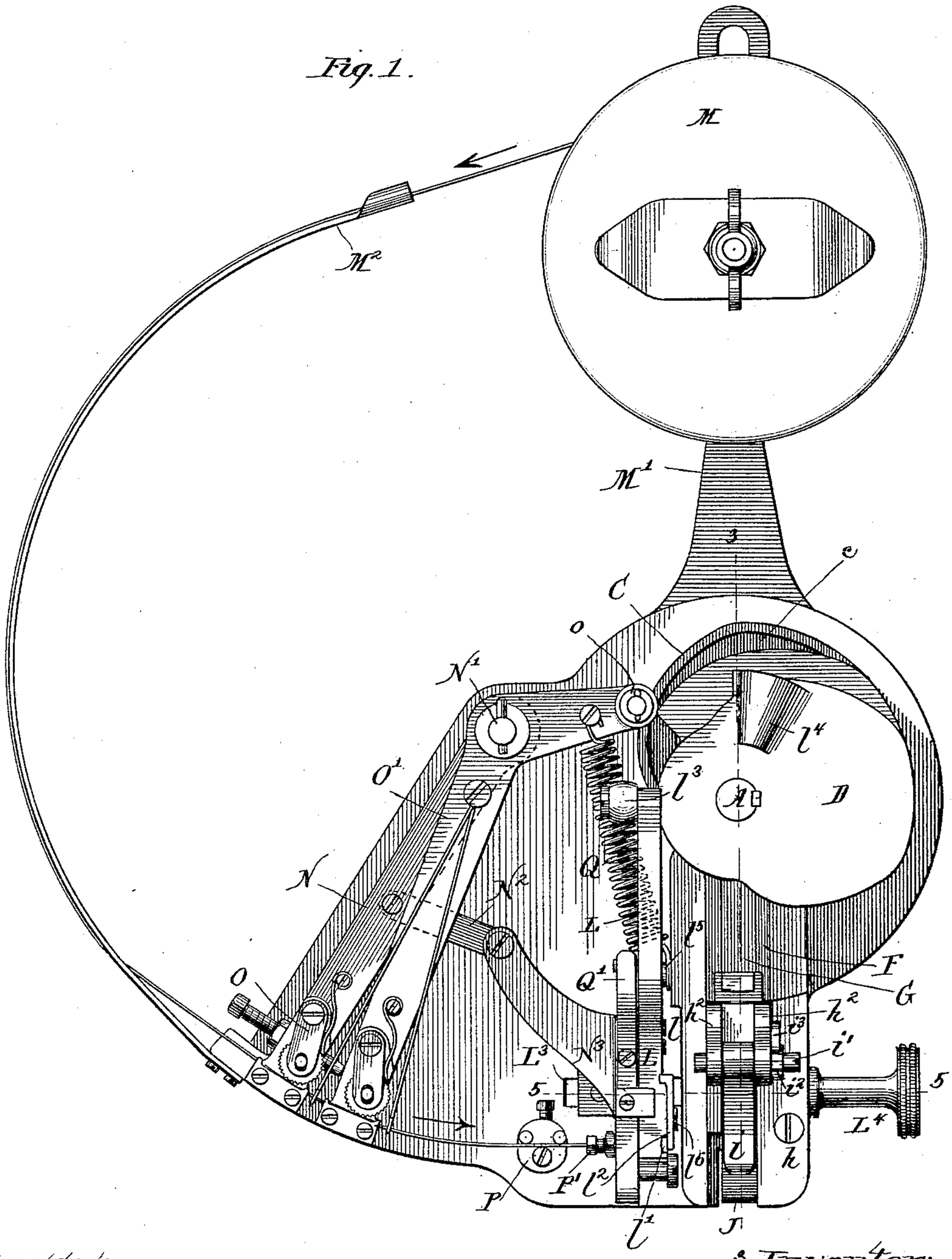
(No Model.) 3 Sheets—Sheet 1.

W. E. HARPER.

WIRE STAPLING MACHINE.

No. 445,139. Patented Jan. 20, 1891.

Fig. 1.



Witnesses:
Wm. M. Rheem.
Fred Gerlach.

Inventor:
William E. Harper
By Elliott & Ormsby
Attorneys.

