Sept. 15, 1970 B. F. SWANWICK ET AL 3,528,266

DRAW MECHANISM FOR STRAIGHT-BAR KNITTING MACHINES

Filed June 3, 1968 3 Sheets-Sheet 1

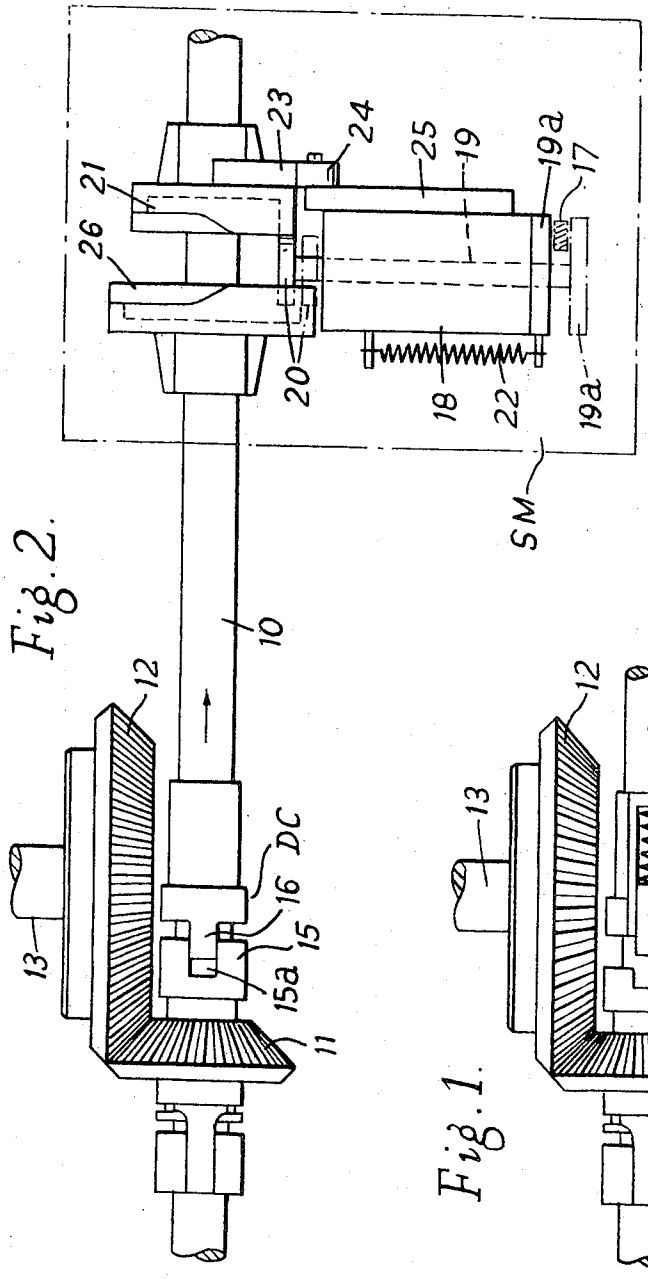

Fig. 2.

Fig. 1.

