May 14, 1940. F. KLUMPP ET AL 2,200,280

KNITTING MACHINE

Filed Nov. 13, 1935 10 Sheets-Sheet 1

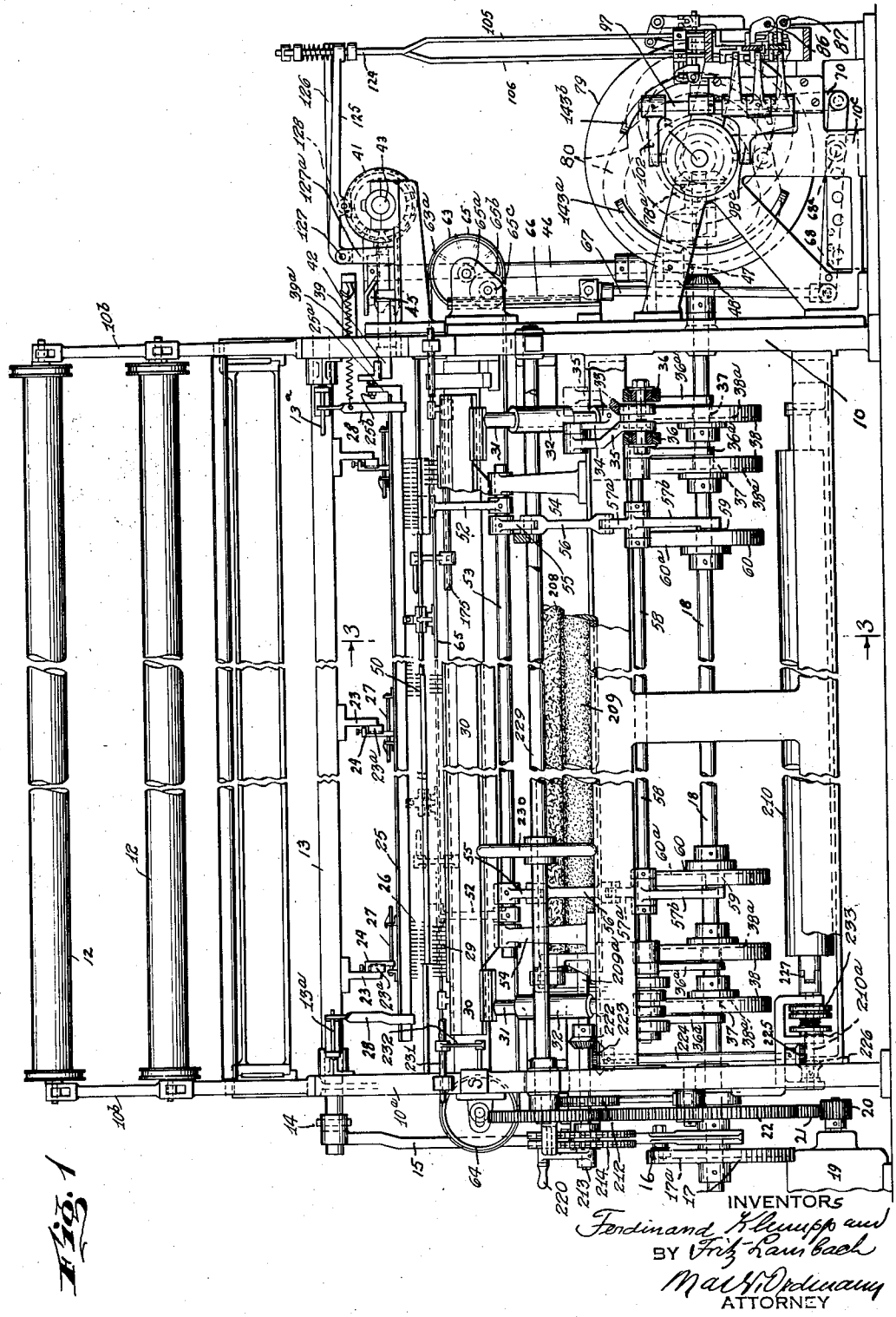

Fig. 1

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May 14, 1940. F. KLUMPP ET AL 2,200,280

KNITTING MACHINE

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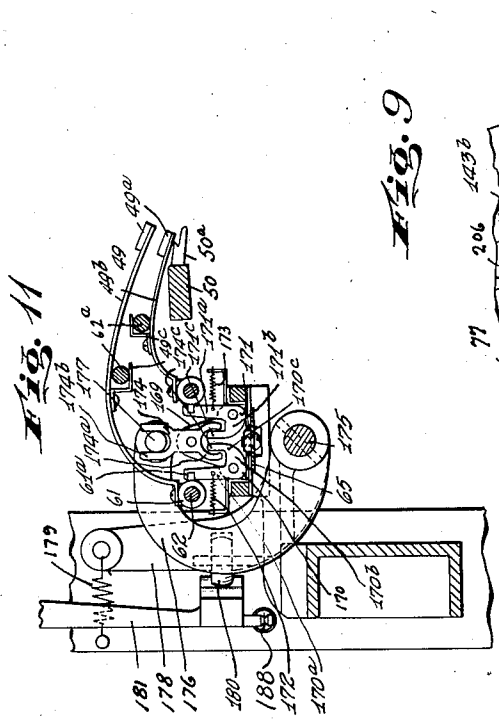

Fig. 11

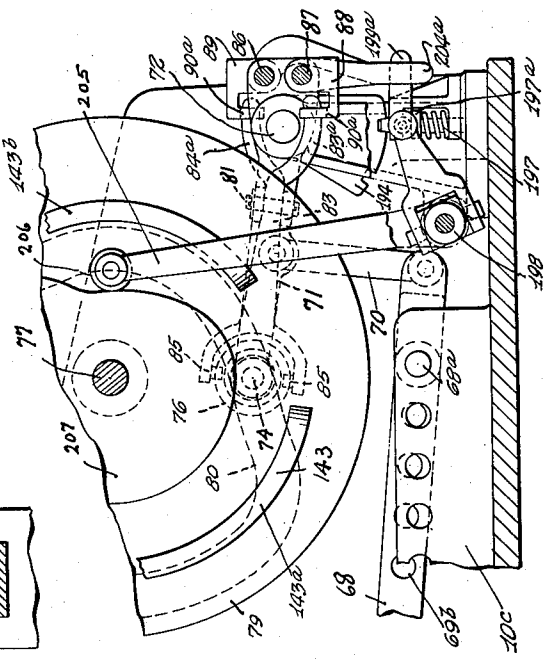

Fig. 9

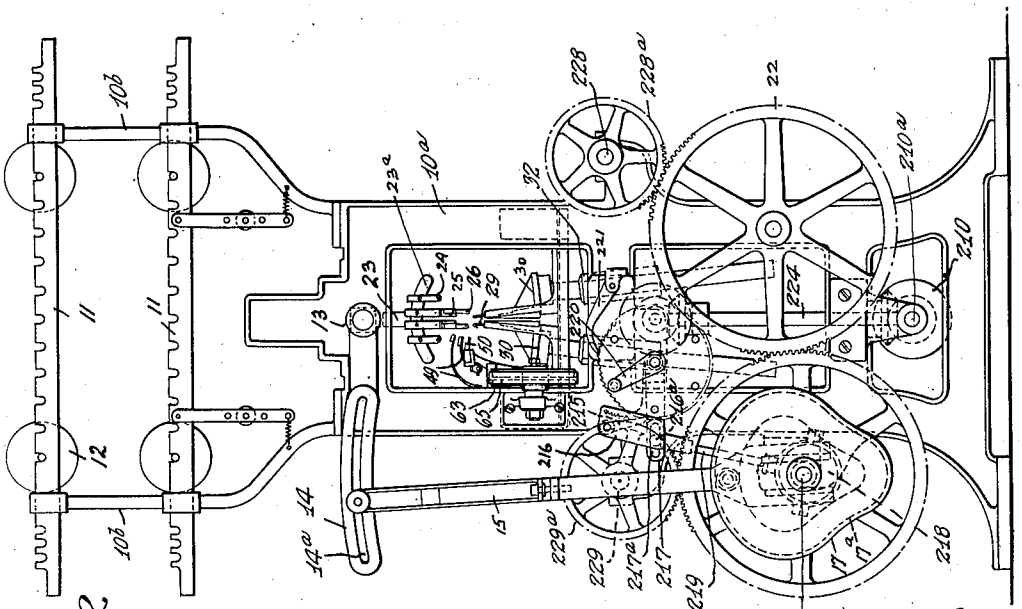

Fig. 2

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May 14, 1940. F. KLUMPP ET AL 2,200,280

KNITTING MACHINE

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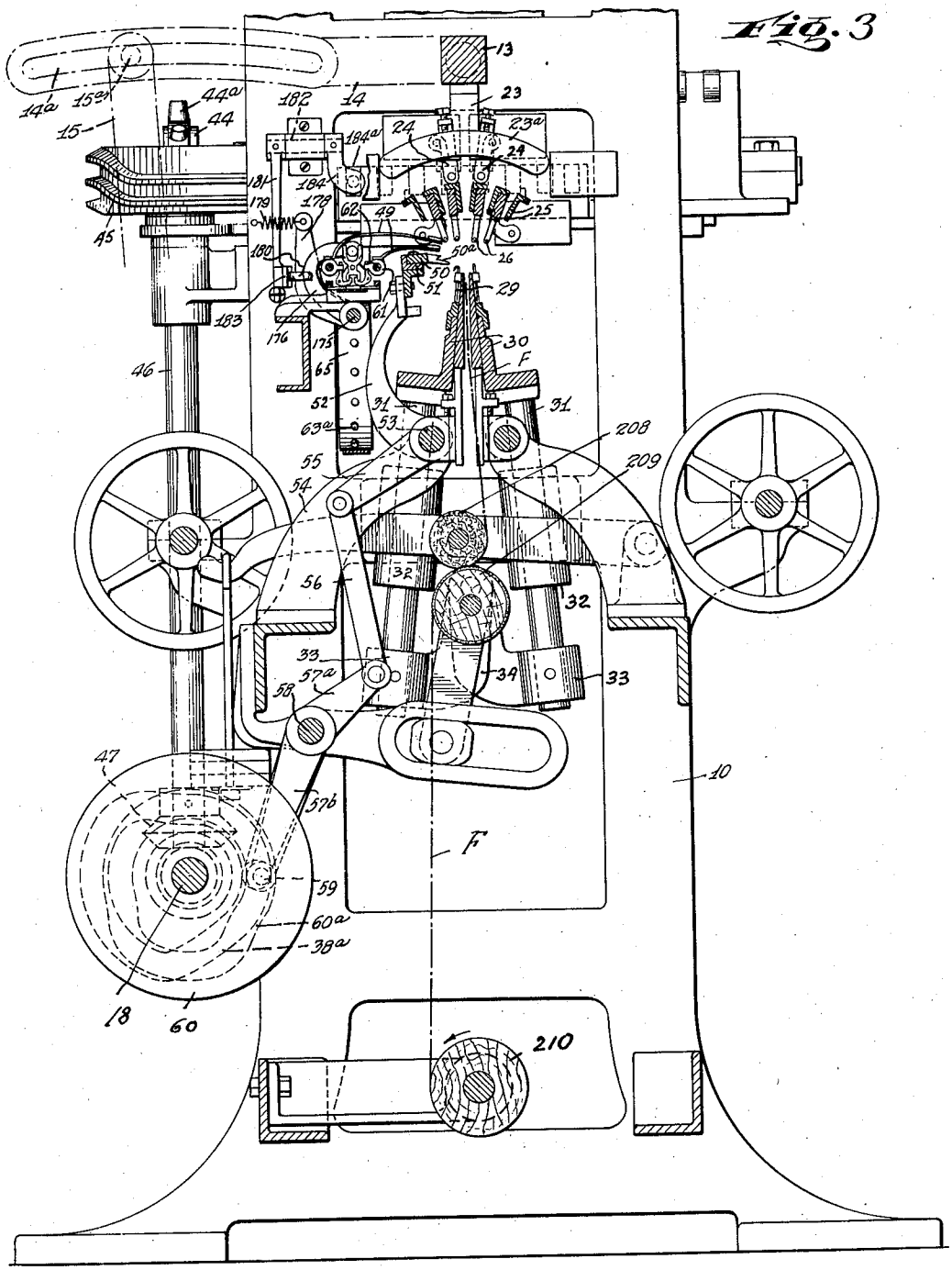
Fig. 3