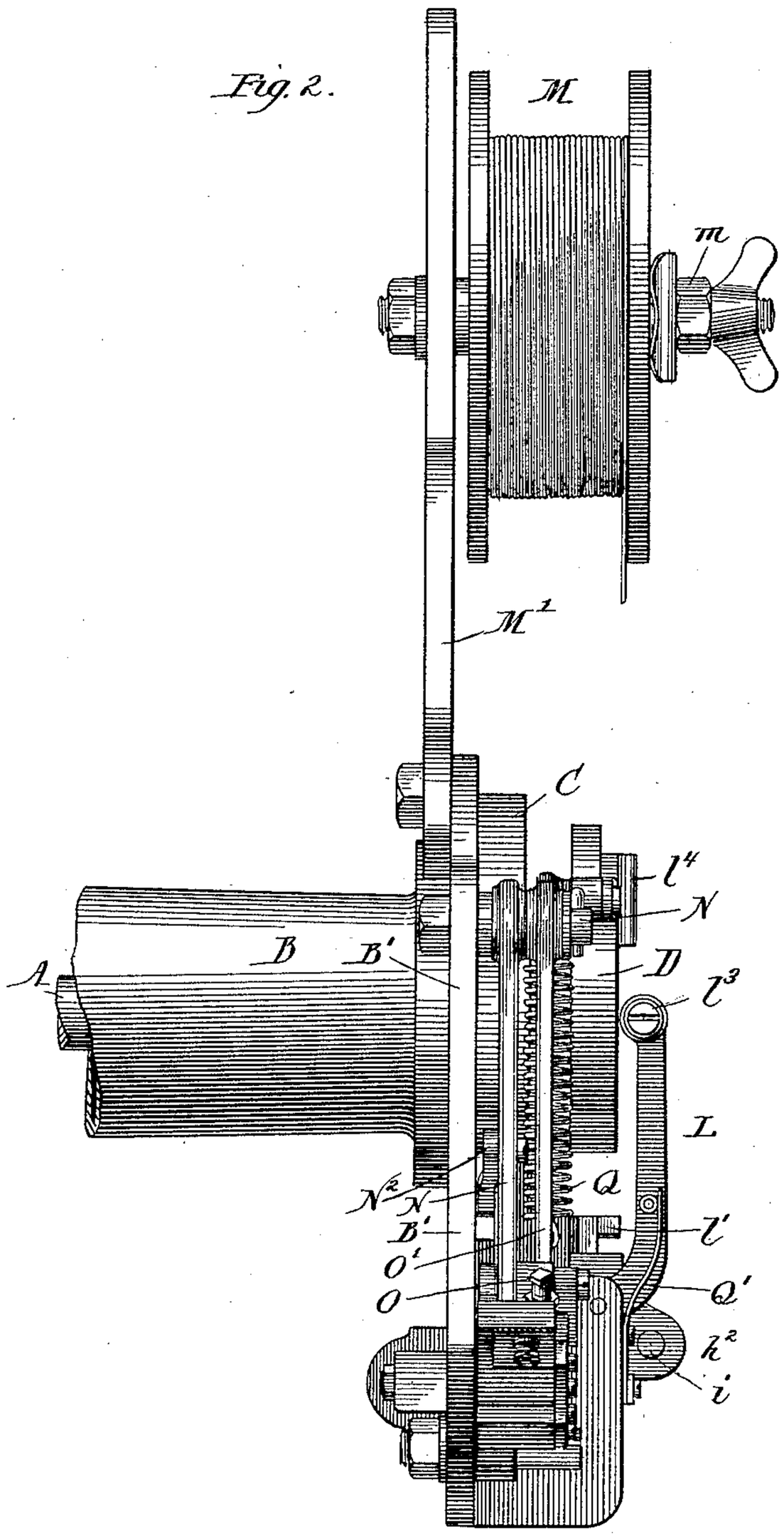
(No Model.) 3 Sheets—Sheet 2.

W. E. HARPER.

WIRE STAPLING MACHINE.

No. 445,139. Patented Jan. 20, 1891.

Fig. 2.



Witnesses:
Wm. M. Rheem.
Fred. Gerlach.

Inventor:
William E. Harper
By Elliott & Ornhundro
Attorneys.

(No Model.) 3 Sheets—Sheet 3.

W. E. HARPER.

WIRE STAPLING MACHINE.

No. 445,139. Patented Jan. 20, 1891.

Fig. 3.

