No. 695,915. Patented Mar. 25, 1902.

W. F. DIAL & G. H. DIMOND.

TAKE-UP FOR SEWING MACHINES.

(Application filed Apr. 27, 1900.)

(No Model.) 3 Sheets—Sheet 1.

Fig. 1.

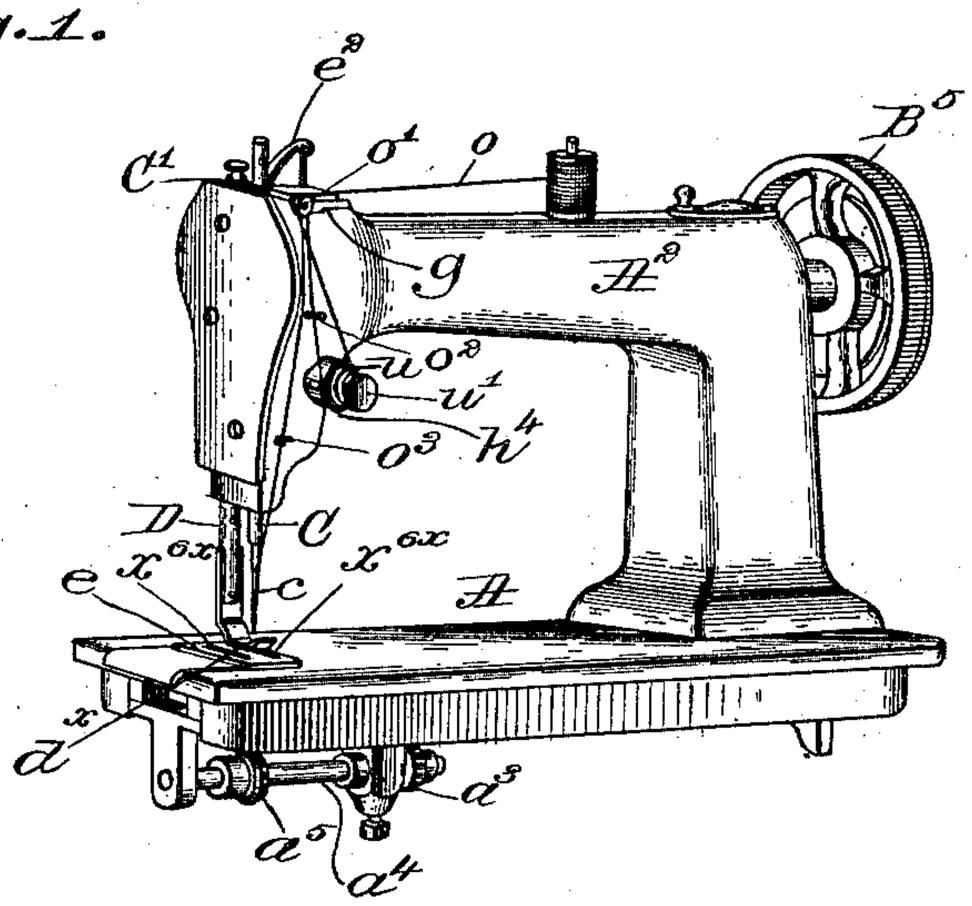


Fig. 2.

