(No Model.) 2 Sheets—Sheet 1.

F. WILCOMB.

STRAIGHT KNITTING MACHINE.

No. 405,636. Patented June 18, 1889.

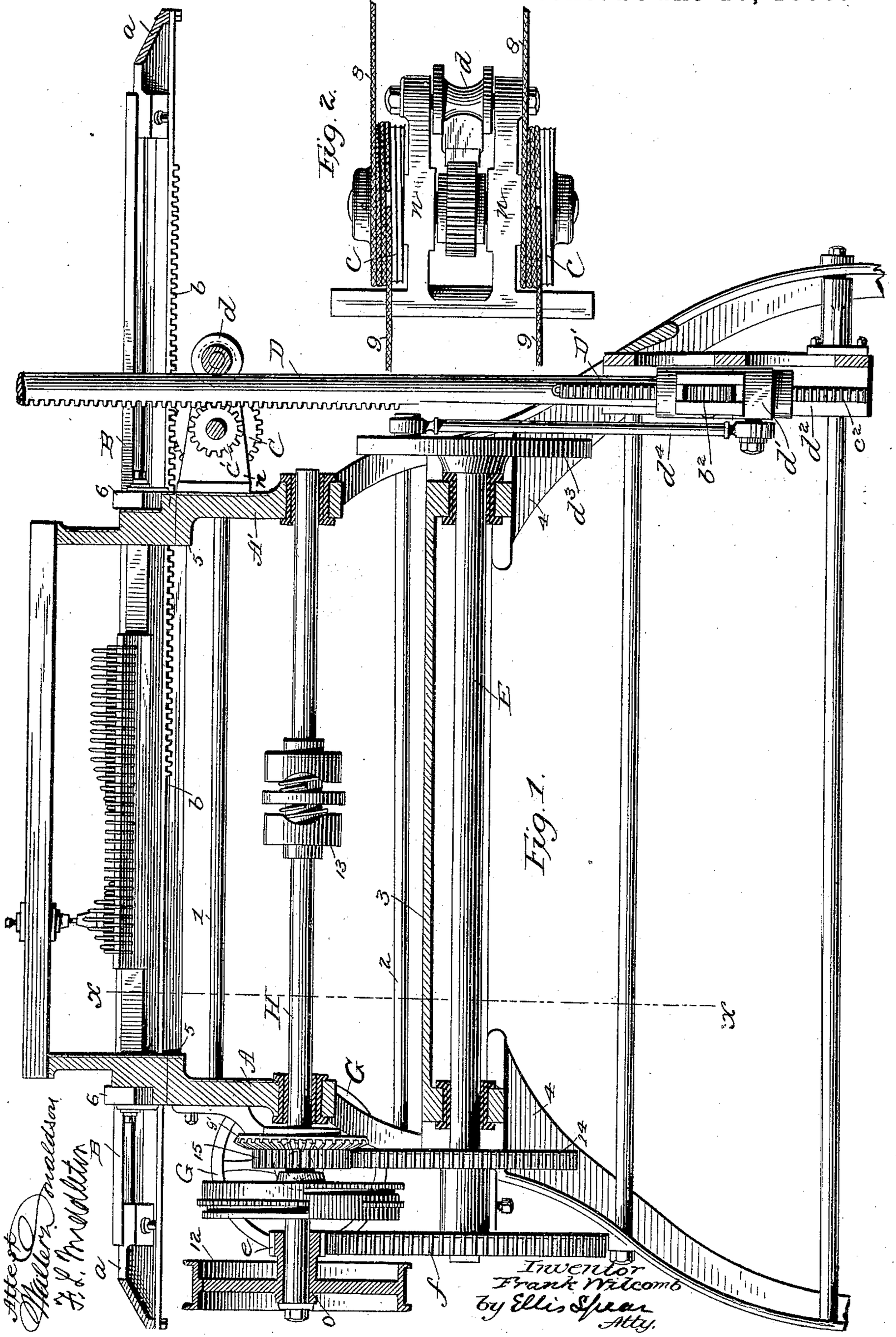

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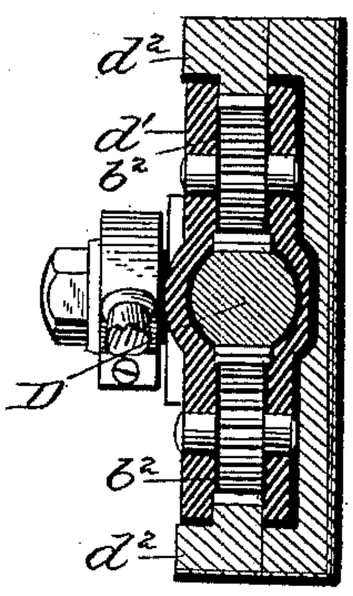
Fig. 3.

Fig. 4.



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UNITED STATES PATENT OFFICE.

FRANK WILCOMB, OF PROVIDENCE, RHODE ISLAND, ASSIGNOR TO THE WILCOMB MANUFACTURING COMPANY, OF SAN FRANCISCO, CALIFORNIA.

STRAIGHT-KNITTING MACHINE.

SPECIFICATION forming part of Letters Patent No. 405,636, dated June 18, 1889.

Application filed February 29, 1888. Serial No. 265,724. (No model.)

To all whom it may concern:

Be it known that I, FRANK WILCOMB, of Providence, in the county of Providence and State of Rhode Island, have invented a new and useful Improvement in Straight-Knitting Machines; and I do hereby declare that the following is a full, clear, and exact description of the same.

My invention is an improvement in mechanism designed for operating the reciprocating slide-bars used in knitting-machines for actuating the needles.

I have sought to provide improved means whereby the movement imparted from the driving-shaft will be transmitted easily to the slide-bars, whereby also ready access may be had to the operating parts of the machine, and also compactness of form and economy of space are secured. Further, I aim to provide such driving means particularly adapted to large-size machines as will enable me to secure a great length and rapidity of stroke without cumbering the machine.

In the accompanying drawings, Figure 1 is a central longitudinal section of the machine with some of the parts in elevation, the view including so much of the machine as relates particularly to my invention. Fig. 2 is a detail view of a combination of modified parts for transmitting the movement. Fig. 3 is a transverse section of Fig. 1 on line $x\,x$, the upper supporting-frame of the machine being indicated in dotted lines. Fig. 4 is a detail sectional view on line $x\,x$ of Fig. 3, showing the pinions for multiplying the movement in plan.

