(No Model.) 4 Sheets—Sheet 1.

W. F. DIAL, A. STEWARD & G. H. DIMOND.

SEWING MACHINE.

No. 405,205. Patented June 11, 1889.

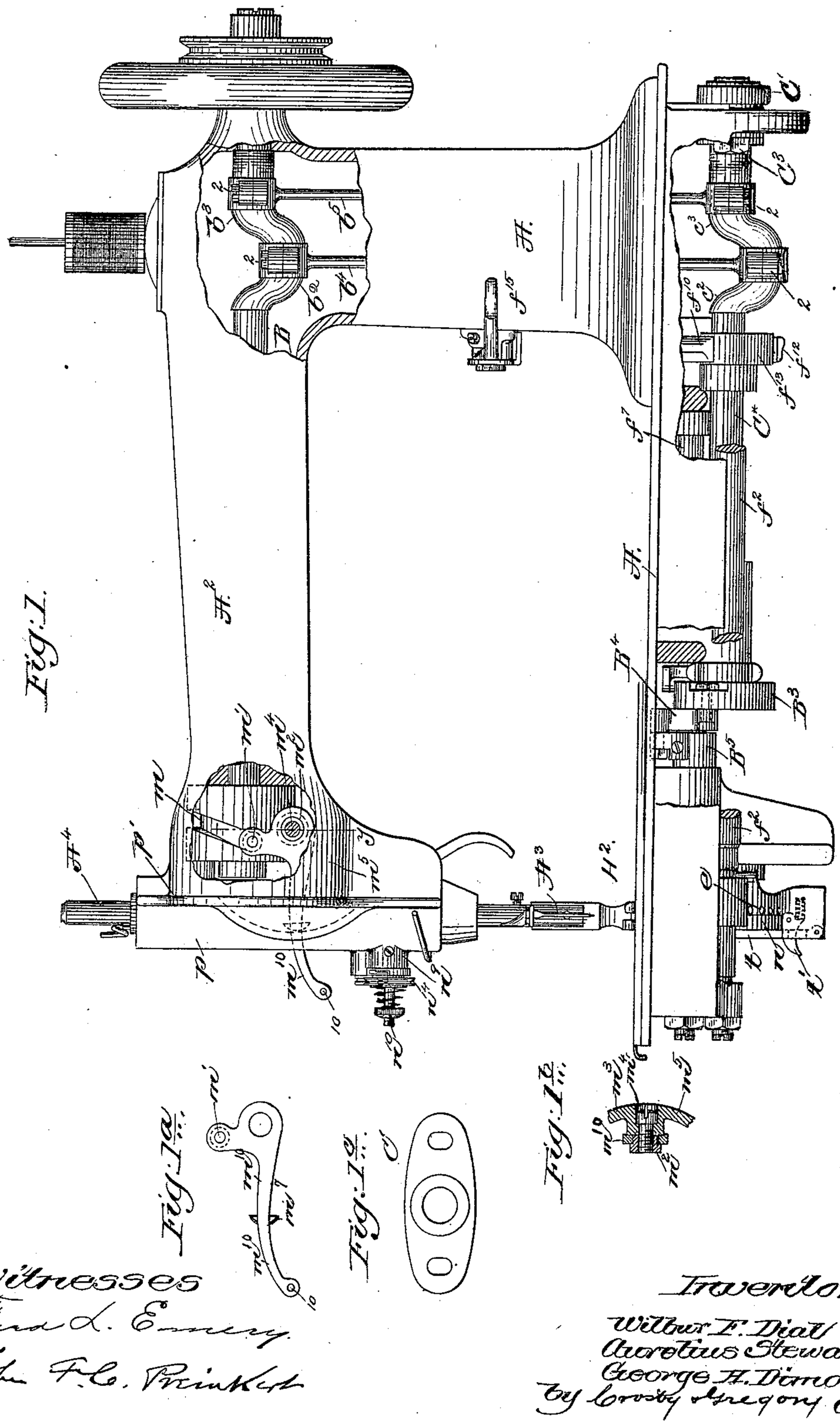


Fig. 1.

Witnesses
Fred L. Emery.
John F. C. Brinkerhoff

Inventors.
Wilbur F. Dial
Aurelius Steward
George H. Dimond.
by Crosby & Gregory Attys.

(No Model.) 4 Sheets—Sheet 2.

W. F. DIAL, A. STEWARD & G. H. DIMOND.

SEWING MACHINE.

No. 405,205. Patented June 11, 1889.

