

Research Article

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Comparative Study between Engineering Stripe and Feeder Stripe

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Abstract

The project work emphasizes the whole information about Engineering Stripe and Feeder Stripe design. Special effort was given to find the basic differences between feeder stripe and Engineering Stripe. This paper is also an attempt to understand about feeder and engineering stripe mechanism, feeding mechanism, tension variation in yarn feeding. Finally, the work revealed that the limitation of 4 finger, 5 finger and 6 finger engineering stripe machine. To continue the project firstly knitted fabric samples along with raw data of different machine parameters, fabric parameters and production parameters were taken.

Keywords: Auto stripe; Feeder stripe; Knitted fabric; Finger; production; Machine

General Introduction

Introduction

Yarn dyed knit fabrics are one of exclusive fabric highly recommended by buyer. In knitwear section yarn dyed fabric is very popular and expensive rather than regular solid dyed fabric. There are two type of yarn dyed fabric used in knitwear garments.

- i. Solid Yarn Dyed Fabric
- ii. Yarn Dyed Stripe Fabric.

Generally, the horizontal coloured stripe designs are produced in course wise direction. According to the stripe design, there are two types of stripe fabric

A. Feeder Stripe

B. Engineering Stripe.

Feeder stripe fabric

When maximum 2-3 colours are used to knit a stripe fabric where the stripe pattern length lower then it is called feeder stripe. The feeder stripe designs are knitted on general circular knitting machine. The main principle is to feed 2-3 colours on the feeders according to design and let the machine knit the reqd. design. The knitting machine has a capacity for 108 cones of yarn. If you have inserted 8 black yarns to the feeder, with 100 cones white yarn next. When knitting starts you will see within the 2" repeat there is a black and white horizontal stripe. Feeder stripe designs can be made on Single jersey, Rib and Interlock machines (Figure 1).

Engineering stripe fabric

When the size of the stripe repeat of the fabric is bigger than 2" which is beyond what the feeder stripe method can do, it is called Engineering stripe. Engineering stripe designs are produced on special type of circular knitting machine named as auto stripe/ engineering stripe machine (Figure 2).

In engineered stripe method, the machine is set to change threads at certain time to from a big repeat. This way the repeat can be of almost any size. However, the price of engineered stripe fabric is substantially higher.

Literature Review

Engineering stripe knitting machine

Computerized Engineering stripe circular knitting machine adjusts

the order of yarn by selector and forms coloured striped fabric. The development of computerized striper circular knitting machine enhances the growth of our knitting industry as well as makes an interaction with the modern knitting technology. Moreover, it's also necessary to be able to put the control theory into practice by the use of numeric control, electronic driving, etc. Nowadays, engineering stripe has been used more frequently than the feeder stripe for big repeat [1,2]. Eventually, the main work of this paper is to identify the limitations of feeder stripe and how Engineering stripe minimize those limitations. Special attentions were given on the machine set up mechanism with stripe pattern processing on the control panel [1].

Feeder stripe knitting machine

In case of feeder stripe machine yarn is fed to the needle directly via a feeder without any finger device. One coloured yarn can be fed at one time by a feeder during the revolution of cylinder. Special design of Cam, heat-radiation and dust-removal are easy, speed and wear proof are high. RPM is above 20 when Lycra units are applied.

Machine type depends on the number of fingers opposite to a

Types of engg. stripe machine



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Figure 2: Engg./auto stripe fabric.



Figure 3: A view of four finger machine [Fukuhara, KCL].

Four Fingers Machine Five Fingers Machine

Six Fingers Machine.

Single Jersey, Terry, Rib/ Interlock m/c

Type of stripe according to its size

- i. Micro Stripe: An ultra-fine stripe that is knitted by maximum 4 courses with stripe width of 1-4 mm.
- ii. Medium Stripe: A moderate stripe that is knitted by 5-20 courses with stripe width of 4.1-14 mm.
- iii. Long Stripe: A thick stripe that is knitted by more than 20 courses with stripe width of more than 14 mm (Figure 4).

