(No Model.) 2 Sheets—Sheet 1.

C. P. HIGGINS.

SECTIONAL MANDREL.

No. 503,960. Patented Aug. 29, 1893.

Fig. 1.

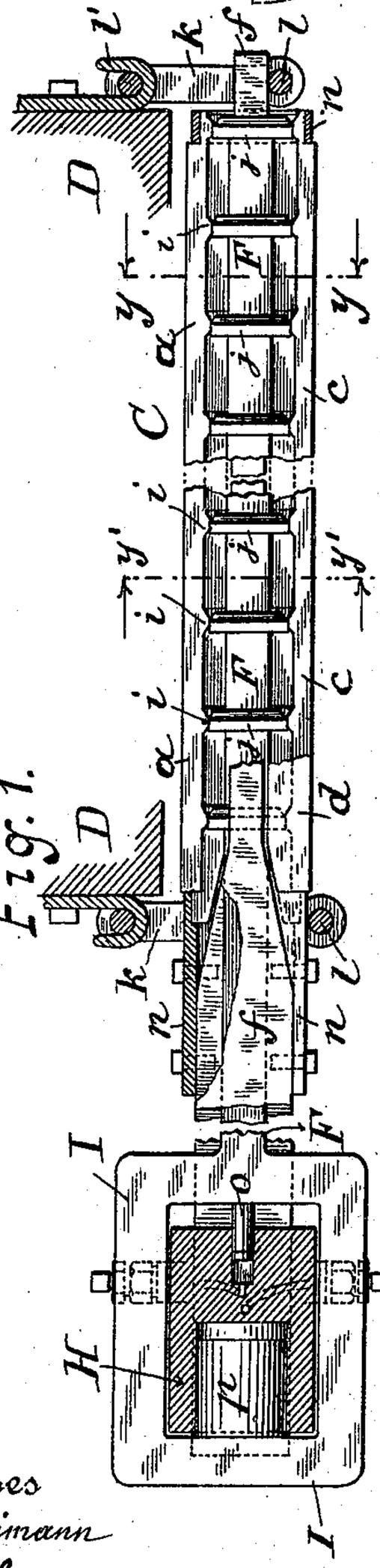

Fig. 2.

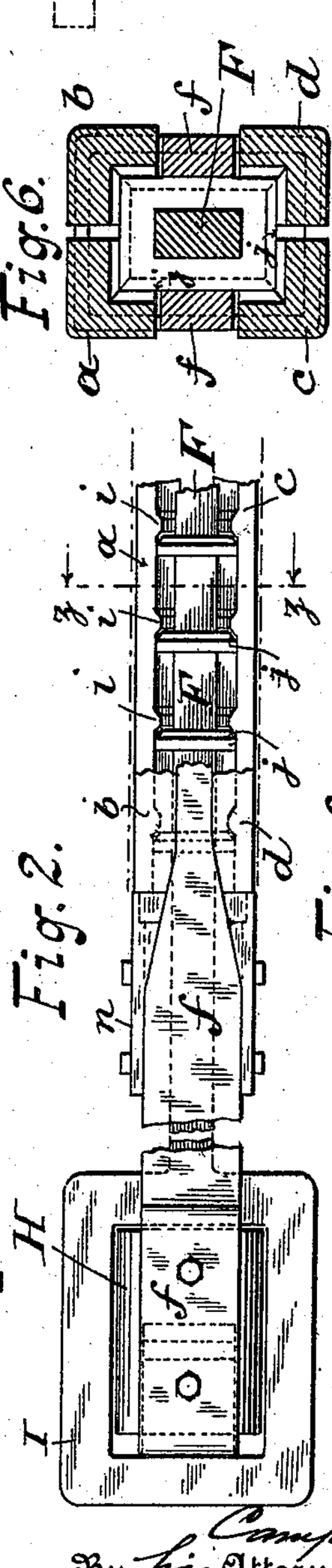

Fig. 3.

