

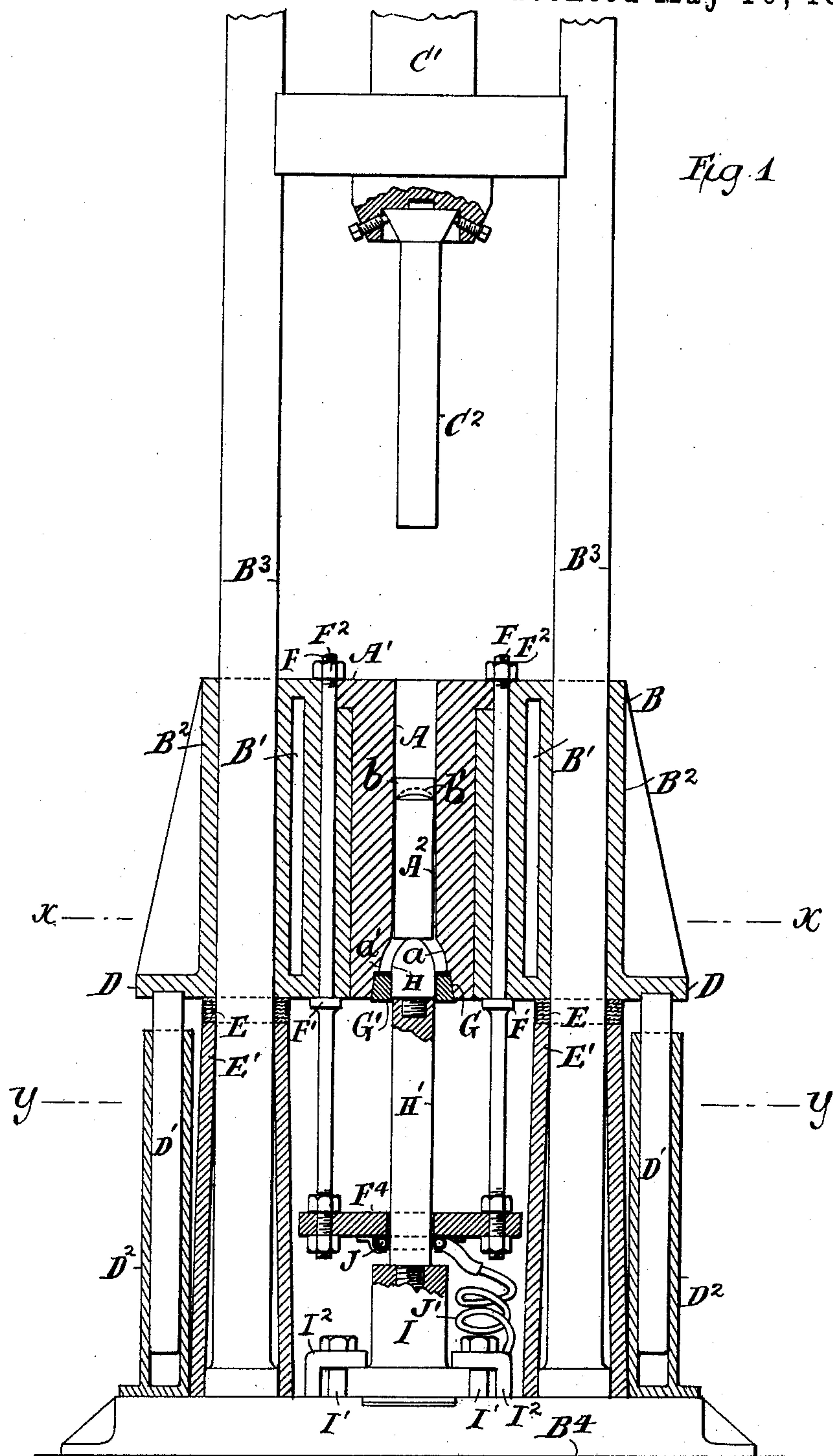
(No Model.)

6 Sheets—Sheet 1.

E. F. HOLINGER.
TUBE FORMING APPARATUS.

No. 603,787.

Patented May 10, 1898.



Witnesses
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A. M. Jones.

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(No Model.)