Main issues of project

The Auto stripers are used on both single and double bed machines. The experiment will include the functions of various important parts of Auto stripe machine, its additional features. The experiment will also include the thread path diagram with brief analysis of its feeding mechanism, finger controlling and changing process. The main aim of this work is to identify the differences between Engineering Stripe and Feeder Stripe as well as calculating the maximum no. of courses per repeat that can be produced on 4, 5 and 6 finger engineering stripe machine [2]. In the result and analysis chapter, the tension variation will be analysed between the feeding system of feeder stripe and auto stripe machine. Then there will be a representation of the major differences between auto stripe and feeder stripe fabric. The striping limit of 4 and 6 finger machines will be analysed and an idea will be given about their limitations [2-4].

Experimental Process

Common parts of feeder and engineering stripe knitting M/C

Side creel



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- Needles
- Sinkers
- Invertor
- Motor
- Needle bed [cylinder, dial]
- Cams
- VDQ pulley
- Yarn guide
- Toothed belt
- Fabric spreader
- Take-down rollers
- Control panel
- Uniwave lubricator
- Lycra attachment with rollers/ yarn feeders
- Lycra guide.

Additional parts of engineering stripe knitting M/C

- Creel stop motion
- Semi-Positive feeder
- Lycra yarn feeder
- Additional tensioners
- Finger
- Finger box
- Cutter
- Actuator
- Swing cam system.

Semi-positive feeder: Engg. Stripe machines have semi-positive yarn feeders. The thread path is given below:



Feeding principle: The striper feeder is based on the friction principle. The income yarn is guided through ceramic eyelets and a torsion rod and wound around the feed wheel for 1-2 circles. For 6 finger m/c, there are 2 feeding device with 3 yarn wheel. These yarn feeders present torsion rod. By means of the friction between yarn and the wheel, the striper feeder provides a reliable yarn transport. Whenever a yarn is selected, it twists and moves away from wheel and thus gives sufficient tension for feeding. Other deselected rods remain close to wheel and where yarn tension is lower [5].

Finger: The yarn is fed with the help of finger motion. There are 4-6 fingers against each feeder. The finger works with the help of actuator. Selection of each finger is effected from control panel in which the design is fed. It has an individual clamping and cutting of yarn at each finger (Figure 6).

Finger box: All the fingers are attached in a box. For 4 fingers there are 4 metallic butts below of every finger box. The actuator selectors beat one of the finger but to make it active (Figure 7).

Piezoelectric data actuator: An electronic actuator activates the powerful yet swift mechanical movement of finger in yarn change [2]. The actuator has 4-6 selectors for four to six finger machines. The actuator is situated below the finger box and rotated with cylinder rpm. For 6 finger machine, 5 selectors will beat the 5 finger box butts. These 5 fingers will disable, only one finger will active. This one finger will take





Figure 6: Four and six finger device.



Figure 7: Finger box.

the selected thread. According to the program predetermined courses will be formed. Thus another predetermined course will form (Figures 8, 9a and 9b) [6].

Auto stripe knitting m/c thread path





Figure 8: Actuator.



Figure 9: Yarn feeding through separate guide and feeder.

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Semi positive feeder Knot catcher Sensor Guide Sensor and breakage indicator Guide Top finger Guide Finger and cutter Yarn feeder and needle.

Additional features of auto stripe m/c

Control panel for auto-striper: Data acquisition system for machine control, recording and displaying the machine functions. Controller with 8 MB memory capacity and easy to select coloured yarn by means of the control panel, it is easy to change or select coloured yarn, and modifies the stripe width. Error messages are shown on the display and can quickly be localized.

Design control system: The pattern data input through LCD touch panel. The computer program controls the changing for 4 or 6 colours striper fabric. With memory function, the computer control thread adjustment system can control many colour threads and can type

a) Colour no.

b) Stripe no.

c) Course no. as you required.

