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6 Sheets—Sheet 1.

E. FRANKE.

MACHINE FOR WINDING THREAD ONTO BOBBINS.

No. 581,708. Patented May 4, 1897.

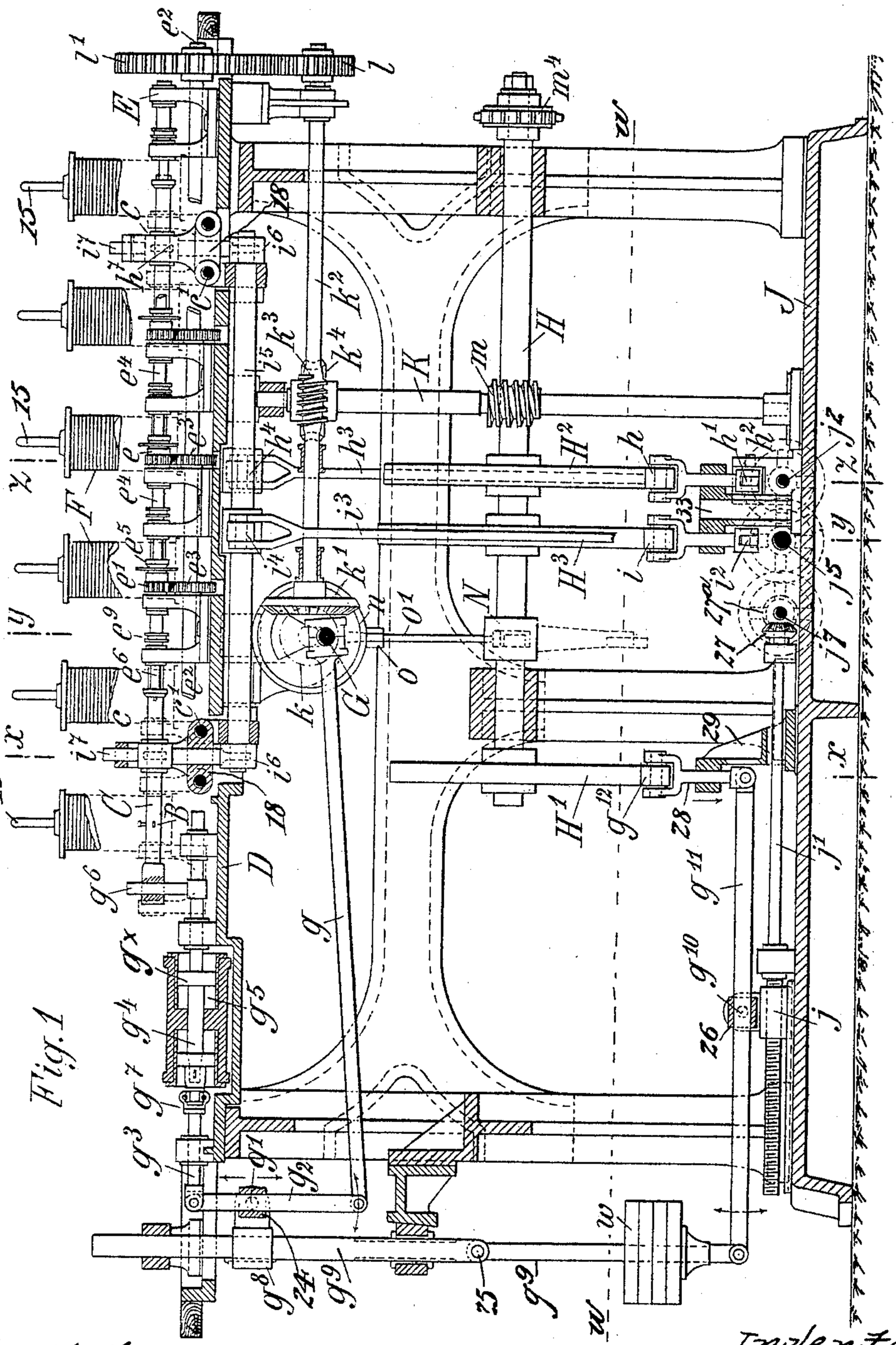

Fig. 1.

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(No Model.) 6 Sheets—Sheet 2.

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MACHINE FOR WINDING THREAD ONTO BOBBINS.

No. 581,708. Patented May 4, 1897.

Fig. 2

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MACHINE FOR WINDING THREAD ONTO BOBBINS.

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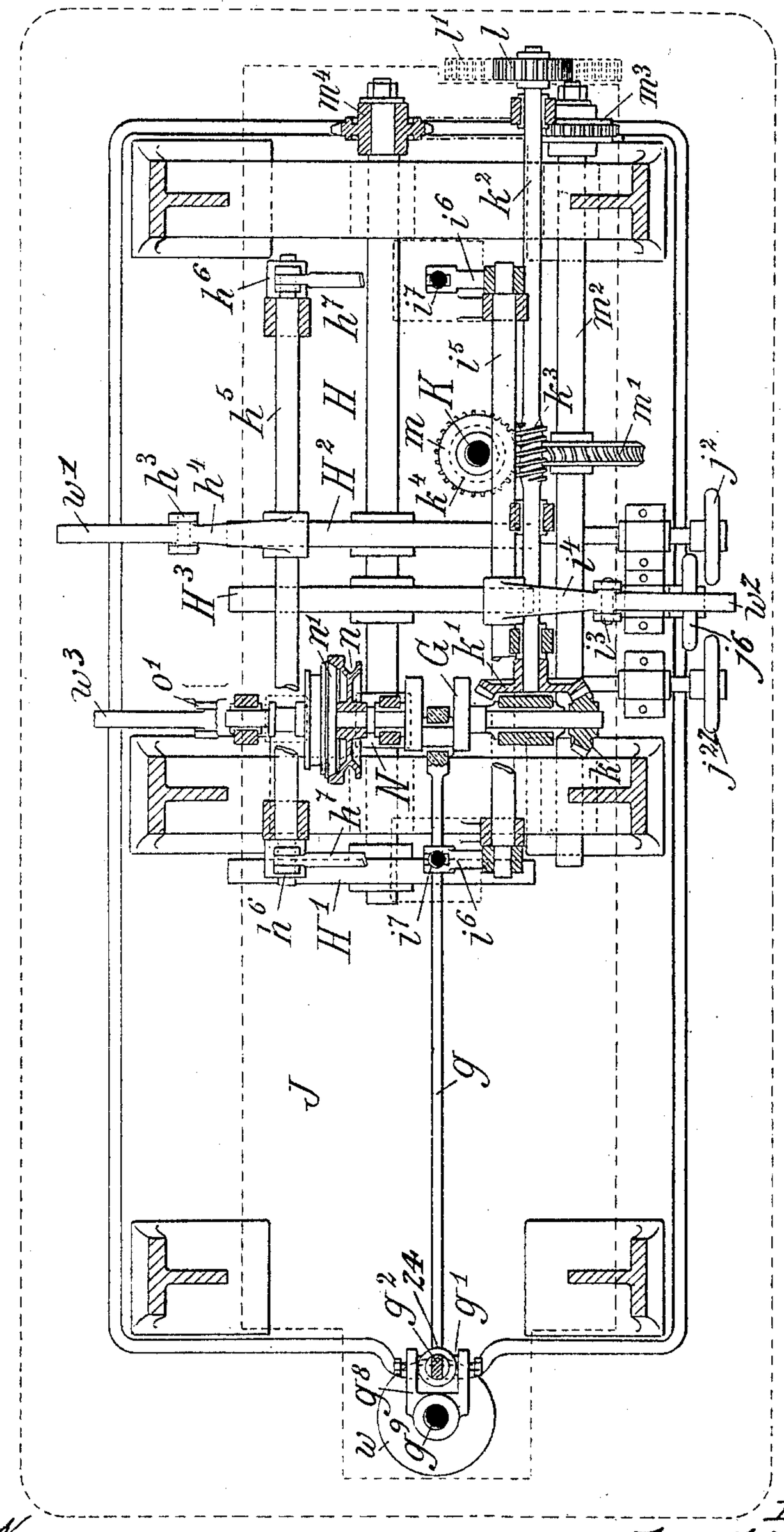
Fig. 3