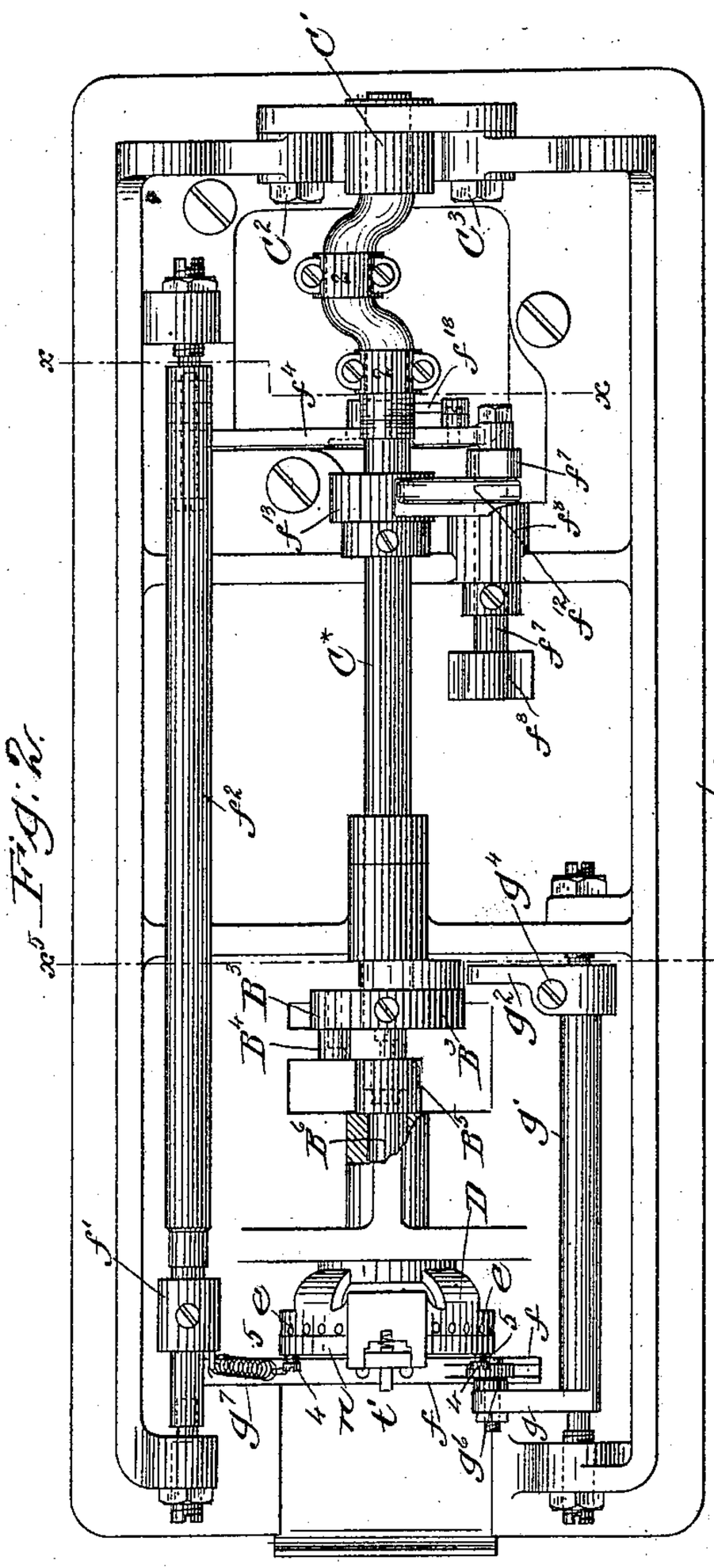


Fig. 2.

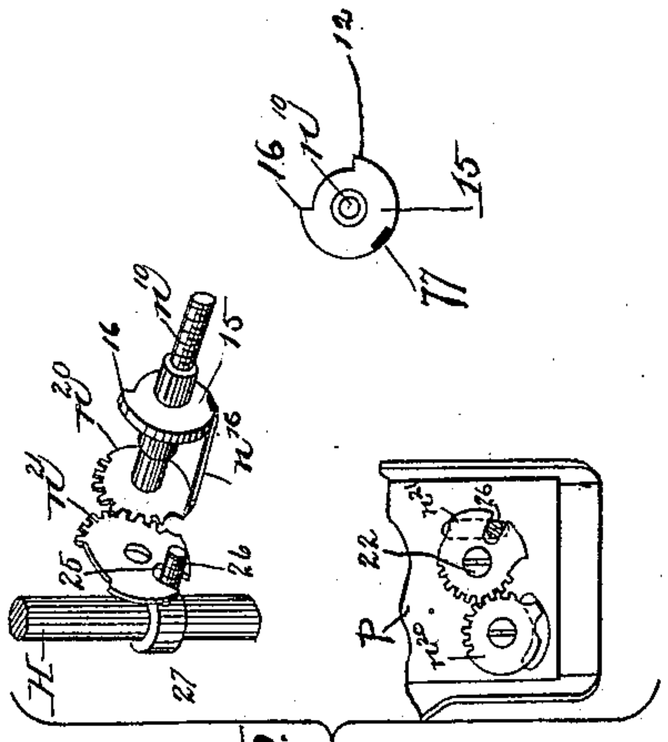


Fig. 5.

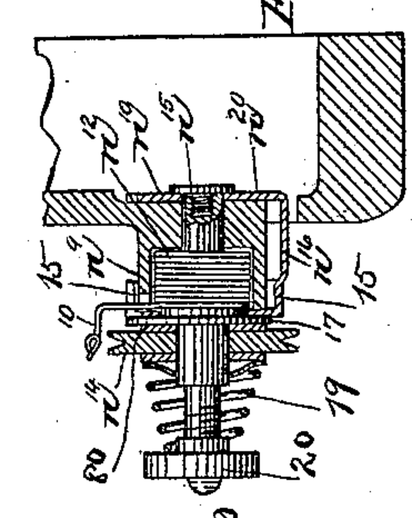


Fig. 4.

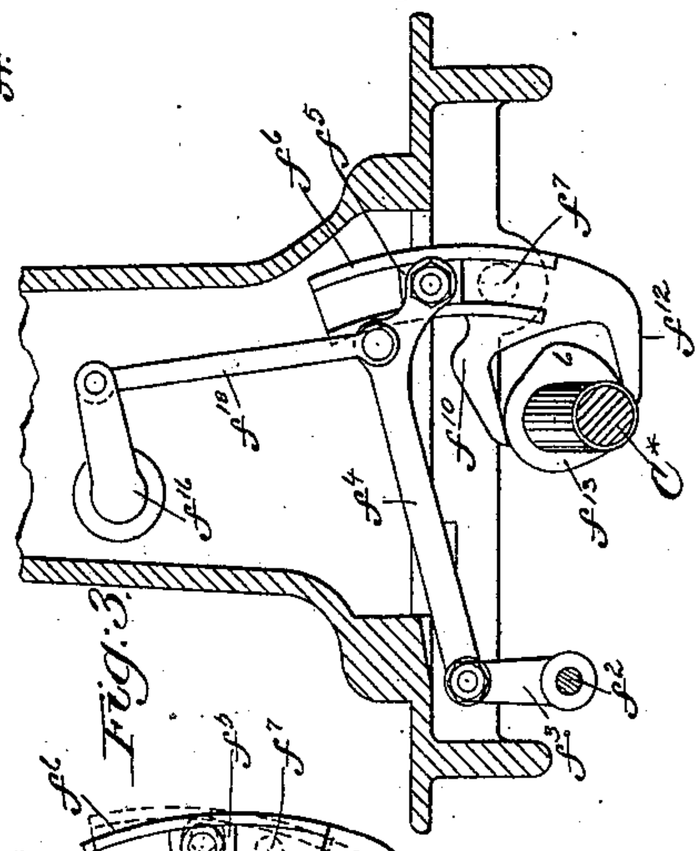


Fig. 3.