6 Sheets—Sheet 2.

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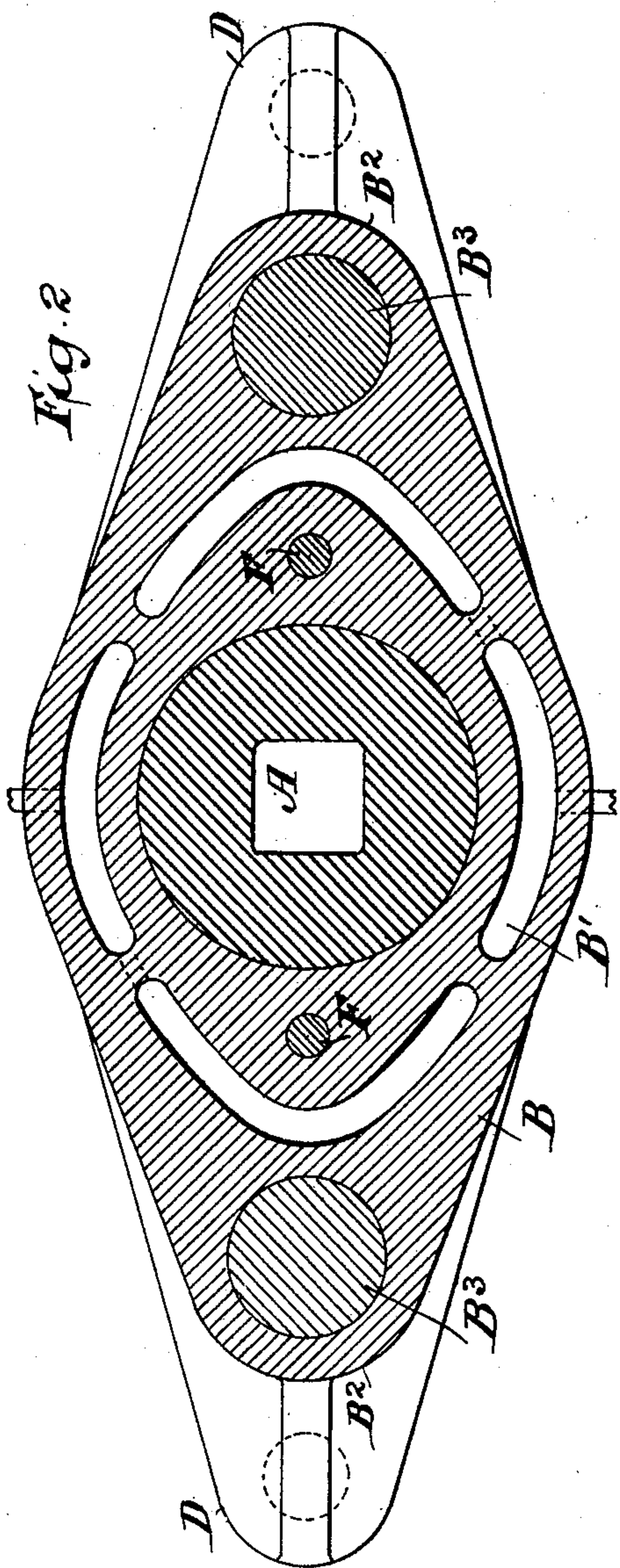
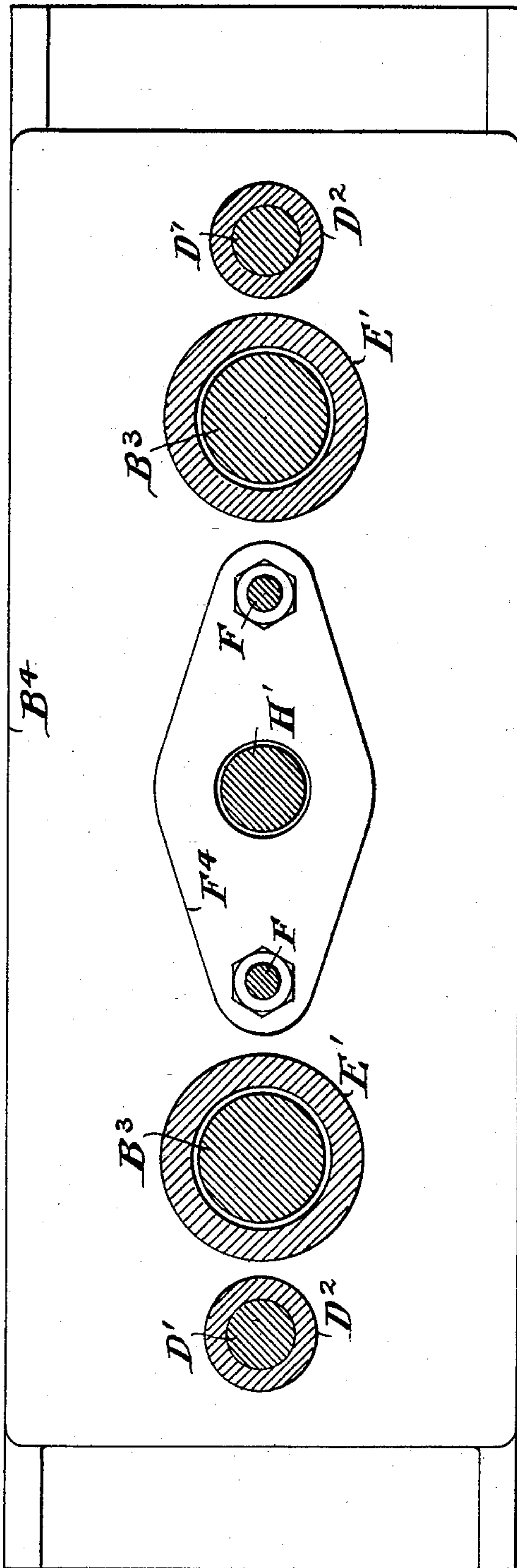