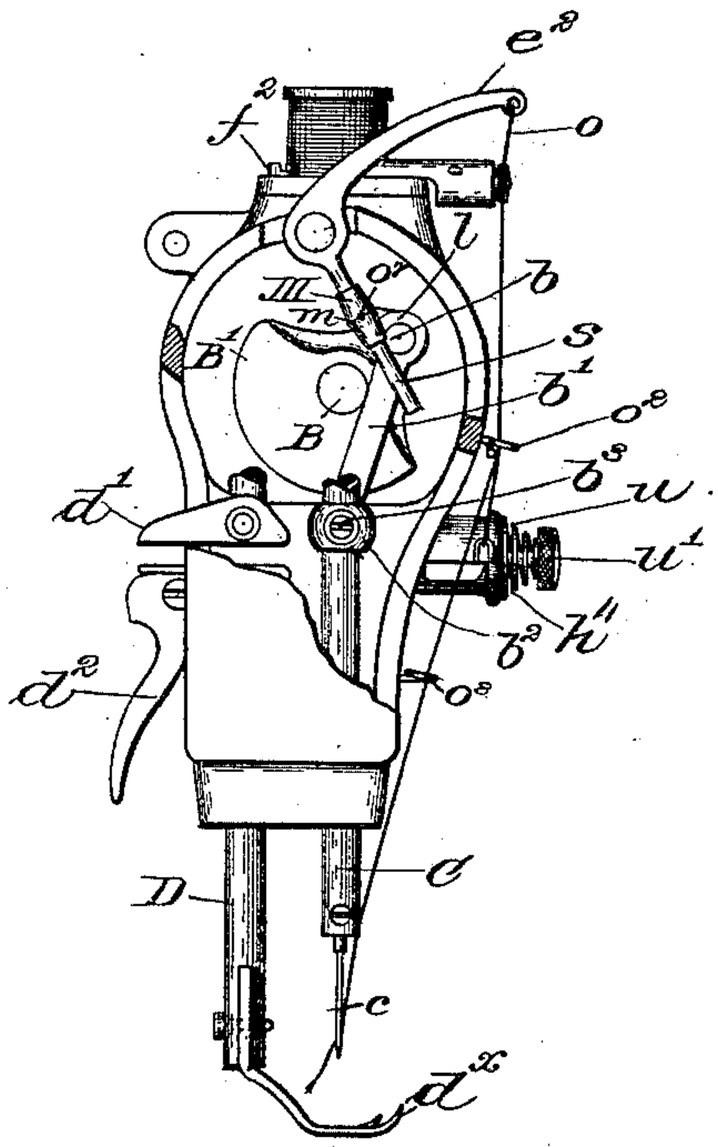


Fig 3

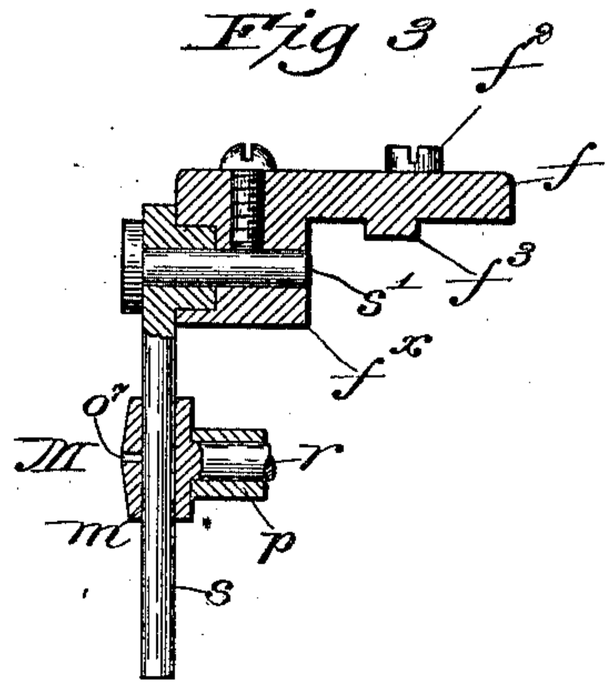
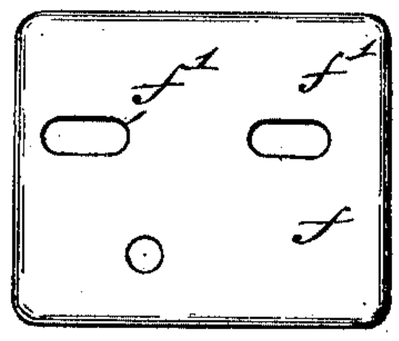


Fig. 4.



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(No Model.) 3 Sheets—Sheet 2.

Fig. 5.

