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T. L. KNUDTSON & J. UHRI.

STAPLE FORMING AND DRIVING MACHINE.

No. 483,254. Patented Sept. 27, 1892.

Fig. 1.

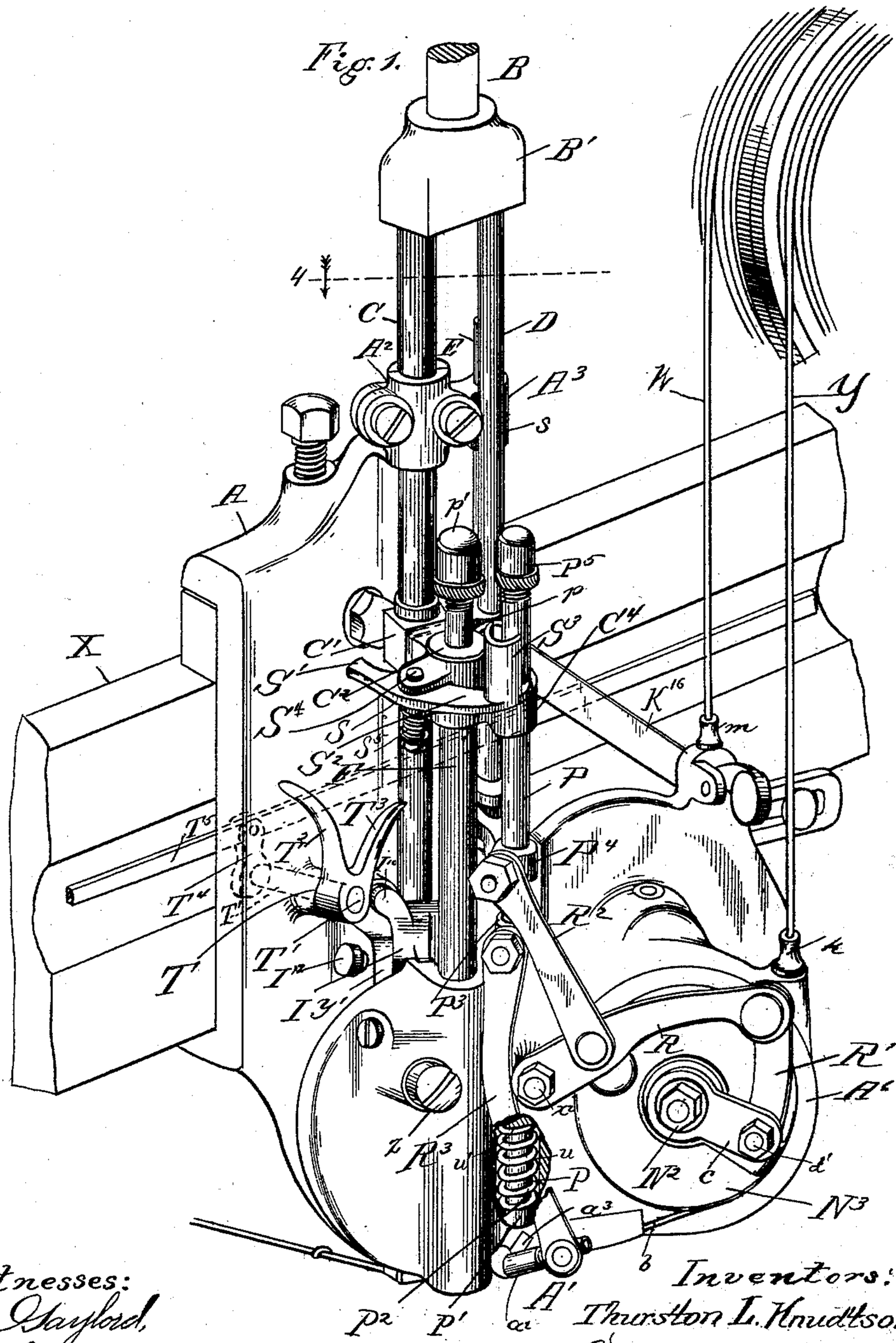

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Fig. 2.

