Sept. 4, 1928. 1,683,540

A. GAGNÉ

STRIPING ATTACHMENT FOR KNITTING MACHINES

Filed March 29, 1921 7 Sheets-Sheet 1

Fig. 1.

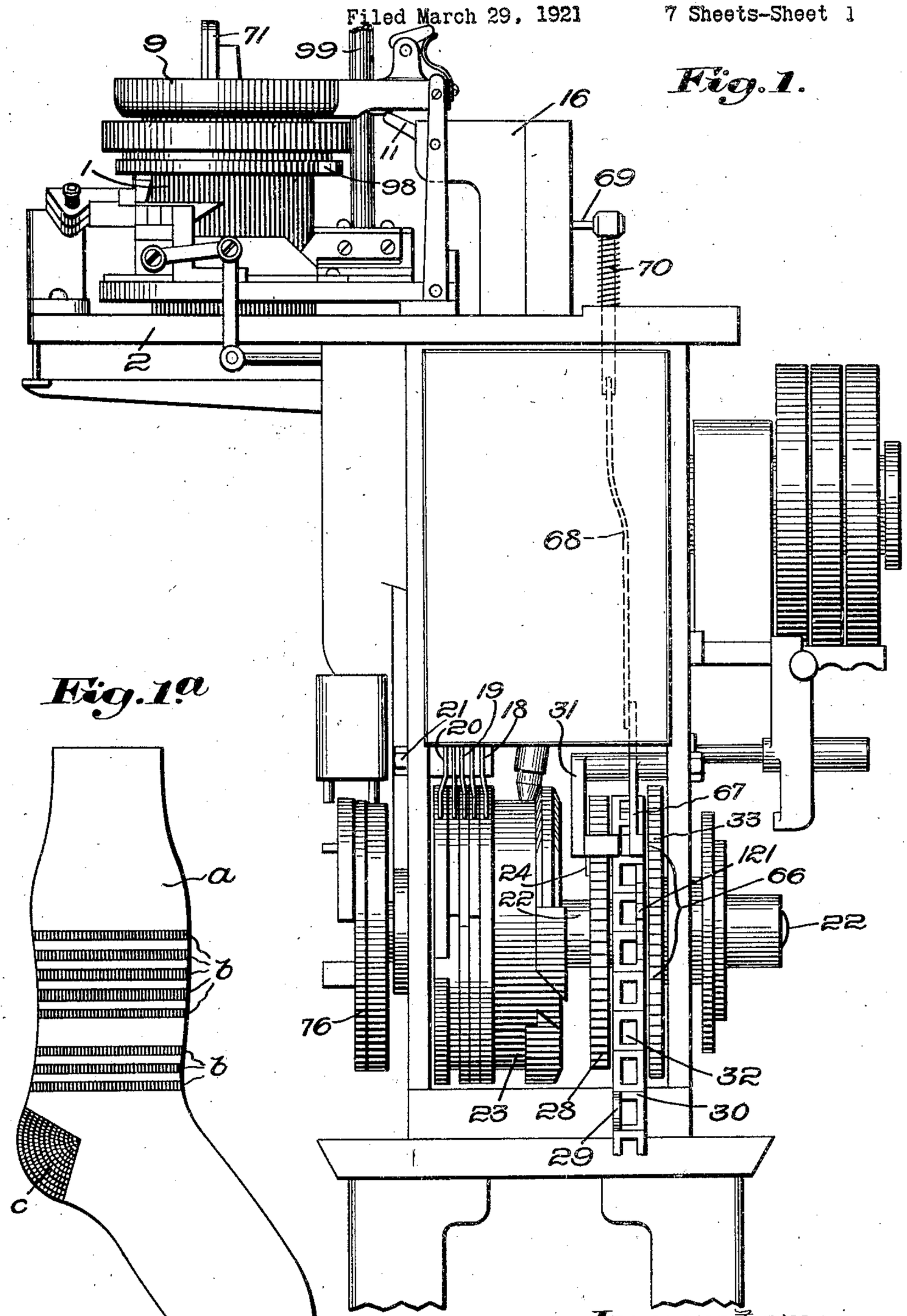
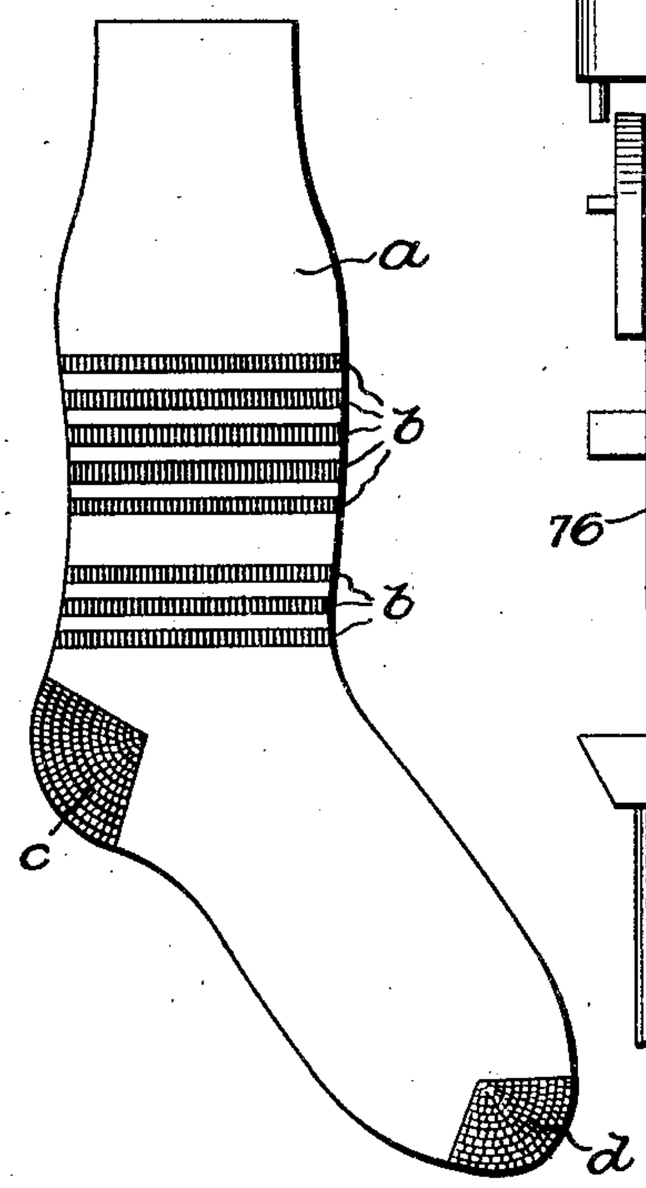


Fig. 1a



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Filed March 29, 1921 7 Sheets-Sheet 2

Fig. 2.

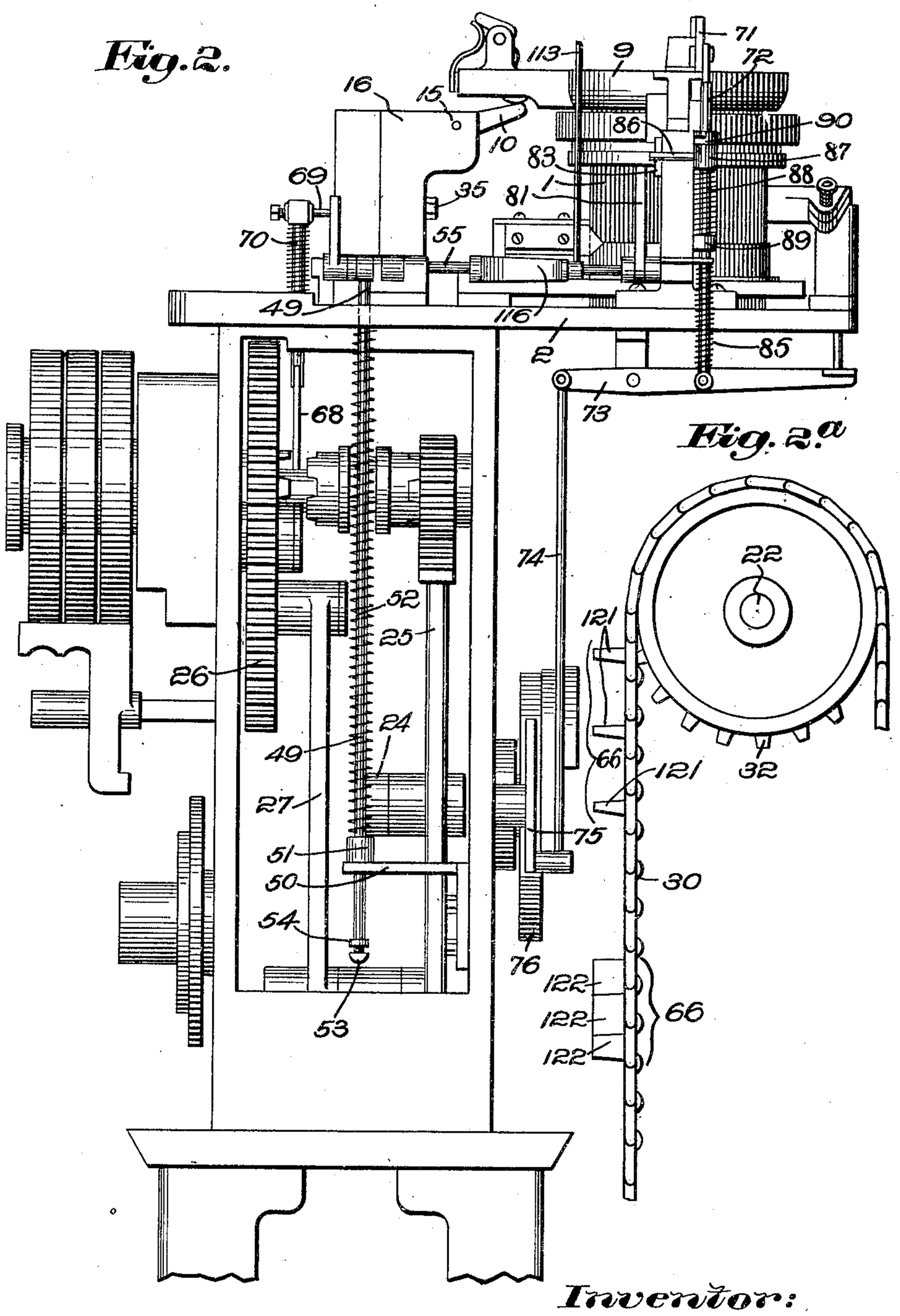

Fig. 2a.