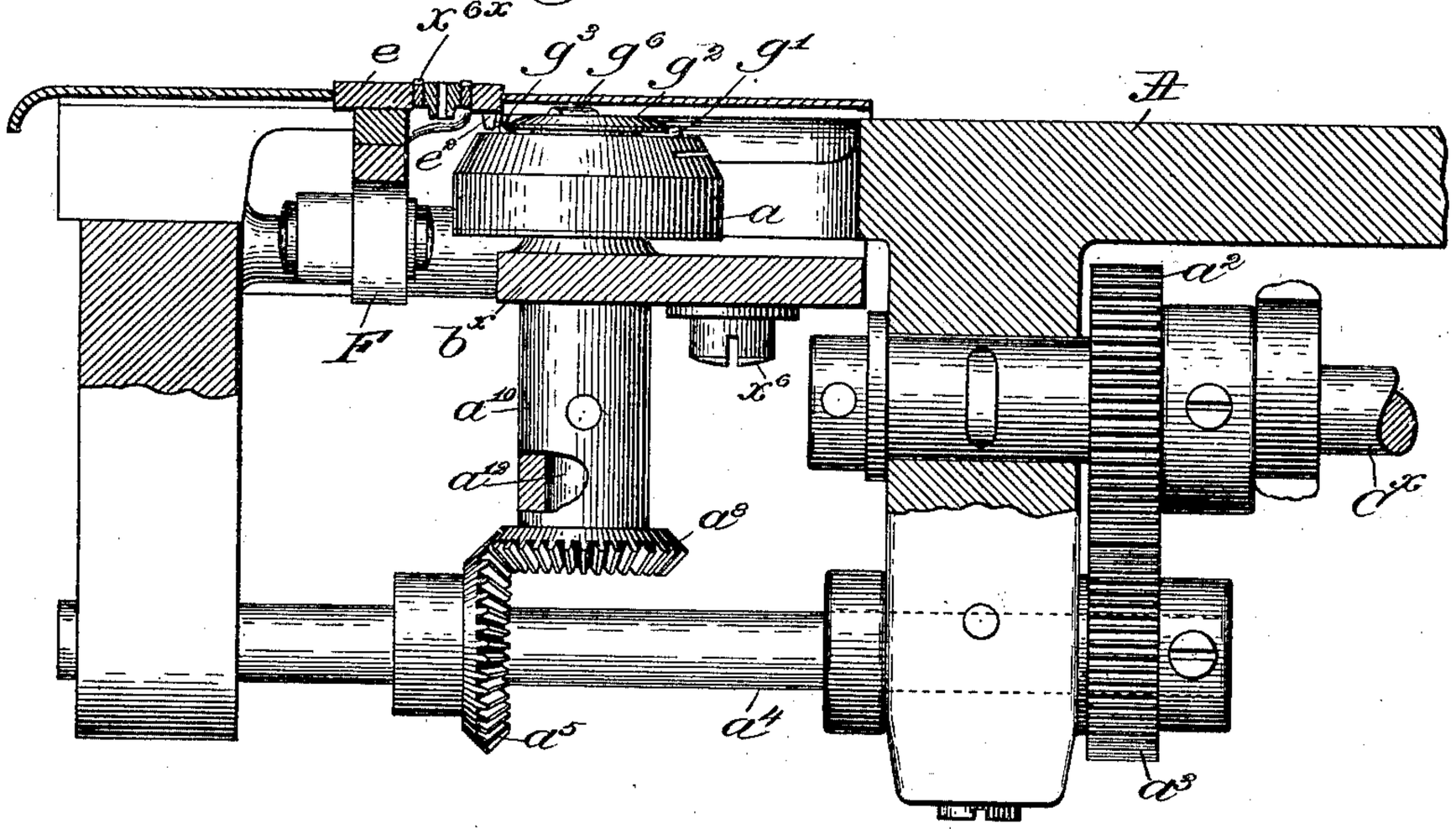


Fig. 6.

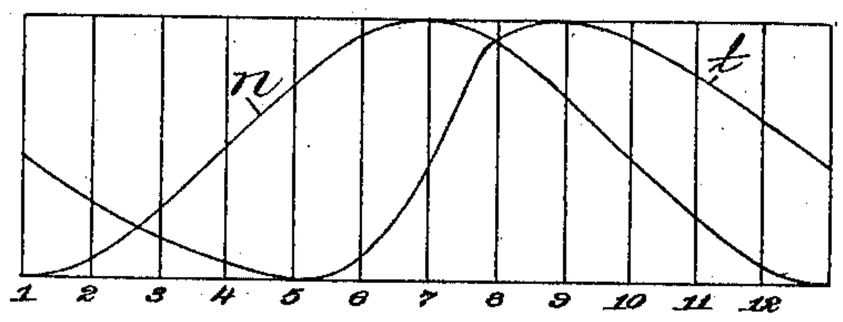
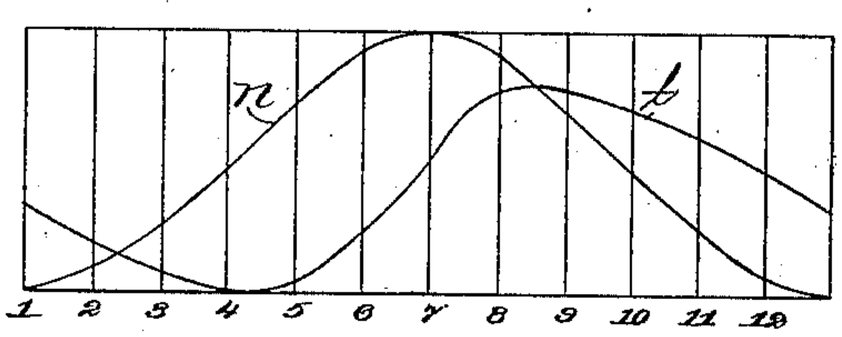


Fig. 7.



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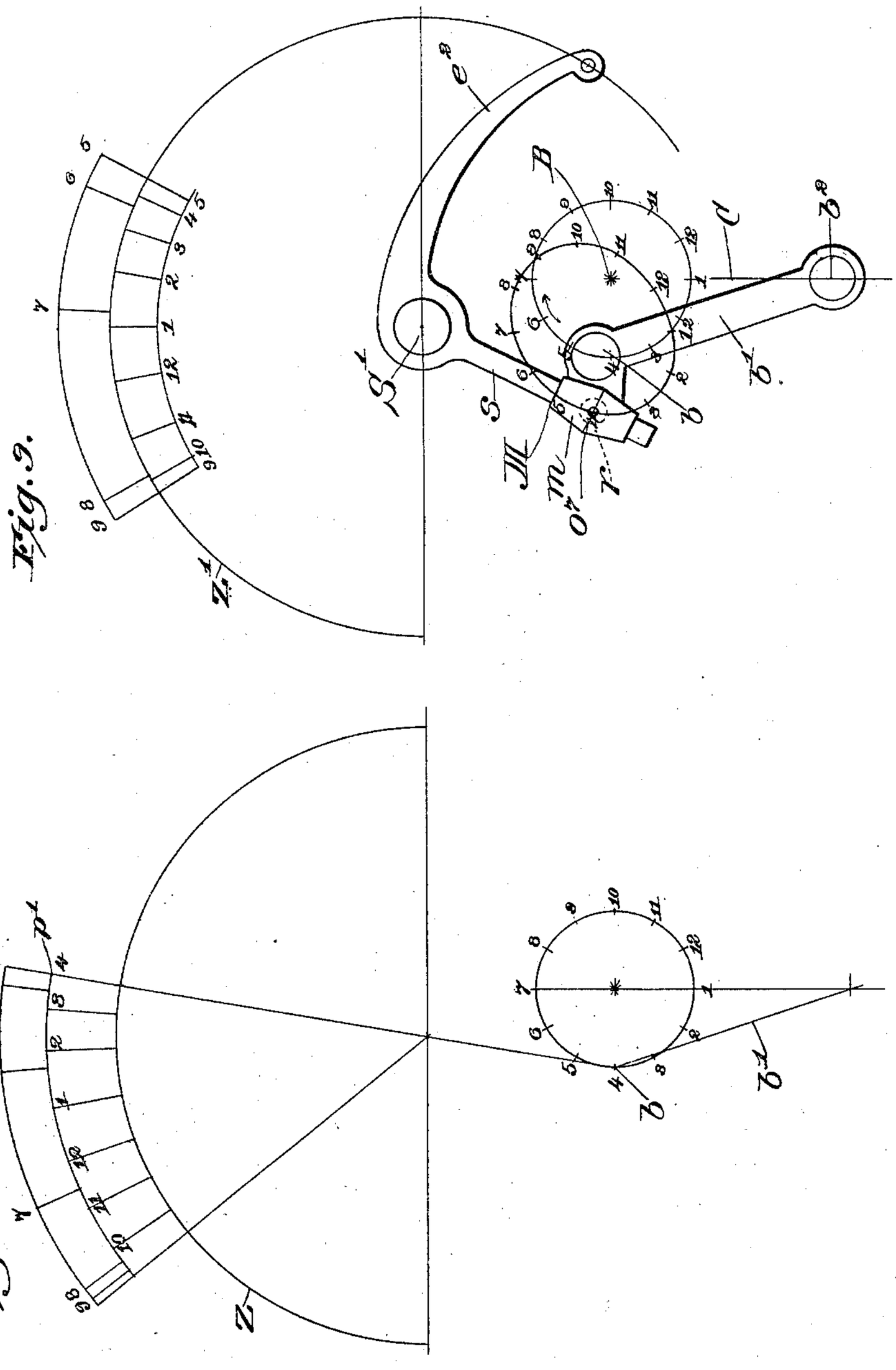

