No. 614,599. Patented Nov. 22, 1898.

C. H. ALDRIDGE.

STRAIGHT KNITTING MACHINE.

(Application filed Dec. 9, 1897.)

(No Model.) 11 Sheets—Sheet 1.

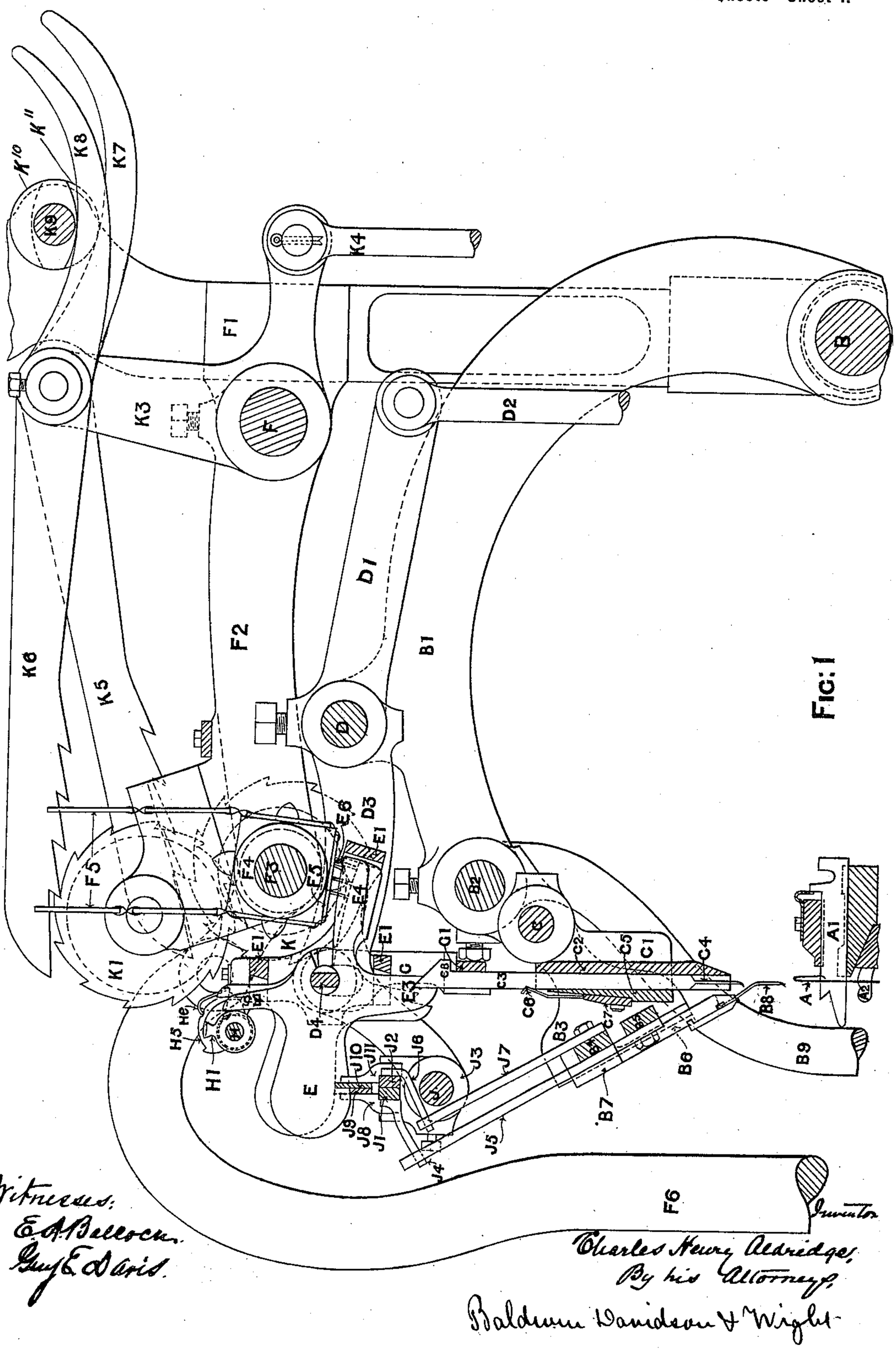

FIG. 1

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No. 614,599. Patented Nov. 22, 1898.

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(No Model.) 11 Sheets—Sheet 2.

Fig. 10a.

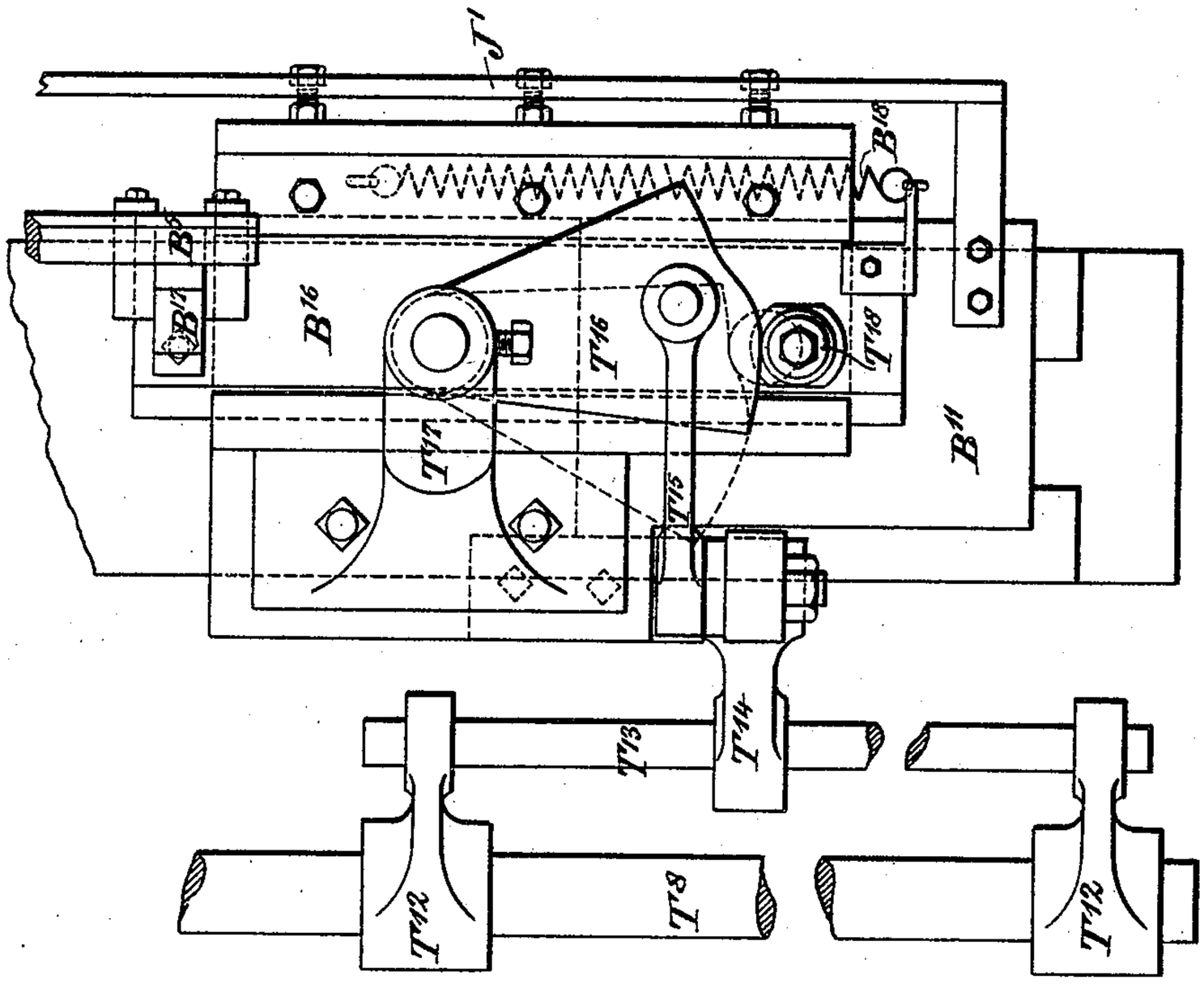


Fig. 2a.

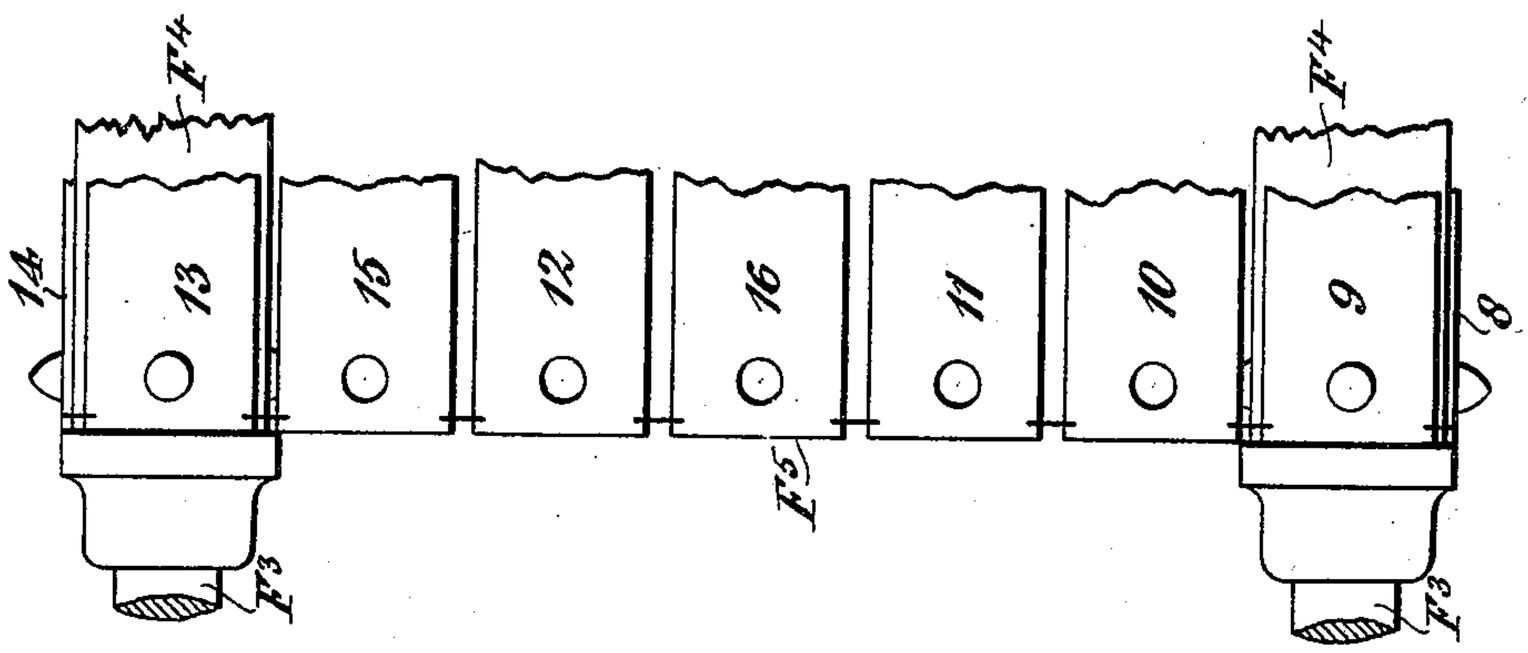
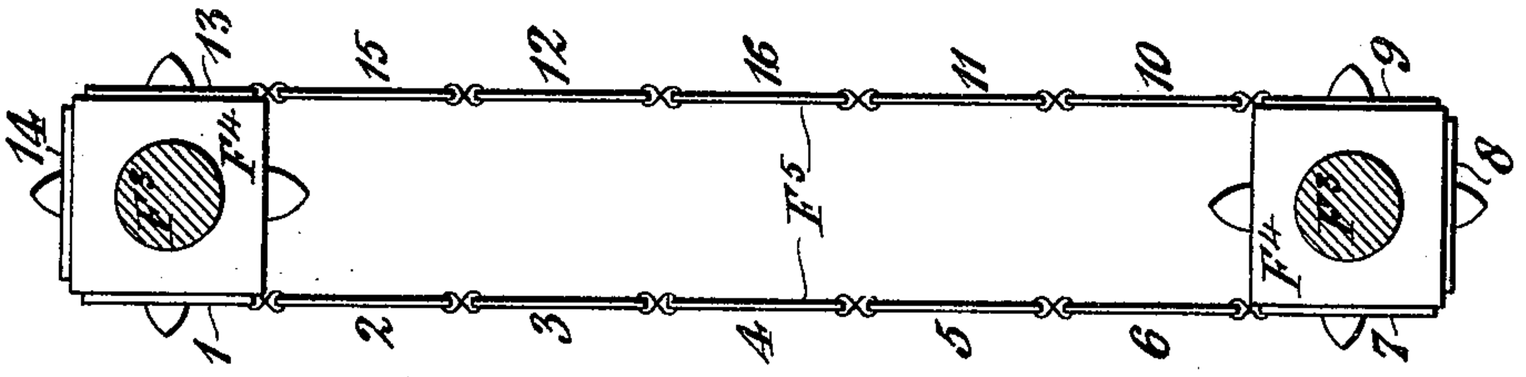


Fig. 1a.



Witnesses.
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Patented Nov. 22, 1898.

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STRAIGHT KNITTING MACHINE.