Fig. 3



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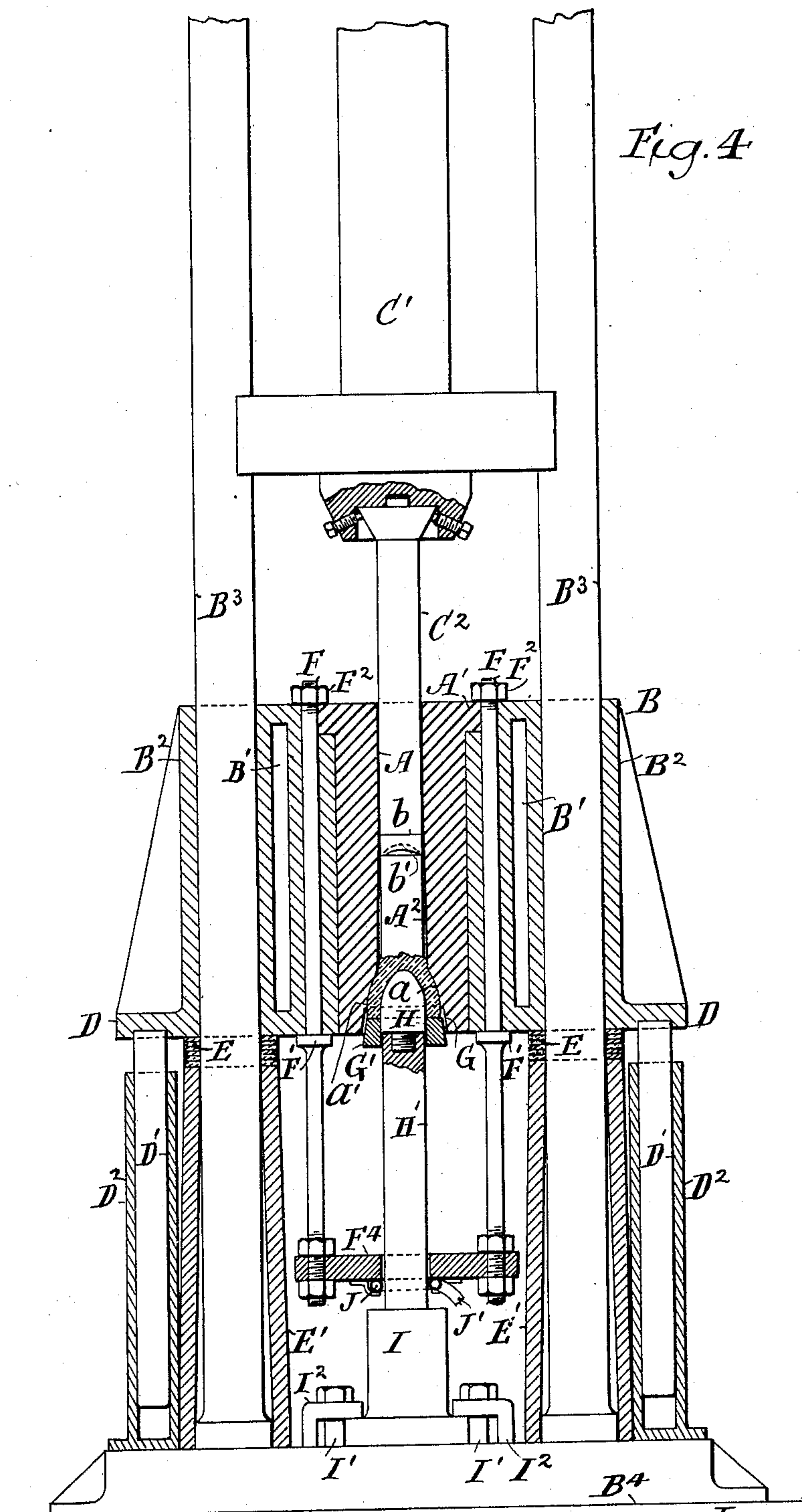
