

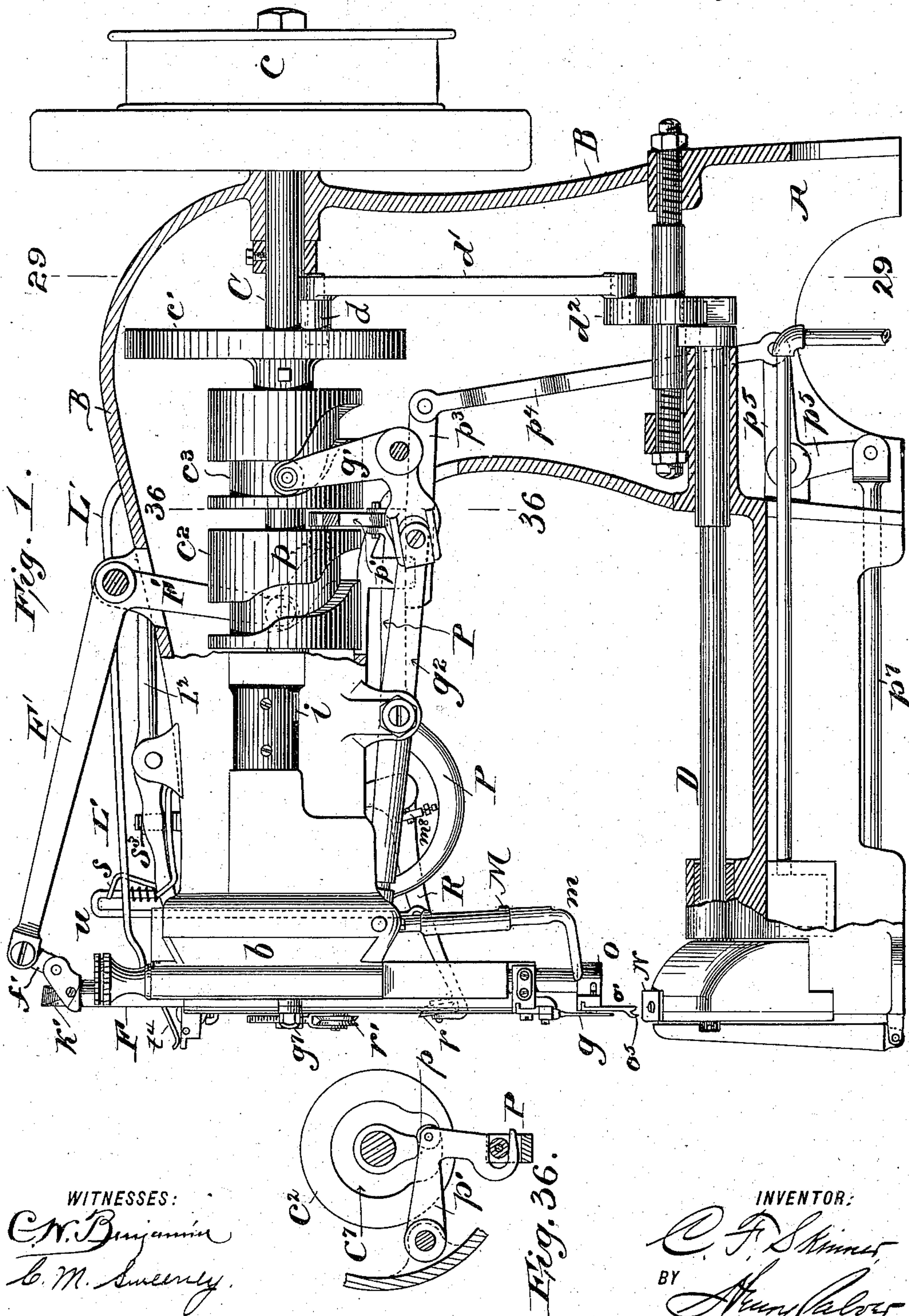
(No Model.)

8 Sheets—Sheet 1.

C. F. SKINNER.
SEWING MACHINE.

No. 559,413.

Patented May 5, 1896.



WITNESSES:
C. N. Benjamin
C. M. Sweeney

INVENTOR:
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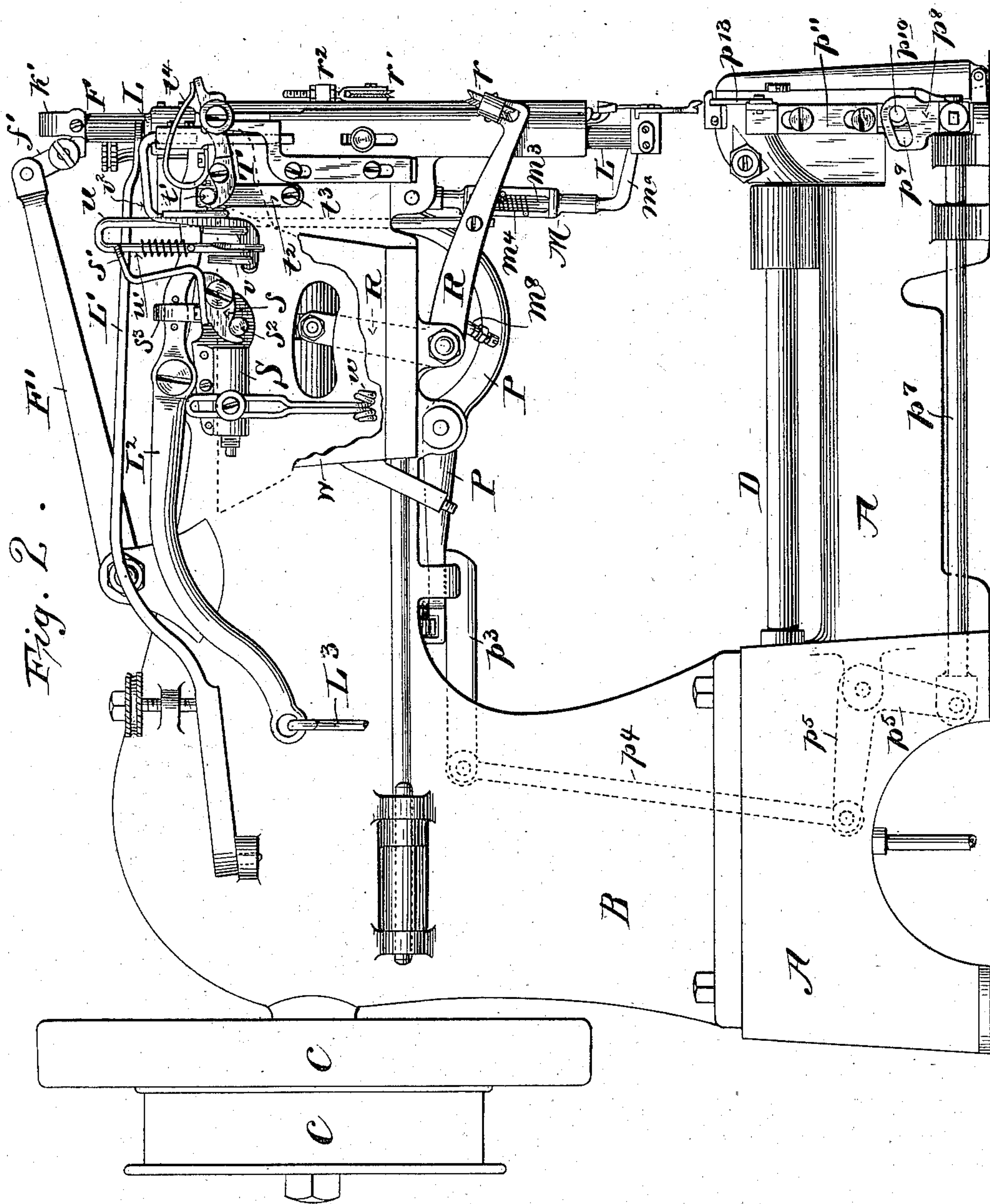
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8 Sheets—Sheet 2.

C. F. SKINNER.
SEWING MACHINE.

No. 559,413.

Patented May 5, 1896.