UNITED STATES PATENT OFFICE.

WILBUR F. DIAL AND GEORGE H. DIMOND, OF BRIDGEPORT, CONNECTICUT, ASSIGNORS TO WHEELER & WILSON MANUFACTURING COMPANY, OF BRIDGEPORT, CONNECTICUT.

TAKE-UP FOR SEWING-MACHINES.

SPECIFICATION forming part of Letters Patent No. 695,915, dated March 25, 1902.

Application filed April 27, 1900. Serial No. 14,539. (No model.)

To all whom it may concern:

Be it known that we, WILBUR F. DIAL and GEORGE H. DIMOND, citizens of the United States, residing at 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 characters on the drawings representing like parts.

This invention has for its object the production of a sewing-machine capable of being run at a very high rate of speed, high-speeded machines being necessary owing to the sharp competition in manufacture, and the faster the speed the more valuable the machine.

In the class of machines upon which this invention is an improvement the loop-taker has been rotated commonly at a variable speed; but a loop-taker having a variable movement cannot be run at a very high speed, and with such loop-taker the take-up has been moved from a groove cut in the face of a rotating hub or cam or by a form of take-up so constructed as to be inherently incapable of high speed. Attempts have been made to increase the speed of this class of machine by imparting to the loop-taker a plurality of movements at high speed for each reciprocation of the needle; but in such attempts the take-up was actuated as previously described, which precluded the production of a high-speed machine.

We have found in the development of a high-speed machine that each of the three agencies for manipulating the thread for forming the stitch—to wit, the needle mechanism, the take-up mechanism, and the loop-taking mechanism — required improvement. By abolishing the variable or oscillating movements of the loop-taker, neither of which movements is capable of use at a high speed from its very nature, and by substituting a loop-taker having a plurality of rotations at a uniform speed for each reciprocation of the needle a looping mechanism has been produced capable of the very highest rate of speed. The needle-operating mechanism must necessarily involve a reciprocating needle-bar, and the momentum of this part, which increases with every increase in the rate of speed, can only be reduced by either decreasing the length of the throw or weight of the part, and, as we shall subsequently show by this invention, we have materially reduced the length of the throw of the needle-bar, and consequently the momentum of the part, thus enabling a proportionally higher rate of speed with respect to the needle-bar.

The prior vibrating take-up arms we have found incapable of being operated at the rate of speed attainable by the needle and looping mechanisms by reason of the fact that it is impossible to prevent the wear of the cam mechanism and properly to lubricate the same and by reason of the fact that hitherto the parts have been incapable of securing the timing required and of being constructed so as to be mechanically capable of high speed.

By this invention we have produced an organized sewing-machine in which each of the instrumentalities referred to is capable of a high and uniform rate of speed, and this end we have secured by combining with a reciprocating needle-bar and a loop-taker rotating at a continuous uniform rate of speed and having a plurality of rotations to each complete reciprocation of the needle-bar a vibrating take-up arm operated by mechanism such as described, whereby it is capable of a speed equal to that of the loop-taking mechanism.

Figure 1 is a view in perspective of a machine embodying our improvements. Fig. 2 is an end elevation of the arm of the machine, showing the face-plate partially broken away and disclosing our improved take-up mechanism. Fig. 3 is a detail in cross-section, showing the actuator and engaging device of the take-up and connected parts. Fig. 4 is a plan view of the cap-plate. Fig. 5 is an enlarged view, partly in cross-section, of the loop-taker mechanism and the means for rotating the same. Fig. 6 is a development of the paths of movement of the needle-point and take-up eye of our improved mechanism. Fig. 7 is a development of the paths of move-

ment of the needle-point and take-up eye of a take-up mechanism wherein the pivot of the actuator is located directly upon the crank-pin. Fig. 8 is a diagrammatic view illustrating the movements of a take-up, the paths of movement of which are shown in Fig. 7. Fig. 9 is a diagrammatic view illustrating the movements of our improved take-up.