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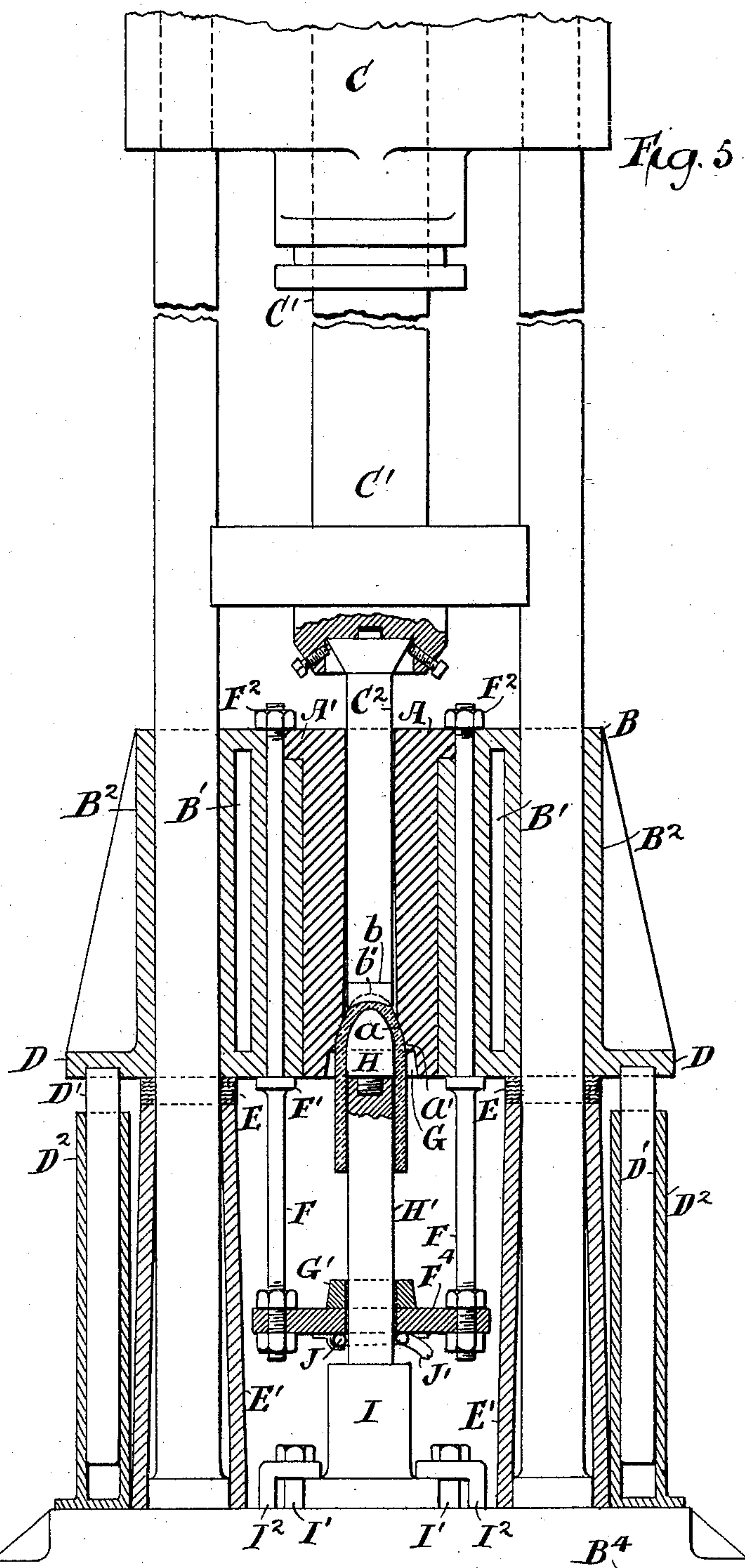
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