

May 9, 1939.

R. H. LAWSON

2,157,989

PATTERN MEANS FOR KNITTING MACHINES

Filed Nov. 6, 1936

3 Sheets-Sheet 1

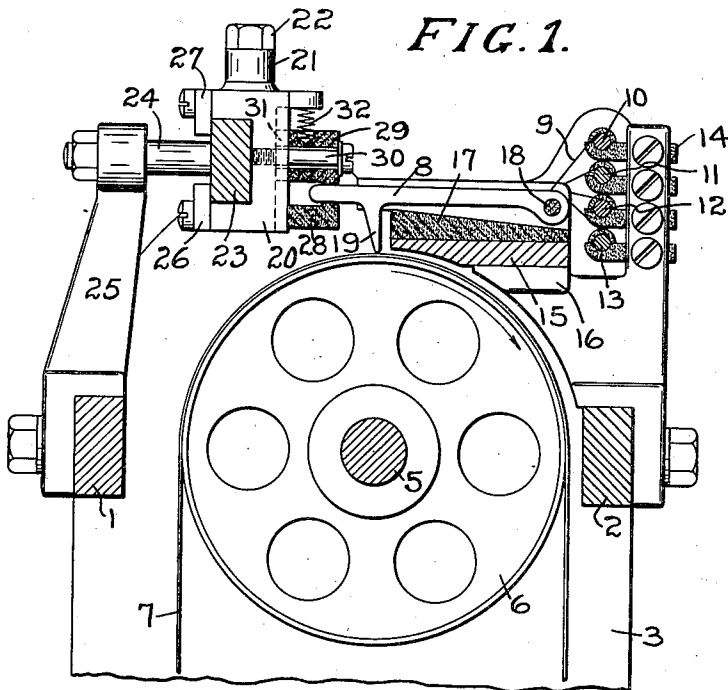


FIG. 3.

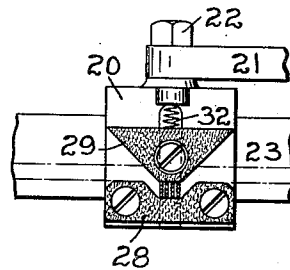
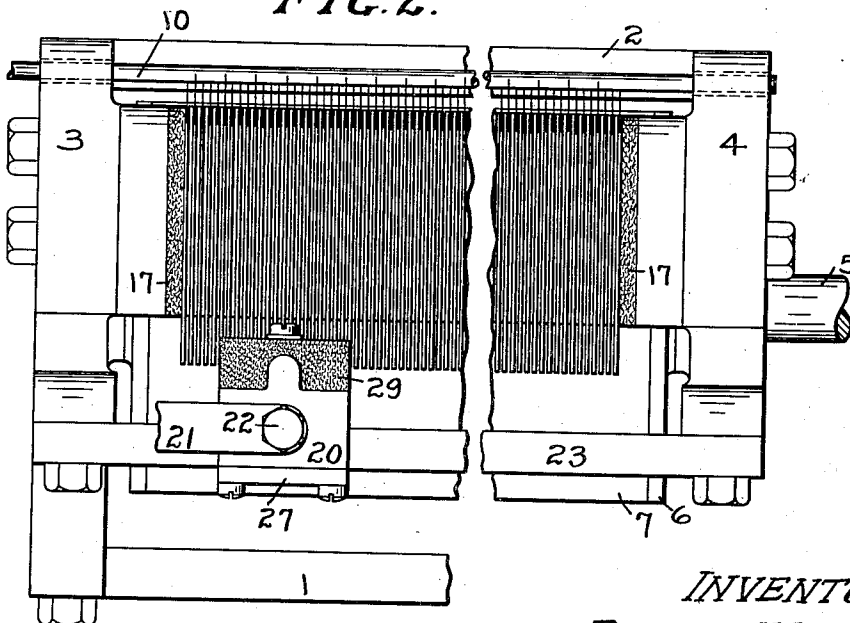


FIG. 2.



INVENTOR:
ROBERT H. LAWSON
By Roy F. Lovell,
ATTY.

May 9, 1939.

R. H. LAWSON

2,157,989

PATTERN MEANS FOR KNITTING MACHINES

Filed Nov. 6, 1936

3 Sheets-Sheet 2

FIG. 6.

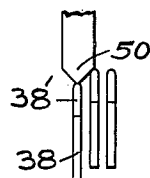


FIG. 5.

