No. 616,642. Patented Dec. 27, 1898.

C. A. STURTEVANT.

MACHINE FOR MAKING ROOF VALLEYS.

(Application filed July 9, 1898.)

(No Model.) 5 Sheets—Sheet 1.

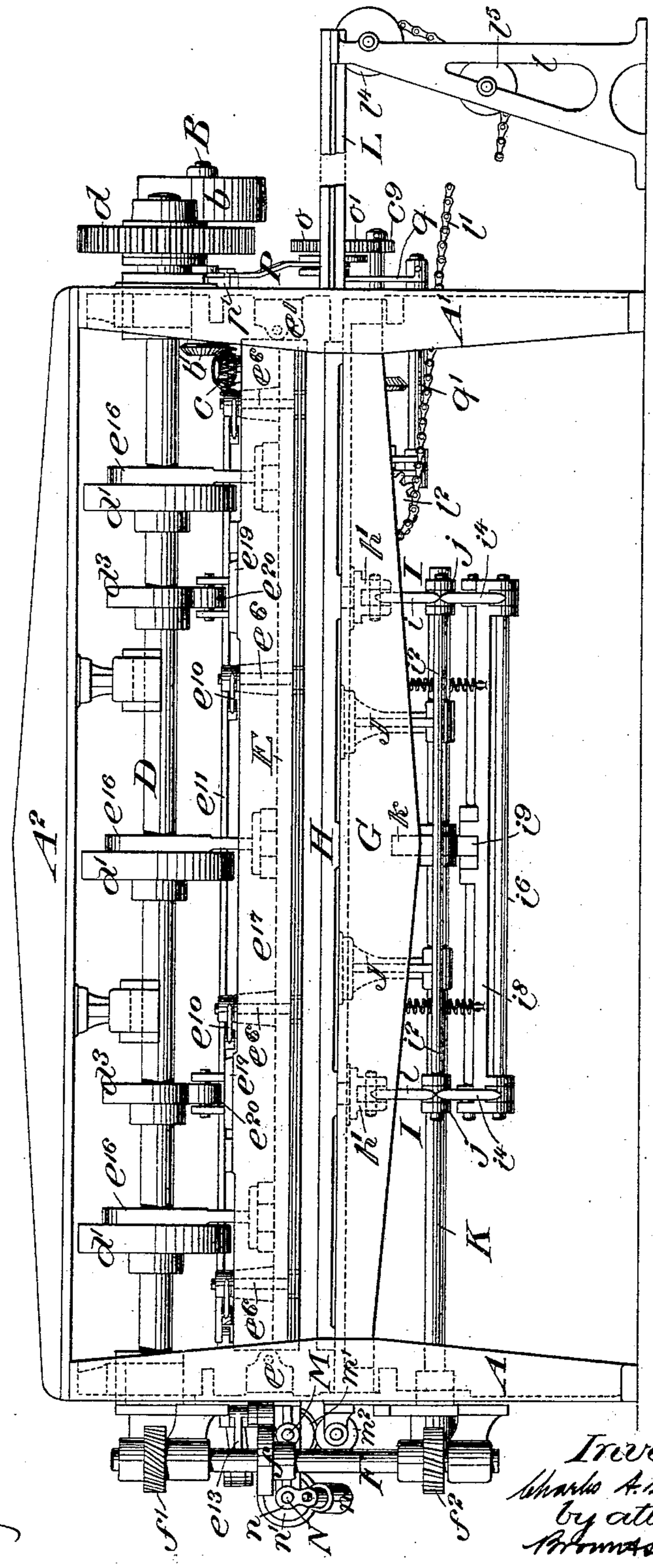

Fig. 1.

