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S. JAROS.

KNITTING MACHINE.

No. 527,113. Patented Oct. 9, 1894.

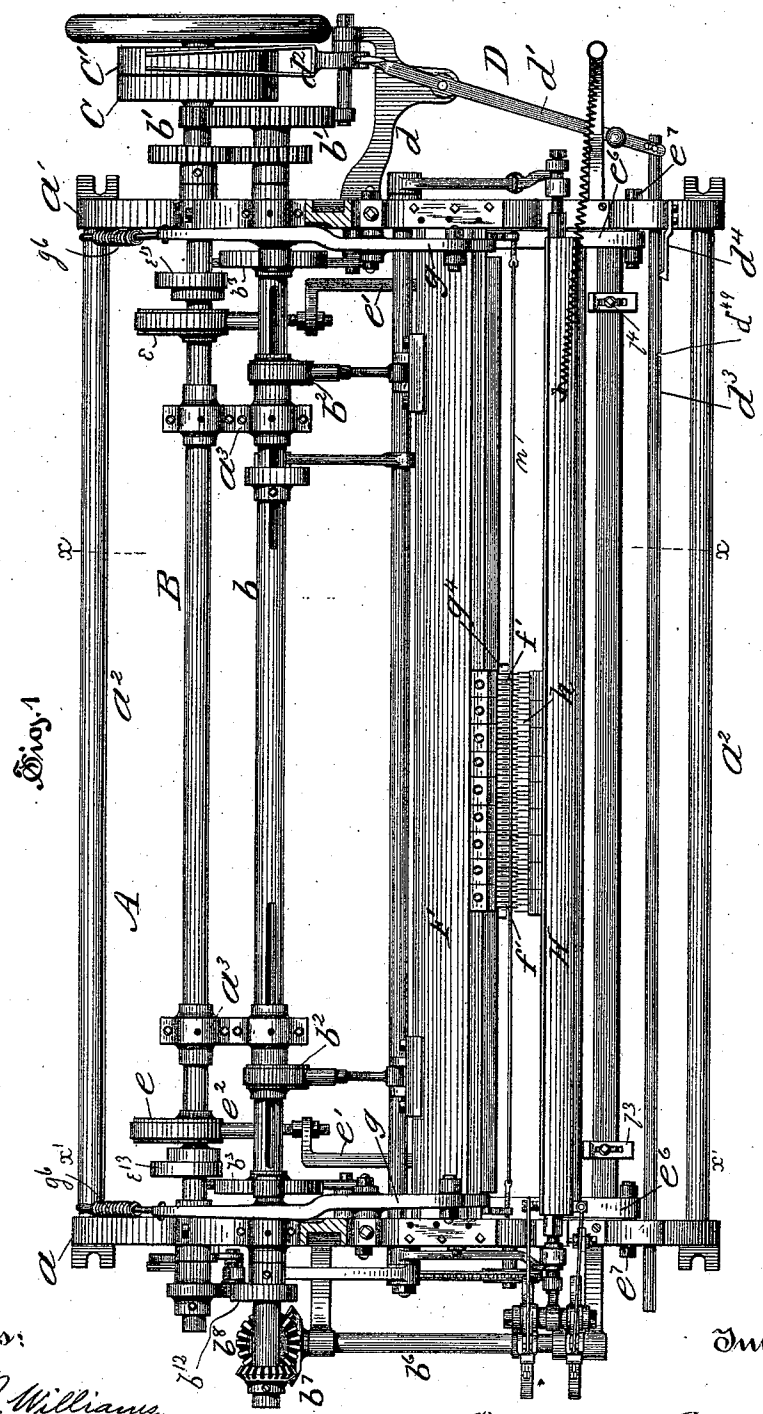

Fig. 1.

Witnesses:
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A. B. Jenkins.

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Samuel Jaros
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(No Model.) 6 Sheets—Sheet 2.

S. JAROS.

KNITTING MACHINE.

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Fig. 2.

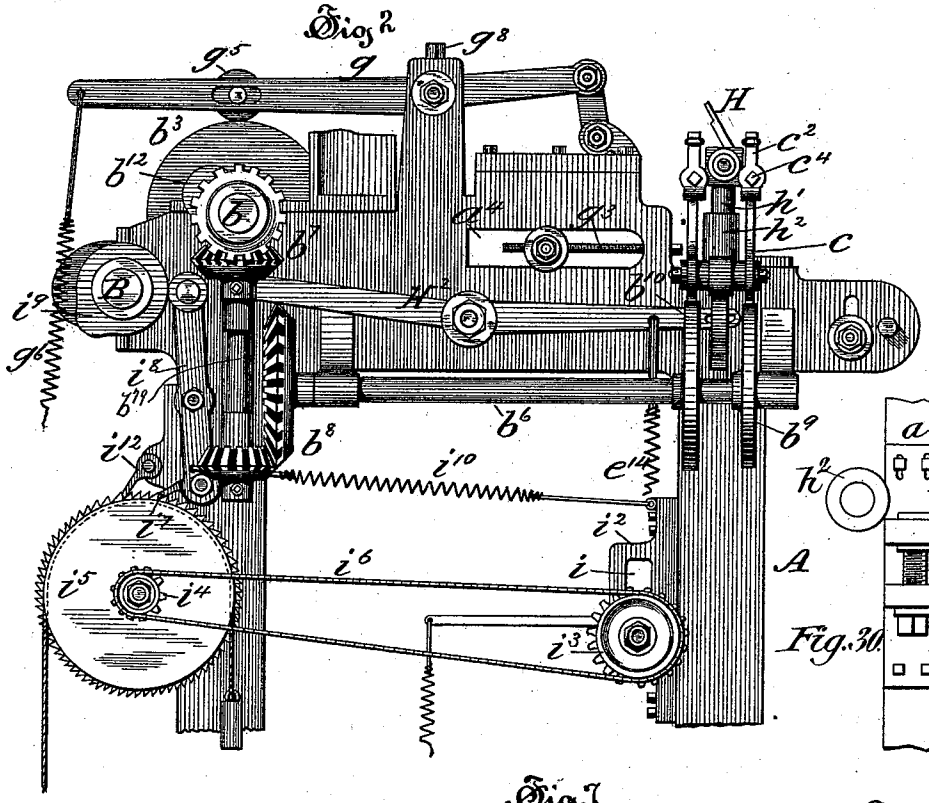

Fig. 3.