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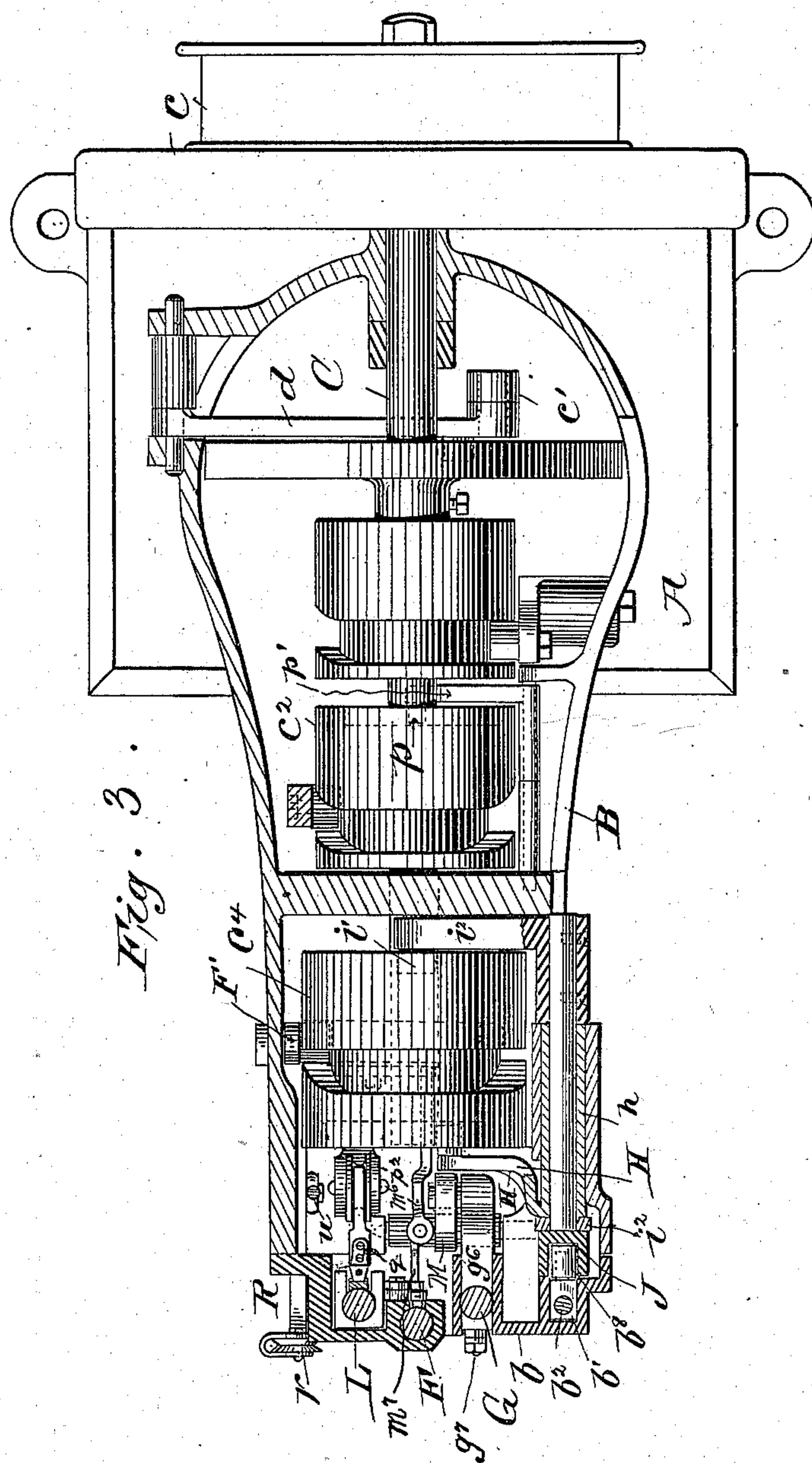
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SEWING MACHINE.

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Patented May 5, 1896.



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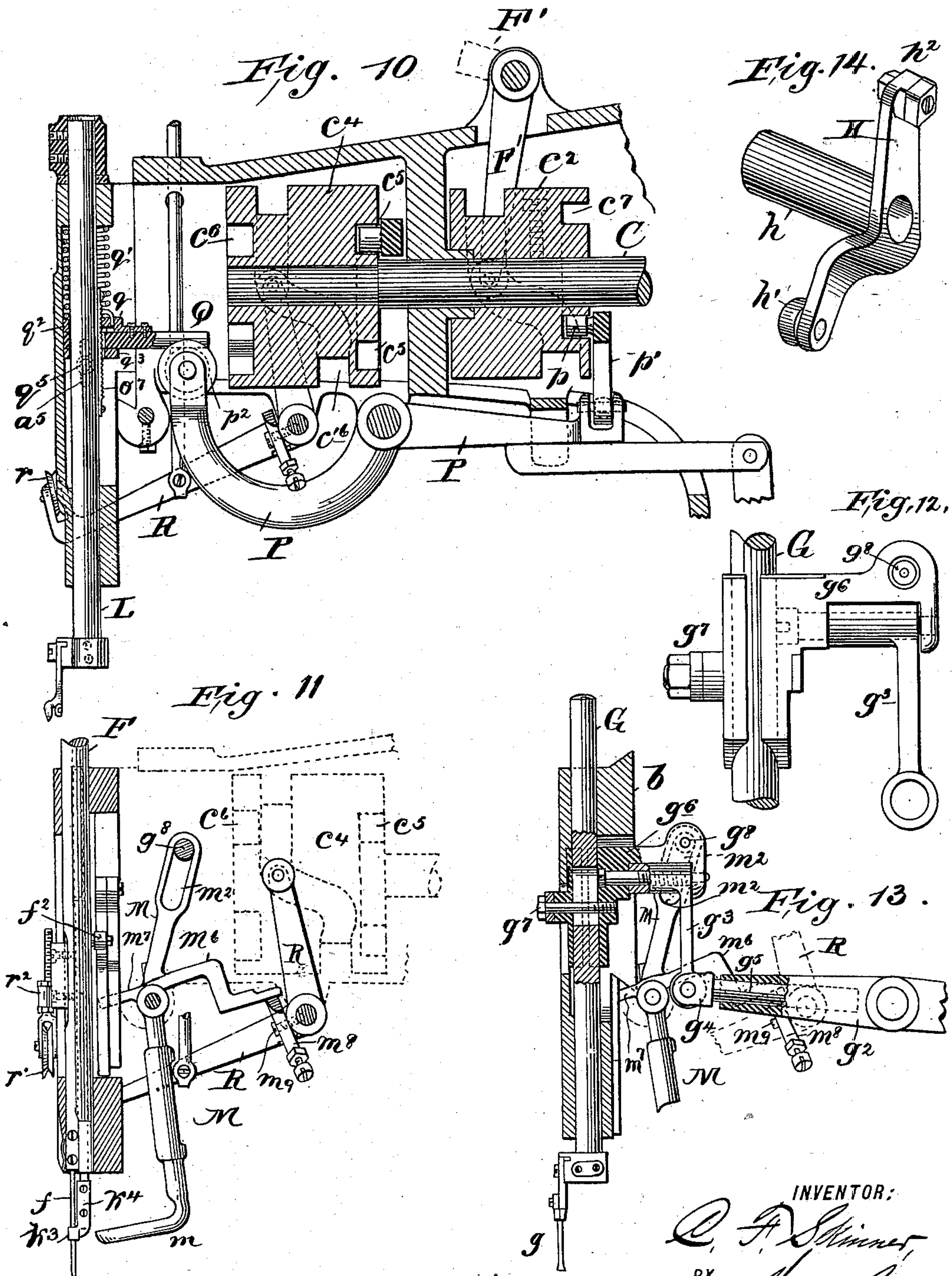
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8 Sheets—Sheet 5.

C. F. SKINNER.
SEWING MACHINE.

No. 559,413.

Patented May 5, 1896.