The aim of this invention is the production of a high-speed sewing-machine in which the loop-taker may make between six thousand and ten thousand revolutions per minute, the machine making a stitch during each two rotations of the loop-taker.

In the production of our novel and high-speed sewing-machine we employ loop-taker mechanism running continuously at a uniform speed, the loop-taker making a plurality of rotations for each complete reciprocation of the needle-bar and needle, and we have chosen for illustration in our present machine a loop-taker and loop-taker-actuating mechanism substantially such as shown in United States Patent No. 578,136, granted to us March 2, 1897. In the use of a machine running at excessive high speed it is necessary that the reciprocating parts shall have the least degree of movement possible, and this is especially true of the needle-bar, which has heretofore had a degree of movement much in excess of that necessary for it to perform its function. To coöperate with this high-speed loop-taker and in order to avail ourselves of the high speed thereof, we have found it necessary to provide a novel take-up and to locate the several parts thereof in certain positions—positions which experience and experiments have shown us to be the ones in which it is possible to obtain excessive high speeds without wear and shock. Our take-up mechanism in the form in which we have herein illustrated it is composed of a lever fulcrumed behind the plane in which the needle-bar is reciprocated. The lever has extended from it an arm vibrating in a plane between and closely adjacent the plane of movement of the needle-bar and the plane of movement of the usual needle-bar-actuating link. This arm forms an engaging portion which coöperates with an actuator comprising a sleeve moving upon said arm and connected with and deriving its movement from a projection on the said link. The arrangement of the take-up, the needle-bar, and the means for actuating them is such that the actuating forces are exerted as directly as possible, and there is little tendency to produce torsion or binding of the parts, either of which results would be prohibitive of a high rate of speed.

In order to avoid the shock which occurs by reciprocating the needle-bar at a very high speed, we have so constructed and arranged our take-up mechanism that we may make use of a comparatively small throw in the needle-bar, thus reducing the throw of the needle-bar to about one and one-eighth inches, whereas hitherto such throw has been usually about one and one-half inches. We have also demonstrated the fact that it is of great advantage to obtain the necessary throw of the take-up arm with as short a take-up arm as possible, since a long take-up arm is in the way and is objectionable. The length of the throw of the take-up arm, as is known, is fixed by the requirement of the parts of the sewing mechanism and the work to be done and cannot be altered without disarranging the entire relation of the parts of the sewing mechanism which long experience and experiments have established. One reason for this is that it is desirable and, in fact, necessary in a machine running at high speed to maintain a large lower-thread supply, which renders necessary a large bobbin, and hence a definite throw of the take-up for controlling the needle-thread which must pass around the bobbin.

We have found that the conditions which exist in a high-speed machine of the character described and the functions which it is demanded shall be performed by the take-up require the placing of the parts of the take-up mechanism in the position shown in the drawings and hereinafter described.

We have found that to secure the best results in the relative timing of the various parts of the take-up mechanism they should be related to each other, as shown chiefly in the three features—that the pivot of the take-up arm be located a certain distance in the rear of the plane of the needle-bar, that the pivot of the actuator be located on the projection of the needle-bar-actuating link extending rearwardly, and that the said projection be located at a certain angle with the said link. Each of these distances and the angle referred to we have found by experiment to be about as shown in the drawings. We have also found that the needle-bar and the take-up lever-arm, herein termed the "engaging device," should be operated from the same link, and that to secure as direct an application of the actuating force as possible and to minimize torsional strains and the binding of the parts the engaging device should be located between the link and the needle-bar. In obtaining these positions for the timing of the parts we have been governed by the conditions before referred to and by the conditions that it is necessary, first, that the take-up should not act to pull on the needle-thread before the needle-thread has slipped past the center line of the bobbin, so as to be free to pass off from around the same; secondly, that the take-up action shall occur during a minor portion of one rotation of the main shaft, that it shall be gradual at its commencement, quick during the greater portion of its extent, and gradual in its finish, that the giving-down action of the take-up shall occur during the major portion of the revolution of

the main shaft and shall be steady and slow throughout its extent, and, thirdly, that the take-up shall cease to act and commence to give down slack thread before the needle has reached the fabric. It is needless to enlarge upon these three requirements, for it is obvious that unless they be fulfilled the machine would be practically inoperative or at least inoperative as a high-speed machine. If the take-up should commence to act so as to pull on the needle-thread before it had passed the center of the bobbin and was ready to cast off therefrom, not only would there be a strain upon the thread at that point, but there would be a consequent drawing of the thread from the spool; but as the take-up has previously drawn the supply for the next stitch from the spool there would be an excess of thread afforded for the next stitch, which would result in imperfect work. The advantages of a take-up acting in the times referred to—that is, quickly during its take-up action and slowly and practically uniformly during the letting down of the thread—are well recognized.

It is necessary that the take-up should have completed its take-up action and commence to furnish slack thread before the needle reaches the fabric in its downward movement; otherwise the thread would be cut or broken by reason of the fact that as soon as the eye reaches the fabric the demand for thread is doubled. It is also to be noted that both at the commencement and at the finish of the take-up action the movement of the take-up is comparatively slight, and in order to fulfil the requirements at this point it is necessary not that the theoretical but that the practical commencement and finish of the take-up action should occur at about the points referred to.

