(No Model.) 3 Sheets—Sheet 1.

W. J. PLECKER.

PIPE CORRUGATING MACHINE.

No. 539,297. Patented May 14, 1895.

fig. 1

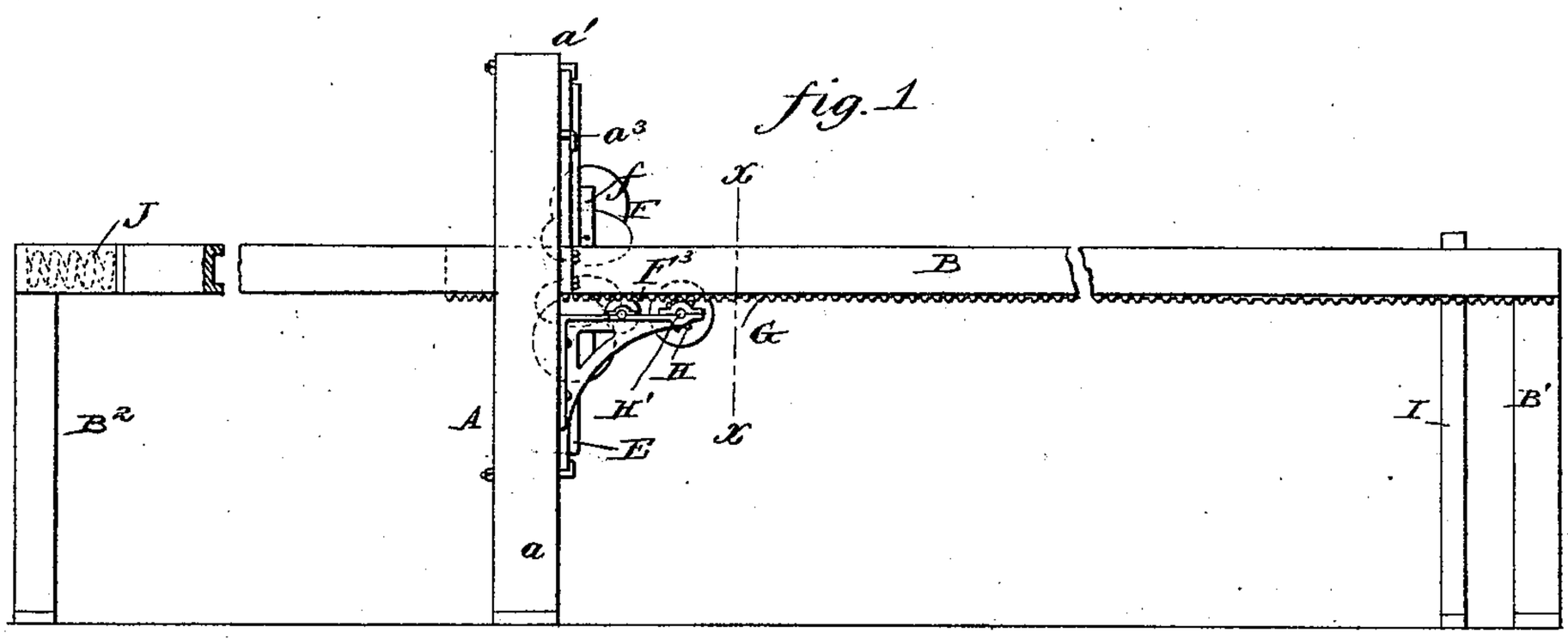


fig. 3

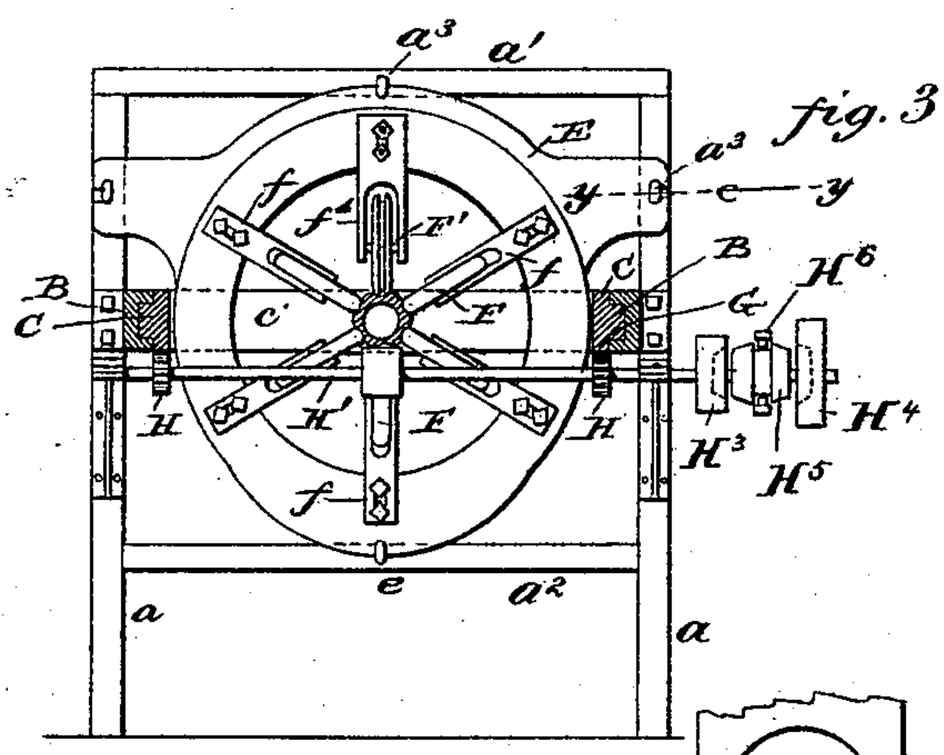


fig. 6

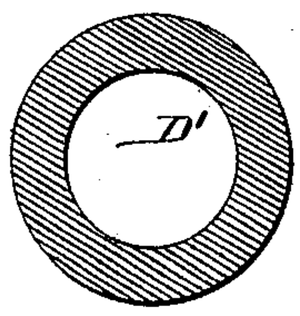


fig. 7

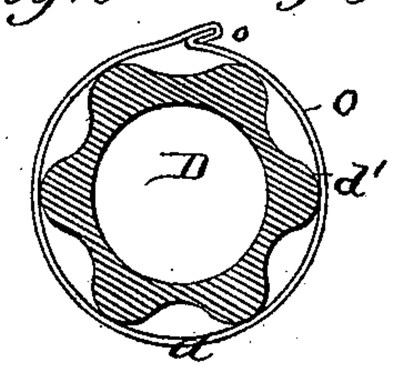


fig. 4

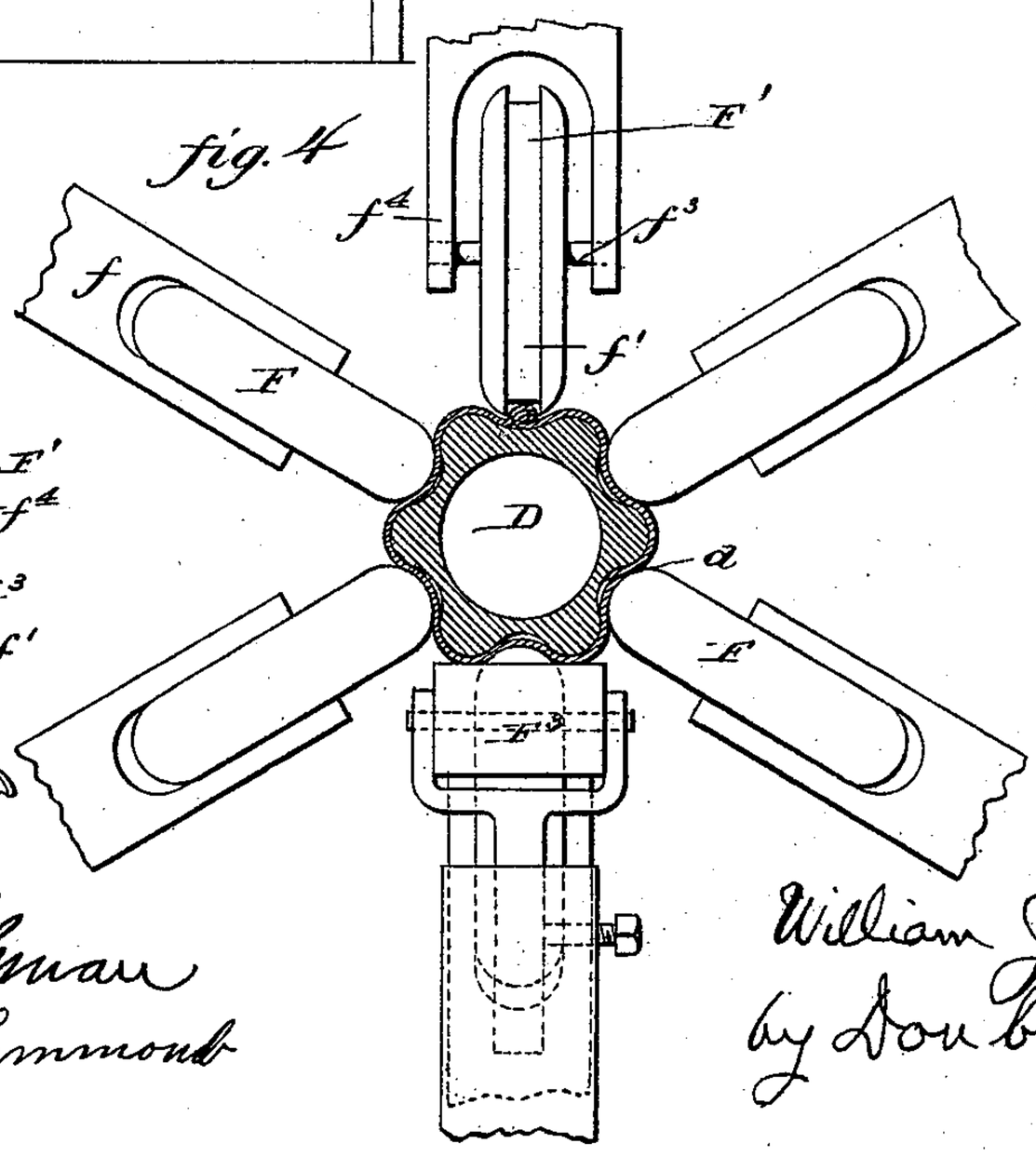


fig. 5

