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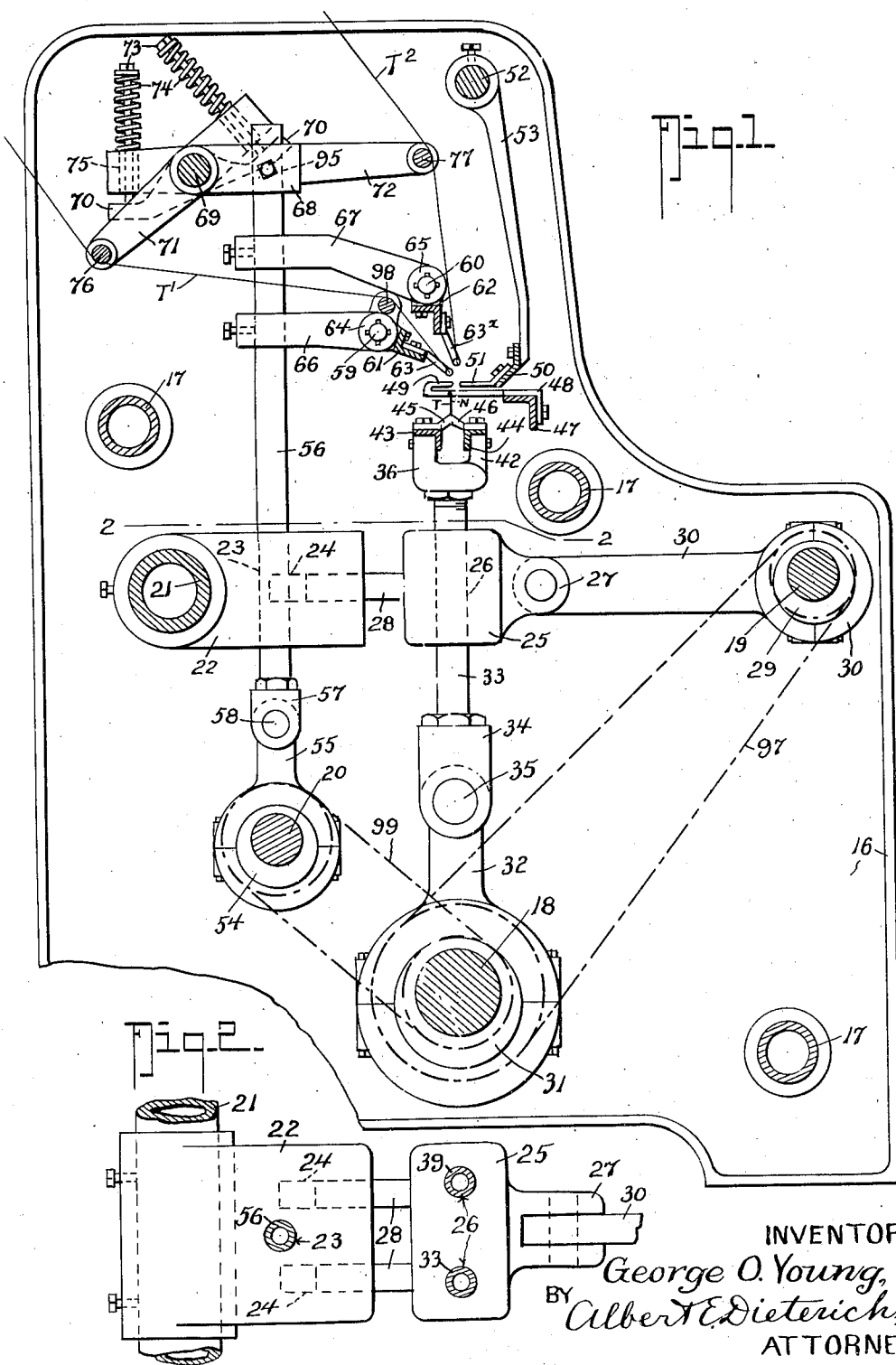
G. O. YOUNG

2,428,405

KNITTING MACHINE

Filed Dec. 18, 1945

8 Sheets-Sheet 1



INVENTOR,
George O. Young,
BY Albert E. Dieterich,
ATTORNEY.

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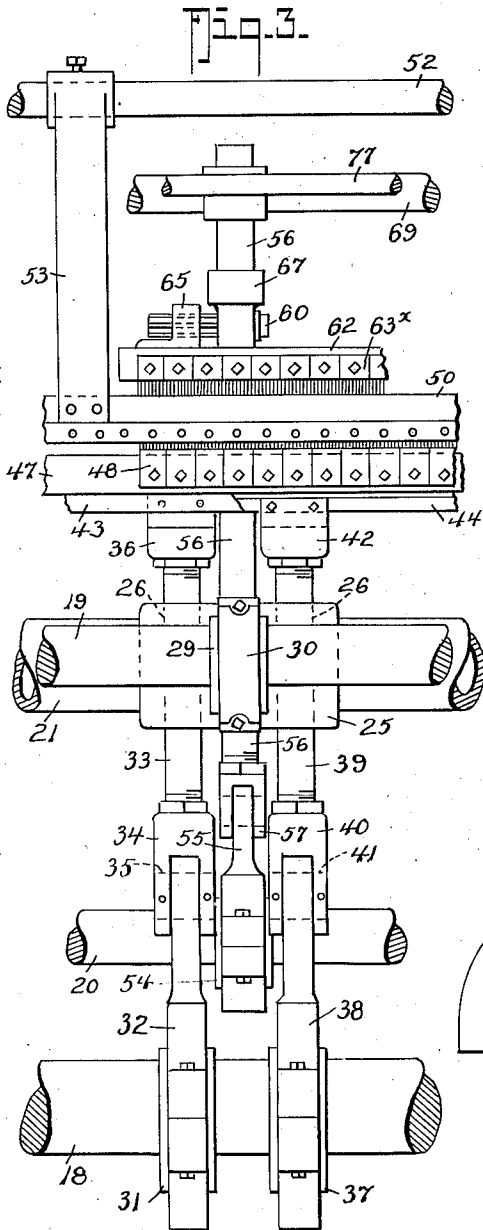
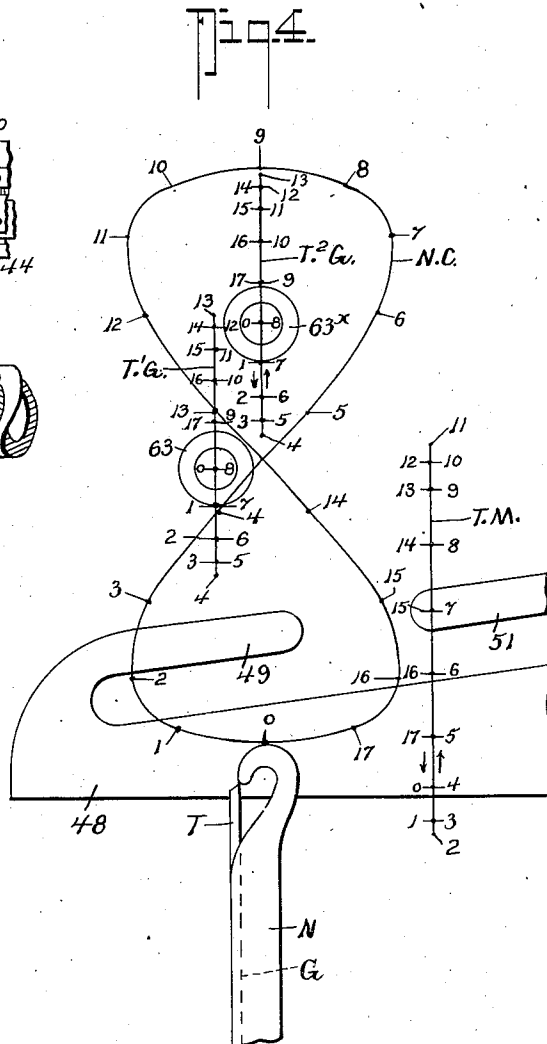
G. O. YOUNG

