No. 667,686. Patented Feb. 12, 1901.

S. E. DIESCHER.

APPARATUS FOR MANUFACTURING SEAMLESS TUBING.

(Application filed May 19, 1900.)

(No Model.) 4 Sheets—Sheet 1.

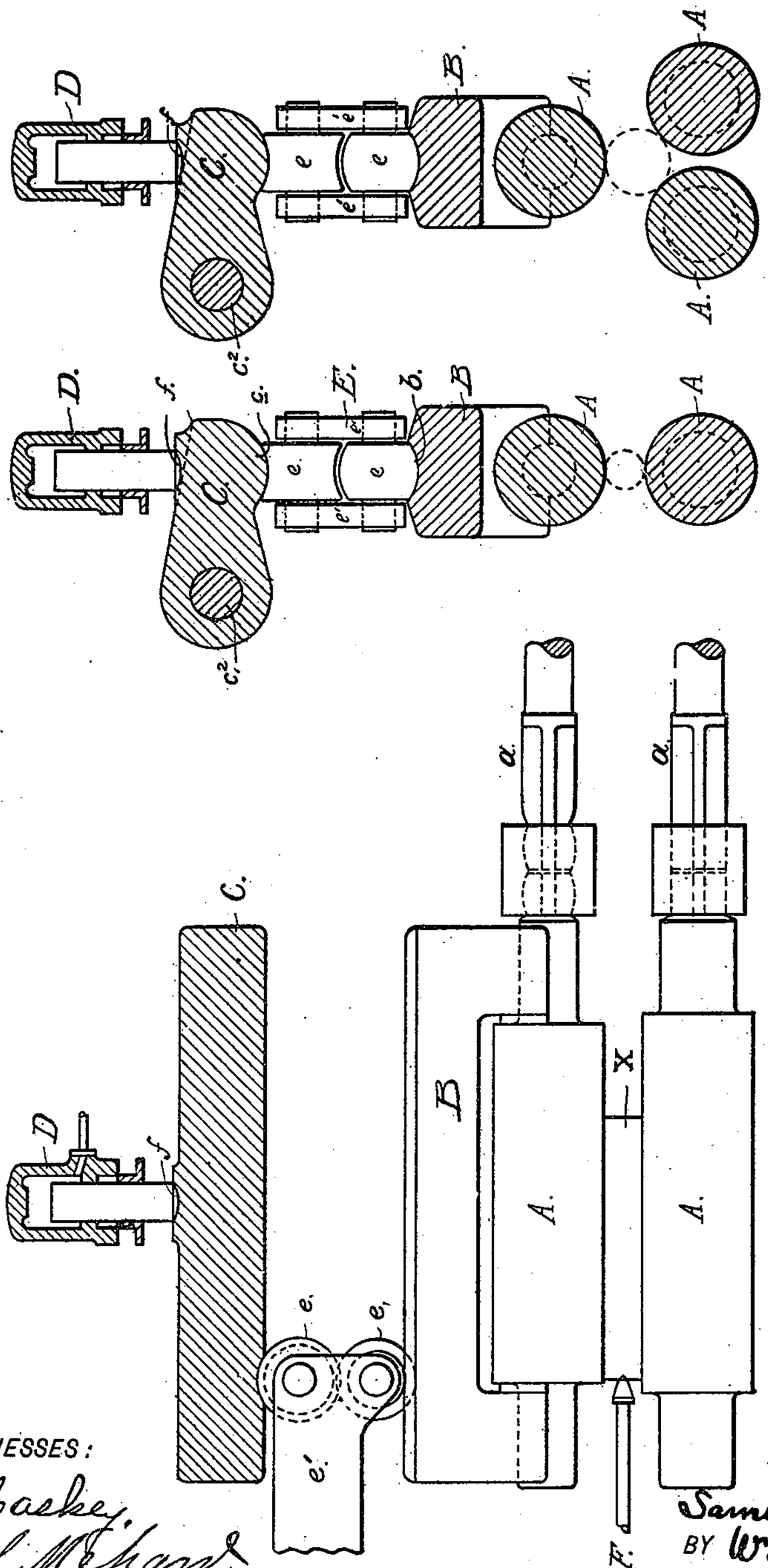

Fig. III.