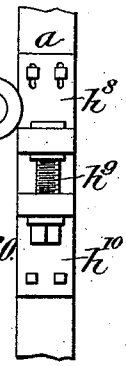

Fig. 7.

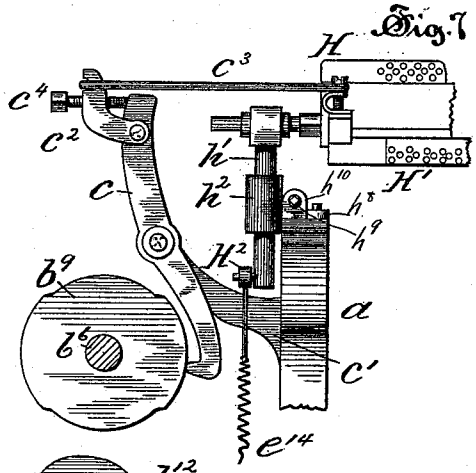

Fig. 8.

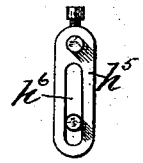

Fig. 10.

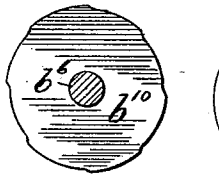

Fig. 9.

Witnesses:
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(No Model.) 6 Sheets—Sheet 3.

S. JAROS.

KNITTING MACHINE.

No. 527,113. Patented Oct. 9, 1894.

Fig. 3

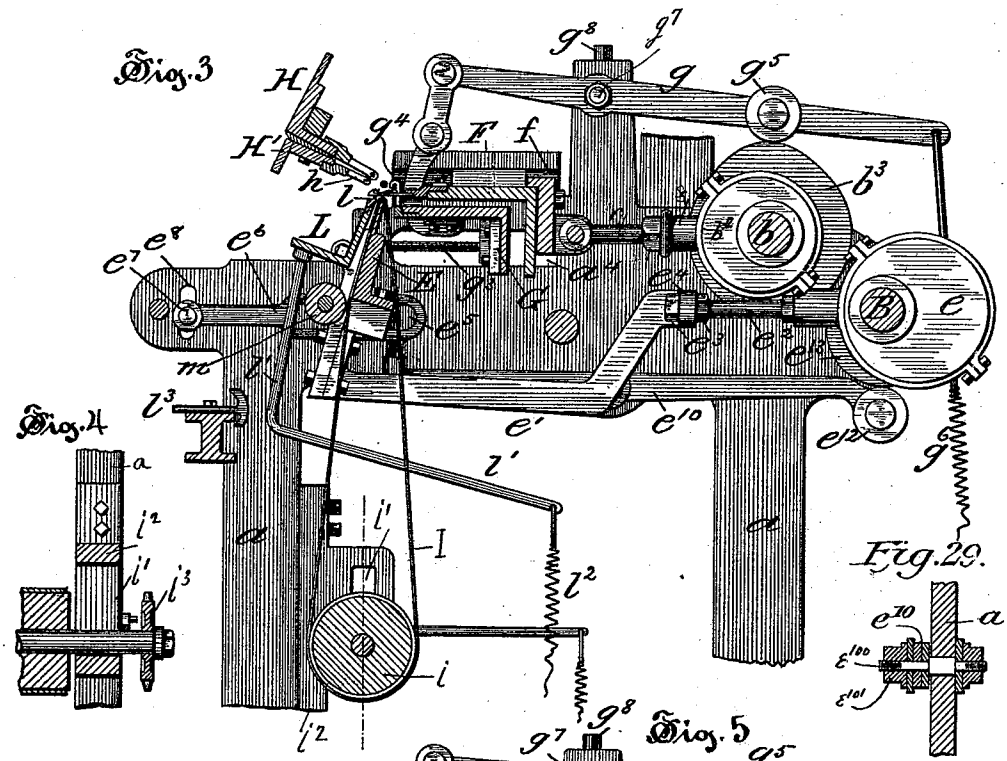


Fig. 4

Fig. 29.

