

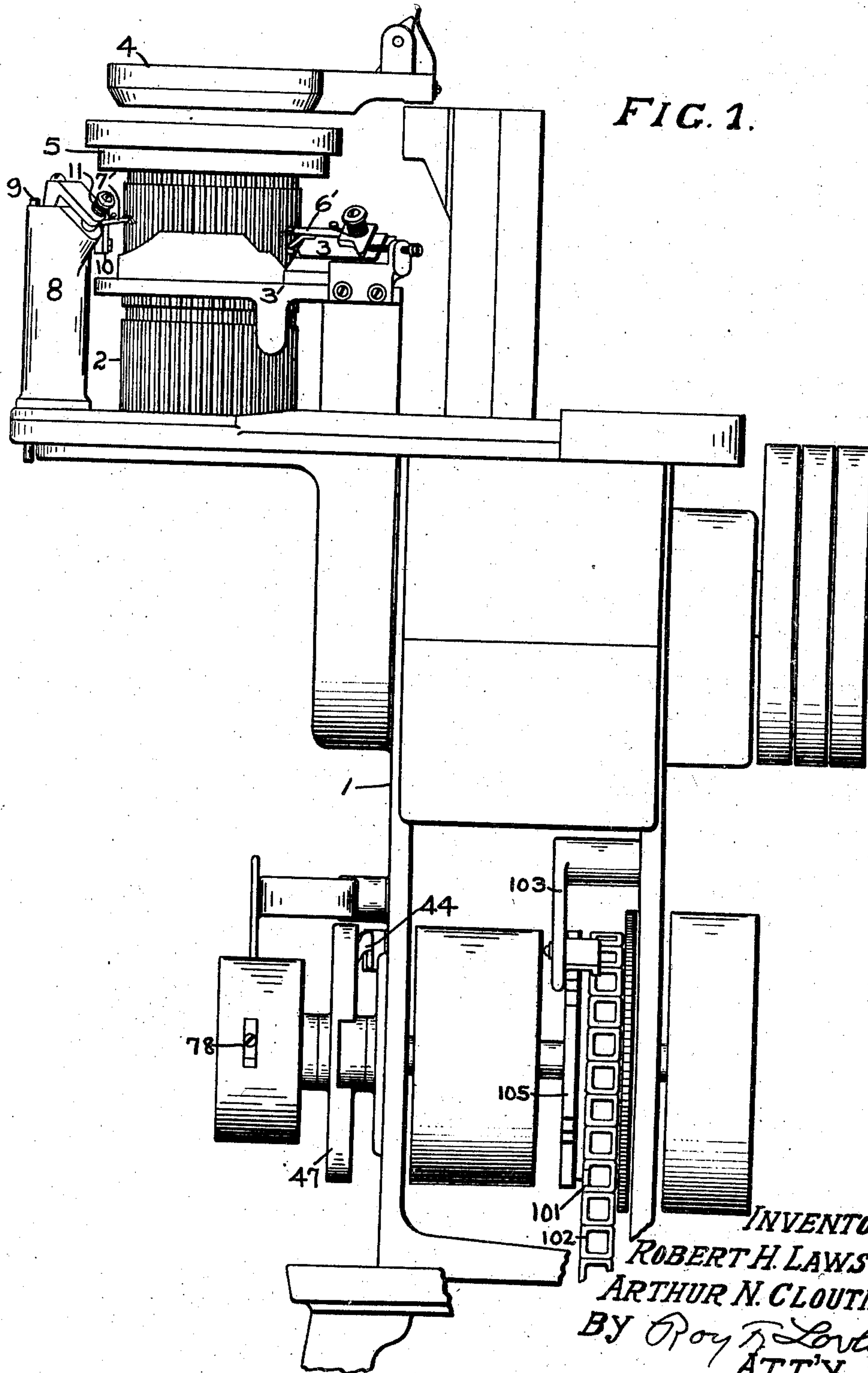
July 12, 1938.

R. H. LAWSON ET AL
KNITTING MACHINE AND METHOD

2,123,284

Filed Aug. 9, 1934

7 Sheets-Sheet 1



July 12, 1938.

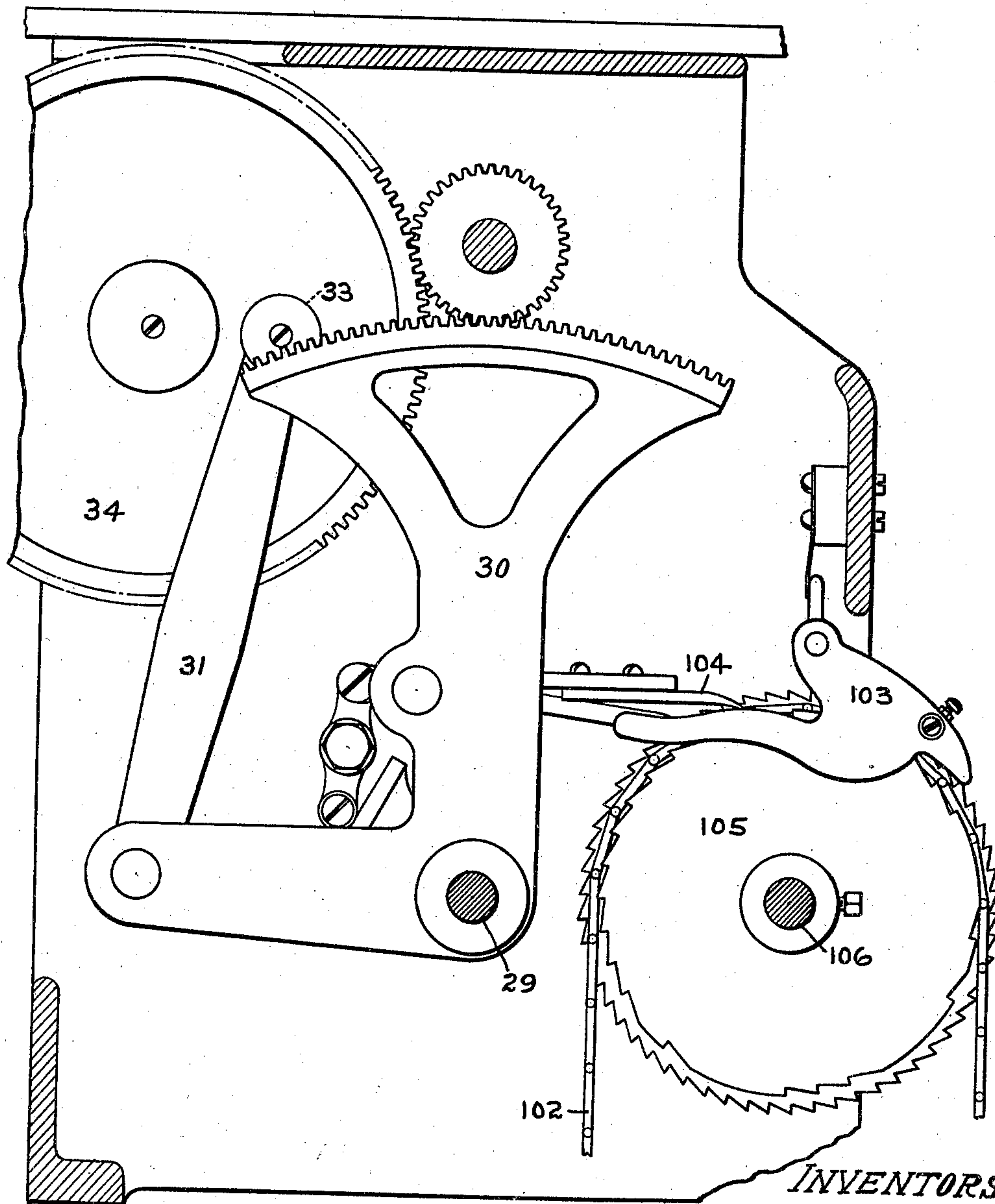
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7 Sheets-Sheet 2

FIG. 2.