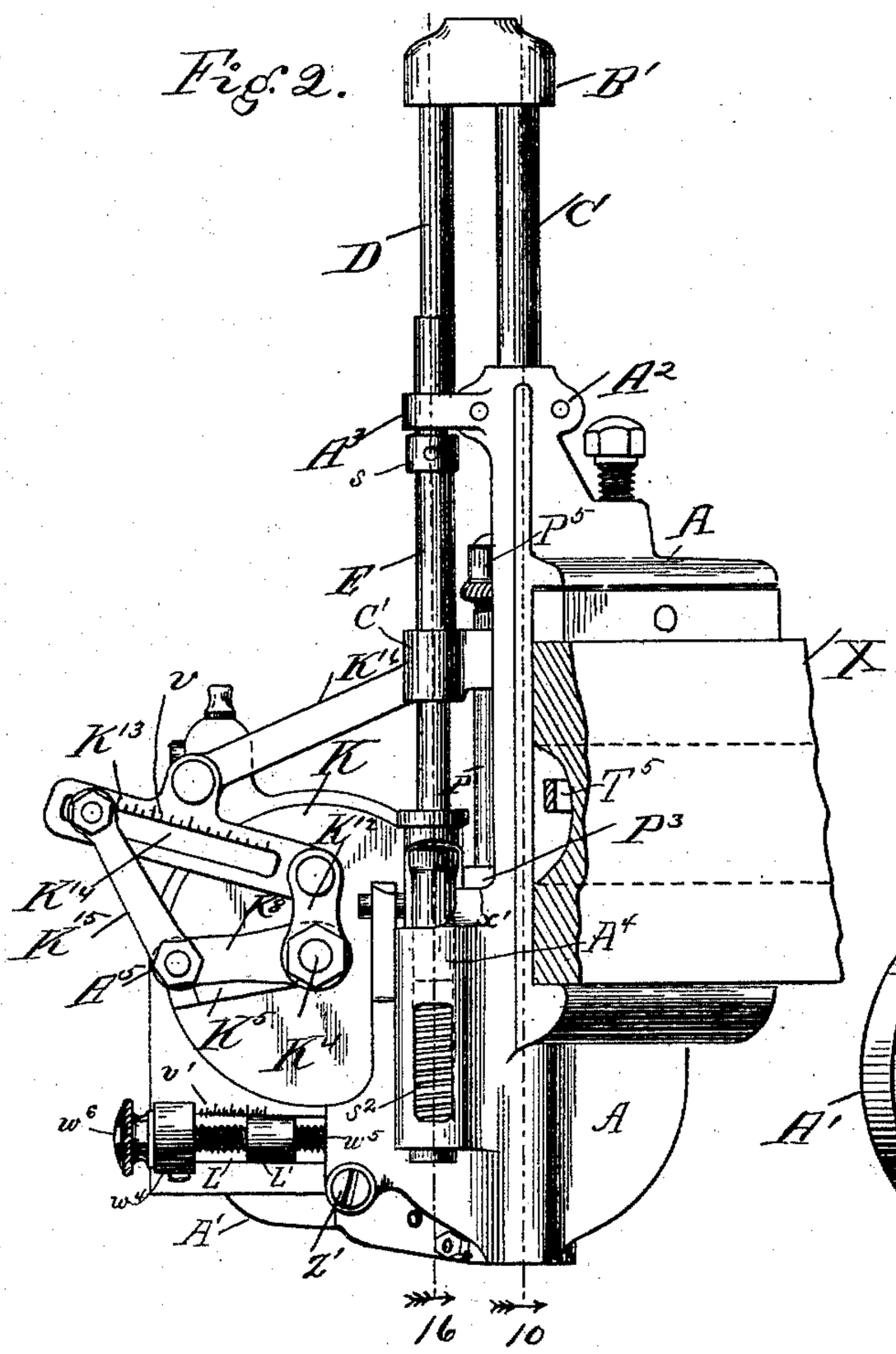
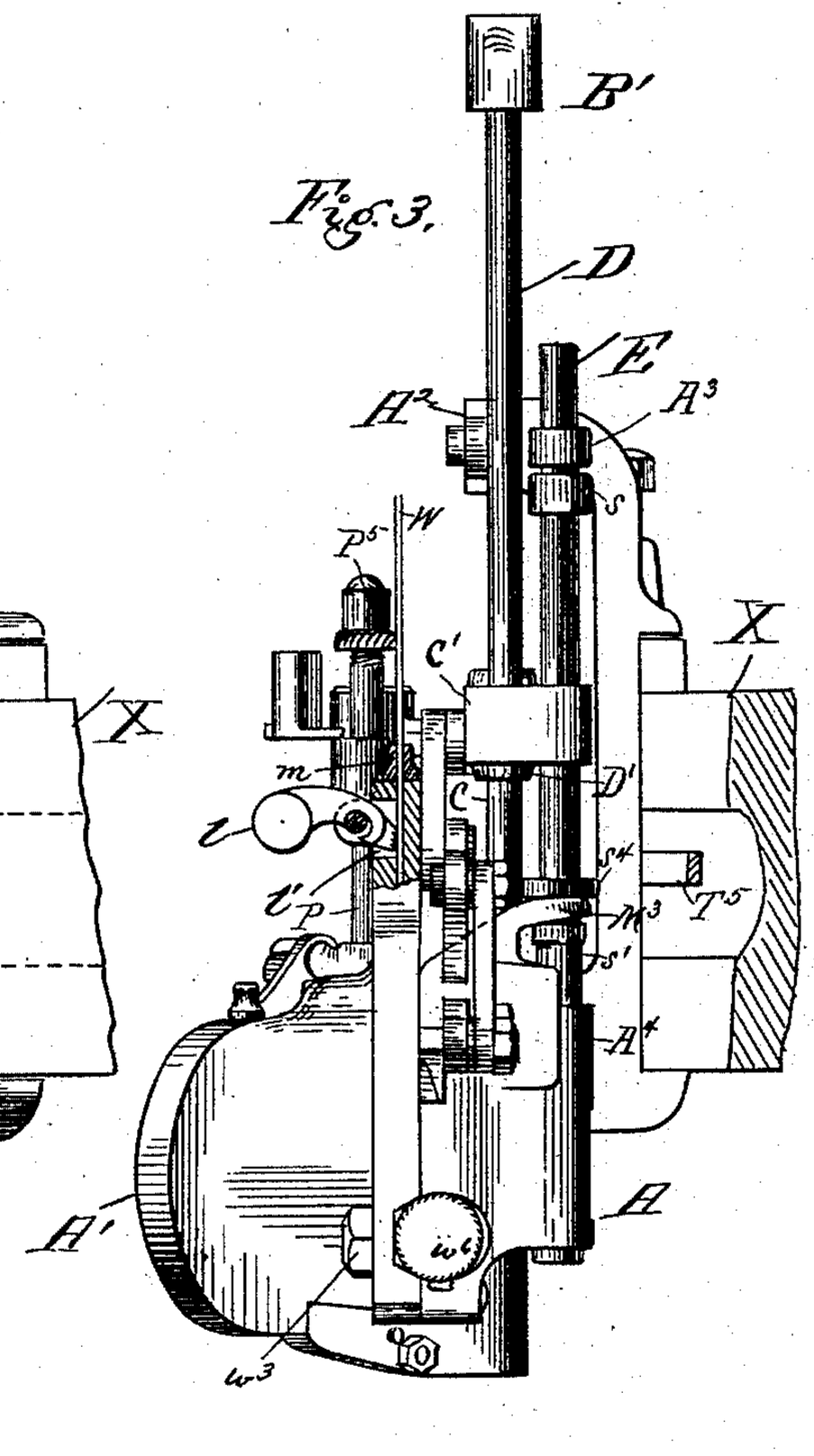


Fig. 3.



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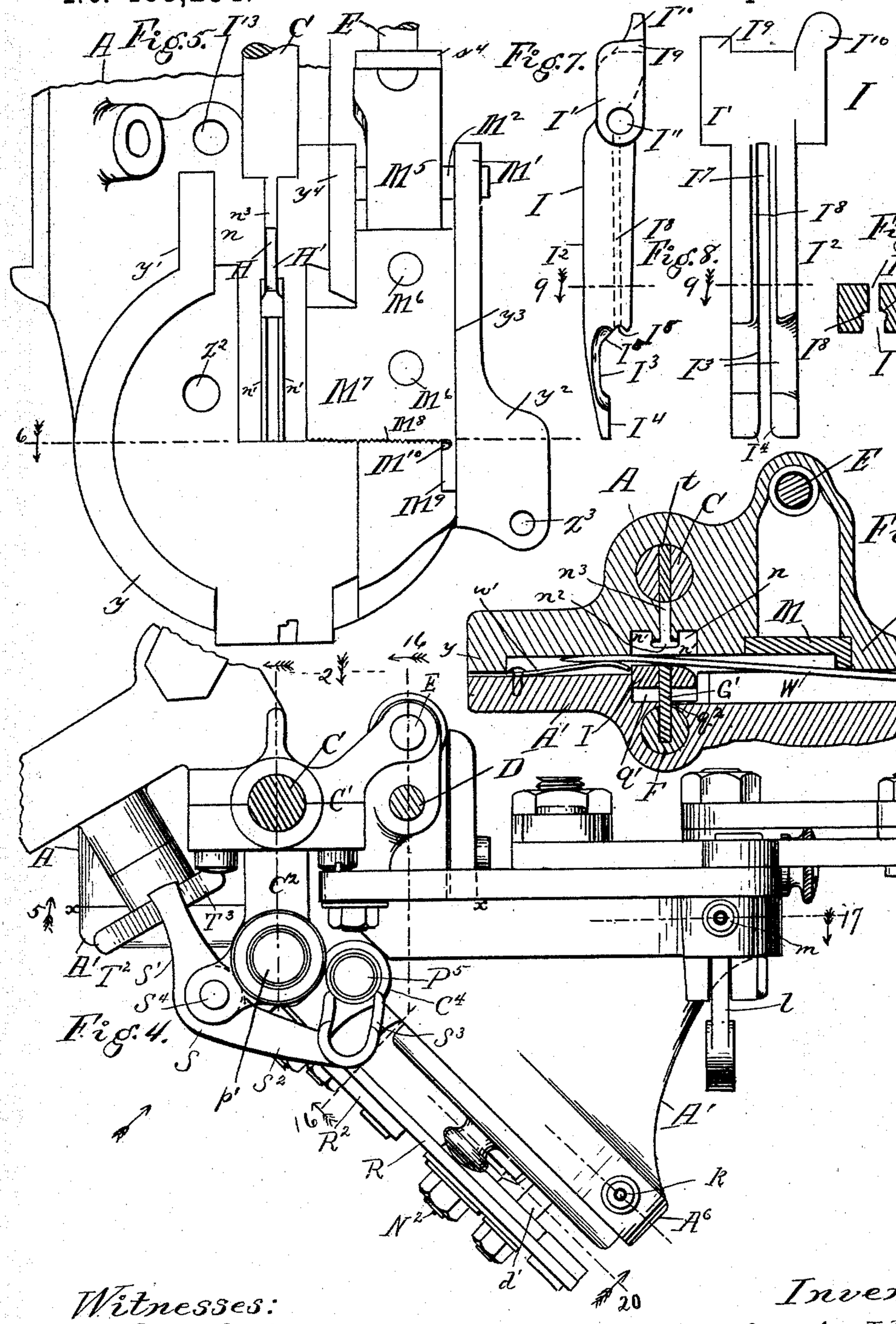

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STAPLE FORMING AND DRIVING MACHINE.