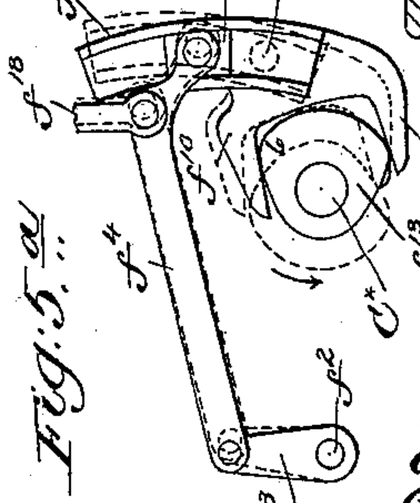


Fig. 6.

Witnesses.
Fred L. Emery.
John F. C. Printzlau

Inventors.
Wilbur F. Dial
Aurelius Steward
George H. Dimond
by Crosby & Gregory Attys

(No Model.) 4 Sheets—Sheet 3.

W. F. DIAL, A. STEWARD & G. H. DIMOND.

SEWING MACHINE.

No. 405,205. Patented June 11, 1889.

Fig. 12.

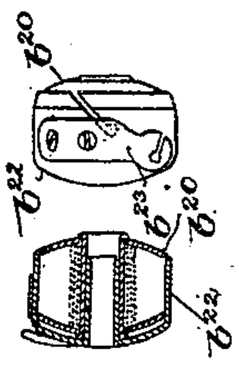


Fig. 13.

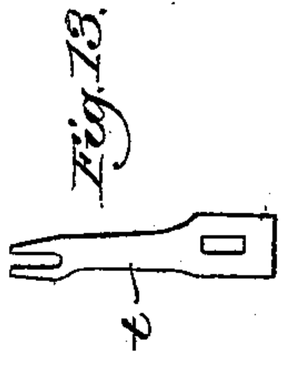


Fig. 9.

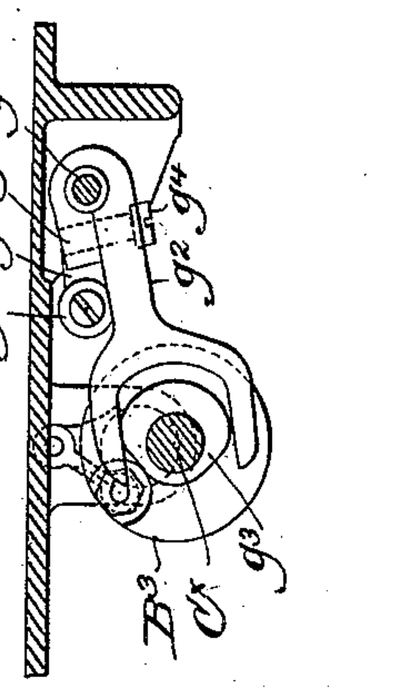


Fig. 6a.

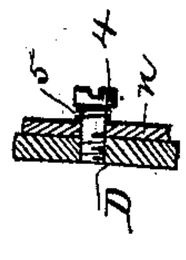


Fig. 1.