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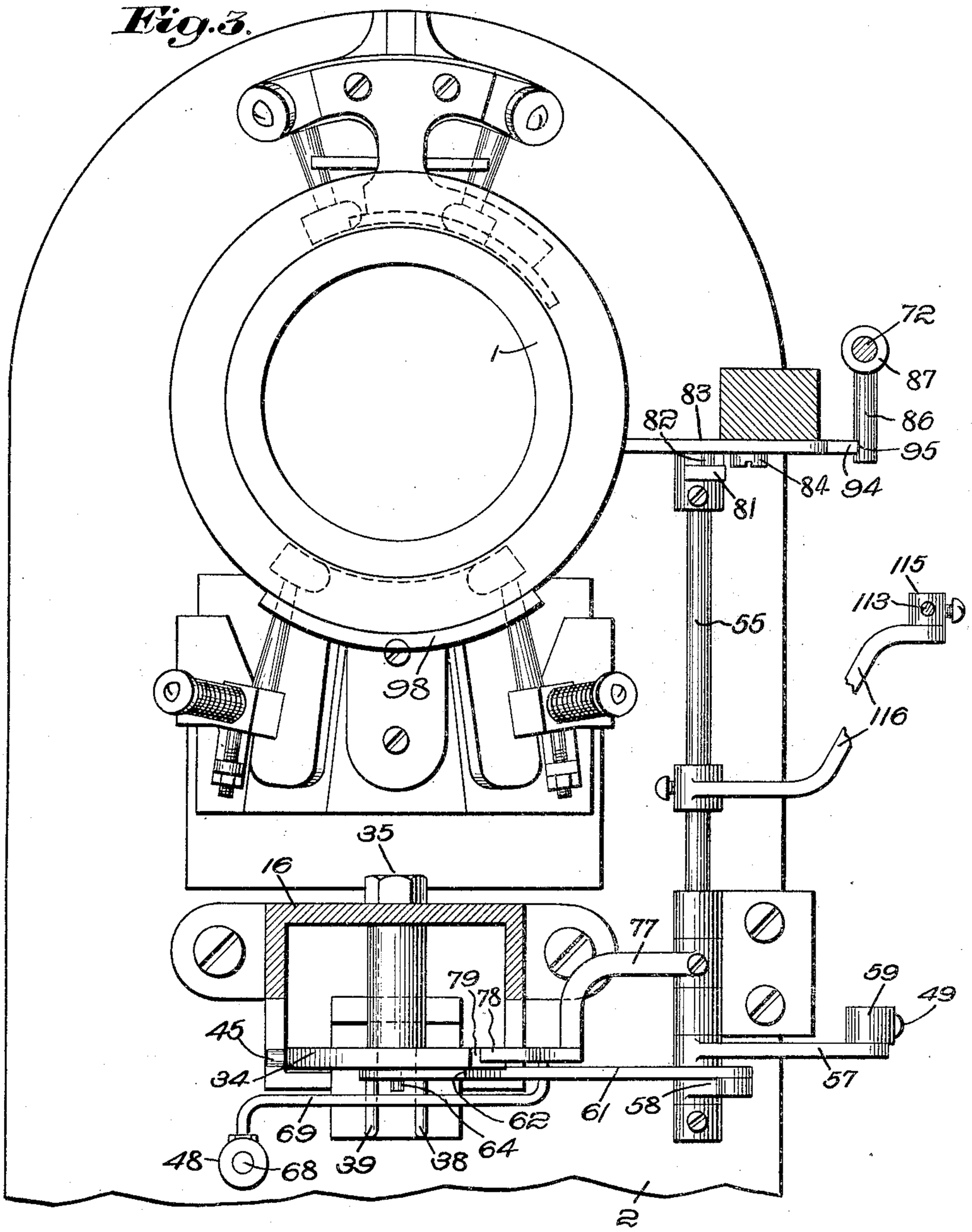
Filed March 29, 1921 7 Sheets-Sheet 3

Fig. 3.



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STRIPING ATTACHMENT FOR KNITTING MACHINES

Filed March 29, 1921 7 Sheets-Sheet 4

Fig. 4.

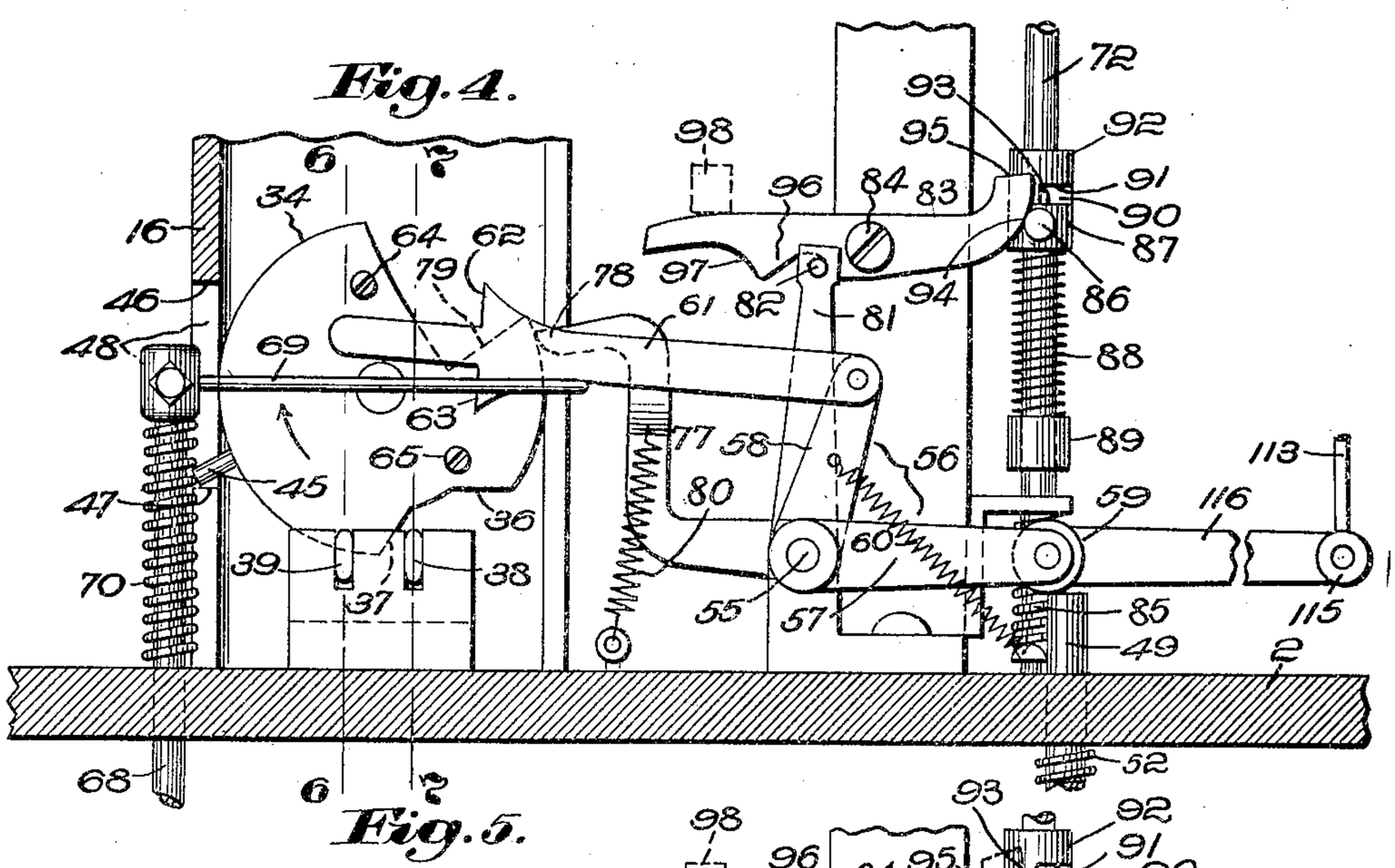

Fig. 5.

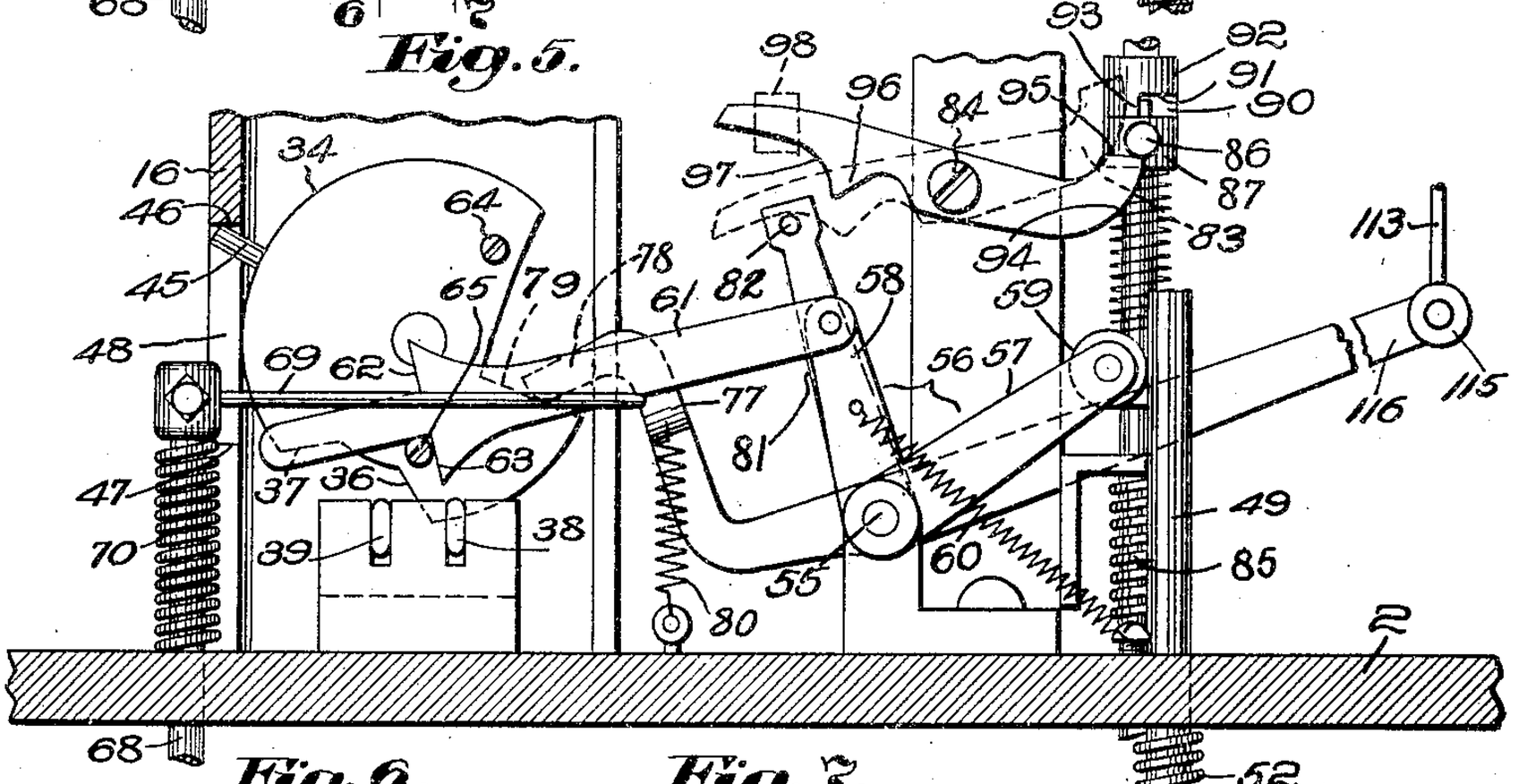

Fig. 6.

