Aug. 29, 1933. J. MORTON 1,924,649

WARP KNITTING MACHINE

Filed May 6, 1930 4 Sheets-Sheet 1

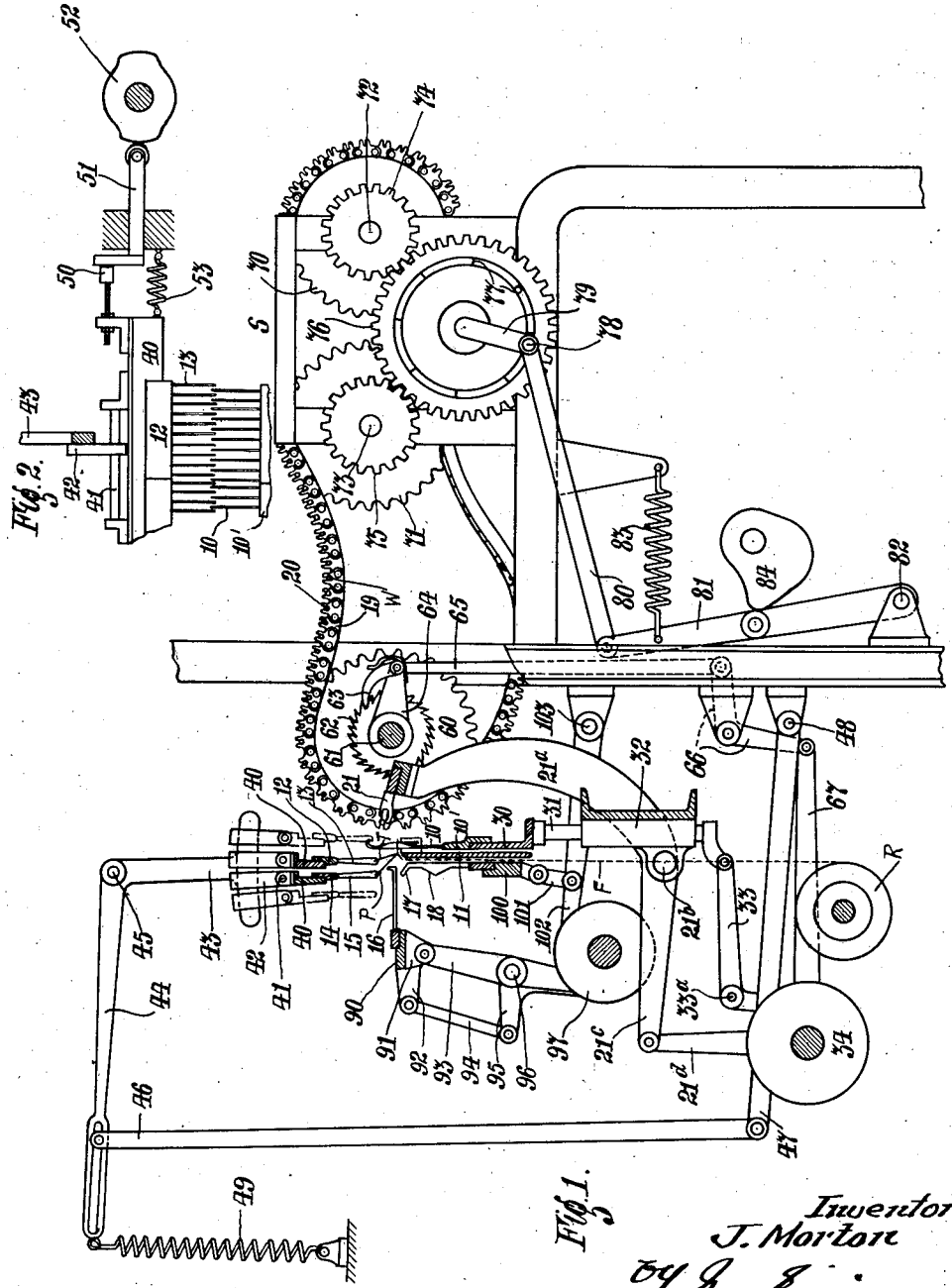


Fig. 1.

Fig. 2.

Inventor
J. Morton
By [illegible]
Atty.

Aug. 29, 1933. J. MORTON 1,924,649

WARP KNITTING MACHINE

Filed May 6, 1930 4 Sheets-Sheet 2

Fig. 3.