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8 Sheets-Sheet 2



INVENTOR,
George O. Young,
BY *Albert E. Dieterich,*
ATTORNEY.

Oct. 7, 1947.

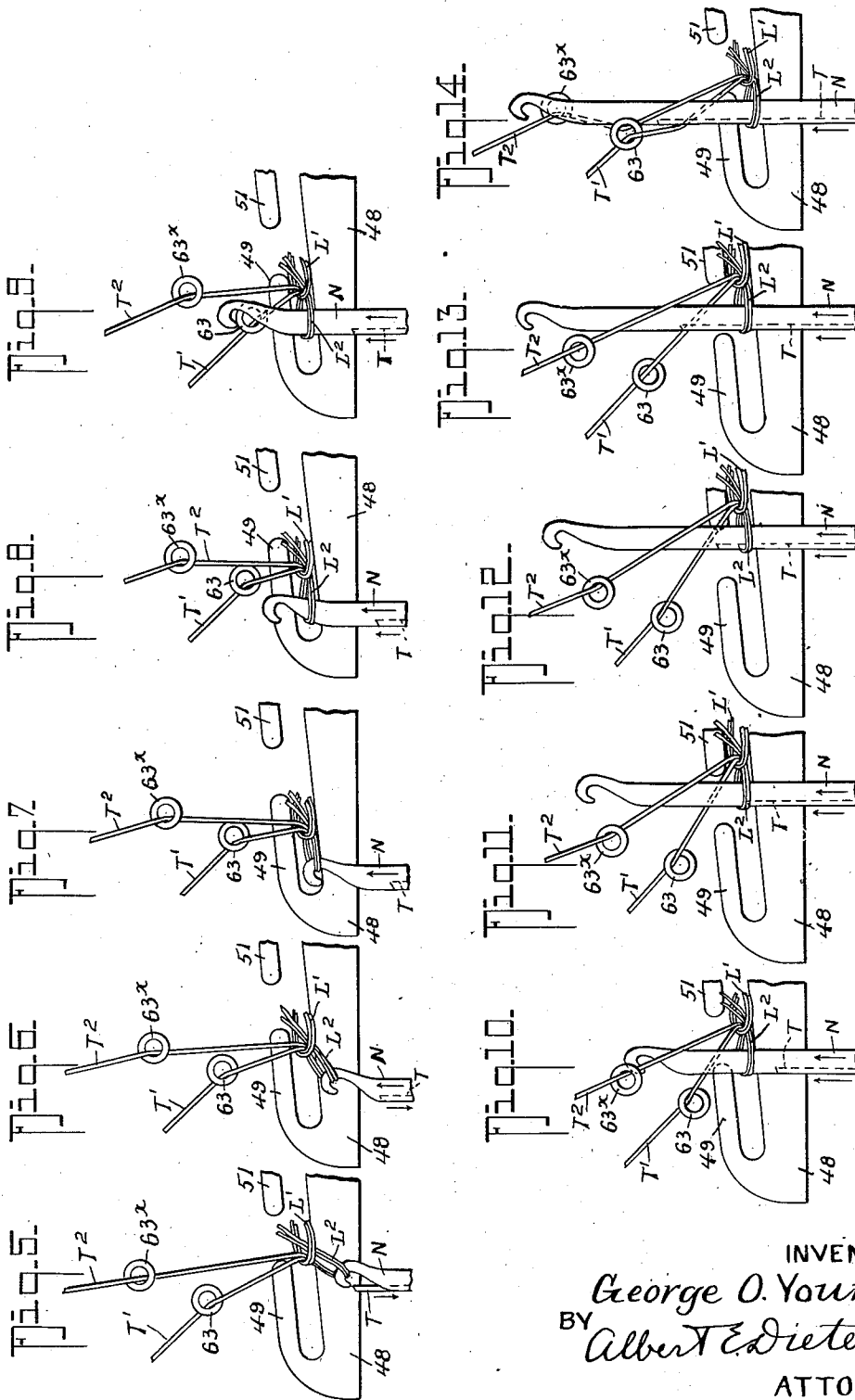
G. O. YOUNG

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8 Sheets-Sheet 3



INVENTOR,
George O. Young,
BY Albert E. Dieterich,
ATTORNEY.

