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R. BUCK

CIRCULAR KNITTING MACHINES

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Serial No.
312,595
4 Sheets-Sheet 1

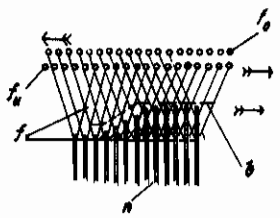
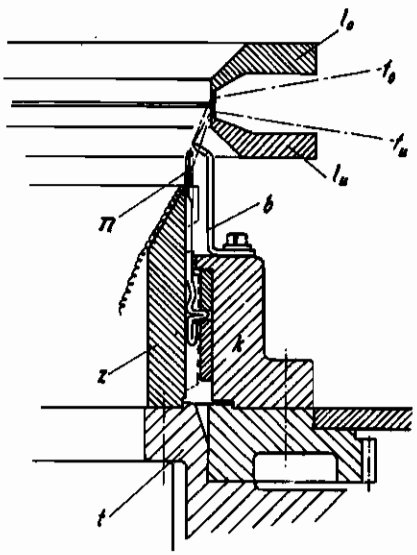


Fig. 4



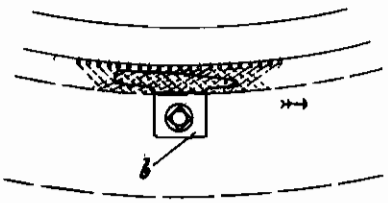


Fig. 3

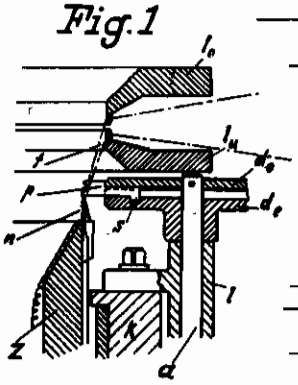
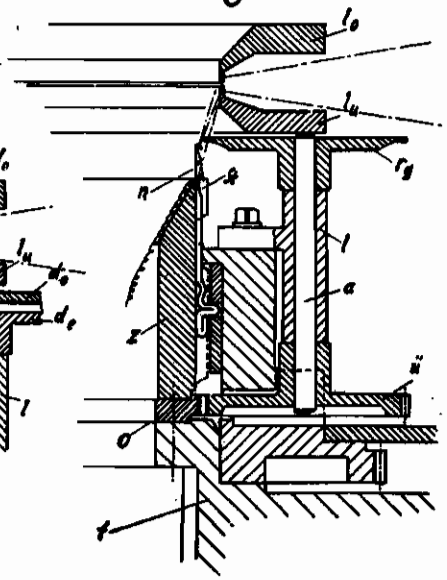


Fig. 1



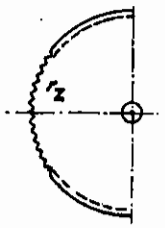


Fig. 2

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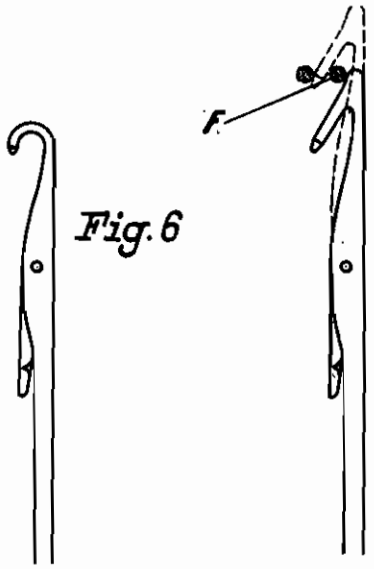

