Feb. 19, 1929. 1,702,608

J. LAWSON ET AL

MECHANISM FOR PRODUCING KNITTED FABRICS HAVING LAP STRIPES AND YARN VARIATION

Filed Nov. 16, 1927 20 Sheets-Sheet 1

Fig. 1.

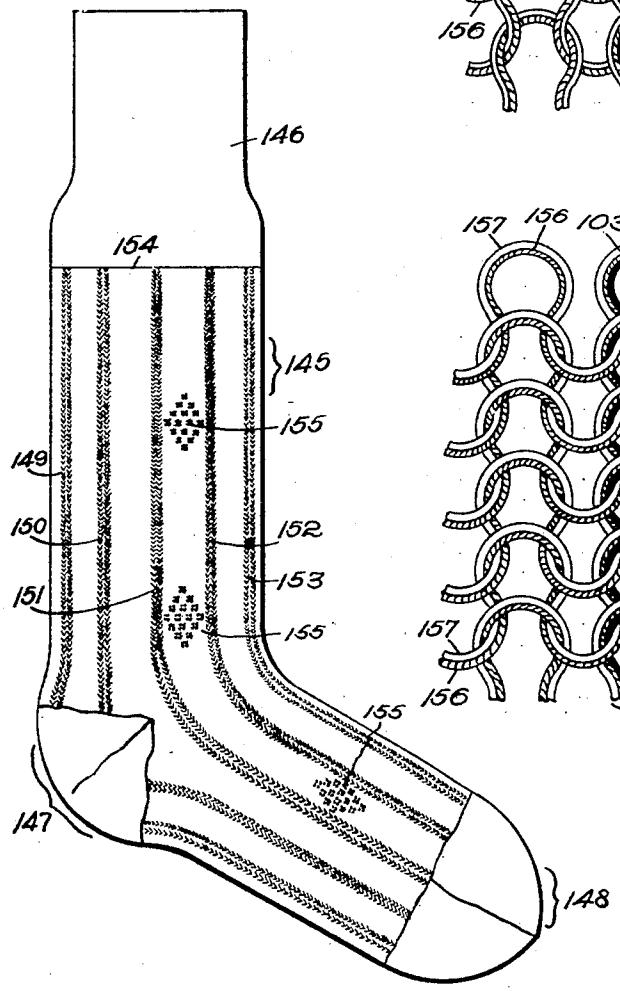


Fig. 2.

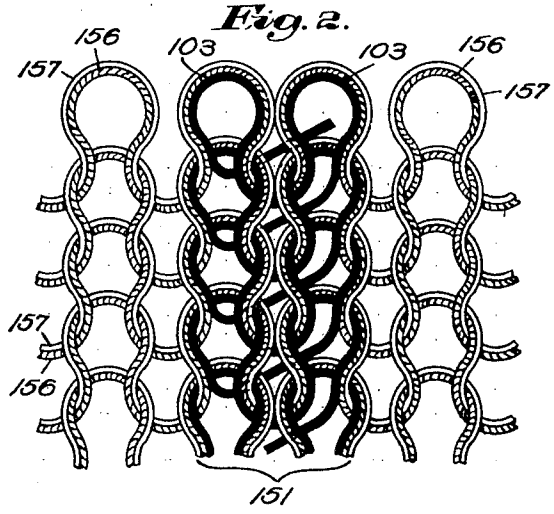
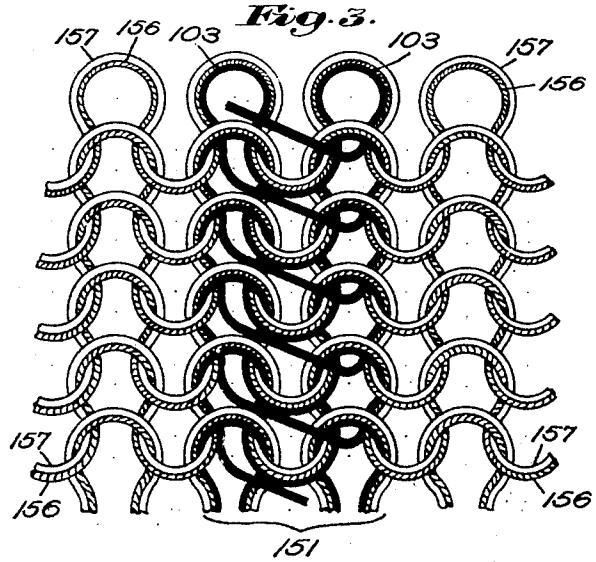


Fig. 3.



Inventors:
John Lawson,
Robert H. Lawson.
by Emery, Booth, Janney and Young
Attys

Feb. 19, 1929 1,702,608

J. LAWSON ET AL

MECHANISM FOR PRODUCING KNITTED FABRICS HAVING LAP STRIPES AND YARN VARIATION

Filed Nov. 16, 1927 20 Sheets-Sheet 2

Fig. 5.

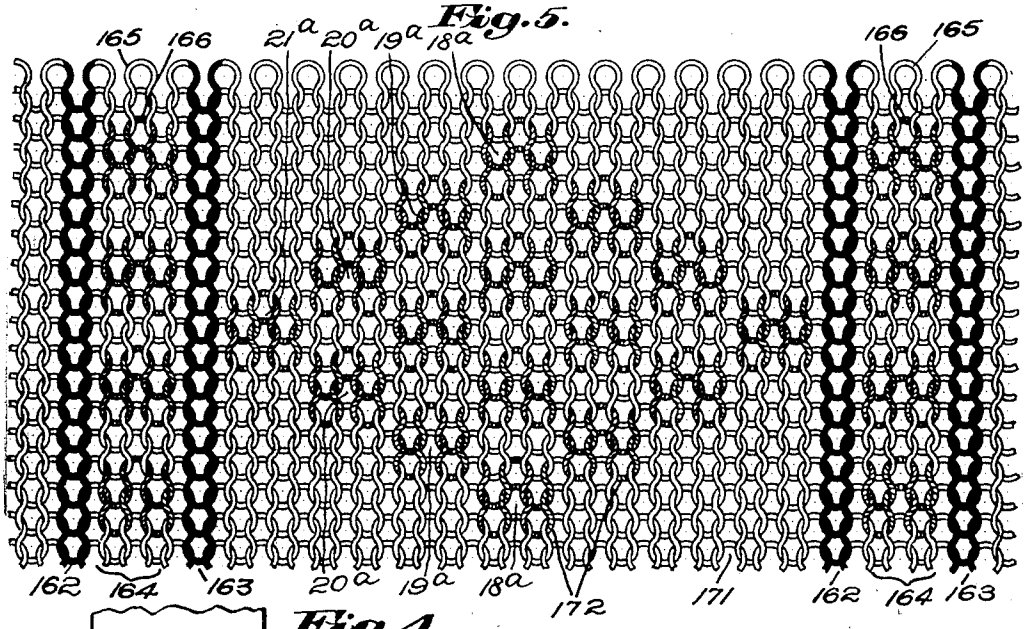


Fig. 4.

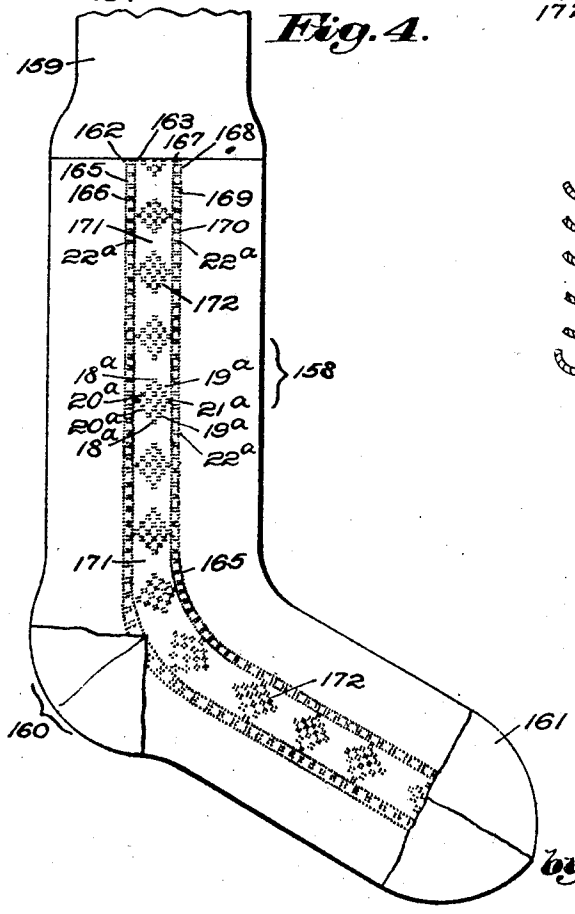
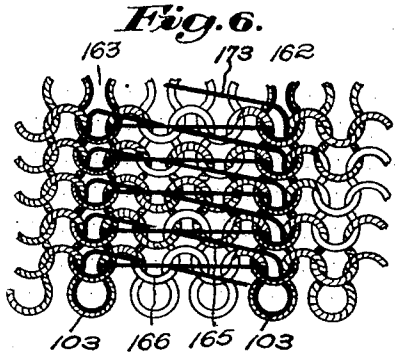


Fig. 6.



Inventors:
John Lawson,
Robert H. Lawson,
by Emery, Booth, Jaung and Young
Attys

Feb. 19, 1929. 1,702,608

J. LAWSON ET AL

MECHANISM FOR PRODUCING KNITTED FABRICS HAVING LAP STRIPES AND YARN VARIATION

Filed Nov. 16, 1927 20 Sheets-Sheet 3

Fig. 7.

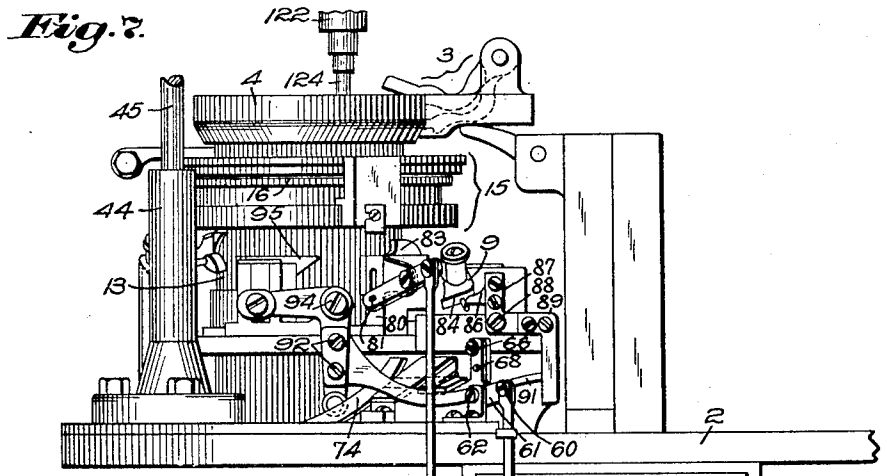
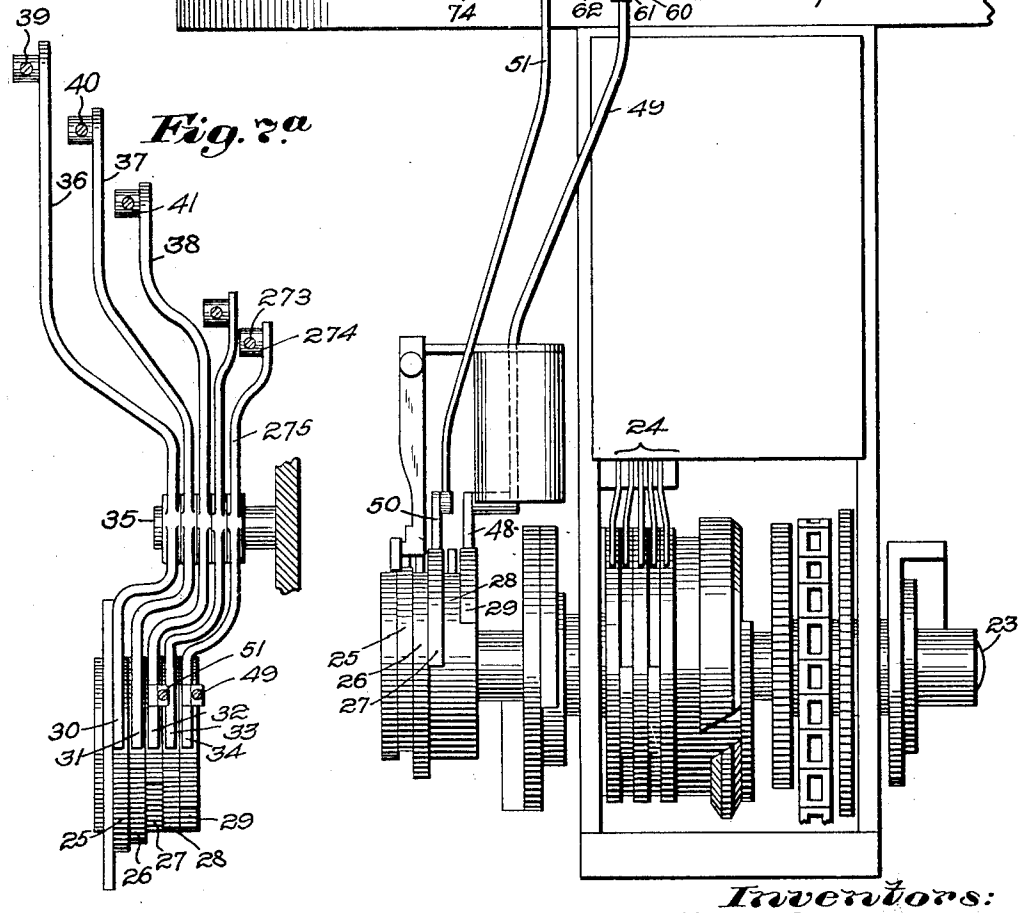


Fig. 7a



Inventors:
John Lawson,
Robert H. Lawson
by Emery, Booth, Janney and Varney
Attys

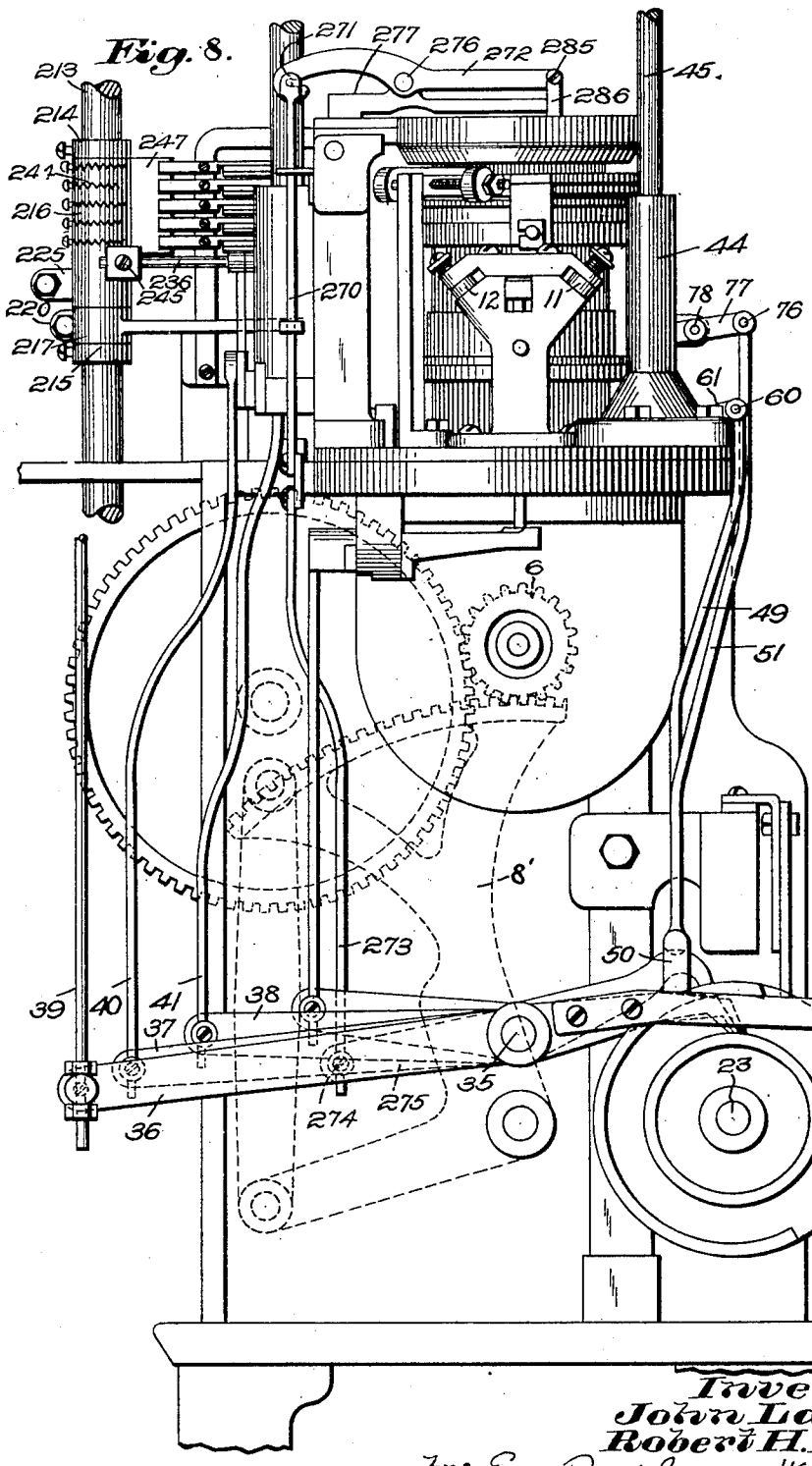
Feb. 19, 1929. 1,702,608

J. LAWSON ET AL

MECHANISM FOR PRODUCING KNITTED FABRICS HAVING LAP STRIPES AND YARN VARIATION

Filed Nov. 16, 1927 20 Sheets-Sheet 4

Fig. 8.



Inventors:
John Lawson,
Robert H. Lawson,
by Emery, Booth, Janney and Varney. Attys.

Feb. 19, 1929. **1,702,608**

J. LAWSON ET AL

MECHANISM FOR PRODUCING KNITTED FABRICS HAVING LAP STRIPES AND YARN VARIATION

Filed Nov. 16, 1927 20 Sheets-Sheet 5

Fig. 9.

