35** is under the control of the timer **25** such that the motor **17** is energized causing a positive feed of the frosting sliver through the belt drive **22, 23** for a period of four-tenths of a second. The solenoid **35** is then energized to raise the cam **30** to provide an obstruction causing the butts **36** of the needles to rise up the inclined surface to raise the needles in advance of the doffing of the frosted filaments onto the knitting needles.

The endless belts **22, 23** which feed the main pile filaments being doffed onto the fabric from the cards **27** and **29** run at about a surface speed of 9.7 feet per minute for a circular knitting machine whose needle cylinder rotates at 19 or 20 r.p.m.'s and this belt feed is continuous. The surface speed of the belts for the frosting cards **28** and **38** run at about 59 feet per minute but since they are energized by motor **17** for only 5.5 seconds out of every minute, their feed in one minute runs a total of about 5.4 feet compared to the 9.7 feet per minute for the cards **27** and **29**. This means that the fabric consists of approximately 36 percent light (in color) filaments and 64 percent dark filaments employing the time base shown in FIGURE 8. We operate the timing cycles out of phase relative to the time for one revolution of the needle cylinder. For example, the needle cylinder runs at about 20 r.p.m. which means it makes one revolution every three seconds. Our timing cycle for the frosting feed runs either at about 4.4 seconds or about 2.4 seconds. If we run the timing cycle at three seconds we form a series of horizontal stripes which fall one above the other. On the other hand, if we choose a time which is not a whole number multiple or quotient of the r.p.m. of the needle cylinder, the shots of frosting filaments appear to have a more random distribution. If our timing cycle comes close to three seconds, then we find that there is a very slight displacement of each successive shot.

When the machine is started two things happen: (1) The needle cylinder starts rotating, knitting takes place at all yarn feed points, and the card carrying the darker sliver filaments starts feeding sliver to the needles in the usual way. Also, the doffer and the main cylinder of the card which carries the lighter filaments starts to run but the feed rolls which supply the light frosting sliver to the card are not put in motion by this mechanism. (2) The sequence timer **25** fires and activates the motor **17** which runs the endless belt feed rolls **22, 23** of the frosting card. After being on for only 0.4 second it turns off and stays off for four seconds.

A second timer in the timer box circuit **25** indirectly activated by the first timer, energizes a solenoid which raises a group of needles directly in advance of the frosting card. These needles are raised after the endless feed belt rolls **22** and **23** start feeding the light frosting filaments to the card. We have arranged the timers so that just about the time the feed rolls **22, 23** have concluded their short run of 0.4 second duration, the solenoid **35** is activated. However, the solenoid stays activated for only about 0.4 of a second and raises only about 45 needles. The raised needles engage the fibers in the doffer and a clump consisting of light "frosting" filaments is formed. The solenoid **35** is not activated again until the first timer starts and in turn triggers the second timer. The sequence of operation just shown is best described in the flow chart of FIGURE 7. The timer delay relay which activates the second timer is necessary in order to supply current to the second timer even when the first timer cuts off. This time delay relay is a pneumatic device which we have adjusted to provide current for about one second after its activating current has been cut off. The dotted line between the POWER FOR OUTPUT OF TIME DELAY RELAY and TIME DELAY RELAY indicates the presence of a power supply to provide current so long as the pneumatic switch stays closed.

The tubular fabric **11** issuing from the Wildman jacquard machine **10** is then slit and opened out into a large fabric which in turn is cut into sections for forming into wigs having a frosted or streaked appearance as in some heads of human hair where certain locks of hair are prematurely gray or different from the main coloration of the hair.

The fabric

Referring now to FIGURES 9 and 10, **40** is the back side of a fabric knit in accordance with one feature of the present invention in which only the sliver feed was intermittent. In FIGURE 9 all the needles were raised prior to arriving at the card. The background fabric is shown at **41** and the horizontal streaks **42** are the frosting filaments. The filaments **42** are dense through the middle area and taper off to each side of the middle area.

By employing both the pulse feed sliver technique as well as simultaneously raising a discrete group of needles in advance of the card a more sharply defined fabric **45** is obtained in which the frosting filament **46** is more sharply defined to provide concentrated tufts of frosted filaments **47** which are sharply definite coursewise over a restricted number of wales thereby producing a fabric particularly useful in making frosted wigs. The fabric in FIGURE 9 while being frosted over a greater area both coursewise and walewise resembles a blended fabric and is more useful in nonwig applications such as articles of clothing as set forth in the patents above identified.

The fabric **45** because of the sharp definition of frosted filament zones **48** makes an excellent wig fabric which resembles closely the natural frosting techniques employed by beauty operators upon the human female natural hair.

It will also be appreciated that, as pointed out in the above-identified U.S. Patent No. 3,199,516, the fabric produced as described above with the frosted effect, may be used for other objects such as bearskin rugs, articles of clothing, etc., where the frosted effect is desired.

Although we have disclosed herein the best forms of the invention known to us at this time, we reserve the right to all such modifications and changes as may come within the scope of the following claims.

What we claim is:

1. An apparatus for knitting a frosted deep pile fabric for making wigs or other textile products on a circular knitting machine equipped with reciprocable butted needles and having at least two cards comprising means

feeding the first card with a first sliver and feeding said card continuously, means intermittently feeding the second card with a sliver of a color different from the first sliver, means positioned circumferentially in advance of the second card to raise the needles in timed relation to the intermittent feed of the second card so that a frosted circular knit fabric will result.

2. An apparatus as claimed in claim 1 wherein the means intermittently feeding the second card comprises separate motor driven feed rolls.

3. An apparatus as claimed in claim 1 wherein said means to raise the needles comprises a solenoid actuated cam positioned to engage the butts of the needles.

4. An apparatus as claimed in claim 1 further comprising a motor, separate motor driven positive feed rolls feeding said second sliver to said second card, a solenoid actuated cam as the means to selectively engage the butts of the needles to raise same and circuit means between said motor and solenoid including a timer to cause said motor to feed sliver and said solenoid actuated cam to raise the needles after feeding of the sliver has begun.

5. An apparatus for producing a frosted knit fabric on a Wildman jacquard-type circular knitting machine comprising two card mechanisms circumferentially of the needle cylinder thereof for doffing filaments into the fabric as the base fabric is being knit, means for feeding a first of said card mechanisms continuously and means for intermittently feeding the second of said card mechanisms for short time periods and supplying a filament of a color different from the filament supplied by the first of said card mechanisms.

6. An apparatus as claimed in claim 5 wherein said second card mechanism comprises

(a) a main card cylinder and doffing means positioned to remove filaments from the card cylinder and to doff same into a fabric being knit, said means for intermittently feeding the second card mechanism including,

(b) a sliver feed means for supplying filaments in a sliver state to the card cylinder comprising

(c) a pair of endless belts in opposed relation receiving and spreading the sliver therebetween,

(d) drive means connected to drive said sliver feed means, and

(e) a motor connected to drive said drive means intermittently for short time periods.

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ROBERT R. MACKEY, *Primary Examiner.*

U.S. Cl. X.R.

19—105; 66—194