Fig. 5

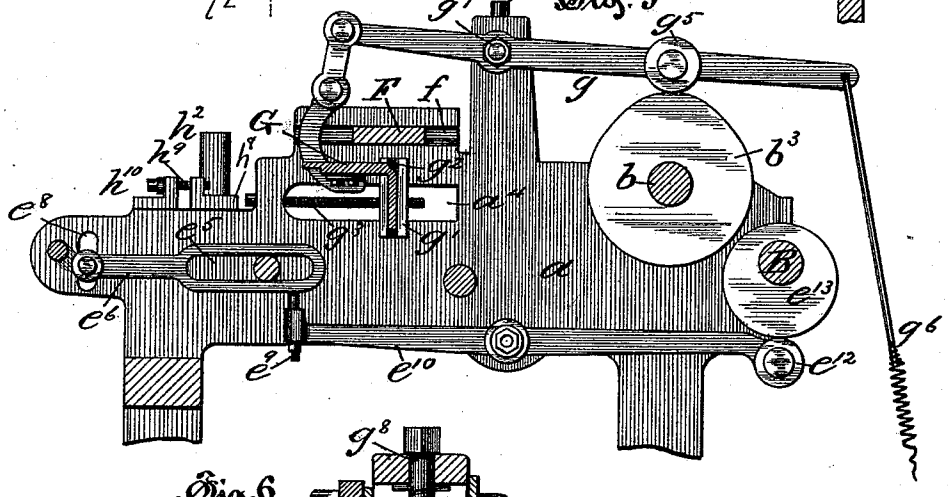
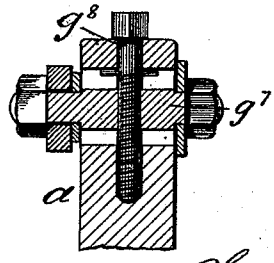


Fig. 6



Witnesses:

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S. JAROS.

KNITTING MACHINE.

No. 527,113. Patented Oct. 9, 1894.

Fig. 11

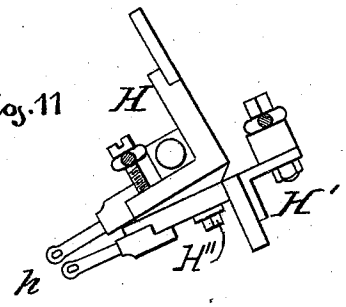


Fig. 12

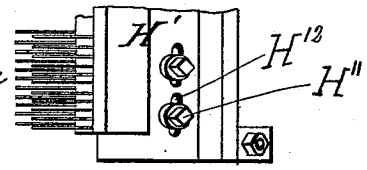


Fig. 13

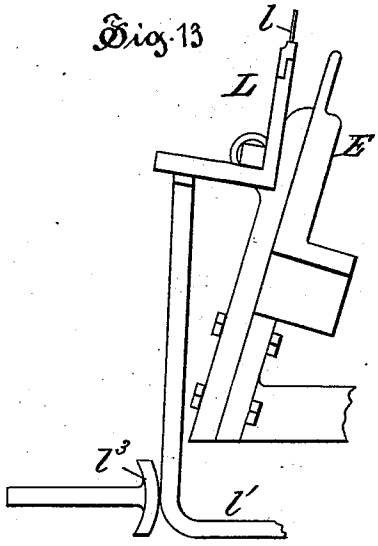
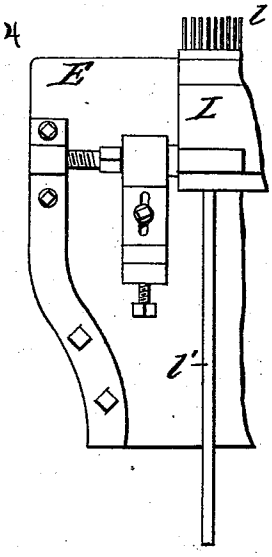


Fig. 14



Witnesses:

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(No Model.) 6 Sheets—Sheet 5.

S. JAROS.

KNITTING MACHINE.

No. 527,113. Patented Oct. 9, 1894.

Fig. 15

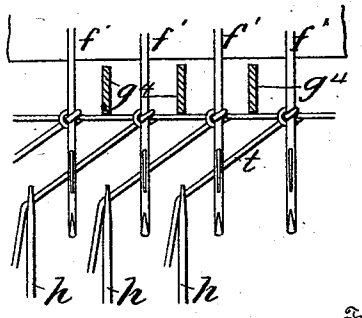


Fig. 16

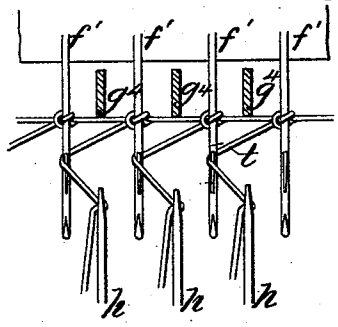


Fig. 17

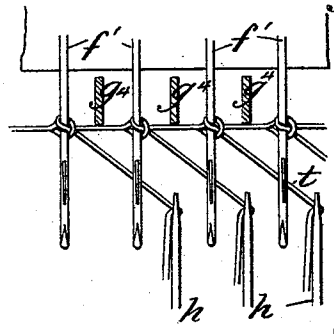


Fig. 18

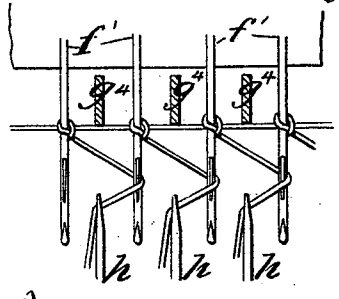


Fig. 19

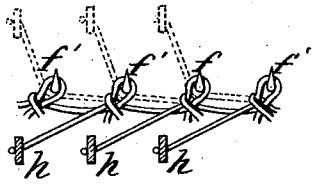


Fig. 20

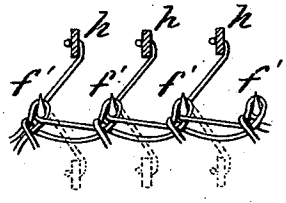


Fig. 21

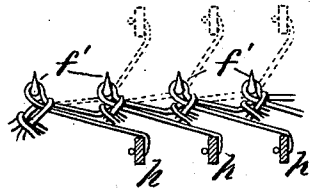
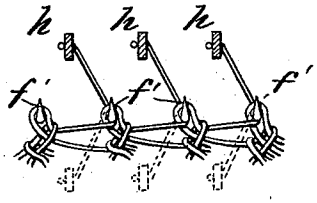


Fig. 22



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(No Model.)

