United States Patent [19]

Spencer

[11] **3,913,353**

[45] **Oct. 21, 1975**

[54] **MANUAL KNITTING MACHINE WITH A NEEDLE SELECTOR MECHANISM**

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[73] Assignee: **Knittax,** Berlin, Germany

[22] Filed: **Apr. 15, 1974**

[21] Appl. No.: **461,097**

[52] **U.S. Cl.** **66/60;** 66/75

[51] **Int. Cl.²** **D04B 7/00**

[58] **Field of Search** ..... 66/75, 60, 60 H, 64

[56] **References Cited**

UNITED STATES PATENTS

3,358,473	12/1967	Suzuki	66/60
3,611,733	10/1971	Krause	66/75

FOREIGN PATENTS OR APPLICATIONS

1,174,060	12/1969	United Kingdom	66/75
536,296	4/1930	Germany	66/75
1,265,336	5/1961	France	66/604
1,189,748	10/1959	France	66/604

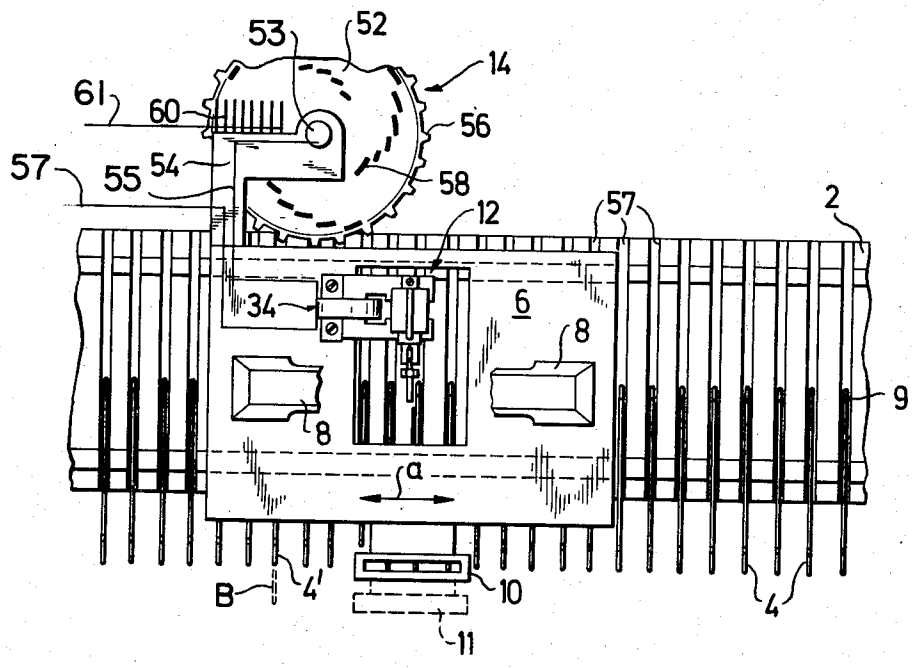
Primary Examiner—Ronald Feldbaum

Attorney, Agent, or Firm—Beaman & Beaman

[57] **ABSTRACT**

A manual knitting machine with a needle bed in which needles are displaceably assembled, having a slide displaceable on the needle bed perpendicularly to the direction of motion of the needles, which slide, through a cam mechanism adapted to cooperate with the butts of the needles, is adapted to move the needles backwards and forwards to execute the knitting action, a needle selector mechanism, assembled on the slide, for moving specific needles out of their normal knitting position into a selecting position, and a control mechanism for arbitrarily operating the needle selector mechanism comprises an adjuster wheel assembled to rotate freely on the slide and having circumferentially distributed projections arranged, when the slide is displaced, to mesh with the needle butts in the manner of a gear, and a brake device which is arranged, when operated by the control mechanism, to stop the adjuster wheel so that the needle butts are displaced by the adjuster by a camming action of the wheel projections and the needles moved into their selector position.