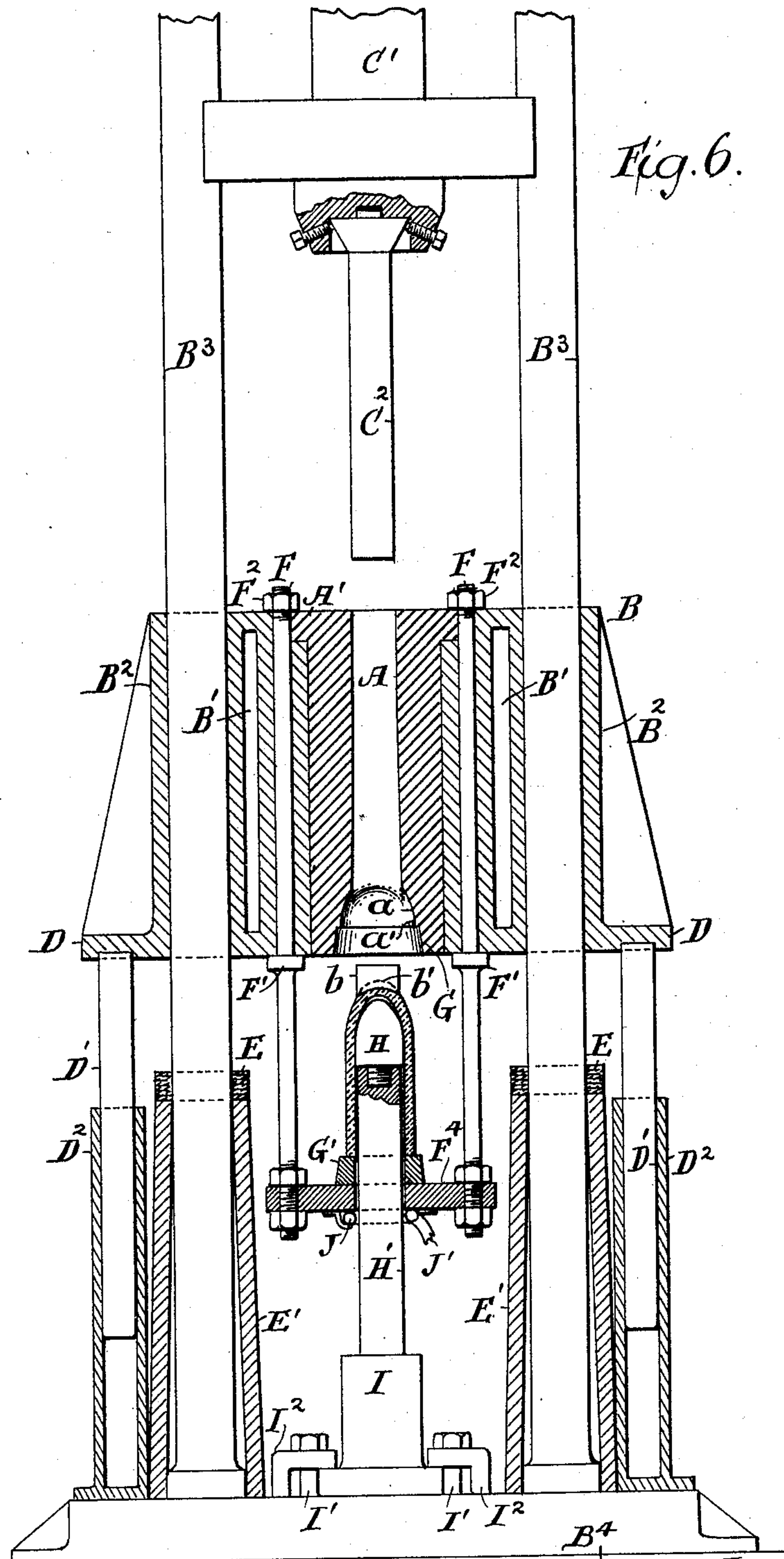
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