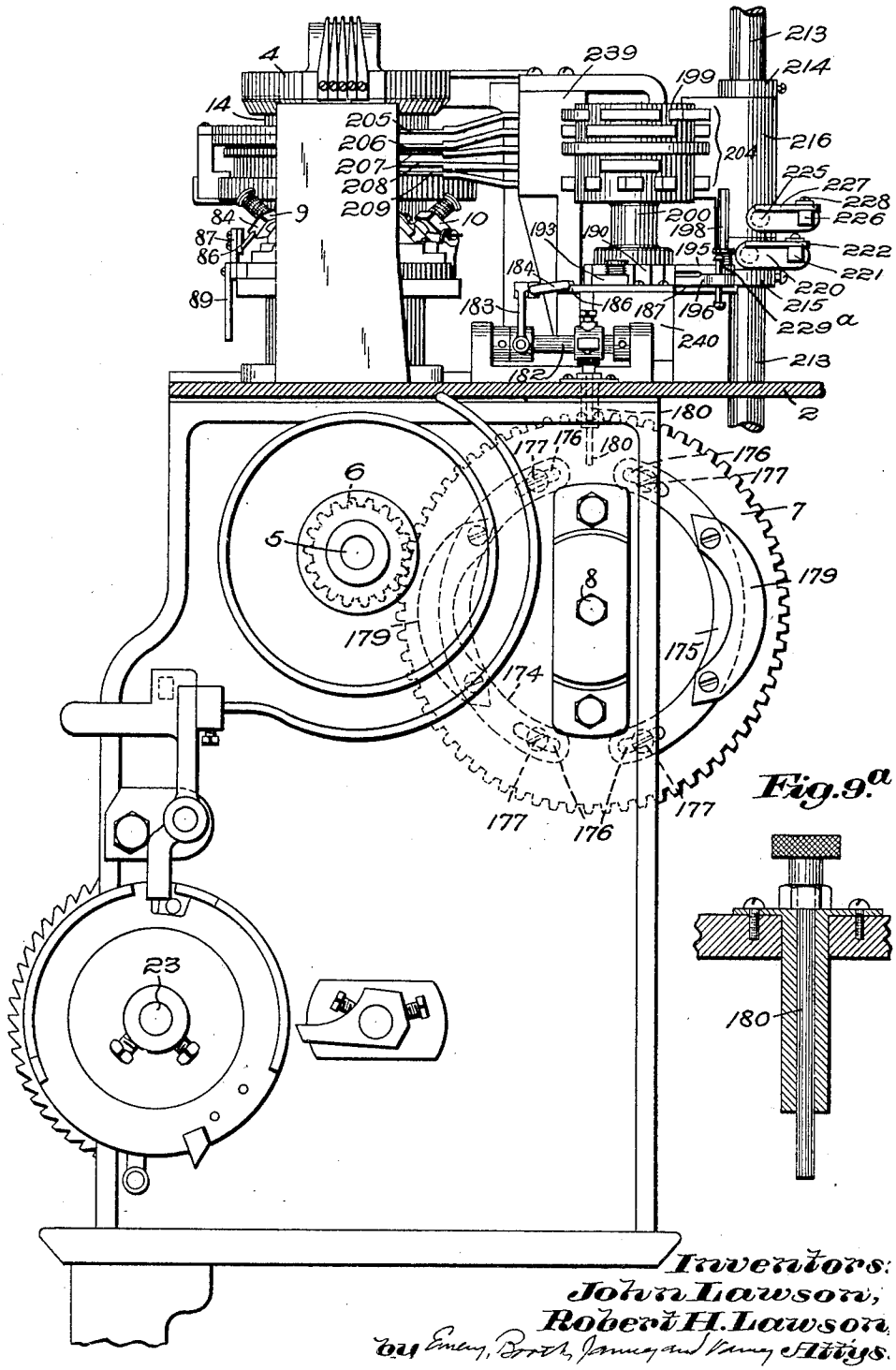


Fig. 9a.

Inventors:
John Lawson,
Robert H. Lawson,
by Emery, Booth, Janney and Varney Attys.

Feb. 19, 1929. 1,702,608

J. LAWSON ET AL
MECHANISM FOR PRODUCING KNITTED FABRICS
HAVING LAP STRIPES AND YARN VARIATION
Filed Nov. 16, 1927 20 Sheets-Sheet 6

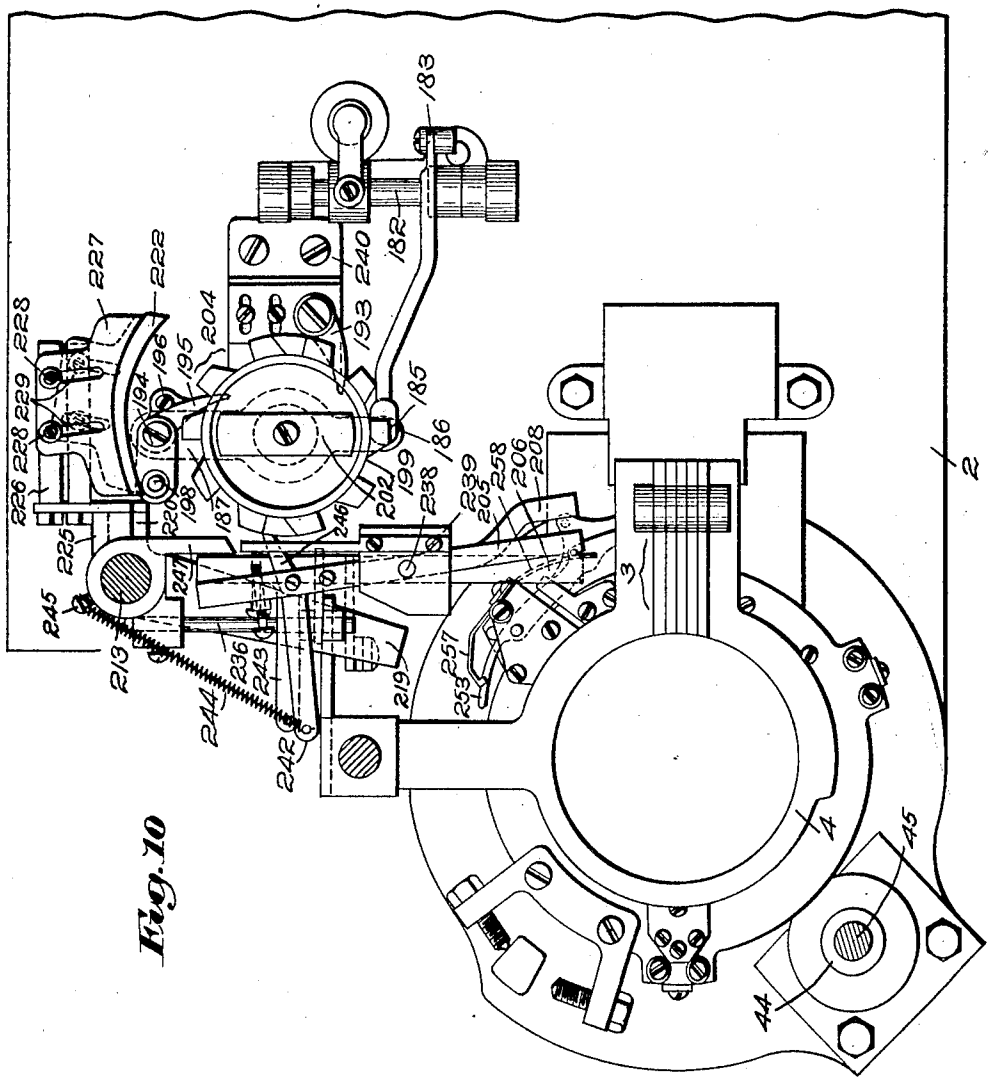


Fig. 10

Inventors:
John Lawson,
Robert H. Lawson
by Emery, Booth, Janney and Varney
Attys.

Feb. 19, 1929. 1,702,608

J. LAWSON ET AL
MECHANISM FOR PRODUCING KNITTED FABRICS
HAVING LAP STRIPES AND YARN VARIATION
Filed Nov. 16, 1927 20 Sheets-Sheet 7

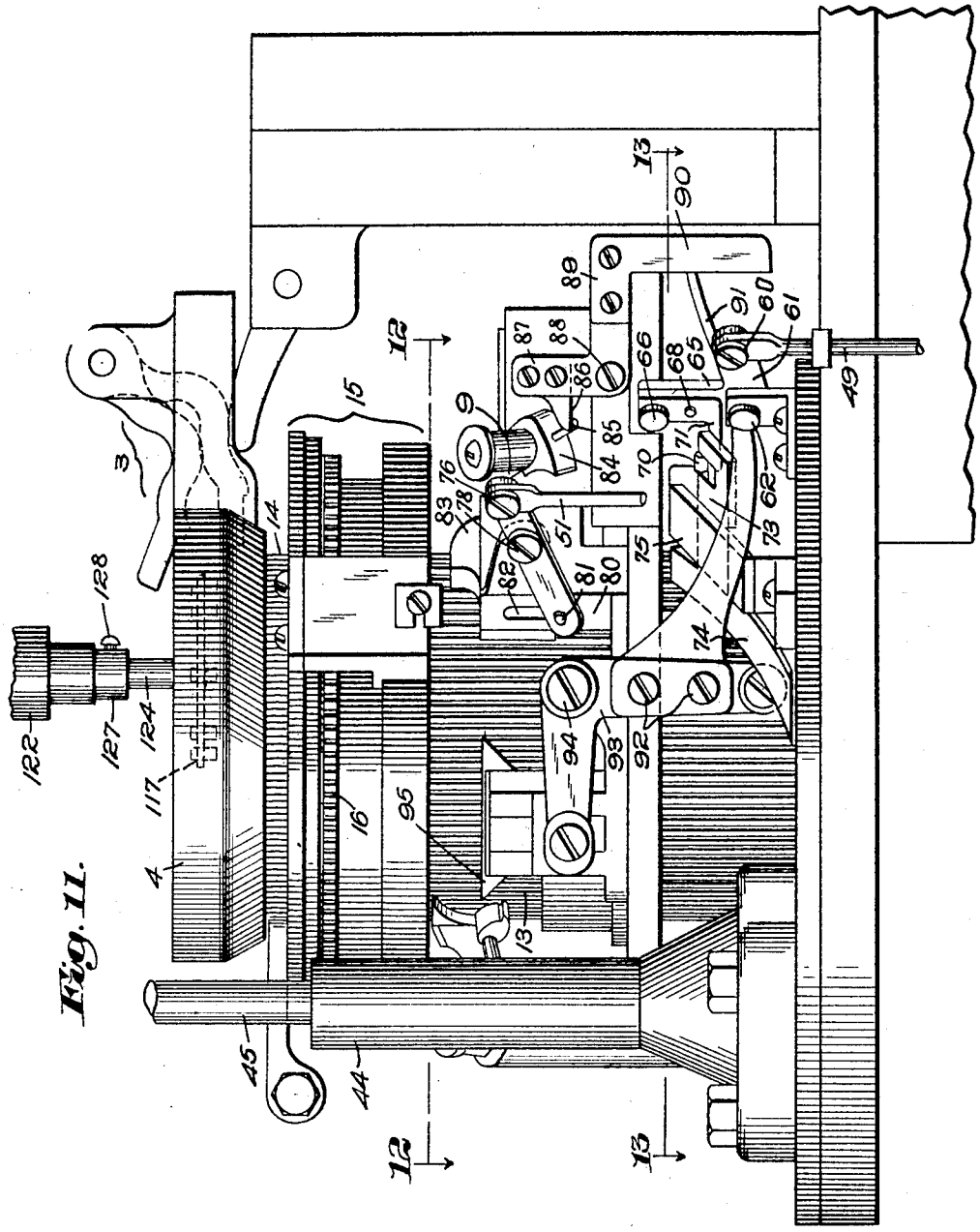


Fig. 11.

Inventors:
John Lawson.
Robert H. Lawson,
by Emery, Booth, Jarney and Varney.
Attys.

Feb. 19, 1929. 1,702,608

J. LAWSON ET AL
MECHANISM FOR PRODUCING KNITTED FABRICS
HAVING LAP STRIPES AND YARN VARIATION
Filed Nov. 16, 1927 20 Sheets-Sheet 8

Fig. 12

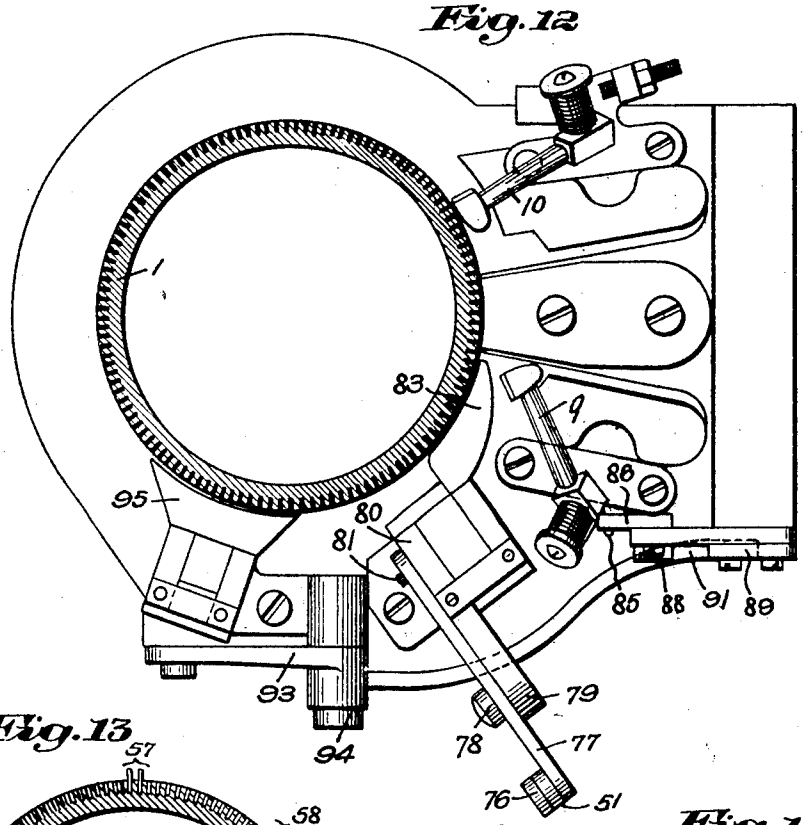


Fig. 13

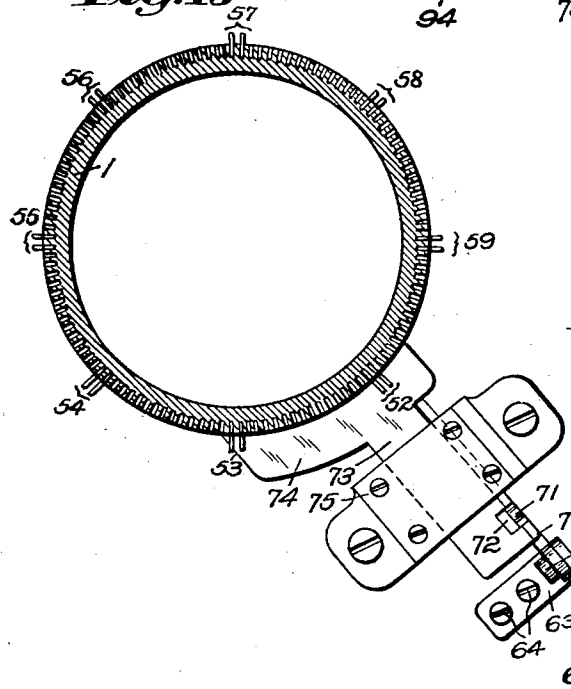


Fig. 14.

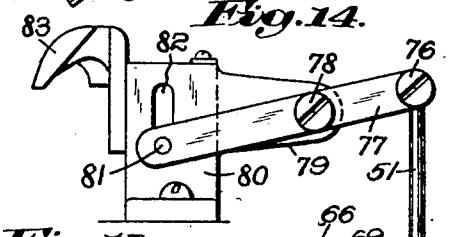
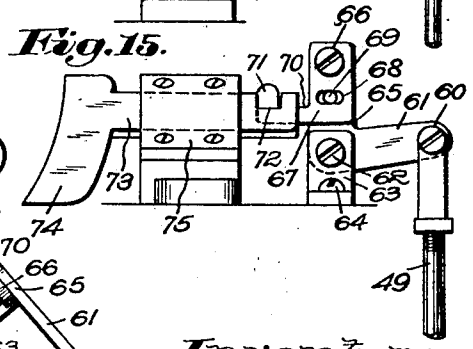


Fig. 15.



Inventors:
John Lawson,
Robert H. Lawson,
by Emery, Booth, Janney and Varney.
Attys.

Feb. 19, 1929. 1,702,608

J. LAWSON ET AL

MECHANISM FOR PRODUCING KNITTED FABRICS HAVING LAP STRIPES AND YARN VARIATION

Filed Nov. 16, 1927 20 Sheets-Sheet 9

Fig. 16.

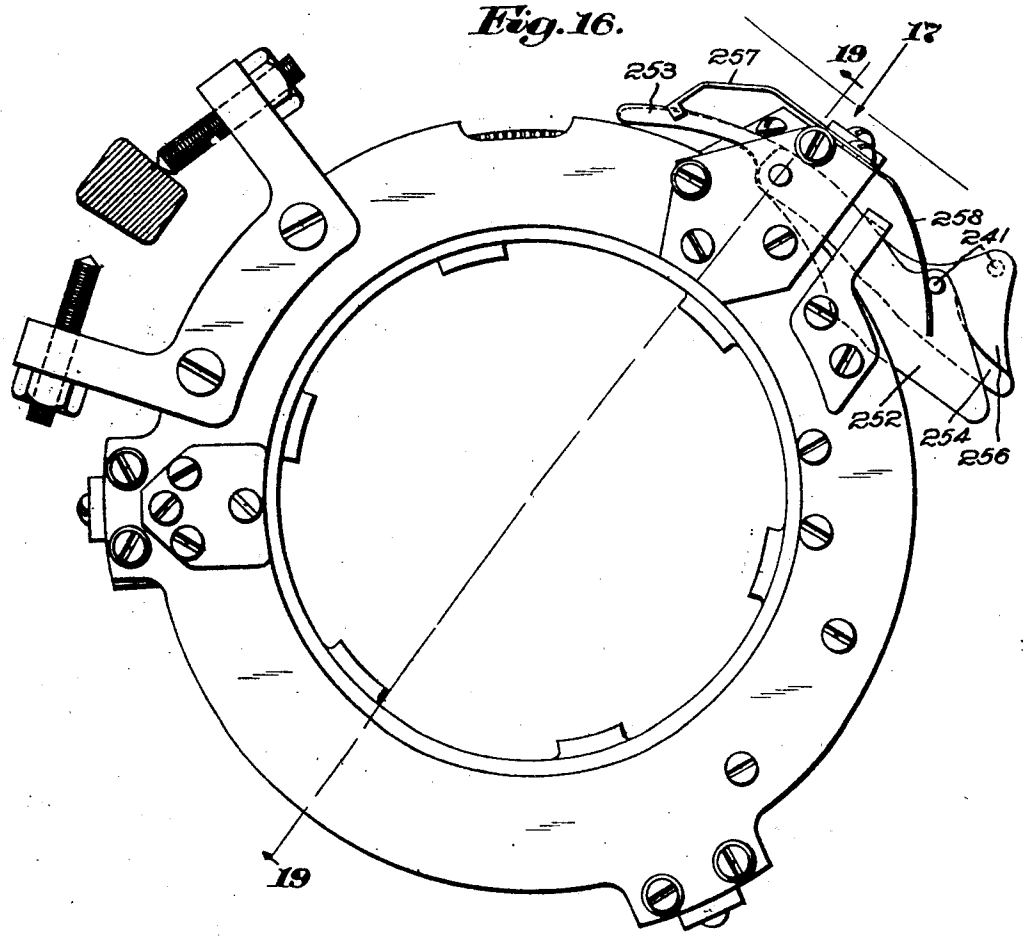
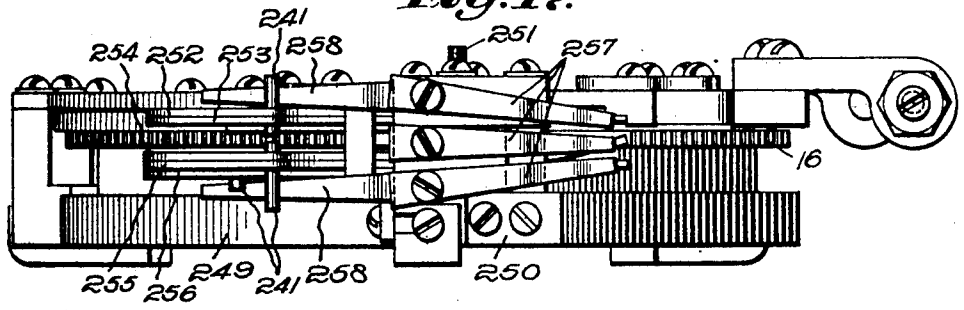


Fig. 17.