In the drawings the upper frames A A′ of the machine are connected and braced by upper and lower girts 1 2. The upper frame rests upon a suitable base 3, which is supported by the standards 4. The needle-beds are supported by the upper frames, as at 5, and these serve to support and guide the movement of the needles in the ordinary manner.

The slide-bars B B of the machine are arranged to reciprocate, and are guided for the purpose by their seats or ways 6 on the needle-beds, as shown in Fig. 1 and in dotted lines on left of Fig. 3. These are provided with any ordinary form of groove or device for acting upon the needle-beds, and are connected at their ends by cross-braces $a\,a$. On either side of the machine and parallel with the bars extends a rack-bar b, these being also connected at their ends to the cross-braces $a\,a$, and being adapted to work through suitable openings formed in the supporting-frame as the bars reciprocate.

On the outside of the frame A′ gears C C are mounted in brackets $n\,n$, secured to the frame and in the same vertical plane with the rack-bars with which the said gears are adapted to engage. They rotate in unison when operated, both being rigidly secured to the same shaft journaled in the arms of the brackets $n\,n$. Centrally of the shaft and between the gear-drums a pinion c' is fixed of smaller diameter than that of the gears. When the pinion is turned in either direction, the motion thereof will be imparted to the rack-bars through the gears, and they will be moved to the right or left, according to the direction of rotation of the pinion.

