No. 638,809. Patented Dec. 12, 1899.

E. E. QUIMBY.

ART OF MANUFACTURING TUBE BLANKS.

(Application filed Mar. 27, 1899.)

(No Model.) 2 Sheets—Sheet 1.

Fig. 1

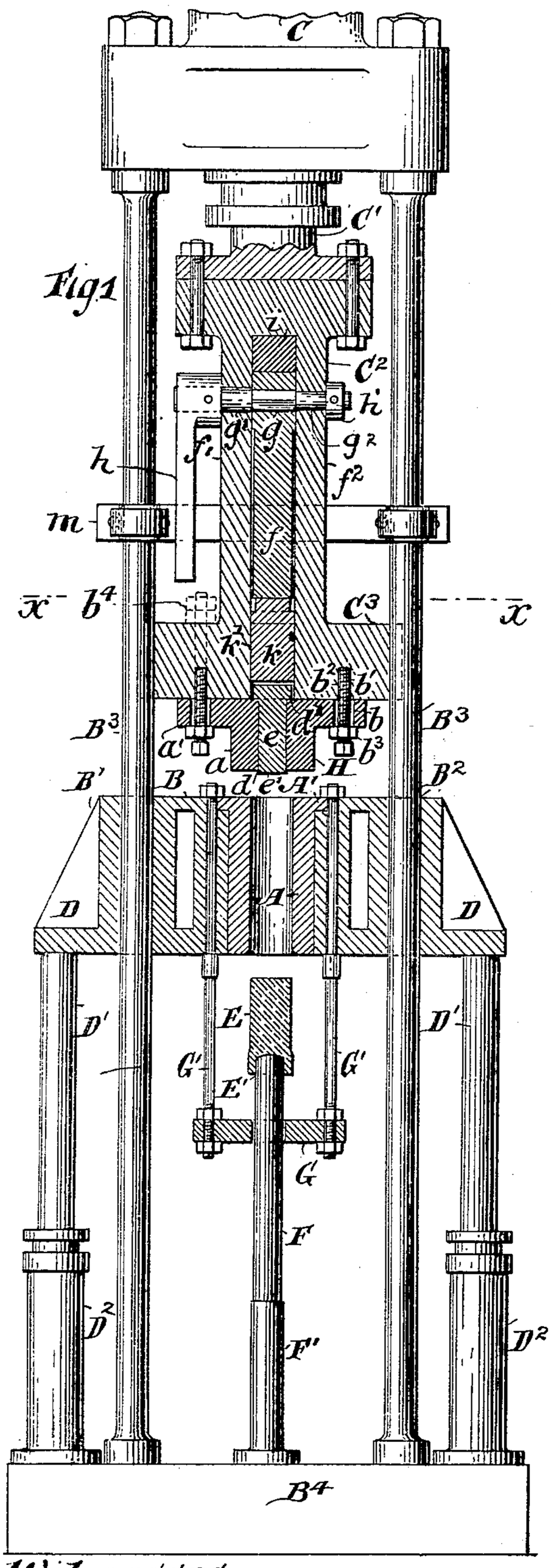


Fig. 2

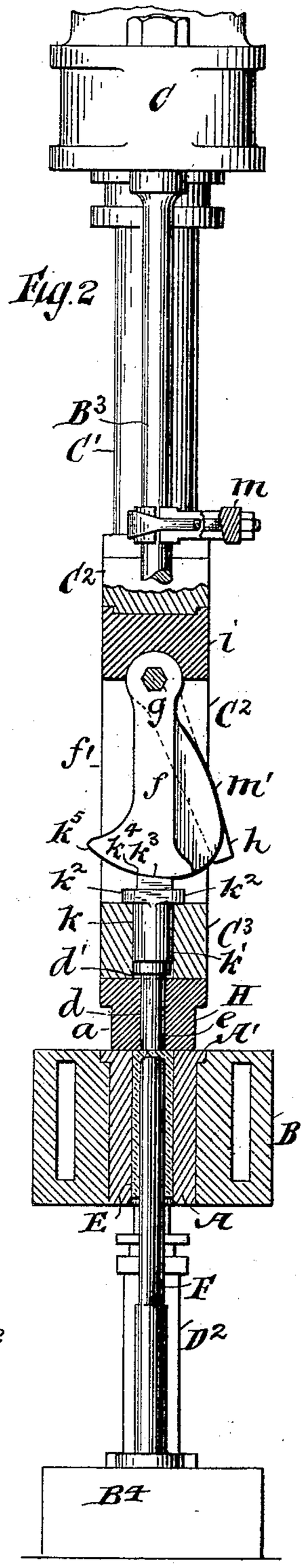


Fig. 4

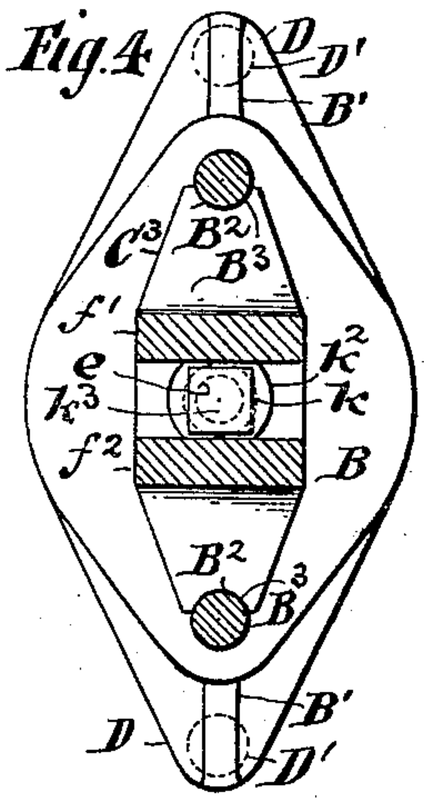
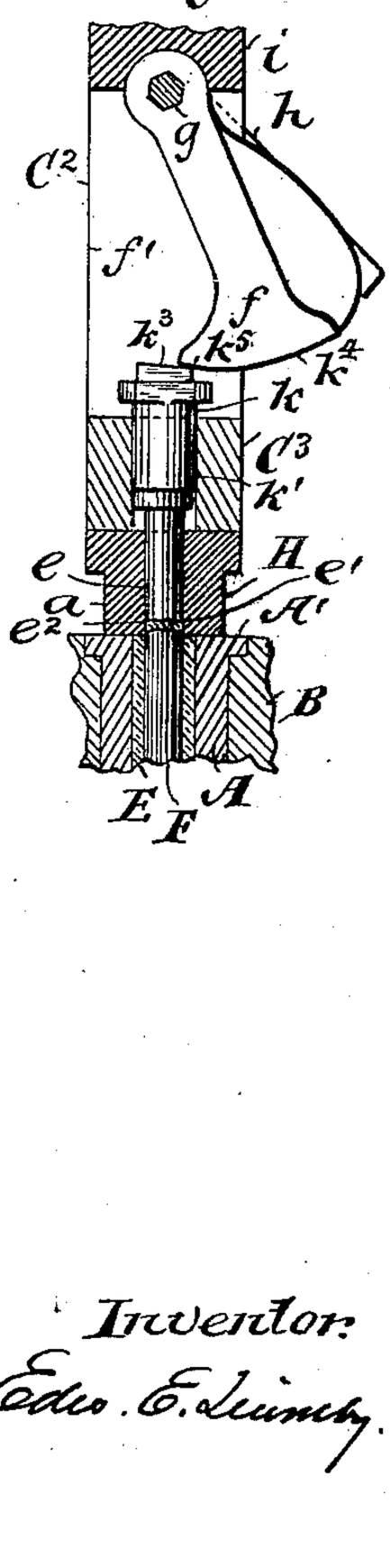