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May 14, 1940. F. KLUMPP ET AL 2,200,280

KNITTING MACHINE

Filed Nov. 13, 1935 10 Sheets-Sheet 4

Fig. 4

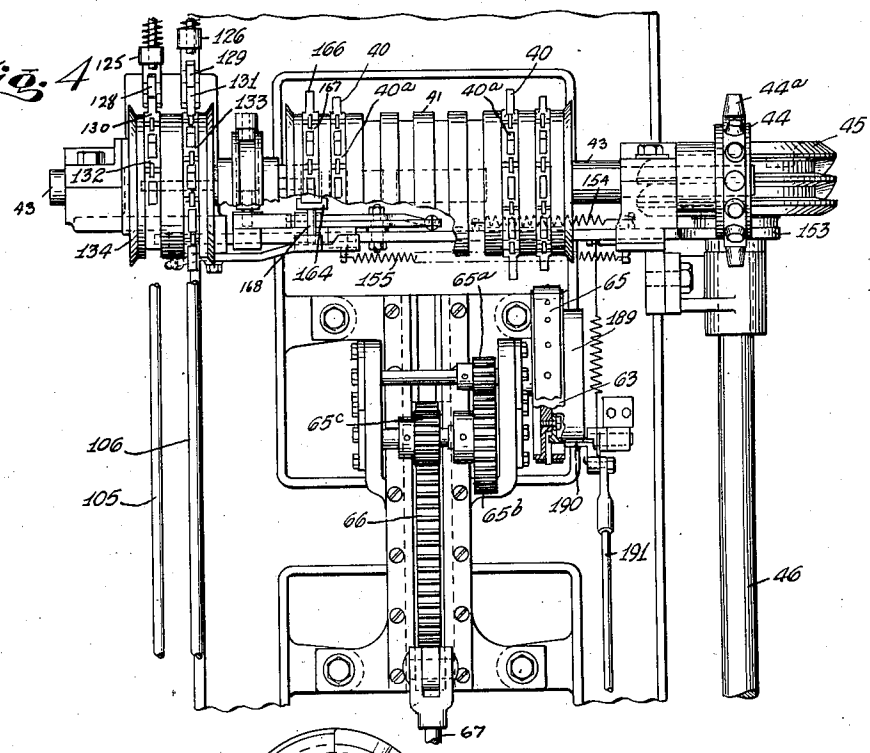
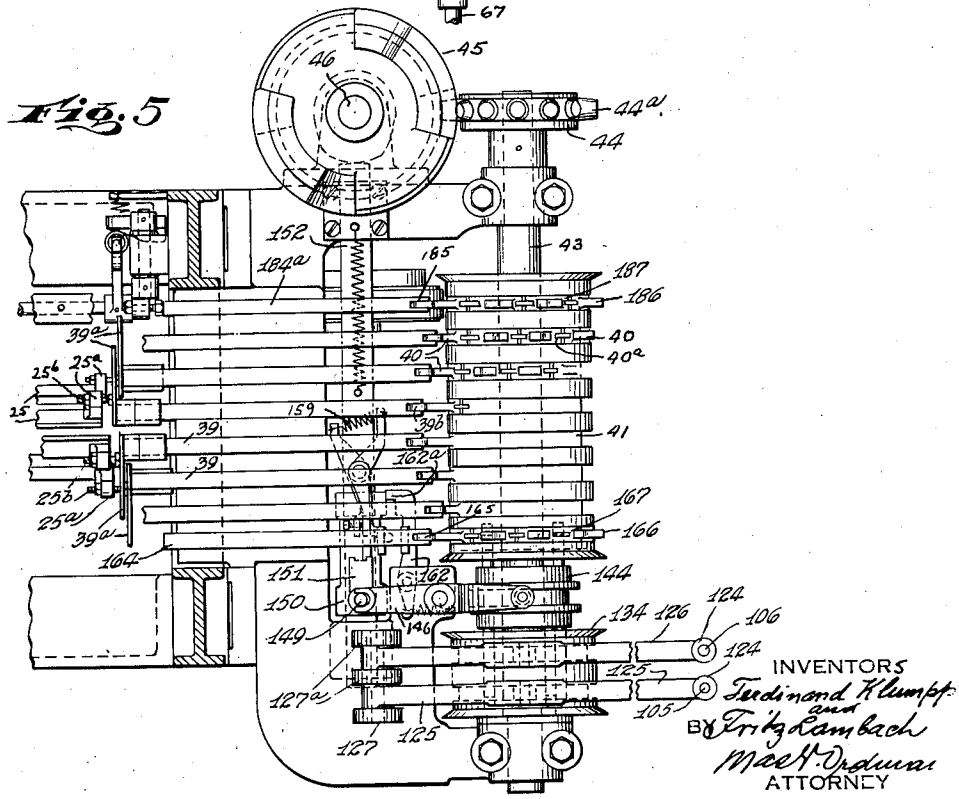


Fig. 5



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KNITTING MACHINE

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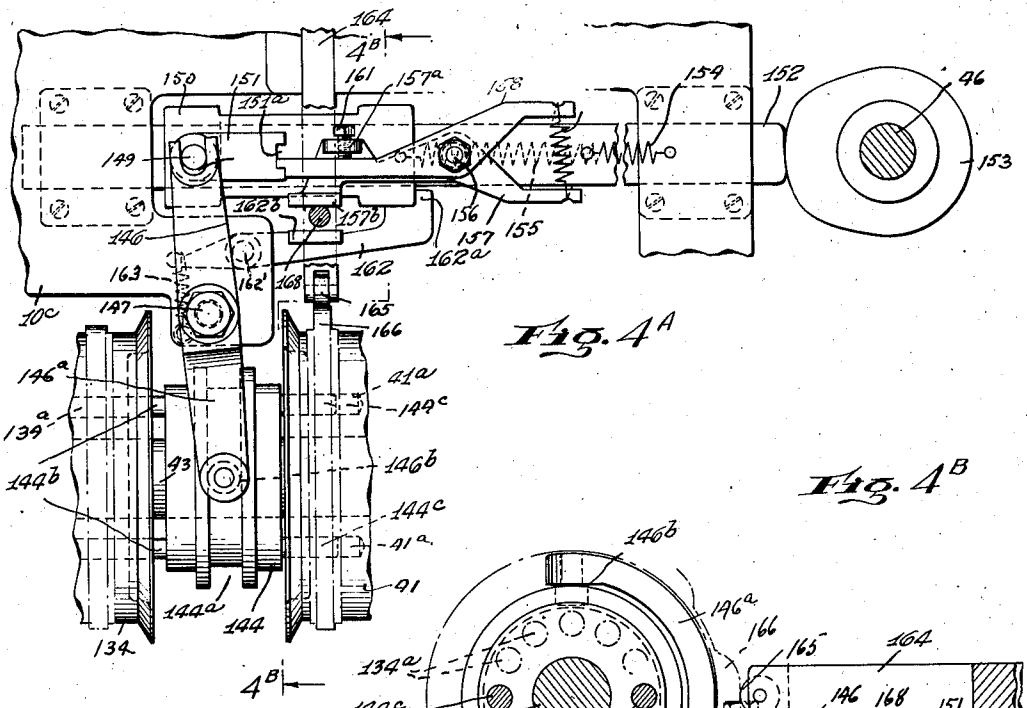

