4 Sheets—Sheet 1.

A. BALL.

Machine for Making Metal Tubes.

No. 212,425. **Patented Feb. 18, 1879.**

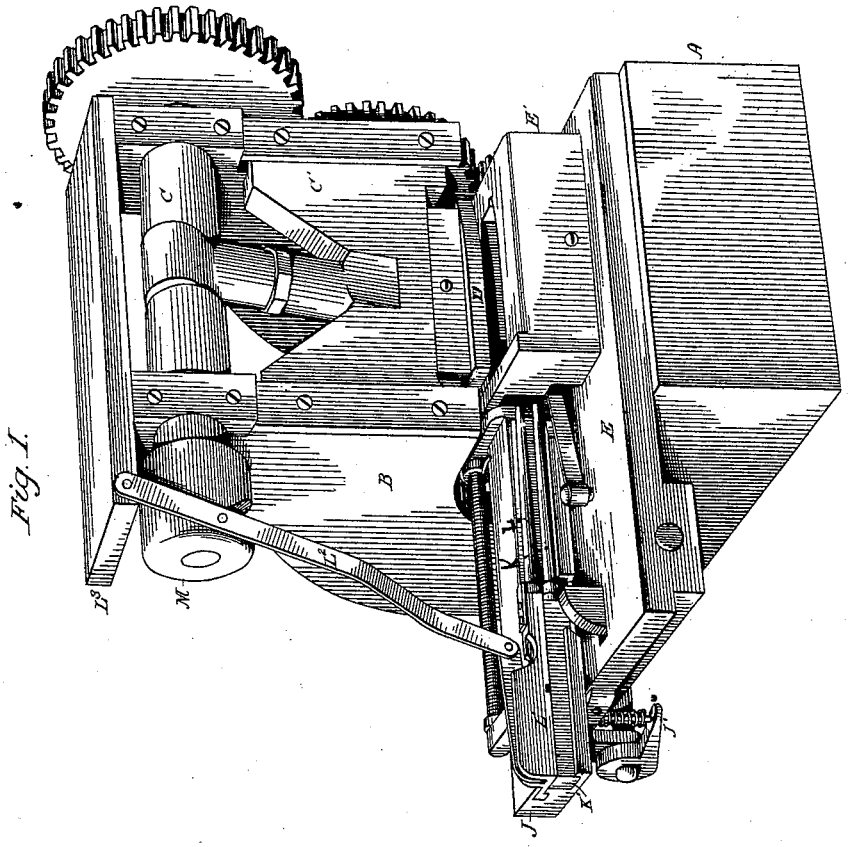

Fig. 1.

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Attys

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Fig. 5.

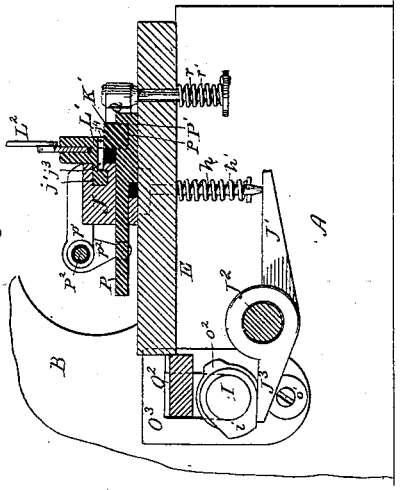

Fig. 6.

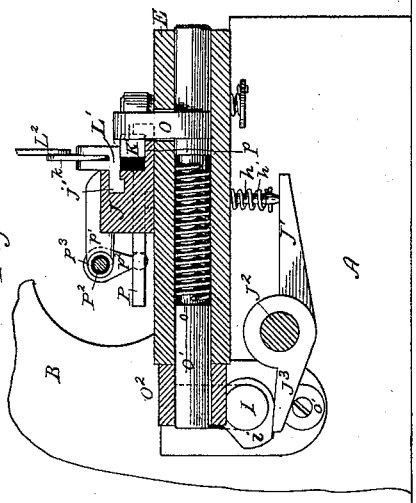

Fig. 2.

