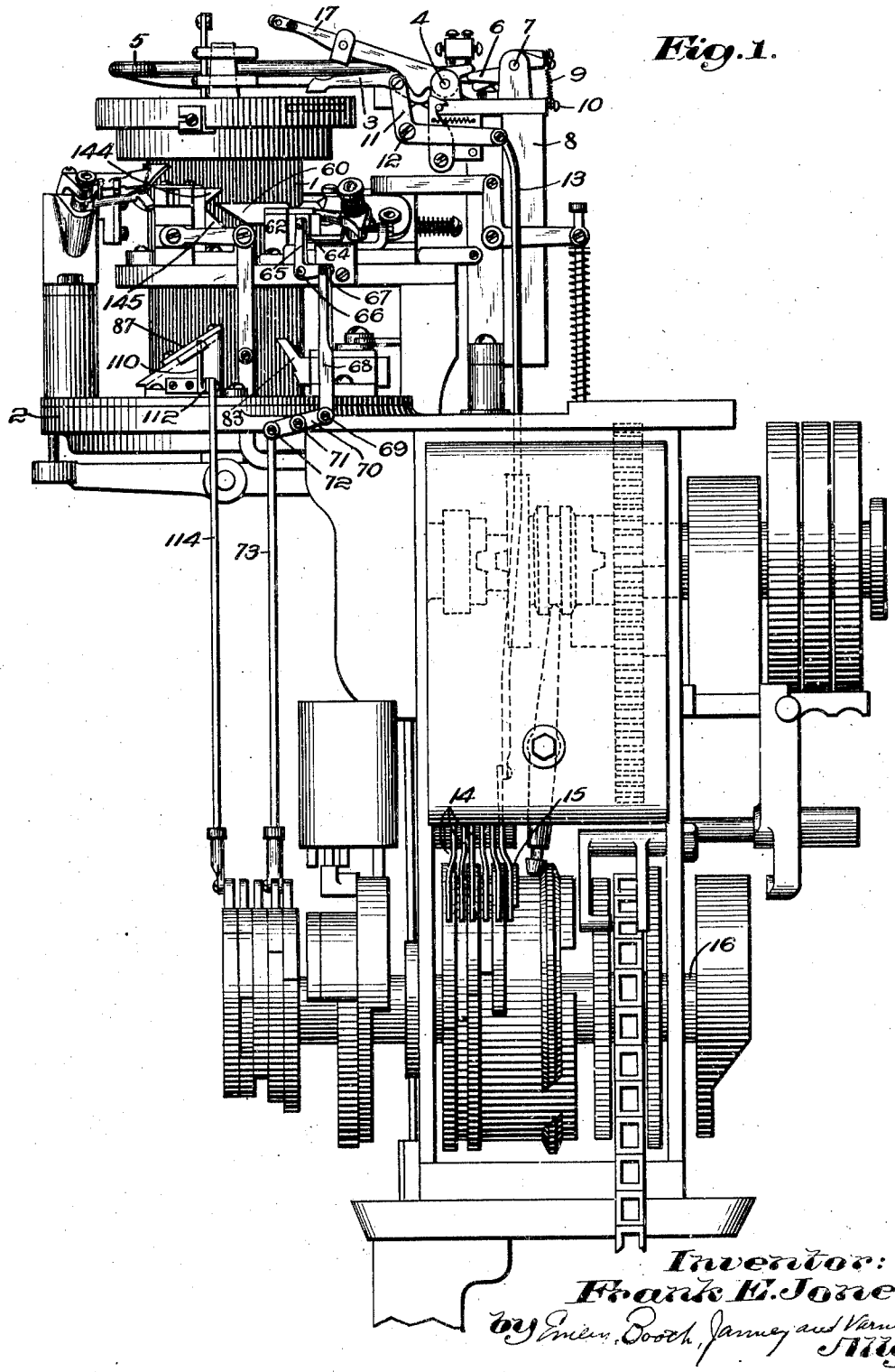
June 25, 1929. F. E. JONES 1,718,932

MECHANISM AND METHOD FOR PRODUCING SEAMLESS REENFORCED HOSIERY

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Fig. 1.



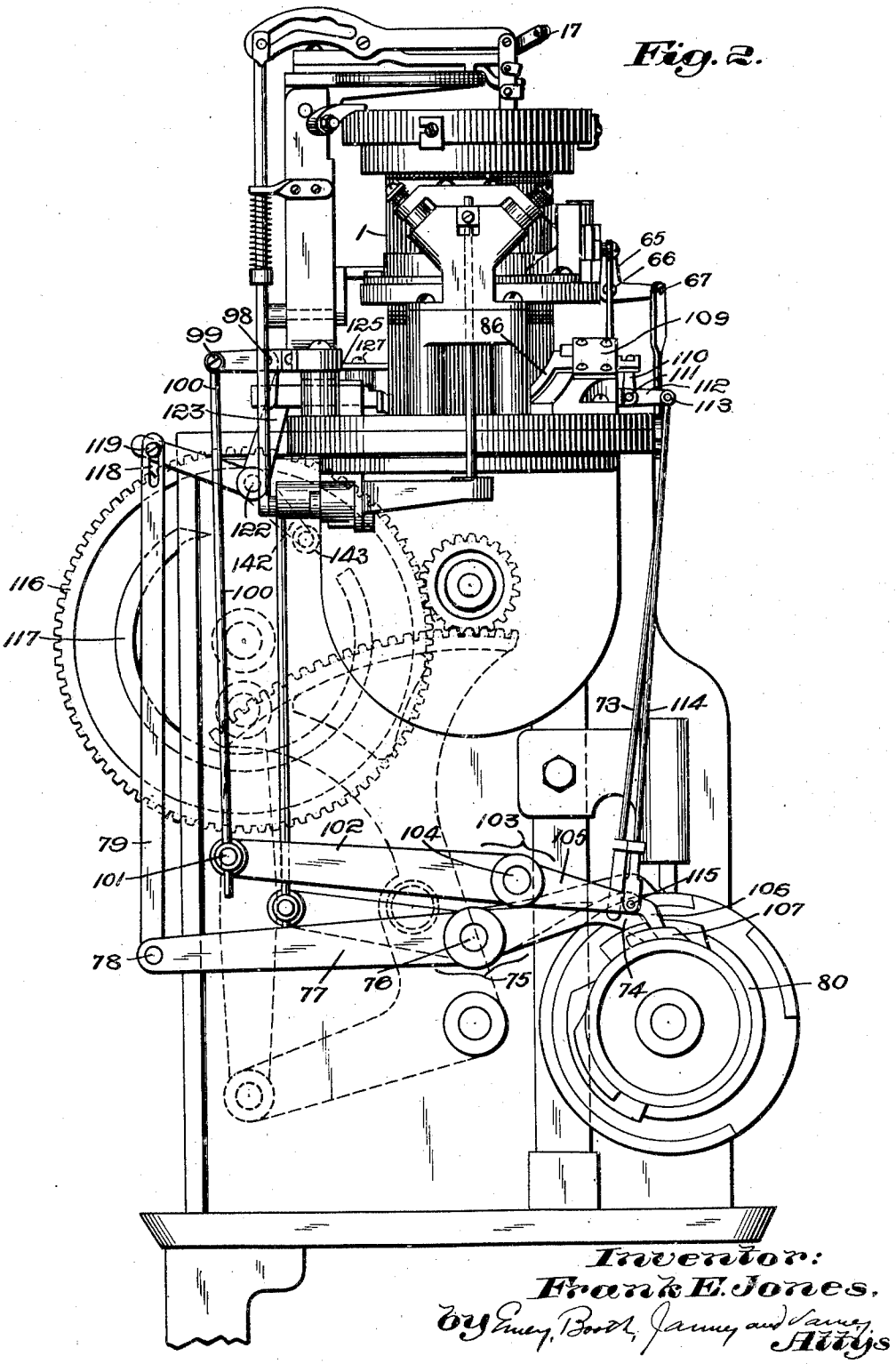
Inventor:
Frank E. Jones.
by Emery, Booth, Janney and Varney.
Attys.

June 25, 1929. F. E. JONES 1,718,932

MECHANISM AND METHOD FOR PRODUCING SEAMLESS REENFORCED HOSIERY

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Fig. 2.



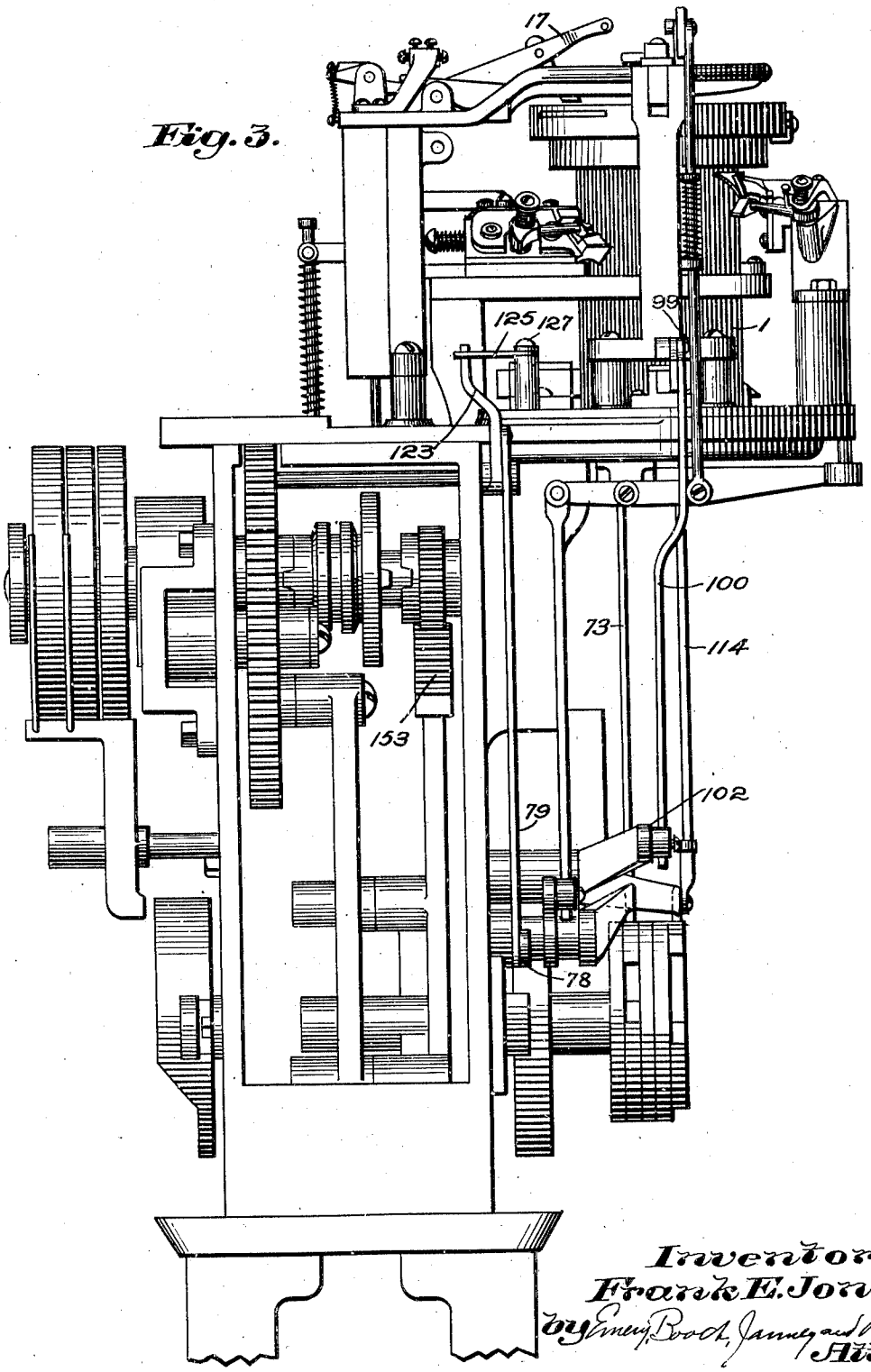
Inventor:
Frank E. Jones,
By Emery, Booth, Janney and Varney
Attys

June 25, 1929. F. E. JONES 1,718,932

MECHANISM AND METHOD FOR PRODUCING SEAMLESS REENFORCED HOSIERY

Filed June 18, 1923 20 Sheets-Sheet 3

Fig. 3.



Inventor:
Frank E. Jones
by Emery, Booth, Janney and Varney
Attys

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MECHANISM AND METHOD FOR PRODUCING SEAMLESS REENFORCED HOSIERY

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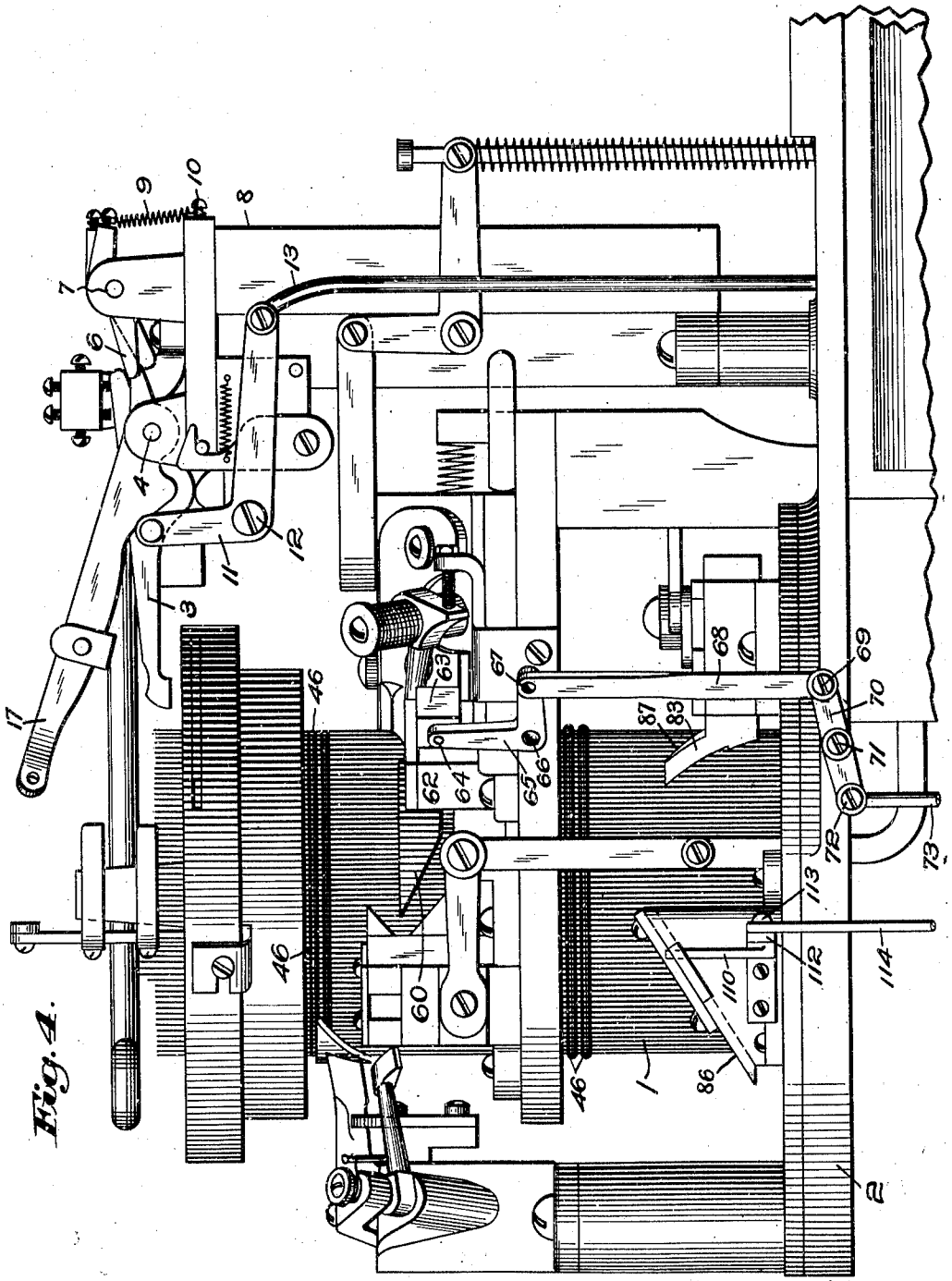


Fig. 4.

Inventor:
Frank E. Jones,
by Emery, Booth, Janney & Varney
Attys

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MECHANISM AND METHOD FOR PRODUCING SEAMLESS REENFORCED HOSIERY

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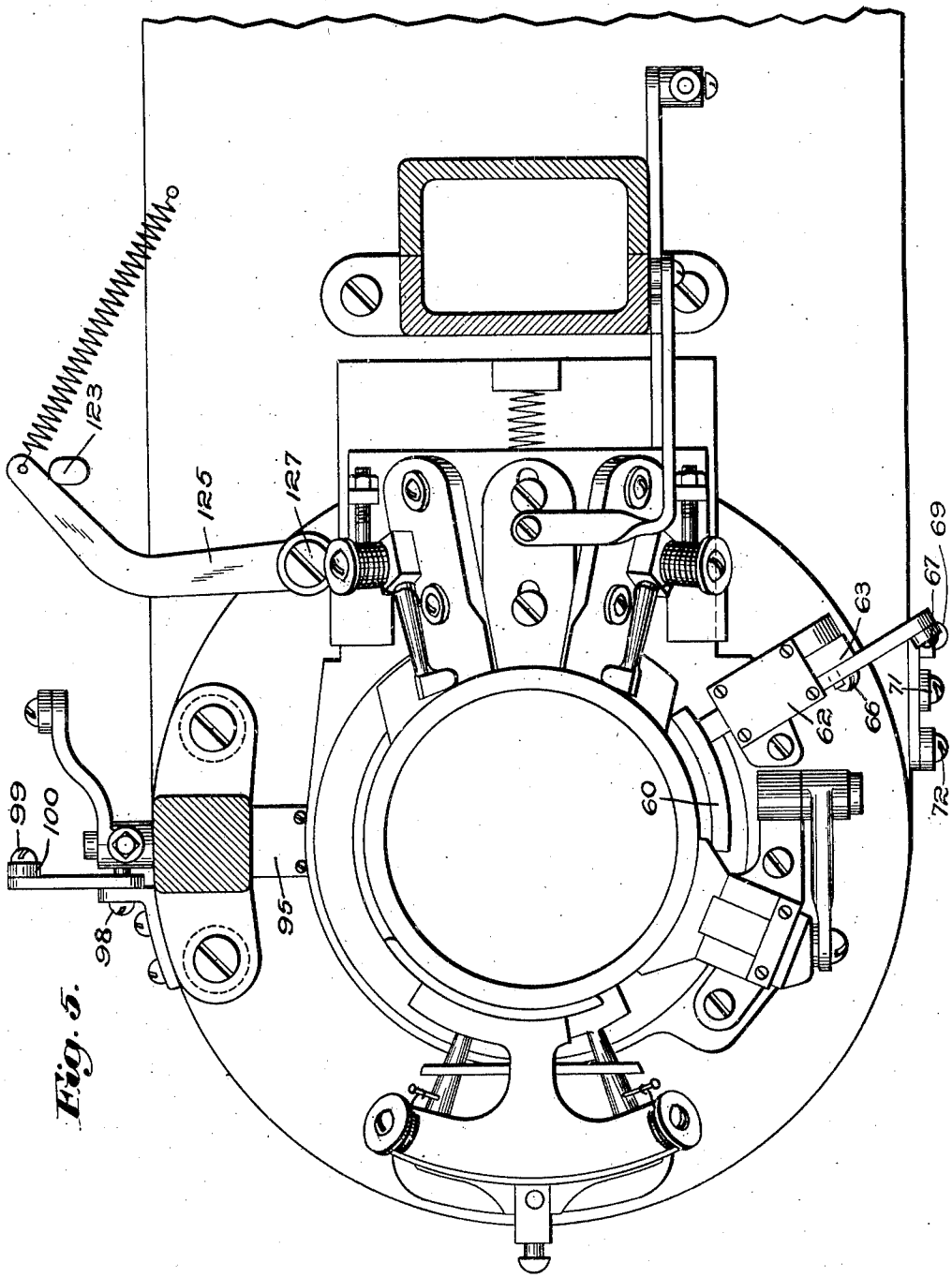


Fig. 5.

Inventor:
Frank E. Jones.
by Emery, Booth, Janney and Varney
Attys.

