5 Sheets—Sheet 1.

E. A. FORBUSH.

Sewing Machine.

No. 12,402. Patented Feb. 20, 1855.

Fig. 1

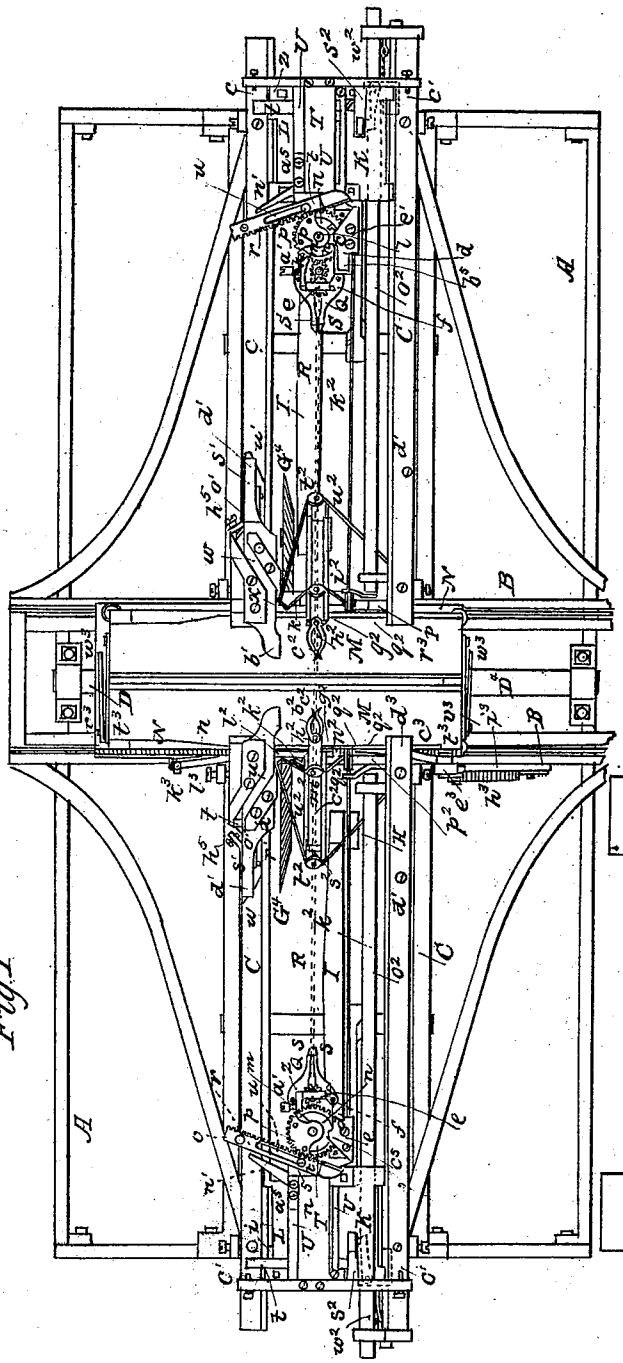
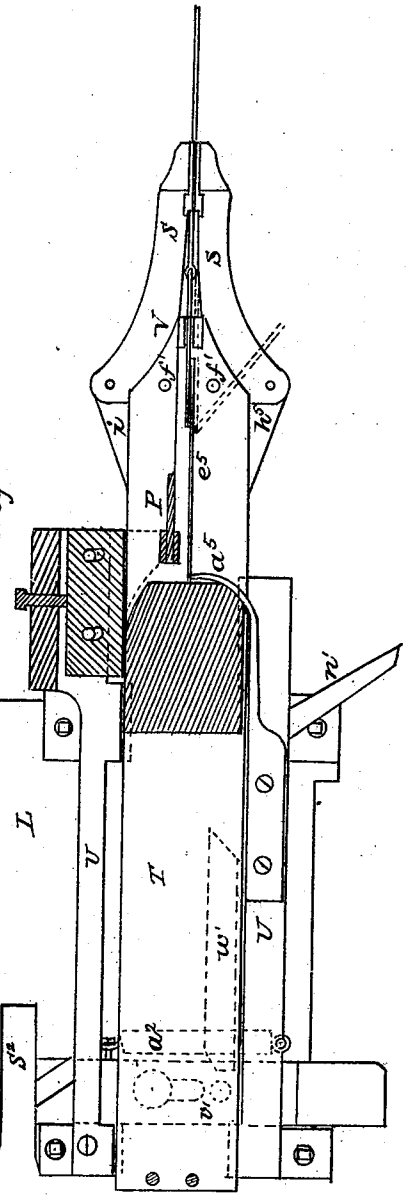


