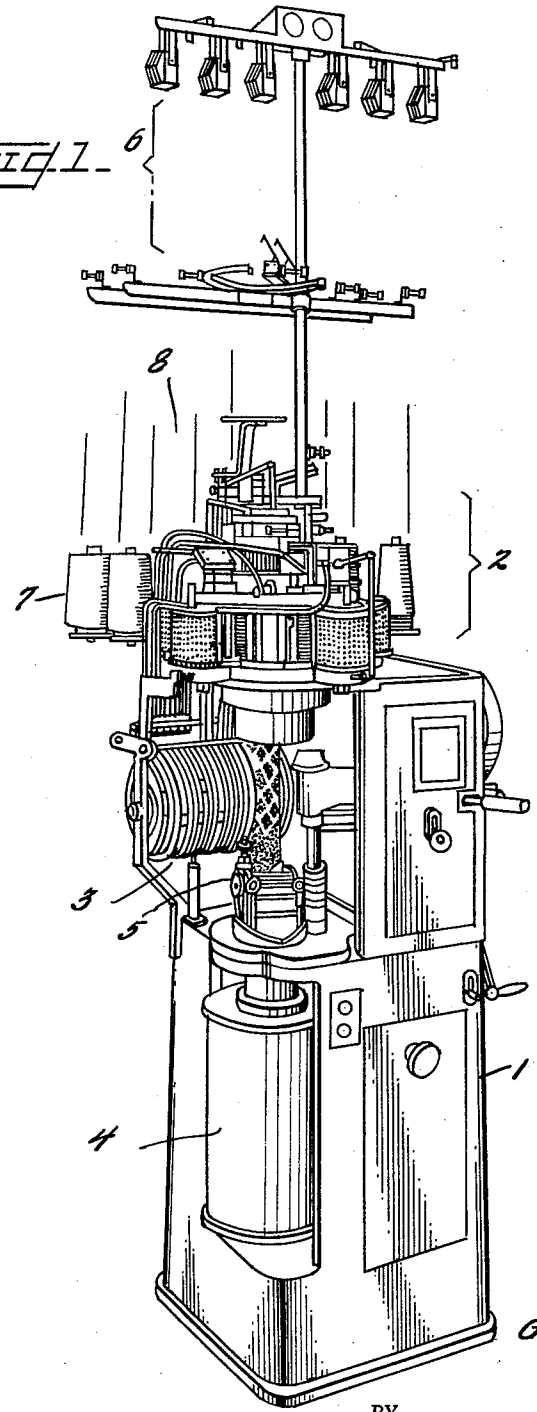
Dec. 29, 1964 G. AZZOLARI 3,163,027

THREAD GUIDING DEVICE FOR HOSIERY AND SIMILAR MACHINES

Filed Dec. 29, 1960 4 Sheets-Sheet 1

FIG. 1



INVENTOR
G. Azzolari,

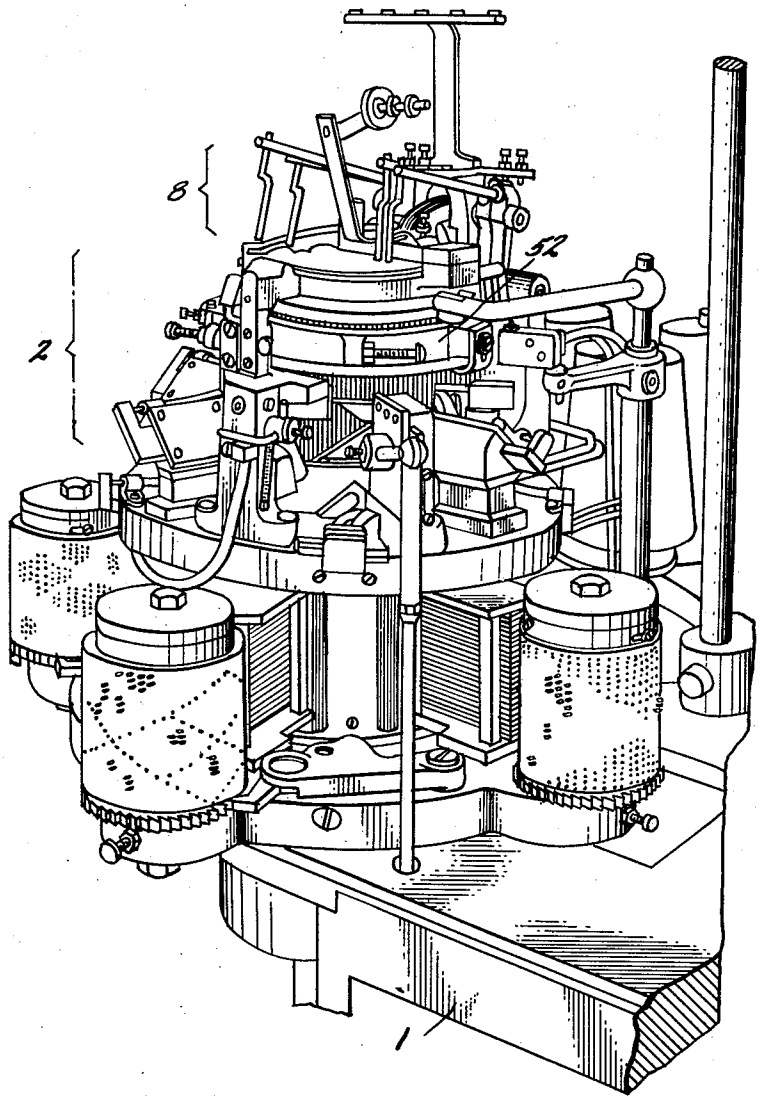
BY
Watson, Cole, Grindle & Watson
ATTORNEYS

Dec. 29, 1964 G. AZZOLARI 3,163,027

THREAD GUIDING DEVICE FOR HOSIERY AND SIMILAR MACHINES

Filed Dec. 29, 1960 4 Sheets-Sheet 2

FIG. 2.



INVENTOR

G. Azzolari,

BY

Watson, Cole, Grindle & Watson

ATTORNEYS

Dec. 29, 1964 G. AZZOLARI 3,163,027

THREAD GUIDING DEVICE FOR HOSIERY AND SIMILAR MACHINES

Filed Dec. 29, 1960 4 Sheets-Sheet 3

FIG. 3.