June 25, 1929. F. E. JONES 1,718,932

MECHANISM AND METHOD FOR PRODUCING SEAMLESS REENFORCED HOSIERY

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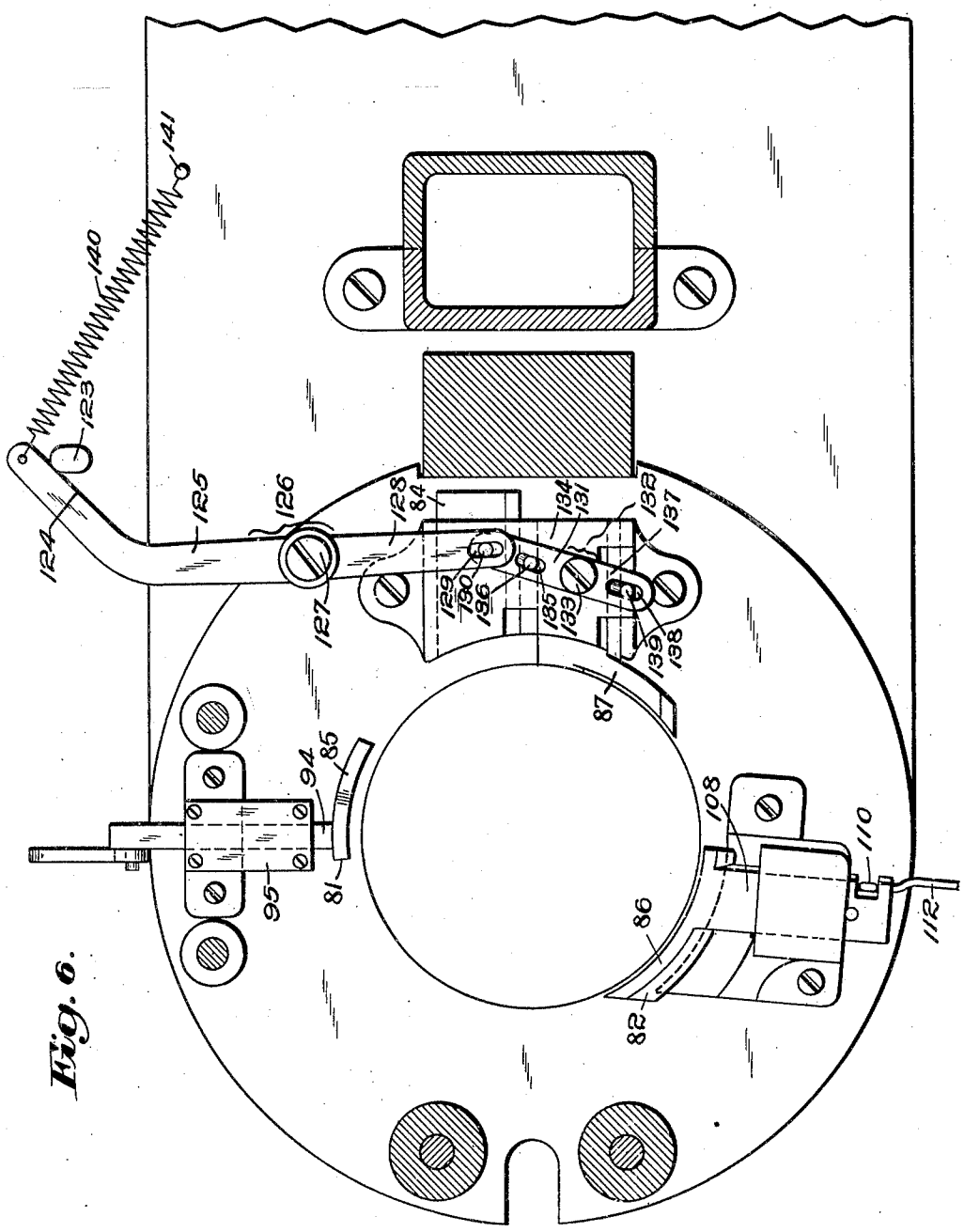


Fig. 6.

Inventor:
Frank E. Jones.
by Emery, Booth, Janney and Varney
Attys

June 25, 1929. F. E. JONES 1,718,932

MECHANISM AND METHOD FOR PRODUCING SEAMLESS REENFORCED HOSIERY

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Fig. 7.

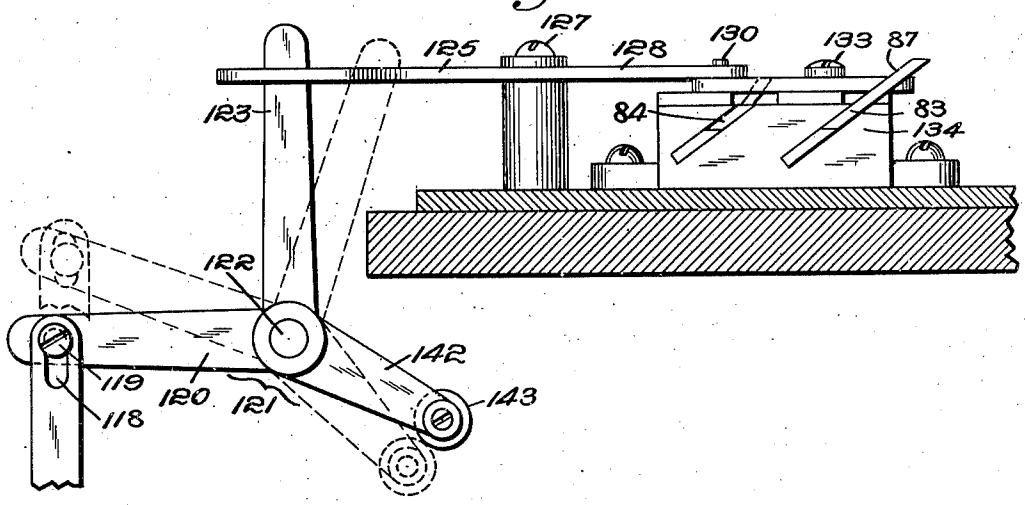


Fig. 8

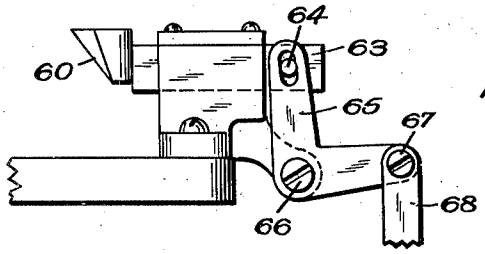


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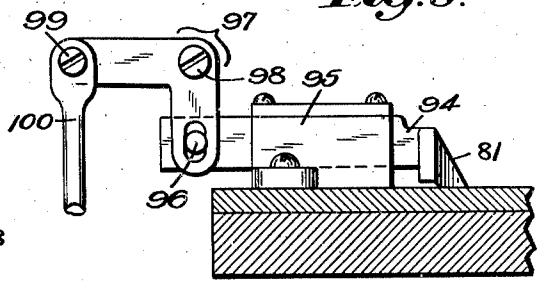


Fig. 10

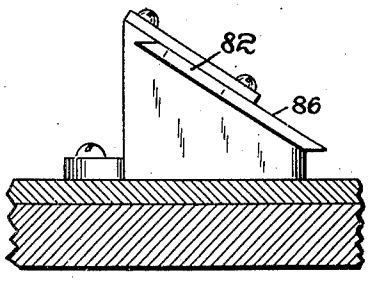
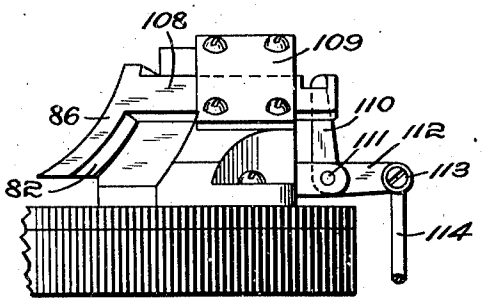


Fig. 11.



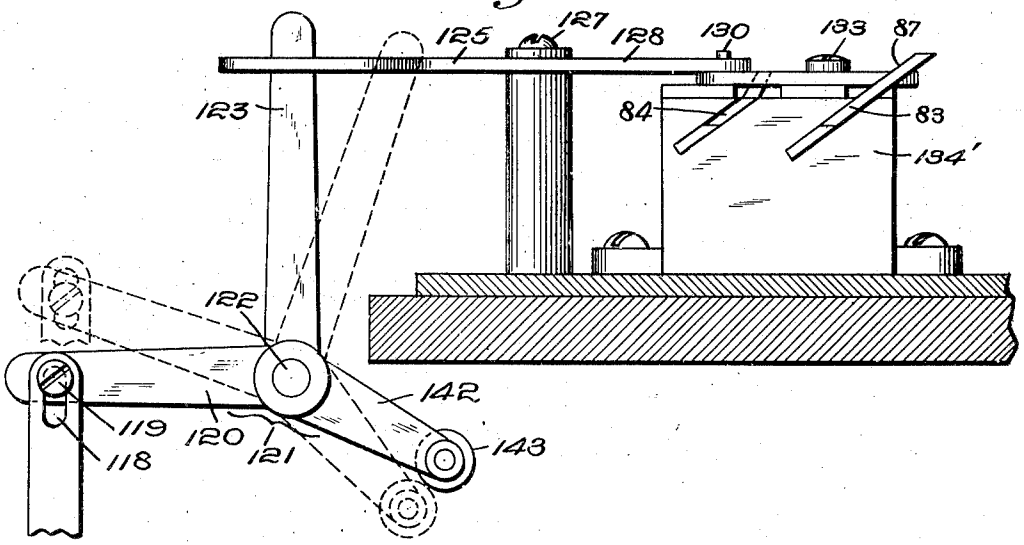
Inventor:
Frank E. Jones.
by Emery, Booth, Jamney and Varney,
Attys.

June 25, 1929. F. E. JONES 1,718,932

MECHANISM AND METHOD FOR PRODUCING SEAMLESS REENFORCED HOSIERY

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Fig. 8a



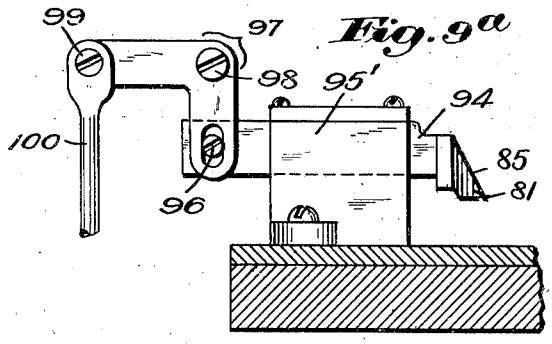


Fig. 9a

Fig. 10a

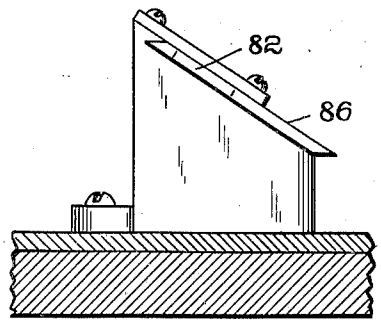
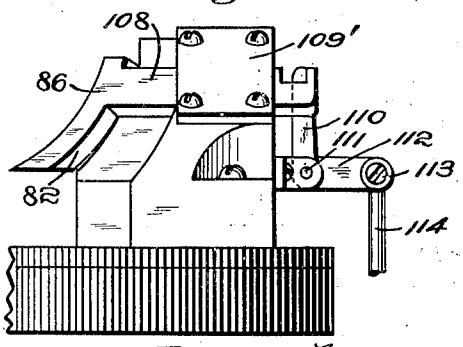


Fig. 11a



Inventor:
Frank E. Jones.
by Emery, Booth, Janney and Varney
Attys.

June 25, 1929. F. E. JONES 1,718,932

MECHANISM AND METHOD FOR PRODUCING SEAMLESS REENFORCED HOSIERY

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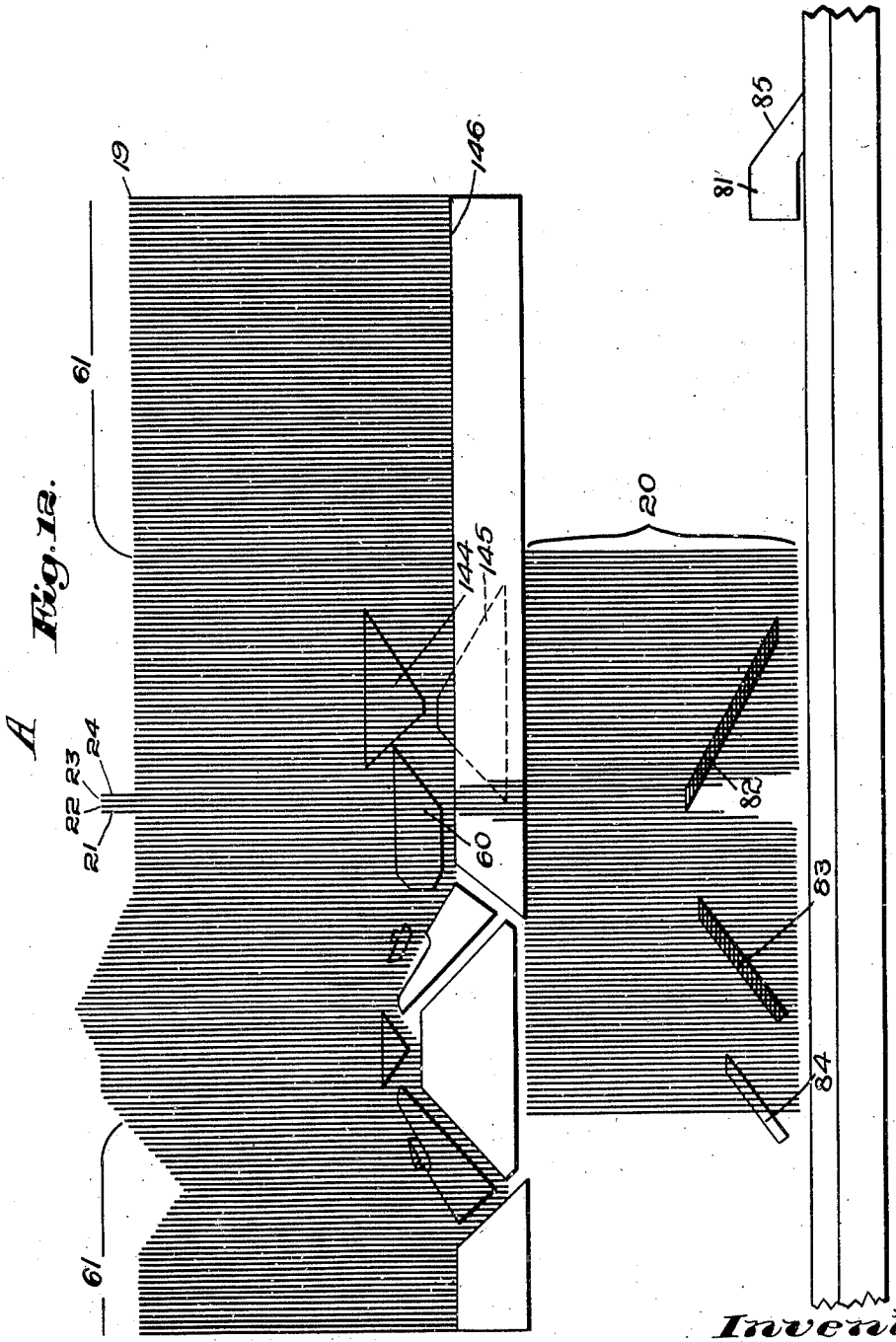


Fig. 12.

Inventor:
Frank E. Jones.
by Emery, Booth, Janney and Varney
Attys.

June 25, 1929. F. E. JONES 1,718,932

MECHANISM AND METHOD FOR PRODUCING SEAMLESS REENFORCED HOSIERY

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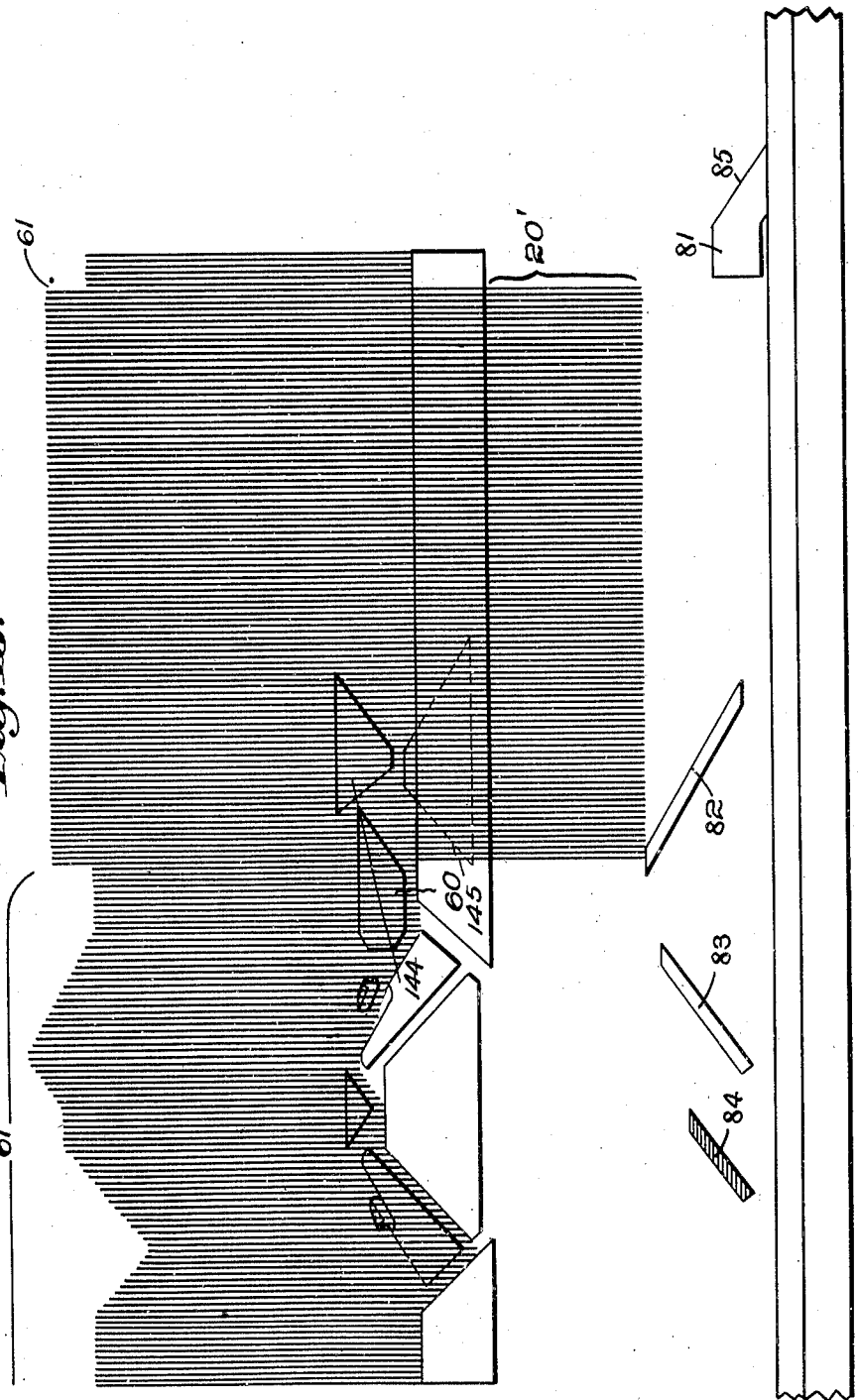


Fig. 13.

Inventor:
Frank E. Jones,
by Emery, Booth, Janney and Varney, Attys.

June 25, 1929. F. E. JONES 1,718,932

MECHANISM AND METHOD FOR PRODUCING SEAMLESS REENFORCED HOSIERY

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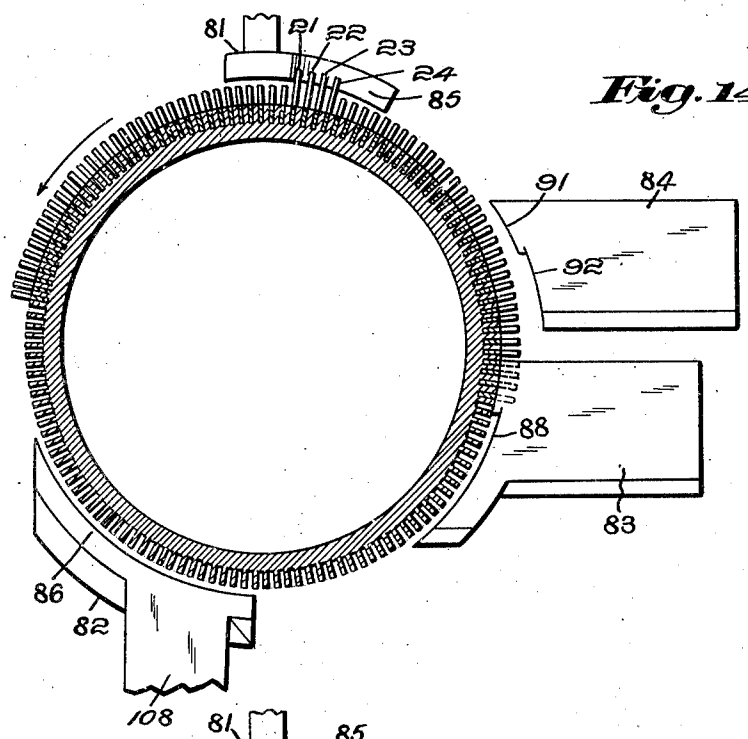


Fig. 14.

