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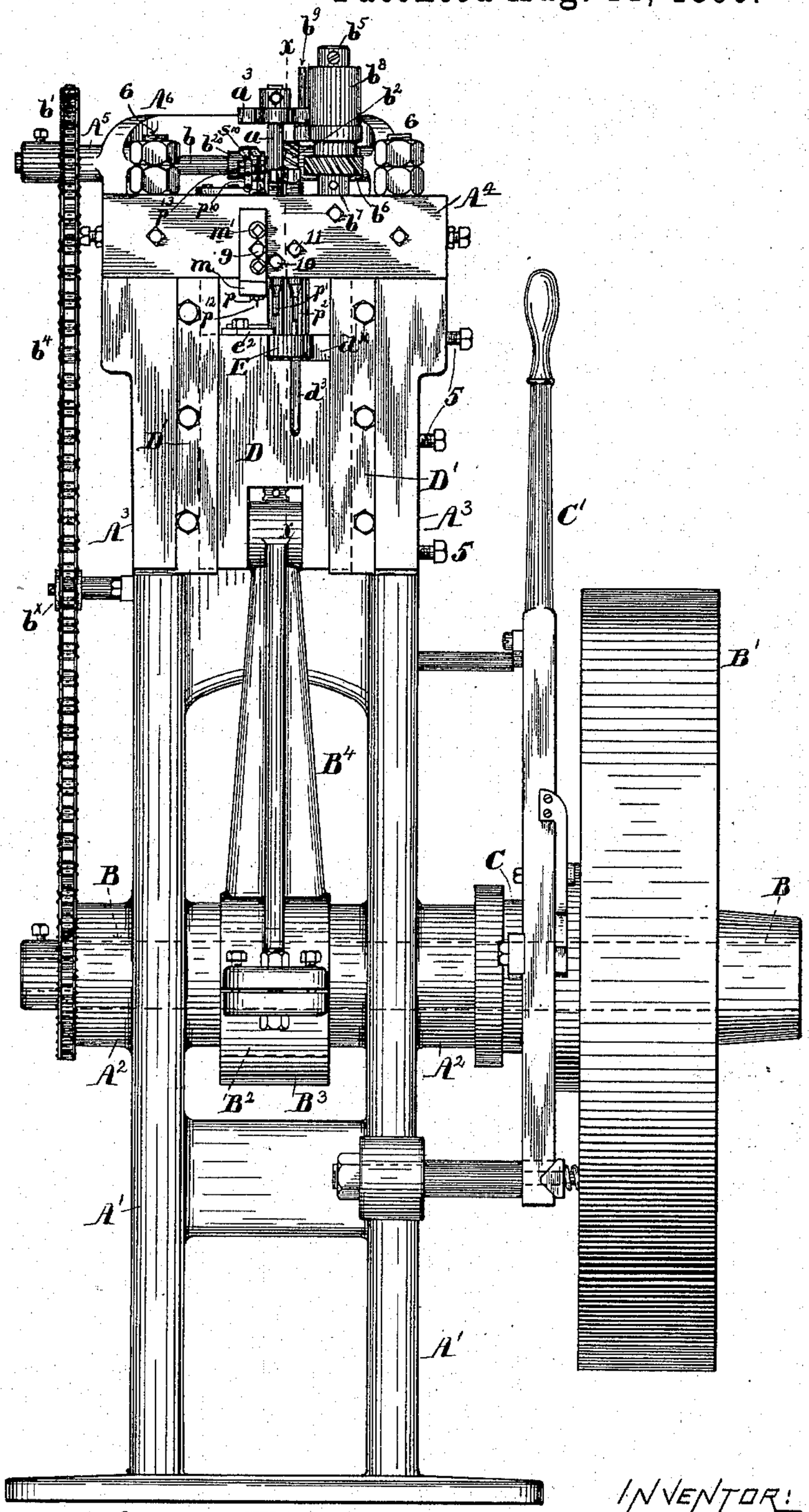
H. H. CUMMINGS.

MACHINE FOR MAKING SHEET METAL RIVETS.

No. 565,855. Patented Aug. 11, 1896.



WITNESSES:
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FIG. 1.