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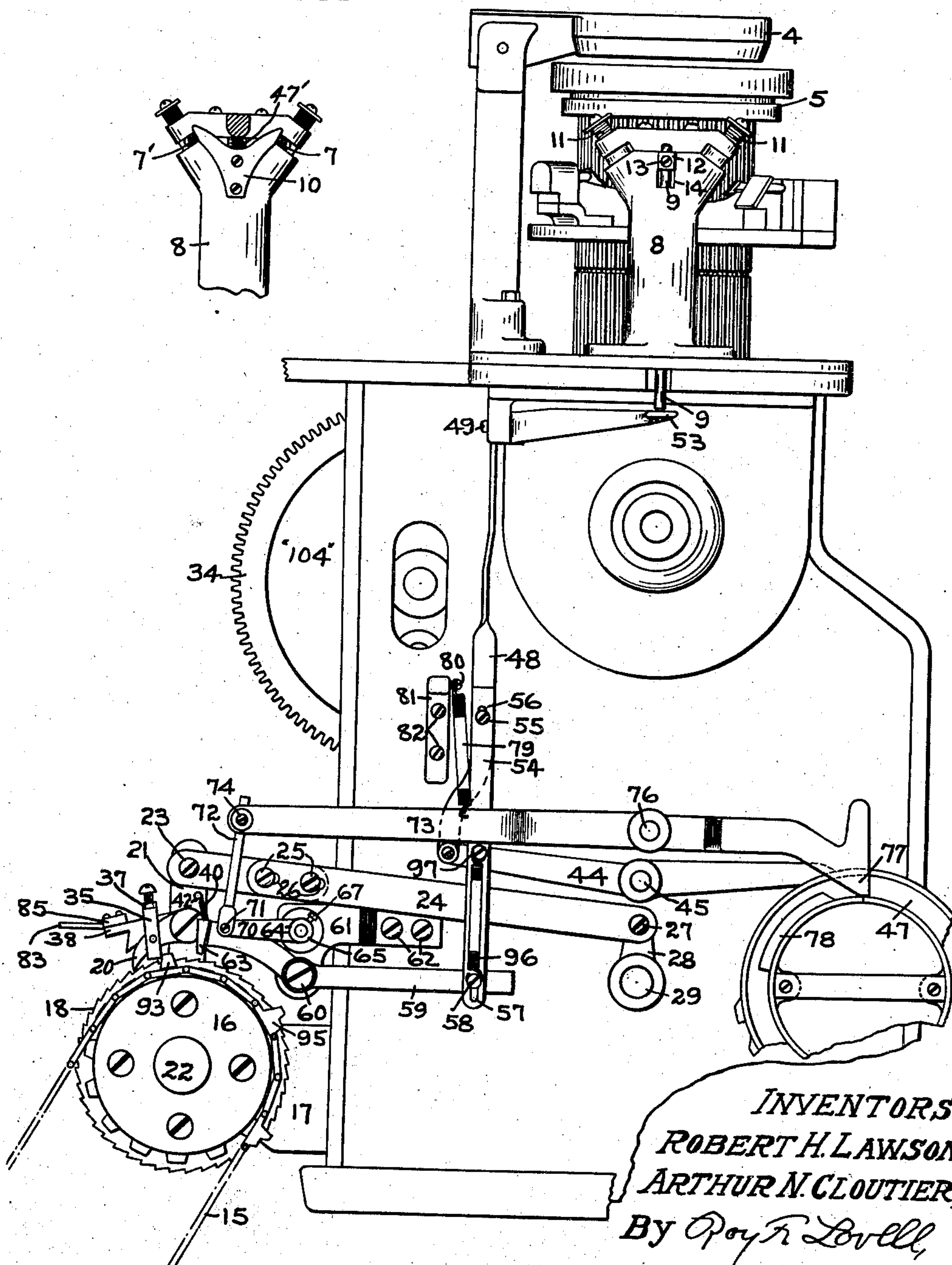
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7 Sheets-Sheet 3

FIG. 3a

FIG. 3.



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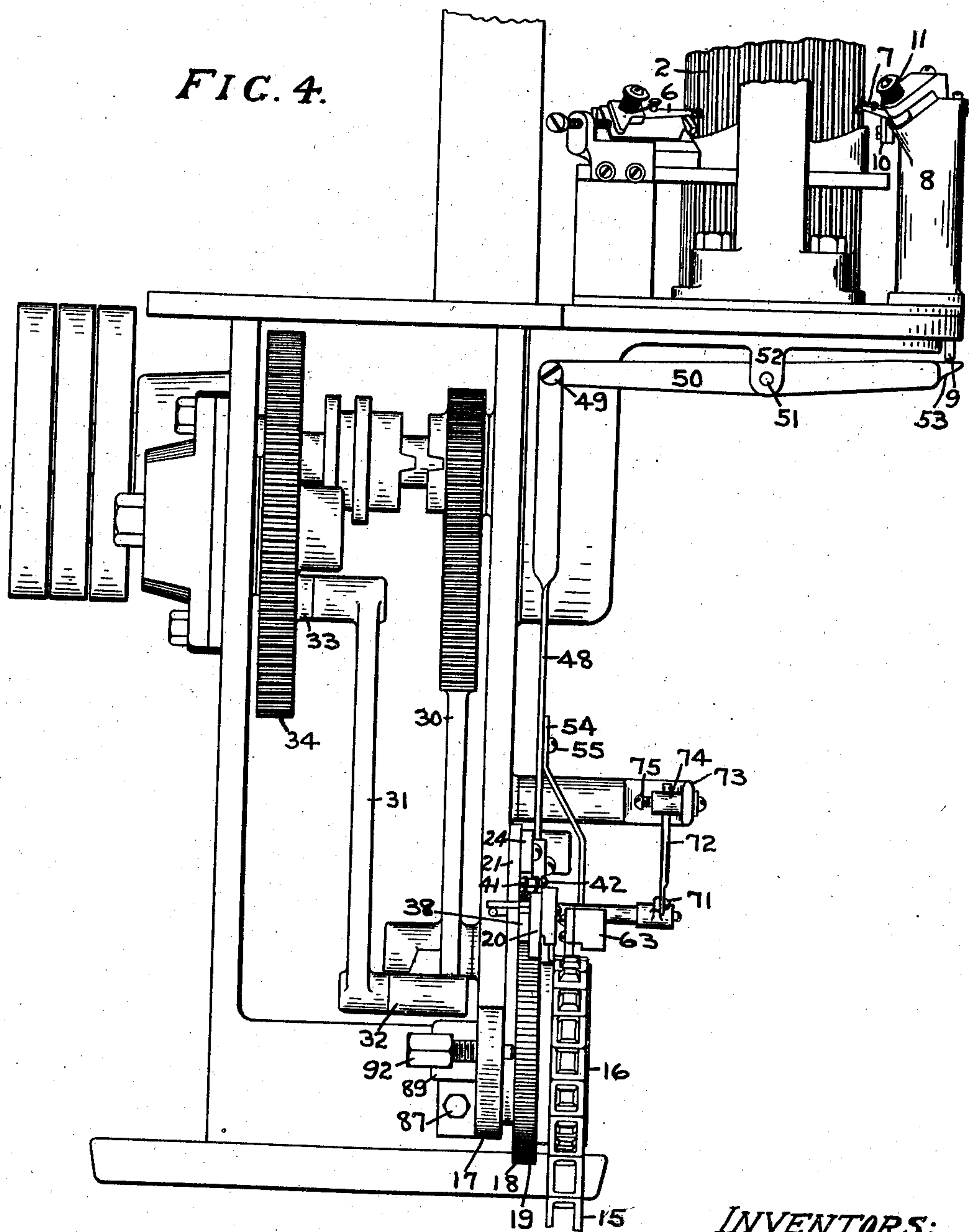
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7 Sheets-Sheet 4