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DRAW MECHANISM FOR STRAIGHT-BAR KNITTING MACHINES

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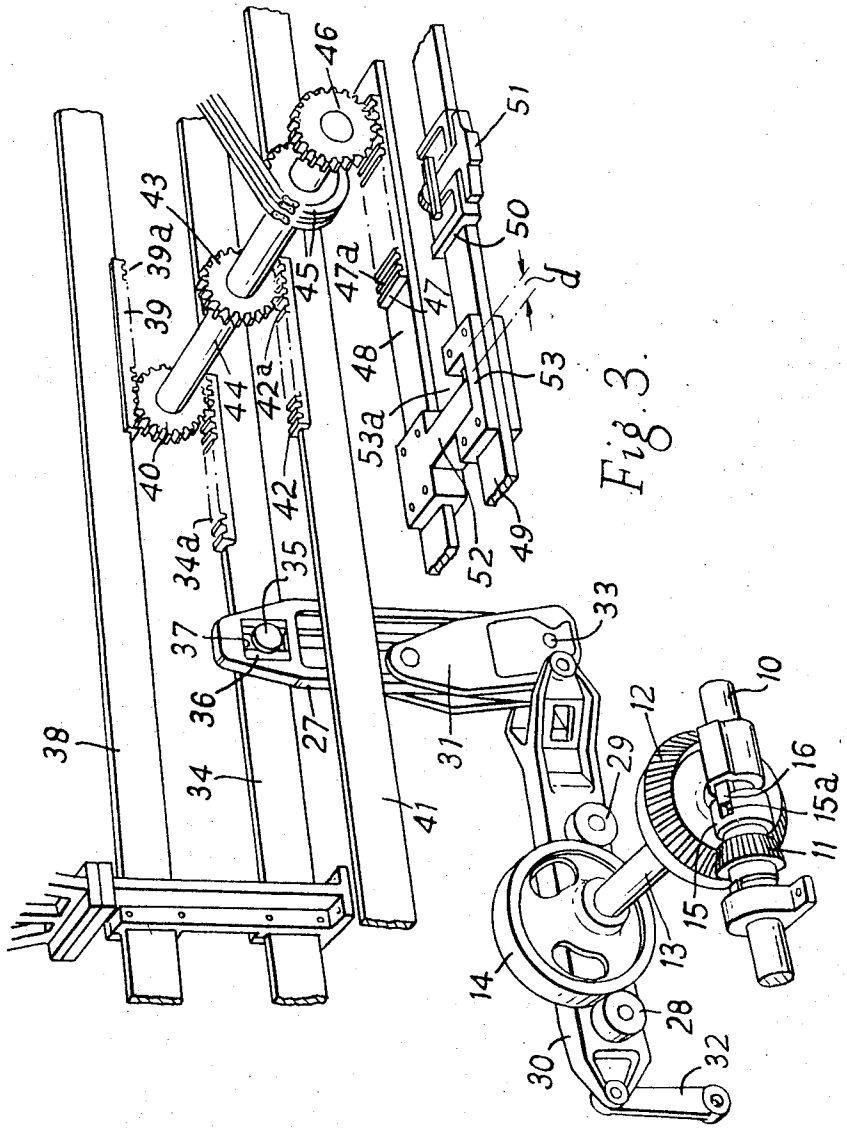

Fig. 3.

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DRAW MECHANISM FOR STRAIGHT-BAR KNITTING MACHINES

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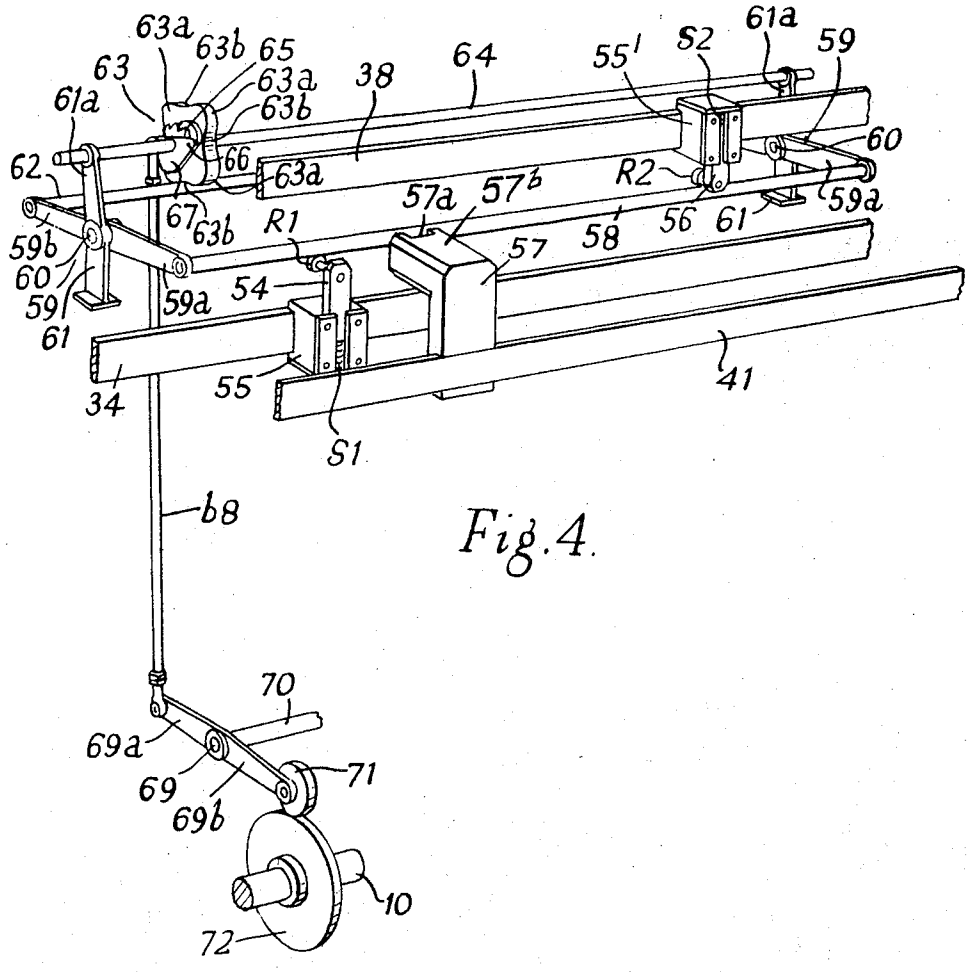