Fig. II.

Fig. 1.

WITNESSES:

M. W. Caskey.

Saml S. Mehard

INVENTOR

Samuel E. Diescher,

BY Wm L. Pierce,

his ATTORNEY

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S. E. DIESCHER.

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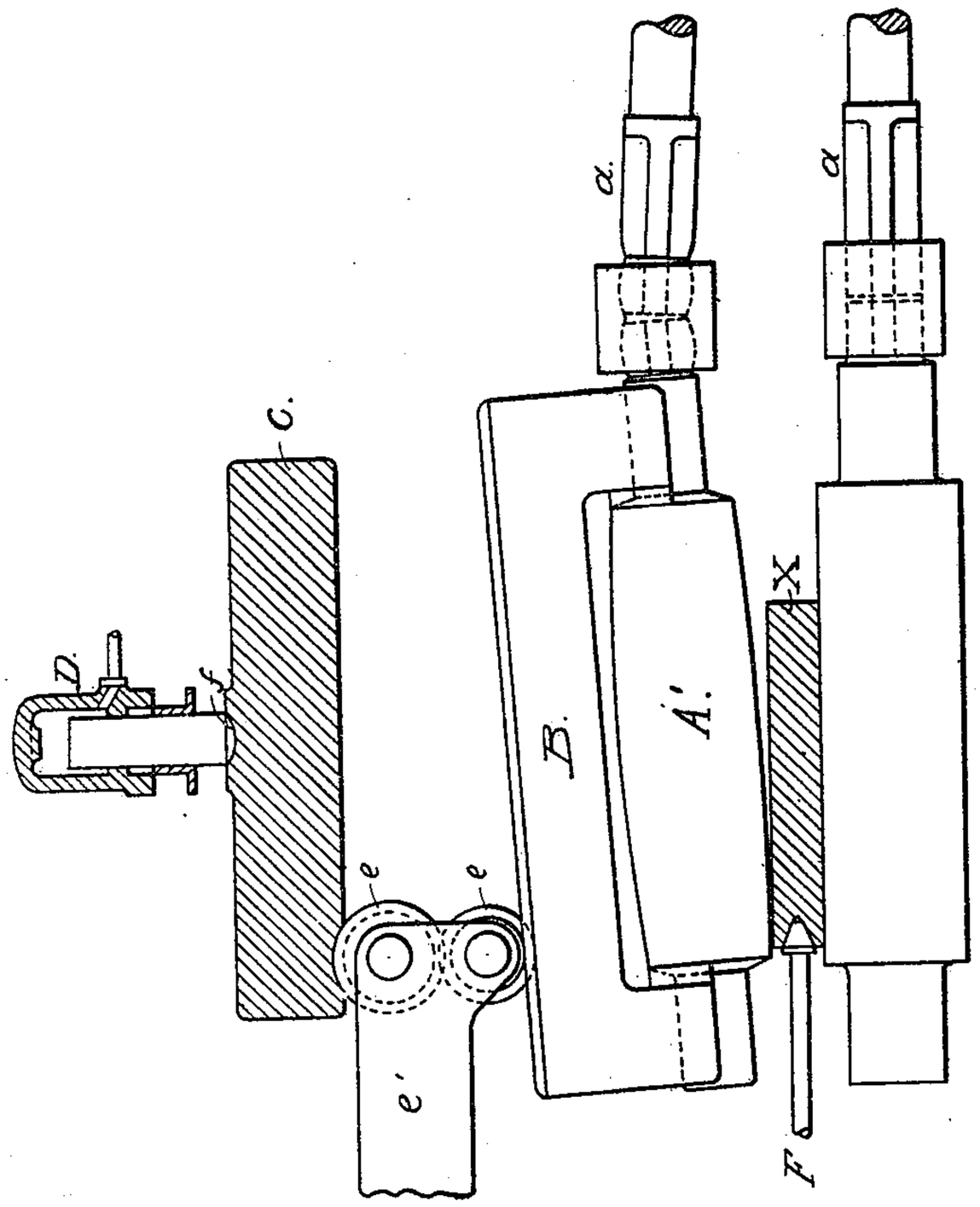