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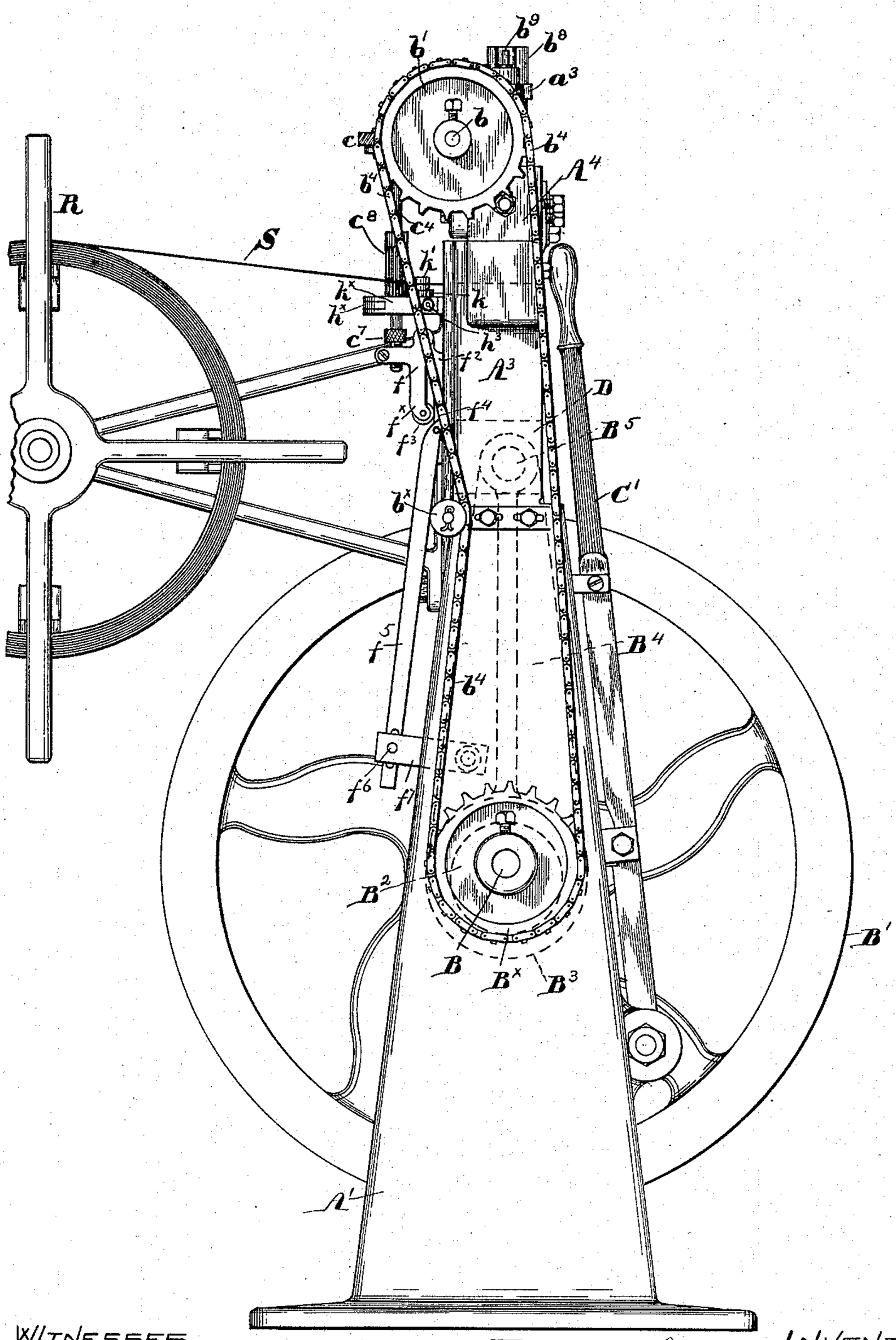

FIG. 2.

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H. H. CUMMINGS.

MACHINE FOR MAKING SHEET METAL RIVETS.