Fig. 4.

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3,528,266

DRAW MECHANISM FOR STRAIGHT-BAR KNITTING MACHINES

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Int. Cl. D04b *15/64*
U.S. Cl. 66—126 9 Claims

ABSTRACT OF THE DISCLOSURE

A draw motion for a straight-bar knitting machine. The cross shaft and the draw cam continuously rotate and the draw lever thus continuously oscillates to reciprocate the main rack irrespective of whether machine is knitting or fashioning. Means are included to transmit a drive from this rack to yarn carrier and slur cam drive systems. Between the rack and the said drive systems are provided automatically operable means to disconnect the drive-transmitting means from the rack, prior to fashioning, and to re-establish the connection between the drive-transmitting means and the rack upon resumption of knitting.

This invention appertains to a draw motion for a multi-head straight-bar knitting machine of the Cotton's patent or similar type for fully-fashioned outerwear manufacture.

The invention, moreover, is concerned particularly with a draw motion of the kind in which a rotary draw cam, operating on trucks mounted on a pitman lever to cause to and fro movement of the latter, is used to effect, through the medium of the pitman lever, oscillatory movements of a swinging type main draw lever which is adapted to drive and reciprocate a main rack from which are in turn driven slur and yarn carrier drive systems.

In a machine of the type concerned, the slur cams, one to each head or division, are mounted on slur cam boxes fastened to a slur rail which extends along the length of the machine. The slur cams are driven across the sinker head through the medium of a tie bar in turn driven from the main rack through rack and pinion mechanism. The said rail, in the case of a machine fitted, as is primarily the intention, with a variable draw, is mounted on small levers to enable the said rail to have a rocking action to remove the slur cams from the rear of the sinker head during the knitting part of the loop forming cycle.

Although a straight-bar knitting machine to which the invention is applied may have a friction type of yarn carrier drive including rods, it is mainly the intention that it shall have a chain type carrier drive arranged to provide a controlled lead of the yarn carriers over the slur cams on virtually all knitting widths.

The invention accordingly has reference exclusively to a multi-head straight-bar knitting machine of the type specified including fashioning mechanism for shaping knitted fabric or garment blanks produced at the divisions as a consequence of widening or/and narrowing by loop transference to increase the number of wales, such increase or decrease being brought about by increasing or decreasing the number of operative needles at either or both selvedges without alteration to the character of the stitch.

As well known to those acquainted with the art concerned, a straight-bar knitting machine of the type referred to is provided with a continuously rotatable main cam shaft from and by which the various machine motions are respectively derived and controlled. From this main cam shaft is driven, usually through the medium of 2:1 bevel gearing, a cross shaft upon which is secured the aforementioned rotary draw cam.

The said cam shaft is adapted to be axially shifted bodily by a longitudinal shogging motion, from a normal position during which yarn sinking and knitting takes place to another position in which fashioning cams are introduced to the various motions for garment shaping and vice versa. The mechanism employed for effecting these shogging motions is known as the "cam shaft shogging motion" and will be hereinafter described because it is used in the performance of the present invention.

Each time the cam shaft is shogged into its fashioning position, and during one revolution thereof, the yarn carriers and the slur cams are required to remain stationary at one side or the other of the knitting widths. To this end it is necessary to disconnect the common drive from the main draw lever and main rack to the yarn carriers and the slur cams whilst fashioning takes place.