Fig. IV

WITNESSES:

M. M. Caskey.
Saml S. McHard

INVENTOR,
Samuel E. Diescher
BY Wm L. Pierce
his ATTORNEY

No. 667,686. Patented Feb. 12, 1901.

S. E. DIESCHER.

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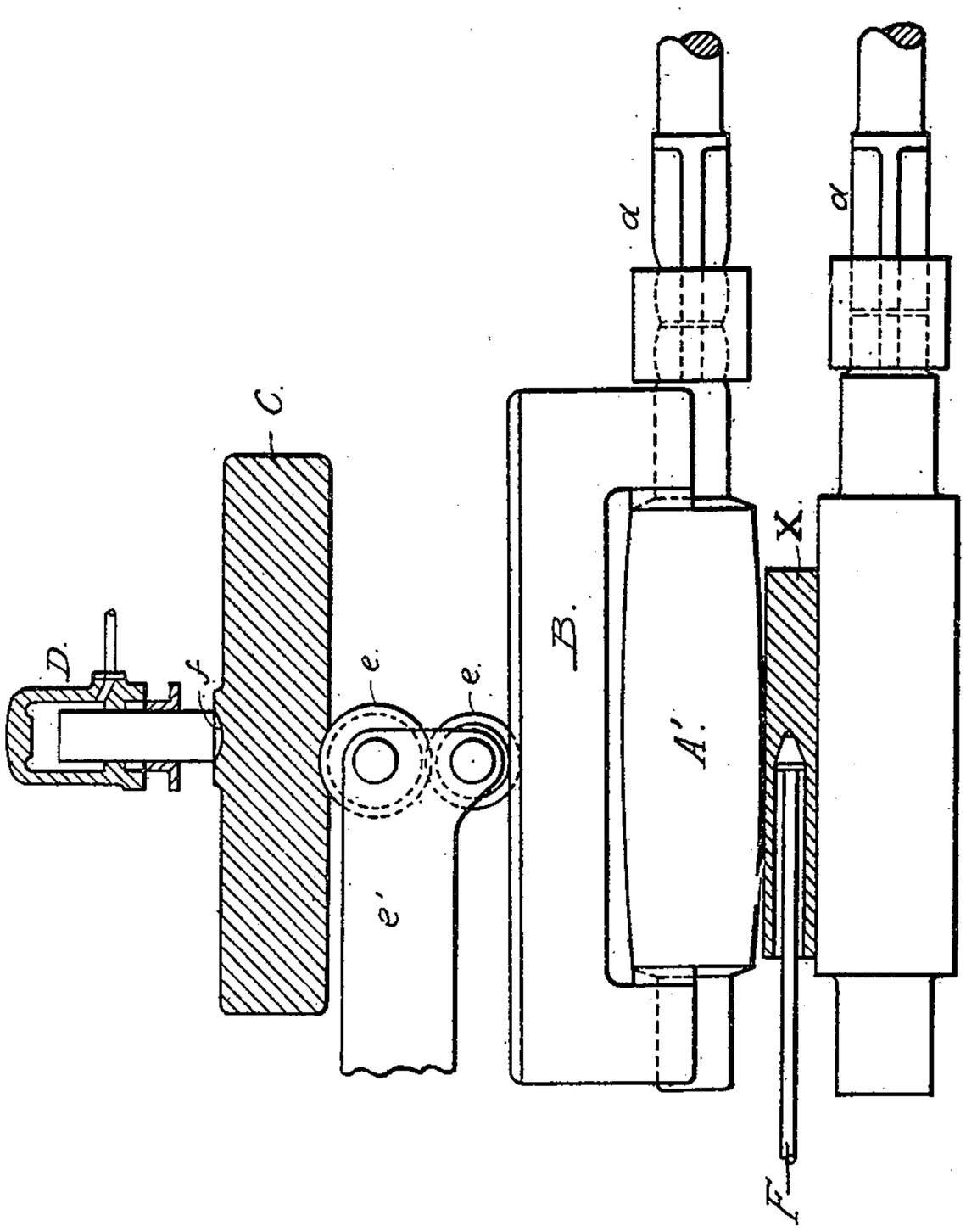