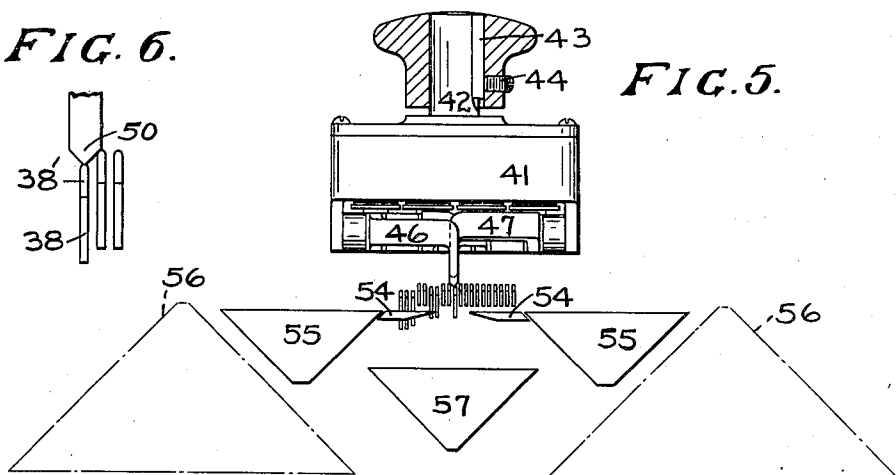


FIG. 4.

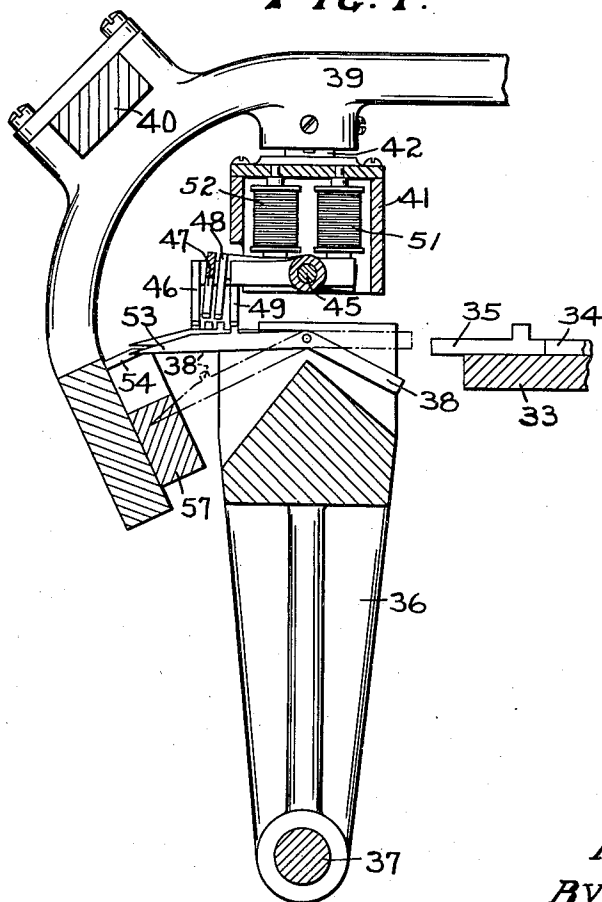


FIG. 7.

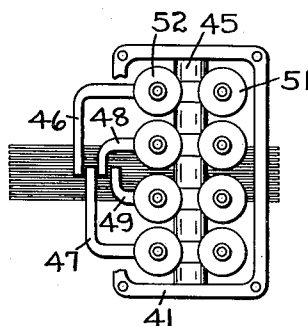


FIG. 8.



INVENTOR:
ROBERT H. LAWSON,
By Roy F. Lovell
ATT'Y.

May 9, 1939.

