July 25, 1939. J. MORTON ET AL 2,167,408

KNITTING MACHINERY

Filed Feb. 6, 1939 2 Sheets-Sheet 1

Fig. 1.

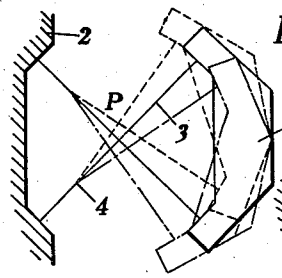


Fig. 2.

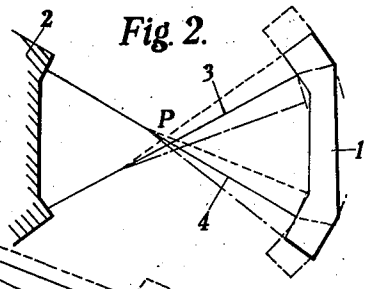


Fig. 3.

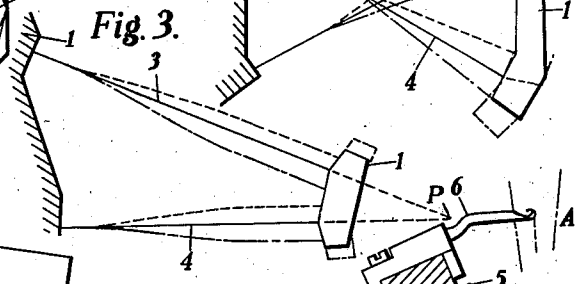


Fig. 4.

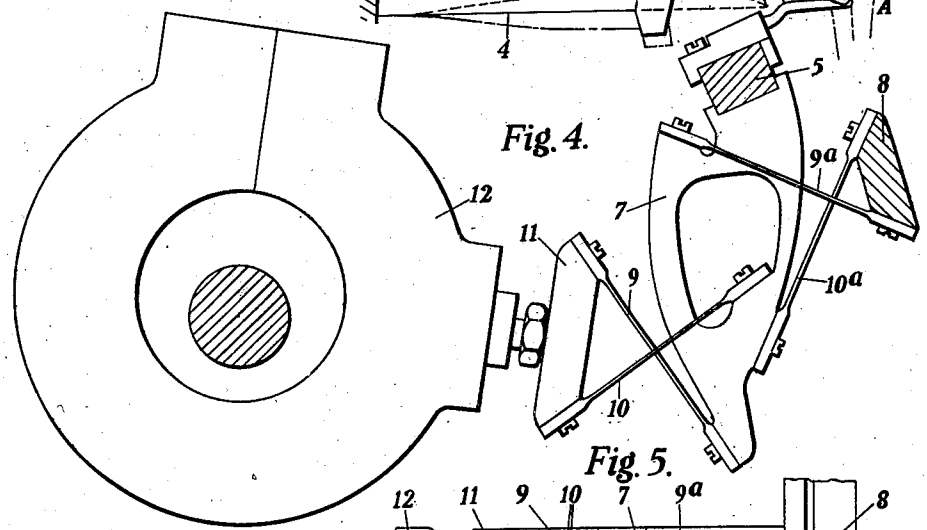


Fig. 5.

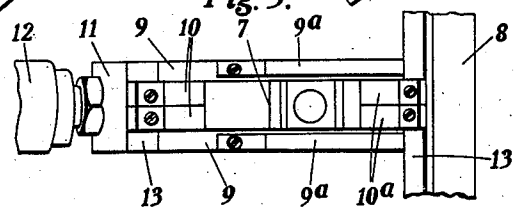


Fig. 6.