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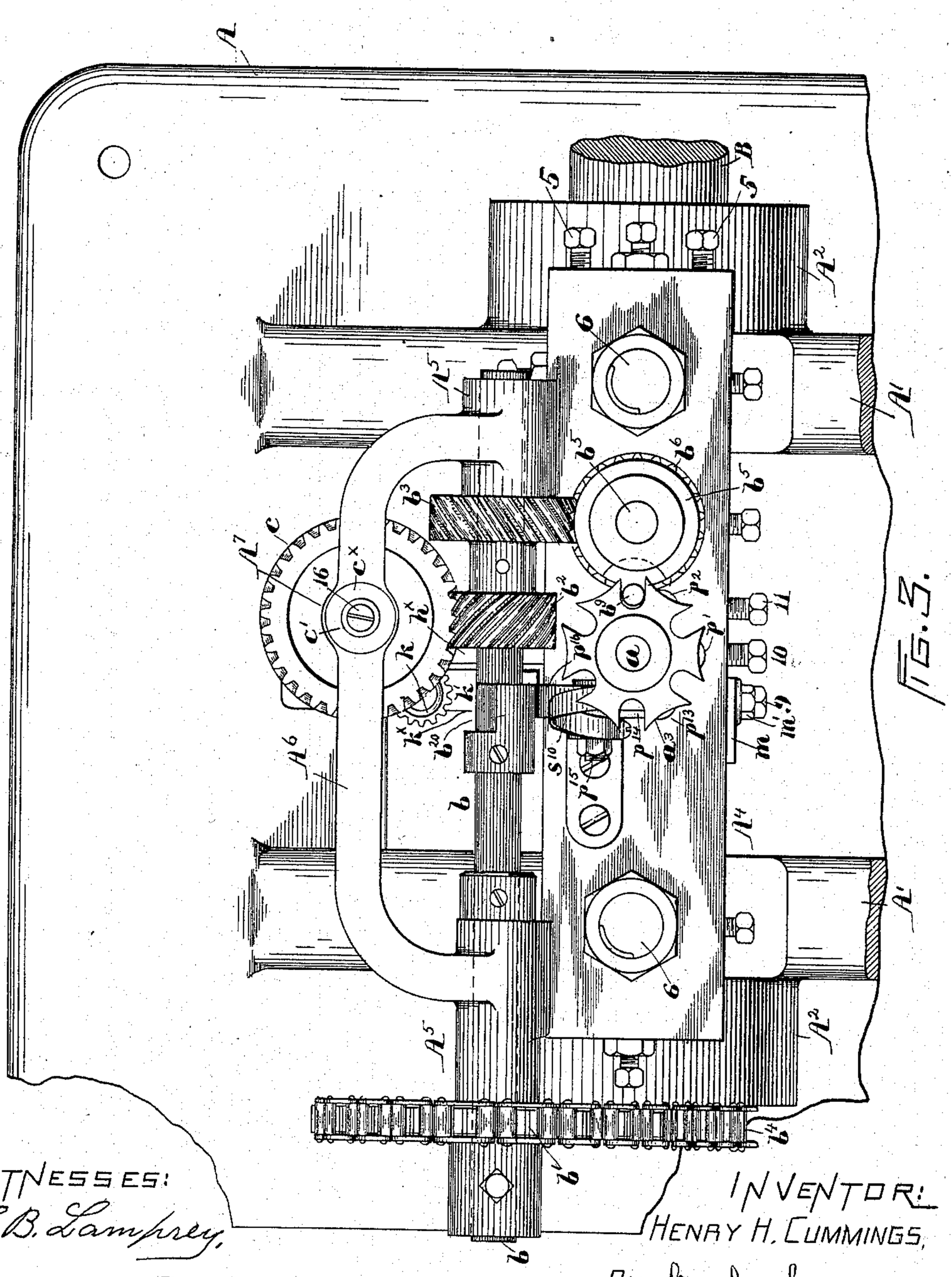

FIG. 3.

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(No Model.) 4 Sheets—Sheet 4.

H. H. CUMMINGS.

MACHINE FOR MAKING SHEET METAL RIVETS.

No. 565,855. Patented Aug. 11, 1896.