Fig. 6



E. A. FORBUSH.

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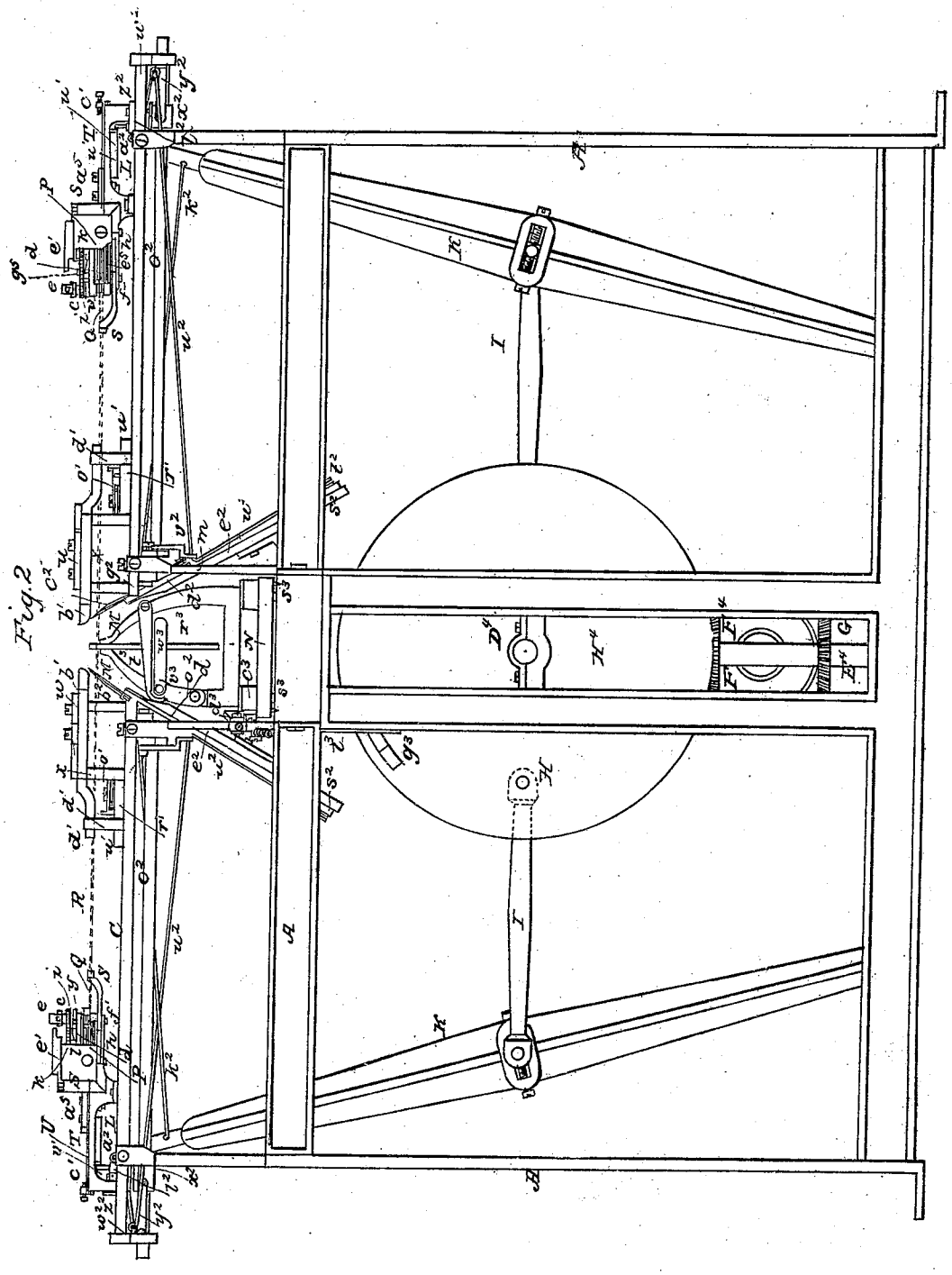
5 Sheets—Sheet 2.

No. 12,402

Patented Feb. 20, 1855.

Fig. 2



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E. A. FORBUSH.

Sewing Machine.

No. 12,402.

Patented Feb. 20, 1855.

Fig. 3

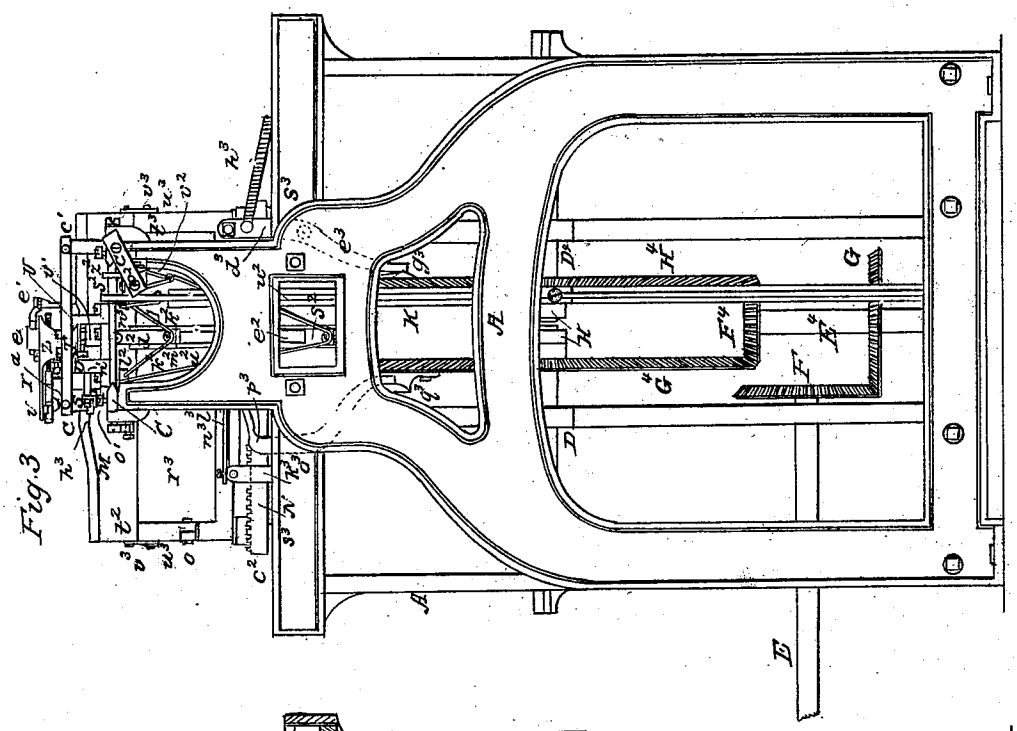
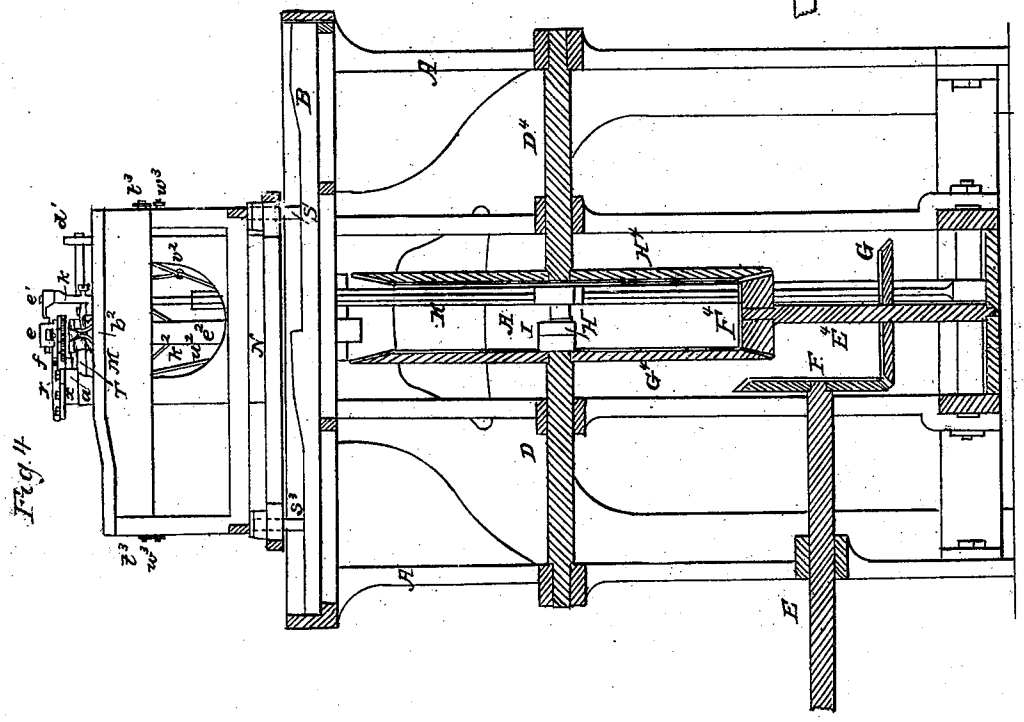