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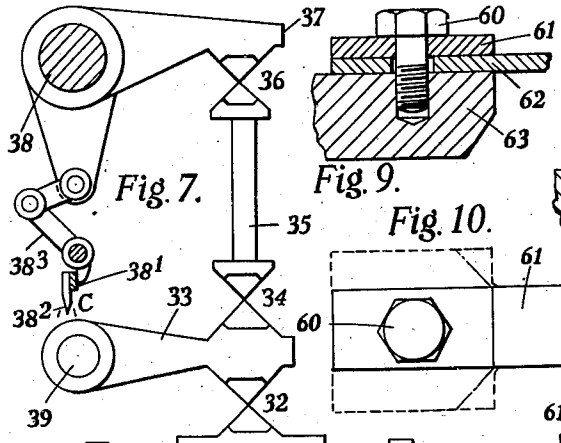


Fig. 7.

Fig. 9.

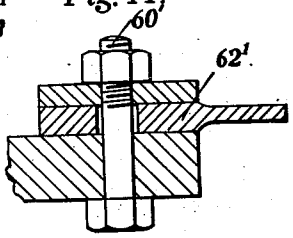


Fig. 11.

Fig. 10.

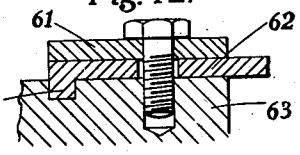


Fig. 12.

Fig. 8.

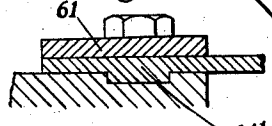


Fig. 13.

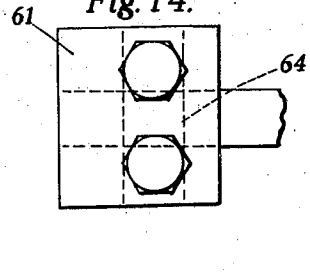
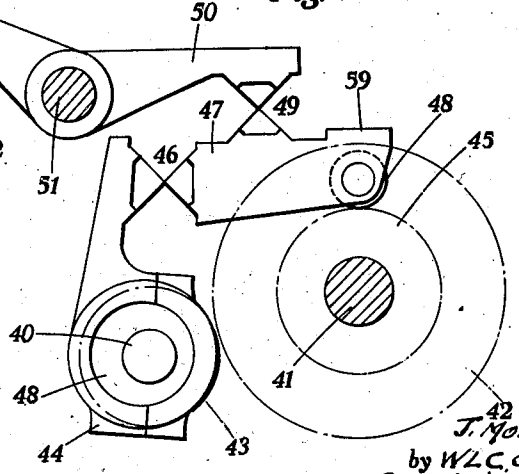


Fig. 14.



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Patented July 25, 1939 2,167,408

UNITED STATES PATENT OFFICE

2,167,408

KNITTING MACHINERY

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Application February 6, 1939, Serial No. 254,952
In Great Britain February 11, 1938

14 Claims. (Cl. 66—86)

This invention relates to warp knitting machines. In such machines there are a number of assemblies, which may be referred to as knitting units. These units include the assemblies that actually perform the knitting operation, such assemblies being the warp guide units, which comprise bars carrying guide fingers, and needle units which comprise bars carrying the knitting needles. The needles may, for example, be bearded needles. They may also be hook needles arranged to co-operate with independent tongues, which serve to cover and uncover the hooks. Such tongues constitute part of a further knitting unit, which is an assembly consisting of a bar carrying the tongues. In addition, there are knitting units which do not play so predominating a part in the knitting. A sinker assembly constitutes such a unit, and consists of a bar carrying the sinkers. A further unit in this category, is the presser bar, which has to be employed when bearded needles are used. All these various units are arranged to undergo to-and-fro motion and the present invention is concerned with methods of mounting such units in warp knitting machines in relation to the members by which they are driven.

One object of the invention is a warp knitting machine comprising, in combination, a knitting unit mounted for to-and-fro movement, a driving member mounted for to and fro movement and a pair of resilient cross members interposed between said unit and said member to provide articulation there-between.

Another object of the invention is a warp knitting machine comprising, in combination, a knitting unit arranged for to-and-fro movement, a member connected to same to constrain its to-and-fro movement, and resilient cross members providing the articulated connection between said member and said unit.

An advantage of the cross members is that they eliminate the use of pin-joints and bearings which wear and then cause noise and faulty operation of the units.

