May 22, 1934. K. R. LIEBERKNECHT 1,959,588

CARRIER ROD OPERATING MECHANISM FOR FLAT KNITTING MACHINES

Filed Dec. 16, 1933 2 Sheets-Sheet 1

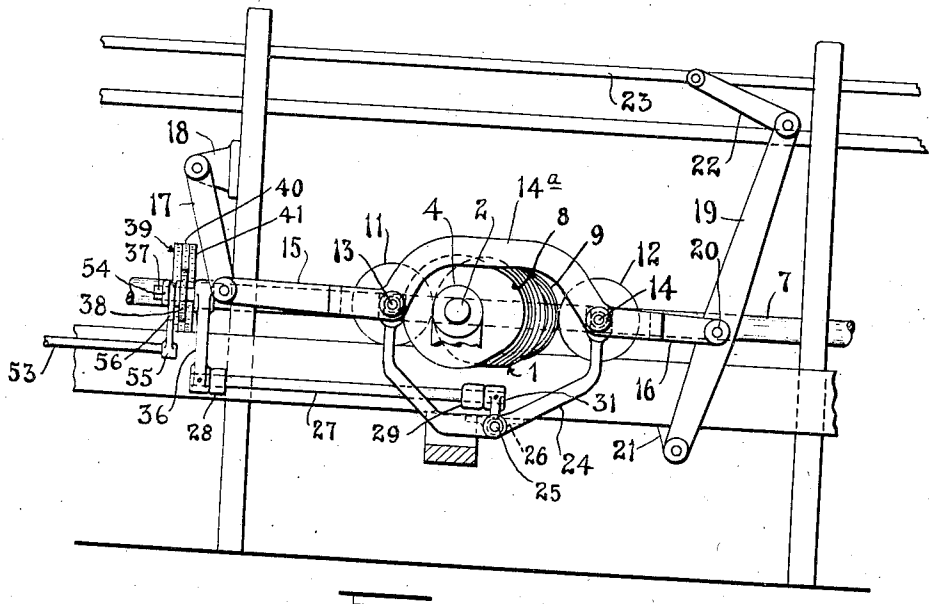


Fig. 1

Fig. 2

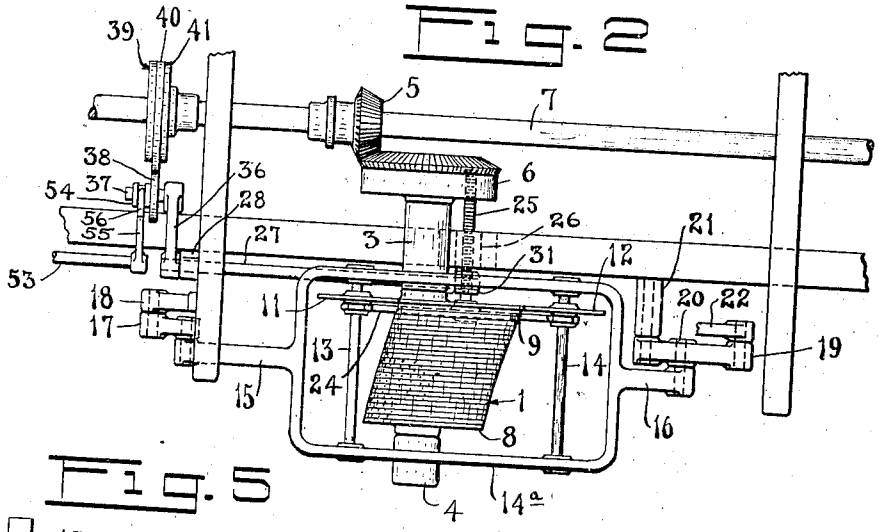
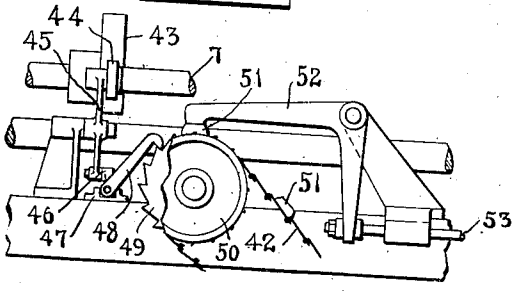