Interchange ability: A quick-response actuator enables electronic selection at high speed. It can knit with various single knit structures such as Jersey, Pique, Lacoste, Terry as well as 1×1 Rib and 1×1 Interlock etc. [4].

Durable and vertical mount fingers: The striper fingers are designed with independent yarn cutter with cancellation function. It is vertically mount for highest productivity, for easy maintenance. 4-colour and 6-colour stripers are built from similar platform and principles. They are used on both S/J and D/J machines [4].

Easy patterning software: It facilitates user in designing creative patterns. For greatest convenience of user, the patterns can be edited at the machine via the striper control panel [7].

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Production of auto stripe fabric from sample

Materials

Machine specification: Following specification of machine is shown below (Table 1).

Typical M/C selection data: Typical M/C selection data is shown into the following tables (Tables 2-4).

Machine set-up process: [Fukuhara]

Step 1: At first a new file is started or existing file is opened.

Step 2: A file no. is selected which is given input through a pen drive or an existing file for editing. After touching ENT it will skip to finger specification.

Step 3: Total No. of Course is edited and press ENT for the full pattern.

Step 4: No. of Total stripe is edited for the full pattern and press ENT.

Step 5: For 1st stripe of the pattern total no. of course is edited and press ENT.

Step 6: For 1st stripe of the pattern the yarn colour is selected as A, B, C based on finger, edited, press ENT and confirm the finger specification.

Brand	Origin	Fabric Type	Dia	Gauge	Feeder	Finger
Fukuhara	Japan	S/J Engg. Stripe	30	20	48	4
Fukuhara	Japan	S/J Engg. Stripe	34	20	48	4
Fukuhara	Japan	S/J Engg. Stripe	30	24	42	6
Fukuhara	Japan	Rib Engg. Stripe	33	18	48	4
Fukuhara	Japan	Interlock Engg. Stripe	36	18	48	4

Table 1: Machine specification.

Gauge	GSM	Count	SL	CPCM
24	150	30	2.6	20
	160	26	2.7	18
	170	24	2.84	18-18.5
20	180	20	3.2	17
	190-200	20	3.04	18
24	110-120	40	2.7	22
	130-135	34	2.56	21

Table 2: S/J engineering stripe.

Gauge	GSM	Count	SL	CPCM
	170	30 (34s can be	2.60	17
18	180	also used but the SL cannot	2.70	(needs to
,		be made tight)		at finishing section)
	200		2.44	
	220	26	2.74	16.5
	240	24	2.84	16

Table 3: Rib engineering stripe.

Gauge	GSM Count		SL	CPCM	
18	200-220	34	2.96	36	
	280	30	2.80	38	

 Table 4: 1×1 interlock engineering stripe.

Step 7: Follow step-6 for the remaining stripes of the pattern.

Step 8: After entering the repeat, the folder has to save. As a result, the finger will work according to the program.

Knitting Operation:

- The control panel sends control pulses to the actuator for the yarn insertion of selected yarn.
- There is a butt below every finger box
- An actuator selector disconnects other butts and only one finger of finger box is selected.
- Actuator selects the finger according to the control panel command
- There is a cutter with every finger box that cuts yarn after the completion of a course
- The insertion process is implemented mechanically by means of cams
- Optimally designed transmission ensures accurate insertion, clamping and cutting of the yarn, even at high machine working speeds.

Yarn changing process through finger

Figure gives the aspect of a 4 fingers striper. We can see that the finger 1 is being selected and the finger 4 is being deselected. A cutting blade cuts the deselected yarn [3]. Yarn change occurs in small zone (about 7 cm width) because in this zone 2 yarns work simultaneously during yarn change (Figure 10) [8].