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Fig. 11.

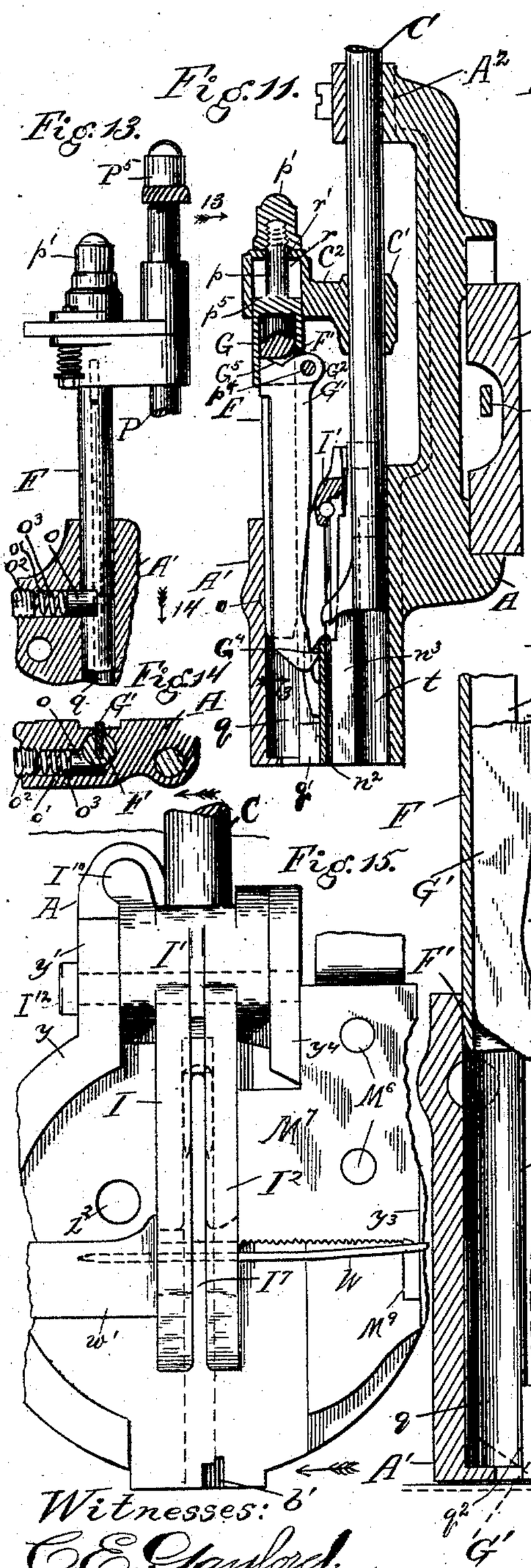

Fig. 10.

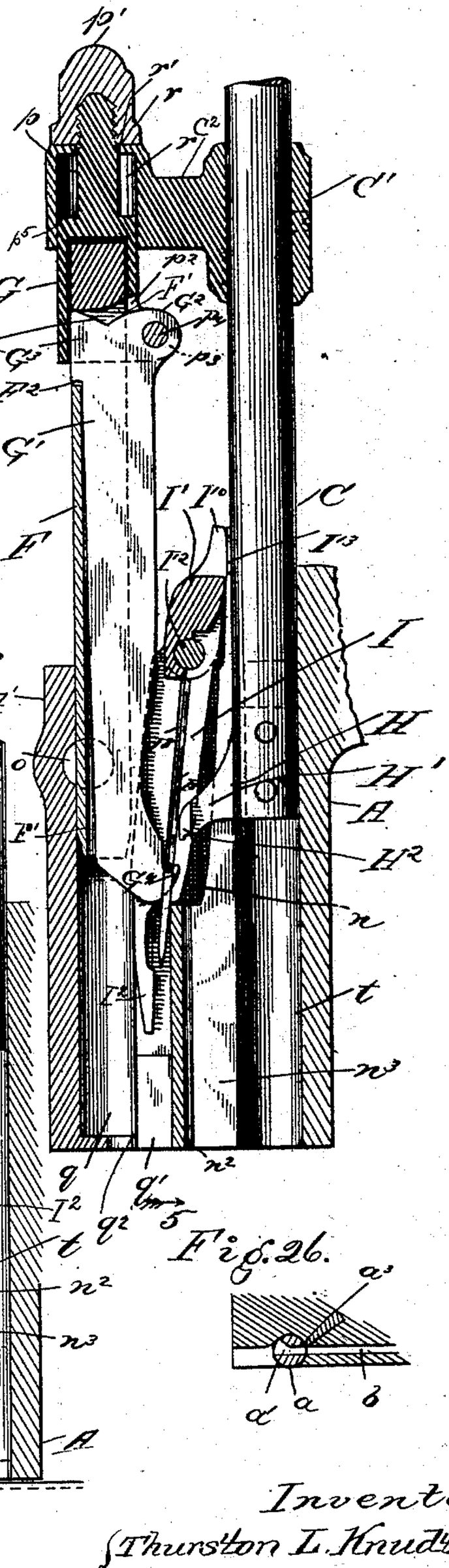

Fig. 13.

Fig. 14.

Fig. 12.

Fig. 15.

Fig. 26.

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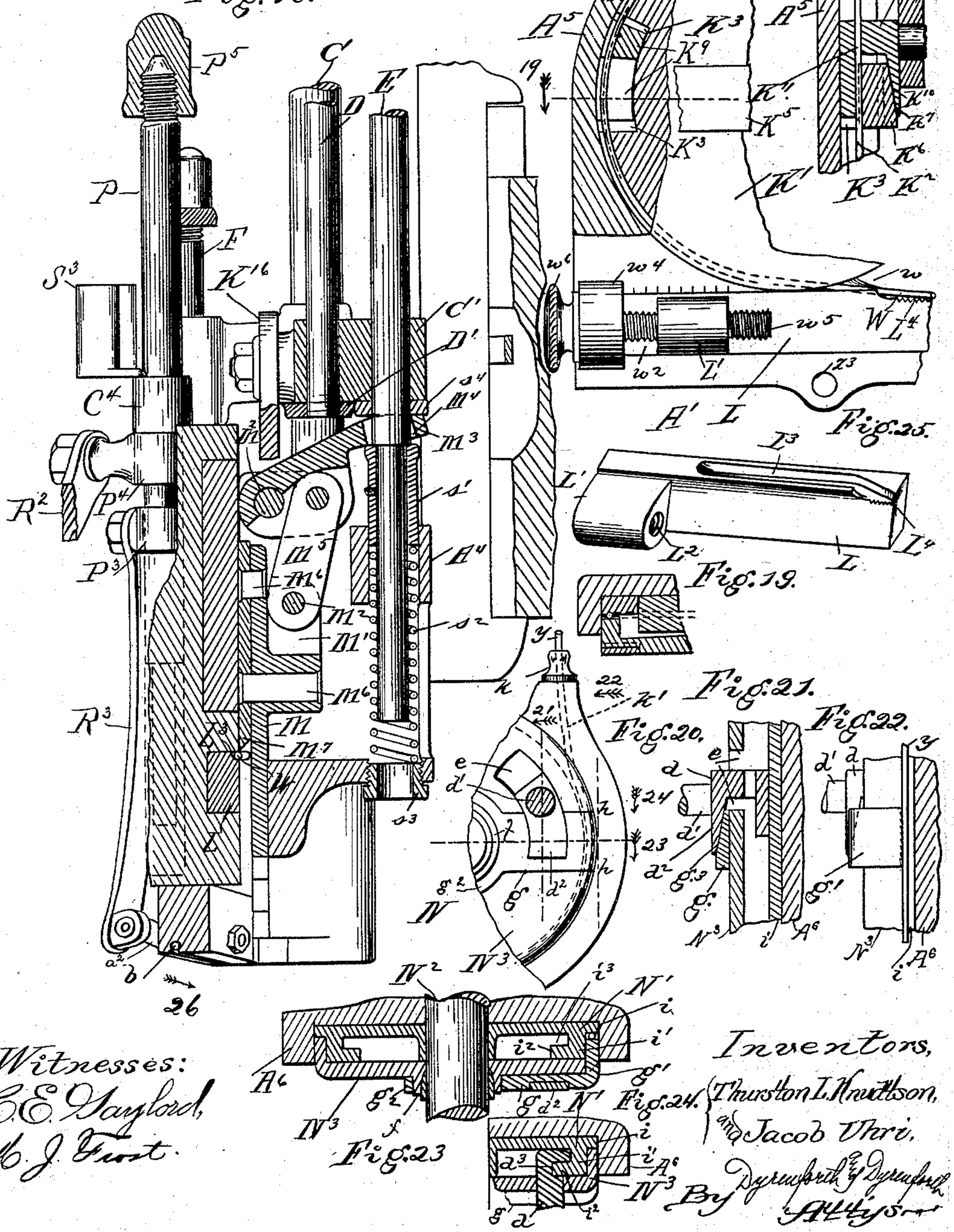
Fig. 16.