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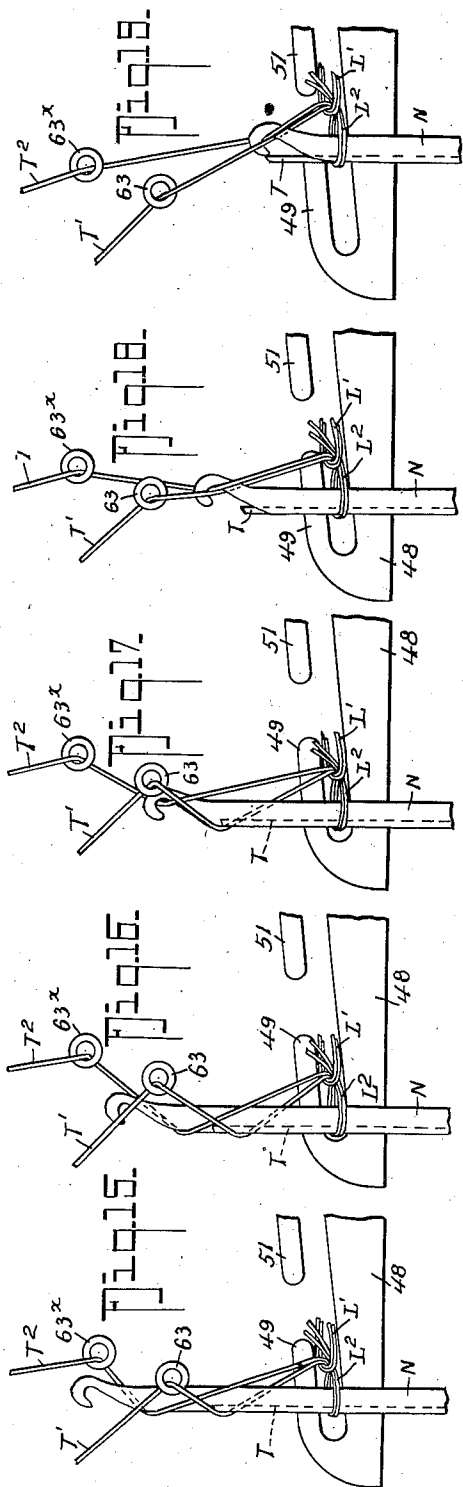
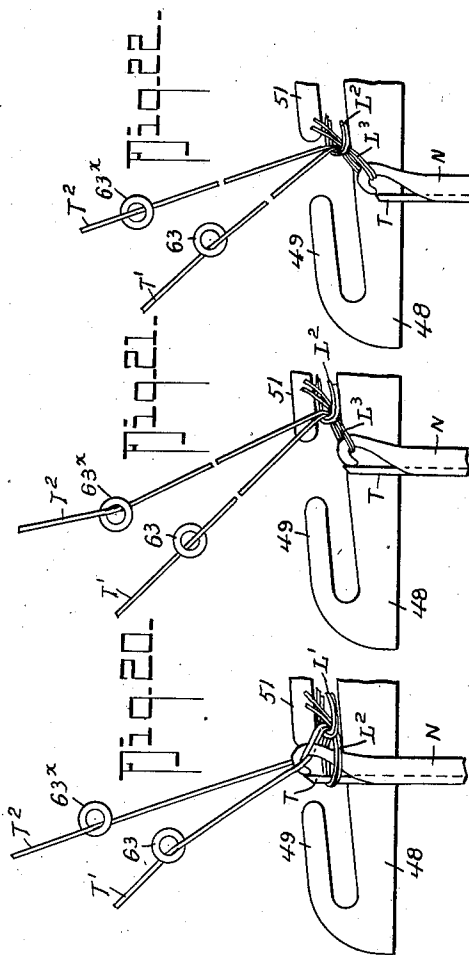
G. O. YOUNG

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8 Sheets-Sheet 4



INVENTOR,
George O. Young,
BY Albert E. Dieterich,
ATTORNEY.

Oct. 7, 1947.

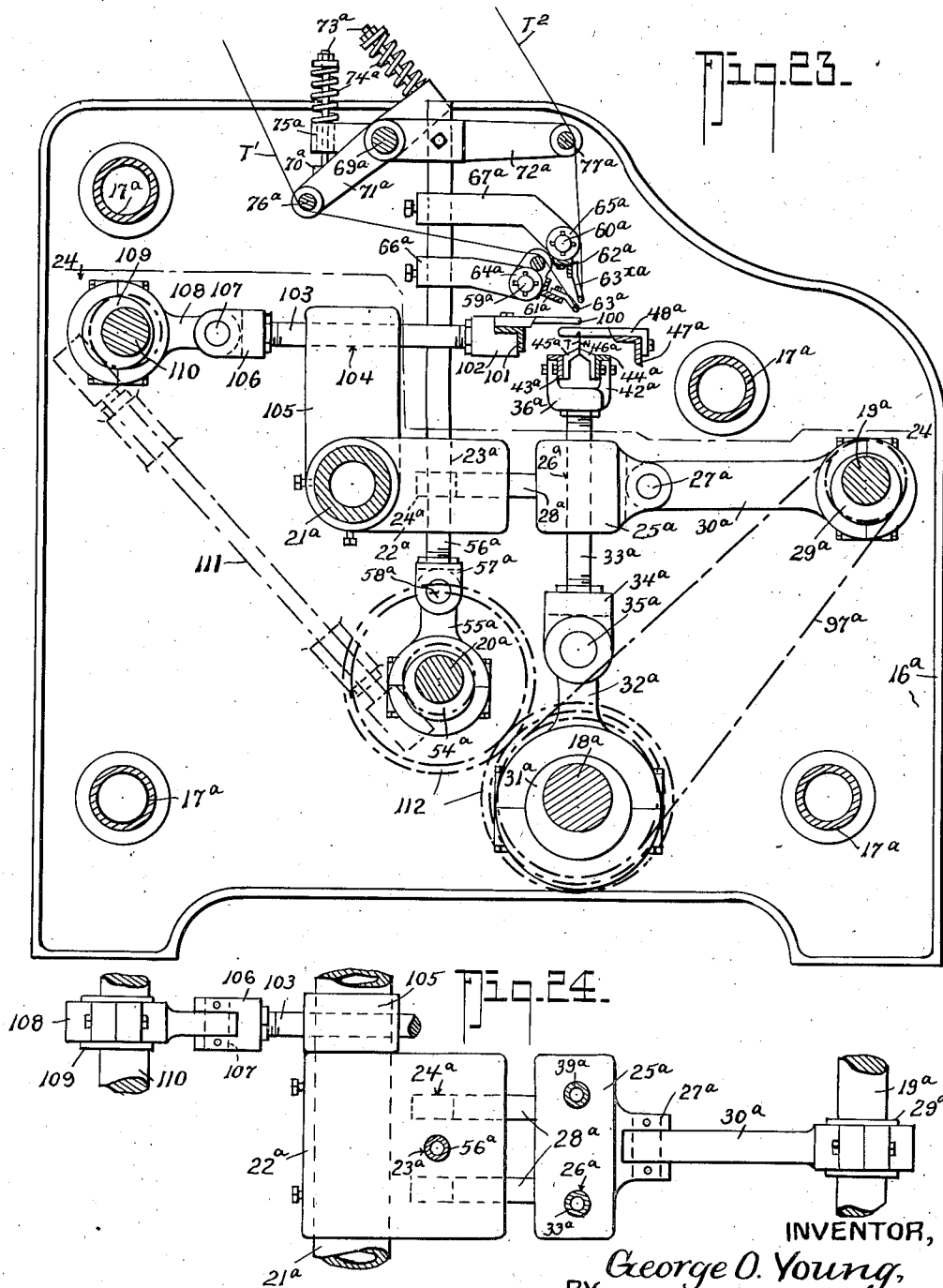
G. O. YOUNG

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8 Sheets-Sheet 5



INVENTOR,
George O. Young,
BY
Albert E. Dieterich,
ATTORNEY.