The invention further comprises the elements and combination of parts set forth in the annexed claims.

In order that the invention may be clearly understood and readily carried into effect, some constructions in accordance therewith will now be described by way of example with reference to the accompanying drawings, in which:

Figures 1 to 3 are explanatory diagrams illustrating the operation of the invention;

Figure 4 is a sectional elevation showing a needle bar in a warp knitting machine, together with mechanism for driving the bar;

Figure 5 is a plan showing certain parts shown in Figure 4;

Figure 6 is a part sectional elevation showing a further needle bar arrangement and driving mechanism therefor in a warp knitting machine;

Figure 7 is a part sectional elevation showing mechanism for driving warp guides in a warp knitting machine;

Figure 8 is a part sectional elevation showing mechanism for driving a sinker bar in a warp knitting machine;

Figure 9 is a section showing a method of attachment for one end of a cross member as used in the construction shown in Figures 4 to 8;

Figure 10 is a plan of the details shown in Figure 9;

Figures 11, 12 and 13 are sections respectively showing further methods of securing one end of a cross member as used in the constructions of Figures 4 to 8, and

Figure 14 is a plan of the details shown in Figure 13.

Referring first to Figs. 1 to 3, in Fig. 1 a mass 1 is shown supported at the free ends of resilient cross beams or members 3, 4 intersecting at a point P and anchored to a supporting structure 2. The cross members are blade springs.

When the member 3 is oscillated about its end anchored to the support 2, then, for small deflections, the free end moves along a path substantially at right angles to the longitudinal axis of the member and the instantaneous centre of such movement at any point within the range of the small deflections, lies substantially on the said axis. Similarly, for the member 4, its instantaneous centre lies substantially on its longitudinal axis. Consequently the mass 1, connected to the free ends of both members or beams, oscillates substantially about the point of intersection P of members 3 and 4.

In Fig. 1 the cross members are shown intersecting at right angles, but, as shown in Fig. 2, the members may subtend other angles. Nor need the cross members themselves actually intersect, for they may converge so that the virtual point of intersection lies on the projected lengths of the members, as shown in Fig. 3. Thus, the term "cross members" herein used must be understood to include within its meaning members whose projections intersect.

The members may be of different lengths, as shown also in Fig. 3.

Cross members embodying the principles de-

scribed with reference to Figs. 1 to 3, can be applied to the operation of machine knitting units in the manner now to be described.

The cross members used must be flexible enough to give, without undue stress, the deflection required for the to-and-fro motion of the knitting unit that they support, while being rigid enough to sustain the load transmitted by them. The cross members may be metal blade springs, and it has been ascertained that they may with advange be made of so-called "plastic" material such, for example, as a synthetic resin.

As shown in Fig. 4, a knitting unit constituted by a needle bar 5 carrying a long series of needles 6 is provided at each of a number of points distributed along its length, with a downwardly extending bracket-like lever 7. The bar is arranged to oscillate in an arc of comparatively short radius and is driven by as many eccentric-and-strap gears 12 as there are levers 7, each eccentric and strap gear 12 being allocated to one of the levers 7. The eccentric-straps have adjustably secured to them, instead of the usual eccentric-rods, small abutment plates 11 (or, if desired, a long single plate interconnecting the several straps could be provided instead of these abutment plates).

As shown in Fig. 4, each of the levers 7 is connected to the corresponding abutment plate by a pair of resilient cross members 9, 10 and is connected, likewise, to a fixed bar 8 by a corresponding pair of resilient cross members 9*a*, 10*a*. The bar 8 is mounted parallel to the needle bar. As shown in Fig. 5, which is a plan to a somewhat larger scale of the cross members and associated parts shown in Fig. 4, each complete member, in reality, consists of two resilient blades 9, 9, or 10, 10, or 9*a*, 9*a* or 10*a*, 10*a*. The blades 10, 10 have their adjacent edges very close together, and the blades 9, 9 are spaced apart at opposite sides of the blades 10, 10. The blades 10*a*, 10*a* and 9*a*, 9*a* are similarly arranged. If desired, instead, each of the cross members may be a single blade, or one member of a pair may be a single broad blade whilst the other member is provided by two narrower blades each having half the breadth of the single blade and disposed on each side thereof.

