

(No Model.)

2 Sheets—Sheet 1.

G. D. BURTON & E. E. ANGELL.
ELECTRICAL METHOD OF AND APPARATUS FOR FORMING TUBES.
No. 486,624.

Patented Nov. 22, 1892.

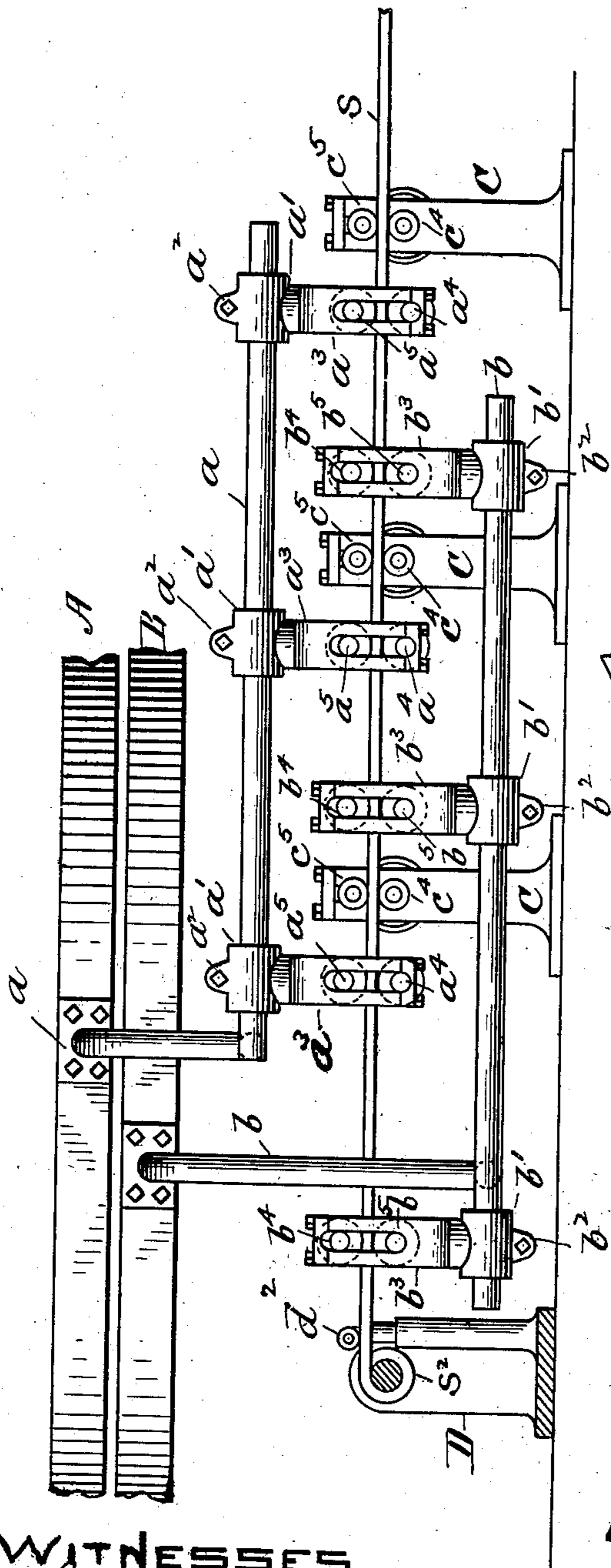


FIG. 1.

