Oct. 17, 1939. A. F. VERBEEK 2,176,650

FLAT KNITTING MACHINE

Filed Sept. 3, 1937

Fig. 3

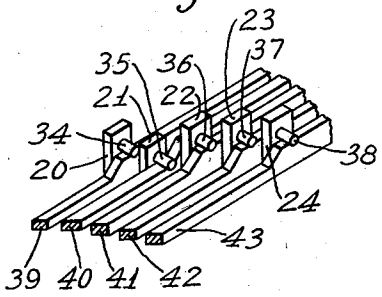


Fig. 1

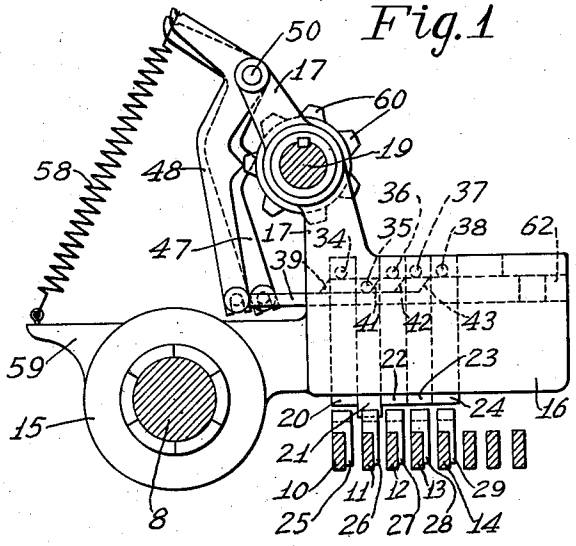


Fig. 4

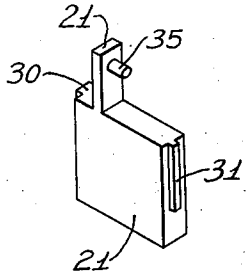


Fig. 2

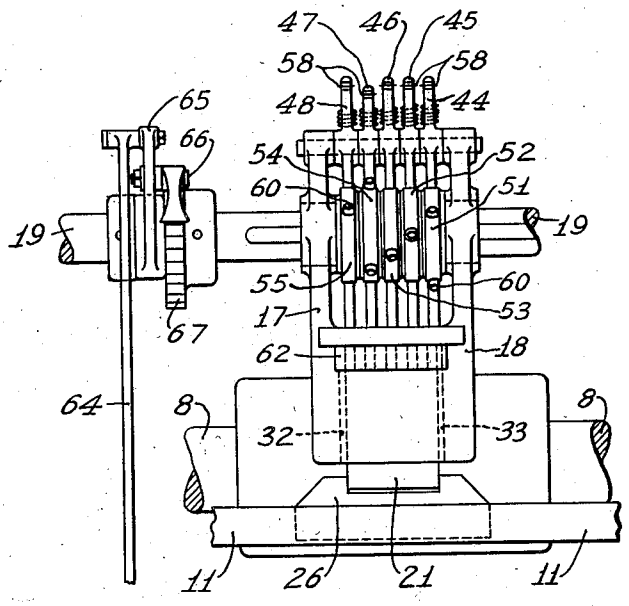
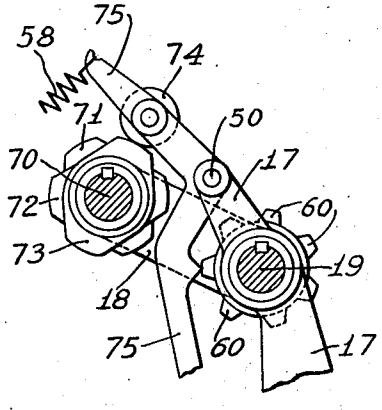


Fig. 5



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Patented Oct. 17, 1939 2,176,650

UNITED STATES PATENT OFFICE

2,176,650

FLAT KNITTING MACHINE

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Application September 3, 1937, Serial No. 162,329
In Germany September 28, 1936

11 Claims. (Cl. 66—127)

The present invention relates to improvements in flat knitting machines, and more particularly to mechanism adapted for use in machines of this type having a plurality of yarn carrier rods for selectively connecting and disconnecting the carrier rods from active operation.

It is a principal object of the present invention to provide novel and improved mechanism which is capable of automatic operation for selectively connecting and disconnecting designated carrier rods which will be more compact in construction, and will operate with a greater degree of precision to maintain an accurate control of the active carrier or carriers.