R. H. LAWSON

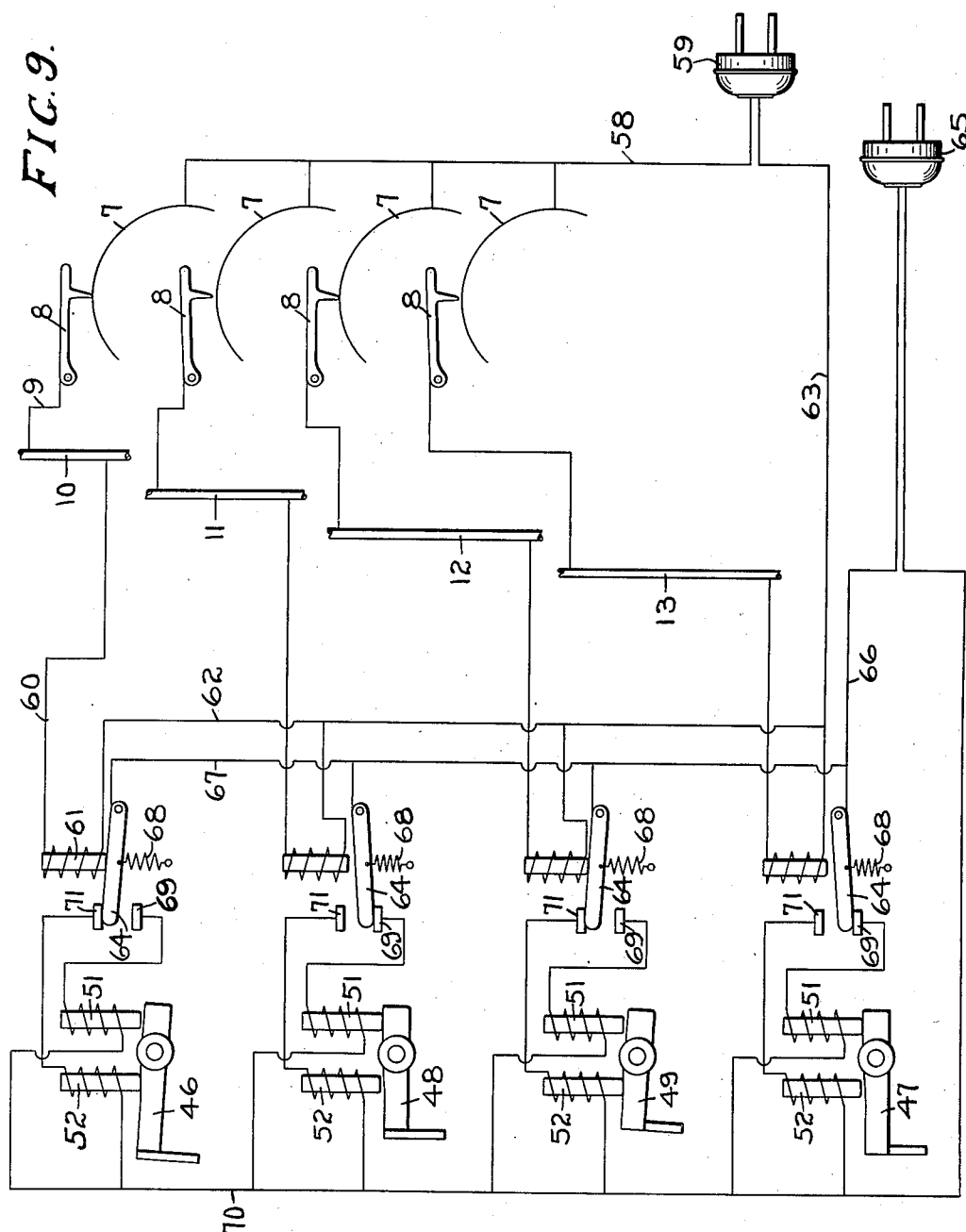
2,157,989

PATTERN MEANS FOR KNITTING MACHINES

Filed Nov. 6, 1936

3 Sheets-Sheet 3

FIG. 9.



INVENTOR:
ROBERT H. LAWSON,
By Roy F. Lovell,
ATT'Y.

UNITED STATES PATENT OFFICE

2,157,989

PATTERN MEANS FOR KNITTING MACHINES

Robert H. Lawson, Pawtucket, R. I., assignor to
Hemphill Company, Central Falls, R. I., a cor-
poration of Massachusetts

Application November 6, 1936, Serial No. 109,514

13 Claims. (Cl. 66—75)

The present invention relates to pattern mechanism for and a method of controlling the selection of knitting instrumentalities in all types of knitting machines, especially the flat bed machines of the type shown in U. S. Patents 1,795,235 and 1,992,982. One preferred embodiment of the invention is herein shown as applied to machines such as have been illustrated in those patents.

Jacquard mechanism has for many years been employed for the selection of knitting instrumentalities such as the needles of the machines under consideration and all connections from said Jacquard to said instrumentalities have been of a mechanical nature up to the development illustrated in Patent 1,795,235, to Ruinnet. In this patent a means of selection has been disclosed wherein a pattern comprising parts constructed as an electrical conductor and other parts as a non-conductor is employed, and other devices including a trolley and solenoid interpret this pattern and transmit the same to the needles or other instrumentalities thereby to produce a knitted fabric with a predetermined design. A difficulty experienced with such a construction as illustrated in the original Ruinnet device is that while it functions satisfactorily at slow speeds and with relatively coarse gaged instrumentalities, practical employment in high speed machines or in machines having finer gaged needles or other instrumentalities is prohibited. The time necessary for the magnet or magnets to work upon an individual instrumentality is such that instrumentalities must be spaced throughout a substantial distance or the movement of the magnet over the instrumentalities must be comparatively slow. Of course, in a practical application to a modern knitting machine speed is necessary and the gage must be as fine as required to produce relatively shear fabrics.