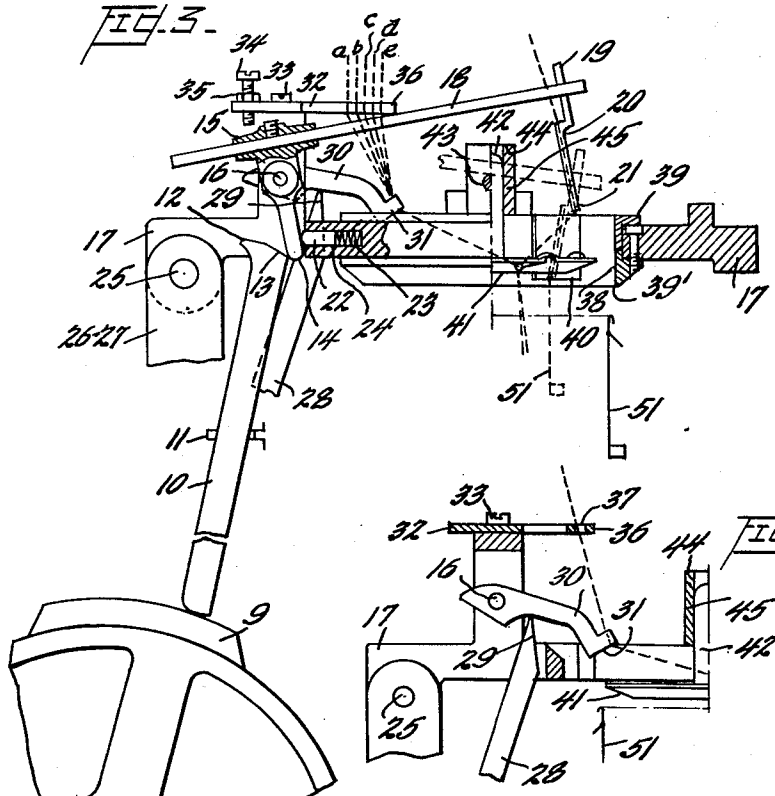
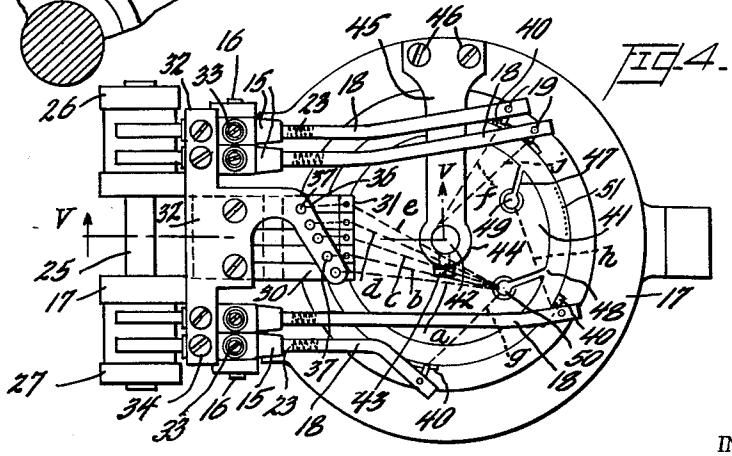


FIG. 5.

FIG. 4.



INVENTOR

G. Azzolari,

BY

Watson, Cole, Grindle & Watson

ATTORNEYS

Dec. 29, 1964 G. AZZOLARI 3,163,027

THREAD GUIDING DEVICE FOR HOSIERY AND SIMILAR MACHINES

Filed Dec. 29, 1960 4 Sheets-Sheet 4

FIG. 6.

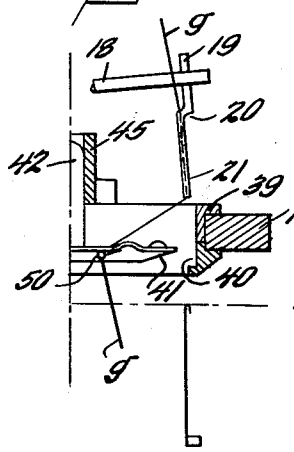


FIG. 7.

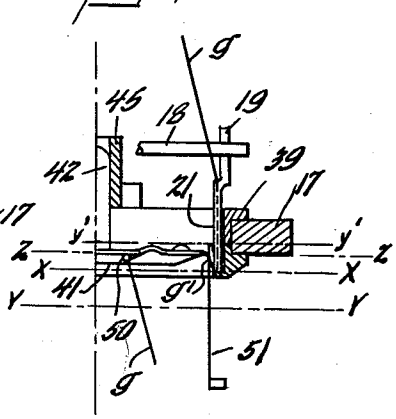


FIG. 8.

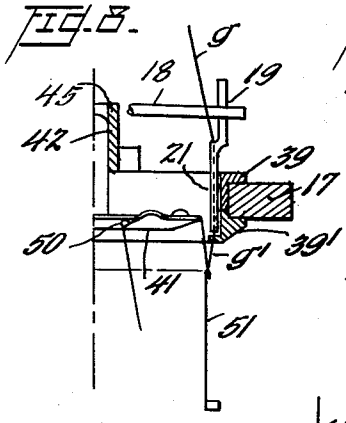


FIG. 9.