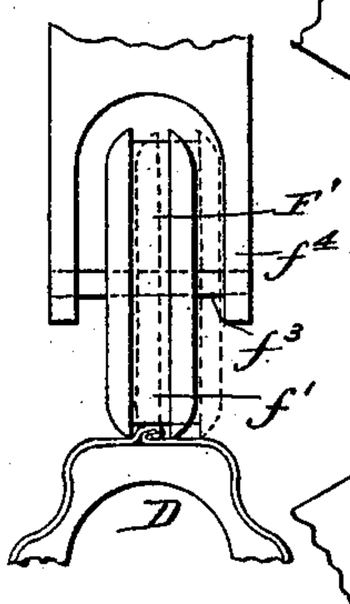
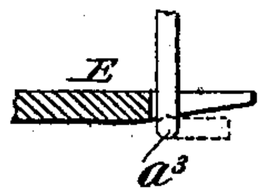


fig. 8



Witnesses.
J. F. Coleman
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Inventor
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(No Model.)

3 Sheets—Sheet 2.

W. J. PLECKER.

PIPE CORRUGATING MACHINE.

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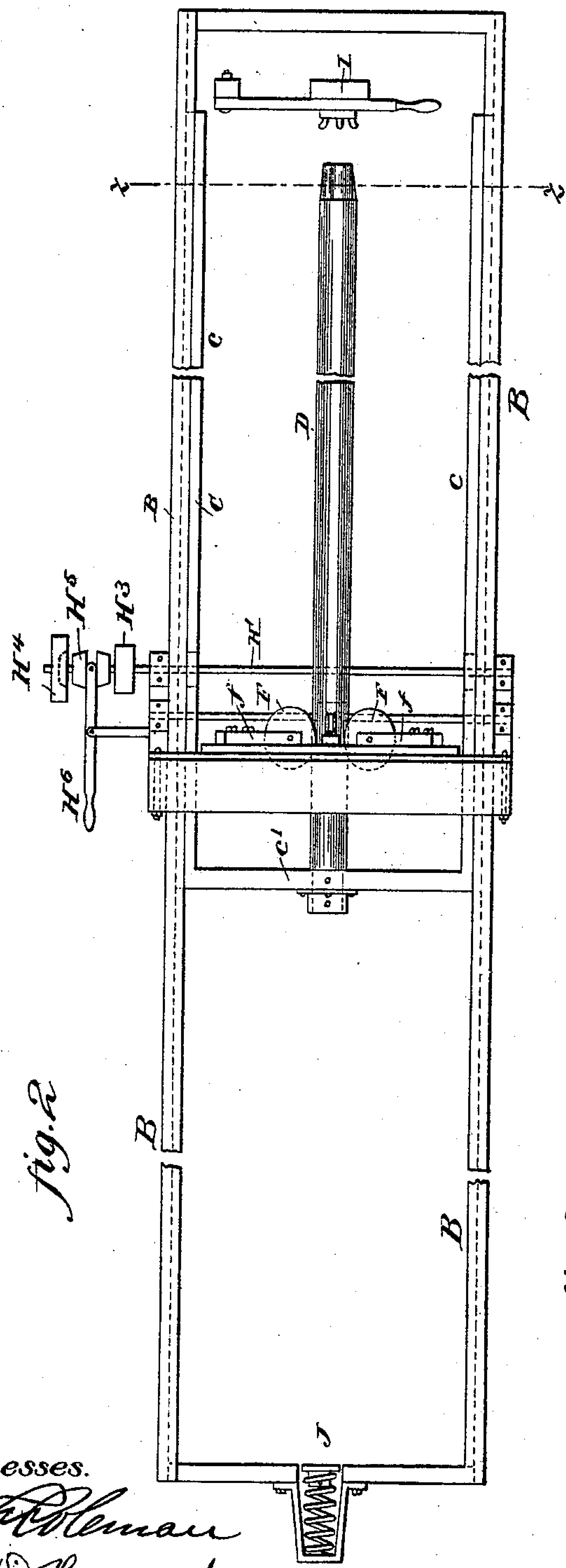