(Application filed Dec. 9, 1897.)

(No Model.)

11 Sheets—Sheet 3.

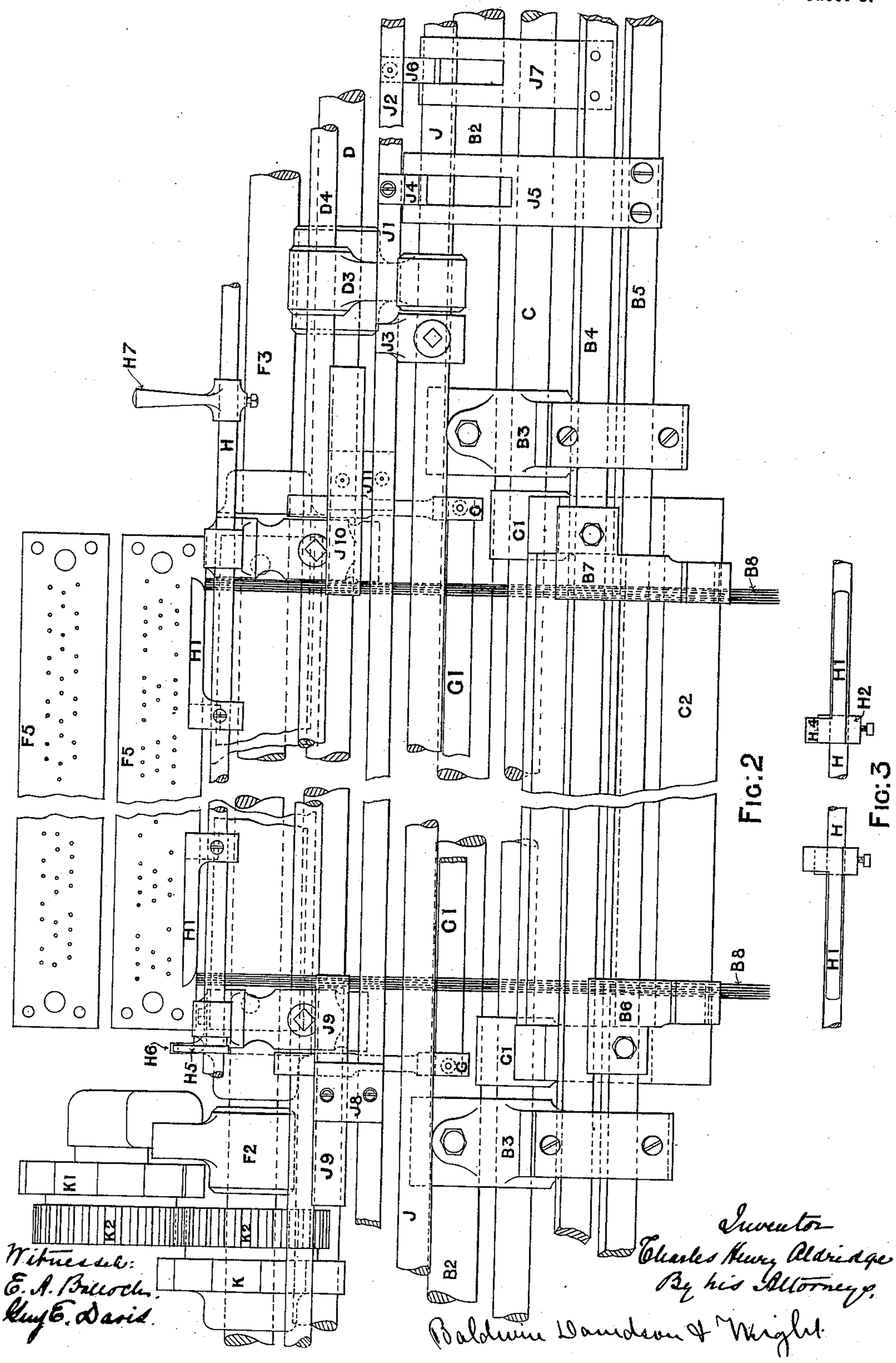

FIG. 2

FIG. 3

Witnesses:
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No. 614,599. Patented Nov. 22, 1898.

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STRAIGHT KNITTING MACHINE.

(Application filed Dec. 9, 1897.)

(No Model.) 11 Sheets—Sheet 4.

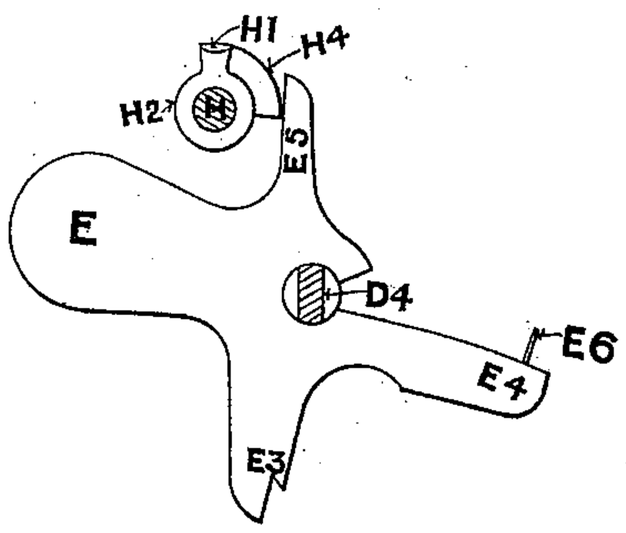

FIG 4

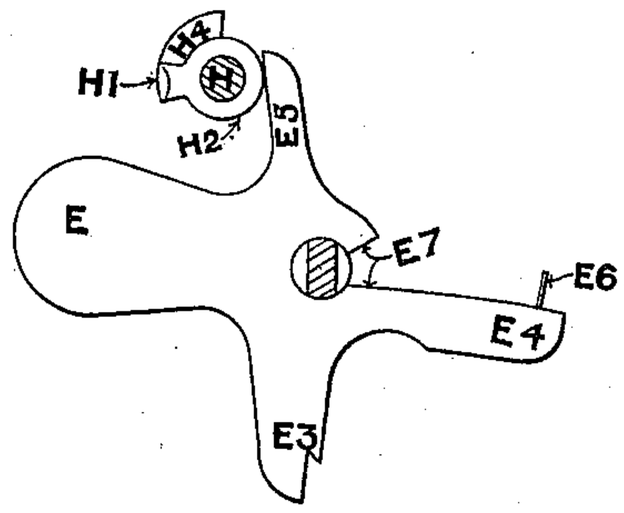

FIG: 5

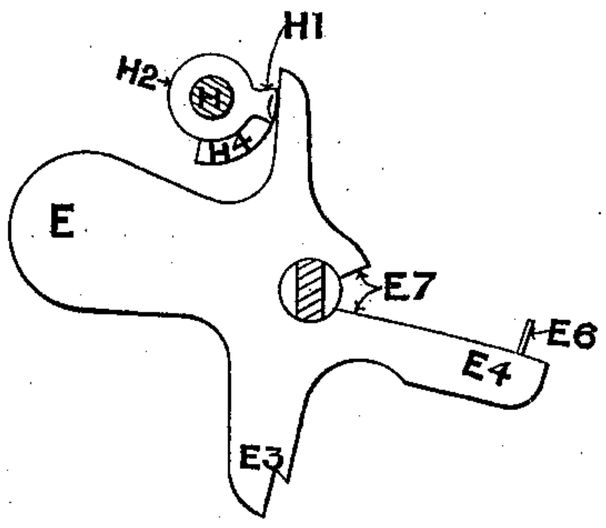

FIG: 6

Witnesses:
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No. 614,599. Patented Nov. 22, 1898.

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STRAIGHT KNITTING MACHINE.

(Application filed Dec. 9, 1897.)

(No Model.) 11 Sheets—Sheet 5.

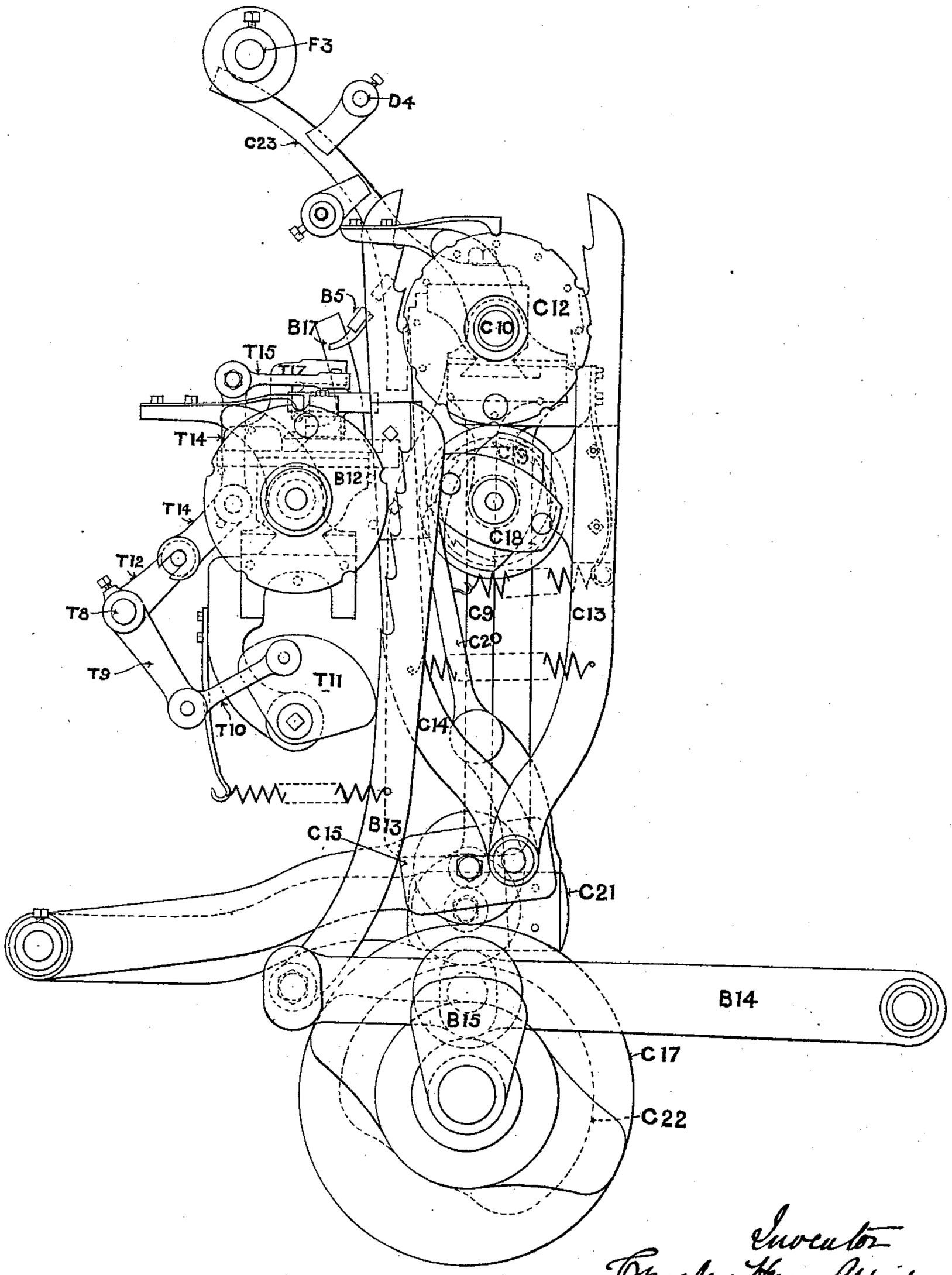

FIG: 7

Witnesses:
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No. 614,599. Patented Nov. 22, 1898.

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STRAIGHT KNITTING MACHINE.

(Application filed Dec. 9, 1897.)

(No Model.) 11 Sheets—Sheet 6.