It will be noted that a counterbalance is provided upon the main shaft to counteract the effect of the oppositely-situated crank-arm and connected parts, thus insuring a steady and even movement of the shaft and connected parts.

Referring to the drawings, A represents the bed-plate; A^2, the overhanging arm; $C^\times$, the main under shaft; c^2, the under rotating shaft; a^2, a gear thereon meshing with a gear a^3, fast on a shaft a^4, provided with a bevel-gear a^5, which engages a bevel-gear a^8 at the lower end of the shaft a^{12}, carrying the hook d, the hook containing within its open space a bobbin-carrier g', having a projection g^3, which enters a notch in a projection e^2, extended downwardly from the throat-plate e, said notch preventing the rotation of the bobbin with the hook, the bobbin g^2 inserted in the bobbin-case in practice and retained therein by a projection g^6, the plate $b^\times$ sustaining the sleeve a^{10}, through which the shaft a^{12} is extended, said plate being held in position by a set-screw x^6, and the feed-bar F, having usual feed-points marked $x^{6\times}$. The parts so far referred to are and may be all as fully described in said United States Patent No. 578,136, dated March 2, 1897, so need not be herein more fully described. The patent referred to shows, however, two loop-takers, each coöperating with its own eye-pointed needle, but herein we have illustrated but one loop-taker and one eye-pointed needle.

The needle-bar C, having an eye-pointed needle c, and the presser-bar D, provided with a presser-foot $d^\times$, which may be lifted whenever desired by turning the lifting-handle D^2, it contacting with the projection d', carried by said bar, are and may be as usual in sewing-machines.

The rotating needle-bar-actuating shaft B, extended through the overhanging arm of the machine and having at its rear end a suitable driving-pulley B^5, has at its end within the head of the machine a crank or plate B', provided with a crank-pin b, which receives a link b', the lower end of which is fitted over a suitable stud extending backwardly from the collar b^2, connected with the needle-bar by a suitable screw b^3. This mechanism for moving the needle-bar is of the well-known type employed in the Wheeler & Wilson sewing-machines, and it may be of any usual or equivalent construction.

The needle-bar-operating link b' is provided at its upper end upon the rear side or the side away from the operator with a projection l, the said projection forming an obtuse angle with the main portion of the link, and upon this projection, at the end thereof, is pivotally mounted the part which we have termed the "take-up actuator" M. The actuator M comprises a sleeve m, provided with suitable oil-holes o^7 and fitted to slide upon the rod s, which we term the "take-up-engaging device" and which is connected with or made an integral part of the take-up arm e^2, the sleeve m having extended from one side thereof and at right angles therewith a second sleeve p, which fits over a pin r, fastened to the end of the aforesaid projection l, whereby the said actuator M may turn about the pin r and slide upon the rod s. The take-up arm is shown as fulcrumed above the main shaft and at the rear of a vertical plane passing through the said shaft.

The take-up arm e^2 has an eye at the end thereof for the thread, the said arm being journaled upon a pin s' in a hub $f^\times$, depending from the cap-plate f, suitably supported on the overhanging arm back of the vertical path in which the needle-bar C is adapted to be reciprocated, said cap-plate being represented as provided with slots f' to receive screws f^2 and having, as herein shown, at its under side a rib f^3, which enters a longitudinal groove g in the top of the arm A; but it will be understood that the hub $f^\times$ may be sustained or carried at the head of the overhanging arm in any way.

The slack-thread controller h^4, bearing on

the needle-thread between the thread-tension device u and thread-receiving eye of the take-up, may be and is substantially such as represented in United States Patent No. 599,894, dated March 1, 1898, and the tension device itself may be of any usual construction, the device herein represented presenting two disks, one of which is acted upon by a suitable spring adapted to be adjusted by a set-nut u'.

The thread o, taken from a suitable spool, may be led through or over a thread-guide o' between the tension device u, thence under the looped end of the slack-thread controller h^4, through the eye of the take-up e^2, and down through suitable thread-guides o^2 o^3 to and through the usual eye at the lower end of the needle.

The operation of the parts during the rotation of the shaft B occurs in the time and order hereinafter described.

The stud r, which forms the pivot of the actuator M, as previously stated, is placed on the projection extending rearwardly from the needle-bar-operating link, and thereby it becomes possible to time the movement of the take-up arm so that it will have a different phase of movement from the movements of the needle-bar and also of the looping mechanism which has a definite relation to that of the needle-bar. The take-up thus attains its maxima and minima of movement after those of the needle-bar, and by reason of the particular arrangement of parts shown has a movement with relation to the movement of the needle-bar which is illustrated by Fig. 6, the difference between the movements of the respective parts being apparent upon a comparison with Fig. 7, which shows the movements of the same parts when the take-up actuator is pivoted upon the crank-pin. In Figs. 6 and 7 the curve n represents the movement of the needle-bar and t that of the take-up, one complete cycle of movements being shown in each instance, the abscissas representing time of rotation and the ordinates length of throw.

By supporting the take-up independently of the crank and shaft for actuating the needle-bar the strains due to the momentum of the parts are reduced to a minimum, and the speed of the machine may be increased and the power required for driving the parts be reduced and the movement is made easy. The positioning of the engaging device between the link and the needle-bar and the direct connection between the link and each of these parts causes the actuating force applied through the link to be exerted with great directness to the needle-bar and also to the take-up, and the tendency to torsion in the parts and the tendency to binding is as slight as possible.