Oct. 7, 1947.

G. O. YOUNG

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KNITTING MACHINE

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Fig. 25

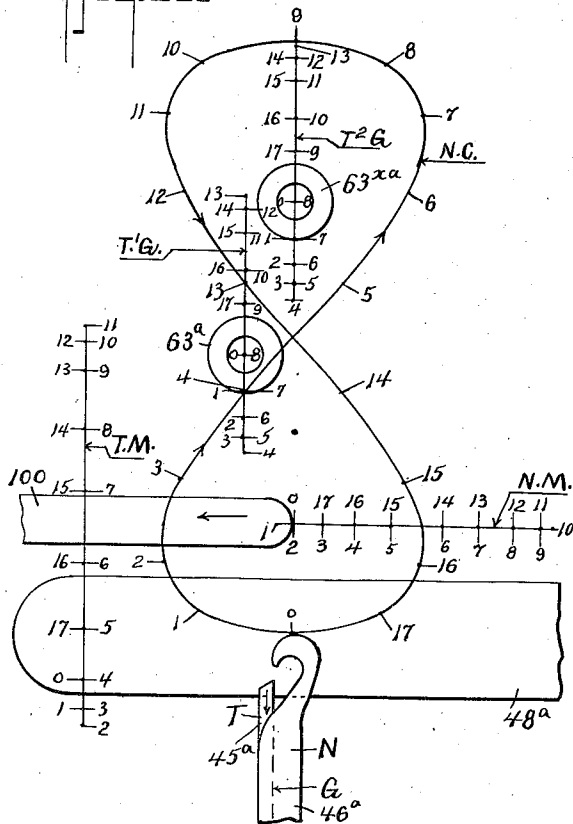


Fig. 27

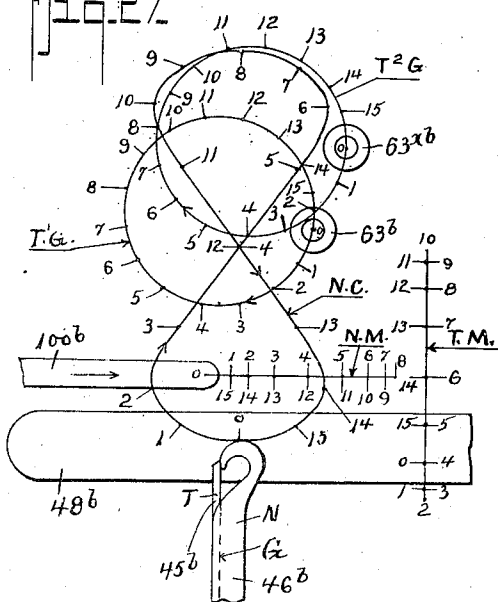
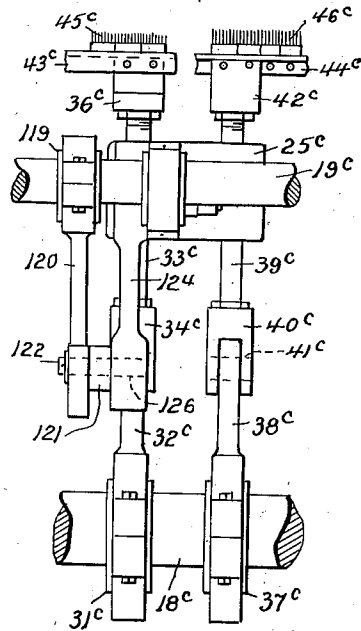


Fig. 31



INVENTOR,
George O. Young,
BY Albert E. Dieterich,
ATTORNEY.

Oct. 7, 1947.