The levers 7, the anchorage bar 8 and the eccentric plates 11 are each formed with pairs of convergent sloping faces 13 for attachment of the ends of the blades.

The arrangement of Figs. 4 and 5, therefore, includes several assemblies of cross members spaced at intervals apart over the length of the bar 5, each assembly consisting of two co-operating pairs of members 9, 10 and 9*a*, 10*a*. The arrangement is such that the points of intersection of the members 9, 10 between the levers 7 and the eccentric-straps, provide a floating axis about which the bar 5 rocks with reference to the eccentric straps, and the points of intersection of the members 9*a*, 10*a* between the levers 7 and the fixed bar 8, provide a substantially stationary axis about which the bar 5 oscillates.

The chain lines at A indicate the limits of travel of the needle throat.

A warp-knitting machine having needles as shown in Figure 4 and supported in the manner described, would also have a similarly supported bar carrying tongues, for cooperation with the needles, driven by eccentric-and-strap gears, whose eccentrics are on the same shaft as the eccentrics which drive the needle bar. Then, the tongue bar may be arranged to oscillate about the same axis as the needle bar.

Fig. 6 shows cross members arranged for controlling the movement of a knitting unit comprising a needle bar 20 in a warp knitting machine. The movement approximates very closely to rectilinear motion, and is derived from eccentric rods 14 operated by eccentric-and-strap gears (not shown). Each eccentric rod is connected by cross members 15 to a lever 16 fixed to the needle-bar 20, there being a lever 16 allocated to each eccentric rod 14. The movement of each lever is controlled by a parallel linkage consisting of two arms 17 and 17*a*, respectively anchored by sets of cross members 18 and 18*a* to the frame 21 of the machine and respectively connected to the lever 16 by sets of cross members 19 and 19*a*.

The limits of travel of the needle throat are indicated by the chain lines at B.

Here, too, a similarly supported bar, carrying tongues for co-operation with the needles is provided.

In Fig. 7 the cross members shown are used in the operation knitting unit consistsing of a warp guide bar carrying guide fingers in a warp-knitting machine. Shafts 21 and 22, carrying eccentrics 23 and 24 are geared together by gear-wheels 25 and 26, the gear ratio being such that shaft 22 rotates at twice the speed of shaft 21. These eccentrics carry eccentric-strap-and-rod units 27 and 28, which are respectively connected to a floating lever 31 by sets 29 and 30 of cross members. The floating lever 31 is suspended by cross members 32 from a lever 33 fulcrumed on a fixed shaft 39. The lever 33 is itself connected with another lever 37, secured to a rock-shaft 38, through a rod 35 and two sets of cross struts 34 and 36. The function of shaft 38 is to oscillate the warp-guide-bar 38' with its guide fingers 38^2, the oscillation being imparted through a linkage 38^3.

The dotted lines at C indicate the limits of travel of the guide fingers.

The entire assembly of parts shown between the shafts 21, 22 and the rock-shaft 38 is repeated along those shafts so that they are connected at a number of points distributed along their lengths.

The arrangement of the two eccentrics 23 and 24 is such that the motion derived from them is that required for the warp-guide bar. As will be manifest, the desired motion could not be obtained from a single ecentric. The motion could, of course, be obtained from cam gear, and obviously the present invention can be applied to warp knitting machines to work in co-operation with cam gear; but eccentric-and-strap gear has certain advantages over cam gear, especially as regards its ability to sustain heavy loading at high speeds, and accordingly, in the example of Fig. 7, double frequency eccentric gears are chosen for illustration.