Fig. 4



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E. A. FORBUSH.

Sewing Machine.

No. 12,402. Patented Feb. 20, 1855.

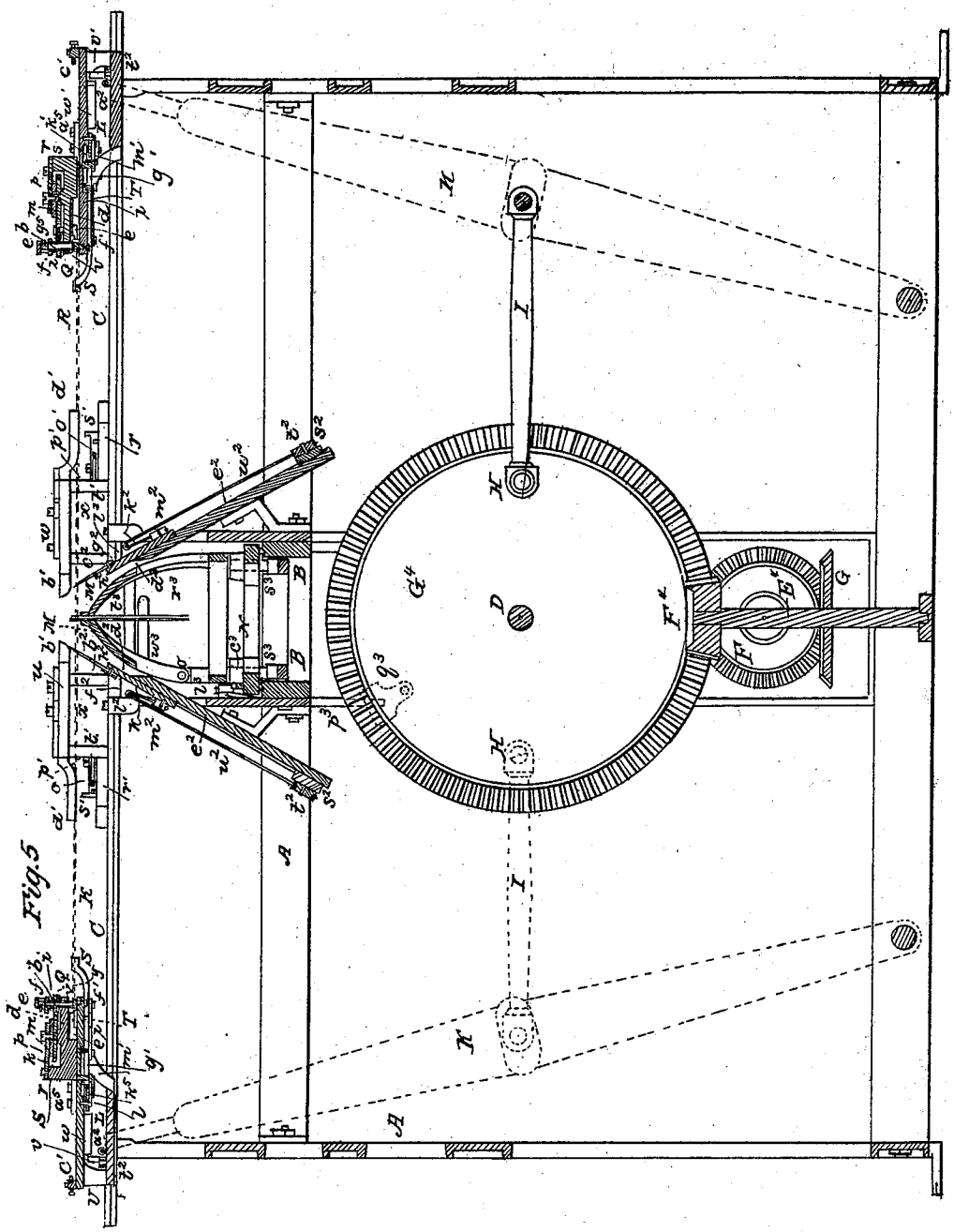

Fig. 5

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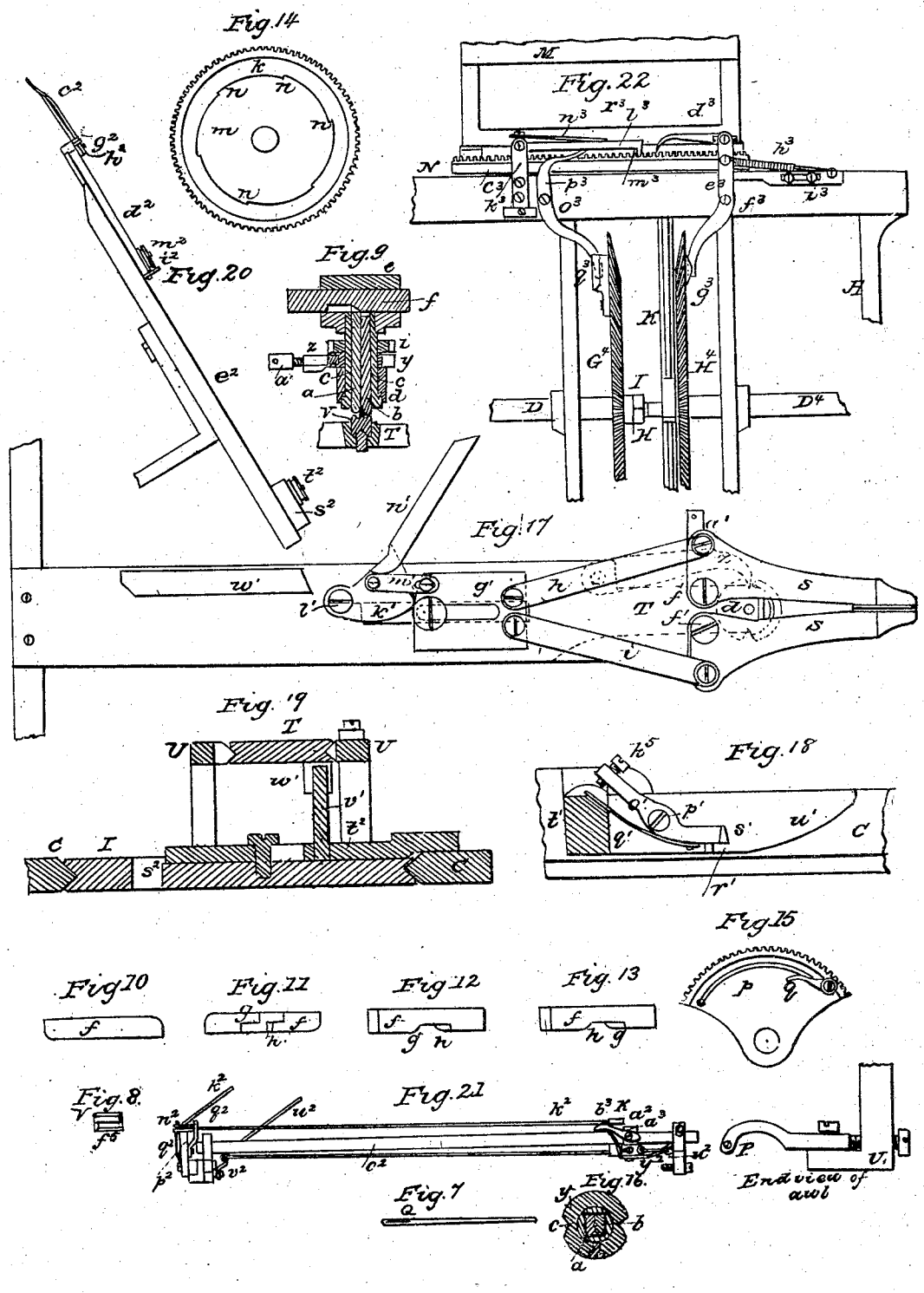
No. 12,402. Patented Feb. 20, 1855.



UNITED STATES PATENT OFFICE.

EDWIN A. FORBUSH, OF ASHLAND, MASSACHUSETTS.

IMPROVEMENT IN SEWING-MACHINES.

Specification forming part of Letters Patent No. **12,402**, dated February 20, 1855.

To all whom it may concern:

Be it known that I, EDWIN A. FORBUSH, of Ashland, in the county of Middlesex and State of Massachusetts, have invented certain new and useful Improvements in Machinery for Sewing Cloth, Leather, or other Material; and I do hereby declare that the same are fully described and represented in the following specification and the accompanying drawings, letters, figures, and references thereof.

Of the said drawings, Figure 1 represents a top view of my improved sewing-machine. Fig. 2 is a side elevation of it. Fig. 3 is an end elevation of it. Fig. 4 is a central, vertical, and transverse section of it. Fig. 5 is a vertical and longitudinal section of it. Such other figures as may be necessary to a full description and delineation of the said invention will be hereinafter more particularly referred to and described.

The main frame-work for supporting the operative parts of the machine is exhibited in the drawings at A, it being formed as therein shown, or in any other proper manner. It sustains two sets, B B and C C, of horizontal and parallel rails arranged with respect to one another, as seen in the drawings. It also sustains the main working and driving shafts D, D', and E. Said main driving-shaft E, placed as seen in the drawings, has a bevel-pinion, F, fixed upon it and made to engage with a bevel-gear, G, fixed upon an upright shaft, E', on the upper end of which is another bevel gear or pinion, F', that works into or engages with two bevel-gears, G' H', fixed, respectively, upon the main working-shafts D and D', by the above rotary motion as communicated from the driving-shaft to the main working-shafts D D' when the former is put in revolution.

On the two bevel-gears G' H' crank-pins H H are fixed, to which crank-pins connecting-rods I I are respectively jointed, these connecting-rods being also respectively jointed to two vibrating levers, K K, whose office is to operate two sliding carriages, L L, that are supported upon and move between the parallel ways C C, these two carriages being made, during the operations of the machine, to alternately move toward and away from one another.