Witnesses:-
M. E. Fletcher.
Fred Haynes

Inventor:-
Charles A. Sturtevant
by attorneys.
Brown & Seward

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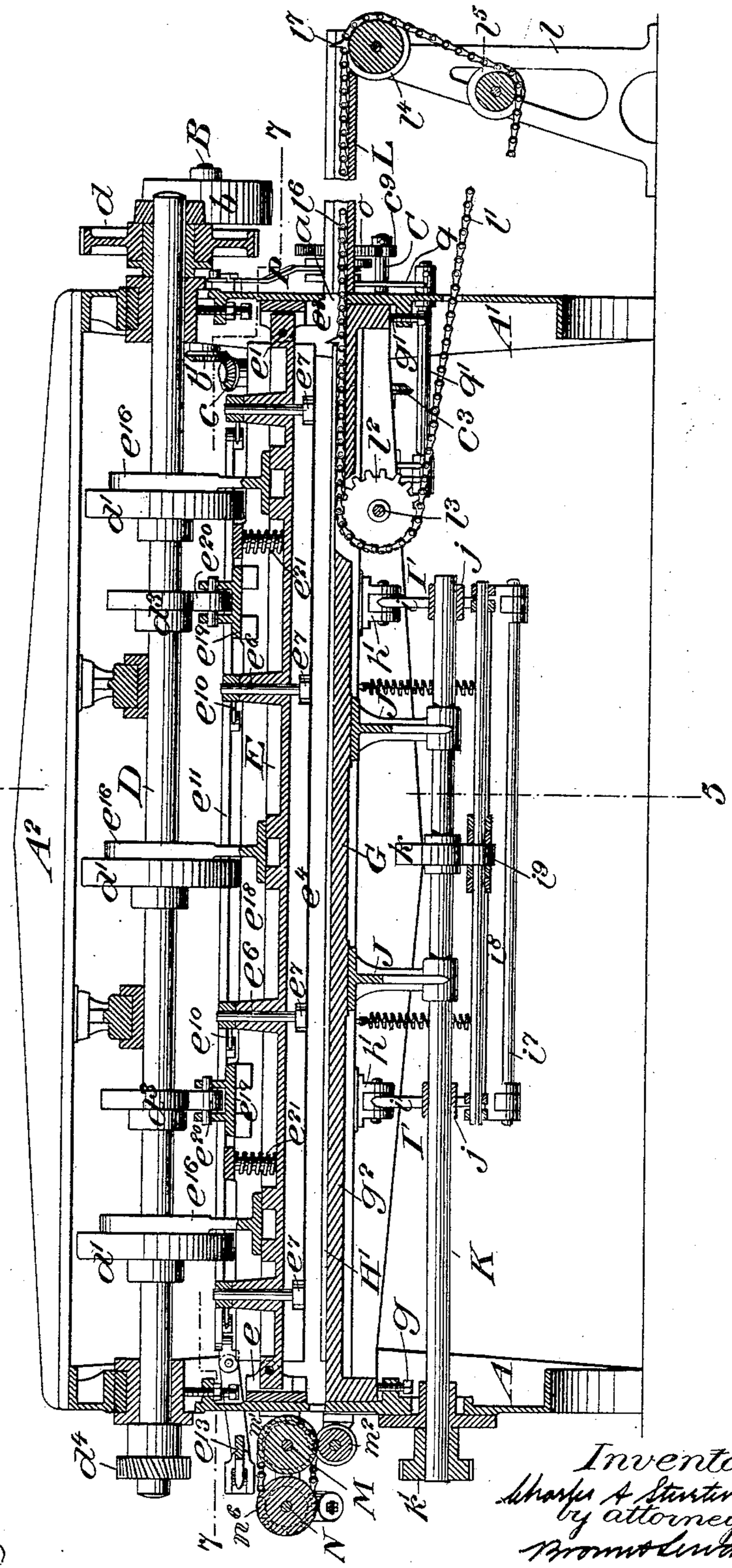
(No Model.) 5 Sheets—Sheet 2.

Fig. 2.



Witnesses:-
M. G. Fletcher.
Jno. Haynes

Inventor:-
Church & Sturtevant
by attorneys.
Brown & Seward

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(No Model.) 5 Sheets—Sheet 3.

Fig. 3.