7 Claims, 6 Drawing Figures



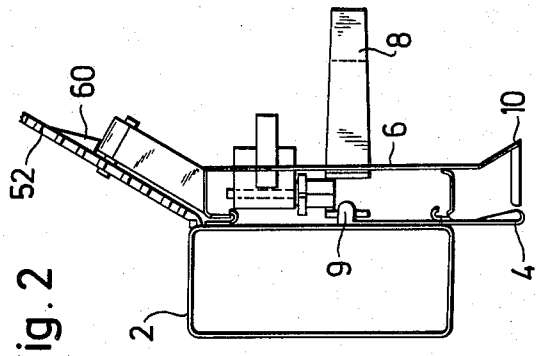

60
52
8
6
10
9
4
2

Fig. 2

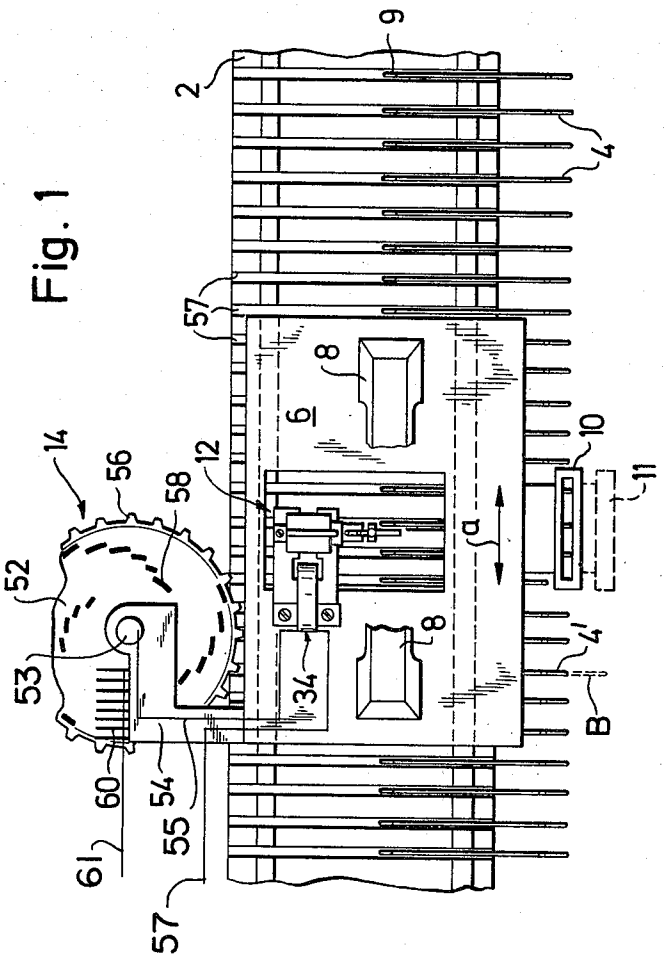

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8
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d
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4'
34
B
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54
55
61
57