Fig. 5



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Fig. 3

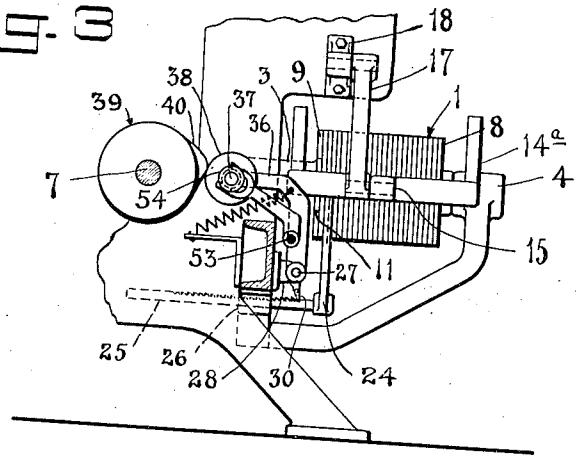
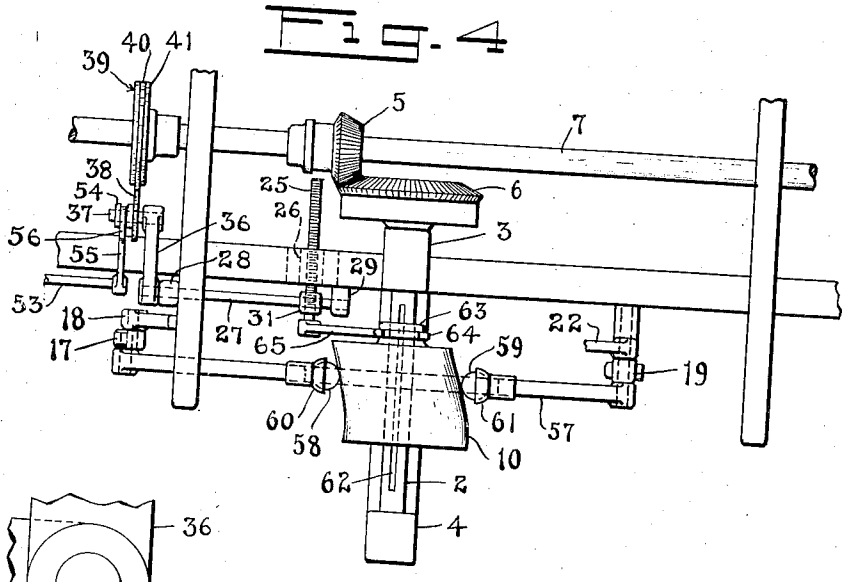


Fig. 4



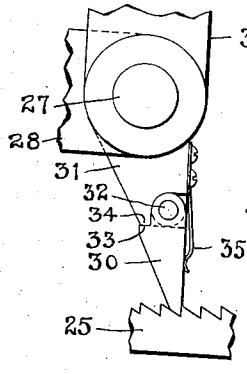


Fig. 6

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CARRIER ROD OPERATING MECHANISM FOR FLAT KNITTING MACHINES

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Application December 16, 1933, Serial No. 702,669
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9 Claims. (Cl. 66—126)

This invention covers a new and useful improvement in flat knitting machines and in particular to the carrier rod operating mechanism.

In present day full fashioned flat hosiery knitting machines both the slur cock bar and friction rod are reciprocated by the same lever operated from the coulier cam. For this reason the travel of the slur cock bar and friction rod are unvarying. Since the slur cocks are fixed to the slur cock bar the slur cocks also travel over unvarying paths. On the other hand, the travel of the thread carriers must be altered at certain periods of the knitting. In particular when narrowing the outer terminus of travel of the thread carriers and consequently of their carrier rods is progressively stepped inwardly so that the travel of these carriers and rods becomes shorter and shorter. This is made possible by the frictions which constitute the working connections between friction rod and carrier rods and which, as is well known, permit of limiting the travel of the carrier rods as required without affecting the unvarying travel of the friction rod.