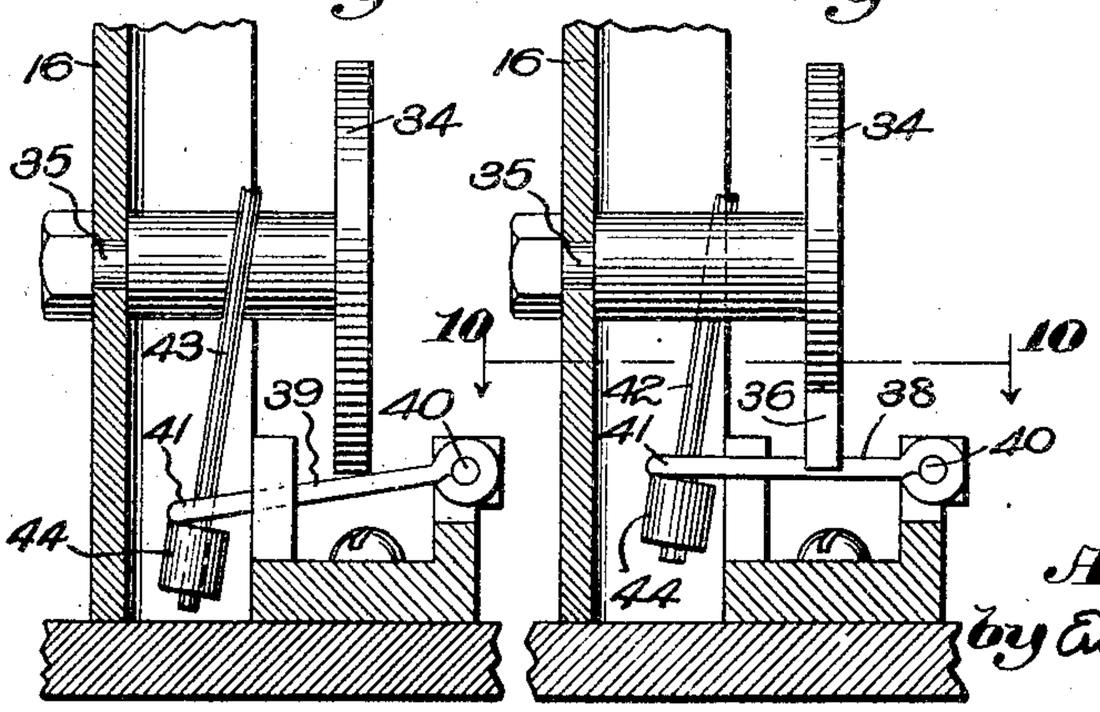

Fig. 7.

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Sept. 4, 1928. 1,683,540

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STRIPING ATTACHMENT FOR KNITTING MACHINES

Filed March 29, 1921 7 Sheets-Sheet 5

Fig. 8

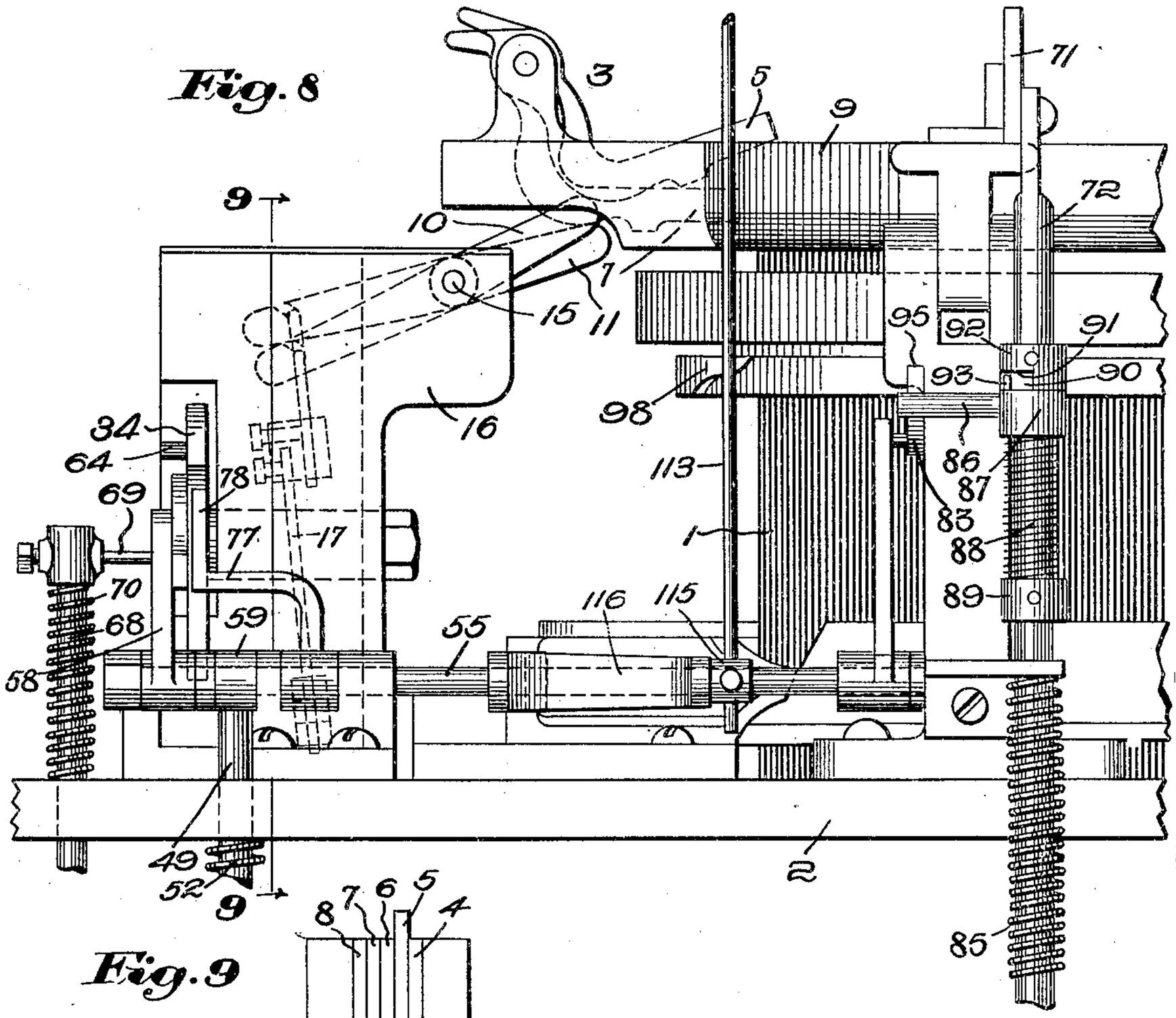


Fig. 9

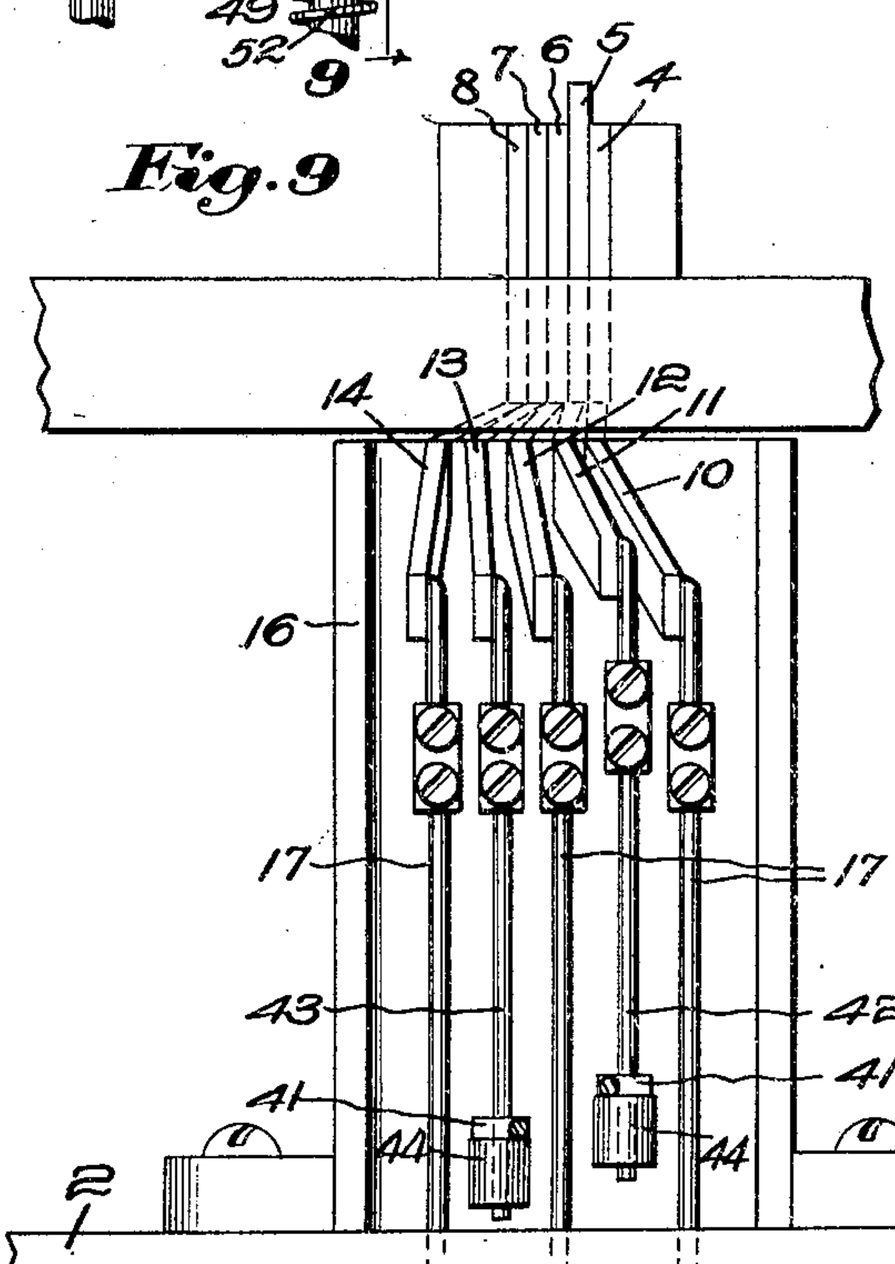
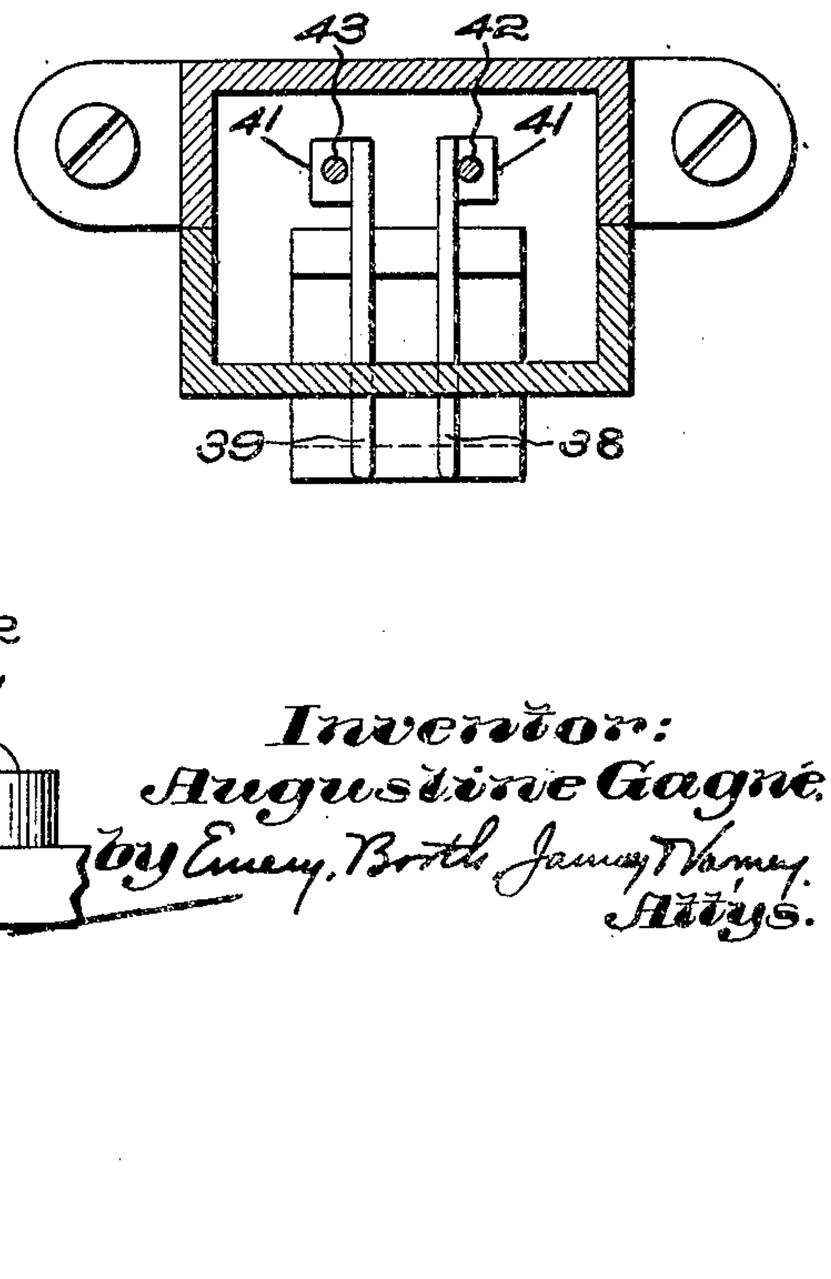


Fig. 10



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STRIPING ATTACHMENT FOR KNITTING MACHINES

Filed March 29, 1921 7 Sheets-Sheet 6

Fig. 11.

