May 9, 1944. T. C. BROMLEY ET AL 2,348,598

MECHANISM FOR SUPPLYING YARN AND THREAD TO THE NEEDLES OF KNITTING MACHINES

Filed Sept. 28, 1942 4 Sheets-Sheet 1

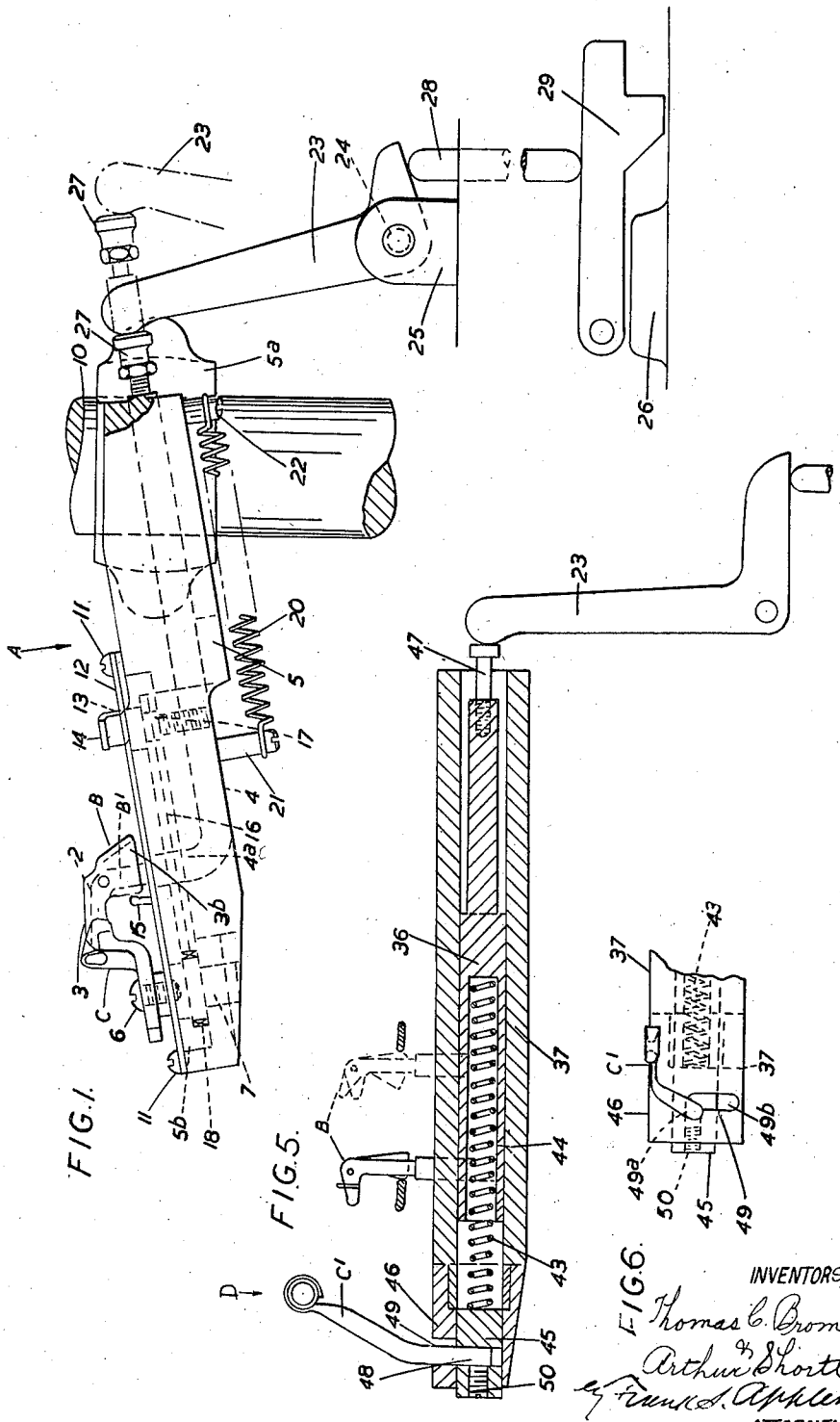


FIG. 1.

FIG. 5.

FIG. 6.

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Filed Sept. 28, 1942 4 Sheets-Sheet 2

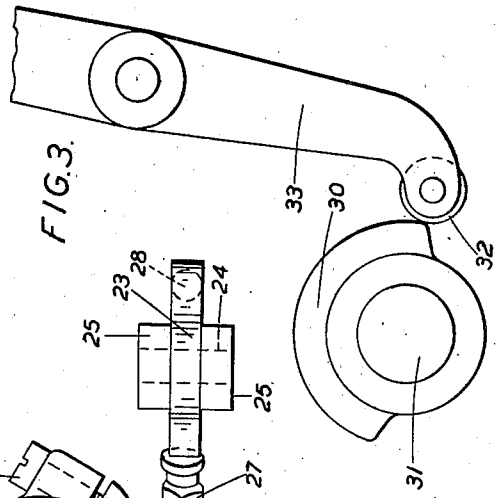


FIG. 3.

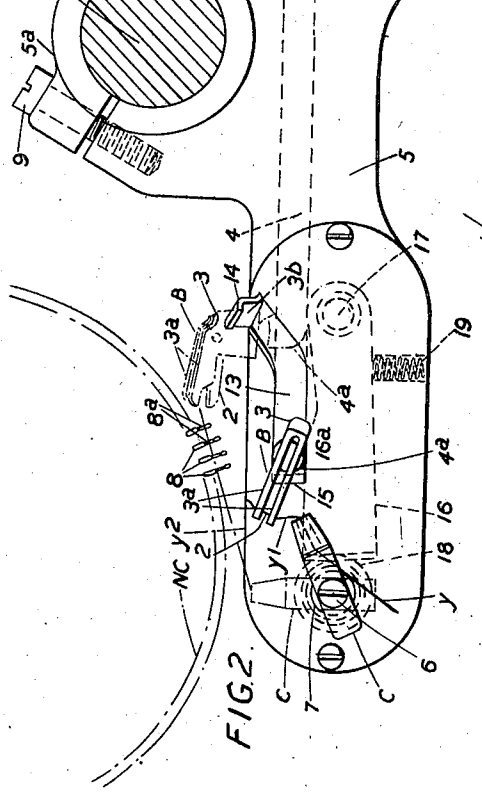


FIG. 2.

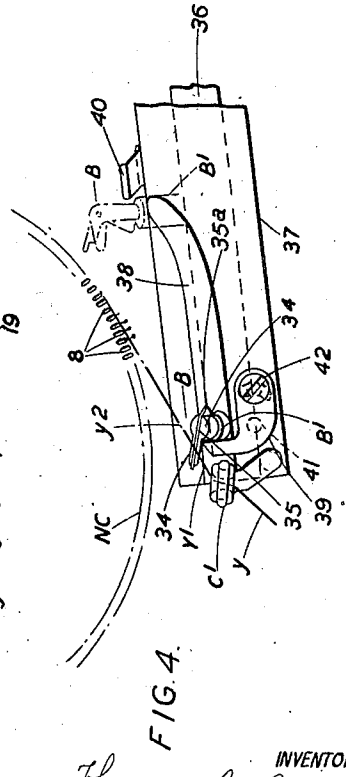


FIG. 4.