Formula creation and commanding the control panel (Figure 11)

Yarn changing with electronic control: The electronic control unit contains the programmed pattern information of the striped pattern. This is recalled from the unit through a rotary code transmitter synchronous to the machine movement and passed on to the magnets of the yarn change fingers in the stripers. The yarn change on a S/J circular knitting machine is illustrated in the figures.

a. Yarn C completes a stripe and it is cut by the clamping cutter. Finger C is in base position. The yarn guide is in top position and the clamp is opened.

b. New yarn D is selected and the finger D moves close to the needle and clamp is closed. Yarn cutter moves upward.

c. Yarn D is fed and needle moves upward. Yarn feeder moves







downward while finger moves to most forward position. Cutter remains in top position.

d. After completion of the courses of next pattern Yarn D is cut by cutter. Finger D clamp closes and takes the yarn to its base position (Figure 12).

Each of the fingers in Engg. Stripe machine can be controlled in such a way that they are brought from the base into the yarn laying in position with a clamping cutter and back to the base position with an open clamping cutter (Table 5) [9,10].

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Results and Analysis

Mechanism of producing feeder stripe

In a 108 feeder m/c, active feeder would be=108/26=4 with remainder 4. 4 patterns produced for 1 revolution of the cylinder. The rest 4 feeders will be needle dropped or, all miss cam for 1 repeat Feeder arrangement (Table 6 and Figure 13).

Feeder stripe pattern limitation

Normal range of Feeder stripe was analysed and it is 2-7.5 cm

In KCL, there are two large dia machines available of LISKY. 44" and 52" diameter feeder stripe machine is possible. Total feeders are 312 possible with 6 feeders/ inch. If the yarn count is 30s, stitch length is 2.60, CPCM is 20. So, 312/20=15.6 cm; so maximum 6.14 inch is possible (Table 7).

Where, Total feeders are 264 possible with 6 feeders/inch. If the yarn count is 30s, stitch length is 2.60, CPCM is 20. So, 264/20=13.2 cm; so maximum 5.2 inch is possible.

So, it can be defined that the feeder stripe, if the course is less than 6.14 inch called feeder stripe. If the course is more than 6.14 inch called engineering stripe. In feeder stripe, to produce big repeat is not possible. By calculating the colour of thread this design is produced. The feeder stripe pattern ranges depend on the no. of feeder, count of yarn, big stitch length and big diameter machine.

i)	Base Point of Feeder	In front of this there is a guide which works as a base point of all fingers in a finger box
ii)	Finger Changing Unit	Controlling the finger on to the yarn presentation point and guiding the finger into the yarn laying-in position
iii)	Clamping Cutter Unit	Opening and closing the combined clamping cutter of the yarn change finger
iv)	Insertion Unit	Different colored yarns are inserted via finger and needles are used to complete a course.

 Table 5: Different finger units for color selection.

Feeder No.	Yarn
31-35	Miss
5-30	Blue
1-4	Grey



 Table 6: For 1 repeat feeder arrangement.

Brand and Origin	Dia	Gauge	Feeder
LISKY, Taiwan	52	24	312
LISKY, Taiwan	44	24	264

 Table 7: Feeder stripe pattern limitations.

Reasons for not Producing 15.2 cm Stripe Pattern on Feeder Stripe machine

• The main reason is the amount of stripes in one revolution of cylinder. The main object in feeder stripe is to get sufficient stripes in one revolution.

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- If more than 2-3 colour is used than there is a possibility of spirality since spirality increases with the no. of feeders.
- If more than 2-3 colours is used then there is a possibility of yarn breakage. Since coloured yarn breaks more than grey yarn and in case of auto stripe machine multiple tensioner and stop motions are used.
- It is easy to set the design on auto stripe and getting the production start. But in feeder stripe for 15.2 cm pattern yarns should be passed through feeder accordingly and should set the cone packages serially in the creel. This makes the process more time consuming. But, it is true that we can make this stripe pattern on 312F machine.
- RPM of feeder stripe is more. That's why more breakage to make 1 pattern and the process becomes economically difficult.

Differences between feeder stripe and engineering stripe

The basic difference between the Feeder stripe and engineering stripe is described in the following Table 8.