Fig. V.

WITNESSES:

M. W. Baskey.
Saml S. Mellard

INVENTOR
Samuel E. Diescher,
BY Wm L. Peirce
his ATTORNEY

No. 667,686. Patented Feb. 12, 1901.

S. E. DIESCHER.

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(Application filed May 19, 1900.)

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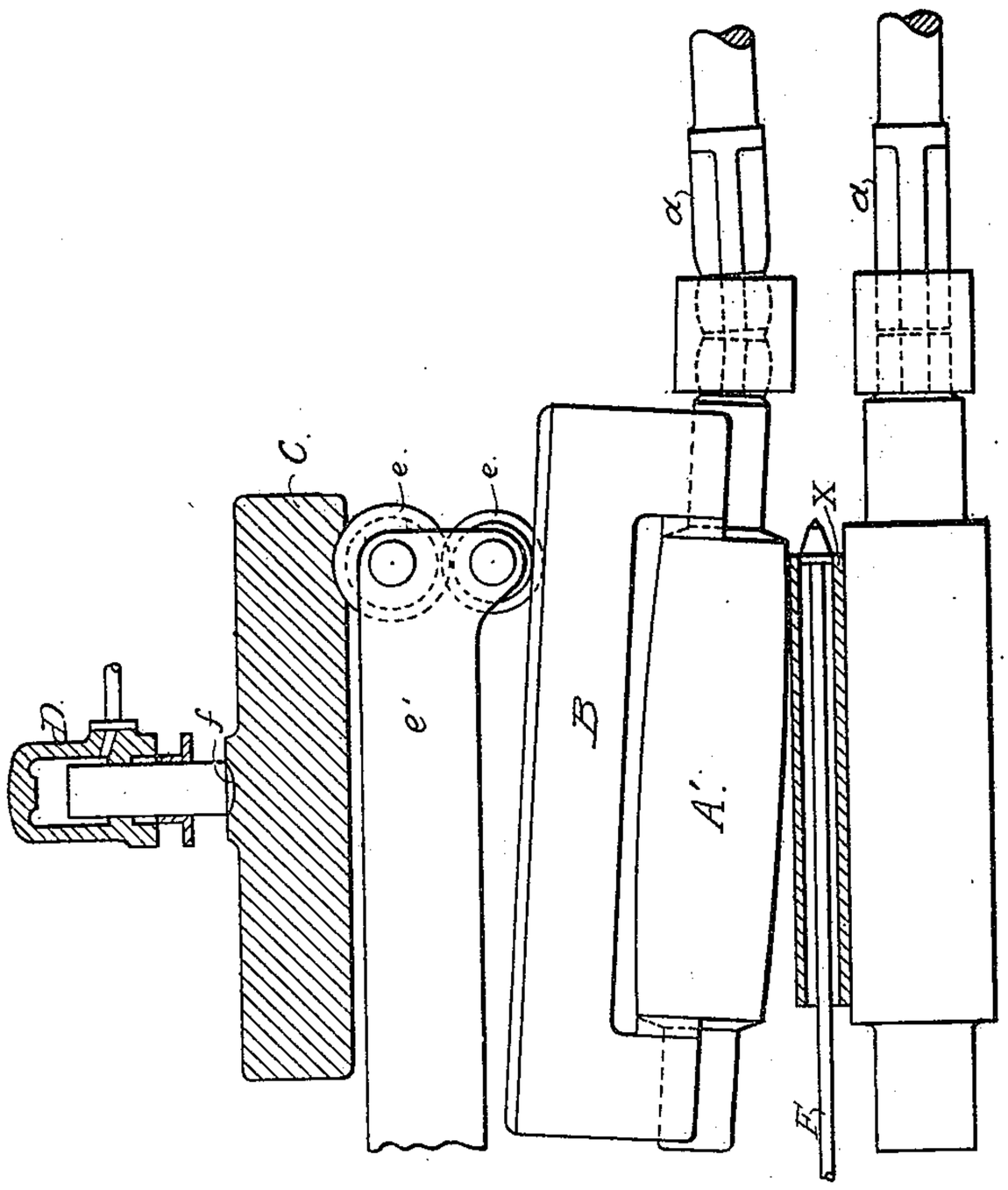