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(No Model.) 6 Sheets—Sheet 4.

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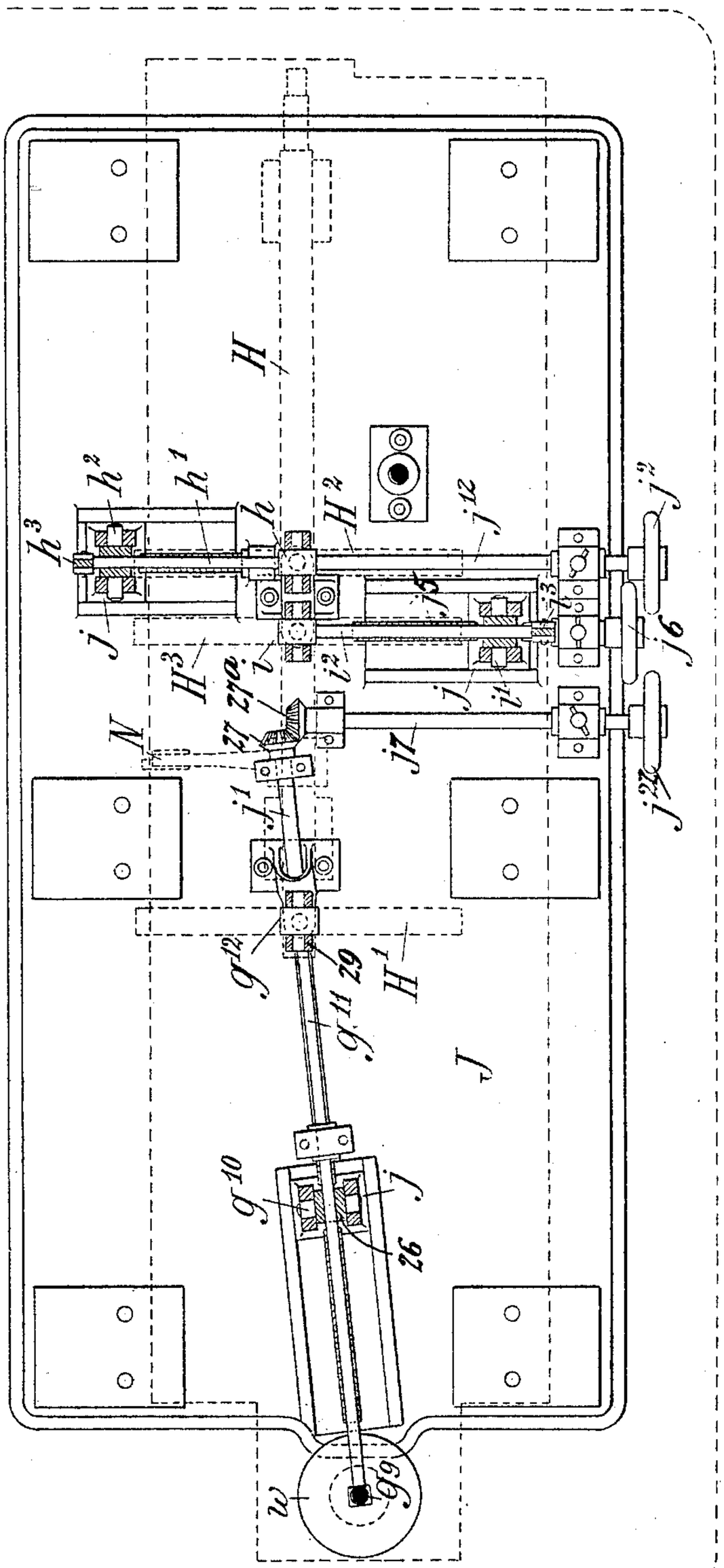
MACHINE FOR WINDING THREAD ONTO BOBBINS.

No. 581,708. Patented May 4, 1897.

Fig. 4



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(No Model.)

6 Sheets—Sheet 5.

E. FRANKE.

MACHINE FOR WINDING THREAD ONTO BOBBINS.

No. 581,708. Patented May 4, 1897.