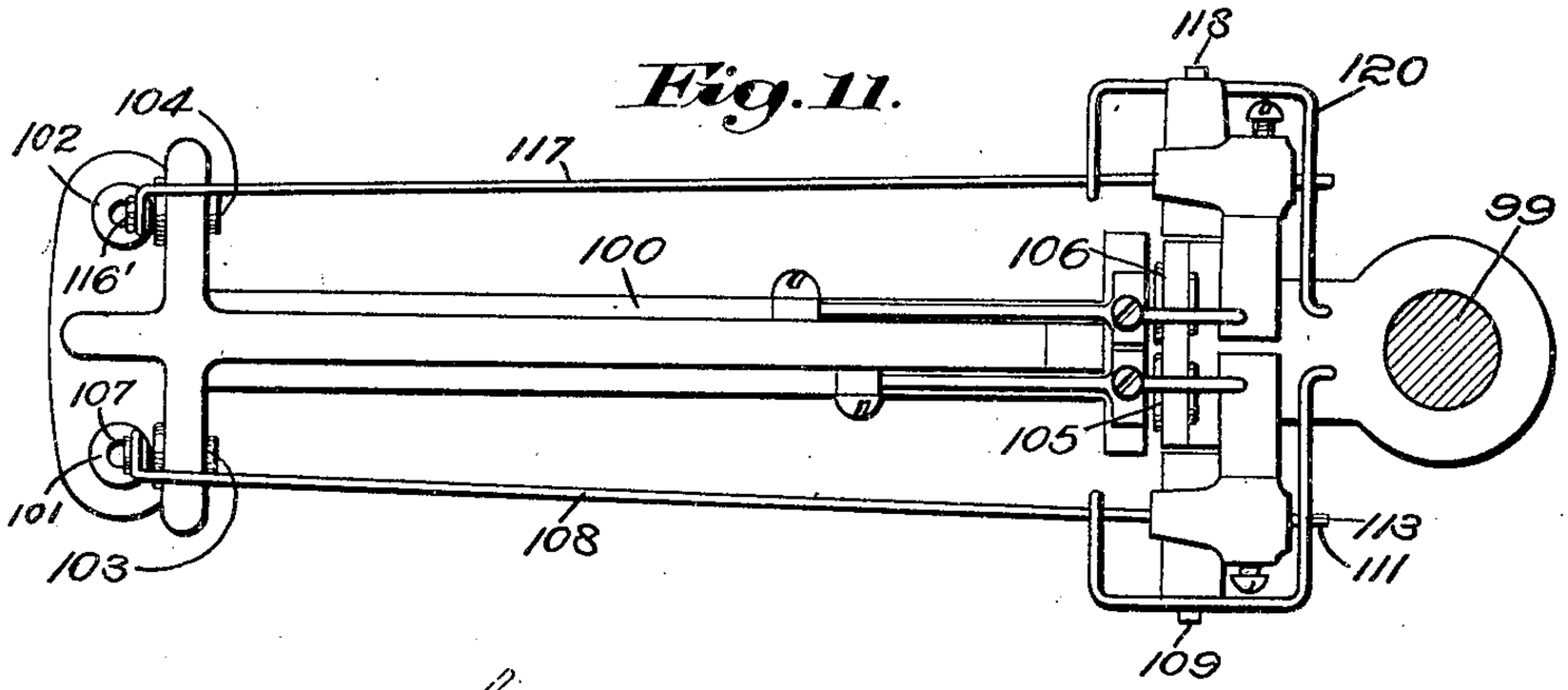
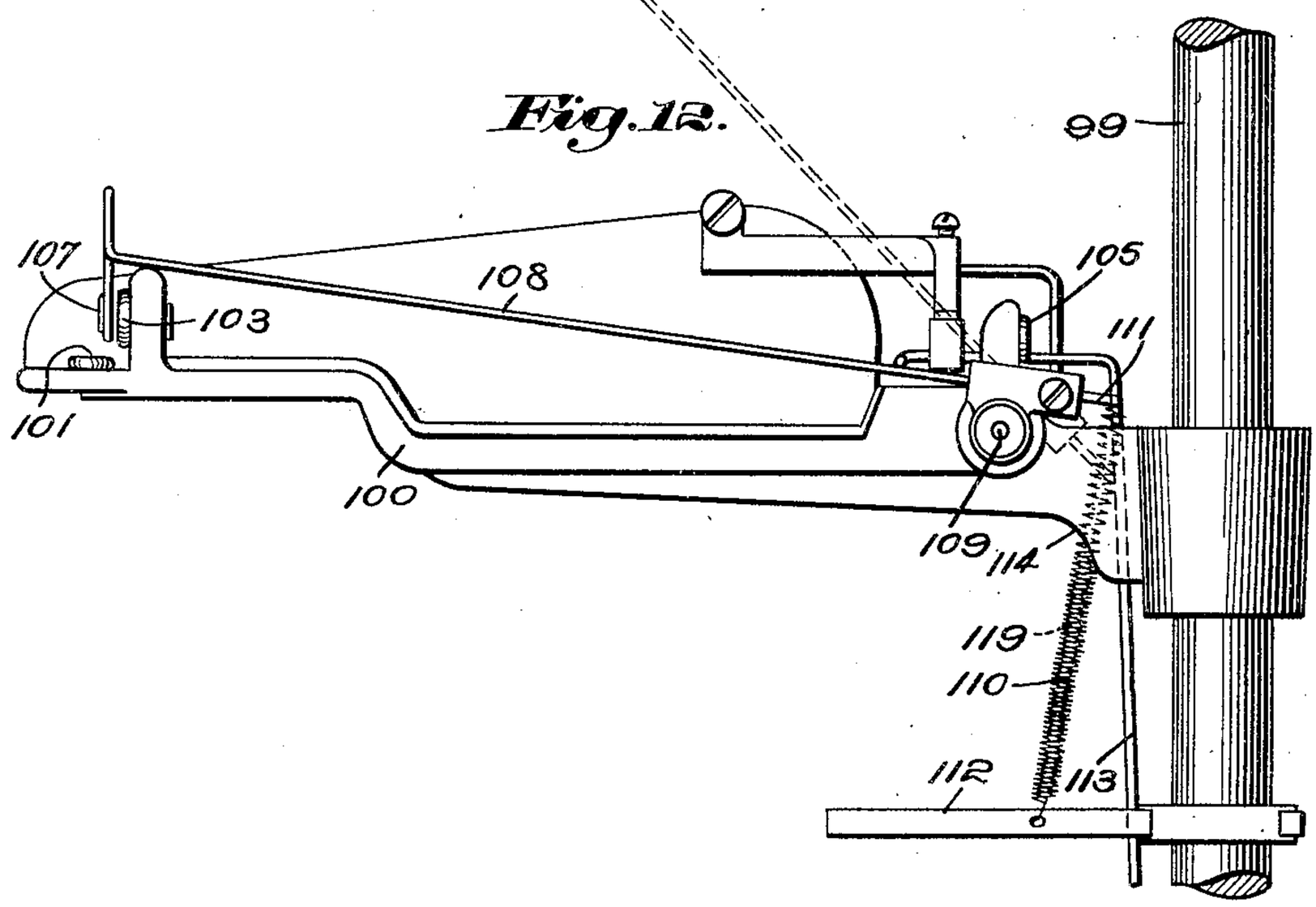


Fig. 12.



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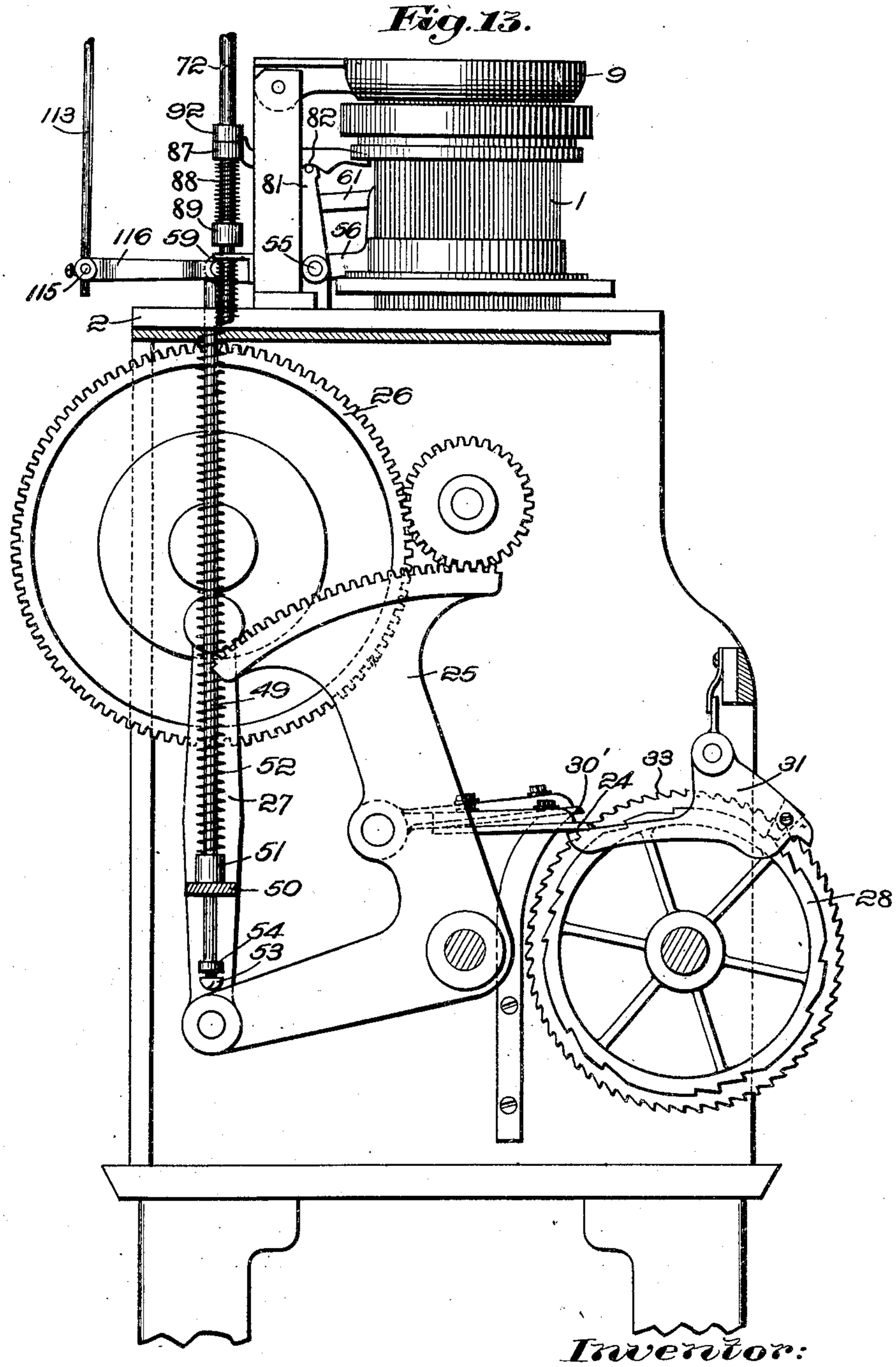
STRIPING ATTACHMENT FOR KNITTING MACHINES

Filed March 29, 1921 7 Sheets-Sheet 7

Fig. 13.