Inventors:
John Lawson.
Robert H. Lawson
by Emery, Booth, Janney and Varney,
Attys.

Feb. 19, 1929. 1,702,608

J. LAWSON ET AL

MECHANISM FOR PRODUCING KNITTED FABRICS HAVING LAP STRIPES AND YARN VARIATION

Filed Nov. 16, 1927 20 Sheets-Sheet 10

Fig. 18

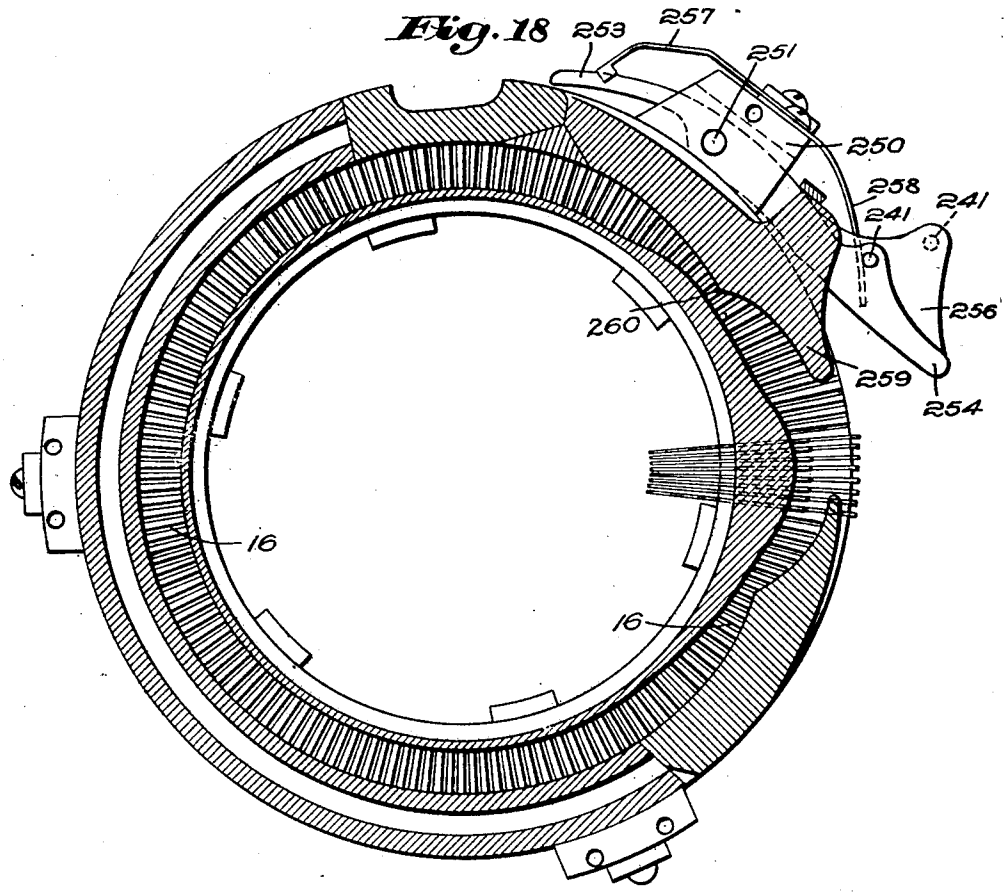
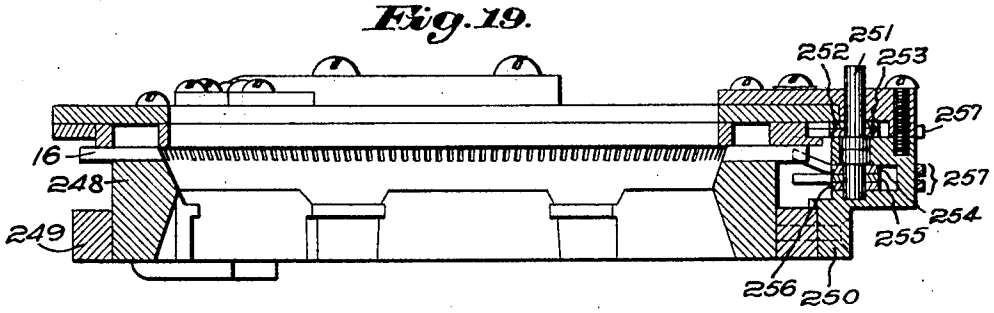


Fig. 19.

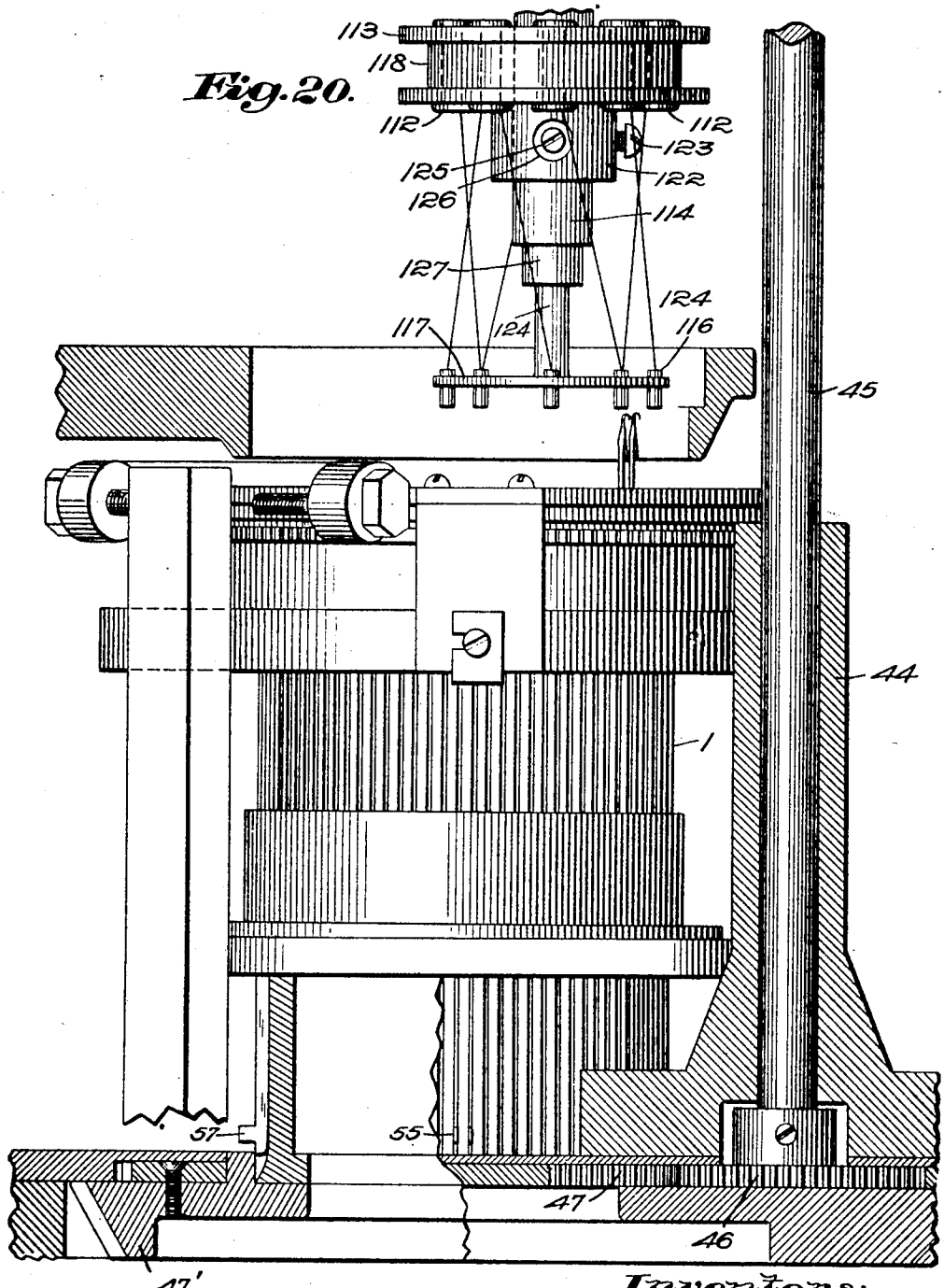


Inventors:
John Lawson,
Robert H. Lawson
by Emery, Booth, Jamney and Varney
Attys

Feb. 19, 1929. 1,702,608

J. LAWSON ET AL
MECHANISM FOR PRODUCING KNITTED FABRICS
HAVING LAP STRIPES AND YARN VARIATION
Filed Nov. 16, 1927 20 Sheets-Sheet 11

Fig. 20.



Inventors:
John Lawson,
Robert H. Lawson,
by Emery, Booth, Jamey and Varney
Attys.

Feb. 19, 1929. 1,702,608

J. LAWSON ET AL
MECHANISM FOR PRODUCING KNITTED FABRICS
HAVING LAP STRIPES AND YARN VARIATION
Filed Nov. 16, 1927 20 Sheets-Sheet 12

Fig. 21.

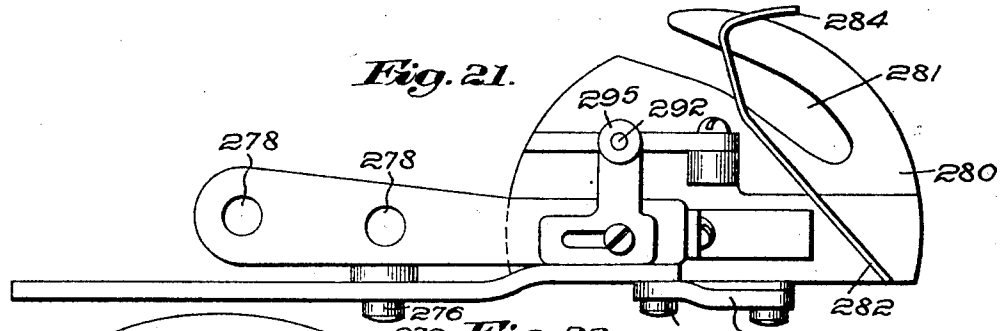


Fig. 22.

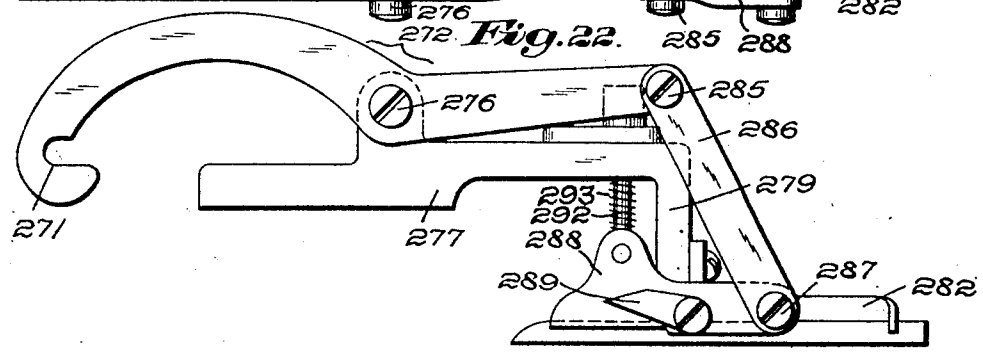


Fig. 23.

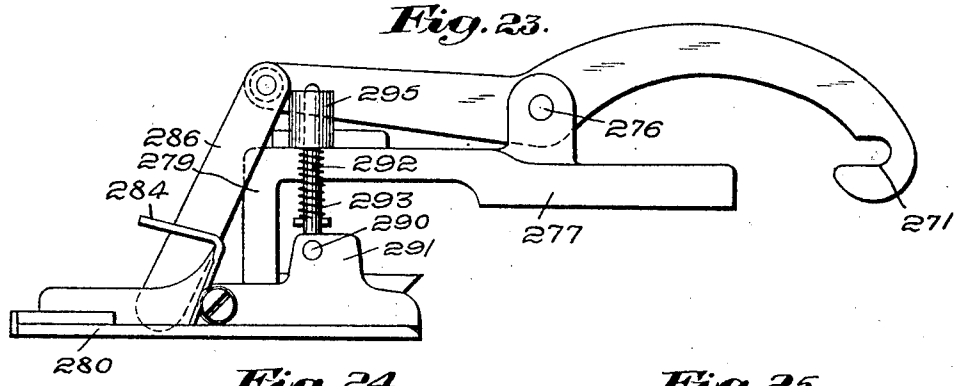


Fig. 24.

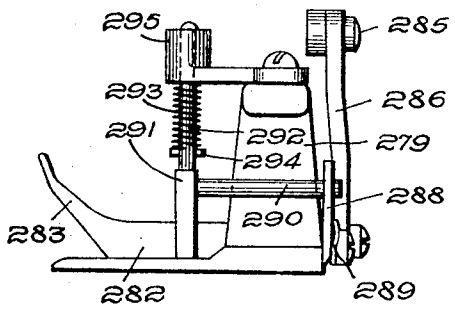
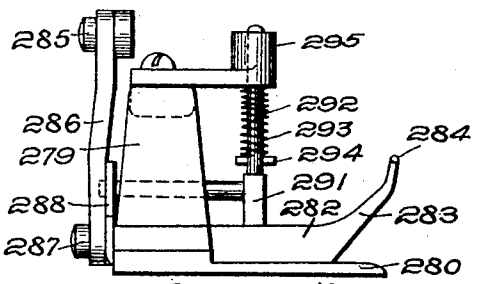


Fig. 25.



Inventors:
John Lawson.
Robert H. Lawson.
by Emery, Booth, Janney and Varney,
Attys.

Feb. 19, 1929. 1,702,608

J. LAWSON ET AL.

MECHANISM FOR PRODUCING KNITTED FABRICS HAVING LAP STRIPES AND YARN VARIATION

Filed Nov. 16, 1927 20 Sheets-Sheet 13

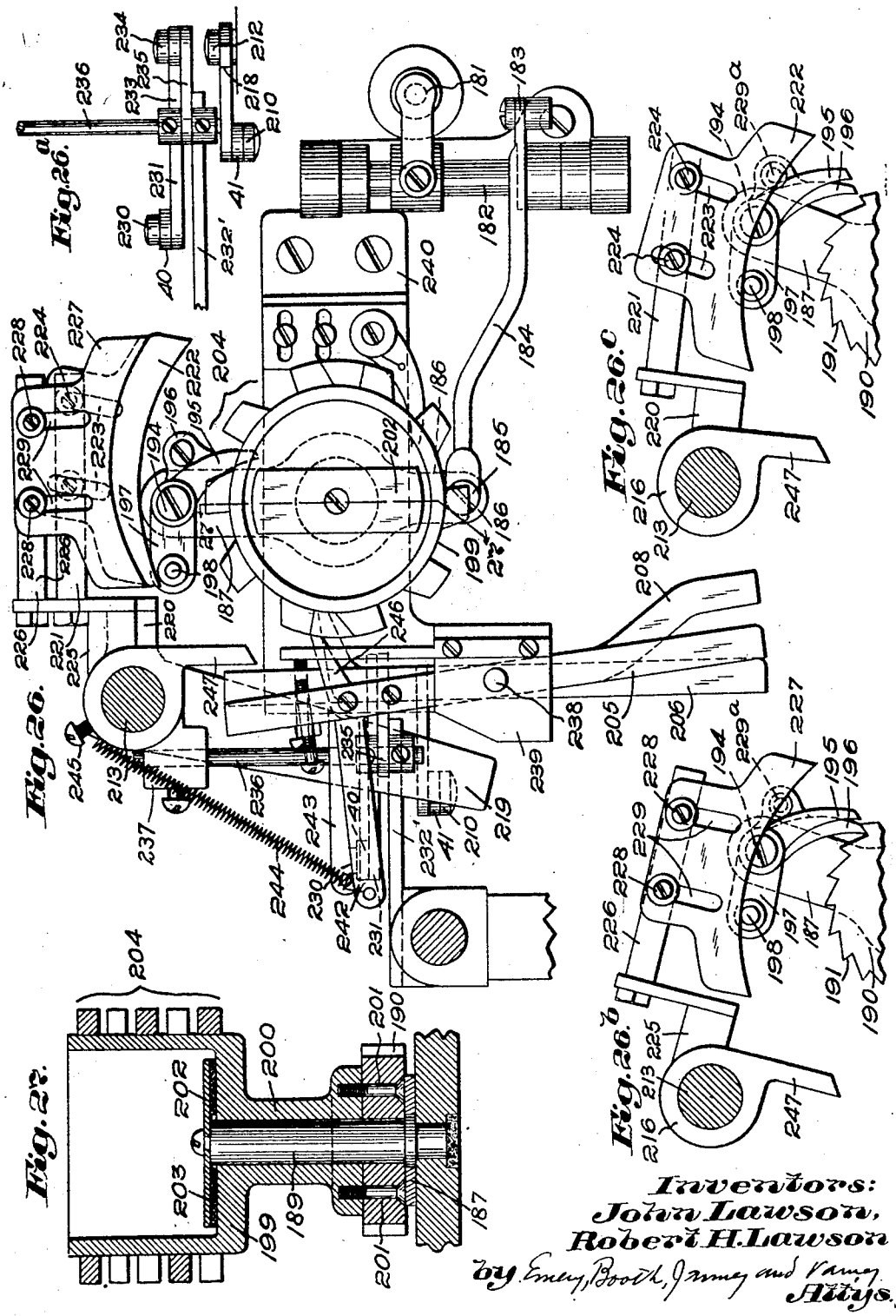


Fig. 26.