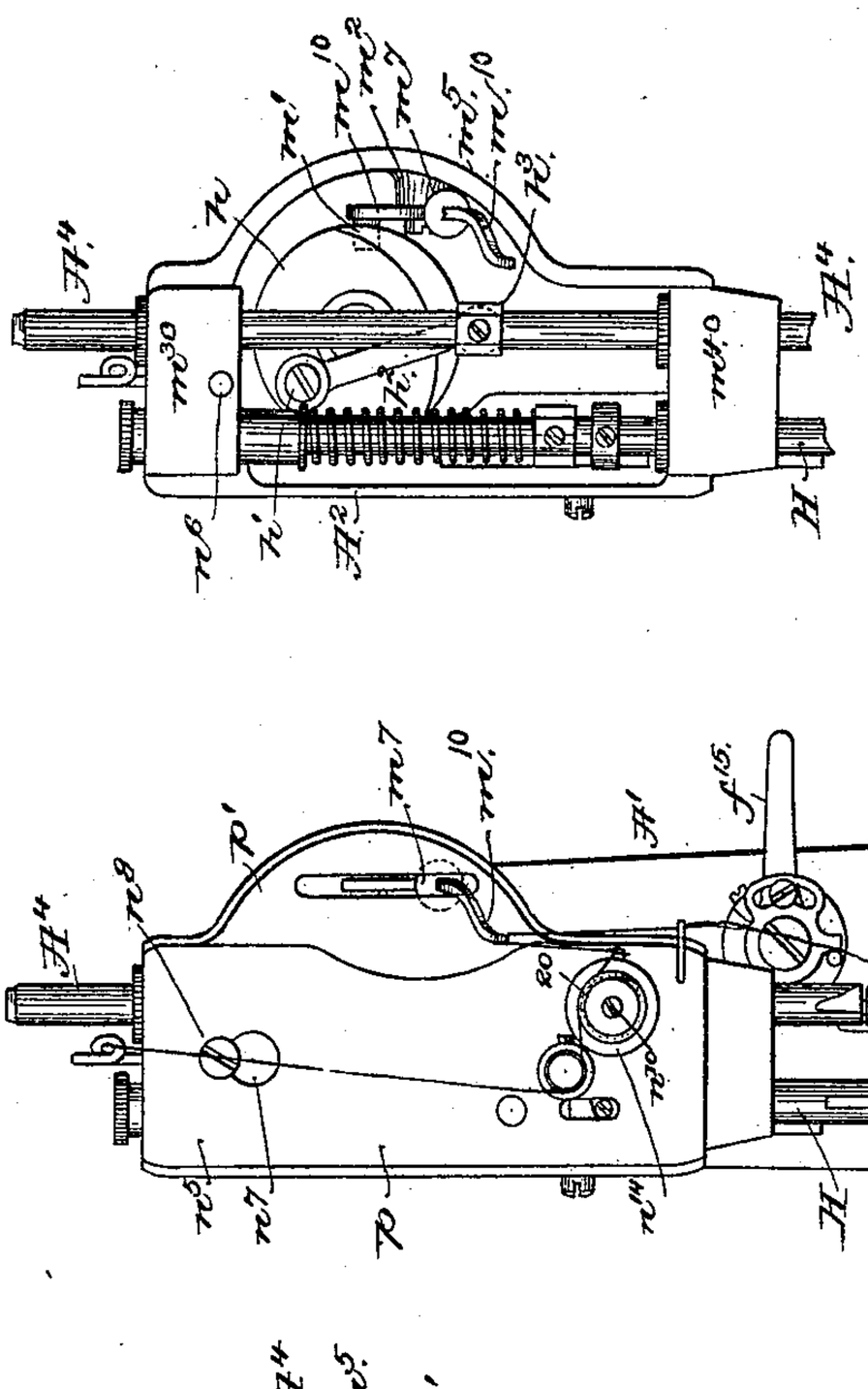


Fig. 6.

Fig. 8.

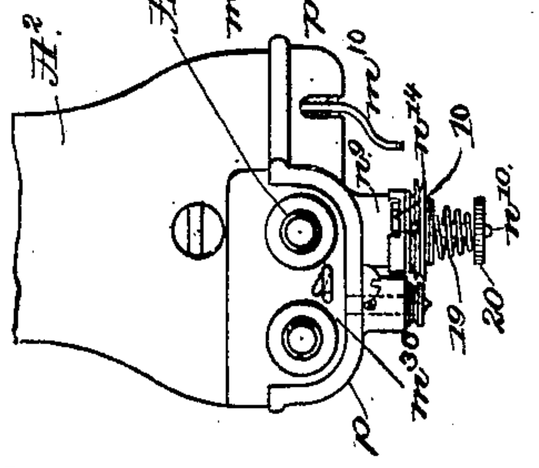


Fig. 10.

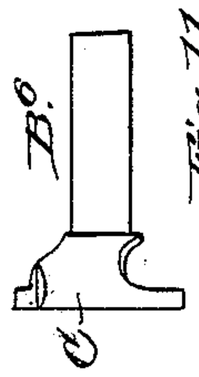
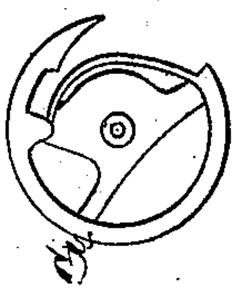


Fig. 11.



Witnesses:
Fred L. Emery.
John F. C. Prindle

Inventors,
Wilbur F. Dial
Aurelius Steward
George H. Dimond,
by Crosby & Gregory Attys.

(No Model.) 4 Sheets—Sheet 4.

W. F. DIAL, A. STEWARD & G. H. DIMOND.

SEWING MACHINE.

No. 405,205. Patented June 11, 1889.

Fig: 14.

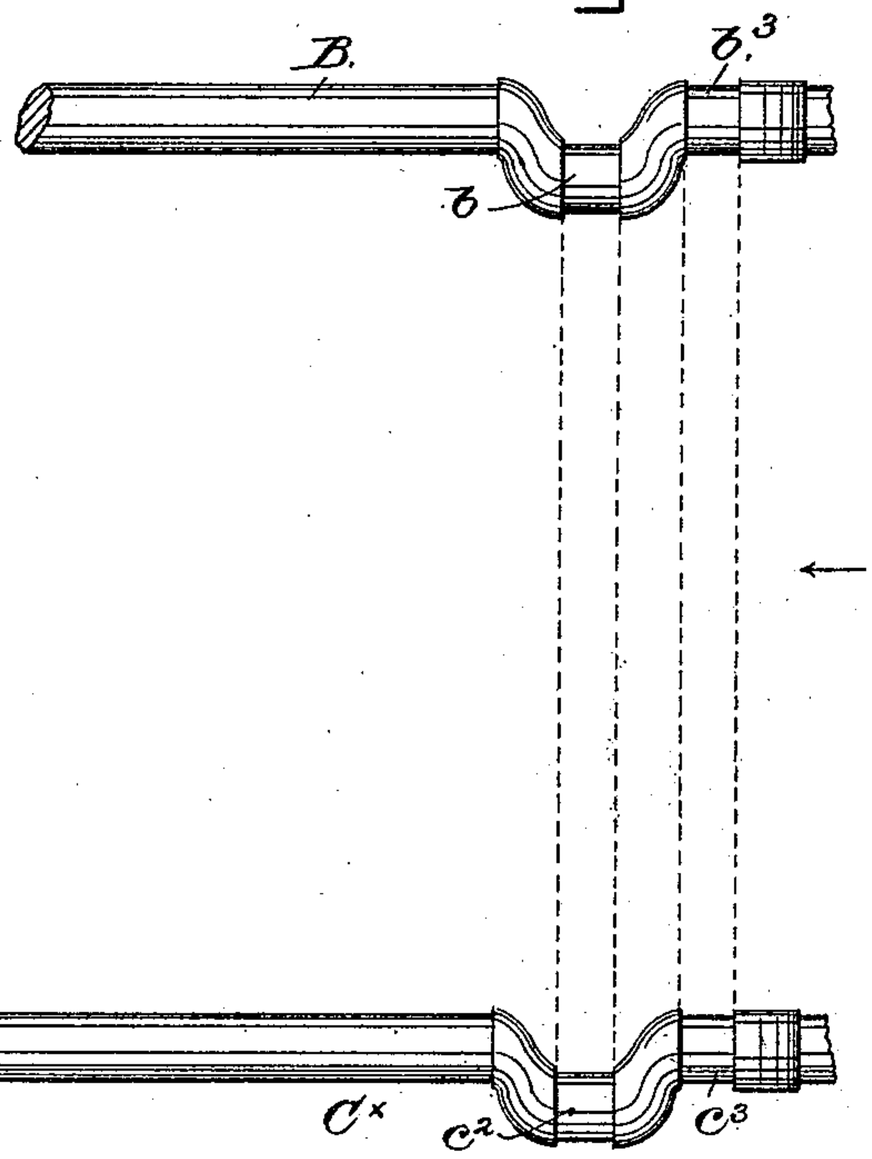


Fig: 15.