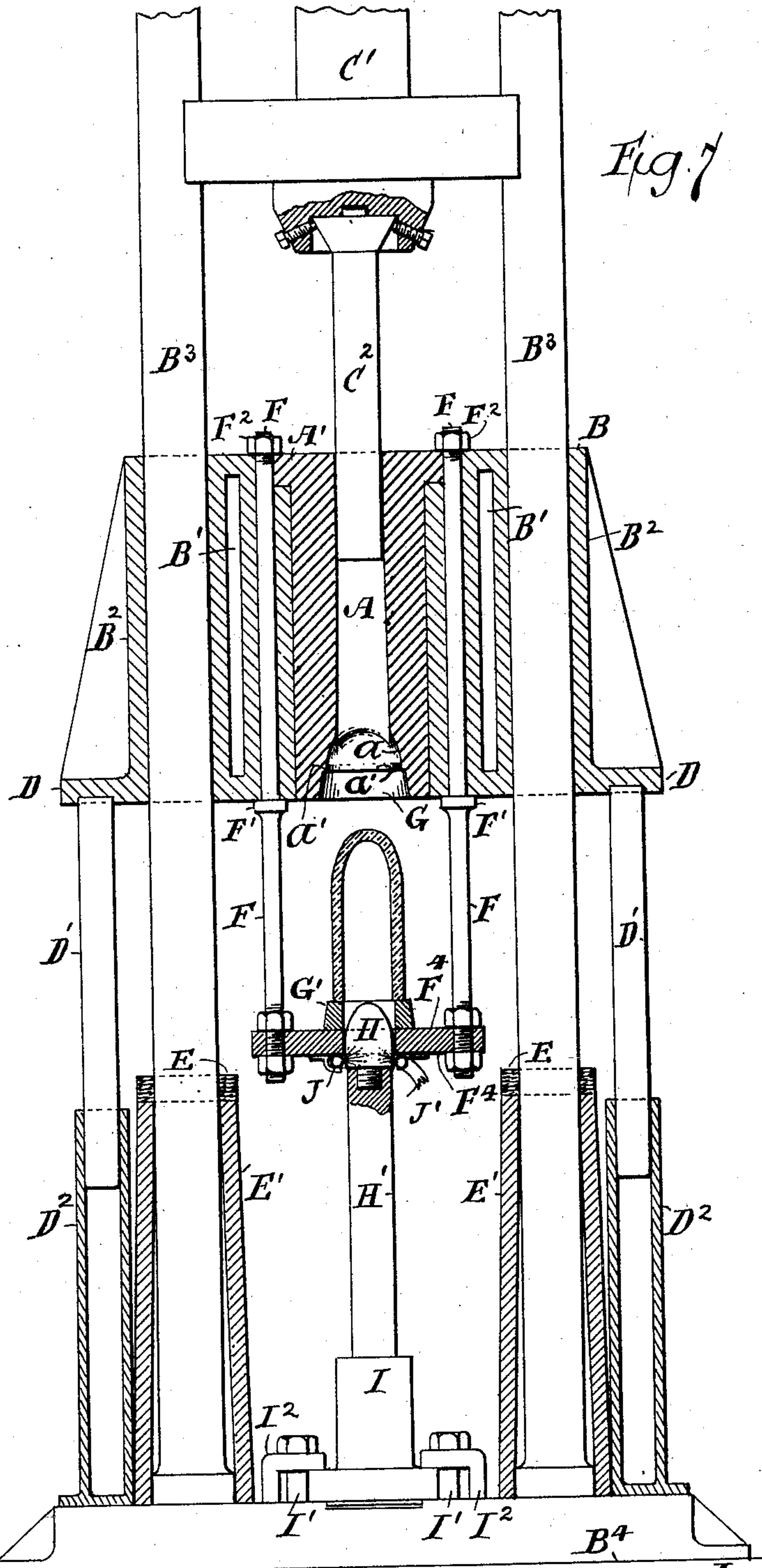
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UNITED STATES PATENT OFFICE.