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UNITED STATES PATENT OFFICE.

THURSTON L. KNUDTSON AND JACOB UHRI, OF CHICAGO, ILLINOIS.

STAPLE FORMING AND DRIVING MACHINE.

SPECIFICATION forming part of Letters Patent No. 483,254, dated September 27, 1892.

Application filed February 8, 1892. Serial No. 420,735. (No model.)

To all whom it may concern:

Be it known that we, THURSTON L. KNUDTSON and JACOB UHRI, citizens of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a new and useful Improvement in Staple Forming and Driving Machines, of which the following is a specification.

Our invention in its broadest sense relates to improvements in machines for forming staples from a continuous length of wire. In its more limited sense it relates to improvements in machines, first, for forming the staples and driving them into material which is fed across the discharge end of the staple-forming mechanism, and, secondly, for forming and driving the staples and directing across the discharge end of the staple-forming mechanism a strengthening-rod or binding-wire, over which the staples are driven to fasten the rod or wire to the material which it is intended to strengthen or bind.

Our objects are, first, to provide improved staple forming and discharge or driving mechanism which shall be particularly quick and accurate in its operation and strong and durable to a high degree; second, to render the staple-forming mechanism adjustable, whereby staples of various sizes may be formed in the same machine, as desired, and, third, to provide feed and severing mechanism for the strengthening-rod or binding-wire, which may be brought into operation when desired.

It is our object, further, to provide a machine of generally improved construction for all the purposes above defined which shall be compact, strong, and durable, and capable of being employed as a hand implement or as a part of a power-machine.

The general operation of our machine to form and drive staples is as follows: The staple-forming wire is passed through adjustable intermittent-grip mechanism, which feeds the wire forward the full length of the material of the staple to be formed with each downstroke of a vertically-reciprocating rod. Adjacent to the staple-forming mechanism the wire describes an angle in its path, across which cutting mechanism passes in the final downstroke of the reciprocating rod to sever the wire in a manner to produce a beveled pointed end. The wire is fed across the lower end of an oscillating former. Working up and down from a point below the path of the wire as it is fed to near the upper end of the former is a bender, which engages the under side of the wire and draws it in the upstroke of the reciprocating rod into the former to give to the wire blank the proper staple shape. When the staple has been formed, the former oscillates backward to disengage the staple from the bender and carry it into line with a discharge-groove and below a vertically-reciprocating ram. In the subsequent downstroke of the reciprocating rod the ram engages the top of the staple and forces it down through the groove and out of the machine.

In the drawings, Figure 1 is a broken perspective view of one side of our machine, the view being taken from line 1 of Fig. 4 in the direction of the arrow. Figs. 2 and 3 are views similar to the last, but on a reduced scale, and taken from lines 2 and 3, respectively, of Fig. 4 in the directions of the arrows; Fig. 4, a broken sectional plan view on line 4 of Fig. 1; Fig. 5, a broken view in elevation, taken on line 5 of Figs. 4 and 10, showing the wire-cutting and staple-driving mechanisms, the staple-former being removed for purposes of illustration; Fig. 6, a section taken on line 6 of Fig. 5 and viewed in the direction of the arrow; Figs. 7 and 8, side and rear perspective views, respectively, of the oscillating staple-former; Fig. 9, a section taken on line 9 of Figs. 7 and 8; Figs. 10, 11, and 12, broken sections taken on line 10 of Fig. 4, viewed in the direction of the arrow and illustrating three different positions of the staple forming and driving mechanism. In Fig. 12 a fourth position of the forming and driving mechanism is indicated by dotted lines; Fig. 13, a broken view partly in elevation and partly in section, the view being taken on the bent line 13 13 of Fig. 11 and viewed in the direction of the arrows; Fig. 14, a broken section taken on line 14 of Fig. 13 and viewed in the direction of the arrow; Fig. 15, a broken view similar to Fig. 5, but showing the former in place, a wire fed across the former and a guide-spring for the wire; Fig. 16, a broken sectional view taken on line 16 16 of Fig. 4 and viewed in the direction of the arrows; Fig. 17, a broken view, partly in section and partly in elevation, illustrating the intermittent-grip staple-wire-

feed mechanism, the section being taken on line 17 of Fig. 4 and viewed in the direction of the arrow; Figs. 18 and 19, broken sections taken, respectively, on the curved line 18 and line 19 of Fig. 17 and viewed as indicated by the arrows; Fig. 20, a broken sectional view taken in the direction of the arrow on line 20 of Fig. 4; Figs. 21, 22, 23, and 24, sections taken on lines 21, 22, 23, and 24 of Fig. 20 and viewed as indicated by the arrows; Fig. 25, a detail perspective view of an adjustable cutting-block, and Fig. 26 a section taken on line 26 of Fig. 16 and viewed in the direction of the arrow.

The frame which affords the bearings and housings of the various mechanisms which make up the machine is in two parts A and A′, the division between the two being at line 5 of Fig. 4 between the points x x. The two sections are secured together in rigid relation by screws z z', which pass, respectively, through openings z^2 z^3. The machine is shown to be secured upon a bar X, which may be part of the framework of a large machine of which the staple-forming machine is an element.

B, Fig. 1, is a vertically-reciprocating operating-bar, which terminates at its lower end in a block B′. Rigidly secured at their upper ends in the block B′ are two vertically-reciprocating rods C and D. The rod C, which constitutes the carrier for the staple bender and driver, passes through a bearing A^2 at the upper end of the section A of the frame and extends down through a vertical guide-opening t, also in the section A. (See Figs. 10, 11, and 12.) Rigidly secured to the rod C is a bracket C′, which reciprocates with the rod C. The rod D passes through the bracket C′ and terminates just below the latter, where it is provided with a clamp-nut D′. (See Fig. 16.) The rod D is merely a strengthening-rod extending between the block B′ and bracket C′.

E is a vertically-reciprocating rod extending at its upper end portion loosely through a bearing A^3 (which is integral with the bearing A^2) and down loosely through an opening in the bracket C′. (See Fig. 16.) Just below the bearing A^3 the rod is provided with a rigid collar s and below the bracket C′ it is provided with a rigid collar or sleeve s'. The sleeve s' is adapted to slide in a bearing A^4 in the section A and at its lower end affords a shoulder or bearing for the upper end of a coiled spring s^2, (see Fig. 6,) which surrounds the rod E below the sleeve s' and bears at its lower end against a tap-screw s^3, which extends through the base portion of the section A in line with the rod E. Thus the rod E when forced down, as hereinafter described, descends against the resistance of the spring s^2, and the rise of the rod E is checked by engagement of its collar s with the under surface of the bearing A^3.