Fig. 26a.

Fig. 26b.

Fig. 26c.

Fig. 27.

Inventors:
John Lawson,
Robert H. Lawson
by Emery, Booth, Jenney and Vaney
Attys.

Feb. 19, 1929. 1,702,608

J. LAWSON ET AL

MECHANISM FOR PRODUCING KNITTED FABRICS HAVING LAP STRIPES AND YARN VARIATION

Filed Nov. 16, 1927 20 Sheets-Sheet 14

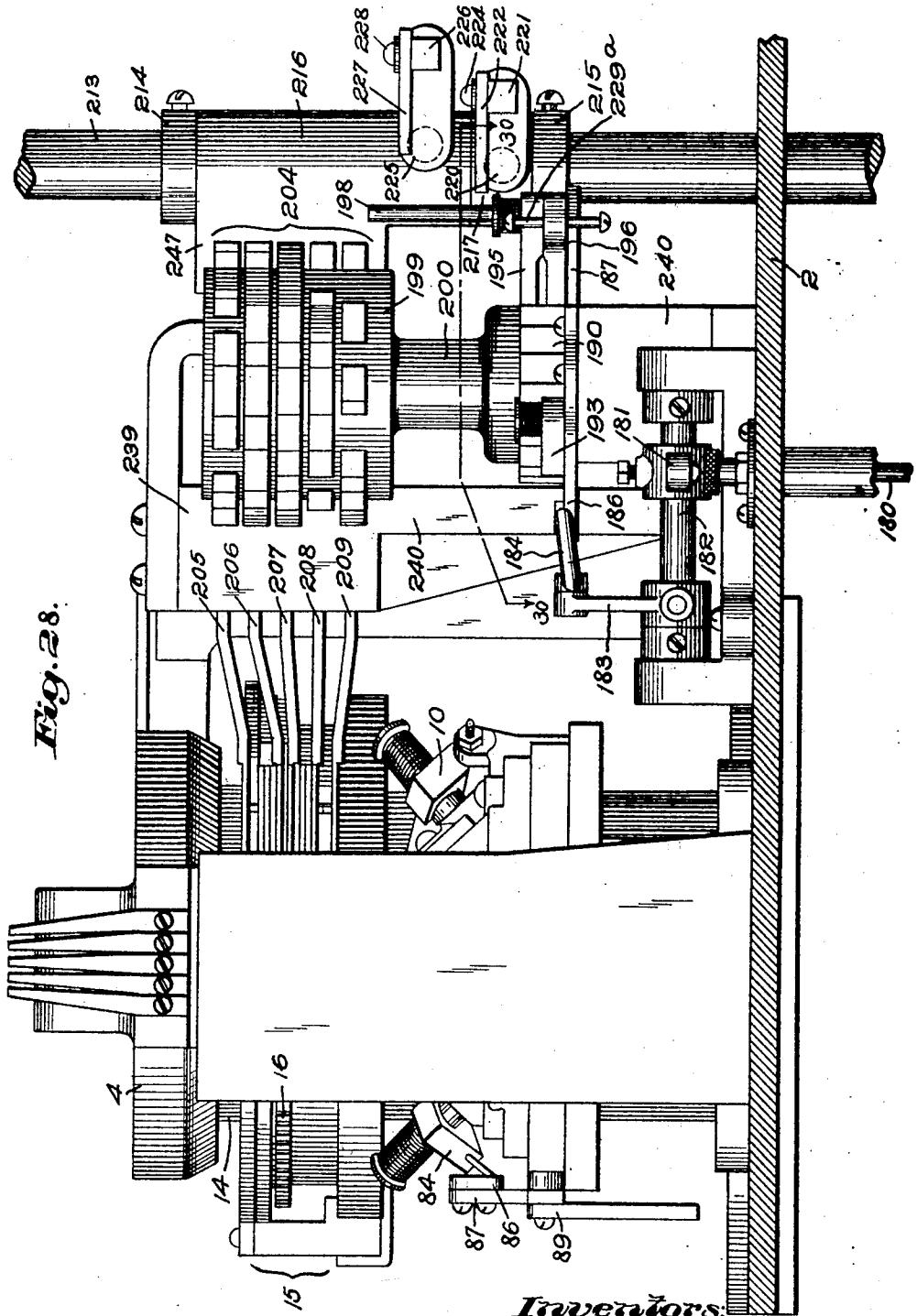


Fig. 28.

Inventors:
John Lawson,
Robert H. Lawson,
By Emery, Booth, Jamieson & Young Attys

Feb. 19, 1929. 1,702,608

J. LAWSON ET AL

MECHANISM FOR PRODUCING KNITTED FABRICS HAVING LAP STRIPES AND YARN VARIATION

Filed Nov. 16, 1927 20 Sheets-Sheet 15

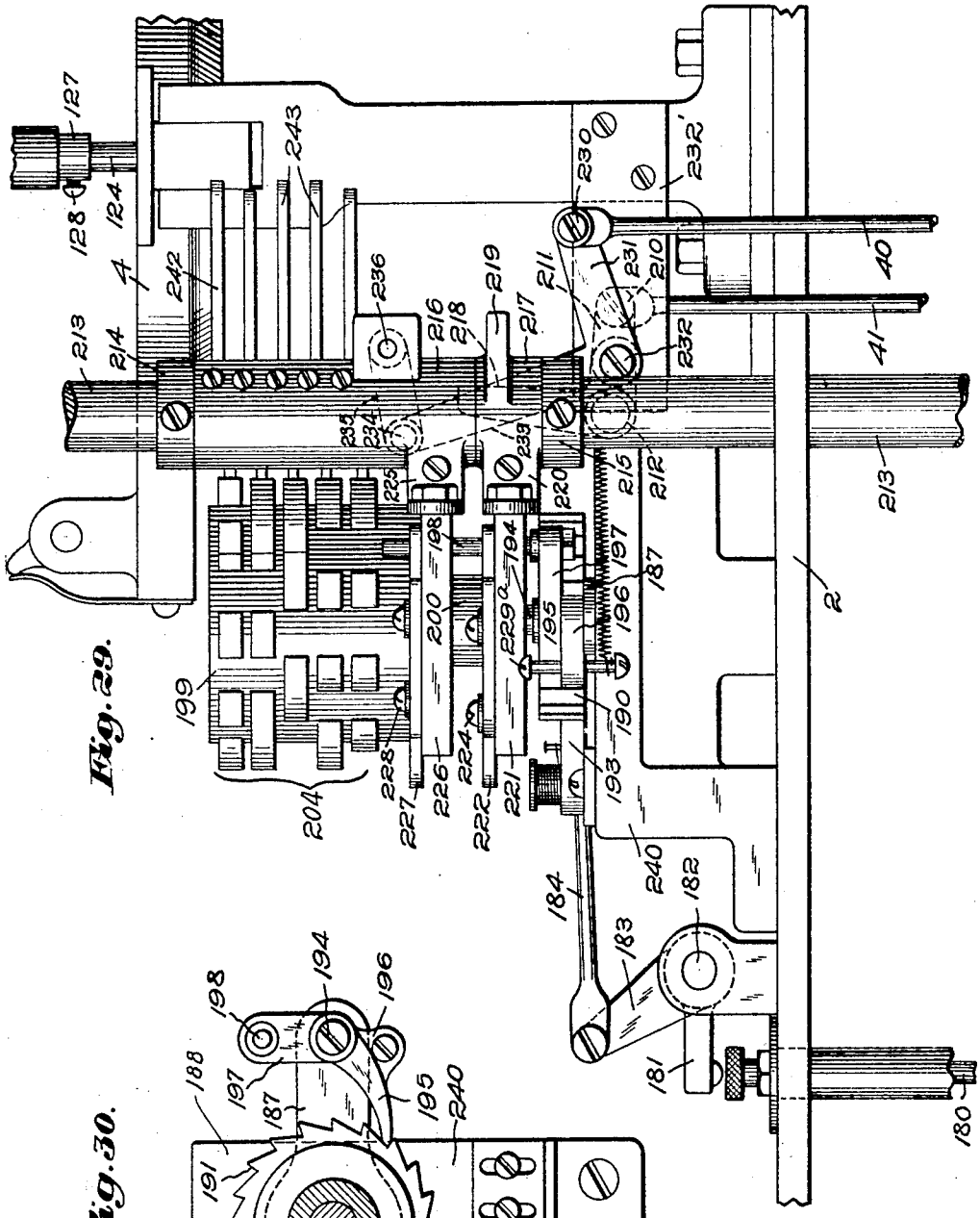


Fig. 29.

Fig. 30.

Inventors:
John Lawson,
Robert H. Lawson,
by Emery, Booth, Janney and Varney
Attys.

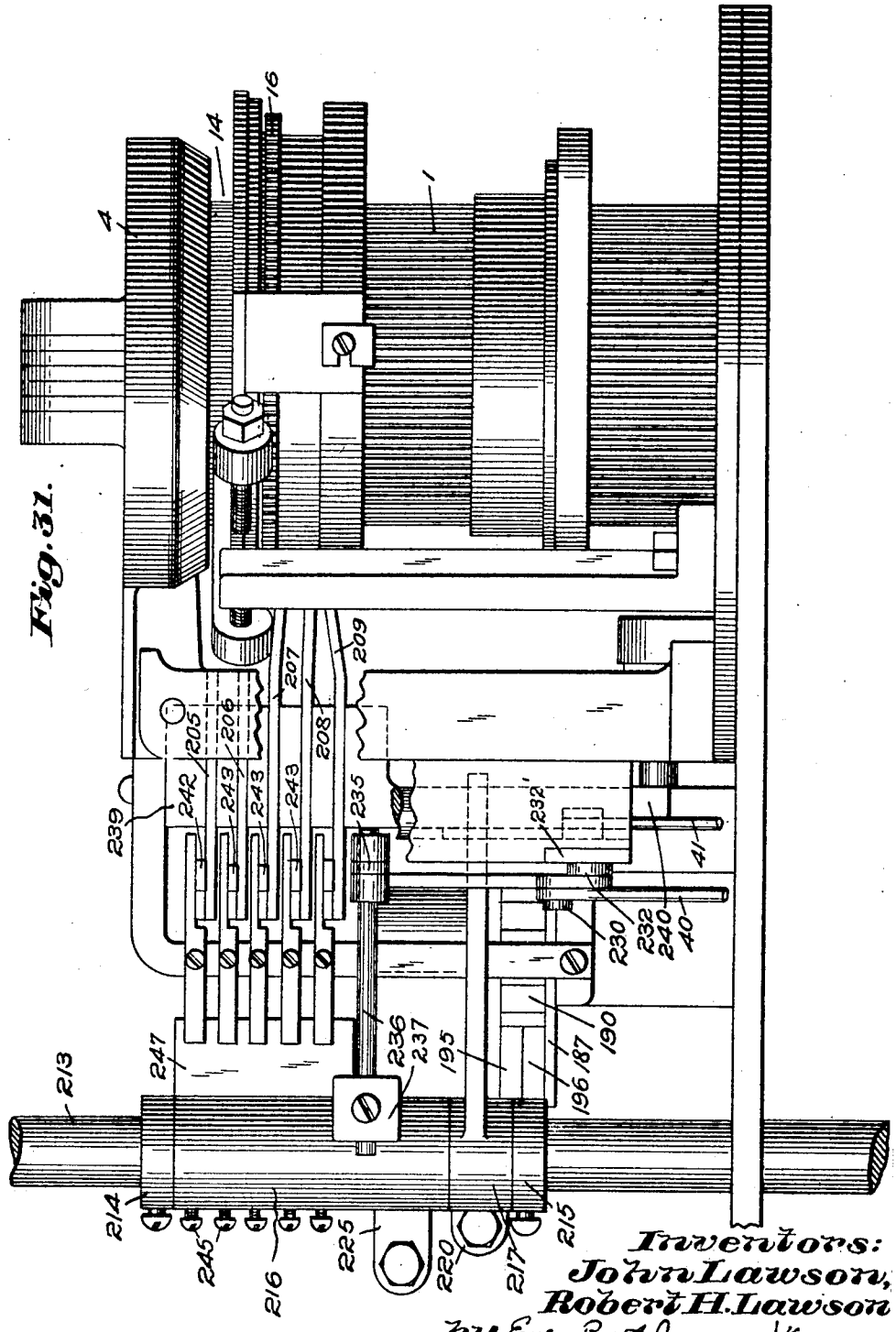
Feb. 19, 1929. 1,702,608

J. LAWSON ET AL

MECHANISM FOR PRODUCING KNITTED FABRICS HAVING LAP STRIPES AND YARN VARIATION

Filed Nov. 16, 1927 20 Sheets-Sheet 16

Fig. 31.



Inventors:
John Lawson,
Robert H. Lawson
by Emery, Booth, Janey and Varney,
Attys

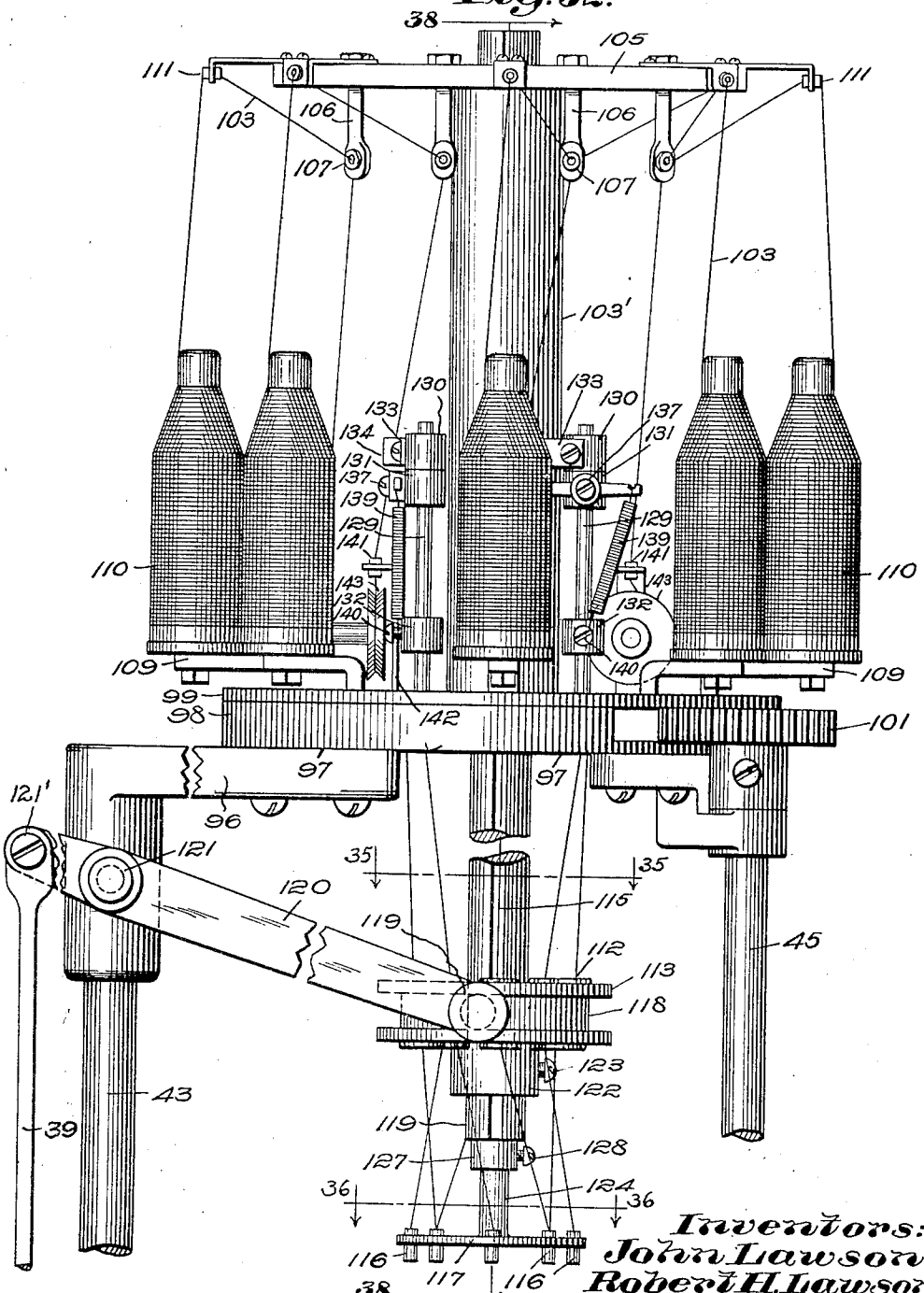
Feb. 19, 1929. 1,702,608

J. LAWSON ET AL

MECHANISM FOR PRODUCING KNITTED FABRICS HAVING LAP STRIPES AND YARN VARIATION

Filed Nov. 16, 1927 20 Sheets-Sheet 17

Fig. 32.



Inventors:
John Lawson.
Robert H. Lawson
by Emery, Booth, Janney and Varney,
Attys.

Feb. 19, 1929. 1,702,608

J. LAWSON ET AL

MECHANISM FOR PRODUCING KNITTED FABRICS HAVING LAP STRIPES AND YARN VARIATION

Filed Nov. 16, 1927 20 Sheets-Sheet 18

Fig. 33.

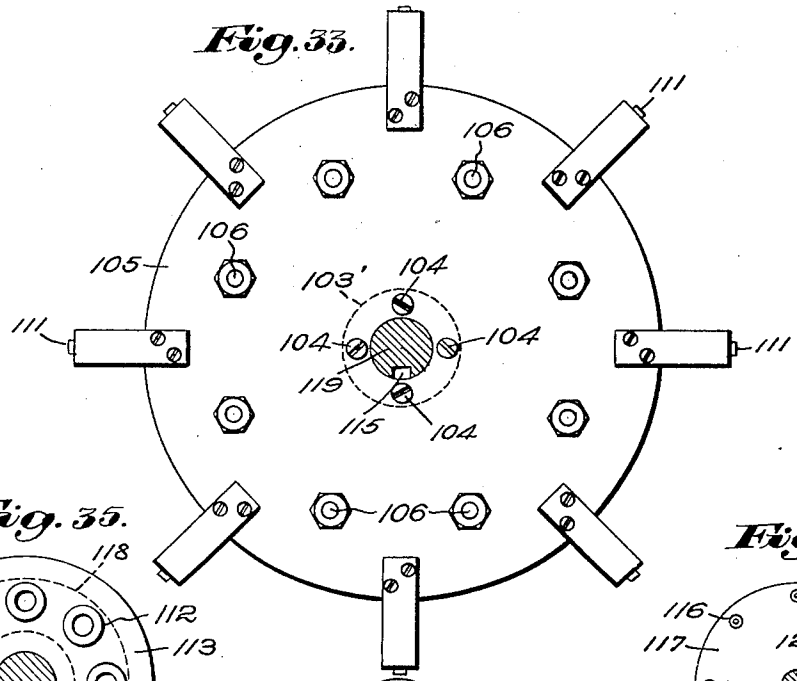


Fig. 35.