Case study

Four finger machine: A fabric sample is analysed where total individual colour is five; black colour used for 4 times. As a result, total no. of courses is 240 which exceed 192 courses (48×4) in four finger machines (Tables 9 and 9a).

If different eight colours used and more than eight colour, total no. of courses will not exceed 192 courses in 4 finger machine (Table 9b and 9c).

In 4 finger machine, we can use more colour when the no. of courses is limited. In this study, we can produce more coloured striper design by reducing the no. of courses in single colour. If we want to create a big courses repeat in more than four colour with each stripe contains different colour, it is not possible in four finger Engg. striper machine with 1 revolution of cylinder only (Table 9d).

In this case no. of courses will also be increased as per wish against four colours only. For this reason, above example each colour contains 96 courses. The total course is 384. Generally, our machines contain 48 feeders. The feeder no. is equivalent to the no. of cam box. Every feeder contains four fingers. Where, machine will rotate one time then it produces 48 courses. 384/48=8 Revolution; so, we can see that total repeat complete in 8 revolutions. If we add a new colour such as Red, it will be not possible to produce in four finger machine. So we have to produce this repeat in 5 finger machine.

Five finger engineering stripe machine: At first it reduces the limitation of 4 finger machine in making 5 colour large stripes. Each stripe contains different colour (Table 10 and 10a).

When machine revolute one times then produce 48 courses. 480/48=10 revolution. So, we can see that total repeat complete in 10 revolutions. We can use more colours when the no of courses is limited or do not exceed $48 \times 5=240$ course limit (Table 10b).

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S.No.	Feeder Stripe	Engineering Stripe
1.	Feeder stripe is the term been used when stripe is manufactured on normal Single Jersey m/c.	Engg. stripe is the fabric knitted on special Engg. stripe m/c.
2.	Smaller stripe repeat is produced.	Bigger stripe repeat is produced.
3.	We can use a limited stripe or courses. Practically 5 cm repeat length is knitted. Maximum stripe repeat width is 15.6 cm.	We can use unlimited stripe or courses. Bigger than 5 cm like 165 cm, 120cm pattern can be easily made. Theoretically capacity: 16000 Stripes; Practically: max. 500 Stripes can be made.
4.	Maximum 3 colors are used.	No color limitation.
5.	There is no extra device on feeder stripe.	There is an extra device named "Finger" that can feed extra thread for knitting.
6.	Repeat size largely depends on the no. of feeder of m/c.	Depends on the no. of finger opposite to a feeder.
7.	Every yarn is fed continuously without any break or cutting after stripe completion.	Every yarn is cut after completion of a course of a same color in a stripe. There is a cutter below finger which cuts the completed course.
8.	Feeder Stripe depends on the dia of the machine. If dia increase the size of stripe pattern can be extended.	Engg. Stripe is finger dependent. It can knit any no. of courses of any color. Say, 500 courses of blue; actuator only selects blue color fingers during rotation until the completion of 500 courses.
9.	Positive Feeding System is used.	Semi Positive feeding system is used.
10.	Feeder stripe pattern is normally repeated multiple times to complete the body panel of a garment.	1 stripe pattern can complete the full body panel of a garment without repeating.
11.	Production cost is low. The price of feeder stripe fabric is lower.	Production cost high approximately 7-10 times higher. The price of engineered stripe fabrics is substantially higher.
12.	Productivity is high.	Low productivity.
13.	Only 1 tensioner is used during yarn feeding.	More than 2 tensioners are used to avoid more breakage.
14.	Oil drops can be more than 80. That's why RPM is more.	Up to 80 oil drops per minute. RPM is less.
15.	No. of feeders are normally very higher, more than 60 F	Less than 50 F
16.	The strength of yarn is more.	The colored yarn is less strong
17.	Tension variation is less during yarn feeding.	Tension variation is more during yarn feeding.
18.	Fewer faults occur during sample stripe fabric production.	More faults occur during sample stripe fabric production.
19.	Less yarn breakage.	The possibility of breakage of yarn will increase
20.	One stop motion is used in feeder stripe machine during yarn feeding.	Several stop motion is used in Engg. Stripe machine.
21.	No slippage of yarn in feeding device due to multiple coil wrapping.	The slippage for semi-positive feeder is about 5-8% during friction between yarn wheel and yarn.