Fig. 1

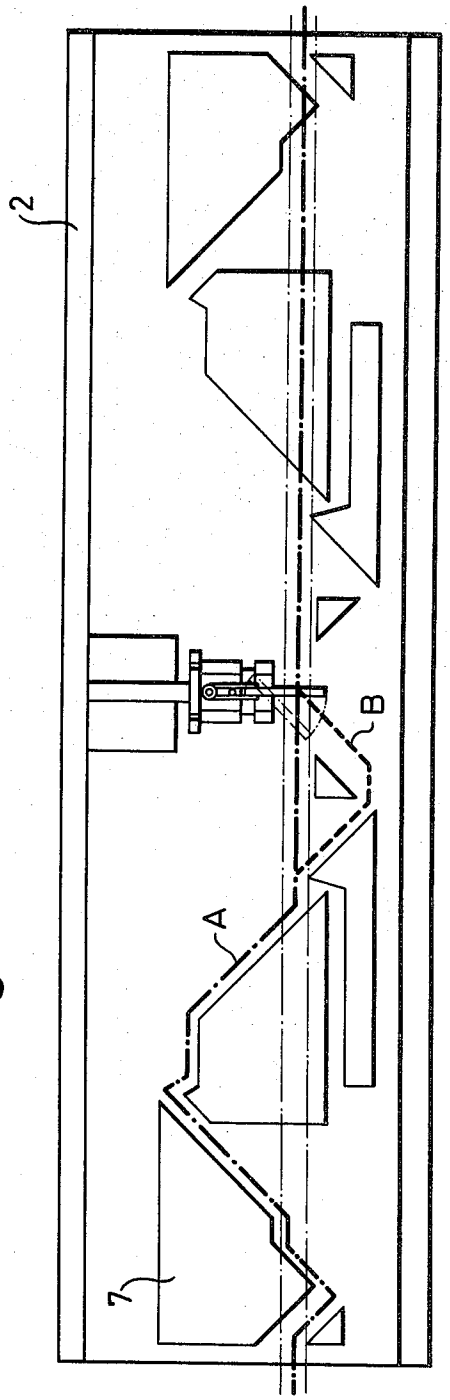


Fig. 3

Fig. 5

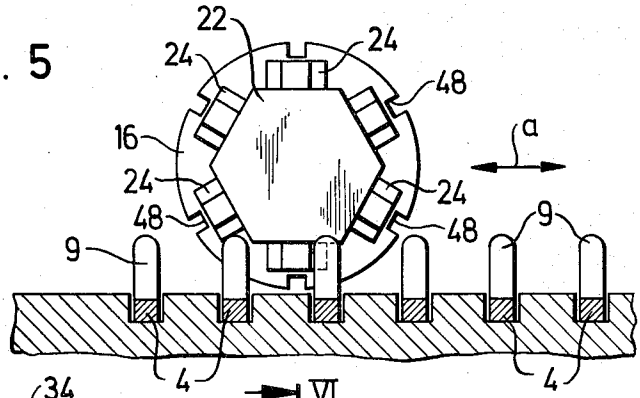

22
24
24
48
16
a
24
24
48
48
9
9
4
4

Fig. 4

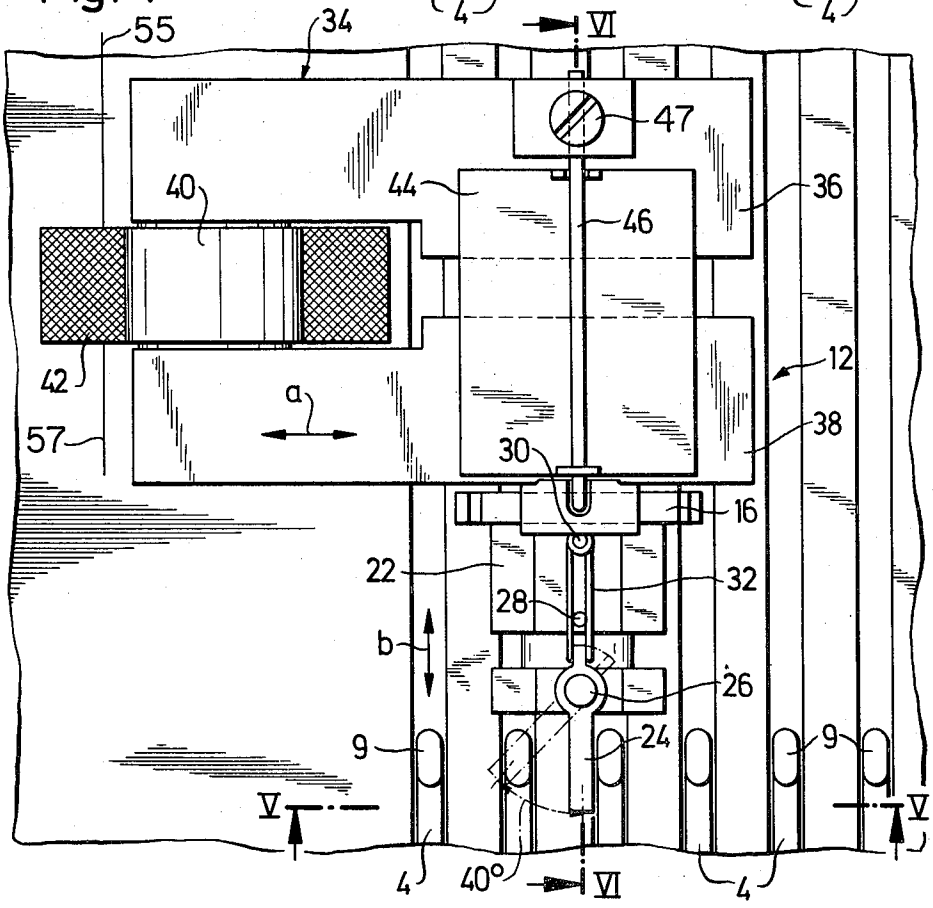
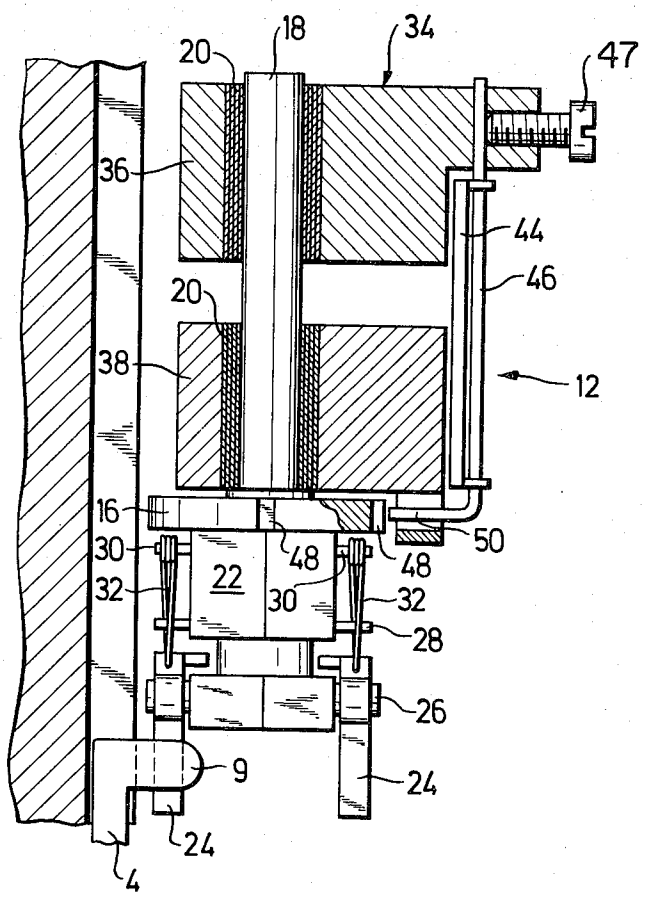