For giving movement to the gears by means of the pinion, I employ a vertically-arranged rack-bar D, meshing therewith, the bar being guided in its vertical movement and held in engagement with the pinion C′ by a friction-roller d, also supported in the brackets $n\,n$, behind the bar and bearing upon its rear face. To the lower end of the bar D, which extends downwardly close to the bottom of the lower supporting-frame, a cross-head d' is attached, which, moving in guideways d^2, secured to the frame, also acts to guide and hold the bar properly in its vertical movement. The guideways are supported by arms 11, having bearing-faces on their ends bolted to the guideways. The vertical movement of the bar is derived primarily from a face-wheel d^3 and a pitman d^4, the face-wheel being carried by a shaft E, which has its bearings in the lower supporting-frame, and derives its motion by means of the small and large gears e and f, hereinafter referred to. One end of the pitman is adjustably held by the face-wheel, as at 7, Fig. 3. The adjustable connection is formed by a screw-bolt 7^a, secured in the end of the pitman and passing through a slot in the face-wheel, this being shown in dotted lines. The pitman at its other end is pivot-

ally secured to the cross-head. Rotary motion imparted to the shaft E by the means indicated will turn the face-wheel, and through the cross-head and pitman connection thereto this will transmit vertical reciprocating movement to the rack, which, as has been seen, causes the movement of the slide-bars of the machine. The connection between the cross-head and the vertically-sliding rack carried thereby is not a direct or rigid one, but is peculiarly adapted for the purpose of transmitting a movement to the bar in excess of that which the cross-head receives. The cross-head is provided with a channel extending centrally from top to bottom, and within this the lower end of the rack-bar is arranged, passing into and through the same. The cross-head is also provided with pinions b^2 b^2 journaled therein and arranged to mesh with racks c^2 c^2, secured to the guideways of the cross-head. These pinions are mounted one on each side of the channel for the vertical rack, and the teeth on their inside mesh with racks D′, secured upon each side of the rack-bar D. They thus form a multiplying connection between the cross-head and the rack-bar. As the cross-head moves upwardly, the pinions will be rotated by reason of their teeth meshing with the racks c^2 c^2, along which they travel. The direction of acceleration of the rack-bar will always be the same as that of the cross-head and in advance of it. The resulting movement of the rack-bar equals the sum of the cross-head's movement and that imparted by the rotation of the pinions, and the result is the same in both directions. In the present case, while the cross-head is moving the distance equal to that between the ends of the guideways the bar being carried thereby will also have moved that distance, but in addition it is projected through the cross-head by the rotation of the pinions, and this movement in the present case makes the stroke just twice that which it receives from the cross-head alone.

It will be understood that the precise connections thus far described may be varied and the fundamental principle of my invention still adhered to; and I have shown in Fig. 2 another manner of transmitting the motion from the vertically-reciprocating rack-bar. This consists, as shown in Fig. 2, in joining the drums *c c* with the cross-braces *a a* at the ends of the slide-bars by means of flexible connections 8 9, preferably of wire rope, which extend from the drums in opposite directions, a pair of ropes 8 9 being used with each drum. The ends of these ropes 8 9 are connected about centrally of the drum, and extend in opposite directions around the same, lying in spiral grooves, formed in the periphery of the drums, which serve to hold them from slipping and to guide them. The other ends of the ropes connect with the cross-braces at the opposite ends of the slide-bars, the rope 9, for instance, of each pair of ropes extending to the left and the other rope 8 to the right. When the drums are rotated in either direction by the vertical rack and pinion, the rope 9, for example, of each pair will be wound and drawn upon, thus moving the slide-bars in that direction, and while these ropes are being wound the other ropes 8 unwind and assume positions for the reversal of the rotary movement, when they in turn will be pulled upon, returning the slide-bars and unwinding the other ropes 9 for the next action, it being understood that all the ropes are always taut and hold the bars rigidly in either direction, the corresponding ropes, as 9, of each pair unwinding only the amount that the other ropes are wound, and thus always bearing the same relation to each other.