Since however the variety of motions to be derived from plural frequency eccentric gears is limited in practice, a compromise may be effected, where a more appreciably irregular motion is necessary, by using an eccentric gear, for taking a substantial or major share of the load, in co-operation with a cam gear for giving the required irregular motion. Such an arrangement will now be described with reference to Fig. 8.

As shown in Fig. 8 resilient cross members are used in the operation of a knitting unit consisting of a sinker-bar carrying the sinkers of a warp-

knitting machine. Here shafts 40 and 41 are inter-connected by gear wheels 42 and 43, the gear ratio being such that the shaft 40 rotates at twice the speed of the shaft 41. The shaft 40 carries an eccentric 48, with an eccentric-strap-and-rod unit 44, which is connected to a floating lever 47 by a set of cross members 46. At the other end of the floating lever is a roller 48 bearing on a cam 45, which is secured to the shaft 41, the floating lever thus serving as follower to the cam.

The floating lever 47 thus serves to combine the motions imposed by the eccentric 48 and the cam 45. This floating lever is connected through a set of cross members 49 to a lever 50 fixed to a fulcrum shaft 51 that extends across the machine and has also fixed to it a number (for example, six) of levers 52. Each lever 52 is connected by a rod 54 and two sets of cross members 53 and 55 to one of an equal number of sinker levers 56 fulcrumed on another cross shaft 58. The sinker-bar 57 is carried on these levers. The limits of travel of the sinker throats are indicated by the dotted lines D.

The entire assembly of parts shown between the shafts 40, 41 and the fulcrum-shaft 51 may be repeated along the lengths of those shafts.

In the various mechanisms particularly described above, the action of the resilient cross members is noiseless and is free from wear. Further, the cross members impose no limitation on the speed of operation. Several ways of securing the ends of the cross members are shown in Figs. 9 to 14.

In the example of Figs. 9 and 10, which are a section and a plan respectively, a screw 60 passes through a clamping plate 61 and through the end 62 of one of the cross members into the face 63 of the part to which the end of the member is connected. The body of the screw may be a close fit in the end 62 or it may be a loose fit, in which event the end is secured solely by the clamping action.

To compensate for the loss of strength due to the provision of a hole for the screw, the end of the cross member may be widened at one or each side. The dotted lines in Fig. 10 show the end 62 widened at both sides; and the dot-and-dash lines show a slight variation.

Alternatively, as shown in section by Fig. 11, the end 62' of the one of the cross members may be thickened. This figure shows also that a bolt 60' may be used instead of a screw.

To locate the struts precisely a feather-and-groove or equivalent form of projection-and-recess may be provided between each end of a cross member and the face to which it is connected. In Fig. 12, which is a section, the end 62 has an inturned projection 64 which engages a recess in the fact 63, whereas in Fig. 13, which is also a section, the end 5 shown has a mid-projection 64'. Alternatively or additionally, a projection such as 64 or 64' can be formed to engage a recess in the clamping plate 61. Alternatively, a projection can be provided on either of or each of the face and clamping plate to engage a recess formed in the end of the cross member. Such projections and recesses can be circular or rectangular in plan. Instead of projections formed as integral parts of the ends of the cross members, cylindrical or tapered pins can be fitted through the ends of the cross members and into the faces to which the ends are connected, and in some cases these pins can be fitted also through the clamping plates.

The screws or bolts need not pass through holes in the ends of the cross members, for the clamping plates may be widened and screws or bolts arranged at the sides of the respective ends. An example of such an arrangement is shown in Figs. 13 and 14, the latter figure being a plan of Fig. 13.

We claim:

1. In a warp knitting machine, in combination, a knitting unit mounted for to-and-fro movement, a driving member mounted for to-and-fro movement, and a pair of resilient cross members interposed between said unit and said member to provide articulation therebetween.

2. In a warp knitting machine, in combination, a knitting unit mounted for to-and-fro motion, a member connected to said unit, a resilient beam secured at one end to said member, a second resilient beam secured at one end to said member and lying in a plane intersecting that of said first-mentioned beam, and a driving member for said unit secured to the other ends of said beams.