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MECHANISM FOR SUPPLYING YARN AND THREAD TO THE NEEDLES OF KNITTING MACHINES

Filed Sept. 28, 1942 4 Sheets-Sheet 3

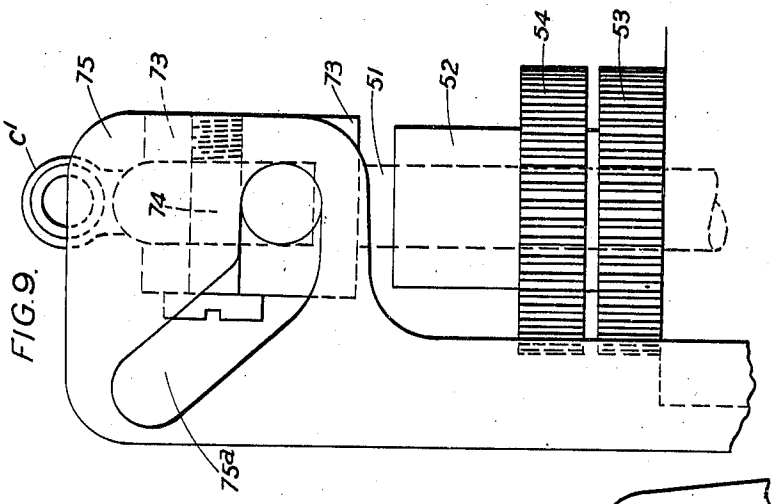


FIG. 9.

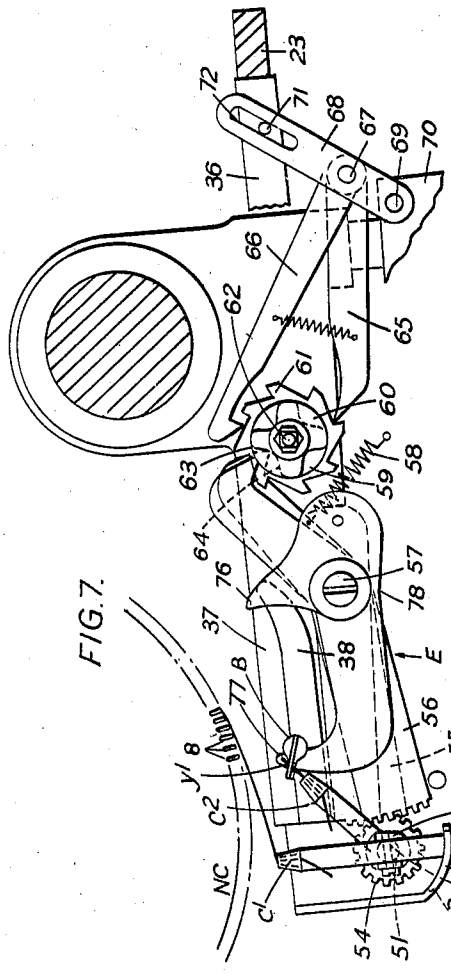


FIG. 7.

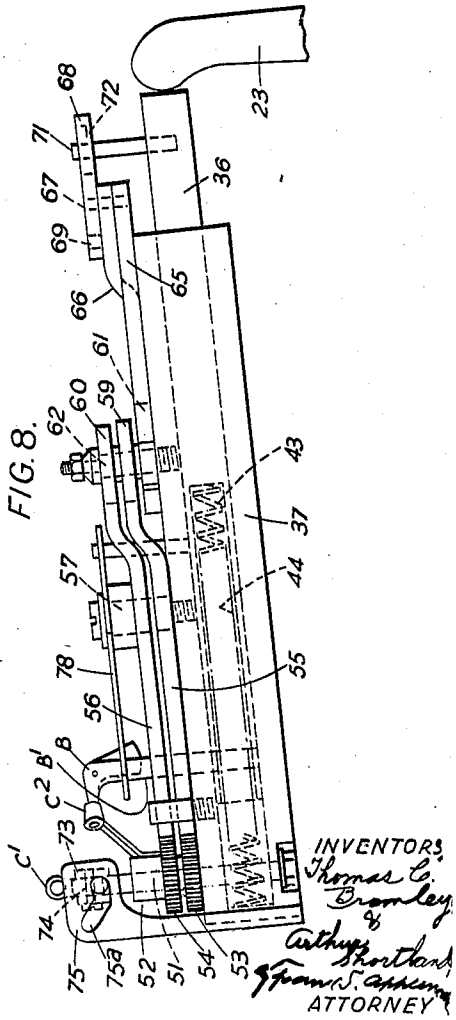


FIG. 8.

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MECHANISM FOR SUPPLYING YARN AND THREAD TO THE NEEDLES OF KNITTING MACHINES

Filed Sept. 28, 1942 4 Sheets-Sheet 4

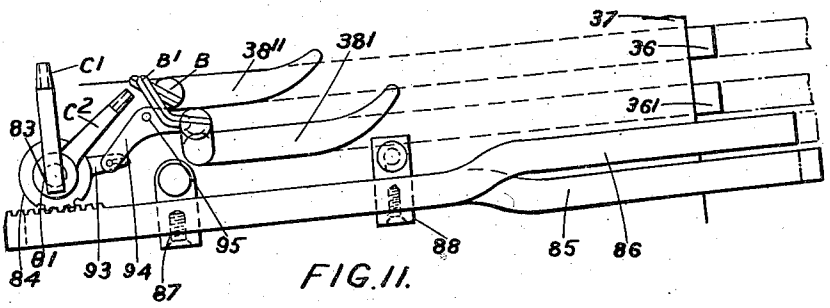


FIG. 11.

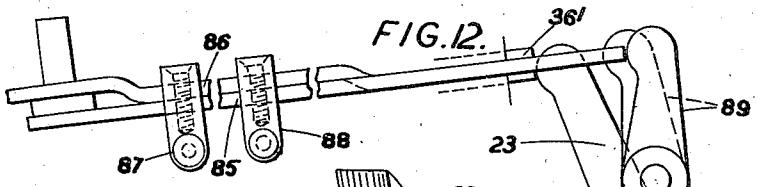


FIG. 12.

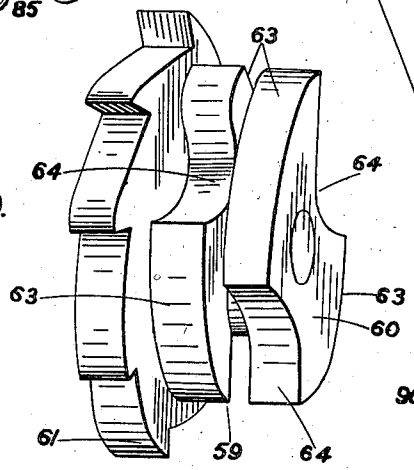
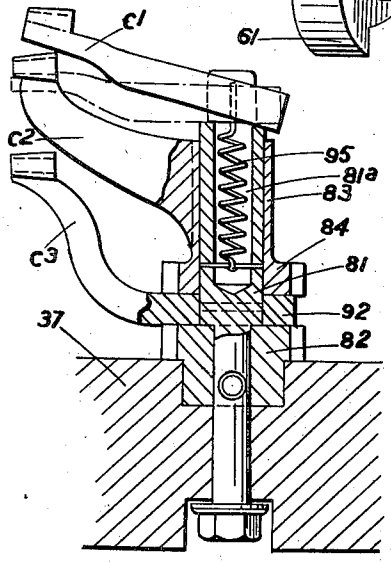
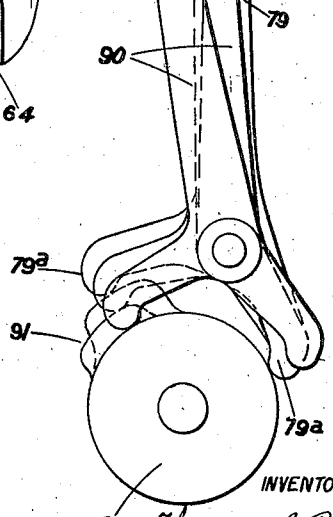


FIG. 10.

FIG. 13.