M M are two jaws, between which the leather or articles to be sewed together are placed and held. These jaws are supported by means of a frame, N, one of the jaws being hinged to it by hinges, as seen at O, in such manner as to be capable of being moved toward and away from the other jaw. The said carriage N is supported and moves upon the rails or ways B B. The machinery for moving the carriage N will be hereinafter described.

To each of the carriages L there is affixed an awl, P. (See Figs. 2 and 6, the latter figure being a horizontal section of one of the carriages L, taken through the awl.) The two awls are arranged so that when they pass through the leather or article to be stitched they shall be at a distance apart from one another the length of a stitch. In the formation of each stitch-hole through the article to be sewed the two awls are employed, one of them being first passed through it in one direction, the other being next forced through it in the opposite direction. Thus the hole is rendered smoother and more open for the reception of the threads or needles than it would be were it made but by one awl. Two needles, Q Q, are used in sewing with this machine, they being of the ordinary kind of sewing-needle, the eye of which is placed at one end, while the point is arranged at the other end of it, as seen in Fig. 7, which represents a side view of such needle. The threads proceeding from the work or article to be sewed, respectively, to and through the eyes of the needles are seen at R R. In being drawn through the work these threads are pulled through it by the action of two sets of jaws or pinchers, S S, which, after the needles have passed through the work and drawn the threads through it a short distance, seize such threads between their respective needles and the work and draw the threads through and into the work. Each of the carriages L L supports what may be termed a "needle-carriage," T, which moves horizontally between parallel rails or ways U U, elevated upon said carriage L.

On the inner end of each carriage T there is a small rotary pin or bearer, V, which is made to rotate horizontally. A top view of the head of this bearer is represented in Fig. 8. The object of the said bearer is to support the needle which lies upon the top of it, and is held down upon it by means of one of two vertical sliding clamps, *a b*, (see Fig. 9,) which

is a cross-section of the two clamps and machinery over and around them. Each set of these two clamps, if placed within one of two vertical shafts, *c c*, which are supported by and made to move or rotate freely in a horizontal direction within a horizontal arm, *d*, that projects from the carriage T.

I would here take occasion to remark that as the mechanism which is supported upon one of the carriages L, and is for operating the needles and the thread-pinchers, is essentially like that which is supported on the other carriage L, it will be only necessary for me to describe such machinery as applied to one of the said carriages.

The vertical shaft *c* carries a small block of metal or frame, *e*, upon its upper end. A cam-slide, *f*, slides horizontally through said block *e*. A top view of this slide is given in Fig. 10, a bottom view of it in Fig 11, and side views of it in Figs. 12 and 13. It is formed with cams or inclined planes *g h*, which actuate the clamps *a b*. While the slide is moved in either direction through the frame *e*, one of its inclined planes forces downward one of the clamps, while the other inclined plane is so moved as to release the other clamp or allow it freely to rise upward.

There is fixed on the shaft *c* a pinion-gear, *i*, which is made on one side of the machine to directly engage with a horizontal gear, *k*, that rotates freely on a stationary journal, *l*, raised upon the arm *d*. On the other side of the machine the engagement is effected by an intermediate gear, g^5.

Fixed on the top surface of the horizontal gear *k* is a wheel, *m*, which is formed with teeth, as seen at *n n n*, &c., in Fig. 14, which represents a top view of the said wheel *m* and the gear-wheel. There is also a toothed gear-wheel or sector, *p*, placed and made to rotate freely upon the journal *l*. This sector is formed as represented in Figs. 1 and 15, the latter of which is an under side view of it, and exhibits a small spring catch or pawl, *q*, as applied to the said under side, and made to work against the periphery and teeth of the wheel *m*. This toothed sector *p* is operated or moved horizontally by a sliding toothed rack, *r*, that is arranged as seen in Figs. 1 and 5, and supported upon a projection, *s*, of the carriage T. This rack is made to move on the top of said projection *s*, and is held to said projection by means of a screw, *t*, which is screwed into the projection and passes through a long slot, *u*, made through the rack, as seen in the drawings. There is a small stud, *v*, that projects down from the under side of the rack, near one end of it. When the carriage L is moved forward toward the work, this stud passes into a cam-groove or passage, *w*, which is formed on the top of a frame, *x*, that is applied to and fixed on top of one of the rails C in a position as seen in Figs. 1, 2, and 5. While passing through such groove the rack *r* is forced inward, so as to turn the sector *p*. This will carry the small click or pawl of said sector against one of the teeth of the wheel *m*, and will thereby cause such wheel to be rotated, so as to produce a rotation of the gear *k*. This of course will effect a rotation of the pinion which engages with the wheel *k*, whereby the shaft on which said pinion is situated will be rotated one hundred and eighty degrees of a circle, so as to turn the needle around and present its point in an opposite direction. During the retreat of the carriage L, or its departure from the work, the stud of the rack *r* passes back through the inclined cam-passage on the frame *x*, and thereby produces a movement of the rack *r* in an opposite direction, whereby the click or pawl of the toothed sector *p* will be made to slide over the circumference of the wheel *m*, and far enough to act against one of the two teeth, or the tooth next succeeding that tooth of it against which the pawl before acted.