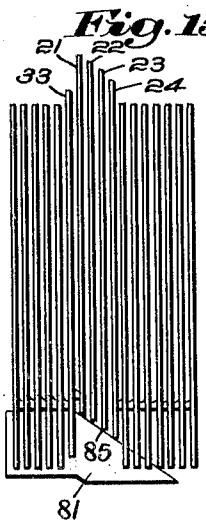


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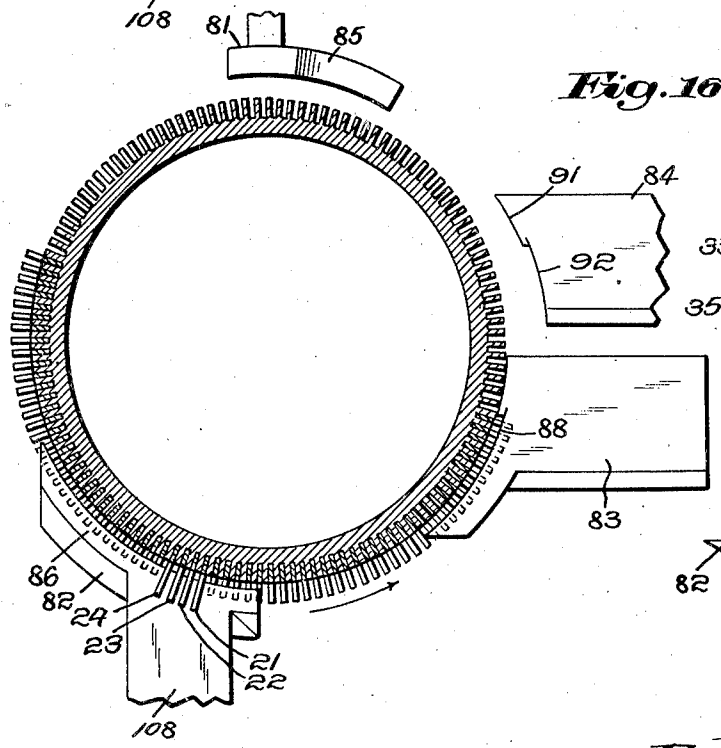


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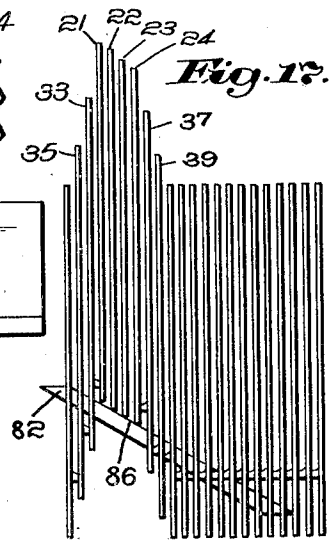


Fig. 17.

Inventor:
Frank E. Jones
by Finley, Brock, Janney and Vance
Attys

June 25, 1929. F. E. JONES 1,718,932

MECHANISM AND METHOD FOR PRODUCING SEAMLESS REENFORCED HOSIERY

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Fig. 18.

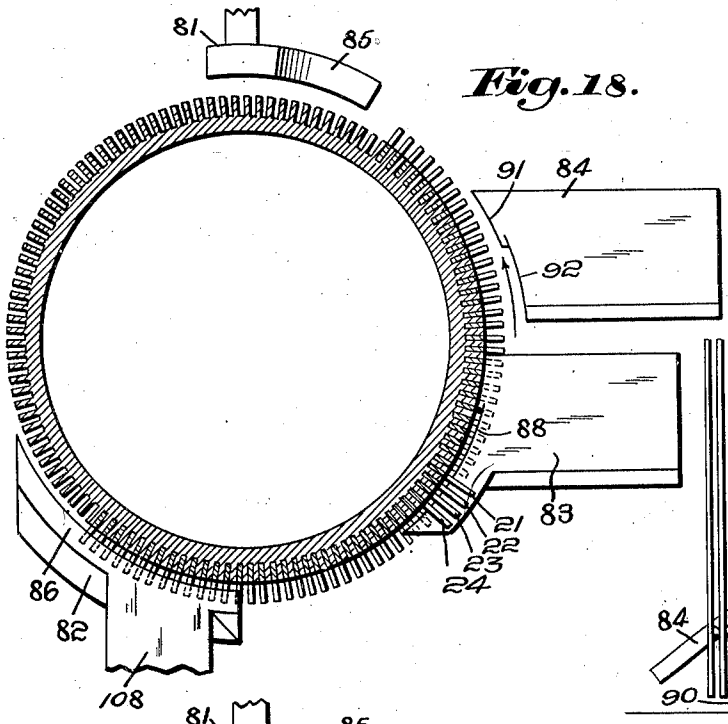


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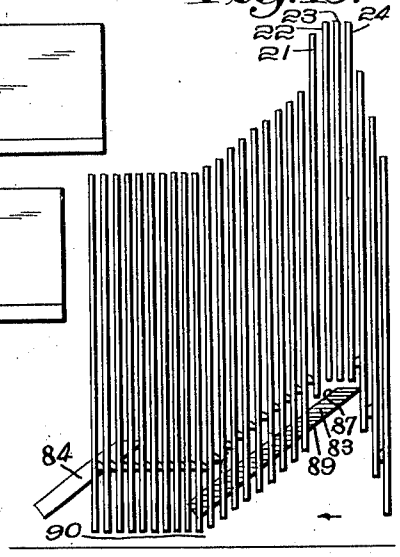


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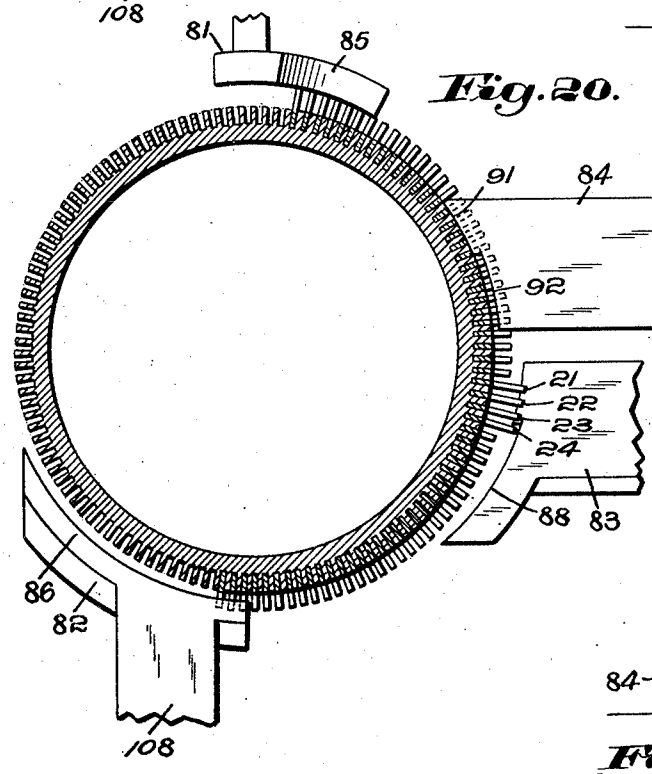
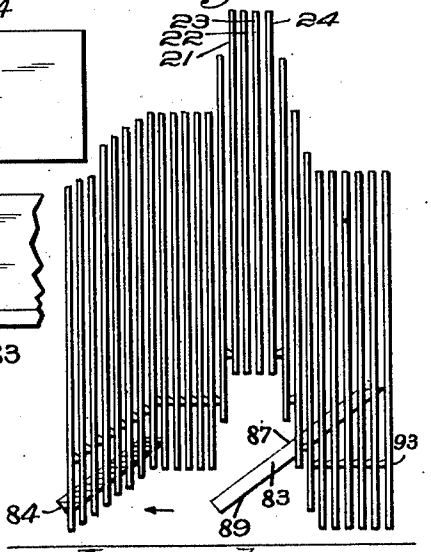


Fig. 21.



Inventor:
Frank E. Jones.
by Emery, Booth, Janney and Varney
Attys

June 25, 1929. F. E. JONES 1,718,932

MECHANISM AND METHOD FOR PRODUCING SEAMLESS REENFORCED HOSIERY

Filed June 18, 1923 20 Sheets-Sheet 13

Fig. 22

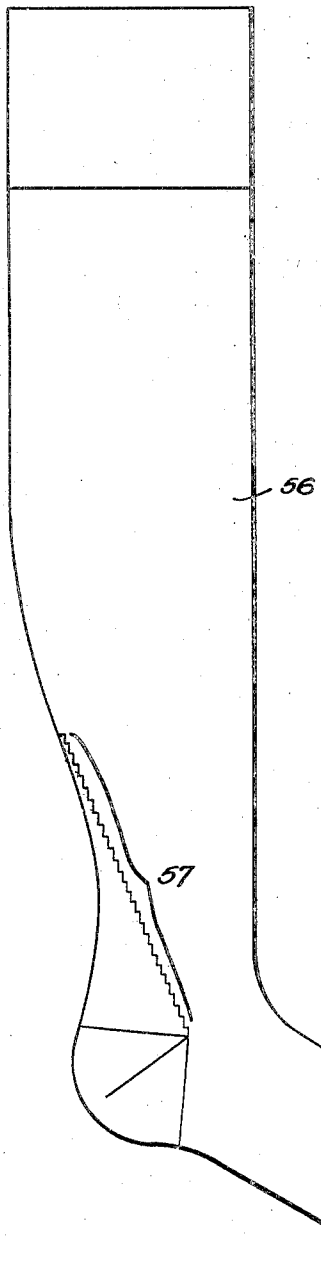


Fig. 24.

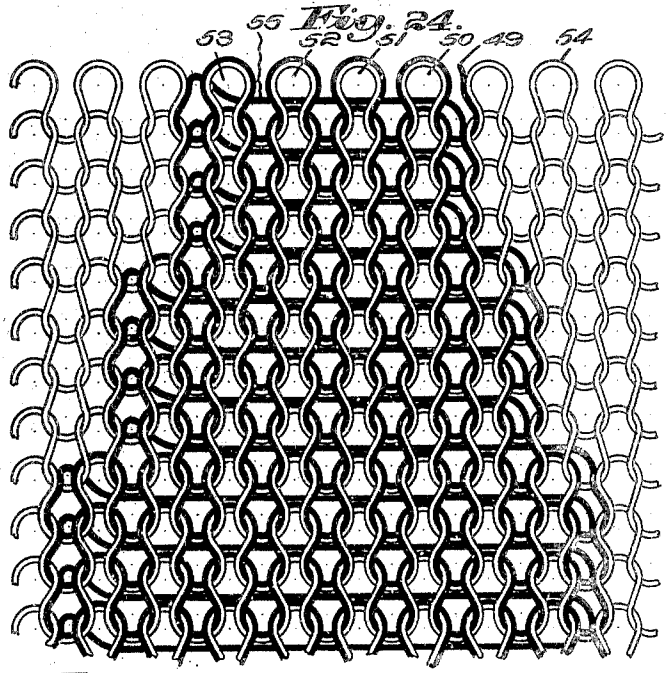


Fig. 24a

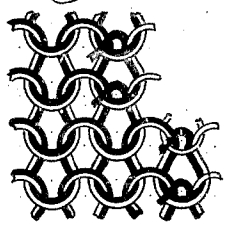


Fig. 24b

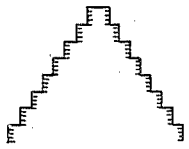
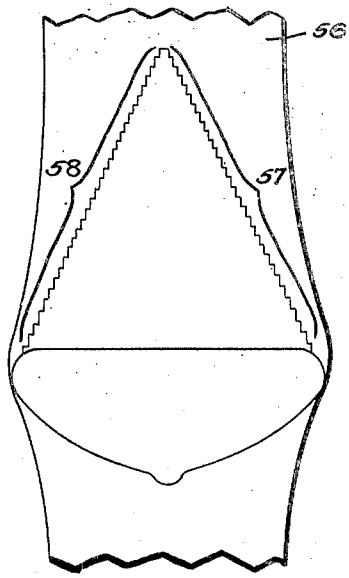


Fig. 23.



Inventor:
Frank E. Jones,
by Emery, Booth, Janney and Varney.
Attys

June 25, 1929. F. E. JONES 1,718,932

MECHANISM AND METHOD FOR PRODUCING SEAMLESS REENFORCED HOSIERY

Filed June 18, 1923 20 Sheets-Sheet 14

Fig. 25.

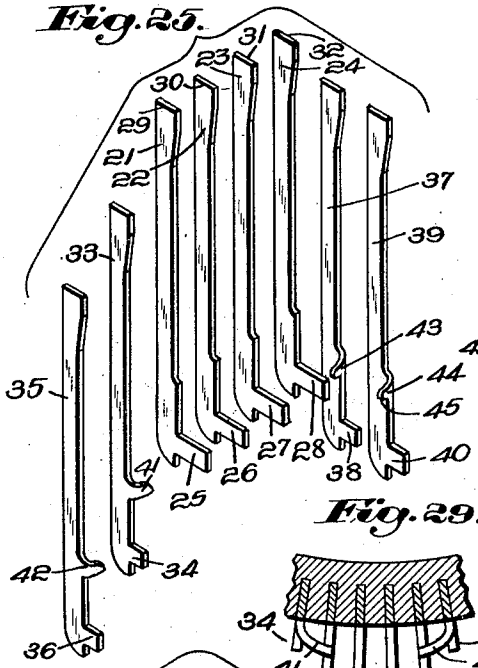


Fig. 26.

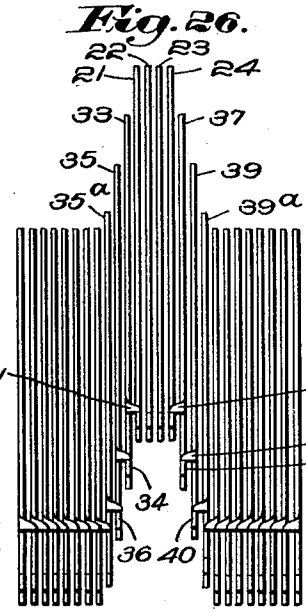


Fig. 31



Fig. 29.

Fig. 28.

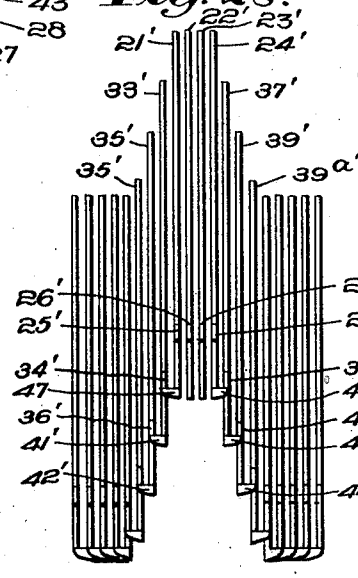


Fig. 27.

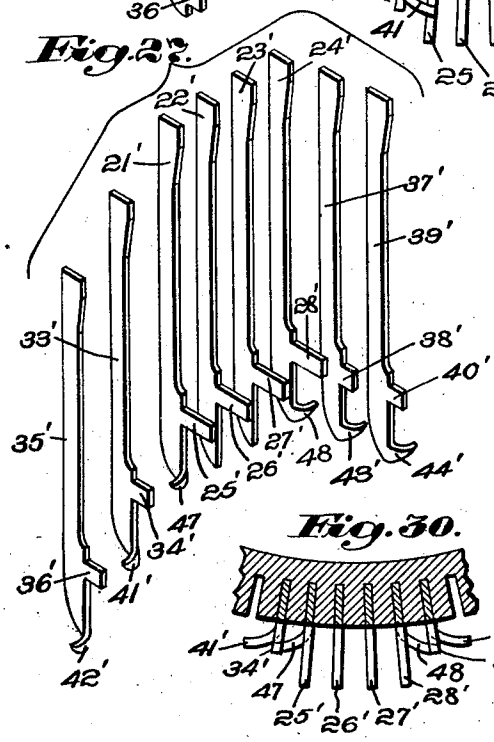


Fig. 30.

Inventor:
Frank E. Jones.
by Emery, Booth, Janney and Varney
Attys

June 25, 1929. F. E. JONES 1,718,932

MECHANISM AND METHOD FOR PRODUCING SEAMLESS REENFORCED HOSIERY

Filed June 18, 1923 20 Sheets-Sheet 15

Fig. 32.

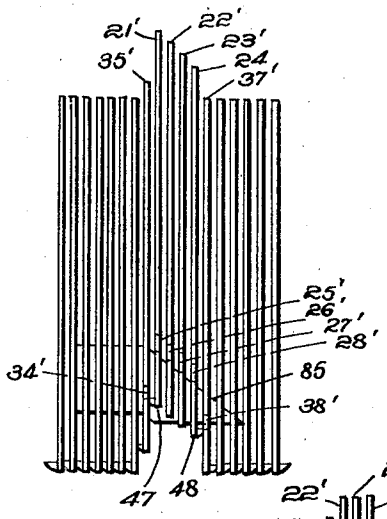


Fig. 33.

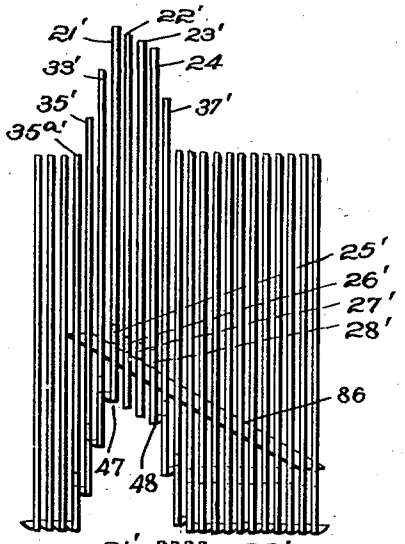


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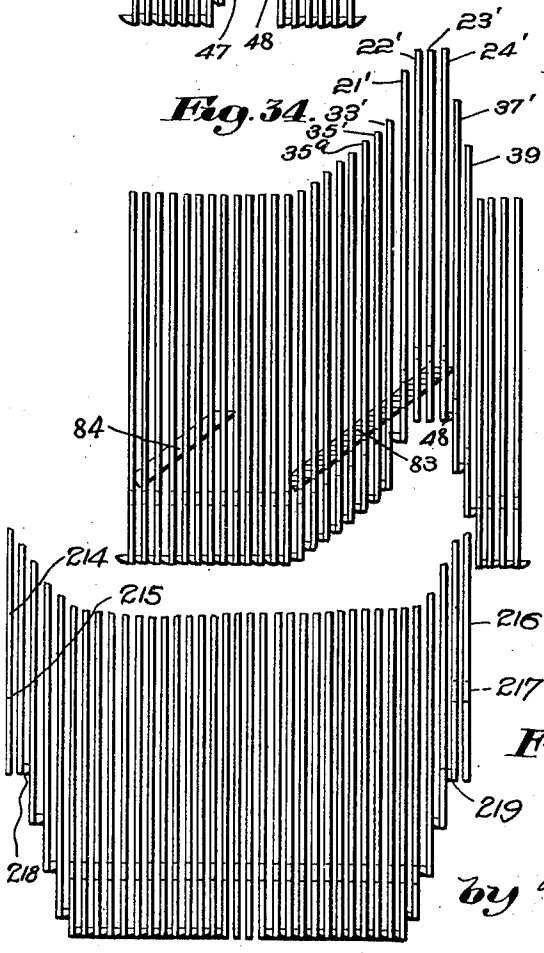


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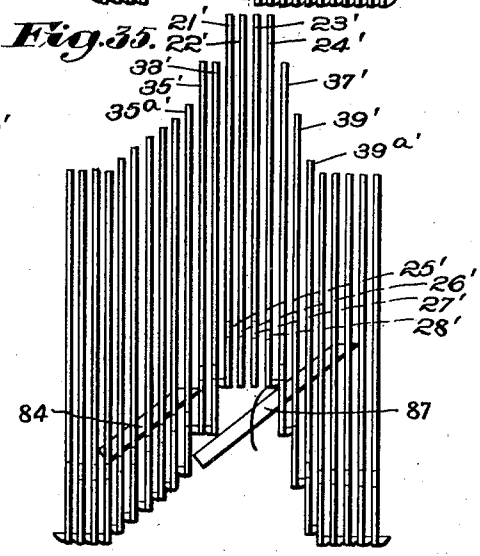


Fig. 46.