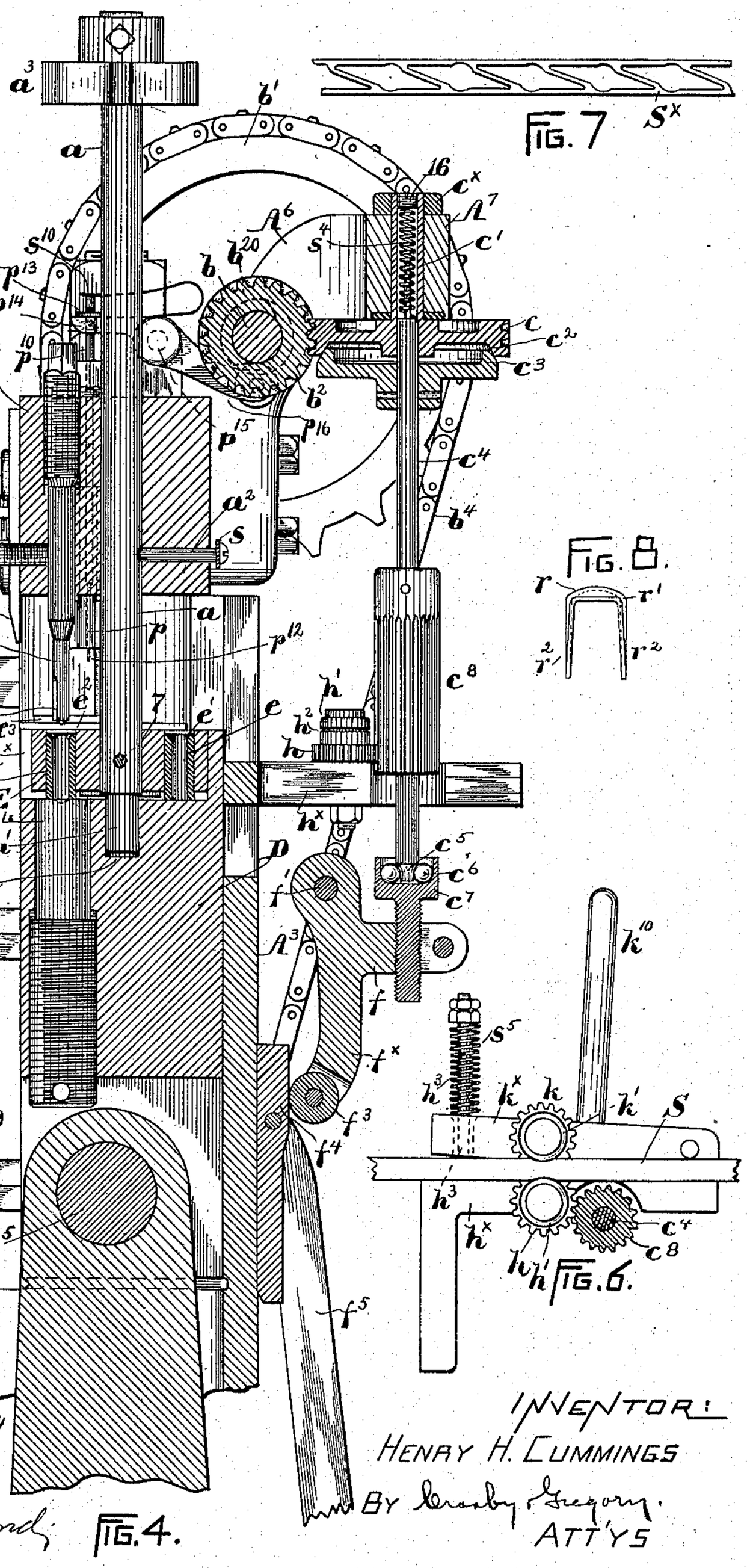

FIG. 7

FIG. 8.

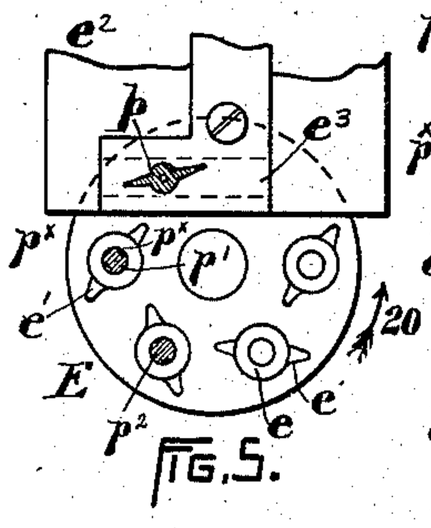

FIG. 5.

FIG. 6.

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FIG. 4.

UNITED STATES PATENT OFFICE.

HENRY H. CUMMINGS, OF MALDEN, MASSACHUSETTS.

MACHINE FOR MAKING SHEET-METAL RIVETS.

SPECIFICATION forming part of Letters Patent No. 565,855, dated August 11, 1896.

Application filed November 4, 1895. Serial No. 567,821. (No model.)

To all whom it may concern:

Be it known that I, HENRY H. CUMMINGS, of Malden, county of Middlesex, State of Massachusetts, have invented an Improvement in Machines for Making Sheet-Metal Rivets, of which the following description, in connection with the accompanying drawings, is a specification, like letters on the drawings representing like parts.

This invention has for its object the production of a machine for making sheet-metal rivets having concavo-convex heads and upturned fastening prongs or legs, the rivet-head being swaged to thin it centrally, and thereby crowd the metal to its periphery to form a strengthening-rib or enlargement between the bases of the legs or prongs.

A sheet-metal strip of suitable thickness and width is fed intermittingly to a reciprocating punch, which, coöperating with a die, punches out the blanks from which the rivets are formed. Mechanism is provided for bending the ends of the blank to form the legs and swage the head to complete the rivet. The blanks are punched from the strip in such manner as to leave the smallest possible amount of scrap or waste, and for convenience in handling I have provided a cutter which severs the strip of waste as it leaves the machine.