Directly underneath the pinion-gear, on the shaft *c*, there is fixed on said shaft a catch-gear, *y*, the form of which is represented in Fig. 16, said catch-gear being provided with two depressions or notches, as represented in said figure, one on each side of it. A locking-pawl, *z*, is applied to the arm *d*, which locking-pawl has a projection or screw, *a'*, extended from it, which projection, just before the needle is passed into the awl-hole, is carried into contact with a projecting part or cam, *b'*, of the frame *x*. This cam presses the locking-pawl *z* into one of the notches of the catch-gear *y*, so as to hold the needle-shaft or needle firmly in position for the needle to enter the work. During the advance of the carriages L L toward one another the needles are turned around and presented with their points toward the work, and made to pass through one of the awl-holes previously made. This done, the carriages T T are stopped from further movements toward one another, said stopping of them being effected by projections *c' c'* from them being brought into contact with projections *d' d'* from the bars or rails C, as seen in the drawings. After the movements of the carriages T T toward one another thus cease, the carriages L L continue to advance toward one another until the awls pass through the work. While doing this cams, *e' e'*, fixed to each of the said carriages L, as seen in the drawings, are moved, respectively, against the ends of the two cam-slides *f*, and move said slides so as to cause the needles to be relieved from the pressure of the two clamps which previously held them, and to be grasped or seized at their points by the other two clamps, so that during the next retreating or back movement of the carriages T T said needles will be drawn in opposite directions through the cloth or work. After they have each been drawn a short distance through the work, the jaws of each set of thread nippers or pinchers S S are moved together and made to grasp or seize the thread and hold upon it firmly, so as to draw it into the work during the back movement of their carriage T.

It should be mentioned that the needles, before they are seized and drawn through the work, are propelled forward, respectively, by two propellers, a^5 a^5, one of which is fixed to each carriage L, or to the top of one of the rails thereof, which supports its carriage T. The form of this propeller is shown in Fig. 6, wherein its front end is seen as extending in rear of the needle and bearing against a vertical plate, e^5, raised on the carriage T.

It should be also mentioned that the cam e' is formed with inclines b^5 c^5 and an intermediate straight surface, d^5, so that just previous to the forward propulsion of the needle the needle may be relieved from the pressure of the clamp which held it, and after it has been driven through the work, the other clamp may be brought down upon the point of the other needle, which has been forced under it. Thus it will be seen that just previous to the forward movement of the needle produced by the propellers when said propellers are moved forward by their respective carriages L L, both needles will be unclamped from all the clamps, and will remain so unclamped while they are propelled into and through the work; also, that after they have passed through the work they will be seized by the proper clamps and drawn through the work when the carriages L and T are next moved backward. On the top of the bearer V there is a small partition or plate, f^5, which rises up a short distance between the clamps a b. It serves to prevent the needles from moving from one clamp to and under the other clamp.

Fig. 17 represents an under side view of the carriage T and the machinery for operating the pinchers. The said pinchers consist of two levers, S S, formed as represented in the drawings, and made to work, respectively, on two fulcra or screw-pins, f' f', inserted in the under side of the carriage T. These levers are connected with a small slide, g', by means of two connecting-rods h' i', and so that when said carriage is moved in a direction toward the work or article to be sewed the pinchers will be so operated as to cause their jaws to be forced toward one another. This slide g' is attached to and slides in the under side of the carriage T. It is thrown forward by means of a cam, k', that turns upon a screw-pin, l', inserted in the under side of the carriage T. It is drawn backward by a connecting-rod, m', which connects the cam with the slide, and is jointed to both. From the cam an arm, n', extends outward, as seen in the drawings. This arm works in connection with a spring-lever, o', which is formed and arranged as seen in the drawings, and turns on a fulcrum, p', inserted in the rail C. The said lever is more particularly shown in Fig. 18, which represents a top view of it and that part of the rail on which it rests. A spring, q', is so applied to the rail C and the lever as to force said lever against a small stud or pin, r', which is made to project upward from the rail C. The lever has not only a projection or stud, s', rising from its inner end, but it has a stop-screw, h^5, inserted through its outer end, which stop-screw, when the lever is turned on its fulcrum far enough, brings up against a stationary shoulder, t'. Now, while the carriage T moves forward the arm of the cam e' will be carried into contact with the projection s', so as to cause said cam to be turned on its pin in such manner as to draw back the slide f, and thereby open the jaws of the pinchers, so to allow of the needles passing into and through the work. When the jaws have been entirely opened, the outer end of the said arm will pass by the projection of the lever, so as to allow said projection to spring inward toward the carriage T until the arm of the lever to which it is attached strikes against the small pin or stud r'. During the next retreating or back movement of the carriage T the end of the said arm is brought against the front side of the stud of the lever, whereby the arm will be moved and its cam so turned as to cause the jaws of the pinchers to approach one another and close upon the thread. Another, or what may be termed the "particular," object of the stop-screw p^5 is to regulate the pressure or grasp of the pinchers upon the thread, which grasp may be increased or diminished by a suitable adjustment of the inner end of the stop-screw. The upper ends of the arms K K, when acting against the carriages L L, respectively extend into notches or recesses S^2, made in each carriage, as seen in Fig. 1. Just previous to the extent of forward motion of the two carriages being produced, a locking spring-bolt, t', applied to each carriage L, is met by a cam, u', and driven forward over the notch of the carriage and in rear of its vibrating bar or arm K. This takes place, however, just before a pin or stud, v', that projects upward from the spring-bolt, meets and passes by the end of a ledge or projection, w', that is made longitudinally on the under side of the carriage T. This ledge and the said stud or projection are shown in Figs. 17 and 19, the latter of which represents a cross-section taken through the carriages T and L and through the bolt and its projection. When the carriage T ceases its forward motion, the carriage L continues to move forward, the stud or pin of the spring-bolt in the meantime being slid along the side of the said ledge, projecting down from the under side of the carriage T. During the next back motion of each rod K it bears against the spring-bolt and forces the carriage L, and of course the carriage T, which rests thereon, backward on the rails C C. While this is taking place, the pinchers close upon their thread and draw it through the work, the carriage T being held to the carriage L with friction sufficient to enable the pinchers to draw the thread through and into its hole in the work. For this purpose a clamp-screw and nut are so applied to the supporting frame or rails of the carriage T as to enable a person to compress them with more or less force upon the carriage T, so as to make it slide in its supports with the degree of fric-

tion required for the draft of the thread through and into the work. As soon as the thread is drawn tightly into the work, the backward movement of the carriage T will be arrested by the thread. The carriage L, however, continues to move or be moved until the stud v' of the spring-bolt passes beyond the rear end of the ledge w'. On this taking place, the spring-bolt will be released, so that it can be thrown backward by its spring a^2 and away from the rear of the arm K, or from over the recess of the carriage L, in which the arm is. As soon as the spring-bolt has so acted, the rearward motion of the carriage L ceases, and this because the spring-bolt is moved away from the arm K. The arm K, however, continues to move back to the extent of its motion, and, having completed the same, is again brought forward to impart a forward motion to the carriage L, as before described.