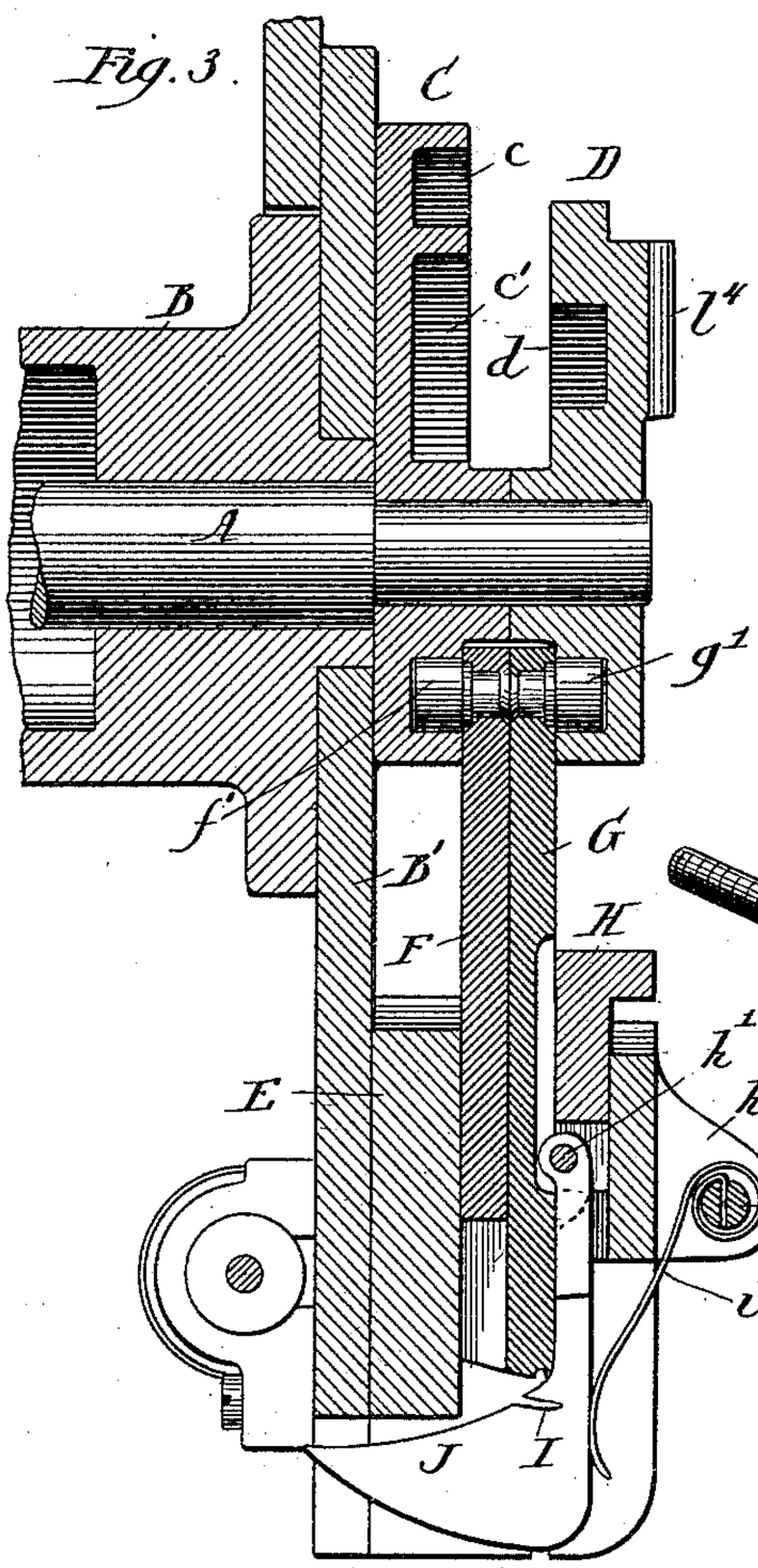


Fig. 4.