Fig. VI.

WITNESSES:

M. H. Caskey.
Sam'l S. McHard

INVENTOR
Samuel E. Diescher
BY Wm. L. Pierce
his ATTORNEY

UNITED STATES PATENT OFFICE.

SAMUEL E. DIESCHER, OF PITTSBURG, PENNSYLVANIA.

APPARATUS FOR MANUFACTURING SEAMLESS TUBING.

SPECIFICATION forming part of Letters Patent No. 667,686, dated February 12, 1901.

Application filed May 19, 1900. Serial No. 17,189. (No model.)

To all whom it may concern:

Be it known that I, SAMUEL E. DIESCHER, a citizen of the United States, residing at Pittsburg, in the county of Allegheny and State of Pennsylvania, have invented or discovered new and useful Improvements in Apparatus for Manufacturing Seamless Tubing, of which the following is a specification.

In the accompanying drawings, which make part of this specification, Figure I is a side elevation, partly in section, of the assembled machine employing parallel rolls. Fig. II is a central vertical section of Fig. I. Fig. III is a like section, but showing the use of two anvil-rolls and one pressure-roll. Fig. IV shows a like view of Fig. I, except where a curved pressure-roll is employed, the mandrel just entering the billet. Fig. V is a like view of Fig. IV with the mandrel half-way through the billet. Fig. VI is a like view of Figs. V and IV, but showing the billet entirely pierced.

The present application is a divided case, including the apparatus, the method being claimed in an application, Serial No. 25,877, filed by me August 4, 1900.

In commercial billet-piercing machines used at the present day the rolls which act on the material to be pierced have working faces provided with converging and expanding portions. Again, most of the piercing-mills in successful operation at present have their faces so set and so rotated that the rolls have a diagonal motion on the billets for the purpose of screwing or drawing the billet through the pass and over a mandrel-point. There are certain objections to the use of rolls for this purpose, in which converging and expanding faces are used, one of the most important objections being that hitherto no commercially-operative machine has been designed in which the working faces are so speeded that said faces will have a travel at the different positions in which they are in contact with the billet which shall equal the varying speed of rotation of the billet. There will be a tendency of the billet to revolve at the different positions in which it is in contact with the working faces of the rolls at different rates of speed, so that these converging and diverging faces will necessarily cause a twist in the billet, or else the faces of the rolls will slide over the billet at some points and the billet slide over the faces at other points. Where the working faces have only either converging or expanding parts and at the same time a diagonal rotative motion, great difficulty is experienced by reason of the fact that the line of contact of the face of the roll of the billet is curved. It is a serious problem to determine the curve for this curved working face so as to avoid twists or slips, and even if this curve is once ascertained the rolls have in actual mill practice only been set and proportioned for one fixed size of tube. An attempt to adjust them for larger or smaller sizes has hitherto in millwork destroyed the uniform rotative effect on the billet. There have also been mills erected for piercing billets where the working faces of the rolls moved at right angles to the center of the billet and means extraneous to the rolls have been adopted for forcing the billet through the pass of the rolls. In such mills there are only single faces used—namely, either a converging or an expanding pass. These mills, while they secure the advantage of a non-twisting rotation on the billet, retain the disadvantage of the size of the outcoming tube being different from the size of the billet entering. These mills also require an excessive force to push the billet through on account of friction on the pass.