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UNITED STATES PATENT OFFICE

2,348,598

MECHANISM FOR SUPPLYING YARN AND THREAD TO THE NEEDLES OF KNITTING MACHINES

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Application September 28, 1942, Serial No. 459,996
In Great Britain September 29, 1941

21 Claims. (Cl. 66—140)

This invention relates to mechanism for supplying yarn and thread to the needles of knitting machines, more especially, though not exclusively, circular knitting machines of the type furnished with independent needles.

The invention has for its object the provision of improved mechanism for this purpose adapted to supply yarn or thread periodically in addition to or instead of a main yarn or thread, as for example to provide draw threads, spliced areas or/and elastic areas (by means of rubber thread) in knitted fabric or articles, or to increase the rate of production of fabric or articles, or/and to supply a plurality of contrasting, e. g., differently coloured, yarns or threads interchangeably for producing horizontal or vertical stripes and other fancy effects in knitted fabric or articles, according to requirements.

Mechanism of the improved form may be used suchwise that the yarn or thread supplied thereby is either knitted by the needles or is run into the knitted fabric or articles without being formed into loops or stitches, i. e., as a non-knitted weft.

For brevity the expression "yarn" will be hereinafter used as designating yarn or thread of any kind which may be used for the purpose intended.

According to the present invention the mechanism provided includes as an essential feature, for operation at a feeder of a knitting machine, a movable gripping device adapted normally to hold yarn in a non-feeding position, to be moved, while retaining its grip on the yarn, to take the same to the appropriate needles, and subsequently to return to the original position to re-engage the yarn when the supply of that yarn to the needles is to be interrupted, temporarily or indefinitely.

By the expression "non-feeding position" is meant a position in which the yarn is normally withheld from the needles.

The said gripping device is adapted to be opened and closed to enable it to receive and grip the yarn, and means are provided for automatically opening and closing the device at the appropriate times. In one arrangement the said device may consist of relatively movable parts, one or each spring loaded, so that the device is normally closed for gripping the yarn, and opening means may be so arranged in proximity to the non-feeding position as to act upon and release the movable part or parts suchwise that the device is quickly opened and closed to receive and grip the yarn. In such case the yarn may be pulled from the gripping device upon being engaged by the needles in consequence of the movement of the device to present the yarn to the needles. In the preferred arrangement, however, the said device consists of relatively movable parts, not spring controlled, and opening and closing means are so disposed in relation to the said device that one or each of the said parts is positively actuated and the device is consequently opened and closed as it nears the limits of the forward and return movements respectively. With this construction and arrangement the device remains open after it has released the yarn and until it is required to re-engage the yarn.

Provision is preferably made for clipping the re-engaged yarn when the gripping device closes upon it. Such provision may be made in or on the device itself, for instance the aforesaid relatively movable parts may be provided with cutting edges, or means may be provided in association with the device and appropriately operated, e. g., like the device itself, for this purpose.

Conveniently the gripping device comprises a bill substantially like that of a knot tying device as used for tying together the ends of yarns in yarn winding operations, said bill being associated with a suitable carrier movably mounted in a bracket or like support so as to enable the required movements to be imparted to the bill, which, however, in contradistinction to a knot tying bill, does not rotate although capable of opening and closing to release and to engage and clip the yarn.

The gripping device is employed in association with a yarn guide, either fixed or movable, through which the yarn runs after it has been introduced to and taken by the needles as aforesaid. That is to say, after the yarn has been pulled from or released by the gripping device it feeds into the needles by simply running through the guide which also serves to hold the yarn or present it in a suitable position for re-engagement by the gripping device when the supply of that particular yarn is to be interrupted.

When a movable guide is provided this is operated so as to be moved, e. g., pivotally or slidably, from the non-feeding position to a feeding position, and vice versa, in timed relation with the movements of the gripping device so that the length of yarn extending between the guide and the gripping device is laid close to the stems of the needles and the length of yarn running between the guide and the needles is disposed in a favourable position for re-engagement

by the gripping device when it and the guide revert to the non-feeding position. In a machine furnished with latch needles the yarn is laid above the closing latches of the appropriate needles at the feeding location so that it is caught up by the latches and thus securely taken by the needles.

According to another feature of the invention the gripping device is arranged so as to be movable across the stems of the needles and, during such movement, also to be movable towards the needles, and in the reverse manner, i. e., away from the needles and across the needles, when it is returned to the non-feeding position.

In a particular illustrative embodiment of the invention the gripping device is carried by a member arranged for combined sliding and turning movement in a bracket or like support.

The operation of the gripping device is effected by means of a spring and a cam or cams on a shaft, chain or drum or equivalent means, or by means of cams or equivalent means only, and suitable timing or controlling mechanism.

When the associated yarn guide is movable, this may be operated either by or from the gripping device or an associated part with or without the aid of a spring, or by independent means similar to those adopted for operating the gripping device and suitable intermediate mechanism.

As will be understood, while there may be only one gripping device and an associated yarn guide at a feeder for supplying a single yarn to the needles as hereinbefore mentioned, two or more of such devices and guides may be provided at one feeder in conjunction with operating means of the form aforesaid designed to effect operation of the gripping devices, and the associated guides, when movable, for supplying yarns, interchangeably or a plurality of yarns at the same time, to the needles, according to requirements.

Controlling means of any appropriate form adopted in knitting machines may be provided for timing the operation of the gripping device or devices, and the guide or guides when movable, according to requirements.

In order that the invention may be more clearly understood and readily carried into practical effect, various constructional examples and specific adaptations thereof will now be described with reference to the accompanying drawings as applied to a circular knitting machine of the rotary needle cylinder type furnished with independent latch needles.

In the drawings,

Figure 1 is a side elevational view of one constructional form of the improved yarn supplying mechanism,

Figure 2 is a plan view of the same as viewed generally in the direction of the arrow A in Figure 1 and shown in relation to the needle circle of the machine,

Figure 3 shows a cam and lever for effecting operation of the gripping device of the said mechanism,

Figure 4 is a detail plan view showing a modified and particularly simple form of the yarn supplying mechanism,

Figure 5 is a longitudinal sectional view depicting means for carrying, controlling and actuating the gripping device, and showing the manner in which an associated normally fixed yarn guide may be displaceably mounted for a purpose hereinafter to be explained,

Figure 6 is a detail plan view as seen in the direction of the arrow D in Figure 5,

Figure 7 is a plan view of a yarn changing mechanism in the form of a two-colour striper constructed in acordance with this invention,

Figure 8 is a side view of the same as seen in the direction of the arrow E in Figure 7,

Figure 9 is an enlarged detail side elevational view of the yarn guide controlling means provided at the free end of the bracket of the said yarn changing mechanism,

Figure 10 is a perspective view including the cams for controlling the interchangeable yarn guides of this mechanism,

Figure 11 is a plan view of a still further example in the form of a combined two colour striper and splicing mechanism,

Figure 12 is a side view of the various connections for operating this combination, and

Figure 13 is an enlarged vertical sectional view showing the manner in which the three yarn guides of the last mentioned example are mounted.

Wherever possible, the parts are designated by similar reference characters throughout the drawings.