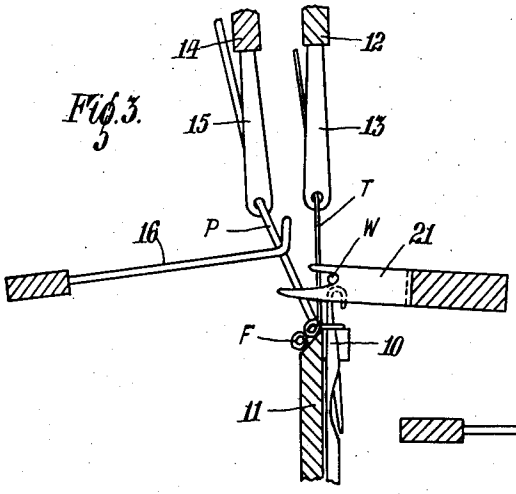


Fig. 6.

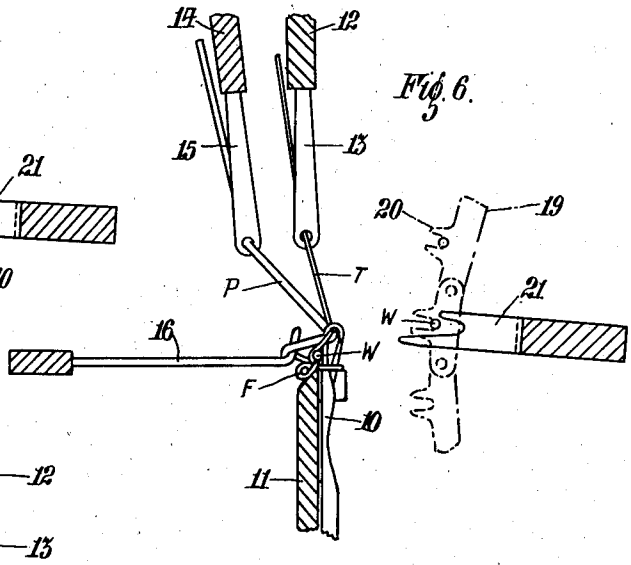


Fig. 4.

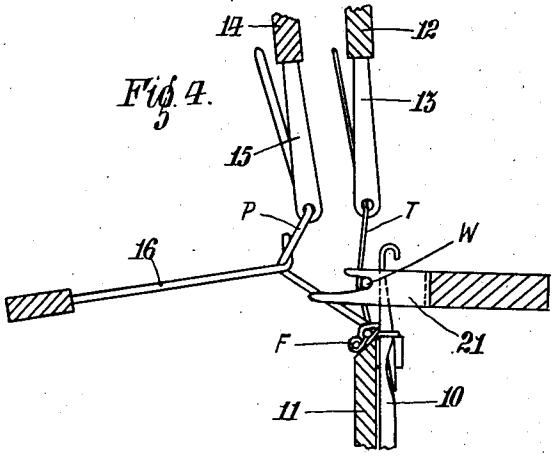


Fig. 5.

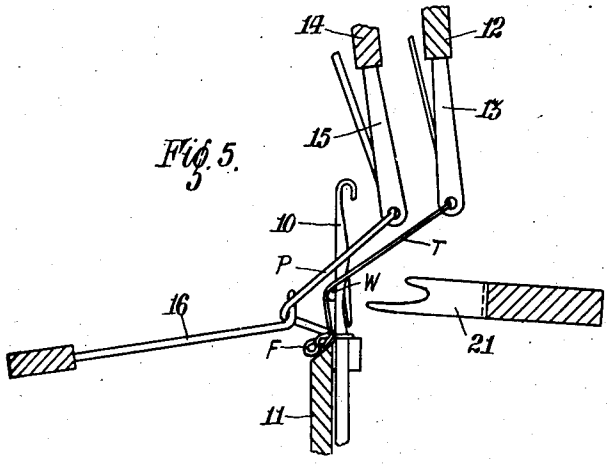
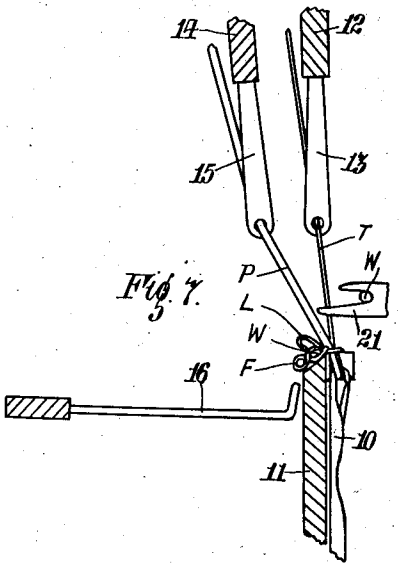


Fig. 7.



Inventor
J. Morton
By J. Laurie
Atty.