Fig. 4A

Fig. 4B

Fig. 4C

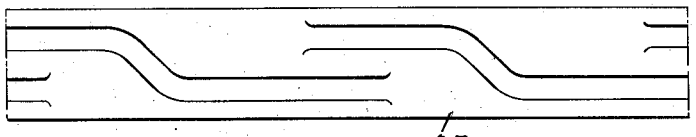

Fig. 4D

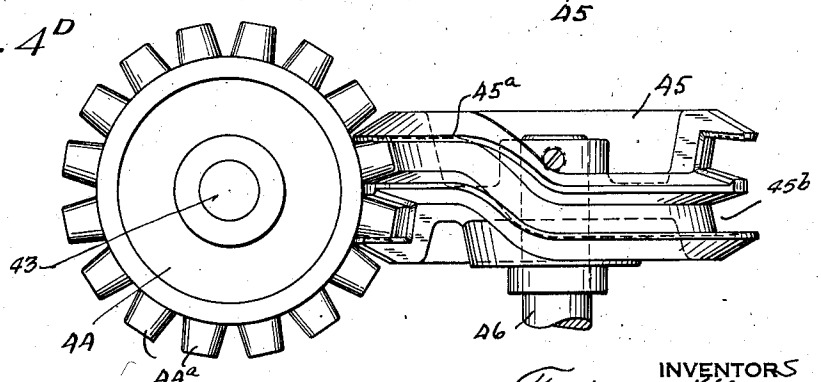

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Fig. 6

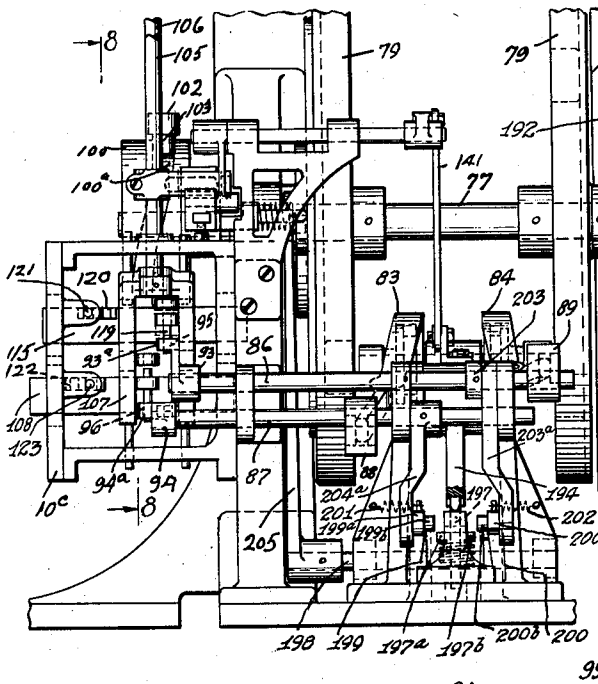

Fig. 8

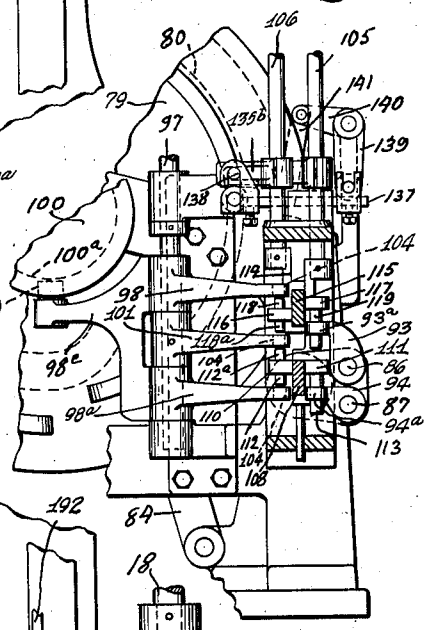

Fig. 7

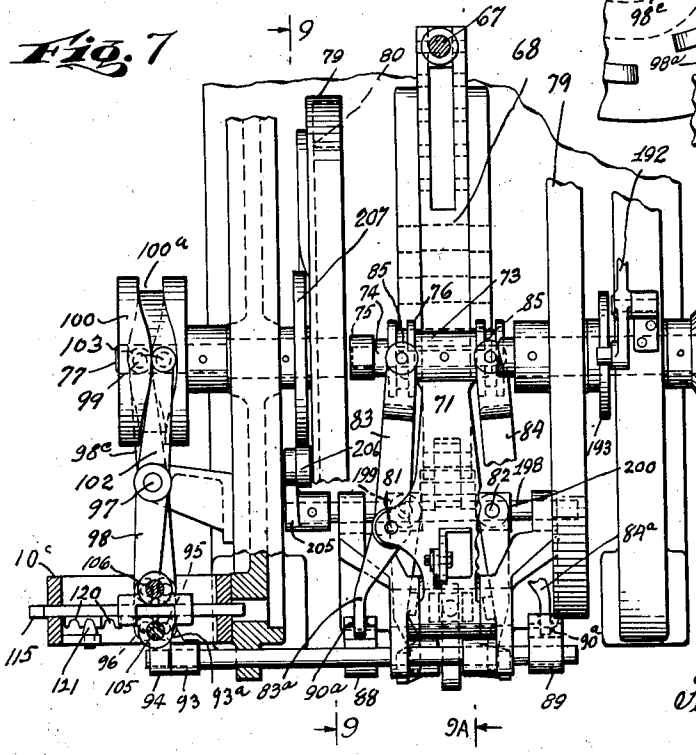

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Fig. 9A

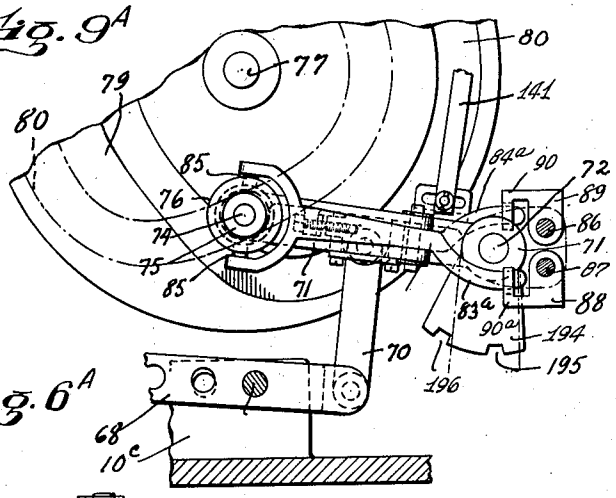
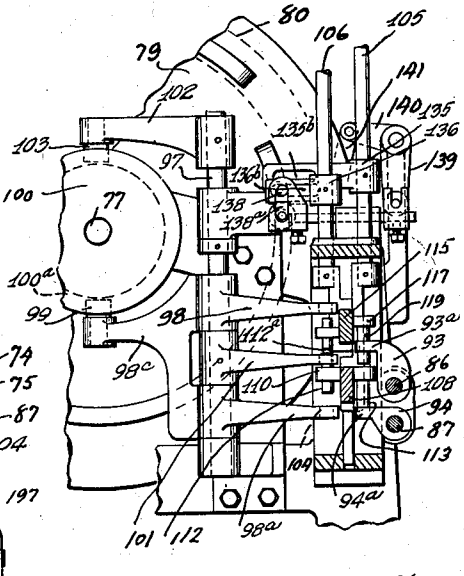


Fig. 6A

Fig. 8A



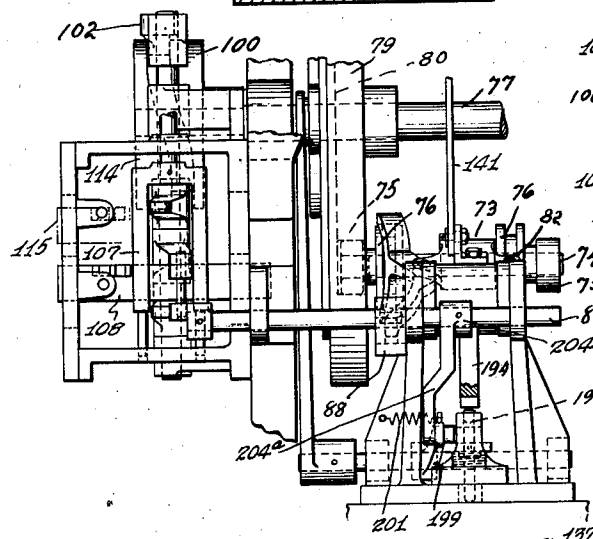
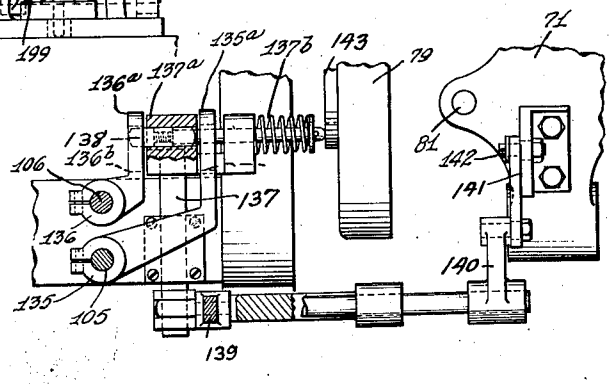


Fig. 10



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May 14, 1940. F. KLUMPP ET AL 2,200,280

KNITTING MACHINE

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Fig. 14

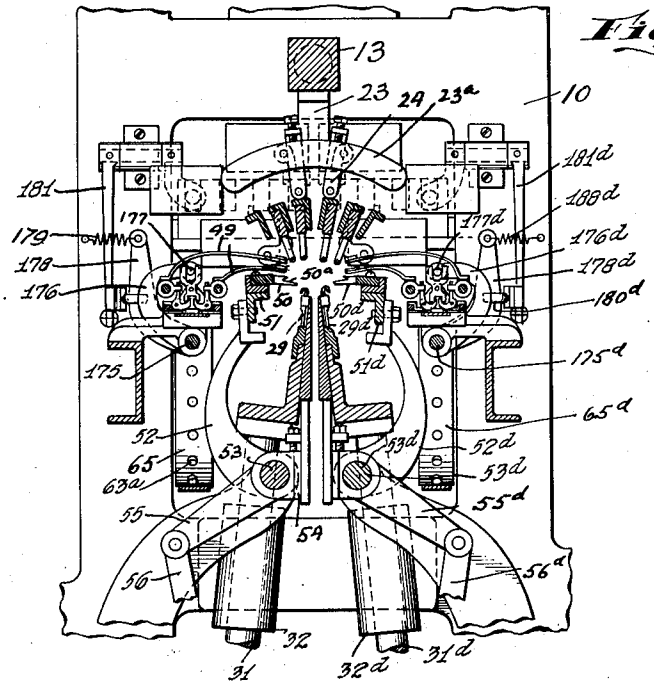


Fig. 12

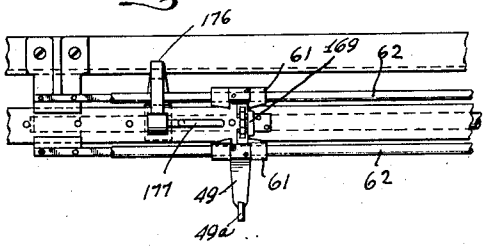


Fig. 12A

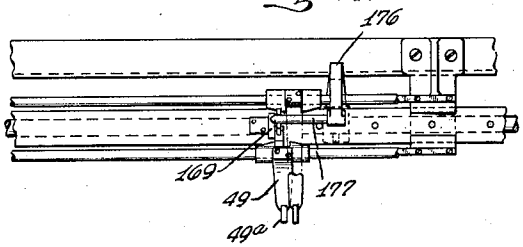
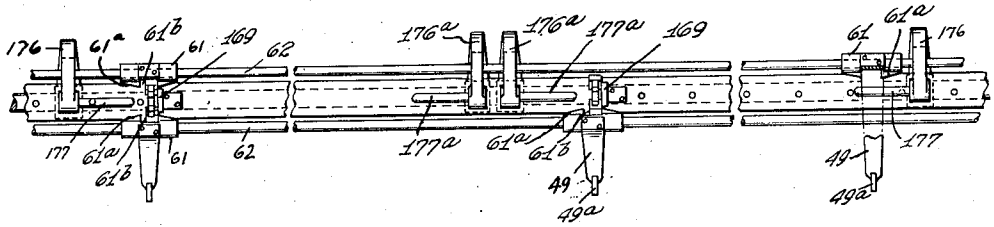


Fig. 13



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May 14, 1940. F. KLUMPP ET AL 2,200,280

KNITTING MACHINE

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Fig. 15

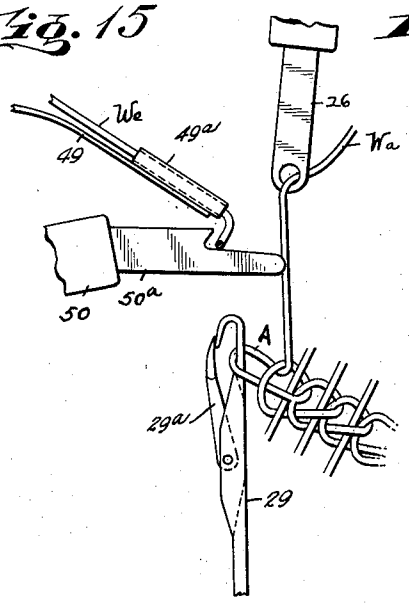


Fig. 15A

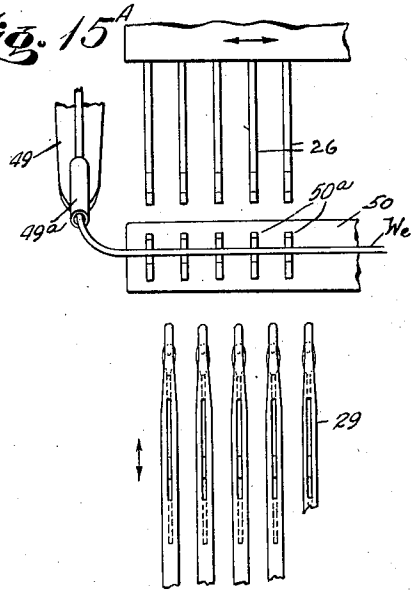


Fig. 16

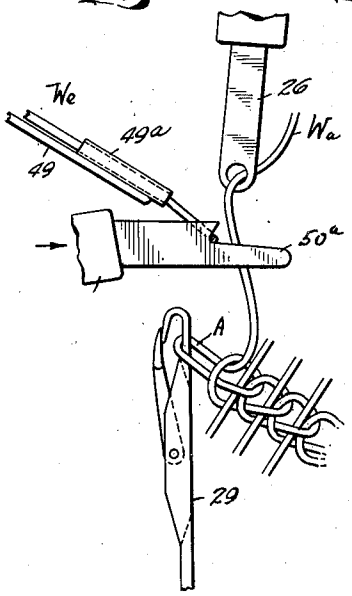


Fig. 17

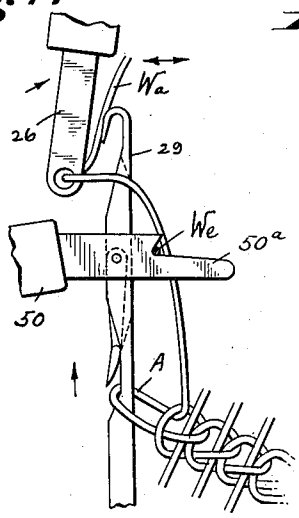
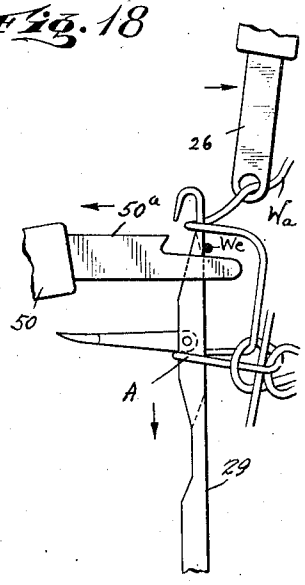