Fig. 6

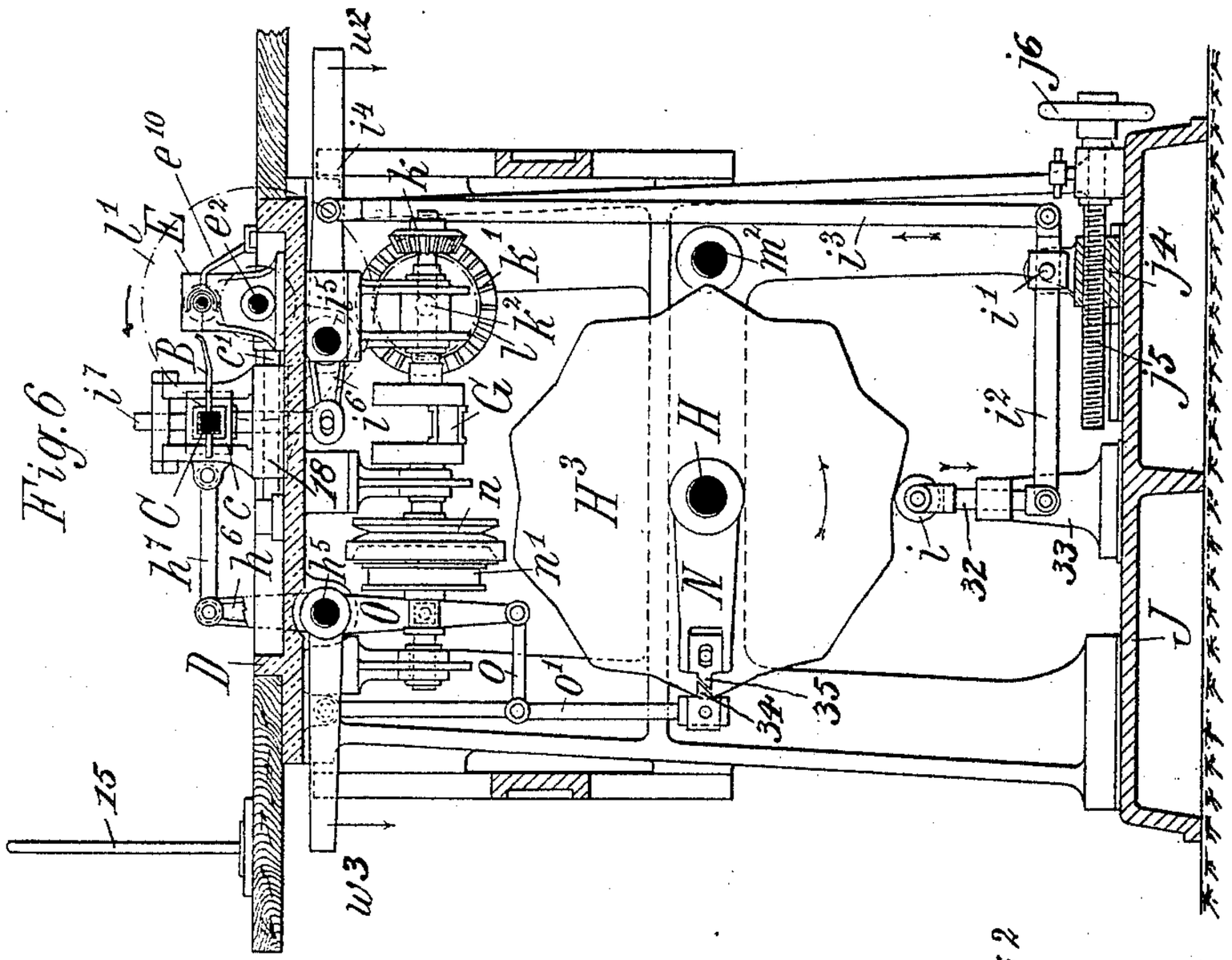
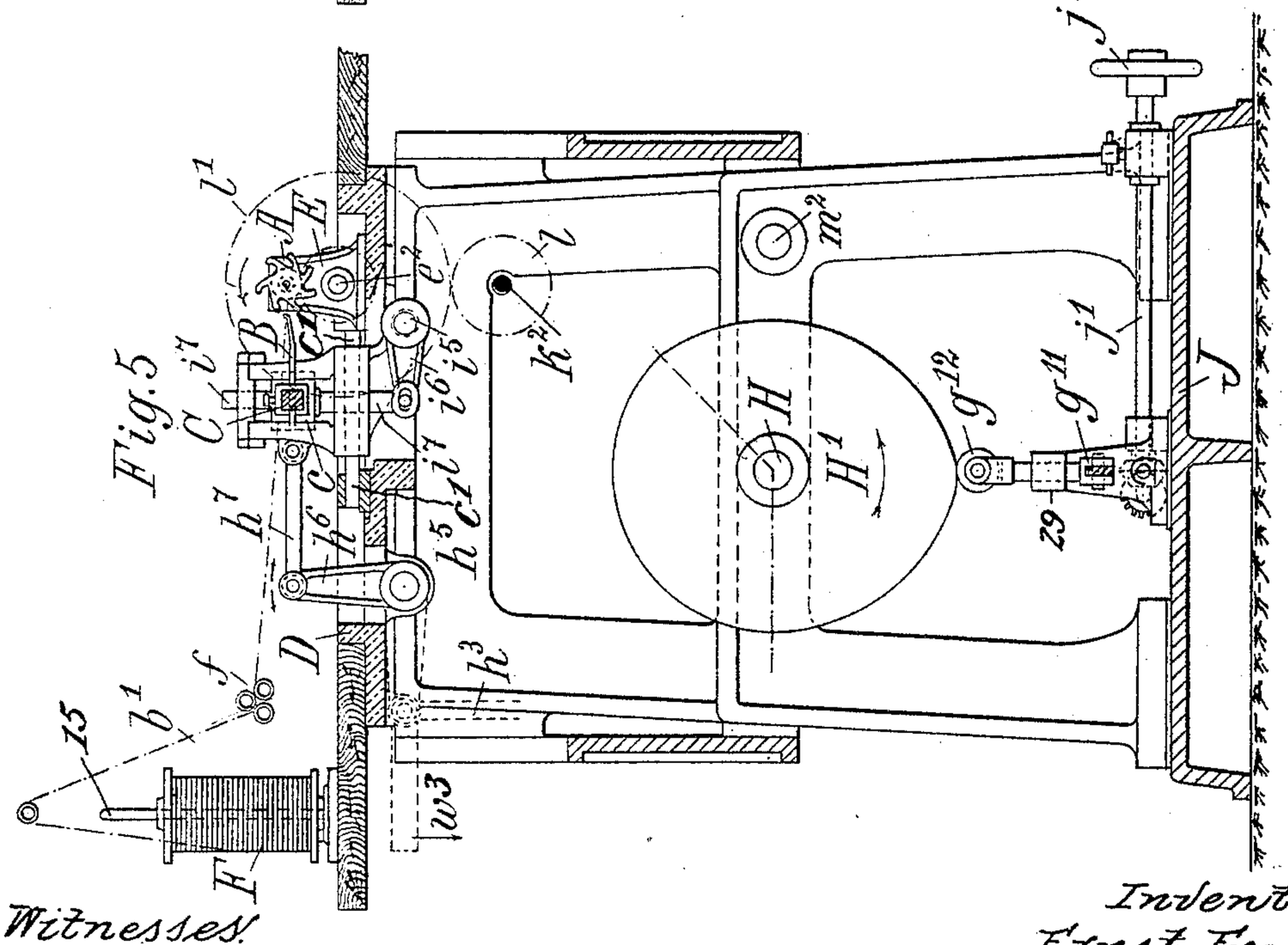


Fig. 5



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(No Model.) 6 Sheets—Sheet 6.

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MACHINE FOR WINDING THREAD ONTO BOBBINS.

No. 581,708. Patented May 4, 1897.