Aug. 29, 1933. J. MORTON 1,924,649

WARP KNITTING MACHINE

Filed May 6, 1930 4 Sheets-Sheet 3

Fig. 8.

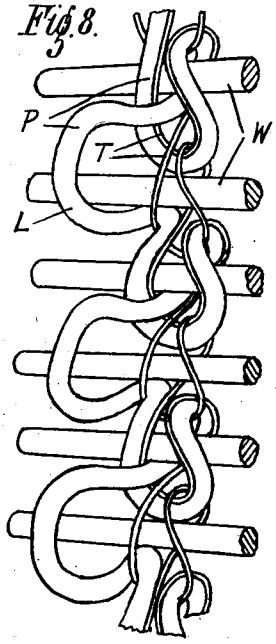


Fig. 9.

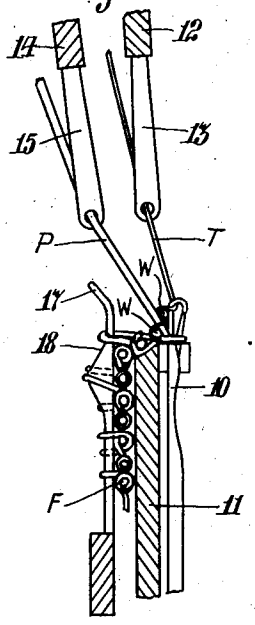


Fig. 10.

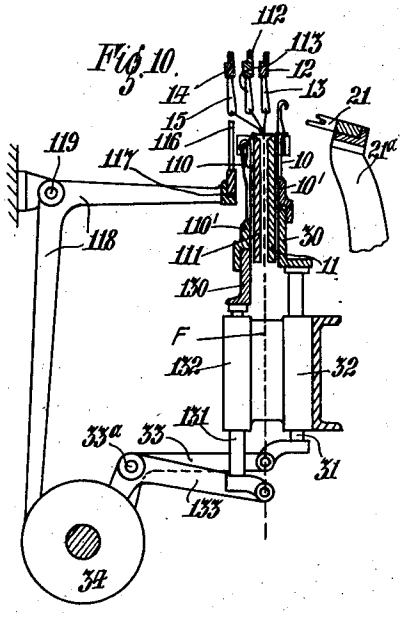


Fig. 11.

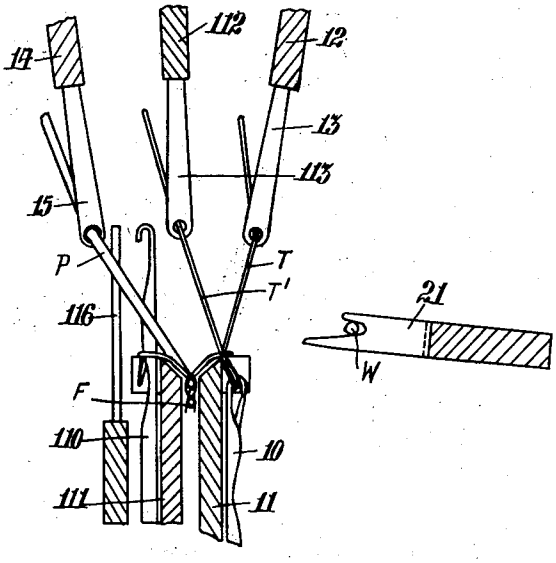
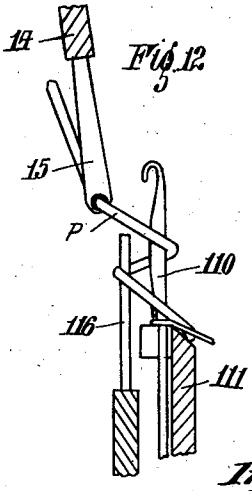


Fig. 12.



Inventor
J. Morton
By
Atty

Aug. 29, 1933. J. MORTON 1,924,649

WARP KNITTING MACHINE

Filed May 6, 1930 4 Sheets-Sheet 4

Fig. 13.

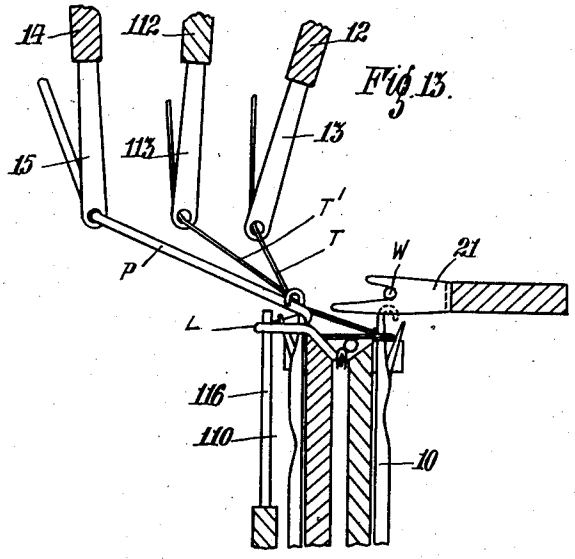


Fig. 14.