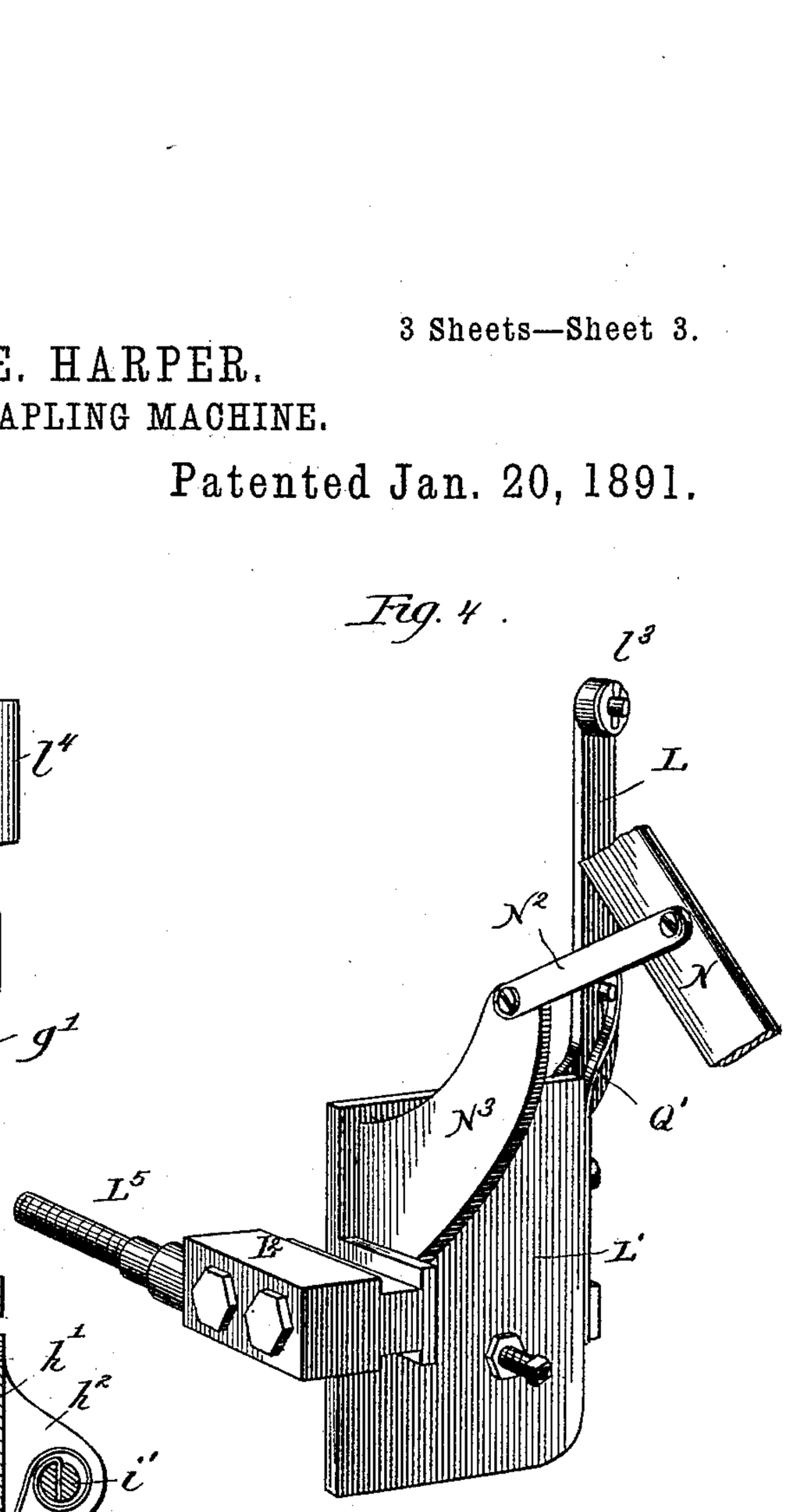
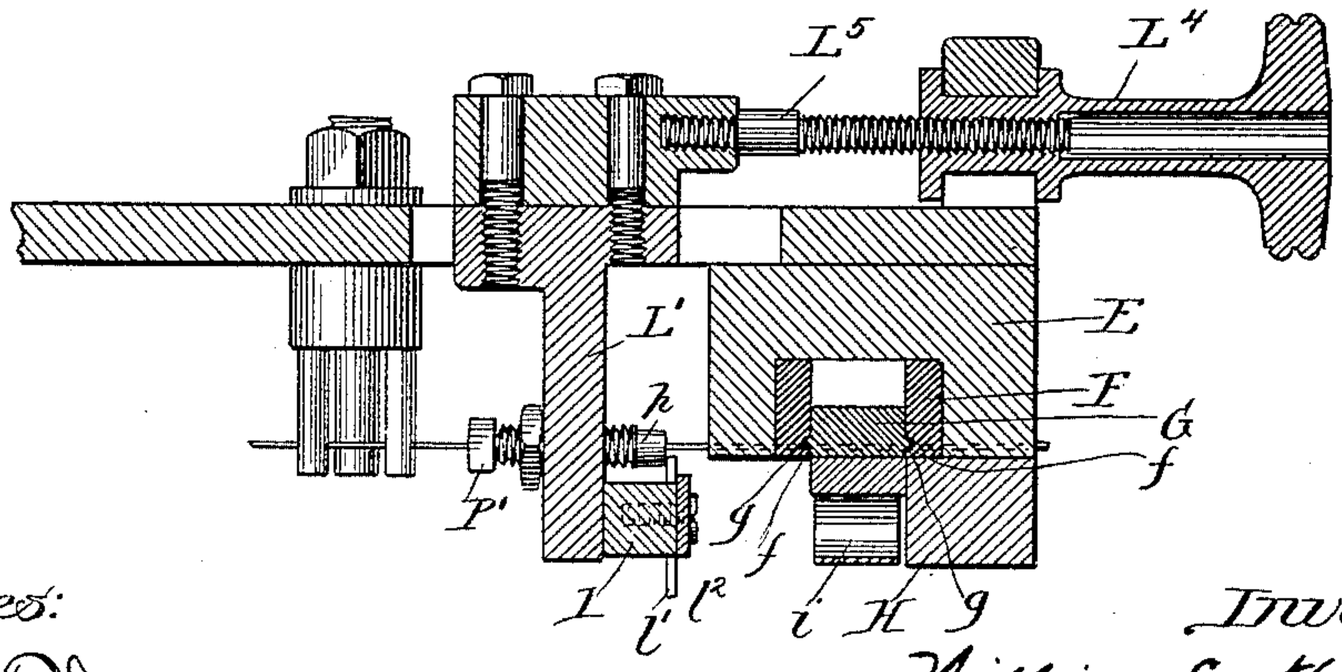


Fig. 5



Witnesses:

Wm. M. Rheem.

Fred Gerlach.

Inventor:

William E. Harper

By Elliott & Cornhumber

Attorneys.

UNITED STATES PATENT OFFICE.

WILLIAM E. HARPER, OF CHICAGO, ILLINOIS.

WIRE-STAPLING MACHINE.

SPECIFICATION forming part of Letters Patent No. 445,139, dated January 20, 1891.