Fig. 18



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KNITTING MACHINE

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Fig. 19

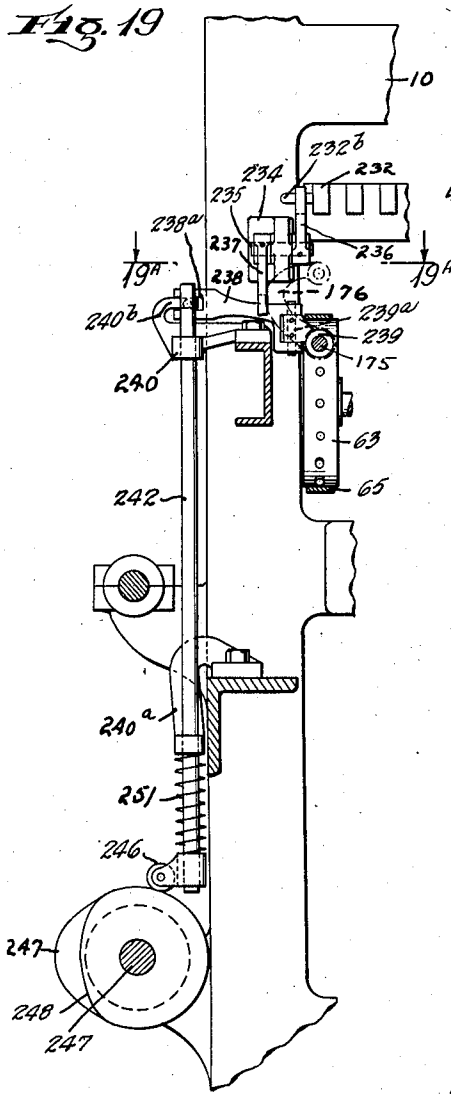


Fig. 20

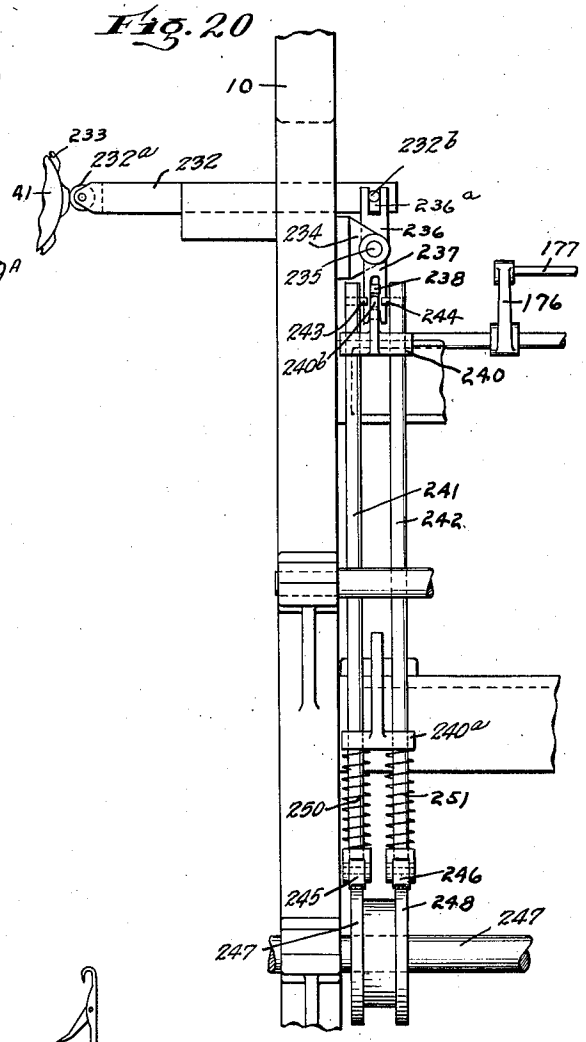


Fig. 21

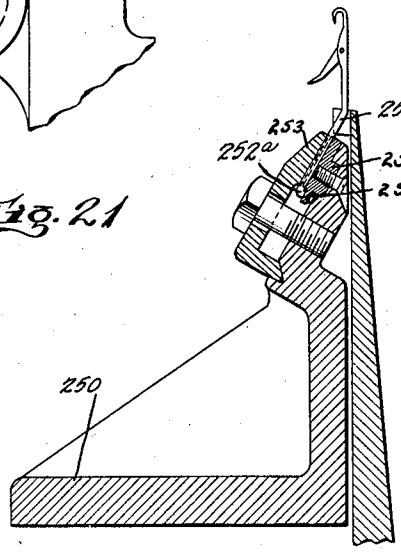
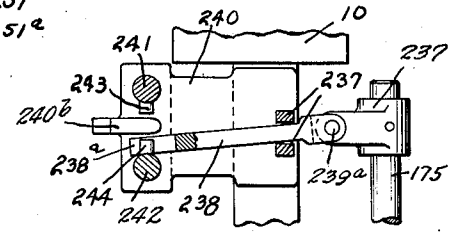


Fig. 19A



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Patented May 14, 1940

2,200,280

UNITED STATES PATENT OFFICE

2,200,280

KNITTING MACHINE

Ferdinand Klumpp and Fritz Lambach, Weehawken, N. J.; said Lambach assignor to said Klumpp

Application November 13, 1935, Serial No. 49,453

15 Claims. (Cl. 66—85)

This invention relates generally to improvements in straight knitting machines and particularly to that class thereof by which novel knitted and textile fabric comprising knitting warp, and non-knitting or weaving filling-weft can be manufactured. A machine made in accordance with this invention also may be employed as a warp knitting machine for conventional knitting as well as a warp knitting machine wherein weft-threads are introduced into the fabric as it is being produced.

The knitting machine contemplated by this invention is provided with novel filling-weft laying or weaving instrumentalities cooperating with the knitting facilites for producing a fabric comprising filing-weft threads (which may extend either from selvedge to selvedge or partly through the fabric and which may be present in any desired courses of the warp threads) enveloped by knitting loops or chains of warp threads, the filling-weft threads connecting with the knitted rows thereby preventing both longitudinal and transverse stretching and in general distortion of the fabric.

One or more filling-weft threads or yarns may be laid in each course of the warp and by employing yarns or threads of different colors for the filling-wefts and warps various desired designs and color effects of fabric may be obtained. The filling-weft may be either of a knitted or an unknitted construction, or of any other suitable construction.

An object of the present invention is to provide in a knitting machine novel, efficient and effective means for feeding, carrying, laying and controlling the distribution of filling-weft thread in desired courses of a knitting fabric.

A further object of this invention is to provide improved means for coordinating, determining and controlling the movements of the warp guide fingers units in their relation to the knitting needles and filling-weft feeding, controlling and laying mechanisms.

For facilitating the carrying out of some of the provisions and objects herein, other objects of this invention are:

To provide for the feeding of filling-weft thread or yarn to and introducing or laying the same into the fabric as it is being knitted, by having a weft carrier selectively connectable with and disconnectable from a flexible transmission band to which is imparted a non-uniform reciprocating motion, the extent of which motion being regulatable.

To provide for interrupting the laying of the filling-weft at predetermined intervals during the continuous running of the machine.

To provide friction brake means for arresting the motion of said band.

To provide a movable bank of projections or sinkers capable of receiving the weft thread directly from the carrier, of positioning the same adjacent the needles and of acting upon a preceding laid weft thread to press the same downwardly.

To provide for the simultaneous use of more than one filling-weft carrier for simultaneously feeding a plurality of weft threads to incorporate the same in separate fabrics simultaneously produced by the knitting machine.

A further object of this invention is to so coordinate the instrumentalities attaining objects hereinabove mentioned, that pattern or design composition and strength of fabric may be obtained to a far greater degree and extent than heretofore.

In a straight or flat knitting machine stitch formation is effected through cooperation between the vertical reciprocating movement of the latch-needle bank and the shiftable oscillating (looping) movements of the warp feeding guide fingers. The pattern effects are predetermined by the selective shiftable movement of the guide fingers which may carry yarns or threads of the same or different colors across one or more of the hooks of the needles, in accordance with a predetermined fashion to produce the desired pattern or design. For this purpose a needle bank is vertically reciprocated relative to a face plate against which it slides. Where two needle banks are employed they are slightly sloped toward each other to bring the needle hooks close together and the face plates against which the needles slide are spaced apart providing room for passage of the knitted fabric. The warp yarn or thread is directed and presented to the bank of latch-needles by the guide fingers of which there may be several units to accommodate different yarns or threads as desired. The reciprocation of the needle bank is determined by a cam. The oscillating movement of the warp feeding guide fingers units are controlled by cams. The shiftable or endwise movements of the warp guide fingers units are respectively controlled by individual pattern chains made up of special, interchangeable cam links. The cooperation of the above various instrumentalities exist in a standard form of straight knitting machine. The invention deals, in part, with improved novel means for coordinating and controlling the move-

ments of these instrumentalities in their mutual relation and in their relation to filling-weft feeding, controlling and laying mechanisms.

According to this invention one or more carriers, to each of which is imparted a controllable non-uniform reciprocating movement, feeds filling weft threads or yarns directly to sinkers which support and lay the same relatively between (1) a connecting link (coming from a preceding loop) and a succeeding loop of the same course as the connecting link and (2) a succeeding loop of a succeeding course which is carried through the said connecting link and supported thereby. One or more of these filling-weft threads may be laid in each course and by the use of more than one carrier, wefts different in quality or color may be laid in the same or different courses. The extent of the movements of the carriers are controlled so that the wefts, if desired, may be extended only partly through the width of the fabric. Active and inactive periods of the carriers are controlled in a predetermined manner by a pattern chain made up of special, interchangeable cam links trained on the same drum as the pattern chain controlling the movements of the warp feeding guide fingers bars or units.

A plurality of simultaneously operable carriers are provided for feeding a plurality of weft threads adjacent the needles to respectively incorporate the same in separate fabrics simultaneously produced by the machine.

The disclosure made the basis of exemplifying the present inventive concept suggest practical embodiments thereof, but the invention is not to be restricted to the exact details of this disclosure, and the latter, therefore, is to be understood from an illustrative rather than a restrictive standpoint.