F is a vertically-reciprocating rod.

G is a socket-piece, which fits loosely over the upper end of the rod F and is provided above its socket portion with a reduced extension p. The socket-piece G is adapted to reciprocate in a socket r, formed in the under face of an arm C^2 of the bracket C′, and the reduced extension p reciprocates through an opening r' at the top of the socket r. Above the bracket-arm C^2 the stem or reduced portion p of the socket-piece G is threaded to receive a cap-screw p'. The rod F extends down into a vertical guide-opening q in the section A′ of the frame. Between the guide-opening q and adjacent face of the section A and formed in the inner face of the section A′ is a vertical recess q'. The guide-opening q and recess q' communicate throughout their entire extents through a vertical groove or opening q^2. The socket-piece G is provided on its rear side with a slot p^2, which extends from the lower end of the sleeve upward a short distance. On the socket-piece G on opposite sides of the slot p^2 are ears p^3, affording a pivot-bearing for the bender G′. The bender G′ is a flat-sided plate, and it extends downward in a groove F′ in the rod F and through the opening q^2 between the guide-opening q and recess q'. The groove F′ extends from near the upper end of the rod F to the lower end of the latter. At the upper end portion of the groove F′ is an opening F^2 through the wall of the rod at the base or back of the groove. The bender G′ is of the shape shown in the figures, having an offset G^2, at which it is pivoted upon a pin p^4, passing through the bearings p^3 on the socket-piece G, an offset G^3 of the shape shown, which extends normally through and nearly, but not quite, fills the opening F^2, and a hook G^4 at its lower end, which engages the staple-blank, as hereinafter described. The upper end of the bender G′ is formed with a cam edge G^5. In the rise of the rod C the arm C^2 of the bracket C′ engages the under surface of the cap-screw p' and draws up the socket-piece G and with it the bender G′. In its upward movement the point of the cam-surface G^5 engages the top of the groove F′ and opening F^2, which causes the bender to be swung forward from the vertical position shown in Figs. 11 and 12 to the slightly-inclined position shown in Fig. 10. The bender is prevented from swinging more than a short distance, as will hereinafter be explained. The further rise of the rod C causes the upper end portion of the cam-surface G^5 to bear against the upper end of the slot F′ and carry the rod F up with it. In the descent of the rod C the arm C^2 slides down upon the reduced portion or stem p of the socket-piece G until the upper end of the socket r strikes the shoulder p^5 at the top of the enlarged part of the socket-piece G and presses it downward, causing the upper part of the socket-piece G to engage the upper end of the rod F. In this movement the lower end of the opening F^2 is engaged by the lower end of the offset G^3 of the bender, and the latter is swung to the vertical position shown in Figs. 11 and 12. The further

descent of the rod C causes the rod F to descend with the socket-piece G. Intersecting the guide-opening q in the path of the rod F is a friction-block o. (See Figs. 13 and 14.) The block o is cylindrical in cross-section and reciprocates in a guide-opening o' in the section A′. The opening o' is closed by a screw o^2, and between the latter and the adjacent end of the block is a coiled spring o^3. The block o is rendered concave at its inner end, as shown at Fig. 14, to conform to the surface of the rod F. The spring o^3 presses the block against the surface of the rod F and retards the motion of the latter. Thus the rod F will only move under force exerted positively against it by the socket-piece G or top of the bender G′, and will remain stationary while the lost motion between the socket-piece G and rod F takes place. It will be understood that it is the lost motion between the two which causes the bender to be swung back and forth, as described.

The face of the section A, against which the section A′ abuts, is shown most clearly in Figs. 5 and 15. It is formed on one side with a rim y, circular throughout part of its extent, with a straight vertical portion y'. On its opposite side it has the rim portion y^2, formed with the straight edge y^3, and between the parts y' and y^3 in the position shown is a guide y^4. It will be understood that the parts y, y', y^2, and y^4 form a rigid portion of the section A. In the face of the part A, exposed to view in Fig. 5, is a shallow socket n, and on the face of that socket are two vertical guide projections n'. Extending from the lower end of the socket n out through the lower end of the section A is a vertical passage n^2. (See Fig. 6.) Between the opening t for the rod C on the one hand and the socket n and passage n^2 on the other hand is an opening n^3, of the shape in cross-section shown in Fig. 6, the said opening being flanked above the passage n^2 by the guides n'. Rigidly secured to the rod C is a ram or hammer H, having a neck portion H′, which extends through the opening n^3, and a head portion H^2, of the shape of the passage n^2 and adapted to slide freely up and down in the latter. The lower end of the head H^2 is rendered concave to fit upon the staple blank, which it engages, as hereinafter described.

I is the former, which is shown in detail in Figs. 7, 8, and 9. It is provided with a head portion I′ and bifurcated downward extension I^2. At its lower end the former is cut away, as shown in the figures, to produce the socket I^3 and face I^4, and in the upper part of the socket, also extending across both forks, is a recess I^5. The forks I^2 are divided by an opening having an enlarged part I^6 and reduced part I^7, (see Fig. 9,) and in the forks on opposite sides of the enlarged part I^6 of the opening are vertical recesses I^8. On one side of the head I′ is a shoulder I^9, and on the opposite side is an ear I^{10}. Extending transversely through the head I′ is an opening I^{11}. The former is pivoted upon a pin I^{12}, which passes through the opening I^{11} and extends at opposite ends into bearings formed in the parts y' y^4. The ear I^{10} bears against a spring-stop I^{13}, housed in the section A, the normal tendency of which is to maintain the former in a vertical position with the inner faces of its bifurcations against the surface of the socket n and its forks embracing the guides n'. The former swings from its normal position (shown in Figs. 11 and 12) to the position shown in Fig. 10 against the resistance of the spring-stop. The hooked end portion G^4 of the bender G′ extends into and moves up and down in the opening between the forks of the former I.

The wire W, from which the staple-blanks are cut, enters the machine at the nipple m and extends down through a guide-passage m' and through intermittent-grip mechanism K. The intermittent-grip mechanism comprises a wheel K′, which fits snugly but loosely in a shallow circular socket formed in the face of the part A^5 of the section A′. The wheel K′ is formed with a circumferential groove K^2 and with a recess K^3. (See Figs. 17 and 18.) The recess K^3 is in the rim portion of the wheel, being of segmental shape, as shown, and extending entirely through the wheel. The wheel K is loosely mounted upon a shaft K^4, (see Fig. 2,) which latter is rigidly secured against turning in the part A^5 of the frame. Adjacent to the outer face of the wheel, also loosely mounted at one end upon the shaft K^4, is a swinging arm K^5, having a flanged end portion K^6, which projects into the recess K^3. The arm K^5 is formed at its outer end portion (at the flange K^6) with a cam-face K^7. Also loosely mounted at one end upon the shaft K^4 is a swinging arm K^8. At its free end the arm K^8 carries a bifurcated block K^9, which projects into the recess K^3. One of the forks of the block K^9 is formed with a cam-surface K^{10}, adapted to engage the cam-surface K^7 of the part K^6, which latter is embraced by the forks of the block K^9. Extending through the part K^9 is a groove K^{11}, which coincides with the groove K^2 in the rim of the wheel K′. The parts K^6 and K^9 are clutch members adapted to grip the wire intermittingly and feed it forward, as hereinafter described. Rigid upon the shaft K^4 is a bracket K^{12}, upon the free end of which is pivoted an arm K^{13}. The arm K^{13} is provided throughout the greater part of its extent with a slot K^{14}. Pivoted at one end to the free end of the arm K^8 and at its opposite end to the arm K^{13} is a link K^{15}. The link K^{15} is fastened to the arm K^{13} by means of a clamp-bolt, which may be adjusted along the slot K^{14} and fastened rigidly in adjusted position without changing the pivotal relation between the link and arm K^{13}. A link K^{16} is pivotally connected at one end with the arm K^{13} and at its opposite end with the bracket C′ upon the rod C.