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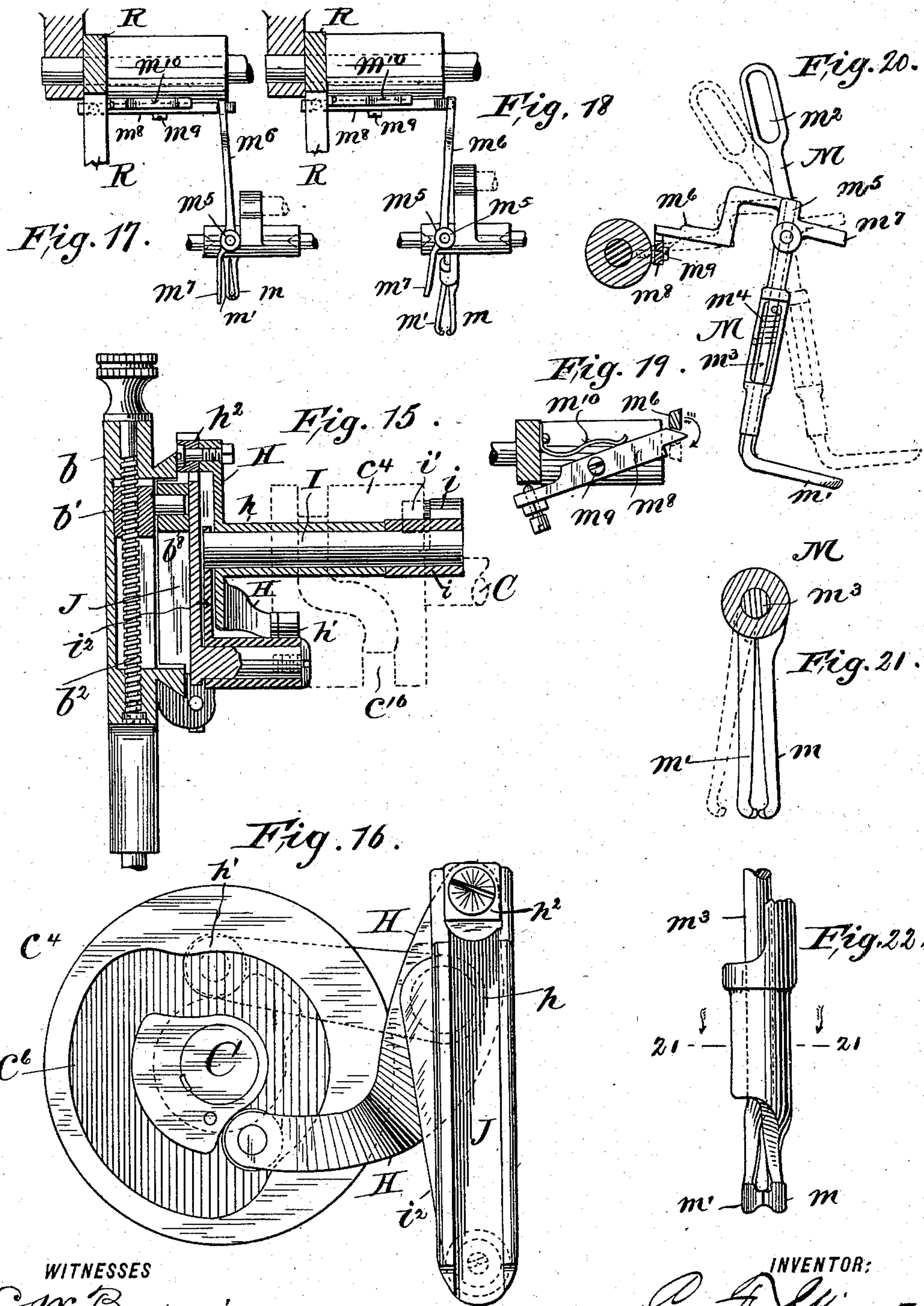
(No Model.)

8 Sheets—Sheet 6.

C. F. SKINNER.
SEWING MACHINE.

No. 559,413.

Patented May 5, 1896.



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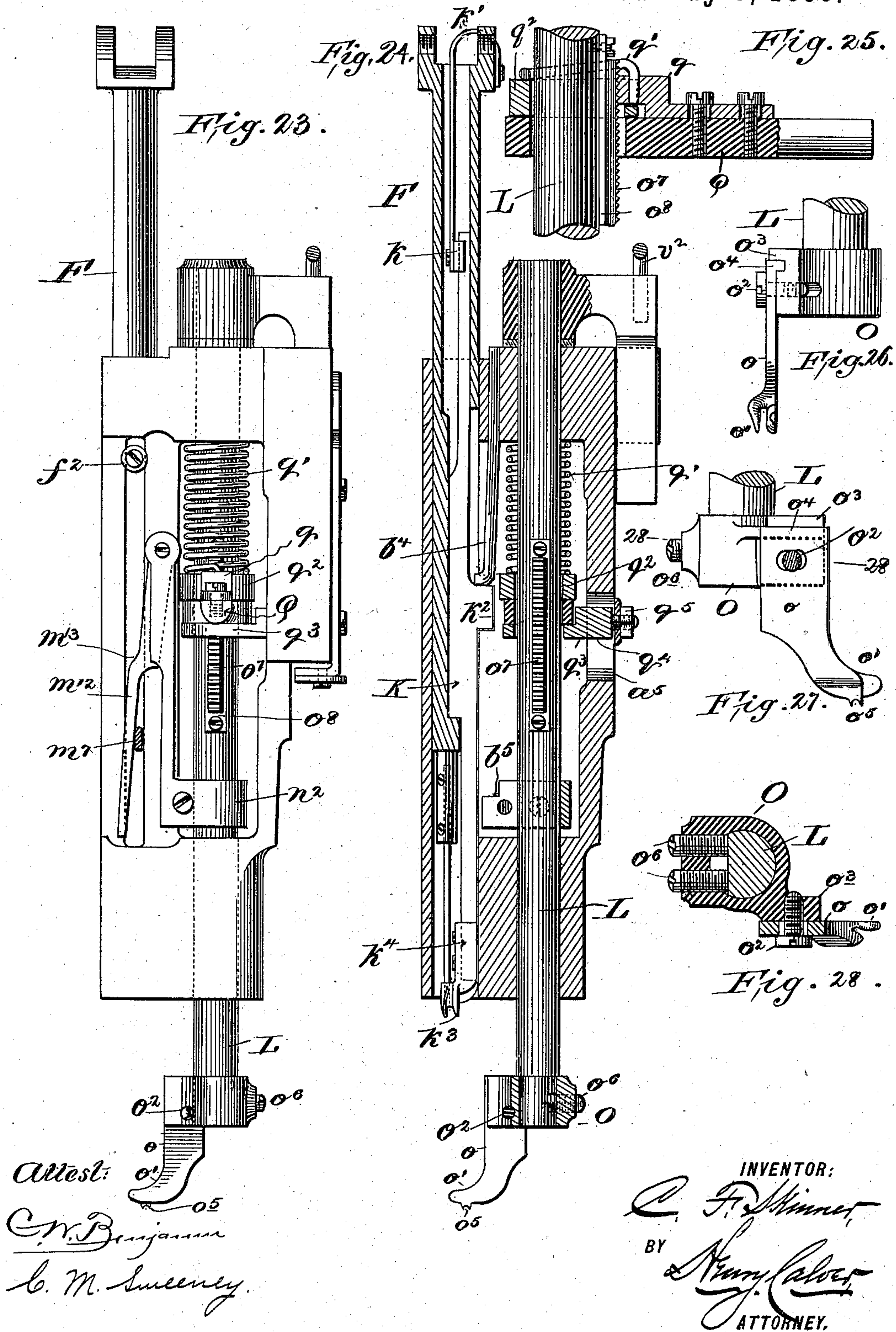
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8 Sheets—Sheet 7.

C. F. SKINNER.
SEWING MACHINE.

No. 559,413.

Patented May 5, 1896.