Fig. 6

Fig. 7

Fig. 5

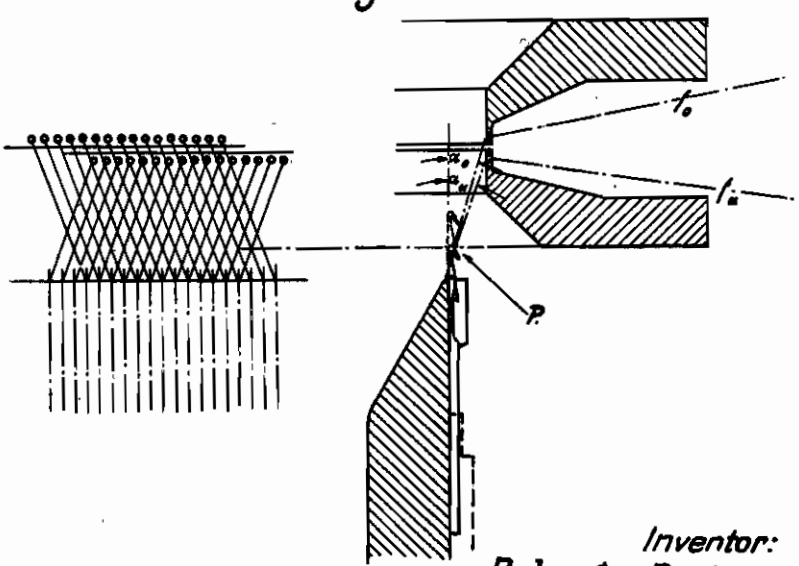

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Fig. 8

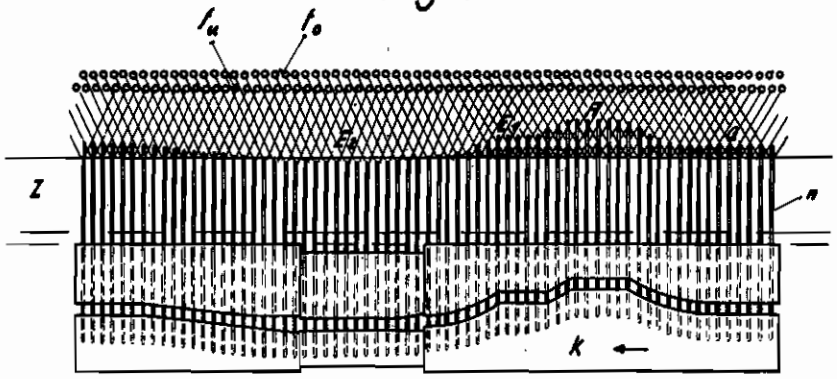

Fig. 10

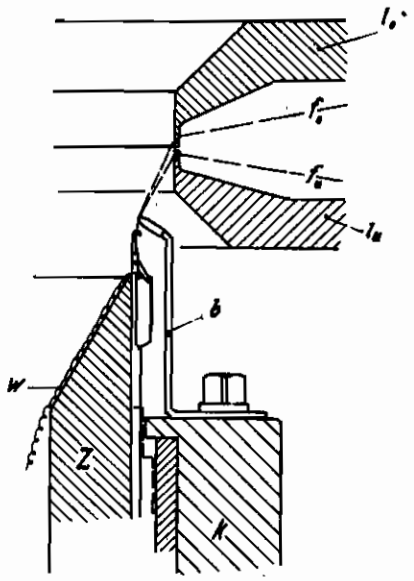

Fig. 9

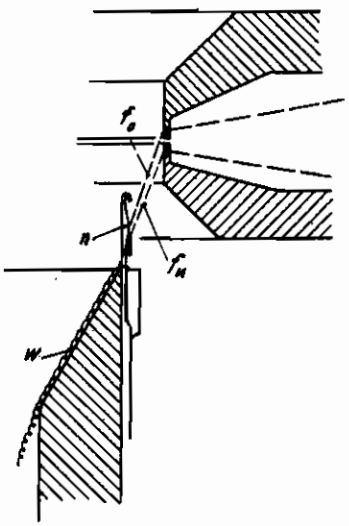

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Fig. 13

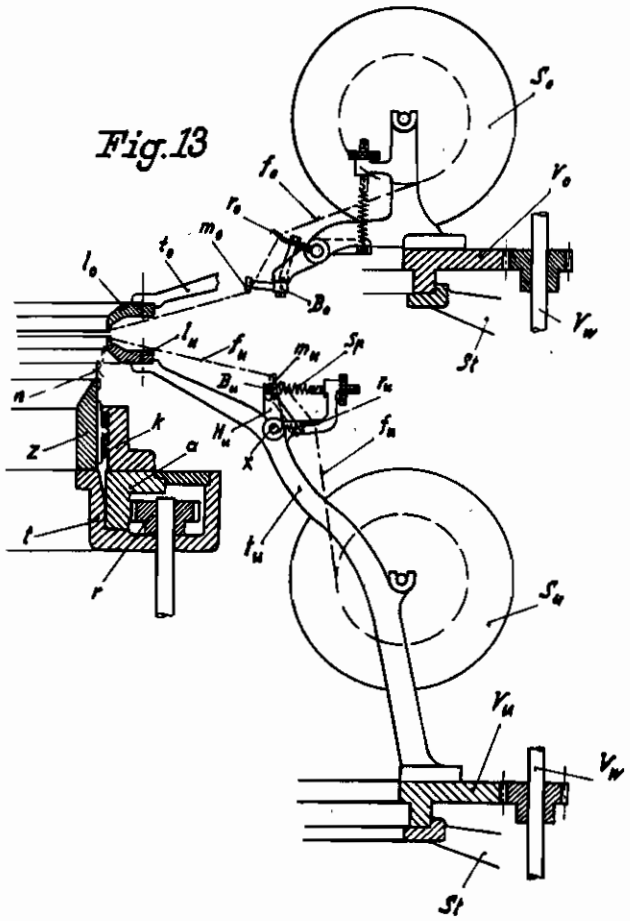


Fig. 11

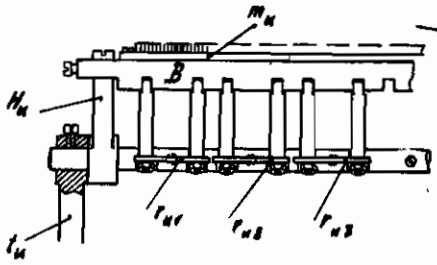
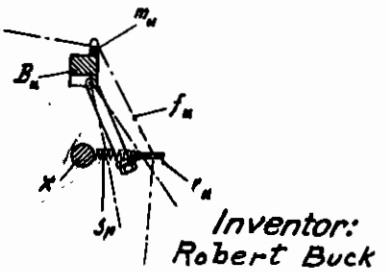


Fig. 12



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ALIEN PROPERTY CUSTODIAN

CIRCULAR KNITTING MACHINES

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Application filed January 5, 1940

In circular knitting machines it has already been proposed to actuate the needles singly by means of rotary cam track members, in order to achieve a knitting operation continuously progressing in a circular path. The warp threads or the thread crossings formed thereby are brought into the path of the needles by the uppermost throat of multi-throated sinker bars, said bars having hooks which on downward movement of the bars grip the thread crossings in order to subject them to the shed or loop forming operation. The sinker bars themselves which are associated with the machine needles are mounted in a fixed guide ring in such a manner that the radial actuation of the said bars also requires cam means moving in a curved path. Under these conditions a common drive for the circular movements of the needles and sinker bars has been provided. The cam contour, however, could be such that each needle or sinker bar during one rotation of the cam means will move up and down four, eight or twelve times, whereby the output of the machine is correspondingly increased. Owing to the presence of the cam means required for the actuation of the sinker bars, the accessibility of the machine and its control by an operator are considerably impaired because the arrangement of the necessary mechanism around the working circumference of the machine occupies useful space apart from the fact that the mechanism itself is expensive to manufacture.

The present invention provides a circular knitting machine in which instead of the sinker bar guide ring, a sinker wheel is employed, having sinker throats which seize the thread crossings and move them to the downwardly moving needles. The shaft of the sinker wheel moves in a planetary path around the needle cylinder at the speed of the cam track member which actuates the needles, so that the above mentioned coordination with the cam track for actuating the needles, is guaranteed.

Such constructions embodying the invention are diagrammatically illustrated in the drawings in which,

Figure 1 is a partial sectional view of the rings,

Figure 2 is a partial side view of the wheel,

Figure 3 is a view similar to Figure 1 of a modified form,

Figure 4 is a diagrammatic view and a sectional view illustrating the method.