Inventor:
Frank E. Jones.
by Emery, Booth, Janney and Varney,
Attys.

June 25, 1929. F. E. JONES 1,718,932

MECHANISM AND METHOD FOR PRODUCING SEAMLESS REENFORCED HOSIERY

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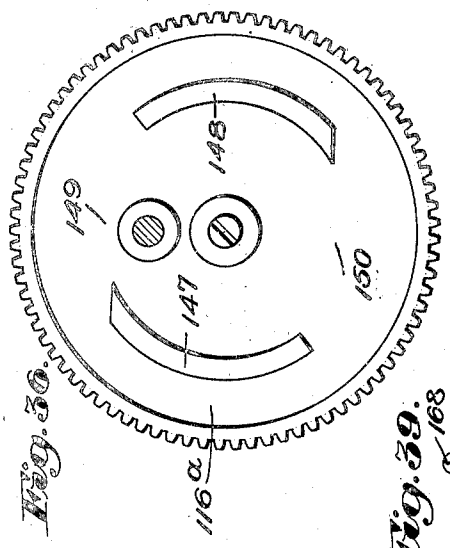


Fig. 39.

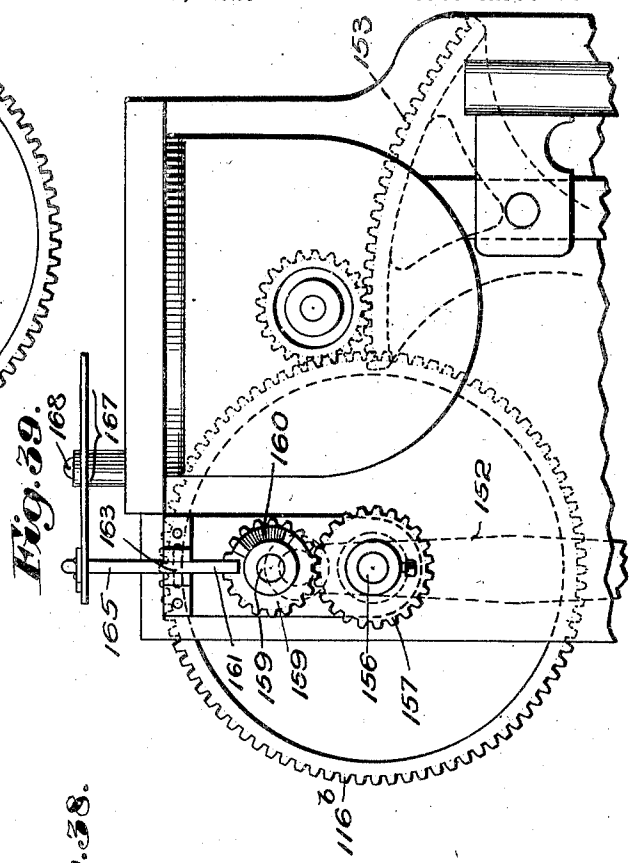


Fig. 37.

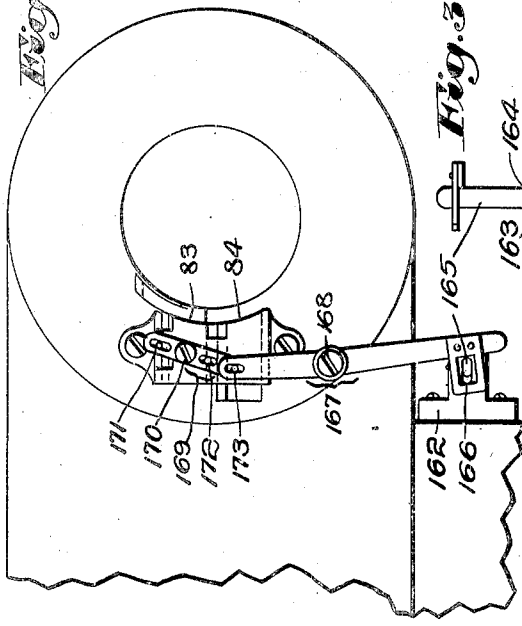
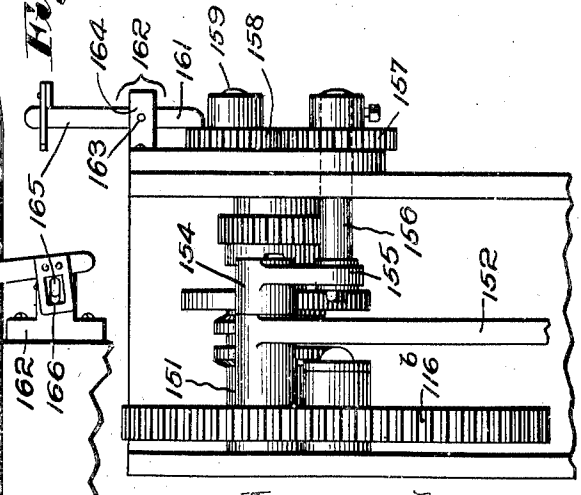


Fig. 38.



Inventor:
Frank E. Jones.
by Emery, Booth, Janney and Varney.
Attys

June 25, 1929. F. E. JONES 1,718,932

MECHANISM AND METHOD FOR PRODUCING SEAMLESS REENFORCED HOSIERY

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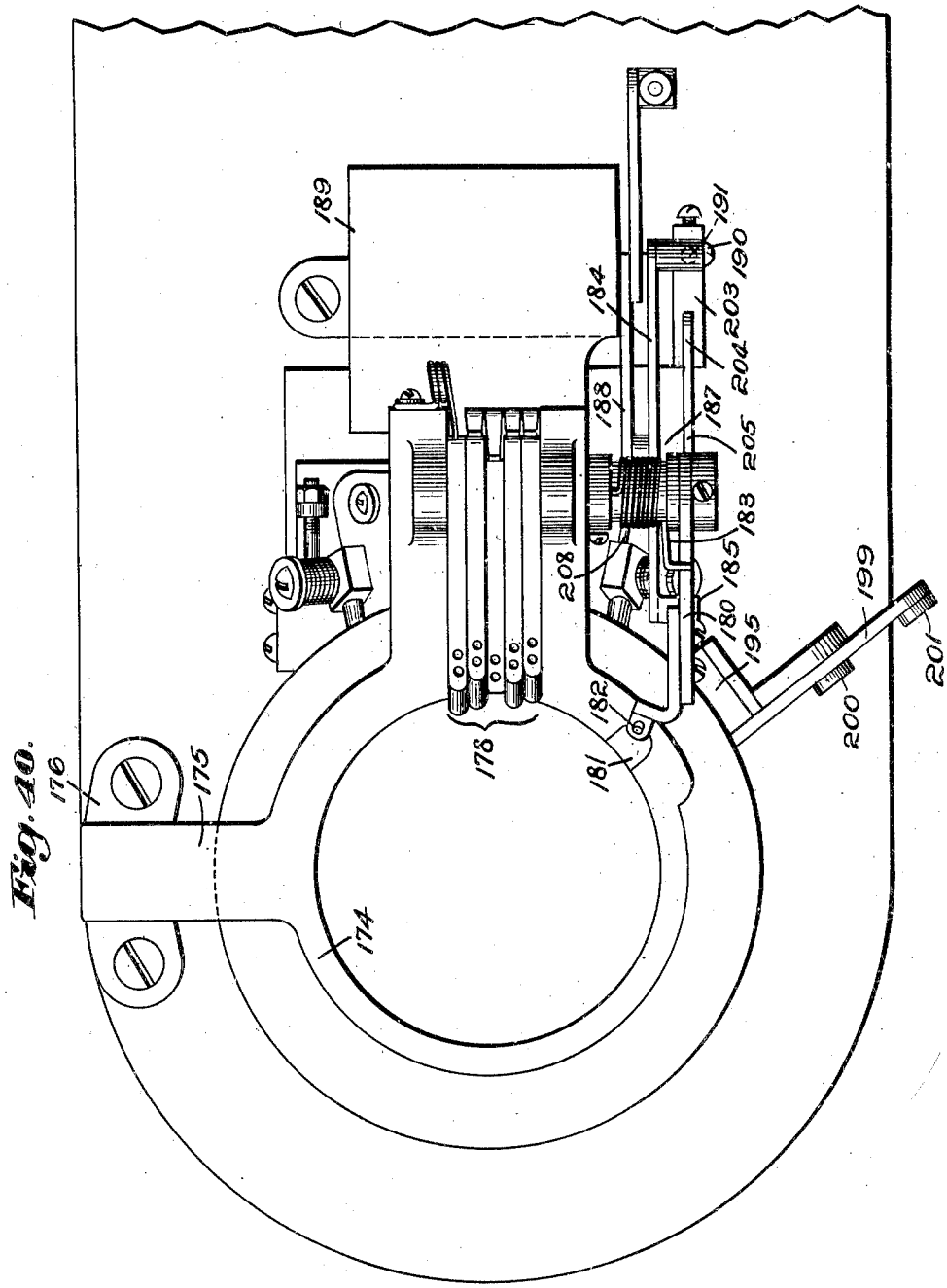


Fig. 40.

Inventor:
Frank E. Jones.
by Emery, Booth, Jaimy and Varney
Attys

June 25, 1929. F. E. JONES 1,718,932

MECHANISM AND METHOD FOR PRODUCING SEAMLESS REENFORCED HOSIERY

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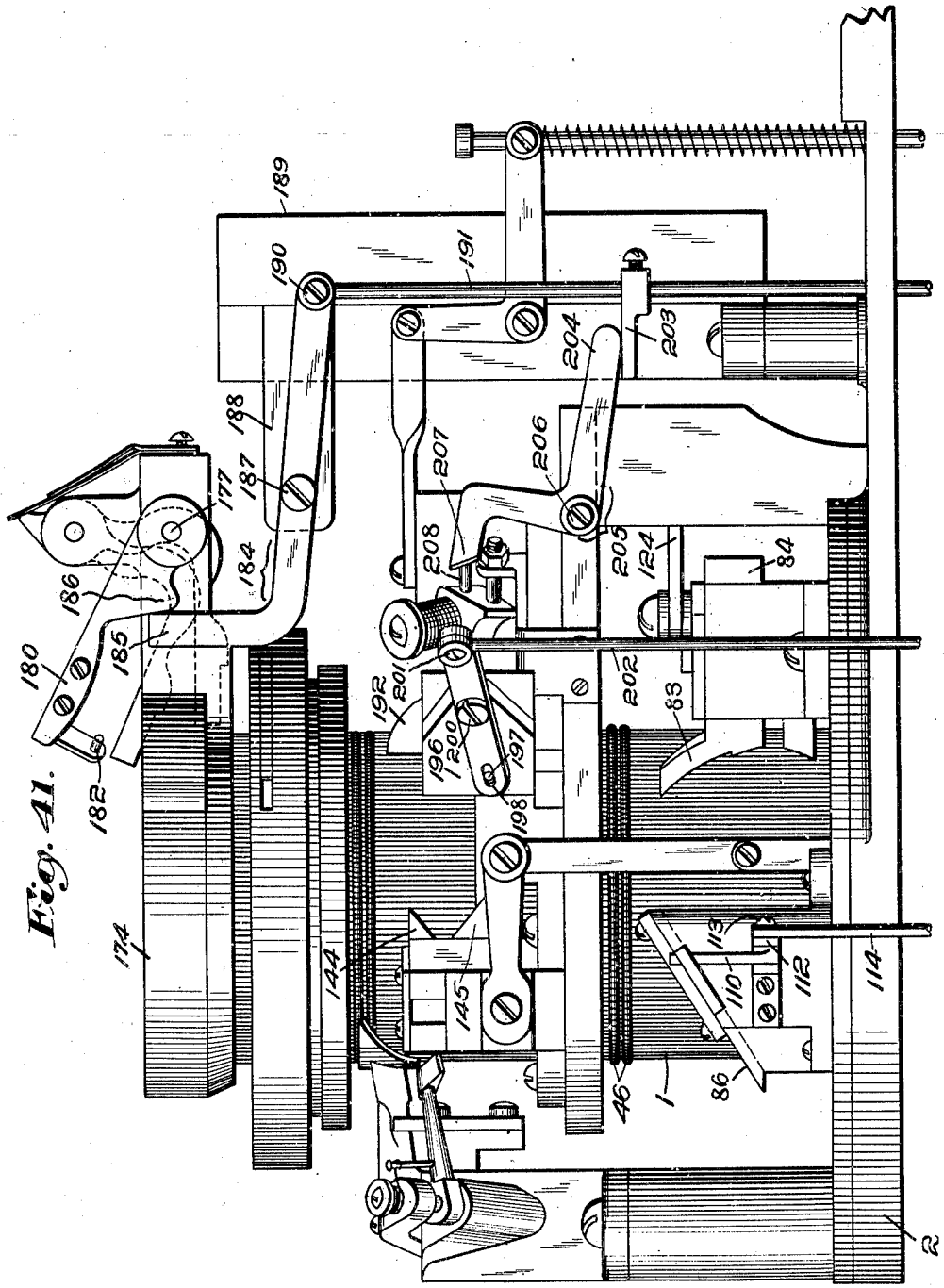


Fig. 41.

Inventor:
Frank E. Jones.
by Emery, Booth, Janney and Varney.
Attys.

June 25, 1929. F. E. JONES 1,718,932

MECHANISM AND METHOD FOR PRODUCING SEAMLESS REENFORCED HOSIERY

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Fig. 42.

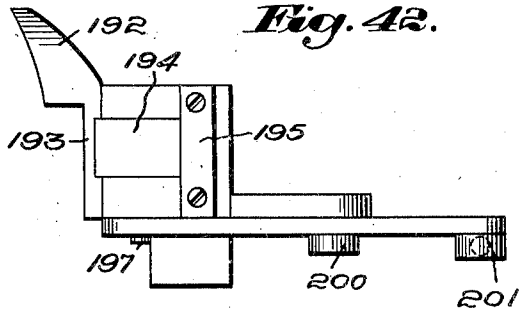


Fig. 43.

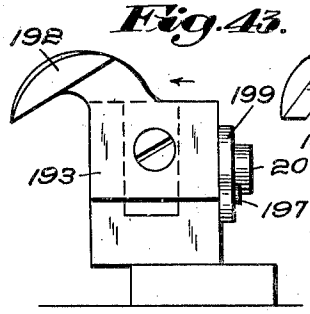


Fig. 44.

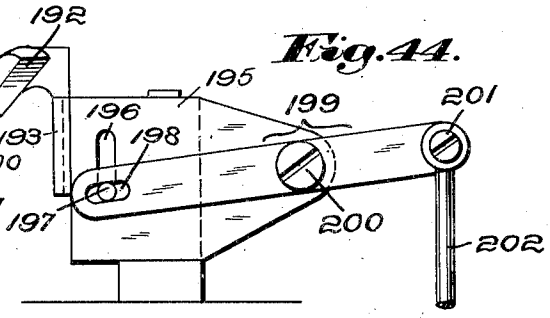
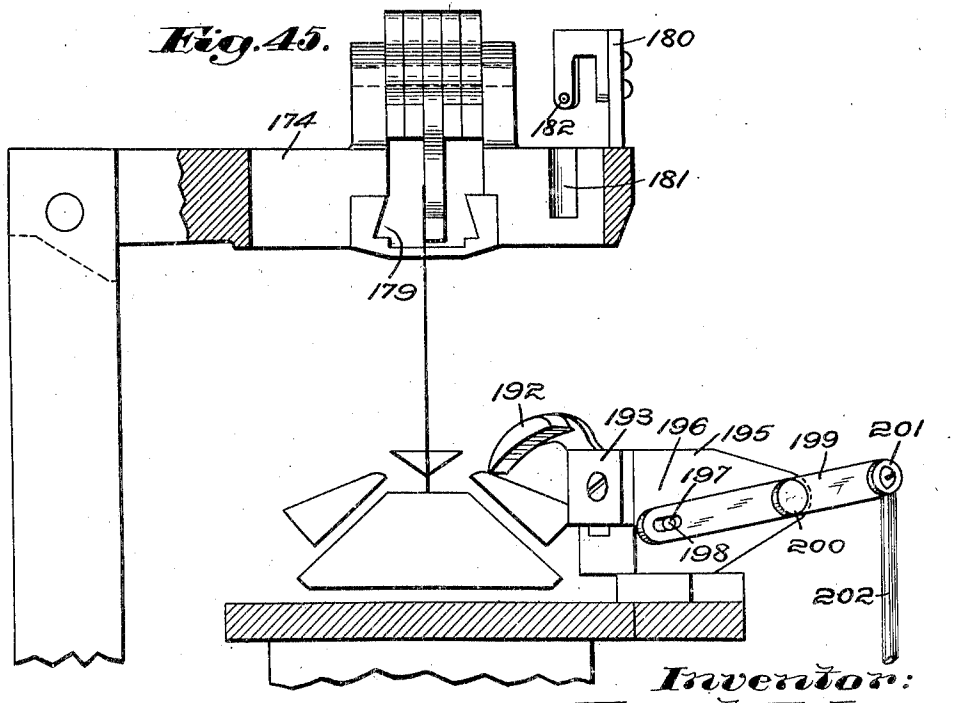


Fig. 45.



Inventor:
Frank E. Jones
by Emery, Booth, Janney and Varney
Attys.

June 25, 1929. F. E. JONES 1,718,932

MECHANISM AND METHOD FOR PRODUCING SEAMLESS REENFORCED HOSIERY

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Fig. 47.

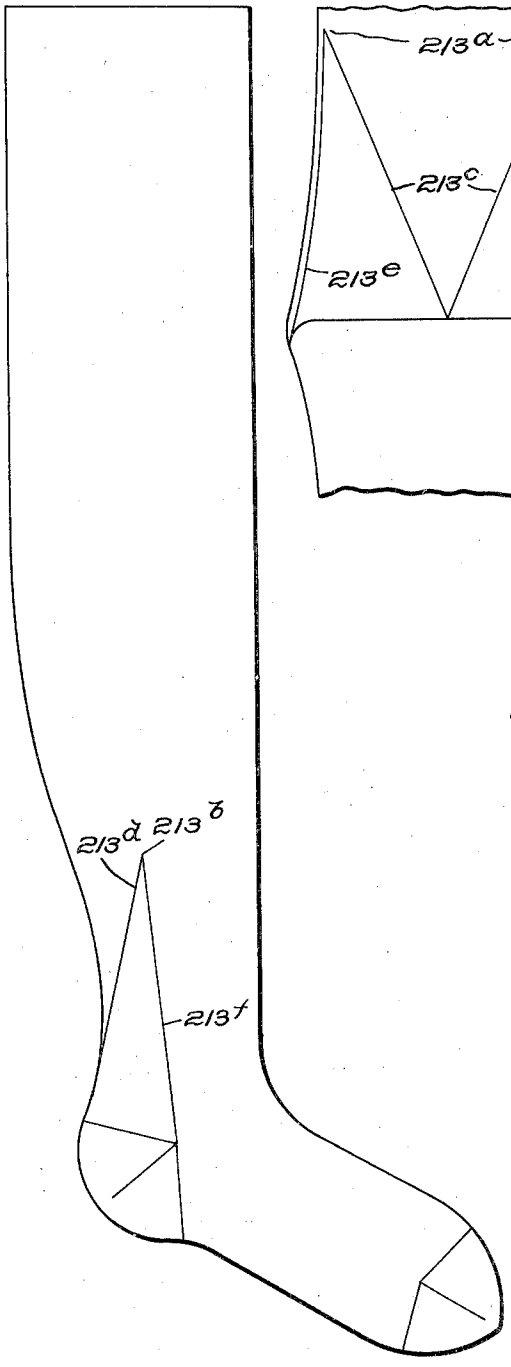


Fig. 48

Fig. 49.

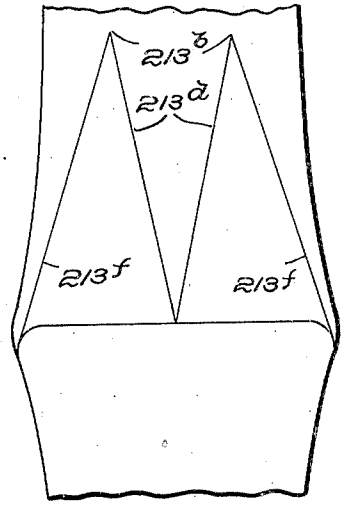
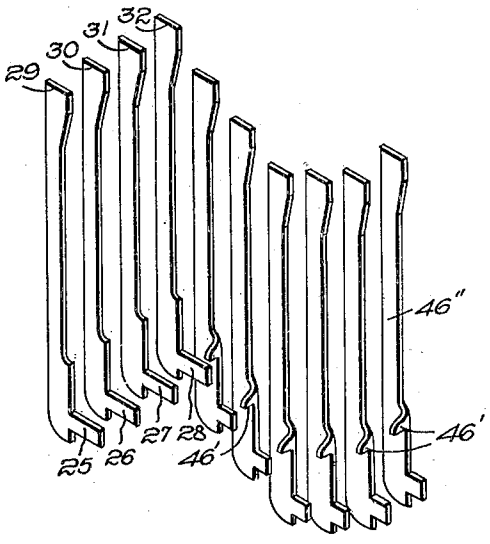


Fig. 50.