Table 8: Differences between Feeder Stripe and Engineering Stripe.

Serial	Color	СМ	1 Pattern of Sample
1	WG	0.6	
2	Green	0.3	
3	RD	1.5	
4	OW	1.2	
5	Pink	1.5	
6	White	1.5	
7	Grey	1.5	
8	Yellow	1.5	

Table 9: Number of individual color analyzed by four finger machine.

CPCM= 20	SI.	Color	СМ	Courses	Sequence	Finger
	1	Black	1.5	30	19-48	В
	2	Pink	1.5	30	37-48	A (12)
					01-Dec	C (12)
					13-18	D (6)
	3	Black	1.5	30	Jul-36	В
	4	PGR	1.5	30	25-48, 1-6	D
	5	Black	1.5	30	43-48,1-24	В
	6	Red	1.5	30	13-42	С
	7	Black	1.5	30	31-48, 1-12	В
	8 Orange		1.5	30	Jan-30	Α
		Total=12 d	m	240		

 Table 9a: Finger selection sequence of four finger machine.

When we use more than five different colours the total no. of courses will be 240. But any colour use more than 48 courses then total no. of courses exceeds the 240 courses (Table 10c).

Here 11 individual colours are used but black colour used eight

Serial	Color	СМ	1 Pattern of Sample
1	WG	0.6	
2	Yellow	0.3	
3	Grey	1.5	
4	White	1.2	
5	Pink	1.5	
6	OW	1.5	
7	RD	1.5	
8	Green	1.5	and the second se

Table 9b: Number of color analyzed in fabric sample by four finger machines.

SI. No.	Color	СМ	CPCM	Courses	Sequence	Finger
1	WG	0.6		12	37-48	А
2	Green	0.3	-	6	31-36	А
3	RD	1.5	20	30	13-30 1-12	B C
4	OW	1.2		24	43-48 25-42	C D
5	Pink	1.5		30	43-48, 1-24	D
6	White	1.5		30	13-42	С
7	Grey	1.5		30	31-48, 1-12	В
8	Yellow	1.5		30	1-30	А
		9.6	Total	192		

Table 9c: Finger selection sequence of four finger machine.

times (30 \times 8=240 courses). As a result, 240-48=192 black colour courses are excess used in five finger Engineering stripe machine.

Six finger machine: We analyse the following sample where 6

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S. No	Color	Courses	Sequence	Finger
1	White	96	1-48,1-48 (cylinder rotates 2 times)	Α
2	Blue	96	1-48,1-48 (cylinder rotates 2 times)	В
3	Navy	96	1-48, 1-48 (cylinder rotates 2 times)	С
4	Yellow	96	1-48, 1-48 (cylinder rotates 2 times)	D
Total	4 colors	384		

Table 9d: Finger selection sequence of four finger machine.

Serial	Color	СМ	1 Pattern of Sample
1	Black	1.5	
2	Pink	1.5	
3	Black	1.5	
4	PGR	1.5	
5	Black	1.5	
6	Red	1.5	
7	Black	1.5	
8	Orange	1.5	

Table 10: Number of individual color analyzed by five finger machine.