The present invention has for a purpose the overcoming of such difficulties as are experienced when it is attempted to apply the original Ruinnet idea to fine gage machines. The invention, although shown as applied to a flat type of machine, is applicable in principle and with slight changes to other machines, for instance, circular machines such as those for producing body fabric and for hosiery, so-called Burson machines and other types of straight or flat knitting machines. The invention in its broadest aspects contemplates the provision of selecting instrumentalities for action upon other knitting instrumentalities such as needles, sinkers, jacks or the like, these selecting elements being provided with

a plurality of butts, said butts being capable of removal so that in the complete bed of the machine these selectors will be arranged with corresponding butts spaced a plurality of selectors distant, this spacing depending upon the number of butts each selector was originally provided with. A plurality of fingers or cams are to be located in a position to engage butts selectively and these cams are to be magnetically moved to and from butt engaging position in accordance with a selection to be derived from a pattern element comprising a drum, strip, or belt which will be constructed with portions of a material which will conduct an electric current while other portions will act as non-conductors.

In the figures of the drawings:

Fig. 1 is a section showing the pattern strip, one of the drums about which it passes, the support, one of the fingers which interpret the pattern on said strip and the cam mechanism for actuating fingers;

Fig. 2 is a fragmentary plan view of the part of the machine showing Fig. 1;

Fig. 3 is a detail view showing the cams which act to move the pattern engaging fingers to and from their active position;

Fig. 4 is a section showing some of the selectors, cams for engaging selector butts, cam actuating solenoids and the yoke and selector actuating cams;

Fig. 5 is an elevation, part being in section, showing cams for selecting certain of the selector elements and other cams for moving them to positions wherein they will engage and cause knitting instrumentalities to function;

Fig. 6 is a detail of one selector butt engaging cam and a few selectors;

Fig. 7 is a plan showing selector butt engaging cams and solenoids for working the same;

Fig. 8 is a view showing one set-up of selectors having four possible butt positions; and

Fig. 9 is a diagrammatic representation of the electrical system employed.

Now referring to the figures of the drawings a description will be given of one preferred embodiment of the invention wherein the selectors for the knitting instrumentalities, in this case the needles, have been provided with butts at four different positions. Obviously, these selectors may be constructed with four butts thereon so that all selectors are identical, and the butts may be broken off or removed in any satisfactory way to set up the proper pattern arrangement as illustrated in Fig. 8. The selectors might also be constructed with single butts, these butts being at the posi-

tions desired so that it would be necessary to construct four different kinds of selectors, these differing only as to their butt position. For purpose of illustration four butt positions are shown in this case but as many positions are available as are found necessary under the circumstances.

Referring to Figs. 1, 2 and 3, the pattern and pattern interpreting part of the device has been shown. In a machine such as has been used for illustration, this pattern interpreting mechanism would be located at one side and at one end of the machine, similar to the location of the pattern means in the patent to Ruinnet. The frame work of the machine has been extended by suitable side pieces 1 and 2 and also includes transverse members 3 and 4. The transverse frame pieces have bearings therein for a shaft 5 carrying a drum 6; this drum has a pattern strip or sheet 7 moving with or driven by the drum and preferably passing about another idler drum or roller at a lower position (not shown). The drum itself may comprise the pattern element as in Ruinnet although I prefer to use such a construction as shown since the same provides a pattern of considerable length and is continuous in that repeats are available without any hand manipulation of the drum 6. Another scheme which I may use is to wind a pattern strip about the drum such as the drum 6, hang suitable weights thereon and allow the same to wind or to unwind under a ratchet movement. Of course, this pattern would be limited in length and must be wound back after each complete winding or unwinding. The pattern strip or sheet 7 will be of a width corresponding to the width of fabric to be knitted and may, of course, comprise several sheets in the event the machine is to knit several strips of fabric simultaneously these fabrics possibly being identical or having different patterns formed thereon. The strip is preferably of thin sheet material such as copper, or any other good conductor of electrical current, and is to have the pattern painted thereon with some sort of paint which will serve effectively as an insulator, or may have the pattern cut from paper or thin cardboard and pasted on the surface of the copper.

The drum 5 is to be moved one step for each knitting stroke of the machine to select instrumentalities for knitting subsequently to that selecting movement. The drum may be ratcheted by any suitable mechanism such as shown in Patent 1,795,235 or in any other convenient manner from suitable connections on the machine itself.