The necessity of thus altering the relative positions of the carriers and slur cocks from time to time during the knitting results in undesirable but unavoidable alterations in the lead between the thread carriers and the sinkers. During narrowing, for example, since the outward movements of the carriers end at a point inside of that in which they originally ended while the slur cocks continue to move over the full distance the lead is increased and this lead grows greater as the narrowing progresses.

In order to produce uniform fabric all of the conditions and particularly those associated with the actual forming of the loops should be maintained as unchanging as practicable.

One of the objects of this invention is the maintenance of a much more uniform lead between thread carriers and sinkers throughout the knitting, including the narrowing.

Also the invention, through the separation of the operating mechanism of the slur cocks and thread carriers, makes it possible to operate each of these elements to best advantage. For example, it now becomes possible to decrease the rate of acceleration and deceleration of the carrier rods at the beginning and end of each stroke irrespective of its length in such a way that the shock of starting and particularly of stopping when the carrier rods hit their limiting stops is greatly reduced. As is well known the impact of the carrier rods against the stops when traveling at high speed is very hard on the machine and not infrequently causes the carrier rods to rebound so that the carriers are displaced from their correct positions. Furthermore, the travel of the carrier rod may, by this invention, be restricted to substantially the required travel of the carriers so that the frictions are substantially stationary upon the carrier rod instead of sliding thereupon for a considerable portion of each stroke. All of these things reduce the driving effort and distribute it to greater advantage causing each device to function more smoothly and accurately.

The nature of the invention may be fully understood from the following description of one form of the device which is shown in the drawings for purposes of illustration only and not with limiting intent. Of the drawings

Figure 1 is a rear elevation of a portion of a knitting machine showing diagrammatically the new friction rod drive of the invention;

Fig. 2 is a similar plan view of the same drive;

Fig. 3 is an end elevation along the line 3—3 of Fig. 1 looking in the direction of the arrows;

Fig. 4 is a plan view of a modified form of the new friction rod drive;

Fig. 5 is a view showing one of the cam roller shifting mechanisms in greater detail; and

Fig. 6 is a view in detail of the rack shifting pawl.

As previously stated, in present day flat knitting machines the slur cock bar and friction rod are both reciprocated by the same lever operated from a single coulier cam. As is well known this coulier cam is mounted on a cross shaft and is driven through beveled gears from the main cam shaft.

In the machine of this invention the usual coulier motion is retained but is employed solely for the purpose of driving the slur cock bar, its connection to the friction rod being eliminated.

A separate friction rod drive is provided which consists of a specially designed cam 1 keyed to a cross shaft 2 resembling the ordinary coulier shaft, mounted in suitable bearings 3 and 4 and similarly driven through beveled gears 5 and 6 from the main cam shaft 7. Rotary motion is thus imparted to cam 1.

As shown in Figs. 1, 2 and 3 cam 1 may consist of a series of separate juxtaposed cam disks having progressively increasing amounts of throw so that the throw of the composite cam is progressively greater from one end to the other. For example, as best shown in Fig. 2, cam disk 8 has the smallest throw and cam disk 9 the greatest, the throw of those in between being progressively graduated.

Instead of the laminated cam 1 shown in Figs. 1, 2 and 3 a solid cam 10 may be employed as shown in Fig. 4. The surface characteristics of this cam, however, will be in all respects identical with those of the composite cam, the only difference being structural. In either case the working surface of the cam should be smooth so that the rollers which engage with it, as will be described, may slide readily from one part of the surface to another. This would, of course, be impossible with the laminated cam 1 if its original step-like surface were preserved.

The dimensions of all the disks of which cam 1 is composed, or of the equivalent cross-sections of cam 10, should be such that the distance from any part of the surface through the center to the opposite surface will be the same in all directions. Otherwise the characteristics may be varied as desired.