fig. 2

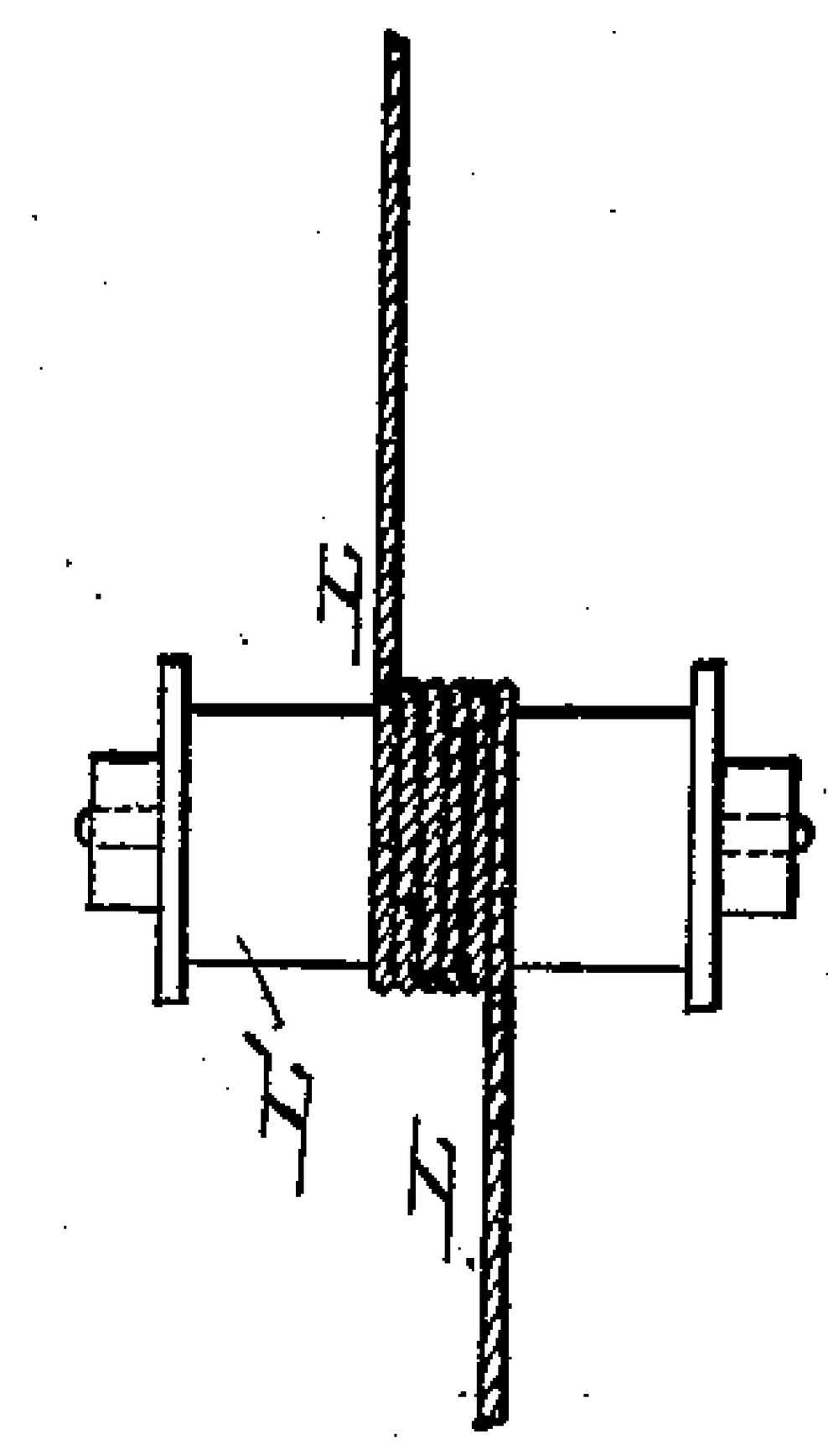

fig. 21

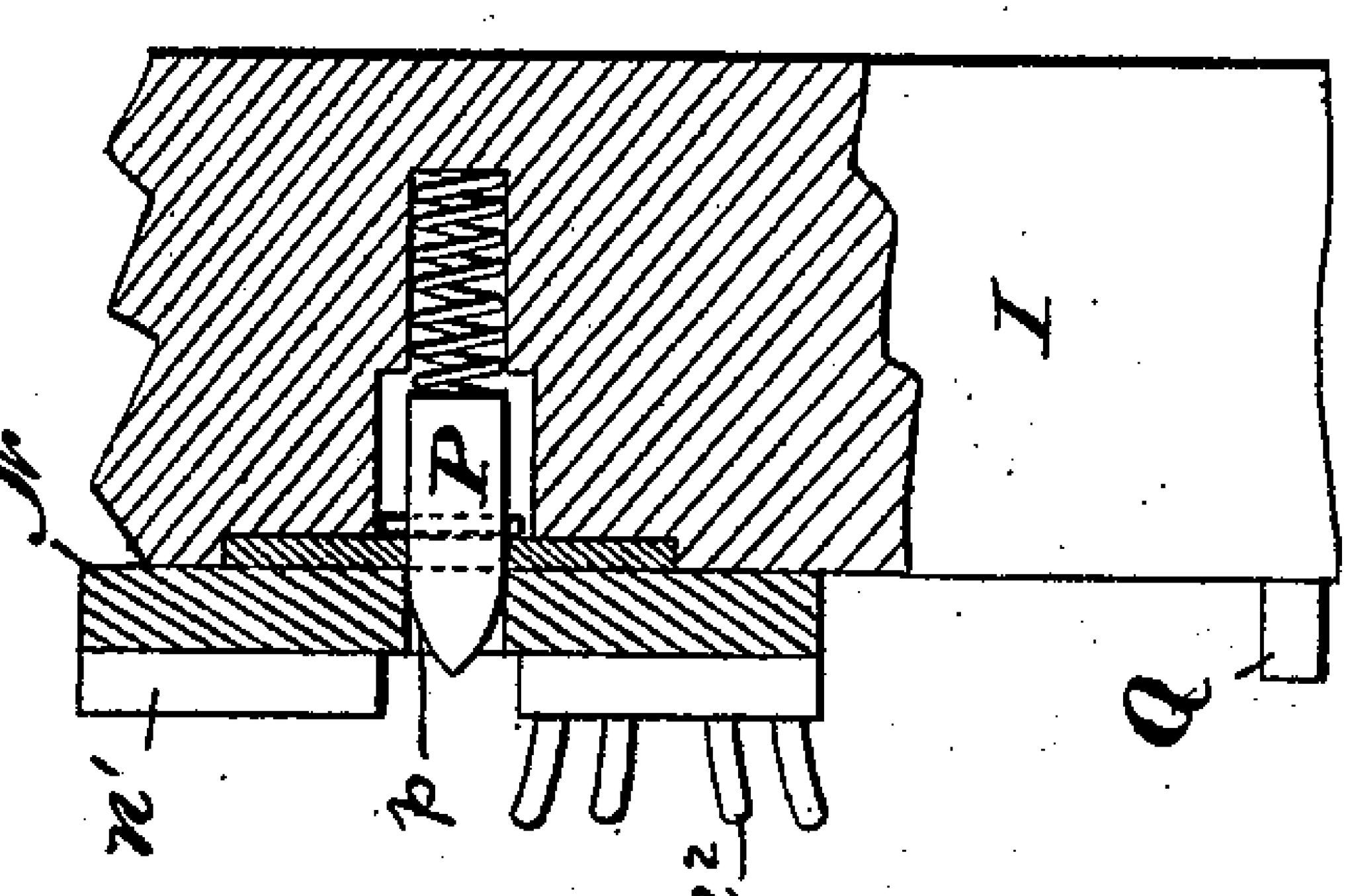

fig. 10

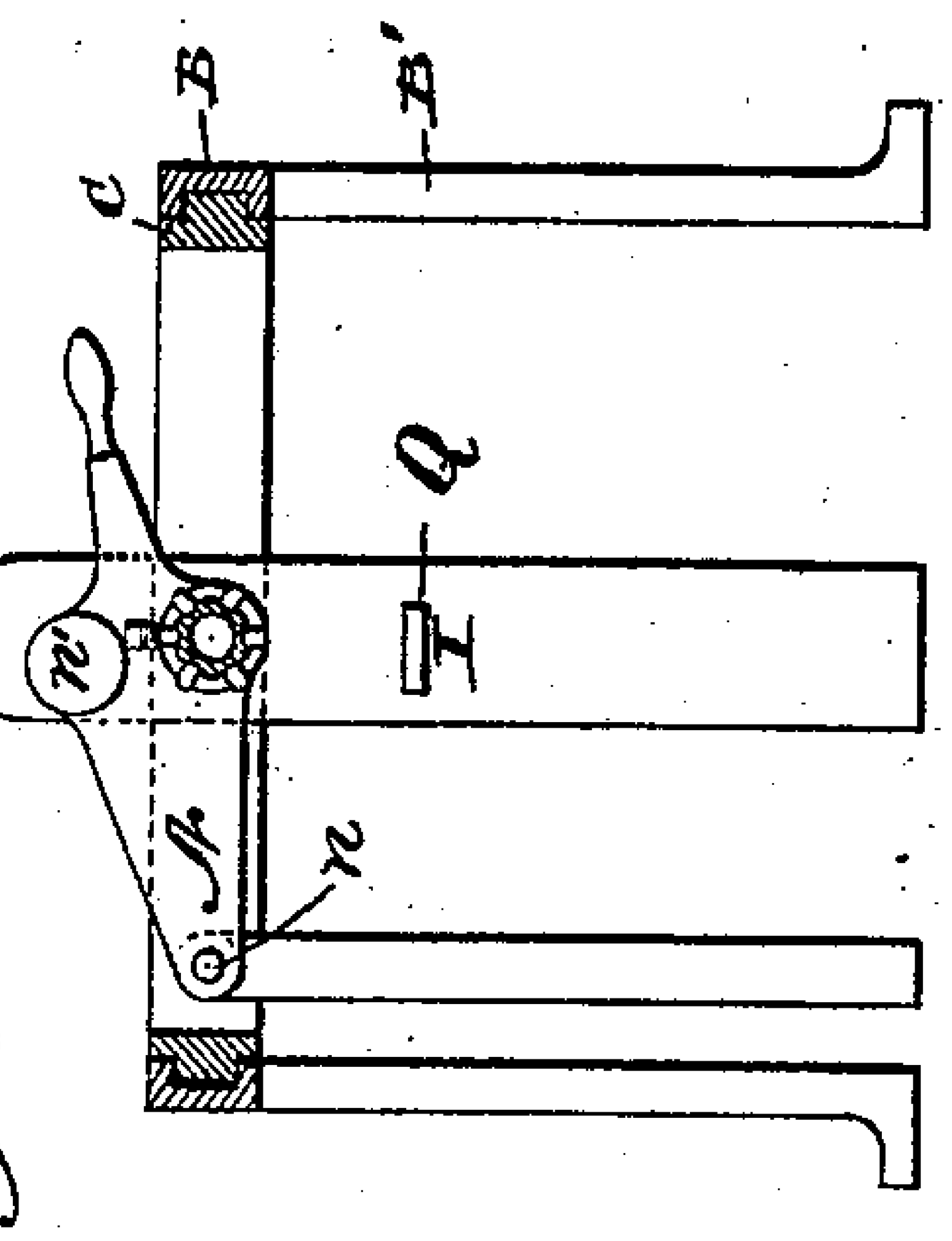

fig. 9

Witnesses.

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(No Model.) 3 Sheets—Sheet 3.

W. J. PLECKER.

PIPE CORRUGATING MACHINE.