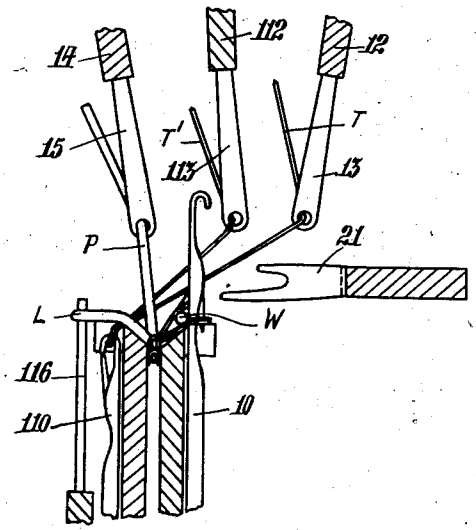
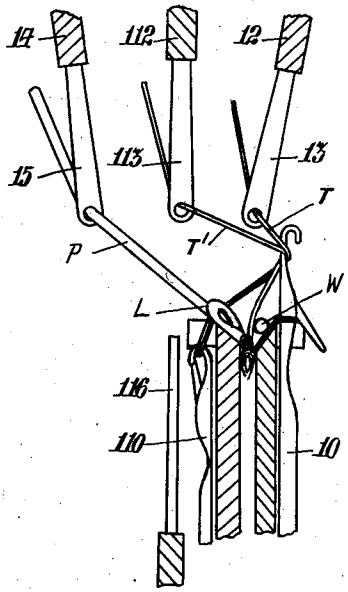


Fig. 15.



Inventor
J. Morton
By [illegible]
Atty.

Patented Aug. 29, 1933 1,924,649

UNITED STATES PATENT OFFICE

1,924,649

WARP KNITTING MACHINE

James Morton, West Lothian, Scotland

Application May 6, 1930, Serial No. 450,283, and in Great Britain June 6, 1929

16 Claims. (Cl. 66—85)

This invention which relates to warp knitting machines has for its object to improve the same so that uncut pile fabrics or cut pile fabrics, or a combination of cut and uncut pile fabrics may be made in the machines.

The present invention is a development of my prior invention forming the subject-matter of United States Patent, filed September 9, 1929, No. 1,804,106.

The invention broadly consists in the provision in a warp knitting machine, of means for supplying thereto in parallel formation and in rapid succession wefts to be bound by the knitting needles to pillar warps to form a fabric and of means for forming loops of pile which appear on the surface of the finished fabric. Means is, or may be, also provided whereby these loops can be cut, or whereby certain only of the loops may be cut and others left uncut in accordance with the character of the fabric being manufactured.

The loops of pile are formed in an extra set of warps which may be termed "pile warps" and which co-operate with the pillar warps to bind the wefts together.

Mechanism for carrying out the invention arranged in conjunction with parts of a warp knitting machine is shown by way of example, in the accompanying diagrammatic drawings, in which:—

Fig. 1 is a sectional elevation of a warp knitting machine and associated mechanism.

Fig. 2 is a fragmentary view of a detail of construction.

Figs. 3 to 7 are views to a larger scale showing different stages in one cycle of knitting operations.

Fig. 8 is a greatly enlarged sectional view of the fabric knitted according to Figs. 3 to 7.

Fig. 9 is a view showing one stage in the cycle of operations in the knitting of a cut pile fabric.

Fig. 10 is a fragmentary view showing parts already shown in Fig. 1 in combination with additional and modified parts.

Figs. 11 to 15 are views to a larger scale than Fig. 10 and illustrating different stages in one cycle of operations of the parts therein shown.

Only such parts of the mechanism are shown as will enable one skilled in the art readily to understand the invention.

Referring generally to Fig. 1, the latch needle 10 represents one of a row carried on a needle-bar 10' and each needle 10 is arranged to act, in well known manner, in association with a trick-bar 11 and a warp-guiding finger 13, the fingers 13 being on a pillar-bar 12 and being adapted to lap the pillar warp threads T, which constitute binding warps round the latch needles at timed intervals in known manner.

In addition to the parts above described and the mechanism for operating them, the warp knitting machine is provided with a second pillar bar 14 carrying a row of fingers 15 which are supplied with pile yarn or thread P (i. e. pile warp) and are adapted to co-operate with the needles 10 in much the same manner as the fingers 13.