On either side of and maintained in engagement with cam 1 are rollers 11 and 12 lying in the same plane so that they will be influenced by the same cross-sectional area of the cam surface. Rollers 11 and 12 are mounted upon shafts 13 and 14 respectively, which are in turn mounted in opposite sides of a frame 14^a. Arms 15 and 16 extending from the respective ends of frame 14 complete a pitman capable of being reciprocated longitudinally of the machine by the rotation of cam 1. This reciprocation will be the same in each direction since rollers 11 and 12 are each acted upon by the same part of the cam surface during opposite halves of its rotation. The outer end of arm 15 is pivoted to a link 17 which is, in turn, pivoted to a suitable support 18 attached to the frame of the machine. The outer end of arm 16 is pivoted to a lever 19 at a point 20 intermediate its ends. One end of lever 19 is pivoted to a suitable bracket 21 attached to the frame of the machine, and the other end connects pivotally with one end of a link 22, the remaining end of which is pivotally connected to friction rod 23. Through these connections the reciprocation of frame 14 will be communicated to friction rod 23, the extent of reciprocation of the frame and, consequently, of the friction rod depending upon the throw of that part of the surface of cam 1 with which rollers 11 and 12 are in contact. For example, when the rollers are in the position shown in Fig. 2 the reciprocation will be the maximum since the throw of that part of cam 1 is maximum.

In order to make use of other parts of the cam surface having less throw rollers 11 and 12 are slidable upon shafts 13 and 14. By so sliding the two rollers along these shafts the reciprocation of frame 14 and, consequently, the throw of friction rod 23 may be progressively decreased. Thus the travel of friction rod 23 may be limited to substantially the distance required for operating the carrier rods, the frictions being maintained substantially stationary upon friction rod 23. In order that rollers 11 and 12 may be always operated upon by the same part of the cam surface they should be connected together as by a yoke 24 which will permit them to rotate freely but will maintain them in the necessary alignment.

Rollers 11 and 12 may be manually adjusted to engage with any desired part of the cam surface by sliding them along shafts 13 and 14 but, since the throw of friction rod 23 must be varied to correspond with and concurrently with the narrowing of the fabric it is preferable, of course, to move them mechanically and automatically. This may be done by the following mechanism. Attached to yoke 24 and paralleling shafts 13 and 14 is a rack 25 slidable in a suitable bearing 26. At right angles to this rack is a shaft 27 mounted in suitable bearings 28 and 29, one end of which overlies rack 25 and is provided with a pawl 30 adapted to engage with rack 25 to move it outwardly when shaft 27 is rocked in one direction and to swing back into engagement with another tooth of the rack when shaft 27 is rocked in the other direction.

One of many suitable pawl mechanisms for this purpose is shown in Fig. 6. It consists of a bracket 31 attached to shaft 27 having a bearing 32 upon which the pawl 30 is pivoted. Pawl 30 is provided with a shoulder 33 which is normally held in engagement with a shoulder 34 on bracket 31 by a spring 35. Thus, as clearly shown in the drawings, when shaft 27 is rocked in the direction for moving rack 25 the pawl is held rigidly upon bracket 31 and the motion of shaft 27 translated into a movement of rack 25. When shaft 27 is rocked in the opposite direction spring 35 permits the pawl to swing back into engagement with the next tooth by riding over its back.

Shaft 27 may be rocked by an arm 36, the free end of which carries a short shaft 37 upon which is slidably mounted a cam roller 38. Upon the main cam shaft 7 is a cam 39 having a working surface 40 and an idling surface 41 with one or the other of which roller 38 engages, depending upon its position upon shaft 37. When roller 38 is in engagement with working surface 40 of cam 39 shaft 27 will be rocked and pawl 30 operated to impart a step by step movement to rack 25 which will, in turn, move rollers 11 and 12 across the face of cam 1 in a similar step by step manner. Whenever roller 38 is in engagement with idling surface 41 of cam 39 no rocking movement will be imparted to shaft 27 and, consequently, the position of rollers 11 and 12 with respect to cam 1 will remain undisturbed.