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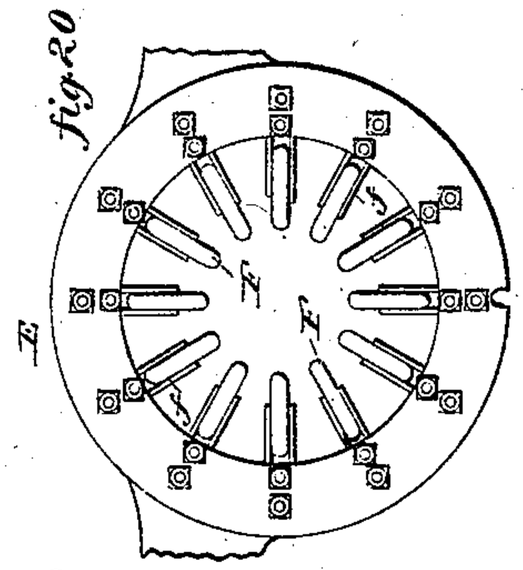

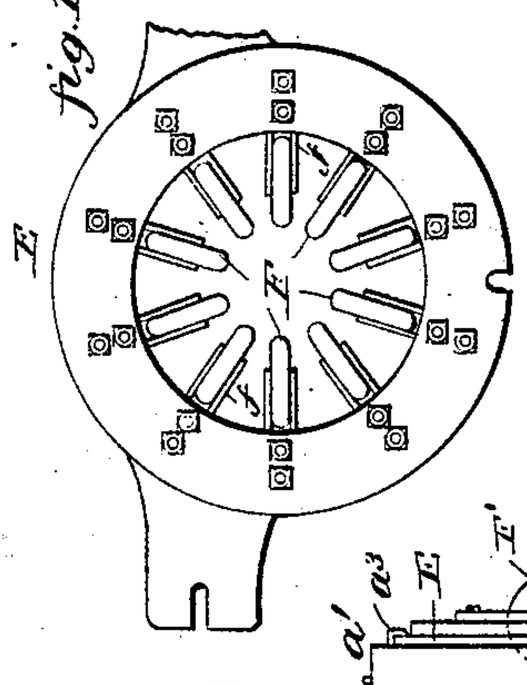

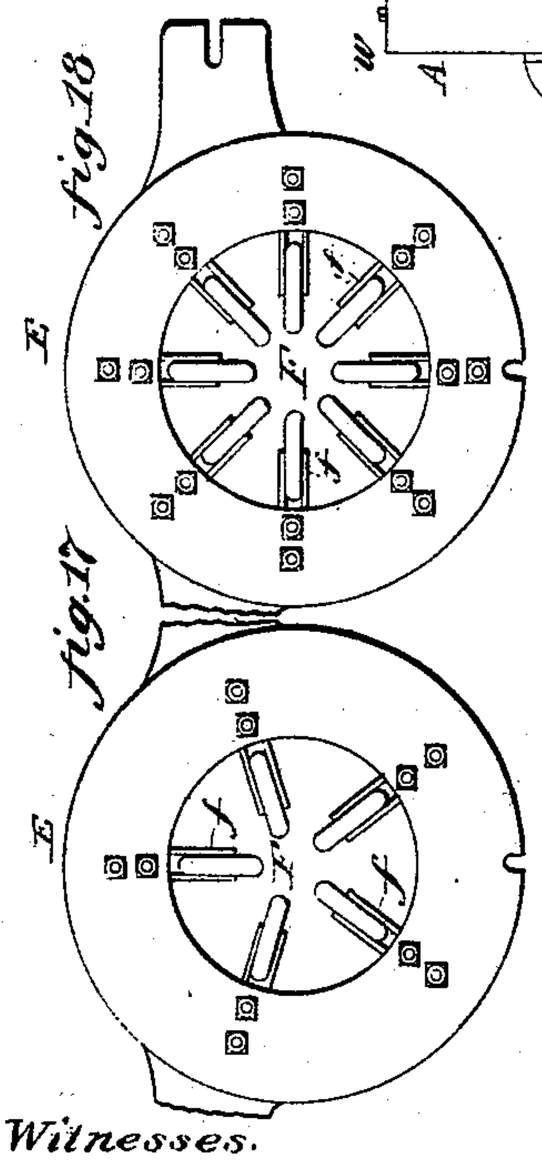

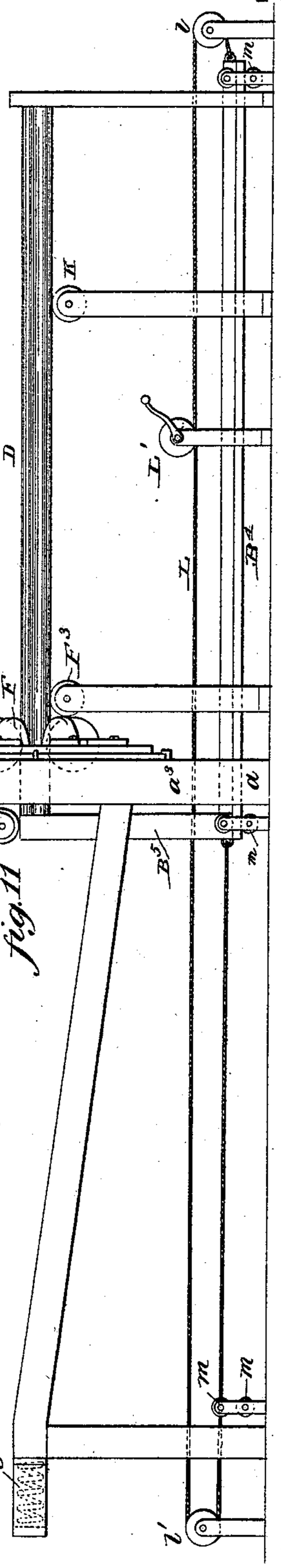

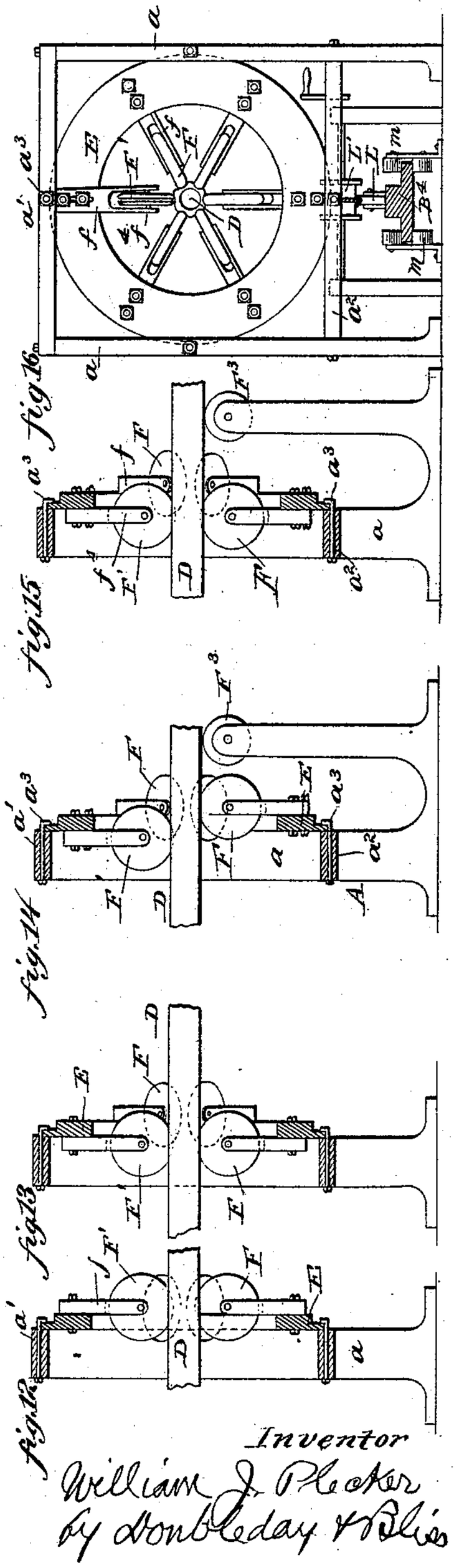

Witnesses.
J. F. Coleman
Curtis Lammond

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Att'ys.

UNITED STATES PATENT OFFICE.

WILLIAM J. PLECKER, OF PEORIA, ILLINOIS.

PIPE-CORRUGATING MACHINE.

SPECIFICATION forming part of Letters Patent No. 539,297, dated May 14, 1895.

Application filed October 17, 1892. Serial No. 449,101. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM J. PLECKER, a citizen of the United States, residing at Peoria, in the county of Peoria and State of Illinois, have invented certain new and useful Improvements in Pipe-Corrugating Machines, of which the following is a specification, reference being had therein to the accompanying drawings.

Figure 1 is a side elevation of a pipe-corrugating machine embodying my improvements. Fig. 2 is a plan view. Fig. 3 is a cross-section on line *x x*, Fig. 1. Fig. 4 is a section, on a larger scale, showing the rolls and mandrel. Fig. 5 shows part of that in Fig. 4, except that the mandrel is flattened on top. Figs. 6 and 7 show a mandrel tube prior to and after its being corrugated. Fig. 8 shows the detachable fastener for the roller-head. Fig. 9 is a front view, and Fig. 10 a section, showing the devices against which the skelp abuts. Fig. 11 shows a modified machine. Fig. 12 is a section of the roller-head and frame, with the corrugating and seaming rolls in the same transverse plane. Figs. 13, 14, and 15 are similar views showing the rolls in modified positions. Fig. 16 is a section taken transversely through Fig. 11. Figs. 17, 18, 19, and 20 show the detachable interchangeable roller-heads. Fig. 21 is a plan view of the rope-drum in Figs. 11 and 16 detached.

In the drawings I have shown a frame work for supporting the operating parts, but it will be understood that there can be variations in respect to the frame, as circumstances, or preference may dictate. As shown there is an upright main frame indicated as a whole at A, it having the side uprights *a*, *a*, a top bar *a'*, and a lower girt or bar a^2. To this central part of the frame I preferably secure the horizontal guiding parts which support and guide the reciprocating mandrel and its carrier. They are indicated by B, B, and extend from points somewhat beyond the ends of the movements of the mandrel, there being posts or uprights at B' B^2 to support the ends of the guiding part of the frame. If desired the uprights or standards of the frame, as at *a*, B', B^2, may be cast together, or in sections of one common bed.

As shown the horizontal guide-bars B have grooves or channels, but instead of these use may be made of any suitable guiding devices, as for instance, a bar or strap above the moving part, and another below it.