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2,123,284

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7 Sheets-Sheet 5

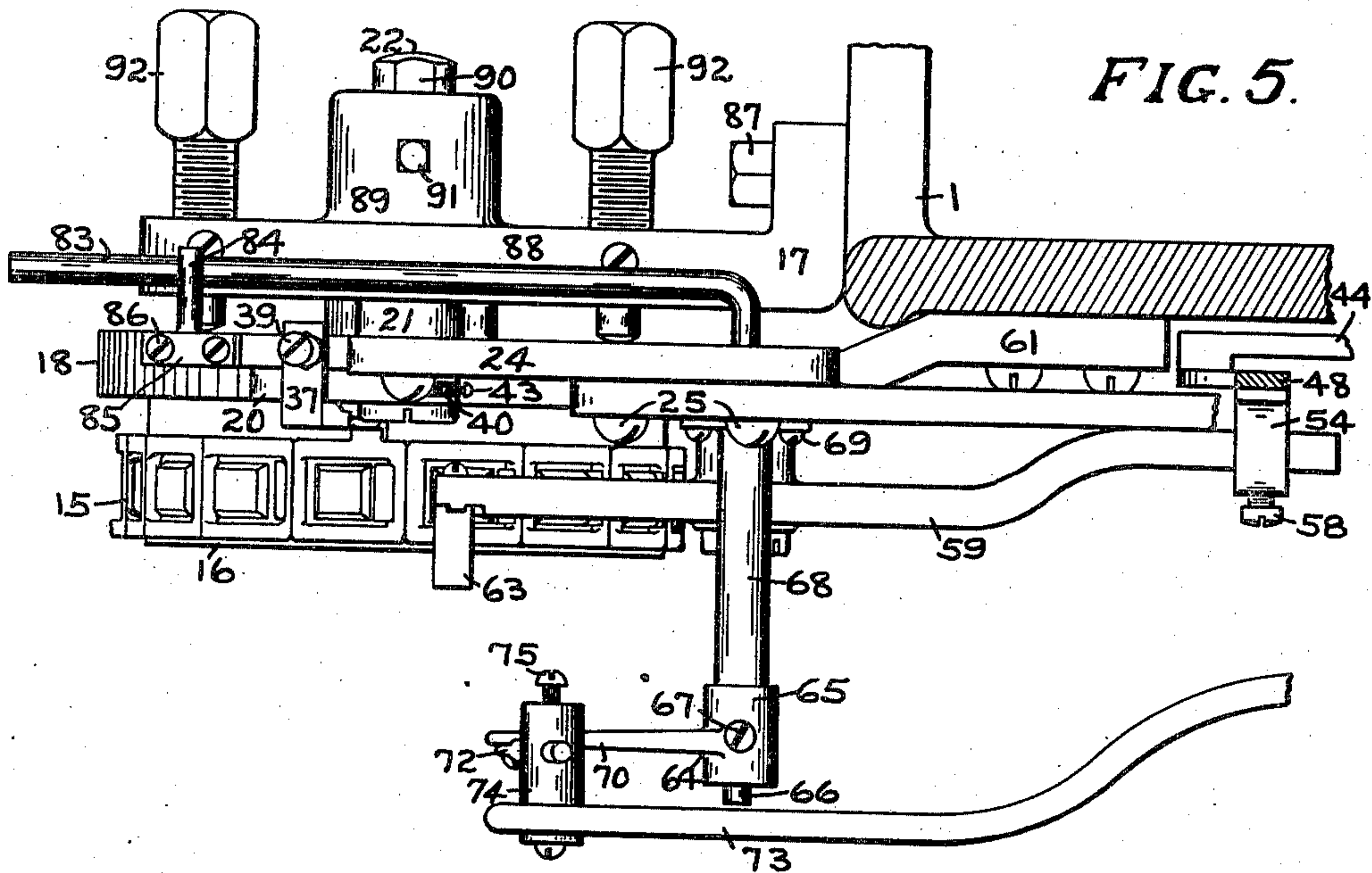


FIG. 5.

FIG. 6.