EMIL F. HOLINGER, OF McKEESPORT, PENNSYLVANIA, ASSIGNOR TO THE
NATIONAL TUBE WORKS COMPANY, OF BOSTON, MASSACHUSETTS.

TUBE-FORMING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 603,787, dated May 10, 1898.

Application filed December 6, 1897. Serial No. 660,828. (No model.)

To all whom it may concern:

Be it known that I, EMIL F. HOLINGER, of McKeesport, Pennsylvania, have invented certain Improvements in Tube-Forming Apparatus, of which the following is a specification.

These improvements relate to the class of mechanism for transforming a suitably-hot solid billet into a hollow object by forcing the hot metal to exude from an annular outlet at the end of a hollow die, in which the hot billet is primarily deposited, against the pointed end and over the body of a conoidally-pointed core.

The characteristic features of the mechanism embodying the improvements shown in the accompanying drawings are as follows, to wit: a stationary (preferably upright) cylindrical conoidally-pointed core-head; a vertically-reciprocable hollow die for containing the hot billet, arranged in axial alinement with and having at the bottom a flaring mouth surrounding the upper part of the core and having a range of movement equal to or slightly exceeding the length of the metallic object to be formed; a swage-block for deposit upon the upper end of the billet within the die, the said swage-block being spheroidally recessed upon its under side and having a flat upper side for engagement by the end of the plunger by which the metal of the billet is forced downward; a dislodgeable centralizing-ring at the lower end of the die having a sliding fit upon the cylindrical part of the core-head; a stripper consisting of a cross-head secured to bolts extending downward from the reciprocable hollow die and perforated to permit the passage through it of the core; a water-jacketed carriage for carrying the hollow die; hydraulic cylinders and pistons for elevating said carriage and hollow die, and, finally, series of independently-removable liners for regulating the position at which the carriage and hollow die come to rest at the conclusion of their downward excursion, and thereby so adjusting the flaring mouth of the die with relation to the conoidal head of the core as to regulate, as may be desired, the width of the annular space between the die and the head of the core, and hence regulate the thickness of the shell of the hollow product.

The drawings are as follows:

Figure 1 is a central vertical section of the apparatus, showing a billet within the die and showing the parts in position for the descent of the main plunger at the commencement of the operation. Fig. 2 is a transverse section taken through the plane indicated by the dotted line xx on Fig. 1. Fig. 3 is a transverse section taken through the plane indicated by the dotted line yy on Fig. 1. Figs. 4, 5, 6, and 7 are central vertical sections similar to Fig. 1, but illustrating successive stages in the operation of transforming the solid billet into a tubular object and finally stripping it from the core.

The drawings represent a hollow die A of a cross area progressively increasing in a downward direction, having at its upper end a flange A', which is seated in the upper end of the carriage B. The carriage B is represented as provided with a water-jacket B', through which it is intended there shall be maintained a constant circulation of cold water. Vertically-perforated ribs B² B² adapt the carriage to slide upon the columns B³ B³, the lower ends of which are fastened to the bed-plate B⁴, while their upper ends are fastened to and support the main hydraulic cylinder C. The ram C' has affixed to its lower end the plunger C², which is in vertical alinement with the die A. Laterally-projecting lugs D D are adapted to engage the upper ends of the vertical pistons D' D', seated in the hydraulic cylinders D² D². These hydraulic appliances are represented conventionally. It will be understood that water under pressure is introduced into the lower ends of the cylinders D² D² when it is desired to elevate the carriage B and die A, after which when it is desired that the carriage and die shall descend the water is allowed to escape from the lower ends of the cylinders D² D². The descent of the carriage and die is arrested by the collision of the bottoms of the ribs B² B² with the uppermost members of the superposed series E E of independently-removable liners deposited upon the upper ends of the hollow standards E' E', which inclose the lower portions of the columns B³ B³.

The carriage B is provided with vertical apertures for admission of the bolts F F, pro-

vided with the fixed collars F' F' for bearing against the bottom of the carriage B and with the nuts F^2 F^2 on their upper ends bearing upon the top of the carriage B and on the flange A' . The lower extremities of the bolts F F are screw-threaded and provided with pairs of nuts the members of which bear, respectively, upon the top and bottom of the cross-head F^4 , which is thereby made to move with the carriage B and die A and serve as a stripper for the finished product.

The lower end of the die A is composed of the spheroidal downwardly-flaring portion a , the cylindrical portion a' , and the slightly-conical annular recess G at the bottom to receive and partially contain the centering-ring G' , which is adapted to bear with a sliding fit upon the cylindrical part of the core-head H, screwed into the upper end of the core-stem H' . The core-stem H' extends downward loosely through a perforation in the cross-head or stripper F^4 and is secured at its lower end to the standard I. The standard I is adjustably clamped to the bed-plate by means of the bolts I' I' and the elbow-clamps I^2 I^2 .

Immediately beneath the stripper F^4 is a circular sprinkler J, which in operation is kept supplied with water under pressure by means of the flexible pipe or hose J' . The water thus supplied is ejected through apertures in the sprinkler against the core-stem H' and ultimately against the core-head H for the purpose of keeping those parts cool.

In operation, the parts having been brought into the relative positions in which they are represented in Fig. 1, a suitably-hot billet A^2 is deposited in the die A. A swage-block b , having its under side provided with a spheroidal cavity b' , is introduced into the die A above the billet A^2 . The main hydraulic ram is then actuated and the plunger C^2 descends and by driving the swage-block downward forces the metal of the billet to exude through the annular outlet between the core-head H and the spheroidally-flaring wall a of the die.