The mandrel carriage is indicated, as a whole, by C, and comprises the side-bars *c*, *c* and end bar *c'*. The mandrel is shown at D and is firmly secured to the carriage, as shown, it being attached to the central part of the cross bar *c'*.

By referring to Figs. 4 and 5, the method which I follow in making the mandrel will be readily understood. A metal tube is taken, such as is substantially illustrated at D', Fig. 6, and by means of a planing machine, or otherwise, grooves are cut, as shown at *d*, the edges of the surfaces being smoothly rounded, as shown at *d'*. The mandrels which have been heretofore used, made of solid metal are not practical in the manufacture of corrugated pipes of large diameter, as the mandrels are of very great weight, and when my process is followed they can be supported at one end only; but whether supported at one or both ends the great weight incident to them, when solid throughout, is a serious obstacle. These objections I overcome by forming them from hollow tubes having, initially, walls thick enough to allow for the corrugations, as I thereby reduce to the minimum the weight, and yet maintain a form possessing the requisite strength.

The mandrel is arranged to be passed endwise through the frame or head which carries the corrugating and other rolls. This head, in the present construction, consists of a plate, or ring E.

I am to provide a machine by which the corrugating of any of several sizes of pipe can be accomplished. In earlier machines which I have devised the variations of the machine to permit working upon different pipes were attained by moving the rolls and the roll-supports laterally from one point to another and re-clamping them, that is, by moving them in arcs around the axis; but I have found that serious trouble and difficulty are incident to machines having these features. The head was rigidly secured to the frame, and it was necessary to form accurate slots, grooves, or other guide-ways for the roll-supports, and much time was consumed in effecting a new or different adjustment. I have overcome, to

a great extent, these difficulties by constructing the head so that it can be quickly detached, or secured in position, and provide each machine with a series of the head plates, each corresponding to a size of pipe, and prepared to receive the rolls and roll-supports on such lines as to form the desired number of corrugations. It will be remembered that the laying out, or arranging of the rolls and roll-supports in their proper relative radial positions is a somewhat difficult matter, and the changing of them from a position where they form say, six corrugation to another where they form, say, ten requires considerable time and effort, if use be made of the head having laterally adjustable roll-supports; but, by following the present plan the change from one to another can be effected quickly.