Since the travel of the thread carriers and, consequently, of carrier rod 23 need be varied only when the width of the fabric is varied the control of cam roller 38 may well be entrusted to the same mechanism that controls the narrowing mechanism. As is well known by those skilled in the art this is ordinarily a pattern chain 42 operated from the main cam shaft by suitable mechanism, such as shown in Fig. 5, as consisting of a cam 43 on the main cam shaft 7, a roller 44 engaging therewith and rotatably mounted upon one end of pivoted rock lever 45, the other end of which is connected to another rocker arm 46 carried in a bearing 47 and having a pawl 48 at its other end arranged to engage and operate a ratchet 49 attached to sprocket 50 of the pattern chain 42. Roller 38 may be shifted into and out of operation with cam 39 by means of suitably placed buttons 51 on the same pattern chain which are adapted to engage with one arm of a bell crank 52, the other arm of which is attached to a rod 53. This, in turn, connects with an annular collar 54 attached to roller 38 by means of an arm 55 terminating in a fork 56. Whenever a button 51 engages with the bell crank 52, rod 53 will be moved longitudinally and roller 38 will be slid upon its shaft 37 from engagement with idling surface 41 of cam 39 on to working surface 40. When a button 51 passes from under bell crank 52 roller 38 will be returned from working surface 40 to idling surface 41. In this manner the throw of friction rod 23 may be progressively altered, as desired, in synchronism with the operation of other parts of the machine. Rollers 11 and 12 may be returned manually to their origi-

nal position when desired by disengaging pawl 30 from the rack and sliding them along shafts 13 and 14.

In Fig. 4 a modification of the device described above is shown. In this the pitman formed by frame 14 and arms 15 and 16 is eliminated together with rollers 11 and 12 and the shafts 13 and 14 on which they slide. In their place is substituted a yoke 57 pivoted at one end to arm 16 and at the other to lever 19 in exactly the same way as the pitman. In place of rollers 11 and 12 two balls 58 and 59 are provided, each mounted in a suitable bearing 60 and 61 respectively on yoke 57 and so positioned as to contact with opposite sides of cam 10. Since balls 58 and 59 are not slidable as were rollers 11 and 12, cam 10 is made slidable upon its shaft 2 so that any part of its surface may be made to engage with balls 58 and 59. To make this possible shaft 2 may be provided with a spline 62 and cam 10 with a corresponding spline slot which will enable cam 10 to slide upon shaft 2 without affecting the rotative connection between them. This combination will impart to arm 19 and, consequently, to friction rod 23 the same reciprocatory motion as was effected by the construction previously described.

In order to slide cam 10 upon its shaft as above described, the cam is provided with an annular collar 63 with which engages a fork 64 forming one end of an arm 65, the other end of which is equipped with the rack 25. Rack 25 is moved outwardly by a mechanism identical to that already described in connection with Figs. 1, 2, 3 and similarly numbered in Fig. 4 so that no further description is required.

The separation of the driving mechanisms of the carrier rod and slur cocks makes it possible to maintain any desired relation between the thread carriers and sinkers at any time. Thus it is possible to start the movement of either the slur cocks or thread carriers ahead of the other with the result, for example, that the lead of the thread carriers over the sinkers may be absolutely uniform throughout the knitting, irrespective of the constant distance traveled by the slur cocks and the decreasing distance covered by the thread carriers and friction rod. The invention also makes possible a more gradual acceleration and deceleration of the carrier rods at the beginning and end of their strokes so that the shock of starting and particularly of stopping is greatly reduced, the carrier rods no longer being driven against their limiting stops at high speed. Another important feature not heretofore mentioned is that the invention may be applied to a standard knitting machine by making relatively simple additions thereto and involves practically no alteration of other parts.

What I claim is:

1. In a flat knitting machine having a reciprocable friction rod, means for reciprocating said friction rod consisting of a rotatable wide-faced cam each cross-section of which differs in degree of throw from adjacent cross-sections, and means for translating the throw of any one of said cross-sections of said cam into an equivalent reciprocation of said friction rod.