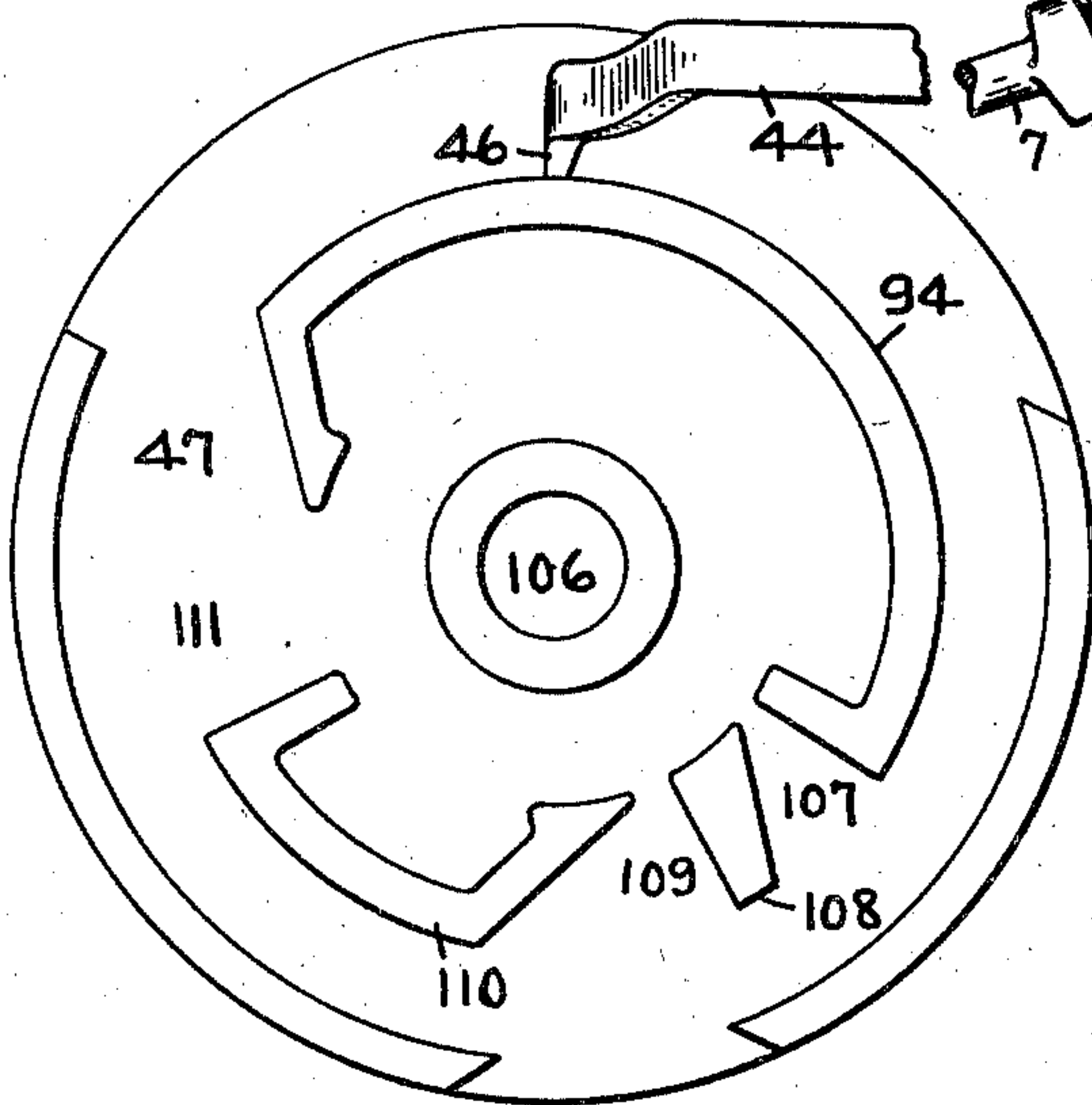
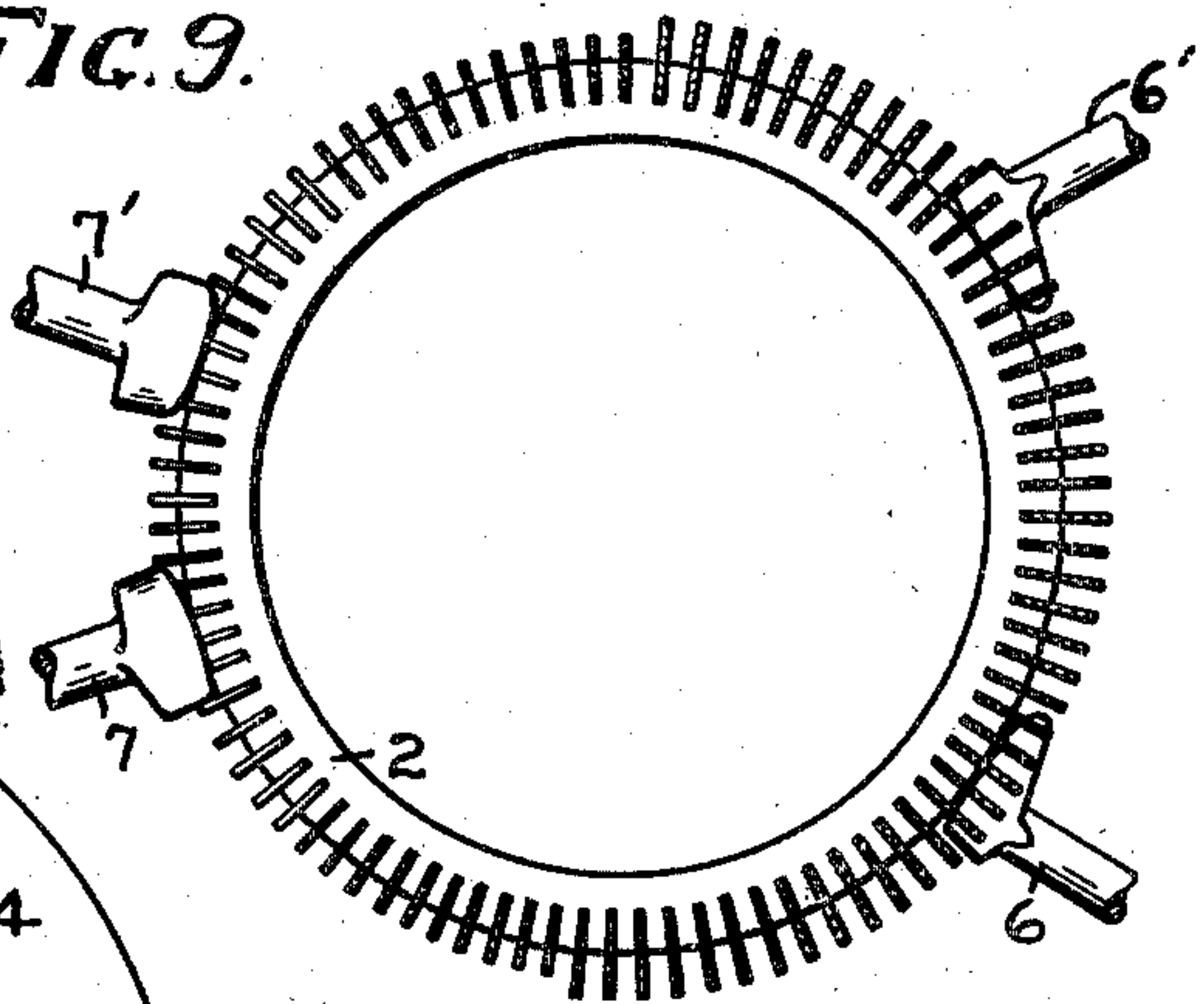


FIG. 9.



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KNITTING MACHINE AND METHOD

Filed Aug. 9, 1934

7 Sheets-Sheet 6

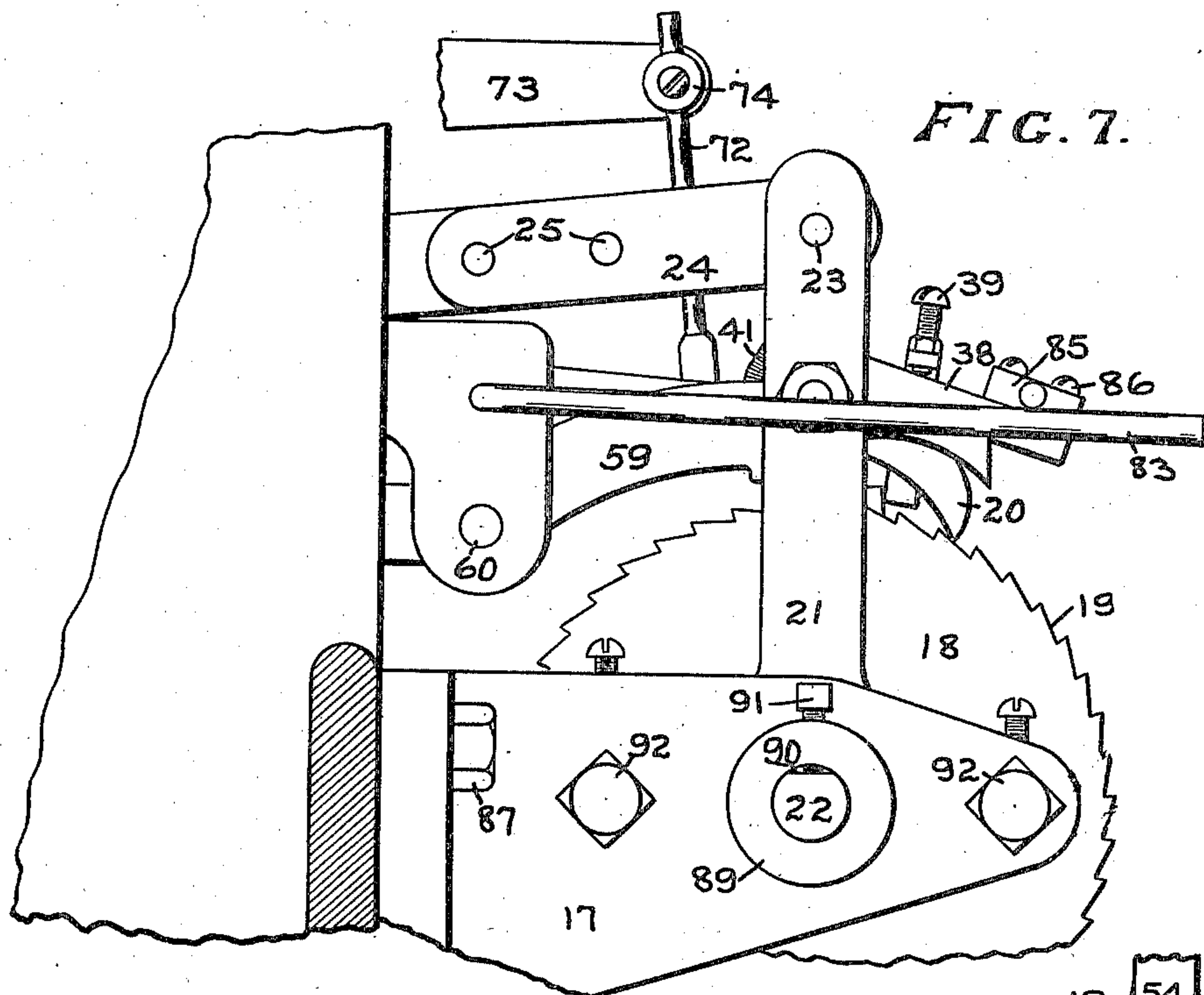


FIG. 7.