The numeral 16 denotes one of a row of hooks adapted, under the control of cam mechanism hereinafter briefly described, to advance and be lapped with pile warp by the fingers 15 every second or other time these fingers are lapping pile warp round the needles 10. When the hooks 16 are lapped with pile warp they are retracted (by the cam mechanism) so that a loop of pile is formed, this loop being knitted in with the stitches formed of the pillar warps T.

The numeral 17 denotes one of a row of hooks adapted to act on the pile warps in a somewhat similar manner to the hooks 16. The hooks 17 however are each formed with a knife-edge 18, the action of these knife-edges being to cut the loops of pile after said loops have been knitted in with the pillar warps.

The machine may be provided only with the hooks 16 or with the hooks 17 and knife-edges 18, but where both rows of hooks are provided their operating mechanism would be arranged so that they come into operation at different times in the working of the machine. Again, in a machine having both rows of hooks, either row of hooks could be rendered inoperative, as desired, for example by removing the cams concerned.

When combined cut and uncut pile fabrics are required the loop forming hooks and the cutter hooks may be arranged to work alternately in such manner that the first motion would form the uncut pile and the next motion the cut pile.

The numeral 19 denotes one chain of a rapidly acting chain conveyor having two parallel chains each of the same construction. As shown, the links of the chain 19 are each provided with a slotted projection 20 adapted to hold one end of a length of yarn, thread or the like of weft, denoted by W. The conveyor, as a whole, feeds forward in parallel formation and in rapid succession a large number of wefts W which are supplied to it for example, as in the manner fully set forth in the specification of my prior United States patent application Serial No. 391,369. As described in said specification, the wefts are con-

veyed by means of the conveyor one at a time, step-by-step, into close proximity to the needles 10, to which they are transferred by points or sinkers 21 on levers 21^a mounted on a rock shaft 21^b which can be oscillated in known manner at the proper times.

Referring now more particularly to the warp knitting mechanism shown in Figs. 1 and 2, the needle-bar 10' is mounted on an angle bar 30 supported at each end by a strut 31 slidably mounted in a fixed guide 32 and borne by a bell-crank-lever 33 which is fulcrumed on a fixed pin 33^a and is oscillated by one of an assembly of rotatable cams conventionally shown at 34. It will be clear that oscillation of the bell-crank-lever 33 results in vertical reciprocation of the needles 10.

Each row of thread-controlling fingers 13 and 15 is carried, as aforesaid by a bar (12 or 14), and this bar is mounted on an angle bar 40, there being one angle bar for each row of fingers. In Fig. 1, two additional angle bars and associated fingers are shown in dotted lines, and machines of this class usually have provision for fitment of as many as six bars. Each bar 40 is supported at each of its ends by a slide-rod 41 slidable in a part 42 fixed to an arm 43 of a lever 43, 44 fulcrumed on a fixed pin 45. The lever 43, 44 is connected by a link 46 to a lever 47 which is fulcrumed on a fixed pin 48 and is controlled by one of the assembly of cams 34. The arm 44 is continuously pulled downwards by a spring 49. Each angle bar, at one end, has an adjustable abutment 50 (see Fig. 2) which co-operates with a tappet 51 controlled by a rotatable cam 52, which may be one of an interchangeable set. The tappet 51 is held against the cam 52 by a spring 53 acting on the bar 40. It will be understood that each bar 40 has its own tappet 51, cam 52 and spring 53. The arrangement is such that, in the rotation of the cams 34, all the fingers (i. e. fingers 13 and 15 with or without others) receive in unison an oscillatory movement around the fulcrum 45; and, in the rotation of the cams 51, the individual rows of fingers independently receive a shogging movement to the extent of one needle pitch (i. e. the distance between each two adjacent needles in a row).

The above-described knitting mechanism is well-known in the art relating to warp knitting machines and need not therefore be described in greater detail.

Each lever 21^a carrying the sinkers 21 has an extension 21^c which derives an oscillatory movement from a rod 21^d actuated by one of the assembly of cams 34. The movement of the sinkers is such that they carry successive weft threads W from the conveyor to the backs of the needles 10.

The conveyor for carrying the wefts W into register with the sinkers is operated by two separate intermittent-motion transmitting mechanisms. One of these mechanisms functions to move the conveyor chains 19 step-by-step past the delivery station (i. e. in the vicinity of the knitting mechanism), a single new weft being brought into position at each step. This mechanism comprises a sprocket 60 for each of the conveyor chains, a rotatable shaft 61 for the pair of sprockets, a ratchet 62 on the shaft, a spring-pressed pawl 63 co-operating with the ratchet, a pawl-carrier 64 freely journalled on the shaft 61, a link 65 for oscillating the pawl-carrier, a bell-crank-lever 66 for actuating the link 65, and a link 67 for actuating the lever 66; and the link 67 is actuated by one of the assembly of cams 24.