It is a further object of the invention to provide a carrier rod control mechanism of this general description, having two or more pattern controls having a different order of selection which may be rendered operative alternatively to control the selection of the active carrier rod.

With these and other objects in view, as may hereinafter appear, one feature of the invention consists in the provision of a plurality of driving members which are slidably supported in a housing forming a forward extension of the usual driving friction box member to provide a fully rigid and accurate control of the active yarn carrier rod or rods, and which are actuated through pattern control mechanisms for operatively connecting or disconnecting selected carrier rods to be driven by the friction member. This construction has been found to be of considerable advantage over those found in the prior art as illustrated, for example, by the disclosure in the patent to Friedman, No. 2,018,059, dated October 22, 1935, in which a number of drivers are employed, movable with a single carrier driving friction, and supported to turn on a single pivotal axis extending lengthwise of the machine. These pivoted drivers are necessarily supported at a considerable distance from the carrier rods associated therewith, and lack the necessary rigidity to insure an accurate operation of the yarn carriers driven thereby. Where it has been attempted to increase the rigidity of such a construction by increasing the size and weight of the drivers, a cumbersome structure has resulted which cannot readily be incorporated within the confined space available within the machine.

Another feature of the invention consist in the provision of alternatively operative pattern controls comprising two individual pattern shafts and pattern cams associated therewith, which are well adapted for operation in accordance with different operating cycles in knitting a full-fashioned stocking, one of these pattern controls being applied, for example, to control the substitution of one carrier for another in the knitting of three carrier ringless hosiery, the other pattern control being adapted for operation to control the substitution of one carrier for another in the knitting of the rib top, leg, foot and diamond toe portions of the stocking.

The several features of the invention consist also in the devices, combinations and arrangement of parts hereinafter described and claimed, which together with the advantages to be obtained thereby, will be readily understood by one skilled in the art from the following description taken in connection with the accompanying drawing, in which Fig. 1 is a sectional view in left side elevation of a portion of a flat full-fashioned knitting machine illustrating particularly the yarn carrier rods, the reciprocating driving friction bar and selectively operable connections for driving the carrier rods; Fig. 2 is a view in front elevation of substantially the parts shown in Fig. 1; Fig. 3 is a detail perspective view of the control slides and the upper portions of the drivers for the carrier rod; Fig. 4 is a perspective view of one of the drivers for the carrier rods; and Fig. 5 is a detail sectional view looking from the left similar to Fig. 1, but showing the addition of a second pattern shaft and cams for selectively moving certain of the carrier rods into and out of active operation.

Applicant's improved mechanism for automatically throwing selected carrier rods into and out of active operation, is illustrated in a preferred form in the drawing as embodied in a flat full-fashioned knitting machine having the usual reciprocating friction driving rod 8 and a number of yarn carrier rods associated therewith, certain of these rods which are to be controlled by applicant's selecting mechanism being designated at 10, 11, 12, 13 and 14. The rods 10 to 14 inclusive, are driven from the reciprocating driving friction rod 8 by means of a friction box 15. A housing 16 rigidly secured to the friction box 15, is arranged to extend forwardly over the carrier rods, being supported in this position by means of two upwardly extending arms 17 and 18 which are sleeved onto a rotatable pattern shaft 19 extending lengthwise of the machine. A number of drivers 20, 21, 22, 23 and 24, are supported within the housing 16 for vertical movement into and out of engagement with stops 25, 26, 27, 28 and 29, formed respectively on the carrier rods 10 to 14 inclusive, and serve to con-

nect the respective carrier rods to be driven by the friction box 15. Fig. 4 of the drawing, illustrates in detail one of these drivers 21 which takes the form of a block having formed on opposite edges thereof, guide surfaces 30 and 31 which are arranged for engagement in corresponding guideways 32 and 33 (see Fig. 2) formed in the housing 16. Each of the drivers 20 to 24 inclusive, has formed thereon an upwardly extending arm to which is secured a laterally extending pin, these pins being designated respectively at 34, 35, 36, 37 and 38, and are arranged to be acted upon by means of forwardly extending control slides 39, 40, 41, 42 and 43 supported in the upper portion of the housing 16. Each of the control slides 39 to 43 inclusive, is formed to provide two pin engaging surfaces at different levels separated by a sloping cam surface, so that forward movement of any one of these control slides will operate to cause the corresponding pin to ride downwardly over the cam surface to the lower level, and thus to cause the driver associated therewith, to drop into locking engagement with the carrier stop on the corresponding carrier rod. In the drawing, the control slides are shown in their fully reacted inoperative position, with the exception of the control slide 40 which has been advanced causing the corresponding pin 35 to ride downwardly on its cam surface to bring the driver 21 into locking engagement with the stop 26 on the carrier rod 11. As best shown in Fig. 3 of the drawing, the positions of the sloping cam surfaces are offset with relation to one another, and the pins 34 to 38 inclusive, are mounted in a correspondingly staggered relation on their respective drivers, so that a slight forward movement of any one of the control slides will operate to release the driver associated therewith.