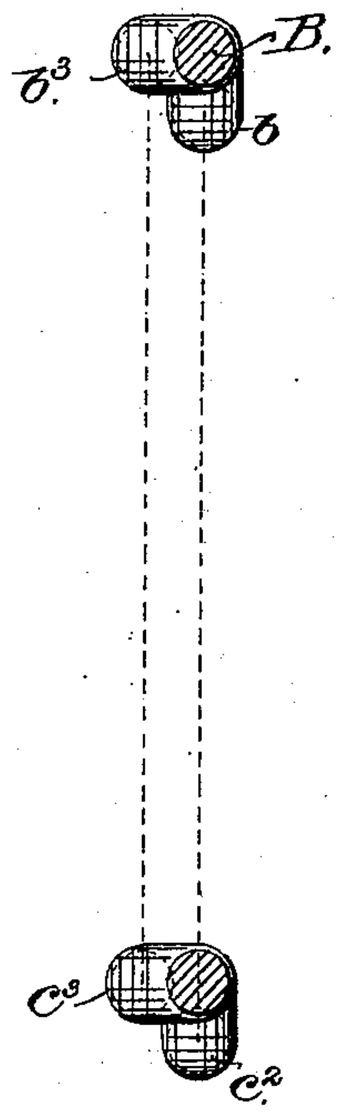
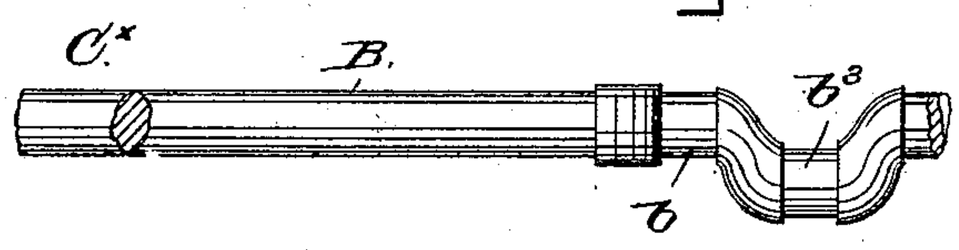


Fig: 16.



Witnesses.
Fred L. Emery.
John. F. C. Prinkerh.

Inventors.
Wilbur F. Dial.
Aurelius Steward.
George H. Dimond.
By Crosby & Gregory Attys.

UNITED STATES PATENT OFFICE.

WILBUR F. DIAL, AURELIUS STEWARD, AND GEORGE H. DIMOND, OF BRIDGEPORT, CONNECTICUT, ASSIGNORS TO THE WHEELER & WILSON MANUFACTURING COMPANY, OF SAME PLACE.

SEWING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 405,205, dated June 11, 1889.

Application filed March 9, 1887. Serial No. 230,170. (No model.)

To all whom it may concern:

Be it known that we, WILBUR F. DIAL, AURELIUS STEWARD, and GEORGE H. DIMOND, of Bridgeport, county of Fairfield, State of Connecticut, have invented an Improvement in Sewing-Machines, of which the following description, in connection with the accompanying drawings, is a specification, like letters on the drawings representing like parts.

This invention has for its object to improve that class of machine represented in United States Patent No. 328,165, in order that greater speed may be attained with less shock, and consequently less wear.

The machine herein shown as embodying our invention has in the overhanging arm a rotary needle-bar-actuating shaft provided with integral quartering-cranks, the said quartering-cranks being joined by connecting-rods to two other quartering-cranks forming integral parts of a shaft parallel to the needle-bar-actuating shaft, but located below the bed-plate, the forward end of the shaft below the bed-plate, through a variable-motion mechanism of usual construction, rotating an auxiliary short shaft parallel thereto, said short shaft having a cradle or driver to rotate the hook or loop-taker employed to engage, distend, and pass the loop of needle-thread about a bobbin carrying the under thread; and to compensate for wear between the wrists of the cranks and the connecting-rods joining them we have mounted one end of one of the crank-shafts in a vertically-adjustable bearing, the shaft so mounted being herein shown as the under shaft, it being made adjustable toward the needle-bar-operating shaft to compensate for the shortening of the connecting-rods due to refacing the caps, which embrace one-half of each wrist. The hook or loop-taker employed is moved at a differential or variable speed during each rotation to thus enable the rotating hook or loop-taker actuated by the crank-shaft below the bed-plate to be rotated at greatly-increased speed from the time of taking the loop of needle-thread until it is cast off, this being done while the take-up is descending, the latter rising immediately as the loop is being cast off and completing its ascent and the stitch before the needle in the next descent reaches the goods.

In United States Patent No. 328,165, referred to, and in the Patent No. 331,174 the feed-driving shaft was operated by a rock-shaft having a slotted segmental arm, the said rock-shaft being moved by means of a face-cam which receives in it a roller-stud mounted on an arm of the said rock-shaft; but such construction has been found objectionable in a very high speed machine because of rapid wear and noise.