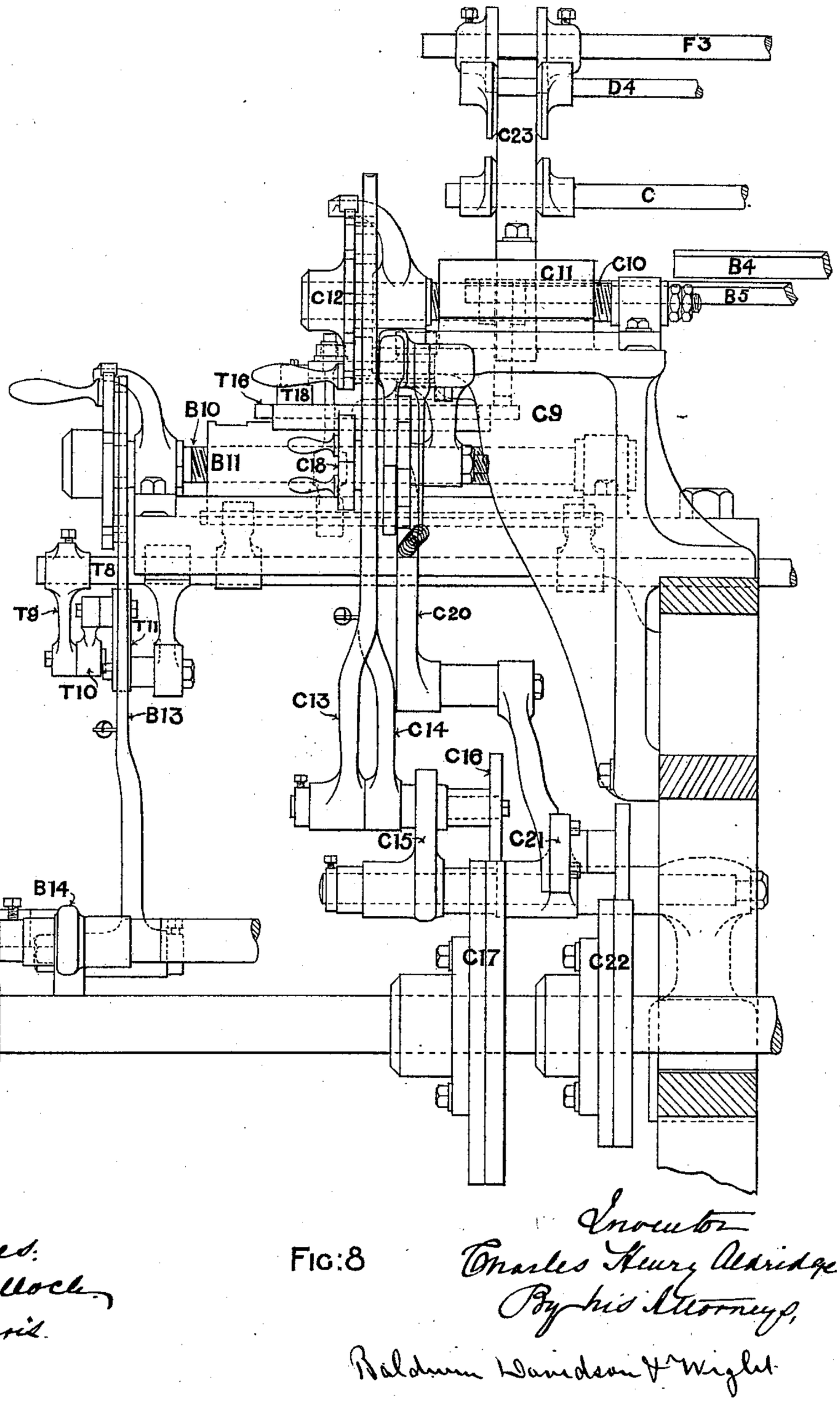

FIG:8

Witnesses:
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No. 614,599. Patented Nov. 22, 1898.

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STRAIGHT KNITTING MACHINE.

(Application filed Dec. 9, 1897.)

(No Model.) 11 Sheets—Sheet 7.

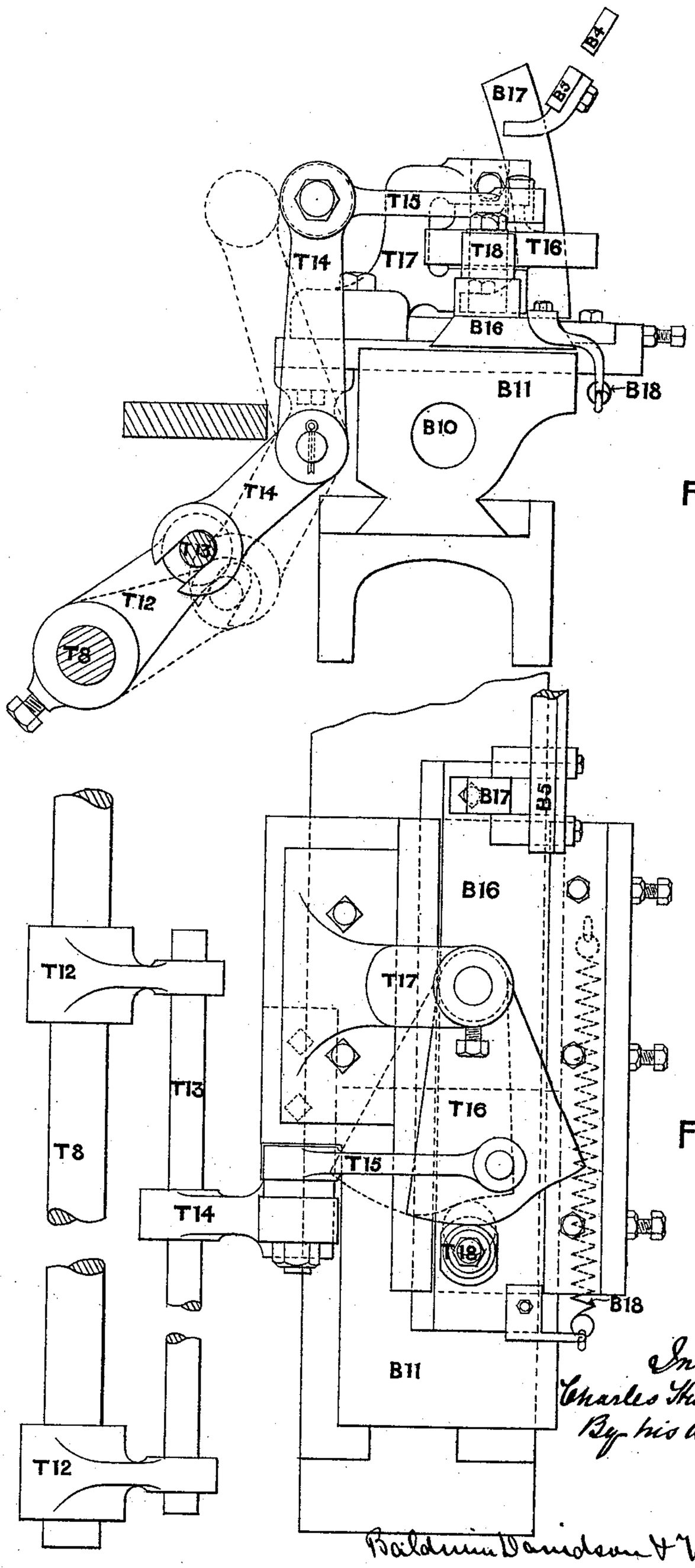

FIG:9

FIG: 10

Witnesses:
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No. 614,599. Patented Nov. 22, 1898.

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STRAIGHT KNITTING MACHINE.

(Application filed Dec. 9, 1897.)

(No Model.) 11 Sheets—Sheet 8.

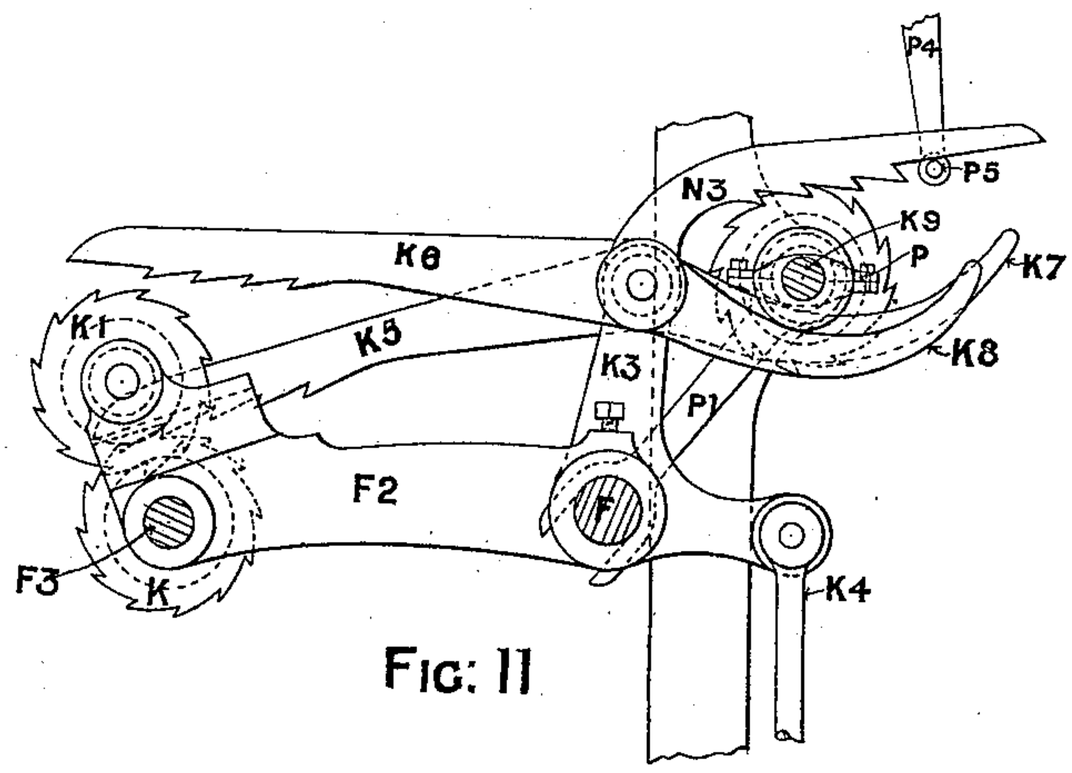

FIG: 11

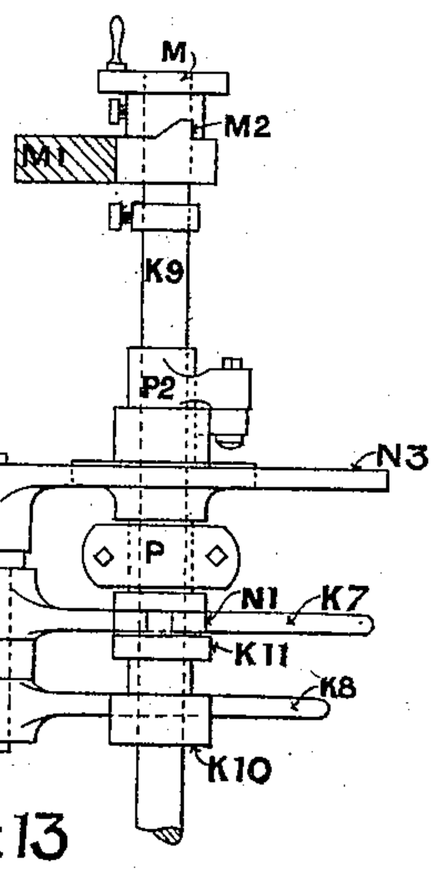

FIG: 13

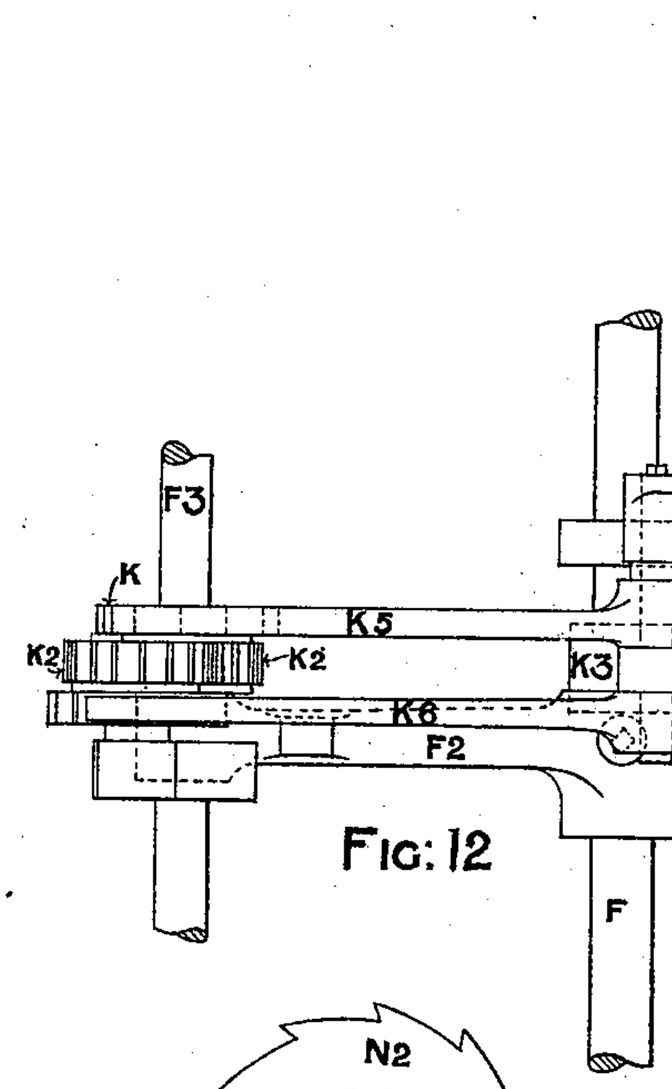

FIG: 12

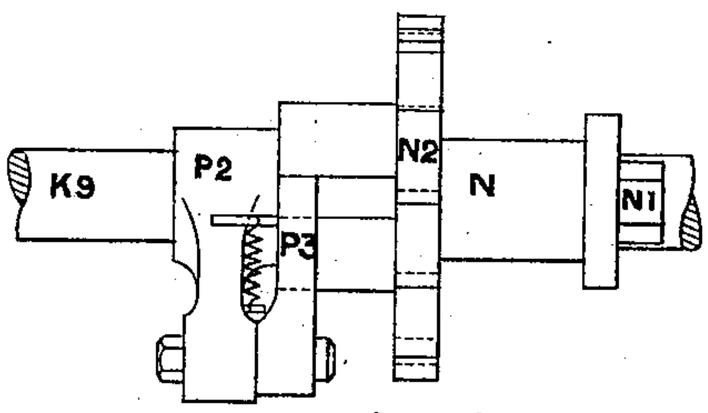

FIG: 14

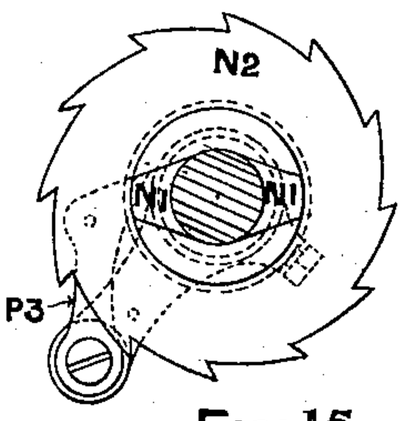

FIG: 15

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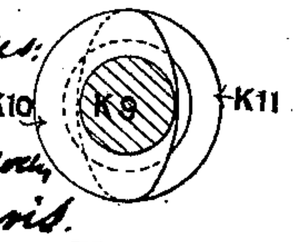

FIG: 16

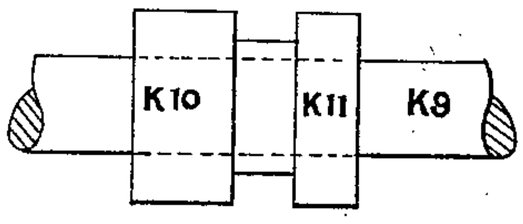

FIG: 17

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No. 614,599. Patented Nov. 22, 1898.