A source of electric current is provided which will be free to flow through the pattern strip 7 at any part thereof except those which have been covered with an insulator. For the purpose of controlling the selectors, later to be described, this current is carried through a series of interpreting fingers 8, each of these fingers having a connecting wire 9 which is attached to one of a series of bars 10, 11, 12 or 13. The construction is such that every fourth finger connects to the same bar, that is fingers connect in sequence to bars 10, 11, 12, 13 across the entire bed. It will be obvious that as many bars are to be employed as there are butt positions on selectors. Each of these bars is of material suitable for conducting current and is carried in insulated openings in the end pieces 3 and 4. Other supports formed of insulating material as at 14 are arranged across the bed, these supports depending upon the length of the machine and being used

for supporting purposes since the bars would tend to sag under their own weight.

The bed within which the pattern interpreting fingers 8 are movable comprises a long supporting plate 15 supported at intervals by brackets such as 16 and carrying a slotted bar 17 made up of insulating material and within the slots of which the fingers 8 are pivoted at 18. The pin 18 is of material which is a non-conductor so that the fingers are completely insulated from all parts of the machine except the pattern strips and the bars 10, 11, 12 or 13 to which they are connected. Each finger 8 has a projection 19 with a fine, rounded end which contacts a strip to convey the pattern on that strip to the knitting instrumentalities according to whether or not a conducting portion or an insulating portion of the strip is encountered.

These fingers 8 are caused to contact the strip, that is, the projections 19 contact the strip, four at a time. Of course, if a system were to be used employing three or five or any other number of selecting butts on the selectors, a corresponding number of fingers would be in contact with the strip at one time. For the purpose of moving these fingers to and from an engaging position with the strip I provide cams on a cross-head 20 which moves back and forth in synchronism with the cam movements of the knitting machine itself being connected thereto by a connecting rod 21 pivoted at 22 on the cross-head and having its opposite end connected to some convenient part of the knitting machine which is reciprocated to and fro at the proper time. This cross-head slides upon a guide 23 fixed at the end pieces 3 and 4 of the frame and supported at intermediate stages by means of studs 24 and brackets 25 which are in turn bolted to the frame member 1. This cross-head is retained on the guide 23 by means of plates 26 and 27, the usual cross-head construction.

The cams which are carried by this cross-head and which move the fingers 8 into and from engagement with the pattern strip comprise a fixed cam 28 attached by suitable connecting means to the lower end of the cross-head and a spring pressed, movable cam 29 bearing above the ends of the fingers. This latter cam is slotted for movement on a pin 30 and has its inner side formed with a key 31 to be guided vertically within a slot cut lengthwise of the cross-head. A spring 32 maintains this cam downwardly under slight pressure against the upper ends of the fingers, thus each finger will be pressed against the surface of the pattern in such a manner as to make a good contact thereon but not to bear with any undue force. The lower portion of cam 28 provides a sufficient clearance so that this resilient effect of cam 29 may be realized. The length of cam 29 is such that four fingers are maintained in contact with the pattern element at all times. Cam 28 will return fingers to inactive position wherein they are held due to their being frictioned within the slots. This friction may be obtained by bending their fingers slightly so that they will be held upwardly against the force of gravity. These cams 28 and 29 are made of non-conducting material for the purpose of thoroughly insulating the fingers so that each finger may act to establish an individual connection between the pattern and one of the bars. If these cams were not of such material, the four fingers affected by the cams would not be insulated from each other.

Now referring to Figs. 4-8, I have shown the

needle bed at 33, needles 34 and short actuating jacks 35. Of course, the selection employed may be used upon any knitting instrumentalities such as sinkers or jacks or wrapping fingers. The usual rocking bar 36 is pivoted at 37 and is to be oscillated to and fro in the proper timed relation in accordance with the selecting movements necessary to be imparted prior to passage of the knitting cams. This bar has a series of slots therein aligning with the needle slots so that a selector 38 in each slot will be in alignment with one of the jacks 35 and, if selected, may impart a movement to that jack.