Figure 1 is a front elevation of a rivet-machine embodying my invention, showing the die-carrier and plunger lowered. Fig. 2 is a left-hand side elevation of the machine, showing a portion of the blank-strip reel or support. Fig. 3 is an enlarged top or plan view of the machine, the base-plate and main shaft being broken off to save space. Fig. 4 is an enlarged vertical sectional view of the upper part of the machine, taken on the line $x\,x$, Fig. 1, looking toward the left, the die-carrier shaft being shown in elevation. Fig. 5 is a top or plan view of the rotatable die-carrier and the blank die. Fig. 6 is a similar view of the feed-rolls and their support. Fig. 7 is a plan view of a portion of the waste-strip, showing the manner in which the blanks are punched therefrom; and Fig. 8 in side elevation shows, enlarged, a completed rivet.

Referring to Figs. 1 and 2, the base A has erected thereon an open standard A′, provided with bearings A^2 for a main shaft B, having loosely mounted thereon a belt-pulley B′, connected by a belt (not shown) with a suitable source of power. A clutch C, of any suitable construction and forming no part of this invention, is controlled by a hand-lever C′, to clutch or unclutch the pulley and shaft. An eccentric B^2, fast on the said shaft between the bearings A^2, is surrounded by a strap B^3, forming part of a pitman B^4, pivoted at its upper end at B^5 to a plunger D, vertically reciprocable, by rotation of the main shaft, in guideways D′ (see Fig. 1) in the head A^3 of the standard A′, one of the guideways being preferably made adjustable by set-screws 5 to take up wear. A cross-head A^4 is rigidly secured by suitable bolts 6 to the top of the head A^3 to form a long bearing or support for a vertical shaft a, extended completely therethrough and having its reduced end a' inserted in a socket d in the plunger, as shown in Fig. 4. A pin A^2, loosely extended through the cross-head A^4, is maintained by a spring s yieldingly against the shaft a to act as a friction-detent therefor, retarding the longitudinal movement of the shaft for a purpose to be described.

The upper end of the head D is cut away at $d^\times$ to receive therein a circular die-carrier E, (shown separately in Fig. 5,) secured as by a pin 7 to the shaft a, to be rotated thereby, said die-carrier having a series of tubular dies e therein, the upper face of the die-carrier being depressed above each die at e' to correspond with the shape of and form seats for the rivet-blanks. A die-plate e^2, bolted to the plunger D, projects partly over the die-carrier E, and has an opening therein of the shape of the blank, a stripper e^3, having a similarly-shaped opening, being secured to the upper side of the die-plate, as shown in Fig. 5, so that when one of the dies e' is under the die-plate opening the passage of a blank-punch, to be described, through the stripper-opening will punch out a blank from the metal strip and place it in the depression or seat e of the die-carrier E beneath.

I have secured in the cross-head A^4 and depending therefrom a blank-punch p, to coöperate with the die-plate e^2 when the plunger is raised, shaped in cross-section as shown in section, Fig. 5, the shank of said blank-punch being adjusted by a backing-screw in the cross-head and held in adjusted position by a set-screw 9. A former p', also similarly adjusted by a backing-screw in the cross-head and projecting a greater distance below it, is

held securely adjusted by a set-screw 10, said former being grooved longitudinally on opposite sides at $p^{\times}$. The length of the former p' is such that when the plunger D is raised the former will enter one of the dies e in the die-carrier E and closely approach the slightly-concaved upper end of an adjustable and removable swaging-die $p'^{\times}$, screwed into the plunger and extending up to the cut-away portion $d^{\times}$ thereof.

Supposing a blank to be resting in its seat e' beneath the former p' when the plunger D is raised, the said former will act upon the central portion of the blank, forcing it down into the die e and against the swaging-die $p'^{\times}$, to swage the rivet-head r, Fig. 8, and give it a concavo-convex form, crowding the metal out to the periphery at r', while the extended points of the blank will be bent up to enter the grooves $p^{\times}$ in the former p', as the latter forces the blank through the die e to form the legs or prongs r^2 of the staple, convexed on their outer sides. The convexity of the end of the former p' is of less radius than that of the concavity in the end of the swaging-die $p'^{\times}$, to give the enlarged periphery to the rivet-head. When the plunger D descends, the former p' is withdrawn and the completed rivet is left in the die e and the die-carrier E is given a partial rotation in the direction of arrow 20, Fig. 5, as will be described, to bring the die containing the rivet beneath the clearer p^2, held in and depending from the cross-head A^4, and at the next ascent of the plunger D the clearer will force the rivet out through the lower end of the die into a discharge groove or channel d^3, formed in the front of the plunger, as shown in Fig. 1. The clearer p^2 is long enough to effectually clear the rivet from the rotatable die-head E, the relative lengths of the punch, former, and clearer being shown in Fig. 1, while they are arranged in an arc of a circle of which the shaft a is the center. A set-screw 11 retains the clearer firmly in adjusted position in the cross-head, the clearer filling the tubular die e' and engaging the points of the upturned rivet-legs r^2 to force the rivet out of the die.