Inventor:
Frank E. Jones,
by Emery, Booth, Janney and Varney,
Attys

Patented June 25, 1929. 1,718,932

UNITED STATES PATENT OFFICE.

FRANK E. JONES, OF PAWTUCKET, RHODE ISLAND, ASSIGNOR TO HEMPHILL COMPANY, OF CENTRAL FALLS, RHODE ISLAND, A CORPORATION OF MASSACHUSETTS.

MECHANISM AND METHOD FOR PRODUCING SEAMLESS REENFORCED HOSIERY.

Application filed June 18, 1923. Serial No. 647,518.

This invention relates to mechanism and method for producing reenforced hosiery, and more especially to means for and to methods of effecting the reenforcing of knitted fabric, particularly stockings, through manipulation of needles as contra-distinguished to manipulation of the yarn feeding means.

In order that the principle of the invention may be readily understood, I have in the accompanying drawings disclosed certain embodiments of means for practising my invention.

In said drawings,—

Fig. 1 is a front elevation of a knitting machine having my invention applied thereto;

Fig. 2 is an end elevation of the mechanism shown in Fig. 1;

Fig. 3 is a rear elevation thereof;

Fig. 4 is a front elevation of the upper part of the mechanism shown in Fig. 1 and upon an enlarged scale;

Fig. 5 is a plan view of the mechanism shown in Fig. 4 but viewed from a plane below the yarn guides and their immediate operating mechanism, parts therefore being in section;

Fig. 6 is a similar view but taken from a plane below the needle pickers and their immediate operating mechanism, parts therefore being in section;

Fig. 7 is a detail partly in vertical section and partly in front elevation of certain of the jack operating cams and their controlling means;

Fig. 8 is a detail in side elevation of the long-butt-needle-withdrawing cam and its operating means;

Fig. 9 is a side elevation with parts in section of another jack-operating cam and a part of its operating means;

Fig. 10 is a detail in inside elevation with parts in section of still another jack-operating cam;

Fig. 11 is a detail in side elevation of the cam shown in Fig. 10 and a portion of its operating means;

Figs. 7^a, 9^a, 10^a, 11^a are views similar to Figs. 7, 9, 10 and 11 respectively but representing the changes in construction incident to the adaptation of my invention to latch needle structures;

Fig. 12 is a development of a portion of the needle cylinder with needles and the cam ring and representing the position of the parts at the commencement of the pointed heel reenforcement or tapered high splice;

Fig. 13 is a view similar to Fig. 12 but indicating the position of the parts at the last course in forming the pointed heel or tapered high splice;

Fig. 14 is a horizontal section taken through the needle cylinder and showing the jacks for the reenforcement-producing needles and the four cams for said jacks, the parts being positioned for the commencement or first step of the first course of a cycle of four courses;

Fig. 15 is a front elevation in detail showing the position of the jacks at the first acting of the four jack cams at the stage indicated in Fig. 14;

Fig. 16 is a view similar to Fig. 14 but indicating the position of the parts at the second step in the same course begun in Fig. 14;

Fig. 17 is a detail in front elevation of the position of the jacks in Fig. 16 at the second of the four jack-operating cams at the second step in the second course;

Fig. 18 is a view similar to Fig. 14, but representing the position of the parts at the third step in the same course;

Fig. 19 is a detail in front elevation of the jacks at the third of the jack-controlling cams at the third step in the said course;

Fig. 20 is a view similar to Fig. 14 but representing the position of the cams and jacks upon the fourth course of the cycle of four courses;

Fig. 21 is a detail in front elevation representing the position of the jacks at the third and fourth jack cams upon said fourth course;

Fig. 22 is a side elevation of a tubular knit or seamless stocking constructed in accordance with my invention;

Fig. 23 is an outside rear view of a portion of a stocking at the tapered high splice area;

Fig. 24 is a much enlarged detail of certain of the loops in the tapered high splice area and indicating also the float threads, before the same have been severed;

Fig. 24^a is a detail showing a part only of the loops shown in Fig. 24 and indicating the fact that the float threads have been cut off extremely close to their terminal loops;

Fig. 24^b is a detail like the upper part of Fig. 23, but viewed from the inside of the stocking and also indicating the fact that

the float threads have been cut off extremely close to their terminal loops;

Fig. 25 is a perspective view indicating a characteristic group of jacks for certain of the heel-reenforcing needles, in accordance with one form of my invention;

Fig. 26 is a front elevation showing the position of certain of the jacks after passing the second jack cam on the first, second or third courses of a four cycle course;

Fig. 27 is a perspective view similar to Fig. 25 but showing the lateral formations of the jacks differently positioned from that shown in Fig. 25, the construction shown in Fig. 27 being in certain aspects the preferred embodiment of my invention;

Fig. 28 is a view similar to Fig. 26 but of a type or form of jack shown in Fig. 27;

Fig. 29 is a horizontal section taken through the needle cylinder showing certain of the jacks and their lateral formation according to that form of my invention shown in Fig. 25;

Fig. 30 is a view similar to Fig. 29 but of that form of my invention shown in Fig. 27;

Fig. 31 is a side elevation of a modified embodiment of my invention wherein the lateral formation is provided upon a part having the butt which engages the knitting cams.

Figs. 32, 33, 34 and 35 are details in elevation corresponding to Figs. 15, 17, 19 and 21 but of that embodiment of my invention shown in Fig. 27.

Fig. 36 is a front elevation of the so-called 104 gear but provided with two cams so as to form the tapered high splice or reenforced area in so-called two and one cycles;

Fig. 37 is a plan view of the third and fourth jack cams and their operating means in accordance with still another embodiment of my invention, when forming the tapered high splice or reenforcement in so-called three and one cycles;

Fig. 38 is a detail in rear elevation of one form of means for operating the cam shown in Fig. 32, when operating according to said three and one cycle;

Fig. 39 is an end elevation of the parts shown in Fig. 33;

Fig. 40 is a plan view of an embodiment of my invention wherein latch needles are employed;

Fig. 41 is a front elevation of the upper part of that embodiment of my invention shown in Fig. 40;

Fig. 42 is a detail in plan of a cam for acting upon the long butt needles;

Figs. 43 and 44 are end and side elevations of the construction shown in Fig. 42;

Fig. 45 is an inside view, partly in vertical section and partly in elevation, showing the latch ring, the yarn guide in relation thereto, the cam for acting upon the long butt needles, and the knitting cams;

Fig. 46 is a detail view in elevation representing a series of jacks as arranged when making a double pointed reenforcement;

Fig. 47 is a side elevation of a stocking having a double pointed or substantially **M** shaped tapered high splice;

Figs. 48 and 49 are rear elevations of a part of a stocking having a double pointed, substantially **M** shaped, tapered high splice, the outline of said two figures differing as hereinafter described;

Fig. 50 is a perspective view showing a series of jacks having their lateral projections all extending in the same direction.

My invention is an improvement upon the invention disclosed in the application of Robert H. Lawson Serial No. 613,853, filed January 20, 1923, now Patent No. 1,459,157, dated June 19, 1923.

My invention both as to mechanism and method relating, as it does, to circular knitting machines, may be applied to or embodied in various types of such machines, but I 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 is cylindrical and 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. I will, however, describe my invention as applied to a machine of the said type without in all respects limiting it thereto.

Generally speaking, the machine includes a rotating needle cylinder 1 mounted upon a suitable table 2 constituting a part of the frame of the machine, and as is customary in this type of machine, said cylinder is arranged to be rotated and reciprocated to form the tubular and the heel and toe portions respectively of the stocking.

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 requires no further description. A plurality of yarn feeding elements is provided at the usual position characteristic of the Banner machine, and one of said feeding elements is indicated at 3 in Fig. 1 in its feeding position. Desirably as many as four or five yarn guides may be mounted at the same place to introduce their yarns as called for by the controlling cam as for example, for the leg, the heel and toe, and the foot, etc. All of said yarn guides are shown as pivoted at 4 upon a partial ring 5, itself suitably pivoted so that it may be swung up out of action to afford access to the needles or for any other purpose. Said ring 5 is of the type usually employed in the Banner machine equipped with spring beard needles, and those forms of my invention shown in Figs. 1 to 30 with the exception

of 7^a, 9^a, 10^a and 11^a represent my invention as applied to a spring beard needle type of knitting machine. The other figures show certain changes incident to the adaptation of my invention to latch needle practice.

My invention is applicable to either spring beard needles or latch needles, and in the latter case a complete circle latch ring is desirably employed.

Each of the yarn guides thus far referred to is normally pressed or urged into action by one of a series of levers 6, certain of which are indicated in Figs. 1 and 4, as pivoted at 7 upon a standard 8 rising from the frame of the machine, each lever having attached to its outer or right hand end viewing Figs. 1 and 4 a coiled spring 9 connected at its lower end to a screw or pin 10 on the standard 8, thus tending to move each of the specified levers into operative position. Such movement of said levers into operative position is, however, at times overcome by a series of levers, one for each of said yarn guides. I have not indicated said series of levers, which may if desired be the same as those shown in the Hemphill Patent No. 933,443, but I have indicated at 11 a lever for operating a certain one of the group of yarn guides, it being pivoted at 12 upon the standard 8 or an extension thereof, and to the other end of said lever, as shown in Figs. 1 and 4, there is connected a link or wire 13 extending downward to and connected each to its proper lever 14 riding upon a suitable cam 15 on the cam shaft 16 in a manner not herein necessary to describe, as it is desirably similar to the construction shown in the said Hemphill patent. Assuming that there are four or five levers in the group referred to, it is evident that according to the dictates of the cams upon the disk or drum on the cam shaft 16, the said yarn guides are permitted to act at suitable times, as, for example, to supply a yarn or thread for the leg of the stocking, another for the heel, another for the foot, etc.

Each of the said yarn guides supplies its yarn or thread in proximity to the knitting point and each yarn so taken is knitted upon all the needles in action; that is to say, such of said yarn guides as are in action during the knitting of a tubular portion of the stocking feed their yarn or thread to the entire circle of needles, and when the heel or toe is being knitted, the yarn guide then in action introduces the yarn to all the active needles.

In addition to the usual yarn guides of the said group, I provide another and preferably longer yarn guide which I have indicated at 17 in Figs. 1, 4 and elsewhere, which is somewhat higher than the lowermost or feeding position of each of the other yarn guides of the said group. While said yarn guide 17 may be mounted at any suitable place and be constructed in any suitable manner, I desirably form it as a lever and mount it upon the said pivotal support 4 for the said group of yarn guides. Desirably said yarn guide 17 is longer than any others of the said group of yarn guides so that it may present its yarn—which is the reenforcing yarn—to the selected needles at a point somewhat removed from the knitting point, the construction and operation of parts being such that in the form of my invention contemplated in Fig. 1 and other figures indicating a knitting machine of the spring beard needle type, the said reenforcing yarn is received under the beards of the needles at substantially the point or level A in Fig. 12, but is not knitted until said needles approach or arrive at the knitting point where they receive the regular yarn. Thus at the knitting point the regular yarn and the reenforcing yarn are both knitted into the fabric.

The reenforcing yarn guide 17 in the disclosed embodiment of the invention has two positions only, namely, the feeding position and the inactive position which is that shown in full lines in Figs. 1 and 4. The active or feeding position namely, the down position is in this embodiment of the invention occupied during all circular work whether or not the reenforcing yarn is to be taken by the needles or any of them, and the inactive position shown in Figs. 1 and 4 is taken only during the knitting of the heel and toe, and is then occupied merely so that said yarn guide will not interfere with the idle or instep needles, and the needles added thereto during narrowing, which at such times occupy an elevated position. The said two positions of the reenforcing yarn guide 17 are given by the proper cam 15 on cam shaft 16 through the proper wire or link and the proper lever 14.

I am enabled to and preferably retain the reenforcing yarn guide 17 in the dotted line position indicated in Figs. 1 and 4 during all circular work whether or not the fabric is being reenforced, for the reason that the needles which take the reenforcing yarn rise as indicated at 18 in Fig. 12 for that purpose above the general level of the needles, indicated at 19. It will be observed that in the disclosed embodiment of the invention the active or feeding position of the reenforcing yarn guide 17 is higher than the feeding position of the regular yarn guide as indicated at 3 in Figs. 1 and 4.

In the disclosed embodiment of my invention the reenforcing yarn guide 17 is for the purpose of introducing the yarn to form the high splice, although obviously my invention may be employed in reenforcing other portions of the stocking or other fabric, or in any suitable way forming a reenforcing or contrasting zone or area in the fabric. The said yarn guide 17 is raised into the inactive position shown in Figs. 1 and 4 for and during the knitting of the heel and toe. Said

yarn guide is not thrown into action for increasing lengths of partial courses, but, as in the said Robert H. Lawson patent whenever thrown into action it is retained in action throughout the entire courses, and in fact is in its feeding position during the knitting of the entire stocking except the heel and toe—in the preferred embodiment of the invention.

The reenforcing or contrasting area may be of any suitable shape. Desirably such area is a tapering one, especially when a high splice is to be formed. For the formation of a tapered high splice, said reenforcing yarn guide or finger 17 is not acted upon by means to cause it to be in operative position or operation for a successively increasing period of time, so as to knit the triangular formation, but as in the said Lawson patent a variable number of needles are in successive courses presented to the fixed-position reenforcing yarn guide.

In order to present a variable number of needles to the yarn guide 17 I desirably provide for each of the needles that is at any time to take the reenforcing yarn, an instrumentality in the nature of a jack. Such jack is, as broadly disclosed in said Lawson patent, distinct from but adapted to move independent of its needle and also with its needle to move the latter. Said jacks, a series of which are indicated at 20 in Fig. 12 and at 20′, Fig. 13, are desirably placed in the needle grooves of the desired number of needles below the latter. I have herein represented said jacks as positioned in a semi-circle beneath all the short butt needles, or in other words, beneath all the heel needles. Thus only the instep needles are unprovided with jacks.

As broadly disclosed in the said Robert H. Lawson patent, the jacks are provided with interengaging formations, most of the jacks being provided with lateral projections for effecting interengagement between neighboring jacks. Such lateral interengagement as clearly disclosed in the said Robert Lawson patent is here provided to permit and effect the presentation of a varying number of needles to the reenforcing yarn guide. While for the best accomplishment of the desired result lateral formations or interengaging provisions are formed upon jacks or instrumentalities separate from the needles and having movement in the machine separate from the needle mechanism, my invention is not restricted to the use or employment of interengaging formations or lateral formations upon jacks or instrumentalities separate and distinct from the needles and having movement independent and distinct from the needles. In certain cases I may, if desired, have the lateral formations or interengaging provisions upon the needle stems themselves or upon integral extensions of the needles or upon jacks or extensions connected to the needles while the same are in the machine. This latter is not the preferred construction but may under certain conditions be employed and is represented in Fig. 31 which will be more fully referred to. It is noted that the needles employed in the machine may be without needle operating jacks detachably attached thereto, and hence adapted to be removed therefrom when not in the machine, or they may be of a type where the operating butt of the needle is formed integrally with the needle shank instead of upon a jack attached to the needle. I will describe one embodiment of means for practising my invention and will refer to an operation thereof whereby a tapered high splice is formed upon a stocking, the stocking being commenced at the top of the leg and the high splice reenforcement being commenced upon a small number of needles at the back median line of the stocking at some suitable point above the commencement of the heel.

While the tapered high splice or other contrasting area or formation may be commenced (or terminated) upon any desired number of needles, I have herein indicated it as commencing upon four needles which I have indicated as a group in Fig. 12. Assuming as is the preferred construction that the interengaging formations hereinbefore referred to are upon jacks or like instrumentalities having movement distinct from the needle movement, and referring to that embodiment of my invention shown in Fig. 25, I provide four jacks indicated at 21, 22, 23, 24, and in Fig. 27, showing another and in certain aspects the preferred embodiment of my invention, I provide four jacks 21′, 22′, 23′, 24′.

In Fig. 25 the said four jacks are provided with butts 25, 26, 27, 28, but are not provided with lateral projections or formations for interengagement with any other jacks. Desirably the upper ends of said jacks are enlarged in a direction from front to rear thereof, as indicated at 29, 30, 31, 32, to prevent all liability of danger of upward movement of said jacks into engagement with their needles causing said needles to tilt in their grooves, as might be the case if said jacks were of the same extent from front to rear throughout and especially if they were of reduced extent at their upper ends. In the construction shown, the two outermost jacks 21, 24, constitute key jacks and as stated any desired number of jacks may be interposed between the key jacks.

It will be observed that the butts 25, 26, 27, 28 of the four central jacks are long butts, said jacks in this particular having the same characteristics as the key jack or jacks of the said Robert Lawson patent.

In that form of the invention shown in Fig. 25, I have at the left of the key jack 21

shown a jack 33, the upper end of which (and the same is preferably true of all the jacks employed) is enlarged and which is provided near its lower end with a butt 34. Next beyond the jack 33 at the left is a jack 35 having a butt 36, and under each of the other reenforcing needles to the left of the needle under which is positioned jack 35, is positioned a jack desirably a duplicate of the jacks 33, 35. At the right of the key jack 24 is positioned a jack 37 having a butt 38 and to the right of the jack 37 is positioned a jack 39 having a butt 40, and under each of the reenforcing needles to the right of the jack 39 is positioned a jack desirably identical with the jacks 37 and 39.

It will be observed that the butts of the jacks 33, 35, 37, 39 are short, and in this respect said jacks are similar to the disclosure in the said Lawson patent.

Each of the jacks 33, 35 has a lateral projection 41, 42, the former being adapted to be engaged by the butt 25 of the jack 21 and the latter being adapted to be engaged by the butt 34 of the jack 33. Similarly, the jacks 37, 39 are provided with lateral projections 43, 44 adapted to be engaged respectively by the butts 28, 38 of the jacks 24, 37. Instead of being formed as shown in the said Lawson patent, the lateral projections are desirably formed by bending an ear or enlargement into a position at nearly right angles to a face of its jack and in such manner as to provide a horizontal or flat under surface 45 upon each of said lateral formations. In the said Lawson patent each lateral projetcion is adapted to engage a lateral projection upon the next jack, but the respective lateral projections adapted for engagement upon adjacent jacks are relatively far apart and the upper lateral formations in said Lawson patent are relatively near the upper end of the jack.

In the construction shown in Fig. 25, it will be observed that the lateral projections or formations are relatively close to the lower ends of the jacks, although they are above the butts. Such lower position of said lateral formations is advantageous in that they are in all positions of said jacks below the spring band 46 shown in Figs. 2, 4 and elsewhere as surrounding the needle cylinder. Thus there is no liability of said lateral projections encountering the spring band in movements of the jack.

In the other and in some respects preferred construction shown in Fig. 27, wherein the corresponding parts are in all cases indicated by the same numerals with a prime, it will be observed that the lateral projections 41′, 42′, 43′, 44′, are formed below the butts 34′, 36′, 38′, 40′. Preferably said lateral projections are formed at the extreme lower ends of said jacks and are formed by a bending operation as in Fig. 25. As in Fig. 25, the butts 34′, 36′, 38′ and 40′ are short whereas the butts of the jacks 21′, 22′, 23′, 24′ are long, as indicated at 25′, 26′, 27′, 28′. In this case, however, the two jacks 21′, 24′ of the series of four central jacks are themselves provided with lateral projections or formations, 47, 48, to take under the short butts 34′, 38′ respectively of the jacks 33′, 37′. This construction is provided because of the fact that the impulse of movement as between any two adjacent or neighboring jacks comes from the lateral formation in the form of the invention shown in Fig. 27, instead of from the butt as in the form of the invention shown in Fig. 25.

The form of the invention shown in Fig. 27, is further desirable in that essentially all tendency of accidental disengagement in operation as between adjacent interengaging jacks is eliminated, and for reasons which I will now fully explain.

Referring first to that form of the invention shown in Fig. 25, it will be understood that all the butts at times ride upon the jack cams and in so doing, there is or may be a tendency of the upper edge of the jack cam which may have an inclination in excess of thirty degrees, to twist the jack very slightly so that there might in some cases be a separation of the butt of an elevating jack from the lateral projection of the next jack which it is lifting. In the case of the construction shown in Fig. 27, however, the lateral pressure of the edge of a jack cam upon a butt would tend to bring the lateral projection of that jack into even more effective relation with the butt of the next jack which it is lifting. In certain cases it may be desirable to have all the lateral projections extending all in the same direction instead of respectively to the left and to the right of the key jack, as in Figs. 25 and 27, and such construction is within the scope of my invention, as shown at 46′ in Fig. 50, wherein the jacks are indicated at 46″. Such direction of the lateral projections in such case is such that the lateral pressure of the jack cam tends to bring the lateral projection into more effective engagement with the adjacent or neighboring jack butt.