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UNITED STATES PATENT OFFICE.

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STRIPING ATTACHMENT FOR KNITTING MACHINES.

Application filed March 29, 1921. Serial No. 456,780.

This invention relates to knitting machines and the object thereof is to provide simple and efficient means for inserting yarn or yarns of different colors or character at selected points in the foot and leg of the stocking in order to produce partial or complete courses or circular stripes and to distinguish the whole or a part of the tip of the toe or heel thereof from the rest of the fabric.

In the drawings I have shown merely for illustrative purposes one example of a machine embodying my invention wherein:

Fig. 1 is a front elevation of a circular knitting machine embodying this invention;

Fig. 1ª is a side elevation of a stocking such as may be knitted upon the example of machine shown.

Fig. 2 is a rear elevation of the machine;

Fig. 2ª is a detail view of a portion of the pattern chain illustrating one arrangement of the lugs for setting into operation the yarn changing mechanism;

Fig. 3 is a plan section through the upper part of the machine wherein is illustrated the striper mechanism;

Fig. 4 is a right hand side elevation of the striper attachment with the parts thereof shown in position to insert one thread.

Fig. 5 is a view similar to Fig. 4 illustrating the parts of the striper in the position wherein another or different thread is being inserted;

Fig. 6 is a detail section taken on line 6—6 of Fig. 4;

Fig. 7 is a detail section taken on the line 7—7 of Fig. 4;

Fig. 8 is a detail rear elevation of the striper attachment, portions of the knitting head of the machine being shown in connection therewith;

Fig. 9 is a detail section taken on the line 9—9 of Fig. 8 illustrating the special connections for the operating levers of the yarn guides that are effected by the striper attachment embodying this invention; and

Fig. 10 is a detail plan section taken on the line 10—10 of Fig. 7;

Fig. 11 is a plan view of the yarn tensioning and take up devices;

Fig. 12 is a side elevation of the same; and

Fig. 13 is a side elevation of the mechanism with parts in vertical section.

Preferably, though not essentially, I have illustrated my invention as applied to a circular stocking knitting machine generally of the type disclosed in the patent to Hemphill 933,443 dated September 7, 1909. In this type of machine the needle carrier is cylindrical and revolves while the cams remain stationary and although the machine disclosed is for the purpose of producing hosiery, it is obviously not limited to this class of work.

Generally the machine includes a revolving needle cylinder 1 mounted on a suitable table 2 constituting a part of the frame of the knitting machine and, as is customary in this type of machine, said cylinder is arranged to be rotated and reciprocated to respectively form the tubular and fashioned portions of a stocking. The means for effecting said rotary and reciprocatory movements are substantially the same as those shown and described in said Hemphill machine and being well known need no further explanation.

A plurality of yarn feeding elements 3 herein consisting of five pivotal yarn guides 4, 5, 6, 7 and 8 are pivoted in a well known manner to the latch ring 9. In the present example these yarn guides are controlled by means including levers 10, 11, 12, 13 and 14 respectively pivotally supported at 15 in a standard 16 secured to the table 2, certain of said levers being in turn controlled from the cam drum 23 of the usual pattern drum of said Hemphill machine. In the present example the levers 10, 12 and 14 are all shown as controlled by said pattern drum 23 and preferably through the usual wires 17, one of said wires being connected with each of the levers named and with cam levers 18, 19 and 20 respectively pivoted at 21 and arranged to engage suitable abutments or interrupted ribs distributed about the face of the drum 23 and properly spaced to bring their respective yarn guides into operative position at suitable times in the knitting of the work. The pattern drum 23 is herein shown mounted upon the usual pattern shaft 22 suitably journalled in the frame of the machine to rotate at certain definite or selected intervals to effect the changes in the character and form of the work.

A forward intermittent rotary motion is imparted to the pattern or cam drum 23 preferably by the usual pawl 24 carried by the usual segment 25, the latter being oscillated by means of the gear 26 through a connect-

ing rod 27 all of which parts are included in the needle carrier reciprocating instrumentalities of the above mentioned Hemphill machine. The pawl 24 is arranged to operate upon a suitable ratchet 28 secured to rotate with the cam drum 23 see Figs. 1 and 13 and the engagement of said pawl with the teeth of said ratchet is herein controlled by lugs 29 on the usual pattern chain 30 through the medium of the usual Hemphill controller 31. A pattern chain 30 is mounted upon a sprocket 32 to which a step-by-step movement is given by the usual operating pawl 30′ carried by the segment 25 shown in Fig. 13, said pawl acting upon a ratchet 33 attached to said sprocket 32 in the usual manner.

In addition to the regular yarn changing devices hereinbefore described which include the pattern cam 23 I have provided an additional, or what I term a supplementary or auxiliary yarn changing device, one purpose of which is to effect additional changes in the work without necessitating an enlargement of the pattern cam 23 or the lengthening of the pattern chain 30 yet enabling yarns of different colors to be inserted at predetermined or selected points in the knitting.

As an example of means for accomplishing the said results I have provided the auxiliary cam member 34 herein oscillatorily mounted upon a stud 35 secured to the standard 16. The cam 34 is of disk form and has a notch in the rim thereof which forms, at opposite ends, cam surfaces 36 and 37.

Cooperating respectively with said cam surfaces are levers 38 and 39 pivoted at 40 in a fixed part of the frame, the free ends of said levers having eyes 41 to receive wires 42 and 43 depending respectively from the operating levers 11 and 13, said wires 42 and 43 having collars 44 secured thereto and against which the eyes 41 abut when acted upon by their respective levers. The cam surfaces 36 and 37 are so arranged as to automatically engage their respective levers 38 and 39; that is to say during the oscillation of the member 34 clockwise or in the direction of the arrow, Fig. 4, the cam 36 which is assumed to be out of engagement with its lever 38 will be brought into engagement therewith and depress said lever from a position shown in Fig. 7 to one corresponding to that shown in Fig. 6 while the lever 39 which, at the start is assumed to be in engagement with the circular periphery of the cam member 34 adjacent to the cam surface 37, will be released by such movement and moved to a position corresponding to that shown in Fig. 7. A result of the movements of the levers 38 and 39 from the positions shown in Fig. 4 to those shown in Fig 5 is to lower the yarn guide 7 from an inoperative to an operative position and to raise the yarn guide 5 from its operative to its inoperative position while the movement of the oscillatory member 34 in an opposite direction to that indicated by the arrow in Fig. 4 will cause the said yarn guides to be returned to their former position. Obviously the movement of the member 34 need not necessarily be an oscillatory movement but where such is employed it is desirable to provide means for limiting or preventing overthrow of said member and herein for this purpose a pin 45 is provided in the periphery of said cam to engage suitable abutments as for example the ends 46 and 47 of a slot 48 formed in one side of the standard 16. The oscillatory movement of said cam 34 may be effected by various means and herein I have provided means operating continuously with the driving elements of the machine which means include a plunger 49 arranged to reciprocate vertically herein in suitable bearings including the table 2 and a bracket 50 secured to the frame of the machine. The lower end of said plunger is arranged in operative relation to an arm of the oscillating segment 25 so that, for each movement of said arm, said plunger 49 will be moved a predetermined distance in its guides.

A collar 51 is herein shown attached to the rod or plunger 49 above the bracket 50 and when said plunger is in its lower position, said collar rests against said bracket so that the downward movement of the plunger will be limited thereby. A spring 52 encircles said plunger between a suitable fixed member, such, for example, as the table 2 and said collar 51 so as to exert a yielding pressure against the plunger in opposition to its movement by the segment 25. The lower end of said plunger is herein shown as having an adjustable contact member herein consisting of a screw 53 having screw-threaded engagement with said plunger and adapted to be held in the desired position by a check nut 54. Mounted on the table 2 in suitable bearings is a rock shaft 55 having loosely mounted thereon a bell crank lever 56. This bell crank lever has two arms 57 and 58, the arm 57 of which extends toward the plunger 49 and has at its free end a roll 59 adapted to roll in contact with the end of the plunger projecting above the table 2. The relation of the roll and plunger is such that when the plunger is in the lowermost position, the roll 59 rests upon the upper end of the plunger as shown in Fig. 4 but as said plunger moves upwardly the roll will move therewith for a predetermined distance or until the end of said plunger clears said roll, whereupon said roll will merely have rolling engagement with the side of said plunger during any further upward movement thereof, and no further movement will be imparted to the lever 56.

A spring 60 secured to said lever 56 and a suitable fixed point on the machine yieldingly maintains the roll 59 in contact with the

plunger. Attached to the free end of the other arm 58 of said bell crank lever is an actuator or pusher 61 which extends toward and adjacent to the face of the cam 34. This pusher is provided with upper and lower shoulders 62 and 63 adapted respectively to cooperate with suitable abutments herein pins 64 and 65 projecting laterally from the face of said cam 34 to oscillate said cam and thereby effect alternate engagement of the cam faces 36 and 37 with their levers 38 and 39. The pins 64 and 65 are disposed upon opposite sides of the axis of the cam 34 and are at such a distance apart that when one of the shoulders of said pusher is in contact with its abutment or pin the other shoulder will not engage its pin. Obviously with this arrangement of the stops and pins the permitting of one shoulder to remain in alignment with its abutment or pin for a number of consecutive movements of the pusher 61 will result in the yarn guides remaining unchanged for that period of operation or until the pusher is moved so as to cause the other shoulder to engage its pin.

The arrangement of said pins is such that when one shoulder moves its pin forward the opposite pin will be retracted to a position where it will be operated upon the next forward movement of the pusher or when the shoulder for that pin is moved to align therewith. It is, therefore, desirable to provide means to effect the shifting of said pusher from one pin to the other whenever a change is desired and, for this purpose, I preferably provide means including the pattern chain 30 for accomplishing such a result and upon which are formed a series of lugs 66 (see Fig. 2[a]), said lugs being formed upon the opposite side of the chain from the regular lugs 29 for actuating the controller 31. Obviously these lugs 66 may be arranged at any desired points on the chain to effect the yarn changes, and the shape or shapes thereof may vary according to the purpose desired, as will hereinafter be more fully described.