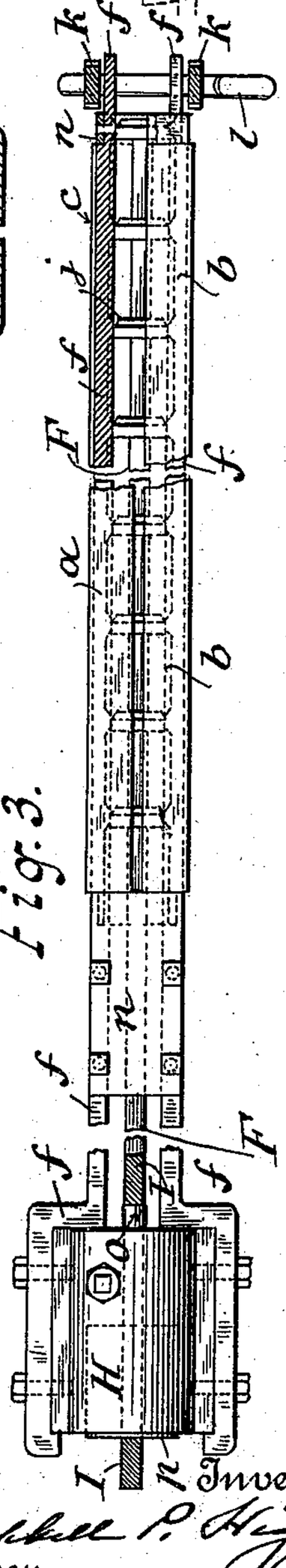

Fig. 4.

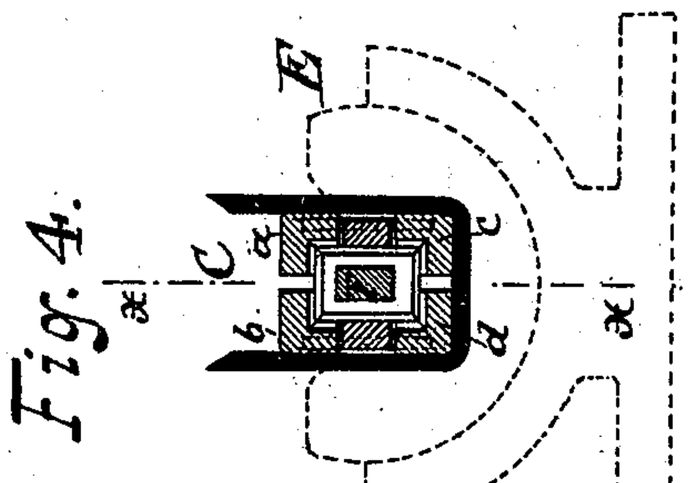

Fig. 5.

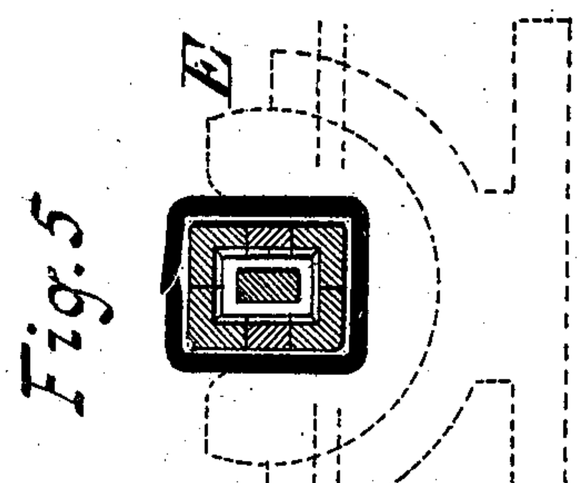

Fig. 6.