Figure 5 is a view similar to Figure 4,

Figures 6 and 7 are side views of two forms of needles,

Figure 8 is a diagrammatic view illustrating the cam track,

Figures 9 and 10 are sectional views illustrating the method,

Figure 11 is a plan view of certain details,

Figure 12 is a sectional view of Figure 11, and

Figure 13 is a cross sectional view of the machine.

The upper and lower warp threads f_o and f_u pass from the warp bobbins to the heald rings e_o and l_u from which they pass as shown in Fig. 1 of the machine needles. A cam track member k rotates in a planetary path around the needle cylinder z which carries the needles n which cam track member carries a bearing l for a shaft a. The sinker bars p are mounted in radial or tangential slots in a sinker wheel comprising discs d_e, d_o between which they are pressed. The drive of the sinker wheel is effected by a guide wheel u which meshes with a fixed toothed ring o. The guide wheel engages either the shanks of the needles n or ribs s_t on the cylinder, and the bearing l of the shaft a is also mounted on the rotary cam track member k. In this connection it should be understood that the drive may also be effected independently of the cylinder and the rotary cam track member k.

The sinker wheel may be so formed that lugs s on the sinker bars k are guided by a cam track which does not rotate with the wheel but is fixed on the bearing l whereby, the sinker bars in addition to their circular movement may receive simultaneously a radial movement beyond the duration of the insertion of the needle produced by the cam track This latter arrangement is not shown in the drawings.

In the modification shown in Fig. 2, the sinker wheel is replaced by a toothed wheel r_x driven in the same manner as the sinker wheel. In this arrangement, however, there are no sinker bars as shown in Fig. 1, between the thread crossings, but teeth are provided on the circumference, the spacing of which corresponds to that of the thread crossings.

According to another modification, even the teeth of the wheel are eliminated, and the wheel r_g as shown in Fig. 3 has its circumference quite smooth. This smooth wheel r_g is driven in the same manner as the sinker wheel and the toothed wheel r_z.

The use of these different wheels clearly indicates that even in a plural system machine there is always enough space available between the separate systems to give accessibility and easy supervision of the machine.

Furthermore, in spite of the increased rapidity of operation, there is greater reliability apart from the fact that the novel constructions are essentially simpler to manufacture and therefore cheaper than the previously known arrangements.

A further modification is shown in Fig. 4, in which instead of a driven wheel, a thread guide cam *b* is employed which may be fixed on the needle cam track member *k*. This circularly moving member at a certain instant forces or displaces the crossing of the threads *f* sufficiently far in the radial direction that they come into the path of the downwardly moving needle hooks whereby the in-drawing of the warp threads can take place in known manner. This modification has the further advantage over the previous constructions that no drive elements are present or necessary. This results in greater reliability of operation as well as improved accessibility, ease of operation, and simplicity of manufacture.

From the foregoing constructions it will be seen that the sinker bars of the sinker wheel, the toothed wheel r_z and smooth wheel r_g, also the thread guide cam *b*, each serve the purpose of forcing the thread crossing in radial direction into the path of the needle hooks, whereupon the needles on their downward movement draw in the new threads required to form the loop or shed. This displacement of the warp threads must naturally be kept as small as possible so that the tendency is to keep the angle of inclination a_o and a_u between the upper and lower warp threads, and the vertical needles, Fig. 5, as small as possible.

To assist in achieving this purpose the present invention provides a hook needle, as shown in Fig. 7, having a head of novel form, as will be seen by comparison with the usual needle shown in Fig. 6. The hook of the new needle is formed as a guide cam so that the ejecting upwardly moving needle contacts the thread crossing at the point P (Fig. 5) which point corresponds to the point F shown in Fig. 7, so that the head slides along the thread crossing, due to its curved form, and the thread crossing is thereby displaced slightly in the radial direction, and after leaving the needle head, it returns to its natural position owing to the tension in the thread. In the ensuing downward movement of the needles, the upper warp thread f_o is thus located near the needle hooks, while the lower warp thread f_n, owing to its somewhat greater angle of inclination a_u, still lies somewhat outside of the needle hook.