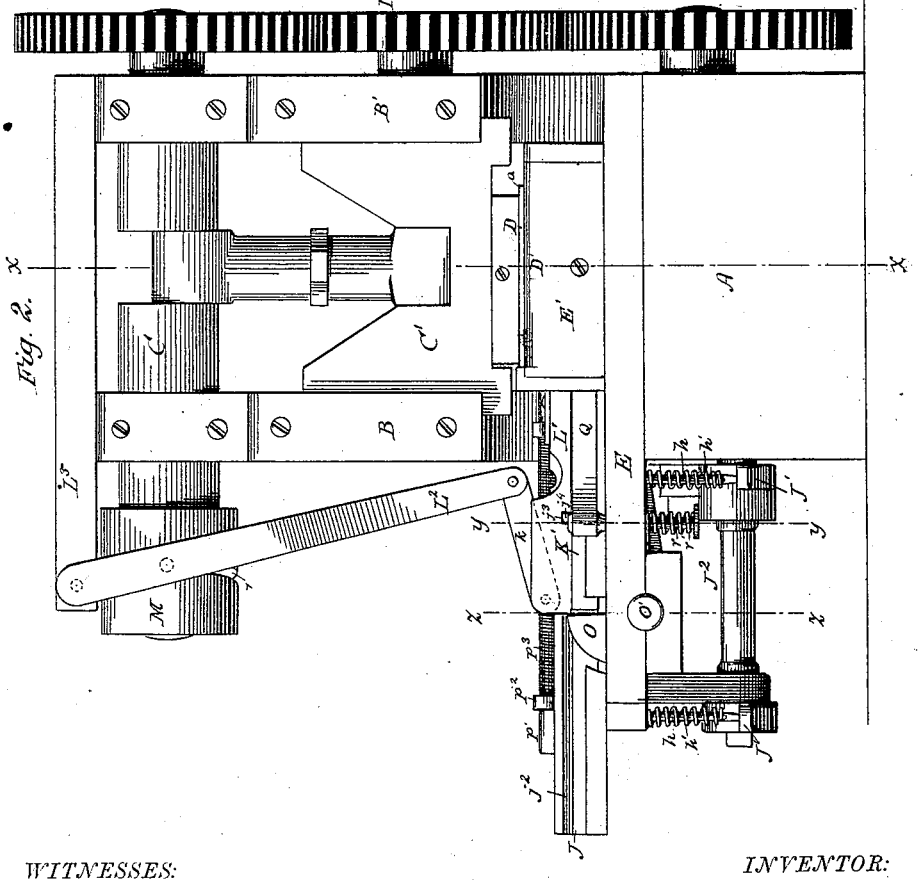

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Fig. 4.

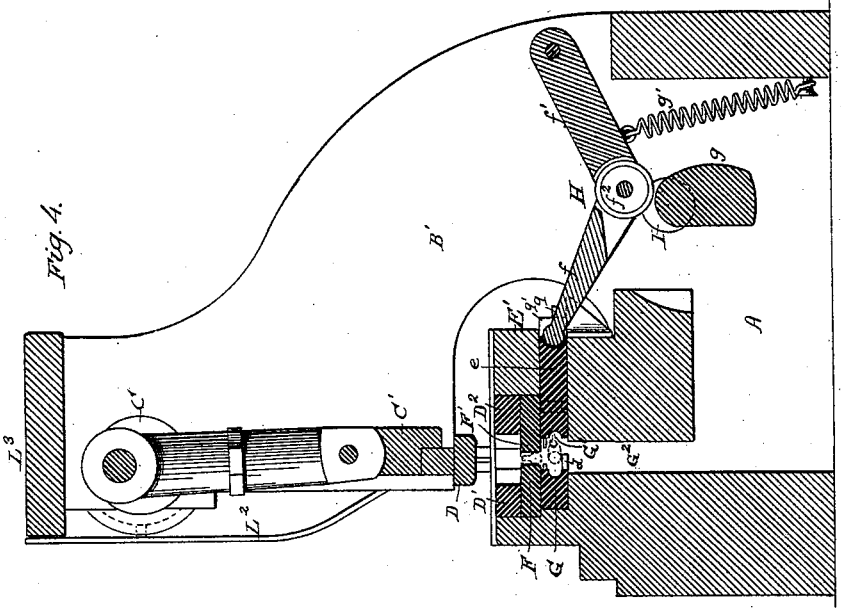

Fig. 3.