In the preferred construction illustrated, a selecting mechanism is provided, which operates automatically to control the positions of the control slides, and thereby to render selected carrier rods operative or inoperative as desired. The positions of the control slides 39 to 43 inclusive, are controlled by means of pattern levers 44, 45, 46, 47 and 48, which are supported in parallel relation on a pivot shaft 50 carried on the arms 17 and 18 of the housing 16, and are connected at their lower ends respectively to the control slides 39 to 43 inclusive. The pattern levers 44 and 48 inclusive, are provided with follower surfaces arranged for engagement with corresponding cam disks 51, 53, 54 and 55, which are keyed to turn with a pattern shaft 19, and are slidable with relation thereto, being rigidly supported in correct operating position with relation to the cooperating pattern levers, between the upwardly extending arms 17 and 18 of the housing 16. The cam disks constructed and arranged as above described, comprise a pattern drum operable to control the positions of the several drivers 20 to 24 inclusive. Tension springs 58 connected between the upper ends of the pattern levers, and a lug 59 on the friction box 15, act to maintain the follower surfaces in engagement with their respective cams. The cams 51 to 55 inclusive, as shown in the drawing, preferably take the form of rings having mounted thereon, knobs 60 which in accordance with the usual practice, may be adjustably supported on the peripheries of the rings, to permit a modification in the sequence of the carrier rod changes pursuant to any particular design of the fabric blank to be knitted on the machine. An end stop 62 on the housing 16, operates to limit the forward movement of the control slides 39 to 43 inclusive, under the influence of their springs 58, when any one of these is released by movement of the follower surface out of engagement with the cam knob 60.

The operation of the pattern shaft 19 is readily controlled by means of actuating mechanism such as that illustrated, for example, in the patent to Friedmann above referred to. This mechanism as shown in Fig. 2, may comprise a reciprocating connecting link 64 which is secured at its upper end to a pawl lever 65 supported to turn on the pattern shaft 19, and having pivotally supported thereon a pawl 66 for engagement with a ratchet 67 secured to turn with the pattern shaft 19.

The selecting mechanism above described including the pattern shaft 19, is particularly designed for effecting the necessary changes of feeding carriers in the machine for the knitting in succession of the welt, leg, foot and toe portions of the blank in the usual manner. In the knitting of three carrier ringless hosiery, in which three of the carrier rods, for example, those designated respectively at 10, 11, and 12, are alternatively thrown into and out of operation in regularly recurring succession, it has been found desirable to provide an additional selecting device which may be rendered operative to cause these selected carriers to be alternatively brought into and out of active operation. As best shown in Fig. 5 of the drawing, an additional pattern shaft 70 is provided in parallel relation to the pattern shaft 19, and having mounted thereon, three cam disks 71, 72 and 73 which are arranged to be engaged by follower rolls 74 carried on upward extensions of similar pattern levers 75 taking the place of levers 44, 45 and 46 respectively. The cams 71, 72 and 73 are keyed to the pattern shaft 70, and are slidably mounted thereon, being held in operative relation to their respective pattern levers between upwardly extending portions of the brackets 17 and 18 on the housing 16. The cams 71, 72 and 73 constructed and arranged as above described, comprise a pattern drum which acts when rendered operative to control the operation of the three carrier rods 10, 11 and 12. The pattern shaft 70 may be driven through mechanism similar to that illustrated and described for driving the pattern shaft 19, and may be controlled from the pattern mechanism of the machine to be thrown into and out of operation in accordance with a desired pattern of operation.