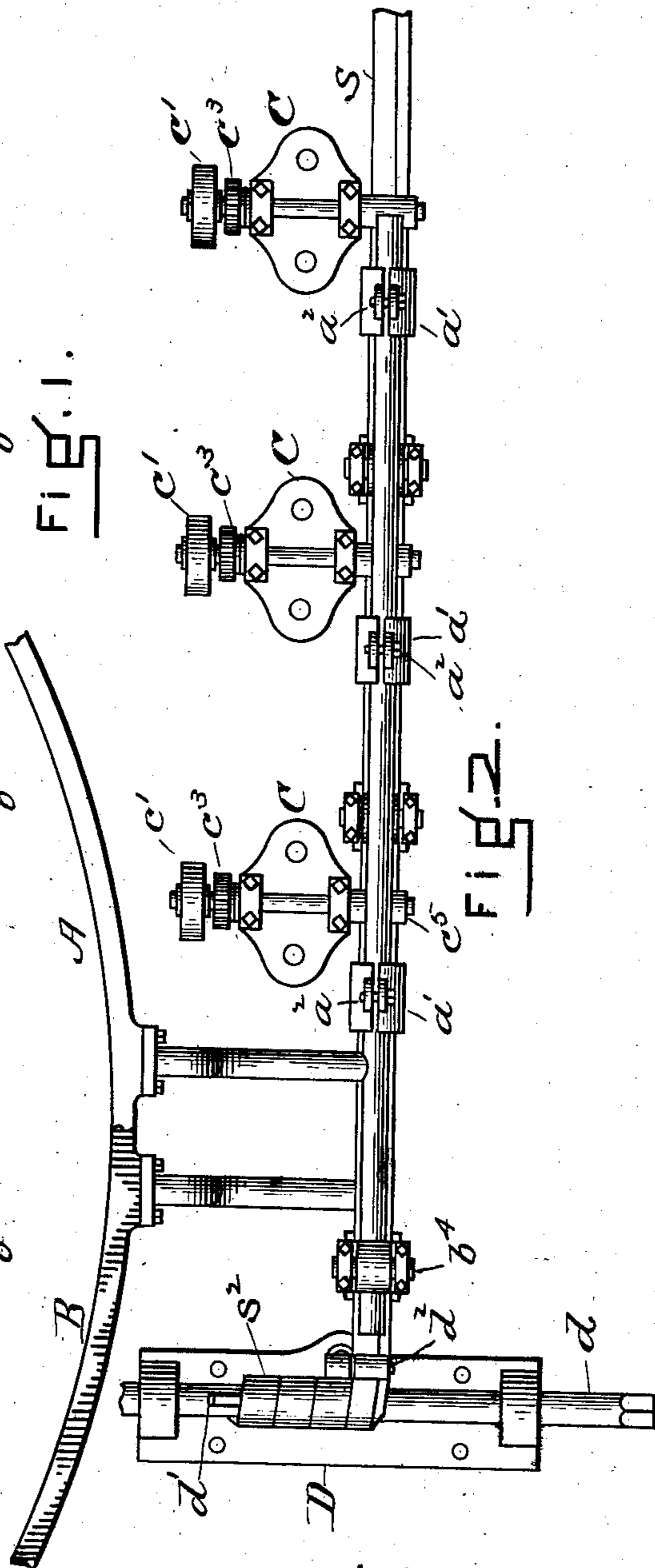


FIG. 2.