Fig. 3



Witnesses.
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Fig. 5

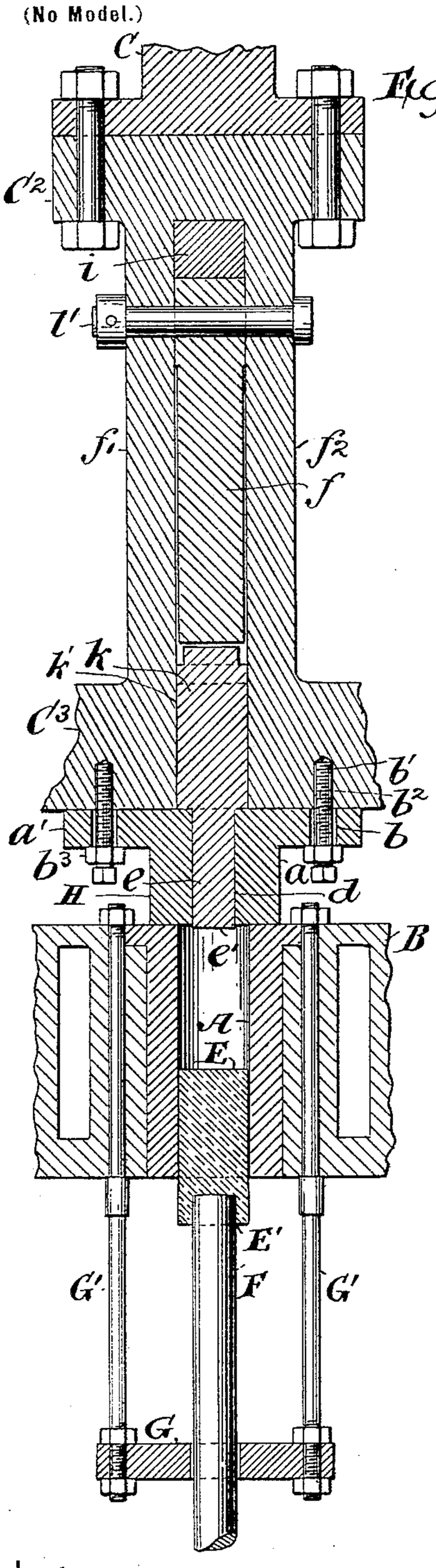
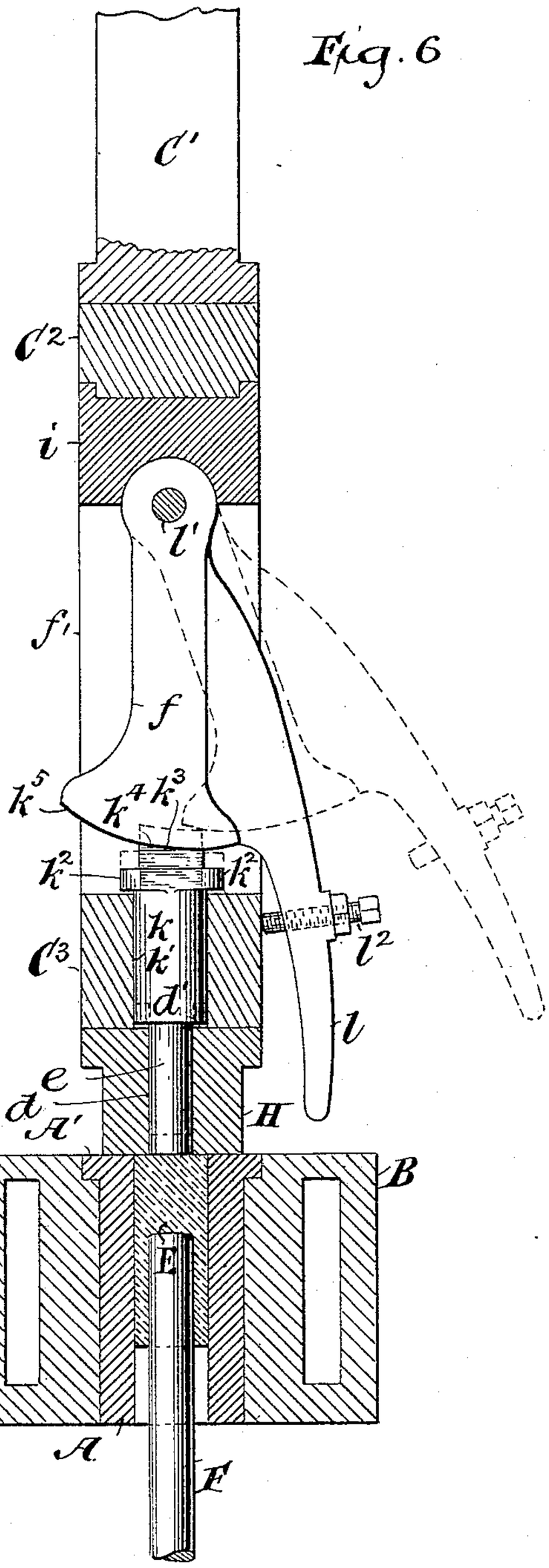


Fig. 6



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UNITED STATES PATENT OFFICE.