3. In a warp knitting machine, in combination, a knitting unit mounted for to-and-fro movement, a driving member mounted for to-and-fro movement, and a pivotal connection provided by resilient cross members secured at their respective ends to said unit and said member.

4. In a warp knitting machine, in combination, a knitting unit, arranged for to-and-fro movement, a member connected to same to constrain its to-and-fro movement, and resilient cross members providing an articulated connection between said member and said unit.

5. In a warp knitting machine, in combination, a knitting unit, a stationary member, resilient cross members interposed between said unit and said member to provide a pivotal connection therebetween, and means for moving said unit to-and-fro along the path permitted by said pivotal connection.

6. In a warp knitting machine, in combination, a knitting unit, a stationary member, resilient cross members interposed between said unit and said member to provide a pivotal connection therebetween, a driving member for moving said unit to-and-fro and resilient cross members interposed between said unit and said driving member.

7. In a warp knitting machine, in combination, a knitting unit, a stationary member, a parallel linkage including two links, two sets of resilient cross members interposed respectively between said links and said unit, and a further two sets of resilient cross members interposed respectively between said links and said stationary member.

8. In a warp knitting machine, in combination, a knitting unit, a lever directly supporting said unit, a stationary member, resilient cross members interposed between said lever and said stationary member to provide a pivotal connection therebetween, a driving member for imparting to-and-fro motion to said unit, and further resilient cross members interposed between the said driving member and said unit to provide a pivotal connection therebetween.

9. In a warp knitting machine, in combination, a knitting unit mounted for to-and-fro motion, a reciprocable member, a second reciprocable member, means for reciprocating said members respectively at different frequencies, a floating lever, resilient cross members providing a pivotal connection between said floating lever and one of said reciprocable members, further resilient cross members providing a pivotal con-

nection between said floating lever and the other of the said reciprocable members, and means interconnecting said knitting unit and said floating lever whereby the to-and-fro motion of said knitting unit comprises components of movement derived from each of said reciprocable members.

10. In a warp knitting machine, in combination, a knitting unit, a pair of eccentrics, a driving interconnection between said eccentrics whereby one rotates at a greater speed than the other, eccentric rods allocated respectively to said eccentrics to be reciprocated thereby, a floating lever, resilient cross members interconnecting said floating lever and one of said eccentric rods so as to provide a pivotal connection therebetween, further resilient cross members interposed between said floating lever and the other of said eccentric rods to provide a pivotal connection therebetween, and mechanism for connecting said floating lever and said knitting unit to impart thereto, from said floating lever, motion derived simultaneously from said eccentrics.

11. In a warp knitting machine, in combination, a knitting unit mounted for to-and-fro movement, a cam mounted for rotation, an eccentric mounted for rotation, a driving interconnection between said cam and said eccentric whereby one rotates at a speed different from that of the other, followers respectively deriving to-and-fro motion from said cam and said eccentric, a floating lever, resilient cross members interposed between said floating lever and one of said followers to provide a pivotal connection therebetween, further cross members interposed between said floating lever and the other of said followers to provide a pivotal connection therebetween, and mechanism interconnecting said floating lever and said knitting unit to impart thereto motion derived, through said floating lever, from both said cam and said eccentric.

12. In a warp knitting machine, in combination, a knitting unit mounted for to-and-fro movement, a driving member mounted for to-and-fro movement, and a pair of resilient cross members, formed of a synthetic resin material, interposed between said unit and said member to provide a pivotal connection therebetween.

13. In a warp knitting machine, in combination, a knitting unit arranged for to-and-fro movement, a member connected to same to constrain its to-and-fro movement, and resilient cross members, formed from a synthetic resin material, providing an articulated connection between said member and said unit.

14. In a warp knitting machine, in combination, a knitting unit arranged to undergo to-and-fro movement, a driving member mounted for to-and-fro movement and resilient cross members, one consisting of relatively narrow members located respectively on either side of the other member providing an articulated connection between said member and said unit.

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