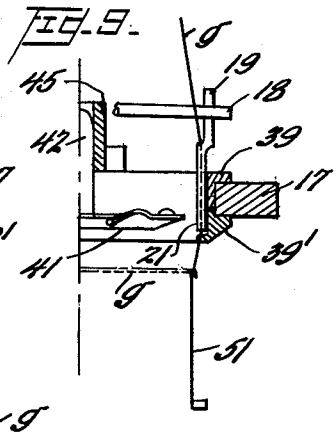
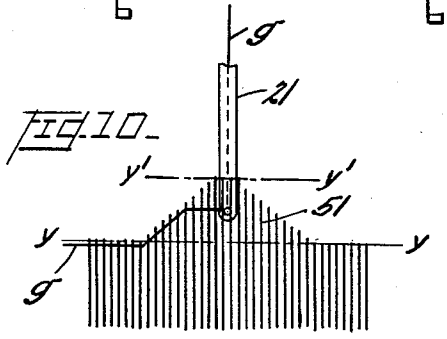


FIG. 10.



INVENTOR

G. Azzolari,

BY

Watson, Cole, Grindle & Watson

ATTORNEYS

United States Patent Office

3,163,027
Patented Dec. 29, 1964

1

3,163,027

THREAD GUIDING DEVICE FOR HOSIERY AND SIMILAR MACHINES

Guido Azzolari, Brignano d'Adda, Bergamo, Italy, assignor to Fabrique National d'Armes de Guerre, Societe Anonyme, Herstal, near Liege, Belgium

Filed Dec. 29, 1960, Ser. No. 79,212
Claims priority, application Italy, Jan. 5, 1960, 139/60; Dec. 12, 1960, 21,304/60
3 Claims. (Cl. 66—138)

This invention concerns a thread guiding device, more particularly for hosiery and similar machines.

It is a known fact that in such machines the thread guides must allow the threads to be placed in or out of the path of the needles, which simultaneously carry out an up-and-down movement as well as a rotational movement around the central axis.

The placing of the thread in or out of the path of the needles, by means of aforesaid thread guides, is controlled by a pattern means actuated according to the type, respectively the design or type of knitting work to be produced, in correlation with the action of cams and levers which actuate and control the vertical movements of the said needles. In consideration of the ever increasing speed with which textile machines operate, it is important that the thread guiding mechanisms be conditioned so as to ensure that the threads are subjected to positive displacements which are brought about and controlled by simple means being systematically operated and permitting the use of sturdy elements. These conditions are certainly not complied with in the mechanisms in use at the present time, which, in most cases, make use of clamping mechanisms. These are delicate, and their very operation limits the maximum speed of the machines equipped with them.

The thread guiding device, subject of this invention, is specially conditioned, not only to be able to ensure a normal feed of the needles, even at very high speeds, but also to be able to ensure such a feed for a large number of thread guides. Indeed, one of the applications intended for this invention is the equipment of knitting machines with four additional thread guides.

Substantially, the thread guide device according to the invention is characterized by the combination of oscillating levers, which constitute the actual thread guides, and a slotted disc, concentric to the rotary needle support, said needles being themselves actuated during their rotational movement, in a known manner, so as to carry out a rectilinear up-and-down movement according to a predetermined sequence.

This new combination is intended to be substituted for the traditional means using clamps and the necessary mechanism to effect the opening and the closing of said clamping means, in order to grip the threads in correct timing to be placed upon or out of the travelling path of the needles.

Independently of the fact that the traditional systems with clamp means are most complex, due to the large number of elements of which they are made up, they can practically not be applied, with any degree of safety, to high speed machines with a large number of thread guides. It will indeed be seen, that if such clamps have been considered for grasping a small number of threads, their action becomes most precarious when they are called upon to grasp large quantities of threads, the combined resistance of which rapidly becomes greatly superior to the resistance proper of the jaws of said clamping means.

2

Now, any deficiency of the functioning of the thread guides will show up as a visible fault, and this fault will become all the greater and the more apparent as the operating speed is increased, and consequently the number of active thread guides become increased.