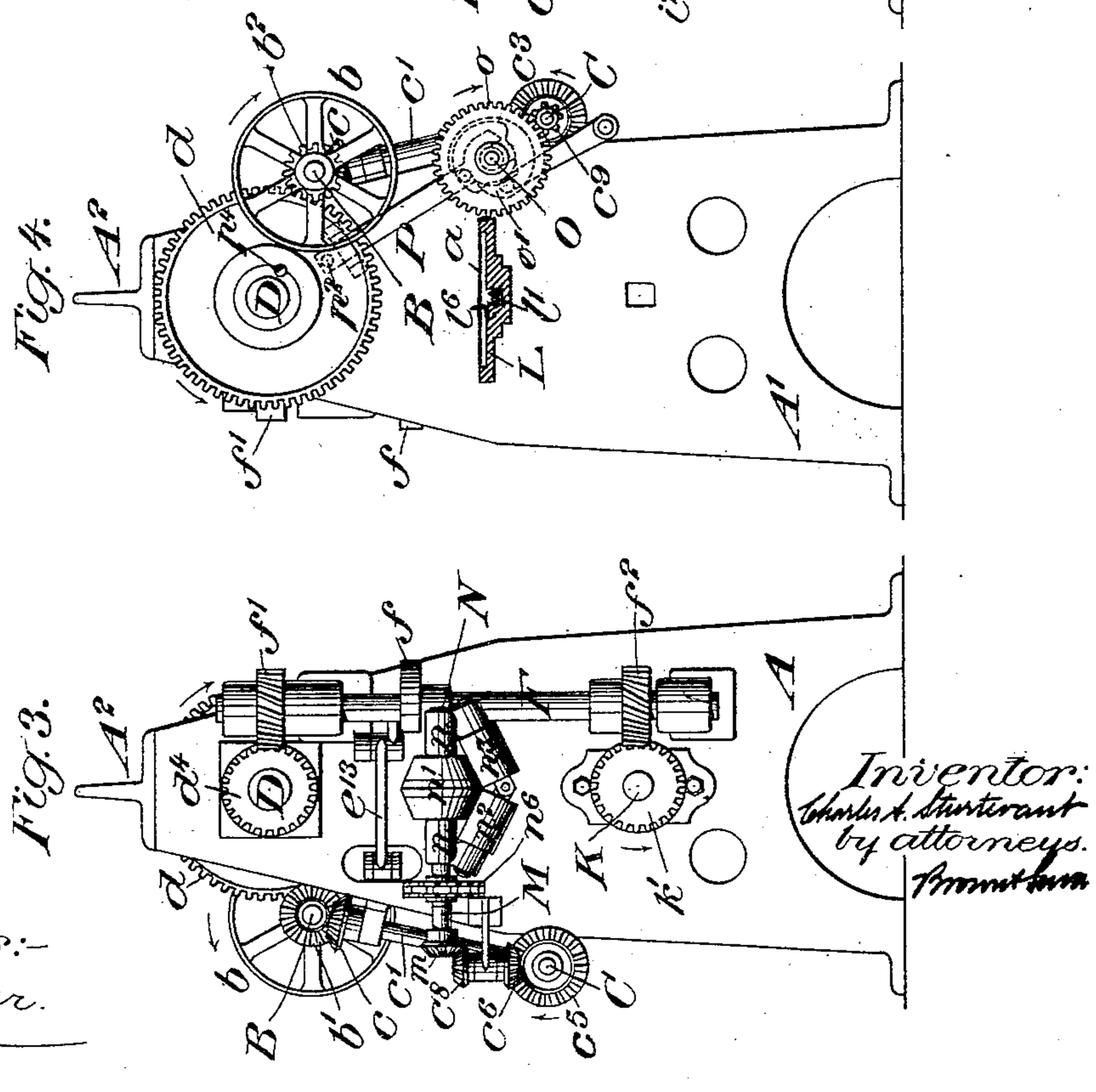
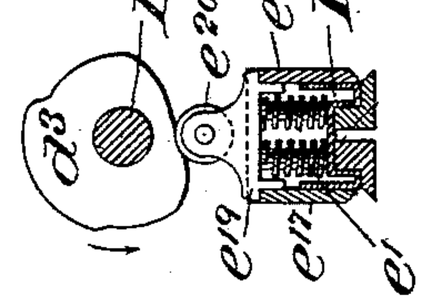


Fig. 4.

Fig. 5.

Fig. 6.



Witnesses:-
M. E. Fletcher.
Fred Haynes

Inventor:
Charles A. Sturtevant
by attorneys.
Brown & Sons

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C. A. STURTEVANT.

MACHINE FOR MAKING ROOF VALLEYS.

(Application filed July 9, 1898.)

(No Model.) 5 Sheets—Sheet 4.

Witnesses:-
M. C. Fletcher.
Fred'k Haynes

Inventor:-
Charles A. Sturtevant
by attorneys.
Brown Lewis & Brown

No. 616,642. Patented Dec. 27, 1898.

C. A. STURTEVANT.

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(No Model.) 5 Sheets—Sheet 5.