From the foregoing it will be seen that at each ascent of the plunger a blank is punched from the strip and laid in the die-carrier, a formerly punched blank is formed into a rivet, and a completed rivet is cleared or discharged from the die-carrier and delivered, each punched blank undergoing successively the forming and clearing steps.

It will be seen from Fig. 4 that the space between the bottom of the cut-away portion $d^{\times}$ of the plunger and the die-plate e^2 is greater than the thickness of the die-carrier E, so that when the plunger D descends it will move slightly in advance of the die-carrier at the beginning, owing to the friction-detent on the shaft a, and when the plunger and die-carrier come to rest the latter will be slightly above the bottom of the recess $d^{\times}$, the bottom of one of the dies e' resting upon the swaging-die $p'^{\times}$.

When the die-carrier E is rotated, as will be described, after the plunger descends, this space affords a clearance for the heads of the formed rivets, which will extend below the lower ends of the dies e, and they will not rub over the plunger on their way to be cleared or discharged from the die-carrier.

Referring to Fig. 3, the cross-head A^4 has bearings A^5 for a shaft b, having fast thereon, preferably, a sprocket-wheel b' and spiral gears b^2 and b^3, a sprocket-chain b^4 passing over the wheel b' and around a similar sprocket-wheel $B^{\times}$ on the main shaft B, whereby rotation is transmitted to the shaft b, a guide-sheave $b^{\times}$, (see Fig. 2,) adjustable on the standard A', taking up undue slack in the chain. A stud b^5 on the top of the cross-head A^4 has mounted loosely thereon a spiral gear b^6 in mesh with the gear b^3 on shaft b, to be rotated thereby, the gear b^6 resting on a collar b^7, and secured to or forming part of said gear is an upwardly-extended hub b^8, (see Fig. 1,) provided with a single long pin or tooth b^9 to engage once at each revolution the star-wheel a^3, fast on the upper end of the shaft a, forming what is commonly called the "Geneva stop-motion." The outer concaved faces of the teeth of the star-wheel a^3 rest against the cylindrical face of the hub b^8 when the tooth b^9 passes out of engagement with the star-wheel, holding the latter and its shaft from rotative movement at such time.

Owing to the length of the hub and its tooth, the star-wheel is always in operative position relative thereto, whether the shaft a is raised or lowered, and an intermittent rotation is imparted to the shaft a and its attached die-carrier E sufficient to bring one after another of the dies e beneath the punch, former, and clearer described, the rotative movement being imparted as the plunger D comes to rest on its downstroke.

A bridge A^6 (shown as attached to the bearings A^5) has a vertical bearing A^7 therein (see Fig. 4) for the upwardly-extended hollow hub c' of a spiral gear c in mesh with the similar gear b^2, the hub c' being retained in place by a collar $c^{\times}$, secured thereto and resting on the top of bearing A^7.

The under side of the gear c is shown in Fig. 4 as made conical at c^2, forming one member of a clutch, the other member c^3 of which is shown as a friction-disk secured to a spindle c^4, extended into the hub c' and normally pressed down by a spring s^4, held at its upper end by a screw-plug 16. At its lower end the spindle is shown as coned at c^5 to rest on a series of antifriction-balls c^6, held in a box c^7, having a threaded shank screwed into an arm of a bell-crank lever f, pivoted at f' to a bracket f^2 (see Fig. 2) on the head A^3.