The other intermittent-motion transmitting mechanism functions to move the conveyor section-by-section past the weft-supplying station S, a plurality of weft-receiving projections 20 being comprised in each section; so that, when each section is stationary at the station S, the plurality of projections can be supplied with wefts simultaneously. The mechanism comprises two pairs of sprockets 70, 71 secured to shafts 72, 73 to which are keyed pinions 74, 75 meshing with a spur-wheel 76. A ring of widely spaced teeth 77 co-operates with a pawl 78 (which may consist of a spring-pressed plunger) on a pawl-carrier 79 which is connected by a link 80 to a lever 81 fulcrumed at 82 and held by a spring 83 against a rotatable cam 84. In each rotation of this cam, the carrier 79 receives an oscillation and imparts a large portion of this in one direction to the spur-wheel 76, which in turn imparts a rotational movement to the pinions 74, 75 and sprockets 70, 71.

The loop-forming members 16 are carried by a bar 90 which has, at each end, two projections 91 and 92, the former of which is pivotally connected to a lever 93 and the latter of which is connected by a link 94 to a bell-crank-lever 95. Both of these levers 93, 95 have the same fixed fulcrum 96 and their lower ends are actuated by elements of an assembly of rotatable cams conventionally shown at 97. The arrangement is such that, when the assembly of cams 97 rotates, both levers 93, 95 receive appropriately timed oscillatory movements, the movements of the lever 93 displacing the members 16 substantially horizontally towards and away from the needles 10 and the movements of the lever 95 rocking the members 16 vertically.

The loop-forming and cutting members 17, 18 are carried by a bar 100 which is guided for vertical movement and is supported at each end by a link 101 connected to a lever 102 which is fulcrumed on a fixed pin 103 and is actuated by one of the assembly of cams 97. The arrangement is such that the members 17, 18 receive a simple vertical movement in the rotation of the assembly of cams 97.

The fabric F knitted by the needles 10 and denoted conventionally by a dotted line in Fig. 1 passes down behind the trick-bar 11 and is wound under tension on a take-up roll R.

A complete cycle of operations of the knitting mechanism and associated parts will now be described with reference to Figs. 3 to 7, the cycle to be described being one in which a weft W is fed to the needles prior to the formation of every stitch and a loop is formed by the member 16 prior to the formation of every second stitch. The loop-cutting member 17, 18 is to be assumed inoperative.

Fig. 3 shows the needle 10 rising, a weft W being advanced over the needle, the fingers 13, 15 being at the left hand side of the needle and the member 16 being in its raised and advanced position. The bars 12 and 14 are shogged towards the reader (by their cams as described with reference to Fig. 2) after which the member 16 may be withdrawn slightly with the pile warp P lapped around it, as shown in Fig. 2. Fig. 2 also shows the weft W trapped behind the rising needle 10. The bars 12, 14 are oscillated in unison to the right and the sinkers 21 withdraw, as shown in Fig. 4, in which the needle 10 has reached the end of its ascent. The bars 12, 14 are now both shogged to the extent of a needle pitch away from the reader and the member 16

is slightly advanced and lowered (see Fig. 5). The bars 12, 14 are oscillated back to the left, and in their movement lap the pile warp P and binding warps T under the hook of the now descending needle 10, as shown in Fig. 6, which also shows the sinkers 21 about to remove a new weft W from the conveyer. Fig. 7 shows the needle at the end of its descent, in which the warps P and T are both drawn through the previous loop in the warp T, thereby binding the weft W into the fabric F. At the same time, the member 16 is lowered, leaving a loop L on the surface of the fabric F. In the next rise and fall of the needle 10, the bar 12 and sinkers 21 receive precisely the same motions, so that another stitch is formed in the warp T and a weft W is bound into this stitch. The member 16 remains inoperative and the bar 14 merely oscillates idly (in unison with the bar 12) and therefore the warp P is not lapped around either the member 16 or needle 10.

By repeating the above cycle of operations, each needle of the machine knits a chain such as shown in Fig. 8, every stitch including the warp T and binding a weft W, and every second stitch including the warp P also. Between every second stitch the warp P is drawn out in a loop L. It will thus be clear that the machine will knit a large number of chains such as illustrated in Fig. 8 and that these chains will all be held together to form a fabric by the wefts W.