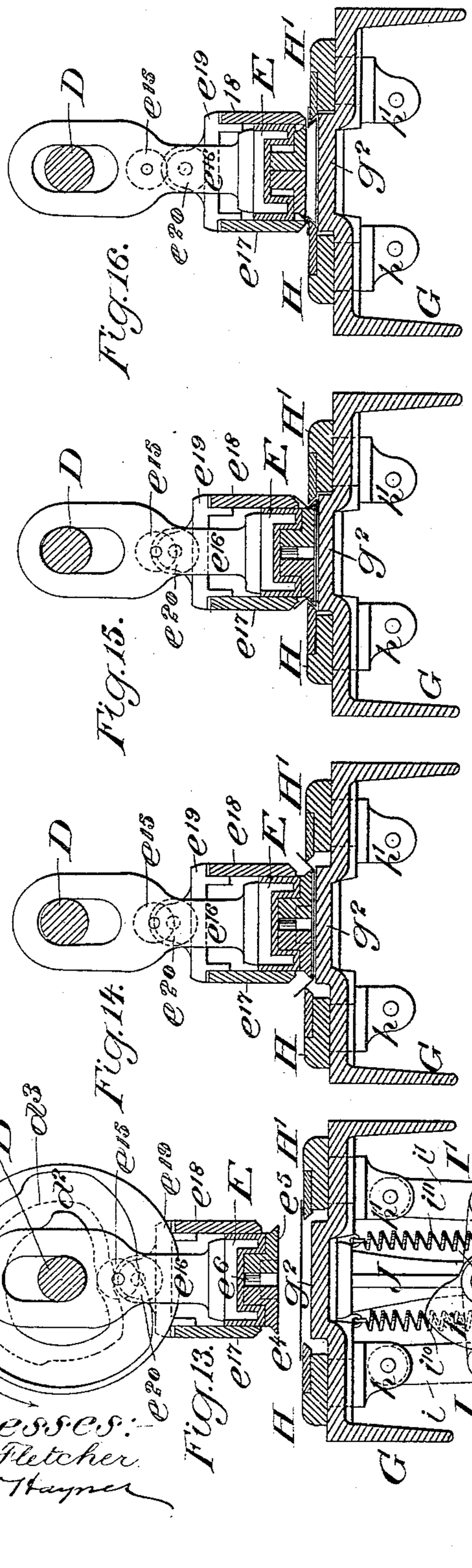

Fig. 16.

Fig. 15.

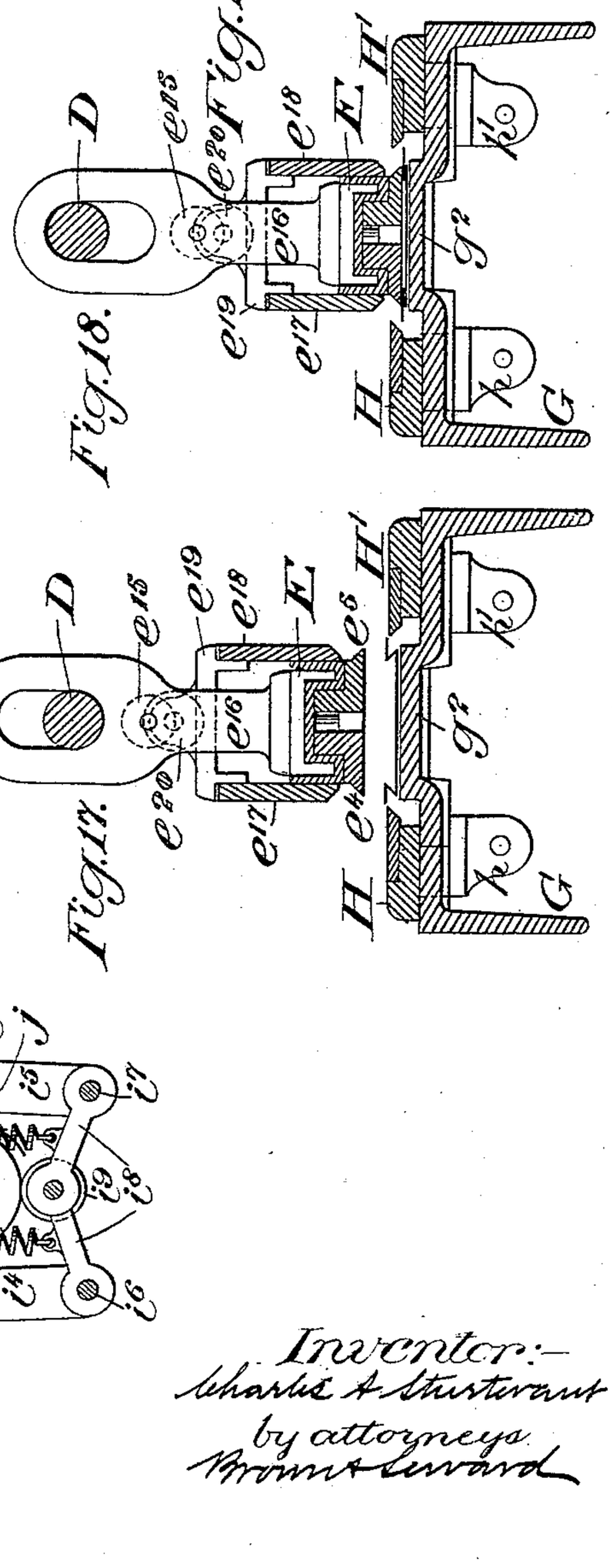

Fig. 18.

Fig. 14.

Fig. 17.

Fig. 13.

Witnesses:—
M. E. Fletcher.
Fred't Haynes

Inventor:—
Charles A. Sturtevant
by attorneys
Brown & Seward

UNITED STATES PATENT OFFICE.