Fig. 8

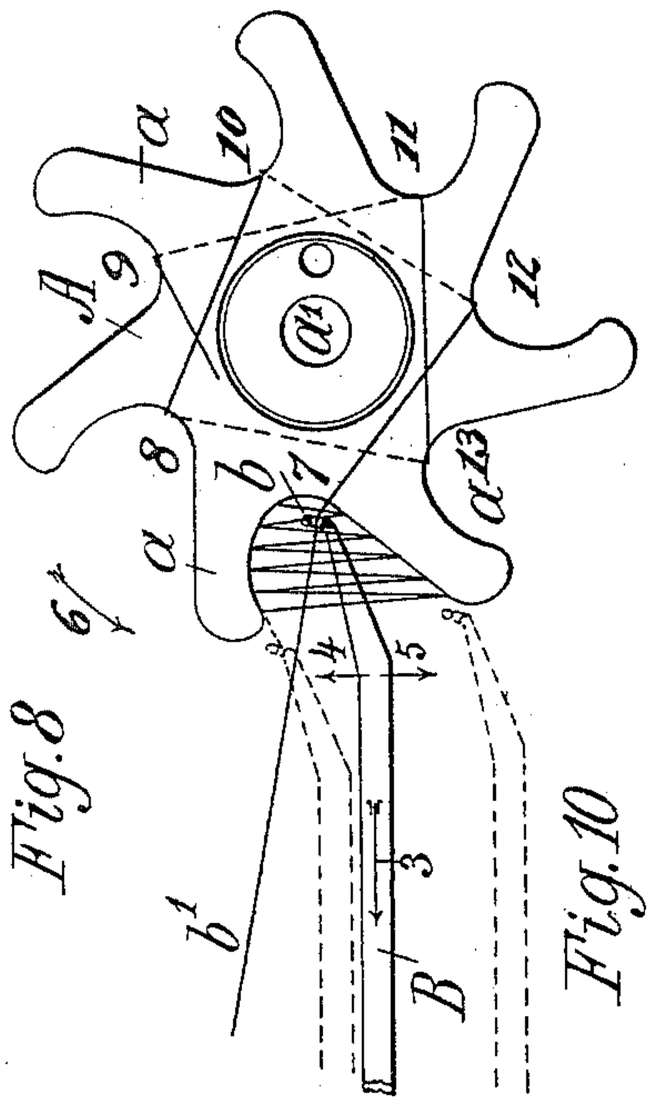


Fig. 9

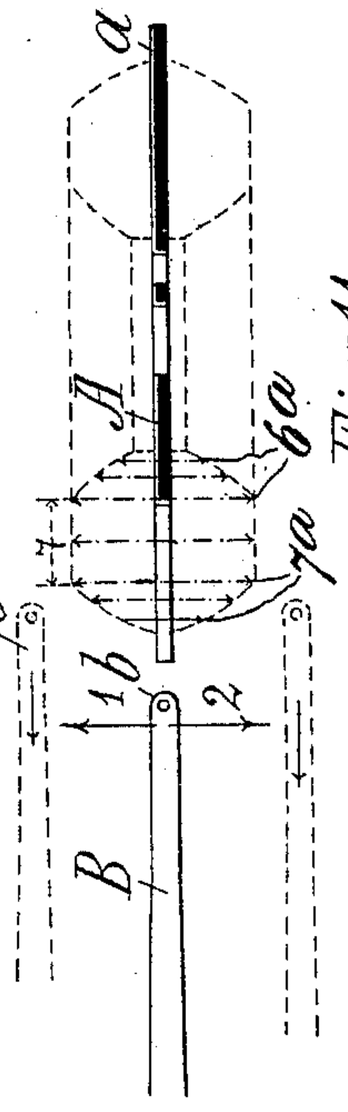


Fig. 10

Fig. 11

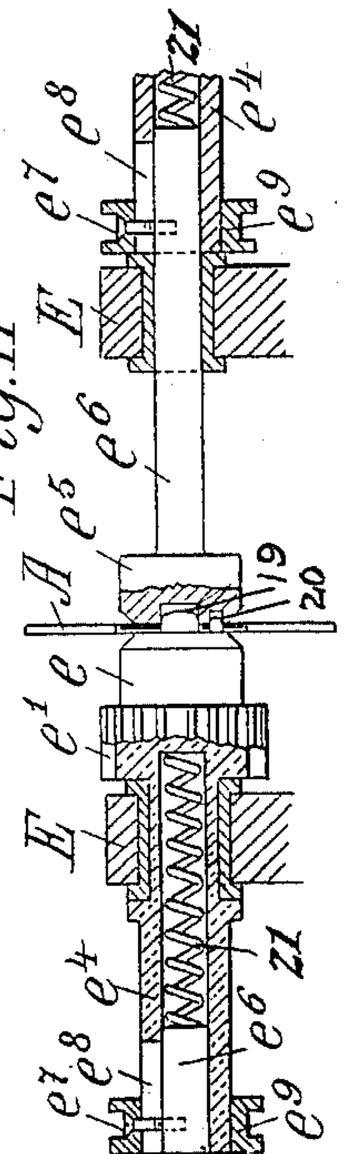
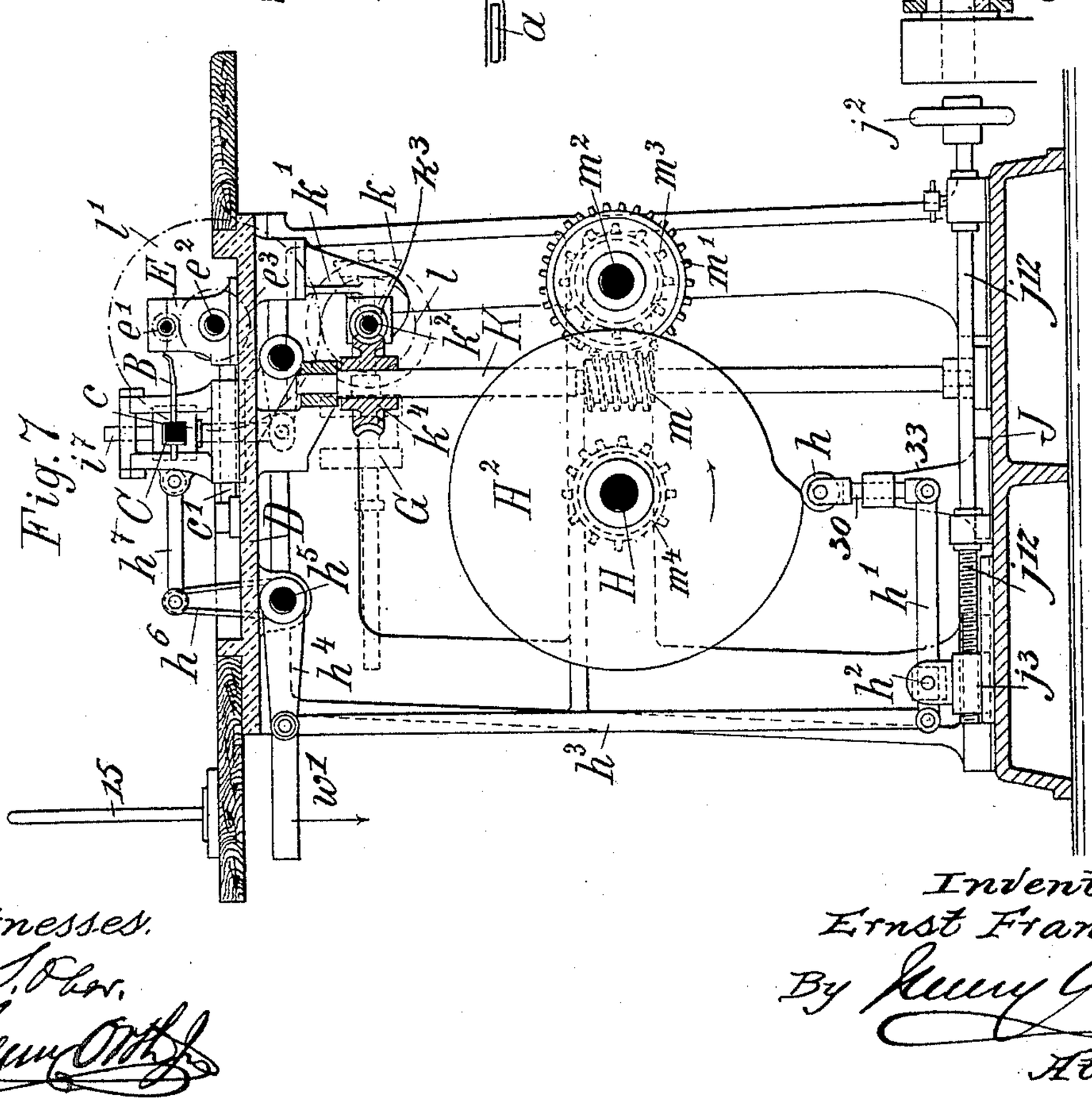


Fig. 7



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UNITED STATES PATENT OFFICE.