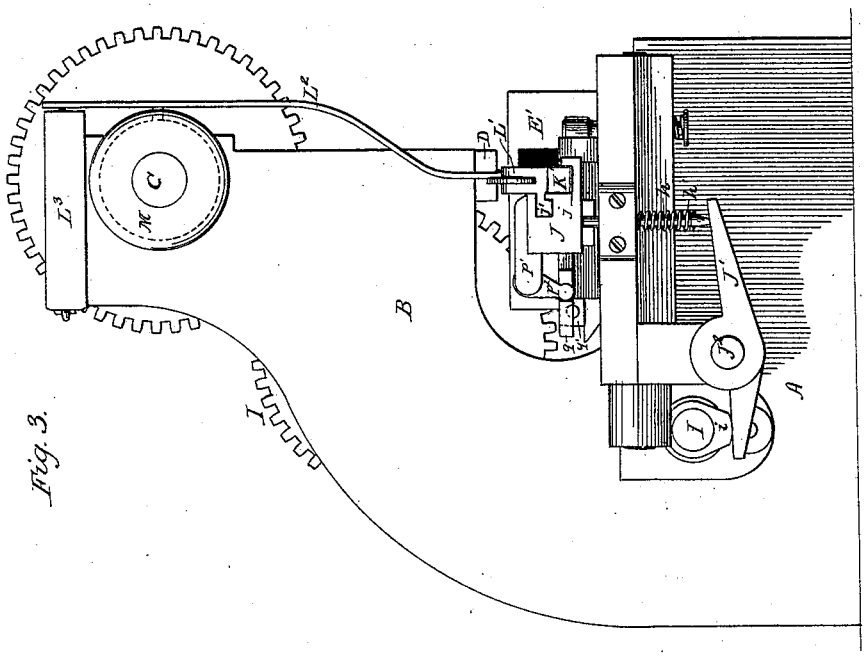

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Fig. 10.

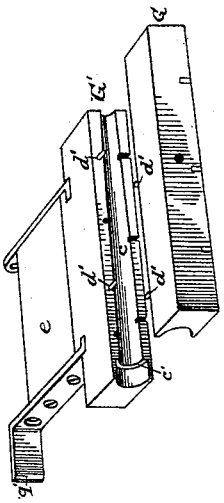


Fig. 11.

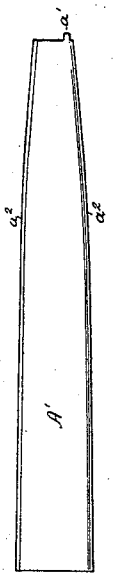


Fig. 12.

Fig. 13.

Fig. 7.

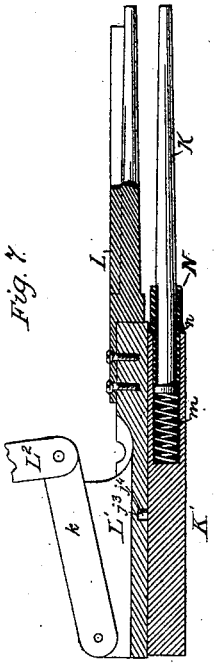


Fig. 8.

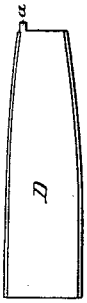
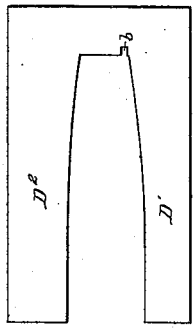


Fig. 9.



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INVENTOR:

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Attys.

UNITED STATES PATENT OFFICE.

ALBERT BALL, OF CLAREMONT, NEW HAMPSHIRE, ASSIGNOR TO SULLIVAN MACHINE COMPANY, OF SAME PLACE.

IMPROVEMENT IN MACHINES FOR MAKING METAL TUBES.

Specification forming part of Letters Patent No. **212,425**, dated February 18, 1879; application filed March 23, 1878.

To all whom it may concern:

Be it known that I, ALBERT BALL, of Claremont, in the county of Sullivan and State of New Hampshire, have invented a new and useful Improvement in Machines for Making Metal Tubes; and I do hereby declare that the following is a full and exact description of the same, reference being had to the accompanying drawings, and to the letters of reference marked thereon.