The yoke 39 slidable on bars, one of which is shown at 40 carries the cams which function upon the needles and jacks and also the solenoids which are to function upon selectors as well as cams for the same purpose. A rectangular box 41 is attached as shown in Figs. 4 and 5 by means of a projecting shaft 42, key 43 and set screws 44 to move with the yoke as it passes to and fro along the length of the machine. This construction provides for vertical adjustment of the entire solenoid assembly so that the cams which function upon selector butts may be properly adjusted as to height. These cams comprise four angular elements all pivoted at 45 and being of different lengths as shown in Fig. 7 so that the outer cam 46 will function upon all butts in the outermost row, the next cam 47 will function upon the second row of butts, the third cam 48, on the same side as 46, will function upon the third row of butts, and the innermost cam 49 will function upon the fourth or innermost row. All of these cams are constructed with a beveled, pointed end 50, Fig. 6, which will select butts 38' on selectors 38, one at a time. Two solenoids 51 and 52 function upon each cam to hold it in butt engaging or in inactive position in accordance with whichever one of the solenoids is energized. It is the purpose of the fingers 3 as they pass over the pattern strip to switch current from one of the solenoids to the other in accordance with the dictates of the pattern on said strips. This will be described in greater detail later. All of the beveled cam points 50 are arranged in line, see Figs. 5 and 7, the staggering of the cams and the different construction of each being for the purpose of suitably spacing solenoids and for pivoting the cams on a common axis.

The yoke 39 and the selector cam assembly attached thereto are timed to move to and fro along the selectors in synchronism with the movement of cams 28 and 29 along the series of fingers. In other words, each needle has a particular selector which is in alignment with it and the timing of the parts is such that a particular finger always controls the selection of that needle through the intermediate selector. Each cam moves past each end of the instrumentalities so that there is what may be termed a rest or idle period as the mechanism comes to the end of its stroke and turns back again, this idle period being the interval within which the rocking, selector carrying bed 36 swings through a short arc to select such needles or other instrumentalities as the pattern has provided for. This rocking movement may occur at each end of the stroke, or in the knitting of some patterns where several colors are used, the cams may be so controlled that one selection will do for more than one stroke of the knitting cams. All this is common practice with respect to machines of the type described and it is not a purpose of this

case to describe the knitting functions of the machine in more than one simple form of the invention.

This selecting movement imparted to the selectors 38 by means of any one of cams 46-49 contacting a butt is merely a preliminary selecting movement and it is necessary to complete this movement by such cams as have been illustrated in Figs. 4 and 5. Each of these selectors has its outer end reduced as shown at 53, these selectors passing over the tops of the series of cams in the event no one of the butts has been engaged by one of the cams 46-49. If there has been a preliminary selection, then the outer end of one of these selectors will be pushed down as shown in Fig. 5 to engage under the point of one of the cams 54. The space between these cams 54 is sufficient to allow the preliminary selecting movement to occur therebetween and such preliminary selection may occur on either direction of reciprocation. After contacting cam 54 the selector will be further depressed at its outer end and will then be further depressed by one of the cams 55. This will bring the inner end of said selector into a position to engage jack 35 when the whole assembly is swung about pivot 37 at the end of a complete stroke of the yoke and its attendant elements over selectors 38.

Cams 56 are movable automatically to and from active position and when in active position will return all selectors to their original or non-selected position. Cam 57 is fixed and functions in three color work to move selectors which have been selected for the first color down to a second inactive position, that is, the outer ends of these selectors will be moved down to a position so that the inner ends will be raised above the ends of jacks 35. For example, on the first stroke of a cycle some of the selectors will be moved by cams 46-49 to engage one of the cams 54 and then the adjacent cam 55, whereupon those selectors which were thus moved may engage butts 35 for one selection of the needles. On the return stroke cam 57 will move those selectors which were selected on the previous stroke to this second extreme or inactive position, while cams 46-49 will move certain others of the selectors to be engaged by the opposite set of cams 54 and 55 whereupon a second group of needles will be selected for the knitting of a second color. At the termination of this second selection, the remaining selectors will be projected down and engaged by a set of cams 54, 55 to select all remaining needles and thereafter the cycle will be started again, one of the other of cams 56 being projected inwardly to raise all the selectors to the first mentioned inactive position, the position shown in full lines in Fig. 4. This brief description of operation is given as illustrative of one manner in which the knitting may be carried on for operating with three colors, but no detailed disclosure of the machine operation is believed essential since these machines are common in the art and the invention herein concerned does not have to deal with the operation of the machine per se or the manner in which it may knit two or more colors to form a pattern.

Now referring to the diagram in Fig. 9, four fingers 3 are illustrated as being in contact with a pattern 7, two of the fingers being on a portion of that pattern which would be of a conducting material, and two other fingers which are shown being raised away from the pattern indicating that they are in contact with a non-

conducting or insulated part of the pattern. Now referring to the uppermost finger for example, it is shown connected to bar 10 by a short connection 9 as in Fig. 1 and the pattern has a connection 58 to one terminal of a plug 59 representing a source of current. From the rod 10 a connection 60 runs to the coil of a solenoid indicated at 61, returning via wires 62 and 63 to the source of power.