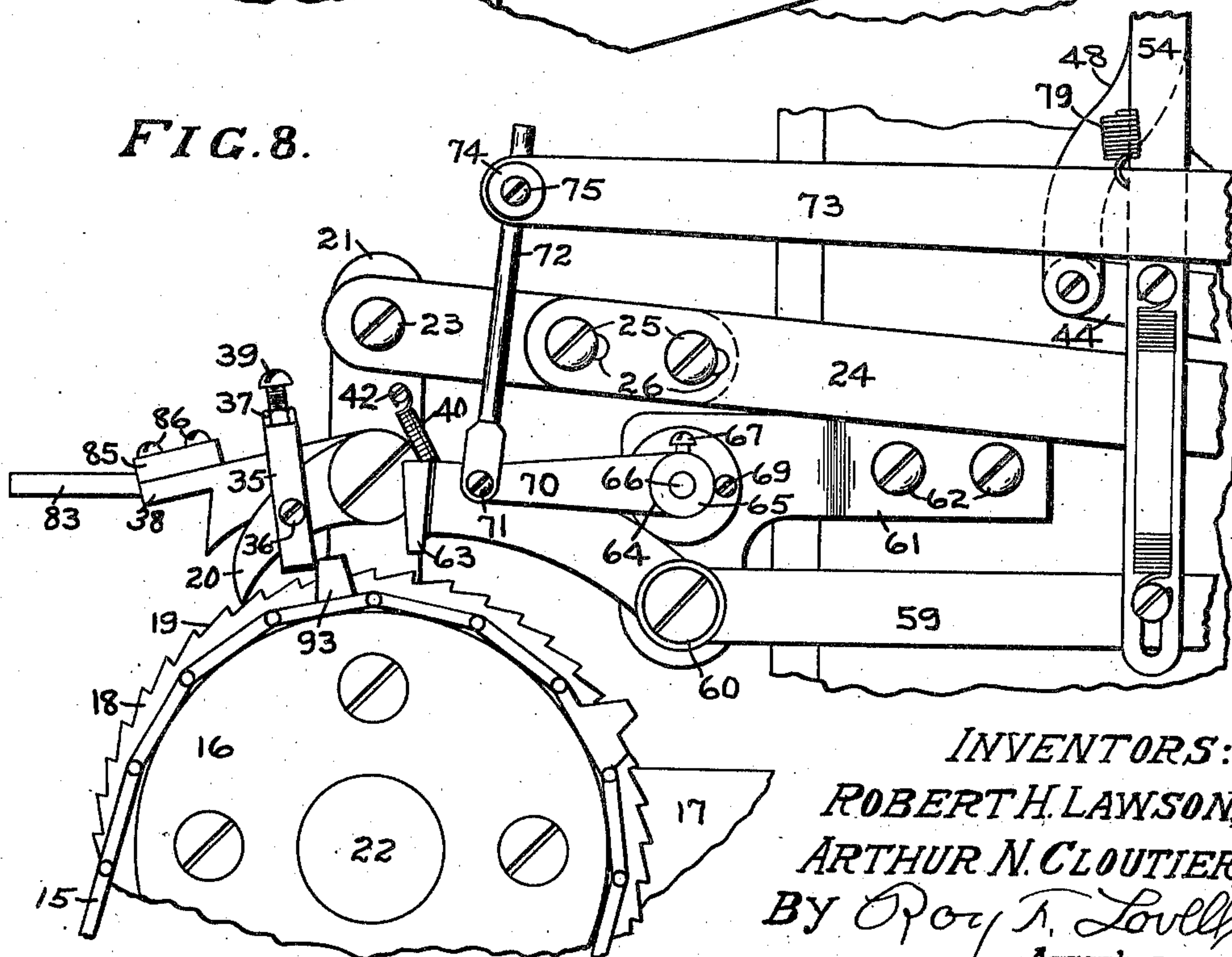


FIG. 8.

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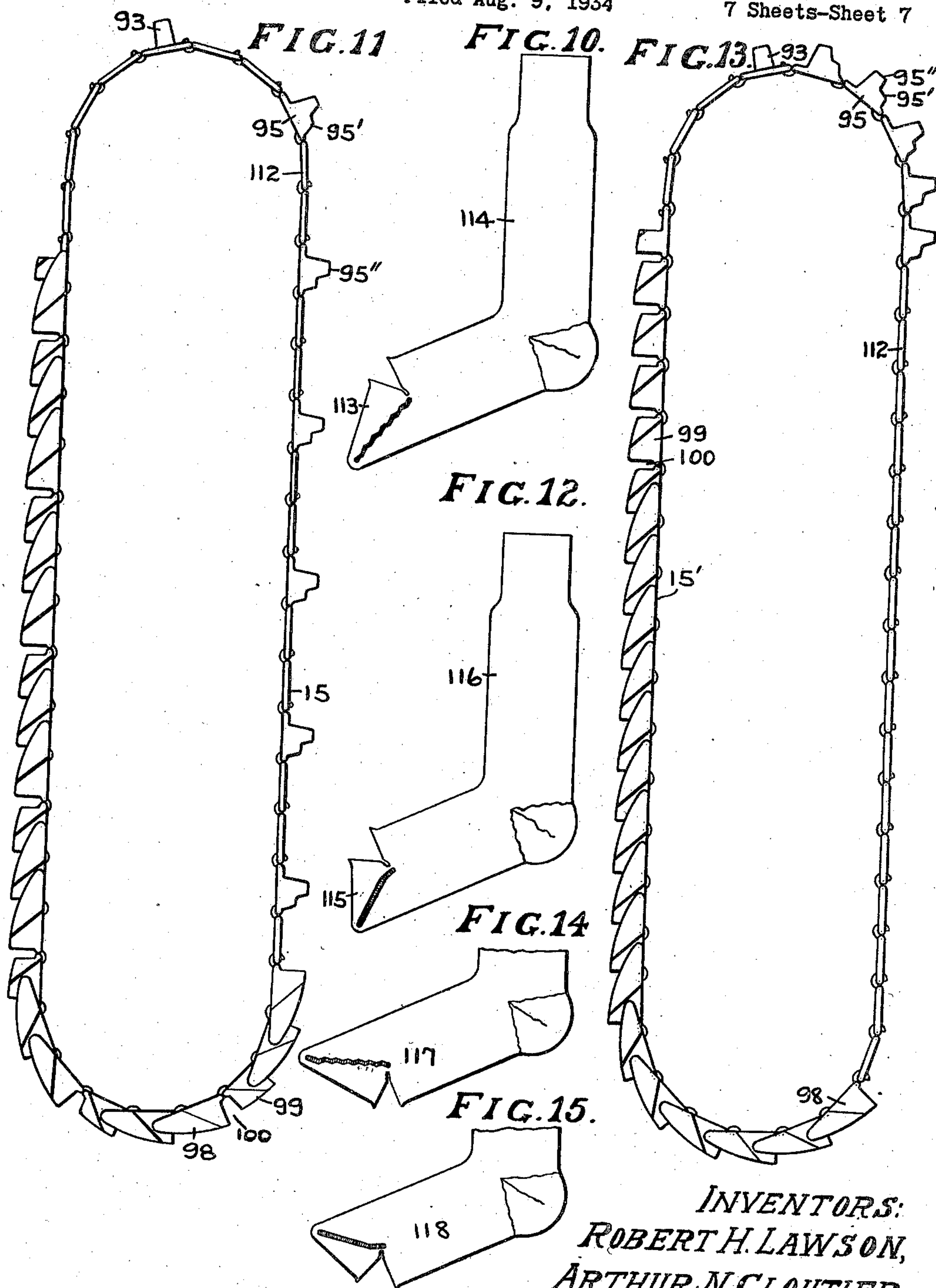
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2,123,284