From the above it will be seen how the machinery is made to operate under the constantly-decreasing length of each thread as it is sewed into the work or cloth, for as soon as the thread is drawn into the work, whatever may be the length of said thread between the pinchers and the work, the backward motion of the carriage T will be stopped or arrested as soon as such length is drawn tight by the pinchers. On the occurrence of this the carriage L continues its motion a little farther, or far enough to release the stud of the spring-bolt from the edge w', so as to free the said bolt from the pressure of the arm K. It will therefore be seen that the combining with the nippers and the vibrating arm K the carriages L and T, the spring-bolt apparatus, and the cam and contrivances for operating the spring-bolt, as before set forth, constitutes one particular part of my invention, the object of the same being not only to draw the thread into the work with sufficient tension, but to do so under any change in the length of it.

We now come to the description of the mechanism for taking up the slack of the thread, and thereby preventing the entanglement of the thread while the carriages L and T are being moved forward toward the work. For this purpose I shall describe such machinery as applied to one of the threads only, that on the other side of the machine, or as applied to other thread, being substantially like it, as will be seen by representation of it in the drawings.

Two spring-nippers, b^2 c^2, formed as seen in Fig. 20, (said Fig. 20 being a side view of these nippers, their slide, and the inclined bar in which said slide moves,) are affixed to the upper end of a slide, d^2, which is made to slide freely up and down on a long inclined plane or bar, e^2, arranged as seen in the drawings. The said nippers are provided with springs f^2 g^2, by which their upper ends are forced toward one another, the nippers being made to turn freely on a screw-pin, h^2, which connects them with their slide-bar. On the lower end of the said slide-bar is a small pulley, m^2, which rotates freely on a pin, i^2, inserted in the slide-bar. One end of a cord, k^2, is fastened to a projection, l^2, of the frame-work, said projection being arranged as seen in the drawings. From the said projection the cord extends downward under the pulley m^2, thence upward around and over a guide-pulley, n^2, arranged as seen in Figs. 1 and 21, the latter figure being a representation of the last-named pulley, a long rod, o^2, and sundry parts connected therewith or adjacent thereto, and to be hereinafter described. The pulley n^2 is applied on the end of an arm, p^2, that projects from the main frame-work and supports two guides, q^2 q^2, for the cord to pass through previous to and after its passage around the pulley n^2. The other end of the said cord is attached to the upper end of the vibrating arm K. As the vibrating arm moves back, it will draw on the thread, so as to elevate the spring-nippers and cause them to pass up and receive the thread between them, when said thread is drawn out to its extreme tension. The pressure of the nippers against the thread under such circumstances causes them to open and receive the thread in the open space r^2 between them. This being done, at the next advance forward of the arm K or the carriages T and L, the nippers and their slide will fall by the action of gravity and carry the thread with them, so as to prevent it from being entangled. When the thread is drawn through the work, it will be pulled out of the nippers by the power which draws it through the work.

In order to prevent the weight of the pinchers and their slide from being thrown upon the thread, so as to break the needle or displace it while the needle is being turned about one hundred and eighty degrees, as hereinbefore set forth, I make use of or employ a mechanism which I shall now proceed to describe. There is a small sliding carriage, s^2, placed below the nipper carriage or slide, and made to slide freely up and down on the inclined bar e^2. This carriage has a pulley, t^2, affixed to it, under which a cord, w^2, passes. One end of this cord is fixed to the projection l^2. The cord, after passing down and around the pulley t^2, is carried toward and through the eye of a guide, v^2, and thence horizontally, or thereabout, to and through another guide, w^2, arranged as seen in the drawings. Thence the cord is carried up and fastened to a small carriage, x^2, that slides upon the long stationary horizontal rod o^2, which is disposed as seen in the drawings.

From one side of the carriage x^2 a spring, y^2, is made to extend and to press against the rod o^2, so as to make the carriage slide on the rod with the degree of friction required.

In order to prevent the carriage from turning around on the rod, any suitable means may be adopted. On the top of this carriage there is not only a projection, z^2, but there is a spring-catch, a^3, which spring-catch is formed as seen in Figs. 1 and 21. Now, while the arm k retreats or goes backward it strikes against

the front end of the spring-catch and moves said spring-catch, so as to enable the arm to slip by it. When the arm next advances in a direction toward the work, it strikes against a shoulder, b^3, of the spring-catch and bears against said shoulder, so as to move the carriage x^2 forward or toward the carriage L until the projection z^2 strikes against the carriage L, whatever may be the position of said carriage L, or whatever may be its distance from the work. Immediately on said projection striking the carriage the further advance of the arm k will cause the spring-catch to be disengaged from such arm. By the movement of the carriage x^2 in the manner before described, such a draft on the cord attached to it is produced as will elevate the carriage or slide s^2 up to a suitable position for the upper slide to rest upon it, so as to relieve the thread from any downward pressure of the upper slide.