2. In a flat knitting machine having a reciprocable friction rod, means for reciprocating said friction rod consisting of a cam having a multiplicity of juxtaposed camming surfaces of varying throw, means for translating the throw of any one of said camming surfaces into a proportionally equivalent reciprocatory motion of said friction rod, and means for rotating said cam.

3. In a flat knitting machine having a reciprocable friction rod, means for reciprocating said friction rod consisting of a rotatable cam having a multiplicity of juxtaposed camming surfaces of varying throw, a roller maintainable in contact with any one of said camming surfaces, means for shifting said roller from one camming surface to another, and means connecting said roller and said friction rod proportionally.

4. In a flat knitting machine having a main cam shaft and a reciprocable friction rod, means for reciprocating said friction rod, consisting of a cam having a multiplicity of juxtaposed camming surfaces of varying throw, a roller adapted to ride upon any one of said camming surfaces, means for shifting said roller from one camming surface to another, means for connecting said roller and said friction rod for translating the rotary motion of said cam into a proportionally equivalent reciprocatory motion of said friction rod, and means for operating said shifting means at predetermined times during the knitting operations of the machine.

5. In a flat knitting machine having a main cam shaft and a reciprocable friction rod, means for reciprocating said friction rod, consisting of a cam having a multiplicity of juxtaposed camming surfaces of varying throw, a roller adapted to ride upon any one of said camming surfaces, means for shifting said roller from one camming surface to another, means for connecting said roller and said friction rod for translating the rotary motion of said cam into an equivalent reciprocatory motion of said friction rod, and means for operating said shifting mechanism to shift said roller from one camming surface to another so as to progressively decrease the throw of the friction rod in timed relation to each operation of the narrowing mechanism.

6. In a flat knitting machine having a main cam shaft and a reciprocable friction rod, means for reciprocating said friction rod, consisting of a cam having a multiplicity of juxtaposed camming surfaces of varying throw, a pair of rollers engageable respectively with diametrically opposed portions of any one of said camming surfaces, means for shifting said rollers from one camming surface to another, means connecting said rollers and said friction rod for translating the rotary motion of said cam into a proportionally equivalent reciprocatory motion of said friction rod, and means for rotating said cam in timed relation to the rotation of said main cam shaft.

7. In a flat knitting machine having a main cam shaft and a reciprocable friction rod, means for reciprocating said friction rod consisting of a cam having a multiplicity of juxtaposed camming surfaces of varying throw, a roller maintainable in contact with any one of said camming surfaces, means for shifting said roller from one camming surface to another, means connecting said roller and said friction rod for translating the rotary motion of said cam into a proportionally equivalent reciprocatory motion of said friction rod and means for rotating said cam in timed relation to the rotation of said main cam shaft, said shifting means consisting of a rack operatively connected to said rollers for shifting the same from one camming surface to another, a pawl engaging with said rack to move it in one direction, and means for operating said pawl to

move said rack in timed relation to the rotation of said main cam shaft.

8. In a flat knitting machine having a main cam shaft and a reciprocable friction rod, means for reciprocating said friction rod consisting of a cam having a multiplicity of juxtaposed camming surfaces of varying throw, a roller maintainable in contact with any one of said camming surfaces, means for shifting said roller from one camming surface to another, means connecting said roller and said friction rod for translating the rotary motion of said cam into a proportionally equivalent reciprocatory motion of said friction rod and means for rotating said cam in timed relation to the rotation of said main cam shaft, said shifting means consisting of a rack operatively connected to said rollers for shifting the same from one camming surface to another, a pawl engaging with said rack to move it in one direction, and means for operating said pawl to move said rack when said friction rod is at rest.

9. In a flat knitting machine having a main cam shaft and a reciprocable friction rod, means for reciprocating said friction rod over varying distances consisting of an arm swingable upon a fixed pivot adjacent one end of said arm, the other end of which is linked to said friction rod so as to reciprocate the same when said arm is swung, and means for swinging said arm through any one of a number of different angles.

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