Obviously if I wish to provide a vertical stripe above the tapered high splice I provide more than four central jacks with long butts, but the illustrated arrangement has been selected merely for purposes of explanation. If a stripe whether long or short be provided, all the needles participating in the formation of such stripe will be provided with long butts, as disclosed in the said Lawson patent.

Assuming for purposes of description merley, and not as a limitation, that the tapered high splice or other reenforcement or contrasting area is commenced upon four needles as represented at 18 in Fig. 12, it will be clear that upon the first course whereon the reenforcing thread 49 is taken by the four needles as represented in Fig. 24, four loops

50, 51, 52 and 53 are formed from both the main yarn 54 and the reenforcing yarn 49, and the reenforcing yarn is floated back as indicated at 55, under control of the tension devices and lies close against the inner face of the fabric as clearly indicated in said Fig. 24.

Within the scope of my invention the angle of taper may be varied as desired. For example, I may upon two successive courses supply the reenforcing yarn 49 to the same number of needles, as, for example, four, and upon the third course supply said reenforcing yarn to one additional needle at each side of said four needles and repeat this operation throughout the formation of the reenforcement. Or if desired I may supply the minimum number of needles, herein four, with the reenforcing yarn for three courses and then upon the fourth course and for two following courses supply said reenforcing yarn to an additional needle at each side of said four needles and repeat such operation. Or—and this is the construction shown in Fig. 24—I may supply the reenforcing yarn to the minimum number of needles for four successive courses and then to an additional needle at each side of said four needles for the next four courses and so on throughout repeated cycles. While I have stated that the reenforcing yarn may be fed to an additional needle at each side of the initially receiving needles, I do not limit myself to introducing the yarn to a single additional needle at each side of the initially receiving needle, but this is the preferred operation since the most effective line is thus secured at the meeting edges of the reenforcing area and the non-reenforced portion of the stocking.

After the stocking, which is indicated at 56 in Fig. 22, has been completed, I cut out the float threads. This practice is, of course, old in itself. Heretofore so far as I am aware, it has been necessary to sever the float threads at a substantial distance from their terminal loops, as otherwise the severed ends pull back into the loops and unravel. Expedients have been resorted to for the purpose of overcoming this difficulty, such, for example, as tightening marginal loops, so that the severed ends cannot readily pull through them. This practice is objectionable, as it requires attachments or special parts for that purpose.

In the course of my experiments, I have discovered that where a large number of float threads all terminate in the same two wales or substantially the same two wales, upon longitudinal pull or even upon lateral pull of the fabric the severed ends of the float threads readily draw into the terminal loops and unravel. Where, however, the terminal loops are spread over a relatively large number of wales as indicated for example at 57 in Fig. 22, and at 57 and 58 in Fig. 23, the tendency of the severed ends to pull through the loop is much lessened and in fact it lessens in substantially the degree of accuracy with which the terminal loops are distributed accurately along increasingly separated wales. Thus where means are provided for very accurately determining the wales along which the terminal loops of the reenforcing yarn exists, there is a lessened tendency of the severed ends of the float thread to pull into their terminal loops and to unravel, and therefore I am enabled, as it were, to shave the float threads at the terminal loops themselves, that is, to sever them at the very throats of the loops and to leave an exposed end not exceeding substantially in length the diameter of the yarn itself or the width of the throat. This structure I have indicated but without attempting to show it in proper proportion in Figs. 24ª and 24ᵇ.

In the said Robert H. Lawson patent there are disclosed two cams for controlling the manipulation of the jacks whereby the preparatory movement is imparted thereto for presenting a varying number of needles to the reenforcing yarn guide. In the present embodiment of my invention, four cams are disclosed for this general purpose, and said cams are operated in accordance with the cycles of presentation of the reenforcing yarn to the same identical needles without increase. In this application, I have disclosed what I term a four and one cycle, a two and one cycle, and a three and one cycle, but in the main figures of the application, I have disclosed a four and one cycle, and as stated, the fabric resulting therefrom is shown in Fig. 24. I will therefore describe the said cams and the manipulation thereof first when operating according to the four and one cycle, and then briefly refer to the operation thereof in accordance with the two and one and three and one cycles.

I have already stated that the reenforcing yarn guide 17 desirably occupies in its feeding position a somewhat higher position than the feeding position of the main yarn guide. It is therefore not essential that the long butt needles, none of which is to take reenforcing yarn, should be moved downward out of the possible range of the reenforcing yarn, but I may employ a cam of any suitable type to act upon the long butt needles just prior to that point in the cam ring where selected needles of the short butt series take the reenforcing yarn. Such a cam if employed may have a fixed inner position or it may be moved inward into active position or outward into inactive position. I have chosen to represent a cam having two radial positions and have controlled the same from a suitable cam upon the pattern drum.

In the several figures, and including Figs. 1, 4, 12 and 13, I have represented such cam at 60, and have positioned the same at such a point and have so constructed the same that the long butt needles are engaged thereby

and drawn down before they reach that portion of the cam ring where a variable number of needles are raised to take the reenforcing yarn. In Fig. 12, a series of long butt needles are shown as included within the bracket 61.

Said cam 60 is desirably mounted in a bracket 62 and is provided with a stem 63 to which is pivotally connected at 64 a bell crank lever 65 pivoted at 66 and itself pivotally connected at 67 to a link 68 having its lower end pivotally connected at 69 to a lever 70 pivoted at 71 and itself connected at 72 to a downwardly extending link 73. The link 73 at its lower end is connected to an arm 74 of a lever 75 pivoted at 76 and having a second arm 77 to which is connected at 78 a link 79.

The end of the lever arm 74 is adapted to ride upon a cam 80 upon the cam drum. Said cam is properly proportioned and shaped so that when the end of the lever arm 74 drops off the end of the cam 80, the said cam 60 is moved inward into position to act upon the butts of the long butt needles and direct them downward beyond any possibility of taking the reenforcing yarn. When the said cam 60 is in its outer position, as it is when the lever arm 74 rides on the cam 80, the long butt needles are not acted upon by the said cam and follow their usual course.

It is however not essential that the cam 60 be employed, but assuming that it be employed and is movable, it is thrown into its inner active position just before the minimum number of needles are presented to the reenforcing yarn guide as illustrated in Fig. 12.

As a preliminary to the presentation of the selected minimum number of needles to the reenforcing yarn guide, the jack cams are positioned as will now be described, reference now being made to Figs. 14 to 21 inclusive to show the steps in the movements of the jacks in a typical course or courses of a cycle of courses, and to Figs. 6, 7, 9, 10 and 11 and others to show the means for moving the said jack cams.

Surrounding the needle cylinder beneath the knitting cams and the narrowing and widening pickers, (the needle cylinder being sufficiently elongated for the purpose), are provided four jack controlling cams 81, 82, 83, 84 shaped as clearly shown in the figures referred to. At or just prior to the commencement of the first course of the first cycle of courses in the reenforcement, the said cams 81, 82, 83, 84, are moved by means which will be hereinafter described into the position shown in Figs. 14, 16 and 18. In said figures, the cams 81, 82, 83, are all in their inner or functioning position. Assuming the needle cylinder to be turned in the usual direction for rotary knitting, namely, in a counter-clockwise direction, as indicated by the arrows in the said figures,—upon the commencement of the said course in question, the four jacks which are the jacks 21, 22, 23, 24, of Fig. 25, or the jacks 21′, 22′, 23′, 24′, of Fig. 27, ride up the inclined edge 85 of the cam 81 as clearly indicated at Fig. 15, and in so doing, because of the interengaging formations, hereinbefore fully described, the first and fourth of said jacks will each commence to elevate a needle to the left and right thereof respectively. In Fig. 15 the jack 21 is shown as having already slightly elevated the jack to the left, namely, the jack 33 of Fig. 25 or the jack 33′ of Fig. 27.

Only the four long butt jacks 21, 22, 23, 24, ride up the edge 85 of the cam 81 at this time, all the short butt jacks riding inside of said cam as clearly indicated in Fig. 14. The said four long butt jacks, in the continued movement of the needle cylinder, next ride up the inclined surface 86 of the second jack-controlling cam 82 as indicated in Figs. 16 and 17, and in doing so the said first and fourth jacks 21, 24, of the four long butt jacks have further carried up one left and one right hand short butt jack, namely, the first left hand short butt jack which is 33 of Fig. 25 or 33′ of Fig. 27, and the first right hand short butt jack, which is the jack 37 of Fig. 25, or the jack 37′ of Fig. 27. Incidentally, and as shown in Fig. 17, said jacks 33 and 37 have themselves slightly lifted respectively the jacks 35 and 39, but this is immaterial and is an incident merely of the distance measured lengthwise of adjacent jacks between their interengaging formations. In fact when the jacks in question have actually passed the cam 82, the full elevation of the four jacks 21, 22, 23, 24 and the partial elevation of other jacks will be as represented in Figs. 26 and 28. That is to say, the jack 21 will have elevated the jack 33 partially, that jack will have partially elevated the jack 35, and that in turn will have slightly elevated still another jack which I have indicated at 35^a in Fig. 26. Also the jack 24 will have partially elevated the jack 37, which in turn will have partially elevated the jack 39 and that in turn will have slightly elevated the jack 39^a. In Fig. 28, the corresponding jacks are indicated by the same numerals as in Fig. 26 but with a prime.

Thus, after passing the cam 82 there are four stages of elevation of jack butts or jacks all above the lowermost level. The fourth or lowest of said elevations is also immaterial, but happens merely because of the distance measured lengthwise of the jacks, between the interengaging formations. Upon further movement of rotation of the needle cylinder, the jacks in question are brought to the third jack-controlling cam, namely, the cam 83 as indicated in Figs. 18 and 19. The four jacks 21, 22, 23, 24, ride above the edge 87 of the cam 83, it being noted that said edge is par-

tially cut away as indicated at 88. All the partially elevated butts ride along the under surface 89 of the cam 83 as indicated in Fig. 19 and are thus brought down to the lowermost level as indicated at 90 in Fig. 19. The result of the operations upon the jacks during this first course has therefore been the complete elevation of the four jacks 21, 22, 23, 24, the needles corresponding to which have therefore all taken the reenforcing yarn. No other needle has, however, taken the reenforcing yarn, nor will any other needle do so until after four courses have been completed as shown in Fig. 24.

The cam 81, the function of which is initially to act upon the four long butt jacks, has now completed its function, but may be and desirably is left in its inner active position for simplicity of operation.

Still referring to the four and one cycle, the second course thereof is a repetition in every way of the first course and the third course is a repetition of the first and second courses.

At the commencement of the fourth course, the cam 83 is moved outward into the inactive position represented in Fig. 20, and the cam 84 is moved into active position as indicated in said figure.

Therefore upon this course the cam 84 whose inner end 91 is partially cut away as indicated at 92 will engage the butts which are at the second of said elevations, namely, at the level 93 indicated in Fig. 21 (the cam 83 which is there shown in outline, being out, and the cam 84, shown with hatched lines, being in), and draw them all down to the lowermost level and they in so doing will draw down all the others proportionately, excepting the two central jacks 22, 23. While this leaves only two jacks,—namely, 22 and 23 entirely elevated, it leaves two more jacks at the third elevation, namely, 21 and 24, and two more jacks at the second elevation, namely, 33 and 27, and therefore there are six jacks which are so positioned that their needles will be elevated to receive the reenforcing yarn upon the fifth course, which will be the first course of the second cycle.

Therefore commencing with the fifth course there is a second cycle of four courses during each of which six needles receive the reenforcing yarn, and then in succession follow other cycles for each of which there are two additional needles, one at each end of the series.

I will now describe the means for operating the four jack cams 81, 82, 83, 84.

Each of the jack-controlling cams 81, 82, 83, 84 is desirably controlled from the pattern drum. While any suitable means may be provided for the purpose, I will describe the preferred embodiment of means without limiting myself thereto.

The cams 81 and 82, being the first and the second of the jack-controlling cams and which are herein respectively located at the back and at the front of the machine, are operated together as follows:

The cam 81 is provided with a stem 94 received in a housing or bracket 95 for sliding movement, and at its outer end is connected by a pin and slot connection 96 with a lever 97 pivoted at 98 upon the framing, and pivotally connected at 99 with the link 100 extending downwardly at the rear of the machine as indicated most clearly in Fig. 2. At its lower end it is pivotally connected at 101 to the arm 102 of a lever 103 pivoted at 104 to the framing and having an arm 105 whose free end 106 is adapted to ride on a suitable cam or cams, such, for example, as the cam 107 upon the pattern drum. When the lever end 106 is supported upon a cam such as 107, the cam 81 will be moved into its innermost or active position represented in Figs. 14, 16 and 18, but at other times the cam will be in its outer or inactive position.

The cam 82, which is the second jack controlling cam, is, as shown in Fig. 11, provided with a stem 108 mounted in a bracket 109 for sliding movement and operatively connected at its outer end with a lever arm 110 pivoted at 111. The co-acting lever arm 112 is pivotally connected at 113 to a rod or link 114, which, as shown most clearly in Fig. 2, extends downwardly and at its lower end is connected at 115 to the lever arm 105. Thus, the elevation of the lever arm 105 by the cam 107 moves the cam 82 into its innermost or active position.

The third and fourth of the jack controlling cams, namely, the cams 83 and 84, are the cams which determine the character of the cycle, that is, whether they are to be two and one, three and one, four and one, etc. I therefore provide means not only whereby the length of each of the cycles is determined but whereby the period of commencement of the first cycle and also that of the termination of the last cycle are determined. For that purpose, I have here described the following means.

Upon the so-called "104 gear" of the Banner machine, which I have indicated at 116 in the several figures, and which rotates once to four revolutions of the needle cylinder, I have provided a cam 117 occupying as shown in Fig. 2 substantially three quarters of the complete circle. I have provided means which is adapted to be brought at the commencement of the first cycle within the path or influence of the cam 117, but which at other times is held elevated above said path and is therefore not influenced thereby. When within said path, the cam 117 acts to maintain the jack controlling cam 83 (the third jack controlling cam) in its inner or active position, but when the gap in said cam 117 is reached, the said cam 83 is moved into its outer or in-

active position for a single course only, and is then returned to its active position to commence the next cycle. For this purpose the following mechanism is shown.

The link 79 heretofore referred to and shown most clearly in Fig. 2 is connected at its upper end by a slot 118 therein and a pin 119 to the arm 120 of a lever 121 pivoted at 122 upon the framing and having an arm 123 which at its upper end as shown most clearly in Fig. 6 is adapted to ride against the inclined end 124 of an arm 125 of the lever 126 pivoted at 127 upon the bed plate and having an arm 128 provided with a slot 129 at its inner end receiving a pin 130 upon the arm 131 of a lever 132 pivoted at 133 upon the housing 134 wherein are received for sliding movement the jack-controlling cams 83, 84. The lever arm 131 is itself provided with a slot 135 receiving a pin 136 in the jack-controlling cam 84. Said lever 132 has a second arm 137 provided with a slot 138 receiving a pin 139 in the jack-controlling cam 83. A coiled or other spring 140 is connected to the lever arm 125 and to a fixed point 141 upon the framing and serves to hold the inclined portion 124 of said lever arm against the lever arm 123. The construction and arrangement of parts are such that when the cam 83 is in its inner or active position, the cam 84 is in its outer or inactive position, and vice versa.

The lever 121 has a third arm 142 shown most clearly in Figs. 2 and 7 as provided with a roll 143 adapted to ride upon the outer edge of the cam 117 or to drop into the space between the ends of said cam so as in the first position to move said cam 83 into active position, and in the second position to move the cam 84 into active position.

The slot 118 is provided to permit the described rocking movement of the lever 121 through the presence or absence of the cam 117, without necessary movement of the link 79. When, however, said link 79 is moved downward as occurs when its inner end 74 rides upon a cam therefor upon the pattern drum, the arm 123 of the lever 121 will be moved outward. This will move the third jack-controlling cam 83 inward, but this is immaterial if and when all the cycles incident to the reenforcement are terminated.

The construction of parts shown in Figs. 7, 9, 10 and 11 is that existing in spring needle practice, as it is necessary to position the cams 81, 82, 83, 84 considerably lower than they are positioned in latch needle practice. This is due to the fact that the yarn must be presented to the spring beard needles below their beards, and therefore at a lower point than in latch needle practice. In latch needle practice, the said cams are supported somewhat higher and the proper position therefor is shown in Figs. 7^a, 9^a, 10^a, and 11^a, wherein the same numerals are employed, with the exception that the housing for cam 81 is indicated in Fig. 9 at 95′, that for cam 82 is indicated in Fig. 11 at 109′, and that for cams 83, 84, is indicated in Fig. 7 at 134′.

While I have stated that the reenforcing yarn guide 17 occupies its dotted line or feeding position during all circular work, it is to be noted that in certain cases, for example, where imitation narrowing marks are produced by tuck stitches, it is desirable to keep said reenforcing yarn guide elevated, as otherwise it might interfere with the needles upon which the imitation narrowing marks are made. To this end, the cam which controls said reenforcing yarn guide 17 may be suitably shaped.

The instep cams for the machine are indicated at 144, 145 in Figs. 1, 12 and 13. Viewing Figs. 12 and 13, it will be observed that the upper edge 146 of the needle butt receiving ledge of the cam ring is located slightly lower—desirably about a quarter of an inch—than heretofore, so that the position of the instep cam 145 is such that the short butt needles pass along said ledge 146 below the level of the top of said instep cam 145, but the long butt or instep needles, when they reach said cam 145, ride up the same and are thereafter depressed by the cam 60.

In Fig. 36, I have represented the so-called "104 gear" 116^a as provided with two cams 147, 148 spaced apart substantially as indicated to provide gaps 149, 150. Inasmuch as said gear 116^a rotates once for four rotations of the needle cylinder, it will be evident that the roll (not shown) adapted to ride upon said cams 147, 148, will continue thereon long enough to shift the jack controlling cams 83, 84 at such times as to produce what I have described as two and one cycles, namely, cycles wherein the reenforcing yarn is fed to the same identical needles for two courses only, and then is fed to a greater number of needles,—desirably one needle more at each end of the series. In such arrangement the said roll will ride, for example, upon the cam 147 during one course of a cycle and then will ride in the gap 150 during which time the shift in the cams 83, 84 will be made, but during that course the same number of needles will be elevated as before described. Then the said roll will ride upon the cam 148 and thereby the number of needles presented to the reenforcing yarn will be increased by two, one at each end of the series, and the roll will then ride into the gap 149, and while riding there the yarn will be supplied to the same increased number of needles, thereby completing the second course. Thereafter the number of needles will be augmented in the succeeding courses as hereinbefore described.

In Figs. 37, 38 and 39 I have represented one form of means for forming the reenforcing area by so-called three and one cycles,

namely those wherein the reenforcing yarn is supplied to the same identical needles for three courses, then to an increased number of needles for the next three courses, and so on. In such construction, inasmuch as the so-called "104 gear" makes one revolution to four revolutions of the needle cylinder, it is necessary to provide special mechanism to secure the proper timing of the parts. This result I have in the present instance secured in the following manner.

The so-called "104 gear" is indicated in said figures at 116^b and as usual it has connected thereto the crank stud 151 from which extends the crank arm 152 for operating the usual quadrant 153 by connections not herein necessary to show. The crank stud 151 has an extension to receive loosely a hub 154 having extending therefrom an arm 155 from which laterally extends a stud 156 supported for rotation in the framing, and the axis of which coincides with the axis of the so-called "104 gear" 116^b. Fast upon the stud 156 is a pinion 157 which rotates coaxially with the gear 116^b, but at such a speed as to provide the three and one cycle referred to. The pinion 157 meshes with the pinion 158 upon a stud 159 on the framing, said stud having a cam 160 upon its face which periodically engages and moves the arm 161 of a lever 162 pivoted at 163 upon a bracket 164. The upper arm 165 of said lever is received in a slotted lateral extension 166 of a lever 167 pivoted at 168 upon the bed plate so that as the cam 160 moves the lever 167, the latter shifts the cams 83, 84,—the third and fourth jack-controlling cams. The said cams are mounted as in the first disclosed embodiment of my invention and are here shown as oppositely moved through the medium of a lever 169, pivoted at 170, and connected by a pin and slot connection 171 to the cam 83 and through a pin and slot connection 172 to the cam 84. The levers 169 and 167 are connected by pin and slot 173.

In this or in any other suitable manner I provide for three and one cycles in the reenforcement. Any cycles in excess of four and one are made through suitable timing of the parts and it will be here unnecessary to refer to the same more fully, but they are all comprehended within the scope of my invention.