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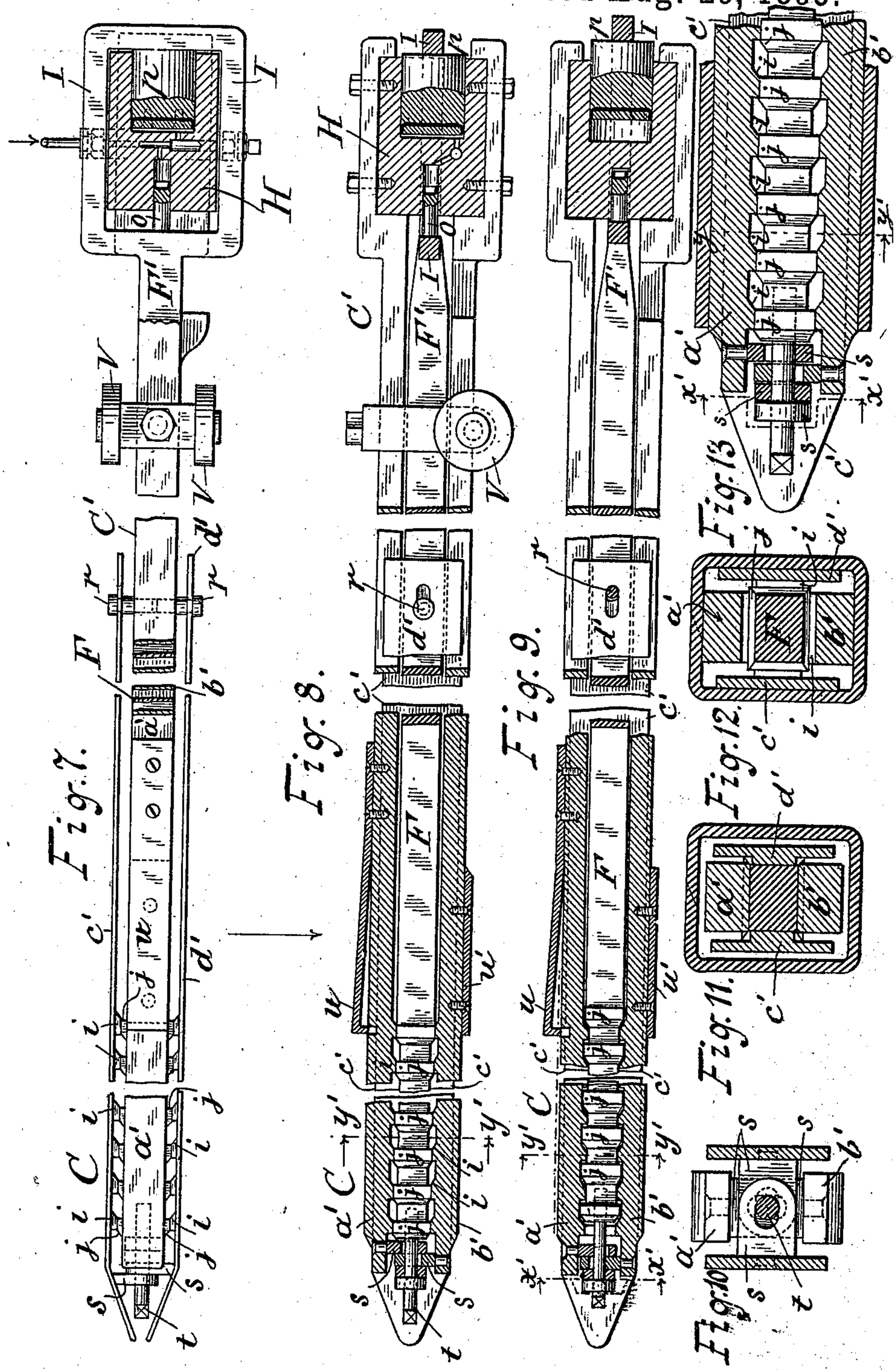
(No Model.)

2 Sheets—Sheet 2.

C. P. HIGGINS.

SECTIONAL MANDREL.

No. 503,960. Patented Aug. 29, 1893.



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UNITED STATES PATENT OFFICE.

CAMPBELL P. HIGGINS, OF NEW YORK, N. Y.

SECTIONAL MANDREL.

SPECIFICATION forming part of Letters Patent No. 503,960, dated August 29, 1893.

Application filed July 5, 1892. Serial No. 439,059. (No model.)

To all whom it may concern:

Be it known that I, CAMPBELL P. HIGGINS, a citizen of the United States, residing in the city, county, and State of New York, have invented certain new and useful Improvements in Sectional Mandrels, of which the following is a specification.

The invention relates to expanding mandrels adapted for making tubes of rectangular or other polygonal cross-sectional form, and the object is to provide a mandrel that may be readily expanded in place or contracted for withdrawal from the finished tube.