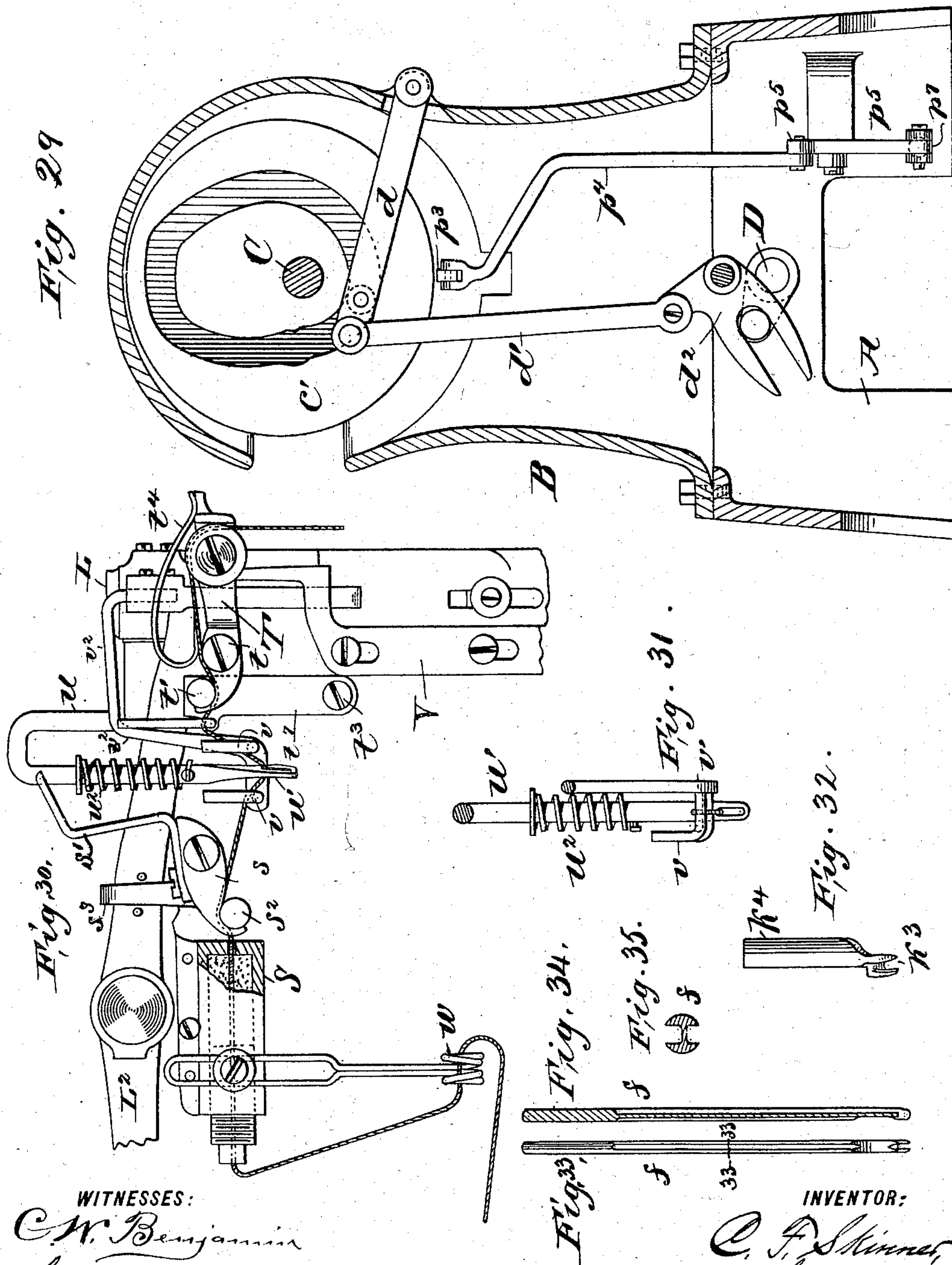
(No Model.)

8 Sheets—Sheet 8.

C. F. SKINNER.
SEWING MACHINE.

No. 559,413.

Patented May 5, 1896.



WITNESSES:
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UNITED STATES PATENT OFFICE

CLARENCE F. SKINNER, OF NEWARK, NEW JERSEY, ASSIGNOR TO THE
SINGER MANUFACTURING COMPANY, OF NEW JERSEY.

SEWING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 559,413, dated May 5, 1896.

Application filed June 4, 1895. Serial No. 551,616. (No model.)

To all whom it may concern:

Be it known that I, CLARENCE F. SKINNER, a citizen of the United States, residing at Newark, in the county of Essex and State of New Jersey, have invented certain new and useful Improvements in Sewing-Machines, of which the following is a specification, reference being had therein to the accompanying drawings.

My invention relates to that class of sewing-machines intended for heavy work, and more particularly to a machine for forming lock-stitch seams with waxed thread, although my machine is also adapted for sewing with dry thread, if desired.

In the drawings, Figure 1 is a front side view of my improved machine with the framework thereof partly in section. Fig. 2 is a rear side view of the same. Fig. 3 is a sectional plan view, and Fig. 4 a front end elevation, of the same. Figs. 5, 6, 7, 8, and 9 are detail views to illustrate the shuttle mechanism and the device coöperating therewith to form the loops of needle-thread for the entrance of the shuttle. Fig. 10 is a sectional view illustrating the mechanism in the forward end of the arm of the machine. Fig. 11 is a detail view illustrative of the take-up and thread-controlling devices and their operating mechanism. Figs. 12 and 13 are detail views showing the awl-bar and a portion of its operating mechanism, as also a part of the thread-controlling mechanism. Figs. 14, 15, and 16 are detail views illustrative of the feeding mechanism and the means for giving the proper clearance movement to the awl-bar. Figs. 17, 18, 19, 20, 21, and 22 are detail views illustrative of the needle-thread-controlling and needle-threading mechanism. Fig. 23 is a detail view to show the presser-bar and connected parts. Fig. 24 is a sectional elevation illustrative of the presser-bar mechanism and also the needle-bar and the thread-guide bar carried by the latter. Fig. 25 is a detail view of the presser-foot-lifting device and the means whereby the presser-bar automatically adapts itself to different thickness of work. Figs. 26, 27, and 28 are detail views of the presser-foot and its connections with the presser-bar. Fig. 29 is a sectional elevation on line 29 29, Fig. 1.

Fig. 30 is a detail view illustrative of a portion of the thread-controlling and pull-off mechanism, and Fig. 31 is a detail view of the pull-off devices. Fig. 32 is a detail side view of the thread-guide and needle-brace, and Figs. 33, 34, and 35 are detail views of the needle. Fig. 36 is a detail view showing a portion of the presser-foot-lifting mechanism.

A denotes the base, and B the bracket-arm, these parts constituting the framework of the machine. Journaled in the upper portion of said bracket-arm is the driving-shaft C, provided with the usual fly and pulley wheel *c* and with a series of cams from which all of the movements of the machine are derived. The shuttle-operating mechanism is essentially that of the well-known "Singer" oscillating-shuttle machine, and comprises the rock-shaft D, journaled in the base A and operated from the cam-groove in the cam-disk *c'* through the rocking arm or lever *d*, pitman *d'*, and rocker *d''*, the shuttle E at the forward end of said rock-shaft D working in a suitable race formed at the forward end of the base A.

F is the needle-bar reciprocating vertically in a suitable fixed bearing at the forward end of the arm B and operated from the cam *c''* on the shaft C through the bell-crank lever F', connected at its forward end to said needle-bar through the short link *f'*. The needle *f* is forked or recessed to form an open eye at its lower end to push the thread through holes in the work previously made for it by an awl *g*, carried by a clamp adjustably connected with an awl-bar G, reciprocating vertically in a sliding head *b*, which moves horizontally in suitable guideways formed at the forward end of the arm B, the horizontal movements of the said head and of the awl-bar mounted therein being for the purpose of feeding the work and for moving the awl-bar out of the way of the needle-bar. The needle *f* is grooved on both sides for the entire portion thereof which enters the thickest work, so that not only may a needle of the smallest possible size for a given size of thread be employed, but the thread is well housed in the needle, so as to be as well protected as possible, the groove on the front side of the needle, in which the thread lies as it comes down from above,

preferably extending to the center of the needle, as more clearly shown in Fig. 35.

The awl-bar is reciprocated vertically from the cam c^3 through the bell-crank lever g^1 , lever g^2 , and link g^3 , the latter having a swivel connection with the forward end of the said lever g^2 through the fork g^4 , formed at the forward end of a swivel-bolt g^5 , fitting in a suitable socket in the said lever g^2 , this connection permitting of the horizontal or feeding movements of the awl-bar with the sliding head b without binding. The upper end of the link g^3 is jointed to a bracket or slide g^6 , fitting in a suitable vertical guideway formed in the head b , said bracket or slide g^6 being formed in two parts connected together and clamped to the awl-bar by a bolt g^7 , passing through a slot in said bar, the latter being thus rigidly held from any turning or torsional movements. The slot in the awl-bar through which the bolt g^7 passes permits of a vertical adjustment of the awl-bar to vary the position of the awl according to the length of the awl or the position desired therefor.

The horizontal movements of the sliding head b and of the awl-bar and awl carried thereby are preferably greater than the feeding movements of the awl, for the purpose of giving a suitable clearance between the awl and needle, and I will now describe the mechanism by which these feeding and clearance movements are effected. At the forward end of the shaft C is a cam-cylinder c^4 , having in its rear face a cam-groove c^5 and in its front face a cam-groove c^6 , the latter being what may be termed the "clearance-cam" and the cam-groove c^5 being the feeding-cam.

H is an angular clearance-lever having a pivot-sleeve h , journaled in the forward part of the bracket-arm B, said lever having a pin or roller-stud h^1 entering the cam-groove c^6 .

I is a rock-shaft extending through the sleeve h and having at its rear end an arm i , having a pin or roller-stud i^1 entering the cam-groove c^5 , said shaft I having at its forward end an arm i^2 .