In Figs. 40 to 45 I have represented an embodiment of my invention wherein latch needles are employed. Except as hereinafter stated, the construction of parts is the same as for the spring beard needle embodiment of my invention, it being noted that the four jack-controlling cams are in this embodiment of my invention supported somewhat higher than in spring beard needle practice, as has been explained in connection with Figs. 7′, 9′, 10′ and 11′. Instead of employing an open ring for supporting the yarn guides, I employ a latch ring 174 pivoted in the manner characteristic of Banner machines upon an arm 175 represented in Fig. 40 as supported in a standard 176. In a lateral extension of said latch ring, upon a pivotal pin 17 are supported a series of yarn guides 178 in the usual manner, so as to operate in the opening 179 of said ring.

I provide means whereby the reenforcing yarn may be introduced to the needles so as to produce any of the reenforcements hereinbefore referred to,—that is, in accordance with two and one, three and one, four and one cycles, etc. To this end, I provide an elongated reenforcing yarn guide which I have indicated at 180 as pivoted co-axially with the other yarn guides at 177 and adapted to swing into a recess 181 in the upper edge of the latch ring 174. Said recess is of sufficient depth to permit the reenforcing yarn to be supplied through the eye 182, so as to be taken by that variable number of needles that are presented thereto in accordance with the foregoing description. Inasmuch as said variable number of needles are elevated to take the reenforcing yarn, it is evident that the eye 182 may in its feeding position be higher than the feeding position of the usual yarn guides 178.

Each of the usual yarn guides is normally pressed down into action in the usual manner and is lifted therefrom in the usual manner. The reenforcing yarn guide 180, which is shown in its inactive position in full lines in Fig. 41, is normally pressed downward into feeding position by a coiled spring 183 against the tendency of a lever 184, the end 185 of which acts against a cam 186 on the under side of said reenforcing guide 180. Said lever 184 is pivoted at 187 upon an extension 188 of the standard 189. At its outer end said lever 184 is pivotally connected at 190 to a downwardly extending link 191 having connected at its lower end a lever riding upon a suitable cam upon the pattern drum, so that said reenforcing yarn guide 180 may be lifted into inoperative position at desired times, as, for example, during the formation of the heel and toe, so as to be at such times out of the way of the elevated idle needles.

If desired, I may provide means for moving downwardly the instep or long butt needles inasmuch as the reenforcing yarn is presented only to short butt needles in the disclosed embodiment of my invention. While for this purpose any suitable means may be provided, I have herein represented in Figs. 41 to 45 a cam 192 shaped as shown most clearly in Figs. 42, 43 and 44. Said cam, which corresponds in function to the cam 60 of the first disclosed embodiment of my invention, is mounted for movement to an upper inactive level or to a lower active level, instead of being mounted for radial movement, as in

the case of the said cam 60. The cam 192 is connected by means of its stem 193 with the slide 194 adapted to be moved up and down in the bracket 195. To this end the bracket is provided with a vertical slot 196, and said slide with a pin 197 extending through said slot 196 and also through a slot 198 in the arm of a lever 199 pivoted at 200 upon the bracket 195 and having at its outer end at 201 a pivotal connection to a downwardly extending link 202. Said link at its lower end is provided with a lever adapted to ride upon a suitable cam on the pattern drum, so that the cam 192 may be thrown into position to engage the long butt needles moving toward it in the direction of the arrow in Fig. 43 prior to the commencement of the reenforcing area.

To avoid all possibility of interference between the first narrowing picker in the contra-clockwise direction of movement of the needle cylinder, and the said long butt needles, I provide means to give a slight upward swinging movement at the proper time to said narrowing picker—namely, at the time when the reenforcing yarn guide 180 is permitted to move downward into feeding position. For this purpose any suitable means may be provided, but I have represented the link 191 as having fast thereon a collar 203 adapted upon upward movement of said link to engage the arm 204 of a lever 205 pivoted at 206 and having an arm 207 with a beveled end adapted to engage a lateral pin 208 upon said narrowing picker, so as to swing the latter slightly upward, thus avoiding the long butt needles.

I have previously stated that while I prefer to have the interengaging formations upon jacks or instrumentalities separate from the needles and having preparatory movement independent of the needle movement, I may in certain cases provide the interengaging formations upon the needle stems or upon integral extensions of the needles or upon jacks or extensions connected to the needles. It is unnecessary to illustrate all of said alternative but less preferred constructions. One of such alternative constructions is shown in Fig. 31 wherein a needle of any suitable type is represented at 209, it being here shown as of the spring beard type. Operatively connected thereto so as to move to and fro therewith at all times when in the machine, I provide a jack such as shown at 210 and in addition to its butt 211 which engages the knitting cams I provide a butt 212 which may be like any of the butts shown in Fig. 25 or in Fig. 27. In addition to such butt 212 I provide a lateral projections 213 which is shown like those in Fig. 27, but which may be like those shown in Fig. 25. In other words, the structure shown in Fig. 31 may be of the type shown in Fig. 25 or the type shown in Fig. 27, and in either case the jack 210 may if desired be integral with the needle 209 or may be formed not as a jack, but as an integral continuation of the needle 209 below the butt thereof which engages the knitting cams.

None of these constructions is as desirable or efficient as the constructions shown in Figs. 25 and 27.

In Figs. 32 to 35 inclusive I have represented parts corresponding to those shown respectively in Figs. 15, 17, 19 and 21, but have shown the jacks constructed as in Fig. 27 instead of as in Fig. 25. Accordingly the numerals applied in said Figs. 32, 33, 34 and 35 are the same as those in Figs. 15, 17, 19 and 21, excepting that numerals pertaining to Fig. 27 are used instead of numerals pertaining to Fig. 25.

I have stated that the construction shown in Figs. 7^a, 9^a, 10^a and 11^a is employed where latch needles are used. Such construction is also desirably used in spring needle practice where the lateral projections upon the butts are of the type shown in Fig. 27.

Referring to Fig. 27 as well as to Fig. 25, it is pointed out that the lateral projections are not bent abruptly at right angles but are bent upon a curve as shown in Figs. 29 and 30, so as not to interfere among themselves. This is very evident from Fig. 30.

I have described means whereby a tapered reenforcement or area is provided, such reenforcement being in the form of an inverted V. Within the scope of my invention, the reenforcement may be of other forms. For example, as shown in Figs. 47, 48, and 49, instead of being of a triangular form, it may be in a form having a double point directed upwardly, thus being approximately of the shape of the capital letter M as shown most clearly in Figs. 48 and 49. In such case the reenforcement as indicated at 213^a in Fig. 48, and at 213^b in Fig. 49, is commenced at two considerably spaced points representing the tops of the inner or inclined lines 213^c, Fig. 48, and 213^d, Fig. 49, of the letter M. The control of the jacks is such that the reenforcement is broadened out at the inner edges only and is continued until said edges meet. Desirably the outer edges of the two parts of the area are along parallel lines as indicated at 213^e, though within the scope of the invention those outer lines may diverge from each other, as indicated at 213^f. In the construction referred to, however, the reenforced areas are two triangles, as shown in Figs. 48 and 49, each having a vertical side and an inclined side, which inclined sides meet or desirably meet at the bases of said triangles. It will be understood that in Fig. 48 the lines 213^e are parallel, but merely appear distended because the fabric is laid down flatwise. In other words, said triangles are desirably right angled triangles and are turned toward each other. In order to make such a reenforcement, I employ jacks of the type shown either in Fig. 25 or in Fig. 27. In Fig. 46, I have

represented a series of jacks representing or corresponding to all the short butt needles. The outermost jack at the left indicated at 214 is provided with a butt 215, and may or may not be provided with a lateral projection. The same is true of the jack 216 at the right of the entire series, it being shown with a butt 217. Between the jacks 216 and 214 one half the jacks, namely, those nearest the jack 214, are provided with lateral projections 218 extending toward the right viewing said figure, and the remaining jacks are provided with lateral projections 219 extending toward the left in said figure. Therefore one half said jacks have lateral projections extending toward the right, and the other half have lateral projections extending toward the left, each lateral projection taking under the butt of the companion jack to the right or the left respectively, or if the type of jack shown in Fig. 25 be employed, the interengaging formations are of the character shown in said figure instead. In either case, however, one half the jacks in a consecutive series have lateral projections extending toward the right, and the other half have lateral projections extending toward the left. In this manner the jacks, which are desirably manipulated by the four cams 81, 82, 83, 84 form a reenforced area having the shape of a capital letter M.

Other shapes of reenforcement may be formed within the scope of my invention.

Having thus described certain illustrative embodiments of my invention and the best modes known to me for practicing the same, I 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. As a new article of manufacture, a jack for imparting movement to a knitting needle of the so-called "independent" type, said jack being distinct from but adapted to move independent of its needle, and also with its needle to move the latter, said jack having a butt lying in its own plane for temporary interengagement with a companion but independently movable jack for movement by said companion jack and also having a lateral projection adapted for interengagement with a second companion jack at the opposite side to impart movement to the latter.

2. As a new article of manufacture, a jack for imparting movement to a knitting needle of the so-called "independent" type, said jack being distinct from but adapted to move independent of its needle, and also with its needle to move the latter, said jack having a butt lying in its own plane for temporary interengagement with a companion jack whereby it is itself lifted by said companion jack and having near said butt a lateral projection adapted for interengagement with a second companion jack but at the other side thereof, whereby one of said jacks lifts the others.

3. As a new article of manufacture, a jack for imparting movement to a knitting needle of the so-called "independent" type, said jack being distinct from but adapted to move independent of its needle, and also with its needle to move the latter, said jack having near its lower end a butt lying in its own plane for temporary interengagement with and movement by a parallelly positioned and lengthwise movable instrumentality and having near said butt a lateral projection which is bent to a position substantially at right angles to the plane of the jack and is adapted for interengagement with a companion jack.

4. As a new article of manufacture, a jack for imparting movement to a knitting needle of the so-called "independent" type, said jack being distinct from but adapted to move independent of its needle, and also with its needle to move the latter, said jack having a butt lying in its own plane for temporary interengagement with a companion but independently movable jack to move said companion jack, and also having a lateral projection adapted for temporary interengagement with a companion jack to receive movement from the latter.

5. As a new article of manufacture, a jack for imparting movement to a knitting needle of the so-called "independent" type, said jack being distinct from but adapted to move independent of its needle, and also with its needle to move the latter, said jack having a butt lying in its own plane near its lower end and adapted for temporary interengagement with a companion but independently movable jack for movement of said companion jack, and also having relatively close to said butt a lateral projection adapted for temporary interengagement by a second companion jack at the opposite side thereof.

6. As a new article of manufacture, a jack for imparting movement to a knitting needle of the so-called "independent" type, said jack being distinct from but adapted to move independent of its needle, and also with its needle to move the latter, said jack having a butt lying in its own plane near its lower end for temporary interengagement with a lateral formation upon a companion jack and also having near said butt and relatively close thereto a laterally bent projection adapted to engage the butt on a second companion jack for lifting movement.

7. As a new article of manufacture, a jack for imparting movement to a knitting needle of the so-called "independent" type, said jack being distinct from but adapted to move independent of its needle, and also with its needle to move the latter, said jack having a butt and a lateral projection both adapted for engagement with a companion jack or jacks

and both positioned substantially close to the lower end of the jack, thereby preventing engagement of either said butts or said lateral projection with the spring band about the cylinder.

8. In a knitting machine for making fabrics with contrasting zones or areas, a series of independently movable needles and a corresponding series of jacks each having preparatory movement independent of its needle and also with its needle, each of a plurality of said jacks having a butt lying in its own plane for temporary interengagement with a companion but independently movable jack of the series for movement by said companion jack and also having a lateral projection adapted for interengagement with a second companion jack of said series at the opposite side to impart movement to the latter.

9. In a knitting machine for making fabrics with contrasting zones or areas, a series of independently movable needles and a corresponding series of jacks each having preparatory movement independent of its needle and also with its needle, each of a plurality of said jacks having a butt lying in its own plane for temporary interengagement with a companion jack of said series whereby it is itself lifted by said companion jack and having near said butt a lateral projection adapted for interengagement with a second companion jack of said series but at the other side thereof, whereby one of said jacks is lifted by the other.

10. In a knitting machine for making fabrics with contrasting zones or areas, a series of independently movable needles and a corresponding series of jacks each having preparatory movement independent of its needle and also with its needle, each of a plurality of said jacks having near its lower end a butt lying in its own plane for engagement with a lateral projection of an adjacent butt and having near said butt a lateral projection which is bent to a position substantially at right angles to the plane of the jack and is adapted for interengagement with a companion jack of the series.

11. In a knitting machine for making fabrics with contrasting zones or areas, a series of independently movable needles and a corresponding series of jacks each having preparatory movement independent of its needle and also with its needle, each of a plurality of said jacks having a butt lying in its own plane for temporary interengagement with a companion but independently movable jack of said series to move said companion jack and also having a lateral projection adapted for temporary interengagement with a companion jack of the series to receive movements from the latter.

12. In a knitting machine far making fabrics with contrasting zones or areas, a series of independently movable needles and a corresponding series of jacks each having preparatory movement independent of its needle and also with its needle, each of a plurality of said jacks having a butt lying in its own plane near its lower end and adapted for temporary interengagement with a companion but independently movable jack of said series for movement of said companion jack and also having close to said butt a lateral projection adapted for temporary interengagement by a second companion jack of the series, at its opposite side.

13. In a knitting machine for making fabrics with contrasting zones or areas, a series of independently movable needles and a corresponding series of jacks each having preparatory movement independent of its needle and also with its needle, each of a plurality of said jacks having a butt lying in its own plane near its lower end for temporary interengagement with a lateral formation upon a companion jack of said series and also having near said butt and relatively close thereto a laterally bent projection adapted to engage the butt on a second companion jack of said series, for relative lifting movement.

14. In a knitting machine for making fabrics with contrasting zones or areas, a series of independently movable needles and a corresponding series of jacks each having preparatory movement independent of its needle and also with its needle, each of a plurality of said jacks having an elongated butt lying in its own plane for engagement by a cam for lifting movement and each of another plurality of said jacks having a butt lying in its own plane for temporary interengagement with a companion but independently movable jack of the series for movement by said companion jack and also having a lateral projection adapted for interengagement with a second companion jack of said series but at the opposite side thereof, to impart movement to the latter.

15. In a knitting machine for making fabrics with contrasting zones or areas, a series of independently movable needles and a corresponding series of jacks each having preparatory movement independent of its needle and also with its needle, each of a plurality of said jacks having an elongated butt lying in its own plane for engagement by a cam to be lifted thereby, and each of another plurality of said series of jacks having a short butt lying in its own plane for temporary interengagement with a companion but independently movable jack of the series for movement by said companion jack and also having a lateral projection adapted for interengagement with a second companion jack of said series at the opposite side to impart movement to the latter.

16. In a knitting machine for making fabrics with contrasting zones or areas, a series of independently movable needles and a cor-

responding series of jacks each having preparatory movement independent of its needle and also with its needle, each of a plurality of said jacks having a long butt lying in its own plane for engagement by a cam for lifting movement thereby and each of another plurality of said jacks having a butt lying in its own plane near its lower end and adapted for temporary interengagement with a companion but independently movable jack of the series for movement of said companion jack and also having close to said butt a lateral projection adapted for temporary interengagement by a second companion jack of the series but at the opposite side thereof.

17. As a new article of manufacture, a jack for imparting movement to a knitting needle of the so-called "independent" type, said jack being distinct from but adapted to move independent of its needle, and also with its needle to move the latter, said jack having a butt adapted to be engaged by a cam to be lifted thereby and also adapted temporarily to engage a lateral projection upon a companion jack, said jack also having a lateral projection adapted for temporary interengagement with a butt upon a companion jack.

18. As a new article of manufacture, a jack for imparting movement to a knitting needle of the so-called "independent" type, said jack being distinct from but adapted to move independent of its needle, and also with its needle to move the latter, said jack having a butt lying in its own plane for engagement at its lower edge by a cam for lifting movement by said cam and for engagement at its upper edge with a lateral projection upon a companion jack, said jack also having a lateral projection adapted for temporary interengagement with a butt of a companion jack.

19. In a knitting machine for making fabrics with contrasting zones or areas, a series of independently movable needles and a corresponding series of jacks each having preparatory movement independent of its needle and also with its needle, each of a plurality of said jacks having a butt for temporary interengagement with a companion but independently movable jack of the series, and also having a lateral projection extending toward the right as the jack is viewed at its edge having said butts for temporary interengagement with the butt of the companion jack, and each of another series of said jacks having a butt for temporary interengagement with a companion but independently movable jack of the series, and also having a lateral projection extending toward the left as the jack is viewed at its edge having said butt.

20. In a knitting machine for making fabrics with contrasting zones or areas, a series of independently movable needles and a corresponding series of jacks each having preparatory movement independent of its needle and also with its needle, each of a plurality of said jacks having a butt for temporary interengagement with a companion but independently movable jack of the series, said butt being also adapted for engagement by a cam, each of said plurality of jacks also having a lateral projection extending toward the right as the jack is viewed at its edge having said butts, for temporary interengagement with the butt of the companion jack, and each of another series of said jacks having a butt for temporary interengagement with a companion but independently movable jack of said plurality and for engagement by a cam and also having a lateral projection extending toward the left as the jack is viewed from its edge having said butts, for temporary interengagement with the butt of the companion jack.

21 As a new article of manufacture, a jack for imparting movement to a knitting needle of the co-called independent type, said jack having movement with its needle to move the latter, and having a butt lying in the plane of the jack and adapted for engagement by a cam to be lifted thereby and adapted to engage by its upper edge a lateral projection from a neighboring jack, and also having a lateral projection adapted to be engaged by the butt of another neighboring jack for lifting movement by that last mentioned butt.

22. As a new article of manufacture, a jack for imparting movement to a knitting needle of the so-called independent type, said jack having movement with its needle to move the latter, and having a butt lying in the plane of the jack and adapted to be engaged by a cam to be lifted thereby, said butt being also adapted to be engaged by a lateral projection upon a neighboring jack for lifting movement by means of said lateral projection, said first mentioned jack having a lateral projection adapted to engage the butt of another neighboring jack to lift the latter.

23. For use in neighboring grooves of a needle carrier, a pair of jacks including a jack for imparting movement to a knitting needle of the so-called independent type, said jack having movement with its needle to move the latter and having a butt lying in the plane of the jack and adapted to be engaged by a cam to be lifted thereby, and also including an associated jack having a lateral projection, said butt of said first jack being also adapted to engage a lateral projection upon said neighboring jack for lifting movement by means of said lateral projection on said associated jack.

24. A circular knitting machine having means to introduce a main yarn and a reenforcing yarn, a circular series of independently movable needles having means to operate the same for the production of non-reenforced circular work, jacks to elevate needles for the production of reenforced work, said jacks having among themselves

movements which are permissibly respectively distinct and which movements are distinct from the yarn taking movement of the corresponding needles, and cam means to control said jacks, said cam means including a cam acting only upon an initial minimum number of jacks to elevate the same; a second cam distinct from the first and materially distant therefrom circumferentially of the cam carrier and adapted also to elevate said initial minimum number of jacks and also jacks subsequently added thereto; and a third cam distinct from the first and second and materially distant therefrom circumferentially of the cam carrier and adapted to depress jacks whose needles are not to take the reenforcing yarn at that time.

25. A circular knitting machine having means to introduce a main yarn and a reenforcing yarn, a circular series of independently movable needles having means to operate the same for the production of non-reenforced circular work, jacks to elevate needles for the production of reenforced work, said jacks having among themselves movements which are permissibly respectively distinct and which movements are distinct from the yarn taking movement of the corresponding needles, and cam means to control said jacks, said cam means including a cam acting only upon an initial minimum number of jacks to elevate the same; a second cam distinct from the first and materially distant therefrom circumferentially of the cam carrier and adapted also to elevate said initial minimum number of jacks and also jacks subsequently added thereto; and a third cam distinct from the first and second and materially distant therefrom circumferentially of the cam carrier and adapted to depress jacks whose needles are not to take the reenforcing yarn at that time, and means periodically to render each of said three cams active and inactive.

26. A circular knitting machine having means to introduce a main yarn and a reenforcing yarn, a circular series of independently movable needles having means to operate the same for the production of non-reenforced circular work, jacks to elevate needles for the production of reenforced work, said jacks having among themselves movements which are permissibly respectively distinct and which movements are distinct from the yarn taking movement of the corresponding needles, and cam means to control said jacks, said cam means including a cam acting only upon an initial minimum number of jacks to elevate the same; a second cam distinct from the first and materially distant therefrom circumferentially of the cam carrier and adapted also to elevate said initial minimum number of jacks and also jacks subsequently added thereto; and a third cam distinct from the first and second and materially distant therefrom circumferentially of the cam carrier and adapted to depress jacks whose needles are not to take the reenforcing yarn at that time, and pattern means to control each of said three cams.