The operation of the take-up may best be understood by reference to Figs. 8 and 9 of the drawings. In the former figure the points s', B, b^2, b, and r represent, respectively, the fulcrum of the take-up, the main shaft, the pivot connecting the link to the needle-bar, the crank-pin, and the stud r, forming the axis of the take-up actuator, while C represents the needle-bar.

In operation the take-up commences to rise and take up the slack in the needle-thread substantially as the loop of needle-thread is in position to begin to be cast off the bobbin, the needle at such time ascending, and as the needle-bar continues to rise the take-up is actuated quickly, completing its operation of taking up and tightening the stitch and drawing thread from the needle-thread supply for a new stitch, the usual feeding device (shown in Fig. 5) acting while the needle is out of the material to engage and move the material being stitched, said material lying in usual manner on the work-support of usual form.

It will be seen that by the positioning of the parts described a comparatively long horizontal movement and a comparatively short vertical movement of the actuator is obtained, and it will be noticed that during any movement in line with or substantially in line with the tangents to the path of the stud r from the fulcrum s' the take-up is practically inoperative, since during such movement the actuator is sliding along the engaging device, while during any horizontal or substantially horizontal movement the take-up is acting either to take up or give down the thread, because during such movement the actuator is swinging the engaging device. It will thus be seen that the take-up commences practically at the point 5 and acts from that point to the point 6 to take up the thread gradually, from the point 6 to the point 7 rapidly, from the point 7 to the point 8 still more rapidly, and from the point 8 to the point 9 very gradually. From the point 9 to the point 10 the take-up while giving down the thread is acting very slowly by reason of the practical coincidence of the path with the tangent, from the point s' the actuator sliding through the engaging device From the point 10 around to the point 4 the take-up acts slowly and practically uniformly, although with slightly increasing and decreasing speed to and from about the middle of such movement. From the point 4 to the point 6 by reason of the practical coincidence of the path with the tangent from the point s' it has slight motion. During the take-up action the actuator is much nearer to the take-up fulcrum than it is during the letting-down action, the change of leverage thus providing to some extent for the difference in speed of the two movements.

It will be seen that by our construction of fulcrumed take-up provided with an engaging device sliding upon an actuator having both a rotary and reciprocating movement we have obviated the use of cams or other similar devices which it is impossible to make use of

successfully in a machine which is run at anywhere near the high rate of speed now demanded.

This device is capable of perfect lubrication and runs smoothly at a great speed.

By the arrangement of the parts whereby the timing referred to is secured and by passing the thread through an eye at the end of the take-up arm the thread is under complete and constant positive control of the take-up during its entire movement.

A reference to Figs. 8 and 9 of the drawings will show to some extent the reasons for the particular construction of the take-up mechanism which we have found necessary. In each of these figures the circular arcs Z Z′ represent the path of movement of the take-up eye, or, more properly, of an imaginary take-up eye located, for convenience, in line with the engaging device of the take-up. As previously stated, the length of throw of the take-up is fixed by the requirements of the machine, and for the relative size of the parts illustrated in these figures it should be of the length shown in Fig. 9. It will thus be seen that a take-up arm of a length sufficient to secure the throw of Fig. 9, operated, as in Fig. 8, by an actuator pivoted directly upon the crank-pin, would have a throw much less than is requisite, and that in order to obtain the necessary throw the take-up arm would have to be lengthened to the point p' to the extent shown in Fig. 8, which is objectionable for the reasons previously noted; but this is not the most serious objection to placing the pivot of the actuator upon the crank-pin. A reference to the respective figures will show the vast difference in the timing of the parts. It will be seen that owing to the fact that one end of the needle-bar link moves in a right line, while the other end moves in a circle, that any point upon the link, or rigidly connected thereto, will move in a path the segments of which form segments of spiral curves. The curve generated by a point of this character we have herein termed an "ovoidal" curve. It will be found that by placing the pivot of the actuator on a projection at an angle to the needle-bar link and rearwardly therefrom, which projection forms a part of or is rigidly connected to the link, that the pivot will be found to move in an ovoidal path, the what may be termed "major" axis of which will be found to be inclined to the horizontal. In each construction the take-up action will commence and finish at points on the respective paths at which lines drawn from the pivot of the take-up arm are tangent thereto. It will be seen that in the construction shown in Fig. 9 the take-up action will commence at about the point 5 and finish at about the point 9, while in Fig. 8 it will commence a little after the point 4 and finish a little before the point 9. The difference between the two constructions in these respects, while not appearing large on the diagrammatic views, are yet of just the extent required by the aforesaid conditions and are the very ones that are necessary to give a successfully-operating high-speed machine. The same result could not be obtained, as might be suggested, by placing the pivot of the take-up arm of the construction, Fig. 8, centrally above the main shaft, for the reason that while this would cause the take-up to commence at the proper time it would fail to secure the proper relative movements of the take-up, the proper timing of the same, and would cause it to finish at a point too near the point 10 or at a point when the needle is about to enter the goods, it being remembered that the motion of the take-up in the vicinity of this point is very slight.