The invention consists in a mandrel made up of longitudinal corner plates and an expanding core extending throughout its length, which by a longitudinal movement is adapted to expand or contract the plates, uniformly and simultaneously, as hereinafter described and claimed.

Referring to the accompanying drawings:—Figure 1, is a longitudinal sectional elevation showing one form of construction of my improved mandrel, taken on the line *x*—*x*, Fig. 4; showing also a suitable operating cylinder therefor; the said mandrel appearing in an expanded position; Fig. 2, a similar view taken partly in elevation, showing the mandrel contracted; Fig. 3, a plan view of Figs. 1, and 2, the position corresponding to Fig. 1; Fig. 4, a cross-section taken on the line *y*—*y*, Fig. 1, and Fig. 5, a cross-section taken on the line *z*—*z*, Fig. 2. Fig. 6, is an enlarged cross-section on line *y'*—*y'* of Fig. 1; the position of the parts being similar to that in Fig. 4. Fig. 7, is a plan view partly in section showing another form of construction of my improved mandrel; the parts being in an expanded position; Fig. 8, a side view partly in longitudinal section its position corresponding to Fig. 7; Fig. 9, a side elevation partly in section, showing the parts in a contracted position. Fig. 10, is an enlarged cross-section taken at *x'*—*x'*, Figs. 9 and 13; Fig. 11, an enlarged cross-section taken at *y'*—*y'* Fig. 9, showing the parts contracted; and Fig. 12, an enlarged cross-section taken at *y'*—*y'* Figs. 8 and 13, showing the parts expanded. Fig. 13, is an enlarged longitudinal section through the end of the mandrel, corresponding in position to Fig. 8.

In Figs. 11, 12 and 13, the tube is indicated in position upon the mandrel.

The construction of the mandrel herein shown in Figs. 1 to 6, inclusive, is well adapted for use in conjunction with a folding die E, indicated by dotted lines in Figs. 4 and 5, such as more fully illustrated and claimed by me in a separate patent application filed simultaneously herewith, Serial No. 439,061, which die E, is adapted for folding the metal plate into a rectangular tube. For this purpose the mandrel C, is provided with longitudinally divided corner sections *a*, *b*, *c*, *d*, which clearly appear in cross-section in Figs. 4 and 6, designed to be expanded in opposite directions preparatory to folding the plate about the same in the die E, as shown in Fig. 5.

The corner pieces *a*, *b*, *c*, *d*, are each provided at suitable intervals longitudinally, with a series of wedge-shaped projections *i*, *i*, *i*, having flat faces, and within the same there is a longitudinally movable core F, provided at corresponding intervals in its length with a co-operating series of corresponding projections *j*, *j*, *j*; around which core are assembled the several sections *a*, *b*, *c*, *d*. When the expanding plates are spread by the action of the core F, a solid bearing is secured upon the opposite flat faces of the projections *i*, *i*, *j*, *j*. The movable pieces *a*, *b*, *c*, *d*, are carried in a suitable frame *f*, *f*, having collars *n*, *n*, at either extremity thereof for preventing the assembled mandrel sections from dropping apart and also confining them against longitudinal displacement.

Upon the extremity of the frame *f*, *f*, a hydraulic cylinder H, is securely bolted, and upon the extremity of the core F, there is provided a yoke I, upon which the respective differential plungers *o*, *p*, engage; the smaller plunger *o*, operating to insert the wedges and expand the mandrel before the plate is folded thereon, and the larger plunger *p*, operating to withdraw the wedges and collapse the mandrel as in Fig. 5, after the tube has been folded and exterior pressure exerted upon the mandrel.

Links *k*, having removable pins *l*, are suspended from the head D, of the press, as indicated in Fig. 1, and the mandrel is thereby suspended by its frame *f*, preparatory to its operation. By the removal of the pins *l*, the mandrel and folded tube may be removed bodily from the die E.