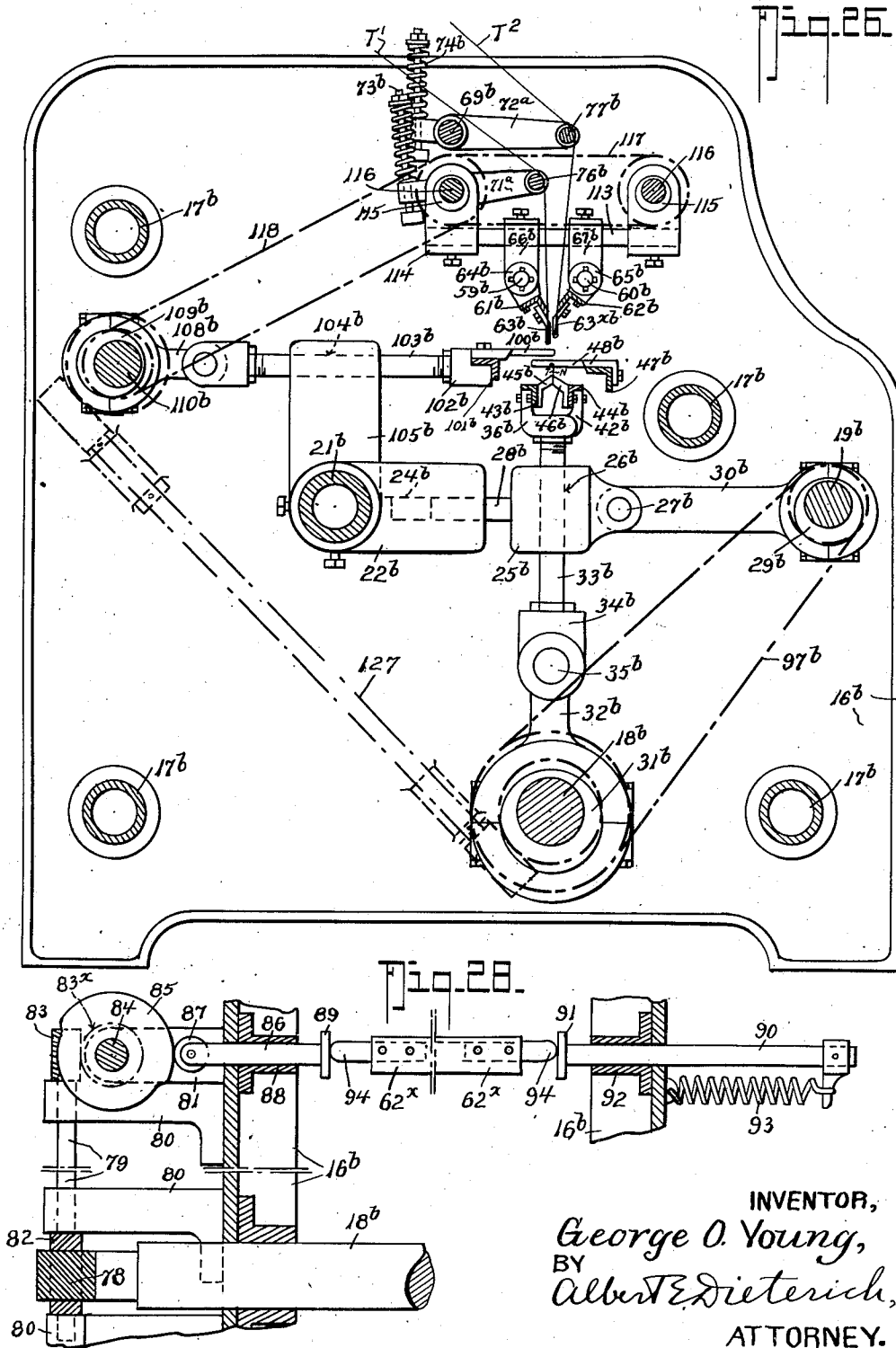
G. O. YOUNG

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KNITTING MACHINE

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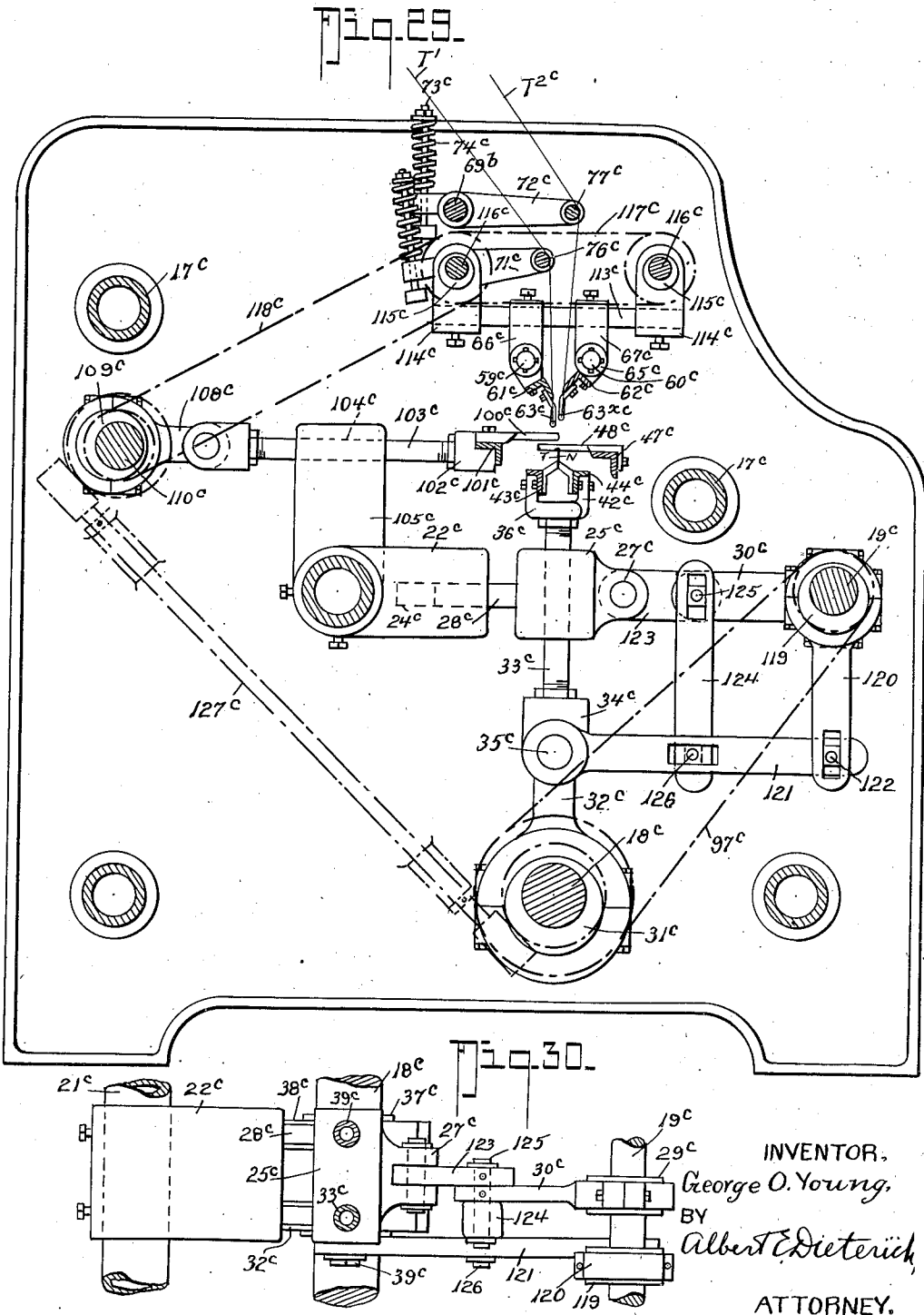
G. O. YOUNG

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KNITTING MACHINE

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UNITED STATES PATENT OFFICE

2,428,405

KNITTING MACHINE

George O. Young, Robesonia, Pa., assignor to
Vanity Fair Mills, Inc., Reading, Pa., a corporation of Pennsylvania

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18 Claims. (Cl. 66—86)

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My invention relates to knitting machines of the tricot type and it has for its objects.

1. To provide a high speed smooth running machine as free from vibration as possible.

2. To provide a machine in which hook needles with sliding tongues are employed, wherein the movements of the needles and tongues are such that thread guides having only up and down motion instead of swinging motion can be employed advantageously.

3. To provide a machine employing stationary sinkers and stationary nibs.

4. To provide a machine in which needles with sliding tongues are moved together through paths resembling a closed figure eight or hour-glass outline.

Other objects will in part be obvious and in part be pointed out hereinafter.

To the attainment of the aforesaid objects and ends the invention further resides in the novel details of construction, combination and arrangement of parts all of which will first be described and then be specifically pointed out in the appended claims, reference being had to the accompanying drawings in which:

Fig. 1 is a cross section of one embodiment using stationary sinkers and nibs.

Fig. 2 is a detail section on the line 2—2 of Fig. 1.

Fig. 3 is a detail front elevation of a portion of the same.

Fig. 4 is a diagrammatic view of the movements of the needle, tongues and thread guides. The spaces between the points 0 to 17 to 0 represent intervals of 20° of movement.

Figs. 5 to 22 are diagrammatic views of the invention showing the relative position of the needles, tongues and guides with respect to one another and to the sinkers at the different points shown in Fig. 4.

Fig. 23 is a view similar to Fig. 1 of a modification using a movable nib and stationary sinker.