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MACHINE FOR WINDING THREAD ONTO BOBBINS.

SPECIFICATION forming part of Letters Patent No. 581,708, dated May 4, 1897.

Application filed May 13, 1896. Serial No. 591,352. (No model.)

To all whom it may concern:

Be it known that I, ERNST FRANKE, a subject of the Emperor of Germany, residing at Wienersdorf, in the Province of Lower Austria, in the Empire of Austria-Hungary, have invented certain new and useful Improvements in Machines for Winding Thread onto Star-Shaped Bobbins; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to letters and figures of reference marked thereon, which form a part of this specification.

My invention has relation to the art of winding thread on bobbins, and more particularly to the winding of such thread on thin, flat, discoidal, star-shaped bobbins.

The invention has for its object a mode of winding the thread on bobbins such as described so as to adapt them for use in machine-sewing. The invention has for its further object the provision of means for carrying out the said mode of winding; also, the provision of means for winding thread on bobbins of different dimensions and for varying the quantity or length of thread wound upon such bobbins, as will now be fully described, reference being had to the accompanying drawings, in which—

Figure 1 is a sectional front elevation of a machine constructed in accordance with my invention. Fig. 2 is a sectional top plan view thereof. Fig. 3 is a horizontal section taken on a line immediately below the top or table of the machine. Fig. 4 is a like view taken about on line *w w* of said Fig. 1. Fig. 5 is a vertical transverse section taken about on line *x x* of Fig. 1, illustrating a portion of the mechanism for imparting to the thread-guide bar a horizontal motion from and toward the bobbins, also showing the cam that serves to vary the amplitude of the traversing motion of said thread-guide bar. Fig. 6 is a like view taken about on line *y y* of Fig. 1, illustrating the main driving-gear and the mechanism for imparting to the thread-guide bar a vertical reciprocating motion of gradually-increasing amplitude. Fig. 7 is also a vertical section taken about on line *z z* of Fig. 1, illustrating the mechanism for imparting to the thread-guide bar a horizontal motion from and toward the bobbins. Figs. 8 to 10 illustrate the operation of winding, and Fig. 11 is a fragmentary longitudinal sectional view of one of the revoluble bobbin-carriers.

I will first describe the mode of winding thread on star-shaped flat bobbins so that such thread will unwind in a uniform manner, whereby such bobbins are adapted for use in machine-sewing.

As shown in Fig. 8, the bobbin A has an odd number of points or radial arms *a*, as seven, for example. It is made of any suitable material, as sheet metal or other like material, though I prefer cardboard, and said bobbin is provided with an aperture $a^{\times}$ for purposes hereinafter described, and with an axial aperture *a'* for the revoluble carrier, it being supposed that said bobbin rotates with its carrier toward the thread-guide B, as indicated by arrow 6 in Fig. 8.

The thread-guide consists of a flat bar or needle having one end bent at a suitable angle and provided at said end with a guide-eye *b* for the thread *b'* coming from a spool or bobbin. The thread-guide is adapted to reciprocate in a plane parallel with the axis of rotation of the bobbin A, or, in other words, it has a traversing motion imparted to it, during which the thread *b'* is caught by the arms *a* of said bobbin and wound thereon. As the thread-guide B moves in the direction of arrow 1, Fig. 9, the thread is laid on the front face of the bobbin from space 7 to space 9, space 8 being skipped, while during the movement of the thread-guide in the direction of arrow 2 said thread is laid on the back of the bobbin from space 9 to space 11, space 10 being skipped, then again on the front face from space 11 to space 13, space 12 being skipped. Inasmuch as the bobbin has an odd number of points or arms *a* the thread will now be laid on the back of the bobbin from space 13 to space 8, space 7 being skipped, then from space 8 to space 10 on the front face and from space 10 to space 12 on the back, and so on, so that the thread is not only laid on the opposite faces of the bobbin A alternately, but into alternate sets of spaces between the points or arms *a* of such bobbin.

As the winding proceeds the thread-guide

B recedes in proportion as the bobbin fills, as shown by arrow 3, Fig. 8, but if this receding movement were to take place in a horizontal plane only, the thread would not be uniformly distributed over the bobbin and would therefore not unwind uniformly. This I avoid by imparting to the thread-guide B during its receding movement also a variable rising-and-falling motion, the amplitude of which gradually increases from the beginning to the completion of the operation of winding, the guide receding in a zigzag path, as shown by the zigzag lines in Fig. 8.

In order that the thread may be wound uniformly upon the bobbin with the threads in each layer parallel with each other, it is essential that the traversing movement of the thread-guide be a variable one, its greatest amplitude corresponding with the greatest number of superposed layers of thread. This amplitude of the traversing motion of the guide increases gradually from the beginning, as shown by the dotted lines 6^a, Fig. 9, after which it remains uniform for a period of time, (dotted line 7, Fig. 9,) and finally gradually decreases, (dotted lines 7^a in said Fig. 9,) whereby during the last period of winding the thread is laid close to and substantially parallel with the arms *a* of the bobbin.

When wound as described, the thread in unwinding is guided by the layers thereof (when arranged to revolve on a vertical axis, for instance, on a sewing-machine to supply the upper thread) until a sufficient quantity of thread has been unwound, after which the points or arms *a* guide the thread and regulate the unwinding, thereby preventing the dropping off of a layer or part of a layer of thread, its becoming more or less tangled, and the breaking of such thread.

I will now describe the mechanism through the medium of which the method of winding above described is effected, reference being had to Figs. 1 to 7 of the drawings, such mechanism being mounted on a suitable frame having a top or table D, to which are secured a plurality of spool-spindles 15 for the spools F, from which the thread is wound onto the star-shaped bobbins A, the thread *b'* passing between tension-rolls *f*, Fig. 5.

To the table D are secured two standards 16 and a suitable number of standards E, the standards 16 being connected with two of the standards E by guide-rods *c'*, which constitute a track or way for a carriage 18, that is provided with bearings for the thread-guide bar or support C, said bearings having free up-and-down motion on their carriage 18, as more clearly shown in Fig. 5, and to said bar C are secured the thread-guides B, hereinbefore referred to, and provided at their free end with a guide-eye *b*, Fig. 8, said thread-guides being adjustable by means of set-screws 18^a, Figs. 2 and 5, toward and from the bobbins A.