The simple mechanism illustrated in Figures 1 and 2 comprises a single gripping device B associated with a movable yarn guide C wherein the gripping device is in the nature of a bill, of the form hereinbefore referred to, consisting of an inner fixed part **2** mounted between two spaced limbs *3a* of a U-shaped outer part **3** which is pivotally mounted upon the said fixed part so as to be movable to open and close the bill. The pivoted outer part **3** is formed with an enlarged portion *3b* (Figure 1) projecting therefrom. The bill is mounted on or formed with a neck B^1 carried by an angularly bent portion *4a* of a carrier rod **4** which is in turn slidably and rotatably mounted in a bracket **5** adapted to be attached to any suitable part of the knitting machine, and the yarn guide C is secured by a screw **6** to a spindle **7** pivoted in this bracket near the free end thereof so that the guide can be turned towards and from the needles **8** as will be hereinafter more fully explained. Conveniently the bracket **5** is bored for reception of the carrier rod **4** and has a split boss *5a* at one end whereby it can be fixed by screws **9** on a post or like support such as **10** transversely to the stems of the needles **8**. As shown, the bracket extends in the direction of a tangent or substantially so to the needle circle NC (Figure 2) so that its free end is disposed more or less towards the needles **8**. At its side nearest to the needles the bracket **5** is recessed or hollowed out suchwise as to permit of turning movement of the bent portion *4a* of the carrier rod **4** within the bracket. Attached by screws **11** to the top of the bracket **5** is a plate **12** having formed therein a cam slot **13** through which the neck B^1 projects from the carrier rod **4** and which for a portion of its length is straight and extends longitudinally of said bracket, and for the remainder is inclined or curved so that it deviates from the longitudinal direction suchwise that, when the bracket is in position in the machine, the curved part of the slot extends more or less towards the needle circle NC (see Figure 2). Thus when the carrier rod **4** is moved axially in the bracket **5** it is also turned therein about its axis by reason of the inclination or curvature of the slot **13**. The pivoted yarn guide C is mounted adjacent to the slot.

Fixed stops 14 and 15 are provided on the plate 12 at opposite ends of the slot 13 for contact with the enlarged portion 3b of the movable part 3 of the bill so as to open and close the same. Conveniently, and as shown, the material cut from the plate to provide the slot is bent up to constitute the two stops. In the non-feeding position indicated in Figure 1 and in full lines in Figure 2 the bill B is located adjacent to the yarn guide C with the movable part 3 thereof in engagement with the adjacent stop 15 so that the bill is closed and grips the end y^1 of the yarn y threaded through the guide. With this construction and arrangement when the carrier rod 4 is moved endwise away from the free end of the bracket 5 the bill B, still closed, is initially moved in a substantially straight path across the stems of the needles 8 at the feeder and then, by reason of the deviation of the cam slot 13, the rod is turned in consequence of continued movement endwise so that compound movement across the stems of the needles and towards the latter is imparted to the bill B whereby a length y^2 (see Figure 2) of the yarn is drawn through the guide and swung inwards so as to be introduced to the needles 8. The mechanism is positioned so that the said length of yarn is laid across the appropriate needles between the hooks and the closing latches 8a. As the bill B approaches the end of this movement the enlarged portion 3b of the outer part 3 which projects rearwards from the bill comes into contact with the opening stop 14 whereby as the result of continued movement of the bill to the end of the slot 13 the bill is opened to release the yarn, the latter being drawn in by the needles and thereafter feeding thereto by simply running through the yarn guide C. The bill remains in this position until movement of the carrier rod 4 in the opposite direction whereupon the bill B, still open, is moved in the reverse manner back to the non-feeding position. As the bill nears the end of its return movement the fixed and movable parts thereof straddle the yarn running between the guide C and the needles 8, and the enlarged portion 3b of the movable part 3, now projecting forwards from the fixed part 2, comes into contact with the closing stop 15 so that as the bill moves to the limit of this movement it is closed thereby clipping the yarn y and gripping the end y^1 which projects from the guide C thus holding it in this non-feeding position until the cycle of operations is repeated. The guide C is operable by means of the angularly bent portion 4a of the carrier rod through the medium of a toothed sector 16 pivoted at one end upon a pin 17 screwed into the bracket 5, and a co-operating pinion 18 fast on the spindle 7 aforesaid. The toothed sector 16 is accommodated within a recessed part 5b of the bracket covered by the plate 12 and is formed with a hump or cam 16a disposed in the path of the bent portion 4a. The said sector, moreover, is controlled by a small compression spring 19 (Figure 2) so that as the gripping device is moved away from the non-feeding position the toothed sector is moved under the influence of the spring and turns the guide C towards the needles. In this way the length of yarn extending between the guide and the gripping device is carried closer to the needles. Upon reverse movement of the gripping device the bent portion 4a of the carrier rod eventually engages the hump or cam 16a and presses the toothed sector 16 back against the action of the spring 19 whereby the guide C is turned away from the needles to position the length of yarn running between it and the needles 8 in a favourable position to be clipped and so that the end y^1 of yarn extending from the guide is held in the non-feeding position by the gripping device preparatory to further action. Alternatively, the guide C may be operated independently of the gripping device from either the same source or a different source but in a similar manner through appropriate intermediate mechanism which may include a cam operated by pawl and ratchet gear or other intermittently operated mechanism, and a toothed sector or rack and pinion as in one of the specific examples hereinafter to be described as appertaining to a yarn changing mechanism.

In this particular example of the invention the carrier rod 4 is moved endwise to move the bill B away from the non-feeding position by means of a tension spring 20 arranged beneath the bracket 5. As shown in Figure 1, this spring is anchored at one end to a pin 21 projecting downwards from the carrier rod and at its other end to a pin 22 fixed in the bracket. The pin 21 works in a slot or gap formed in the said bracket. The rod 4 is moved endwise in the opposite direction by a two-armed lever 23 pivoted at 24 between lugs 25 in a suitable position in the machine and actuated by or from a cam or cams such as that indicated at 26 in Figure 1 on a shaft or drum appropriately mounted in the machine and suitably driven according to requirements. At one end the lever 23 impinges on the relevant end of the rod 4, or, as shown, on a screw 27 therein, and at the other end makes contact with a push rod 28 in turn engaged by another pivoted lever 29 acted upon by the cam or cams. Alternatively, the end of the lever 23 remote from the carrier rod may be fitted with a roller for contact with the said cam or cams.

This constructional example of the invention may be used for several purposes. For example, it may be applied to a single feeder machine for supplying a splicing yarn or contrasting yarn, e. g., coloured or elastic, in conjunction with the main yarn. In this respect the gripping device and associated mechanism may be employed for producing sectional spliced areas or contrasting or elastic areas, e. g., vertical stripes or blocks, in which case a cam having an operative portion or portions of appropriate angular extent, e. g., one like that shown at 30 in Figure 3 of substantially 180°, may be provided on a shaft such as 31 driven in time with the rotation of the needles so that the gripping device is moved from and back to the non-feeding position once or more than once each revolution of the needles to supply the splicing or contrasting yarn to the desired number, e. g., substantially half, of the needles and then to reengage and clip the yarn in the manner described so that the remainder of the needles take the main yarn only. As will be seen in Figure 3, the cam 30 is arranged for contact with a roller 32 carried by a pivoted lever 33, and this lever is intended to be employed in lieu of the lever 23 for actuating the carrier rod 4. Any appropriate means may be provided for automatically controlling the cam shaft or drum or the lever so as automatically to render same operative and inoperative periodically in order to restrict the splicing, contrasting or elastic effects to desired areas lengthwise of the knitted fabric. For instance, provision may be made on the existing timing chain of the machine or on an auxiliary timing chain for positioning the cam

actuated lever in and out of contact with the cam or cams or for starting and stopping the cam shaft or drum at required times. Accordingly, the said example may be advantageously applied to a circular seamless hosiery knitting machine for splicing the foot bottoms and heel and toe pouches of stockings, half hose and socks, and for high splicing, i. e., at the back above the heels, in the case of stockings.

By employing a graduated cam or adjustable cam means and appropriate intermediate connections suitably controlled, spliced areas of graduated form can be produced. Alternatively, by employing a cam drum or a chain with cam bits thereon or equivalent means suitably racked and controlled, the gripping device may be moved from and back to the non-feeding position more than once per revolution of the needles so as to produce circumferentially spaced spliced, contrasting or elastic areas, or the return movement may be delayed for as long as desired so that the yarn is supplied to the needles for a succession of courses, as for example for splicing welts and tops of stockings, or effecting other all round splicing, or producing horizontal or ring stripes or elastic sections.