In actual practice the connections 60 and 63 from the bars 10—13 to the solenoids of the switches are in the form of cables which provide sufficient slack for movement of the machine carriage back and forth, the said cables being drawn out toward either end of the machine and swinging back and forth during these movements. The cables are to be heavily insulated and their contact with other parts of the machine or with the floor upon which the machine is mounted would have no effect. Other satisfactory schemes may be used for conveying the current through the pattern to the bars 10—13 and to complete a circuit through these switch solenoids so long as they compensate for the movement of the machine carriage while the bars themselves remain stationary. One such scheme might involve the use of elongated bars 10—13 and brushes or trolleys running on these bars and carrying current through to the solenoid in case a finger is bearing upon an insulated part of the pattern.

Solenoid 61 controls an armature 64 which in turn switches current from one solenoid 51 to the other solenoid 52 and vice versa for changing the position of cam 46. These solenoids are supplied from a source of electric current indicated at 65 passing through wires 66 and 67 to the element 64 which under the influence of a spring 68 and 67 to the element 64 which under the influence of a spring 68 would normally tend to contact one side of the switch at 69 and energize solenoid 51, the current returning through the wire 70 to complete a circuit. If solenoid 61 were not energized, that is, if the finger 8 were not in contact with a conducting part of the pattern, solenoid 51 would be energized and would cause the cam 46 to act upon any butts which pass in line with it.

If on a conducting part of the pattern as actually illustrated, solenoid 61 would be energized, the armature 64 would be drawn up against the other side of the switch 71 as shown to switch the flow of current through solenoid 52. This would draw the cam 46 to an inactive position as shown. In the diagrammatic illustration both positions of fingers and also of the armatures and the cams 47, 48 and 49 are shown. It is obvious that the electric connections might be altered so that either conducting or insulating parts of the pattern may force cams 46—49 into butt engaging position. In one instance the insulated part of the pattern would control the ornamental work produced on a basic fabric and in the other the plain copper portion of the pattern would effect the reproduction of a pattern on the fabric.

The workings of one finger and the solenoids which that finger would control have been described; it is to be understood that the remaining fingers function in a similar manner and further description is not believed necessary. In the particular embodiment shown four fingers are in contact with some part of the pattern at all times and four cams 46—49 are caused to act upon selectors 38 through whatever butts may

be on those selectors. The time required for a cam such as 46 to be moved to contact a single butt without contacting any other butt on the way in or out is such that a single cam could not properly function upon all of the selectors as in previous constructions. In this invention each cam has a space of four selectors in which it may be moved to engage a single butt and another space of four selectors in which it may be retracted, thus, the machine may be of extremely fine gage and yet be run at commercial speed. It is obvious that different numbers of butts may be provided and, of course, corresponding numbers of cams and fingers be in contact with the pattern, all as required by the particular problem at hand.

The invention has been described with respect to a rather simple type of flat machine, but it is to be understood that I contemplate the use of the invention in all types of knitting machines or other textile machinery and that the principle by means of which I obtain selections of instrumentalities which normally would require extremely rapid movements of parts within very close limits, are easily taken care of by arranging the selection into different steps as herein shown and described.

In circular machines the principle may be applied to instrumentalities having any number of butts and a selection may move those instrumentalities for engagement with other cams which will thereafter affect them for the carrying out of some desired function. In certain instances it is contemplated to employ one pattern device and to connect that to many machines which are all knitting fabric with the same pattern. By this it would be possible to save the expense of having all patterning mechanism on each machine and a change of a single pattern would effect the knitting of a different pattern on the total group of machines which are connected. The invention is to be limited only by the scope of the appended claims.

I claim:

1. In a knitting machine, selecting elements for acting upon knitting instrumentalities to determine their selection for knitting patterned fabric, spaced butts on said elements, adjacent elements having differently positioned butts, and cams controllable by magnetically operated means for engaging the differently positioned butts on said elements whereby selection may be imparted to the knitting instrumentalities.

2. In a knitting machine the combination of a plurality of selecting elements having spaced butts thereon, adjacent elements having differently positioned butts, a plurality of cams for functioning on said differently positioned butts, magnetic means for changing the position of said cams and a pattern comprising conducting and non-conducting portions said pattern being connected to a source of electric current, and means for conveying said electric current through the conducting portions of said pattern for determining the action of said magnetic means on the cams.

3. In a knitting machine the combination of a plurality of selecting elements, a plurality of cams for relative movement past said selecting elements and a plurality of spaced butts on the elements, spaced elements having a butt in alignment with one of said cams, two solenoids for changing the position of each cam, a switch for determining which of said solenoids shall be energized, and a pattern comprising conducting and

non-conducting surfaces, said pattern being connected to a source of electric current and means including a plurality of movable fingers for interpreting said pattern and conducting current from the pattern to said switch in case said finger is in contact with a conducting portion of the pattern.