The object I have in view is the production of a machine for making metal tubes from tin or other sheet metal, but especially adapted for constructing the Essex cop-tubes, except winding the wire thereon, which is done by a separate machine of my invention.

It is necessary that these tubes should be light and strong, and of exactly the same bore, more particularly at the ends, so that they will fit closely to the spindles, and will not throw the spindles out of balance. This my machine is designed to accomplish in an inexpensive manner.

My invention therein consists in the construction of the bending-punch, and in the various combinations of the operative parts, as hereinafter pointed out and claimed.

In the drawings, Figure 1 is a perspective view of the entire machine, with the former and the mandrel removed from the dies; Fig. 2, a front elevation, the former and mandrel being moved forward between the dies; Fig. 3, an end view; Fig. 4, a vertical cross-section on the line *x x*, Fig. 2; Fig. 5, a cross-section through the table and the carrier-block on the line *y y*, Fig. 2; Fig. 6, a cross-section through the table, the carrier-block, and the sliding heads on the line *z z* in Fig. 2; Fig. 7, a longitudinal section through the former and the mandrel, and the heads carrying the same; Fig. 8, a view of the face of the punching-die; Fig. 9, a top view of the stationary cutting-dies; Fig. 10, a separate view of the forming-dies; Fig. 11, a view of the blank cut by the punching-die; Fig. 12, the same after being bent by the former; Fig. 13, a view of the tube as completed upon this machine.

Like letters denote corresponding parts.

A represents the base or stock of the machine, and B B′ the standards projecting from the rear of the base forward over a portion of the same. In the upper part of these standards is journaled a crank-shaft, C, connected by a pitman to a cross-head, C′, which slides vertically between the standards. Centrally to the lower end of the cross-head is attached the punching-die D, of the form shown particularly in Fig. 8, with tapering sides, to produce a blank of the required shape to form a tapering tube. It is not essential that the sides of this die should be tapering, since, if the tube to be formed were straight instead of being made with tapering walls, the punching-die would also be made with parallel sides, and the cutting, bending, and forming dies, mandrel, and former would be correspondingly shaped. This die is of the same length as the blank to be cut, A′, Fig. 11, and has a small projection, *a*, to form the projection a^1 at the small end of the blank. It is constructed to work closely in the stationary cutting-dies D^1 D^2, but has its side edges beveled, Figs. 4 and 8, so as to turn up the side edges, a^2, of the blank, as shown in Fig. 11.

Upon the base or stock A is secured the table E, which projects at one end beyond the base, and upon this table, below the cross-head, is mounted a rectangular frame, E′, in which the stationary dies are supported, having an opening in one side, through which the bending-punch, and the mandrel work.

In the top of the frame are situated the stationary cutting-dies D^1 D^2, of exactly the same shape as the punch D. These dies have a small slot, *b*, to receive the projection *a* on the punch. Below the cutting-dies, within the frame E′, are the bending-dies F F′, which are placed nearer together than the cutting-dies, Fig. 4, and are arranged so that the space between them is of tapering form, to conform to the taper of the sides of the blank. Below the bending-dies are situated the forming-dies G G^1, the die G being stationary, while the die G^1 is reciprocated back and forth away from and toward the stationary die.

The forming-dies are constructed with concave faces *c*, of the exact form of the tube to be made, and at the large ends of these tapering concaves the faces of the dies are enlarged and provided with a shoulder, *c′*, against which

the flange at the large end of the cop-tube is bent.

The stationary die G is provided on its lower edge with pins *d*, for supporting the partly-formed tube. These pins work in holes in the moving die and act as guides, and other guiding-pins, *d'*, are placed on the upper edges of both dies, working in holes opposite to them. An opening, G^2, is cut in the table E just below the dies, through which the tube drops after being formed into a suitable receptacle. To the die G^1 is connected a block, *e*, which works through the rear side of the frame E', and to this block is hinged one arm, *f*, of a toggle-joint, H, the other arm, f^1, of which is pivoted between the standards. At the point of meeting of the two parts of the toggle-joint is placed an anti-friction-roller, f^2, turning on the same rod which pivots the arms of the toggle-joint together. This toggle-joint is moved upwardly by a cam, *g*, on the cam-shaft I, which is journaled in the base. The cam *g* strikes the roller f^2 as the cam-shaft turns, raising the center of the toggle and straightening the same. A spring, *g'*, attached to one arm of the toggle, draws it downwardly. The cam-shaft I is geared to the crank-shaft C by an intermediate cog-wheel, I', so that both the crank-shaft and the cam-shaft revolve in the same direction and with equal speed.