CHARLES A. STURTEVANT, OF PLAINFIELD, NEW JERSEY.

MACHINE FOR MAKING ROOF-VALLEYS.

SPECIFICATION forming part of Letters Patent No. 616,642, dated December 27, 1898.

Application filed July 9, 1898. Serial No. 685,496. (No model.)

To all whom it may concern:

Be it known that I, CHARLES A. STURTEVANT, a citizen of the United States, and a resident of Plainfield, in the county of Union and State of New Jersey, have invented a new and useful Improvement in Machines for Making Roof-Valleys, of which the following is a specification.

My invention relates to an improvement in machines for making roof-valleys, the object being to provide a machine by means of which the strips of sheet metal of which the roof-valleys are to be made may be continuously fed into the machine in the form of blanks and discharged therefrom in completed form.

A further object is to provide a machine of the above character in which the several operations required to form the roof-valleys may be made expeditiously and rapidly.

A practical embodiment of my invention is represented in the accompanying drawings, in which—

Figure 1 represents a side view of the machine. Fig. 2 represents a longitudinal vertical central section through the same. Fig. 3 is a rear end view of the machine. Fig. 4 is a front end view of the same. Fig. 5 is a transverse vertical section in the plane of the line 5 5 of Fig. 2. Fig. 6 is a detail transverse vertical section through the die and die-operating shaft to show clearly the cam for operating the side plates of the die. Fig. 7 is a horizontal longitudinal section in the plane of the line 7 7 of Fig. 2. Fig. 8 is an inverted plan view of the die. Figs. 9, 9ª, 10, 11, and 12 are detail views illustrating the connections between the main operating-shaft, the die-operating shaft, and the chain-operating shaft, whereby the last two named shafts are alternately operated during the continuous rotary movement of the main shaft. Fig. 13 is an enlarged transverse vertical section through the several parts which operate upon the blank for bending it into the required shape, the said parts being shown in the position which they assume after the blank has been fed into position within the machine. Fig. 14 is a view similar to Fig. 13 with certain of the parts removed, the parts which are shown therein being represented in the positions which they assume when the first bend in the blank has been completed. Fig. 15 is a similar view showing the positions which the parts assume after the second bend has been made. Fig. 16 is a similar view showing the positions which the parts assume after the third bend has been accomplished. Fig. 17 shows the parts in the positions which they assume preparatory to completing the folds along the edges of the blank. Fig. 18 shows the positions which the parts assume when the said folds are completed, and Fig. 19 represents cross-sections of the blank after each of the successive operations has been performed.

The frame proper of the machine is composed of end uprights A A′, connected at their upper ends by means of a longitudinal girder A^2.

The drive-shaft B of the machine is mounted in suitable bearings in the end upright A′, and it is provided with a pulley *b*, which may be engaged by a suitable driving-belt. (Not shown.) This shaft B is further provided with a bevel-gear *b*′, which intermeshes with a bevel-gear *c* on the upper end of a connecting-shaft *c*′, mounted on the end upright A′, the lower end of the said shaft *c*′ being provided with a bevel-gear c^2, which intermeshes with a bevel-gear c^3, carried by the main operating-shaft C, which is mounted in suitable bearings in the end uprights A A′. This drive-shaft B is also provided with a spur-gear b^2, which intermeshes with a spur-wheel *d*, arranged on the die-operating shaft D, so as to be alternately locked to and released therefrom, as will be hereinafter more fully described.

The main bar of the vertically-reciprocating die is denoted by E, which bar extends longitudinally of the machine, and it is provided at its ends with hinged guide-blocks *e e*′, which slide in vertical ways or tracks e^2 e^3, carried by the end uprights A A′. A pair of laterally-movable bottom plates e^4 e^5 are located along the bottom of the bar E, the said bottom plates being L shape in cross-section and having their outer edges beveled, as shown. These plates are mounted to reciprocate vertically with the bar E by means of suitable tie-bolts e^6, the elongated heads e^7 of which are adapted to engage corresponding semi-cylindrical recesses e^8 e^9 in the said bottom plates. These heads e^7 of the bolts e^6 serve

to force the said bottom plates apart when the bolts are turned in one direction and permit the plates to be forced together when the bolts are turned in the opposite direction. The means which I have shown for rocking these bolts comprise arms e^{10}, extending laterally from the upper ends of the bolts e^6, the free ends of the said arms being connected to a longitudinal bar e^{11}. This bar e^{11} may be provided with a retracting-spring e^{12}, extending between its forward end and the upright A', tending to draw the bar in that direction, and its other end is connected to the free end of the long arm e^{13} of a rocking lever mounted on the upright A, the short arm e^{14} of which is adapted to be engaged by a cam f on the vertical shaft F, to be hereinafter described.