The main yarn may be supplied through a fixed guide on the free end of the bracket. Instead of supplying a splicing or additional yarn as aforesaid the gripping device may be used for substituting a reinforcing, i. e., coarser or heavier, yarn or other contrasting or elastic yarn for the main yarn. Moreover, the said example may be used for substituting a draw yarn for a main yarn, and by adopting a cam drum, chain, or equivalent, or intermediate connections suitably operated and controlled, the gripping device may be operated periodically as, for example, in a machine for knitting gloves, to produce partial courses for thumb holes, or, in a machine for knitting footwear, garments, garment lengths, and other pieces of fabric or articles, to produce parting courses between successive articles. In each of these cases, if the additional yarn is supplied at the same feeding location as the main yarn the latter may be supplied and cut off as required by means of an arrangement similar to that adopted for supplying the substitute yarn and appropriately controlled, or a movable yarn guide, a trapping and severing device and controlling means of any usual form employed in circular knitting machines may be adopted for this purpose.

In a further application of this example of the invention, however, it may form, in conjunction with an auxiliary knitting cam system, an auxiliary feeder for supplying an additional yarn, conjointly with a main yarn, i. e., a draw yarn or a contrasting or elastic yarn, as aforesaid, or a yarn of the same kind as the main yarn, for increasing the rate of production of knitted fabric, as, for example, in knitting the leg and foot portions of footwear in a seamless hose machine, the gripping device, and the stitch cam or some other appropriate cam movably arranged, being placed under the control of a cam drum, chain or equivalent suitably arranged and operated so as to render the auxiliary feeder operative for knitting, and inoperative so as to stop the feeding of the yarn and avoid casting off, at the required times.

An even more simple form of the improved yarn supplying mechanism is shown in Figure 4. In general, this mechanism is similar to that already described with reference to Figures 1 and 2 and accordingly it is only considered necessary to mention the constructional differences. The single gripping device B in this instance consists of two spaced fixed parts **34** and an inner part **35** pivotally mounted between the fixed parts with an enlarged portion **35***a* projecting therefrom. The bill is mounted on or formed with a neck B^1 extending at right angles from a carrier rod **36** which is slidably and rotatably mounted in a bracket **37**, and the yarn guide C^1 in this example is fixedly mounted on this bracket. The bracket **37** is mainly of tubular or hollow cylindrical form and is itself formed with a cam slot **38** through which the neck B^1 projects. For a portion of its length this slot extends straight from the free end of the bracket and for the remainder is inclined or curved as in the previous example. The yarn guide C^1 is fixedly mounted at the said free end of the bracket. A stop **39** is fixed on the bracket **37** near the free end so as to extend across the slot and another stop **40** is fixed on the bracket near the inner end of the slot **38** for contact with the enlarged portion **35***a* of the inner movable part **35** of the bill so as to open and close the same. The stops **39** and **40** may be adjustably fixed on the bracket **37** so as to enable the opening and closing of the bill to be effected precisely. Thus, for example, the stop **39** in Figure 4 consists of a flat member mounted for turning movement on a pin **41** inserted in the bracket and fixed after adjustment by a screw **42** inserted into the bracket through a slot in the said member. The stop **40** may be made similarly adjustable.

In this example of the invention the carrier rod **36** may be of the construction shown in Figure 5. That is to say it may be moved endwise in one direction, e. g., to move the bill B from the non-feeding position, by means of a compression spring **43** housed in a bore **44** in the rod and abutting against a socket or an end piece such as **45** fitted in a sleeve or collar **46** applied to the free end of the bracket. The rod is moved endwise in the opposite direction by any of the various means hereinbefore mentioned, e. g., by a two-armed pivoted lever **23** actuated by or from a cam or cams on a shaft or drum appropriately mounted in the machine and suitably driven according to requirements. At one end the lever **23** impinges on a screw **47** in the bored rod **36**.

When a fixed guide is provided in the bracket for the additional or substitute yarn or/and the main yarn as aforesaid the said guide or each guide may be displaceably mounted so as to facilitate threading up. Conveniently for this purpose the end piece **45** in the particular construction illustrated in Figure 5 is fitted slidably and rotatably in the socket, sleeve or collar **46** applied to the end of the bracket **37** and the guide C^1 is provided with a stem **48** inserted into the end piece through a bayonet or L-shaped slot **49** in the socket, sleeve or collar and is either fixed in the end piece **45** by means of a screw **50** or is screwed into the end piece. As shown in Figure 6, one part **49***a* of the slot **49** extends axially and the other part **49***b* extends circumferentially of the socket, sleeve or collar **46**. Normally the guide has its stem **48** located in the axially extending part **49***a* of the slot in which it is held by the spring **43** abutting against the end piece **45**. By pushing the end piece axially into the bracket **37** the stem **48** of the guide is brought into line with the circumferentially extending part **49***b* of the slot so that the guide can then be turned away from the needles for threading. On the reverse movement of the guide the stem thereof eventually snaps back into the part **49***a* of the slot under the action of the spring.

The yarn changing mechanism illustrated in Figures 7–9 is in the form of a two-colour striper in which a bill B constructed, arranged and operating in a similar manner to that hereinbefore specifically described co-operates with two movable yarn guides, one, C^1, of which is carried by a spindle 51 pivoted in the bracket 37 and the other, C^2, is carried by a sleeve 52 rotatably mounted on the said spindle. For operating these guides pinions 53 and 54 are provided on the spindle 51 and sleeve 52 respectively and two-armed toothed sectors 55 and 56, one for each pinion, are pivotablly mounted on a pin 57 inserted in the bracket 37 with their toothed arms respectively in mesh with the pinions 53 and 54 and their other arms connected to springs 58 (Figure 7). A pair of cams 59, 60 and an attached ratchet wheel 61 are rotatably mounted co-axially on a spindle 62 inserted in the bracket suchwise that the cams respectively oppose the free arms of the sectors 55 and 56 which are held in contact with the cams by the associated springs 58. As shown more clearly in Figure 10, each of these cams has two convex peripheral portions 63 and intermediate concave peripheral portions 64 and said cams are so arranged relatively that the convex portions of one correspond in angular position with the concave portions but overlap the convex portions of the other. The cams 59 and 60 are rotated, step by step, to oppose the convex and concave portions of each alternately to the corresponding sector by means of spring controlled pawls 65 and 66 formed and arranged suchwise as to operate one (65) with pushing action on the ratchet wheel 61, on one side of the axis, and the other (66) with pulling action on the wheel on the opposite side of the axis. Conveniently, and as shown, the pawls are both pivoted at 67 on a link 68 in turn pivoted at 69 on the bracket or on an adjacent fixture 70 (see Figure 7) and connected by a pin and slot connection 71, 72 to the rod 36 which carries the bill B. By reason of this construction and arrangement, when the bill B is in the non-feeding position shown a convex portion 63 of the cam 60 is opposed to the relevant arm of the sector 56 while the corresponding concave portion 64 of the other cam 59 is opposed to the similar arm of the other sector 55 whereby the guide C^2 is located in the non-feeding position in which the end y^1 of yarn extending therefrom is held by the bill B, and the other guide C^1 is located in the feeding position. When the rod 36 is moved as hereinbefore described to cause the bill to take the held yarn to the needles the pulling pawl 66 acts on the ratchet wheel 61 to rotate the cams 59 and 60 but the angular extent of the said convex and concave portions is such that no movement is imparted to the guides. On the reverse movement of the said rod, however, the pushing pawl 65 acts upon the ratchet wheel to rotate the cams another step whereupon the arm of the sector 56 previously opposed by a convex portion 63 of the cam 60 is opposed to the following concave portion of the same cam, while the arm of the sector 55 previously opposed by a concave portion 64 of the other cam 59 is acted upon by the following convex portion of this cam whereby the sectors are moved so as to cause the guides C^1 and C^2 to change places. Since, however, the convex portions of one cam overlap somewhat the convex portions of the other cam, the guides both momentarily occupy the non-feeding position at the same time, i. e., the one takes up the non-feeding position just before the other is moved from this position. To enable each guide when moved from the feeding position to the non-feeding position to hold its yarn in the same position for engagement by the bill B on its return movement, one of the guides, i. e., C^1, is displaceably arranged so that the eye or throat through which the yarn is threaded can be moved into and out of the plane in which the bill B moves and the other guide C^2 is spring controlled or, as shown, made flexible so that it can yield when the guide C^1 is returned to the non-feeding position before the guide C^2 leaves this position. The displaceable guide C^1 is controlled by a cam and a spring, or a grooved or slotted part appropriately shaped. Conveniently for this purpose, and as shown more clearly in Figure 9, the spindle 51 is provided with a bifurcated part 73 in which the guide C^1 is pivoted centrally upon a pin 74, and a plate 75 with an angular slot 75a therein is attached to the bracket 37 adjacent to the spindle for reception of the free end of the said guide whereby as the latter is turned to and from the non-feeding position the eye or throat is moved into and out of the plane in which the bill B moves. When the guide C^1 reaches the non-feeding position, the eye or throat thereof presses against the eye or throat of the other guide C^2 and the latter thereupon yields before moving to the feeding position. In this way both yarns are supplied to a few needles 8 so as to effect a join before the yarns are changed, and the yarn to be withheld from knitting is positioned favourably for engagement and severance by the bill B as the latter nears the limit of its return movement. Thus, by movement of the bill from and back to the non-feeding position at appropriate intervals determined by cams on a shaft, chain, drum or equivalent means appropriately prearranged or/and operated and controlled, the yarns can be fed to the needles alternately for partial, single or a plurality of courses so as to produce vertical or horizontal striping effects, checks and like pattern or design formations. In this form of the invention the stops 76 and 77 for opening and closing the bill B are formed on a plate 78 fixed over the toothed sectors 55 and 56.