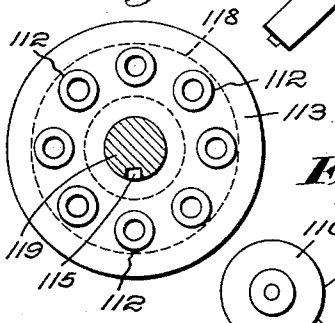


Fig. 36.

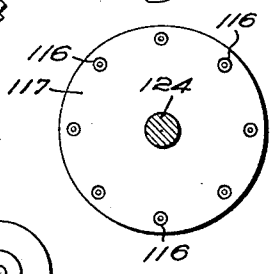


Fig. 34.

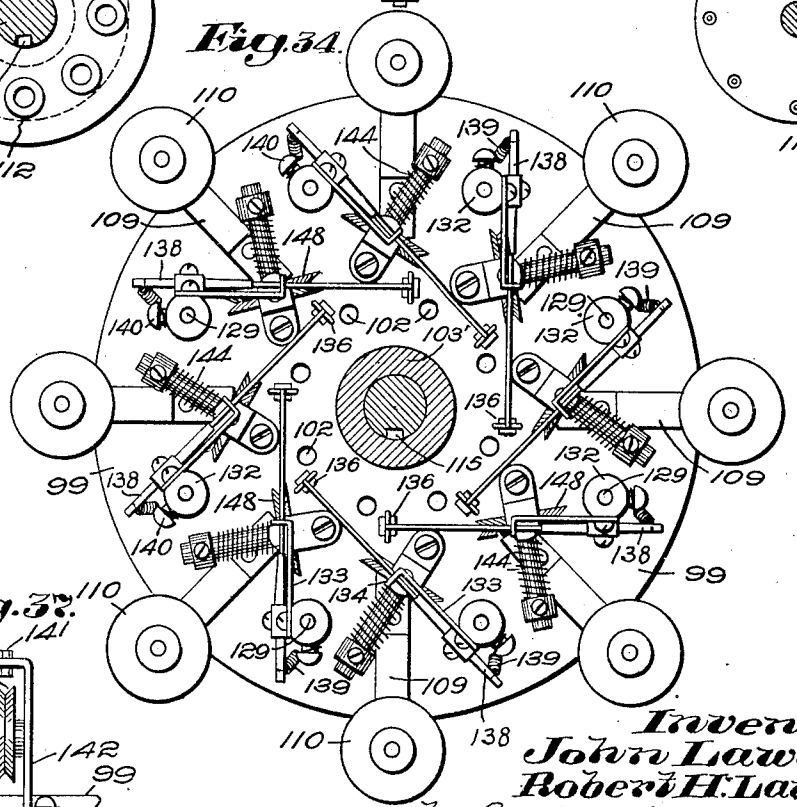
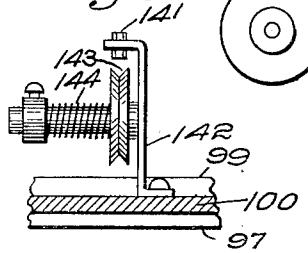


Fig. 37.



Inventors
John Lawson,
Robert H. Lawson,
by Emery, Booth, Janney and Varney,
Attys

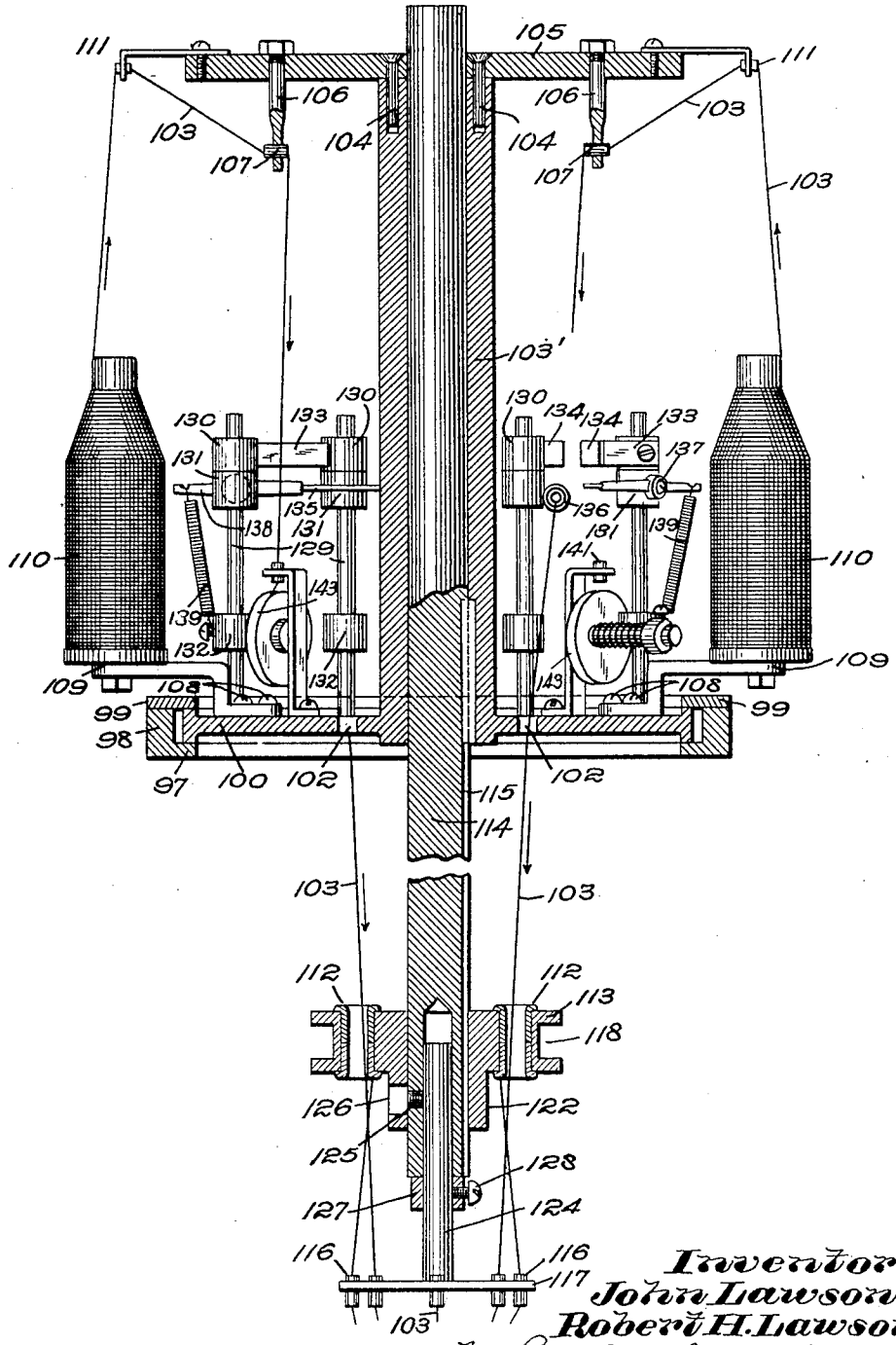
Feb. 19, 1929. 1,702,608

J. LAWSON ET AL

MECHANISM FOR PRODUCING KNITTED FABRICS HAVING LAP STRIPES AND YARN VARIATION

Filed Nov. 16, 1927 20 Sheets-Sheet 19

Fig. 38.



Inventors:
John Lawson,
Robert H. Lawson,
by Emery, Booth, Janney and Varney
Attys

Feb. 19, 1929. 1,702,608

J. LAWSON ET AL

MECHANISM FOR PRODUCING KNITTED FABRICS HAVING LAP STRIPES AND YARN VARIATION

Filed Nov. 16, 1927 20 Sheets-Sheet 20

Fig. 39.

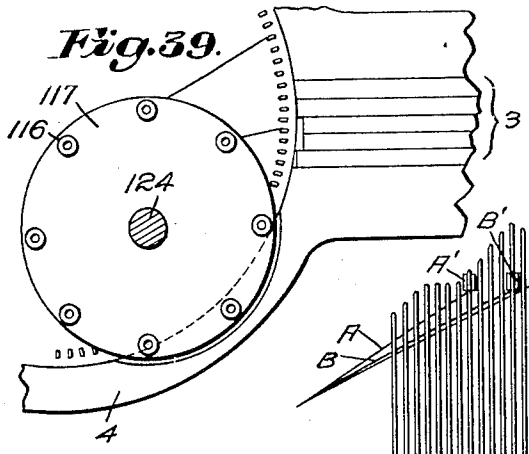


Fig. 40

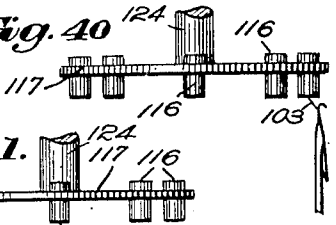


Fig. 41.

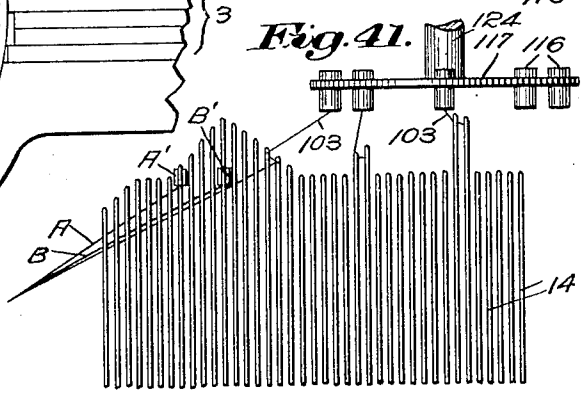


Fig. 43.

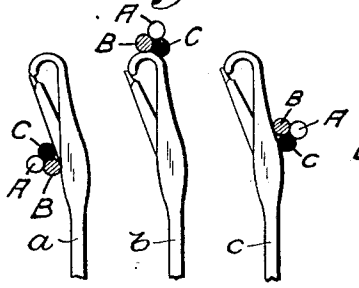


Fig. 44.

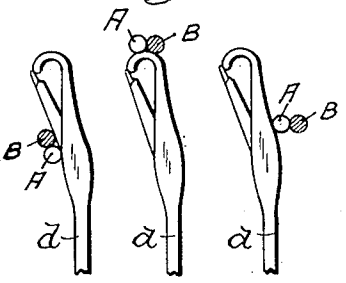


Fig. 45.

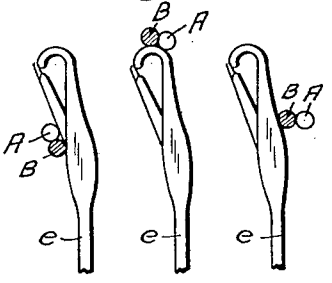
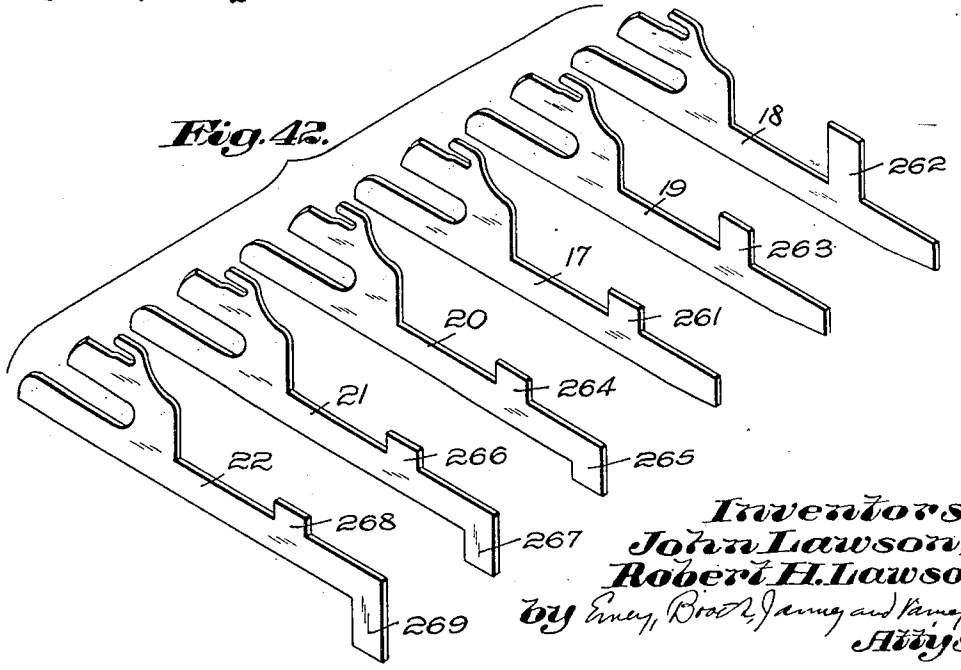


Fig. 42.



Inventors:
John Lawson,
Robert H. Lawson,
by Emery, Booth, Janney and Varney
Attys.

Patented Feb. 19, 1929. 1,702,608

UNITED STATES PATENT OFFICE.

JOHN LAWSON AND ROBERT H. LAWSON, OF PAWTUCKET, RHODE ISLAND, ASSIGNORS TO HEMPHILL COMPANY, OF PAWTUCKET, RHODE ISLAND, A CORPORATION OF MASSACHUSETTS.

MECHANISM FOR PRODUCING KNITTED FABRICS HAVING LAP STRIPES AND YARN VARIATION.

Application filed November 16, 1927. Serial No. 233,637.

This invention relates to mechanism for producing knitted fabrics, particularly hosiery, and more especially seamless hosiery having lengthwise stripes made by additional threads, and also having patterning effects produced through yarn manipulation or variation, and more particularly through the manipulation of a plurality of yarns to produce plating and reverse plating. We are, however, not limited thereto as the invention covers equivalents and other means than those herein disclosed. The invention also relates to the method of producing the fabric in question and to the resulting fabric claimed in our divisional application Ser. No. 244,072. filed January 3, 1928.

In order that the principle of the invention may be readily understood, we have disclosed a single embodiment of means constituting the invention of the mechanism by which the process of the invention may be practised and the fabric of the invention produced.

In the said drawings:

Fig. 1 is a side elevation of a seamless stocking having the lengthwise extending stripes which, for convenience of description, we shall herein refer to as reinforced or lap stripes, and also indicating the normal plating and reverse plating areas;

Fig. 2 is a plan view upon a greatly enlarged scale of the outside of a portion of the fabric shown in Fig. 1, and particularly representing the manner in which each additional thread is laid or incorporated in forming the reinforced or lap stripe;

Fig. 3 is a similar view looking at the fabric from the inner side;

Fig. 4 is a view generally similar to Fig. 1, and also representing the patterning effect produced by plating and reverse plating of the main threads;

Fig. 5 is a view, somewhat similar to Fig. 2, of the outside of the stocking shown in Fig. 4, and particularly disclosing how the two main threads are positioned in the plating and reverse plating;

Fig. 6 is a view similar to Fig. 5 but taken from the inside of the stocking or other fabric;

Fig. 7 is a front elevation of the entire machine, excepting the holder for the bobbins, the thread tensions, etc.;

Fig. 7ª is a plan view of the levers for operating the blocking device, by which the changes from normal plating to reverse plating are effected, and the cams for raising the jacks for the needles taking the additional threads, and the means for raising the bobbin holder for the additional threads out of action at predetermined times;

Fig. 8 is a left hand elevation of the mechanism shown in Fig. 7;

Fig. 9 is the right hand elevation of the mechanism shown in Fig. 7;

Fig. 9ª is a detail in vertical section of a plunger shown in Fig. 9;

Fig. 10 is a plan view of the mechanism shown in Fig. 7;

Fig. 11 is a front elevation upon an enlarged scale of the upper portion of the knitting mechanism shown in Fig. 7;

Fig. 12 is a plan view in horizontal section taken through the needle cylinder on the line 12—12 of Fig. 11;

Fig. 13 is a horizontal section through the needle cylinder upon the line 13—13 of Fig. 11;

Fig. 14 is a detail in side elevation of the cam shown in Fig. 12 for lowering the needles that take the additional threads;

Fig. 15 is a detail in side elevation of the cam for raising the jacks for the purpose of presenting the needles to the said additional threads;

Fig. 16 is a plan view of the sinker cam ring;

Fig. 17 is a side elevation of the structure shown in Fig. 16 looking in the direction of the arrow shown in Fig. 12;

Fig. 18 is a horizontal section taken through the sinker cam ring, the cap being removed;

Fig. 19 is a central vertical section taken through the sinker cam ring on the line 19—19 of Fig. 16;

Fig. 20 is a view, partly in side elevation and partly in vertical transverse section, of the needle cylinder, and means driven therefrom for controlling the movement of the bobbin carrier or support for the reinforced or lap stripes;

Fig. 21 is a plan view of the binder mechanism for the main yarns;

Fig. 22 is a side elevation thereof;

Fig. 23 is a side elevation from the direction opposite to that of Fig. 22;

Fig. 24 is an end view of the mechanism shown in Fig. 21;

Fig. 25 is a view taken from the opposite end of the same mechanism;

Fig. 26 is a plan view of that portion of the mechanism controlling the two main yarns in effecting plating and reverse plating;

Fig. 26[a] is a detail in plan of a part of the mechanism shown in Fig. 26;

Figs. 26[b] and 26[c] are details in plan showing the two pawls for turning the ratchet of the pattern drum or barrel and the means for controlling said pawls;

Fig. 27 is a vertical section of the controlling cam taken upon the line 27—27 of Fig. 26;

Fig. 28 is a right hand side elevation of the mechanism shown in Fig. 26;

Fig. 29 is a rear elevation of the mechanism shown in Fig. 26;

Fig. 30 is a horizontal section of the portion of said mechanism upon the line 30—30 of Fig. 28;

Fig. 31 is an elevation from the left hand side of the mechanism shown in Fig. 26;

Fig. 32 represents the bobbin carrier, stand or support and directly associated parts in side elevation;

Fig. 33 is a plan view of the upper part of the bobbin carrier, stand or support shown in Fig. 32;

Fig. 34 is a similar view of the lower part of said bobbin carrier, stand or support and representing the several bobbins, their thread tensioning means, etc.;

Fig. 35 is a transverse section of a portion of the means for lifting and lowering the bobbin carrier, stand or support, taken on the line 35—35 of Fig. 32;

Fig. 36 is a similar section upon the line 36—36 of Fig. 32;

Fig. 37 is a detail in side elevation of one of the tension devices for an additional thread for making a lap stripe;

Fig. 38 is a transverse vertical section taken through the bobbin carrier, stand or support and the directly associated parts; on line 38—38 of Fig. 32;

Fig. 39 is a plan view indicating the relation to the needle circle of the member whereby the additional threads are introduced to the needles;

Fig. 40 is a detail with a needle in side elevation showing how an additional thread is taken thereby;

Fig. 41 is a detail in side elevation representing a portion of the circle of needles and the taking of an additional thread and the two main yarns by the needles;

Fig. 42 is a perspective view showing one each of the several types of sinkers employed;

Fig. 43 is a diagram representing the relative positions of the two plating yarns and an additional thread in forming a lap stripe;

Fig. 44 is a diagram indicating the position of the two plating yarns in normal plating; and

Fig. 45 is a similar view representing the position of the two yarns in reverse plating.