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7 Sheets-Sheet 7



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UNITED STATES PATENT OFFICE

2,123,284

KNITTING MACHINE AND METHOD

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Application August 9, 1934, Serial No. 739,152

7 Claims. (Cl. 66—48)

This invention relates to knitting machines and more particularly to knitting machines of the type disclosed in the patent to Hemphill 933,443, September 7, 1909, and to a means for knitting an improved and more closely fitting form of toe in a stocking.

In the drawings:

Fig. 1 is a view of a knitting machine in front elevation showing the narrowing and widening picks and a pattern chain for timing the operations of the machine, other parts being omitted;

Fig. 2 is a sectional view showing the pattern chain as well as a quadrant drive for effecting reciprocatory movements of the needle cylinder;

Fig. 3 is a side elevational view of the knitting machine shown in Fig. 1 showing mechanism for specially controlling the movements of the widening picks;

Fig. 3a is a detail view showing the widening picks and the wing cam;

Fig. 4 is a view in rear elevation showing certain connections for controlling the movements of the widening picks;

Fig. 5 is a fragmentary plan view showing an auxiliary pattern chain and parts pertaining thereto;

Fig. 6 is a detail view showing a portion of the main pattern shaft and a drum thereon;

Fig. 7 is a fragmentary view in elevation showing a ratchet and means for advancing the said ratchet and auxiliary pattern chain;

Fig. 8 is a view similar to Fig. 7 but taken from the opposite side of the machine;

Fig. 9 is a diagrammatic view showing the relative positions of the needles and picks just before the first widening pick acts upon the leading short butt or other needles theretofor elevated by a narrowing pick during the knitting of the first few courses of the toe;

Fig. 10 is a view showing a stocking provided with one form of improved toe;

Fig. 11 is a view of a pattern chain showing the relative disposition of plain and special links for effecting the knitting of the stocking toe disclosed in Fig. 10;

Fig. 12 is a view of another form of toe less pointed than that shown in Fig. 10;

Fig. 13 is a view similar to Fig. 11 but showing an arrangement of pattern links to effect the knitting of the stocking toe disclosed in Fig. 12;

Fig. 14 is a view of a portion of a stocking having a toe similar to that in Fig. 10 but wherein the closing of the toe is at the bottom of the foot of the stocking; and

Fig. 15 shows a portion of the stocking hav-

ing a toe similar to that disclosed in Fig. 12 but wherein the toe is to be closed at the bottom of the foot as in Fig. 14.

The knitting machine 1 has mounted therein for rotary and reciprocatory movements a needle cylinder 2 the needles being independently mounted in the slots of the cylinder and being controlled in their independent stitch forming movements by cams included in the cam block 3 and other cams mounted on the cam ring 3'. The usual or any desired form of latch ring 4 and sinker head 5 co-operate with the needles in the formation of stitches. Mounted upon the cam block in the usual manner are narrowing picks 6, 6' and positioned diametrically opposite thereto are widening picks 7, 7' said widening picks being supported in a bracket 8 mounted upon the circular base plate of the machine.

For the purpose of knitting stockings in the manner hereinafter to be more fully described, a rod 9 is mounted in bracket 8 to slide vertically therein. To the upper end of said rod 9 is fastened the usual butterfly cam 10, the wings of which, when the butterfly cam is elevated, permit the springs 11 to maintain the widening picks 7, 7' in an operative position adjacent to the needle cylinder where they act upon butts of the needles to effect the widening of the heels and toes of stockings and also co-operate with the narrowing picks in a manner hereinafter to be more fully described to effect the knitting of the specially constructed stocking toes shown in Figs. 10, 12, 14 and 15. When the butterfly cam is moved to a relatively lowered position the widening picks 7, 7' are maintained below and spaced from the needle butts in which position the said widening picks are inoperative. The connection (Figs. 3, 4) between the rod 9 and the butterfly cam 10 includes a rod 12 which is attached to the cam 10 at one end and to the rod 9 at its other end as by means of a set screw 13. The rod 12 is received within and guided vertically by a slot or opening 14 provided in the upper end of the bracket 8.

To effect periodic movements of the widening picks 7, 7' to and from their operative positions adjacent to the needle cylinder supplemental chains such as 15, 15' are provided. As more particularly shown in Figs. 3, 4, 5 and 8 the chain 15 is mounted upon a sprocket wheel 16 which is supported by a bracket 17 made fast to the machine frame. Attached to and forming part of the sprocket wheel 16 is a ratchet wheel 18 the peripheral teeth 19 of which are adapted to be intermittently engaged and advanced as by a

means of a pawl 20. The pawl 20, as is more clearly shown in the relatively enlarged views of Figs. 5, 7 and 8, is pivotally connected to a lever 21 which lever is in turn pivotally mounted upon a shaft 22 the latter being supported in the bracket 17. The lever 21 is pivotally connected at one end as at 23 to a link 24 which consists of two parts adjustably connected together as by means of screws 25 which pass through elongated slots 26 in one part of the link 24 and into threaded engagement with the other. The link 24 at its other end (Fig. 3) is pivotally connected as at 27 to a lever arm 28 rigidly mounted upon and carried by the quadrant shaft 29. During the knitting of the heels and toes the quadrant 30 (Figs. 2 and 4) is rocked once every two courses of knitting by means of a link 31 which link at one end is connected to a hub 32 extending laterally from the quadrant, the link at its other end being connected to a hub 33 mounted upon and forming part of one face of the "104" gear 34.

To effect the knitting of the stocking toes disclosed in Figs. 10, 12, 14 and 15 the widening picks 7, 7' are automatically and periodically moved to the position shown diagrammatically in Fig. 9 in which position the widening picks 7, 7' act upon needles that have theretofore been elevated by the narrowing picks 6, 6', all for the purpose of knitting a more pointed toe than would be ordinarily knitted by having only the narrowing picks 6, 6' in operative position during the knitting of the narrowed portion of the toe of the stocking. Furthermore, during the widening of the toe of the stocking the widening picks 7, 7' are automatically and periodically rendered inactive, the rendering inoperative of the widening picks during the widening of a toe of the stocking being timed so that the same needles, or needles adjacent thereto, as were acted upon by the widening picks during the narrowing of the toe are not acted upon by the widening picks during the widening of the toe.