Now heretofore in a conventional machine this has been achieved by causing the previously mentioned cross shaft, the draw cam, the pitman lever and the main draw lever (together with the short auxiliary draw lever in the case of a variable draw motion) to remain stationary. This involved a disconnection of the drive, caused by shogging the continuously rotating cam shaft, from a bevel pinion on the latter to a bevel wheel secured upon the cross shaft. The said disconnection of the drive was effected, in fact, by disengagement of a driving dog from the bevel pinion. Thus, whenever the cam shaft returned from its fashioning position to its knitting position the driving dog re-engaged the bevel pinion and, by impact, caused the cross shaft the draw cam to rotate again and so re-established the drive to the yarn carriers and slur cams. As will be readily appreciated, with the increasingly heavy machines now made and the higher speeds now possible this impact is most undesirable as it tends to create excessive stresses and mechanical failures.

The object of the present invention is to provide, in a multi-head straight-bar knitting machine, an improved draw motion of the kind herein referred to designed to obviate any necessity to disconnect, for fashioning, the drive from the continuously rotatable cam shaft to the cross shaft, thereby eliminating all shock loads between drive-transmitting components, whilst at the same time retaining conventional means for synchronising the direction and timing of the yarn carrier and slur draw drive systems.

According to this invention the cross shaft and the draw cam of the improved draw motion continuously rotate and the main draw lever thus continuously oscillates to reciprocate the main rack irrespective of whether the machine is knitting or fashioning, and means are provided between the continuously reciprocable main rack and the carrier and slur cam drive systems for automatically disconnecting the said systems from the main rack, prior to fashioning, and for re-establishing the connection of the systems to the main rack upon a resumption of knitting.

An important feature of the improved arrangement is

that the yarn carriers and the slur cams can be picked up upon a resumption of knitting from those side edges of the garment blanks at which they were deposited prior to fashioning irrespective of the direction of oscillation of the main draw lever.

In a convenient embodiment of the invention, the main rack constitutes one of two continuously and contra-reciprocating bars arranged to be driven by or from the main draw lever, and automatically actuatable latch means are provided to effect a drive-transmitting connection between these two bars and a further reciprocable member from which the yarn carrier and slur cam drives are controlled during knitting operations. The said latch means are essentially also appropriately operable to effect disconnection of the reciprocable member from the relevant one of the two contra-reciprocating bars prior to a fashioning operation.

Advantageously, these latch means may be arranged to be actuated by a cam on the continuously rotatable main cam shaft of the machine, through the medium of any suitable intermediate linkage, this cam being brought into co-operative relationship with the linkage each time the said cam shaft is shifted longitudinally by the cam shaft shogging motion for a fashioning operation.

The contra-reciprocating bars may be combined with opposed racks having interposed therebetween an idler pinion whereby the racks have imparted thereto identical but opposite traverses.

As to the aforesaid reciprocable member from which the carrier and slur cam drives are controlled during knitting, this may conveniently consist of a third rack bar which, in effect, takes the place of the main rack in regard to its relationship to the carrier and slur cam drives.

Thus, as will be appreciated, this third rack bar, and hence also the carrier and slur drives may, by the simple automatic actuation of latches, be caused to remain quiescent whilst the cross shaft, the draw cam and the associated levers continue to operate.

In order that the invention may be more clearly understood and readily carried into practical effect, a specific constructional example thereof applied to a variable draw motion will now be described with reference to the accompanying drawings, wherein,

FIG. 1 is a fragmentary plan view illustrating the existing drive-transmitting arrangement between the continuously rotatable main cam shaft and the cross shaft of such a variable draw motion, i.e. the conventional arrangement wherein the cross shaft and hence also the rotary draw cam are stopped from rotating during fashioning,

FIG. 2 is a view similar to FIG. 1 depicting, by way of comparison, the improved drive-transmitting arrangement of the present invention wherein the drive from the main cam shaft to the cross shaft is never interrupted, thereby enabling the draw cam to rotate both when the main cam shaft is in the fashioning as well as in the knitting position, this figure also showing the cam shaft shogging motion common to the existing and the improved arrangements,

FIG. 3 is a general perspective view, from the front of the machine, of so much of the improved variable draw motion as is necessary to show the aforementioned two continuously and contra-reciprocating bars and the means by which they are driven from the main draw lever, and

FIG. 4 is another perspective view, also from the front, illustrating extensions of the said two continuously and contra-reciprocating bars, and the automatically actuable latch means whereby these bars are alternately connected to a third reciprocable bar from which the yarn carrier and slur cam drives are controlled during knitting cycles.

Like parts are designated by similar reference characters throughout the drawings.