6 Sheets—Sheet 6.

S. JAROS.

KNITTING MACHINE.

No. 527,113. Patented Oct. 9, 1894.

Fig. 23

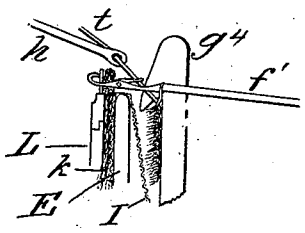


Fig. 24

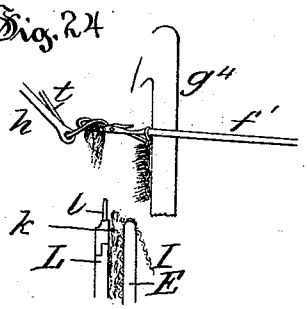


Fig. 25

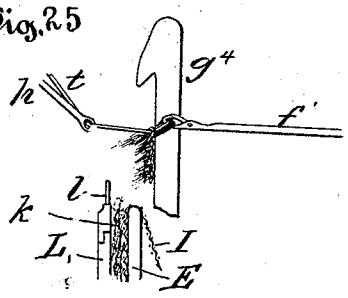


Fig. 26

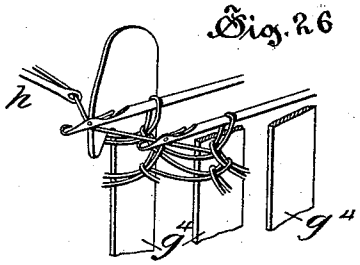


Fig. 27

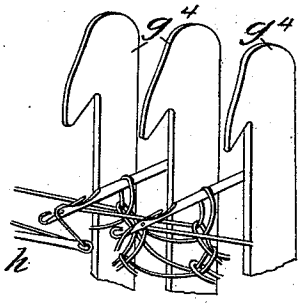
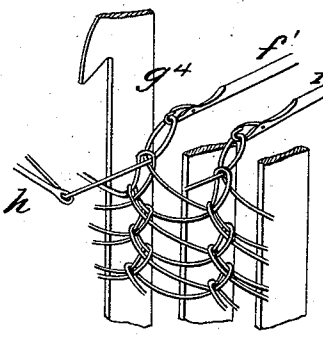


Fig. 28



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UNITED STATES PATENT OFFICE.

SAMUEL JAROS, OF HARTFORD, CONNECTICUT, ASSIGNOR TO THE BEACH MANUFACTURING COMPANY, OF SAME PLACE.

KNITTING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 527,113, dated October 9, 1894.

Application filed January 3, 1889. Serial No. 295,354. (No model.)

To all whom it may concern:

Be it known that I, SAMUEL JAROS, of Hartford, in the county of Hartford and State of Connecticut, have invented certain new and useful Improvements in Knitting-Machines, of which the following is a full, clear, and exact description, whereby any one skilled in the art can make and use the same.

The main object of my invention is to provide a machine on which a fleece lined fabric may be made, the fibrous facing material being deposited on the thread and secured thereon in the process of knitting.

My invention relates to the class of knitting machines commonly known as "warp knitting machines," the reciprocating latch needles being borne on a long bar and having operating in connection therewith a series of thread-guides or carriers and a corresponding number of sinkers.

My invention consists in details of the parts bearing the needles, the thread-guides, the sinkers, the fleece, and in their combination, and in details of the mechanism for moving and operating the several parts, as more particularly hereinafter described and pointed out in the claims.

In the operation of the within described form of knitting machine in which my invention is embodied a series of needles are fixed in a line along the edge of a bar, and they have a rectilinear reciprocation in the line of the needles. The sinkers that are located between each two of the needles have also a rectilinear reciprocation, but it is at about right angles to the plane of the movement of the needles. A number of thread-guides, equal in number to the needles, are so supported and arranged that they have an irregular movement across and around the needles so as to wrap the thread first around one needle and then the next adjacent one to form a loop. The several movements of the above parts are timed with relation to each other and they are substantially continuous during the operation of knitting.

Referring to the drawings: Figure 1 is a top or plan view of a knitting machine embodying my invention. Fig. 2 is a detail view in end elevation looking from the left, the scale in this view being enlarged. Fig. 3 is a detail view in transverse section of the machine looking at the reverse side of the end shown in Fig. 2. Fig. 4 is a detail view on enlarged scale in lengthwise section of part of the fleece roll and its bearing. Fig. 5 is a detail view in transverse section of the machine near one end looking from the right. Fig. 6 is a detail view on enlarged scale in vertical section of the adjustable bearing of the sinker bar lever. Fig. 7 is a detail view of part of the thread-guiding devices and the operating mechanism thereof. Fig. 8 is a detail end view of part of the thread-guide mechanism. Fig. 9 is a detail view of the mechanism that gives a vertical movement to the thread-guide bars. Fig. 10 is a detail side view of one of the cams used in operating the thread-guide bars. Fig. 11 is a detail end view of the thread-guide bars. Fig. 12 is a detail bottom view showing how the thread-guide bars are united. Fig. 13 is a detail side view of the fleece clamp. Fig. 14 is a detail face view of one end of the fleece clamp. Figs. 15, 16, 17, 18, 19, 20, 21, and 22 are diagrams illustrating the operation of the thread carriers in forming the stitch in the process of knitting. Figs. 23, 24 and 25 are diagrams illustrating the operation of the machine in incorporating the fleece in the process of knitting. Figs. 26, 27 and 28 are diagrams illustrating the method of knitting the fabric. Fig. 29 is a detail view showing the construction of the jointed lever supporting the bat feed device. Fig. 30 is a detail view on enlarged scale showing the method of attaching the thread guide supporting brackets to the side parts of the machine.