The purposes of the present invention are to devise an apparatus wherein the foregoing disadvantages are overcome.

By the invention herein described there is absolutely no twisted fiber in the blank or ingot, and, furthermore, the rolls can be adjusted for different sizes of billets, while still retaining this non-twist feature. The range of sizes which the machine is adapted to handle is wider than that of other machines, while the mechanism is simpler and less expensive.

In the accompanying drawings, which make part of this specification, in Figs. I and II, A A represent rolls adapted to act on the billet X and revolve in a direction at right angles to the line of passage of the billet through them. These rolls may be two or more in number and in Fig. I are shown as ordinary

cylindrical rolls, while in Figs. IV, V, and VI the upper roll is shown as having a curved face. These rolls are mounted in suitable journals and are driven by the spindles *a a*, as shown. In Figs. I and II two rolls only are illustrated; but more rolls may be used, if desired—as, for instance, in Fig. III, where two anvil-rolls and one pressure-roll are employed. The bottom rolls are preferably mounted so as to be adjustable for different-sized billets, while the top roll is susceptible of a rocking vertical motion during the process of piercing. The top roll, which may be called the "pressure-roll," is so mounted that it can be brought down on the billet, which rests on the bottom rolls or anvil-rolls, with force or pressure and likewise so mounted that the pressure may be concentrated on any point on the billet. During the process of piercing this concentration of pressure should be directly over or substantially over the position of the mandrel-head. As the mandrel passes through the billet the point of concentration of pressure travels with it. This is accomplished by the following-described mechanism: The pressure-roll A has its journals mounted in the bearings of the yoke B. This yoke is so held that it may have a free up-and-down motion and also a free rocking motion. It is provided with a longitudinal groove *b*, which acts as a concave rail as a lower track for the traveler, hereinafter described. Above the yoke B is located a pressure-plate C, so mounted that it is susceptible of an up-and-down motion, and its face is always parallel with the horizontal center line of the billet. On the under side of this pressure-plate there is a rail, shown as a raised curved bead *c* in section, acting as the upper track for the traveler. The pressure-plate is mounted on a pivot or shaft c^2, journaled in suitable housings. This will confine the pressure-plate to the parallel motion required. Above the pressure-plate is shown a hydraulic cylinder D, which transmits the required pressure upon the pressure-plate. However, a suitable weight would serve the same purpose, or heavy springs may be used. Between the pressure-plate and the yoke and traveling on the rail or bead *f* of the pressure-plate and the concave rail *c* on the yoke is the traveler E, consisting of two rollers *e e*, as shown, and a frame *e'*, supporting the rollers and extending backward to the source of motion of the power-actuated mandrel F. Mandrel F is preferably only rotated by the action of the billet, although it may have rotation independent thereof. The position of the traveling rollers may be determined relative to the mandrel, and this relation should be maintained as the mandrel travels forward, or, in other words, after the location of the traveler has once been determined and set it will travel forward substantially with the same movement as the mandrel. It will be seen that when there is pressure applied through the cylinder upon the pressure-plate it will be transmitted through the traveler into the yoke and through the yoke into the roll, and the roll in turn applies it to the billet. In Figs. IV, V, and VI the pressure-roll is shown as a curved roll at A'.