C. H. ALDRIDGE.

STRAIGHT KNITTING MACHINE.

(Application filed Dec. 9, 1897.)

(No Model.) 11 Sheets—Sheet 9.

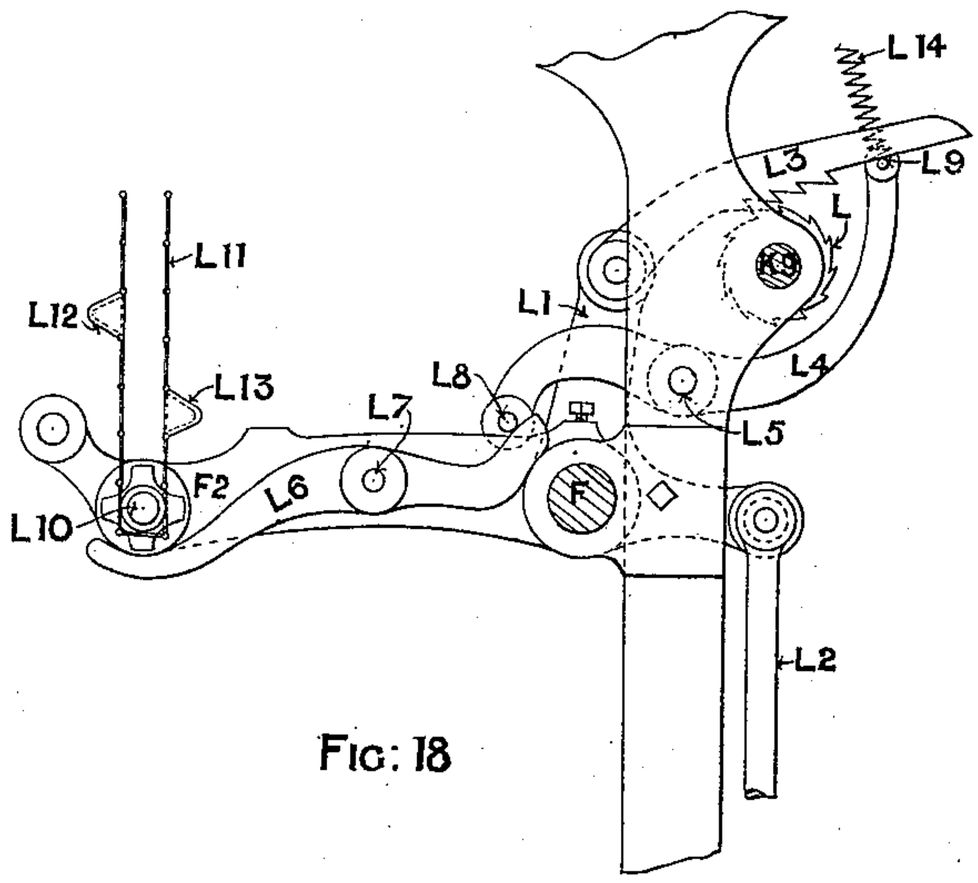

FIG: 18

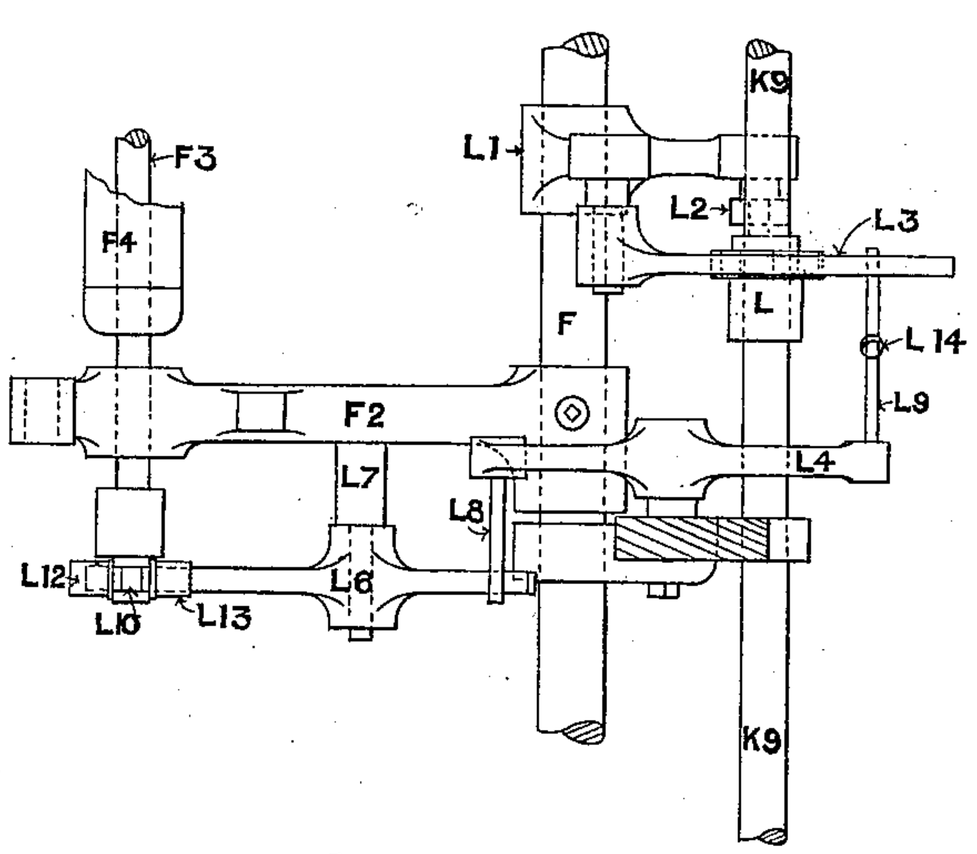

FIG: 19

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No. 614,599.

Patented Nov. 22, 1898.

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STRAIGHT KNITTING MACHINE.

(Application filed Dec. 9, 1897.)

(No Model.)

11 Sheets—Sheet 10.

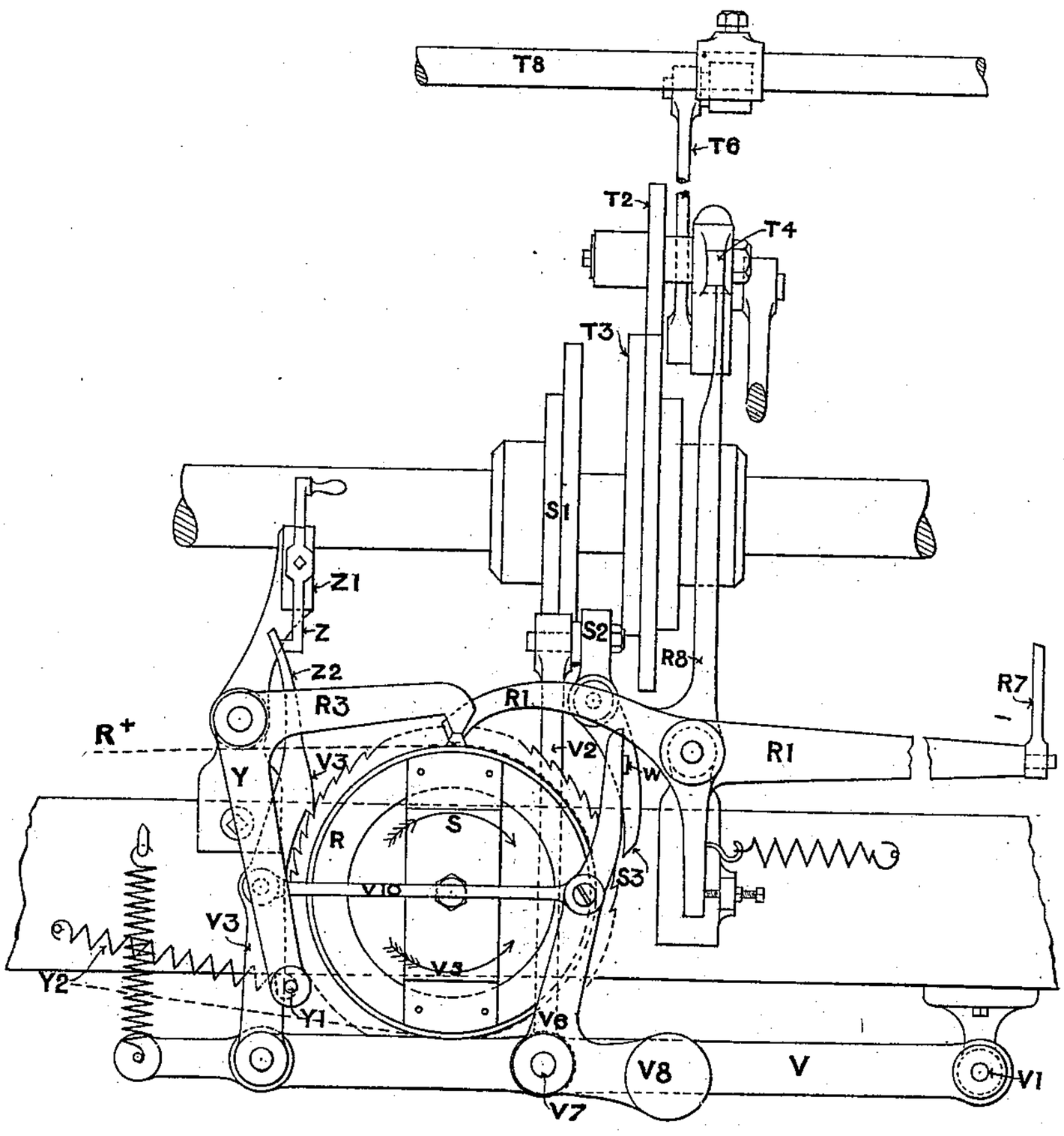

FIG:20

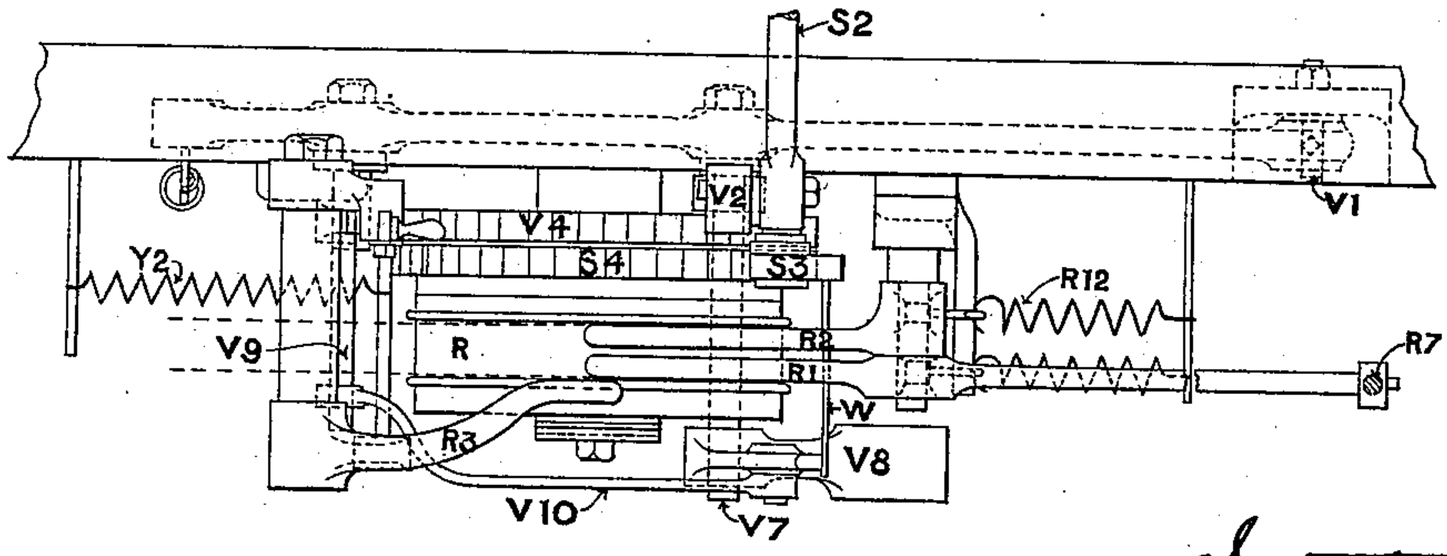

FIG:21

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No. 614,599. Patented Nov. 22, 1898.