In the accompanying drawings the letter A denotes the frame of the machine as a whole; a, a', side parts that are arranged in an upright position and are held together by cross ties a^2, and are supported in part by braces a^3 that extend to the floor, or to cross ties not shown in the drawings, and serve to stiffen the frame and the shafts. The main shaft B that is supported in suitable bearings in the side parts of the frame extends across it and has the fast pulley C and loose pulley C' in

convenient position to be driven as by means of a belt from a counter-shaft. The belt shifter D is pivoted to a bracket d on the side of the frame, the lever d' being connected at one end to the sliding fork d^2 that engages the belt, while the opposite end is connected to the shifter rod d^3 that extends across the front of the machine in a position where it is easy of access to the operator. The spring latch d^4 is fast to the frame and its free end is adapted to engage a notch d^{49} in the shifter bar so as to lock the latter at either end of its throw.

On the main shaft B are secured the eccentrics e near opposite ends of the frame, each eccentric being connected by means of a rod e' with the fleece bar E. The rods e' are each composed of two parts that permit the rods to be made longer or shorter within certain limits, one part e^2 being threaded and bearing the nuts e^3, while the other part has a bent or offset portion e^4 through which the end of part e^2 passes and to which it is secured by means of the nuts e^3 arranged on opposite sides of the bent portion, as shown in Figs. 1 and 3 of the drawings. The fleece bar is supported at each end in a slot e^5 in the lever e^6 that is pivoted to the frame by a bolt e^7 passing through the slot e^8 that enables the pivot to be fixed in various positions within the extent of the slot. The slotted end of this lever e^6 rests upon an adjustable pin e^9 (see Fig. 5) in the end of the jointed lever e^{10} that is pivoted to the side a of the frame and bears on its outer end a friction roll e^{12} in engagement with the cam e^{13} that is fast to the main shaft B. This lever e^{10} is made in two parts united by means of the bolt e^{100} that forms the pivot, a nut e^{101} forming a means of clamping the parts together so that they may be set either in exact alignment with each other or at any desired angle, the bend coming at the pivot. The ordinary means of clamping such parts together is employed. By means of the eccentric and parts connecting it to the fleece bar the latter is given a sliding movement toward and from the front of the machine, and by means of the cam e^{13} the levers supporting the fleece bar, and the latter with them, are given a vertical movement, the location of the fleece bar and its supporting levers depending upon the relative position as to alignment with each other of the two parts that make up the lever e^{10}. It is the location of this vertical play and not the extent of the motion of the several connected parts just described that is determined and controlled. As the movements of the several mechanisms that tend to produce the movements of the fleece bar in both a horizontal and a vertical plane are contemporaneous the result is that the fleece bar is given a resultant curved motion for the purpose of causing the fleece bar to move outward, then upward and then forward and downward so as to avoid the needles in the upward movement of the fleece, and to then carry it diagonally downward upon the needles that tear off a portion of the fleece and leave it hanging on the needles, where it is bound by the thread in the making of the loops in the knitting operation. The cam shaft b is also supported in bearings in the frame and extends across it in a line parallel to the main shaft B, and is driven from the latter by means of intermeshing gears b' borne on the outer ends of the respective shafts. This cam shaft b supports near the opposite sides of the frame the eccentrics b^2 which are, by means of straps and rods connected to the needle bar F, and serve to produce a rectilinear reciprocation of the needle bar as the shaft b revolves. The rods connecting the needle bar with the eccentrics that impart a sliding movement to the needle bar are made up of jointed sections r s, one being fast to the eccentric strap and having a threaded socket into which the rod r is screwed, and a nut t located on the threaded portion of this connecting bar forming a lock nut by screwing it down upon the end of the socket piece on the eccentric when the proper length of the connecting bar has been obtained to give the needle bar the proper throw. The opposite ends of the needle bar F travel in grooves f in the side parts a a' of the frame, and the rods that connect the needle bars to the eccentrics are made adjustable lengthwise so that the limits of the movement of the needle bar may be determined, while the extent of this movement is always the same, the purpose being to control the relation of the needle to the thread guide. The needles are set in a convenient number in a cast block, preferably of soft metal, the needles being held in the block in the process of casting, and these blocks are clamped as by means of screws or bolts to the front edge of the needle bar so that the needles all lie in one plane extending in the line of direction of movement of the needle bar.

The sinker bar G is suspended from the ends of the sinker bar levers g that are located near the opposite ends of the machine, the bar extending lengthwise across it and underlying the needle bar F. The opposite ends of the sinker bar G are located in slots g^2 formed in adjustable blocks g', the blocks being located in slots a^4 in the frame and adjustable thereon in a direction parallel to the movements of the needles by means of feed screws g^3 that extend through sockets in the frame and also each through a threaded socket in a block g'. On the front edge of the sinker bar the sinkers g^4 are secured, the soft metal bases in which they are held being clamped in sections of convenient length to the front edge of the sinker bar. The sinkers stand in a position at right angles to the plane of the needles and extend between them as illustrated in Fig. 3 of the drawings. The vertical movement of the sinker bar is produced by means of the cams b^3 borne on the shaft b, anti-friction rollers g^5 pivoted to the

levers g being held in contact with the surface of the cams by means of the springs g^6 that are connected to the levers and to some fixed point, as the base of the machine.