J is the feed-lever jointed at its lower end to the lower end of the arm i^2 , this joint being preferably an extended one to give strength of movement and avoid wear, and said lever J is forked at its upper end to embrace a fulcrum block or pin h^2 , carried at the upper end of the clearance-lever H.

The feed-lever J is slotted to receive a roller-stud b^8 , carried by a vertically-adjustable block b^7 , which is received in a slot in the head b and is engaged by a screw b^2 , mounted in the said head, and thus by turning said screw the said block may be moved nearer to or farther from the pin or block h^2 at which the said feed-lever has its fulcrum, so that the movements of said slide or head b , imparted thereto from the said feed-lever, which latter is operated from the arm i^2 of the rock-shaft I, may be varied to vary the horizontal feeding movements of the awl-bar and awl movable with said slide or head.

To avoid abrasion of the thread by reeving the same back and forth in contact with the needle I prefer to employ the open-eyed or forked needle hereinbefore mentioned. This open-eyed or forked needle must be threaded, or have its thread drawn across its line of descent at each stitch, and this result is effected by mechanism which I will now describe.

K is a thread-guide bar placed in the hollow needle-bar F and held in frictional contact with said needle-bar by means of a shoe k carried by a spring k^1 which is attached at its upper end to the needle-bar and which presses said shoe against said thread-guide bar, so that the latter will reciprocate with said needle-bar during a part of the travel of the said needle-bar, the upward movements of the said thread-guide bar with the needle-bar being limited by a fixed stop b^4 , attached to a stationary part of the casing or frame and the downward movements of said thread-guide bar being limited by a stop b^5 , attached to the presser-bar L, said stops being arranged in the path of movement of a lug k^2 on the thread-guide bar. The thread-guide k^3 is made in the form of an eye surrounding the needle and is carried by a shank k^4 , attached to the said thread-guide bar. The stop b^4 is so placed that the thread-guide will be lifted high enough, so that the needle in rising will never be lifted clear of the same, but will have the thread recess or "eye" at its lower end within said thread-guide when said needle is in its highest position. The vertical position of the presser-bar is governed by the thickness of the work beneath the presser-foot, and thus the position of the variable stop b^5 , which limits the downward movement of the thread-guide k^3 with the needle-bar and which is attached to the presser-bar, will also be governed by the thickness of the work, so that the thread-guide in its lowest position is always at a uniform height above the upper surface of the work, thus securely holding the thread in such position that it must be forced into the work by the needle. The thread-guide k^3 also serves as a needle-brace and steadies the needle as the latter passes through the work.

To draw the thread (which runs down the front side of the needle) across the path of the latter in its descent, so that the thread will be securely placed in the thread recess or eye at the lower end of the needle, I provide a needle-threading and slack-thread-drawing device, consisting, preferably, of a pair of nippers or jaws m m^1 at the lower end of a lever M, pivoted to swing toward and from the needle longitudinally of the machine, said lever having in its upper arm a slot m^2 , entered by a pin or roller-stud g^8 , carried by the slide g^6 , attached to the awl-bar. The jaw m of the needle-threading and slack-thread-drawing device is rigid with the lever M, and the jaw m^1 is carried by a shank or bar m^3 within the hollow lower part of the

said lever M and is normally held against the fixed jaw m by a torsional coil-spring m^4 . To the upper end of the bar m^3 is attached a collar m^5 , having arms m^6 m^7 , the arm m^6 being so placed as to engage an incline formed at the end of a latch m^8 when the upper end of the lever M moves backward, so that the contact of said arm with said incline will turn the bar m^3 slightly against the stress of the torsional spring m^4 to move the jaw m' away from the jaw m , and thus open the nippers to receive the needle-thread as said jaws, during the descent of the awl-bar, are swung forward beneath the needle, which is at this time lifted to its highest position. After the nippers have thus received the thread the arm m^6 rides over the incline at the end of the latch m^8 and the nippers are then closed by the spring m^4 , holding the thread between them. The awl-bar now rises and the roller-stud g^8 , moving therewith, causes a reverse movement of the lever M, the nippers m m' moving backward, drawing a loop of needle-thread with them, the upper limb of said loop being directly beneath the lower end of the eye or thread-guide k^3 , at this time moving downward with the needle and through which thread-guide the needle-thread runs, so that when the said thread-guide is arrested in its downward movement by the stop b^5 and the open eye of the needle emerges from said thread-guide said open eye will receive the thread thus held directly in its path by the said thread-guide and the nippers, the latter drawing out a loop and thus taking up the slack given up by the needle as the latter descends. The latch m^8 , which caused the nippers m m' to open when they moved forward, is engaged by the arm m^6 when the nippers move backward; but as said latch is upwardly yielding (being pivoted at m^9 and pressed downward by spring m^{10}) it is now lifted by the said arm, so that the latter can pass it without opening the nippers.

It is desirable that the thread held by the nippers should be released just when the open eye of the needle enters the work, whatever may be the thickness of the latter, and to this end I have provided means whereby the arm m^7 of the bar m^3 , by which the thread is released, may be operated by a device the position of which is controlled by the presser-foot.

To the presser-bar L is clamped a collar n^2 , having an upwardly-extending arm, to the upper end of which is pivoted a lever m^{12} , having an incline m^{13} , arranged to be engaged by a stud or roller f^2 , carried by the needle-bar F. The outer end of arm m^7 is contiguous to the lever m^{12} , so that when the incline m^{13} on said lever is struck by the roller-stud f^2 said lever will move said arm and open the nippers m m' to release the thread held thereby. As the lever m^{12} is connected with the presser-bar, it will be higher or lower according to the thickness of the work beneath the presser-foot, and it will thus be obvious that the in-

cline m^{13} will be engaged earlier in the downward movement of the needle-bar when the work is thick than when it is thin, and thus when the machine is once properly adjusted the thread held by the nippers will always be released just when the eye of the needle enters the work.

Coöperating with the forked or open-eyed needle and the shuttle I employ a loop-spreading device consisting of a yielding or spring-pressed plunger e , supported by a carrier e' , having a shank e^2 entering a socket formed for its reception in the forward end of the shuttle-operating rock-shaft D and connected to said shaft to rock therewith by a spring d^3 , which normally holds the said carrier e' in contact with the horn e^3 of the shuttle-driver E'. Within the cavity of the work-support A' at the forward end of the base A, in which the shuttle-driver works, is arranged a stop a^4 , which limits the backward movement of the carrier e' with the shuttle-driver, arresting said carrier in its backward movement when the plunger e is directly in line with the vertical path of movement of the needle, the spring d^3 , which forms a yielding connection between the shank e^2 of the carrier e' , and the shaft D yielding to permit the loop-spreading device thus to stop while the said shaft and the shuttle-driver continue their travel to complete the backward movement of the shuttle. The loop-spreading device thus remains stationary while the needle descends against the spring-pressed plunger e' and forces the latter downward for about one-fourth of an inch, and as the needle rises the plunger, under the stress of its spring e^5 , follows it upward, thus spreading the loop laterally to open it out for the entrance of the beak of the shuttle. To insure the proper spreading of the loops toward the rear side of the needle, or that side thereof from which the shuttle takes the said loops, the carrier e' has a projection e^4 placed closely adjacent to the plunger e , and which extends for some little distance above the top of the said plunger when the latter is at the limit of its upward movement. When in the forward movement of the shuttle-driver the horn e^3 of the latter again comes in contact with the carrier e' , said carrier is forced forward away from the stop a^4 and continues to move with the said driver first forward and then again backward until said carrier again comes in contact with said stop.

The presser-bar L, which is normally forced downward by the plate-spring L', has attached to its lower end a collar or bracket O, to which the shank o of the presser-foot o' is adjustably secured by means of the screw o^2 passing through a slot in said shank. To provide for a strong rigid connection of the said shank with the arm o^3 of the said bracket or collar, said arm is preferably provided with a horizontal groove in which fits a horizontal lip o^4 , formed at the top of said shank. The presser-foot is provided on its under side with stitch-setting teeth o^5 , and the horizontal adjust-

ment of the said foot on the arm o^3 of the collar O is for the purpose of bringing said teeth into proper position longitudinally of the seam relative to the stitches. To provide
 5 for a fine torsional or lateral adjustment of the presser-foot to bring the teeth o^5 into exact alinement with the awl and needle the collar O is preferably attached to the presser-bar by two set-screws o^6 , slightly separated
 10 from each other and engaging a flattened surface formed by cutting out or notching the round presser-bar. Thus by slackening one and tightening the other of said screws the collar O may be adjusted torsionally to move
 15 the presser-foot slightly laterally one way or the other to bring the stitch-setting teeth o^5 into perfect alinement with the seam. The awl is preferably connected with the awl-bar in the same manner that the presser-foot is
 20 connected with the presser-bar, as just described, so that the awl may be adjusted similarly to the presser-foot and for a similar purpose.