We next come to a description of the machinery by which the carriage N is moved on its supporting-rails B B with an intermittent movement during the operation of making the stitches, and in order that the awls may puncture the work in a proper manner for the formation of the stitches. For this purpose it is provided with a rack, c^3, which has the same number of teeth to the inch in length as there are stitches to be sewed to an inch of length of the work. Into this rack an impelling-pawl, d^3, operates, the said impelling-pawl being jointed to the top or upper end of the upper arm of a lever, e^3, that moves upon a fulcrum, f^3, all arranged as seen in the drawings. The vibratory motion of this lever on its fulcrum is produced by a cam, g^3, (fixed upon the side of the bevel-gear H^4,) and a spring, h^3, connecting the upper arm of the lever with the rail B. The extent of backward movement of the impelling-pawl is regulated by a stop, i^3, affixed to the side of the rail B, said stop being made adjustable. During the revolution of the bevel-gear H^4 the cam g^3 will be moved against the lower arm of the lever to which the impelling-pawl is jointed, and will so move said lever and impelling-pawl as to produce a movement of the carriage N on the rails B B. Now, as such movement may not always be exactly in accordance with the distance required to enable the needles to pass into the awl-hole that is to receive them, I have applied to the machine a mechanism which regulates such movement of the carriage N in such manner as to insure to the awl-hole its correct position for the reception of the two needles. In Fig. 22 I have represented a side view of the rail B, the apparatus which propels the carriage N, together with the apparatus for insuring the correct position of the awl-hole, as above specified. There is affixed to the rail B a standard, k^3, which has jointed to its upper end a pawl, l^3, that extends directly over the rack of the carriage N. The inner end of said pawl has a tooth, m^3, affixed to it, which tooth is made to exactly fit the space between any two teeth of the rack that are next adjacent to one another. A powerful spring, n^3, is affixed to the top of the standard k^3, and made to press downward on the pawl l^3 with a force sufficient to press its tooth between two of the teeth of the rack, so as to move the carriage N, as hereinafter described.

Underneath the pawl, and working on a fulcrum or pin, o^3, is a lever, p^3, whose upper end is bent, and extends as seen in Fig. 22. The lower arm of said lever is moved in a direction toward the middle of the machine, or inward, by a cam, q^3, fixed upon the surface or side of the bevel-gear G^4. During the revolution of the said bevel-gear, and just at the time the carriage N is being moved by its impelling-pawl, the lever p^3 is moved by the cam q^3, so as to lift the catch-pawl l^3 above the rack and allow it to drop down upon the rack instantly after the impelling-pawl has effected a movement of the carriage N. The downward pressure of the catch-pawl upon the rack will bring the carriage N into its correct position, should it have been moved either not quite far enough or too far by the impelling-pawl. The jaw-frame r^3, or the frame that carries the jaws M M, rests on the frame N, and has four pins, s^3 s^3 s^3 s^3, extending down from it and passing some distance through the frame N. Two of these pins s^3 s^3 on each side of the frame r^3 are made to rest on one of two guideways or rails, which are applied to the inner sides of the rails B, and are suitably curved on their upper surfaces or ledges, so as to elevate the jaws with respect to the needles, so that such needles shall pass into the work whatever may be the line of sewing, whether such be a straight or curved line.

In the drawings it will be seen that I have represented the jaws M M as formed on their edges in a suitable shape for sewing the side seam of a boot-leg. Now, if the pins s^3 s^3 of the jaw-frame are made to slide on curved rails or ways, as described, the sewing may be done on a line which is partly straight and partly curved, or entirely curved, as circumstances may require. In general the curves of the upper surface of these rails will be the reverse of that of the line of sewing or top edges of the jaws M M. On the ends of these jaws I have represented a clamp-hook, t^3, operating in connection with a cam, u^3, which turns on a pin, v^3, and is turned by a lever, w^3, the same being for the purpose of drawing or forcing one of the jaws toward the other. I do not, however, confine my invention to any such contrivance for such purpose, as there are many others which may be used for the same object with as good or better advantage; nor do I confine my invention to the precise form or forms of its parts as represented in the drawings, as I intend to vary the same in any manner and to any extent as circumstances may require, so long as I do not change the principle of those parts thereof which I claim as new.

Although I have above represented in my machine that the sewing is to be done with

two threads passed through each stitch-hole in opposite directions at the same time, yet my machine can easily be used to perform the sewing with but one thread without any alteration in the principles claimed.

I would remark that I do not lay claim to any method of drawing the thread through the work by seizing the needle by a pair of pinchers and performing the whole operation of drawing the thread close into the work by draft on the said needle; nor do I claim a mode of drawing the thread into the work by means of a tripping-roller moved by an endless chain; but

What I do claim as my invention is—

1. The combining with the carriage T the clamps *a b* and bearer V, or mechanism which draws the needles through the work, a set of pinchers, S S, made to firmly grasp the thread between the needle and the work, and to be so moved away from the work as to draw the thread firmly into it, as above specified.

2. In combination with the said machinery for holding the needle and drawing it through the cloth or work, machinery or mechanism—viz., the rotary shaft *c*, the clamps *a b*, and the bearer V, operated as described, or their equivalents—for rotating the needle or turning or rotating it around one hundred and eighty degrees, or end for end, as above specified, such mechanism allowing me to make use of a common or ordinary needle made with one eye and but one point, as described.

3. The combining with the nippers S S and the vibrating arm K the carriages L and T, the spring-bolt, and contrivances for operating it, as set forth, the same being not only to draw the thread into the work with sufficient tension, but to do so under any change in the length of it, essentially as specified.

4. The combination of the rotating bearer V, the two needle-clamps *a b*, and the vertical rotary shaft *c*, as operating together, or operated substantially as above described, and for the purpose of holding, releasing, and reversing the needle or turning it around, substantially as above set forth.

5. Combining with the rotary bearer V and its clamps and shaft *c*, or machinery for holding, releasing, and directing a needle into the work, a propeller, a^2, operated or made to operate substantially in manner, and so as to force the needle into the work, as specified.

6. Combining with the spring-nippers b^2 c^2, or machinery for taking up the slack of the thread and preventing entanglement of the thread while the carriages are being moved toward the work, the sliding carriage s^2, or mechanism operating, as described, for preventing the weight of the said spring-nippers b^2 c^2 and their slide d^2 from being thrown upon the thread, so as to break the needle or displace it while it is being turned around, as hereinbefore set forth.

EDWIN A. FORBUSH.

Witnesses:
R. H. EDDY,
JOHN NOBLE.