J is a narrow carrier frame or block, which is placed on the table E, with one end near to or against the end of the frame E', while the other end projects over the end of the table. This frame or block is supported on two or more rods, *h*, which pass vertically through the table outside of the base A, and are stepped in the ends of levers J^1, extending from a rock-shaft, J^2. Below the table these rods *h* are provided with spiral springs *h'*, which serve to keep the carrier-block down close upon the table, except when lifted by the levers J^1. An arm or lever, J^3, projects to the rear from the rock-shaft J^2, and is depressed by a cam, *i*, on the end of the cam-shaft I. When the arm J^3 is depressed the levers J^1 and the carrier-block will be raised, and this movement of the carrier-block takes place once every time the cam-shaft revolves, and just previous to the descent of the punch into the stationary cutting-dies. When the projecting portion of the cam *i* passes the arm J^3, the springs *h'* act to pull the carrier-block down again onto the table.

The carrier-block is provided on its front edge with a channel or way, *j*, in which the head K', which carries the mandrel K, slides. Upon the mandrel-carrying head K' is placed the head L^1, with the former L, having a rounded lower side projecting from its inner end. The head L^1 has a laterally-projecting rib, j^1, with enlarged edge, which works in a slot, j^2, in the carrier-block, so that the head L^1 and the former are prevented from moving laterally. The head L^1 has a lateral slot, j^3, on its under side, and into this slot projects a stud, j^4, on the head K'. By means of this slot and stud the head K' can be moved laterally independent of the head L^1, but both are so connected as to move together longitudinally. When the head K' is moved laterally outward, however, it can be forced forward a short distance independent of the head L^1, the slot j^3 being enlarged at its outer end to allow of this movement. The heads K' and L^1 are reciprocated upon the carrier-block by means of a lever, L^2, which is connected to a link, *k*, pivoted to the upper head, L^1. The upper end of the lever L^2 is pivoted to a cross-piece, L^3, secured to the top of the standards B B'. Below the point where the lever L^2 is pivoted to the cross-piece this lever is provided with an inwardly-projecting pin and roller, which work in the groove *l* of a cam, M, keyed to the end of the crank-shaft C. The groove *l* is so formed and the cam M so situated upon the crank-shaft that the heads K' and L^1, with the bending-punch and the mandrel, will be thrown forward with a quick motion after the carrier-block is lifted to its highest position, and just before the punch descends, or as it is descending, and before the moving die G^1 is pushed forward. The heads are held in that position while the carrier-block descends, and after the moving die and the punch are withdrawn the heads are thrown back again with a quick stroke.

The mandrel K is a rod with a taper corresponding to that of the tubes to be formed, and having a small shoulder on its inner end, which fits the bore of the opening in the head K'. In this opening is placed a spiral spring, *m*, Fig. 7, against which the large end of the mandrel presses. Upon the mandrel is sleeved the heading-tool N, projecting into the head K', and provided with a shoulder, *n*, abutting against the end of such head. The heading-tool extends along the mandrel outside of the head, and its forward end, *n'*, is of the same size as the enlargement of the concave faces of the forming-dies G G^1 outside of the shoulder *c'*.

When the mandrel is held between the forming-dies it will be seen that the head K' and the heading-tool can be moved forward as far as the slot j^3 will allow independent of the mandrel, which will press back upon the spring *m*.

O is the heading or striking lever, which projects upwardly through the table on the front side of the carrier-block, and just behind the head K', when in its forward position. The lever is pivoted on the under side of the table to a rock-shaft, O^1, and has a spring, *o*, which keeps the upper end or head of the lever in its outward position. The rock-shaft O^1 projects transversely beneath the table to the rear side of the same, where it is provided with an arm, O^2, which extends inwardly toward the base at right angles to the shaft, and engages with a vertically-sliding frame, O^3, placed against the side of the base. This frame incloses the cam-shaft I, and is provided at its lower end, below such shaft, with a roller, o^1, against which works a cam, o^2, keyed on the cam-shaft