The invention is equally applicable to expansive mandrels having longitudinally divided sections otherwise located than at the corners; for example, upon one or more of the respective sides of the rectangular or other polygon, according to form, as shown in Figs. 7 to 13, inclusive. The construction of mandrel therein shown is particularly adapted for use in conjunction with a heating and welding apparatus, which I have described in a separate patent application filed simultaneously herewith, Serial No. 439,065, the mandrel proper C, being designed for insertion into and expansion in the interior of the tube preparatory to its passage between the welding rolls. The stock C′, which is a continuation of the expanding faces a', b', constitutes the frame corresponding to f, in Fig. 3, on which the operating cylinder H, is supported. The expanding faces a', b', and also the expanding faces c', d', on the remaining sides of the mandrel are interiorly provided at suitable intervals longitudinally, with a series of wedge-shaped and flat faced projections i, i, i, similar to those hereinbefore described with reference to Figs. 1 to 5, inclusive, and the longitudinally movable core F, within the mandrel is likewise provided at corresponding intervals with the series of wedge-shaped and flat faced projections j, j, j. The shank F′ of the core F, is also provided with a yoke I, connected as before described with the differential plungers of the operating cylinder H. The inner extremities of the plates c', d', are connected together by the studs r, upon which they move longitudinally by means of slots in said plates as appear in Figs. 8 and 9; the said studs being fastened in the central core F; and the outer extremities of the plates c' d' as also the outer extremities of the welding faces a', b', are provided with lugs s, s, that are retained together upon a central pin t, Fig. 10, and all sides of the mandrel are thus retained together. A shoulder, or latch, or other suitable device is provided at u, u', on the body of the mandrel, for the purpose of pushing the tube toward the welding rolls when the mandrel has been inserted the proper distance. V, represents a traveling roller which runs upon a suitable way designed for supporting the stock of the mandrel and its cylinder when moved by the carrier arm of the welding furnace in the manner described in my last mentioned patent application.

The operation of the mandrel shown in Figs. 1 to 6, inclusive, is as follows: The mandrel is first expanded by the plunger o, which moves the core wedges j, into contact with and between the flat faces of the section wedges i, as seen in Fig. 1. The metal plate is then laid on the folding die E, and pressed by the compression die D, of the press into the form shown at Fig. 4, and subsequently folded over at the projecting edges by the oscillation of the die E, as more fully described in my first mentioned patent application. After the plate has assumed the tubular form shown in Fig. 5, and the head D, retracted, pressure is applied to the plunger p, of the cylinder H, which moves the core F, endwise to release the wedges, as shown in Figs. 2 and 5, the mandrel being then withdrawn.

The operation of the mandrel shown in Figs. 7 to 13 inclusive, is as follows:—The mandrel is first inserted into the tube (lying within the welding furnace or other intended place), and the sides a', b', c', d', then expanded by means of the plunger o, which moves the core wedges j, into contact with and upon the flat faces of the sectional wedges i, as before, and thereby secures a solid bearing against the end of the tube abutting on the shoulder u, u', as seen in Figs. 8 and 13. The advancement of the mandrel toward the welding rolls then being continued, the seam in the tube is welded over one of the faces a', or b', and after delivery from the rolls, the tube is secured from a return motion by a suitable latching device, while the core F, of the mandrel is retracted by means of the plunger p, and the mandrel withdrawn.

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

1. A sectional mandrel adapted for the formation thereon of tubes of rectangular cross-sectional shape, consisting of longitudinal corner strips, and a core provided with means for moving outward the said corner strips of the mandrel.

2. A sectional mandrel adapted for the formation thereon of tubes of rectangular cross-sectional shape, the same consisting of longitudinal corner strips having a series of interior wedge-shaped and flat faced projections, and between the said longitudinal strips, a core having corresponding projections engaging therewith and means for moving said core longitudinally, substantially as described.

3. In combination with a sectional mandrel, a core provided with means for moving outward the sections of the mandrel, a cylinder attached to the mandrel, a plunger within the cylinder attached to the core of the mandrel, and means for operating the said plunger by fluid pressure.

4. The combination of a sectional mandrel, a core provided with means for moving outward the sections of the mandrel, two cylinders of different sizes attached to the mandrel and plungers therein of different size connected to the said core of the mandrel; the larger for expanding, the smaller for contracting the same by actuating said core in opposite directions, and means for operating the said plungers by fluid pressure.

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