The presser-foot o' is lifted at each stitch,
 25 when the feed occurs, and is then suddenly dropped to give a suitable blow or stroke to cause the stitch-setting teeth o^5 to operate properly. It is desirable with a certain class of work that the presser-foot lift should be
 30 uniform regardless of the varying thickness of the work, and it is also desirable that the presser-foot lift should be adjustable, so as to vary the impact or blow given to the stitch-setting teeth for different classes of work,
 35 and I will now describe the means by which these results are secured.

The needle-bar-operating cam-cylinder c^2 is provided in its rear face with a cam-groove c^7 , entered by a pin or roller stud p , carried
 40 by a swinging arm or lever p' , pivoted to the arm B and loosely connected at its lower side to the rear arm of a lifting-lever P, preferably provided at its forward end with a grooved roller p^2 . The presser-bar L is preferably provided for a portion of its length
 45 with a toothed or serrated surface o^7 , herein shown as being formed on a plate o^8 attached to said bar. Q is a tilting gripping-dog having an opening loosely receiving the presser-bar and its attached serrated plate o^8 , said
 50 dog carrying on its upper side a gripping lug or block q , adjustably attached to said dog and preferably having a roughened or serrated face for engagement with the roughened
 55 or serrated face of the plate o^8 . The tail portion of the gripping-dog Q extends inward above the grooved roller p^2 at the forward end of the lifting-lever P. Above the gripping-dog Q is a block or collar q^2 , loosely embracing the presser-bar and the plate o^8 , and pressing on the said collar q^2 and the gripping-block q is a spring q' , which serves, through
 60 its pressure on said collar and block, to release the gripping-dog from the presser-bar at the proper times.

Attached to a fixed part of the head or frame of the machine, beneath the outer end of the

gripping-dog Q, is a grip-arresting plate q^3 , having a shank q^4 extending through a slot a^5
 70 in the said head and provided with a set-nut q^5 , said plate having an opening through which the presser-bar and the plate o^8 can freely pass. When the gripping-dog Q is resting on the plate q^3 , the spring q' holds the said dog horizontal with the block q disengaged from
 75 the plate o^8 , and the presser-bar is free to rise or fall to adjust itself to the thickness of the work passing beneath the presser-foot. When the tail of the gripping-dog is engaged by the lifting-lever P, or rather by the roller p^2 carried thereby, the said dog is tilted and the
 80 block or lug q bites the serrated plate o^8 , and the continued upward movement of the lifting-lever now raises the presser-bar and holds the presser-foot above the work while the awl
 85 feeds it laterally; and when this feeding operation has been effected a quickly-acting part of the cam c^7 causes the forward end of the lifting-lever to fall suddenly, so that the spring q' releases the gripping-lever from the
 90 presser-bar, and the latter is then forced downward by its spring L' quickly enough to cause the presser-foot to strike a stitch-setting blow, the force of which depends on the height to which the presser-foot has been lifted
 95 above the work, and this can be regulated by vertically adjusting the grip-arresting plate q^3 , which stops the downward movement of the gripping-dog with the downward movement of the forward arm of the lifting-lever
 100 P. Thus if the greatest possible lift of the presser-foot, to give a very strong stitch-setting blow, is desired the plate q^3 is placed low enough to permit the dog Q to follow the full throw of the lever P; but if a lighter
 105 stitch-setting blow is desired the plate q^3 will be adjusted higher, so that when the dog Q is resting thereon there will be more or less lost motion between said dog and lever, and thus the lift of the presser-bar may be as much
 110 less than the full throw of said lever as may be desired.

The presser-bar-lifting lever P has a rearwardly-extending tailpiece p^3 , connected by a pitman p^4 to one arm of a bell-crank lever p^5 ,
 115 the other arm of which is jointed to the rear end of a horizontally-sliding rod p^7 , having at its forward end an arm p^8 , provided with an inclined slot p^9 , receiving a roller-stud p^{10} on a vertically-sliding bar p^{11} , carrying an under-stitch-setting device consisting of the arm p^{13} , rigidly but preferably adjustably attached to
 120 said sliding bar p^{11} , and having stitch-setting teeth p^{14} extending upward through an opening in the work-plate N and working in opposition to the stitch-setting teeth on the bottom of the presser-foot, so that as the latter falls the stitch-setting teeth p^{14} rise to engage the work.

The stitch-setting teeth or devices above described are for the purpose of impressing the
 130 stitches into the surfaces of the work so that they will be flush with or slightly below the said surfaces on both sides of the work, and

also for the purpose of giving a finished or evenly-divided appearance to the stitches, as is well understood by those skilled in the art to which my invention relates, this effect on both sides of the work being more particularly desirable with harness-work, which shows on both sides.

I will now describe the take-up and thread-controlling mechanism for the needle-thread herein shown, although I do not wish to be understood as limiting my invention to the details of this mechanism as herein illustrated, as such details may be varied widely in practice.

R denotes the take-up lever operated from the cam-groove c^{16} in the cam-cylinder c^4 , which has in its ends the feed and awl clearance cam-grooves c^5 and c^6 . The said take-up lever has at its free or operating end a grooved roller r , over which the waxed thread runs, and r' denotes a second take-up roller suspended from a bracket r^2 , attached to the needle-bar, the said take-up roller r' in the take-up or stitch-tightening operation moving in opposition to the take-up roller r .

Within the wax-pot W is a thread-guide w from which the thread runs through a stripper S to a thread-grip consisting of a lever s and a stud s^2 on which the forked end of said lever nearest the stripper bears. T denotes a second thread-gripping lever pivoted at t , and bearing at its gripping end against the under side of a resistance-stud t' , carried by a bar or plate t^2 , pivoted at its lower end, at t^3 , to the machine-frame. The gripping end of the lever T is pressed against the stud t' by a spring t^4 bearing on the forward end of said lever. By mounting the resistance-stud t' on the pivoted plate t^2 said stud will be free to adjust itself to the curved gripping-seat of the lever T to accommodate different sizes of thread or to compensate for wear, and thus a stronger grip on the thread is at all times secured than would otherwise be effected.

Between the thread-grips just described is a pull-off device consisting of a rod u , attached at its lower end to the take-up lever R and having a depending arm u' provided with a thread slot or eye, and interposed between two resistance-pins v , carried by a bracket v' , attached to an arm v^2 , extending laterally from the presser-bar, the height of said pins v being thus governed by the thickness of the work beneath the presser-foot, so that more thread will be drawn from the thread-supply by the uniformly-reciprocating pull-off when the work is thick than when the work is thin, the increased amount of thread thus drawn by the pull-off for thicker work being twice that of the increased thickness of the work, owing to the use of the two resistance-pins vertically movable with the presser-foot.

The depending arm u' of the pull-off is surrounded by a coil-spring u^2 , the upper end of which is beneath a tailpiece s' of the gripping-lever s , and thus when the pull-off is in

its elevated position the stress of said spring will be applied to said lever to cause the latter to grip the thread against the stud s^2 ; but when the said pull-off is in its lowered or pull-off position the stress of said spring will be removed from said tailpiece, leaving the thread free to be drawn from the wax-pot by the pull-off, the thread-gripping lever T being at this time in clamping position to prevent the pull-off from drawing the thread backward.

The gripping-lever T is released on the extreme upward movement of the take-up lever R after a stitch has been set by the engagement of said lever with a slide V, the upper end of which engages the forward arm of said lever T and lifts the same to lower the rear gripping-arm of said lever out of contact with the stud t' . The take-up lever remains elevated, and the gripping-lever T remains released from the thread until the needle, which was rising during the stitch-tightening operation, shall have again descended to its lowest position and then partly risen and its loop has been fully expanded by the entrance of the shuttle therein, so that all of the slack thread drawn from the wax-pot by the pull-off and required for the passage of the shuttle will have passed by the forward thread-grip, and the latter will then again clamp the thread when the take-up commences its operation of setting the next stitch. It will thus be understood that the forward or take-up thread-gripping lever T will be closed against the thread when the take-up is operating to tighten a stitch and also when the pull-off is operating to draw thread from the wax-pot, and that the rear thread-gripping lever s will clamp the thread to prevent the shuttle from drawing down too much slack when the gripping-lever T is released from the thread.