When the loops L have to be cut, the member 16 is maintained inoperative (i. e. in its withdrawn position) and the member 17 is brought into operation. The cycle performed by the knitting mechanism is the same as described with reference to Figs. 3 to 7, except that the pile P is lapped round the member 17 while the latter is raised. The member 17 is lowered as the needle 10 descends to bind in the weft W in loops formed in both warps P and T (see Fig. 7) and, in rising to be lapped again with the warp P, the knife edge 18 severs a previous loop L. The action of the knife edge is aided by the fact that the fabric F is withdrawn under tension.

The fabric produced is the same as shown in Fig. 8 except that the loops are cut.

Referring now to Fig. 10, the knitting mechanism therein shown comprises the parts already described with reference to Figs. 1 and 2 and works in association with similar conveyor mechanism for the wefts W. In addition, the knitting mechanism comprises a row of latch needles 110 arranged on a bar 110' back-to-back with respect to the needles 10. The needles 110 are otherwise arranged and operated similarly to the needles 10, being associated with a trick-bar 111, a bar 112 carrying warp-guiding fingers 113, an angle bar 130 carried at each end by a slidable strut 131 in a fixed guide bracket 132, and a lever 133 fulcrumed at 33^a and actuated by one of the assembly of cams 34. The fingers 113 guide additional warps to the needles 10 and 110 as hereinafter explained with reference to Figs. 11 to 15. The fabric F passes down between the two trick-bars 11 and 111.

The pile-forming members consist of a row of upright rods 116 carried by a bar 117 which is supported at each end by a lever 118 fulcrumed on a stationary pin 119 and actuated by one of the assembly of cams 34. It will be clear that, in the rotation of the assembly of cams 34, the lever 118 is oscillated and the rods 116 are raised and lowered.

If desired, the rods 116 may be replaced by members, such as the members 17 in Figs. 1 and 9, having knife edges for cutting the pile loops.

Referring now to Figs. 11 to 15, Fig. 11 shows the needle 10 lowered and engaging loops of both binding warps T and T', a weft W being ready to advance. The needle 110 is raised and so is the loop-forming member 116. The fingers 13, 15 and 113 are in their central position. First of all, the bar 14 shogs away from the reader, then all the bars 12, 14 and 113 are rocked to the right, the bar 14 is shogged back again, and all the bars are rocked back to their central position. The result of the above action is to lap the warp P round both the needle 110 and the member 116, which is now descending. This result is illustrated in Fig. 12. The bars 12, 14 and 112 all rock in unison to the left and are all shogged away from the reader, so that all the warps are lapped around the needle 110, which is descending, as shown in Fig. 13. This figure shows the member 116 still descending with its loop L and the weft W advancing over the needle 10. Fig. 14 shows the needle 110 at the end of its descent, in which position it has carried loops of all the warps P, T and T' through the loops which previously embraced it and which are now cast off. Fig. 14 also shows all the fingers 13, 15 and 113 rocked to the right in readiness for the bars 12 and 112 to be shogged towards the reader. The needle 10 is at the end of its ascent in readiness to be lapped with the warps T and T' and has trapped behind it the weft W, which is now about to be bound into the fabric. Fig. 15 shows the member 116 at the end of its descent and the loop L cast off. The needle 10 is lapped with the warps T and T' and all the fingers 13, 15 and 113 have rocked to the left. It will be obvious that, on the descent of the needle 10, the weft W is locked into the fabric by the warps T and T'.

Thus it will be seen that the warps T and T' are together knitted into the fabric by the needles 10 and 110 alternately, the former of which acts to bind-in the wefts W and the latter of which acts to bind-in the loops L. This fabric may be in general of a heavier structure than the fabric shown in Fig. 8, since it incorporates the additional warps T', and the structure is therefore suitable, for example, for carpet manufacture.

I claim:—

1. A warp knitting machine including knitting needles supplied with warps and having combined therewith means for supplying to said needles in parallel formation and in succession wefts to be bound thereby to said warps, so as to produce a fabric, and means for forming in said warps loops which appear as pile on the surface of said fabric.

2. A warp knitting machine including knitting needles and means for leading warps to said needles, in combination with means for conveying wefts towards said needles in parallel formation and in succession, means for transferring said wefts from said conveying means to said needles so that said wefts can be bound thereby to said warps so as to produce a fabric and means for forming in said warps loops which appear as pile on the surface of said fabric.

3. A warp knitting machine including knitting needles supplied with warps and having combined therewith means for supplying to said needles in parallel formation and in succession wefts to be bound thereby to said warps, so as to produce a fabric, means for forming loops in said warps during knitting and means for cut-

ting said loops or certain thereof to form pile tufts.