It is for all these reasons that the new thread guide device with levers and disc, according to the invention, is particularly effective, as it systematically eliminates said clamp means and consequently the inconveniences inherent thereto.

The most characteristic element of this new device consists of the slotted disc which is a one piece unit, without delicate parts, and which can retain or release the threads, even when the latter are displaced at high speed and in large numbers.

A further consequence of the application of this device with slotted disc consists in the fact that it becomes possible to locate a relatively large number of oscillating levers in quite a reduced space at the head of the needle carrier, without the slightest operating deficiency, the position of all the threads being selectively determined by the interaction of said oscillating thread guides and said fixed slotted disc.

Substantially, the threads guide device, according to the invention, consists of a combination, for each thread guide unit, of a pattern drum, a lever transmitting the movements generated by the shape of said cam, an oscillating lever at the end of which is located the thread guide proper and of the slotted disc which is concentric with the needle carrier, said slotted disc being located at an intermediate level between the highest level reached by the needles on their upward stroke and the lowest level reached by said oscillating levers in their downward stroke. Taking into consideration the large number of thread guides, and consequently also the large number of threads which can be used due to the new design of thread guides, the oscillating levers will preferably be divided into two groups, the one being made up of long oscillating levers and the other of short oscillating levers, the assembly and the profiles being such that the threads be located with respect to the fixed slotted disc and to the needles in motion.

These characteristics will become more evident from the following description of one form of embodiment and its operation, with reference to the appended drawings in which:

FIGURE 1 shows a perspective view of a type of machine, to which the thread guides according to the invention can more particularly be adapted;

FIGURE 2 is a perspective view or an enlarged scale with respect to FIGURE 1, showing the head of a machine equipped with the thread guides according to the invention;

FIGURE 3 schematically shows the essential elements of the thread guide according to the invention, in half front view with partial cross-section, and half radial cross-section;

FIGURE 4 is a top view of the upper part of FIGURE 3;

FIGURE 5 is a cross-section taken on line V—V of FIGURE 4;

FIGURES 6, 7, 8 and 9 are cross sections schematically showing four characteristic phases of the thread guide according to the invention; and

FIGURE 10 is a diagrammatic view showing the characteristic relative position between needles and a thread guide.

The machine shown as example in FIGURES 1 and 2 consists mainly of the general frame 1, the knitting head 2, the set of cams 3 which constitute the pattern device, the bin 4 for reception of the knitted ware 5, the rack of countershaft 6 for the distribution of the threads leaving coils 7. Among other elements, the head also comprises the thread guiding device 8, according to the invention.

This thread guiding device consists of a certain number of thread guides, each of which will hereafter be referred to as: thread guide unit.

Each unit device is substantially made up of a lever mechanism in combination with a slotted disc which is common to all the lever mechanisms. The number of lever mechanisms is variable according to the type of machine and more particularly in accordance with the number of threads.

According to the invention, each lever mechanism substantially consists of the combination of one cam, of one oscillating lever and of one element transmitting the motion generated by the cam to said oscillating lever.

In the example illustrated, two groups of such lever mechanisms have been used.

In the first group, comprising four lever mechanisms, each of these consists mainly of a cam 9, which is part of the above mentioned set of cams 3; this cam 9 being in permanent contact with one of the ends of a rod 10, the transverse movements of which are duly limited by an appropriate device shown schematically at 11. The other end of rod 10 is formed into the shape of a beak 12, one part 13 at least of which has a beveled surface. The latter is intended to make contact with the lower end of arm 14 which is a solid part of rocker device 15, fitted on shaft 16. This shaft is supported by a support 17 and may be common to a plurality of such rocker devices, all identical and in the present case four in number. This rocker device 15 carries an arm 18 which is extended and shaped in such a manner that one of its free ends is located vertically above a position predetermined with respect to the needle cylinder. Towards this free end, arm 18 carries a finger 19, the lower end of which has a lateral projection 20 to which the top-end of a guiding element 21 for the passing of the thread is solidly fixed. The location, orientation and dimensions of this set-up are such, that in the raised position of the lever mechanism, the lower end of guiding element 21 is located above and retracted with respect to the upper level reached by the needles, while in the lower position it is located beyond and below the said upper level.