Cooperating with the lugs 66 is a pawl 67 pivoted herein upon the same stud with the controller 31. Connected with said pawl and preferably upon the opposite side from the portion thereof which engages the lug 66 is a rod 68 (see Figs. 1, 2, 4, 5 and 8), the upper end of which has sliding engagement with the table 2 through which it projects and carries at its extremity a finger 69. Surrounding said rod between said finger and the table 2 is a spring 70 which acts to maintain said rod in its elevated position with the end of the pawl 67 in contact wih the face of the pattern chain and operates in opposition to the raising of said pawl by the lugs 66. The finger 69 is arranged to project beneath the pusher 61 and when the finger is in its elevated position the pusher will be supported thereby with its shoulder 62 in a position to engage the lug or pin 64 so that each movement of said pusher toward the left would, after the first movement of the cam 64, be an idle movement but when a change is to be made in the yarn one of the lugs 66 on the pattern chain passes beneath the end of the shoulder 63 elevating said end, compressing the spring 70 and depressing the finger 69, thus permitting the shoulder 63 to drop to its lower position where, upon the forward movement of said pusher, said shoulder will engage the lowermost pin 65 and lock said cam.

Naturally the movement of the pusher from one position to the other may take place when said pusher is in its forward position. Hence the rear portions of the shoulders 62, and 63 are so shaped, and the raising and lowering means for said pusher so constructed, as to cause the said pusher to yield and thus ride easily over the pins on its backward stroke, and upon clearing said pins, said pusher will move to its operative position either up or down as the case may be.

When the yarn changes are made by the usual means including the pattern cam or drum 23, the cutting and clamping of the yarn that is withdrawn from action is effected by the usual yarn cutting and clamping devices herein including a cutter lever 71, link 72 connected with said cutter lever 71 and with one end of an intermediate lever 73 pivotally supported beneath the table 2, the opposite end of said lever 73 being connected by means of a link 74 with a cam lever 75 operating in contact with the face of a cam 76 arranged to rotate with the pattern drum 23, (see particularly Figs. 2 and 8), said cam 76 having cam surfaces at predetermined intervals in its periphery to cause the cutter lever to operate to cut and clamp the yarn whenever the same is withdrawn from action. The action of the cam surfaces, however, in the present example, merely effects the opening of the jaws of the cutter and the opening of the yarn clamp so that the yarn is permitted to enter and be subsequently clamped and cut, the clamping and cutting operations being effected by means of a spring 85 (see Figs. 2, 4, 5 and 8) arranged to encircle the link 72 between a suitable shoulder and a fixed point to cause said link to move downwardly when the same is released by the cam 76.

As previously stated, however, this mechanism co-operates with the yarn guides, which latter are affected by movement of the pattern cam 23 but it is desirable that said cutter and clamp should operate when the yarn guides 5 and 7 are operated to withdraw their yarns from action. Therefore to accomplish this result means are provided for imparting additional or independent movements to said cutter lever and the yarn clamp when either one of the yarn guides 5 and 7 is withdrawn,

said means herein consisting of a lever 77 of goose-neck formation. The nose 78 of said lever 77 is arranged to engage the periphery of the cam 34, which latter is provided with a recess at its edge forming a cam surface 79, alternate movements of said cam 34 being adapted to cause the nose 78 of said goose-neck lever to pass from the outer periphery of said cam 34 as shown in Fig. 4 into said recess and against the cam surface 79 or from said latter position to the former according to the direction of movement of said cam.

The lever 77 is caused to follow the periphery of said cam 34 by pressure exerted thereon by a spring 80 so that the nose 78 of said lever will, at all times, be maintained in contact with said member 34. The lever 77 is herein shown loosely mounted to the shaft 55 to rock therewith and also secured to said shaft 55 is an arm 81 carrying at its upper end a pin 82 adapted to engage the under edge of a lever 83, the latter being pivoted at 84 to a fixed part of the machine frame, herein the supporting standard for the latch ring 9.

The lever 83 is arranged to cooperate at one end, preferably the end opposite to that engaged by the pin 82, with an arm 86 projecting laterally from a collar 87 mounted upon the cutter actuating link 72 (see Figs. 4 and 5). The arm 86 is positioned normally to intersect the path of movement of said lever so that when the end of said lever whose path of movement is intersected by said arm is depressed, said arm 86 will be swung outwardly away from said lever sufficient only to allow the end of said lever to pass below the said arm. To facilitate the movements of said arm, the collar 87 has a limited rocking movement upon the link 72, which movement is in opposition to the action of a torsional spring 88 herein arranged to encircle a portion of the link 72 between a collar 89 secured to said link and a collar 87 bearing the arm 86, opposite ends of said spring being connected respectively with said collars.

As previously stated the collar 87 has a limited rocking movement upon said link 72, the purpose whereof is to confine the action of said spring within certain predetermined limits. As a means of limiting the movements of said collar I have herein provided the same with a tooth or abutment 93 which extends upward into a segmental recess 91 formed in the under side of a collar 92, the latter being secured to the link 72. Opposite ends of the segmental slot 91 preferably constitute abutments against which the abutment or tooth 93 is arranged to strike in its pivotal movements, the abutment 90 constituting the means for maintaining the arm 86 normally in the path of the arm of the lever 83. During the normal operations of the machine, the lever 83 remains either in the position shown in full lines in Fig. 4 or in that position indicated by the dotted lines, Fig. 5, in either of which positions the end 95 of said lever will be above rather than below said arm, and when the link 72 is raised by its regular operating means, as for example the cam 75 and the parts operated thereby, the arm 86 will merely idle against or near the curved end 94 of said lever 83. But when a change is to be made in the yarns controlled by the auxiliary cam member 34, at which time it is desirable to clamp and cut the yarn that is withdrawn, said lever 83 will be rocked about its pivot 84 so as to cause its squared end 95 to be moved below the arm 86 where, upon a reverse movement of said lever 83 will raise the arm 86, and through the collar 92, effect an upward movement of the rod 72 for the purpose of opening the clamping and cutting members to receive the yarn that is withdrawn.

To effect the rocking of said lever 83 for the purpose of placing its end surface 95 below the arm 86, said lever 83 is provided with inclines 96 and 97 upon its under edge and at the opposite side of the pivot 84 from the end of the lever which cooperates with the arm 86. The inclines 96 and 97 are at times engaged by the pin 82 carried by the lever 81 which pin and lever oscillate with the goose-neck shaped member 77 and each time the oscillatory cam member 34 is moved from one of its positions to the other to change the yarns.

By reference to Fig. 4 it will be seen that the pin 82 is at the right of the incline 96 of the lever 83 and the nose 78 of the lever 77 is held by the spring 80 in contact with the outer or circular periphery of the cam member 34. The parts referred to remain in the positions indicated until a change in the yarn or yarns is to be made through the proper instrumentalities, or until the finger 69 operates to vary the position of the pusher or actuator 61. From the positions illustrated in Fig. 4 of the parts to which reference has just been made, said parts will move upon the next operation of the machine to the positions shown in Fig. 5; that is the pusher 61 will be lowered so as to engage, through the shoulder 63, the pin 65 and as said pusher moves forward, the cam member 34 will be rocked to bring the cam surface 79 in a position to be engaged by the nose of the lever 77 whereupon the spring 80 will cause said lever to follow said cam surface and move with it the lever 81 and pin 82. During this latter movement the pin 82 engages the incline 96 and causes the end of the lever 83 bearing said incline to be raised while the opposite end of said lever is depressed, the inclined or rounded portion 94 thereof engaging the arm 86 and rocking the same upon the link 72 from its normal to its deflected position sufficient to allow that end of said lever to pass therebeneath and after said end has cleared the arm 86, the spring 88 acting upon the col-

lar 87, causes said arm to return to its normal position above and in contact with the surface 95, the opposite end of said lever being held in its elevated position shown in Fig. 5.

The various parts just described are designed to function at a certain definite time with respect to the rocking of the cam member 34, which latter effects the change of yarn, but this mechanism operates merely to maintain the lever 83 in such a position that it may subsequently be acted upon to open the jaws of the cutter and clamping devices and in the present example I have shown means consisting of a cam 98 attached to a predetermined portion of a revolving part of the machine as for example the needle carrier so as to engage the uplifted end of the lever 83 and depress the same. In view of the fact that the arm 86 is at this time above the end 95 of said lever 83, said arm will be lifted together with the link 72 and the cutters and clamping devices will be opened to receive the yarn. The pivotal movement of the lever 83 under the action of the cam 98 continues until the end 95 of said lever escapes from the arm 86 but not until said arm has been raised sufficiently to open the jaws of the cutters and clamps and as the raising movement of the link 72 is in opposition to the spring 85, said rod will, upon being released, return to its lower or normal position and thereby cause the yarn clamping device to clamp the yarn and the cutter thereof to sever said yarn.

Obviously the cam 98 may be placed in any desired position on the needle cylinder and may be of any length consistent with the proper performance of its function.

There are occasions, as for example, when a knitting machine is operating reciprocatingly when it is desired to provide means for taking care of slack yarn produced by the turning back or reversal in the direction of movement of the needle cylinder or, in some cases, of the cam cylinder and in machines of the character set forth herein such devices are usually employed.

In the present example is illustrated a common or known form of take up or tensioning device consisting of a vertical shaft or standard 99 arranged herein at the back of the machine (see Figs. 1, 11 and 12) which supports an arm 100. At the outer extremity of said arm are provided yarn guides or eyes 101 and 102, the holes through said eyes being disposed in substantially upright positions and in close proximity to said eyes 101 and 102 are other thread eyes or guides 103, 104 cooperating respectively with the guides 101, 102.

The guides 103, 104 are positioned slightly above the guides 101, 102 and the holes therein extend substantially horizontal or approximately at right angles to the holes in the guides 101, 102.

Near the inner end of the arm 100 are other eyes 105, 106 through which the yarn is led from suitable yarn masses to the eyes 103, 104. Interposed between the yarn guides or eyes 101, 103 is a movable guide eye 107 mounted at the outer free end of a pivotal take up arm 108, the latter being arranged to rock about the axis of a pivot 109 near the supported end of the arm 100. The arm 108 is arranged normally to be maintained in its uppermost position as shown in dotted lines, Fig. 12, by means of a light spring 110 attached at opposite ends respectively to an extension 111 of said arm 108 and to a fixed bracket 112.

The normal position of the guide eye 107 when the machine is knitting rotatably is, as shown in full lines Figs. 11 and 12, in which time there is no need of taking up the yarn and in order to maintain said guide eye in the position referred to, means are provided for depressing the arm 108 and in the present example the means employed for this purpose includes a wire rod 113 arranged to slide in the arm 100 at 114, the lower end of said wire being attached to a stud 115 pivotally supported in the outer end of an arm 116 secured to the rock shaft 55. The guide eyes 102, 104 also have a cooperating take-up guide eye 116 mounted in an arm 117 similar to the arm 108. Said arm 117 is likewise pivoted as at 118 upon the arm 100, the axis of said pivot being substantially coaxial with the axis of the pivot 109 for the arm 108.

A spring 119 acts upon the arm 117 to maintain the arm 117 in its uppermost position as shown in dotted lines, Fig. 12, said spring being attached to an extension of said arm 117 and to a fixed bracket similar to the bracket 112. The arm 117 is held, at certain times in the operation of the machine, in its lowermost or depressed position by a rod 120 similar to the rod 113 hereinbefore described, the rod 120 being of the usual type employed in the "Banner" machine and operated by suitable instrumentalities not shown or described herein.