On one end of the frame A the shaft b^6 is supported in bearings, and it is driven from the cam shaft b by means of the intermeshing gears b, b, and intermediate shaft, the cams b^9, b^{10} on said shaft b^6 being used to produce the horizontal sliding movement of the guide bars H, H that support the thread guides h. (See Figs. 2 and 7 of the drawings.)

In the within described machine two thread guide bars with corresponding sets of thread guides are used, one set of thread guides (on guide bar H′) being used, in forming the stitch, simply for passing a strengthening thread through the fabric, and the other set of guides (on guide bar H) beir g used for the purpose of forming a regular stitch, but the principle on which the machine works and the method of making the stitch are the same when a single set of thread guides on a single guide bar is used for the purpose of forming the regular stitch.

The guide bars H, H′ are supported on the levers H^2 that are pivoted to the opposite ends of the frame (see Figs. 1, 2, and 9) by means of the vertical shafts h' that slide in the barrels h^2 that are secured to the frame, the pins h^3 on the shafts projecting into the slots h^4 in the ends of the lever H^2. These shafts or supports have a movement in a straight line, and the term reciprocation in the specification and claims herein when referring to these parts is used in contradistinction to the terms oscillating or vibrating. The guide bar H extends across the frame of the machine between the shafts h', to which the bar is secured by arms passing through the upper ends of the shafts, and the vertical movement of the guide bar is produced by cams b^{12} secured to the shaft b with their faces in contact with rolls borne on the levers H^2, the said rolls being held in contact with the cams by means of springs e^{14} extending from the opposite ends of the levers to a fixed part of the frame or to the floor. This lever H^2 is formed in two parts and jointed at the pivot in like manner as is the lever e^{10} so that these two parts may be clamped in line or at an angle with each other, and this adjustability of the lever at the pivot enables the path of movement of the thread guide bar to be changed in position vertically but not in extent of movement. To one of the arms that project from the thread guide bar H a guide h^5 is clamped, the said guide having a slot h^6 in which a pin h^7 projects from the fixed part of the frame, the function of this guide being to prevent the bar from tilting while it is being moved up and down by means of the mechanism above described. On the lower side of the thread guide bar H is supported the thread guide bar H′ by bolts H^{11} that extend from the former through slotted openings H^{12} in the latter to allow it a lateral sliding movement independent of while supported on the bar H. In addition to the vertical movement of the thread guide bars they have also a lengthwise reciprocation, this movement of the bar H being determined by the cam b^{10}, while the movement of the bar H′ is determined by the cam b^9. This construction and arrangement of the cams as shown permits a movement of each guide supported on the guide bar H′ to have lateral movement about one needle only while each guide supported on the guide bar H has a movement about two needles. The edge of the cam b^9 is in contact with the lower, end of the lever c that is pivoted to the bracket c' projecting from the frame a, (Fig. 7) the upper end of this lever c bearing an adjustable arm c^2 connected by the rod c^3 to the guide bar H′. The arm c^2 is pivoted to the upper end of the lever c, and an adjusting screw c^4 extends through the nut or threaded socket in this arm and engages the end of the lever in such manner that by means of this adjusting device the lateral position of the bar may be adjusted. The connections just described between the cam b^9 and guide bar H′ are duplicated between the cam b^{10} and guide bar H.

The object of providing a guide bar with lateral adjustment is to provide for the precise location of the thread guides borne on the bar one to each needle, the proper location of each thread guide being, however, between each two adjacent needles. By means of the thread guide mechanism just described each guide of the guide bar H is given a movement resembling somewhat a figure ∞.

The movement of a single thread guide and the thread supported by it on the guide bar H with relation to the needles on either side is as follows: A thread started in its movement from a point below the plane of the needles moves upward, then to the right over the needle, down one side, then returning below moves upward again crossing between the needles over and around the needle on the left and back to the point of beginning. By this movement of the thread it is wrapped as it were around the two needles next adjacent to it on each side.

The barrels h^2 that support the shafts h' on which the thread bars are mounted are each secured to a base h^8 that is adjustably attached to the top of a side part a, or a' of the frame by means of bolts passing through slotted openings in the base and into the side part a or a'. Adjusting screws h^9 pass through threaded sockets in the brackets h^{10} fixed to the frame and are secured against lengthwise movement in upturned flanges of the bases h^8. (See Fig. 30.) By means of this arrangement the thread guides can be adjusted horizontally with relation to the needles so as to aid in determining the exact position where the thread shall be laid across the needle.

In the operation of the knitting machine each thread guide h is threaded and it is ar-

ranged normally about half way between each two of the needles and below them, as shown in Fig. 19. The thread guides are, by the above described mechanism, moved first to the left, then up between the needles, then over one toward the right, and then down, laying a loop or turn of the thread t over the needle (Figs. 15, 19, 16 and 20), that is next withdrawn so that the sinkers g^4 cause the loop to catch in the hook on the needle at the same time that they push the previously formed loop over the one newly caught by the hook, the latch of the needle closing over the loop that is hung on the needle, as shown in Fig. 28. The sinker descends before the needle withdraws so that it holds the loop down upon the needle and insures the closing of the latch by the loop already on the shank of the needle, as shown in Fig. 26. The needles are then moved forward so as to slip the new loop back along the needle, the sinkers rise and the thread guide h, then moves to the right under the needle next to the one on which it threw a loop of the thread, then up between the needles, and then to the left over the second needle (this being the needle just mentioned under which the guide moved on going to the right) and down between the first and second needles (said first needle being that on which was formed the loop first described) to the position from which it started laying a loop of the thread around the second needle. (Figs. 17, 18, 21 and 22.) The sinkers then descend, the needles withdraw and a new loop is thrown off from each needle, and as the several threads are looped together as well as onto the needles simultaneously a row of loops or stitches along the edge of the fabric is formed.