4. A warp knitting machine including knitting needles and means for leading warps to said needles, in combination with means for conveying wefts towards said needles in parallel formation and in succession, means for transferring said wefts from said conveying means to said needles so that said wefts can be bound thereby to said warps so as to produce a fabric, means for forming loops in said warps during knitting and means for cutting said loops or certain thereof to form pile tufts.

5. A warp knitting machine including two sets of knitting needles arranged back-to-back and means for leading warps to said needles, in combination with means for supplying to said needles in parallel formation and in succession wefts to be bound thereby to said warps so as to produce a fabric, and means for forming in said warps loops which appear as pile on the surface of said fabric.

6. A warp knitting machine including two sets of knitting needles arranged back-to-back and means for leading warps to said needles, in combination with means for supplying to said needles in parallel formation and in succession wefts to be bound thereby to said warps so as to produce a fabric, means for forming loops in said warps during knitting and means for cutting said loops or certain thereof to form pile tufts.

7. A warp knitting machine including knitting needles, means for leading binding warps to said needles and separate means for leading pile warps to said needles, in combination with means for supplying to said needles in parallel formation and in succession wefts to be bound thereby to said binding warps so as to produce a fabric and means for forming in said pile warps loops which appear as pile on the surface of said fabric.

8. A warp knitting machine including knitting needles, means for leading binding warps to said needles and separate means for leading pile warps to said needles, in combination with means for supplying to said needles in parallel formation and in succession wefts to be bound thereby to said binding warps so as to produce a fabric, means for forming loops in said pile warps during knitting and means for cutting said loops or certain thereof to form pile tufts.

9. A warp knitting machine, including knitting needles and guides for leading warps to said needles, in combination with chain means for conveying wefts towards said needles in parallel formation and in rapid succession, sinkers for transferring said wefts from said conveying means to said needles so that said wefts can be bound thereby to said warps and pile forming hook means for forming loops in said warps.

10. A warp knitting machine, including knitting needles and guides for leading warps to said needles, in combination with chain means for conveying wefts towards said needles in parallel formation and in rapid succession, sinkers for transferring said wefts from said conveying means to said needles so that said wefts can be bound thereby to said warps, hook means for forming loops in said warps, and means for cutting said loops or certain of them to form pile tufts.

11. A warp knitting machine, including knitting needles, guides for leading binding warps to said needles and separate guides for leading pile warps to said needles, in combination with chain means for conveying wefts towards said needles in parallel formation and in rapid succession, sinkers for transferring said wefts from said conveying means to said needles so that said binding warps can be bound thereby to said warps, and hook means for forming loops in said pile warps.

12. A warp knitting machine, including knitting needles, guides for leading binding warps to said needles and separate guides for leading pile warps to said needles, in combination with chain means for conveying wefts towards said needles in parallel formation and in rapid succession, sinkers for transferring said wefts from said conveying means to said needles so that said binding warps can be bound thereby to said warps, hook means for forming loops in said pile warps, and means for cutting said loops or certain of them to form pile tufts.

13. A warp knitting machine, including two sets of knitting needles arranged back-to-back and guides for leading pile and other warps to said needles, in combination with chain means for conveying wefts towards said needles in parallel formation and in rapid succession, sinkers for transferring said wefts from said conveying means to said needles so that said wefts can be bound thereby to said warps, and hook means for forming loops in said pile warps.

14. A warp knitting machine, including two sets of knitting needles arranged back-to-back and guides for leading pile and other warps to said needles, in combination with chain means for conveying wefts towards said needles in parallel formation and in rapid succession, sinkers for transferring said wefts from said conveying means to said needles so that said wefts can be bound thereby to said warps, hook means for forming loops in said pile warps, and means for cutting said loops or certain of them to form pile tufts.

15. A warp knitting machine, including two sets of knitting needles arranged back-to-back, guides for leading binding warps to the respective sets of needles and separate guides for leading pile warps to said needles, in combination with means for conveying wefts towards said needles in parallel formation and in rapid succession, sinkers for transferring said wefts from said conveying means to said needles so that said wefts can be bound thereby to said warps, and hook means for forming loops in said pile warps.

16. A warp knitting machine, including two sets of knitting needles arranged back-to-back, guides for leading binding warps to the respective sets of needles and separate guides for leading pile warps to said needles, in combination with means for conveying wefts towards said needles in parallel formation and in rapid succession, sinkers for transferring said wefts from said conveying means to said needles so that said wefts can be bound thereby to said warps, hook means for forming loops in said pile warps, and means for cutting said loops or certain of them to form pile tufts.

JAMES MORTON.