The wire from which the staple-blanks are formed passes along the groove K^2 in the wheel K′ and across the recess K^3. In the recess

the wire passes through the groove K^{11} in the clutch member K^9 and thence between the said clutch member and the clutch member K^6. In the downward movement of the reciprocating rod C and its bracket C′ the link K^{16} is forced down, causing it to swing the arm K^{13} down on its pivot. The downward movement of the arm K^{13} causes it, through the medium of the link K^{15}, to swing down the arm K^8. The arm K^5 rests normally at its end portion K^6 against the lower end of the recess K^3. As the arm K^8 swings down the cam-surface K^{10} of the clutch member K^9 engages the cam-surface K^7 of the clutch member K^6 and presses the engaging edge of the latter clutch member against the wire, causing the wire to be gripped between the clutch members. The further downward movement of the parts oscillates the wheel K′ downward, carrying with it the wire, which is thus fed forward the distance of the wheel's oscillation. In the upward movement of the rod C the link K^{16} is drawn upward, dragging with it the arm K^8. In the upward swing of the arm K^8 the cam-surface of the clutch member K^9 is disengaged from the clutch member K^6, and the wire thus released. The upper edge of the clutch member K^9 engages the upper end of the recess K^3 and oscillates the wheel K′ upward.

To insure disengagement of the intermittent-grip mechanism from the wire in the upstroke of the rod C, a detent is provided in the passage m' below the nipple m. It comprises a dog l, pivoted in an opening l', which intersects the passage m'. (See Fig. 3.) The dog is pivoted in the said opening, is serrated at its inner end to engage the wire, and at its outer end is weighted, as shown. In its downward passage the wire moves freely past the dog; but any tendency to force the wire in the upward direction is resisted by engagement of the dog, which clamps the wire in the passage m'.

At the under side of the wheel K′ the metal of the part A^5, which forms the housing for the wheel, is cut away, as shown at w in Fig. 17, to afford an outlet-passage for the wire from the groove of the wheel. The wire passes from that outlet through the recess I^3 of the bender I between the latter and the adjacent surface of the section A below the socket n, as indicated in Fig. 6. At the side of the former opposite that at which the wire enters is a flat spring w', which is secured upon the inner face of the section A′ and bears normally against the inner surface of the section A. The spring w' is curled at its free end portion to afford a guide for the wire, which passes between it and the surface of the section A, the wire being pressed with desired firmness against said surface to steady it. Just below the opening w is a shallow horizontally-extending guide-recess w^2 on the inner face of the section A′. The guide-recess w^2 extends from the edge of the section A′ to the vertical recess q'. Secured by a nut-bolt w^3, Fig. 3, to the edge of the section A′ in the recess w^2 is a bearing w^4, and between the said bearing and recess q' is a longitudinally-adjustable cutter-block L, which is of a width corresponding with the depth of the recess w^2 and fits the latter snugly but loosely. On the outer face of the cutter-block L is a boss L′, provided with a threaded opening L^2 through it to receive an adjusting-screw w^5. The adjusting-screw w^5 is held against longitudinal movement in the bearing w^4 and may be turned from the thumb-piece w^6 at the end of the screw. The screw w^5 engages the thread in the opening L^2 of the boss L′, and turning of the screw causes the cutter-block to move longitudinally in the groove w^2. In its upper surface the cutter-block L is provided with a guide-groove L^3, Fig. 25, which near the end of the block turns out at the corner, as shown, to produce the cutting-edge L^4.

In a shallow recess in the face of the section A is a vertically-sliding plate M, (see Figs. 6 and 16,) provided on its rear side with a bearing M′. Pivoted upon a pin M^2, having its bearings in the section A, is a lever M^3, which at its free end is provided with an opening M^4, at which it loosely surrounds the vertically-reciprocating rod E above the collar s'. Upon the rod E, above the lever M^3, is a loose washer s^4. Pivoted at its end to the lever M^3, between the fulcrum of the latter and rod E, is a link M^5, which at its lower end is pivotally secured in the bearing M′ on the plate M. Downward movement of the rod C causes its bracket C′ in the final downward movement of the rod to engage the washer s^4. The force thus exerted upon the washer s^4 presses down the lever M^3, which bears against the upper surface of the collar s' and carries the rod E down against the resistance of the spring s^2. In its downward movement the lever M^3, through the medium of the link M^5, moves the plate M downward. In the rise of the rod C the bracket C′ releases the washer s^4, and the rod E, lever M^3, and plate M are raised by the action of the spring s^2. Fastened by rivets, preferably in the form of stud-pins M^6, to the face of the plate M is a cutting-blade M^7, having the cutting-edge M^8. The cutting-blade moves up and down with the plate M between the guides y^3 and y^4. On its side adjacent to the guide y^3 the cutting-blade is provided with a downwardly-extending lip M^9, in the inner corner of which, adjacent to the cutting-edge, is a guide-groove M^{10}. The cutting-blade M^7 works against and past the cutting-edge L^4 of the cutter-block L.

As the wire for the staple-blanks is fed forward, as described, by the intermittent-grip mechanism it is guided from the opening w through the groove L^3 in the cutter-block, which deflects it past the cutting-edge L^4. Thence the wire passes across the surface of the section A to between the spring w' and said surface, as shown in Fig. 6. In its movement to the spring w', as described, the wire

W passes between the former I and the face of the section A below the lower end of the recess *n* and extends through the recess I^3 of the former I below the recess I^5.

The operation of the machine thus far described is as follows: In the descent of the rod C the ram or hammer H is carried down to the position shown by dotted lines in Fig. 12. The arm C^2 of the bracket C′ descends upon the extension or stem *p* of the socket-piece G until the upper surface of the latter is engaged by the upper inner surface of the socket *r*, and the rod F and bender G′ are carried down to the position shown by dotted lines in Fig. 12. The intermittent grip engages and advances the wire W to the position shown in Fig. 6, and as the rod C nears the lowest limit of its descent the cutting-blade is forced past the cutting-edge of the cutter-block L to sever the wire. Owing to the angle at which the wire passes the cutting-edge L^4 it is severed diagonally to produce a long beveled point. In the rise of the rod C the ram or hammer H is raised to a plane above the hook end of the bender before the top of the arm C^2 of the bracket engages the under side of the screw-cap *p*′ and raises the rod F and bender G′. In the rise of the bender the lower end of the latter is swung backward or outward, as before described, to the adjacent surface of the section A. In its further rise the hook end G^4 of the bender engages the wire W and draws it upward to the groove I^5 at the lower end of the former. In its further rise the bender draws the wire by bending it over at the point of engagement with the latter into the grooves I^8 of the former I. The face of the recess I^3 is cam-shaped, as shown at I^9 in Fig. 7, and the action of the bender in drawing the wire upward into the grooves I^8 causes the staple-blank as it rises into the former I to bear against the surface of the section A at the lower end of the recess *n* and swing the former I forward to the position shown in Fig. 10. When the staple thus formed has been drawn upward beyond the lower end of the recess *n*, the former I, through the action of the spring-stop I^{13}, forces the former I to its vertical position, (shown in Figs. 11 and 12,) which brings the grooves I^8 coincident with the passage n^2. The moment the rod C commences again to descend the bracket-arm C^2 releases the cap-screw *p*′, permitting the socket-piece G to descend sufficiently upon the rod F to swing the bender to its vertical position and cause the latter to release the staple. The further descent of the rod C′ causes the ram or hammer H to engage the upper bent end of the staple, as shown by full lines in Fig. 12, and force it downward through the grooves I^8 and guide-passage n^2 and out through the bottom of the machine, as shown by dotted lines in Fig. 12. In forcing the staple out of the machine, as described, the ram will drive the staple into any suitable material which extends across the mouth of the guide-passage n^2.