Referring to FIG. 1, it will be seen that rotation of the

main cam shaft **10** causes rotation of the bevel pinion **11** rigid therewith and hence also of the bevel gear **12** and the cross shaft **13** to which the said bevel gear is secured. It is on the cross shaft **13** that the rotary draw cam **14** of the illustrated variable draw motion (see FIG. 3) is rigidly secured so as to rotate together therewith. The bevel pinion **11** has integrally combined therewith the suitably slotted female member **15** of a dog clutch DC. The slot **15***a* in the member **15** is adapted to receive a spring-influenced driving dog **16** protruding from a clutch block **16***a* on the main cam shaft **10**.

Now in the existing arrangement, the cross shaft **13** and the draw cam **14** rotate only during knitting—at which time the driving dog **16** is engaged in the slot in the female member **15**. However, during fashioning, initiated by an axial shogging movement of the main cam shaft **10** to the right, effected by the cam shaft shogging motion SM illustrated within the chain-line rectangle in FIG. 2, the driving dog **16** is, in the existing arrangement, disengaged from the female member **15**, as shown in FIG. 1, thereby allowing the cross shaft **13** and the draw cam **14** to be stationary, with the cam shaft **10** continuing to rotate.

But in the proposed improved draw arrangement (a part of which is illustrated in FIG. 2), the dog clutch is so designed and arranged that the driving dog **16**, which does not in this case require to be spring-influenced, and the female member **15** are permanently engaged. This, of course, results in the drive from the main cam shaft **10** to the cross shaft **13** never being disconnected. That is to say, even when the cam shaft **10** is shogged to the right by the shogging motion SM, for fashioning, the driving dog **16** will remain in the slot **15***a* in the female member **15**, and the cross shaft **13**, instead of being stopped as heretofore, will continue to rotate.

It will be convenient here briefly to describe the cam shaft shogging motion SM which is of quite conventional form and, as previously mentioned, common to both the existing and the improved arrangements shown in FIGS. 1 and 2 respectively.

A selection obtained from the fashioning frequency control unit (not shown) results in the removal of a latch **17** from a position between a truck housing **18** and an enlarged portion **19***a* of a truck shaft **19** where it holds a shog truck **20** in the knitting position indicated in chain lines in FIG. 2. With the retaining latch **17** removed, however, the shog truck **20** is moved forward to the full line position to be presented to a shog cam **21** under the action of a tension spring **22**. As the main cam shaft **10** revolves, the shog truck **20** acts on the shog cam **21** to move the said cam shaft axially to the right from its normal knitting position to its fashioning position. By this shogging movement the fashioning cams are introduced to the various motions. But as the cam shaft **10** revolves for the transfer of loops, the selection for fashioning is cancelled and the shog truck **20** returned to the knitting position by a shog release cam **23**. This shog release cam **23** acts on a roller **24** mounted at the end of a slide **25** attached to the shog truck assembly to return the shog truck **20** to the knitting position against the action of the spring **22**. As the shog truck is withdrawn, the retaining latch **17** is re-introduced between the truck housing **18** and the portion **19***a* of the truck shaft **19** to hold the shog truck in the knitting position. In this position the shog truck **20** is presented to a return cam **26** which returns the cam shaft **10** to the knitting position at the end of the fashioning cycle.

In general terms, the illustrated variable draw motion is basically of the standard form wherein the thrust applied to a main draw lever **27** is supplied by the draw cam **14** which converts rotary motion of the main cam shaft **10** into the required lateral movement. Viewing FIG. 3, it will be seen that the said rotary draw cam **14** operates on and between two trucks **28** and **29** mounted on a pitman lever **30**. The latter is caused, by the action of

the cam and the trucks, to oscillate to and fro between a short draw lever **31** and a supporting lever **32** between the fixed throw of the pitman lever **30** and the variable throw of the main draw lever **27**. The connection between the levers **27** and **31** is obtained by a connecting pin **33** which connects together two sliding die blocks operating respectively in the usual slot in the lever **31** and on the conventional lead screw (not shown) in the main draw lever **27**.

The drive from the main draw lever **27** to the main rack **34** of the variable draw motion is through a pin **35** and an associated die block at **36** operating in a slot **37** cut in the top of the said draw lever **27**. In all other respects, including the manner in which the draw is automatically varied upon variation of the knitting width, the components of variable draw motion between the cam **14** and the main rack **34** are conventional and accordingly do not require any further description.