The shaft carrying the face-wheel is driven by means of a large gear-wheel *f* thereon, with which meshes a pinion *e*, running loosely on the shaft H of the machine. The pinion is on a sleeve *o*, which carries also the belt-pulley 12, to which power is applied, and the relation of the pinion and gear is such that the power necessary to overcome the resistance attending the working of a large-sized machine is secured, though at the expense of speed. This speed, however, is regained by the use of the multiplying movement described, which incidentally secures this advantageous result, while at the same time accomplishing the primary object of obtaining a great length of stroke.

The driving mechanism proper, consisting of the pulleys and train of gears, is applicable more especially to the form of knitting-machines disclosed by me in an application filed by me on the 8th of April, 1888, Serial No. 271,026, in which devices for fashioning the fabric (not shown herein) are operated automatically from the main shaft of the machine by means of cams placed thereon—as, for instance, those shown at 13—and as the position of these cams must be determined and accurately fixed in order to make the said fashioning device perform their several functions properly in time and in proper succession, it is desirable to prevent any undue straining and to insure the maintenance of the necessary relation between the cams and the operating parts. In order to prevent this straining or twisting, therefore, under the resistance of the machine the power is not communicated to the cam-shaft directly or at first, but instead the arrangement of a loose belt-wheel and pinion is employed thereon, and the power is applied first to the shaft E, carrying the face-wheel, meeting here and overcoming the main resistance, and thence to the cam-shaft through the gears 14 and 15. By this means the accuracy of the cams in relation to each other and the operating parts is preserved without regard to the size of the machine or the grade of work to be accomplished. For driving the machine by hand, a crank-wheel G is employed, from which the movement is communicated by means of a beveled pinion on the journal thereof, as

shown in dotted lines, and a beveled gear g' on the main shaft.

It will be understood that different connections may be made between the vertically-moving bar and the drums or gears to change the direction of reciprocation—as, for instance, a similar arrangement of flexible connections and spirally-grooved drums—but the form of connections described has the advantage of accuracy and stability in action.

I am aware that in a circular-knitting machine a reciprocating rack-bar operated by a wrist-pin on a face-plate and adapted to be connected to the cam-plate is not new.

I claim as my invention—

1. In combination, the slide-bars, the horizontal rack-bars, the vertical rack-bars, gear-and-pinion connections to the horizontal rack-bars which move the slide-bars, a cross-head provided with pinions, stationary racks, and guideways, the pinions being in mesh with the vertical rack-bars and stationary racks, a driving-wheel, and a pitman connecting the cross-head to the driving-wheel, all substantially as described.

2. In combination, the slide-bars, a shaft disposed transversely with relation to said slide-bars and having driving-connections therewith, a reciprocating operating-bar arranged to move across the plane of the slide-bars and having operating-connections with said transverse shaft, the driving-shaft, and connections whereby said bar is reciprocated from said driving-shaft.

3. In combination, the slide-bars, the vertical reciprocating operating-bar therefor, intermediate connections between the same, the cross-head, and an accelerating connection between the vertical operating-bar and the cross-head for reciprocating the said bar, and means for operating the cross-head, substantially as described.

4. In combination, the slide-bars, the reciprocating operating-bar, connections between the slide-bars and operating-bar, said operating-bar having rack-teeth on its lower end, the cross-head having a channel to receive the end of the reciprocating-bar, means for reciprocating the cross-head, a pinion carried by the cross-head and meshing with teeth on the operating-bar, and the rack-teeth on the guideway, also engaging with the pinion, substantially as described.

5. In a knitting-machine and in combination, the slide-bars, the driving-shaft, and connections from said shaft to the bars for operating them, the cam-shaft of the machine, the pulley 12 and pinion e, the gear f, and the gears 14 15, for imparting the movement from the driving-shaft to the cam-shaft, substantially as described.

6. In combination, the slide-bars, the driving-shaft having the large gear thereon, the pinion meshing with said gear for driving it, a reciprocating operating-bar with connections to the slide-bars, the cross-head connection therefrom to the driving-shaft, the multiplying-pinion carried by the cross-head, and the rack-teeth on the guideways and operating-bar, substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

FRANK WILCOMB.

Witnesses:
GEO. L. BARNES,
GEO. R. WILSON.