55
34
VI
47
40
44
46
36
42
12
a
57
38
30
16
22
32
28
b
26
9
24
9
V
V
4
40°
VI
4

Fig. 6



MANUAL KNITTING MACHINE WITH A NEEDLE SELECTOR MECHANISM

BACKGROUND OF THE INVENTION

This invention relates to a manual knitting machine with a needle bed in which the needles are displaceably assembled, with a slide displaceable on the needle bed perpendicularly to the direction of motion of the needles, which slide, through a cam machanism cooperating with the butts of the needles, moves the needles backwards and forwards in order to execute the knitting action, a needle selector mechanism assembled on the slide, by means of which specific needles can be moved out of their normal knitting position into a selecting position, and a control mechanism for arbitrarily operating the needle selector mechanism.

In one known manual knitting machine of this kind as shown in Swiss Pat. No. 387,214, the needle selector mechanism consists of a lever pivotally assembled on the slide, which can be pivoted against the bias load furnished by a spring and under the control of an electromagnet, into the path of movement of the needle butts. The end of the lever is designed as a cam face, so that the needle butt engaged by the lever is displaced along a guide track provided in the slide, into its "selector position". The control of the electromagnet is effected through electrical contacts arranged in the guides, which contacts are operated by the needle butts sliding through the guides.

By means of this device, the needles can be moved out of the knitting position, in which they perform the normal knitting action, into a selector position in which they are displaced externally in relation to the knitting position. In this fashion, specific knitting patterns can be produced because the sequence of stitches can be changed from row to row. However, it has been found in practice that this kind of mechanism is unsuitable for high speeds of operation because the lever operated by the electromagnet must execute a relatively large pivoting motion in an extremely short time. Also, the known mechanism has the drawback that a separate electromagnet is required for each direction of motion of the slide.

In another known manual knitting machine of similar design as shown in German Pat. No. 1,207,540 likewise an elastically biassed lever is provided which, in its operating position, transfers the needle butts from one guide path to another. In this case, however, the levers must be displaced manually into their operating positions, and this restricts the range of applications of this mechanism.

In another known manual knitting machine as shown in U.S. Pat. No. 3,358,473 and Great Britain Pat. No. 1,174,060 punched cards are used to control the needle selector mechanism, the cards being carried along with the slide.

Through relatively complicated cam mechanisms with needle linkages, gears and cams, then, in accordance with the information contained in the punched card, specific needles are moved into their selector position. These known needle selector mechanisms involve such a large constructional outlay that they are uneconomical when applied to manual knitting machines.

SUMMARY OF THE INVENTION

The object of the invention is to provide a manual knitting machine of the kind described in the introduction, whose needle selector mechanism can also be used for high speeds of operation, without involving too heavy an outlay in construction.