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STRAIGHT KNITTING MACHINE.

(Application filed Dec. 9, 1897.)

(No Model.) 11 Sheets—Sheet 11.

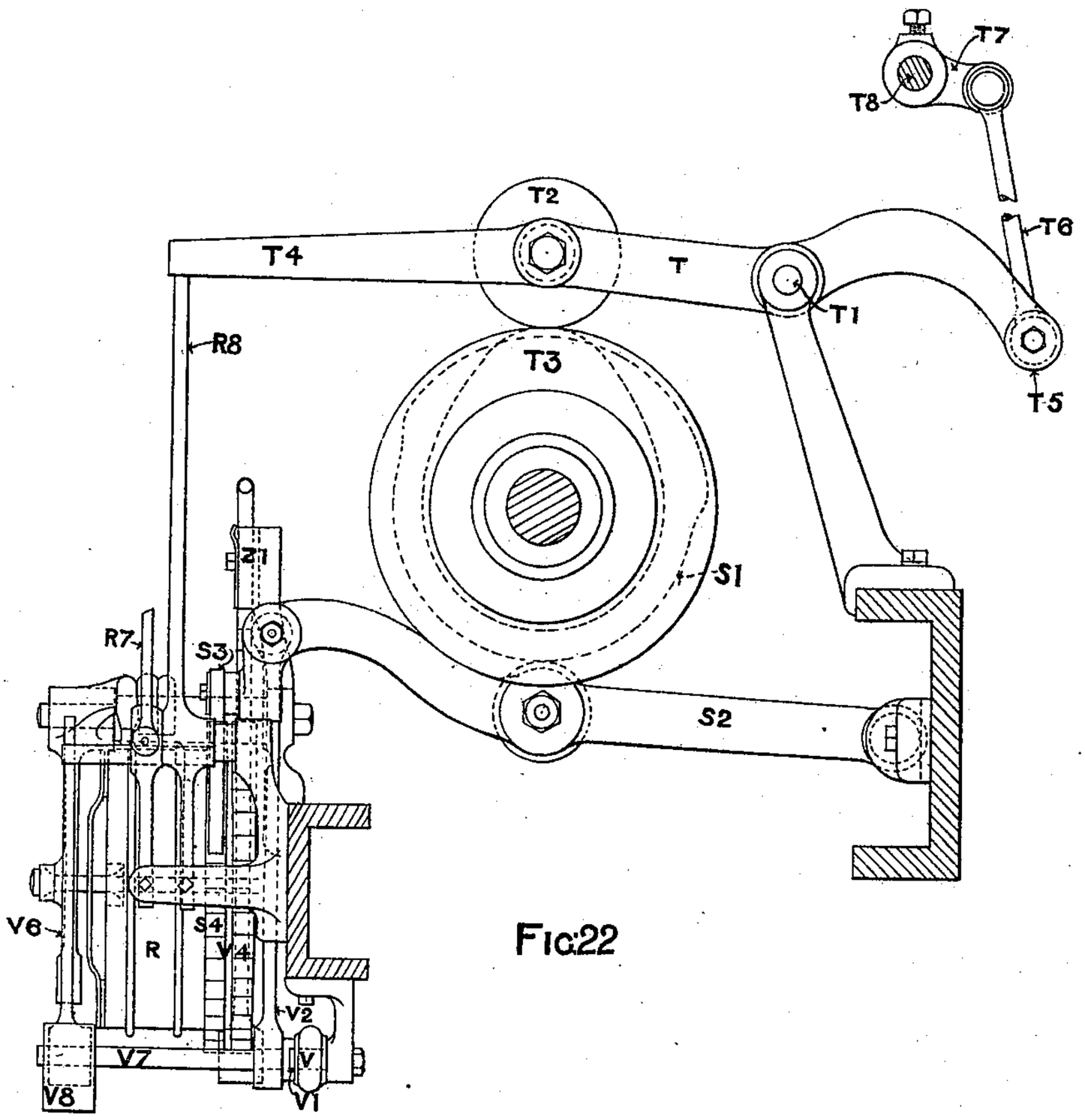

FIG:22

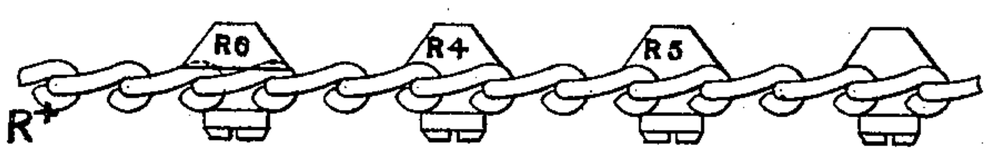

FIG:23

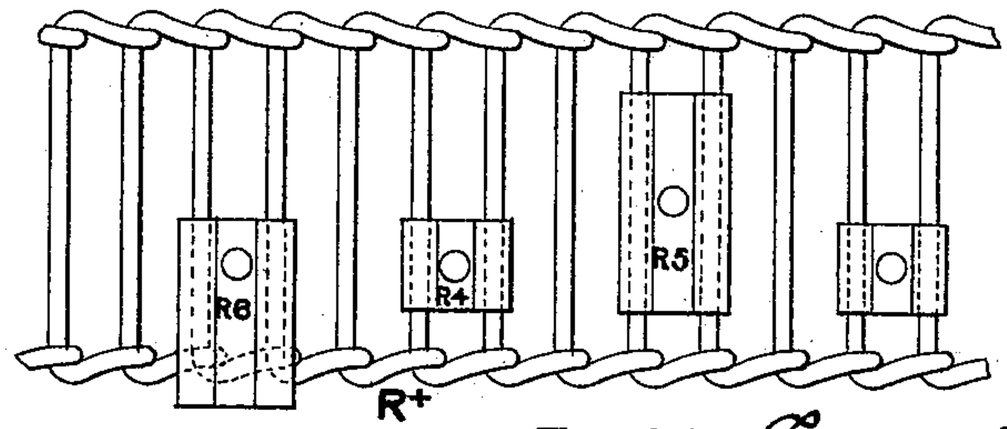

FIG:24

Witnesses:
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Inventor
Charles Henry Aldridge
By his Attorneys
Baldwin Davidson & Wright

UNITED STATES PATENT OFFICE.

CHARLES HENRY ALDRIDGE, OF LOUGHBOROUGH, ENGLAND.

STRAIGHT-KNITTING MACHINE.

SPECIFICATION forming part of Letters Patent No. 614,599, dated November 22, 1898.

Application filed December 9, 1897. Serial No. 661,281. (No model.)

To all whom it may concern:

Be it known that I, CHARLES HENRY ALDRIDGE, hosiery machinist, a subject of the Queen of Great Britain, residing at Pinfold Gate, Loughborough, in the county of Leicester, England, have invented certain new and useful Improvements in Straight-Knitting Machines, (for which I have received Letters Patent in Great Britain, No. 7,252, dated April 2, 1896,) of which the following is a specification.

This invention consists of certain improvements in straight or flat-bar knitting machines which are particularly applicable to the type of machine known as "Cotton's patents," where such are used for making lace or open work, hose, socks, underwear, and the like. In these machines I provide a separate lacing-point for each needle or for every other needle or other proportion desired. Each lacing-point is carried by a separate sliding "jack." Each jack has its corresponding "dropper," by which it can be pushed down into action, and the droppers are selected or put into and out of action for pushing down the jacks by the action of "jacquard-cards."

The main object of my invention is to enable fully-fashioned hose, socks, underwear, and the like to be made with the lace or open work running within a few stitches of the selvages all through the narrowings or widenings without loss of production and also to enable the lacework to be carried down the heels and instep, while at the same time the selvages of both heels and instep or other "partings" may be properly formed.

To enable the lacework to be carried within a few stitches of each selvage, notwithstanding that the fabric is being fashioned at the same time, I so mount the narrowing-points and the sliding jacks which carry the lace-points that when the lace-points are lifted out of action they and the jacks which carry them are out of the way of the ordinary narrowing-finger; also, as the narrowing-fingers are moved inward the lace-points immediately over the narrowing-fingers are held out of action by bars or stops, which are moved inward or outward step by step with the narrowing-fingers when fashioning. In addition other stops are used and are caused to act upon certain predetermined droppers and hold them out of action at certain times or places—as, for instance, where the "instep-partings" are required in hose and the like or for stopping the lacework in the heels or other parts.

In order that the lace design may be produced with a reasonable number of cards, and especially if the design in one part of the fabric has to be different from that in another following part of the fabric, I arrange and operate the band of cards in a manner hereinafter described. I also arrange and work the pattern and fashioning chain or chains in a manner hereinafter described, whereby any length of lacing-work and number of fashionings can be produced with very short chain or chains and a corresponding small number of studs.

These several improvements will be understood by referring to the accompanying drawings, where the mechanism relating thereto, together with some adjacent parts, is shown.

In the drawings I have only shown so much of a knitting-machine as is directly affected by my invention, the other parts not shown being similar to those used upon or in an ordinary plain-knitting machine of the Cotton type, which is well understood by all conversant with knitting machinery—such, for example, as shown in the specification of Cotton's British Patent No. 3,123 of 1864.

Figure 1, Sheet 1, is a part section through the narrowing mechanism and some adjacent parts, and Fig. 2, Sheet 2, is a front view of parts of same. Figs. 1^a and 2^a are similar views of the jacquard-cards and the barrels by which they are carried. Fig. 3 shows separately a portion of the rod H and stops carried by it. Figs. 4, 5, and 6 show these stops in three different positions relatively to the droppers. Figs. 7 and 8 show an end view and front view of the usual mechanism at the left hand of the machine for racking or imparting the endwise movements to the narrowing-fingers and other adjacent parts. Figs. 9 and 10 are end and plan views, on a larger scale, of the mechanism for drawing aside the narrowing-fingers when not required to narrow. Fig. 10^a is a view similar to Fig. 10, but showing the rod J′ connected to the

screw-box B^{11}. Figs. 11 and 12 show separately an end and plan view of the parts for turning the axis of the jacquard-barrel in either direction. Fig. 13 is a plan view of some of the parts in Fig. 12 when the shaft K^9 has been moved a distance endwise. Figs. 14 and 15 show an end and plan view of some of the parts carried by the shaft K^9. Figs. 16 and 17 show end and plan views of the cams carried by the shaft K^9. Figs. 18 and 19 show end and plan views of the parts for controlling the times at which the shaft K^9 shall have a partial turn given to it. Figs. 20 and 21 show front and plan views, and Fig. 22 a part section and end view, of the parts for causing the pattern-chain to repeat and some adjacent parts. Figs. 23 and 24 are an elevation and a plan of a portion of the pattern-chain on a larger scale.

A are the needles; A′, the sinkers; A^2, the knocking-over bits.

B is the narrowing-mechanism shaft, to which the arms B′ are fast. These arms carry the shaft B^2, to which brackets B^3 are fast. These brackets carry the sliding rods or bars B^4 B^5, to which the fashioning-fingers B^6 B^7 are attached, the finger B^6 being fast to the rod B^5 and the finger B^7 being fast to the rod B^4. B^8 are the coverers or fashioning-points. The finger B^6 transfers the loops at the left-hand or No. 1 selvage, and the finger B^7 transfers the loops at No. 2 selvage in the usual well-understood manner.

The necessary movements are imparted to the narrowing mechanism by means of cams and levers through the connecting-link B^9 in the usual well-understood manner.

C^4 are the lacing-points, each carried by a sliding jack C^3. As will be seen from Fig. 1, the sliding jacks C^3 are in a different plane to the fingers B^6 and B^7, which carry the fashioning-points, so that they do not interfere with one another's movement. The sliding jacks C^3 slide in tricks or grooves cut vertically in a bar C^2, which may extend the full width of the division of needles. This bar is carried by brackets C′ from a rod C, which may pass through the brackets B^3.

C^5 is a cover-plate to keep the jacks C^3 in the bar C^2.

C^6 are springs (one to each jack) which are carried by or fast to a suitable bar C^7 and may be attached to the cover-plate C^3. The jack C^3 has a V-shaped nick in its edge at such a position that when the jack is in its raised position, as shown in Fig. 1, the nose of the spring C^6 catches in the V-nick and supports the jack in its raised position—*i. e.*, out of action. When the lacing-point C^4 is required in action, its jack C^3 is pressed downward until the lacing-point C^4 is brought into line with the fashioning-points B^8, when it will be in position for transferring loops from its corresponding needle.

The rod or shaft C (and consequently the lace-points C^4 also) has an endwise movement imparted to it, so that when a lacing-point is in action and has taken a loop from a needle it may be made to place it upon an adjacent needle and so form a lace-hole in the fabric.