Fig. 24 is a detail section on the line 24—24 of Fig. 23.

Fig. 25 is a view similar to Fig. 4 showing the relative movements of the needles, tongues, nibs and thread guides of Fig. 23. The spaces between the points 0 to 17 to 0 represent 20° intervals of movement.

Fig. 26 is a view similar to Figs. 1 and 23 of another embodiment of the invention using stationary sinkers, movable nibs and rotary thread guides.

Fig. 27 is a view similar to Figs. 4 and 25 showing the relative movements of the needles, tongues, nibs and thread guides. The spaces between the points 0 to 15 to 0 represent intervals of 22.5°.

Fig. 28 is a detail, somewhat schematic, vertical

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elevation and part section of one way to rack the thread guides.

Fig. 29 is a view similar to Figs. 23 and 26 of a fourth modification of my invention.

Fig. 30 is a detail plan view of a portion of the mechanism shown in Fig. 29.

Fig. 31 is a detail elevation of the working parts of the same looking from right to left in Fig. 29.

Referring now to the accompanying drawings, and particularly to Figs. 1 to 22 illustrating the first embodiment of my invention 16 represents the end and intermediate frames of a knitting machine of the tricot type, and 17 represents the longitudinal pipes for connecting the end and intermediate frames 16 together as per the usual practice in machines of this type.

Mounted in suitable bearings in the frames 16 (compare 96 in Fig. 28) is a main eccentric shaft 18. A second eccentric shaft 19 is mounted above the shaft 18 and toward the front of the machine while a third eccentric shaft 20 is mounted above and behind shaft 18.

A supporting pipe 21 is rigidly mounted in the frames 16 in back of and above the shaft 20 and in horizontal alignment with shaft 19. Adjustably and rigidly mounted on the pipe 21 are stationarily held blocks 22 each having a vertical bearing-bore 23 and two horizontal bearing-bores 24.

Associated with each block 22 is a shiftable block 25 having guide and supporting pins 28 which operate in the bearing bores 24. Each block 25 also is provided with a pair of vertical bearing bores 26 and ears, the latter being pivoted at 27 to the end of the eccentric strap 30 which cooperates with an eccentric 29 on the shaft 19. The shaft 19 is driven at twice the speed of shaft 18 in any suitable way, as for example a sprocket and chain drive 97 indicated by dot and dash lines in Fig. 1.

I have illustrated my invention as applied to machines employing needles with sliding tongues and the mechanism for reciprocating the needles and that for reciprocating the tongues are alike.

The tongue operating mechanism being visible more fully in Fig. 1 will now be described. It comprises an eccentric 31 on the shaft 18, an eccentric strap 32 being pivoted at 35 to the forked member 34 which is secured to the lower end of the tongue-bar-carrying shaft 33. The shaft 33 passes through one of the bearing apertures 26 in the block 25 and at the upper end there is fastened a tongue-bar-carrying head 36. It should be understood that there are at least two groups or sets of needle-bar-carrying and tongue-bar-carrying (as well as two sets of thread-guide-carrying) mechanisms used, one at each end of the machine. As these mechanisms are duplicates only one set has been illustrated in Figs. 1, 2 and 3 of the drawing.

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Referring now to Fig. 3 it will be seen that a second eccentric 37 is secured on shaft 18 and has its strap 38 pivoted at 41 to the forked member 40 which is secured to the lower end of the needle-bar-carrying shaft 39. The shaft 39 passes through the other bearing aperture 26 of the block 25 parallel to the shaft 33. The shaft 39 has a needle-bar-carrying head 42.

A needle-bar 44 is secured to the head 42 of each group of mechanisms while a tongue-bar 43 is secured to the heads 36. Tongue leads 45 with their tongues are mounted in the tongue-bar 43 and needle leads 46 with their needles are mounted on the needle-bar 44 in the usual manner.

A sinker bar 47 is fixedly secured to the end frames 16 in any suitable way. The sinker-leads 48 with their sinkers are mounted on the bar 47 in the usual way. The sinkers have integral nibs 49, to cooperate with supplemental nibs 51 mounted on a bar 50 supported by brackets 53 hung from a shaft 52 mounted fixedly in the frames 16.

Mounted on the shaft 20 is an eccentric 54 whose strap 55 is pivoted at 58 to the forked member 57 that is secured on the lower end of a rod 56. The rod 56 carries and effects the raising and lowering of the thread guides as will soon appear.

Carried by brackets 66 and 67 that are adjustably carried on the shaft 56 are guide-bar slider pins 59 and 60. The guide bars 61, 62 have brackets 64, 65 which slide on the pins 59, 60, respectively, and to which the leads of the thread guides 63, 63* are secured. The thread guide-bars move up and down in unison as shaft 20 turns. They are racked individually, however, by any suitable pattern-wheel-operated mechanism, such for example as that schematically illustrated in Fig. 28 hereinafter specifically referred to.

Supported by a bracket 68 on each shaft 56 of the machine, is a shaft 69 on which thread tensioning levers 71, 72 are pivoted and on which arms 70 are immovably mounted. The arms 70 carry tension rods 73 which pass through openings 75 in the short ends of the levers 71, 72 and carry, adjustably, tension springs 74. On the free ends of the levers 71, 72 are mounted thread tensioning rods 76, 77 under and over which, respectively, the threads T^1 , T^2 pass on their way from the beams (not shown) to the thread guides. A second rod 98 for the thread T^1 to pass over is carried by extensions of the brackets 64. The bracket 68 has a bore 95 to receive the shaft 56.

The shaft 20 rotates at the same speed as shaft 18 and may be driven from that shaft in any approved manner, as for example by a sprocket and chain drive 99, indicated by dot and dash lines in Fig. 1.

By referring now to Figs. 4 and 5 to 22 the operation of my machine of the first embodiment of my invention will be clear. The needles N move through a curve N. C. of figure eight or hour-glass form carrying the tongue with it. At the same time the tongue moves up and down in its groove in the needle in a straight line indicated by T. M. in Fig. 4. The points marked on the curve N. C. and those on the lines T. M., T^1G and T^2G represent increments of 20° each.

The eccentrics are set so that when the needles are at 0 (Figs. 4 and 5) the tongues T will be at the level of the point 0 on the line T. M. The thread guide movements are straight up and down along the line T^1G and T^2G , Fig. 4. The eccentrics 54 are set so that when the needles and tongues are at zero the guides are also at zero.

Figs. 5 to 22 respectively represent diagram-

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matic views of the positions of the guides, needles, tongues with relation to one another and to the sinkers and these views are taken 20° degrees apart and correspond respectively to the points numbered 0 to 17 in Fig. 4. In Figs. 5 to 22 inclusive the first loop formed by a needle is indicated by L^1 , the second by L^2 , and the third by L^3 .