The standards E are provided with bearings for a shaft e^2, that carries a number of pinions e^3 equal to the number of bobbins to be wound, six such being shown in Figs. 1 and 2, though a greater or less number may be used, and above the bearings for shaft e^2 the standards E are provided with bearings for the bobbin carriers or spindles, one for each bobbin A.

Referring more particularly to Fig. 11, it will be seen that each bobbin-carrier is composed of two parts, namely, a socketed or partly-tubular spindle e^4, having its bearings in the arms of a standard E and being provided with a head *e*, that has an axial pin 19, that passes through the axial aperture *a* in the bobbin A, and a smaller pin 20, that passes through the aperture $a^\times$ of said bobbin, and on said spindle-head is secured or formed a gear *e'*, that meshes with the pinion e^3 on the driving-shaft e^2. The tubular spindles e^4 contain each a coiled spring 21, that has bearing against the spindle-head and against the inner end of a headed piston or plunger e^6, the head e^5 of which is provided with two recesses or sockets for the reception of the pin or journal 19 and the locking-pin 20, projecting from the outer face of the head *e* of the spindle e^4, whereby the bobbins A are clamped between the heads *e* and e^5 by a yielding pressure, while the pin 20 locks the plunger e^6 to the spindle e^4 and causes the two to revolve together. At their left-hand end the spindles e^4 are slotted longitudinally and carry a grooved shifting-wheel e^9, secured to the plunger-stem e^6 by a screw e^7, that passes through the slot e^8 in said spindles for the purpose of moving the plungers, against the stress of their springs 21, out of engagement with the heads *e* of their respective spindles e^4 to release the bobbins by the following means:

In suitable bearings rising from the table D of the machine in front of the bobbin-carriers slides a shifting-rod 22, operated by a suitable hand-lever 23, said rod having forked shifting-arms e^{10}, that lie in the grooves of the shifting-wheels e^9, whereby all of the bobbins can be simultaneously released when full of thread.

By means of the described construction of bobbin-carriers I provide a substantially continuous carrier and at the same time means for disconnecting all the bobbins therefrom simultaneously.

The thread-guide bar C has at its left-hand end a slotted head through which passes freely a radial arm g^6 on the rod g^4 of twin pistons $g^\times$, that work in a corresponding cylinder g^5, the left-hand end of such rod being connected by a gimbal or universal joint g^7 to one end of a connecting-rod g^3, whose opposite end is connected with one of the arms of a two-armed lever g^2 for purposes presently explained.

All of the mechanism above described is arranged on the table D of the machine, and below said table revolves the main driving or crank shaft G, from which motion is communicated to all the operative elements, motion

being communicated to said shaft through the medium of a grooved pulley n thereon, Fig. 3, and a cord or belt (not shown) connecting said pulley with a suitable prime motor.

Referring now more particularly to Figs. 1, 3, 4, and 6, the crank-shaft G carries at its front end a bevel-gear k, meshing with a like gear k' on a counter-shaft k^2, that carries at its outer end a gear l, which meshes with a gear l' on the bobbin-carrier-driving shaft e^2, said shaft k^2 carrying also a worm k^3. To the crank of shaft G is connected one end of a rod g, whose opposite end is connected to the two-armed lever g^2, that moves the twin pistons $g^\times$, and therethrough the thread-guide bar C, already referred to. The lever g^2 has motion in a sleeve 24, journaled at g' in the fork on a sleeve g^8, keyed to a rod g^9, Figs. 1 and 3, said rod g^9 being made in two parts pivoted together at 25 and provided with a seat for a weight or weights w. The lower end of the rod g^9 is pivoted to one end of a two-armed lever g^{11}, that has endwise motion in a sleeve 26, journaled at g^{10} in a fork on an interiorly-threaded sleeve j, mounted on a screw-rod j', that carries at one end a bevel-gear 27. Said bevel-gear 27 meshes with a like gear 27^a on a counter-shaft j^7, that carries a hand-wheel j^{22}, by means of which instrumentalities the fulcrum of the lever g^{11} can be displaced and the amplitude of its vibrations, and consequently the amplitude of the traversing motion of the thread-guide bar, varied in accordance with the size of the bobbins A or the length of thread to be wound thereon. The lever g^{11} is also connected to a rod 28, that carries at its outer end an antifriction-roller g^{12} and is guided in a standard 29 on the base-plate J of the machine, said roller g^{12} bearing on the periphery of a cam H′ (see also Fig. 5) on a shaft H, the roller being held in contact with the said cam by the weight or weights w on rod g^9, above described. The cam-shaft H carries a sprocket-wheel m^4, chained to a like wheel m^3 on a shaft m^2, carrying a worm-wheel m', that meshes with a worm m on a vertical shaft K, which also carries a worm-wheel k^4, meshing with the worm k^3 on counter-shaft k^2, hereinbefore referred to. (See also Fig. 7.)

By means of the mechanism just described the thread-guide bar C and with it the thread-guides B are traversed in front of the bobbins and the traversing motion is varied by the displacement of the fulcrum of the lever g^2, which has up-and-down motion in its fulcrum-sleeve 24, the cam H being so shaped that the amplitude of the traversing motion in the direction of arrows 1 and 2, Fig. 9, will gradually increase from the beginning of the winding, then remain uniform for a certain period of time, and then gradually decrease to the end of the winding operation, for purposes already explained, and this is attained by the shape of the cam and the shifting of the fulcrum; hence the variation in the relative length of the arms of lever g^2, that communicates motion to the thread-guide bar C, through the instrumentalities above described.

The object of using a twin-piston connection between the lever g^2 and the thread-guide bar C is to obviate jerking movements of said bar, the air in the cylinder g^5 acting as a buffer for the pistons during the traversing motion of said bar C, as will be readily understood.

The receding movement of the thread-guide bar C, that is to say, its horizontal movement in a plane perpendicular to the axis of rotation of the bobbins A and the simultaneous vertical reciprocating movement of said bar, the amplitude of which movement gradually increases from the beginning to the ending of the winding, as and for the purposes described in reference to Fig. 8, is effected as follows:

The carriages 18 of the thread-guide bar C are connected by means of rods h^7 to radial arms h^6 on a rock-shaft h^5, Figs. 2, 5, and 7, said shaft h^5 having a radial arm h^4, (whose outer end w' is weighted or acts as a weight,) connected by a rod h^3 with a two-armed lever h', that also has endwise motion in a sleeve journaled in a fork h^2 on an interiorly-threaded sleeve j^3, mounted on a screw-rod revoluble in bearings on the base-plate J of the machine and carrying a hand-wheel j^2.

The lever h' has pivoted thereto a rod 30, that carries an antifriction-roller h and is guided in a suitable standard 33, rising from the aforesaid base-plate J, said roller having bearing on the periphery of a cam H^2, also mounted on cam-shaft H, the said roller h being held to the periphery of cam H^2 by the weighted arm h^4 on shaft h^5.

The shape of the cam H^2 is such as to cause the carriages 18 of the thread-guide bar C to gradually recede from the bobbin-carrier spindles during the operation of winding and to return said carriages into their normal position after the completion of the winding.