S. No	Color	No. of Courses	Sequence	Finger
1	White	96	1-48,1-48	E
2	Blue	96	1-48,1-48	D
3	Navy	96	1-48, 1-48	С
4	Yellow	96	1-48, 1-48	В
5	Red	96	1-48, 1-48	A
Total	5 Color	480		

SI. No.	Color	СМ	CPCM	Courses	Sequence	Finger
1	Black	Black 1.5	30	43-48	С	
					25-42	D
					19-48	В
2	Pink	1.5	20		13-18	В
				30	01-Dec	С
					37-48	A
3	Black	1.5		30	31-36	A
					25-30	В
					Jul-24	E
4	PGR	1.5		30	25-48, 1-6	E
5	Black	1.5		30	43-48,1-24	D
6	Red	1.5		30	13-42	С
7	Black	1.5]	30	31-48, 1-12	В
8	Orange	1.5		30	Jan-30	A
		12 cm	Total	240		

Table 10a: Finger selection sequence of five finger machine.

 Table 10b: Finger selection sequence of five finger machine.

colours are used. Grey colour is inserted for finger A, White for B, Red for C, Yellow for D, Sky for E and Green for F. Actuator will select the yarn from the fingers until completing a stripe automatically. A practical fingering sequence is given below where some fingers will not be selected (Tables 11 and 11a).

Summary of case study

- Four, five and six finger machine means each feeder contains four, five and six finger respectively. In four, five and six finger machine four, five and six colours stripe designs can be produced as long course as possible.
- Normally multiple coloured yarns are fed for different fingers

SI. NO	Color	No. of Courses	Sequence	Finger
1	Red	6	43-48	C(6C)
2	Black	30	13-42	В
3	Grey	6	7-12	D(6C)
4	Black	30	25-48, 1-6	В
5	Yellow	6	19-24	D(6C)
6	Black	30	37-48, 1-18	В
7	Green	6	31-36	E(6C)
8	Black	30	1-30	В
9	Brown	18	31-48	A(18C)
10	Silver	30	1-12 13-18 19-30	C(12C) D(6C) E(12C)
11	Black	30	19-48	В
12	White	30	37-48, 1-18	E
13	Black	30	07-36	В
14	G. Blue	30	25-48, 1-6	D
15	Black	30	43-48,1-24	В
16	America	30	13-42	С
17	Black	30	31-48, 1-12	В
18	Neo	30	1-30	A
Total		432		

Table 10c: Finger selection sequence of five finger machine.

S. No	Color	No. of Courses	Sequence	Finger
1	Pink	84	1-42,1-42	F
2	White	84	1-42,1-42	E
3	Blue	84	1-42,1-42	D
4	Navy	84	1-42,1-42	С
5	Yellow	84	1-42,1-42	В
6	Red	84	1-42,1-42	А
Total	6 Color	504		

Table 11: Finger selection sequence of six finger machine.

and control panel gives command while actuator selects the desired colour from any finger until it completes a stripe.

- If fingering sequence is followed then less wastage, otherwise some fingers will never be selected and yarn remains idle.
- In 4 finger machine, we can use more colour when the no. of courses is limited. In this study, we can produce more coloured stripe design by reducing the no. of courses in single colour.
- If we want to create a big courses repeat in more than four colours, it is not possible in four finger Engg. Striper machine with 1 revolution of cylinder only.
- But this analysis use more different colourise; eight, ten, twelve and so on then you cannot be exceeded 192 (48×4) courses per repeat for four finger machine, 240 (48×5) courses for five finger machine and 252 (42×6) courses for six finger machine.
- Six finger machines give more flexibility in colour selection than 4 and 5 finger machines.
- Pattern width in 6 finger machine is more than other two and usually over 15 cm.
- The work also revealed that any colour use more than 48 courses per repeat then exceeds 192 courses for four finger, 240 for five finger machine and show similar effect on other finger machine.