According to the invention the needle selector mechanism consists of an adjuster wheel assembled to rotate freely on the slide and equipped with circumferentially distributed projections which, when the slide is displaced, mesh with the needle butts in the manner of a gear, and of brake device which, when operated by the control mechanism, stops the adjuster wheel so that the needle butts are displaced by the adjuster wheel projections, these now acting as cams, and the needles moved into their selector position.

Where the manual knitting machine of the invention is concerned, in order to switch needle selector mechanism in and out, it is merely necessary to operate the brake device. In this fashion, it is possible to readily cope even with very high operating speeds so that even if the needle selector mechanism is actuated from one needle to the next, no difficulties are encountered. The constructional outlay is relatively low so that the cost of manufacture of the manual knitting machine can be kept within reasonable bounds. A further advantage of the manual knitting machine in accordance with the invention resides in the fact that the needle selector mechanism is operative in both direction of motion of the slide. Yet another advantage is that the pattern produced by the needle selector mechanism need not necessarily extend over the full width of the knitted item, but can be restricted to any arbitrary part thereof.

In a convenient embodiment of the invention, the projections of the adjustable wheel are designed as levers pivotally attached to the wheel, each of which is biassed into a centre position by a spring device and, when the adjuster wheel is braked, is pivoted by the relevant needle butt into an operative position determined by a stop, these levers presenting the needle butts with an inclined surface. Conveniently, the axis of rotation of the adjuster wheel will here be disposed parallel to the direction of motion of the needles and the axis of pivot of the levers perpendicularly to the axis of rotation of the adjuster wheel so that the levers, projecting axially away from the adjuster wheel, extend between the needle butts. In this fashion, smooth and reliable guidance of the needle butts is ensured.

In an advantageous further embodiment of the invention, the brake device exhibits an electromagnet and the armature thereof or an actuator element attached to it, will be designed to engage in a groove in the adjuster wheel. The use of an electromagnet as the brake device makes for particularly simple operation of the needle selector operation.

When using an electromagnet as the brake device, it is particularly advantageous furthermore that in a further embodiment of the invention the control device exhibits an electrical or electronic switching device, operable by the slide movement, in order to actuate the electromagnet. Preferentially, the switching device will have a switching wheel, rotatably assembled on the slide and driven by the slide motion, with a printed circuit arranged in a predetermined pattern, said circuit, in a sequence determined by the contact block arranged along the slide, producing signals which ener-

gise the electromagnet. In order to control the knitted pattern, it is thus simply necessary to change the printed circuit of the switching wheel. Because the switching device is driven by the slide motion, special matching of the control device to different widths of knitwear, is unnecessary.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will now be further described, by way of example, with reference to the accompanying drawings, in which:

FIG. 1 illustrates a schematic plan view of a manual knitting machine in accordance with the invention;

FIG. 2 illustrates a side elevation of the manual knitting machine as shown in FIG. 1;

FIG. 3 illustrates a schematic view of the path of motion of the needle butts, relative to the slide;

FIG. 4 illustrates a plan view of a needle selector mechanism of the manual knitting machine shown on FIG. 1, on a larger scale;

FIG. 5 is a cross-section in the line V—V of FIG. 4; and

FIG. 6 is a cross-section on the line VI—VI of FIG. 4.

DESCRIPTION OF PREFERRED EMBODIMENTS

The manual knitting machine shown schematically in FIGS. 1 and 2, has a needle bed 2 in which the needles 4 can move backwards and forwards in a linear fashion. On the top of the needle bed, a slide 6 is assembled to be displaced perpendicularly to the direction of motion of the needles 4, in the direction of the arrow *a*, and can be moved backwards and forwards by means of a handle 8. On the bottom of the slide 6 a cam mechanism 7 is provided (schematically shown in FIG. 3), which cooperates with the butts 9 of the needles 4.

The slide 6 also carries a mechanism 10 for guiding the yarn.

When the slide 6 is displaced, the needles are displaced in accordance with a path indicated by the chain-dotted line A of FIG. 3, and in so doing perform the knitting action.