The further example of the invention depicted in Figures 11, 12 and 13 is in the form of a combined two colour striper and splicing mechanism in which there are provided two gripping devices (bills) B and B^1 and three movable guides C^1, C^2 and C^3. One of the gripping devices co-operates with the guides for the coloured yarns, and the other gripping device co-operates with the guide for the splicing yarn. The gripping devices B^1 and B^2 are constructed and arranged as hereinbefore particularly described but the levers such as that indicated at 23 in Figure 12, which levers act upon the carrier rods 36 and 36^1 in the supporting bracket 37, are in turn pivotally connected respectively to the arms of bifurcated levers such as 79 the prongs 79a of which are acted upon at appropriate times by cams on a drum 80. The three guides are rotatably arranged co-axially for movement towards and from the needles. Conveniently, and as shown in Figure 13, one of the guides, C^1, for the coloured yarns is attached to a spindle 81 which is fitted with a pinion 82 and rotatably mounted in the bracket 37, and the guide C^2 for the other coloured yarn is formed on or attached to a hollow boss 83 formed or fitted with a pin-

ion 84 and mounted concentrically on the spindle 81. These guides are operated by racks 85 and 86 slidably mounted in guides 87 and 88 on the bracket and actuated by levers 89 and 90, similar to those employed for actuating the rods 36, 36^1, from cams such as 91 on the cam drum 60. The guide C^3 for the splicing yarn is formed on or attached to a boss 92 (Figure 13) furnished with an arm 93 (Figure 11) and rotatably mounted on the spindle 81 between the pinions 82 and 84. The guide C^3 is controlled from the associated gripping device B^1 by means of a cam lever 94 which is pivoted at 95 on the bracket so as to be engaged by the neck of the device and connected to the arm 93 by means of a pin and slot. The cam lever 94 may be moved positively in each direction by the gripping device B^1 as the latter is moved from and back to the non-feeding position, or it may be moved in one direction by a spring and in the other direction by the said gripping device. The cam drum 60 may be operated in any suitable manner, e. g., racked by pawl and ratchet mechanism controlled from the timing mechanism of the machine, so that by appropriate prearrangement of the cams and timing of the drum the striping mechanism and the splicing mechanism will be operated at different times and also rendered operative and inoperative periodically according to requirements. Thus, when the gripping device B^2 associated with the striping guides C^1 and C^2 is moved from the non-feeding position the yarn held thereby is taken to the needles and the corresponding guide, operated by the relevant rack and pinion mechanism, is also turned towards the needles. When the said device is returned to the non-feeding position the other guide, operated by the associated rack and pinion mechanism, is turned away from the needles in time to present its yarn to the returning bill which clips and holds the yarn, as hereinbefore described. Likewise, when the gripping device B^1 holding the splicing yarn is moved to take the yarn to the needles, the associated guide C^3 operated by the intermediate connections is turned towards the needles, and during reverse movement of the gripping device B^1 the guide C^3 is turned away from the needles so as to present the splicing yarn for re-engagement by the gripping device. To enable both of the striping guides C^1 and C^2 momentarily to occupy the feeding position and to present their yarns in the same plane for re-engagement by the gripping device B^2 one of the guides is made yieldable or is yieldingly mounted and cam means are provided for deflecting this guide as it approaches the feeding position before the other guide vacates it. Conveniently, and as shown in Figure 13, the guide C^1 carried by the spindle 81 is pivotally mounted on or in the latter in connection with a tension spring 95 located in a hollow part 81*a* of the spindle, and a cam formation is provided on this guide, or on the other guide C^2, whereby, as the pivoted guide C^1 approaches the feeding position, it is tilted, and when the guide C^2 vacates the feeding position its place is taken by the pivoted guide C^1 moving under the influence of the spring 95.

The cam slots formed in the bracket for controlling the movements of the gripping devices B^1 and B^2 are indicated at 38^1 and 38^{11} respectively.

Suitable mechanism may be employed in conjunction with the hereinbefore described splicing mechanism for taking up slack in the splicing yarn during narrowing and widening actions in the production of heel and toe pouches.

There may be provided adjacent to the feeding location, e. g., on the aforesaid bracket, a pin or projection (not shown) for contact with the yarn taken to the needles by the gripping device, or each gripping device when there is more than one, so that yarn running between the operative guide and the needles is maintained close up to the needles to facilitate its reception by the needles.

In order to avoid as far as possible the appearance of loose ends of yarn in the knitted fabric there may also be provided for the yarn, or each yarn, to be supplied to the needles a dropper or take-up member (also not shown) adapted to act upon the yarn, under the influence of gravity or a spring, between the guide and the needles, whereby when the yarn taken to the needles is freed from the gripping device, the droppper or take-up member functions to draw the loose portion back somewhat so that the first needle to take it does so as near as possible to the free end. A stop may be provided for limiting the movement of the dropper or take-up member to the extent required to achieve this result.

The invention is applicable to multi-feeder as well as single feeder circular knitting machines and is this respect may be applied to one, or more, or each of the feeders.

Moreover, mechanism according to the invention may be applied to circular rib knitting machines of the cylinder and dial type and of the double axially opposed cylinder type as well as to plain machines, for producing fabric in continuous lengths for manufacture into garments, or for producing knitted articles, such as stockings, half hose and socks, or garments or garment lengths, either separately or in string formation. In the application of the invention to rib knitting machines the yarn supplying means may be arranged so as to introduce yarn either to the rib needles or to the plain needles.

Furthermore, the improved yarn supplying means may be applied to circular knitting machines of the stationary cylinder type as well as to machines of the rotary cylinder type, and, by suitable adaptation and arrangement of operating means, to flat knitting machines having either latch or bearded needles.