EDWARD E. QUIMBY, OF ORANGE, NEW JERSEY, ASSIGNOR, BY MESNE ASSIGNMENTS, TO THE NATIONAL TUBE COMPANY, OF PITTSBURG, PENNSYLVANIA.

ART OF MANUFACTURING TUBE-BLANKS.

SPECIFICATION forming part of Letters Patent No. 638,809, dated December 12, 1899.

Application filed March 27, 1899. Serial No. 710,592. (No model.)

To all whom it may concern:

Be it known that I, EDWARD E. QUIMBY, of Orange, New Jersey, have invented certain Improvements in the Art of Manufacturing Tube-Blanks, of which the following is a specification.

These improvements relate to the art of manufacturing a tube-blank from a solid metallic billet by causing such billet, when suitably heated, to be pierced longitudinally by a stationary punch while the billet is contained in a moving hollow die, as illustrated in the piercing apparatus shown and described in Emil F. Holinger's pending application for Letters Patent of the United States, serially numbered 706,366. In such apparatus the die is the active and the punch the passive member of the piercing-couple. The carriage containing the die is forced downward by a hydraulic ram to effect the piercing operation and is subsequently raised by hydraulic pistons arranged beneath it. As the apparatus shown in the said Holinger application is designed for the manufacture of hollow projectiles, it employs a hollow die which is interiorly shaped to conform to the cylindrical surface and the conoidally-pointed head of the projectile. The billet is prepared by having its lower end recessed to fit the upper end of the punch and is placed upon the punch before the carriage is lowered, the billet having been thus placed in position and the carriage lowered so that the die envelops the billet. A hydraulic ram, administering its downward thrust upon the top of the die, forces the metal of the billet to fill the upper end of the descending die and the annular space between the surface of the stationary punch and the wall of the die. The modification of said apparatus by which it is made to contain the present invention embraces the substitution of a tubular die or matrix for containing the billet, a telescopic ram for administering its downward stroke upon the top of the matrix and directly upon the upper end of the billet therein, and a removable chucking instrumentality for maintaining the inner member of the ram in fixed relation to the outer member, so that the lower end of such inner member is made to act as the middle portion of the working face of the ram during a prescribed part of the downward stroke and then by the removal of said chucking instrumentality is permitted to yield or remain stationary during the concluding part of the downward stroke while a disk of metal is being punched out of the top of the billet and into the mouth of the aperture in which the inner member of the ram is seated. The said disk of metal is subsequently dislodged by the act of pushing the inner member of the ram downward to its normal position after the ram has been raised a suitable distance above the matrix. The sliding carriage for supporting the matrix is proportioned with reference to containing matrices of different internal diameters for employment in connection with punches of different diameters.

A part of the present invention consists in making the telescopic ram easily separable from the hydraulic piston or reciprocating structure which drives it, to the end that when occasion arises for changing the size of the punch employed the telescopic ram can readily be removed and be replaced by another of appropriately different dimensions.

The accompanying drawings are as follows: Figure 1 is a front elevation, partly broken out and partly in section, showing the billet in place ready for the descent of the matrix. Fig. 2 is a side elevation, partly broken out and partly in section, illustrating the stage in the piercing operation at which it is necessary to release the inner member of the telescopic ram from the chucking-cam. Fig. 3 is a detail showing the chucking-cam fully dislodged from its chucking position and illustrating the final stage in the piercing operation. Fig. 4 is a transverse section taken through the plane indicated by the dotted line $x\,x$ on Fig. 1. Figs. 5 and 6 are details illustrating modifications of the chucking instrumentality.

In the apparatus represented in the drawings there is contained, as shown, a hollow cylindrical matrix A, having a flange A′, by means of which it is sustained in the reciprocable carriage B. The carriage is provided with vertical ribs B′ B′, having the perforations B^2 B^2, adapting them to slide upon the

column B^3 B^3, the lower ends of which are fastened to the bed-plate B^4, while their upper ends are fastened to and support the main hydraulic cylinder C. The main hydraulic piston C′ is secured to a downward extension C^2, provided at its lower end with the cross-head C^3, adapted to slide upon the vertical columns B^3 B^3. Affixed to and projecting downwardly from the cross-head C^3 is the hereinafter-described telescopic ram H, the working face of which is adapted to bear upon the top of the matrix A and directly upon the upper end of the billet contained in the matrix. The carriage B is also provided with laterally-projecting lugs D D, adapted to bear upon the upper ends of the vertical hydraulic pistons D′ D′, seated in the hydraulic cylinders D^2 D^2. It will be understood that the hydraulic appliances are represented conventionally.