The slide 6 also carries a needle selector mechanism 12 by means of which the needles can arbitrarily be moved into a selector position in which they are displaced to the exterior in relation to the normal needle position, this being indicated in the case of the needle 4′ by the broken lines B. By displacing specific needles into their selector position, it is possible to produce specific knitted patterns. The selector position B, however, can also be used in order, in addition to the normal yarn, to knit another yarn of a different colour, so that multicolour patterns can be produced. In this case, the yarn feed mechanism 10 must be accompanied by an additional yarn feed mechanism 11 (shown in broken line) in order to supply the yarn of the other colour.

The needle selector mechanism 12 is arbitrarily controlled by a control mechanism 14 likewise carried by the slide 6, so that in departure from the normal needle motion A, the needle motion B shown in broken line in FIG. 3, can be produced.

The construction of the needle selector mechanism 12 has been shown in more detail in FIGS. 4 to 6. The needle selector mechanism 12 exhibits an adjuster wheel 16 freely rotatable on the slide 6 through the medium of a spindle 18 and bearings 20. The adjuster wheel 16 has an axial extension 22 of hexagonal cross-section. On each of the external surfaces of the axial extension 22, a projection in the form of a lever 24 is provided, the various levers pivoting about pivots 26. Each of the levers 24 is centered by a spring 32, in a central position which is aligned with the axial direction of the adjust wheel 16.

Each of the springs 32 exhibits a portion which is coiled around a pin 30, from which coiled portion two spring arms extend away so that their ends embrace a short portion of the lever 24 between them. Between the two levers there is furthermore arranged a pin 28 attached to the axial extension 22, which pin is disposed between the pin 30 and the fulcrum pin 26 of the lever. The pin 28 is used to limit the deflection of the legs of the spring 32 in one direction.

The spindle 18 of the adjuster wheel 16 is disposed perpendicularly to the direction of motion *a* of the slide, and the fulcrum pin 26 of the lever 24 is disposed perpendicularly to the axis of rotation of the adjuster wheel 16. Thus, the lever arms 24 extend parallel to the direction of motion *b* of the needles. The adjuster wheel 16, with its levers 24, is here disposed relatively to the needles 4 in such an attitude that the levers 24 engage between the needle butts 9. The dimensions are so chosen that with displacement of the slide 6 the adjuster wheel 16 meshes with the needle butts 9 after the manner of a gear. The needle butts act as a rack while the levers 24 form the teeth of this "gear drive".

The force exerted by the springs 32 is of such magnitude that the levers 24 do not shift away from their central position during the meshing engagement with the needle butts 9, as long as the adjuster wheel 16 is able to rotate freely. If, however, the adjuster wheel 16 is stopped, the lever 24 which is in engagement at the time is pivoted by the associated needle butt 9 against the force of the spring 32. The lever 24 then moves into the position shown in chain-dotted fashion in FIG. 4, this position being limited by a stop (not shown) and being displaced through about 40° in relation to the initial position. The lever 24 here forms an inclined cam face over which the associated needle butt slides allowing the relevant needle to move into its selector position.

To arbitrarily stop the adjuster wheel 16, a brake mechanism is provided in the form of an electromagnet 34. The electromagnet 34 has two halves, 36, 38, the magnetic circuit formed by the halves 36, 38, being closed through a cylindrical element 40 carrying a coil 42. The armature 44 of the electromagnet is supported by a spring component 46 one of whose ends is attached by a screw 47 to the magnet half 36. The spring component 46 is equipped at its ends remote from the fixed end, with a bent portion 50 which can engage in one of several grooves 48 distributed around the periphery of the adjuster wheel, when the armature 44 is attracted towards the halves 36, 38 on activation of the electromagnet. By operating the electromagnet 34, the adjuster wheel 16 can thus be halted.

To control the operation of the electromagnet 34, the control mechanism 14 shown in FIGS. 1 and 2 is provided. The control mechanism 14 exhibits a switching wheel 52 which is mounted to rotate freely on pivot 53 located on an arm 54 of the slide 6. The switching wheel 52 is provided with teeth 56 distributed around its circumference, these meshing with openings 57 provided in the needle bed 2. When the slide 6 is displaced

the switching wheel is rotated in accordance with the speed of the displacement of the slide.