The mechanism for controlling the widening picks in the manner stated in the immediately preceding paragraph includes an idler 35 (Figs. 3, 5, 7 and 8) which is connected to the pawl 20 by means of a pin 36 the said idler having an arm 37 which projects over an additional and starting pawl 38 which is also pivotally mounted upon and movable with lever 21. Adjustably passing through the arm 37 of the idler 35 is a screw 39 the end of which engages the upper surface of the pawl 38. Springs 40 and 41 are each connected at one end to a pin or screw 42 carried by the lever 21 and at their other ends to pins 43 (Fig. 5) which are carried by the pawls 20 and 38 and act normally to urge the pawls into engagement with the ratchet teeth 19.

During circular knitting a lever 44 (Figs. 3, 6 and 8) pivoted at 45 to the machine frame has a toe 46 in engagement with cams carried by a cam drum 47. As reciprocating knitting for the toe of the stocking commences toe 46 of the lever 44 drops off one of the said cams whereupon a spring 47' contained within the bracket 8 lowers the butterfly cam 10. The connections between the lever 44 and cam 10 include a link 48 pivotally connected at its upper end at 49 (Fig. 4) to a lever 50 which is pivoted at 51 to a lug 52 depending from the machine frame and at its other end is provided with a shoe 53 with which the pin 9 is maintained in contact by means of the afore-said spring 47'.

Supplemental means including the pawls 20, 38 and supplemental chain 15 are provided so

that, during the knitting of the toe, the widening pick cam 10 may be rendered inoperative from time to time. For this purpose a link 54 is connected to the link 48 by means of a pin or screw 55 passing through an elongated slot 56 provided in the link 54 and into threaded engagement with the link 48. The pin and slot connection permits lost motion between the links 48 and 54. The lower end of the link 54 is provided with an elongated slot 57 through which passes a pin or screw 58 carried by a lever 59. The lever 59 is pivoted intermediate its ends as at 60 to a bracket 61 attached to the machine frame as by screws 62 and is provided with a toe 63 adapted to be engaged by lugs carried by pattern chain 15 as hereinafter more specifically described. Also pivotally connected to the bracket 61 is a lever 64 a hub 65 thereof being made fast to a shaft 66 by means of a set screw 67. The shaft 66 passes through the bracket 61 and through a bushing 68 connected to the bracket 61 as by screws 69. The bushing 68 and bracket 61 provide a bearing for the shaft 66. One arm 70 of the lever 64 is integral with the hub 65 and has pivotally connected thereto at 71 a link 72 in turn connected to a lever 73 by passing through a bushing 74 carried by said lever, being retained in said bushing by a screw 75. The lever 73 is pivoted intermediate its ends to the machine frame at 76 and one arm thereof has a toe 77 normally held in engagement with a drum 78 or cam 78' mounted thereon by the tension of a coil spring 79 connected at one end to the other arm of a lever 73 and at its other end to a pin or screw 80 carried by a plate or bracket 81 connected to the machine frame as by screws 82. The other arm 83 of the lever 64, which is a right angled continuation of shaft 66, projects in the direction of the pattern chain 15 and normally seated thereupon is a pin 84 connected to and laterally extending from a block or plate 85 fastened to the starting pawl 38 by screws 86.

The angle bracket 17 which is connected to the machine as by bolts 87 includes an arm 88 which carries a hub 89 through which passes the shaft 22. The said shaft has a face 90, a set screw 91 passing through the hub 89 to engage the face 90 thereby preventing the shaft 22 from turning. Other screws 92 pass through the bracket 17 and engage one face of the ratchet wheel 18 thus preventing overthrow of the same when advanced by the pawls 20 and 38.

During the knitting of the leg and until the knitting of the toe is commenced the idler 35 carried by the pawl 20 is in engagement with a lug 93 carried by a link of the pattern chain 15 which lug holds the pawl 20 elevated and prevents the same from engaging the teeth 19 and advancing ratchet 18 although the pawl 20 is constantly reciprocated once every two courses throughout the knitting of the stocking.

As hereinbefore stated the butterfly cam 10 withdraws the picks 7, 7' from operative position when a cam such as 94 moves out from under the toe 46 of the lever 44. At the same time the cam 78 (Fig. 3) moves under the toe 77 of the lever 73 and causes the link 72 to be depressed and the lever arm 83 (Figs. 5, 7, 8) to drop whereupon the starting pawl 38 is released and permitted to drop into engagement with the ratchet teeth 19 so that the next forward movement imparted to the pawl 38 by the oscillations of the quadrant 30 starts a racking of the ratchet wheel 18 and chain 15. After two or three rackings the idler 35 drops off the lug 93 which permits the

pawl 20 also to engage the ratchet teeth 19 and thereafter advance the pattern chain 15.

The two pawls 20 and 38 act as one during the knitting of the bottom half or narrowing of the toe to advance the pattern chain once for every two courses of knitting throughout the knitting of the toe. At certain times in the knitting of the toe the widening picks 7, 7' are rendered active and for this purpose special links 95 (Fig. 13) are provided with cut-away portions 95' and relatively high lugs 95'' engage the toe 63 of the lever 59 to elevate that arm of the lever and depresses the other arm which by means of the pin 58 depresses the link 54 and consequently permits the widening picks to be raised to an operative level by springs 11.

A spring 96 attached at one end to the pin or screw 58 and at its other end to a pin or screw 97 together with the pin and slot connections between the lever 59 and the link 54, compensate for inequalities in the heights of the lugs 95''. The spring 96 is much stronger than the spring contained within the pick block 8 and consequently when the toe 63 of the lever 59 is raised by a lug 95'' the pins 55, 58 are maintained in the upper portions of their respective slots 56, 57 notwithstanding the fact that the lever 50 at the same time, raises the butterfly cam 10 against the tension of the spring contained within the pick block 8. If a lug 95'' is higher than necessary to elevate the widening picks to operative position the extra height is taken up by the spring 96.

After desired number of courses have been knit with the toe 63 of the lever 59 resting on the lug 95'' the next racking of the chain 15 moves the lug 95'' from under the toe 63 of the lever 59 thus permitting the said toe to drop off the lug 95'' whereupon the spring 47' again moves the cam 10 downwardly thus moving the picks 7' below the level of the inoperative needles. When the toe drops off the high lug 95'' it first rests upon that portion of the special link 95 indicated at 95' thus avoiding the possibility of the picks 7, 7' being thrown down to such a position as to damage the butts moving along the knitting level which might occur if the toe 63 were permitted to drop immediately to its lowest position. Subsequently to the knitting of a certain number of courses with the picks 7, 7' inoperative, the lug 95'' on the following special link engages the toe 63 which elevates the butterfly cam 10 thus permitting the springs 11 to swing the widening picks 7, 7' to an operative position at the level of the inactive needles. The cycle of operations just recited is repeated throughout the narrowing of the toe or a portion thereof depending upon the number of special links 95 on the chain 15.

As the point of the toe of the stocking is reached the toe 77 of the lever 73 drops off the cam 78 whereupon spring 79 elevates the other arm of the lever and consequently rocks the lever arm 83 which by engaging the laterally extending pin 84 raises the starting pawl 38 to the idle position of Fig. 7. Thereafter the pawl 20 alone racks the ratchet 18 throughout the knitting of the remaining portion of the toe at the completion of which the chain lug 93 again engages the idler 35 and thereafter prevents the constantly reciprocating pawl 20 from racking the ratchet 18 until the starting pawl 38 again initiates movements of the pattern chain 15 as hereinbefore described.