The set-bar E and bottom plates e^4 e^5 are raised and lowered by means of face-cams d' on the die-operating shaft D, which cams are provided with grooves d^2 for the reception of rollers e^{15}, carried by yoke-pieces e^{16}, uprising from the bar E. The upper ends of these yoke-pieces e^{16} are of loop form, as shown, and embrace the shaft D, serving to guide the die in its upward and downward movements.

The vertically-reciprocating die is further provided with a pair of independent vertically-movable side plates e^{17} e^{18}, which are located along the opposite sides of the bar E and have their bottom edges beveled, as shown. The tops of these side plates are spaced apart by suitable bridges e^{19}, which are provided with cam-rollers e^{20}, which are adapted to be engaged by cams d^3 on the die-operating shaft D.

Sets of expansion-springs e^{21} are inserted between the bridges e^{19} and the bar E, normally forcing the side plates and bottom plates away from each other.

The vertical shaft F, hereinbefore referred to, is mounted in suitable bearings on the end upright A at the rear of the machine, and the shaft is geared to the die-operating shaft D, as shown at f' d^4, whereby the said shaft F is rotated.

A bed-plate or table G extends the length of the machine and its ends rest upon suitable adjusting-screws g g', carried by the uprights A A', whereby the said table may be accurately adjusted with respect to the die. The table G is provided with a longitudinal raised portion g^2, between which and the bottom plates of the die the blank which is to form the valley is inserted.

A pair of laterally-movable jaws H H' are mounted on the top of the table G along the opposite sides of the raised portion g^2, which jaws are provided with beveled inner edges, as shown. These jaws are of substantially the length of the die. The jaw H is provided with a pair of shanks h, and the jaw H' is similarly provided with a pair of shanks h'. These shanks extend through elongated slots in the table G and are provided underneath the table with ears, to which are attached the free ends of the upper arms i i' of pairs of levers l l', which levers are fulcrumed on rods i^2 i^3, supported by suitable brackets j, carried by the jaw-operating shaft K.

The free ends of the lower arms i^4 i^5 of the levers l l' are provided with bars i^6 i^7, upon which the arms of a toggle-lever i^8 are mounted. A roller i^9 is carried by the toggle-lever i^8 in position to be engaged by a cam k, mounted on the shaft K. This shaft K is supported upon opposite sides of the cam k by suitable hangers J, dependent from the bed-plate or table G. This shaft K also has a bearing in the upright A, and it is geared to the vertical shaft F, as shown at k' f^2, whereby the rotation of the shaft K is dependent upon the rotation of the die-shaft D. The jaws H H' are held normally at the limits of their outward movement away from each other, and the roller i^9 is also held in engagement with the periphery of the cam k by means of retraction-springs i^{10} i^{11}, extending between the toggle-lever i^8 and the table G.

The means for feeding the blank strips into the machine are as follows: An auxiliary table L projects from the front of the upright A' of the machine, the front end of the said table being supported by a suitable frame l. This auxiliary table L forms a continuation of the bed-plate or table G of the machine. An endless carrier, shown in the present instance as a chain l', passes around a sprocket l^2, carried by a drive-shaft l^3, mounted in suitable bearings in the table G a short distance to the rear of the front upright A'. This sprocket-chain l' also passes around idler-pulleys l^4 l^5, carried by the frame l. The pulley l^4 is so situated that the chain l' runs along within a groove l^6 in the front end of the table G and throughout the length of the table L between the said idler-pulley l^4 and the sprocket-wheel l^2. This chain is provided with projections l^7, spaced apart a sufficient distance to permit the insertion of a length of blank equal to the length of the shaping-die.

A suitable slit or opening a is formed in the front upright A', through which the blank is fed into the machine.

The sprocket-wheel shaft l^3 is provided with a bevel-gear l^8, which intermeshes with a gear c^4, carried by the operating-shaft C and arranged to be intermittently driven and released by the said shaft.

The means which I employ for delivering the sheet from the machine and imparting its longitudinal central bend is as follows: The rear end of the operating-shaft C is provided with a bevel-gear c^5, which intermeshes with a bevel-gear c^6 on the lower end of a short connecting-shaft c^7, the upper end of the said shaft being provided with a bevel-gear c^8, intermeshing with a bevel-gear m, carried by a shaping-roller shaft M, which is mounted in suitable bearings on the rear upright A. This shaft M is provided with a shaping-roller m', having a convex angular periphery. Beneath this roller is mounted a

corresponding roller m^2, which is provided with a concave angular periphery corresponding to the convex angular periphery of the roller m'. These two rollers are adapted to receive the metallic sheet between them and impart to the said sheet its longitudinal central bend.