On the top of the switching wheel **52,** a printed circuit **58** is provided which consists of spaced conducting segments electrically connected to pivot **53,** the segments define a pattern corresponding to the desired knitting pattern, the printed circuit is formed in the normal fashion by etching away the unwanted metal and the pivot **53** is electrically connected to electromagnet **34** by conductor **55.** The printed circuit **58** segments are sequentially engaged by the radially spaced contacts of a contact block **60** connected to conductor **61** so that with rotation of the switching wheel **52,** a predetermined sequence of "on-off" signals is produced in the electromagnet **34** through the supply switch conductors **61** and **55,** and supply conductor **57** also connected to electromagnet **34.** These electrical signals are employed to control the electromagnet.

The mode of operation of the needle selector mechanism **12** described, and its associated control devive **14,** is as follows:

In the normal operation, when the electromagnet **34** is not energised and the needle selector mechanism **12** is thus not operative, the adjuster wheel **16** is rotated, with any displacement of the slide **6,** due to the engagement between the needle butts **9** and the levers **24,** without the adjuster wheel **16** having any influence upon the movement of the needles **4.** At the same time, the switching wheel **52** is rotated by the slide motion, the rotary motion of the switching wheel **52** being proportional to the linear motion of the slide **6.** If, at a predetermined position in the slide motion, the switching wheel **52** then produces an electrical signal in accordance with the given pattern of the printed circuit, then the electromagnet **34** is energised. The armature **44** and therefore the spring component **46** are attracted towards the halves **36, 38** so that the curved end **50** can engage in one of the grooves **48** in the adjuster wheel **16.** Consequently, further rotation of the adjuster wheel **16** is prevented.

However, because the adjuster wheel and the levers **24** continue to move on linearly together with the slide **6,** in relation to the needle bed **2,** the particular lever **24** which is in engagement with a needle butt **9,** is pivoted against the action of the spring **32** and by the relevant needle butt, into the position shown in chain-dotted fashion in FIG. **4** until the lever comes up against the associated stop (not shown). As the slide moves onwards, the needle butt **9** slides over the entire surface of the lever **24** so that the needle **4** is moved into its selector position.

by an appropriate choice of the printed circuit **58** on the switching wheel **52,** any arbitrary knitting pattern can be produced.

What is claimed is:

1. A manual knitting machine comprising, in combination, a needle bed, a plurality of needles displaceably supported on said bed each having a butt, a slide displaceable on said needle bed perpendicularly to the direction of displacement of said needles, camming means defined on said slide cooperating with the butts of said needles to move said needles backwards and forwards to execute the knitting action, needle selector means mounted on said slide for moving specific needles out their normal position into a selecting position, control means mounted on said slide operating said needle selector means in a predetermined manner, said needle selector means comprising an adjuster wheel assembled to rotate freely on said slide, projections circumferentially distributed on said adjuster wheel and pivotal between camming and non-camming positions meshing with said needle butts whereby said wheel is rotated during movement of said slide, and braking means operable by said control means adapted to selectively stop and adjuster wheel rotation whenever a needle is to be moved to its selecting position so that said needle butts are displaced by said adjuster wheel by a camming action of said projections and said needles moved into their selecting position.

2. A manual knitting machine is claimed in claim **1** in which said projections of said adjuster wheel comprise levers pivotally mounted on said adjuster wheel, a spring device biasing said levers into a center non-camming position and said levers being pivoted by the engaged needle butt into an operative camming position whereby said needles form an inclined plane to displace the engaged needle butt when said adjuster wheel is braked and said slide is displaced.

3. A manual knitting machine as claimed in claim **2,** in which the axis of rotation in said adjuster wheel extends parallel to the direction of displacement of said needles and the pivot axis of each of said levers extends perpendicularly to the axis of rotation of said adjuster wheel, so that said levers project axially away from said adjuster wheel, between said needle butts.

4. A manual knitting machine as claimed in claim **1,** in which said braking means includes an electromagnet.

5. In a manual knitting machine as claimed in claim **4,** in which said electromagnet includes an armature engaging a groove defined in said adjuster wheel when said electromagnet is energized.

6. A manual knitting machine as claimed in claim **5** in which said control means includes programmed electric switching means mounted on said slide, said switching means being operable by the motion of said slide to actuate said electromagnet.

7. A manual knitting machine as claimed in claim **6** in which said switching means includes a switching wheel engaging the needle bed and driven by the slide motion and rotatably mounted on said slide, said switching wheel carrying a printed circuit arranged in a specific pattern, and a contact block mounted on said slide having a plurality of contacts sequentially engaging said printed circuit whereby the engagement of said contacts with the printed circuit generate signals for energizing said electromagnet in a predetermined sequence.

* * * * *