The material into which the staples are driven is fed across the lower end of the machine described, and this may be done by any suitable feed mechanism, depending upon the construction of the machine of which the present invention might form a part. The binder-wire or strengthening-rod, over which the staples are to be driven, would be fed by being drawn along, after it has been fastened with one staple, by the material to which it is secured. The material to which the strengthening-wires are to be stapled is usually fed in given uniform lengths to the machine, and it is desirable for certain purposes for which the lengths of material strengthened by the stapled wires, as described, are to be used that the strengthening-wire should project a desired distance—say two inches—beyond opposite ends of the material. In the machine shown the strengthening-wire is caused to pass through grip mechanism, which may be operated at proper intervals to feed the strengthening-wire forward the desired distance after the latter has been severed.

The strengthening-wire Y enters the machine at the nipple *k* and passes down through a passage *k*′ and thence through grip mechanism N. The grip mechanism N comprises a wheel N′, placed in and filling a shallow circular recess in the part A^6 of the section A′. The wheel N′ is formed, as shown in Fig. 23, with a flange *i* and laterally-projecting rim *i*′, having an inward radially-extending flange i^2, producing the annular socket i^3 on the under side of the rim. The wheel N′ is loose upon a shaft or bearing N^2, forming a rigid part of the section A′. Fitting over the wheel is an annular flanged disk N^3, the flange of which extends into the space between the flange *i*′ of the wheel N′ and adjacent surfaces of the housing A^6 and loosely against the flange *i* of the wheel N′. The disk N^3 is also mounted to rotate loosely upon the bearing N^2. The flange and edge portion of the disk N^3 are cut away between the points *h h*, Fig. 20, to receive the flanged end *g*′ of an arm *g*. The arm *g* terminates at its opposite end in a collar g^2, which fits loosely over a boss *f*, formed upon the outer surface of the disk N^3 and surrounding the shaft N^2. At one side of the arm *g* is a segmental opening *e* through the disk N^3 (see Figs. 20 and 21) and coinciding with the opening *e*. The outer surface of the arm *g* is beveled off, as indicated at g^3. Extending through the opening *e* is a clutch-block *d* on a stem *d*′. The clutch-block *d* is provided on the outer side of the disk with a cam projection d^2, adapted to engage the cam-surface g^3 of the arm *g*, and at its end, which projects through the opening *e*, it is provided with a recess d^3, which embraces the flange *i*′ of the wheel N′. Pivotally mounted at one end upon the bearings N^2 is an arm *c*, which at its opposite end is pivotally connected with the stem *d*′ of the clutch-block *d*. (See Fig. 1.)

P is a vertically-reciprocating rod extend-

ing down through a guide-opening *u* in the section A′, which opening affords the bearing for the said rod. At its lower end the rod P is provided with a nut P′, and between the said nut and a shoulder *u′*, formed in the guide-opening for the rod, is confined a coiled spring P^2. The spring operates to maintain the rod P at the lowest limit of its play and to resist the rise thereof. Firmly secured to the rod is a collar P^3, which rests normally upon the shoulder *x′*, Fig. 2, at the top of the guide-opening *u* for the rod. Above the collar P^3 and loosely surrounding the rod P is a collar P^4. Pivoted at one end at x^2 to the section A′ to one side of the disk N^3 is a lever R.

R′ is a link pivotally connected at opposite ends, respectively, to the free ends of the lever R and arm *c*. A link R^2 is pivotally connected at one end to the collar P^4 and at its opposite end to the lever R between the ends of the latter. The rod P passes through an opening in an arm C^4 of the bracket C′, and at its upper end it is provided with a cap-screw P^5.

The wire Y extends from the grip mechanism N through a groove or passage *b* in the section A′ at the base of the latter and a groove *b′* in the section A, which is coincident with the groove *b*, described. The groove or passage *b′* is in the bottom of the section A and crosses the vertical passage n^2 in a direction diagonally to the inner face of the section A. Extending transversely through the section A′ at the passage *b* is a solid cylinder *a*, having an opening *a′* through it, (see Fig. 26,) which registers normally with the passage *b* and is of a diameter to permit the wire Y to pass readily through it. The cylinder *a* is provided at its outer end with an arm a^2. Pivotally connected at one end to the arm a^2 and at its opposite end to the loose collar P^3 on the rod P is a link R^3. Extending transversely through the section A′ is a stationary cutting-blade a^3, which crosses the upper side of the passage *b* and affords a cutting-edge at the cylinder *a*.

Fulcrumed in bearings on the bracket C′ is a lever S, having an arm S′ and an arm S^2. On the end of the arm S^2 of the lever is a vertical concave extension S^3, adapted to embrace the rod P between the bracket-arm C^4 and screw-cap P^5. The lever S is fulcrumed upon a pin S^4, which extends down through a bearing in the arm C^2 of bracket C′, and carries a confined spring S^5, which bears against the lever S and operates merely as friction mechanism to prevent too ready turning of the lever upon its fulcrum. The lever S rises and falls with the bracket C′ and rod C, and near the lowest limit of its fall in the path of the arm S′ of the lever is an oscillating switch T. The switch T is rigid upon a shaft T′, which extends through the section A, and the switch is formed with two cam-fingers T^2 and T^3. (See Fig. 1.) On the rear side of the section A the shaft T′ is provided with a crank T^4, which is pivotally connected to a reciprocating rod T^5. The rod T^5 is operated in any suitable manner to reciprocate, when desired, and turn either finger of the switch into engagement with the descending lever S.

The operation of the feed and cutting mechanism for the wire Y is as follows: When the material into which the staples are driven has passed from under the passage n^2, the rod T^5 is moved to turn the cam-finger T^3 of the switch into the path of the descending lever S. The engagement of the lever S with the switch-finger T^3 turns the lever to carry its concave extension S^3 against the rod P. In the subsequent rise of the rod C the upper end of the part S^3 engages the under side of the cap-screw P^5 and raises the rod P against the resistance of the spring P^2. As the rod P rises it draws up the link R^3 and turns the cylinder *a*. The turning of the cylinder *a* carries up the wire Y and shears it off against the blade a^3. In the rise of the rod P collar P^3 lifts the collar P^4 and the link R^2 is drawn upward, drawing with it the lever R, link R′, and arm *c*. The upward movement of the arm *c* carries with it the clutch-block *d* until the latter reaches the upper end of the socket *e*. The further rise of the arm *c* causes the clutch-block *d* to oscillate the disk N^3 upward, which carries with it, of course, the arm *g*. As shown in Fig. 22, the end of the flange *g′* of the arm *g* is serrated and the wire Y passes down between the said serrated end and the flange i^2 of the wheel N′. In the rise of the clutch-block *d* its cam d^2 disengages itself from the cam-surface g^3 of the arm *g*, permitting the serrated end of the latter to slide freely over the wire Y. As the rod C descends the lever S disengages itself from the cap P^5 and the rod P is drawn down by its spring P^2. In the descent of the rod P the cylinder *a* is turned to its normal position, wherein its passage *a′* registers with the passage *b*. The under surface of the bracket-arm C^4 strikes the collar P^4 and forces it down to the collar P^3, swinging the lever R and arm *c* in the downward direction and causing the clutch-block to descend and engage the cam-surface g^3 of the arm *g*. This engagement between the clutch-block and arm *g* causes the latter to be pressed inward, whereby its serrated end engages the wire Y, the latter being gripped between the serrated end of the arm *g* and flange *i* of the wheel N′. The further descent of the rod P turns the grip mechanism and feeds the wire Y forward. Owing to the leverage connection between the sliding collar P^4 and grip mechanism, the latter is turned a distance of about two inches with the movement of but a fraction of an inch of the collar P^4. While the rods C and P are descending, as described, the reciprocating rod T^5 is moved to turn the switch-finger T^3 into the path of the descending lever S and the latter is swung out of contact with the rod P.