Application filed January 30, 1890. Serial No. 338,558. (No model.) Patented in England August 9, 1886, No. 10,145, and in Germany May 8, 1888, No. 44,976.

To all whom it may concern:

Be it known that I, WILLIAM E. HARPER, a citizen of the United States, residing in the city of Chicago, in the county of Cook, State of Illinois, have invented certain new and useful Improvements in Wire-Stapling Machines for Books and Pamphlets, (for which I have obtained a patent in Germany, No. 44,976, bearing date May 8, 1888, and in Great Britain, No. 10,145, bearing date August 9, 1886,) of which the following is a specification.

My invention relates to improvements in wire-stapling machines for books and pamphlets in which wire supplied from a reel is severed into proper lengths for the size of the staple, then bent to form, then driven through the book or pamphlet to be stapled while its legs are boxed between the bender and a supporter, and finally clinched upon the under side of said book or pamphlet, these several operations being performed automatically, consecutively, and by continuous operation of the machine. In this class of machines it is necessary for the successful driving of a staple that both of its legs should be of uniform length, for otherwise one side of the staple is subject to greater resistance in driving it through the material to be stapled, and, furthermore, the work is not neatly finished unless the clinched ends of the staple are practically of the same length.

Before my invention in adjusting these machines for a staple of any particular length the adjusting devices for this purpose have required that the feeding-levers and head-block shall be separately adjusted for this purpose, and as a result considerable manipulation is invariably necessary back and forth before any adjustment resulting in staple-legs of uniform length can be or is secured.

One object of my invention is to have such a connection between the feeding-lever and the head-block that both may be adjusted simultaneously, uniformly, and by means of single thumb-screw or other manipulating devices, whereby a uniform length of staple-legs is not only insured, but any possibility of having said legs of different lengths is wholly avoided. In the prior constructions referred to the anvil over which the staple is formed has invariably been a sliding piece of metal and the supporter (for preventing the inward cripple of the legs) either an incline projecting beyond the end of the anvil proper or a separate hinged piece arranged opposite the anvil. In the constructions in which the supporter is an inclined piece projecting beyond the anvil the said anvil and supporter, and particularly the anvil, has been actuated, and necessarily actuated, by a lever connection with a cam on the power-shaft, and in the constructions in which the anvil and supporter have consisted in separate pieces the anvil has been actuated and in advance of the actuation of the supporter, and such construction not only requires the formation of two separate pieces, but other complications in the machine, which it is desirable to avoid.

The further object of my invention is therefore to have the anvil and the supporter constructed of a single piece and both of these elements simultaneously actuated by the direct action of the driver alone.

The cutter for severing the wire into proper lengths has heretofore consisted of a slide-bar having one end terminating in a cutting-edge and actuated from at or near its other end by an engagement with a cam, this cam action producing uniform length of stroke of the cutter, and there being no provision for the adjustment of the cutting-edge the result is the wire is severed too soon, or if of the proper length the wearing away of the cutter prevents it cutting the wire soon enough. Furthermore, cutters of this character operating as they do by a direct cut produce a ragged edge and incline face on the end of the staple, the tendency of which is to prevent direct movement of the staple through the materials to be stapled.

Now one object of my invention is to sever the wire by a shear-like cut, and thereby avoid any such inclination or ragged edge at the end of the staple, so that the plane of the end of the staple will be at right angle to its length and precisely parallel with the edge of the driver and at the same time to have said cutter not only adjustable as it becomes worn

away, but adjustable at any time for the purpose of severing the wire at the instant desired.

These objects are attained by devices illustrated in the accompanying drawings, in which—

Figure 1 is a front elevation of the wire-feeding, staple-supporting, staple-forming, and staple-driving devices of a wire-stapling machine so far as said machine contains my invention, the work-supporting table and clinching devices below said parts being omitted because not necessary to an understanding of my invention. Fig. 2 is a side elevation of the same; Fig. 3, a vertical section on the line 3 3 of Fig. 1; Fig. 4, a detail perspective of the connection between the head-block and the feeding-lever for simultaneously adjusting both of said members; Fig. 5, a transverse section on the line 5 5 of Fig. 1.

Similar letters of reference indicate the same parts in the several figures of the drawings.

The machine shown and hereinafter described is a power-machine, the power-shaft A of which is journaled in an arm B, having secured at its end a plate B′. On the end of this power-shaft are cam-wheels C D, the cam C of which is provided on its outer face with camways *c c′* and the cam D with a camway *d*, as clearly shown in Fig. 3. Below these cams is secured to the plate B′ a head-block E, grooved to receive a forked bender F, having internal opposing vertical grooves *f*, (see Fig. 5,) which said bender is provided at its upper end with a projecting pin, preferably having thereon a friction-roller *f′* engaging the camway *c* in the cam C, as shown in Fig. 3. Between the legs of the bender is a driver G, (see Fig. 5,) having splines *g g* projecting and working in the grooves of the bender and serving not only to direct the driver, but to give it a width equal to or substantially equal to the staple, so that the force of the driver is imparted to the staple in a direct line through its legs, and not at an oblique angle thereto, as it would be if the driver were of a less width, resulting from the omission of the splines, and it is obvious that such a directness of force is of substantial advantage in driving staples. The said driver has at its upper end a projection or pin, preferably having thereon a friction-roller *g′* projecting into the camway *d* on the cam D, as shown in Fig. 3, these said camways *c d* being so formed and timed as to cause the bender to descend in advance of the driver and form the same over the anvil, as hereinafter described, and after said staple is formed likewise to cause the driver to descend and drive the staple through the material to be stapled.