What we claim then is:

1. For operation at a feeder of a knitting machine equipped with independent needles, mechanism for supplying yarn to said needles, said mechanism comprising, in combination, a movable gripping device adapted normally to hold yarn in a non-feeding position, means for moving said device transversely with respect to the needles suchwise as to take the held yarn to and lay it across the stem of appropriate needles, and means for subsequently returning the device to its original position with movement across the needle stems to re-engage the yarn when the supply of that yarn to the needles is to be interrupted.

2. For operation at a feeder of a knitting machine equipped with independent needles, mechanism for supplying yarn to said needles, said mechanism comprising, in combination, a movable gripping device adapted normally to hold yarn in a non-feeding position, said device consisting of relatively movable parts suchwise that it can be opened and closed, means for moving said device transversely with respect to the needles while in a closed condition to take yarn to

and lay it across the stems of appropriate needles, means for automatically opening the device near the limit of its forward movement, means for subsequently returning the device in an open condition to re-engage the yarn when the supply of that yarn to the needles is to be interrupted, the return movement also being across the stems of the needles, and means for automatically closing the device so that it will grip the yarn near the limit of its return movement.

3. For operation at a feeder of a knitting machine equipped with independent needles, mechanism for supplying yarn to said needles, said mechanism comprising, in combination, a movable gripping device adapted normally to hold yarn in a non-feeding position, said device consisting of relatively movable parts suchwise that it can be opened and closed, means for moving said device transversely with respect to the needles suchwise as to take the held yarn to and lay it across the stems of appropriate needles, means for subsequently returning the device to its original position to re-engage the yarn when the supply of that yarn to the needles is to be interrupted, the return movement also being across the stems of the needles, and means for automatically opening and closing the device to enable it to release and grip the yarn at appropriate times.

4. For operation at a feeder of a knitting machine equipped with independent needles, mechanism for supplying yarn to said needles, said mechanism comprising, in combination, a movable gripping device adapted normally to hold yarn in a non-feeding position, said device consisting of relatively movable parts suchwise that it can be opened and closed, means for moving said device transversely with respect to the needles suchwise as to take the held yarn to and lay it across the stems of appropriate needles, means for subsequently returning the device to its original position to re-engage the yarn when the supply of that yarn to the needles is to be interrupted, the return movement also being across the stems of the needles, means for automatically opening and closing the device to enable it to release and grip the yarn at appropriate times, and provision for clipping the re-engaged yarn when the gripping device closes upon it.

5. For operation at a feeder of a knitting machine equipped with independent needles, mechanism for supplying yarn to said needles, said mechanism comprising, in combination, a movable gripping device adapted normally to hold yarn in a non-feeding position, said device being constituted by a bill consisting of relatively movable parts capable of opening and closing to release and to engage and clip the yarn, a carrier for said bill, a bracket in which said carrier is movably mounted, means for moving the carrier in such a way that the bill takes the held yarn to appropriate needles, means for subsequently moving the carrier in the reverse direction to return the device to its original position for re-engagement with the yarn when the supply of that yarn to the needles is to be interrupted, and means for automatically opening and closing the bill to enable it to release and to engage and clip the said yarn at appropriate times.

6. For operation at a feeder of a knitting machine equipped with independent needles, mechanism for supplying yarn to said needles, said mechanism comprising, in combination, a movable gripping device adapted normally to hold yarn in a non-feeding position, means for moving said device transversely with respect to the needles suchwise as to take the held yarn to and lay it across the stems of appropriate needles, means for subsequently returning the device to its original position to re-engage the yarn when the supply of that yarn to the needles is to be interrupted, the return movement also being across the stems of the needles, and a yarn guide through which the yarn runs after it has been introduced to and taken by the needles.

7. For operation at a feeder of a knitting machine equipped with independent needles, mechanism for supplying yarn to said needles, said mechanism comprising, in combination, a movable gripping device adapted normally to hold yarn in a non-feeding position, means for moving said device transversely with respect to the needles suchwise as to take the held yarn to and lay it across the stems of appropriate needles, means for subsequently returning the device to its original position to re-engage the yarn when the supply of that yarn to the needles is to be interrupted, the return movement also being across the stems of the needles, a movable yarn guide through which the yarn runs after it has been introduced to and taken by the needles, and means for operating the said guide suchwise as to move it from the non-feeding position to a feeding position, and vice versa, in timed relation with the movements of the gripping device so that the length of yarn extending between the guide and the gripping device is laid close to the stems of the needles and the length of yarn running between the guide and the needles is disposed in a favourable position for re-engagement by the gripping device when it and the guide revert to the non-feeding position.

8. For operation at a feeder of a knitting machine equipped with independent needles, mechanism for supplying yarn to said needles, said mechanism comprising, in combination, a movable gripping device adapted normally to hold yarn in a non-feeding position, means for moving said device to take the held yarn to appropriate needles, means for subsequently returning the device to its original position to re-engage the yarn when the supply of that yarn to the needles is to be interrupted, and means for so controlling the gripping device that in moving away from the non-feeding position it first moves across the stems of the needles and then towards the latter, whereas during its return movement said device moves first away from and then across the needles.

9. For operation at a feeder of a knitting machine equipped with independent needles, mechanism for supplying yarn to said needles, said mechanism comprising, in combination, a movable gripping device adapted normally to hold yarn in a non-feeding position, a member for carrying said device, a bracket in which said carrier member is arranged for combined sliding and turning movement, means for effecting such movement of the carrier member in one direction to move the gripping device so that it takes the held yarn to appropriate needles, and means for subsequently effecting the aforesaid combined movement of the carrier member in the reverse direction whereby the gripping device is returned to its original position to re-engage the yarn when the supply of that yarn to the needles is to be interrupted.

10. For operation at a feeder of a knitting machine equipped with independent needles, mechanism for supplying yarn to said needles, said mechanism comprising, in combination, a movable gripping device adapted normally to hold yarn in a non-feeding position, said device being constituted by a bill consisting of relatively movable parts capable of opening and closing to release and to engage and clip the yarn, a carrier for said bill, a bracket in which said carrier is movably mounted, a spring associated with the carrier for moving the latter in such a way that the bill takes the held yarn to appropriate needles, cam means and intermediate members for subsequently moving the carrier in the reverse direction to return the device to its original position for re-engagement with the yarn when the supply of that yarn to the needles is to be interrupted, and means for automatically opening and closing the bill to enable it to release and to engage and clip the said yarn at appropriate times.

11. For operation at a feeder of a knitting machine equipped with independent needles, mechanism for supplying yarn to said needles, said mechanism comprising, in combination, a movable gripping device adapted normally to hold yarn in a non-feeding position, means for moving said device to take the held yarn to appropriate needles, means for subsequently returning the device to its original position to re-engage the yarn when the supply of that yarn to the needles is to be interrupted, a movable yarn guide through which the yarn runs after it has been introduced to and taken by the needles, and intermediate gearing between the gripping device and the yarn guide whereby the latter is operated suchwise as to move it from the non-feeding position to a feeding position, and vice versa, in timed relation with the movements of the gripping device so that the length of yarn extending between the guide and the gripping device is laid close to the stems of the needles and the length of yarn running between the guide and the needles is disposed in a favourable position for re-engagement by the gripping device when it and the guide revert to the non-feeding position.