Water under pressure is introduced into the lower ends of the cylinders D^2 D^2 when it is desired to elevate the carriage B and matrix A. When it is desired to force the carriage and matrix downward, water under pressure is introduced into the main hydraulic cylinder C, and at the same time the water is allowed to escape from the lower ends of the cylinders D^2 D^2. As the carriage descends the lower open end of the matrix A encounters and incloses the upper end of the billet E. The lower end of the billet is provided with the recess E′ and is seated upon the apex of the stationary piercing-punch F. A cross-head G, connected by means of vertical bolts G′ G′ to the carriage B, is vertically perforated to loosely admit the punch F and its supporting-post F′ and constitutes the stripper for stripping the product from the punch.

The telescopic ram H consists of the tubular member *a*, detachably secured to any suitable carrier—as, for example, to the cross-head C^3—in such wise as to facilitate its lateral adjustment for the purpose of accurately alining it with relation to the stationary piercing-punch F. A simple mode of providing for such adjustment is illustrated in the drawings, in which, as will be seen, the vertical bolt-holes *b b* in the flange *a′* are represented as of sufficiently large diameter to loosely contain the shanks of the fastening-screws *b′ b′*, inserted in the holes b^2 b^2, tapped in the cross-head C^3, and provided with the jam-nuts b^3 b^3. If preferred, bolts extending entirely through the cross-head C^3, as indicated by the dotted lines b^4 b^4 in Fig. 1, may be employed as the fastening devices instead of the screws *b′ b′*. The lower end of the tubular member *a* constitutes the annular portion of the working face of the ram and is adapted to bear in part upon the upper end of the matrix A and in part directly upon the upper end of the billet E. The vertical aperture *d* of the tubular member *a* is of the same diameter as that of the stationary piercing-punch F. The aperture *d* is counterbored at its upper end to afford the annular seat *d′* for the flanged head of the cylindrical plug *e*, seated with a sliding fit in the aperture *d*.

The lower end of the plug *e* constitutes the inner portion *e′* of the working face of the ram H so long as the plug *e* is maintained by any suitable chucking instrumentality in fixed appropriate relation to the tubular member *a*. The two forms of chucking instrumentality shown by way of illustration in the drawings each employ the chuck-cam *f*, adapted to swing between the side bars *f′* f^2 of the downward extension C^2 of the main piston. In the form shown in Figs. 1, 2, 3, and 4 the cam *f* is rigidly mounted upon the rock-shaft *g*, which is journaled in a relatively large bearing *g′* in the side bar *f′* and in the relatively smaller bearing g^2 in the side bar f^2. The intermediate portion of the rock-shaft is formed into a polygonal prism for insertion transversely through the head of the chuck-cam. The larger end of the rock-shaft projects outside the side bar *f′* and has secured to it the hub of the radius-arm *h*, by means of which the cam may be swung upon its axis. The smaller end of the rock-shaft *g* projects outside the side bar f^2 and has secured to it a collar *h′* to retain the rock-shaft in place.

The upper end of the chuck-cam is concentric with its axis and is seated in a correspondingly concentric bearing formed for convenience of construction in the bearing-block *i*, extending across the space between the upper portions of the side bars *f′* f^2. The object of the bearing for the upper part of the perimeter of the chuck-cam is to afford rigid support for the cam when it is performing its chucking function.

In the modification shown in Figs. 1, 2, and 3 the plug *e* is held to its work by the bearing upon its head of the lower end of the chuck-block *k*, which is loosely seated in a vertical aperture *k′* in the cross-head C^3, the diameter of which is just equal to the width of the space between the side bars *f′* and f^2. The chuck-block *k* is provided with winged flanges k^2 k^2, by means of which it is suspended in the aperture *k′*. At its upper extremity the chuck-block is provided with the slightly-concave face k^3, adapting it to be closely engaged by the eccentric part k^4 of the working face of the chuck-cam.