To the head-block E is secured a plate H by means of a set-screw *h*, and to this plate is pivoted at *h′* (see Fig. 3) the shank of my combined anvil I and supporter J, while a spring *i* on an adjustable pintle *i′*, journaled in parallel lugs h^3 h^2, serves to maintain the combined anvil and supporter against the driver, but so that they may yield to the action thereof, the tension of the spring being adjusted by means of ratchet i^2 on the pintle and a pawl i^3, pivoted to the lug h^2, engaging with said ratchet.

The combined anvil and driver are both of the same width to correspond with the distance between the legs of the staples, and taken together in side elevation are substantially triangular in form, although their upper face is slightly concaved and the lower face of the supporter somewhat convexed.

The anvil is practically formed by a notch, into which the wire is projected and held until the wire is severed and the staple formed from the severed piece by the descent of the bender, after which the movement of the driver takes place and in doing so strikes the incline above the operative face of the anvil, forcing the anvil outwardly from the staple, the legs of which are in the meantime confined in the grooves of the bender until the crown of the staple is over the inclined face of the supporter, which supporter, as the driver continues its descent, is as gradually swung on its pivot and retreated out of the staple, but does not escape the staple until its prongs have been driven through or practically through the book or pamphlet being stapled.

It will be understood that the under face of the supporter is at all times during its retreating movement in proximity to the book or pamphlet being stapled and that its greatest depth is equal to or about equal to the length of the longest staple designed to be used, so that whatever lengths the staples may be they will have so much of their legs supported and confined within a metallic box as will have any tendeney to cripple during the driving operation, three sides of which box are formed by the walls of the grooves in the bender and the fourth side by the sides of the supporter, which thereby prevents the inward crippling of the staple-legs.

The devices for separating the wire into proper lengths for the desired length of staple is substantially a pivoted cutter, consisting of a lever L, pivoted on a set-screw I and projecting into a movable plate L′, the lower end of said arm being provided with a slot, through which is projected a cutter-bar *l′*, (see Fig. 5,) adjustably confined in the slot by a clamping-plate l^2, held by a set-screw l^6, the upper end of said lever L having projected therefrom a friction-roller l^3, adapted to engage with a raised or cam surface l^4 on the cam D, which cam gives the cutter at proper intervals its vibrating or shear-like movement for severing the wire after the wire has been fed forward across and beyond the face of the anvil.

The wire for these machines is commonly upon a spool M, which for convenience is removably mounted upon a pintle *m*, projecting from standards M′, screwed to and raised

above the face-plate of the machine, and is directed and given tension by passing it through the eyes of and over the surface of a spring-arm M^2, attached at one end to the plate C or other stationary portion of the machine, the wire on its passage from the machine to the spool being directed between the ordinary gripping-jaws N, (see Fig. 1,) which is pivoted upon stud N′ and connected by a link N^2 with an arm N^3, projecting from the movable plate L′. Bolted to this plate L′, as shown in Figs. 4 and 5, is a grooved block L^2, which is fitted to slide in a slot L^3 (see Fig. 1) in the plate C, the slot being of sufficient length to permit the block to have the desired movement, hereinafter described.

Projecting through the plate H, and free to turn therein without an endwise movement, is a thumb-piece L^4, which is connected with a sliding block L^2 by a right-and-left-hand screw L^5, (see Figs. 4 and 5,) whereby upon turning the thumb-nut the block will be given its reciprocating movement in the slot of the plate C, and in making this movement will advance the plate L′ toward or retreat it from the face-plate E, and in doing so cause a similar movement of the vibrating cutter and the pivoted gripping-jaw lever, for the purpose hereinafter described. Passing through the gripping-lever is a set-screw O, serving as a stop for the feed-lever O′ and for taking up any lost motion when a very fine adjustment of the feed-lever is desirable.