The gripping-lever s is provided with a hook s^3 , extending up over the presser-foot-lifting lever L^2 , so that said gripping-lever will be raised to release the thread when the presser-foot is lifted by the operator (by means of the treadle-operated rod L^3 or otherwise) to remove the work, this being done when the needle and awl bars are above the work and when the take-up lever is in its highest position, so that the gripping-lever T is released from the thread by the slide V.

In the operation of my machine the awl first descends and is then moved horizontally, to feed the work, with the slide b' , operated by the feed-lever J, receiving its feeding movement from the cam c^5 through the rock-shaft I. While the awl was descending the thread-nippers $m m'$, carried by the lever M, moved forward and seized the needle-thread, and as the awl-bar rises and is moved backward by the feeding and clearance mechanism above described the thread-nippers swing back, carrying a loop of thread with them, this loop representing slack partly given up by the take-up and partly given up by the

needle, which begins its descent just before the awl-bar has completed its upward movement. As the needle-bar and needle move downward the thread-guide k^3 moves with them until the lug k^2 on the thread-guide bar K strikes the stop b^5 , attached to the presser-bar, at which time the eye or lower end of the needle has nearly reached the work, so that the thread, passing through the thread-guide and drawn across the path of the descending needle by the nippers, is securely maintained in the recess or eye of the needle and is by the latter forced into and through the hole in the work previously made for it by the awl. Just as the needle enters the work the roller-stud f^2 on the needle-bar engages the incline m^{13} on the lever m^{12} , and said lever now moves the arm m^7 , as hereinbefore described, to open the nippers and release the thread, so that the slack drawn out by said nippers, and which is sufficient to afford a loop of proper size for the passage of the shuttle, will be free to be drawn down by the latter at the proper time. When the needle rises after having reached its lowest point and depressed the yielding loop-spreading plunger e , the latter, under the stress of its spring, follows the needle upward for a limited distance and opens the loop which is immediately entered by the beak of the advancing shuttle, and the latter now draws down the slack needle-thread and passes through the loop, and as the needle continues its upward movement the take-up operates to tighten the stitch before the awl has closed up its clearance movement and again descends to puncture the work for the next stitch. In other words, each stitch is fully set before the awl enters the work to form the hole for the next succeeding stitch, and thus the objectionable crowding of the stock toward a stitch being tightened while the take-up is still drawing thread, which occurs in all lock-stitch wax-thread machines now in use, so far as I am aware, is avoided, such crowding of the stock toward the drawing-thread causing too much friction on the thread and requiring the use of an awl of considerably larger diameter than the needle, while in my machine, operating as just described, I am able to use an awl having the same diameter as the needle.

Although I have herein described my invention as a wax-thread sewing-machine it will be understood that it is also adapted for dry-thread sewing in leather or other heavy work, and that some features of my machine may be used independently of others in machines for heavy work.

Having thus described my invention, I claim and desire to secure by Letters Patent—

1. In a sewing-machine, the combination with an awl to perforate the work, of a needle having an eye or thread-receiving recess at its extreme end, a device cooperating with said needle to form stitches, a yielding loop-spreader movable in the same plane as the

needle and against which the end of said needle impinges, and operating mechanism for said awl, needle and cooperating device. 70

2. In a sewing-machine, the combination with a needle having an eye or thread-receiving recess at its extreme end, a complementary stitch-forming device cooperating with said needle and means for operating said device and needle, of a yielding loop-spreader movable in the same plane as the needle and against which the end of the needle impinges, and means for threading said needle at each stitch. 80

3. In a sewing-machine, the combination with a needle having an open eye at its extreme end, a shuttle, and operating mechanism for said needle and shuttle, of means for threading the said needle at each stitch, and a yielding loop-spreader movable in the same plane as the needle and against which the end of the said needle impinges, said loop-spreader following the needle in its upward or retreating movements to open the needle-loops for the entrance of the point of the shuttle. 90

4. In a sewing-machine, the combination with a needle having an open eye at its extreme end, an awl, a shuttle, and operating mechanism for said needle, awl and shuttle, of means for threading the said needle at each stitch, and a yielding loop-spreader movable in the same plane as the needle and against which the end of said needle impinges, said loop-spreader following the needle in its upward or retreating movements to open the needle-loops for the entrance of the point of the shuttle. 100

5. In a sewing-machine, the combination with an open-eyed needle, an awl and a shuttle and their operating mechanism, of means for threading the needle at each stitch, said mechanism comprising a reciprocating eye or thread-guide surrounding the needle and a loop-former engaging the thread between the needle and the work and serving to draw the thread across the path of the descending needle and hold the slack thread until the eye of the needle reaches the work, when the thread is released. 110

6. In a sewing-machine, the combination with an open-eyed needle, an awl and a shuttle and their operating mechanism, of means for threading the needle at each stitch, said mechanism comprising a reciprocating eye or thread-guide surrounding the needle and a loop-former engaging the thread between the needle and the work and serving to draw the thread across the path of the descending needle and hold the slack thread until the eye of the needle reaches the work, when the thread is released, a presser-foot and connections between the latter and said loop-former, so that the latter is operated to release the thread earlier or later according to the thickness of the work. 115

7. In a sewing-machine, the combination with an open-eyed needle and a complementary stitch-forming device, of a needle-thread-

ing and slack-thread-drawing device arranged to engage the thread between the needle and the work and draw the thread across the path of the descending needle and also take up the slack needle-thread, and a yielding loop-opener serving to spread the loops of needle-thread.

8. In a sewing-machine, the combination with an open-eyed needle and a shuttle, of means for threading the needle at each stitch and for drawing out the slack thread given up by the stitch-tightening take-up and the descending needle, and a yielding loop-opener below the work-plate against which the needle impinges and which spreads the loop for the entrance of the point of the shuttle.

9. In a lock-stitch sewing-machine, the combination with the stitch-forming mechanism thereof, of two independent stitch-setting devices placed on opposite sides of the work-plate and operating mechanism for said devices to cause them to reciprocate toward and from the work.

10. In a sewing-machine, the combination with the stitch-forming mechanism and the presser-bar and presser-foot, of a reciprocating pull-off and a resistance device connected to the said presser-bar and thus varied in position according to the thickness of the work beneath said presser-foot, said device comprising two resistance pins or parts placed on opposite sides of the path of movement of the said pull-off, so that the latter, as the thickness of the work is increased, will pull off an increased amount of thread double that of the increased thickness of the work.

11. In a sewing-machine, the combination with the work-plate thereof, of awl and needle bars both arranged above or on the same side of said work-plate, a fixed bearing in which the needle-bar reciprocates vertically, a horizontally-movable slide or bearing in which said awl-bar reciprocates vertically, operating mechanism for reciprocating said awl and needle bar, a work-feeding awl carried by said awl-bar, and operating mechanism for said horizontally-movable slide or bearing whereby a horizontal movement, in excess of the work-feeding movement, is imparted to said slide or bearing to give a suitable clearance between said awl and needle bars.

12. In a sewing-machine, the combination with the work-plate thereof, of awl and needle bars both placed above or on the same side of said work-plate, a fixed bearing in which said needle-bar reciprocates vertically, operating mechanism for said needle-bar, a work-feeding awl carried by said awl-bar, a horizontally-movable slide or bearing in which said awl-bar reciprocates vertically, feed and clearance levers suitably connected to said awl-bar, and a cam for operating each of said levers, to impart, at suitable times, independent feeding and clearance movements to said levers.

13. The combination with the needle *f* pro-

vided with an open eye or thread-receiving recess at its end, of a shuttle cooperating with said needle, operating mechanism for said needle and shuttle, and a yielding or spring-pressed plunger *e* arranged and operated so as to be in the path of movement of said needle when the latter is making the last part of its downstroke and first part of its upstroke, said plunger following said needle upward so as to throw out a loop to be engaged by the beak of the shuttle.

14. The combination with the needle *f* having an open eye or thread-receiving recess at its end, of the shuttle *E*, operating mechanism for said needle and shuttle, the carrier *e'* having a yielding connection with the shuttle-operating shaft, the spring-pressed loop-forming plunger *e* mounted in said carrier, and a stop, as *a*⁴, placed in the path of movement of said carrier and serving to arrest the same when the said plunger is in the line of movement of the needle, so that the latter will descend against said plunger which will follow the needle upward and throw out a loop for the entrance of the beak of the shuttle.