However, the illustrated draw motion differs from a conventional draw motion in that, in accordance with the present invention, there is arranged directly above the bar constituting the main rack **34** a second bar **38** provided with a toothed rack **39**. The two bars **34** and **38** are horizontally disposed and spaced apart parallel to one another. An idler pinion **40** interposed between and arranged in mesh with the two opposed series of rack teeth **34***a* and **39***a* serves to drive the second bar from the main rack bar **34** so that the two have imparted to them identical but opposite traverses. The two bars **34** and **38** can, therefore, be aptly described as two continuously and contra-reciprocating bars arranged to be driven respectively by and from the main draw lever **27**.

A third horizontal and reciprocable bar **41**, provided with a toothed rack **42**, is mounted in front of the main rack bar **34**. Arranged in mesh with the rack teeth **42***a* of this third bar **41** is a pinion **43** which is rigid with a turnable shaft **44** disposed parallel with respect to the cross shaft **13**. The arrangement is accordingly such that any traverse imparted to the third bar **41** in either direction from the continuously contra-reciprocating bars **34** and **38** by means presently to be described, will effect turning movements of the shaft **44**. Merely for convenience, the aforementioned idler pinion **40** is also mounted on, but is, of course, rotatable independently of, the shaft **44**.

Mounted on a forward extension of the shaft **44** so as to rotate together therewith are chain sprockets **45** or any other appropriate drive media to the carrier drive system of the machine, and also a slur drive gear **46** arranged to mesh with teeth **47***a* of *e* rack **47** combined with the slide bar **48**. Thus, the idler pinion **40**, the pinion **43** and the slur drive gear **46** are all co-axially arranged.

The conventional slur rail **49**, upon which are mounted boxes such as **50** incorporating the slur cams, one of which is designated by the numeral **51**, is adapted to be reciprocated from the slide bar **48** to drive the slur cams to and fro across the knitting width. For this purpose, the slide bar **48** is fitted wtih a slur drive bolt **52** arranged to engage in a suitably dimensioned recess **53***a* in a drive component **53** attached to the slur rail **49**. The distance a slur cam lags behind the relevant yarn carrier is indicated at *d* in FIG. 3.

Extensions of the two continuously and contra-reciprocating bars **34** and **38** are shown in FIG. 4 in which figure means for connecting these two bars alternately to the third reciprocable bar **41** from which, as already explained, the yarn carrier and slur cam drives are controlled during knitting cycles.

The said latch means, as will be seen, comprise an upwardly directed spring-influenced latch **54** slidable vertically in a box **55** attached to the bar **34** (main rack), and a downwardly directed similar latch **56** slidably mounted in a like box **55**[1] attached to the oppositely reciprocable bar **38**. The two latches **54** and **56** extend at right angles to the contra-reciprocating bars **34** and **38**, the latch **54** on the lower bar **34** being spring-loaded in a vertically upward direction and that, **56**, on the upper bar **38** being similarly spring-loaded but in a vertically downward direction. As will be appreciated, as the lower bar **34** is caused to reciprocate by the oscillating main draw lever **27** and hence the upper bar **38** is contra-reciprocated through the medium of the idler pinion **40**, the two latches **54** and **56** will repeatedly pass one another in opposite directions. These latches will, in fact, pass one another during each revolution of the cam shaft **10** since the cross shaft **13** continuously rotates and the main draw lever continuously oscillates.

On the third reciprocable bar **41** is fixedly attached a driving block **57** which is vertically slotted at **57***a* suchwise as to be capable of receiving either the latch **54** from below or the latch **56** from above. It will be noted that not only are the sides of the latches chamfered at the leading ends thereof, but also the upper and lower edges of the horizontal portion **57***b* of the driving block **57** are chamfered to facilitate engagement of a latch in the slot **57***a*.