In accordance with our invention, we provide means whereby one or more additional threads or yarns may be introduced to make longitudinal stripes spaced as desired, and which we herein refer to as reinforced or lap stripes. In the disclosed embodiment of the invention, we have represented the introduction of eight such additional threads, but it is to be understood that the number may be varied as desired within the scope of our invention and that the introduction of said threads, or any of them, may be interrupted at predetermined points, and particularly at the commencement of the heel and again at the commencement of the toe. The said additional threads are introduced through a special feeding device to which said threads are delivered from an elevated bobbin carrier, stand or support, here shown as eccentrically arranged with respect to the needle cylinder.

The regular threads or yarns, which merely for purposes of distinction we will refer to as the main yarns, are at least two in number, and they are fed in a plating relation, as, for example, in the manner shown in the patents to Robert H. Lawson, Reissue No. 16,584, April 5, 1927, and No. 1,605,896, November 2, 1926.

In accordance with our invention, the two main yarns are fed in any suitable manner in a normal plating relation, as hereinafter described in detail, and at desired times the plating is reversed so as to produce figures or patterns of any desired character between the lengthwise extending stripes produced by the said additional threads. So far as we are aware, we are the first, in a knitted fabric, to provide lengthwise extending stripes or areas consisting of an additional thread for each stripe and two yarns fed in a plating relation, onto which the said additional thread or threads are superimposed, and desire to claim the same broadly.

In the disclosed embodiment of the invention, the said two main yarns are fed in a normal plating relation, and the additional threads by which the stripes are made upon the main yarns are received by the predetermined needles, so that at each point where the stripes are formed, three threads are received by the needles and knitted or incorporated thereby into the fabric, namely, the two plating yarns or threads and the said additional thread. The said two main yarns at the said stripe are laid and knitted in a normal plat-

ing relation with the said additional thread also knitted into the needles and appearing on the outer face of the fabric as a stripe covering the plating yarns and superimposed thereon. Between the said stripes the two main yarns alone are introduced, and they are knitted either in a normal plating relation or in a reverse plating relation, according to the dictates of the pattern mechanism. Even though two of the lengthwise stripes may be very close together, as shown for example in Figs. 3 to 6, the wales between said stripes may consist partly of normal plating and partly of reverse plating, or either, and the patterns in those parts of the fabric where the stripes are more widely separated may be varied as desired. While the normal plating and reverse plating operations are carried out in a manner broadly similar to the disclosure in the said patents to Lawson, and while the reverse plating may be effected in any suitable manner, we have, in the disclosed embodiment of the invention, provided a pattern cylinder supported above the bed plate and equipped with five annular rows of cams respectively controlling five cams of the sinker cam ring. In the disclosed embodiment of the invention, to which, however, our invention is not limited, we provide only a single sinker in each of the radial grooves, and all of these sinkers are of a type adapted to the knitting of yarns in a plating relation. In the disclosed embodiment of the invention certain of the sinkers (to be hereinafter described) are adapted only for normal plating, and the remaining sinkers are contrasted among themselves, according to the butt length or otherwise, so as to provide five different groups for respective operation by the said five cams, all as will be described in detail.

We have referred to the feeding of the yarns in a plating relation and, according to the preferred embodiment of the invention, the plating and normal plating are effected as stated in the general manner disclosed in the said Lawson patents Reissue No. 16,584 and No. 1,627,290, but within the broad scope and purpose of the invention we may in any suitable manner so feed or control one of the yarns, so as to cause the other main yarn to show at the surface, and do this in cooperation with the additional threads by which the lengthwise, reinforced or lap stripes are produced. Preferably, however, the two main yarns appear in a normal plating or reverse plating relation, as disclosed in the said Lawson patents.

The invention may be practised in any suitable type of machine, but preferably we practise the same in a circular knitting machine of the independent needle type. While the invention is not restricted to the formation of hosiery, we preferably practice the same in the production of seamless hosiery, and have so herein disclosed the same without limiting our invention thereto.

While the invention may be embodied in various types of circular hosiery knitting machines, we have chosen to represent the same as applied to a machine of the well known Banner type disclosed in the patent to Joshua B. Hemphill, No. 933,443, dated September 7, 1909. In this type of machine, the needle cylinder rotates 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. We will describe the invention as applied to a machine of such type without limiting it thereto, excepting when expressly so stated in the claims.

Generally speaking, the knitting machine includes a needle cylinder 1 mounted on a suitable table or base 2 constituting a part of the frame of the knitting machine, and, as is customary in this type of machine, the said cylinder is arranged to be rotated to form the leg and the foot of the stocking, and to be reciprocated to form the heel and the toe thereof. The means for effecting the rotary and reciprocating movements are substantially the same as those shown and described in the said Hemphill patent, and, being well known, require no further description.

A plurality of yarn feeding elements is provided, as generally indicated at 3 in Fig. 10, so as to feed not only the two main yarns for plating, but so as to feed such other yarns as may be required, as, for example, the yarn for the garter top, the yarn for the heel and the toe, the high splicing yarn and the sole reinforcing yarn. The means for introducing the said yarns, excepting the two plating yarns, are preferably the same as those used upon the Banner machine and need not be here more fully described.

The machine herein disclosed is of the independent needle type, and the needles are desirably latch needles, as will be hereinafter more fully pointed out, but our invention is not limited to the use of latch needles. In the disclosed machine, however, we employ a latch ring 4 equipped with suitable binder mechanism which is particularly adapted to the purposes of our invention and may be more fully hereinafter described.

The entire mechanism is driven from the main drive shaft 5, shown in Fig. 9 and elsewhere, said shaft having thereon the usual pulleys and also having suitable gearing including the pinion 6 for driving the large gear 7 known as the "104" gear and which is mounted on a shaft 8. From said main drive shaft is also driven in usual manner the quadrant 8' whereby the machine is reciprocated during the knitting of the heel and toe. The machine is also provided with the usual narrowing pickers, shown at 9 and 10 in Fig. 12, and the widening pickers, indicated at 11

and 12 in Fig. 8. These pickers are desirably those of the Banner machine, and require no further description, but we will at a subsequent point disclose means for moving one of the narrowing pickers out of the way of the cam for lowering the needles that take the additional threads.

The needle cylinder 1 is provided with the usual needle grooves 13 wherein are mounted the latch needles 14. At the upper end of the cylinder is provided the web holder bed ring 15 having formed in its upper face, as usual, radial grooves 16 receiving web holders or sinkers which, in the disclosed embodiment of the invention, are of the form shown respectively at 17, 18, 19, 20, 21 and 22, Fig. 42. The said sinkers or web holders are capable of radial movement in the said grooves, and are reciprocated therein by certain cams to be more particularly described. Before describing in detail the sinkers or web holders themselves, we will disclose the manner in which the several sets of cams are operated to render the said sets of sinkers 18 to 22 inclusive effective in the production of normal or reverse plating, it being understood that the sinkers 17 always function in the production of normal plating.

The pattern cam shaft is indicated at 23 in Figs. 7, 8, 9, and elsewhere. It is located as usual in the Banner machine and, excepting as hereinafter stated, it is provided with the usual cams, ratchets, pattern chain, etc., which need not be particularly referred to. At 24 are indicated the series of levers that control the yarn fingers indicated at 3 in the usual manner. Upon the left hand end viewing Fig. 7ª of the pattern shaft 23, there are provided five cams indicated at 25, 26, 27, 28, 29, and upon them rest the ends of five levers respectively indicated at 30, 31, 32, 33, 34. All of said levers are pivoted upon a stud 35 secured upon the framing as indicated in Fig. 7ª, and three of the lever ends extend horizontally outward, as indicated in said figure at 36, 37, 38. To the outer end of the lever arm 36 is pivotally connected the upwardly extending rod 39 which, at its upper end, is connected as hereinafter more fully described to the means for lifting the bobbin support or carrier for the additional threads out of action and for lowering the same into action. Said bobbin carrier is automatically lifted out of action at predetermined times, as, for example, when transferring is to take place, and it is necessary to swing the latch ring upward to expose the circle of needles. To the outer end of the lever arm 37 is pivotally connected the upwardly extending rod 40 which, at its upper end, is connected, in a manner hereinafter more fully disclosed, to the means to throw out of action the five levers that control the change from normal plating to reverse plating and the reverse. To the outer end of the lever arm 38 is pivotally connected the upwardly extending rod 41, which at its upper end is connected to the means controlling the rotation of the pattern drum or barrel acting upon the said five levers that in themselves control the changes from normal to reverse plating, and the reverse.

Upon the rear of the framing of the machine there is provided, as most clearly shown in Fig. 8, a creel rod hereinafter referred to. At the front of the machine, as clearly shown in Fig. 8, there is provided a hub or bearing 44 in which is received for rotation the vertical shaft 45 which at its lower end has fast thereon a pinion 46, shown most clearly in Fig. 20, and which meshes with a gear 47, shown in Fig. 20 as fast upon the bevel gear 47′ secured to the needle cylinder. The construction is such that the upright shaft 45 is rotated in unison with the needle cylinder. Said shaft at its upper end carries a pinion, hereinafter referred to, meshing with a gear constituting the bobbin carrier or support upon which are positioned the series of bobbins for the additional threads introduced for the purpose of making the lengthwise extending stripes to which, for convenience of description, we will refer to as the lap stripes.

Upwardly extending from the lever 33 is a projection 48, to which is pivotally connected a rod 49 which, as shown most clearly in Figs. 7ª and 8, extends upwardly to the means for controlling the cam for raising the jacks of those needles which are to receive the additional threads for the lap stripes. Upwardly extending from the lever 34 is a projection 50 to which is pivotally connected the rod 51 that at its upper end is connected to the means for lowering those needles, which through their jacks were elevated to take the said additional threads for the lap stripes.

The said needles are lowered in order that they may, with all the other needles, take the two main yarns, namely, the two plating yarns, so that at the proper times those needles which receive the additional threads will cast off in the knitting operation said additional threads and also the two plating yarns, thus completing each lap stripe.

In Fig. 13, we have represented the connections for elevating the jacks of those needles that are to take the additional threads. Obviously any desired number of needles may be provided in each group that together take a single additional thread. We have, however, in Fig. 13, represented two jacks in a group, and have represented eight groups arranged about the needle cylinder at 52, 53, 54, 55, 56, 57, 58, 59. It will be understood that said groups of jacks 52 to 59 need not be arranged at regular distances apart as indicated. Their distribution depends entirely upon the pattern, and in some cases we prefer to have adjacent groups of such jacks very close to each other, as, for example, removed

only two or three wales from each other, and in such case would control the additional thread in suitable manner within the scope of our invention. This is done mainly for simplification of operation. In cases where adjacent groups of jacks are spaced at substantially great distances apart, the additional threads are localized at the needles which make that particular lap stripe, as will be more fully explained hereinafter.

As shown in Figs. 8, 13 and 15, the rod 49 at its upper end is pivotally connected at 60 to the arm 61 of a bell crank lever itself pivoted at 62 upon a bracket 63 secured by screw 64, or otherwise, to the framing. The other arm 65 of the bell crank lever extends upwardly, and pivotally secured flatwise against one face thereof by the screw 66 is a right angled lever 67. In the lower part of said lever 67 is a slot 68 receiving a pin 69 on the bell crank lever arm 65 to guide the lever 67 in its movement. Said lever 67 has a horizontally extending arm 70 provided with an ear 71 taking into a slot 72 upon the stem 73 of a sloping cam 74. Said stem 73 is adapted to slide in a bracket or housing 75 provided therefor upon the bed 2 of the machine. The said cam 74, as shown most clearly in Fig. 13, is adapted to take under, in turn, the groups of jacks 52, 53, etc., so as to elevate the corresponding needles in turn that they may take the additional threads for the lap stripes.

To the upper end of the rod 51, shown in Fig. 8, is pivotally connected at 76, as shown most clearly in Figs. 8 and 14, a lever 77 pivoted at 78 upon the arm 79 of the bracket 80. The opposite arm of said lever is connected by a pin 81 working in a vertical slot 82, to a cam 83 which acts immediately after each group of jacks has been elevated, so as, immediately their needles have taken the appropriate additional thread, to lower said needles, whereby, as stated, said needles are restored to the level of the other needles, and thus take both the main yarns, namely, the two plating yarns.

Because of the position of the cam 83 for lowering the needles that take the additional threads, it is necessary, while said cam 83 is in its inner active position, to provide means for swinging out of the way the narrowing picker 9, shown most clearly in Fig. 12. For this purpose we have provided the following mechanism.

As clearly shown in Fig. 11, the base 84 of said picker is provided with a pin 85 adapted to be engaged so as to swing the picker into the position shown in Fig. 12 by a lug 86 upon the arm 87 of a lever pivoted at 88 upon the block carrying both the narrowing pickers. Said lever 88 is of right angled or bell crank form, and its lower arm 89 is provided with a depending extension 90 adapted to be engaged by a tail piece 91 that is secured by screws 92 upon a lever 93 pivoted at 94 for raising the usual instep cam 95. Thus, when the lever 93 moves said instep cam upwardly, the tail piece 91 acts through the levers 87, 89 to move the narrowing picker 9 out of the way of the cam 83.

We will now describe in detail the means for supporting the additional threads and for supplying them to the needles, and then will refer in detail to Figs. 1 to 6 showing selected fabrics made in accordance with our invention.

The vertical rod 43, the lower end of which is represented in Fig. 8, and which, as already stated, is for supporting the bobbin carrier for the additional threads, is of suitable length, and at its upper end it is suitably secured to a bracket 96, clearly shown in Fig. 32, which has secured thereto a disk like member 97 with an upstanding annular flange 98. Upon said flange is received a ring 99 which overlies the outer edge of a horizontally positioned gear 100 that is in meshing relation with and is driven by a pinion 101 upon the upper end of the shaft 45 in Fig. 8. In this manner the gear 100 is rotated at the same surface or peripheral speed as the needle cylinders. The said gear 100 is provided with a series of openings 102, herein eight in number, through which extend the several additional threads generally indicated at 103.

The gear 100 has integrally formed therewith or attached thereto an upwardly extending hub or sleeve 103′ which, at its upper end, has secured thereto by a series of screws 104 a horizontally positioned circular disk or plate 105, which is provided with a suitable number of depending short rods 106. In the present instance said rods are eight in number, and each is provided with an eye 107, through which pass the several additional threads 103. Upon the upper face of the gear 100 are secured, by screws 108, a number of brackets 109, herein eight in number, upon which are supported for free rotation the several bobbins 110 for the additional threads. As here shown, we have provided a series of thread or guide eyes 111 extending outwardly from the perimeter of the disk or plate 105, and through which the additional threads from the bobbins 110 pass on their way to the guide eyes 107. From said guide eyes 107 the threads extend downwardly through suitable tension devices to be described and then through the openings 102 in the gear 100. They then extend through porcelain or other eyes 112 provided in a sleeve 113. The said sleeve 113 is fast upon a vertical shaft 114 provided with a spline 115 and extending upwardly through the gear 100 and the hub 103′ thereof. The threads 103 from the openings 112 pass through a series of small thread eyes 116 in a small disk 117 which, as shown in Fig. 11, is positioned inside the latch ring. Said disk 117 is eccentrically

positioned with respect to the circle of needles, as shown most clearly in Fig. 20 and also in Fig. 39, so that in the rotation of the circle of needles the several additional threads 103 are presented to the needles therefor which have been elevated by means already described, and which, after having received said additional threads, are at once lowered to the level of the circle of needles.

As already stated, it is desirable at times to lift the disk 117 sufficiently above the latch ring so as to permit the latter to be swung upward for transferring purposes, and for other reasons. In order to bring about this result automatically at the proper times, we have in this instance provided the sleeve 113 with an annular groove 118 that is engaged by pins 119 upon a lever 120 pivoted at 121 upon the bracket 96 that supports the bobbin carrier. To the outer end of said lever 120, there is pivotally secured at 121′ the upper end of the vertical rod 39, shown in Fig. 8 and already described.

The sleeve 113 has a hub 122 which by a screw 123 or otherwise is secured to the rod 114. Thus, when the rod 39 and lever 120 are moved at the proper time to lift the sleeve 113, the shaft 114 and the disk 117 are lifted with it sufficiently to permit transferring or for other purposes.

The disk 117 is not desirably integrally formed with the vertical rod 114, as it is desirable to provide for the easy removal of said disk 117 and also to provide for vertical adjustment of said disk 117 with respect to the rod 114. For this purpose, we have here represented the disk 117 as having an upwardly extending stem 124 received within a socket in the lower end of the rod 114, wherein it is secured by a set screw 125 accessible through an opening 126 in the hub 122 of the sleeve 113. A collar 127 is secured by a screw 128 to the said stem 124 at the lower end of said rod 114.

We provide suitable tensioning means for each of the said additional threads 103. Such means are most clearly shown in Figs. 32, 34, 37 and 38, and will now be described.

Referring particularly to Fig. 34, the gear 100 has secured upon its upper face a number of tension devices corresponding to the number of additional threads, which herein are eight in number. Upstanding from the gear 100 are eight rods 129, shown also in Fig. 32. Fast upon the upper end of each of said rods is an upper collar 130, an intermediately positioned collar 131, and a lower collar 132. Laterally extending from each upper collar 130 is a relatively strong stop piece 133 having a right angled end 134. Pivoted upon each collar 131 is a long tension rod or wire 135 which, as shown most clearly in Fig. 34, extends inwardly to a point in the vicinity of the appropriate guide opening 102. Said tension wire 135 is provided with a terminal guide eye 136. The said tension wire 135 is pivoted at 137 and is prolonged at 138 in the rear of the pivot, and has there connected to it a coil spring 139, the lower end of which is attached to the collar 132 or to the securing screw 140 thereof.