Each head-plate or ring E, as shown, has a slot or recess at *e* at the bottom, and also one or more, as at the top, and the sides. The frame A has at corresponding points fasteners a^3 adapted to enter these slots and to be then turned around sufficiently to firmly hold the heads in place. The surface of the head adjacent to the fasteners a^3 may be inclined a little so that they shall bear firmly against said surface to effect a tight binding of the head. Upon this head-plate the corrugating rolls F, F, are supported, preferably in the way in which I have heretofore followed, viz: by means of arms *f*, *f*, secured radially to the head-plate, and having radial adjustment, if necessary. These rolls act in the well known way to force the metal into the corrugations of the correspondingly shaped mandrel. The seaming roll is indicated by F′, and in my present machine, as shown in Figs. 1, 2, 3 and 12 it is arranged to lie in substantially the same transverse plane as the rolls F. It is formed with a groove *f′* to receive the overlapping edges of the sheets, and is mounted so as to be automatically, or otherwise, adjusted laterally, it having an elongated shaft or axle f^3, and bearings f^4, situated far enough apart to permit the desired lateral play of the roll, these features of construction and arrangement being for purposes to be described.

In my earlier machines I connected the mandrel at one end to a carrier which extended away from, and on lines substantially the same as those of the mandrel, that is to say, I employed a bar or carriage together with a rack or pinion to support the mandrel, the mandrel projecting beyond the transverse planes of the rack; but, while a machine with its parts constructed and related in that way is very advantageous for many reasons and largely superior to any other machine for this purpose with which I am acquainted (on account of the presence of a mandrel reciprocating longitudinally through a relative stationary, roll-supporting, head, the mandrel being adapted to have a cylindrical skelp with joined edges placed so as to completely encircle it while carrying it through the rolls); yet there were some disadvantages incident to it, which I have succeeded in overcoming, although maintaining all of the advantageous features of the earlier machine. One of the objects of my work has been to enable the manufacturer to treat long sections of pipe rapidly and cheaply; and when a machine of my earlier sort is used it requires considerable foot room as the total length must be somewhat more than three times that of the mandrel and pipe-section.

By examining Figs. 1, 4, and 11 it will be seen that in my present machine the mandrel does not project beyond the transverse planes of the carriage, but that these two parts overlap each other transversely, more or less, they preferably lying as nearly as possible in the same transverse planes throughout. As a consequence I not only shorten the machine to a great extent, but I make its parts more compact and accessible at any moment, as the operator who is stationed near the roll has substantially all of the operating parts directly under his supervision.

In order to effect the to and fro movements of the mandrel, use may be made of any suitable mechanism. I have shown some of the many that are possible. In the construction in Figs. 1, 2, and 3, the shaft H′ is employed it having pinions H, which engage with racks G G, on the side bars *c* of the mandrel carriage. Power is applied to the feed-shaft H′ from any suitable motor (as a counter-shaft or line-shaft) by belts adapted to engage with the pulleys at H^3 H^4. At H^5 there is a friction-clutch by which the pulleys can be alternately connected to the shaft, one being intended to move the mandrel during the corrugating operation, and the other to reverse it after the completion of that operation.

I have found serious difficulty to arise from various causes, if the mandrel be driven through the corrugating rolls with a fixed or unyielding feed. There are times when (because of the character of the metal, or the presence of obstructions of one sort or another to the rolls) the metal is unduly strained if an unyielding feed is applied. To overcome this and allow for either a yielding feed, or one which is practically positive, when such is desired, I have combined the above described friction feed or clutch devices with the machine. As a result the mandrel can move faster or slower during any one of its traverses and accommodate itself in its motions to the character of the metal of the skelp, which varies greatly.

In my earlier machines I had to locate the feed-shaft at a point considerably back of the head, as will be understood; but, when the carriage and the mandrel overlap transversely, as they do here, I can arrange the feed-devices, with their controlling levers, &c., in close proximity to the head frame, so that the operator can regulate the feeding-devices according to the necessity of each occasion; or, if desired a hand crank can be used for operating the feed-shaft, and in that case also the

same advantages are present, arising from the proximity to the head-frame.

A yielding feed of another sort is shown in Figs. 11 and 16 in which case a rope or cable L is shown as being attached to the carriage and engaging with a drum at L′ by one or more convolutions. When the drum is rotated in one direction the carriage is drawn backward, and when rotated in the other direction it is advanced. The rope passes over guide wheels, as at *l l′* so as to properly apply the draft. These views, Figs. 11 and 16, also show how the present principle of construction can be applied in a modified way, the mandrel's carriage here lying below it, instead of at its sides. It comprises the bar B^4 in the transverse planes of the mandrel and the connecting bar B^5 to which the mandrel is connected. With this construction use is made of guiding and bracing rollers, as at M, *m*, *m* to hold the carriage and mandrel in proper line.

When the machine is operated rapidly powerful and disastrous blows are experienced when the mandrel reverses, particularly after it has passed through the corrugating rolls and returns to deliver the pipe. To avoid the effects of such blows I have combined with the machine a buffer or cushion J, which may be of any of the sorts used for such purposes. I have shown a coiled spring at J supported in the frame work and adjusted in position so as to be impinged upon by the mandrel carriage as it reaches that end of its throw.

At I, I place an abutment adapted to receive the thrust of the pipe at the time the mandrel is being inserted, and also to support the means which I employ for finishing the ends of the pipe, as will be described.

It will be seen that I arrange diametrically opposite to the seaming roll F′, a roll which can be utilized for corrugating and which also serves to take the thrust of the seaming roll. When the rolls are arranged as shown in Fig. 1, and others, this roll F^2 is in the transverse plane of the rolls F. When the seaming roll F′ is placed a little behind the corrugating rolls as in Fig. 13 this opposite roll should be correspondingly arranged as is shown in that figure. In some cases the dominant pressure on the mandrel is in a downward direction. In fact, this is always true in manufacturing pipes of sizes at all above the smallest. The seaming roll is, first, arranged to work on the top of a mandrel so that the seam and the action of this roll shall be always readily visible; second, is set so as to bear more severely than the others; third, is constantly exerting a pressure above the normal because of its rising upon two or more layers of the metal, and, finally, the weight of the mandrel itself is of such nature as to increase the downward strain upon it. To receive this severe strain I place an anti-friction support in the form of a roller at F^3, it being situated as close to the corrugating rolls as possible; and in order to prevent its unduly creasing the skelp before the latter reaches the rolls F, I make it long enough to extend across from one of the ribs or corrugations of the mandrel to the next so that the outermost lines of the mandrel ride upon the roller and the metal is not bent. This roller can be made vertically adjustable so as to hold the mandrel accurately on the lines desired. An important advatage incident to its use is that I can provide for forming corrugations of one depth in the skelp or another depth, with one and the same mandrel. The grooves can be cut deep enough to form the corrugations of the utmost depth desired, and also permit the forming of corrugations of less depth, when the rolls F are so adjusted as to enter but part way. If the supporting roll F^3, or its equivalent were not used the above described tendency of the mandrel to press or sag downward would result in having the rolls along the lower part of the mandrel crowded to the bottom of the grooves, while those at the upper part would enter but part way, and therefore no variation would be possible and in every case there would be an unevenness in the corrugations formed.