To the rear of the shaft M, I mount a second shaft N in suitable bearings at the ends of the bracket-arms n, projecting from the bearings of the shaft M.

A roller n' is mounted directly to the rear of the roller m' and in line therewith. This roller is similarly provided with a convex angular periphery. Beneath this roller n' I mount a pair of rollers n^2 n^3 on suitable inclined axle-studs n^4 n^5, so that the said rollers n^2 n^3 correspond to the two angular faces of the periphery of the roller n'. These rollers are adapted to receive the metallic sheet from the rollers m' m^2 and permanently set the bend which the said last-named rollers have imparted to the sheet. The roller n' is driven positively in the same direction as the roller m' by means of a sprocket-chain connection n^6 between the shafts M and N.

The means which I employ for causing the die-operating shaft to rest idly while the endless carrier is operated for feeding the blank into the machine and for causing the carrier to rest idly while the die-operating shaft is operated for performing the several operations upon the blank is as follows: A stub-shaft O is mounted in suitable bearings upon the front upright A', and it is provided at its front end with a spur-gear o, which intermeshes with a spur-pinion c^9, mounted to rotate with the operating-shaft C, whereby the said shaft O is continuously rotated. The gear between the drive-shaft B and the die-operating shaft D and the gearing connection between the drive-shaft, the operating-shaft, and stub-shaft, is such that the stub-shaft will rotate once to two rotations of the said die-operating shaft D. This shaft O is provided with a cam o', the periphery of which is adapted to engage a stud p, carried by a tripping-bar P. This tripping-bar P is guided in its reciprocating movements by bifurcating its lower end, as shown, and having its upper end confined in a suitable bearing p', carried by the upright A'. The upper end of this bar P is provided with a stud p^2, which is adapted to be moved into and out of the path of a spring-actuated rocking dog p^3, projecting from a locking-pin p^4, which serves to lock and release the gear-wheel d and die-operating shaft D. The pin p^4 is mounted in a socket in the face of the inner hub-flange of the gear-wheel d, and its projecting end, from which the dog p^3 projects, is cut away to form an eccentric, as clearly shown in Figs. 9 and 9^a. The shaft D has a sleeve d^* keyed thereto, which sleeve has a notch d^{**} in its periphery arranged to receive the eccentric portion of the pin p^4 therein for locking the gear-wheel to the shaft. This rocking dog p^3 is so arranged that when the tripping-bar P is in its lowered position the gear-wheel d and the shaft will be locked by the pin p^4 so as to rotate together. When the bar P is in its raised position, the rocking dog will be engaged by the stud p^2 as the gear-wheel d is rotated, thereby causing the dog to be rocked sufficiently to free the eccentric portion of the pin p^4 from the notch d^{**}, thereby releasing the gear-wheel d from the sleeve d^*, carried by the shaft D, so that the gear-wheel d will rotate around the shaft while the shaft remains stationary. The geared relation between these two shafts above referred to is such that the shaft D is rotated one revolution while the shaft O is rotating one half of a revolution, and the shaft D is then held idly while the shaft O is rotating its second half of its revolution. The stub-shaft O is further provided with a cam o^2, the periphery of which engages a stud upon one arm q of a rocking lever Q, the axle q' of which is mounted in a suitable bearing carried by the front upright A'. The other arm q^2 of this lever Q is secured to the rear end of the axle q', which arm is in position to release the bevel-gear c^4, which meshes with the carrier drive-shaft pinion l^8, whereby the carrier and driving-shaft are alternately driven and permitted to stop during the constant rotation of the operating-shaft C. The slip connection between the bevel-gear c^4 and the shaft C is of the usual form and is shown quite clearly in Fig. 12. The device therein shown comprises a spring-actuated bolt c^{10}, projecting from a fixed sleeve on the shaft C normally into engagement with the gear c^4, and having a beveled end which is adapted to be engaged by the arm q^2 and thereby released from the said gear. The cam o^2 is of such shape that the endless carrier is driven for feeding the blank into the machine during the second half of the rotation of the shaft O, at which time the die-operating shaft D is at rest. The geared connection between the shaft C and the carrier-driving shaft l^3 is such that the said shaft l^3 is driven a sufficient distance to feed a blank from the exterior of the machine into a position beneath the die. The next operation of the shaft l^3 after the die has operated upon the blank will serve to feed the advance end of the blank which was operated upon into engagement with the rolls m' m^2, where it will be rapidly drawn from the machine and at the same time feed the next succeeding blank into the machine.