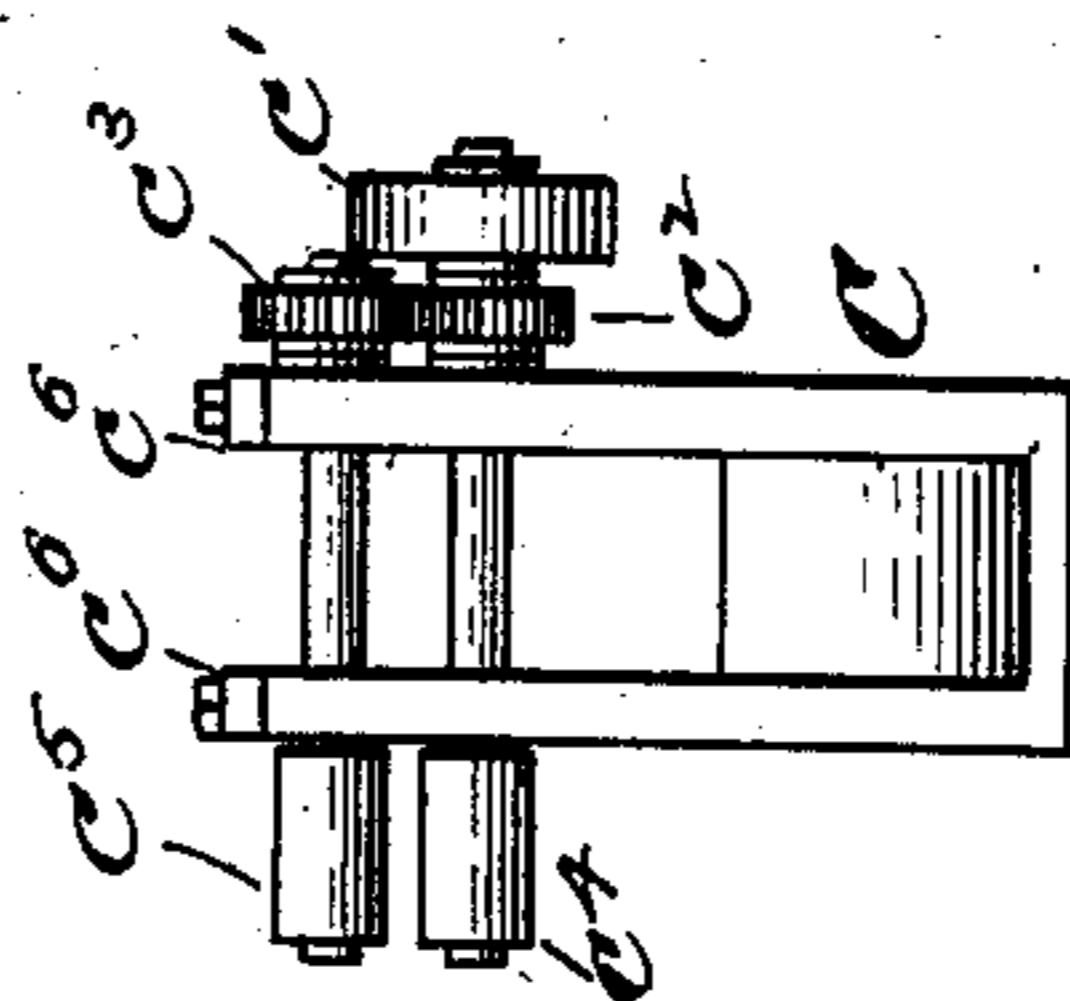
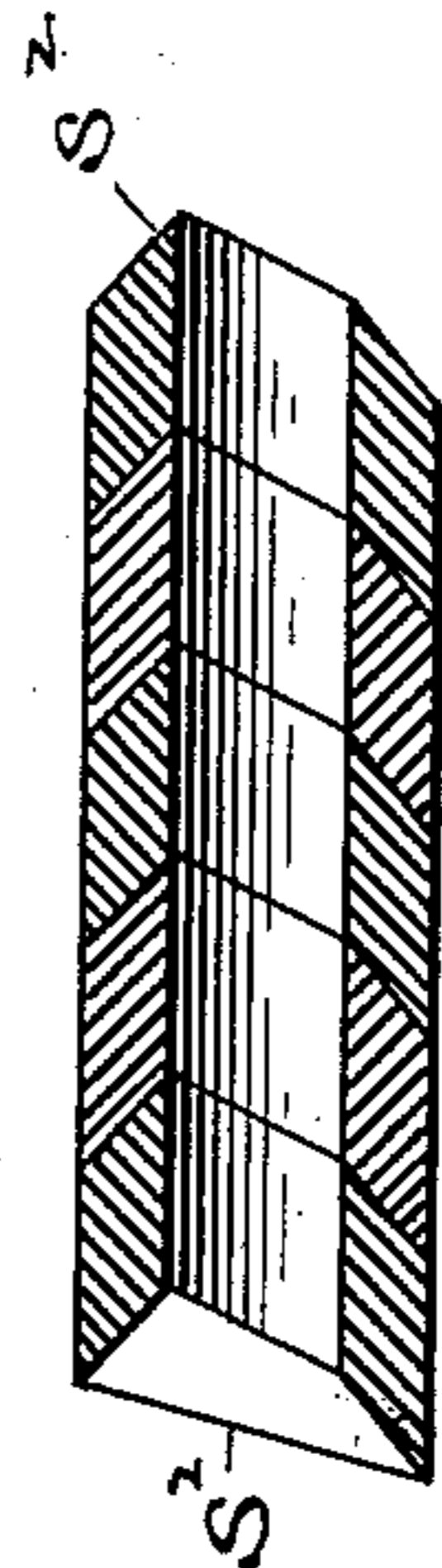