The thread guides begin to rack on approaching the position shown in Fig. 11 and complete same before reaching the position shown in Fig. 13; they begin to rack again on approaching the position shown in Fig. 21 and complete same before reaching the position shown in Fig. 5.

15 The embodiment shown in Figs. 23 and 24

This embodiment differs from the preceding one in that the sinker has no nib and the supplemental nib and its supports are omitted. In their place I use movable nibs 100 carried by a nib-bar 101 mounted on the heads 102 on the ends of shafts 103, longitudinally and horizontally mounted in bearing bores 104 in blocks 105 rigidly secured to the pipe 21^a. At the rear ends the shafts 103 carry forked members 106 which are pivoted at 107 to the eccentric straps 108 which cooperate with eccentrics 109 on a fourth eccentric shaft 110 that is suitably journaled in the end frames 16^a. It should be understood that only one shaft 110 is used and at least two of the elements 102 to 109 inclusive. (Only one set of elements 102 to 109 inclusive is shown in the drawings as the other set is a duplicate thereof.)

The shaft 110 is driven at the same speed as shaft 20^a and 18^a by any suitable means, a worm-gear, worm shaft drive 111, for example, being indicated in dot and dash lines in Fig. 23. A spur gear connection 112 is indicated in dot and dash lines in Fig. 23 as another example of a suitable means for driving the shaft 20^a from shaft 18^a.

In Figs. 23 and 24 those parts which are like corresponding parts in Fig. 1 bear the same reference numbers plus the index letter *a*.

The operation of the embodiment of Figs. 23, 24 is graphically illustrated in Fig. 25 where the needle, tongue, movable nib, stationary sinker and up and down movable thread guides are indicated at their zero positions. In this figure N is the needle, T the tongue, N. C. the needle movement curve, T. M. the line indication of the tongue movement in the needle, N. M. the line indication of the nib movement and T^1G and T^2G the lines indicative of the thread-guide movements respectively.

Referring now to Fig. 26 it will be seen that those parts which are like or similar to parts in Figs. 1 and 23 bear the same reference number plus the index letter *b* and need not again be described. This embodiment of the invention substitutes mechanism for imparting a circular or rotary movement to the thread guides in place of a straight up and down movement and to that end the brackets 66^b, 67^b are mounted on a cross rod mounted on a pair of eccentric blocks 114 carried by eccentrics 115 on a pair of shafts 116.

The shafts 116 are suitably mounted in bearings in the end frames 16^b and are made to rotate in the same direction in unison in any suitable way as for example a sprocket and chain connection 117, indicated by dot and dash lines in Fig. 26.

The shafts 116 may be driven from and at the same time speed as shafts 110^b, 18^b in any suitable way, as for example by a sprocket and chain connection 118 indicated by dot and dash lines in

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Fig. 26 and a worm and worm shaft connection 127 between shafts 110^b and 118^b.

The racking mechanism shown in Fig. 28 is especially adapted for use with the embodiment of the invention just described. By reference to Fig. 28 it will be seen that to each end of a guide bar say 62^x is secured a pin 94. These pins contact discs 89, 91 respectively carried by slide rods 86, 90 respectively, that are journaled in suitable bearings 88, 92 respectively in the end frames of the machine. The rod 86 carries a contact wheel or roller 87 that is held to engage a pattern wheel 85 in any suitable way, as by a spring 93. The pattern wheel shaft 84 is journaled in suitable bearing brackets 80, 81 and may be driven from the main eccentric shaft by a worm 78 thereon meshing with a worm 82 on a worm shaft 79 having a second worm 83 meshing with a worm 83^x on the pattern wheel shaft.

The discs 89 and 91 are of sufficient diameter to allow for the rotary motion imparted to the thread guides by the eccentrics 115.

It should be understood that there is a pattern wheel for racking each thread guide bar and the parts shown in Fig. 28 which effect cooperation between the guide bars and pattern wheels are duplicated, only one set being shown.

The operation of the third embodiment of my invention will be clear by reference to Figs. 26 and 27. In the latter figure the spaces between the points zero to 15 to zero represent increments of 22.5 degrees. In Fig. 27 the needle is indicated by N, the tongue by T, the sinker by 48^b, the nib by 100^b, the thread guides by 63^b, 63^{xb}, the path of movement of the thread guides T¹G and T²G respectively, the tongue movement in the needle by T. M. and the nib movement by N. M. The needle, tongue, nib and guides are indicated at the zero positions and in proper relation to the stationary sinker.

While I have shown in the aforescribed embodiments single eccentric drives for effecting the lateral movements of the blocks 25, 25^a, 25^b, double eccentric drives may be employed, such for instance as that shown in Figs. 29, 30 and 31, by reference to which it will be seen that those parts which correspond to like parts in Fig. 26 bear the same reference number with the index letter c in place of b.

In the form of my invention shown in Figs. 29, 30 and 31, there is another eccentric 119, on shaft 19^c, the eccentric strap 120 of which is connected to a link 121 by an adjustable pivot 122. The link 121 is in turn pivoted to an extension of the pivot 35^c.

The eccentric strap 30^c of the eccentric 29^c (Figs. 29, 30) is shortened and is pivoted to a link 123, at 125, the link 123 being pivoted at 27^c to the block 25^c. A link 124 is vertically adjustably pivoted at one end to the pivot 125 and at the other end is pivoted at 126 to the link 121, the pivot 126 being adjustable along the link 121.

With the set up as shown in Fig. 29, the movements of the needles, tongues, nibs and thread guides will be approximately the same as is indicated in Fig. 27. By changing the positions of the pivots 122, 125, 126 the needle-tongue path of movement under the action of the eccentrics 31^c, 119^c, 37^c can be considerably varied if desired.

From the foregoing description taken in connection with the accompanying drawings it will be seen that machines of high speeds and smooth operation can be produced.

What I claim is:

1. In a knitting machine employing stationary

sinkers, movable thread guides above the sinkers, sinker nibs, hook knitting needles and tongues, the improvement which comprises eccentric-operated means to impart longitudinal movement to the needles and tongues in combination with means to move the needles and tongues bodily laterally as they are moved longitudinally, all in timed relation to effect knitting operations.

2. The improvement of claim 1 wherein the means which moves the needles and tongues bodily laterally is an eccentric-operated means.