There will now be described a further and very important feature relating to this minimum radial displacement of the warp threads at the needles. Fig. 8 shows a formation of the cam track member *k*, which moves from right to left. The needles *m*, separately movable in the fixed cylinder *z*, are brought from the base position G into the ejecting position A in order to bring the fabric W (Fig. 9) reliably behind the needle hooks, without requiring the use of any auxiliary means such as sinkers, clamp rings or the like to hold back the fabric. The needles *n* are not withdrawn as heretofore in a single stroke, but in two strokes by means of of a double stepped cam. The first in-drawing step E_1 terminates at the instant that the fabric *w* on the needles begins to touch the hooks and thus is not yet closed. Owing to the ensuing downward movement of the needles, the needle hooks draw the thread crossings of the warp threads f_o and f_u closer, so that the thread guide cam *b*, shown for example in Fig. 10 has to effect a shorter displacing movement to force the warp threads into the needle hooks, which movement may be produced by the shape and position of the thread guide cam. The second in-draw in step E_2 now takes place, beginning at the instant that the warp threads or their crossings are moved to the needle hooks, whereby uniform loops or sheds are formed, this instant being designated by the extended portion A_2.

In this connection a new feature in loop sinking should be noted because whereas in all other machines with separately movable needles one needle must complete the loop forming operation before the next begins such operation, in the present invention two or even more needles can form loops almost simultaneously.

In view of this feature it will be clearly recognized that the above mentioned shifting of the thread crossing is very slight so that it is practically impossible for any of the threads to get out of place whether by action of the sinker wheel, of the toothed wheel, of the smooth wheel, or of the thread guide cam.

The above mentioned almost simultaneous loop sinking of a plurality of loops has a great advantage from the mechanical point of view that the cams for the ejecting and in-drawing movements of the needles do not have such abruptly varying contour as in known circular knitting machines, whereby a higher speed of operation and a correspondingly greater output can be achieved without the danger of breaking off needle heads, bending cylinder ribs, or injuring needle channels due to excessively abrupt variation in the contour of cams.

In circular knitting machines for the manufacture of chain knitted goods, in which the knitting operation advances continuously in a circular path, means have already been provided for individually tensioning the threads whereby each warp thread is imparted the necessary tension for the knitting operation. Mechanism of this kind is very cumbersome, complicated, difficult to overlook and consequently expensive because each separate thread tensioning device must have an adjustable equalization of tension by such means.

The present invention provides thread tensioning means arranged in groups and controlled by springs or weights, the regulation of which can be carried out in very much simpler and easier manner than heretofore, whereby greater facility of supervision of the machine results. The novel arrangement also provides more reliable operation because there is also means for equalizing the tension inside the groups themselves since the device controlling the threads of each group can yield not only in the drawing-in direction, but also in the transverse direction. Since each individual group is yieldably mounted transverse to the drawing-in direction, the whole aggregate can be subjected to a displacement so that a complete accommodation of the warp threads to the advancing knitting operation is possible. This novel mechanism is shown in Figs. 11 to 13. The warp threads f_o and f_u pass through eye plates r_o and r_u and combs m_o and m_u to the heald rings l_o and l_u from the upper and lower warp bobbins s_o and s_u, and are guided to the needles *n*. The number of threads from one and the same warp bobbin may be divided into six, eight, or more groups. Each group, for

example of the lower threads, has assigned thereto an eye plate r_u, these being designated in Fig. 11 ru_1, ru_2 and ru_3. These eye plates r_u are shown in Fig. 12, for example, as under the influence of a helical spring s_p to hold the threads f_u in properly tensioned condition. The shifting of the eye plates r_u transversely to the drawing-in direction, which provides a further adaptation to the progressive knitting operation, is obtained as shown in Fig. 11 by a loose mounting of a lever l_u of the plate r_u in a cross bar B, which also carries the comb n_u. The above mentioned yielding of the aggregate in order to permit more perfect adaptation of the thread tension to the continuously progressing knitting operation, is obtained by suitable mounting of the cross bar B in left and right hand levers H_u, which levers rotate about a fixed shaft x supported by a frame member t_u.

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