The lace-points are selected and brought into acting position as follows:

D is a shaft carried by bearings in or upon the narrowing mechanism B′, and it is free to rock therein. To this shaft D arms D′ are attached, and to the ends of these connecting-links D^2 are jointed. Through these links D^2 a suitable rocking motion is imparted to the shaft D by a cam or cams upon the main shaft. Fast to the shaft D are other arms D^3. These arms carry a rod or shaft D^4. Upon this shaft D^4 droppers E are threaded, one to each lace-jack C^3. These droppers are free to rock upon the shaft D^4 and are held in their correct positions, each over its corresponding lace-jack, by means of comb-bars E′ E′ E′. These comb-bars may be carried by suitable brackets, which may be fast to the shaft D^4.

The shaft D^4 may have parallel flat surfaces formed thereon, as shown more clearly in Figs. 4, 5, and 6, Sheet 4, and the droppers may have a gap E^7, Figs. 5 and 6, formed thereon, so that when the shaft D^4 is turned into a suitable position any one of the droppers may be removed or replaced without unthreading the adjacent droppers.

It will be seen that the dropper as shown has four arms or members E, E^3, E^4, and E^5. The lower arm E^3 is formed with a V-shaped catch, which may engage with the top of its corresponding lace-jack C^3. The arm or member E^4 of each dropper is provided with a pin E^6, which engages with jacquard-cards, as hereinafter described. Instead of the pins E^6 being all in one line they may be arranged in two or more rows, so that no two adjacent droppers shall have their pins at the same distance from the shaft D^4, by which means larger holes may be made in the selecting-cards. The top arm or member E^5 is acted upon by cam or stop pieces H′ for stopping or throwing out of action certain droppers, as hereinafter described. The larger arm E acts as a weight, whereby the lower arm E^3 is brought into contact with its lace-jack when permitted by the selecting-cards.

F is a shaft carried by brackets F′, which may be fast to any convenient part of the framing of the machine. Arms F^2 are fast to the shaft F. These arms carry a rotating shaft F^3, which is rotated by means hereinafter described. This shaft carries the card-cylinders F^4. These cylinders carry and present the cards F^5. To the arms F^2 connecting-links F^6 may be attached, through which a rising-and-falling motion may be imparted to the shaft F^3, and consequently to the card-cylinders also. The cards F^5 are perforated in the usual well-understood manner of jacquard mechanism.

When a card F^5 is presented by the card-cylinder F^4 to the pins E^6 on the droppers and

there is a hole in the card over a dropper-pin E^6, the heavier arm E of the dropper will cause the pin E^6 to enter the hole in the card, whereby the catch E^3 of the dropper will engage with its corresponding lace-jack, so that when the shaft D is rocked, as hereinbefore described, the corresponding lace-point will be lowered and brought into action, and where there is no hole in the card over a dropper-pin E^6 that dropper-pin will be depressed and the catch E^3 will not engage with its lace-jack, and so its corresponding lace-point will not be brought into action. When the droppers are again lifted into their raised position, a bar G′, suspended by links G from the shaft D^4, catches the heads C^8 of the jacks C^3 and lifts them all out of action ready for the next selection by the cards.

In some cases—for instance, when making hose or the like—when the part is reached where the instep-partings are made—*i. e.*, where the extra carriers are brought into action for forming the heels—a certain number of lace-points adjacent to the selvages made by the partings are required to be held out of action, while the remainder of the lace-points shall continue to come into action as selected by the cards, and then when the lacing has been continued down the heels a certain distance those lace-points which form the lacing in the heels are required to be stopped or held out of action, while the remainder may continue in action, as before, for lacing down the instep. To do this I employ cam or stop pieces to act upon the droppers in the following manner:

H^4 are the cam or stop pieces formed upon collars H^2, Figs. 3 to 6, Sheets 3 and 4, which are fast upon a light shaft H, which is carried by suitable bearings or brackets.

H^7 is a handle (see Fig. 2) fast upon the shaft H, by means of which the shaft H may be turned.

H^5 is a notched wheel or segment also fast upon the shaft H, and H^6 is a spring engaging with the notches to retain the shaft in any desired position.

When the shaft H is turned so as to bring the cam-collars H^2 into the position shown in Fig. 5, then the droppers are not affected by them, and so are under the control of the cards. When the shaft is turned into a position as shown in Fig. 4, then those droppers which are covered by the cam-pieces H^4 will be held out of action, and when it is turned into a position as shown in Fig. 6 the cam-pieces H′ will hold out of action all the droppers covered by them. Thus when lacing down the leg of a hose, sock, or the like the cam-pieces H^4 will be in the position shown in Fig. 5. When the partings are made, then the shaft H will be turned and the cam-piece H^4 will be brought into the position shown in Fig. 4, and plain work will be made at each selvage. Then when the heel-lacing is completed the shaft H is turned, so that the cam-pieces are brought into the position shown in Fig. 6, when all the droppers except those engaged in lacing the instep will be thrown out of action.

Each plate may be thick enough to catch one dropper, so that for every extra dropper required to be stopped a plate is added.

So far I have simply described the cam-pieces H^4 and adjacent parts as used for making the partings and for stopping the lacings in the heels; but it will be evident that where desired several cam-pieces of different shapes may be used, so as to stop various portions of lacework and so leave spaces for embroidery or the like, without altering the regular full pattern of the cards.

The mechanism for imparting the endwise movements to the rod or shaft C, and consequently to the lace-points also, will be understood by referring to Figs. 7 and 8, Sheets 5 and 6. Fig. 7 is an end view of the mechanism, together with some adjacent parts, and Fig. 8 is a front view of the same. C^9 is a suitable bracket attached to a convenient part of the framing of the machine. C^{10} is a screw or worm carried in bearings attached to the bracket C^9. C^{11} is a nut or screw-box working upon the screw C^{10}. C^{12} is a rack-wheel attached to the screw C^{10}. C^{13} C^{14} are two racks which can gear into the rack-wheel C^{12}. These racks are jointed to the lever C^{15}. This lever carries a "truck" or roller C^{16}, which runs upon a cam or cams C^{17}. C^{18} is a cam-wheel which acts upon the racks C^{13} C^{14}. C^{19} is a rack-wheel attached to the cam-wheel C^{18}. C^{20} is a pawl which acts upon the rack-wheel C^{19}. This pawl C^{20} is jointed to the lever C^{21} by a suitable axle or pin and bracket, and motion is imparted to the lever C^{21} by the cam or cams C^{22}. Thus the cam or cams C^{22} rotates the cam-wheel C^{18} step by step. This cam-wheel is so shaped that as it is rotated it throws the racks C^{13} C^{14} in and out of action in a certain predetermined order. The screw-box C^{11} carries a bracket C^{23}. To this bracket the rods C, D^4, and F^3 are suitably connected, so that the lace-points, the droppers, and the card-cylinders all move together endwise for the transfer of loops from needle to needle, as governed by the shape of the cam-wheel C^{18}.

In some cases I impart a horizontal sliding motion to the narrowing-finger rods, so that the narrowing-fingers may be drawn out clear of the fabric altogether when a lace-course is made without fashioning, and when a fashioning is required the fashioning-fingers are set in to such a position as will enable them to make the desired fashionings and then be again drawn out clear of the fabric. This will be understood by referring to Figs. 7 to 10, Sheets 5, 6, and 7. Figs. 7 and 8, Sheets 5 and 6, show the usual end mechanism (for the left-hand or No. 1 end) for racking or imparting the endwise movements to the narrowing-fingers, together with some adjacent parts, and Figs. 9 and 10, Sheet 6, are enlarged views of the special mechanism whereby the narrowing-fingers may be auto-

matically drawn out clear of the acting lace-jacks and the selvage-needles when not required to narrow. The movements will be best understood by referring to the enlarged views Figs. 9 and 10, and this mechanism will be seen localized in Figs. 7 and 8, Sheets 5 and 6. B^{16} is a slide the bed of which is fast to the screw-box B^{11}. Upon the end of this slide is a bracket B^{17}. To this bracket the finger-rod B^5 is connected by suitable brackets. Thus by the endwise movement of the slide B^{16} all the left-hand selvage-fingers B^6 are moved endwise also. T^8 is a light shaft carried in suitable bearings and running from end to end of the machine. To the end of this shaft an arm T^9 is fast, Figs. 7 and 8. A connecting-link T^{10} connects this arm to the cam-wheel T^{11}, Figs. 7 and 8. This cam-wheel acts upon the narrowing-rack B^{13} so as to hold it out of or let it into action by the rocking of the shaft T^8. This shaft T^8 is rocked in such a manner and at such a time by mechanism hereinafter described that when a lace course only is made the cam-wheel T^{11} holds the narrowing-rack out of action; but when a narrowing is required the shaft T^8 is rocked and the cam-wheel T^{11} permits the narrowing-rack B^{13} to fall into action. Also fast to the shaft T^8 are two arms T^{12}, which carry a rod T^{13}. A bent or bell-crank arm or lever T^{14} rocks upon a suitable pin which is conveniently attached and fast to the bed of the slide B^{16}. The bottom end of the lever T^{14} embraces the rod T^{13} and the top end has a connecting-rod T^{15}, which connects it to a cam T^{16}. This cam is jointed to a bracket T^{17}, which is fast to the bed of the slide B^{16}. A truck or roller T^{18} runs upon a stud or pin which is fast to the slide B^{16}. A spring B^{18} holds this truck up to the cam T^{16}. This cam is so shaped that when in the position shown in full lines in Fig. 10 the narrowing-fingers will be drawn out clear of the selvage-needles or out of action, and when it is in the position indicated by dotted lines the slide B^{16} will be drawn in by the spring B^{18}, as permitted by the shape of the cam T^{16}, whereby the narrowing-fingers are brought into action. Thus it will be seen that by the rocking of the shaft T^8 by mechanism hereinafter described the narrowing-ratchet B^{13} is thrown into action and at the same time the narrowing-fingers move into their position over the selvage-needles to transfer the loops as required, or the narrowing-ratchet B^{13} is thrown out of action and at the same time the narrowing-fingers are drawn out clear of the selvage-needles and the lace-jacks and the selvage-loops are not removed from their needles except when a narrowing is required. Similar mechanism is located at the right-hand end of the machine for moving and controlling the right-hand fashioning-fingers, and the two sets of mechanism are controlled simultaneously by means of the shaft T^8, which will be well understood.

When making fashioned work, it is sometimes desirable that the lacework should be made right across the fabric to within a few needles of each selvage, and as the fabric is narrowed or widened the lacework shall be narrowed or widened also. To do this, I arrange certain mechanism to act upon the droppers so as to throw them in or out of action in regular consecutive order as the fabric is narrowed or widened. This arrangement will be understood by referring to Figs. 1 and 2, Sheets 1 and 3. A rod or shaft J, Figs. 1 and 2, is carried by the arms D^3, so that it will move up and down with the droppers and their adjacent parts. Two sliding rods or bars J' J^2 are carried by suitable brackets J^3, which are fast to the shaft J. A stop-bar J^9 is attached by a bracket J^8 to the sliding bar J', and similarly a stop-bar J^{10} is attached by a bracket J^{11} to the sliding bar J^2. These rods J' J^2 are caused to traverse or rack with the narrowing-finger rods B^4 B^5. To do this, a finger-bracket J^4 is fast to the bar J' and fits into the fork-bracket J^5, which is fast to any convenient part of the narrowing-finger rod B^5, so that all lengthwise movements imparted to the finger-rod B^5 are imparted to the rod J' also. In a similar manner the rod J^2 is connected to the finger-rod B^4 by means of the finger J^6 and the fork-bracket J^7.

When the stop-bars J^9 J^{10} are under the tails of any of the droppers E, they hold these droppers out of action, their inner ends always supporting those droppers which would engage with the lace-jacks immediately over the fashioning-points. Thus it will be seen that as the fashioning-fingers B^6 B^7 are narrowed or racked in the droppers immediately over the fashioning-points are always held out of action, and so the lacework is narrowed also independently of the selection made by the cards.

In some cases instead of the rods J' J^2 being connected to the finger-rods B^4 B^5, as hereinbefore described, I connect them, as illustrated in Fig. 10^a, by suitable brackets or the like directly to the screw-box B^{11} or to parts which are fast thereto, so that instead of the stop-bars J^9 J^{10} being drawn out each time the fashioning-fingers are moved outside the selvage-needles by means of the cam T^{16}, as hereinbefore described, they will only be moved inward as the work is narrowed, and so cause a margin all down the selvages.

The stop-bars J^9 J^{10} can be set inwards at each narrowing, as above described, without their ends coming against the sides of any of the tail ends E of the droppers, because the racking in of the fashioning-fingers takes place just when the points are above the knocking-over bits, and consequently at the time when the shaft D^4 is in its lowest position in relation to the lacing-points. As the shaft D^4 is moved into this position the droppers turn somewhat upon it until when the shaft is in its lowered position the arms E of all the droppers are lifted above the level of the stop-bars J^9 J^{10}, and so do not interfere with the bars being moved endwise.

I will now describe the construction of the band of cards and the mechanism for and the manner of rotating the card-cylinder shaft F^3.

The endless band of cards may be carried upward, as indicated in Fig. 1, and may pass over a suitable tightening-roller, as illustrated in Figs. 1^a and 2^a, to which springs, cords, or other suitable equivalents may be attached in order to retain a constant tension upon the band of cards. In some cases where a large number of cards are used they may pass over suitably-located guide-rollers to the back of the frame, where the tightening-roller may be located, or they may be gathered up and stored in any other convenient manner.