The depending arm $f^{\times}$ of the lever is provided with a suitable roll f^3 to be engaged by a cam-lug f^4, pivotally mounted on an arm f^5, jointed at f^6 to a stand f^7, adjustably secured to and projecting from the rear side of the pitman B^4, whereby the cam-lug f^4 will

slide up and down on the back of the head A^3 by movement of the pitman. When the cam-lug is raised simultaneously with the plunger D, the roll f^3 passes on to the low portion of said lug, allowing the bell-crank lever f to turn on its pivot, and the spring s^4 depresses the spindle c^4, disengaging the clutch member c^3 from its continuously-rotating member c^2 on the gear c, so that the spindle c^4 will not rotate. A long pinion c^8 is fast on the spindle c^4 in continuous engagement with the teeth of a gear h, rotatably mounted on a bracket $h^\times$, rigidly secured to the plunger D and projecting through the open back of the head A^3, said gear h having an upwardly-extended hub or roll h', provided with an annular groove h^2 (see Fig. 4) to receive one edge of the blank strip S, the groove being preferably corrugated at its bottom. An arm $k^\times$ is pivoted to the bracket $h^\times$, (see Fig. 6,) and has rotatably mounted thereon a gear k, normally in mesh with gear h and having a hub or roll k' annularly grooved to receive the opposite edge of the blank strip, the gears being held in engagement by a spring s^5, surrounding a stud h^3 on the bracket and extended loosely through the arm $k^\times$.

When the spindle c^4 is rotated, the clutch members c^2 c^3 being in engagement, the feed-rolls h' k' will be rotated to feed the blank strip S forward over the top of the die-carrier E and through the stripper, but as soon as the proper length has been fed the roll f^3 leaves the high part of the cam f^4 and the clutch will be disconnected, stopping rotation of the spindle c^4, and consequently the feed will be stopped, the now non-rotating rolls moving up with the plunger, but the gear h will remain in mesh with the long pinion c^8, ready to begin feeding when the parts return to position shown in Fig. 4. The thin-metal blank strip S is conveniently wound in a coil and supported on a suitable reel R. (Shown only in Fig. 2.)

When it is desired to insert the strip between the feed-rolls or to remove it, the arm $k^\times$ is turned on its pivot away from the bracket $h^\times$ by a suitable handle k^{10}, Fig. 6, against the action of spring s^5, to separate the feed-rolls h' and k'.

When the blank-punch p leaves the punched-out blank, the latter is liable to stick to the punch and so displace it from its seat on the die-carrier E, and to prevent this I have provided a separator.

The punch is made hollow, and a plunger-rod p^{10} is extended therethrough with its preferably-reduced lower end p^{12} normally projecting beyond the end of the punch, as shown in Fig. 4, by the action of a bent or other spring s^{10} acting on the upper end of the plunger-rod.

One end of the spring is rigidly secured to the cross-head A^4, and a collar p^{13} on the plunger-rod is adapted to be engaged and lifted at times by a dog p^{14}, pivoted at p^{15} on a part of the cross-head, the tail p^{16} of the dog extending in the path of a cam b^{20} on the shaft b.

When the punch is about to punch a blank, the cam b^{20} lifts the dog p^{14}, raising the plunger-rod p^{10} and drawing its tip p^{12} up out of the way within the punch, but as soon as the die-carrier E begins to descend, the cam b^{20} permits the dog to drop, and the spring s^{10} pushes down the tip p^{12} against the blank, separating it from the end of the punch, so that the blank will not be removed from its seat e' in the die-carrier.

The opening in the die-plate e^2 is arranged diagonally to the length of the blank strip, so that the blanks are cut therefrom in such manner as to leave a waste strip shown at $S^\times$, Fig. 7, economizing material and making the least possible waste while not destroying the integrity of the skeleton strip of waste as it passes through the machine.

A cutting-blade m is adjustably secured by screws m' to the front of the cross-head A^4 to act in conjunction with the die-plate e^2 at each ascent of the plunger to cut or sever the waste strip $S^\times$ into short portions as it leaves the machine, thus avoiding a long strip which would have to be broken off or removed by the attendant from time to time.

My invention is not restricted to the precise construction and arrangement of parts as herein shown, as it will be obvious that various details of the apparatus may be rearranged or modified without departing from the spirit and scope of my invention.

While I have shown herein what is known as the "Geneva stop-motion" for controlling the intermittent rotation of the die-carrier my invention is not restricted thereto.

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

1. In an apparatus for making sheet-metal rivets, the following instrumentalities in combination, viz: blank-making devices, to make and place blanks in the seats of the die-carrier, a rotatable die-carrier having a series of tubular dies and seats to receive the blanks, made by said devices, a former and a clearer coöperating with the die-carrier, means to bring said former, clearer and die-carrier into operative engagement, and means to rotate the die-carrier, step by step, substantially as described.

2. In an apparatus for making sheet-metal rivets, the following instrumentalities in combination, viz: blank-making devices, a rotatable die-carrier adjacent the said devices and having a series of tubular dies and seats, to receive the blanks as they are made, means to rotate said die-carrier intermittingly to receive the blanks from the blank-making devices, a former and means to cause operative engagement of the former with one blank after another on the die-carrier, substantially as described.