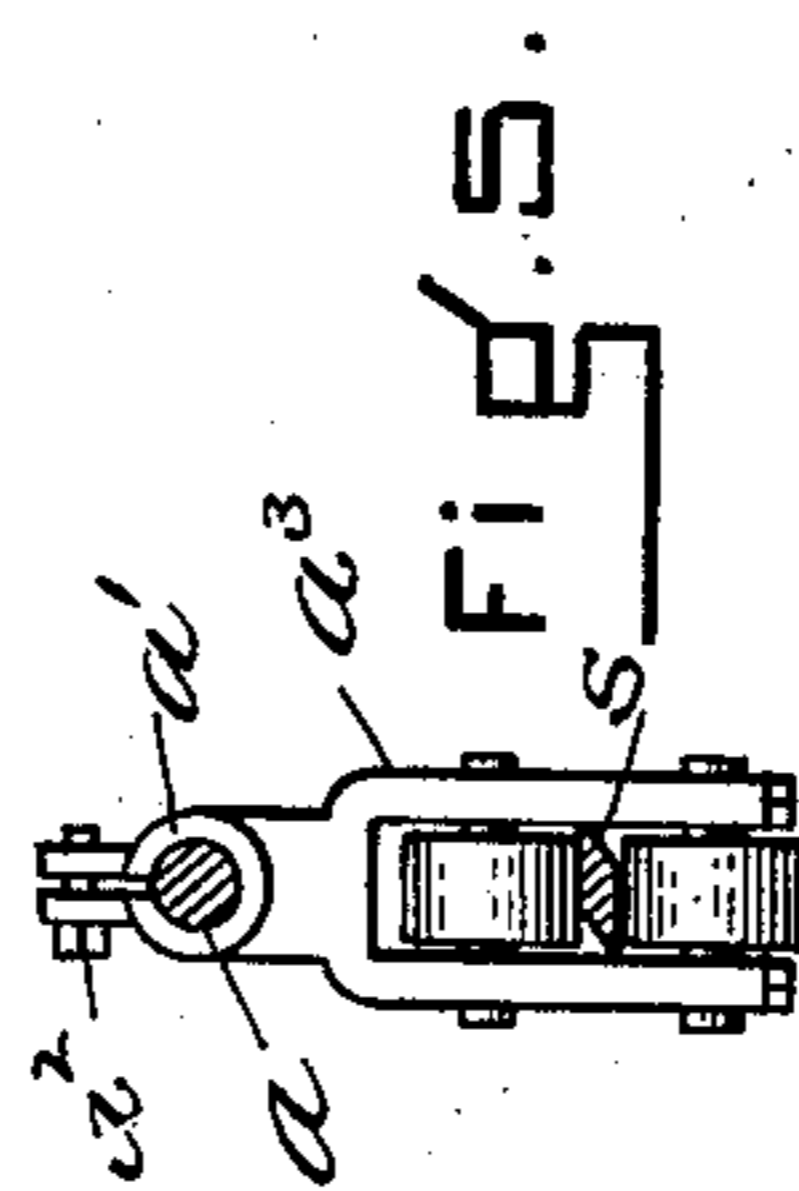
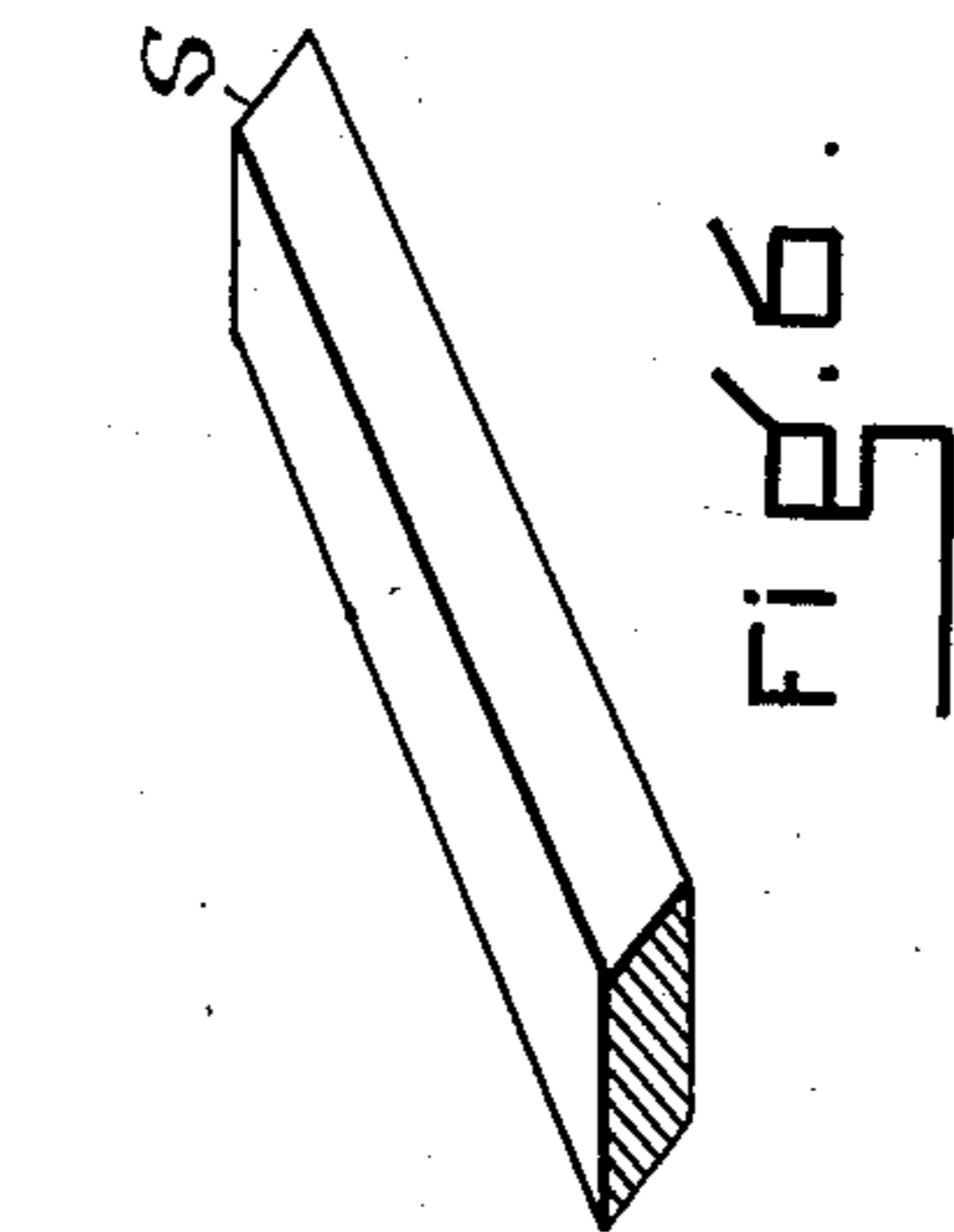
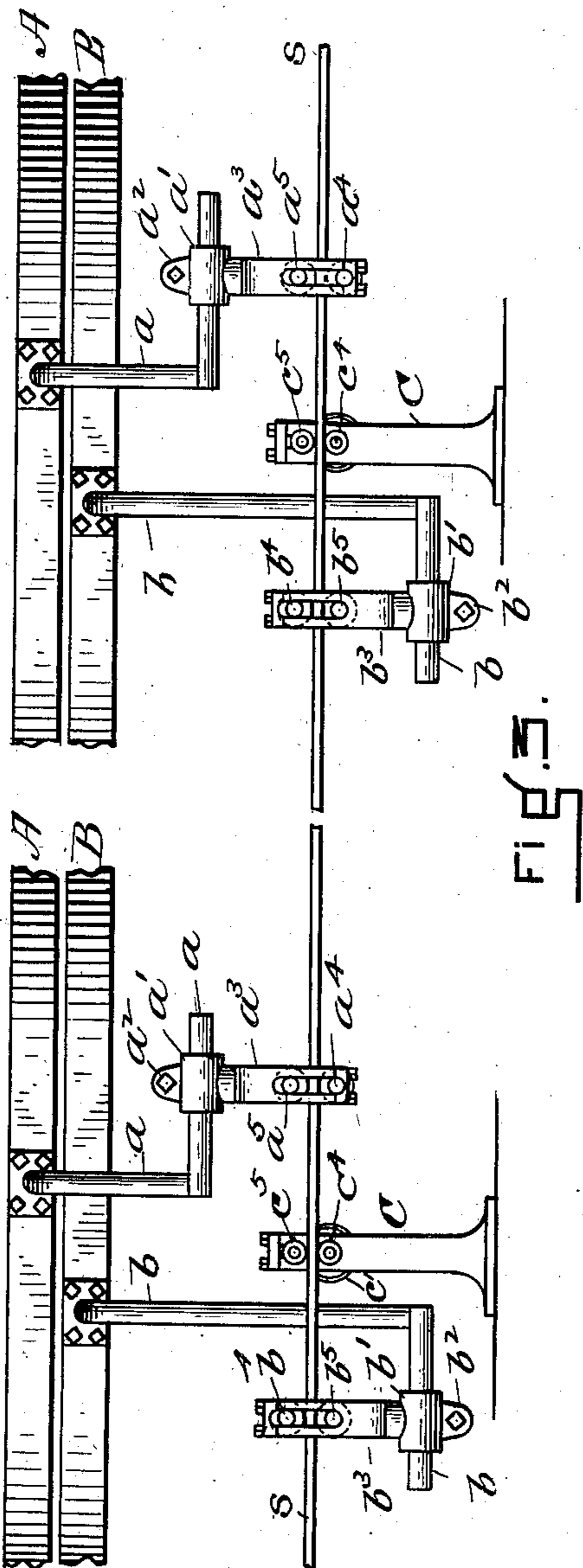
WITNESSES.
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UNITED STATES PATENT OFFICE.