For controlling the engagement of the latches **54** and **56** into, and their withdrawal from, the slot **57***a*—alternately—there is provided a horizontal rod **58** which is carried between the forward ends of arms **59***a* of suitably spaced levers **59**. The rod **58** is for action upon small rollers **R1** and **R2** carried by the latches **54** and **56** respectively. The levers **59** are fulcrummed at **60** midway between their opposite ends in fixed brackets **61**. The forward ends of the arms **59***b* of the levers **59** are connected by a further horizontal rod **62** which is parallel to the rod **58** and is arranged to be acted upon by a suitably contoured edge cam **63**. This cam is adapted to be turned intermittently about the axis of a carrier shaft **64** which is mounted in upwardly directed extension arms **61***a* of the brackets **61**. The cam **63** has thereon four convex rises **63***a* spaced 90° apart and four intervening concave depressions **63***b*. Thus, as the said cam is intermittently rotated, the rod **62** will be alternately depressed and allowed to rise as a consequence of which the rod **58** will be alternately raised and lowered to actuate and control the latches **45** and **56**. The rollers **R1** and **R2** are, of course, both held permanently in contact with the rod **58** by the latch springs **S1** and **S2** respectively. That is to say, the roller **R1** is always held up against the underside of the rod **58** under the action of the spring **S1**, whereas the roller **R2** is at all times held down on to the upper side of the same rod under the action of the spring **S2**—the two springs acting upwardly and downwardly respectively.

The cam **63** has combined with it at one side thereof a ratchet wheel **65**, and for indexing this wheel to turn the said cam there is provided a spring-influenced pawl which is pivotally mounted at **66** upon a rockable lever **67**. The latter is connected, by a link **68**, with one arm **69***a* of a two-armed lever **69** which is arranged to fulcrum about a fixed shaft **70**. The other arm **69***b* of the lever **69** is furnished with a cam follower **71**. The main cam shaft **10** has thereon a cam **72** which, whenever the said shaft is shogged to the right into the fashioning position by the cam shaft shogging motion SM is moved into line with the cam follower **71**. Conversely, whenever the cam shaft **10** is shogged back leftwards into the knitting position, the cam **72** will be displaced out of line with the cam follower **71**.

The operation of the herein described improved draw motion will now be described. Assume first that the machine is knitting plain courses and that the latch **54** is engaged in the slot **57***a* in the draving block **57**. In these conditions, the reciprocating bar **34** (main rack) imparts an identical reciprocating motion to the third bar **41** so that the yarn carriers and the slur cams correspondingly reciprocate from side to side simultaneously with the oscillatory movements of the main draw lever **27**. But if the machine is required to fashion, the main cam shaft **10** is shogged laterally to the right and the cam **72** is thereby

brought into line with the cam follower **71**. At this instant, the latch **54** on the bar **34** and also the driving block **57** on the third bar **41** are both at the end of a traverse. The cam **72**, acting on the follower **71**, now indexes the ratchet wheel **65** as a consequence of which the cam **63** is turned through 45° from a position in which a rise **63***a* thereon is in contact with the rod **62** to another position in which a depression **63***b* in the cam is opposed to the said rod. The rod **62** accordingly moves upwards and the rod **58** downwards—see-saw fashion. The result of this is that the latch **54** is depressed against the action of its spring S1 and thereby disengaged vertically downwards from the slot **57***a* in the driving block **57**. At the same time the latch **56** is permitted to move vertically downwards under the action of its spring S2 so as to be in a suitable position for engaging in the slot **57***a*. The disengagement of the latch **54** from the driving block **57** disconnects the third bar **41** so that it remains quiescent and imparts no motion to the yarn carrier and slur cam drives during fashioning. Meanwhile, the draw cam **14** continues to rotate and the draw lever **27** proceeds with its traverse as fashioning takes place. By the time the draw lever has completed its traverse, the upper reciprocating bar **38** will have traversed in the reverse direction until, at the completion of the fashioning course, the latch **56** engages downwardly in the slot **57***a* in the driving block **57** under the influence of the spring loading. Thus, during the next draw, the bar **38** will transmit motion to the third bar **41** but this time in the opposite direction with respect to the draw lever traverse. Accordingly, an idle draw during fashioning, i.e. a draw as a consequence of which no motion is imparted to the yarn carriers and slur cams, is brought about by indexing of the ratchet wheel **65** and a one eighth turn of the cam **63** initiated by shogging of the main cam shaft **10** to the right.

Prior to the next fashioning course, latch **56** will be in engagement with the block **57**, and so the purpose of the next operation of the linkage **67**, **68** and **69** must be to effect disengagement of the latch **56** from the said block and to release the latch **54** for subsequent engagement in the slot in the block. This is achieved as a consequence of the next indexing movement of the ratchet wheel **65** which causes the cam **63** to be turned through a further 45° from the position in which a cam depression **63***b* is opposed to the rod **62** to another position in which a rise **63***a* on the cam is in contact with the said rod. As a result, the rod **62** is moved downwards and the rod **58** upwards so that the latch **56** will be moved up and withdrawn from the block **57** and the latch **54** permitted to move up so as to be in a position for engaging in the slot **57***a*.