From the foregoing description it will be obvious that circumferential stripes may be produced in the leg or foot portions of the stocking and moreover the heel of the stocking and in particular that part of the heel which is produced by reciprocating knitting and by so-called narrowing and widening, may be formed of yarn differing in color or character from that composing the regular loops of the fabric. Likewise the tip of the toe which also is produced by narrowing and widening may be formed of distinct yarn and these results may all be obtained merely by the insertion of special links at selected points in the pattern chain and without unnecessarily complicating the machine or necessitating the addition of a prohibitive number of links in the pattern chain.

Although the machine embodying this invention is capable of producing a large variety of designs in striping, a single example

is shown in Fig. 1ª. In this example, let it be assumed that the yarn composing the body of the stocking is white and in this white body, as indicated at *a* I insert a plurality of circumferential stripes *b* formed for example of blue yarn. Also let it be assumed that that portion of the heel pocket produced by narrowing and widening is also formed of blue yarn as indicated at *c* and at the toe of the stocking the portions thereof that are produced by narrowing and widening are also knitted with blue yarn as indicated at *d*. It should, however, be understood that the stocking is not limited to the design described.

Assuming now that the machine is to be threaded and adjusted to produce the example shown in Fig. 1ª; first the pattern chain 30 may be adjusted so that the links bearing lugs 66 (see Fig. 2ª) will be placed at the proper points to engage the pawl 67 for the purpose of effecting changes in the yarn.

It will, however, be noticed by reference to Fig. 2ª that the lugs 66 are of two kinds for example the lugs 121 are shorter than a second set of lugs 122, the latter being long enough to overlap each other to the extent that when two or more of these lugs are placed next to each other the pawl 67 will be elevated and maintained in its elevated position until all of the overlapping lugs of the group have passed, whereas with the lugs 121 the pawl 67 will be raised and permitted to drop back to its former position before a second lug is brought into engagement therewith. The result of the arrangement of the lugs, as stated, is that when the group of lugs 122 is acting upon the pawl 67, one yarn will be employed continuously throughout the entire series of lugs while with the lugs 121, two yarns will alternately be employed. Thus in knitting the sections *c* and *d* the lugs 122 will be engaged while the stripes *b* will be produced alternating with the regular yarn when the lugs 121 are acting upon the pawl 67.

The stocking illustrated in Fig. 1ª involves the use of only two yarn guides viz, the yarn guide 5 and the yarn guide 7 (see Fig. 8), the guide 5 serving, in the present example, to feed the white yarn to the work while the yarn guide 7 leads the blue yarn to the work.

The regular yarn guides 4, 6, and 8 which are operated in the manner common to the "Banner" knitting machine will not henceforth be referred to in the operation of the machine although obviously there are many classes of work where all of the yarn guides of the machine may be utilized. Obviously any one of the regular yarn guides 4. 6, 8 can be used at some period in the manufacture of the stocking together with the yarn from the yarn guide 5 or that from the yarn guide 7, and especially the latter, in which event one of said latter threads would act as a reinforcing thread.

Briefly the operation of the machine is as follows: The white yarn herein used in the body of the stocking is threaded through the guide 106, eye 104, take-up eye 116 and the guide-eye 102, thence to the guide-eye of the yarn lever 5, the latter in Fig. 8 being shown in its operative or yarn feeding position. The blue yarn is similarly threaded through the guide 105, eyes 103, 107 and 101 to the yarn lever 7.

Assuming the machine to be operating to knit tubular work, the yarn guides remain in the positions indicated in Fig. 8 and with their actuating parts as shown in Fig. 4 from which it will be seen that the two take-up arms 108 and 117 will be held depressed as shown in Fig. 12 by the wires 113 and 120. When the point in the knitting is reached where a considerable section of stocking is to be knitted in solid blue as for example in the tip of the toe, the lugs 122 are brought into engagement with the pawl 67 so as to raise the end of the pawl engaging said lugs or depressing the opposite end thereof. This action effects dropping of the finger 69 from the position shown in Fig. 4 to that shown in Fig. 5 with the result that the shoulder 63 of the pusher 61, in its subsequent forward movement, engages the pin 65 of the oscillatory member 34, whereupon the latter will be rocked to depress the lever 38 and raise the lever 39 which withdraws the white yarn guide 5 and throws into operation the blue yarn guide 7. This movement of the member 34 also effects the rocking of the shaft 55 and the consequential tilting of the lever 83 from the position shown in Fig. 4 to that shown in Fig. 5 in readiness to be acted upon by the cam 98, which in due course, engages said lever and through it elevates the link 72, opening the yarn clamping and yarn cutting devices to receive the white yarn thus withdrawn from action and forthwith said members are closed by the dropping of the lever 83 and consequential release of the spring 85. It will be remembered that the blue section *d* of the stocking is produced by reciprocating knitting. Hence it is desirable at this time to release the take-up arm 108 so that it may automatically act during subsequent oscillatory or reciprocatory movements of the needles to take up the slack produced thereby and in view of the fact that the lever 116 is secured to the rock shaft 55 and is operatively connected with the rod 113 by which said arm 108 was held in its depressed position, said lever 116 will be raised as the nose of the lever 77 drops into the notch in the member 34, thus releasing the arm 108. The parts thus described remain in their new positions until it is desired to withdraw the blue yarn from operation or until the pawl 67 drops off of the lugs 122. When the latter movement

takes place the finger 69 will be returned to its upper position as shown in Fig. 4 by means of the spring 70 carrying with it the free end of the pusher or actuating member 61 to a position where the abutment or shoulder 62 thereof will, in its next forward movement, engage the pin 64 of the oscillatory member 34 whereupon said oscillatory member will be moved to effect the withdrawal of the blue yarn and the restoration of the white yarn, also returning the lever 77 to the position shown in Fig. 4 and during this return movement the pin 82 will strike the incline 97 tilting the lever 83 to the position shown in Fig. 5 where it will again be actuated by the cam 98 to open the yarn grippers and cutters and clamp and cut the blue yarn and as this concludes the reciprocating knitting the dropping of the arm 116 to its former position causes the wire 113 again to engage the yarn take-up lever or arm 108 and depress the same in which position it will remain until the blue yarn is again inserted.

While I have herein shown and described certain embodiments of my invention and have disclosed and discussed in detail the construction and arrangement incidental to such disclosure it is distinctly to be understood that the invention is limited neither to the mere details or relative arrangement of parts nor to the specific applications herein shown but that extensive variations may be made without departing from the principles thereof.

Claims.

1. In a hosiery knitting machine, auxiliary yarn changing means to effect changes of yarn at the tips of the toe and heel, said means including a pair of yarn guides, a cam member having peripherally positioned thereon two spaced cams sloping toward each other, one of said cams adapted to act in one direction of movement upon one of said yarn guides and the other adapted to act in the opposite direction of movement upon the other yarn guide, and means to impart to and fro movement to said cam means.

2. In a hosiery knitting machine, auxiliary yarn changing means to effect changes of the yarn at the tips of the toe and heel and to produce stripes at selected points in the foot and leg portions of a stocking, said means including a pair of yarn guides, a cam member having peripherally positioned thereon two spaced cams sloping toward each other, one of said cams adapted to act in one direction of movement upon one of said yarn guides and the other adapted to act in the opposite direction of movement upon the other yarn guide, and means to impart to and fro movement to said cam means.

3. Knitting mechanism comprising, in combination, means for knitting stockings including cooperating means to effect changes in the yarn at the tip of the toe and heel and at selected courses in the foot and leg portions thereof, said means including a pair of yarn guides, a cam member having peripherally positioned thereon two spaced cams sloping toward each other, one of said cams adapted to act in one direction of movement upon one of said yarn guides and the other adapted to act in the opposite direction of movement upon the other yarn guide, and means to impart to and fro movement to said cam means.

4. Knitting mechanism comprising auxiliary yarn changing means to change the yarn at selected courses in the foot or leg of a stocking, said means including a series of yarn guides, primary means controlling the position of a plurality thereof, and auxiliary means to control the position of one member of said series of yarn guides, said auxiliary means including a cam member having peripheral spaced cams sloping toward each other, and means to move said cam member to and fro, thereby to control the movements of said yarn guide into and out of action.

5. Knitting mechanism comprising, in combination, means for knitting heel and toe pockets by narrowing and widening, means to effect changes in the yarn, and to and fro movable auxiliary control means to effect additional changes in the yarn at a selected number of courses during said narrowing and widening operations, said auxiliary control means including a cam member having two peripherally arranged spaced cams thereon sloping toward each other, one of which cams acts in one direction of movement and the other in the opposite direction of movement to effect yarn change.

6. Stocking knitting mechanism comprising, in combination, means including a pattern cam to effect changes in the form of the work, auxiliary pattern means mounted for backward and forward movement, means for imparting backward and forward movement to said auxiliary pattern means, said auxiliary pattern means having spaced cam members sloping toward each other and adapted respectively to cooperate with yarn changing means in said backward and forward movements, and a plurality of yarn feeding members operatively positioned with respect to said auxiliary pattern means and adapted to be acted upon by the said sloping cams of the latter to effect a change in yarn feed.

7. Knitting mechanism comprising, in combination, a plurality of yarn feeding elements, means including a pattern cam to operate said elements to effect changes in the yarn, and means including oscillatory pattern means for acting upon at least one yarn feeding element, and thereby determining the periods of operation thereof for knitting the tips of the heel and toe, said auxiliary pattern means having thereon oppositely sloping, spaced cams adapted alternately and respec-

tively to act upon two of said yarn feeding elements in the oscillatory movement of said pattern means.

8. Knitting mechanism comprising, in combination, a plurality of yarn feeding elements, means including a pattern cam to function said elements to effect changes in the knitting, auxiliary yarn changing means having oppositely sloping, spaced cams adapted alternately and respectively to act upon two of said yarn feeding elements, means to impart backward and forward movements to said auxiliary yarn changing means, and connections therefrom to control the periods of operation of two yarn feeding elements and means controlled thereby to effect the cutting and clamping of the withdrawn yarn.

9. Knitting mechanism comprising, in combination, a plurality of yarn guides, a pattern chain, means including a series of lugs on said chain to effect movement of certain of said yarn guides to and from operative positions, means including a second series of lugs on said chain and an oscillatory cam member controlled thereby and having spaced, oppositely sloping cams adapted respectively and alternately to act in opposite movements of said cam member upon two of said yarn guides to effect movement of said yarn guides to and from operative positions.

10. Knitting mechanism comprising, in combination, two sets of yarn guides, independent means for operating said sets, a pattern chain, means on said chain respectively to control the operations of said sets and a cam control member having spaced, oppositely sloping cams thereon adapted respectively and alternately to act in opposite directions of movement of said cam member upon two of said yarn guides, and means to move said cam member in opposite directions.

11. Knitting mechanism comprising, in combination, two sets of yarn guides, independent means for operating said sets, a pattern chain, means on opposite sides of said chain respectively to control the operations of said sets and a cam member having thereon a pair of spaced, oppositely sloping cams adapted in opposite directions of movement of said cam member to act respectively and alternately upon two of the yarn guides, and means to impart opposite directions of movement to said member.

12. Knitting mechanism comprising in combination, a series of yarn guides, main pattern control means for a plurality of said yarn guides, auxiliary pattern control means for two yarn guides of said series of yarn guides, and connections from said control means to said guides, said auxiliary pattern control means including a cam disk having a pair of spaced cams thereon sloping toward each other and adapted alternately and respectively to act upon said two yarn guides, and means to move said cam disk in opposite directions to cause said cams respectively to act.