In their active position, i.e., in the lowered position of their guide element 21 each of these lever devices is individually subjected, by means of finger 22, to the pressure of an elastic element 23 pushing it against aforesaid arm 14 which is solidly fixed to rocker 15. This finger 22 and its spring 23 are duly guided in a radial channel 24 drilled in the support 17, the latter being hinged around shaft 25 which bears in pillars 26 and 27, which in their turn are solidly attached to the frame of the machine. This arrangement permits the complete thread guide assembly to be lifted almost instantaneously as a whole, thus giving access to the top part of the needle carrier crown or ring. This is a most practical arrangement for the preparation of the work and for the maintenance and the inspection of this part of the machine.

In the second group, which in the present case comprises five lever mechanisms, each of the latter consists mainly of a cam (not shown) which is part of the same aforementioned set of cams 3, of a rod 28, one end of which is in permanent contact with said cam and the other end 29 of which, duly shaped, is in contact with rocker arm 30 oscillating around said shaft 16 which is common to all rocker arms. End 31 of rocker arm 30 is bent outward and provided with a channel drilled right there through and intended for the passage of a thread.

All oscillating levers 18 and 30 are located under plate 32 which is fixed to said support 17, in the present case by screws 33. This plate is shaped in such a manner that its edge extends substantially over the total dimensional width of oscillating levers 18; moreover, vertically above the rear end of rockers 15, into which are fitted said oscillating levers 18, and adjusting screws 34 are located in aforementioned plate 32, the adjusted position of which screws can be secured by locknuts 35. The function of these adjusting screws is to limit the downward angular displacement of elements 21, maintaining them in correct position with respect to the ring of needles with which they have to cooperate. The part of plate 32 which extends in the direction of said oscillating arms 18 and 30, is cut away in the shape of an outrigger 36 which is oblique with respect to the rocker shaft 16 and has an opening 37 drilled therein vertically above each of the oscillating levers 30. Abovementioned support 17, which can hinge around shaft 25 and in a way carries the entire thread guiding mechanism, has a circular opening 38 into which is fixed a two part bushing 39 and 39′ provided, at the locations reached by guiding elements 21 of the oscillating mechanisms, with hollows or cavities 40. Inside and concentrically to said bushing, slotted disc 41 is located, which is one of the essential elements of this invention. This slotted disc has a shaft 42 which is fixed by means of pressure screw 43 in the tubular free end 44 of an outrigger 45, itself fixed to the annular edge of said support 17 by means of screws 46. Disc 41 is provided with two narrow slots 47 and 48 opening up into eyelets 49 and 50. These slots 47 and 48 are inclined with respect to the circumference of disc 41 and said slots are directed in the direction of rotation of the needle cylinder. Moreover, the edges of said slots, or of one of them, is shaped undulated, so as to facilitate the guidance of the thread toward said slots.

Aforesaid support 17 is provided above needle cylinder 52 which is externally grooved and serves as a rotary support of the needles 51, slotted disc 41 being coaxial with respect to aforementioned needle cylinder 52.

The form of embodiment represented on the appended drawings concerns a thread guide device for a knitting machine with four guide units of which one main guide unit with five threads and guides, three complementary guide units and one elastic thread, i.e., a machine operating with nine threads. The five threads of the main unit, respectively threads *a–b–c–d–e*, are guided by the lever devices of the second group, while threads *f–g–h* of the three complementary units as well as elastic thread *j*, are guided by the lever devices of the first group.

If, in order to facilitate the comprehension of the operation of this thread guiding device according to the invention, the knitting of socks or stockings is considered, the following five parts should be taken into consideration: the free edge, the leg, the heel, the foot and the toe.