When making a hose, sock, or the like, it is mostly desirable that two or more distinct patterns or designs shall be used, one or more designs forming a heading or bracelet, followed by another design, which may be repeated all down the leg and foot. To produce such an arrangement of designs with the smallest number of cards possible, I construct and arrange the band of cards as follows: The cards necessary to form the heading or bracelet are laced up and presented all in regular consecutive order, and these are followed by the cards necessary to form one or more complete patterns of the repeating portion of the design. In a single design, where the pattern is reversible, the band of cards may be racked forward one card at a time until the pattern is completed, when the movement of the band of cards is reversed, and the cards are then racked back one at a time until the first card of the repeating portion is reached, when the racking is again reversed, and so on, as long as desired; but when the design of the repeating portion is not reversible I arrange and work the band of cards as follows: When the band of cards has been racked forward one card at a time until the heading or bracelet is completed, I then cause the band of cards to be racked twice between each selection of lace-points, so that instead of each following card being brought into action consecutively every second card is brought into action, except when the movement of the band of cards is reversed, when it is racked once only, as hereinafter described.

The mechanism for producing the varied movements of the band of cards will be understood by referring to the accompanying drawings. Figs. 1^a and 11 to 19, Sheets 2, 8, and 9, show this arrangement. K is a ratchet-wheel which is fast to the cylinder-shaft F^3. K′ is a second similar ratchet-wheel which is geared to the ratchet-wheel K by the equal gear-wheels K^2 K^2. K^5 is a pawl by which a step-by-step turning movement can be imparted to the ratchet-wheel K, and K^6 is a pawl by which a similar movement can be imparted to the ratchet-wheel K′. Thus the card-cylinders will be turned in one direction when the pawl K^5 is in action and in the opposite direction when K^6 is in action. The pawls K^5 K^6 are carried by a bell-crank lever K^3, Figs. 1, 11, and 12, which is rocked upon the shaft F by a connecting-link K^4, actuated by suitable cam or cams. Two forward movements are imparted to the pawls K^5 K^6 by the rocking of the bell-crank lever K^3 between each selection of lace-points, so that two turning movements can be given to the card-cylinders in either one or other direction between successive selections. Either one or other or both of the ratchets can be held out of action by the action of cams K^{10} K^{11}, which are fast on a shaft K^9 and act upon the tails or extensions K^7 K^8 of the pawls K^5 K^6. Separate views of these cams are shown at Figs. 16 and 17. The shaft K^9 is racked or rotated a quarter of a revolution at a time by mechanism yet to be described.

When the cams K^{10} K^{11} are in the position shown in Fig. 11, the pawl K^5 will be in action and the band of cards will be advanced. Then if the shaft K^9 be turned a quarter of a revolution both pawls K^5 and K^6 will be held out of action. If the shaft K^9 be again turned a quarter of a revolution into the position shown in Fig. 1, then the pawl K^6 will be in action and the pawl K^5 out of action and the movement of the band of cards will be reversed. A step-by-step turning movement can be imparted to the shaft K^9 in the following manner: The shaft K^9 has fast upon it a ratchet-wheel L, Figs. 18 and 19. A bell-crank lever L′ rocks upon the shaft F. This lever receives its rocking movements from a suitable cam through the connecting-rod L^2, attached to one of its ends. The other end of the lever L′ carries a rack or pawl L^3, which acts upon the ratchet-wheel L. The ratchet can be held up and out of action by a pin L^9 on a lever L^4. This lever works upon a fixed pin or axle L^5. Another lever L^6 works upon a pin or axle L^7 in the arm F^2. A pin L^8 in one end of the lever L^4 rests upon one end of the lever L^6. To the end of the card-cylinder shaft F^3 a four-toothed wheel L^{10} is attached. Around this wheel a suitable endless chain L^{11} is passed having the same number of links as there are cards in the band of cards. Two inclines or studs L^{12} L^{13} are attached to this chain, so that as the card-cylinder shaft F^3 is rotated the inclines L^{12} L^{13} come into contact with and depress the end of the lever L^6. The inclines L^{12} and L^{13} are so located upon the chain L^{11} that when the first of the repeating cards is in acting position the incline L^{12} will depress the lever L^6, and when the last of the repeating cards is in acting position the incline L^{13} will depress the lever L^6. A spring L^{14} may be attached to any convenient part of the lever L^4 and the whole mechanism may be so set and adjusted that when the inclines L^{12} and L^{13} are not in contact with the lever L^6 the spring L^{14} holds the pin L^9 on the lever L^4 in such a position that the pawl L^3 is held out of contact with the ratchet-wheel L, and when the inclines L^{12} or L^{13} depress the lever L^6 the pawl L^3 is let fall into

action and the shaft K^9 is racked, and consequently the cams K^{10} K^{11} are racked also.

To make the relative movements of the mechanism shown in Figs. 11, 12, 18, and 19 clearer, I will consider them in conjunction with the construction or method of lacing up the band of cards. Taking, for example, the number of cards in the repeating portion of the band of cards as six, and suppose there are ten cards required to form the heading or bracelet, then cards Nos. 1 to 10 will be the non-repeating cards and cards Nos. 11 to 16 the repeating cards, and the whole band of cards will be laced together as follows: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 16, 12, 15, 13, 14, as illustrated in Figs. 1^a and 2^a.

I will first describe the reversing movements of the repeating portion of the band of cards hereinbefore described.

The movements imparted to the pawl L^3, through the connecting-link L^2, are such as to cause the pawl L^3 to move or rack twice between each selection of lace-points, each movement of the pawl L^3 following immediately after the movement of the pawls K^5 K^6. The band of cards having been advanced one card at a time for cards Nos. 1 to 11, the pawl K^5 will be in action and will then rack the band of cards forward twice between each selection of lace-points, so that cards Nos. 11, 12, and 13 come into action in regular order, as hereinbefore described. During this series of movements the cams K^{10} K^{11} will be in the position shown in Fig. 11. Then after No. 13 has been presented—*i. e.*, acted upon by the droppers and so made a selection of lace-points—the first time the pawl K^5 is advanced No. 14 card is brought into acting position, and at the same time the incline L^{12} depresses the lever L^6, whereby the ratchet L^3 is brought into action and the shaft K^9 is racked one-quarter of a revolution, as hereinbefore described. This movement of the shaft K^9 turns the cams K^{10} K^{11} into such a position that both the pawls K^5 K^6 are held out of action. Thus when the pawl K^5 advances for the second time the cylinder-shaft F^3 is not racked, so that No. 14 card is presented for the next selection. The incline L^{12} being still in contact with the lever L^6, the ratchet L^3 (which moves immediately after the pawls K^5 K^6) again racks the shaft K^9 one-quarter of a revolution, which brings the cams K^{10} K^{11} into the position shown in Fig. 1, where the pawl K^6 is brought into action and the pawl K^5 lifted out of action, so that before the next selection of lace-points the pawl K^6 will rack the band of cards back two cards, which brings No. 15 into action, and so on for No. 16. After No. 16 has been in action the first time the pawl K^6 is advanced No. 11 card is brought into acting position, and at the same time the incline L^{13} acts upon the lever L^6, whereby the ratchet L^3 is brought into action, the shaft K^9 is racked one-quarter revolution, and the pawls K^5 K^6 are then both held out of action, while the pawl K^5 is advanced for the second time, so that the shaft F^3 is not racked, and this leaves card No. 11 to make its selection. The second racking movement of the lever L^3, which follows the second racking movement of the levers K^5 K^6, again turns the shaft N^9 one-quarter revolution, bringing the pawl K^5 into action and throwing the pawl K^6 out of action. This completes the cycle of movements, which is repeated as often as desirable.

I will now describe the mechanism which governs the movements of the band of cards during the formation of the heading or bracelet. These movements precede the reversing movements hereinbefore described. During the formation of the heading or bracelet the band of cards has to advance one card at a time between each selection, each card coming into action in consecutive order. To do this, the pawl K^5 has to be in action; but as the pawl K^5 moves twice between each selection of lace-points, as hereinbefore described, it is necessary that it shall be held out of action every other time, so that it shall only rack once between each selection. This is effected by shifting the shaft K^9 endwise, so that the cam K^{11} no longer acts upon the tail K^7 of the pawl K^5, and in place of it cam-noses N' N' are brought into position to act upon the tail of the pawl and hold the pawl out of action every other time that it makes its forward movement. The mechanism for effecting this will be understood by referring to Figs. 11, 12, 13, 14, and 15, Sheet 8. To the end of the shaft K^9 a wheel or collar M is fast. M' is part of the framing of the machine or a bearing attached thereto, through which the shaft K^9 passes. Upon the bearing M' is a suitably-shaped fixed incline M^2. The wheel or collar M is cut out so as to fit over the incline M^2, so that when the shaft K^9 is turned or racked for the first time, after starting the band of cards, by the ratchet L^3, as hereinbefore described, the incline M^2, bearing upon the wheel or collar M, causes the shaft K^9 to move endwise in the direction of the arrow, Fig. 12, into the position shown in Fig. 12. When the shaft K^9 is in the position shown in Fig. 13, the cam K^{11} is not acting upon the tail of the ratchet K^5. Upon the shaft K^9 is a loose sleeve or collar N. (Seen best in the enlarged views, Figs. 14 and 15.) Upon the ends of this collar are two cam-noses N' N'. Fast upon this collar is a rack-wheel N^2. The bell-crank lever K^3 carries a pawl N^3, which acts upon the rack-wheel N^2, and so turns the collar N. When the shaft K^9 is in the position shown in Fig. 13, the cam-noses N' N' are above the tail K^7 of the ratchet K^5 and the pawl N^3 is in contact with the rack-wheel N^2. When the cam-noses N' N' are in the position shown in Fig. 13, the pawl K^5 will be in action and will rack the shaft F^3. Then as the pawl K^5 retires the pawl N^3 will rack the collar N one-quarter of a revolution, so as to bring one of the noses N' into contact with the tail of the pawl K^5, so that as it advances for the second

time it is held out of action. Then when it retires the collar N is again racked, whereby the pawl K^5 is again brought into action. Thus the pawl K^5 racks the cylinder-shaft at every other advance. A friction-clip P, Fig. 13, may embrace the collar N. It may have a tail P′ to engage with the shaft F to prevent the clip turning. An arm or collar P^2 is fast to the shaft K^9. To this arm or collar a pawl or ratchet P^3 is jointed and engages with a suitable nick or groove in the boss of the rack-wheel N^2 or the collar N. This pawl may be held in its nick or groove by a spring, as shown.

Before starting the knitting of a hose, sock, or the like the shaft K^9 is turned round by hand until the recess in the wheel or collar M, Fig. 13, is opposite the incline M^2. The shaft K^9 is then pushed endwise into the position shown in Fig. 13. In turning the shaft K^9 into this position the pawl P^3, Figs. 12, 14, and 15, engages with its nick or groove in the rack-wheel N^2 and turns it, and consequently the cam-noses N′ N′ also, into the correct position for starting the band of cards. The machine is then started. The pawl K^5 racks the band of cards one card at a time between each selection of lace-points, as hereinbefore described, until the bracelet or heading is completed, when the incline L^{13}, Fig. 18, comes into action. The shaft K^9 is rocked and at the same time is shifted endwise by the incline M^2, Figs. 12 and 13, whereby the cam-noses N′ N′ are thrown out of action and the cam K^{11} is brought into action, and the band of cards is then advanced two cards between each selection, except when the movement of the band of cards is reversed, as hereinbefore described. A bracket P^4, attached to any convenient part of the framing, may carry a pin P^5 to support the pawl N^3 when the rack-wheel N^2 is moved from under it by the endwise movement of the shaft K^9, as shown in Fig. 12 and hereinbefore described.