15. In a sewing-machine, the combination with the needle *f* having an open eye or thread-receiving recess at its end, the needle-bar by which said needle is carried, a thread-guide *k*³ surrounding said needle, a bar by which said thread-guide is carried and which has a frictional connection with said needle-bar, stops to limit said thread-guide bar so that it will have reciprocating movements of less extent than said needle-bar, and a loop-forming device consisting of a pair of nippers which are caused to move beneath the needle, when the latter is lifted, to seize a loop of needle-thread and are then moved backward to hold said loop in such position beneath the needle that when the latter descends the eye or thread-receiving recess of said needle will not fail to engage the thread thus held in its path of movement.

16. In a sewing-machine, the combination with the needle *f* having an open eye or thread-receiving recess at its end, a needle-bar by which said needle is carried, a shuttle cooperating with said needle, and operating mechanism for said needle and shuttle, of the lever *M* carrying a pair of nippers consisting of the jaws *m* and *m'* one of which is movable toward and from the other, and means for vibrating said lever and for operating said movable jaw so that said nippers will be caused to move forward beneath the needle in an open condition, when the needle is lifted, and then be moved backward in a closed condition, drawing a loop of thread with them, after which said jaws are opened to release said loop.

17. In a sewing-machine, the combination with the needle *f* having an open eye or thread-receiving recess at its end, a needle-bar by which said needle is carried, a shuttle cooperating with said needle and operating mechanism for said needle and shuttle, of the le-

ver M carrying a pair of nippers consisting of the jaws m and m' one of which is movable toward and from the other, and means for vibrating said lever and for operating said movable jaw so that said nippers will be caused to move forward beneath the needle in an open condition, when the needle is lifted, and then be moved backward in a closed condition, drawing a loop of thread with them, and means, controlled as to time by the vertical position of the presser-foot, whereby the said jaws will be opened to release said loop earlier or later according to the thickness of the work.

18. In a sewing-machine, the combination with the needle-bar F carrying the open-eyed needle f and provided with the stud or roller f^2 , of the thread-controlling lever M provided with the fixed jaw m , the torsionally-movable bar m^3 provided with the movable jaw m' and with the arms m^6 , m^7 , the torsional spring m^4 acting in said bar m^3 , a latch, as m^8 , arranged in the path of movement of the arm m^6 and serving to move said jaw m' away from the fixed jaw m , the presser-bar L, the collar n^2 attached to said presser-bar and having an upwardly-extending arm, the lever m^{12} pivoted to said arm and provided with an incline m^{13} arranged to be engaged by said stud or roller f^2 carried by the needle-bar, said arm m^7 being arranged to be engaged by said lever m^{12} so that when the latter is operated by said stud or roller the nippers, consisting of the jaws m and m' , will be opened to release the loop of needle-thread held thereby, and means for vibrating said lever M on its pivot to cause the said jaws to move forward beneath the needle and then backward out of the way of the needle.

19. In a sewing-machine, the combination with the needle-bar F carrying the open-eyed needle f and provided with the stud or roller f^2 , of the thread-controlling lever M provided with the fixed jaw m having at its upper end the slot m^2 , the torsionally-movable bar m^3 provided with the movable jaw m' and with the arms m^6 , m^7 , the torsional spring m^4 acting on the said bar m^3 , a latch, as m^8 , arranged in the path of movement of the arm m^6 and serving to move said jaw m' away from the fixed jaw m , the presser-bar L, the collar n^2 attached to said presser-bar and having an upwardly-extending arm, the lever m^{12} pivoted to said arm and provided with an incline m^{13} arranged to be engaged by said stud or roller f^2 carried by the needle-bar, said arm m^7 being arranged to be engaged by said lever m^{12} so that when the latter is operated by said stud or roller, the nippers, consisting of the jaws m and m' , will be opened to release the loops of needle-thread held thereby, the presser-bar G provided with the bracket g^6 carrying the stud or roller g^8 working in the said slot m^2 , and means for lifting the said presser-bar at intervals.

20. The combination with the presser-foot provided with the stitch-setting teeth o^5 , the

presser-bar by which said foot is carried, and means for lifting said presser-bar at intervals, of the lower stitch-setting device p^{13} provided with teeth p^{14} , and operating mechanism for said lower stitch-setting device whereby the same is reciprocated toward and from the work.

21. The combination with the presser-foot provided with the stitch-setting teeth o^5 , the presser-bar by which said foot is carried, and means for lifting said presser-bar at intervals, of the lower stitch-setting device p^{13} provided with teeth p^{14} , a vertically-movable sliding bar p^{11} provided with the stud p^{10} , the longitudinally-movable sliding bar p^7 having the arm p^8 provided with the inclined slot p^9 receiving said stud p^{10} , and means for reciprocating said sliding bar p^7 .

22. In a sewing-machine, the combination with the stitch-forming mechanism and the presser-bar and presser-foot, of a bracket, as v' , connected to the said presser-bar so as to be controlled in its vertical position according to the thickness of the work beneath the presser-foot, two pins or resistance devices, as v , carried by said bracket, and a reciprocating pull-off working between said pins and serving to draw more or less thread according to the thickness of the work beneath the presser-foot.

23. In a sewing-machine, the combination with a stitch-forming mechanism, of a horizontally-movable sliding head or slide b , a vertically-reciprocating awl-bar mounted in said slide and thus horizontally movable with the latter, the feed-lever J connected with said slide, the clearance-lever H connected with said feed-lever, the feeding rock-shaft I having an arm connected with said feed-lever, and cams for operating said clearance-lever and said feeding rock-shaft; whereby independent feeding and clearance movements may be imparted to said slide or sliding head b , substantially as set forth.

24. The combination with the presser-bar L, of the gripping-dog Q having a portion loosely surrounding said presser-bar and provided with the gripping lug or block q , the lever P arranged to engage said gripping-dog, operating mechanism for said lever, a block or collar q^2 also loosely surrounding the said presser-bar, the spring q' exerting a pressure on said block and said gripping-dog, and the grip-arresting plate q^3 arranged below said gripping-dog and also loosely surrounding said presser-bar.

25. The combination with the presser-bar L, of the presser-foot provided with stitch-setting teeth, the gripping-dog Q having a portion loosely surrounding said presser-bar and provided with the gripping lug or block q , of the lever P arranged to engage said gripping-dog, operating mechanism for said lever, a block or collar q^2 also loosely surrounding said presser-bar, the spring q' exerting a pressure on said block and said gripping-dog, and the grip-arresting plate q^3 arranged below said

gripping-dog and also loosely surrounding said presser-bar, said plate being vertically adjustable so that the stitch-setting blow of the presser-foot may be varied.

5 26. The combination with a bar, as L, notched to form a flattened portion, of a collar or bracket, as O, having two separated adjusting and attaching screws o^6 , and a device or presser-foot connected with said collar or bracket, and capable of being varied
10 in position, torsionally, relative to said bar, by means of said adjusting and attaching screws.

27. The combination with the presser-bar L notched to form a flattened portion, of the
15 bracket or collar O provided with two separated adjusting and attaching screws o^6 and with the arm o^3 , the presser-foot o' provided with the stitch-setting teeth o^5 and having a shank o which is to be attached to the said
20 arm o^3 .

28. The combination with the presser-bar L, of the bracket or collar O attached to said bar and provided with the arm o^3 having a groove, of the presser-foot having a shank o
25 provided with a lip o^4 entering said groove and with a horizontal slot, and the screw o^2 tapped in the said arm o^3 , and by means of which the presser-foot shank may be adjustably secured relative to said collar or bracket O.

29. In a sewing-machine, the combination 30 with the stitch-forming mechanism thereof, of a thread-gripping device consisting of a lever and a resistance-stud between which the thread runs, of a pivoted bar or plate, as t^7 ,
35 by which said stud is carried, so that the latter may adjust itself to compensate for wear or to accommodate different sizes of thread.

30. The combination with the awl-bar G provided with a slot, of a bracket or slide g^6
40 formed in two parts arranged on opposite sides of said bar opposite said slot, and the screw or bolt g^7 passing through said slot, and serving to adjustably secure said bar and said slide or bracket together.

31. The combination with the sliding head 45 or slide b provided with a slot, of the block b' arranged in said slot, and provided with the roller-stud b^8 , the screw b^2 mounted in said head and passing through said block, the feeding-lever J having a slot receiving said roller-
50 stud, and means for operating said feeding-lever.

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

CLARENCE F. SKINNER.

Witnesses:

HENRY CALVER,
JOSEPH F. JAQUITH.