As shown in the drawings, the cutting-edges of the blade M^7 and cutter-block L are ser-

rated to serrate the ends of the staples along their severed faces.

The intermittent-grip mechanism K, which feeds the wire W, may be adjusted to advance the wire any desired distance with each operation. The adjustment is effected by loosening the link K^{15} at the lever K^{13}, shifting it in the groove K^{14}, and tightening it in adjusted position. The sweep of the intermittent-grip mechanism is increased by shifting the link K^{15} in the direction of the free end of the lever K^{13} and diminished by shifting the link in the direction of the fulcrum of the lever K^{13}. The cutter-block L may be shifted toward or away from the path of the staple-forming mechanism by means of the adjusting-screw w^5, so that the engagement of the cutting-blade M^7 with the cutting-edge L^4 of the cutter-block may be at any desired distance from the path of the staple-forming mechanism.

In practice when it is desired to adjust the feed and cutting mechanisms to produce a longer staple the intermittent-grip mechanism is adjusted to feed the proper increased length of wire and the cutter-block is shifted one-half of that distance. To facilitate the adjustment, a scale v is provided upon the lever K^{13} and a scale v', one-half the size of the scale v is provided upon the face of the part A′ at the side of the cutter-block.

It will be seen from the foregoing description that our improved machine may be used merely to manufacture staples from a continuous length of wire. It may be also employed to drive the staples into material fed across the bottom of the machine, and it will also, if desired, feed a strengthening-wire across the discharge end of the machine, which the staples will straddle as they are ejected from the machine. It will be noticed that the strengthening-wire passes the discharge-opening of the machine in a direction diagonally of the staple at an angle preferably of about forty-five degrees to the latter. This is a precautionary measure to prevent the staples from splitting the material into which they are driven.

While the construction shown and described is the one we prefer to employ, it is obvious that it may be modified in the matter of details without departing from the spirit of our invention as defined by the claims.

What we claim as new, and desire to secure by Letters Patent, is—

1. In a staple-forming machine, the combination, with the stationary frame and feed and severing mechanisms for the wire, of the staple-former mounted in the stationary frame, a carrier reciprocating in the stationary frame, a bender reciprocated by the carrier and operating in the movement of the carrier in one direction to engage the staple-blank, force it into the staple-former, and then release the staple, and a ram upon the carrier, operating in the reverse movement thereof to engage and discharge the staple from the staple-former, substantially as described.

2. In a staple-forming machine, the combination, with the stationary frame and feed and severing mechanisms for the wire, of a staple-former mounted in the stationary frame, a bender reciprocated by the carrier and having an independent oscillating movement and operating in the movement of the carrier in one direction to engage the staple-blank, force it into the staple-former, and then release the staple, and a ram upon the carrier, operating in the reverse movement thereof to engage and discharge the staple from the staple-former, substantially as described.

3. In a staple-forming machine, the combination, with the stationary frame and feed and severing mechanisms for the wire, of a discharge-passage in the frame for the staple, a staple-former mounted in the frame and movable into and out of coincidence with the said discharge-passage, a reciprocating carrier in the frame, a bender reciprocated by the carrier and operating in the movement of the carrier in one direction to engage the staple-blank, force it into the staple-former, and then release the staple, and a ram upon the carrier, operating in the reverse movement thereof to engage the staple and force it out of the staple-former and through the discharge-passage, substantially as described.

4. In a staple-forming machine, the combination, with the stationary frame and feed and severing mechanisms for the wire, of a discharge-passage in the frame for the staple, a staple-former movable into and out of coincidence with the said discharge-passage, a carrier reciprocating in the stationary frame, a bender engaged and released by the carrier in its movements and reciprocated thereby a distance less than that traversed by the carrier and having an oscillating motion independent of the carrier and operating when engaged by the carrier in the movement thereof in one direction to engage the staple-blank, force it into the staple-former, and then release the staple, and a ram upon the carrier, reciprocating past the engaging end of the bender and operating in the reverse movement of the carrier to engage the staple and force it out of the staple-former and through the discharge-passage, substantially as described.

5. In a staple-forming machine, the combination, with the frame having a discharge-passage for the staple and with the feed and severing mechanisms for the wire, of an oscillating staple-former pivoted to the frame and provided with forming-grooves which in the backward oscillation of the staple-former are brought into coincidence with the said discharge-passage and with a transverse opening between the forming-grooves, a bender reciprocating in and longitudinally of the said transverse opening and movable at its engaging end into and out of coincidence with the

forming-grooves, and a ram reciprocating in the said discharge-passage and in the transverse opening of the staple-former past the engaging end of the bender, substantially as described.

6. The combination of the staple-former, a reciprocating ram, a bender, means for oscillating the bender, and means for reciprocating the same upon the movement of the said ram a distance less than that traversed by the ram, whereby the ram with each reciprocation passes the engaging end of the bender, substantially as described.

7. The combination of the frame provided with the discharge-passage for the staple, reciprocating ram, bender having a reciprocating and an oscillating motion, oscillating staple-former pivoted to the frame and having staple-forming grooves, and a spring-stop on the frame, operating to maintain the staple-former normally, with its forming-grooves coincident with the said discharge-passage, substantially as described.

8. The combination, with the reciprocating rod C, ram thereon, and staple-former, of a reciprocating slotted rod F, a socket-piece G on the rod, having a stem p, provided with stops p' and p^5, an arm C^2 on the rod C, loosely embracing the stem p between the stops p' p^5, and a bender G', pivoted to the socket-piece G, extending in the slot of the rod F and having a cam-shaped end to engage the end of said slot, whereby in the reciprocation of the rod C the stops on the socket-piece are alternately engaged by the arm C^2, the rod C has limited movement in advance of such engagement, the rod F and bender are reciprocated, and the bender is oscillated, substantially as described.

9. In a staple-forming machine, the combination, with the staple-forming and wire-sevving mechanisms, of a reciprocating bearing and intermittent-grip feeding mechanism for the wire, comprising a reciprocating clutch to engage and advance the wire and adjustable lever mechanism between the reciprocating bearing and clutch, whereby the distance of movement of the clutch with relation to the movement of the bearing may be varied at will, substantially as described.

10. The combination, with the reciprocating staple-driving mechanism and discharge-opening for the staple, of strengthening-wire-severing mechanism, feed mechanism adapted to engage and advance said wire across the said discharge-opening, and means for automatically throwing the said severing and feed mechanisms into and out of operation, substantially as described.

11. The combination, with the reciprocating staple-driving mechanism, of a movable support, strengthening wire-severing-and intermittent-feed mechanisms connected with the said support, support-engaging mechanism reciprocating with the staple-driving mechanism and adapted to engage and release the said support, and intermittingly-actuated switch mechanism in the path of the said support-engaging mechanism operating to throw the said engaging mechanism into and out of engagement with the said movable support, whereby the said severing and feed mechanisms are operated, substantially as described.

12. The combination, with the reciprocating staple-driving mechanism, of strengthening-wire-severing and intermittent-feed mechanisms, a longitudinally-movable rod with which the said severing and feed mechanisms are connected, a spring resisting movement of the said rod in one direction, rod-engaging mechanism reciprocating with the staple-driving mechanism and adapted to engage and release the said rod, and intermittingly-actuated switch mechanism in the path of the said rod-engaging mechanism operating to throw the said engaging mechanism into and out of engagement with the said rod, whereby the rod is moved against the resistance of its spring and is returned by its spring, substantially as and for the purpose set forth.

13. The combination, with the staple-driving mechanism, of a feed-passage for the strengthening-wire, an oscillating cutter extending across the said feed-passage and having an opening through it for the wire, normally coinciding with said feed-passage, a cutting-edge at the said feed-passage past which the said cutter oscillates, and feed mechanism for said wire arranged to engage the wire behind the cutter and advance the wire after severance, substantially as described.

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In presence of—
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