We claim:

1. In a multi-head straight-bar knitting machine having a main cam shaft; fashioning mechanism adapted to be brought into operation by a longitudinal movement of the said main cam shaft; a cam shaft shogging unit for so moving the cam shaft; a yarn carrier drive system and a slur cam drive system, a draw motion comprising, in combination, a cross shaft driven from said main cam shaft; a rotary draw cam on said cross shaft; a pitman lever having thereon spaced trucks between which the draw cam is located for action thereupon to move the pitman lever to and fro; a pivoted draw lever which is oscillated from the said pitman lever; a main rack which is connected to the draw lever and is thus reciprocated therefrom and drive-transmitting means between the said rack and the aforesaid yarn carrier and slur cam drive systems, wherein the improvement comprises the provision, between the reciprocable rack and the yarn carrier and slur cam drive systems, means automatically operable to disconnect the drive-transmitting means from the rack prior to fashioning and to re-establish the connection between said drive-transmitting means and the rack upon a resumption of knitting, wherein, when the machine is in operation the cross shaft and the draw cam continuously oscillates to continuously reciprocate the rack irrespective of whether the machine is knitting or fashioning.

2. A draw motion according to claim **1**, wherein the main rack constitutes the first of two parallel bars the first bar being so driven from the second that the two traverse to the same extents but in respectively opposite directions, and automatically actuatable means are provided to effect a drive-transmitting connection between one or the other of the said two bars and a third reciprocable member from which the yarn carrier and the slur cam drives are controlled during knitting operations, the said means being operable to effect disconnection of the third reciprocable member from the relevant one of the two contra-reciprocable bars prior to each fashioning operation, whereby the yarn carriers and the slur cams can be picked up upon a resumption of knitting from those side edges of blanks being produced at which they were deposited prior to fashioning irrespective of the direction of oscillation of the draw lever.

3. A draw motion according to claim **2**, wherein the said automatically actuatable means consist of two latches which are respectively carried by and are traversible together with the two contra-reciprocable bars, each of these latches being adapted for engagement at an appropirate time in a driving component carried by the third reciprocable member and one of them being automatically withdrawn from, whilst the other is released for subsequent engagement in, the driving component, immediately prior to each fashioning operation, whereby during the latter the third reciprocable member remains quiescent.

4. A draw motion according to claim **3**, wherein the latches are arranged to be actuated by a cam on the continuously rotatable main cam shaft of the machine through the medium of intermediate linkage, this cam being brought into co-operative relationship with the said linkage each time the cam shaft is shifted longitudinally by the cam shaft shogging motion for a fashioning operation and disengaged from the linkage whenever the said cam shaft is shogged in the opposite direction upon a resumption of knitting.

5. A draw motion according to claim **4**, wherein the two latches extend at right angles to the contra-reciprocable bars, one of the latches being spring-loaded in a vertically upward direction and the other being similarly spring-loaded but in a vertically downward direction.

6. A draw motion according to claim **4**, wherein the intermediate linkage includes a horizontal rod which is arranged for permanent engagement with rollers on the latches this rod being movable up and down by operating means under the control of the cam on the main cam shaft, the arrangement being such that whether the rod is moved up or down, one of the latches will be withdrawn downwardly from a vertical slot in the aforementioned driving component carried by the third reciprocable member while the other latch is released for subsequent upward engagement into this slot, or vice versa.

7. A draw motion according to claim **6**, wherein the horizontal rod is connected by rocking levers to a second rod parallel with the first so that as the second rod is pushed down the first rod will move up, and vice versa, and the operating means consist of a suitably profiled cam which is arranged in contact with the second rod and is adapted to be racked round by indexing means operable from the cam on the main cam shaft.

8. A draw motion according to claim **2**, wherein both of the contra-reciprocable bars are provided with rack teeth thereby providing opposed racks, and wherein there is interposed between and in mesh with said racks an idler pinion.

9. A draw motion according to claim **2**, wherein the third reciprocable member consists of a rack bar arranged in mesh with a pinion secured upon a shaft upon which are also mounted carrier drive sprockets and a slur drive

gear in mesh with a rack on a bar from which the slur cams derive their movements.

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