In the accompanying drawings which form part of this specification and in which similar reference characters denote corresponding parts:

Fig. 1 is a broken front elevation of our knitting machine;

Fig. 2 is a left side elevation thereof;

Fig. 3 is an enlarged vertical section on line 3—3 of Fig. 1 seen in the direction of the arrows;

Fig. 4 is an enlarged view of the upper portion of the right end of the machine;

Fig. 4A is an enlarged top plan view of a coupling mechanism shown in Figs. 4 and 5;

Fig. 4B is a vertical section on line 4B—4B of Fig. 4A;

Fig. 4C is an evolution of the worm gear for driving the cam drum shown in Figs. 4 and 5;

Fig. 4D is a side elevation view of said gear and the pin wheel cooperating therewith;

Fig. 5 is a top plan view of Fig. 4;

Fig. 6 is an enlarged elevation of the lower right hand end of the machine;

Fig. 6A is an elevation of a detail of Fig. 6 shown in a different position;

Fig. 7 is a top plan view of Fig. 6;

Fig. 8 is a vertical section on line 8—8 of Fig. 6, seen in the direction of the arrows;

Fig. 8A is a similar sectional view to that of Fig. 8 showing a detail in a different operating position;

Fig. 9 is a vertical section on line 9—9 of Fig. 7 seen in the direction of the arrows;

Fig. 9A is a vertical section on line 9A—9A of Fig. 7 seen in the direction of the arrows;

Fig. 10 is a sectional plan view of a safety device shown in Figs. 5, 6 and 9;

Fig. 11 is an enlarged sectional elevation of the weft feeding mechanism;

Figs. 12, 12A and 13 are plan views of the weft feeding, guiding and control mechanism;

Fig. 14 is a partial vertical section similar to that of Fig. 3 of a modified form of construction;

Figs. 15 and 15A are diagrammatic views in side and front elevation of the knitting and weft feeding implements and illustrate the operations at the start;

Figs. 16, 17 and 18 are diagrammatic side elevations of the same implements illustrating the succeeding steps.

Fig. 19 is an enlarged partial vertical section similar to Fig. 3, illustrating a modification of the shuttle selecting mechanism;

Fig. 19A is a section along line 19A—19A of Fig. 19 seen in the direction of the arrows;

Fig. 20 is a front elevation of said modification; and,

Fig. 21 is a sectional detail illustrating a modified means for mounting latch needles.

Referring to the drawings, 10 and 10A denote the machine frame formed with vertically extending arms 10B in which are slidably supported superposed, transversely extending notched bars 11 carrying the beams 12 for the warp threads.

Extending longitudinally of the machine and suitably journaled in the end pieces of the frame is a rock shaft 13 (Figs. 1, 2 and 3). Attached to one end of the shaft is a laterally extending arm 14 having an arcuate groove 14^a in which engages a pin 15^a provided on the upper end of a vertically extending rod 15. The lower end of said rod 15 carries a roller 16 operating in a cam groove 17^a of a cam 17 mounted on the main driving shaft 18 of the machine, impelled from a motor 19 or other suitable source of power through a set of gears 20, 21 and 22.

Suitably fixed to said rocking shaft 13 and extending downwardly therefrom are a plurality of members 23 formed with arcuate yokes 23^a extending transversely of the machine and from each of which are suitably and adjustably suspended arms 24 for slidably and rockingly supporting bars 25. These bars 25 extend longitudinally of the machine and each carries a plurality of downwardly extending perforated loopers or guides 26 for the warp threads W^a which are adapted to cooperate with the usual latch needles 29 carried by a vertically reciprocating bar 30 (Figs. 1, 2 and 3) in knitting operation, as will be hereinafter fully described. At the upper edge of each bar 25 are fixed a series of longitudinally extending pins 27, which slidably pass through perforations provided in the lower ends of said arms 24. The ends of each bar 25 are fixed to arms 28 slidably mounted on horizontal pins 13^a suitably fixed to the shaft 13. Through this arrangement each bar 25 is able to be rocked around a horizontal axis, transversely to the machine, and also to be displaced in longitudinal direction thereof. Rocking motion is imparted to the shaft 13 and consequently to the looper bars 25 from the cam groove 17^a through the rod 15. Longitudinal reciprocal motion is separately imparted to each of the looper bars through the medium of the following mechanism:

At one of its ends each looper bar 25 is formed with an upwardly extending flange or knee 25^a (Figs. 1 and 5) in which are provided adjustable horizontally extending pins 25^b. Slidably guided in the frame 10 opposite said pins 25^b are a

plurality of parallelly and horizontally mounted slides 39, corresponding in number to that of the looper bars 25. The inner end of each slide 39 has a transversely extending segment 39a adapted to be constantly in contact with the respective looper bar pin 25b. The end of pin 25b, when rocked about rock-shaft 13 with bar 25 moves in an arcuate path on the surface of segment 39a. The opposite or outer end of each slide 39 is provided with a cam follower or roller 39b (Figs. 4 and 5) adapted to cooperate with a set of exchangeable cam links 40 borne in well known manner in chain form 40a on a rotary drum 41. Suitable means, such as spring 42 acting on arm 28 adjacent to the flange 25a is provided to keep the pin 25b constantly in engagement with the face of the corresponding segment 39a of the slide 39. As the chain drum 41, driven in a manner to be presently described, rotates, the roller 39b in contact with the cam links 40, displaces the slide 39 which in its turn by its segment 39a contacting with pin 25b causes the corresponding looper bar 25 to be displaced horizontally, so that the loopers 26 will cooperate with said latch needles 29 in performing the knitting operation in the manner hereinafter to be described.

The rotary drum 41 (Figs. 1, 4 and 5) is mounted on a suitably supported shaft 43, which is adapted to be intermittently rotated. Such intermittent or step by step rotation may be imparted to shaft 43 by any suitable means. However, for the purpose of effecting a positive and noiseless drive and eliminating clutches or other auxiliary elements we employ the following means:

Keyed or otherwise fixed to shaft 43 is a driven pin gear 44 whose pins 44a are conically shaped and extend radially from the circumference of said gear. Two pins 44a are adapted to engage simultaneously with gear 45 suitably mounted at right angles to gear 44 on a shaft 46, which through bevel gears 47 and 48 (Figs. 1 and 6) is driven from the main shaft 18. By reason of simultaneous engagement of at least two pins 44a in the cam gear, the gear 44 will be held against slipping.

As previously stated the different sets of loopers 26 cooperate with a set or bank of latch needles 29 to produce the knitted fabric. In the example shown, two sets or banks of such latch needles are shown, parallelly mounted and suitably spaced from each other, each set being independently controlled, for the purpose to be hereinafter described.

The reciprocation of each of bar 30 is effected by providing at its ends downwardly extending rods 31 suitably fixed thereto and slidably borne in guide sleeves 32 suitably supported in the frame. Attached to the lower end of each of said rods 31 is a collar 33 formed with an arm 34 extending laterally therefrom. (Figs. 1–3.) The arms 34 are connected to respective arms 36 of bell crank levers through respective links 35, said levers being rotatively borne on shaft 58. The other arms 36a of said bell cranks carry rollers 37 which operate in respective cam grooves 38a of cams 38 (Fig. 1), suitably mounted on the main driving shaft 18. By the above described mechanism purely knitted fabric can be produced. In order to permit the production of knitted fabric with limited stretch and variegated design, by using fillers of weft thread to extend across the knitted fabric, we provide the following means:

The weft thread We is adapted to be fed longitudinally of the machine and transversely of the bank of latch needles 29 by means of weft feeders or shuttles 49, the latter being suitably moved in a manner to be presently described. During their longitudinal movement the said feeders are adapted to deposit the weft thread We on tine like projections 50a provided on weft sinkers or guides 50 arranged in front of the bank of latch needles 29 and movable transversely thereof. (Figs. 3 and 11.) The tine shaped projections 50a are adapted during the knitting operation to carry the weft thread We to the back of said needles to be interlocked with the loops formed by the knitting implements. To this end a plurality of such sinkers are suitably mounted on a horizontal bar 51 (Fig. 3) and are so disposed relative to the bank of needles 29 as to operate through the spaces between said individual needles. The bar 51 is suitably supported on the upper ends of a lever arm 52 whose lower end is fixedly mounted on a horizontally extending rotary shaft 53 journaled in stationary brackets 54 and operated from the main driving shaft 18 by means of a crank 55. The latter is connected by a link 56 to one arm 57a of a bell crank rotatively mounted on shaft 58. The other arm 57b of said bell crank carries a roller 59 which engages a cam groove 60a in a cam 60 fixedly mounted on the main driving shaft 18 (Fig. 3). By these means the weft guides are caused to reciprocate transversely of the machine in a predetermined time relationship to the needles 29, so as to carry the weft thread behind the needles during the knitting operation of the machine.

The weft feeder or shuttle 49 comprises a tubular member 49a formed on a curved arm 49b extending transversely of the machine and slidably mounted by means of a sleeve 61 on a horizontally disposed rod 62 which extends longitudinally of the machine. In the present embodiment, as shown in Figs. 1, 2, 3 and 11 there are two weft feeders 49 of identical construction. Each sleeve 61 is provided on its periphery with a projection 61a having a recess 61b (Figs. 12, 12A and 13). Auxiliary parallel guide rods 62a (Fig. 11) to which the arms 49b of the feeders 49 are attached by spring clips 49c, serve to properly guide the arms 49. (Fig. 11).

Suitably mounted between and engaging spikes or pins 63a provided on pulleys 63 and 64 rotatively borne at opposite ends of the machine is an endless longitudinally perforated band 65, (Figs. 1, 2, 3, 4 and 11) which in the present embodiment is made of a flat flexible strip of metal or the like. The pinned pulley 63 is driven from the main shaft 18 through gears 65a, 65b and 65c, and vertical rack 66 meshing with gear 65c. The lower end of the rack is joined by a link 67 to one end of a lever bar 68 which is adjustably journaled at 68a intermediate its ends in a bracket 10c of the frame (Fig. 1), so that the stroke of the rack 66 and consequently that of the band 65 may be varied at will. The opposite end of lever 68 is connected by a link 70 (Fig. 1) to a rock arm 71 (Fig. 9A) whose one end is carried on a rotatable horizontally disposed shaft 72 journaled in the bracket 10c and the other end of which is formed to a journal 73 (Figs. 6A and 7), slidably and rotatively bearing a shaft 74 each end of which carries a cam follower 75. Intermediate its ends said shaft has fixed thereon circumferentially grooved sleeves or members 76 for the purpose hereinafter described. Fixed to a shaft 77 suitably extending above shaft 72 (Figs. 6A and 9A) and located at opposite sides of the cam followers 75

and journal 73 (Figs. 6 and 7) are cam disks 79 having cam grooves 80 on their inner faces in which are adapted to alternately engage the cam followers 75, as will be more fully described. For the purpose hereinafter specified, the spacing between the two cams is so admeasured as to permit two positions of the cam followers, to wit, engagement of the left hand cam follower in the left hand cam groove, or engagement of the right hand cam follower in the right hand cam groove. Shaft 77 is driven by bevel gear 78 meshing with gear 78a on shaft 18.

Selection of the particular position is automatically effected by the following means:

The rock arm 71 has pivotally mounted in it at each side, as at 81, 82, levers 83 and 84, which are rotatable about vertical axes (Fig. 7). The inner ends of levers 83 and 84 are each provided with a pin roller 85 engaging the grooves of the annular members or sleeves 76 at diametrically opposite points.

Transversely slidable, vertically superposed, horizontal shafts 86 and 87 (Figs. 4, 9 and 9A) are suitably supported in brackets in front of shaft 72. Keyed to the respective shafts 86 and 87 are sleeves 89 and 88, respectively having laterally extending oppositely directed vertical hook shaped projections 90 and 90a respectively, adapted to engage the respective ends 84a and 83a of levers 84 and 83 (Fig. 7), so that movement of the latter is thus controlled by movement of the respective shafts 86 and 87.