Having fully described our invention, what we claim, and desire to secure by Letters Patent, is—

1. A sewing-machine comprising a needle-bar, an eye-pointed needle, a revoluble crank-pin operatively connected with the said needle-bar, a loop-taker rotating continuously at a uniform speed, and means for giving the same a plurality of rotations for each complete reciprocation of the needle-bar, and a vibrating take-up arm deriving its movement from the movement of the crank-pin which actuates the needle-bar and needle whereby the machine is capable of a high rate of speed.

2. A sewing-machine comprising a needle-bar, an eye-pointed needle, a revoluble crank-pin operatively connected with the said needle-bar, a loop-taker rotating continuously at a uniform speed, and means for giving the same a plurality of rotations for each complete reciprocation of the needle-bar, a vibrating take-up arm fulcrumed at a point above and to one side of the center of motion of the said crank-pin and deriving its movement from the movement of said crank-pin whereby the machine is capable of a high rate of speed.

3. A sewing-machine comprising a needle-bar, an eye-pointed needle, a revoluble crank-pin, a link connecting the crank-pin and the needle-bar and provided with a lateral projection, a take-up arm having its fulcrum above and to one side of the center of motion of said crank-pin, an actuator connected with the take-up arm and pivoted on the said lateral projection, a loop-taker rotating continuously at a uniform speed, and means for imparting to the said loop-taker a plurality of rotations for each complete reciprocation of the needle-bar whereby the machine is capable of a high rate of speed.

4. A sewing-machine comprising a needle-bar, an eye-pointed needle, a revoluble crank-pin, a link connecting the crank-pin and the needle-bar and provided with a lateral projection, a take-up having its fulcrum above and to one side of the center of motion of said crank-pin and provided with an engaging de-

vice, an actuator coöperating with said engaging device and pivoted on the said lateral projection, the actuator and engaging device operating in a plane between the needle-bar and the crank-pin, a loop-taker rotating continuously at a uniform speed, and means for imparting to the said loop-taker a plurality of rotations for each complete reciprocation of the needle-bar, whereby the machine is capable of a high rate of speed.

5. A sewing-machine comprising a needle-bar provided with an eye-pointed needle, a shaft for operating the needle-bar, a loop-taker rotating continuously at a uniform speed, means for giving the looper a plurality of rotations for each complete reciprocation of the needle-bar, a take-up arm, an actuator therefor pivoted to the moving part of the machine, the pivot of the said actuator having a continuous motion in an ovoidal path the major axis of which is at an oblique angle to the horizontal whereby the machine is capable of a high rate of speed.

6. A sewing-machine comprising a needle-bar provided with an eye-pointed needle, a shaft for operating the needle-bar, a loop-taker rotating continuously at a uniform speed, means for giving the loop-taker a plurality of rotations for each complete reciprocation of the needle-bar, a take-up arm having its fulcrum located above and to one side of the center of the needle-bar-operating shaft, an actuator connected with the take-up arm and pivoted upon a moving part of the machine, the pivot of the said actuator having a continuous motion in an ovoidal path the major axis of which is at an oblique angle to the horizontal whereby the machine is capable of a high rate of speed.

7. A sewing-machine comprising a revoluble crank-pin, a rectilineally-movable needle-bar, a link connecting the crank-pin and the needle-bar and provided with a lateral projection, a take-up arm fulcrumed above the center of motion of the crank-pin, an actuator connected with the take-up arm and pivoted on said lateral projection.

8. A sewing-machine comprising a revoluble crank-pin, a rectilineally-movable needle-bar, a link connecting the crank-pin and needle-bar and provided with a lateral projection forming an oblique angle with the link, a take-up arm fulcrumed above the center of motion of said crank-pin, an actuator connected with the take-up arm and pivoted on said lateral projection.

9. A sewing-machine comprising a revoluble crank-pin, a rectilineally-movable needle-bar, a link connecting the crank-pin and needle-bar and provided with a lateral projection forming an oblique angle with the link, a take-up arm fulcrumed above and to one side of the center of motion of said crank-pin, an actuator connected with the take-up arm and pivoted on said lateral projection.

10. In a sewing-machine, a rectilineally-movable needle-bar, a revoluble crank-pin, a link connecting the crank-pin and needle-bar and having a projection extending laterally therefrom, a take-up arm fulcrumed above and at one side of the center of motion of the crank-pin and provided with an engaging device rigidly connected therewith, an actuator pivoted upon the lateral projection of the link and slidingly connected with the said engaging device.

11. In a sewing-machine a rectilineally-movable needle-bar, a revoluble crank-pin, a link connecting the crank-pin and needle-bar and having a projection extending laterally therefrom, a take-up fulcrumed above and at one side of the center of motion of the crank-pin and provided with an engaging device rigidly connected therewith, an actuator pivoted upon the lateral projection of the link and slidingly connected with the said engaging device, the said actuator and engaging device operating in a plane between the needle-bar and link.

12. In a sewing-machine, a rectilineally-movable needle-bar, a revoluble crank-pin, a link connecting the crank-pin and needle-bar and having a projection extending laterally therefrom and at an oblique angle thereto, a take-up arm fulcrumed above and at one side of the center of motion of the crank-pin and provided with an engaging device rigidly connected therewith, an actuator pivoted upon the lateral projection of the link and slidingly connected with the said engaging device.

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

WILBUR F. DIAL.
GEORGE H. DIMOND.

Witnesses:
ISAAC HOLDEN,
GEORGE CORNWELL.