3. In an apparatus for making sheet-metal rivets, the following instrumentalities in com-

bination, viz: blank-making devices, a rotatable die-carrier having a series of tubular dies and blank-receiving seats, to receive the blanks as they are made, means to rotate said die-carrier intermittingly to receive the blanks, a former, a coöperating swaging-die, and means to force the blanks in succession into the tubular dies and swage the rivet-heads between the former and swaging-die, substantially as described.

4. In an apparatus for making sheet-metal rivets, the following instrumentalities in combination, viz: a reciprocating die-carrier, a series of tubular dies therein, each having at its upper end a blank-seat, a die-plate reciprocable with the die-carrier, a coöperating fixed blank-punch, a former to force the blanks so made in succession into the tubular dies, and means to eject the finished rivets, substantially as described.

5. In an apparatus for making sheet-metal rivets, the following instrumentalities in combination, viz: an intermittingly-rotatable die-carrier having a series of tubular dies and non-radial blank-receiving seats, blank-punching mechanism to punch the blanks from the strip and deliver them directly to the seats in the die-carrier, a former and a clearer, to respectively form a rivet in the die-carrier and clear a previously-finished rivet therefrom, and means to move the die-carrier toward and from the former and clearer, substantially as described.

6. In an apparatus for making sheet-metal rivets, the following instrumentalities in combination, viz: a reciprocating plunger, a rotatable die-carrier, mounted thereon provided with tubular forming-dies, blank-seats, blank-making devices, to make and deliver blanks to the die-carrier, a rivet-former and a swaging-die, one of which is movable toward the other, to form a rivet in the die-carrier and swage its head, mechanism to feed a blank-strip to the blank-making devices, and connections between the plunger and feed mechanism, to actuate the latter intermittingly, substantially as described.

7. In an apparatus of the class described, the following instrumentalities in combination, viz: a reciprocating plunger, a die-carrier rotatably mounted therein, provided with tubular forming-dies, a swaging-die in the plunger beneath the die-carrier, a fixed former adapted to enter successively the forming-dies, to form the rivet and swage its head, and means to bring said dies into the path of the former successively, substantially as described.

8. In an apparatus of the class described, the following instrumentalities in combination, viz: a reciprocating die-plate, a coöperating blank-punch, means to feed a blank strip between them, a separator within the blank-punch, means to positively withdraw the separator as the punch operates, and a spring to project the separator thereafter beyond the end of the blank-punch, substantially as described.

9. In an apparatus of the class described, the following instrumentalities in combination, viz: a reciprocating plunger, a die-carrier rotatably mounted therein and movable axially relative to the plunger, means to control such movement, a former coöperating with the die-carrier, to form the rivet, a swaging-die, to swage the rivet-head between it and the former, and a clearer to remove a finished rivet from the die-carrier, substantially as described.

10. In an apparatus of the class described, the following instrumentalities in combination, viz: blank-punching mechanism, blank-strip-feeding mechanism including positively-rotated feed-rolls, an actuating-spindle for said rolls, a driven clutch member on said spindle, a continuously-rotating driving-clutch member, and means to automatically engage and release said clutch members, to feed the blank strip intermittingly, substantially as described.

11. In an apparatus of the class described, the following instrumentalities in combination, viz: blank-strip-feed mechanism, comprising two peripherally-grooved rolls to receive the edges of the blank strip, a rotatable spindle geared to said rolls, a main driving-shaft, connections including a clutch, between it and the spindle, to rotate the latter, and means controlled by said main shaft to engage and release the clutch, to thereby feed the blank strip intermittingly, substantially as described.

12. In an apparatus of the class described, the following instrumentalities in combination, viz: rivet-forming mechanism, a reciprocating plunger, a blank-punch, mechanism to intermittingly feed a blank strip thereto, said mechanism comprising feed-rolls, a rotatable spindle geared thereto and having a clutch member thereon, a coöperating continuously-rotating clutch member, and connections between the plunger and spindle, to move the latter longitudinally and release the clutch members when a blank is being punched, substantially as described.

13. In an apparatus of the class described, the following instrumentalities in combination, viz: rivet-forming mechanism, including a reciprocating plunger, a die-carrier, and a former, a blank-punch, blank-strip-feed rolls movable with the plunger, an actuating-spindle having a long gear thereon, in engagement with the feed-rolls, and means to control rotation of said spindle by the reciprocation of said plunger, substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

HENRY H. CUMMINGS.

Witnesses:

J. COUPER EDWARDS,

AUGUSTA E. DEAN.