When not in action, the top of the plug *e* stands slightly below the lower end of the chuck-block *k*. The lower end of the plug *e* projects more or less below the plane of the under end of the tubular member *a* of the ram. The object of this construction is to afford an opportunity to relieve the chuck-cam from friction when, near the conclusion of the piercing operation, it becomes necessary to dislodge the chucking instrumentality, and thereby permit the punching out of a disk of metal from the upper end of the billet during the final part of the downward stroke of the matrix, such relief being afforded by slightly

raising the carriage preparatory to dislodging the chucking instrumentality and then resuming and completing the downward stroke of the matrix.

Figs. 5 and 6 exhibit two modifications, either or both of which may be employed. One modification consists in making the plug *e* and the chuck-block *k* in one piece, in which case provision is made for leaving a small gap between the eccentric working face k^4 of the cam and the concave top face k^3 of the inner member of the telescopic ram when the cam is in working position. The face k^3 is forced against the cam when the lower end of the plug *e* is pressing upon the billet, and, as in the previously-described modification, the cam is released from said pressure by slightly raising the die-carriage. The other modification consists in providing the chuck-cam with an outwardly and downwardly projecting arm *l* and in loosely mounting the head of the cam upon a cylindrical shaft *l'*, inserted transversely through the side members f' f^2 of the downward extension C^2 of the main piston. A screw-bolt l^2 serves to stop the cam in the right position to leave the gap referred to. The shaft *l'* is retained in position in any convenient manner—as, for example, by being provided with a head at one end and a collar at the other—the radius-arm *h* being in this case dispensed with. It will be seen that during the concluding portion of the downward stroke the lower end of the hole in the tubular part of the ram performs the function of the female member of an ordinary die and punch. The disk of metal punched from the hot billet shrinks in cooling, and therefore can easily be dislodged from the said female member after the die-carriage is raised sufficiently by swinging the chuck-cam inward, and thereby causing the paracentric part k^5 of its working face to wedge the plug *e* downward. Such swinging inward of the chuck-cam may be effected by force exerted either manually or otherwise, if required, upon the radius-arm *h* or upon the arm *l*, as the case may be.

If necessary, the chuck-cam may be forced inward positively during a part of the upward stroke of the piston by collision with a crossbar *m*, affixed to the columns B^3 B^3 and intersecting the path of bodily upward motion of the radius-arm *h* or the arm *l* or a projection *m'*, formed upon the edge of the chuck-cam, as shown in Fig. 2.

It is to be understood that the details of construction which are herein shown may be varied in form without departure from the invention, the principal feature of which consists in the combination of the telescopic ram with any suitable removable chucking instrumentality for maintaining the inner cylindrical member of the ram in fixed relation to the tubular member during a prescribed part of the billet-piercing operation.

What is claimed as the invention is—

1. In a piercing-press, a stationary vertical punch, a reciprocable matrix, a telescopic ram composed of a cylindrical inner member and a tubular outer member, and a movable chucking instrumentality for maintaining the inner member of said telescopic ram in fixed relation to the tubular member thereof during a prescribed part of the piercing operation.

2. The combination in a piercing-press, substantially such as described, of a telescopic ram composed of a cylindrical inner member and a tubular outer member; a movable chucking instrumentality for maintaining the inner member of said telescopic ram in fixed relation to the outer member thereof during a prescribed part of the piercing operation, and means for forcing said inner member of the telescopic ram downward after the conclusion of the piercing and punching operation, substantially as and for the purposes set forth.

3. The combination, in a piercing-press, of a stationary vertical punch; a reciprocable matrix; a telescopic ram for bearing upon the top of the matrix and upon the end of a billet contained within said matrix, and a movable chucking instrumentality for forcing the interior member of said telescopic ram downward into its working position, and for subsequently maintaining the same in fixed relation to the tubular member of said telescopic ram during a prescribed part of the descending stroke of the ram and matrix.

4. In a piercing-press, substantially of the character set forth, a telescopic ram detachably secured to and extending downwardly from, a suitable carrier; a hydraulic piston adapted to work in a vertical path above said carrier, and a rigid connection between said piston and said carrier.

5. In a piercing-press, substantially such as described, a stationary vertical piercing-punch; a vertically-reciprocable matrix; a hydraulic piston for furnishing the force to drive downward said matrix, together with a billet therein contained; a downward extension of said piston, and a telescopic ram adjustably secured to the lower extremity of said extension.

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