In this case, the machine having to be conditioned so as to manufacture socks or stockings in successive and continuous fabrication, the movements of the needles on the one hand, and the movements of the thread guides on the other hand, will have to be considered so as to insure the feed of the needles with aforesaid threads *a–b–c–d–e–f–g–h–j* in such a manner, that four rows, i.e. four units, be carried out each revolution of the needle cylinder, which constitutes the common rotary support for all the needles. In the present case, said threads will be set to work as follows: for the knitting of the edge, threads *a* and *f* as well as elastic thread *j*; for the knitting of the leg, threads *b–f–g–h*; for the knitting of the heel, thread *c*; for the knitting of the foot, threads *b–f–g–h*, and finally for the knitting of the toe, thread *c*.

Moreover, between each sock or stocking, thread *d*, generally of cotton, will be used for the knitting of one row, and thread *c* for the knitting of the separation zones.

The operation of the thread guiding device according to the invention can more easily be comprehended, and particularly when referring to FIGURES 6 to 10, in the following manner: as schematically shown in FIGURE 6, the rest position of a thread, i.e. the position in which the thread does not partake of the knitting operation, said thread *g* for example, passes through disc **41**, for instance through eyelet **50**, and through the guiding element **21** of the corresponding oscillating mechanism placed in its uppermost or rest position. This thread runs from one of the coils **7**, by means of the rack **6**. When aforesaid thread *g* has to take part in the knitting, automatically and according to the guide device, namely the shape of corresponding cam **9** which is part of the set of cams **3** of the machine, the oscillating mechanism is lowered and the lower end of guide element **21** brings the corresponding portion of thread *g* to a level X—X located between the normal level *y'—y'* on the top ends of needles **51** and level Z—Z of slotted disc **41**. In this manner, as more particularly shown schematically in FIGURE 7, thread *g* having passed through disc **41** by means of eyelet **50** now rests on the top surface of disc **41** and then makes a downward loop, as shown in *g'*. Simultaneously, one or more needles **51** are brought, by means of their own operating mechanism and by a vertical upward movement during their rotation around the axis of needle cylinder **52**, to a level Y'—Y' which is higher than the level X—X and generally slightly higher than level Z—Z of slotted disc **41**. These needles are now in a position enabling them to graps thread *g* in said loop *g'*. During their downward movement, aforesaid needles **51** will pull said loop *g'* down, as schematically represented in FIGURE 8, thread *g* temporarily remaining applied against the corresponding part of slotted disc **41**. When now, by its rotational movement, the first needle **51**, coming from the position represented by FIGURE 8, passes in front of corresponding slot **48** which corresponds to eyelet **50**, thread *g* will release itself and continue to feed successively all needles brought to level Y'—Y' as long as the corresponding oscillating mechanisms remain in their lowered position.

In order to remove thread *g* from the feed circuit, it will be sufficient that the oscillating mechanism be raised by means of aforesaid mechanism, i.e. by the shape of corresponding cam **9**. As a result, thread *g* will automatically come into contact with the outer edge of disc **41**, being pulled along by the last needle which has caught it up and is moving in rotation with the needle cylinder. At the moment when, by this movement, thread *g* comes opposite slot **48**, and due also to the fact that this slot is directed in the opposite direction to the pull applied to the thread, above slotted disc **41**, said thread *g* will almost instantaneously enter this slot finally to reach corresponding eyelet **50**, which represents the rest position (FIGURE 6). This same operational cycle is followed by the various rocker mechanisms and hence by the various threads *a* to *j*, each of said mechanisms, respectively aforesaid threads, being operated according to the general cycle of the machine, which itself depends upon the articles to be manufactured.

In this described mechanism, the elements and their various combinations may in no way be considered as limiting, as it is quite obvious that the same effect can be obtained by any elements or combinations which are equivalent or have equivalent functions. The number of oscillating mechanisms will be a function of the number of threads, respectively the number of feed stations which characterize the machine.