Each additional thread 103 passes direct from the guide eye 107 therefor down through a guide eye 141, shown most clearly in Fig. 37 as provided in the end of a small bracket 142. Said thread 103 then passes between two tension disks, shown respectively at 143, and held in tensioning relation by the spring 144. From between the tension disks 143 the thread 103 passes next through the eye 136 of the tension wire 135 and then down through hole 102 in the gear 100.

The disk 117 is so eccentrically positioned that in the rotation of the needle circle and the rotation of the disk 117 (the said parts both making one turn in the same period of time) the needles of the knitting series travel at a sufficiently faster rate (because arranged in a larger circle), so that each additional thread 103 is suitably taken by the proper needles that have been elevated to receive the same, as already stated.

In Figs. 1 to 6 inclusive, we have represented two fabrics illustrative of the many that may be formed in accordance with our invention, and which may be taken as representative of the many different ones embodying the invention, and which may be formed by the mechanism herein disclosed. In the disclosed fabrics, we have represented hosiery, here shown as socks. In each of them there are represented the so-called lap stripes to which we have referred, and also normal plating areas and reverse plating areas between said lap stripes, it being understood that each lap stripe is, in the disclosed embodiment of the invention, superimposed upon a normal plating area. The reverse plating areas are, in the disclosed embodiment of the fabric of our invention, between the lap stripes. In the event that two of the lap stripes are relatively close to each other, as we will disclose in connection with Figs. 4, 5 and 6, the few wales between the closely adjacent stripes are herein partly formed in normal plating and partly in reverse plating.

Referring more particularly to Figs. 1, 2 and 3, the hose is represented at 145. It is here shown as provided with a rib top 146 desirably incorporated with the rest of the stocking by a transferring process. The heel 147 and the toe 148 are both formed by a narrowing and widening operation. The dark lengthwise extending lines 149, 150, 151, 152, 153 are lap stripes formed as already stated. Between the lap stripes, the white areas (indicated generally at 154) are normal plating and the darker areas (indicated generally at 155) are reverse plating.

In Fig. 2, we have represented the outside of a portion of the fabric upon a greatly enlarged scale and have therein shown a portion of one of the lap stripes, as, for example, a portion of the lap stripe 151. The two main yarns, which are the yarns fed in a planting relation, are shown at 156, 157. An additional thread, which is introduced to form a lap stripe, is indicated at 103. The course of said lap thread, both at the inside and at the outside of the fabric, is indicated in the two views Figs. 2 and 3. The thread 103, in the illustrated case of Fig. 2 and Fig. 3, is knitted upon two needles only, and the thread passes from one needle to the next adjacent needle in each course and then back to the first needle for the next course, and so on, so long as the lap stripe is being formed. In Fig. 1 we have represented the lap stripes 149, 150 as interrupted at the heel 147 and all of the lap stripes as terminating at the toe 148. Our invention obviously is in no sense limited or restricted to terminating the lap stripe or stripes at any particular point or points, since we regard our invention as of broad character, as defined in the claims, irrespective of the extent of the lap stripe or stripes.

In Fig. 4, we have represented a hose 158 having a rib top 159, a heel 160, and a toe 161, said heel and toe being formed by narrowing and widening. In this instance, we have represented one lap stripe 162 which is a single needle in width, as most clearly shown in Fig. 5. Adjacent thereto is another lap stripe 163 seperated therefrom by two wales, indicated generally at 164 in Fig. 5. Between the said lap stripes 162, 163, there are small spot-like areas 165 of normal plating and 166 of reverse plating, in alternation. Said spots of normal plating and reverse plating are shown upon a larger scale in Fig. 5. We have also shown a lap stripe 167 one needle in width, and adjacent thereto another lap stripe 168 a needle in width, and therebetween we have shown spot-like normal plating areas 169 and spot-like reverse plating areas 170. Between the lap stripe 163 and the lap stripe 167, which are relatively widely spaced, there are areas of normal plating (indicated generally at 171) and darker areas 172 of reverse plating. It will, of course, be understood that the lap stripes 162, 163, 167 and 168 may, if desired, be more than a single wale in width. Where the lap stripes are relatively very close together, as, for example, in the embodiment of our invention shown in Fig. 5, a single additional thread 103 serves for both of the stripes, and the portion of said additional thread 103 between said two closely adjacent lap stripes is floated back and forth, as clearly indicated at 173 in Fig. 6, which is an inside view of the fabric.

It will, of course, be understood that the pattern effect of reverse plating may be widely varied within the scope of our invention. The particular means for introducing the two main yarns 156, 157 in a plating relation and for changing from a normal plating to a reverse plating relation will be hereinafter described.

We have described means for feeding two main yarns in a plating relation, and have herein disclosed means for changing from normal plating to reverse plating, and vice versa. Instead of changing from normal plating to reverse plating by reversing the position of the two main yarns, it is to be understood, as already indicated, that the two main yarns may be fed in a normal plating relation, and then at desired points we may otherwise control one of the yarns, so that the yarn which was previously at the inside of the fabric will now show at the outside of the fabric. This is not our preferred construction, but we have referred to this as within the scope of our invention, and refer to the two procedures by the general term "yarn variation" or "yarn manipulation", which therefore is to be taken to mean a plurality of yarns fed in a normal plating relation and then either so manipulated as to result in reverse plating or we otherwise control one of the yarns so as to effect any equivalent formation in the fabric.

It has been stated that the two main yarns are fed in a plating relation in the general manner disclosed in the patents to R. H. Lawson, Reissue No. 16,584, and No. 1,605,896. The said two yarns are fed in a normal plating relation, and the changes to reverse plating are controlled by pattern mechanism, which will now be described in detail. It has been stated that sinkers such as 17 to 22 are employed and that sinkers such as 17 always effect normal plating. The sinkers 18 to 22 are, as stated, differentiated as to their butts, and all of the sinkers of each of the groups 18 to 22 are controlled by a cam individual to that particular group, and these cams are themselves controlled by five different levers which are themselves moved in accordance with the dictation of a pattern barrel, the construction and control of which will first be described.

Referring first to Fig. 9, the "104" gear 7 is provided with two arc shaped plates 174, 175, which are provided with longitudinal slots 176 receiving screws 177 by which they may be secured in any position of circumferential adjustment. Upon the two plates are respectively secured the two cams 179, 179, which in the rotation of the "104" gear 7 act to lift a plunger 180 which when elevated strikes a lateral projection 181 upon a horizontal rock shaft 182, shown also in Fig. 28. Said rock shaft has rigidly extending therefrom an arm 183 which at its upper end is connected to a link 184, shown also in Fig. 29. Said link constitutes a push rod, and is

pivotally connected at 185 to an extension 186 of a lever arm 187, which, as shown also in Fig. 30, overlies a bracket 188 fastened to the bed plate 2 of the machine, and is pivoted co-axially with a stud 189 riding from the bracket. Surrounding said stud 189 is a ratchet 190 provided with a series of teeth 191, it being noted that there is a blank space 192 provided between two of the teeth for a purpose to be hereinafter stated. A holding pawl 193 is provided to engage the teeth of the ratchet 190, and upon the end of the lever 187 opposite the push rod 184 there are pivoted at 194 two pawls 195, 196. Extending from the upper pawl 195 is an arm 197 from which extends a vertical pin 198, the purpose of which is at the proper time to render both pawls inactive. In the pushing movement of the rod or link 184, the two pawls 195, 196 engage the teeth of the ratchet 190, so as to rotate the same in a step by step manner and with it the pattern drum or barrel 199, shown in Fig. 27 as cup shaped and having a sleeve 200 surrounding the stud 189 and secured at its base by pins 201 to the said ratchet 190. Upon the upper end of the stud 189 within the drum or barrel 199 is a friction member consisting of a thin disk 202 and washer 203 preventing overthrow of the drum or barrel 199. Upon said drum or barrel 199 are positioned in five annular rows the series of cams 204, shown in Figs. 9, 26, 29 and elsewhere. The said cams control five levers 205, 206, 207, 208, 209, which, in a manner to be hereinafter described, control the positions of the cams that themselves act directly upon the several series of sinkers 18, 19, 20, 21, 22.

It has been stated that the rod 41, shown in Fig. 8, controls the means for rotating the pattern drum or barrel 199. This mechanism will therefore be next described.

The upper end of the rod 41 is shown in Fig. 29. It is pivotally connected at its upper end 210 to arm 211 of a bell crank lever pivoted at 212 upon the creel rod 213 extending vertically from the base plate or table 2 as usual. Upon said creel rod there are fast two collars 214, 215, and between them are mounted for independent rocking movement upon the creel rod a long upper hub 216 and a short lower hub 217. The bell crank lever pivoted at 212 is provided with an upstanding arm 218 that, in the rocking movement of said bell crank lever, wipes against an arm 219 extending from the short hub 217 so as to rock said hub. Extending from said hub 217 at the opposite side is a boss 220 to which is rigidly secured a bar 221, shown also in Fig. 26. To the said bar 221 is secured a cam piece 222 provided with slots 223, by which it can be adjustably secured by screws 224 to the said bar 221. The upper hub 216 is provided with a boss 225 to which is rigidly secured a bar 226 overlying the bar 221 and shown also in Fig. 26. To said bar 226 is secured a cam piece 227 by means of screws 228 taking into slots 229 whereby adjustment of said cam piece 227 may be effected. As clearly shown in Fig. 29, the said cam pieces 227, 222 lie one over the other, but they move upon slightly different arcs.

They are both in the path of arcuate movement of the pin 198 upon the lever 187 that operates the ratchet 190. There is a pin 229^a upon the lower pawl. As shown most clearly in Figs. 26^b and 26^c, the said pin 229^a is adapted at times to be struck by the back of the upper pawl 195, so as thereby to move the lower pawl also out of engagement with the teeth of the ratchet. When the knitting has reached the top of the heel, as indicated in Fig. 26^b, the described movement of the upper pawl 195 serves, through engagement with the pin 229^a, to move the lower pawl also out of engagement with the ratchet. When, however, the toe is reached, the movement of the upper pawl 195 does not cause the lower pawl 196 to be thrown out of engagement with the teeth of the ratchet, and therefore the said lower pawl contacts with the teeth thereof during the knitting of the toe.

The rod 40, shown in Fig. 8, the upper end of which is shown in Fig. 29, not only controls at times the functioning of the five levers that through the respective cams control the series of sinkers 18, 19, 20, 21 and 22, but said rod 40 also functions at times to throw out of action the upper pawl 195 for the ratchet 190. For this purpose the said rod 40 is pivotally connected at its upper end at 230 to an arm 231 of a bell crank lever pivoted at 232 upon the bracket 232′. Said bell crank lever has an upwardly extending arm 233 which is pivotally connected at 234 by a link 235 to a laterally extending rod 236, shown also in Figs. 26 and 26^a.

The said rod 236 is secured to a boss 237 of the hub 216, and therefore the movement of the vertical rod 40 causes rocking movement of the hub 216 through the described connections, and therefore of the bar 226 and its cam 227 for the purpose of rendering inactive the upper pawl 195 (see Fig. 30). The five levers 205 to 209 inclusive are, as most clearly shown in Figs. 26, 27 and 31, co-axially pivoted upon a pin or stud 238 extending upward from that portion 239 of the bracket 240 supporting the pattern drum or barrel. The said levers 205 to 209 extend horizontally as indicated in the several views, and each of them is adapted at the proper time to contact with a pin upon a pivoted cam of the sinker cam ring controlling one of the sets of sinkers. One of said pins is indicated at 241 in Fig. 26. There are five of the said pivoted cams upon the sinker cam ring and they will be hereinafter described.

Each of said levers 205 to 209 is provided

with a right angled arm, certain of which are shown at 242, 243 in Fig. 26. To each of them is connected one of a series of springs, generally indicated at 244 in Fig. 26, and each of said springs is connected to a suitable screw 245 upon the hub 216. Said springs tend normally to move the said five levers into contact with the cams upon the pattern drum or barrel 199. Each of said levers 205 to 209 is also provided with a tail piece, certain of which are indicated at 246 in Fig. 26, and said tail pieces respectively ride upon the cams 204 or upon the surface of the pattern drum or barrel 199 between the cams pertaining to each individual lever 205 to 209.

The upper hub 216 heretofore referred to is provided with a lateral projection 247 that, in the rocking movement of said hub, engages all of the five levers 205 to 209 inclusive, so as to swing them all away from the drum or barrel 199 and the cams thereon, the said projection 247 being of sufficient vertical extent for this purpose, as shown clearly in Fig. 31. Such movement of the hub 216 occurs at the commencement of the heel and at the commencement of the toe, and may be caused to occur at other times if it be desired to render said levers 205 to 209 inoperative at other times.

It will be understood that the plating and reverse plating occur throughout the formation of the leg and the foot in the disclosed embodiment of the invention, and that the plating and reverse plating is suspended during the formation of the heel and the toe. During the formation of the heel and the toe, as already stated, the formation of the lap stripes is discontinued.

The cam drum or barrel 199 is turned a complete rotation for the production of each figure of the reverse plating pattern. It is necessary that said drum or barrel be turned to just the proper extent as the stocking is being finished, so that upon the commencement of the next stocking the cams of the drum or barrel 199 will be positioned for the proper commencement of the pattern. Therefore the lower pawl 196 shown in Fig. 30 is continued in action after the upper pawl 195 has been rendered wholly inactive and said lower pawl 196 continues to turn the pattern drum or barrel 199 until the blank space 192 is reached, whereupon the said lower pawl 196 continues to play back and forth in said blank space until the time comes to start the next stocking.

When the formation of the heel is commenced, both the pawls 195, 196 are thrown out of action, and all five levers 205 to 209 inclusive are also thrown out of action. When the toe is being formed, however, the bottom pawl 196 continues in action as stated. That is to say, during the formation of the toe the bar 221 is moved outward away from a position where its cam will act upon the pin 198, but the bar 226 is in and thus throws the top pawl 195 out in the manner described.

Having thus described the connections to the rods 39, 40 and 41 for operating certain of the parts, we will next refer to the construction of the sinker or web holder bed ring, the sinker cam ring, the series of cams which act upon the special or reverse plating sinkers and directly associated parts.

In Figs. 16, 17, 18 and 19, the web holder bed ring is indicated at 248. It may be and preferably is of the general character of that shown in the patent to R. H. Lawson, Reissue No. 16,584. Surrounding and tightly fitting the same is a spacer ring 249, and secured to the latter, by suitable screws or otherwise, is a bracket 250 upon which are mounted certain parts now to be described.

Vertically positioned in said bracket 250 is a pivot stud 251, upon which are co-axially pivoted the five cams that are operated upon by the five levers 205 to 209 heretofore referred to. Said cams are respectively indicated at 252, 253, 254, 255, 256. For each of said cams we provide a spring, and for convenience said springs are, in the disclosed embodiment of the invention, arranged in two sets, said sets being respectively indicated at 257 and 258 in Figs. 18 and 19. The second, third and fourth of the cams, counting from the top downward, are provided with the springs 257 engaging the tails or free ends thereof, so as normally to move outwardly away from functioning position the opposite ends of the said cams. The first and fifth of the said cams are acted upon by the two springs 258 that take behind the pins 241 of the said two cams as indicated in Fig. 18.

Said cams 252 to 256 are individually moved into functioning position through the instrumentality of the corresponding levers 205 to 209 as already described.

In Fig. 18 are shown the cams which act in normal plating. The cam 259, having a point 260, lies below the two uppermost special cams 252, 253, but above the three lowermost special cams 254, 255, 256, and is the cam which acts upon the sinkers 17 by which normal plating is at all times effected. The cams 252 to 256 inclusive act respectively upon the sets of sinkers 18, 19, 20, 21, 22. When, therefore, any one of said cams 252 to 256 is moved inwardly by its appropriate lever 205 to 209, according to the call of the pattern drum or barrel 199, the sinkers which are so shaped as to be acted upon by that particular cam are pressed inward to a greater extent than normally so as to result in reverse plating in a manner which will be referred to more in detail, but which is generally similar to that disclosed in the said Lawson patents.

It will be observed that the normal plating sinkers 17 have a short butt 261. The sinkers 18 each have a high butt 262, the sinkers 19 each have intermediate length butts 263, the

sinkers 20 each have a short butt 264 and also have at the under surface a short butt 265. The sinkers 21 each have a short upper butt 266 and an intermediate length butt 267, and the sinkers 22 each have a short upper butt 268 and a long lower butt 269.

Referring to the pattern represented in Figs. 4 and 5, and to any one of the diamond shaped patterns shown in Fig. 6, it is to be understood that the upper block of four loops or stitches of each and every one of said diamonds is made in reverse plating through the action of the sinkers 18, and we have here marked the same 18^a. The two blocks next underneath are produced through the action of the sinkers 19 and we have marked the same 19^a. The three blocks next underneath are produced through the action of the sinkers 20, and we have marked the same 20^a. The four blocks next underneath are produced through the action of the sinkers 21, and we have marked them 21^a. The three blocks next underneath are produced through the action of the sinkers 20 and we have marked them 20^a. The two blocks next underneath are produced through the action of the sinkers 19, and we have marked them 19^a, and the single block terminating the diamond is produced through the action of the sinkers 18, and we have marked the same 18^a.

In this manner the series of diamonds between the widely separated lap stripes 163 and 167 are produced, and in a similar manner those blocks of reverse plating that are between closely adjacent lap stripes are produced. Where, however, blocks or areas of reverse plating are made which are not in the same courses as blocks of reverse plating in the diamonds, the sinkers 22 are employed, and certain of such blocks we have marked 22^a in Fig. 4.

Obviously the diamond pattern is selected merely for illustration, as the reverse patterning may be widely varied within the scope of our invention.

The sinker cam ring, excepting as already described, may be generally that indicated in the patent to R. H. Lawson, Reissue No. 16,584, and need not further be described.

The binder mechanism is shown in Figs. 8 and 21 to 25 inclusive. In order to operate the same there is provided a vertical rod 270, shown in Fig. 8 as connected to the end 271 of the operating lever 272. The rod 270 is connected by a short horizontal lever to a lower vertical rod 273 which at its lower end is pivotally connected at 274 to a lever 275, the opposite end of which bears upon the pattern drum to be operated in usual manner.

The lever 272 is pivoted at 276 upon a bracket 277 that is provided with openings 278 for the reception of screws by which the said bracket is secured to the latch ring 4. The said bracket 277 has a depending arm 279, to the lower end of which is secured the plate 280 substantially semi-circular in form and positioned within the circle of needles in a manner that need not be more fully described. The said plate 280 is provided with a long, relatively narrow, generaly parallel sided, open ended slot 281, through which the entire series of additional threads from the bobbins 110 are led downward in a position to be taken by the needles that make the lap stripes. Secured to the upper face of the plate 280 is an edgewise positioned, elongated, thin plate or member 282 that is parallel edged throughout a considerable portion of its extent as indicated in Figs. 24 and 25, and then extends upwardly as indicated at 283 and terminates in a wire like part 284 that is bent around into a hook form, as most clearly indicated in Fig. 21. The upwardly inclined part 283 overlies the slot 281 and confines the additional threads to the said slot, so that in the rotation of the needle cylinder and of the disk 117 through which said additional threads are fed, said threads play around in said slot 281 and extend under the inclined edge or portion 283 to the needles that make the lap stripes.