The operation of applicant's mechanism for moving yarn carrier rods selectively into and out of operation, may be briefly described as follows;

In accordance with the usual mode of operation of flat full-fashioned knitting machines of the general type to which applicant's invention has been applied, the yarn carriers are engaged and disengaged from the carrier stops at the extreme end of the carrier stroke, so that these carriers will be rendered inoperative and will again be picked up in their idling positions at the ends of the knitting sections. The carrier stops 25 to 29 inclusive, are therefore, located on their respective carrier rods, to cause these stops to be in alignment with the cooperating drivers 20 to 24 inclusive, when the friction box 15 has reached the end of its travel. It may be further assumed in accordance with the usual practice, that the operation of the pattern shafts 19 or 70, is controlled in such a manner as to cause the

shifting in the positions of the drivers 20 to 24 inclusive, to take place only while the friction box 15 remains in this dwell position at the end of its travel. Assuming that the carrier rod 26 is to be rendered operative, the racking of the pattern shaft 19 operates to cause the engaging surface of the pattern lever 45 to ride off a corresponding knob 60, allowing the pattern lever 45 to move to the right under the pressure of its spring 58, as shown in Fig. 1, causing the pin 35 to ride down an inclined cam surface on the slide member 40 to engage the driver 21 with the stop 26 on the carrier rod 11. This condition is shown in Figs. 1 to 3 of the drawing, in which the remaining drivers 20, 22, 23 and 24 are maintained in inoperative position due to the engagement of their respective pattern levers with knobs 60 properly mounted on their respective actuating cams 51, 53, 54 and 55. The carrier rod 26 will remain in operation until a subsequent racking of the pattern shaft 19 takes place which may operate to bring another knob 60 into engagement with the pattern lever 45 to again move the driver 21 to its raised inoperative position. In the knitting of three carrier ringless hosiery, the pattern shaft 70 may be rendered operative either manually or through operation of the machine pattern mechanism, to cause each of the carrier rods 10, 11 and 12 to be rendered successively operative to knit successive courses with each of three separate feeding yarns.

With the construction illustrated, it will readily be understood that any one of the selected carriers may be rendered inoperative at either end of the knitting stroke. Under these conditions it is, of course, imperative that an arrangement of the knobs or rise portions 60 of the pattern cam be chosen which will cause a selected driver to be moved downwardly only when the friction 15 reaches that end of its stroke corresponding to the idling position of the carrier rod to be thrown into active operation.

It will be understood that the invention is not limited to the specific embodiment shown, and that various deviations may be made therefrom without departing from the spirit and scope of the appended claims.

What is claimed is:

1. In a flat knitting machine having a multiplicity of carrier rods and a reciprocating driving friction rod, a carrier frction member associated with the rod overlying the carrier rods, carrier stops on each of said carrier rods, driving members for each of said carrier rods slidably supported on the friction member for movement into and out of engagement with the cooperating stop, a selector device comprising a pattern drum supported to move with the friction member and connections controlled thereby for selectively moving said driving members to operatively connect selected carrier rods to or disconnect the same from the friction member and additional means independent of said selector device for retracting selected driving members to inoperative position.

2. In a flat knitting machine having a multiplicity of carrier rods and a reciprocating driving friction rod, a carrier friction member associated with the rod overlying the carrier rods, carrier stops on each of said carrier rods, driving members for each of said carrier rods supported on the friction member for movement into and out of engagement with the cooperating stop, slides on the friction member for controlling respectively the movements of said driving members, said slide members and driving members having cooperating cam and follower surfaces to control the movement of the driving members into and out of engagement with the stops, and a selector device comprising a pattern drum supported to move with the friction member for selectively moving said slides to operatively connect selective carrier rods to or disconnect the same from the friction member, and means for rotating the drum.

3. In a flat knitting machine having a multiplicity of carrier rods and a reciprocating driving friction rod, a carrier friction member associated with the rod, carrier stops on each of said carrier rods, driving members for each of said carrier rods supported on the friction member for movement into and out of engagement with the cooperating stop, slides on the friction member for controlling respectively the movements of said driving members, said slide members and driving members having cooperating cam and follower surfaces to control the movement of the driving members into and out of engagement with the stops, a selector device comprising control levers on said friction member connected respectively to said slides, and a pattern cam engaging each of said levers.

4. In a flat knitting machine having a multiplicity of carrier rods and a reciprocating driving friction rod, a carrier friction member associated with the rod, carrier stops on each of said carrier rods, driving members for each of said carrier rods movably supported on the friction member for movement into and out of engagement with the cooperating stop, slides on the friction member for controlling respectively the movements of said driving members, said slide members and driving members having cooperating cam and follower surfaces to control the movement of the driving members into and out of engagement with the stops, a selector device comprising control levers on said friction member connected respectively to said slides, a pattern cam shaft, cams keyed to said shaft for controlling each of said levers, and means for moving said cams with the friction member on the pattern shaft.