Ordinarily during the knitting of the last half or widened portion of the toe, the narrowing picks 6, 6' continue in action to pick up one needle during each half reciprocation and the widening

picks 7, 7' pick down two needles each such half reciprocation or course while knitting the upper portion of the toe. However, to knit the toes disclosed in Figs. 10, 12, 14 and 15 the widening picks 7, 7', during widening, are, as hereinbefore stated, periodically rendered inactive and to accomplish this purpose special links 98, 99 are provided on the pattern chain 15. The links 98 and 99 function in the same manner as do the lugs 95 in that they engage the toe 63 of the lever 59 and consequently permit the springs 11 to raise the widening picks 7, 7' to an operative position where they remain until the chain 15 has been racked by the pawl 20 to such a position that the toe 63 of the lever 59 drops into a recess or space 100 between adjacent links 98, 99 whereupon the spring 47' again raises the butterfly cam 10 to an inoperative position which movements permit the springs 11 to render the widening picks 7' operative.

The special links 95, Fig. 11, and the relative location of the said links and recesses 100 causes the widening picks to be inoperative during widening on the same needles or needles adjacent thereto as were acted upon by the said widening picks during the narrowing of the toe.

The relative arrangement, spacing and number of special links 95, 98, 99 in a pattern chain depends upon the form of toe desired, the chain 15, Fig. 11, effecting the knitting of the elongated toe disclosed in Fig. 12 while the arrangement of links 95, 98, 99 on the pattern chain 15', Fig. 13, results in the somewhat shorter or less pointed toe shown in Fig. 12. The arrangements of links 95, 98, 99 shown in Figs. 11 and 13 are shown by way of example only, and other forms of toes may be knitted by the mechanism hereinbefore disclosed by suitably arranging special links 95 and 98 on chain 15.

Operation of the machine

The knitting machine operation is usual up to the beginning of the knitting of the toe at which time the lug 101 on the main pattern chain 102 rocks lever 103 which permits a pawl 104 to engage ratchet wheel 105 which advances the main shaft 106 which carries the cams for controlling various operations of machine. The advance of the shaft 106 causes the wheel or drum 47 which is fixedly mounted upon the shaft 106 to advance thus causing the toe 46 of the lever 44 to drop off cam 94 at 107, Fig. 6. The movement of the drum or disk 47 permits the spring 47' to lower the butterfly cam 10 thus swinging the widening picks 7, 7' to an inoperative position where they remain during the narrowing of the heel. At the beginning of the widening of the heel of the stocking a cam 108 engages the toe 46 and, by means of the connections hereinbefore described, permits the springs 11 to restore the picks 7, 7' to an operative position. Following the knitting of the heel the drum 47 is again advanced the toe 46 dropping off the cam 108 and resting in the space 109 and then being elevated by the cam 110 the toe remaining on the cam 110 during the knitting of the foot. At the beginning of the narrowing of the toe of the stocking the toe 46 of the lever 44 drops off the cam 110 at 111 where it remains throughout the knitting of the toe of the stocking, the spring 47' causing the toe 63 of the lever 59 to drop into engagement with the plain links 112. As the drum 47 is advanced to cause the toe 46 to drop off the cam 110 the cam 78 engages toe 77 of the lever 73 which lowers the

lever arm 83 thus permitting the starting pawl 38 to drop into engagement with the ratchet wheel 19 thus initiating the advancing movement of the auxiliary chain 15 which during the knitting of the toe of the stocking controls the movements of the widening picks 7, 7'. Although the cam 78 may be of any length desired it must be of sufficient length to permit the starting pawl 38 to advance the ratchet wheel 18 and the chain 15 through a distance represented by three teeth 10 15 by which time the pawl 20 is clear of the pattern chain lug 93 and is in position to advance the ratchet wheel 18 and chain 15.

When the knitting of the toe is completed one 15 or more plain links 112 permit pawl 20 to retime the pawl mechanism and chain 15, by continuing to advance the ratchet wheel 18 until the chain lug 93 again engages the idler 35 to idle the pawl 20.

20 The arrangement of links shown in Fig. 11 effects the knitting of the stocking toe 113 of the stocking 114 shown in Fig. 10. By re-arranging the links as indicated on the pattern chain 15' in Fig. 13 a less pointed toe 115 shown in 25 stocking 116 Fig. 12 is effected. The stocking 117 in Fig. 14 has a toe similar to that shown in Fig. 10 excepting that the toe is closed at the bottom of the foot instead of the top as in Fig. 10; likewise the stocking 118 shown in Fig. 30 15 has a toe like that shown in Fig. 12 excepting that the toe is closed at the bottom of the foot.

Although as hereinbefore disclosed the widening picks 7, 7' are specially controlled to effect 35 the knitting of the stocking toes shown in Figs. 10, 12, 14, 15, the narrowing picks 6, 6' may be specially controlled or both the narrowing and widening picks may be specially controlled. Furthermore, the picks may act upon jacks or 40 other butts instead of on the butts of needles to effect the desired results.

Present day hosiery knitting machines frequently have two hundred or more needles although for convenience of illustration Fig. 9 45 shows ninety needle butts only.

The several forms of narrow toe which have hereinbefore been described, provide a toe more nearly conforming to the contour of the human foot and consequently providing a more comfortable fit than is provided by toes of stockings 50 knitted in the usual manner.

Although in the foregoing description various parts and combinations thereof have been described in specific terms, it is not the intention 55 to limit the appended claims otherwise than by express limitation in the claims themselves.

We claim:

1. A circular knitting machine having narrowing and widening picks for effecting the knitting 60 of heels and toes of stockings during reciprocatory knitting, means for specially controlling the widening picks during the narrowing and widening of the toes to variably affect the knitting and wherein some of the needles operating during the knitting of heels and toes temporarily 65 resume knitting after having been acted upon by the narrowing picks.

2. A circular knitting machine of the independent needle type having narrowing and widening picks, said narrowing picks being adapted to move needles designed to knit heels and toes of stockings to a nonknitting position, in combination with means acting upon the widening picks, during narrowing, temporarily to restore to the knitting position needles theretofore acted upon by the narrowing picks and acting upon the said widening picks, during widening, temporarily to render the widening picks ineffective. 5 10

3. A circular knitting machine of the independent needle type having narrowing and widening picks, said narrowing picks being adapted to move needles designed to knit heels and toes 15 of stockings to a nonknitting position, and means for rendering widening picks temporarily operative during the narrowing and inoperative during the widening of the toe.

4. A circular independent needle knitting machine having narrowing and widening picks, means for so acting upon the picks as to knit a relatively narrow pocket by reciprocatory knitting by occasionally interrupting the narrowing and by occasionally interrupting the widening, 25 said means for interrupting the narrowing including the widening picks and said means for interrupting the widening also including the said widening picks.

5. A circular knitting machine having independent needles and narrowing and widening picks for knitting toe pockets of stockings, means for continuously operating the narrowing picks throughout the narrowing of the toe and means for occasionally causing the widening picks to 35 render ineffective the operations of the narrowing picks, and means for causing the widening picks to function during the knitting of a plurality of successive courses while widening the toe and means for rendering the said widening picks ineffective during knitting of following reciprocatory courses for the toe. 40

6. A circular knitting machine having narrowing and widening picks, said narrowing picks being adapted to move needles to an inactive position and said widening picks being adapted and having means for controlling them to restore certain needles to knitting position during the knitting of heels or toes of a stocking, and supplemental pattern mechanism for acting upon 50 the widening picks to modify the action of said narrowing picks and to effect the knitting of a relatively pointed toe of a stocking.

7. A method of knitting a toe pocket in a stocking by reciprocatory knitting, said method including the withdrawal of a needle during each successive course of knitting to narrow the fabric and in varying the said narrowing by interrupting the rate thereof by periodically returning to action needles which have been withdrawn, and thereafter widening said fabric by returning needles to action during certain reciprocatory courses in the knitting, but not at each successive reciprocatory course. 60 65

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