The cam-shaft H carries a third cam H^3, that has a series of peripheral cam-faces the depth and length of which vary in accordance with the gradually-increasing vertical reciprocating movements to be imparted to the thread-guide bar C from the beginning to the completion of the winding operation. Upon said cam-surface bears a roller i on the end of a rod 32, guided in a standard 33 on bed-plate J and connected to one end of a two-armed lever i^2, the other arm of which is connected by a rod i^3 to a radial arm i^4 on a rock-shaft i^5, the outer end of said radial arm i^4 being weighted or serving as a weight w^2 to keep the roller i in contact with cam H^3.

On shaft i^5 are secured two radial arms i^6, connected by pin and slot, Fig. 6, with two rods i^7, secured to the sliding bearings c for the thread-guide bar, so that as the cam H^3 is revolved the said bearings will be moved up and down, the amplitude of this motion being gradually increased from the beginning to the completion of the winding operation.

The lever i^2 has, like the levers g^{11} and h', endwise movement in a sleeve that is journaled in a fork i' on an interiorly-threaded sleeve j^4, in which works a screw-rod j^5, that carries a hand-wheel j^6. By means of the screw-rods j^{12} and j^5 the fulcra of the levers h' and i^2 can be displaced to vary the relative length of the arms of said levers, and consequently the amplitude of their vibrations, so that the various movements of the thread-guide bar C can be regulated in accordance with the diameter of the bobbins A to be wound with thread and the length of thread to be wound thereon.

The operation of winding is completed after each revolution of the cam-shaft H, and it is necessary that the rotation of said cam-shaft should then be stopped in order that the full bobbins may be removed and an empty set of bobbins connected with their carriers, and in order that this may be effected automatically the driving-pulley n, which is loosely mounted on crank-shaft G, is constructed as hereinbefore described and performs the function of one half of a friction-clutch, the other half n' being feathered and having sliding motion on said shaft G. The sliding half n' of the friction-clutch is connected to a shifting-lever O, loose on shaft h^5, which lever is moved back to a normal position by a weighted radial arm w^3. The lever O is connected by a rod o with a pendulous rod o', provided at its outer end with a tappet 34 in the path of a corresponding tappet 35 on the outer end of a radial arm N, secured to the cam-shaft H and so positioned on said shaft that when the operation of winding is completed the tappet 35 on said arm N will move the pendulous lever outwardly, thereby moving the clutch-half n' out of contact with the clutch-face of pulley n, causing the latter to revolve freely on main driving-shaft C, and thereby stopping the operation of the machine.

In practice and to effect a perfect winding the driving mechanism through the medium of which the described variable traversing movement and the compound rectilinear and variable rising-and-falling motions are imparted to the thread-guides is so geared that the guides will receive a rapid traversing motion and a slow receding and rising-and-falling motion.

Having thus described my invention, what I claim as new therein, and desire to secure by Letters Patent, is—

1. In a thread-winding machine in combination, a revoluble bobbin-carrier, a thread-guide, mechanism for imparting to such guide a rectilinear receding motion, and mechanism for imparting thereto a simultaneous rising-and-falling motion of gradually-increasing amplitude, for the purpose set forth.

2. In a thread-winding machine in combination, a revoluble bobbin-carrier, a thread-guide, mechanism for imparting to such guide a traversing motion of gradually-increasing, then uniform, and finally of gradually-decreasing amplitude, and mechanism to impart to said guide a simultaneous rectilinear receding motion, and a rising-and-falling motion of gradually-increasing amplitude for the purpose set forth.

3. In a thread-winding machine in combination, a revoluble bobbin-carrier, a thread-guide, mechanism for imparting to the latter a rectilinear receding motion, mechanism for simultaneously imparting to such guide a traversing motion of gradually-increasing, then of uniform, and finally of gradually-decreasing amplitude, and adjusting devices for adjusting the amplitude of such movements in accordance with the lengths of the windings, for the purpose set forth.

4. In a thread-winding machine in combination, a revoluble bobbin-carrier, a thread-guide, mechanisms for imparting to such guide a rectilinear receding motion, mechanism for simultaneously imparting to such guide a rising-and-falling motion of gradually-increasing amplitude, and adjusting devices for adjusting the amplitude of the latter motion in accordance with the number of layers of thread to be wound on a bobbin, for the purpose set forth.

5. In a thread-winding machine in combination, a revoluble bobbin-carrier, a thread-guide, mechanism for imparting to the guide a rapid traversing motion of gradually-increasing, then of uniform, and finally of gradually-decreasing amplitude, and mechanism for simultaneously imparting to said guide a slow rectilinear receding motion and a slow rising-and-falling motion of gradually-increasing amplitude, and adjusting devices for adjusting the amplitude of the traversing and rising-and-falling movements of said thread-guide in accordance with the lengths of the windings, and the number of layers of thread to be wound on a bobbin.

6. In a thread-winding machine in combination, a revoluble bobbin-carrier, a thread-guide, mechanisms for imparting to such guide a rapid traversing motion of gradually-increasing, then of uniform, and finally of gradually-decreasing amplitude, and simultaneously therewith a slow rectilinear receding motion and a slow rising-and-falling motion of gradually-increasing amplitude, and a stop mechanism operating to automatically stop the aforesaid movements at a predetermined time, for the purpose set forth.

7. In a thread-winding machine, the combination with a revoluble bobbin-carrier, a thread-guide bar, a thread guide or guides secured thereto, and a support for and in which said bar has endwise motion; of a lever connected with the bar and having a shiftable fulcrum, a crank-shaft connected with said lever, and mechanism operating to shift the fulcrum of such lever so as to impart to the thread-guide bar a traversing motion of gradually-increasing, then of uniform, and finally

of gradually-decreasing amplitude at each revolution of the actuating-cam, for the purpose set forth.

8. In a thread-winding machine, the combination with a revoluble bobbin-carrier, a thread-guide bar, a thread guide or guides secured thereto, and a support for and in which said bar has endwise motion; of a lever connected with the bar and having a shiftable fulcrum, a crank-shaft connected with said lever, and mechanism operating to shift the fulcrum of such lever so as to impart to the thread-guide bar a traversing motion of gradually-increasing, then of uniform, and finally of gradually-decreasing amplitude at each revolution of the actuating-cam, and appliances operating automatically to stop the rotation of the crank-shaft and shifting appliances at the completion of the aforesaid movements of the thread-guide bar, for the purpose set forth.

9. In a thread-winding machine, the combination with a revoluble bobbin-carrier, a thread-guide bar, a thread guide or guides secured thereto, and a support for and in which said bar is free to traverse, a lever connected with the bar, and a crank-shaft connected with said lever; of a shiftable fulcrum for such lever comprising a sleeve in which the lever has free motion, a carrier in which said sleeve is fulcrumed, a rod to which said sleeve-carrier is secured, a shifting-lever connected with said rod, and a cam operating to vibrate the shifting lever and rod to shift the fulcrum-sleeve along and vary the amplitude of the vibrations of the lever connected with the thread-guide bar, for the purpose set forth.