The operation of the machine is as follows: Supposing that a blank has been fed into the machine beneath the die, the carrier drive-shaft has been disconnected from the operating-shaft C, and the die-operating shaft D connected therewith, the first portion of the rotation of the shaft D will bring the die down onto the blank and press it against the raised portion g^2 of the table G, making the first bend, as shown in Fig. 14. The jaws H H' will then

be caused to approach each other, making the second bend. (Shown in Fig. 15.) The side plates e^{17} e^{18} are then brought down to complete the second bend, as shown in Fig. 16, and the bottom plates e^4 e^5 are then raised, this movement serving to draw the said bottom plates together, as shown. The die is then raised and the jaws moved outwardly into the position shown in Fig. 17. The die is then brought down, and completes the fold, as shown in Fig. 18. After the die has been brought back into the position shown in Fig. 13 the die-operating shaft is disconnected from the drive-shaft and the carrier driving-shaft is connected therewith. The rotary movement of the carrier driving-shaft will then cause the carrier to feed the blank which has been operated upon to the mechanism for making the central longitudinal bend and at the same time feed a second blank into position beneath the die. The bending mechanism and the rollers for setting the bend will rapidly draw the completed blank out of the machine.

By adjusting the several parts the folds made along the sides of the blank may be made deeper or shallower, as may be desired, and by adjusting the rollers at the rear of the machine the blank may be bent to any desired angle.

The machine as above described is adapted to feed the blanks, bend them, and deliver the completed valleys very rapidly and at the same time insure the perfect formation of the bends, which has heretofore been a very difficult operation. The timing of the several operations is such that the machine is practically automatic, the only manual labor required being the laying of the blanks onto the carrier at the proper points.

It is evident that slight changes might be resorted to in the form and arrangement of the several parts without departing from the spirit and scope of my invention. Hence I do not wish to limit myself strictly to the structure herein set forth.

What I claim is—

1. A machine for making roof-valleys from strips of metal comprising mechanism for forming longitudinal side folds in a strip while it is held stationary, mechanism for forming a longitudinal central bend in the strip and discharging it from the machine, a strip-carrier and means for causing the carrier to first feed the strip to the fold-forming mechanism and then to the bend-forming mechanism, substantially as set forth.

2. A machine for making roof-valleys from strips of metal comprising mechanism for forming longitudinal side folds in a strip while the strip is held stationary, rolls for forming a longitudinal bend in the strip, a strip-carrier for first feeding the strip to the fold-forming mechanism and then to the bend-forming rolls, and rolls for setting the bend in the strip arranged to receive the strip from the bend-forming rolls, substantially as set forth.

3. In a machine for making roof-valleys from strips of metal, mechanism for forming longitudinal folds along the strips comprising a vertically-reciprocating die having a pair of laterally-movable bottom plates, a pair of independently vertically movable side plates, a bed-plate or table and a pair of laterally-movable jaws and means for operating the several parts, substantially as set forth.

4. In a machine for making roof-valleys from strips of metal, a bed-plate or table, a pair of laterally-movable jaws mounted thereon, a die comprising bottom plates and side plates and die and jaw operating shafts having cams arranged to impart successive movements to the said die and jaws for forming longitudinal folds in the strip of metal, substantially as set forth.

5. A die comprising laterally-movable bottom plates and vertically-movable side plates and means for holding the bottom plates and side plates in different assembled adjustments, substantially as set forth.

6. A die comprising laterally and vertically movable bottom plates, vertically-movable side plates and means for holding the bottom plates and side plates in different assembled adjustments, substantially as set forth.

7. A die comprising a pair of laterally and vertically movable bottom plates, a pair of side plates arranged to force the bottom plates inwardly when the bottom plates are moved in one direction and means for positively forcing the bottom plates outwardly when the bottom plates are moved in the opposite direction, substantially as set forth.

8. In a machine for making roof-valleys, a drive-shaft, a main operating-shaft geared permanently thereto, a die-operating shaft geared to the drive-shaft, a feed-carrier shaft geared to the main operating-shaft and means for alternately connecting and disconnecting the die-operating shaft and feed-carrier shaft, substantially as set forth.

9. In a machine for making roof-valleys, a drive-shaft, a main operating-shaft geared permanently thereto, a stub-shaft having cams thereon, and geared permanently to the operating-shaft, a die-operating shaft geared to the drive-shaft, a feed-carrier shaft geared to the main operating-shaft and mechanism under the control of the said cams on the stub-shaft for alternately connecting and disconnecting the die-operating shaft and feed-carrier shaft, substantially as set forth.

In testimony that I claim the foregoing as my invention I have signed my name, in presence of two witnesses, this 1st day of July, 1898.

CHARLES A. STURTEVANT.

Witnesses:
FREDK. HAYNES,
C. S. SUNDGREN.