Also fixed to the shafts 86 and 87 by means of sleeves 93 and 94, are arms 93a and 94a, respectively, which in their free ends are formed with vertical holes 95 and 96 respectively (Fig. 6).

Borne in the bracket 10c of the frame is a vertically extending rotary shaft 97, on which is rotatively mounted a rock lever formed with a pair of horizontally extending spaced arms 98 and 98a, and a third oppositely extending arm 98c, which latter at its free end is provided with a cam follower 99 (Figs. 8, 8A). The cam follower 99 engages in a cam groove 100a formed on the peripheral surface of a cam 100 keyed to shaft 77. Keyed or otherwise fixed to the vertical shaft 97 and extending intermediate and in the same direction as the spaced arms 98 and 98a, is an arm 101, and to the upper end of said shaft a crank arm 102. The latter is provided at its free end with a cam follower 103 adapted to engage in the cam groove 100a at a point diametrically opposite that of cam follower 99. The movement of the pair of arms 98 and 98a and arm 101 are, therefore, aways in opposite directions. Each of said last named arms is provided at its free end with a vertical hole 104, the three holes being at the same distance from the axis or shaft 97 (Figs. 8 and 9A). The shafts 86 and 87 are thus shifted longitudinally by causing them to be coupled either to arms 98 and 98a or to arm 101. This coupling is controlled automatically in the following manner:

There are two vertical slidably supported rods 105 and 106 of which rod 105 has fixed to its lower end a downwardly extending yoke 107 (Figs. 6 and 6A) in which is carried a transversely slidable bar 108. This bar has two oppositely extending lateral arms 110 and 111 (Figs. 8 and 8A) of which arm 110 is provided with oppositely extending vertical pins 112 and 112a and arm 111 with a vertical downwardly extending pin 113 (Fig. 8). The relative location of said pins is such that vertical movement of rod 105 downwardly will cause pin 112 to engage in the hole 104 of arm 98a. Pin 113 engages in the hole 96 of arm 94a (Fig. 6) and is so admeasured in length as to always engage said hole irrespective of the upward or downward movement of the rod 105. A similar coupling means is attached to the lower end of rod 106 comprising a yoke 114 carrying a transversely slidable bar 115 with oppositely extending lateral members 116 and 117 (Figs. 6A, 8 and 8A). Opposite vertically extending pins 118 and 118a on member 116 adapted to engage respectively in the hole either in arm 101 or 98 are provided. Likewise a pin 119 extending vertically downward from member 117 engages the hole 95 in arm 93 irrespective of the upward or downward movement of rod 106 (Figs. 6, 8).

Bar 115 is provided with two vertical slots 120 (Figs. 6 and 7) along one of its sides, in any of which a suitable locking pin 121 extending from bracket 10c may engage (Fig. 6). The spacing of said slots corresponds to the aforenamed two positions of the cam followers 75 (Fig. 7) and serves to lock the bar 115 against sliding after it has been moved into one of said positions. While the bar 115 is in coupling position, the said slots are clear of the locking pin.

A similar set of slots 122 are provided on bar 108 together with the locking pin 123 on the bracket 10c.

Rods 105, 106 are yieldingly connected by means of spring couplers 124 (Fig. 1) to respective ends of horizontally extending parallel levers 125 and 126, the opposite ends of said levers being rotatively supported on a shaft 127 borne in uprights 127a (Fig. 1). The levers are each provided intermediate their ends with respective cam following rollers 128 and 129 (Figs. 1 and 4). These rollers serve to engage on respective high or low exchangeable selector cam links 130 and 131 on the respective cam chains 132 and 133, the latter being mounted on the rotatively borne drum 134 on shaft 43. The said drum is adapted to be coupled to said shaft in a manner to be presently described. The selector cam links 130, 131 automatically control the operation of said rods 105 or 106, so that according to which of them is operated, the coupling mechanism which controls the movement of the cam followers 75 into their two aforenamed positions will be operated.

The internal cam grooves 80 on the cam disks 79 (Figs. 6A and 9A) which face each other are so shaped as to move the followers 75 rapidly but not abruptly and to return them to rest in the same way, the motion beginning and ending at speeds less than the maximum in order to accelerate the followers 75 at a relatively low rate. The grooves 80 are each of the same shape but 180° out of phase with each other for the purpose of permitting depositing of weft threads in alternate courses without the necessity of stopping the machine. Use of a single cam would result in depositing a weft thread in each course with the gearing ratio used in the machine. When it is desired to insert a weft thread in alternate courses both cams are used by shifting the cam followers 75 alternately from one cam into the other and vice versa.

To insure timely entering of the cam followers 75 into their respective cam grooves and thereby prevent shifting of the former while not in alignment with the opposite cam groove which may result from an error of the operator in the

arrangement or choice of the proper cam links, we provide the following safety device:

Rods 105 and 106 have respectively mounted thereon collars 135 and 136 (Fig. 10) which latter have laterally extending, parallel arms 135a and 136a. Reciprocally and slidably supported in bracket 10c and extending between the said arms is a bar 137 whose inner end has a transverse member 137a through which is guided an engaging pin 138. The latter is so admeasured in length as to extend either to the right or left of said guide member 137a and engage one of the slots 135b or 136b formed in the parallel arms 135a and 136a respectively.

Reciprocation of bar 137 is effected through pin and slot engagement at its outer end with a crank 139 (Figs. 8A and 10) operatively connected to rock arm 71 at 142 through levers 140 and 141. Movement of the rock arm thus reciprocates bar 137. Extending laterally through a suitable slot (not shown) in guide 137a from the pin 138 is a member 138a (Fig. 8A). A spring actuated plunger 137b suitably supported from the guide 137a and movable in the same direction as pin 138 is attached to said member 138a at one end and its opposite end is adapted to ride on an external cam 143 which is provided on the outer face of cam disk 79. Said external cam 143 consists of two circular segments 143a and 143b (Figs. 1 and 9) concentric about the axis of the drive shaft 77, spaced 180° out of phase. The terminals of said segments are separated from each other by suitably admeasured spaces at diametrically opposite points. While the plunger 137b rides on the segments of the cam 143, it forces pin 138 into engagement with slot 136b, locking rod 106 against vertical movement and making the mechanism controlled by said rod ineffective. Should a high link at this time engage the roller on lever 126 the movement of the latter will be taken up as lost motion by the spring coupling connector 124 (Fig. 1). Rod 105 during this period is free. Whenever the plunger 137b rides off the cam 143 into one of the spaces between the segments thereof, pin 138 is shifted out of engagement with slot 136b, and enters engagement with slot 135b, freeing rod 106 and locking rod 105. By the proper arrangement of the cam segments, therefore, rods 105 and 106 can be alternately locked, so that the mechanism controlled by them can also be locked to prevent improper shifting of the cam followers 75.

The selector drum 134 which is rotatively mounted on shaft 43 adjacent drum 41 may be removably coupled and driven from the latter in controlled manner as follows:

Rotatively borne on the shaft 43 between the two drums is a coupling collar 144 provided with an annular groove 144a. Extending on opposite sides of said collar and diametrically opposite each other are sets of coupling pins 144b and 144c. Pins 144b are so admeasured in length as to permanently but slidably engage in suitably provided holes 134a in the side wall of drum 134. A plurality of suitably spaced holes 41a are provided in the adjacent face of drum 41, and pins 144c may removably engage in any diametrically opposite pair of said holes by sliding collar 144 longitudinally along the shaft 43 towards them (Figs. 4A and 4B).

Longitudinal shifting of collar 144 is effected by means of lever 146 (Figs. 4, 4A, 4B, 5) fulcrumed at 147 to part 10e of frame 10 and forked at one end as at 146a, said forks engaging with pins 146b in groove 144a of collar 144. The opposite end of said lever is grooved as at 148 engaging pin 149 extending laterally from a sleeve 150 slidably borne on a bar 152 extending parallel to shaft 43 and slidably mounted in the machine frame. One end of said bar 152 is continually urged against a cam 153 keyed to shaft 46 by a suitable tensioning spring 154 attached to said bar and said part 10e of machine frame. Suitable tensioning means 155 between part 10e of said frame and said sleeve 150, urge the latter in the same direction as bar 152. Pivotally mounted at 156 (Fig. 4A) in scissors-like fashion on the bar 152 are two levers 157 and 158, the free ends of which are being contracted by suitable tensioning means, as spring 159. The other end of lever 158 engages a suitably shaped recess 151a formed on a member 151 projecting from the surface of sleeve 150, and thereby transmits motion of bar 152 to said sleeve. The other end of lever 157 is forked, the tines 157a and 157b of which project upwardly at both sides of lever 158. The tine 157a carries an adjustment screw 161 or other suitable means which serves for the proper positioning of the operative end of lever 158 in the recess 151a. Tine 157b is provided with a bearing surface on its outer face for a purpose to be presently described.

Fulcrumed at 162' to part 10e of frame is a catch lever 162 (Fig. 4A) whose one end is provided with a projection 162a adapted to engage and lock the sleeve 150 against sliding. The opposite end of said lever is attached to part 10e of machine frame by a spring 163. Lever 162 is provided with a lateral extension 162b extending parallel to and spaced from tine 157b of lever 157.

Extending transversely of bar 152 above the latter and slidably borne in the machine frame adjacent to and parallel to bars 39 is a bar 164 (Fig. 5) one of whose ends is provided with a cam roller 165 adapted to follow removable links 166 (Figs. 4 and 5) borne on a chain 167 mounted on the drum 41. Extending vertically from said bar 164 and between the tine 157b and extension 162b is a pin 168. Suitable tensioning means (not shown) maintain said roller in contact with said cam links. Operation of the coupling means above described is as follows:

Rotation of cam 153 causes movement of rod 152 against action of spring 154 causing lever 158 to move sleeve 150 against action of spring 155 into position whereby catch lever 162 is moved into locking position to prevent return of sleeve 150 to its initial position. In this locked position ring 144 is moved by lever 146 so that pins 144c are coupled to drum 41 and the latter then causes rotation of drum 134. If bar 164 now is moved to cause pin 168 to force catch lever out of engagement with sleeve 150, the latter will return to its initial position, under action of its spring 155 and shift pins 144c out of engagement with drum 41, uncoupling it from drum 134.

Movement and selection of the shuttles 49 is effected as follows:

Selectively fixable to the endless band 65 at an opening or perforation thereof is an upright support or carriage 169 extending upwardly between the sleeve supporting bars 62 (Fig. 11). Pivotally supported from said upright 169 are toggle levers 170 and 171 having vertically extending arms 170a and 171a respectively, each adapted to engage in the recess 61b of one of the shuttle carrying sleeves 61. Suitable tensioning means as springs 172 and 173 attached to the respective upright arms and to suitable laterally projecting

members from the upright 169 tend to rotate the respective arms in opposite directions. The levers are also provided with arms 170b and 171b which project towards each other and have parallelly upwardly extending projections 170c and 171c. Pivotally mounted to the upright 169 above the toggle levers is a rock lever 174 whose lower end is forked and between the tines 174a of which the projections 170c and 171c of the toggle levers extend. The free end of rock lever 174 is provided with a vertically extending slot 174b.