The feed-lever O′ is a bell-crank lever fulcrumed on the pivot L′, with its upper and short arm pivoted to a projecting friction-lever *o*, engaging the outer surface of the cam C, the lower end of said lever being provided with the usual gripping-jaws, which when advanced toward the cutter carries with it the wire. In this connection it is proper to observe that the gripping-jaws of the lever N and the feed-lever O′ are so constructed that in drawing the wire forward it freely passes between the jaws of the gripping-lever, but is clamped firmly between the jaws of the feeding-lever, and that while the feed-lever may make its backward movement without its jaws clamping the wire the jaws of the gripping-lever will hold the wire in its forward position. After the wire is fed through the grip and feed-levers it passes thence between the usual triangular finger-straightener P, thence through a tubular guide P′, the inner end *p* of which constitutes a fixed jaw opposing the action of the swinging cutting-lever, as shown in Fig. 5. With the construction and arrangement of these several feeding devices and their connection by means of the screw O with each other and the connection of the gripping-lever with the slide-plate L′ it will be seen that if the plate is advanced toward the staple-manipulating devices, and at the same time the gripping-lever is likewise advanced, the stroke of the feed-lever is correspondingly shortened, and as a result the staple-leg formed by the forward end of the wire will be correspondingly shortened, while at the same time the cutter will sever the main wire at a correspondingly closer proximity to the anvil, and as a result both legs of the staple, of whatever length it may be, will have precisely the same length if these several parts are in the first instance of the proper dimension and arrangement, as they should be. In other words, the length of stroke of feed-lever O′ determines the distance the wire shall project beyond the farthest side of the anvil when the feed-lever has completed its forward stroke, and therefore the length of the staple-leg formed on that side of the anvil, while the point at which the wire is severed by the cutter determines the length of the staple-leg on the side of the anvil next the cutter, and it is therefore obvious that as the length of stroke of the feed-lever is increased or diminished this simultaneous adjustment therewith of the cutter will increase or diminish the distance from the anvil at which the cutter will sever the wire. This result is accomplished by having the pivotal point of the link midway between the operative faces of the gripper and the pivotal point thereof, for by thus locating the pivot of the link the movement of the gripping-lever will be double that of the cutter, and the stroke of the feed-lever correspond with the length of adjustment of the gripping-lever, so that the feed-lever, for instance, will carry the wire forward one-sixteenth of an inch, leaving the end of the wire one-sixteenth of an inch on the farther side of the anvil, while the cutter, moving, as it does, but one-sixteenth of an inch, will sever the wire at a corresponding distance on the cutter side of the anvil, and hence both staple-legs will be precisely of the same length, excepting so far as there may be any lost motion of the feed-lever, which motion, as before stated, may be taken up by the adjusting-screw O′. The feed-lever O′, after feeding the wire forward, is retracted, and therefore held against the cam C at all times by a coiled spring Q, secured at one end to the short arm thereof at a point between the fulcrum of the lever and the cam, the other end of which spring (see Fig. 1) is secured to a fixed stud l^5, projecting from the face-plate E. The cutting-lever is held against the face of cam B by a flat spring Q′, secured to the plate L′, and retracted the moment it is released from the cam L^4 to a position to make the succeeding cut—that is to say, as soon as the feed-lever has completed its forward stroke and is passing off the apex of its cam the spring Q′ will hold the lever against the cam-face, and as a result cause the lever to recede to the limit of its backward stroke. Now at the same time the same spring Q′ will maintain the cutter away from the wire until the end of the cutter-lever, striking the cam L^4, is caused thereby to swing inwardly and sever the wire, but as the cutter-lever passes off the cam L^4 the spring Q′ as gradually forces its

cutting-edge backward to its original position, where it remains until the wire is again fed forward by the feed-lever.

With the machine constructed as now described, and with the parts in the position shown in Figs. 1 and 3, the starting of the power-shaft will cause the feed-lever to commence its forward movement, at which instant it will grip the wire, draw it through the gripping-lever, force it between the triangular straightener, the tubular guide P′, and finally across the face of the anvil, after which the feed-lever will begin to recede and at this instant release its grip on the wire; but the wire is prevented receding because at the same instant the gripping-lever takes hold of it. Immediately after the wire has been carried to its operative position across the face of the anvil the cam l^4 engages the cutting-lever, swinging it upon its pivot, and causes it to sever the wire with a shear-like cut against the inner end p of the tubular guide P′. About this time the camway c' actuates the bender, causing it to descend and bend the wire over the anvil in a perfectly-formed staple, when the driver is actuated by the camway d, and, striking the curved or inclined surface above the anvil, forces the anvil away from the staple and upon the inclined surface of the supporter, and the driver, continuing its descending movement, strikes the staple upon its crown, gradually forcing it through the material to be stapled and as gradually likewise forcing the supporter to retreat out of the staple; but, as before suggested, the supporter in the meantime substantially fills the staple between its legs during the entire driving operation, and in any event until the staple-legs are driven through or practically through the book or pamphlet. In this connection it should be observed that the end of the driver is notched or grooved to recive and embrace the crown of the staple, so as to prevent any possibility of the crown bending laterally, and also that by reason of the splines of the driver working in and filling the grooves in the bender in which the staple-legs are held, the force of the driver on the legs is in a line directly through said legs, which are thereby caused to enter the book or pamphlet in a strictly direct line and without the driver producing any lateral strain upon the legs having a tendency to weaken them, as would be the result if the force of the driver were imparted to the crown at a point within the legs, and the face of the severed ends of the staple were not parallel with the force exerted by the driver or within the crown of the staple. If, for instance, the force of the driver were exerted on the crown of the staple within and not directly through the staple-legs, said force would be imparted to the legs at an angle inclined relatively to their length, and hence the legs be subject to a lateral strain, which in itself tends to weaken them, and so, on the other hand, even though this force is on a line direct through the staple, for it is obvious that if the faces of the ends of the staple were not perfectly parallel with the operating-face of its driver, and therefore its force, the tendency of the legs is to penetrate a book or pamphlet, and particularly a reasonably thick one, at an inclination relative to the normal direction of the legs, and thereby not only cause faulty stapling, but at the same time weaken the legs by bending them out of a direct line, and, besides, when so bent it is equally obvious that the under clinching of the projecting ends cannot be so perfectly accomplished as when the staple-legs are maintained in a perfectly-straight line.