Under ordinary conditions the downward thrust upon the upper end of the billet would tend to upset and expand the metal laterally, and thereby cause the billet to jam in the die. To provide for this contingency, two expedients are employed: First, as has already been mentioned, the die is made to progressively increase in cross area in a downward direction; secondly, the downward thrust is given to the billet by an instrumentality having on its underside a spheroidal cavity, owing to the presence of which the displaced metal at the upper end of the billet is made to flow convergently toward the center and to fill said cavity, the sides of which oppose any lateral flow of the metal contained within the cavity.

Instead of employing the swage-block b , a spheroidal cavity might be formed in the lower end of the plunger C^2 ; but it is preferable to employ the swage-block in order to protect the lower end of the plunger from im-

mediate contact with the hot billet, and because the swage-block, when worn by continued use, can be replaced at small cost.

Fig. 4 represents the condition of the parts when the exuding metal has inclosed the upper portion of the core-head and partially dislodged the centering-ring G' from its seat.

Fig. 5 represents a further stage in the operation after the centering-ring, having been fully dislodged from its seat, has dropped and lodged upon the top of the stripper F^4 .

Fig. 6 represents a further stage in the operation after the metal has been entirely expelled from the die, the plunger C^2 elevated to its normal position, and the carriage B, by the actuation of the hydraulic pistons D' D' , has ascended so far as to start the work upward upon the core. The swage-block b , which in Fig. 6 is represented as deposited upon the apex of the product, is now to be removed by tongs.

Fig. 7 represents the conclusion of the stripping operation, showing the sprinkler discharging its jets of water against the core-head H, and showing the product completely stripped from the core in readiness to be removed preparatory to restoring the parts of the apparatus to the positions in which they are represented in Fig. 1 for a repetition of the operation.

The employment in the described organization of a core-head having below its conoidal point a cylindrical portion for combination with the centering-ring is of the essence of the invention. Because of this device the centering-ring is not dislodged from its seat, and hence does not cease to perform its centralizing function until there has been formed around the core-head a tube of sufficient length to thereafter itself preserve the centralization of the core-head with relation to the die.

What is claimed as the invention is—

1. In apparatus for transforming hot billets into hollow objects by forcing the exudation of the hot metal through an annular orifice, the combination, as herein set forth, of a stationary upright core having at its upper end a conoidally-pointed cylindrical core-head; a vertically-reciprocable hollow die and means for holding said hollow die stationary for feeding a billet in axial alinement with said core; means for imparting vertical movement to said die; a hydraulic plunger for forcing said billet downwardly through said die; a flaring mouth for said hollow die surrounding a prescribed portion of said conoidally-pointed core-head, and a centering-ring dislodgeably seated in a bearing at the lower end of said hollow die and having a sliding fit upon the cylindrical portion of said core-head, for centralizing said core-head with relation to said flaring mouth during the initial part of the billet-transforming operation.

2. The combination, as herein set forth, of a stationary upright core having a conoidally-pointed cylindrical head; a vertically-recip-

rovable hollow die having a flaring mouth concentrically surrounding said conoidally-pointed core-head at a prescribed distance therefrom; a hydraulic plunger for forcing a hot billet downward through said hollow die against and around said core; means for imparting vertical motion to said hollow die, and a stripper connected to and moving with said hollow die for stripping from said core the hollow object formed thereon by the downward thrust of said plunger upon said billet.

3. In apparatus for transforming a hot billet into a hollow object by forcing the hot metal through a hollow die against and around a conoidally-pointed cylindrical core-head; a hollow die composed of an upper portion corresponding in the shape of its cross-section to the cross-sectional shape of said billet and in a slight degree progressively increasing in cross area in a downward direction, and of a lower portion composed of a spheroidally-flaring section concentrically surrounding the conoidal part of the head of said core at a prescribed distance therefrom, and below said flaring section a cylindrical section concen-

trically surrounding the cylindrical part of the said core-head at a prescribed distance therefrom.

4. In apparatus for transforming a hot billet into a hollow object by forcing the hot metal to exude from an annular orifice, a stationary upright conoidally-pointed core; a hollow die arranged in appropriate alinement with said core; a vertically-reciprocable carriage for carrying said hollow die; a stripper arranged at a prescribed distance below and connected to and moving with said hollow die and carriage; means for imparting vertical movement to said carriage; a reciprocable plunger arranged at a prescribed distance above said hollow die in appropriate alinement therewith and adapted to enter said hollow die, and means for imparting endwise reciprocating movements to said plunger, as and for the purposes set forth.

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A. M. JONES.