5. In a flat knitting machine having a multiplicity of carrier rods and a reciprocating driving friction rod, a carrier friction member associated with the rod, said friction member having a housing extending forwardly over the carrier rods, carrier stops on each of said carrier rods, driving members for each of said carrier rods slidably supported in the housing for movement downwardly into engagement with the cooperating stop, control members for each of said driving members slidably supported for forward and back movement in the housing, said control members and driving members having cam and follower connections for controlling the positions of the driving members, and a selector device comprising control levers connected to each of said control members pivotally supported on the housing, a pattern shaft, and cam associated with each of said control levers keyed to the pattern shaft and supported to move axially thereon in the housing.

6. In a flat knitting machine having a multiplicity of carrier rods and a reciprocating driving friction rod, a carrier friction member associated with the rod, said friction member having a housing extending forwardly over the carrier rods, carrier stops on each of said carrier rods, driving members for each of said carrier

rods slidably supported in the housing for movement downwardly in a substantially vertical plane into engagement with the cooperating stop, and control members for each of said driving members slidably supported for forward and back movement in the housing, each pair of said control members and driving members having cam and follower connections actuated by movement of the control member for controlling the positions of the driving members.

7. In a flat knitting machine having a multiplicity of carrier rods and a reciprocating driving friction rod, a carrier friction member associated with the rod, said friction member having a housing extending forwardly over the carrier rods, carrier stops on each of said carrier rods, driving members for each of said carrier rods slidably supported in parallel relation in the housing for movement downwardly in a substantially vertical plane into engagement with the cooperating stop, and control members slidably supported in parallel relation in substantially a horizontal plane for forward and back movement, each pair of said control and driving members having cam and follower connections actuated by movements of the control member to permit downward movement and to positively retract the cooperating driving member.

8. In a flat knitting machine having a multiplicity of carrier rods and a reciprocating driving friction rod, a carrier friction member associated with the rod, said friction member having a housing extending forwardly over the carrier rods, carrier stops on each of said carrier rods, members for each of said carrier rods slidably supported in parallel relation in the housing for movement in a substantially vertical plane downwardly into engagement with the cooperating stop, and control members slidably supported in parallel relation in substantially a horizontal plane for forward and back movement, each pair of said control and driving members having cam and follower connections for controlling the position of the cooperating driving members, the cam and follower connections for the several pairs of control and driving members being staggered with relation to one another in said horizontal plane.

9. In a flat knitting machine having a multiplicity of carrier rods and a reciprocating driving friction rod, a carrier friction member associated with the rod, carrier stops on each of said carrier rods, driving members for each of said carrier rods supported on the friction member for movement into and out of engagement with the cooperating stop, a selector device comprising a pattern drum movable with the friction member and connections actuated thereby for selectively moving said driving members to operatively connect or disconnect selected carrier rods from the friction member, and a second selector device comprising a pattern drum movable with the friction member and connections actuated thereby having a different order of selection for selectively moving said driving members to cause said carrier rods to operatively connect selected carrier rods to or disconnect the same from the friction member.

10. In a flat knitting machine having a multiplicity of carrier rods and a reciprocating driving friction rod, a carrier friction member associated with the rod, carrier stops on each of said carrier rods, driving members for each of said carrier rods supported on the friction member for movement into and out of engagement with the cooperating stop, control levers pivotally supported on the friction member for controlling the positions respectively of the driving members, a selector device comprising a pattern shaft and cams keyed to the shaft and connected to move axially thereon with the friction member for selectively moving the control levers to operatively connect selected carrier rods to or disconnect the same from the friction member, and a second selector device having a different order of selection comprising a second pattern shaft and cams keyed to said second shaft connected to move axially thereon with the carrier friction for controlling the position of said control levers and driving members controlled thereby.

11. In a flat knitting machine having a multiplicity of carrier rods and a reciprocating driving friction rod, a carrier friction member associated with the rod, said friction member having a housing extending forwardly over the carrier rods, carrier stops on each of said carrier rods, driving members for each of said carrier rods slidably supported in the housing for movement downwardly into engagement with the cooperating stop, control members for each of said driving members slidably supported for forward and back movement in the housing, said control members and driving members having cam and follower connections for controlling the positions of the driving members, a selector device for selectively moving said control members to operatively connect selected carrier rods to or disconnect the same from the friction member, and a second selector device having a different order of selection to operatively connect selected carrier rods to or disconnect the same from the friction member.

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