Keyed to an oscillatable shaft 175 (Figs. 1 and 11) extending longitudinally of the machine frame and which is suitably journaled in the end pieces thereof, is a crank arm 176 whose free end projects into the path of the rock lever 174. Extending longitudinally from said end and suitably supported therefrom is a pin 177, onto which the slot 174b may ride. During engagement of said pin on said slot clockwise rotation of the crank on 176 will cause counterclockwise rotation of toggle lever 171 against the action of spring 173 causing upright arm 171a to rotate free of the engaging recess 61b on the corresponding sleeve 61, uncoupling the latter from the band 65. In like manner, counterclockwise rotation of the crank arm 176 will cause clockwise rotation of the upright arm 170a against the action of its spring 172 releasing the said arm from the corresponding recess 61b. In neutral initial position both toggle levers are free to engage in the respective recesses. Through proper rotation, therefore, either of the desired shuttles (two being shown) may be uncoupled or coupled to the driving band 65.

The desired rotation of the crank arm 176 is obtained by a lever 178 (Figs. 3 and 11) one end of which is keyed to shaft 175 and the other end of which is connected through suitable tensioning means as spring 179 to the machine frame. A suitable cam roller 180 is borne in one edge of the crank 178. A cam lever 181 is rotatively supported from the end piece 10 on a shaft 182 and near its lower end is provided with a laterally projecting cam surface 183, on which the roller 180 contacts, whereby rocking of lever 181 will cause rotation of crank 178 as the cam surface sweeps past the said roller. Rocking of lever 181 is effected through a crank 184 keyed to shaft 182 whose free end engages the outer end of a slide bar 184a (Figs. 3 and 5) the latter mounted parallel to the bars 39 and provided at its inner end with a roller 185 which is adapted to follow exchangeable cam links 186 on a cam chain 187 borne on the drum 41. Suitable tensioning means as spring 188 attached to the free end of lever 181 and to the end piece serves to urge continuous engagement of a roller 185 with the cam links 186. Through said cam links, therefore, properly timed rotation of the crank 176 and consequent selection of the shuttles 49 may be effected. As shown in Figs. 12 and 12A, selection is made at each end of the stroke of the shuttles by providing duplicate sets of crank arms 176 one at each end of said stroke, the only difference in structure being the extension of the pins 177 in opposite direction. In the modification of Fig. 13 two shuttle slides are shown mounted on each of the guide bars 62. Likewise a pair of uprights 169 and associated apparatus are spacedly mounted on the band 65. A pair of shuttle sleeves is controlled by the mechanism on each upright 169. The stroke of the band 65 is reduced by proper shifting of the fulcrum of lever 68 to reduce the stroke of the rack 66 and two additional crank arms 176a keyed to the shaft 175 halfway between the extreme cranks 176 are provided, the pins 177a thereof extending in opposite directions. Thereby selection of any of the desired sleeves at the stroke ends of the band 65 may be effected.

Suitable braking means to overcome the inertial effects at the end of each stroke of the reciprocally moving band 65 are provided in the form of a brake drum 189 (Fig. 4) attached to the pulley 63 with which a brake 190 cooperates. The latter is suitably operated through a brake rod 191 and bell crank lever 192 (Figs. 6 and 7) controlled by a cam 193 on shaft 77.

The rock arm 71 is adapted to be automatically locked in the two extreme positions of its reciprocal rotary motion about the shaft 72 to prevent undesired motion during non-weft feeding periods of the machine operation, by means of a downwardly extending sector 194 (Fig. 9A) attached to said arm and having two spaced notches 195 and 196 separated by a distance equal to the angular displacement of said rock arm. Slidably mounted in a support extending from the base of the frame 10c is a spring actuated plunger 197 (Figs. 6A, 9, 9A) adapted to engage in either of said slots, and when so engaged serving to lock the arm 71 against rotation. Cam controlled release mechanism timed to properly move said plunger out of engagement with the respective slot during rotary movement of arm 71 is provided and may comprise the following mechanism:

Slidably borne on a transversely horizontally extending shaft 198 (Figs. 6, 6A, 7 and 9) are two spaced slidably keyed collars 199 and 200 provided with laterally extending arms 199a and 200a respectively, projecting on opposite sides of said plunger. Laterally extending from the respective arms are projections 199b and 200b, which may engage respective projections 197a and 197b extending from the said plunger 197. Suitable tensioning means as springs 201 and 202 serve to urge the respective projections out of contact. Keyed to the shafts 86 and 87 are the respective collars 203 and 204 having the respectively downwardly extending arms 203a and 204a which engage respectively the arms 200a and 199a. Thus shifting of either of the respective rods 86 or 87 will cause corresponding shift of the respective arms 200a or 199a, causing one of the latter at a time to engage by means of its projection 199b or 200b, one of the respective projections 197a or 197b of plunger 197. Rotation of the arms 199a or 200a downwardly while such engagement exists will force the plunger 197 out of engagement with the engaged slot in the sector 194. Such rotation is effected by means of the crank arm 205 keyed to the shaft 198 and provided at its free end with the cam following roller 206 which engages the cam 207 keyed to the shaft 77.

The finished knitted material F (Fig. 3) which passes down through the space between the two sets of latched needles 29 is carried between tensioning drums 208 and 209 and on to a receiving drum 210.

Drum 209 is driven through a pinion 212 (Fig. 1) keyed to shaft 209a which supports the drum. Said pinion meshes with a pinion keyed to a shaft 213 rotatively supported on the end piece 10a. Keyed to the latter shaft are ratchet wheels 214. A split driving pawl 215 (Fig. 2) is pivotally mounted to a member 216 and has spring means urging one of its halves against each of said wheels. The member is pivotally supported by pins 216a in a slot 217a of a bracket arm 217 mounted on the end piece 10a. Said member is

oscillated by an eccentric 218 on shaft 18 through a connecting rod 219, so as to cause the ratchet wheel it engages to be advanced a single tooth or more per revolution of shaft 18 and cause corresponding rotation of roller 209. A crank handle 220 keyed on shaft 213 serves for manual rotation of said roller if desired. A split locking pawl 221 suitably supported from the machine frame prevents unwinding of the roller during the return stroke of the feeding pawl by engagement with either one of the other of said two ratchet wheels.

The receiving roller 210 is driven from the shaft 209a by a bevel gear 222 (Fig. 1) on said shaft which meshes with a gear 223 on a vertically supported shaft 224 on which a second bevel gear 225 is keyed, the latter meshing with a bevel gear 226 on supporting shaft 210a of roller 210. The latter has a suitable clutch 227 and slip coupling 233 so that the fabric may be kept tightly rolled on the roller 210 and that the latter may be coupled or uncoupled at will from the driven shaft 210a.

Manual drive for the entire machine is provided by mounting shafts 228 and 229 (Figs. 1 and 3) between the end pieces at the front and back of the machine respectively. Hand wheels 230 (Fig. 1) are keyed to the respective shafts which respectively also have the gears 228a and 229a keyed thereto. The latter mesh respectively with gears 22 and 21.

A control S for the power source is mounted to end piece 10a and may be operated either from front or back of the machine by means of longitudinal rotatable rods 231 (Fig. 1) mounted respectively to front and back of the machine and provided with cranks 232 connected by suitable links (not shown).

The modification of Fig. 14 provides for the knitting of differing designs on the front and back faces of the fabric. This is effected by duplicate shuttles and shuttle feed mechanism arranged at the front and back of the machine, the movement of the front shuttles being effected through feed band 65, and the movement of the rear shuttles being effected through feed band 65d. The bands are adapted to be driven alternately each from a mechanism similar to rack 66 or the like. Selection of desired shuttles on the rear band is effected through the selector mechanism carried on an upright band 65d exactly similar to that carried on band 65 and controlled through pins 177d on crank arms 176d which are keyed on shaft 175d. Rotation of the latter is controlled from cam links (not shown) similar to link 186 on a chain (not shown) borne on the drum 41 through the follower bar like bar 184a and cam lever 181d, and roller 180d on crank 178d which serve to properly rotate the levers 178d in the same way as levers 178 are rotated. The subscript d following a numeral in this figure indicates that the part is identical in purpose with the part denoted by the corresponding plain reference numerals in Fig. 3 and serves in the operation of duplicated shuttles and shuttle feeding means at the back of the machine.

Likewise, corresponding weft guides 50d and associated mechanism to carry the rear weft thread, forwardly behind the rear set of latch needles 29d during the knitting operation, is provided.

The front set of weft guides and shuttles cooperate with the front set of latch needles 29 and the rear set of weft guides and shuttles cooperate with the rear set of latch needles 29d. Thus a fabric can be produced in which the front and rear faces differ in pattern, both faces being simultaneously knitted whereby the operation is expedited.

The mode of operation:

The operation of the machine in producing knitted fabric with fillers is diagrammatically illustrated in Figs. 15 to 18 inc. It is assumed that the weft thread shuttle 49a supported on the inner of the two sleeves 61 is to be employed and that the weft thread is to extend over the whole course width of the knitted fabric. To this end, the links 186 which engage roller 185 are so shaped as to cause the toggle lever 170 to be disengaged from the sleeve of the outer shuttle while toggle lever 171 engages the recess of inner sleeve, thereby coupling it to the band 65. Assuming also that only a single weft thread is deposited per course and a single warp thread for each latch needle is used, then only a single one of the bars 25 with its downwardly extending warp loopers or guides 26 is employed. Further, assume that the shuttle in use is at the extreme left end of its stroke (Fig. 1), and further, that the cam follower 75 is engaged in the cam groove 80 of the front cam disk 79.

When the motor is started, the locking plunger 197 releases arm 71 through the afore-described cam 207 and associated mechanism and permits rack 66 to move upwardly under action of the follower in the active portion of cam groove 80, moving band 65 to the right and causing shuttle 49 to correspondingly move and deposit the weft thread on the weft guides 50, transversely of the latch needles. Upon completion of this movement, through action of cam 207, plunger 197 relocks arm 71 against further movement, the follower 75 now riding into the inactive portion of the groove 80.

Movement of the followers in cam grooves 60a of cams 60 now cause movement of the guides 50 to carry the weft threads behind the latch needles 29 and they remain in this position.

The latch needle 29 in the hooked ends of which are loops A of the warp thread which have been threaded through the loopers or guides 26, now are moved upward between the weft guides 50 by action of cam followers 37 in cam grooves 38a of cam 38, the loops sliding downwardly on the needles, rotating the latches 29a out of engagement with the hooks and resting in recesses behind the lowermost positions of said latch needles when the latter arrive at the limit of their upward stroke.

Rock beam 13 now is rotated by movement of cam follower 16 in cam groove 16a of cam disk 17 to move the looper guides 26 carried on bar 25 forwardly between the needles 29 carrying the warp threads over the weft thread carried on guides 50.

Bar 25 now is shifted longitudinally by action of cam links 40 on bar 39 causing looper guides 26 to move longitudinally and to carry the thread across the front of the open latch needles, below their hooks, the drum 41 being driven through engagement of pins 44a in the active portion of the annular groove of driven gear 45.

Rock beam 13 then is rotated in opposite direction, carrying the warp thread behind the latch needle and thus serving to loop the warp thread about said latch needles under their hooks. Then the latch needles move downward said hooks engaging the newly formed loops and the latter are carried through the old loops A which latter lift the latch 29a into place and slide off the closed needle ends.

The knitted course thus formed is drawn toward the receiving drum 210 through rotation of the tensioning and winding drums 208, 209 and 210.

The process is now ready to repeat itself knitting the next course. With the gearing ratio employed, the band 65 is now moved back to its original position because cam follower 75 now re-enters an active portion of the cam groove 80 and the next course will also be knitted with a weft thread i. e. the gearing ratio is two rotations of the main drive shaft 18 to one of the cam driving shaft 77.

In order to exclude a weft thread, the cam follower 75 must be moved out of the cam groove it engages and the other follower 75 moved into cam groove 80 of the other cam 79, the latter groove being, as described, 180 degrees out of phase with the groove of the front cam.