The operation of the apparatus is as follows: Assume that the traveler stands in the position as shown in Fig. I and pressure is transmitted through it into the yoke. Then it is plain that the yoke in transmitting this pressure into the roll will transmit most pressure through the journal nearest to the traveler and least through the journal farthest away from the traveler. Now if the roll be flat this pressure will be applied on a greater length of the billet. It is, however, desirable, but not indispensable, that this pressure be concentrated over a determined length of the billet, and this is accomplished by curving the face of the pressure-roll as seen at A', giving it a rocking motion on the surface of the billet as the traveler is moved forward and returned. The roll will then always contact with the billet directly under the traveler and over the mandrel. Even with the flat roll the concentration of pressure is helped by the tubular formation in the billet, because it is plain that the tubular part while hot and in a pliable state will assume an elliptical shape under pressure and relieve itself, thereby throwing the pressure on that part of the billet that can support it—namely, over the mandrel-head. This shows that the ordinary cylindrical roll will do the work; but better results will be had with the slightly-curved roll for the reasons above given, while the curvature is so slight that the twist occasioned thereby is practically unnoticeable. The curved roll has also the advantage that it does not come in contact with the solid part of the billet except right where the work is done, thereby leaving the billet more free to lengthen as the cross-section is reduced by the penetration of the mandrel.

In Fig. II there are two rolls shown acting on the billet, and in Fig. III there are three rolls shown. The bottom rolls are mounted in fixed bearings and the top roll in adjustable bearings.

During the operation of piercing the rolls act as a vise or grip to hold the billet in position against the punching action of the mandrel. The rolls also act as swages upon the billet, while the mandrel-head assumes the function of an anvil. Again, the rolls retard the stretching of the billet circumferentially, causing the billet to flow out lengthwise, while retaining the original diameter of the billet. One important advantage of my form of apparatus is that the mandrel is supported by the billet, while the billet is supported upon the lower roll or rolls, thus reducing the tendency to break the mandrel or distort the same.

The apparatus shown in the drawings is

merely mechanically illustrative of one way of carrying out my improved method. It may be modified in a number of ways, and, in fact, I myself have already designed a variety of modifications of the same, in all of which a traveling pressure is concentrated substantially upon the head of the mandrel as it travels through the billet. Of course other portions of the billet may receive a portion of the pressure, but not to such a degree as that part of the billet which is adjacent to the mandrel-head.

Obviously by various apparent adjustments the pressure may be applied through either the upper or lower roll or through both the upper and lower rolls, but preferably as shown and described. Either of the upper or lower rolls may be curved or cylindrical or both curved or both cylindrical.

Having described my invention, I claim—

1. In billet-piercing mechanism the combination of a power-advanced mandrel; rolls revolving in a direction at right angles to the path of advance of said mandrel and a traveling pressure mechanism adapted to bear upon the upper roll and to advance practically evenly with the mandrel.

2. In billet-piercing mechanism the combination of a power-advanced mandrel; rolls revolving in a direction at right angles to the path of advance of said mandrel; a pressure-plate mounted above the upper roll and a traveler interposed between said pressure-plate and said upper roll whereby the pressure may be concentrated at any desired point of the upper roll.

3. In billet-piercing mechanism the combination of a power-advanced mandrel; rolls revolving in a direction at right angles to the path of advance of said mandrel; a pivoted pressure-plate mounted above the upper roll and a wheeled traveler interposed between said pressure-plate and said upper roll whereby the pressure may be concentrated at any desired point of the upper roll.

4. In billet-piercing mechanism the combination of a power-advanced mandrel; an anvil roll or rolls revolving in a direction at right angles to the path of advance of said mandrel; an upper roll free to move vertically in its bearing and mechanism for applying a traveling pressure upon said upper roll substantially over the head of the mandrel as the same advances.

5. In billet-piercing mechanism the combination of a power-advanced mandrel; rolls revolving in a direction at right angles to the path of advance of said mandrel and a traveling pressure mechanism adapted to bear upon one or more of said rolls and to advance practically evenly with the mandrel.

Signed at Pittsburg, Pennsylvania, this 11th day of May, 1900.

SAMUEL E. DIESCHER.

Witnesses:
WM. L. PIERCE,
ALFRED W. BEATTY.