In a very high speed machine the rock-shaft carrying the segmental arm referred to, when effecting the feeding movement of the feed-bar, must be moved positively and during a certain definite portion of each rotation of the needle-bar-actuating shaft; but to do this unerringly within the specified time and with that class of cam known as "triangular," it being preferred because of its lightness and durability, we have been obliged to so locate the centers of the said cam and the said rock-shaft that the actuating-point of the said cam when effecting the feeding movement of the feed-bar strikes one toe of a forked arm of the said rock-shaft at a point nearer the center of the said shaft than when the actuating-point of the said cam strikes the said forked arm to effect the backward movement of the feeding-bar.

The take-up lever has imparted to it a movement sufficient for the maximum thickness of material to be stitched, and hence it will be obvious that when the material is of less than maximum thickness there will be an excess of needle-thread to be taken care of; otherwise the needle-thread will fall and be caught under the point of the needle. To obviate this difficulty the needle-thread, at a point between the eye of the needle and the usual tension device, is carried through a yielding or springing arm, the normal position of which is made variable through the presser-foot and presser-bar and intermediate devices, so that any excess of slack thread is compensated for, as will be described.

In this our invention the take-up lever will be operated positively and uniformly as to distance notwithstanding variations in the thickness of the material; but the slack-controlling spring-arm will, as stated, be moved variably, according to the thickness of the material. Operating the take-up positively in both directions enables the machine to be run at a much greater rate of speed, and without liability of overthrow, than is possible in a machine where the take-up is operated in but one direction positively, as in United States Patent No. 124,360. We have combined with the presser-bar mechanism for automatically controlling the slack thread, which, as the presser-bar is lifted by variation in thickness of material under the presser-foot, gives up the requisite amount of thread.

The particular features in which our invention consists will be hereinafter fully described, and specified in the claims at the end of this specification.

Figure 1 in side elevation represents a sufficient portion of a sewing-machine embodying our invention to enable the same to be understood, the frame-work being broken out to better show some of the working parts. Fig. 1ª shows the take-up lever detached. Fig. 1ᵇ is a partial section to the right of the dotted line *y*, Fig. 1. Fig. 1ᶜ shows detached the bearing for the shaft C×. Fig. 2 is an under side view of Fig. 1. Fig. 3 is a partial section of Fig. 2 at the left of the dotted line *x x*. Fig. 4 is a sectional detail of the tension device and devices co-operating with it to automatically control the slack of the needle-thread; Fig. 5, details of the devices intermediate the presser-bar and the tension device; Fig. 5ª, a diagram representing portions of the devices shown in Fig. 3, but in different positions. Fig. 6 is a front or left-hand end elevation of Fig. 1, the cap for retaining the loop-taker guide being broken out to show the plugs, all but a small portion of the loop-taker being omitted, as well as the usual bobbin and bobbin-holder and most of the saddle C. Fig. 6ª is an enlarged detail of part of the loop-taker guide, its cap, and one of the screws 4 and spring 5; Fig. 7, a detail showing part of Fig. 6 with the face-plate removed; Fig. 8, a top view of the front end of the machine to show the face-plate and parts co-operating with it. Fig. 9 is a section of Fig. 2 in the line x^5, looking to the left, but with the machine right side up; Fig. 10, a detail of the short shaft B^6 and saddle to move the loop-taker. Fig. 11 shows the loop-taker alone. Fig. 12 shows the bobbin for the loop-taker, the bobbin-case being broken out. Fig. 13 shows separately the arm or detainer for the bobbin-case. Fig. 14 is a diagram showing the upper and lower crank-shafts removed from the machine, the dotted lines showing the connecting-rods between them. Fig. 15 is a view of the said shafts, looking at them in the direction of the arrow 14 or from the rear end of the machine; and Fig. 16 is a top or plan view of Fig. 14.

The frame-work, including the bed-plate A, standard A′, and overhanging arm A^2 is and may be as usual. The overhanging arm has suitable bearings for the rotating needle-bar-actuating shaft B, having two cranks b^2 b^3 set quartering and preferably forged as an integral part of the shaft. The wrists of the two cranks b^2 b^3 are connected, respectively, by connecting-rods b^4 b^5 to the wrists of two similar quartering-cranks c^2 c^3, preferably forged as integral parts of the shaft C×, located below the bed A and parallel to the shaft B, by which shaft the shaft C× is rotated continuously in one direction. As the parts of the connecting-rods which embrace the wrists of the cranks referred to become worn in the use of the machine, the caps 2, co-operating with the said rods and wrists, will be removed and be "faced off," thus shortening somewhat the connecting-rods; so, to compensate for such shortening, we have made the bearing C′ for the shaft C× adjustable, the said shaft being attached to a portion of the bed by two screws, as C^2 C^3. (See Fig. 2.) The shaft C× at its front end is provided with a disk or wheel B^3, having a crank-pin embraced by a link B^4, the opposite end of which embraces a pin of a crank B^5 on a short horizontal shaft B^6, having attached to it a saddle C, (see Fig. 10,) the said disk, link, crank, shaft, and saddle being the same as in United States Patent No. 328,165, wherein the said devices are designated by like letters, the said saddle in operation rotating a loop-taker G, substantially such as represented in the said patent by like letter, but not herein fully shown, except in Fig. 11, to save complication in the drawings, the said loop-taker being arranged to be rotated in a loop-taker guide D′, the loop-taker entering the loop of thread thrown out from the eye of the eye-pointed needle A^3, attached to a needle-bar A^4, all as in the said Patent No. 328,165. This loop-taker guide is provided with a circular recess, the surrounding flange of which (see Figs. 1, 2, and 6) has numerous small radial holes which receive in them anti-friction plugs *e*, preferably of rawhide, the said plugs being inserted through the said holes, so as to present their ends for contact with the periphery of the loop-taker, the said plugs being fitted snugly in the holes, so as to prevent them from being exposed to atmospheric changes except at their extremities, the employment of the rawhide as small plugs enabling any part of the wearing-surface formed by them to be adjusted or renewed readily.