The number and order of the lacing-courses, as also the number and order of the narrowings, are regulated and governed by means of studs acting upon certain levers, which in turn act upon the well-understood mechanism which shogs or shifts the cam-shaft endwise, whereby the set of narrowing or fashioning cams come into action and the fashioning or lace courses are made. If when making a full-length hose—for example, which has lacework from welt to toe—the endless chain had one continuous step-by-step forward movement given to it in the ordinary way, the chain would have to be of such a length that it would be almost impracticable to use it. To obviate this, I provide certain arrangements of mechanism whereby at times the chain may be racked backward and forward, so as to keep repeating certain studs while making lacework without fashioning, and then racked straight forward in the usual well-understood manner, while that portion of the fabric is made which is required to be fashioned. By these means a much shorter chain, and consequently smaller number of studs, will regulate and govern the lace courses and narrowings in the longest hose. This arrangement will be understood by referring to Figs. 20 to 24, Sheets 10 and 11. Fig. 20 is a front elevation, Fig. 21 a plan, and Fig. 22 is a part end view and section, of the mechanism for causing the chain to repeat and some adjacent parts. Figs. 23 and 24 are elevation and plan of a portion of the chain, showing the studs, inclines, or notches. R is the chain-wheel, around which the endless chain $R^{\times}$ (similar to that shown in Figs. 23 and 24) passes, as indicated by dotted lines in Fig. 20. The chain-wheel R is racked in the direction of the arrow S in the usual well-understood manner by means of the ratchet-wheel S^4, which is fast upon it, being acted upon by a pawl S^3, carried by a lever S^2, (see Fig. 22,) acted upon by the cam S′. Three levers R′, R^2, and R^3 are provided, which are to be lifted at certain predetermined intervals by the studs R^4 R^5 R^6, which are fixed upon the endless chain. The lever R′ has a connecting-rod R^7 jointed to its extremity. This rod is attached at its other extremity to the pawl which racks the usual well-understood shogging mechanism, whereby the cam-shaft is shogged or shifted endwise for the purpose of making a narrowing or lace course. Thus when a stud R^4, R^5, or R^6 comes under the nose of the lever R′ the connecting-rod R^7 lowers the hereinbefore-mentioned pawl, which racks the shogging mechanism, whereby the cam-shaft is shifted endwise and a lace or fashioning course is made according to which of the studs is in action, as hereinafter described. R^2 is another lever which is acted upon by the stud R^5. It serves to put into or out of action the mechanism for shifting the fashioning-points sidewise according to whether a lace-course or a fashioning-course is to be made. This lever has a vertical arm or prop R^8. T is a lever jointed or working upon a pin or axle T′. T^2 is a truck or roller carried by the lever T and which runs upon the cam T^3. One extremity of the lever T is so arranged that it can rest upon the top of the arm or prop R^8 of the lever R^2. When it does so, this arm is held up and the truck T^2 cannot follow the path of the cam T^3. To the other extremity T^5 of the lever T a connecting-rod T^6 is jointed and connects it to the arm T^7, which is fast to the shaft T^8. This shaft T^8 runs from end to end of the machine and carries the arms T^9 and T^{12}, Figs. 8, 9, and 10, Sheets 6 and 7, as hereinbefore described. Thus when there is no stud R^5 below the nose of the lever R^2 the spring R^{12}, Fig. 21, holds the lever in such a position that the arm or prop R^8 is under the end T^4 of the lever T and the shaft T^8 is not turned, and the narrowing-fingers are not racked and are held outside the selvage-needles; but when a stud R^5 comes under the nose of the lever R^2 the prop R^8 is shifted

from under the end T^4 of the lever T. The truck T^2 is then free to follow the path of the cam T^3. The shaft T^8 is consequently turned in its bearings when the narrowing-fingers are brought into acting position over the selvage-needles, and the racking-clawkers are thrown into action. The selvage-loops are then shifted, and the narrowing is made. The chain is made up with studs similar to R^4 where lacework is required, and a stud similar to R^5 is placed where a narrowing is required at the same time as the lace-course.

While making lacework in the parts of a hose, for example, where there are no narrowings—*i. e.*, above the calf-narrowings, also down the ankle and instep—instead of continuously advancing the chain and so using many studs I cause the chain to repeat on one or more studs, as follows: A lever V is jointed upon a fixed pin or axle V′. A connecting-rod V^2 connects this lever with the lever S^2. To the end of the lever V a clawker V^3 is jointed and engages with a second rack-wheel V^4, also fast to the chain-wheel R. Thus it will be seen that when the pawl S^3 is in action the chain-wheel R will be racked in the direction of the arrow S and when the clawker V^3 is in action the chain-wheel R will be racked back in the direction of the arrow V^5. A lever V^6 is jointed upon a pin or axle V^7, which is carried by the lever V. The lever V^6 is provided with a weighted arm V^8 at its lower end, and its top end is so shaped as to form a guide or stop for the finger or bracket W, which is fast to or part of the pawl S^3, so that the weighted arm V^8 tends to hold the pawl S^3 out of action. A pin V^9 projects from and is fast to the clawker V^3. A connecting-link V^{10} connects the pin V^9 (and consequently the clawker V^3 also) with the arm V^6 in such a manner that when the clawker V^3 is in action the arm V^6 holds the pawl S^3 out of action, and when the clawker V^3 is held out of action the pawl S^3 falls into action. The stud-lever R^3 has a lower arm or member Y. This carries a pin Y′ at its lower extremity. Against this pin the clawker V^3 can rest. A spring Y^2, attached to the pin Y′, tends to hold the clawker V^3 out of action. When a stud, such as R^6, Fig. 24, comes under the nose of the lever R^3, the weighted arm V^8 causes the clawker V^3 to engage with the rack-wheel V^4, and the chain-wheel, and consequently the chain also, is racked back in the direction of the arrow V^5. The stud R^6 is thus drawn from under the nose of the lever R^3, and the pull of the spring Y^2 throws the clawker V^3 out of action, whereby the pawl S^3 falls into action and the chain is again racked forward, which brings stud R^6 again under the nose of the lever R^3, and the chain is racked back as before. Thus the chain continues to move forward and backward as long as lacework without narrowings is required. When it is desired to narrow, then the attendant racks the wheel R forward, (by the ordinary hand racking-lever, not shown,) so that the stud R^6 is racked clear of the nose of the lever R^3, when the chain continues to advance, regulating the lace and fashioning courses, as hereinbefore described, according to the arrangement of studs, such as R^4 R^5. When the one set of narrowings is completed, another stud, such as R^6, comes under the nose of the lever R^3, and the repeating process is continued as before until it is desired to again narrow, when the chain is racked on once more by hand and the fashioning-studs are brought into action as before. By these means any number of lace courses can be produced between the sets of fashionings without continuously advancing the chain, and thus a short length of chain is sufficient for the longest hose.

When using a repeating chain, as hereinbefore described, it is sometimes desirable that the chain shall be racked forward one bar at a time for two consecutive courses and then at the third course to be racked back two courses, thus completing the cycle of movements in three courses. It will be seen that by the arrangement and connection of the levers S^2 and V the amount of movement of the clawker V^3 is greater than that of the pawl S^3. This I so arrange that when uncontrolled by other mechanism the pawl S^3 will rack the chain forward one bar or tooth at a time, and the clawker V^3 when in action will rack back two bars or teeth. A bolt Z may be carried by a bracket Z′, so that when in its raised position it is clear of the extension Z^2 of the clawker V^3, and the clawker V^3 will then rack two or more teeth, as hereinbefore described; but when the bolt Z is pushed down it comes into contact with the extension Z^2 of the clawker V^3, which is so shaped that the clawker V^3 is held out of the first tooth it would take, and so it only racks one tooth. Thus when the bolt Z is down the movement of the chain will be one bar forward, then one back, and so on, and when the bolt Z is up the movement of the chain will be one bar forward for two consecutive rackings, then two bars back in one rack or other proportion, as desired.

What I claim is—

1. In a flat-bar knitting-machine for making lace or open-work hose, socks, underwear and the like, the combination of the needles, the lace-points, the sliding jacks by which they are carried, the droppers one for each sliding jack tending always to move into a position above the jacks, mechanism for raising or lowering all droppers simultaneously, the jacquard mechanism by which any one or other of the droppers can be moved away from its position above the jack it works with, so that when all the droppers are lowered simultaneously the sliding jacks which are below the droppers thus moved away are not depressed into acting position.

2. The combination of the needles, the lace-points, the sliding jacks by which they are carried, the bar carrying these sliding jacks,

mechanism for raising and lowering and moving backward and forward this bar and for moving it endwise, the droppers, mechanism for simultaneously raising or lowering all the droppers, the jacquard-barrel, mechanism for giving a step-by-step turning movement to the jacquard-barrel and for lowering and raising it to bring it against or move it away from the droppers, and the bar raised and lowered with the droppers for raising all the sliding jacks to bring them all back out of acting position when the droppers are raised.

3. The combination of the needles, the lace-points, the sliding jacks, the bar or bracket carrying the sliding jacks, the arms from which this bar or bracket is carried, the rocking shaft from which these arms extend, the droppers, the rod upon which they are mounted, the arms carrying this rod, and the shaft from which these arms extend carried in bearings in the first-mentioned set of arms.

4. The combination of the needles A, the fashioning-points B^8, the bars B^4 B^5 by which they are carried, the bracket B^3 carrying these bars, the shaft B^2 by which it is carried, the arms B′ carrying this shaft from a rocking shaft B, the lace-points C^4, the sliding jacks C^3, the bracket C′ by which they are carried, and the shaft C to which this bracket is fixed and which is carried by the bracket B^3, the droppers E, the rod D^4 by which they are carried and the rocking shaft D carried by the arms B′ and from which the rod D^4 is carried.

5. The combination of the needles A, the fashioning-points B^8, the bars B^4 B^5 by which they are carried, the bracket B^3 carrying these bars, the shaft B^2 by which it is carried, the arms B′ carrying this shaft from a rocking shaft B, the lace-points C^4, the sliding jacks C^3, the bracket C′ by which they are carried, and the shaft C to which this bracket is fixed and which is carried by the bracket B^3, the droppers E, the rod D^4 by which they are carried and the rocking shaft D carried by the arms B′ and from which the rod D^4 is carried, the jacquard-barrel F^4 and the arms F^2 by which it is carried from a rock-shaft F.

6. The combination of the needles, A, the rock-shaft, B, the arms, B′, extending from it, the lace-points, C^4, and the endwise-sliding jacks, C^3, which carry them; the fashioning-points, B^8, the acting ends of which are always in the same vertical plane as the lace-points, the fingers, B^6, B^7, by which they are carried and which lie in a plane inclined to the plane occupied by the jacks and do not extend into this plane and supports for the fingers and jacks carried from the ends of the arms, B′.

7. The combination of the needles A, the lace-points C^4, the sliding jack C^3, the droppers E, the fashioning-points B^8, the sliding bars B^4 B^5 from which they are carried, the sliding bars J′ J^2, the stops J^9 J^{10} carried by these bars and which when brought below the tail ends of the droppers hold the droppers out of action, and the arms J^5 J^7 extending from the bars B^4 B^5 and causing the bars J′ J^2 to move endwise to and fro with the bars B^4 B^5 so that as the fashioning-points are moved inward or outward to narrow or widen the fabric all lace-points which are immediately above the fashioning-fingers remain raised and out of action.

8. The combination of the needles, A, the lace-points, C^4, the sliding jacks, C^3, by which they are carried, the droppers, E, mechanism for raising and lowering the droppers and movable stop-pieces for holding any of the droppers in such a position that when lowered they do not carry down with them the corresponding sliding jacks.

9. The combination of the needles, A, the lace-points, C^4, the sliding jacks, C^3, by which they are carried, the droppers, E, mechanism for raising and lowering the droppers, the shaft, H, and stop-pieces carrried by this shaft so that by turning the shaft into different positions the stop-pieces can be brought into position to hold some or other of the droppers in such a position that when lowered they do not carry down with them the corresponding sliding jacks and thereby leave the lace-points carried by these jacks out of action.

10. The combination of the needles A, the rods B^4 B^5 carrying the fashioning-fingers, the slides B^{16} to which at one of their ends the rods are connected, the rocking cam-pieces T^{16} the brackets T^{17} which carry the cam-pieces, the slides B^{11} by which the brackets are carried and which are moved inward or outward as narrowings or widenings are to be made, and mechanism for rocking the cam-pieces T^{16} each time that the fashioning-fingers are to be brought into action so that the fashioning-fingers may be kept outside the selvage except when required to narrow or widen.

11. The combination of the droppers, the jacquard-barrel, and the jacquard-cards laced together in such manner that a portion of them adapted for producing any complete portion of the pattern are laced together in consecutive order so that they are successively brought into active position by continuously moving the bands forward step by step, one step at a time, while the remainder are laced together in such order that they can be brought into action consecutively when the band is moved forward two steps at a time, and then after a single forward or backward movement afterward move backward two steps at a time, so that this portion of the pattern can be repeated continuously.

12. The combination of the needles, the lace-points, the sliding jacks by which they are carried, the droppers, one for each sliding jack, the jacquard-barrel adapted to be moved up to and away from the droppers, the band of jacquard-cards passing around this barrel,

and mechanism by which the barrel can be caused to make either one or more partial turns in either direction after each time that it has been brought against the droppers.

13. The combination of the jacquard-barrel, the ratchet-wheel fast with it, a second ratchet-wheel fast on an axis geared with the jacquard-barrel, two pawls K^5 K^6 one engaging with one ratchet-wheel the other with the other, the rocking lever K^3 by which the two pawls are carried and the step-by-step rotated cams K^{10} K^{11} acting on the tail ends of these pawls for putting either one or other or both out of action.

14. The combination of the jacquard-barrel, the band of cards F^5 passing around it, the ratchet-wheel fast with it, the second ratchet-wheel fast on an axis geared with it, two pawls K^5 K^6 one engaging with one ratchet-wheel the other with the other, the cams K^{10} K^{11} on the axis K^9, the ratchet-wheel L fast with this axis, the pawl L^3 engaging with this ratchet-wheel and reciprocated to and fro, mechanism for putting the pawl into and out of gear with the ratchet-wheel, and a pattern chain or band moved synchronously with the band of cards, F^5, controlling this mechanism.

15. The combination of the endless pattern-chain, the chain-wheel around which it passes, two pawls or ratchets one for turning the chain-wheel in one direction the other in the other, and mechanism acted on by studs on the endless pattern-chain whereby the two pawls can be thrown alternately into and out of action.

16. The combination of the endless pattern-chain, the chain-wheel around which it passes, two pawls or ratchets one for turning the chain-wheel in one direction, the other in the other, the length of stroke given to the reversing-pawl being sufficient to turn the chain-wheel two steps backward and the sliding bolt or equivalent, Z, by which the reversing-pawl can be restrained from giving more than one backward step at a time to the chain-wheel.

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Witnesses:
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