One might also, in cooperation with the slotted disc, make use of any other devices capable of appropriately displacing the thread so as to bring it in the correct relative position with respect to the needles, on the one hand, and to engage it, respectively release it from the slotted disc, on the other hand.

This invention not only concerns this thread guiding device, but also all its characteristic elements as well as any textile machines using the device.

What I claim is:

1. Thread guiding device for knitting machines comprising a plurality of needles, a plurality of individual mechanisms for changing the position of each thread used to obtain the desired article in said machine, means for actuating each individual mechanism to enable the guiding of the thread to a point where the latter can be grasped by the needles which are operated to that end, a slotted disc common to all of said individual mechanisms to appropriately maintain the threads out of reach of the needles, the individual mechanisms for each thread being divided into two groups, one group for controlling all the threads of the main feed, and the other group for controlling the remaining threads, the second-mentioned group having each oscillating mechanism mainly consisting of a cam, an element for transmitting the movements resulting from the shape of the cam, an arm which is solidly fixed to a rocker freely fitted over a shaft which is common to all the oscillating mechanisms of the thread guiding device, and the rocker carrying an arm at the end of which is fixed a guiding element constituting the thread guide proper and being on the one hand subjected to the permanent pull of an elastic element towards its working position and on the other hand to the drive of the cam device towards its position of rest.

2. Thread guiding device for knitting machines comprising a plurality of needles, a plurality of individual mechanisms for changing the position of each thread used to obtain the desired article in said machine, means for actuating each individual mechanism to enable the guiding of the thread to a point where the latter can be grasped by the needles which are operated to that end, a slotted disc common to all of said individual mechanisms to appropriately maintain the threads out of reach of the needles, the individual mechanisms for each thread being divided into two groups, one group for controlling all the threads of the main feed, and the other group for controlling the remaining threads, the second-mentioned group having each oscillating mechanism mainly consisting of a cam, an element for transmitting the movements resulting from the shape of the cam, an arm which is solidly fixed to a rocker freely fitted over a shaft which is common to all the oscillating mechanisms of the thread guiding device, and the rocker carrying an arm at the end of which is fixed a guiding element constituting the thread guide proper and being on the one hand subjected to the permanent pull of an elastic element towards its working position and on the other hand to the drive of the cam device towards its position of rest, and to limit the angular displacement of the oscillating mechanisms of the second-mentioned group on their downward stroke, there is provided an adjustable stop carried by the plate with the shaped form of which constituting an outrigger through which the threads pass.

3. Thread guiding device for knitting machines comprising a plurality of needles, a plurality of individual mechanisms for changing the position of each thread used to obtain the desired article in said machine, means for actuating each individual mechanism to enable the guiding of the thread to a point where the latter can be grasped by the needles which are operated to that end, a slotted disc common to all of said individual mechanisms to appropriately maintain the threads out of reach of the needles, and a support carrying the slotted disc and which also carries the shaft around which all rocker mechanisms oscillate, said support being provided with a large circular opening into which is fitted a bushing, the inner diameter of which is larger than the outer diameter of said slotted disc, said bushing having spaces therein in its inner surface and the oscillating mechanisms being provided in such a way as to bring the thread between said bushing and the outer edge of the disc within said spaces.

(References on following page)

References Cited by the Examiner

UNITED STATES PATENTS

645,676	3/00	Wilcomb	66—125
645,708	3/00	Houseman	66—125
1,155,373	8/15	Stewart	66—145
1,359,250	11/20	Houseman	66—145
2,420,771	5/47	Crawford et al.	66—9
2,713,254	7/55	Minton	66—145

2,716,876	9/55	Suratt	66—9
2,720,096	10/55	Feustel et al.	66—125
3,055,198	9/62	Burleson	66—125

FOREIGN PATENTS

853,038	10/52	Germany.

RUSSELL C. MADER, *Primary Examiner.*