This feature of our invention is not limited to use in the organization such as shown and which is merely selected for disclosure of one use of this feature of our invention, but is of broad use, as set forth in the claims more particularly directed thereto.

The lever 272 is pivotally connected at 285 to a link 286 that is pivoted at its lower end 287 to the knife 288. A spring 289 is employed to press against the side of the knife. To the upper part of the said knife is connected a transversely extending rod 290, the other end of which is connected to the binder 291, so that the knife and the binder are operated together. Pressing upon the upper edge of the binder 291 is a pin 292 surrounded by a light coil spring 293 confined between a pin 294 and a bracket piece 295. The pin 292 tends to hold the binder 291 down. The knife and binder act only upon the regular knitting yarns, that is to say, upon the two plating yarns and such other yarns as form time to time are introduced in knitting the hose or stocking. The additional threads 103 are not acted upon by the cutter or binder as, in the disclosed embodiment of the invention, they extend down freely through the slot 281 to the lap stripes.

In Fig. 39, there are represented the circle of needles and the disk or plate 117 from which the exact position of said plate with respect to the needle circle is made clear.

In Figs. 40 and 41, we have represented the taking of an additional thread by one or more needles which are satisfactorily elevated for the purpose, and it will be observed in Fig. 41 that the two main threads indicated at A and B therein are introduced through thread guides A′, B′, so located that the needles which take the additional threads are restored

to the level of the adjacent needles of the series, and that they take the two plating threads A and B. In Fig. 43, we have indicated three needles at *a*, *b*, *c*, these being three needles that are elevated to take an additional thread and, after being restored to the level of the adjacent needles, then take the two plating threads. The two plating threads in said view are indicated at A and B, and the additional thread for the lap stripe at C.

In Figs. 44 and 45, we have indicated two of the needles at *d* and *e*, and have indicated the two plating threads A and B with relation thereto at several different periods of the loop forming or loop completion operation.

It will be clearly evident from the foregoing description that it is very important to maintain plating control of the plating thread or threads not only at the areas where normal or reverse plating occur and there are no lap thread stripes or areas, but also at said lap thread stripes or areas. If plating control be surrendered or relaxed at the lap thread areas, it is our belief that satisfactory work cannot be secured at the wales next to or closely adjacent to the outgoing or incoming edges of the lap stripes, and particularly at the outgoing edges, and this is true whether it is desired to make reverse plating in the wale or wales next to said edges or whether it is desired to make normal plating at said points. Moreover, if plating control be surrendered or relaxed at the lap thread areas, the lap thread areas or stripes are liable to become mottled, because of the indiscriminate appearance of one of the plating threads upon the outer surface.

The expression "plating control" refers to plating relation of the main threads, whatever the plating relation may be at the point or points in question. In the disclosed embodiment of the invention the two main yarns are in a normal plating relation beneath the lap threads, but the scope of the invention is not confined to such plating relation.

Having thus described one illustrative embodiment of our invention, and the best mode known to us for practising the method of our invention and the fabric produced thereby, we desire it to be understood that although specific terms are employed, they are used in a generic and descriptive sense and not for purposes of limitation, the scope of the invention being set forth in the following claims.

Claims:

1. Mechanism for producing plated, lap striped, knitted fabric comprising means for feeding two yarns in a plating relation, means for varying the yarn incorporation into the fabric, whereby the backing yarn will appear at the outer surface, and means to interknit one or more lap threads with the said two yarns at normally plated portions of the fabric, and keeping said two plating yarns under plating control where the additional thread or threads is or are interknitted therewith.

2. Mechanism for producing plated, lap striped, knitted fabric comprising means for feeding two yarns in a normal plating relation, means for causing reverse plating to occur at portions of the fabric, and means for interknitting in superposed relation with said yarns at normally plated portions thereof a lap thread or threads to form lengthwise extending stripes, and keeping said two plating yarns under plating control where the additional thread or threads is or are interknitted therewith.

3. A circular knitting machine having means to feed two yarns in a plating relation to the entire circle of needles, and means to cause predetermined needles of the circle of needles to take lap threads and interknit the same as lap stripes while keeping said two yarns under plating control at said predetermined needles.

4. A circular knitting machine comprising in combination, a circular series of needles, means to present two main yarns thereto in a normal plating relation, and to cause said yarns to appear in the fabric in a normally plated relation, and means to present spaced groups only of said needles to lap threads while keeping said two main yarns under plating control at said spaced groups of needles, whereby said lap threads are interknitted in superposed relation with said normally plated yarns.

5. A circular knitting machine comprising in combination, a circular series of needles, means for interknitting two main yarns upon all of said needles in a plating relation, and means to present selected groups only of said needles to lap threads, and means for interknitting said lap threads with the plating yarns while maintaining plating control of said plating yarns at said selected groups of needles, and casting them off therewith.

6. A circular knitting machine comprising in combination, a circular series of independent needles, a circular series of independent sinkers, means to present two yarns in a plating relation to said needles and sinkers, means for elevating selected groups of said needles to take lap threads, and means whereby said lap threads are knitted in a superposed relation onto the surface of the fabric, while said two yarns are kept under plating control at said selected groups of needles.

7. A circular knitting machine comprising in combination, a circular series of independent needles, means to present two main yarns thereto in a normal plating relation, means acting prior to such yarn presentation to elevate selected needles of the series to take respectively lap threads, and then to restore said needles to their normal position in the series

of needles while keeping said two main yarns under plating control at said selected needles, and means for causing the two plating yarns and the lap thread or threads to be cast off together, thereby providing normal plated areas having lap stripes thereon.

8. A circular knitting machine comprising in combination, a circular series of independent needles, a circular series of independent sinkers, means to present two yarns in a plating relation to said needles and sinkers, means acting prior to said yarn presentation to elevate selected needles to take respectively lap threads, means to act upon predetermined sinkers to cause said two main yarns to appear in a reverse plating relation, and means to cast off the two main yarns and the lap thread or threads, whereby the plated fabric has lap stripes appearing upon the outer surface thereof.

9. A circular knitting machine comprising in combination, a circular series of independent needles, a circular series of independent sinkers, means to present two yarns in a plating relation to said needles and sinkers, means to cause selected groups only of said needles to take lap threads prior to the presentation thereto of the two main yarns and to keep plating control of said two yarns also at said selected groups of needles, and means to cause the simultaneous casting off of the two yarns and the lap thread from those needles receiving the same.

10. A circular knitting machine comprising in combination, a circular series of independent needles, a circular series of independent sinkers, means to present two yarns in a plating relation to said needles and sinkers, means to cause selected groups only of said needles to take lap threads prior to the presentation thereto of the two main yarns, means to cause certain of the sinkers in cooperation with their needles to effect reverse plating at predetermined needles, and means for causing the simultaneous casting off of the two yarns and the lap thread or threads on those needles receiving the same.

11. A circular knitting machine comprising in combination, a circular series of independent needles, a circular series of independent sinkers, means to present two yarns in a plating relation to said needles and sinkers, a cam to elevate the groups of needles to take respectively lap threads, a cam to depress said needles with said threads for taking the two yarns in a plating relation, and means to cast off both said yarns and said lap threads.

12. A circular knitting machine comprising in combination, a circular series of independent needles, a circular series of independent sinkers, means to present two yarns in a plating relation to said needles and sinkers, a cam to elevate the groups of needles to take respectively lap threads, a cam to depress said needles with said threads for taking the two yarns in a plating relation, means to manipulate selected sinkers whereby the two yarns appear in the fabric in a reversely plated relation, and means to cast off both said yarns and said lap threads.

13. A circular knitting machine comprising in combination, a circular series of needles, means for interknitting two main yarns upon all of said needles in a plating relation, a plate supported within the circle of needles, and having yarn cutter and binder mechanism for said main yarn or yarns, means for presenting one or more lap threads to the needles to produce lap stripes, and provisions whereby the lap threads are delivered through said plate, without interfering with the cutter and binder mechanism.

14. A circular knitting machine comprising in combination, a circular series of needles, means for interknitting two main yarns upon all of said needles in a plating relation, a plate supported within the circle of needles, and having yarn cutter and binder mechanism for said main yarn or yarns, said plate having an opening therethrough for lap threads, a guard for said threads, and means for introducing a series of said lap threads to the needles for the formation of lap stripes.

15. A circular knitting machine comprising in combination, a circular series of independent needles, a corresponding series of plating sinkers arranged in a plurality of groups, the sinkers of the several groups having distinguishing configurations, a series of cams for acting upon said sinkers according to their configurations, a series of levers for acting respectively on said cams, a pattern drum or barrel above the bed plate of the machine for acting upon said levers, means to feed two yarns in a plating relation, means to interknit one or more lap threads with the said two yarns at normally plated portions of the fabric while keeping said two plating yarns under plating control where the said lap thread or threads is or are interknitted therewith.

16. A circular knitting machine comprising in combination, a circular series of independent needles, a corresponding series of plating sinkers arranged in a plurality of groups, the sinkers of the several groups having distinguishing configurations, a series of cams for acting upon said sinkers according to their configurations, a series of levers for acting respectively on said cams, a pattern drum or barrel for acting upon said levers, means for turning said pattern drum or barrel, means acting periodically to place all of said levers in a non-functioning position with respect to said drum or barrel, means to feed two yarns in a plating relation, means to interknit one or more lap threads with the said two yarns at normally plated

portions of the fabric while keeping said two plating yarns under plating control where the said lap thread or threads is or are interknitted therewith.

17. A circular knitting machine comprising in combination, a circular series of independent needles, a corresponding series of plating sinkers arranged in a plurality of groups, the sinkers of the several groups having distinguishing configurations, a series of cams for acting upon said sinkers according to their configurations, a series of levers for acting respectively on said cams, a pattern drum or barrel, means to rotate the same in a step by step manner, means to suspend the rotation of said drum or barrel, means to feed two yarns in a plating relation, means to interknit one or more lap threads with the said two yarns at normally plated portions of the fabric while keeping said two plating yarns under plating control where the said lap thread or threads is or are interknitted therewith.

18. A knitting machine comprising a circular series of independent needles, a corresponding series of plating sinkers movable transversely of the needle series, means to feed two threads in a plating relation, means to act upon said sinkers so as to cause said plating threads to appear in the fabric either in a normal plating relation or in a reverse plating relation, a carrier for a series of lap threads, means to rotate said carrier with the needle series but upon an axis eccentric to the axis of the needle cylinder, means to present predetermined needles to take respectively said lap threads, and to retain them within their hooked portions until the plating threads are also received thereby, and means to cast off the two yarns and the lap threads simultaneously.

19. A knitting machine comprising a circular series of independent needles, a corresponding series of plating sinkers movable transversely of the needle series, means to feed two threads in a plating relation, means to act upon said sinkers so as to cause said plating threads to appear in the fabric either in a normal plating relation or in a reverse plating relation, a carrier for a series of lap threads, means to rotate said carrier with the needle series but upon an axis eccentric to the axis of the needle cylinder, a cam to project groups of selected needles to take the lap threads, a cam to restore said needles with said threads to the level of the adjacent needles of the series, and means whereby those needles taking the lap threads also take the two yarns in a plating relation.

20. A knitting machine comprising a circular series of independent needles, a corresponding series of plating sinkers movable transversely of the needle series, means to feed two threads in a plating relation, means to act upon said sinkers so as to cause said plating threads to appear in the fabric either in a normal plating relation or in a reverse plating relation, a carrier for a series of lap threads, means to present predetermined needles to take respectively said lap threads, and to retain them within their hooked portions until the plating threads are also received thereby, and means to cast off the two yarns and the lap threads simultaneously.

21. A circular knitting machine comprising in combination, a circular series of needles, a plate supported within the circle of needles and having yarn cutter and binder mechanism for a main yarn or yarns, means for introducing one or more such main knitting yarns, means for presenting one or more lap threads to selected needles to produce lap stripes, and provisions whereby said lap threads are delivered through said plate without interfering with the cutter and binder mechanism.

22. A circular knitting machine comprising in combination, a circular series of needles, means for introducing one or more main knitting yarns, a plate supported within the circle of needles and having yarn cutter and binder mechanism for said main yarn or yarns, said plate having an opening therethrough for lap threads to be fed to selected needles, a guard for said lap threads, and means for introducing a series of such lap threads to the needles for the formation of lap stripes.

23. A circular knitting machine comprising in combination, a circular series of needles, means to feed a main thread or threads thereto, means to feed a series of lap threads to selected needles, a binder for the main thread or threads, and means to control the path or paths of the lap threads, thereby to keep the lap threads out of the binder.

24. A circular knitting machine comprising in combination, a circular series of needles, means to feed a main thread or threads thereto, means to feed a series of lap threads to selected needles, a binder for the main thread or threads, means to open and close said binder, and means to control the path or paths of the lap threads, thereby to keep the lap threads out of the binder.

25. A circular knitting machine comprising in combination, a circular series of needles, means to feed a main thread or threads thereto, means to feed a series of lap threads to selected needles, a binder and a cutter, and means to control the path or paths of the lap threads, thereby to keep the lap threads out of the binder and the cutter.

26. A circular knitting machine comprising in combination, a circular series of needles, means to feed a main thread or threads thereto, means to feed a series of lap threads to selected needles, a cutter for the

main thread or threads, and means to control the path or paths of the lap threads, thereby to keep the lap threads out of the cutter.

27. A circular knitting machine comprising in combination, a series of needles, means to introduce a main yarn or yarns thereto, a member having means to present a series of lap threads to separated, selected sets of needles, said member being mounted upon a fixed axis parallel and eccentric to the axis of the needle circle, and means to move said member along said axis into and out of lap thread feeding relation to the said needles.

28. A circular knitting machine having a circular series of independent needles, means to feed any one of a plurality of main threads to the needles and including thread fingers movable into and out of action, means to feed a plurality of lap threads to selected groups of needles, a binder and cutter for the main threads, and means whereby the movement of a retiring thread finger moves the retiring thread into the binder, and provisions for preventing the lap threads from getting into the binder.

29. A circular knitting machine comprising in combination, a circular series of independent needles, means to introduce a main yarn or yarns to the needles, means to present a plurality of lap threads to spaced selected groups of the needles, and means distinct from the lap thread-presenting means and between the latter and the needles to provide a confined path for the lap threads between the yarn feeding means therefor and the needles thereby to prevent interference with the intended feeding of said threads, by means acting upon a retiring main yarn.

30. A circular knitting machine comprising a circular series of needles, means to feed a lap thread into the hooks of each of a series of selected needles, and means to feed into the hooks of said needles two additional threads in a plating relation above the first thread, said two main threads also being fed to the hooks of all the remaining needles of the series, and means for casting off all of said three threads simultaneously from each needle receiving that number of threads, whereby the said lowermost thread in the hook appears upon the outer face of the fabric as a lap stripe thread and the two remaining threads appear in a plating relation.

31. A circular knitting machine comprising a circular series of needles, means to feed a lap thread into the hooks of each of a series of selected needles, and means to feed into the hooks of said needles two additional threads in a plating relation above the first thread, said two main threads also being fed to the hooks of all the remaining needles of the series, said first thread being taken by the hooks of the needles slightly prior to but adjacent the point where the two remaining threads are delivered to the hooks of the needles.

32. A circular knitting machine comprising a circular series of needles, means to feed a lap thread into the hooks of each of a series of selected needles, and means to feed into the hooks with said needles two additional threads in a plating relation above the first thread, said two main threads also being fed to the hooks of all the remaining needles of the series, and means for casting off all of said three threads simultaneously from each needle receiving that number of threads, whereby the said lowermost thread in the hook appears upon the outer face of the fabric as a lap stripe thread and the two remaining threads appear in a plating relation, and means whereby prior to the completion of the loops the said two last fed threads are reversed in position in the hooks of selected needles, whereby reverse plating is effected.

33. A circular knitting machine comprising in combination, a circular series of independent needles, means to feed three threads in superposed relation to the hooks of needles, two of said threads being fed simultaneously into the hooks of all of the needles in a plating relation and the other thread being fed into the hooks of selected needles only as a lap thread, at a lower point in the hook than the other two threads are fed thereinto, and means for casting off all three threads simultaneously and whereby the said lowermost fed thread appears on the outer face of the fabric as a stripe and whereby the other two threads appear in plated relation throughout the unstriped portion of the fabric.

34. A circular knitting machine comprising in combination, a circular series of independent needles, means to feed three threads in superposed relation to the hooks of needles, two of said threads being fed simultaneously into the hooks of all of the needles in a plating relation and the other thread being fed into the hooks of selected needles only as a lap thread, at a lower point in the hook than the other two threads are fed thereinto, means for acting prior to completion of the stitches for reversing at selected needles the position in the hook of the two threads fed thereinto at a higher point, and means for casting off all three threads simultaneously.

35. Mechanism for producing plated, lap striped, knitted fabric comprising means for feeding two yarns in a plating relation, means for varying the yarn incorporation into the fabric, whereby the backing yarn will appear at the outer face, and means to interknit one or more lap threads with said two yarns at plated portions of the fabric and maintaining said two yarns under plating control where said lap thread or threads is or are interknitted therewith.

36. In a type of knitting machine adapted

to introduce a plurality of lap threads each to a selected group of knitting needles of the machine, in addition to the main yarn or yarns, yarn-engaging means located in substantial proximity to the needle series and between the same and the yarn guide or guides, therefor, to act upon a retiring main yarn or yarns, and means to prevent entanglement of a lap thread or threads with said yarn-engaging means between the lap thread supply means and the needles, whereby the intended feeding of said lap threads and the functioning of said yarn-engaging means are both permitted to occur without interference of either one by the other.

37. A circular knitting machine having means to feed a main yarn or yarns to the needles, means to feed a lap thread or threads to selected needles, means for acting upon a retiring main yarn or yarns, a support for said last mentioned means at the needle circle and means carried by said support to prevent the lap thread or threads from being acted upon by said means that acts upon a retiring main yarn or yarns.

In testimony whereof, we have signed our names to this specification.

JOHN LAWSON.
ROBERT H. LAWSON.

CERTIFICATE OF CORRECTION.

Patent No. 1,702,608. Granted February 19, 1929, to

JOHN LAWSON ET AL.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 11, line 129, claim 7, after the word "threads" and before the comma insert the words "while keeping said two main yarns under plating control at said selected needles", and page 12, same claim, lines 1, 2 and 3, strike out "while keeping said two main yarns under plating control at said selected needles"; and that the said Letters Patent should be read with these corrections therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 26th day of March, A. D. 1929.

M. J. Moore,
Acting Commissioner of Patents.

(Seal)