There is nothing new in this operation of a web knitting machine, although there are several features of invention in the mechanism involved and in that relating to securing the fleece or fibers to the web in the process of knitting. The fleece bar E, that has been already described, forms a part of the mechanism for depositing the fleece on the needles and loops of thread, the upper edge of the bar being arranged to support the fleece feed apron I which is an endless belt or apron of a width equal to the length of that part of the needle bar supplied with needles. The construction shown is intended to cause the fleece roll i to be depressed by spring action as well as gravity so as to regulate the tension upon the apron, and also to control the direction of the feed by regulating the angular position of the axis of the roll with reference to the upper edge of the bar E. This apron passes over the fleece bar and under the bat feed roll i that is supported in bearings in slots i' in the brackets i^2 that are fast to the frame A, so as to allow an adjustment of the roll toward and from the fleece bar in a manner to tighten or loosen the apron, and also to place the axis of the roll parallel to the edge of the fleece bar, or at such an angle therewith as to insure a proper movement of the apron without any tendency to crawl to either end of the roll or of the fleece bar in feeding.

On the projecting end of the journal of the bat feed roll i is secured a toothed wheel i^3, (Fig. 2) and a similar toothed wheel i^4 is secured to the journal of the ratchet wheel i^5, the chain i^6 extending between them communicating the motion of the ratchet wheel to the bat feed roll. The ratchet wheel i^5 is driven by the spring pawl i^7 borne on the lower end of the tilting lever i^8 that is pivoted to the side part a of the frame of the machine and is operated by means of the cam i^9 on the main shaft B, the spring i^{10} fast to the lever and to a fixed part of the frame holding a roller on the upper end of the lever i^8 in engagement with the face of the cam. The ratchet wheel i^5 is held against any return movement by the pawl i^{12} secured to the frame and engaging the teeth of the ratchet.

The fleece k, or mass of fibers, usually and preferably of wool, is made up into a sheet or bat, and from any roll or like source of supply is fed upon the apron and by it moved with an intermittent action timed with the formation of the loops in the knitting thread toward the upper edge of the fleece bar above which it projects a slight distance passing between the front face of the bar and the fleece clamp L. This clamp L is a bar that is hinged or pivoted on the fleece bar E and extends from end to end thereof with the needle-like guard fingers l projecting from its upper edge, and an arm l' extending downward and inward, as shown in Fig. 3. This clamp bar is hinged to the bar E by a pin on each end of the bar L entering socket pieces fast to the bar E (see Fig. 3) and the needed swinging movement is thus permitted. The function of the guard fingers l is to back up or support the edge of the bat of fibers that projects above the edge of the fleece bar, the needles passing between the fingers that are arranged one on each side of each of the needles. (See Fig. 23). A spring l^2 is attached to the clamp arm l' in such manner that the clamp is held close upon the bat except when the fleece bar is thrown forward and the arm strikes against the adjustable stop l^3 secured to the frame which throws the clamp forward and releases the apron and bat which are then fed upward a short distance depending on the amount of fiber it is intended the bar shall leave upon the needles when it moves backward and downward. In Fig. 1 these stops l^3 are clearly shown in plan and they are adjustable by being slotted for the passage of a bolt l^4 the head of which overhangs the edges of the slot, and when tightened operates so as to bind the stop to the bar. The movement of the fleece bar that deposits the fiber on the needles (Figs. 23, 24 and 25) is followed immediately by the movement of the guide bar that causes the thread guide to lay the thread across the needle in front

of the latch, and this binds the fiber into the fabric as the successive loops are thrown off in knitting.

The tension roll m is supported across the fleece bar with its surface adapted to press against the apron and the bat that passes between the roll and the fleece bar, the object of this roll being to regulate the movement of the apron and fleece as the latter is fed toward the upper edge of the fleece bar.

The small bunches of fibers that are deposited on the needles and secured in the fabric may vary in grade as to fineness, and in order to adapt the machine to various grades of stock and also to the kind of work to be done the sinker bar is provided with the means already described to adjust its extent of movement forward and back, and in order to draw the stitch tight provision is made for a vertical adjustment of the sinker bar and of the sinkers carried by it by making the pivot pin g^7 of the sinker lever g vertically adjustable in the frame by supporting it on the screw shaft g^8, as shown in Fig. 6 of the drawings, that extends down through the slot in which the pivot is arranged and through a threaded socket in the latter, while it is held against lengthwise movement in the frame although turning loosely in a socket thereon. This screw shaft g^8 is held against lengthwise movement by the head of the screw shaft overlying the socket piece and a pin in the shaft under the socket piece as clearly set out in the drawings. By thus providing means by which the extent of movement of the sinkers can be exactly adjusted it is possible to make stitches of various sizes to accommodate varying amounts of fleece or grades of stock that may be desired to use in the machine.

A further feature of improvement in the within described machine is in providing means whereby the thread guide has a movement in a straight line up and down between the needles as it prevents any chance of laying the thread on the wrong needle, that was a fault in prior machines owing to the curved path of movement of the thread guide, and by this improvement any chance of the thread catching back of the latch and closing it so as to cause a thread to be dropped is avoided. The accidental closing of the latches of the needles by the motion of the machine is guarded against by providing the latch guard n that is borne on the sinker bars and extends directly across and over the needles while the thread is being laid in the hook.