10. In a thread-winding machine, the combination with a revoluble bobbin-carrier, a thread-guide bar, a thread guide or guides secured thereto, and a support for and in which said bar is free to traverse, a lever connected with the bar, and a crank-shaft connected with said lever; of a shiftable fulcrum for such lever, comprising a sleeve in which the lever has free motion, a carrier in which said sleeve is fulcrumed, a rod to which said sleeve-carrier is secured, a shifting-lever connected with said rod, and a cam operating to vibrate the shifting lever and rod to shift the fulcrum-sleeve along and vary the amplitude of the vibrations of the lever connected with the thread-guide bar, and means for holding said shifting-lever in contact with the aforesaid cam, for the purpose set forth.

11. In a thread-winding machine, the combination with a revoluble bobbin-carrier, a thread-guide bar, a thread guide or guides secured thereto, and a support for and in which said bar is free to traverse, a lever connected with the bar, and a crank-shaft connected with said lever; of a shiftable fulcrum for such lever comprising a sleeve in which the lever has free motion, a carrier in which said sleeve is fulcrumed, a rod to which said carrier is secured, a shifting-lever connected with said rod, and a cam operating to vibrate the shifting lever and rod to shift the fulcrum-sleeve along and vary the amplitude of the vibrations of the lever connected with the thread-guide bar, and means for varying the amplitude of the vibrations of the shifting-lever, for the purpose set forth.

12. In a thread-winding machine, the combination with a revoluble bobbin-carrier, a thread-guide bar, a thread guide or guides secured thereto, and a support for and in which said bar is free to traverse, a lever connected with the bar, and a crank-shaft connected with said lever; of a shiftable fulcrum for such lever comprising a sleeve in which the lever has free motion, a carrier in which said sleeve is fulcrumed, a rod to which said carrier is secured, a shifting-lever connected with said rod, and a cam operating to vibrate the shifting lever and rod to shift the fulcrum-sleeve along and vary the amplitude of vibrations of the lever connected with the thread-guide bar, and mechanism operating automatically to stop the rotation of the crank-shaft and cam at each complete revolution of the latter, for the purpose set forth.

13. In a thread-winding machine, the combination with a revoluble bobbin-carrier, a thread-guide bar, a thread guide or guides secured thereto, and a support for said bar adapted to move from and toward the bobbin-carrier; of a rock-shaft, radial arms thereon connected with the aforesaid support, a cam, and intermediate mechanism between the cam and rock-shaft to rock said shaft and move the support away from and back toward the bobbin-carrier, for the purpose set forth.

14. In a thread-winding machine, the combination with a revoluble bobbin-carrier, a thread-guide bar, a thread guide or guides secured thereto, and a support for said bar adapted to move from and toward the bobbin-carrier; of a rock-shaft, radial arms thereon connected with the aforesaid support, a cam, a lever vibrated by the cam, a weighted radial arm on the rock-shaft and a connecting-rod connecting said lever with said arm, for the purpose set forth.

15. In a thread-winding machine, the combination with a revoluble bobbin-carrier, a thread-guide bar, a thread guide or guides secured thereto, and a support for said bar adapted to move from and toward the bobbin-carrier; of a rock-shaft, radial arms thereon connected with the aforesaid support, a cam, a lever vibrated by the cam, means for adjusting the amplitude of the vibrations of said lever, a weighted arm on the rock-shaft and a connecting-rod connecting said lever with said arm, for the purpose set forth.

16. In a thread-winding machine, the combination with a revoluble bobbin-carrier, a thread-guide bar, a thread guide or guides secured thereto, and a support for said bar adapted to move from and toward the bobbin-carrier; of a rock-shaft, radial arms thereon

connected with the aforesaid support, a cam, a lever vibrated by the cam, a weighted radial arm on the rock-shaft, a connecting-rod connecting said lever with said arm, and mechanism operating to stop the rotation of the cam at each complete revolution thereof, for the purpose set forth.

17. In a thread-winding machine, the combination with a revoluble bobbin-carrier, a thread-guide bar, a thread guide or guides secured thereto, supports and bearings for said bar, said bearings adapted to move vertically in their supports; of a rock-shaft, radial arms thereon connected with the aforesaid bearings, and mechanism adapted to rock said shaft and impart to said bearings a rising-and-falling motion of gradally-increasing amplitude, for the purpose set forth.

18. In a thread-winding machine, the combination with a revoluble bobbin-carrier, a thread-guide bar, a thread guide or guides secured thereto, supports and bearings for said bar, said bearings adapted to move vertically in their supports; of a rock-shaft, radial arms thereon connected with the aforesaid bearings, and mechanism adapted to rock said shaft and impart to said bearings a rising-and-falling motion of gradually-increasing amplitude, and mechanism operating to automatically stop said movements at a predetermined period, for the purpose set forth.

19. In a thread-winding machine, the combination with a revoluble bobbin-carrier, a thread-guide bar, a thread guide or guides secured thereto, supports and bearings for said bar, said bearings adapted to move vertically in their supports; of a rock-shaft, radial arms thereon connected with the aforesaid bearings, a cam, and a lever vibrated thereby and connected with the aforesaid rock-shaft, said cam constructed to impart to the lever vibrations of gradually-increasing amplitude, for the purpose set forth.

20. In a thread-winding machine, the combination with a revoluble bobbin-carrier, a thread-guide bar, a thread guide or guides secured thereto, supports and bearings for said bar, said bearings movable vertically in their supports, a rock-shaft and connections between it and said bearings to impart vertical motion thereto, a weighted radial arm on said rock-shaft, a revoluble cam, a lever vibrated thereby and a connection between said lever and weighted arm, said cam constructed to impart to said lever vibrations of gradually-increasing amplitude, substantially as set forth.

21. In a thread-winding machine, the combination with a revoluble bobbin-carrier, a thread-guide bar, a thread guide or guides secured thereto, supports and bearings for said bar, said bearings adapted to move vertically in their supports; of a rock-shaft, radial arms thereon connected with the aforesaid bearings, a cam, a lever vibrated thereby and connected with the aforesaid rock-shaft, said cam constructed to impart to the lever vibrations of gradually-increasing amplitude, and means for displacing the fulcrum of said lever, for the purpose set forth.

22. In a thread-winding machine, the combination with the thread-guide bar and its actuating-lever g^2, of the twin-piston cylinder, the pistons working therein, a piston-rod common to both pistons, a radial arm at one end of said rod, said arm extending freely through a slot in the thread-guide bar, a rod connected with said lever g^2 and a universal joint between said rod and the other end of the piston-rod, substantially as and for the purpose set forth.

23. In a thread-winding machine, a sectional bobbin-carrier, each section comprising a hollow spindle open at one end and containing a coiled spring, said spindle slotted at its open end and provided at its opposite end with a head having two pins or studs projecting from its face, and with gear-teeth on its periphery, and a headed plunger provided in its face with sockets for the reception of said pins, the stem of said plunger fitting the bore of a succeeding spindle and being held against the head of a preceding spindle by the coiled spring in said succeeding spindle, and a shifting-wheel at the slotted end of the spindles connected with the plunger-stem therein, substantially as and for the purpose set forth.

In testimony whereof I affix my signature in presence of two witnesses.

ERNST FRANKE.

Witnesses:
HARRY BELMONT,
JOSEF ZEHETNER.