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ELECTRICAL METHOD OF AND APPARATUS FOR FORMING TUBES.

SPECIFICATION forming part of Letters Patent No. 486,624, dated November 22, 1892.

Application filed September 16, 1891. Serial No. 405,895. (No model.)

To all whom it may concern:

Be it known that we, GEORGE D. BURTON, of Boston, in the county of Suffolk, and EDWIN E. ANGELL, of Somerville, in the county of Middlesex, State of Massachusetts, have invented a new and useful Improvement in the Mode of Forming Tubes and Coils of Metal by Electricity and Apparatus Therefor, of which the following is a specification.

Our invention relates to a method and mechanism for heating and coiling bars into tubes by electricity; and it consists in certain new and useful constructions and combinations of mechanism for performing said operation and in the method of manipulating the same, substantially as hereinafter described and claimed.

In the drawings, Figure 1 is a side elevation of the mechanism for heating and coiling the tube, partly in section, to exhibit the invention more clearly. Fig. 2 is a top plan view of the same. Fig. 3 represents a double heating apparatus applied to the tube-coiling mechanism, showing the manner in which it is to be partially heated by one of the converters and the heating completed from the second converter. Fig. 4 is an enlarged view of the rollers for passing the bar through them during the heating operation. Fig. 5 shows a section of the bar in the rollers which form the electrodes to convey the electricity into the bar. Fig. 6 is a section of the bar which is used for forming the tube. Fig. 7 is a section through the coil or tube, showing the manner in which the successive coils of the same fit against each other.

A B are the rings formed of copper, which are connected to the secondary coils of the converter to convey the heavy electric current from it to the metal to be heated, the negative terminal of the coil being attached to one ring and the positive terminal to another, so that when the bar of steel to be heated is in place in the electrodes it will complete the circuit between the conductor-rings A B.

From one side of the conducting-ring A extends a copper rod of large dimensions a , which is bolted to the conducting-ring A and is of sufficient size to convey the current with-

out heating the bar. To the other converter-ring B is attached the corresponding copper rod b , which extends parallel to the conductor a or nearly so, and both are parallel, or substantially so, to the bar to be heated. Connected to the conducting-rod a are a series of copper clamps a' of tubular form, which are secured to the conductor a by screw-bolts a^2 , which enable the clamps to be drawn tightly in place and secured at different distances, as may be desired, upon the rod a . Depending from the clamps a' are bifurcated copper bars a^3 , which carry in their bifurcations the rollers $a^4 a^5$, of copper, the axes of these rollers moving closely in slots so that the upper roller may accommodate itself to the different thicknesses of bars which it is desired to heat to form tubes of different sizes. Each of the rods b has clamps b' held by clamp-screws b^2 to the rod, and having upwardly-projecting bifurcated copper pieces b^3 carrying rollers of copper $b^4 b^5$ in slots in their bifurcations, similarly to the arrangement of the similar parts on the rod a . The parts and connections attached to the rod b are of copper, so as to convey the electricity readily, and the rollers $b^4 b^5$ are in line with the rollers $a^4 a^5$, so that the bar to be heated will pass in a straight line through both of them. It will thus be seen that the electricity is made to pass from the electrodes attached to the rod a to the electrodes attached to the rod b through the bar S in five different sections or segments, as shown in Fig. 1, and is heated by different portions of the electric current forming a circuit through it for some considerable distance before the coiling operation is commenced, thus insuring the effective preparation of the bar S by heat for being formed into the tube.