13. Knitting mechanism comprising, in combination, two sets of yarn guides, independent pattern means to respectively control the operations of the guides of said sets, an oscillatory sector constituting common actuating means for both of said pattern means, one of said pattern means being constructed and arranged to be oscillated by said sector, said oscillatory pattern means having a pair of spaced, oppositely sloping cams thereon adapted in the opposite directions of oscillation to act respectively and alternately upon said two yarn guides.

14. Knitting mechanism comprising, in combination, a pair of yarn guides, pattern means to effect the throwing of one of said yarn guides into operative position and the other out, yarn clamping and cutting means, and means including a reciprocating plunger to impart to and fro movement to said pattern means, thereby to change the yarn, and whereby clamping and cutting of the withdrawn yarn is effected.

15. In a knitting machine, the combination of a plurality of yarn feeds, means to operate said yarn feeds to feed yarn at selected points in the knitting and to hold said yarn feeds either in or out of operation for a predetermined number of courses, said means including an oscillatory cam member having a plurality of spaced, oppositely sloping cams thereon adapted in opposite directions of movement of said cam member to act respectively and alternately upon yarn feeds, and means for imparting opposite movements of oscillation to said cam, so as thereby to control said yarn feeds.

16. Knitting mechanism comprising, in combination, a plurality of yarn feeds, means to operate said yarn feeds to change the yarn at selected points in the knitting and to hold said yarns either in or out of operation for a predetermined number of courses, said means including an oscillatory cam, means including a reciprocating plunger to operate said cam, and pattern controlling means to effect cooperation between said plunger and said cam to change the yarn.

17. Knitting mechanism comprising in combination, a plurality of yarn feeds, means including an oscillatory cam, a plunger coacting therewith to impart movements of oscillation to said cam, a plurality of movable yarn feeds, and means cooperating with said yarn feeds and said plunger, including a pattern chain, whereby the oscillatory movements of said cam control the operation of said yarn feeds.

18. Knitting mechanism comprising in combination, a plurality of yarn feeds, an oscillatory cam member for moving said yarn feeds into and out of operative position, means for

imparting movement of oscillation to said oscillatory cam, the latter having thereon two spaced, oppositely sloping cams, one of which is adapted to act only in one direction of movement of the member upon one of said yarn feeds, and the other of which is adapted to act only in the opposite direction of said member upon another of said yarn feeds.

19. Knitting mechanism comprising, in combination, a pair of yarn guides, means to move said yarn guides into and out of operative yarn feeding positions, said means including an oscillatory cam member having thereon oppositely sloping, spaced cams alternately active respectively upon said yarn guides, an actuator for said oscillatory member, a pattern chain, and means controlled by said pattern chain to maintain said actuator in predetermined positions with respect to said oscillatory member whereby predetermined yarn feeds may be moved to yarn feeding position.

20. In a stocking knitting machine, a needle carrier arranged for rotary and reciprocatory movement, a plurality of yarn guides, means to move one of said yarn guides into and out of its yarn feeding position, an oscillatory cam member, means to actuate said cam member, a pattern chain, means controlled by said pattern chain to effect cooperation between said oscillatory cam member and its actuator, a plurality of lugs on said pattern chain to effect movement of said oscillatory member to maintain said yarn guide in its yarn feeding position.

21. Knitting mechanism comprising, in combination, a plurality of yarn feeding elements, a pattern cam, means operatively connecting said pattern cam with a selected number of said yarn feeding elements to effect movement of said elements to and from their operative positions, a pattern chain, means controlled by said pattern chain to effect movement of said pattern cam, an auxiliary pattern cam adapted to move to and fro operatively connected with a selected number of said yarn feeding elements, means to move said auxiliary pattern cam to and fro to move the yarn feeding elements connected therewith into and out of yarn feeding position, and means controlled by said pattern chain to effect cooperation between said auxiliary pattern cam and its operating means.

22. Knitting mechanism comprising, in combination, a plurality of yarn feeding elements, a pattern cam, means operatively connecting said pattern cam with a plurality of said yarn feeding elements, a pattern chain, means controlled by said pattern chain to effect movement of said pattern cam, an auxiliary oscillatory pattern cam, means operatively connecting said auxiliary pattern cam with a plurality of said yarn feeding elements, means to oscillate said auxiliary pattern cam to move the yarn feeding elements connected therewith into and out of yarn feeding position, and means controlled by said pattern chain to effect cooperation between said auxiliary pattern cam and its operating means.

23. Knitting mechanism comprising, in combination, a plurality of yarn feeding elements, a pattern cam for controlling the movements of certain of said yarn feeding elements, means including an oscillating segment to impart a step-by-step rotary movement to said pattern cam, a pattern chain to control the operation of said pattern cam by said segment, an auxiliary cam member having spaced cams alternately operative in oscillatory movements thereof adapted to effect movement of certain of said yarn feeding elements to and from their yarn feeding positions, a plunger operated by said segment to oscillate said auxiliary pattern cam member, and means including said pattern chain to control the operations of said auxiliary pattern cam member.

24. Knitting mechanism comprising, in combination, a pattern drum, a pattern chain, means under the control of said pattern chain to operate said pattern drum and effect changes in the knitting, a yarn guide, and an oscillatory cam independent of said pattern drum but controlled by said pattern chain, said oscillatory cam having spaced cam members thereon adapted in opposite movements of oscillation to manipulate said yarn guide to produce a change of yarn at predetermind points in the knitting.

25. Knitting mechanism comprising, in combination, a plurality of yarn feeding elements, and means to operate said yarn feeding elements to change the yarns at selected points in the knitting, said means including an oscillatory cam, a continuously operating actuator for said cam, and pattern controlled means to operatively connect said operating member with said cam, and move said oscillatory cam in a predetermined direction.

26. In a hosiery knitting machine, a set of yarn guides, a primary pattern control for a plurality of said guides, auxiliary yarn changing means to effect changes of yarn at the tips of the toe and heel, said means including an oscillatory cam member having spaced cams thereon sloping toward each other to act respectively in opposite directions of movement upon a plurality of said series of yarn guides, and means to impart a movement of oscillation thereto whereby said cams are alternately active respectively upon said yarn guides.

27. In a hosiery knitting machine, a set of yarn guides, a main pattern control for a plurality thereof, auxiliary yarn changing means to effect changes of the yarn at the tips of the toe and heel and to produce stripes at selected points in the foot and leg portions of a stocking, said means including

an oscillatory cam member having spaced cams thereon sloping toward each other to act respectively in opposite directions of movement, and operative connections respectively controlled by said cams to move a plurality of said yarn guides, and means to impart movement of oscillation thereto thereby to control a plurality of said yarn guides in said opposite movements.

28. Stocking knitting mechanism comprising, in combination, a set of yarn guides, a primary control for a plurality thereof, means including a pattern cam to effect changes in the form of the work, and auxiliary pattern means including a pivoted cam member having thereon spaced cams sloping toward each other adapted respectively to act on opposite directions of movement, and means to impart rotatory movement in opposite directions to said pivoted cam member to effect yarn changes at selected points in the work.

29. In a hosiery knitting machine, a series of yarn guides, a main pattern control for a plurality thereof, a pattern chain having movement in one direction and auxiliary yarn changing means to effect changes of yarn of at least one yarn guide of said series at the tips of the toe and heel, and connections between said pattern chain and said auxiliary yarn changing means to move the latter to and fro, and thereby to effect said yarn changes, said auxiliary yarn changing means having spaced cam formations sloping toward each other and adapted respectively to act in effecting said yarn changes.

30. In a hosiery knitting machine, a set of yarn guides, primary pattern control means for a plurality thereof, a pattern chain having movement in one direction, auxiliary yarn changing means to effect changes of the yarn of at least one yarn guide of said series at the tips of the toe and heel and to produce stripes at selected points in the foot and leg portions of a stocking, said auxiliary yarn changing means having spaced cam formations sloping toward each other and adapted respectively to act in effecting yarn changes, and connections between said pattern chain and said auxiliary yarn changing means to impart to and fro movement to the latter to produce said yarn changes.

31. Knitting mechanism comprising in combination, a series of yarn guides, a main pattern control for a plurality thereof, means for knitting stockings including a pattern chain having movement in one direction, cooperating means to effect changes in the yarn of at least one yarn guide of said series at the tip of the heel and toe and at selected courses in the foot and leg portions thereof, said cooperating means having spaced cam formations sloping toward each other and adapted respectively to act in effecting yarn changes, and connections between said pattern chain and said cooperating means to impart to and fro movement to the latter and thereby to effect said yarn changes.

32. Stocking knitting mechanism comprising in combination, a series of yarn guides, a main pattern control for a plurality thereof, a pattern cam to effect changes in the form of the work, a pivoted cam member constituting auxiliary pattern cam means and having peripherally positioned thereon two spaced cams sloping toward each other and adapted respectively to act in opposite directions of movement, and means to impart rotatory movement in opposite directions to said pivoted cam member to effect changes in the yarns from a pair of yarn guides of said series at selected points in the work.

33. Knitting mechanism comprising in combination, a pair of yarn guides, an oscillatory cam member having thereon spaced cams alternately operatively in opposite movements of oscillation to effect the throwing of one of said yarn guides into operative position and the other out, yarn clamping and cutting means, and means including a segment controlling to and fro knitting, and a reciprocating plunger controlled by the segment for actuating said pattern means to change the yarn and clamp and cut the withdrawing yarn.

34. Knitting mechanism comprising in combination, a plurality of yarn feeds including a continuously operating plunger to operate said yarn feeds to effect a change in the knitting, a cam member adapted to be oscillated by the movement of said plunger, and having spaced cams thereon alternately active in opposite movements of oscillation and thereby to effect said yarn changes, and means including a pattern chain to control the cooperation between said plunger and said yarn feeds.

35. Knitting mechanism comprising, in combination, a plurality of yarn feeding elements, a pattern cam for controlling the movements of certain of said yarn feeding elements means including an oscillating segment to impart a step-by-step rotary movement to said pattern cam, a pattern chain to control the operation of said pattern cam by said segment, an auxiliary oscillatory cam adapted to effect movement of certain of said yarn feeding elements to and from their yarn feeding positions, a plunger operated by said segment to oscillate said auxiliary pattern cam, and means including said pattern chain to control the operations of said auxiliary pattern cam.

36. A circular knitting machine having a circular series of needles and a series of pivoted yarn guides including a so-called horizontal or circular striper, a main pattern shaft carrying pattern indications for a plurality of the yarn guides of said series, and an auxil-

iary pattern control for said striper guides, and operative connections between said auxiliary pattern control and said striper guides, said auxiliary pattern control and its connections to said striper yarn guide including an auxiliary mounted, rigid, disk-like member having a peripheral cam formation rigid therewith for acting upon said striper for causing it to introduce complete circular courses, and means for periodically moving said disk-like member in opposite directions about its axis to vary the effective relation of its peripheral cam formation with respect to said striper yarn guide, and thereby to determine the movement of said striper yarn guide into and out of operation.

37. A circular knitting machine having a circular series of needles and a series of pivoted yarn guides including a so-called horizontal or circular striper, a main pattern drum for a plurality of the yarn guides of said series, rigid rod-like controlling members extending upward from said main pattern drum and moved up and down in response to the pattern indications thereon, and thereby controlling a plurality of the yarn guides of said series of yarn guides, a disk-like cam member having rigid therewith a peripheral cam, means to move said disk-like cam member in opposite directions for effecting the yarn changing movement, means adapted to be directly engaged by and operated by said cam member, and operative connections from said means to said striper yarn guide to determine its feeding position and to cause it to introduce complete circular courses.

In testimony whereof, I have signed my name to this specification.

AUGUSTINE GAGNÉ.