I claim as my invention—

1. In a knitting machine, in combination with a reciprocating needle bar and a series of latch needles secured thereto, a fleece bar the intermittingly actuated fleece clamp borne on said fleece bar, means for actuating the fleece clamp, and means for feeding the fleece to the needles independent of the clamp, all substantially as described.

2. In combination in a knitting machine, the hooked needles, a fleece bar, a feed roll and the endless apron extending over the fleece bar and the feed roll, the fleece clamp borne on the fleece bar, and a stop located in the path of movement of the fleece clamp and by contact with which the clamp is opened; all substantially as described.

3. In a knitting machine, in combination with the reciprocating needle bar, bearing a series of fixed latch needles, the cam shaft b having an eccentric secured thereto, an adjustable connecting rod extending from said eccentric to said needle bar, the sinker bar G, the sinker lever g, guide blocks g' located in guide slots in the side parts of the frame of the machine, means for actuating the lever g, means for actuating the guide blocks g', the thread guide bar H, and means for operating the said bar, all substantially as described.

4. In a knitting machine, in combination with a reciprocating needle bar, bearing a series of fixed needles, the lever g, the reciprocating sinker bar suspended from said lever, the vertically adjustable pivot support for said lever g formed in the frame of the machine, means for actuating the lever g, the adjustable lever e^6, the fleece bar E, supported on said lever, the lever e^{10} supporting the lever e^6 at one end, and in operative contact with the cam e^{13} on the shaft B at the opposite end, the cam e^{13}, and the fleece clamp mechanism, all substantially as described.

5. In a knitting machine, in combination with a series of latch needles fixed to a reciprocating needle bar, the lever e^6, the reciprocating fleece bar E borne on said lever, the adjustable pivot e^7 of the supporting lever e^6, and the lever e^{10} having an adjustable pin at one end and its opposite end in operative contact with the cam on the main shaft B, all substantially as described.

6. In a knitting machine, in combination with a series of latch needles fixed on a reciprocating needle bar, the sinker bar borne in an adjustable guide and bearing a series of sinkers, the fleece bar E, and mechanism for moving said fleece bar, the feed roll i, the endless apron I passing around the fleece bar and feed roll, the fleece clamp L bearing a series of guard fingers l and pivotally supported on the fleece bar, the arm projecting from the fleece clamp, and the adjustable stop l^3 secured to the frame of the machine, all substantially as described.

7. In a knitting machine, in combination with a series of latch needles secured to a reciprocating needle bar, the sinker bar, borne in an adjustable guide, the fleece bar, the fleece clamp pivoted thereon and the fleece feed mechanism connected therewith and independent of the clamp, the thread carrier, and mechanism whereby each thread guide is moved in a path around and between each of two adjacent needles, all substantially as described.

8. In a knitting machine, in combination

with the fleece bar E, the feed roll *i*, the belt I passing over the said roll and the fleece bar, the pressure roller *m*, the fleece clamp L pivotally connected to the fleece bar, the clamp opening device, mechanism for operating the fleece bar, the sinker bar *g* borne in an adjustable guide, the sinker bar operating mechanism, the needle bar F bearing the fixed series of latch needles, and the guide bar bearing a series of thread guides, and the means whereby said guides are given a rectilinear movement around each of two adjacent needles, all substantially as described.

9. In a knitting machine, in combination with fleece feeding mechanism, fabric forming devices including a guide bar borne on the reciprocating supports on the frame of the machine, means for reciprocating said supports, and means for causing an endwise reciprocation of the guide bar on the supports, all substantially as described.

10. In a knitting machine, in combination with the fabric forming mechanism driven from a shaft *b*, the shaft B bearing the cam i^9, the tilting lever i^8 bearing a spring pawl i^7 and in operative contact with the cam i^9, and a ratchet wheel i^5, the fixed pawl i^{12}, the toothed wheel i^4 borne on the journal of the ratchet wheel i^5, the chain i^6, the toothed wheel i^3 secured to the shaft of the fleece feed roll *i*, and the within described fleece feed roll and apron, all substantially as described.

11. In a knitting machine, in combination with the needle bar and its operative mechanism as described, the sinker bar and its operative mechanism, the thread guide bar H supported on the shafts *h'*, the shafts *h'* in engagement with the jointed lever H^2, the cam b^{12} borne on the rotary shaft *b* and in operative contact with the end of the lever H^2 opposite the thread guide bar, and means for moving said bar longitudinally, all substantially as described.

12. In a knitting machine, in combination with a reciprocating needle bar bearing a series of fixed needles, a fleece bar movably supported on a system of levers including a jointed lever, the jointed lever provided with clamping means at the joint, and means for actuating the lever, all substantially as described.

13. In a knitting machine, a thread guide bar borne on reciprocating supports, the supports and means for reciprocating them, means for imparting longitudinal reciprocation to said bar, a secondary bar supported by the first mentioned bar, and means for imparting longitudinal movement to said secondary bar, all substantially as described.

14. In a knitting machine, in combination with a needle bar and its operating mechanism, a sinker bar and its operating mechanism, a thread guide bar borne on reciprocating supports, the supports, means for reciprocating the supports, and the guides as described for preventing a tilting movement of the said bar, all substantially as described.

15. In a knitting machine, a thread guide bar borne on reciprocating supports, the reciprocating supports borne in bases adjustably secured to the frame of the machine, the bases and the thread guide bar operating mechanism, all substantially as described.

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Witnesses:
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