4. In a knitting machine the combination of a plurality of selecting elements pivoted within slots in a bed, a plurality of swinging cams for engagement with butts on said elements, spaced elements having butts in substantial alignment with the path through which one of said cams will travel, magnetic control means for said cams and pattern means for determining the action of said magnetic control means including a pattern comprising conducting and non-conducting portions, means for connecting said pattern within an electrical circuit and other means for completing said circuit including a plurality of fingers movable by means of a traveling cam into and from engagement with the surface of said pattern.

5. Means for selecting pattern controlled instrumentalities including a pattern element having conducting and non-conducting portions, a plurality of fingers and a cam for moving said fingers into engagement with the surface of said pattern, a plurality of connecting bars for conducting current which passes through the pattern and fingers to a magnetically operated switch, a plurality of cam elements for functioning in the selection of the instrumentalities and solenoids for moving said cam elements from active to inactive positions, the construction being such that the switch controls the energizing of said solenoids in accordance with the passage of a cooperating finger over conducting and non-conducting parts of the pattern.

6. Pattern means for knitting machines of the type described wherein a plurality of selecting elements having spaced butts thereon are to be moved for the knitting of patterned fabric, including in combination a series of cam elements for engagement with said spaced butts, solenoids for moving said cam elements to and from butt engaging position, a switch for controlling the flow of current through said solenoids and a pattern element conducting an electric current but having insulated areas at the surface thereof and pattern interpreting means periodically moved into contact with the surface of said pattern to actuate said switch for determining through which solenoid said switch will cause current to flow.

7. Pattern means for knitting machines including a plurality of selector elements having spaced butts thereon, a plurality of cam elements for engaging said butts, solenoids and pattern means for controlling the flow of current through said solenoids to move said cam means to and from butt engaging position and other cam means for moving selector elements the butts of which have been engaged by the first mentioned cam elements to a position for completing the selection.

8. Selecting means for knitting machines of the type described including a pattern element comprising a conducting portion and an insulated portion, means for periodically advancing said pattern element, a series of fingers adjacent said pattern element but normally maintained separated from the surface thereof, a plurality of bars, said bars being connected in sequence

to spaced ones of said fingers and cam means movable along said series of fingers for maintaining a predetermined number of them in contact with the surface of said pattern at all times.

9. Pattern means for knitting machines of the type described including a pattern comprising conducting and insulated portions, a driven roll over which said pattern passes and by means of which it is to be periodically advanced, a bed constructed of insulating material and having in slots thereof a plurality of fingers for engaging the surface of said pattern but normally maintained separated therefrom, a plurality of conducting bars adjacent said fingers and connected in sequence to spaced ones of the fingers and a cross head slidable along the surface of the pattern and having a fixed and a spring pressed cam for engaging said fingers and maintaining a predetermined number of them in contact with the surface of the pattern at all times.

10. In a knitting machine the combination of a plurality of selecting instrumentalities, butts on these instrumentalities arranged in different positions along the length thereof but arranged to recur at the same position on spaced instrumentalities to form rows of equally spaced butts, cams functioning in alignment with each row of butts and magnetically controlled means for moving said cams to and from active position.

11. In a knitting machine the combination of selecting instrumentalities having an operating butt thereon, spaced, recurrent instrumentalities having butts in the same position whereby said instrumentalities present a plurality of rows of butts but no two instrumentalities having adjacent butts in the same row, cams for engagement with each row of butts and magnetically controlled means for moving said cams to and from active position.

12. In a knitting machine, instrumentalities for cooperating in the knitting of patterned fabric, selecting means for acting upon said instrumentalities and magnetically operated means for determining the position of said selecting means, a pattern and progressively moving pattern contacting elements for affecting the magnetically operated means, said magnetically operated means having such relative speed of travel over the selecting means that it would be impractical for the magnetic means to act between single selecting elements, the construction being such that the selecting means are provided with a series of butts so arranged that adequate time is allowed for the magnetic means to act on any single selecting element to the exclusion of others.

13. A knitting machine having in combination instrumentalities by means of which selections are imparted to the knitting instrumentalities of the machine, magnetically controlled means progressively movable past said instrumentalities for functioning upon spaced ones of said selecting instruments and other magnetically controlled means similarly movable but positioned to avoid interference with the first said means, a pattern and progressively moved pattern contacting elements operable upon a part of said pattern only at any particular instant, the construction being such that selections are derived from the pattern and imparted to the instrumentalities of a finer gauge that might be selected by a single progressively movable magnetic means.