At this time, therefore, the pin 138 engages slot 135[b] locking rod 105 and releasing rod 106. The latter is raised through action of the cam links 129, causing the coupling pin 118 on bar 115 to engage in the perforation on arm 98, thereby coupling bar 86 to it. Rotation of arm 98 under action of cam 100 slides the sleeve 89 forwardly rotating lever 84 clockwise and carrying the rear cam follower 75 into the cam groove 80 of the rear cam 79, the safety device including cams 140, preventing this from occurring as described unless the follower is in proper position to enter said groove.

Since the follower 75 is in an inactive portion of said groove, the rack 66 remains stationary and no weft thread is deposited on the weft guides prior to the knitting of the course, which now proceeds in the same manner as before.

Through control of the rods 105 and 106 by links on drum 134 and selective coupling of the latter to the driving drum 41 by the cam controlled coupler ring 144 and associated mechanism afore-described, any desired selection of courses in which weft threads are to be deposited may be made.

For example, if with the initial setting described, the drum 134 were to remain stationary, being uncoupled from drum 41, the shift of the cam followers 75 above described would not occur and all courses would have weft threads.

Further, for example, if it were desired to knit a fabric in which every third course contained no weft thread, drum 134 would be uncoupled during the knitting of the first and second courses so that the cam follower remains in the groove 80 of one of the cams during the knitting of these two courses, and a weft thread is deposited by the shuttle in each course. The drum would then be coupled at the conclusion of the second course to cause a shift of the follower 75 to the other of the two cam grooves which is 180 degrees out of phase with the first and would enter an inactive portion thereof whereby no weft would be deposited in the third course. Then the drum would be uncoupled again remaining so during the knitting of the fourth and fifth courses, the follower remaining in its shifted position, so that the shuttle would deposit weft threads in the fourth and fifth courses. Thus the first and second courses would have a weft, the third would have none and the fourth and fifth would again have wefts.

In other words, the drum remains uncoupled during the knitting of courses in which weft threads are to be deposited and is coupled just prior to the course in which a weft is to be omitted i. e. the cam follower 75 is shifted just prior to the knitting of courses in which wefts are to be omitted.

Any other desired combinations could be arranged by suitable choice of the cams 166, and 130 and 131.

By employing separate drums 41 and 134 instead of mounting the cams 130 and 131 on chains on the drum 41, it is possible to perform the course selection without resorting to long, cumbersome, unwieldly chains which would otherwise have to be employed and also to effect the desired selection for any course without stopping the machine.

An alternative means of operating the crank arm 176 used in coupling or uncoupling shuttles, to replace the mechanism heretofore described which is more positive in its action may be provided by eliminating the link 178, cam lever 181, crank 184 and slide bar 184[a] and substituting the following, as shown in Figs. 19, 19A and 20: A slide bar 232 whose inner end is provided with a cam following roller 232[a] adapted to engage the cam links 233 suitably carried on a chain on the drum 41 is substituted for bar 184[a]. The opposite end of said bar 232 is provided with a laterally projecting pin 232[b]. Suitable tensioning means (not shown) urge said roller against the cam link.

Rotatively journaled in the end piece 10 on a suitable support 234 is a shaft 235 to which a crank arm 236 is keyed, its outer end being slotted at 236[a] for engagement with said pin 232[b]. Also keyed to shaft 235 is a downwardly projecting lever 237 whose end is bifurcated and adapted to engage between its tines the lever 238 carried on a vertical pivot 239[a] suitably supported from a collar 239 keyed to shaft 175. The free end of said lever 238 is slotted as at 238[a] for a purpose hereinafter stated.

Slidably supported in journals 240 and 240[a] from the frame of the machine are two vertical rods 241 and 242, whose upper ends are provided laterally extending pins 243 and 244 respectively, on to either of which the slotted end of lever 238 may ride and thereby couple either of said rods to said lever. The lower ends of the respective rods 241 and 242 are provided with cam following rollers 245 and 246 respectively, which engage the respective cams 247 and 248, both keyed to the suitably driven shaft 249. Suitable tensioning means as springs 250 and 251 serve to urge said cam rollers against the respective cams.

Operation is as follows:

The slide bar 232 whose movement is controlled by cam links 233 is capable of rotating lever 238 either into engagement with the pin 243 of rod 241 or the pin 244 of rod 242. If it engages pin 243 vertical movement of said rod under the action of cam 247 will cause reciprocal rotary motion of shaft 175 through lever 238 and consequent rotation of crank arm 176 to the right side of neutral position shown in Fig. 19. Likewise, engagement of the slotted end of lever 238 with pin 244 of rod 242 will cause the latter to transmit reciprocal rotary motion to the crank 176 to the left of said neutral position. The cams 247 and 248 being so shaped as to cause the required movement of the respective rods. The support 240 is provided with a member 240[b] extending between the two rods and over which the slot in lever 238 rides. In the neutral position shown the lever is thus locked against rotation. During engagement of said slot with either

of the pins 243 or 244, it clears said member 240b and lever 238 is free to rotate.

In the embodiments shown in Figs. 1–18 inclusive, the latch needles are mounted in successive, adjacent groups each group being fixedly borne in a cast holder, the respective holders being removably carried on the support 30. If a single needle in one of these groups breaks, the whole group must be replaced, causing waste of the unbroken needles. To eliminate this difficulty individual mounting of the latch needles may be provided as shown in the modification of Fig. 21 wherein the vertically reciprocating bar 30 for latch needles may be supplanted by the vertically reciprocating support 250 to whose upper end a needle bed 251 may be removably attached, the said bed being transversely grooved to receive latch needles and provided with eyelets 251a along its inner edge into which the laterally bent ends 252a of latch needles 252 may engage and when so engaged prevent rotation of said needles about their longitudinal axes. A sectionalized suitable cover plate 253 transversely grooved to correspond with the transverse grooves in the needle bed 251 may be removably attached to the support 250 and serves to clamp said latch needles in the bed. Thus, if an individual needle breaks, the section of the cover plate 253 over it may be removed, the broken needle replaced, and the cover plate refastened. Only broken needles need be replaced and only a few needles are loosened when the short section of the cover plate is removed.

It can be readily seen by the above description that a plurality of simultaneously operable carriers may be provided for simultaneously feeding a plurality of weft threads adjacent the needles to respectively incorporate the same in separate fabrics simultaneously produced by the machine. For this purpose warp threads are omitted from the warp feeding guide fingers at predetermined intervals leaving spaces, the width of a fabric produced being fixed by the distance between two successive inactive guide finger spaces. One or more of the filling-weft thread carriers can be made to selectively operate between these successive spaces since the length of the carrier travel may be varied.

Our invention may be modified by suitable substitution of mechanical equivalents for structural details described without departure from the spirit thereof, and we therefore do not wish to be limited to the details shown and described.

What we claim is:

1. In a warp knitting machine, means for laying filler thread comprising a carrier, a flexible transmission band having openings, a carriage for said carrier, said carriage being selectively fixable on said band at openings thereof to determine the stroke of said carrier in accordance with the length of filler desired to be laid, means for imparting a non-uniform reciprocating motion to said band, means for limiting the extent of said motion, and means for selectively connecting and disconnecting said carrier from said band.

2. In a warp knitting machine, according to claim 1, friction brake means for arresting the motion of said element.

3. In a warp knitting machine having means for feeding filler thread, a filler thread carrier, a transmission flexible band having openings, and means for connecting and disconnecting said carrier from said band comprising a support element selectively fixed to said transmission band at said openings, a control element, a lever pivoted on said support element, a portion of said lever being adapted to engage a recess in said carrier, and another portion of said lever being adapted to be actuated by said control element to cause disengagement of said carrier.

4. In a warp knitting machine having filler thread feeding means, means for selectively actuating said feeding means comprising a rotary cam link feeding drum, a continuously driven grooved gear and a pin gear meshing with the latter and coupled to said drum, the grooved gear being so shaped as to permit intermittent rotation of said pin gear without cessation of rotation of said grooved gear.

5. In a warp knitting machine of the character described, a set of filler thread feeders, a flexible band to which said feeders are adapted to be coupled and means for uncoupling undesired feeders from said flexible band, said uncoupling means including a rockable lever member and an oscillatable crank member adapted to be oscillated to each side of a neutral position for operating said uncoupling means, and drum-operated cam means for oscillating said crank member.

6. In a warp knitting machine, a set of filler thread feeders, a flexible band to which said feeders are adapted to be coupled and means for uncoupling undesired feeders from said flexible band, said uncoupling means including an oscillatable crank member adapted to be oscillated to either side of a neutral position, and drum-controlled means for oscillating said member.

7. In a warp knitting machine, the combination with knitting implements including a bank of needles, a bank of looping means cooperating with said needles for forming loops, means for rocking said looping means transversely of said bank of needles and means to reciprocate said looping means longitudinally of said bank of needles, said last-named means including exchangeable cam links and means for intermittently moving said links, said intermittent moving means comprising a continuously driven grooved gear and a pin gear meshing with said grooved gear, the groove in the latter being shaped to permit intermittent rotation of said pin gear without cessation of rotation of said grooved gear.

8. In a warp knitting machines, a bank of needles; means for feeding warp threads to the needles; and means for feeding filler thread adjacent the needles to incorporate the filler thread in fabric produced by the machine, and comprising a filler thread carrier, a flexible band, a carriage for said carrier and selectively fixable on said band, means for imparting a non-uniform reciprocating motion to said band, and means for varying the length of the carrier travel.

9. In a warp knitting machine, a bank of needles; means for feeding warp threads to the needles; means for feeding filler threads adjacent the needles to incorporate the filler threads in fabric produced by the machine, and comprising filler thread carriers, a flexible band, a carriage for each of said carriers and selectively fixable on said band, and means for varying the length of carrier travel; and means for selectively actuating said carriers.

10. In a warp knitting machine, a bank of needles; means for feeding warp threads to the needles; means for feeding filler threads adjacent the needles to incorporate the filler threads in fabric produced by the machine, and comprising filler thread carriers, a flexible band, a carriage for each of said carriers and fixable on said band,

means for imparting a non-uniform reciprocating motion to said band, means for selectively connecting and disconnecting said carriers from said carriage, and means for varying the length of carrier travel.

11. In a warp knitting machine, a bank of needles, a transmission flexible band and a plurality of simultaneously operable carriers selectively connectable to said band for simultaneously feeding a plurality of filler threads adjacent respective needles to respectively incorporate the threads in separate fabrics simultaneously produced by the machine.

12. In a warp knitting machine, a bank of needles, a reciprocatable transmission flexible band, carriages on said band; and a plurality of simultaneously operable carriers selectively connected to said carriages respectively for feeding a plurality of filler threads adjacent respective needles to respectively incorporate the threads in separate fabrics simultaneously produced by the machine.

13. In a warp knitting machine, a bank of needles, and a plurality of carriers for simultaneously feeding a plurality of filler threads adjacent respective needles to respectively incorporate the threads in separate fabrics simultaneously produced by the machine, a reciprocatable element, and carriages on said element to which said carriers may be operably connected.

14. In a warp knitting machine, a bank of needles, and a plurality of carriers for simultaneously feeding a plurality of filler threads adjacent respective needles to respectively incorporate the threads in separate fabrics simultaneously produced by the machine, a reciprocatable element, carriages on said element to which said carriers may be operably connected, and means to impart a non-uniform motion to said element.

15. In a warp knitting machine, a set of filler thread feeders, a flexible band to which said feeders are adapted to be coupled and means for uncoupling undesired feeders from said flexible band, said uncoupling means including an oscillatable crank member adapted to be oscillated to either side of a neutral position, and means for oscillating said member.

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