The loop-taker is retained in the open space of the loop-taker guide by means of a rigid cap *n*, which is secured to the said guide by screws 4 4, the said screws being surrounded between the under sides of their heads and the outer face of the rigid cap by spiral springs 5, (see Fig. 2,) which enable the cap

to be moved outwardly bodily away from the front of the loop-taker guide should the thread, for any reason, be caught within the said guide.

It will be noticed that the two screws 4, holding the rigid cap *n*, are located substantially in a horizontal line drawn through the center of rotation of the loop-taker, thereby leaving the said cap *n*, pressed against the loop-taker guide by a force due to the springs 5, free to yield or move bodily away from the loop-taker guide at any part thereof.

We will now describe the mechanism for operating the feed-bar *f*.

The feed-bar *f* is jointed at one end to an arm *f'* (see dotted lines, Fig. 6) of a feed-driving rock-shaft f^2, a second arm f^3 of the said rock-shaft having jointed to it a radius-bar f^4, having a stud, upon which is mounted loosely a block f^5, which enters a slot or channel in a segmental portion f^6 of a rock-shaft f^7, mounted to turn in bearings f^8 of the frame, the said rock-shaft f^7 having a forked arm provided with two toes f^{10} f^{12}, which are extended in the same direction to embrace a cam f^{13} on the shaft $C^{\times}$, the said cam moving the said rock-shaft f^7 and its segmental portion positively in both directions, rocking the shaft f^2 more or less, according to the position of the block f^5 in the groove of the segmental portion f^6, the said block being made adjustable therein toward and from the center of the shaft f^7 by means of a stitch-regulating lever f^{15}, (see Fig. 6,) attached to the outer end of a short rock-shaft f^{16}, (see Fig. 3,) having at its inner end an arm f^{17}, which, by a link, f^{18}, is connected to the radius-bar f^4, the farther the block f^5 from the center of the shaft f^7 the longer the stitch, and vice versa.

Referring to Figs. 3 and 5^a, we have designated by the numeral 6 the actuating point of the cam f^{13}; and in Fig. 5^a, where the cam is shown by full lines as just commencing to effect the forward movement of the feed-bar and by dotted lines as just commencing to effect the backward movement thereof, it will be seen that, owing to the portion f^{10}, acted upon by the cam f^{13}, being nearer the center of the rock-shaft f^7 than is the portion f^{12}, the actuating-point 6 of the said cam f^{13} will strike the portion f^{10} of the forked arm of the rock-shaft f^7, as the forward movement of the feed is to take place closer to the center of the said shaft f^7 than when the said point 6 meets the forked arm f^{12} (see dotted lines) to effect the backward movement of the feed-bar.

It is well known that a triangular cam operating on a bifurcated lever and in the direction herein shown will cause the movement of the lever to be quicker when the cam acts upon the upper arm of the fork than when it acts upon the lower arm, this difference of movement being due to the relative positions of the two arms with regard to the center of the rock-shaft f^7. As a result the said rock-shaft is turned about its center at a greater speed when the material is being fed forward in stitching, the portion f^{10} then being acted upon by the cam f^{13}.

The upward movement of the feed-bar is effected by an arm *g* of a feed-lifting rock-shaft *g'*, having an arm g^2, forked at its inner end (see detail, Fig. 9) to embrace a triangular cam g^3, forming part of the disk D^3. The hub of the arm g^2 is split, as best shown in Fig. 9, and the two parts of the hub so formed are entered by a clamp-screw g^4, which passes freely through the main body of the hub and screws into the part g^5. This clamp-screw enables the arm to be adjusted on the shaft *g'* to vary the point of ascent and descent of the teeth of the feed-bar. The arm *g* at its inner end carries a roll g^6, which (see Figs. 2 and 6) enters a groove cut into the feed-bar *f* at its under side, the said roll g^6 serving as a guide for that end of the feed-bar farthest from the operator and preventing lateral movement thereof. A spring g^7 holds the free end of the feed-bar down upon the roller *g*.

The needle-bar-actuating shaft B at its front end (see Fig. 7) has a disk *h*, provided with a crank-pin *h'*, upon which is placed one end of a link h^2, the opposite end of the link embracing a stud on a block h^3, attached to the needle-bar A^4 in usual manner.

The disk *h* at its periphery (see Fig. 1) is provided with a cam-groove *m*, which receives a roller or other stud *m'*, attached to the take-up lever m^{10}, which is of bell-crank shape. This take-up lever is mounted upon a fulcrum-sleeve m^2, having a head and a hollow threaded shank, the latter entering a hole in the take-up lever from its inner side, (see Figs. 1^b and 7,) the end of the said shank abutting against the flat inner end of a hub m^3, located at the inner side of the overhanging arm, where it is held by means of a set-screw m^4, the head of which is exposed at the outer side of the overhanging arm, rotation of the said screw enabling the end of the shank of the fulcrum-sleeve to be drawn firmly against the inner end of the hub m^3, and the shank of the fulcrum-sleeve m^2 being longer than the take-up lever is thick, the latter is left free to be moved on the said sleeve without binding, yet all lateral play of the take-up lever is overcome.

By referring to Figs. 1, 6, and 7 it will be noticed that the overhanging arm at its front end nearest the operator is bulged outwardly at the front side to form a support for the set-screw m^4 and the fulcrum-sleeve of the take-up lever, so that the periphery of the disk *h* is readily made available to actuate the take-up lever, the said projecting portion also concealing from the view of the operator the greater portion of the take-up lever, and also lessening the liability of oil being thrown by the disk in its rotation.

In Fig. 1 the bulged portion of the arm has been broken away to show the take-up within it, and in the said figure the head of the set-screw m^4 is cut off.

The take-up arm just within the face-plate p is provided with a small disk or projection, as m^7, which at its rear side is concaved or made cup-shaped to thus prevent the outward movement of oil along the take-up arm to soil or come in contact with thread in the eye 10 of the take-up lever.