Sample Pattern	SI.	Color	СМ	Courses	Sequence	Finger
	1	White	0.2	4	13-16	В
	2	Green	0.1	2	11-12	F
	3	White	0.8	16	37-42,1-10	В
Contraction of the Contraction of the	4	Green	0.2	4	33-36	F
	5	White	0.4	8	25-32	В
	6	Green	1	20	1-20	F
	7	White	0.2	4	39-42	В
	8	Sky	0.1	2	37-38	E
and our party of the second states of	9	White	0.8	16	21-36	В
NAMES ADDRESS OF TAXABLE PARTY OF TAXABLE PARTY OF	10	Sky	0.2	4	17-20	E
	11	White	0.4	8	9-16	В
	12	Sky	1	20	31-42,1-8	E
Construction of the Owner of th	13	White	0.2	4	27-30	В
A Colored and a state of the second second	14	Yellow	0.1	2	25-26	D
	15	White	0.8	16	9-24	В
And States of St	16	Yellow	0.2	4	5-8	D
STREAM CONTRACTOR OF STREAM	17	White	0.4	8	39-42,1-4	В
and the second second second second	18	Yellow	1	20	19-38	D
	19	White	0.2	4	15-18	В
CPCM= 20	20	Red	0.1	2	13-14	С
	21	White	0.8	16	39-42,1-12	В
	22	Red	0.2	4	35-38	С
	23	White	0.4	8	27-34	В
	24	Red	1	20	7-26	С
	25	White	0.2	4	3-6	В
	26	Grey	0.1	2	1-2	С
	27	White	0.8	16	33-42	В
	28	Grey	0.2	4	29-32	Α
	29	White	0.4	8	21-28	В
	30	Grey	1	20	1-20	Α
				Total 324		

Table 11a: Finger selection sequence of six finger machine.

	0.1.1		00014	•
Serial	Color	СМ	CPCM	Courses
1	Navy B.	5.5	15	83
2	White	0.2		3
3	Navy B.	1.5		23
4	White	1		15
5	Navy B.	1		15
6	White	1		15
Total		10.2		154

Table 12: Auto Strip Calculation.

- Practically, if 3-4 colours are used with pattern width of 10-25 cm, 4 finger machine is used. But, theoretically up to 8 colours can be used.
- Practically, if 3-4 colours are used with pattern width over 25 cm, 6 finger machine is used. But, theoretically more than 8 colours can be used.

Calculation for auto stripe fabric (1 × 1 Rib)

Calculation for auto stripe fabric is shown below with proper table and figure (Table 12) and (Figure 14).

Production calculation: Reqd. no. of Pattern=100

RPM=16, Feeder=48, YC=30 Ne, Dia=33", Gauge=18, WPCM=10, SL=2.88

Rounds for 100 Pattern
$$=\frac{15+15+15+23+3+83}{48} \times 100 = 321$$



Fabric Width
$$=\frac{33 \text{ x}\pi \text{x} 18}{10 \text{ x} 100} = 1.87 \text{ m}$$

Length of 1 course $=\frac{2\pi \text{x} 33 \text{ x} 18 \text{ x} 2.88}{10 \text{ x} 100} = 10.75 \text{ m}$

Weight of 1 course = $\frac{10.75 \text{ x } 1.09 \text{ x } 453.6}{30 \text{ x } 840}$ = 0.211 gm

Fabric Weight for 100 Pattern=weight of 1 course x 15400=3248 gm

Weight of 1 Round Length=3248/321=10.12 gm

Production / 8 Hours =
$$\frac{16 \times 8 \times 60 \times 10.12}{1000}$$
 = 77.72 Kg

Yarn Consumption

Production of fabric=77.2 kg; Allowance=8%; So, Required Fabric=83.38 kg

White colored yarn requires
$$=\frac{2.2}{10.2} \times 83.38 = 17.98 \text{ Kg}$$

Navy B colored yarn requires $=\frac{1+1.5+5.5}{10.2} \times 83.38 = 65.40 \text{ Kg}$

Conclusion

Four, five and six finger machine means each feeder contains four, five and six finger respectively and each machine contains 48 feeders. In four, five and six finger machine four, five and six colours stripe designs can be produced as long course as possible. The work revealed that any colour use more than 48 courses per repeat then exceeds 192 courses for four finger, 240 for five finger machine and show similar effect on other finger machine.

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