My invention is not limited to the precise detail of construction shown—as, for example, so far as the simultaneous adjustment of the cutter and the feed-lever is concerned, so that both staple-legs shall invariably be of the same length, it is immaterial whether the cutter itself be pivoted and have shear-like cut or whether it be reciprocating and have a chisel or knife cutting action, for having once disclosed such a construction between the feed-lever and cutter of a wire stapling machine as provides for this simultaneous adjustment of these elements to secure an invariable uniformity in the length of staple-legs it will require only the most ordinary mechanical skill to change the form or movement of the cutter and the feed-lever to some other form of feeding devices. Neither is my invention limited to securing the removable and adjusting cutting-edge or cutter to a vibrating lever, for obviously the same advantages may be gained by securing said cutter to a reciprocating bar and without departing from the spirit of my invention in this particular. Nor is my invention limited to the precise angularity of form of my pivoted combined anvil and supporter, for obviously said elements may have a substantially different form without modifying or substantially changing their mode of operation or detracting from the advantages which they secure. My invention in this respect includes a vibrating combined anvil and supporter, as distinguished from a reciprocating combined anvil and supporter, and also from a separated anvil and supporter when one of said elements is reciprocating and the other vibrating, and inasmuch as a vibrating combined anvil and supporter is believed to be novel at the date of my invention my invention in this regard is not to be restricted to the actuation of such anvil and supporter, either by direct or indirect action of the driver, for it is obvious that said two combined vibrating elements may be successfully operated when actuated by other and substantially different devices, although their actuation by the driver is the preferred and believed to be the best and most economical means for this purpose.

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

1. In a wire-stapling machine, a movable feed device, an adjustable gripper engaging said feed, a cutter, a sliding block for said cutter connected with the adjustable gripper, and means for simultaneously actuating said cutter and gripper, substantially as described.

2. In a wire-stapling machine, the combination of a vibrating feed and adjustable gripper, a stop-connection between said gripper and feed, a sliding block, a cutter mounted upon said block, and a link connecting the gripper and block, substantially as described.

3. In a wire-stapling machine, a feed-lever and gripping-lever, a pivot-bearing common to both of said levers, a sliding block and cutter mounted upon said block, a link connecting the block with the gripping-lever and pivoted thereto centrally of its length, and an anvil across which the wire is fed, whereby the feed and cutting devices may be adjusted for staples of different length without producing any variation in the relative length of legs thereof, substantially as described.

4. In a wire-stapling machine, the combination of a wire-feed, a vibrating cutter, a cam directly engaging and actuating said cutter, and a spring maintaining said cutter in contact with the cam and in a position to sever the wire when actuated by said cam, substantially as described.

5. In a wire-stapling machine, the combination of a wire-feed, a vibrating cutter provided with an adjustable and removable cutting-jaw, and means for actuating said cutter, whereby the cutting-edge may be adjusted both for wear and to sever at the proper moment when actuated, substantially as described.

6. In a wire-stapling machine, the combination of a bender provided with internal grooves receiving the legs of the staple, and a driver provided with splines working in said grooves, whereby the width of the driver is equal to or substantially equal to the entire width of the staple and its force is imparted in a direct line through the legs of the staple, substantially as described.

7. In a wire-stapling machine, the combination of the bender and driver, a pivoted and combined anvil and supporter, and means for actuating the same, substantially as described.

8. In a wire-stapling machine, the combination of the bender, the driver, and a pivoted and combined anvil and supporter provided on their upper surface with an incline engaged by the driver, substantially as described.

9. In a wire-stapling machine, the combination of a bender and driver, a pivoted and combined anvil and supporter, and means for actuating the same and normally maintaining said anvil and supporter in their operative position under the driver, but permitting them to yield as the driver descends, substantially as described.

10. In a wire-stapling machine, the combination of the bender, the driver, the pivoted and combined anvil and supporter, a spring maintaining said anvil and supporter in the path of the driver, but permitting them to recede as the driver descends, and means for adjusting the tension of said spring, substantially as described.

WILLIAM E. HARPER.

Witnesses:
R. C. OMOHUNDRO,
W. R. OMOHUNDRO.