27. A circular knitting machine having means to introduce a main yarn and a reenforcing yarn, a circular series of independently movable needles having means to operate the same for the production of non-reenforced circular work, jacks to elevate needles for the production of reenforced work, said jacks having among themselves movements which are permissibly respectively distinct and which movements are distinct from the yarn taking movement of the corresponding needles, and cam means to control said jacks, said cam means including a cam acting only upon an initial number of jacks to elevate the same; a second cam distinct from the first and located at a different point on the cam cylinder and adapted also to elevate said initial minimum number of jacks and also jacks periodically added thereto; and a pair of interchangeably acting cams distinct from the first and second and located at a point on the cam cylinder distinct from the locations of the first and second specified cam means and adapted to depress jacks whose needles are not to take the reenforcing yarn at that time.

28. A circular knitting machine having means to introduce a main yarn and a reenforcing yarn, a circular series of independently movable needles having means to operate the same for the production of non-reenforced circular work, jacks to elevate needles for the production of reenforced work, said jacks having among themselves movements which are permissibly respectively distinct and which movements are distinct from the yarn taking movement of the corresponding needles, and cam means to control said jacks, said cam means including a cam to elevate jacks, and two cams distinct therefrom and from each other to depress selected jacks.

29. A circular knitting machine having means to introduce a main yarn and a reenforcing yarn, a circular series of independently movable needles having means to operate the same for the production of non-reenforced circular work, jacks to elevate needles for the production of reenforced work, said jacks having among themselves movements which are permissibly respectively distinct and which movements are distinct from the yarn taking movement of the corresponding needles, and cam means to control said jacks, said cam means including a cam acting only upon an initial number of jacks to elevate the same; a second cam distinct from the first and adapted also to elevate said initial minimum number of jacks and also jacks periodically added thereto; and a pair of interchangeably acting cams distinct from the first and sec-

ond and adapted to depress jacks whose needles are not to take the reenforcing yarn at that time, and cam means to control said jacks, said cam means including a cam to elevate jacks, and two cams distinct therefrom and from each other to depress selected jacks, and means to operate said two last mentioned cams in alternation.

30. A circular knitting machine having means to introduce a main yarn and a reenforcing yarn, a circular series of independently movable needles having means to operate the same for the production of non-reenforced circular work, jacks to elevate needles for the production of reenforced work, said jacks having among themselves movements which are permissibly respectively distinct and which movements are distinct from the yarn taking movement of the corresponding needles, and cam means to control said jacks, said cam means including a cam acting only upon an initial number of jacks to elevate the same; a second cam distinct from the first and adapted also to elevate said initial minimum number of jacks and also jacks periodically added thereto; and a pair of interchangeably acting cams distinct from the first and second and adapted to depress jacks whose needles are not to take the reenforcing yarn at that time, and cam means to control said jacks, said cam means including a cam to elevate jacks, and two cams distinct therefrom and from each other to depress selected jacks, and a single means to throw one of said two last mentioned cams out of action and to throw the other into action.

31. A circular knitting machine having means to introduce a main yarn and a reenforcing yarn, a circular series of independently movable needles having means to operate the same for the production of non-reenforced circular work, jacks to elevate needles for the production of reenforced work, said jacks having among themselves movements which are permissibly respectively distinct and which movements are distinct from the yarn taking movement of the corresponding needles, and cam means to control said jacks, said cam means including two cams distinct from each other to depress selected jacks.

32. A circular knitting machine having means to introduce a main yarn and a reenforcing yarn, a circular series of independently movable needles having means to operate the same for the production of non-reenforced circular work, jacks to elevate needles for the production of reenforced work, said jacks having among themselves movements which are permissibly respectively distinct and which movements are distinct from the yarn taking movement of the corresponding needles, and cam means to control said jacks, said cam means including two cams distinct from each other to depress selected jacks, and means to operate said two cams in alternation.

33. A circular knitting machine having means to introduce a main yarn and a reenforcing yarn, a circular series of independently movable needles having means to operate the same for the production of non-reenforced circular work, jacks to elevate needles for the production of reenforced work, said jacks having among themselves movements which are permissibly respectively distinct and which movements are distinct from the yarn taking movement of the corresponding needles, and cam means to control said jacks, said cam means including two cams distinct from each other and of different heights so as to act upon jack formations at different elevations to depress selected jacks respectively.

34. A circular knitting machine having means to introduce a main yarn and a reenforcing yarn, a circular series of independently movable needles having means to operate the same for the production of non-reenforced circular work, jacks to elevate needles for the production of reenforced work, said jacks having among themselves movements which are permissibly respectively distinct and which movements are distinct from the yarn taking movement of the corresponding needles, and cam means to control said jacks, said cam means including a cam to elevate the jacks and two cams distinct therefrom and from each other to depress selected jacks, said two cams being of different heights and adapted to act upon jack formations at different levels.

35. A circular knitting machine having means to introduce a main yarn and a reenforcing yarn, a circular series of independently movable needles having means to operate the same for the production of non-reenforced circular work, jacks to elevate needles for the production of reenforced work, said jacks having among themselves movements which are permissibly respectively distinct and which movements are distinct from the yarn taking movement of the corresponding needles, and cam means to control said jacks, said cam means including a cam to elevate the jacks and two cycle character determining cams distinct therefrom and from each other to depress selected jacks, said two cams being of different heights and adapted to act upon jack formations at different levels, and means to operate said two last mentioned cams in alternation.

36. A circular knitting machine having means to introduce a main yarn and a reenforcing yarn, a circular series of independently movable needles having means to operate the same for the production of non-reenforced circular work, jacks to elevate needles for the production of reenforced work, said jacks having among themselves movements which are permissibly respective-

ly distinct and which movements are distinct from the yarn taking movement of the corresponding needles, and cam means to control said jacks, said cam means including a cam acting only upon an initial number of jacks to elevate the same; a second cam distinct from the first and adapted also to elevate said initial minimum number of jacks and also jacks periodically added thereto, and third and fourth cams distinct from the first and second and from each other and constituting cycle character-determining cams, and means to move each of said four cams into and out of action.

37. A circular knitting machine having means to introduce a main yarn and a reenforcing yarn, a circular series of independently movable needles having means to operate the same for the production of non-reenforced circular work, jacks to elevate needles for the production of reenforced work, said jacks having among themselves movements which are permissibly respectively distinct and which movements are distinct from the yarn taking movement of the corresponding needles, and cam means to control said jacks, said cam means including a cam acting only upon an initial number of jacks to elevate the same; a second cam distinct from the first and adapted also to elevate said initial minimum number of jacks and also jacks periodically added thereto, and third and fourth cams distinct from the first and second and from each other, and constituting cycle character-determining cams, and pattern controlled means to move each of said four cams into and out of action.

38. A circular knitting machine having means to introduce a main yarn and a reenforcing yarn, a circular series of independently movable needles having means to operate the same for the production of non-reenforced circular work, jacks to elevate needles for the production of reenforced work, said jacks having among themselves movements which are permissibly respectively distinct and which movements are distinct from the yarn taking movement of the corresponding needles, and cam means to control said jacks, said cam means including a cam acting only upon an initial number of jacks to elevate the same; a second cam distinct from the first and adapted also to elevate said initial minimum number of jacks and also jacks periodically added thereto, and third and fourth cams distinct from the first and second and from each other and constituting cycle character-determining cams, said third and fourth cams being of different heights and adapted to act upon jack formations at different levels.

39. A circular knitting machine having means to introduce a main yarn and a reenforcing yarn, a circular series of independently movable needles having means to operate the same for the production of non-reenforced circular work, jacks to elevate needles for the production of reenforced work, said jacks having among themselves movements which are permissibly respectively distinct and which movements are distinct from the yarn taking movement of the corresponding needles, and cam means to control said jacks, said cam means including a plurality of distinct cams to engage said jacks to lower the same, a gear having an established rate of rotation with respect to that of the needle carrier or cam ring, and cam means upon said gear to determine the periodicity of action of at least one of said jack controlling cams.

40. A circular knitting machine having means to introduce a main yarn and a reenforcing yarn, a circular series of independently movable needles having means to operate the same for the production of non-reenforced circular work, jacks to elevate needles for the production of reenforced work, said jacks having among themselves movements which are permissibly respectively distinct and which movements are distinct from the yarn taking movement of the corresponding needles, and cam means to control said jacks, said cam means including two cams distinct from each other and adapted in alternation to act upon selected jacks, a gear having an established rate of rotation with respect to that of the needle cylinder or cam ring, and cam means upon said gear to determine the periodicity of action of said two cams.

41. A circular knitting machine having means to introduce a main yarn and a reenforcing yarn, a circular series of independently movable needles having means to operate the same for the production of non-reenforced circular work, jacks to elevate needles for the production of reenforced work, said jacks having among themselves movements which are permissibly respectively distinct and which movements are distinct from the yarn taking movement of the corresponding needles, and cam means to control said jacks, said cam means including a cam to elevate jacks, and two cycle character determining cams distinct therefrom and from each other to depress selected jacks, a gear having an established rate of rotation with respect to that of the needle cylinder or cam ring, and cam means upon said gear to determine the periodicity of action of said two last mentioned jack controlling means.

42. A circular knitting machine having means to introduce a main yarn and a reenforcing yarn, a circular series of independently movable needles having means to operate the same for the production of non-reenforced circular work, jacks to elevate needles for the production of reenforced work, said jacks having among themselves movements which are permissibly respectively distinct and which movements are dis-

tinct from the yarn taking movement of the corresponding needles, and cam means to control said jacks, said cam means including a cam to elevate jacks and two cams distinct therefrom and from each other, and of different heights, so as to act upon cam formations at different levels, a gear having an established rate of rotation with respect to that of the needle cylinder or cam ring, and cam means upon said gear to determine the periodicity of action of said two last mentioned cams.

43. A circular knitting machine having means to introduce a main yarn and a reenforcing yarn, a circular series of independently movable needles having means to operate the same for the production of non-reenforced circular work, said jacks having among themselves movements which are permissibly respectively distinct and which movements are distinct from the yarn taking movement of the corresponding needles, and cam means to control said jacks, said cam means including two cams distinct from each other and materially removed from each other circumferentially of the cam carrier to depress selected jacks, and lever means for connecting said two cams and for operating them to move them into and out of action alternately.

44. A circular knitting machine having a cam carrier and also having means to introduce a main yarn and a reenforcing yarn, a circular series of independently movable needles having means to operate the same for the production of non-reenforced circular work, jacks to elevate needles for the production of reenforced work, said jacks having among themselves movements which are permissibly respectively distinct and which movements are distinct from the yarn taking movement of the corresponding needles, and a series of at least three separate jack controlling cams distinct from each other and circumferentially spaced about the cam carrier to control said jacks to produce partial reenforced courses progressively increasing in length by groups of at least two courses, all of which are of the same length and means for controlling said cams separately.

45. A circular knitting machine having a cam carrier and also having means to introduce a main yarn and a reenforcing yarn, a circular series of independently movable needles having means to operate the same for the production of non-reenforced circular work, jacks to elevate needles for the production of reenforced work, said jacks having among themselves movements which are permissibly respectively distinct and which movements are distinct from the yarn taking movement of the corresponding needles, and a series of four separate jack controlling cams distinct from each other and circumferentially spaced about the cam carrier to control said jacks to produce partial reenforced courses progressively increasing in length by groups of at least three courses, all of which are of the same length and means for controlling said cams separately.

46. A circular knitting machine having a series of at least three separate jack controlling cams distinct from each other and circumferentially spaced about the cam carrier, means to introduce a main yarn and a reenforcing yarn, a circular series of independently movable needles having means to operate the same for the production of non-reenforced circular work, jacks to elevate needles for the production of reenforced work, said jacks having among themselves movements which are permissibly respectively distinct and which movements are distinct from the yarn taking movement of the corresponding needles, distinct cam means circumferentially spaced about the cam carrier to control said jacks to produce partial reenforced courses progressively increasing in length by groups of at least two courses, both of which are of the same length, and a gear having a determined number of rotations with respect to that of the needle cylinder or cam ring, said gear having means to control the said cam means and means for controlling said cams separately.

47. A circular knitting machine having a cam carrier and also having means to introduce a main yarn and a reenforcing yarn, a circular series of independently movable needles having means to operate the same for the production of non-reenforced circular work, jacks to elevate needles for the production of reenforced work, said jacks having among themselves movements which are permissibly respectively distinct and which movements are distinct from the yarn taking movement of the corresponding needles, a series of four separate jack controlling cams distinct from each other and circumferentially spaced about the cam carrier to control said jacks to produce partial reenforced courses progressively increasing in length by groups of at least three courses, all of which are of the same length, and a gear having a determined number of rotations with respect to that of the needle cylinder or cam ring, said gear having means to control the said cam means and means for controlling said cams separately.

48. A circular stocking knitting machine having means to introduce a main yarn and a reenforcing yarn, a circular series of independently movable needles including a set of short butt needles and a set of long butt needles, means to operate short butt needles for the production of reenforced work, said means including jacks having among themselves movements which are permissibly respectively distinct and which movements are

distinct from the yarn taking movements of the corresponding needles, and cam means to direct long butt needles away from the path of engagement of the reenforcing yarn.

49. A circular stocking knitting machine having means to introduce a main yarn and a reenforcing yarn, a circular series of independently movable needles including a set of short butt needles and a set of long butt needles, means to operate short butt needles for the production of reenforced work, said means including jacks having among themselves movements which are permissibly respectively distinct and which movements are distinct from the yarn taking movements of the corresponding needles, cam means to direct long butt needles away from the path of engagement of the reenforcing yarn, and cam means to control said jacks to cause the presentation of selected needles to the reenforcing yarn.

50. A circular stocking knitting machine having means to introduce a main yarn and a reenforcing yarn, a circular series of independently movable needles including a set of short butt needles and a set of long butt needles, means to operate short butt needles for the production of reenforced work, said means including jacks having among themselves movements which are distinct from the yarn taking movements of the corresponding needles, cam means to direct long butt needles away from the path of engagement of the reenforcing yarn, and cam means to control said jacks to cause the presentation of a variable number of short butt needles to said reinforcing yarn, said cam means including a jack elevating cam and a jack depressing cam distinct from and movable separately from each other.

51. A circular knitting machine having a main yarn guide, and a reenforcing yarn guide having a feeding position above that of the main yarn guide, a circular series of independently movable needles including a group of short butt needles and a group of long butt needles, means to operate said needles for the production of non-reenforced circular work, jacks to elevate needles to said reenforcing yarn guide, said jacks having among themselves movements which are permissibly respectively distinct and which movements are distinct from the yarn taking movement of the corresponding needles, a cam to direct the long butt needles away from the reenforcing yarn guide, and cam means to control said jacks.

52. A circular knitting machine having a main yarn guide, and a reenforcing yarn guide having a feeding position above that of the main yarn guide, a circular series of independently movable needles including a group of short butt needles and a group of long butt needles, means to operate said needles for the production of non-reinforced circular work, jacks to elevate needles to said reinforcing yarn guide, said jacks having among themselves movements which are permissibly respectively distinct and which movements are distinct from the yarn taking movement of the corresponding needles, a cam to direct the long butt needles away from the reenforcing yarn guide, and cam means to control said jacks, said cam means including a plurality of distinct cams, at least one of which elevates said jacks and another of which depresses said jacks.

53. An independent needle, circular, stocking knitting machine having a needle cylinder and a cam ring, a ring-like member above the needle cylinder, one or more main yarn guides, a reenforcing yarn guide of greater length than said main yarn guide so as to deliver the reenforcing yarn at a point substantially spaced from the point of delivery of the main yarns, said ring-like member being recessed for the reception of said reenforcing yarn guide, a circular series of needles including a group of short butt needles, and a group of long butt needles, means to move said reenforcing yarn guide into feeding position at predetermined times, and a cam to move the long butt needles away from the path of reception of the reenforcing yarn.

54. An independent needle, circular, stocking knitting machine having a needle cylinder and a cam ring, a ring-like member above the needle cylinder, one or more main yarn guides, a reenforcing yarn guide of greater length than said main yarn guide so as to deliver the reinforcing yarn at a point substantionally spaced from the point of delivery of the main yarns, said ring-like member being recessed for the reception of said reenforcing yarn guide, a circular series of needles including a group of short butt needles and a group of long butt needles, means to move said reenforcing yarn guide into feeding position at predetermined times, a cam to move the long butt needles away from the path of reception of the reenforcing yarn and means to present short butt needles to the said reenforcing yarn guide, said means including jacks having among themselves movements which are permissibly respectively distinct and which movements are distinct from the yarn taking movement of the corresponding needles.

55. An independent needle, circular, stocking knitting machine having a needle cylinder and a cam ring, a ring-like member above the needle cylinder, one or more main yarn guides, a reenforcing yarn guide of greater length than said main yarn guide so as to deliver the reenforcing yarn at a point substantially spaced from the point of delivery of the main yarns, said latch ring being recessed for the reception of said reenforcing yarn guide, a circular series of needles including a group

of short butt needles and a group of long butt needles, means to move said reenforcing yarn guide into feeding position at predetermined times, a cam to move the long butt needles away from the path of reception of the reenforcing yarn, means to present short butt needles to the said reenforcing yarn guide, said means including jacks having among themselves movements which are permissibly respectively distinct and which movements are distinct from the yarn taking movement of the corresponding needles and means for moving said cam for controlling the long butt needles into and out of operative relation with respect to said long butt needles.

56. A circular stocking knitting machine having means to introduce a main yarn, a reenforcing yarn guide, a circular series of independently movable needles, narrowing and widening means including a narrowing picker, means periodically to move said reenforcing yarn guide into feeding position, and means to move said narrowing picker out of the path of engagement of needle butts upon the bringing of said reenforcing yarn guide into action.

57. A circular stocking knitting machine having a main yarn guide, a reenforcing yarn guide movable into and out of feeding position, a circular series of independently movable needles including a set of short butt needles and a set of long butt needles, fashioning means including a narrowing picker, and co-acting means to move said reenforcing yarn guide into action and to move said narrowing picker out of the path of engagement of long butt needles.

58. A circular stocking knitting machine having a main yarn guide, a reenforcing yarn guide movable into and out of feeding position, a circular series of independently movable needles including a set of short butt needles and a set of long butt needles, fashioning means including a narrowing picker, means to move said reenforcing yarn guide into action, and means acting substantially simultaneously with said last mentioned means to move said narrowing picker out of the path of engagement of the butts of the long butt needles.

59. As a new article of manufacture a jack for imparting movement to a knitting needle of the so-called independent type, said jack being distinct from but adapted to move independent of its needle, and also with its needle to move the latter, said jack having a butt lying in the plane of the jack for temporary interengagement with a companion but independently movable jack and also having a lateral projection upon an outward curve, for interengagement with a companion jack, said lateral projection being thereby so shaped that the corresponding projections of a series of like jacks do not interfere with each other.

60. As a new article of manufacture a jack for imparting movement to a knitting needle of the so-called independent type said jack being distinct from but adapted to move independent of its needle and also with its needle to move the latter, said jack having near its lower end a butt lying in its own plane and having therebelow a lateral projection bent at a sufficient outward inclination to the plane of the jack to engage a companion jack but so that like projections upon a series of like jacks do not interfere with each other.

61. A circular knitting machine having means to introduce a main yarn and a reenforcing yarn, a circular series of independently movable needles having means to operate the same for the production of non-reenforced circular work, jacks to elevate needles for the production of reenforced work, said jacks having among themselves movements which are permissibly respectively distinct and which movements are distinct from the yarn taking movement of the corresponding needles and means to control said jacks to cause the presentation to the reenforcing yarn substantially simultaneously of two progressively increasing series of needles.

62. A circular knitting machine having means to introduce a main yarn and a reenforcing yarn, a circular series of independently movable needles having means to operate the same for the production of non-reenforced circular work, jacks to elevate needles for the production of reenforced work, said jacks having among themselves movements which are permissibly respectively distinct and which movements are distinct from the yarn taking movement of the corresponding needles, and means to control said jacks to cause the presentation to the reenforcing yarn substantially simultaneously of two progressively varying series of needles.

63. A circular knitting machine having means to introduce a main yarn and a reenforcing yarn, a circular series of independently movable needles having means to operate the same for the production of non-reenforced circular work, jacks located in the needle groove to elevate needles for the production of reenforced work, said jacks having among themselves movements which are permissibly respectively distinct and which movements are distinct from the yarn taking movement of the corresponding needles, and means to control said jacks in said needle grooves to cause the presentation to the reenforcing yarn substantially simultaneously of two progressively increasing series of needles, and means to continue such progressive increase until two reenforced areas are produced each being of substantially triangular shape and substantially touching at their bases.

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

FRANK E. JONES.