In order to drive the bar along through the different electrode-rollers $a^4 a^5$ and $b^4 b^5$, a series of driving-rollers $c^4 c^5$ are mounted in the stands C in line with the path of the bar, so that it may pass through between them. These rollers are driven by the pulleys c' on the shafts of the lower ones and are geared together by a pair of gears $c^2 c^3$, as shown in Fig. 4. The upper roller, with its shaft, is free to rise in a slot in the stand C to accommodate itself to different thicknesses of bars and

may be held down by springs or other suitable means under the caps c^6 .

In order to coil the bar S into the tube S^2 , a stand D is provided having a mandrel d , which is capable of moving endwise in the uprights of the stand in which the mandrel is journaled. This mandrel is provided with a slot d' , which will receive the end of the heated bar and hold it while the following portions are wound upon the mandrel. The bar passes under the roller d^2 , attached to the stand D before being wound on the mandrel. As the heated bar is wound on the mandrel it forms itself into the tube S^2 , and the beveled or inclined side of the bar overlapping its other inclined side, against which it is continuously wound, heats or cements the bar into one continuous tube, the heat of the bar being greater in the middle of it than on its exterior, causing the abutting edges to fuse themselves together as the bar is wound on the mandrel.

It will be observed that the clamps $a' b'$, being adjustable upon their electric conducting-rods $a b$, can be set nearer to or farther apart, so as to cause the electricity to traverse greater or less lengths of metal between them, and that this adjustment may be accomplished immediately and a fresh electrical contact made by the clamp-screws $a^2 b^2$.

The modification shown in Fig. 3 consists of two converters and sets of converter-rings connected electrically with the bar instead of a series of positive and negative electrode-rollers connected in multiple arc, as in Fig. 1. The stands C and D are insulated from their bases, to which they are fastened by a thin sheet of non-conducting material, such as paper, fiber, or vulcanite.

The mandrel d is revolved by a crank applied to its squared end and turned by hand.

With this invention tubes may be formed suitable for gun-barrels and other analogous purposes, which require to be made of steel or iron without brazing or uniting together other than by the heat of the metal caused by their being laid side by side to come to their touching or contiguous surfaces. The heat of the bar S to accomplish this effect is preferably raised to a point where the internal core of the bar approaches fluidity, while the surrounding atmosphere keeps the exterior comparatively cool, except where the successive coils touch or abut against each other. Brazing or soldering material may be applied to the edges of the bar, if desired, while it is being coiled on the mandrel; but it is not necessary if the heating is properly conducted. The mandrel may also be used to form the coil of the bar upon it with the edges of the

successive turns separated, which will form the coil into a spring, if desired.

Instead of rollers $a^4 a^5 b^4 b^5$ blocks of metal may be employed, between which the bar S is moved, as before described.

What we claim as new and of our invention is—

1. The process of forming a metal tube, which consists in heating a bar electrically to a higher degree at its core or internal part than upon its exterior, coiling said bar in its heated state upon a mandrel with its successive turns abutting against each other, and permitting the coils to expand under the action of the internal heat, whereby their abutting edges are fused together, substantially as set forth.

2. The process of forming a metal tube, which consists in forming a bar with its opposite edges beveled or inclined to its faces, heating said bar by an electric current to a higher degree at its core than upon its exterior, coiling the so-heated bar upon a mandrel, with its beveled edges overlapping each other, and permitting the coils to expand under the action of the internal heat, whereby the abutting overlapping edges of the coils are fused together, substantially as set forth.

3. The combination of two rods of conductive material connected to opposite electric terminals and disposed parallel to each other, clamps adjustable on said rods, and electrodes projecting in opposite directions from said clamps from each conducting-rod toward the other, each of said electrodes being provided with a pair of contact-rolls adapted to receive a bar between them, and feed-rolls for feeding a bar between said electrodes.

4. The combination of two sets of converter-rings, each set being independent of the other, a set of electrodes connected with opposite terminals of one set of rings, a set of electrodes connected with opposite terminals of the other set of rings, and feed mechanism for passing a bar through both sets of electrodes successively.

5. The combination of the rods a and b , respectively connected to the positive and negative terminals of the converter, and the clamps a' and b' , respectively arranged to slide along their rods, provided with the clamping-screws $a^2 b^2$, arranged to clamp them to their rods and carrying their respective electrodes, which complete the circuit through the metal bar to be heated, substantially as described.

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