The face-plate p has a slotted projection p', which, besides covering the end of the enlarged portion m^5 of the overhanging arm, receives through it the take-up lever. The face-plate p, of concavo-convex form, (see Fig. 8,) embraces the shouldered portions m^{30} m^{40} of the bearings for the presser and needle bars to thus prevent lateral movement of the face-plate. We have provided the face-plate with an elongated slot, as n^7, the longer end of which is of greater diameter than the head of the set-screw n^8, screwed into the hole n^6, so that the said face-plate may be readily passed over the said screw in position and then be pushed downward until the smaller or slotted end of the said opening n^7 embraces the shank of the screw, and when brought down to the proper position the said set-screw is tightened to confine the face-plate in place. In this way to remove the face-plate requires the loosening of but a single screw. The face-plate has a hub n^9, through which is passed a stud n^{10}. (See Fig. 4.) This stud within the hub n^9 is surrounded by a spiral spring n^{12}, one end of which is fixed with relation to the stud, while the opposite or free end of the spring is extended, as at 10, outwardly through a notch at the end of the hub n^9, the extreme outer end of the said spring being thereafter bent to form an eye to receive and guide the needle-thread between the usual tension device or pulley n^{14} and the take-up lever m^{10}, the normal position of the free end of the thread-controlling spring being against a shoulder, as 12, of a stop 15 for the thread-controlling spring, the said stop being under the control of and made movable through the movement of an arm n^{16} of a segmental gear n^{20}, to be described, the said stop being herein shown as a piece of metal made movable about the end of the hub n^9. The stop is of such shape as to afford ample free space above the shoulder 12, in which may move the said controller-spring when drawn upon by the thread acted upon by the take-up, this space being herein shown as between the shoulders 12 and 16; but in practice the shoulder 16 has no function as to the control of the thread. Next, outside the stop 15 the stud n^{10} has fast to it a collar 17, which, co-operating with the end of the hub n^9, serves as a guide for said stop. The outer side of the collar 17 receives against it the usual felt washer 80, and next to it the tension device or pulley n^{14}, acted upon in usual manner by the spring 19, controlled by a nut 20 on the screw-threaded outer end of the stud n^{10}. The stud n^{10} at its inner end is tapped for the reception of a binding-screw n^{15}, (see Fig. 4,) which by its head retains on the said stud the gear n^{20}, (herein shown as segmental in shape,) it having the arm n^{16}, the free end of which is extended outwardly through a slot in the face-plate and is made to operate the stop having the shoulder 12, the said arm being shown as entering a notch 77 of the said stop, as best shown by the detail, Fig. 5. This gear n^{22} is engaged by a gear n^{21}, mounted on a screw 22, secured to the inner side of the face-plate b. The gear n^{21} is notched, as at 25, to receive the pin 26, which serves to attach the collar 27 to the presser-bar H, so that as the presser-bar is lifted by material under the presser-foot H^2 the gears n^{21} and n^{20} are partially rotated to turn the stop 15 about the stud n^{10} in a direction to enable it to give up slack thread to the needle or to furnish the necessary amount of thread for the stitch. In this way the thickness of the material is made effective through the presser-foot and its bar to automatically vary the amount of slack thread given to the needle, the thicker the material the greater the amount of slack thread given up for the formation of the stitch, and vice versa.

We do not herein claim, broadly, two rotating shafts, one above and the other below the bed-plate, when the same are connected together by toothed gears or when connected by links.

We have herein shown the shafts $C^\times$ and B^6 connected by a variable-motion device such as common to United States Patent No. 328,165; but instead thereof we desire it to be understood that we might employ any other equivalent well-known devices capable of operating in like manner.

In Fig. 11 we have shown the loop-taker separately, and in Fig. 12 the bobbin b^{20} and its case b^{22}, the said case in practice being restrained from rotation within the loop-taker by a holding-arm t, held in place by a suitable latch, as t', as in the said patent. The tension device for the under thread is marked b^{23}.

We claim—

1. The needle-bar to carry a needle, the rotating shaft B, provided with quartering-cranks, the rotating shaft $C^\times$, located below the bed-plate parallel to the shaft B, an adjustable bearing to enable the centers of the said shafts to be varied with relation to each other, and two connecting-rods embracing the wrists of the said cranks, whereby the shaft B imparts rotation to the shaft $C^\times$, combined with a rotating loop-taker, a short shaft B^6, and means, substantially as described, to rotate the shaft B^6 from the shaft $C^\times$, but at a different speed, as and for the purposes set forth.

2. The feed-bar, the rock-shaft f^2, to move it forward and backward positively, and the rotating shaft $C^\times$, and its attached cam f^{13}, combined with the rock-shaft f^7, having the segmental arm f^6 and the forked arm provided with toes to embrace the said cam, and with the arm f^3 and radius-bar f^4 and stud to engage the said segmental arm, the center of

rotation of the said rock-shaft and the shaft C× being in different planes, whereby the said cam is enabled to move the rock-shaft f^7 at a speed faster while the feed-bar is moving the material forward than when the said feed-bar is moving backward under the said material, substantially as described.

3. The feed-bar, the rock-shaft g', having an arm to support the free end of the feed-bar, and the forked arm g^2, having a slotted hub, and clamping-screw g^4, to clamp the said arm adjustably to the said rock-shaft, combined with the shaft C× and cam thereon to raise the said feed-bar, the adjustment of the arm g^2 on the rock-shaft g' enabling the feed-points of the feed-bar to be raised more or less above the throat-plate, substantially as described.

4. The bed-plate, the face-plate, the stud n^{10}, the presser-foot, the presser-bar, the slack-thread-controlling spring, and the pin or projection 26, made movable vertically with the presser-bar, combined with the notch-gear n^{21}, the segmental gear n^{20} engaged by it, the arm n^{16}, and stop for the controlling-spring, the position of the said stop being changed by the position of the presser-foot resting upon the stock under it and the take-up, substantially as described.

In testimony whereof we have signed our names to this specification in the presence of two subscribing witnesses.

WILBUR F. DIAL.
AURELIUS STEWARD.
GEORGE H. DIMOND.

Witnesses:
WILLIAM A. NEELY,
A. R. LACEY.