12. For operation at a feeder of a knitting machine equipped with independent needles, mechanism for supplying yarn to said needles, said mechanism comprising, in combination, a movable gripping device adapted normally to hold yarn in a non-feeding position, said device being constituted by a bill consisting of relatively movable parts capable of opening and closing to release and to engage and clip the yarn, a carrier rod for the bill which latter is formed with a neck extending angularly from said rod, a bracket wherein the carrier rod is slidably and rotatably mounted and having a cam slot through which the aforesaid neck projects, said slot for a portion of its length extending straight in the longitudinal direction of the bracket while the remainder is curved so that it deviates from the longitudinal direction and extends towards the needle circle, means for moving the carrier rod in one direction so that the bill first moves across the stems of the needles and then towards the latter to take the held yarn thereto, means for subsequently moving the carrier rod in the reverse direction to return the bill to its original position by a movement first away from and then across the needles so that said bill will re-engage the yarn when the supply thereof to the needles is to be interrupted, and means for automatically opening and closing the bill to enable it to release and to engage and clip the said yarn at appropriate times.

13. For operation at a feeder of a knitting machine equipped with independent needles, mechanism for supplying yarn to said needles, said mechanism comprising, in combination, a movable gripping device adapted normally to hold yarn in a non-feeding position, said device being constituted by a bill consisting of relatively movable parts capable of opening and closing to release and to engage and clip the yarn, a carrier rod for the bill which latter is formed with a neck extending angularly from said rod, a bracket wherein the carrier rod is slidably and rotatably mounted and having a cam slot through which the aforesaid neck projects, said slot for a portion of its length extending straight in the longitudinal direction of the bracket while the remainder is curved so that it deviates from the longitudinal direction and extends towards the needle circle, means for moving the carrier rod in one direction so that the bill first moves across the stems of the needles and then towards the latter to take the held yarn thereto, means for subsequently moving the carrier rod in the reverse direction to return the bill to its original position by a movement first away from and then across the needles so that said bill will re-engage the yarn when the supply thereof to the needles is to be interrupted, and fixed stops on the bracket at opposite ends of the cam slot for contact with the appropriate part of the bill so as to open and close the same, for the purpose specified.

14. For operation at a feeder of a knitting machine equipped with independent needles, mechanism for supplying yarn to said needles, said mechanism comprising, in combination, a movable gripping device adapted normally to hold yarn in a non-feeding position, said device being constituted by a bill consisting of relatively movable parts capable of opening and closing to release and to engage and clip the yarn, a carrier for said bill, a bracket in which said carrier is movably mounted, means for moving the carrier in such a way that the bill takes the held yarn to appropriate needles, means for subsequently moving the carrier in the reverse direction to return the device to its original position for re-engagement with the yarn when the supply of that yarn to the needles is to be interrupted, means for automatically opening and closing the bill to enable it to release and to engage and clip the said yarn at appropriate times, a movable yarn guide through which the yarn runs after it has been introduced to and taken by the needles, a spindle carrying said guide, a pinion fast on said spindle, and a toothed sector arranged in mesh with said pinion which sector is pivoted on the bracket and adapted to be influenced by contact with a portion of the aforesaid carrier, the arrangement being such that the yarn guide is moved from the non-feeding position to a feeding position, and vice versa, in timed relation with the movements of the gripping device so that the length of yarn extending between the guide and gripping device is laid close to the stems of the needles and the length of yarn running between the guide and the needles is disposed in a favourable position for re-engagement by the gripping device when it and the guide revert to the non-feeding position.

15. Yarn supplying mechanism according to claim 14, wherein the said toothed sector is spring-controlled and formed with a hump dis-

posed in the path of the carrier, for the purpose specified.

16. For operation at a feeder of a knitting machine equipped with independent needles, mechanism for supplying yarn to said needles, said mechanism comprising, in combination, a movable gripping device adapted normally to hold yarn in a non-feeding position, said device being constituted by a bill consisting of relatively movable parts capable of opening and closing to release and to engage and clip the yarn, a carrier rod for the bill which latter is formed with a neck extending angularly from said rod, a bracket wherein the carrier rod is slidably and rotatably mounted and having a cam slot through which the aforesaid neck projects, said slot for a portion of its length extending straight in the longitudinal direction of the bracket while the remainder is curved so that it deviates from the longitudinal direction and extends towards the needle circle, a compression spring housed in a bore in the carrier rod, a socket against which said spring abuts, a sleeve applied to the bracket and in which the socket is fitted, said compression spring constituting means for moving the carrier rod in one direction so that the bill first moves across the stems of the needles and then towards the latter to take the held yarn thereto, a pivoted lever for action upon the carrier rod, cams for actuating said lever, said cam-actuated pivoted lever constituting means for subsequently moving the carrier rod in the reverse direction to return the bill to its original position by a movement first away from and then across the needles so that said bill will re-engage the yarn when the supply thereof to the needles is to be interrupted, and means for automatically opening and closing the bill to enable it to release and to engage and clip the said yarn at appropriate times.

17. A mechanism for supplying yarns interchangeably to independent needles of a knitting machine, comprising, in combination, a movable gripping device adapted normally to hold yarn in a non-feeding position, means for moving said device to take the held yarn to appropriate needles, means for subsequently returning the device to its original position to re-engage the yarn when the supply of that yarn to the needles is to be interrupted, two movable yarn guides for co-operation with said movable gripping device, a pivoted spindle by which one of said guides is carried, a sleeve rotatably mounted on said spindle and by which the other of said guides is carried, pinions provided on the spindle and sleeve respectively, pivoted toothed sectors, one in mesh with each pinion, a pair of rotatable cams for actuating the toothed sectors, and pawl and ratchet gearing for effecting rotation of the cams step by step, all for the purposes herein specified.

18. Mechanism according to claim 17, wherein each of the cams has two convex peripheral portions and intermediate concave peripheral portions, and said cams are so arranged relatively that the convex portions of one correspond in angular position with the concave portions but overlap the convex portions of the other, for the purpose specified.

19. A combined two colour striper and splicing mechanism for a knitting machine equipped with independent needles, comprising a movable gripping device adapted normally to hold one of two coloured yarns in a non-feeding position, another similar gripping device for normally holding a splicing yarn in a non-feeding position, respectively separate means for moving said gripping devices independently to take a held yarn to appropriate needles, means for subsequently returning each of the devices to its original position to re-engage the appropriate yarn when the supply of the latter to the needles is to be interrupted, two movable yarn guides in association with the first mentioned gripping device and through which the coloured yarns run, means for operating the said two guides suchwise as to move them alternately from the non-feeding position to a feeding position, and vice versa, in timed relation with the movements of said first mentioned gripping device, a third yarn guide in association with the second mentioned gripping device and through which runs the splicing yarn, and means for operating said third guide to move it towards and away from the needles in timed relation with the movements of the second mentioned gripping device.

20. Mechanism according to claim 19, wherein the three guides are rotatably arranged co-axially for movement towards and away from the needles.

21. A combined two colour striper and splicing mechanism for a knitting machine equipped with independent needles, comprising a movable gripping device adapted normally to hold one of two coloured yarns in a non-feeding position, another similar gripping device for normally holding a splicing yarn in a non-feeding position, respectively separate means for moving said gripping devices independently to take a held yarn to appropriate needles, means for subsequently returning each of the devices to its original position to re-engage the appropriate yarn when the supply of the latter to the needles is to be interrupted, two movable yarn guides in association with the first mentioned gripping device and through which the coloured yarns run, a rotatable spindle to which one of the guides for the coloured yarns is attached, a pinion fast on said spindle, a hollow boss which is formed with the other of the two guides for the coloured yarns and mounted concentrically on the spindle, a pinion provided on the hollow boss, slidable racks in mesh with the pinions, means for operating said racks suchwise as to cause the corresponding guides to move alternately from the non-feeding position to a feeding position, and vice versa, in timed relation with the movements of said first mentioned gripping device, a third yarn guide for the splicing yarn, which guide is provided on a boss furnished with an arm and rotatably mounted on the spindle between the aforesaid pinions, and a pivoted cam lever which is connected to the arm and adapted to be actuated by contact with an appropriate portion of the said second mentioned gripping device whereby the third guide is operated in timed relation with the latter.

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