3. The improvement of claim 1 wherein the means which effects the bodily-lateral movement of the needles and tongues, includes at least one fixed block, one movable block slidably connected with the fixed block and supported thereby, an eccentric shaft with an eccentric thereon, an eccentric strap connecting said eccentric with said movable block, and wherein the means which imparts longitudinal movement to the needles and tongues includes at least one tongue-bar-carrying shaft and one needle-bar-carrying shaft passing through bearing apertures in said movable block, another eccentric shaft with an eccentric for operating said tongue-bar-carrying shaft and an eccentric for operating said needle-bar-carrying shaft, and eccentric straps connecting the needle-bar-operating shaft and the tongue-bar-operating shaft with their respective eccentrics.

4. In a knitting machine wherein hook knitting needles, thread guides, sinkers, sinker nibs, and needle tongues are employed to effect knitting operations, the improvement which includes means to cause the needles to pass up from the sinkers through the nibs and between the thread guides without hooking the thread and then pass down back to the sinkers and hook the thread during the downward passage, said means including at least one movable block having a vertical bearing aperture, a needle-bar-carrying shaft operable in said bearing aperture, a shaft having an eccentric with an eccentric strap connected to said needle-bar-carrying shaft to impart longitudinal motion to said needle-bar-carrying shaft, means to support said block for horizontal movement, and an eccentric operated means to move said block back and forth horizontally in timed relation to the longitudinal movements of said needle-bar-carrying shaft for purposes described.

5. In a knitting machine wherein hook knitting needles, thread guides, sinkers, sinker nibs, and needle tongues are employed to effect knitting operations, the improvement which includes means to cause the needles to pass up from the sinkers through the nibs and between the thread guides without hooking the thread and then pass down back to the sinkers and hook the thread during the downward passage, said means including at least one movable block having a vertical bearing aperture, a tongue-bar-carrying shaft operable in said bearing aperture, a shaft having an eccentric with an eccentric strap connected to said tongue-bar-carrying shaft to impart longitudinal motion to said tongue-bar-carrying shaft, means to support said block for horizontal movement, and an eccentric operated means to move said block back and forth horizontally in timed relation to the longitudinal movements of said tongue-bar-carrying shaft for purposes described.

6. The improvement of claim 5 wherein the eccentric that effects the horizontal movement of

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the block rotates twice as fast as the eccentric that effects the vertical movements of the tongue-bar-carrying shaft.

7. The improvement of claim 4 wherein the eccentric that effects the horizontal movement of the block rotates twice as fast as the eccentric that effects the vertical movements of the needle-bar-carrying shaft.

8. In a knitting machine: a frame including a fixedly held pipe for supporting one or more blocks; at least one block stationarily secured on said pipe and having a shaft bearing; a thread-guide-carrying shaft vertically slidable in said bearing; means to reciprocate said shaft in said bearing; at least one thread guide carried by said shaft; a stationary sinker; a sinker nib; a needle-bar; a tongue bar; knitting needles and tongues carried by the respective bars; a needle-bar-carrying shaft; a tongue-bar-carrying shaft; means to reciprocate said needle-bar-carrying and said tongue-bar-carrying shaft in the direction of their axes; means to impart back and forth movements to said needle-bar-carrying and said tongue-bar-carrying shafts in a direction normal to their axes; and means for coordinating the movements of said thread-guide-carrying, said needle-bar-carrying and said tongue-bar-carrying shafts to effect, in cooperation with said sinker and nib, knitting operations.

9. The machine of claim 8 wherein a movable block is slidably connected to said stationary block and is provided with bearing apertures for said needle-bar-carrying shaft and for said tongue-bar-carrying shaft.

10. The machine of claim 8 wherein a movable block is slidably connected to said stationary block and is provided with bearing apertures for said needle-bar-carrying shaft and for said tongue-bar-carrying shaft; said means for moving said tongue-bar-carrying shaft and said needle-bar-carrying shaft in a direction normal to their axes, including said movable block and an eccentric drive operating to impart two back and forth movements to said block for each complete reciprocation of said needle-bar-carrying shaft and said tongue-bar-carrying shaft.

11. In a knitting machine, a stationary sinker having a nib; a stationary supplemental nib cooperatively located with respect to said sinker and its nib; vertically movable thread guides above the nibs; means for imparting up and down movements to said guides from and toward said nibs; knitting needles with sliding tongues operating through said sinkers and nibs; means for separately imparting up and down movements to said needles and to said tongues; means for imparting bodily lateral back and forth movements simultaneously to said needles and tongues; and means for coordinating all said movement imparting means to effect knitting operations.

12. In a knitting machine, a stationary sinker having a nib; a stationary supplemental nib cooperatively located with respect to said sinker and its nib; vertically movable thread guides above the nibs; means for imparting up and down movements to said guides from and toward said nibs; knitting needles with sliding tongues operating through said sinkers and nibs; means for separately imparting up and down movements to said needles and to said tongues; means for imparting bodily lateral back and forth movements simultaneously to said needles and tongues; and means for coordinating all said movement imparting means to effect knitting operations, there being two lateral back and forth movements im-

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parted to one up and down movement of said needles and tongues and one up and down movement of said thread guides.

13. In a knitting machine, a stationary sinker; a nib above the sinker; means for moving said nib back and forth; vertically movable thread guides above the nibs; means for imparting up and down movements to said guides from and toward said nibs; knitting needles with sliding tongues operating through said sinkers and nibs; means for separately imparting up and down movements to said needles and to said tongues; means for imparting bodily lateral back and forth movements simultaneously to said needles and tongues; and means for coordinating all said movement imparting means to effect knitting operations.

14. The machine of claim 13 wherein there is imparted two lateral back and forth movements to one up and down movement of said needles and tongues, and one back and forth movement of said nib, and one up and down movement of said thread guides.

15. In a knitting machine; stationary sinkers; nibs movable back and forth over and in cooperative relation to said sinkers; means for imparting back and forth movements to said nibs; hook knitting needles and tongues operable through said sinkers and nibs; means to impart up and down movements to said needles and tongues; means to impart back and forth movements to said needles and tongues in a direction normal to their axes; thread guides mounted above said nibs; means to cause said thread guides to travel in circular paths in planes parallel to the planes of the sinkers and nibs; and means to coordinate the movements of the needles, tongues, nibs and thread guides to effect knitting operations.

16. The machine of claim 15 wherein said coordinating means includes provisions to effect two of said back and forth movements to the needles and tongues to each up and down movement of the same.

17. The machine of claim 15 wherein said coordinating means includes provisions to effect one complete circular movement of the thread guides to one up and down movement of the needles and tongues and two of said back and forth movements of said needles and tongues.

18. The machine of claim 15 wherein the means to impart the circular path movement to the thread guides includes two parallel disposed rotatable shafts connected to turn in the same direction in unison, an eccentric on each of said shafts, an eccentric block for each eccentric, a cross-bar connecting said blocks together, brackets on said cross-bar, and thread-guide-bars carried by said brackets.

GEORGE O. YOUNG.

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