The operation of a machine like that shown in Figs. 1 and 2 will be readily understood. The clutch lever H^6 is moved so as to throw the friction clutch into engagement with wheel H^4, whereupon the mandrel carriage and mandrel are moved toward the left in said figures. Then a circular skelp like that in Fig. 6 is placed with its end against the abutment at I, and the friction clutch is reversed, that is, moved into engagement with H^3, whereupon the carriage is taken toward the right and the mandrel is forced into the skelp. As soon as this has occurred, the clutch is again shifted so as to connect wheel H^4 to shaft H′, and then the mandrel D with the skelp O is drawn toward the left, and the roll F crowds the metal into the grooves or corrugations *d* and the seaming roll F′ forcibly binds down the overlapping edges at *o*. When the outer end of the mandrel has passed through the rolls the carriage is again reversed and moved to the right, and the finished tube is removed. Just as the tube reaches the end of the movement last referred to, its outer end is reduced in diameter somewhat by the following devices.

N is a lever or swinging carriage pivoted at a suitable point, as at *n*, and adapted to be thrown up and down by the operator. It is provided with an abutment plate *n′* which can be brought to the axial line of the mandrel, and is placed there when the skelp O is being put in position. This carrier N is also provided with guides or fingers n^2 which preferably flare outwardly somewhat, and are so situated as to register with the grooves *d* of the mandrel when the carrier is moved into its other position, as shown in Figs. 9 and 10, that is, moved so that the fingers n^2 shall be situated on the lines of the mandrel. This carrier N can be held in its different positions in any desired way. I have shown a spring catch at

P supported on the post I, it being adapted to engage with an aperture at p in a carrier. As the carrier moves up or down it automatically forces the catch P inward out of its path until the latter is free to move out again.

At Q there is a stop or rest to hold the carrier when the abutment plate n' is in operative position.

What I claim is—

1. The combination of the main frame having the parallel side guides braced together and the upright portion intermediate of its ends, the roll supporting head mounted on the said upright portion, a series of three or more independently rotatable compressing rolls mounted on said head radially around a common center, a seam locking roll, a non-rotatable vertically stationary mandrel, a carriage to which said mandrel is secured at one end whereby said mandrel is surrounded by a free space, said carriage having side bars sliding in the aforesaid side guides on the frame, said carriage and mandrel lying in the same transverse plane whereby the whole machine is shortened, and means independent of the rolls for sliding the carriage relatively to the main frame, whereby the mandrel and a smooth skelp are both fed between the compressing rolls, substantially as set forth.

2. The combination of the longitudinally grooved mandrel, the traveling carriage supporting the mandrel and to which it is detachably secured, the main frame having guides for the mandrel and an upright portion, the carriage moving mechanism, a series of compressing rolls, roll supports, and a head to which said roll supports are secured, said head being detachably secured to said upright portion whereby it may be removed for the purpose of attaching another head, substantially as set forth.

3. The combination with the stationary frame having longitudinal guides, and an upright portion, of a carriage sliding in said guides, a mandrel detachably supported in said carriage, carriage moving mechanism, three or more compressing rolls arranged radially around the axis of said mandrel, a roll supporting head having slots e e, and movable fasteners a^3 on the upright portion of the bed, engaging said head in the slots, all arranged substantially as set forth whereby one head and mandrel may be detached for the purpose of attaching another head and mandrel as described.

4. The combination with the corrugated mandrel, the roll supporting head, and the compressing rolls mounted on said head radially around the axis of the mandrel, of a roll support, and a seam locking roll loosely mounted in said support and laterally movable at all times in either direction to follow the seam, substantially as and for the purposes set forth.

5. The combination with the corrugated mandrel, the head the compressing rolls mounted on said head radially around the axis of the mandrel, and means for reciprocating the head and mandrel relatively to each other, of a roll support mounted on said head, and a seam locking roll loosely mounted in said support and laterally movable in both directions at any time during the reciprocations of the mandrel or head, whereby said roll can follow the seam, said roll having a flat face with side flanges, substantially as set forth.

6. The combination, in a machine for corrugating sheet metal pipes, of the longitudinally reciprocating grooved mandrel, the carriage therefor lying in the transverse planes thereof and supporting the mandrel at one end only, mechanism for moving the carriage and pushing the mandrel endwise between the rolls, of a roll supplemental to the corrugating rolls and mounted in front thereof for supporting the free end of the mandrel, and of a length greater than the bottom groove of the mandrel, substantially as and for the purpose set forth.

7. In a pipe corrugating machine, the combination with the non rotary horizontal, longitudinally reciprocating mandrel having longitudinal grooves, and a reduced end, a series of corrugating rolls adapted to press the metal of a smooth skelp into the grooves of the mandrel, and means for passing the mandrel and skelp between the rolls, of a relatively stationary corrugating mechanism situated in the longitudinal lines of the mandrel, and having converging walls to engage the end of the skelp and press it inward against the reduced end of the mandrel, substantially as set forth.

8. In a pipe corrugating machine, the combination with the non rotary reciprocating corrugated mandrel, having a reduced end, a series of corrugating rolls which press the metal of a smooth skelp into the corrugations of said mandrel, and means for passing said mandrel with the skelp between the rolls, of a compressing mechanism situated stationarily in the path of the mandrel and having converging fingers corresponding to the grooves in the mandrel and adapted to press the end of the skelp against the reduced end of the mandrel, substantially as set forth.

9. The combination with the set of stationary corrugating rolls, and the longitudinally reciprocating corrugated mandrel, of a plate mounted in the path of the mandrel, a compressing mechanism on said plate, and a boss or rest on said plate, and means for moving said compressing mechanism into the path of the mandrel, substantially as set forth.

10. In a pipe corrugating machine, the combination with the stationary main frame having parallel guides, a series of compressing rolls mounted on said main frame, a mandrel passing between said rolls, and a carriage sliding in said guides for supporting said mandrel and situated in the transverse planes thereof, of a carriage moving mechanism con-

sisting of a rack bar secured to the carriage parallel to the mandrel and lying in the transverse plane thereof, a pinion secured to a shaft mounted on the main frame, oppositely moving belt wheels loose on said shaft, and a friction clutch keyed to and sliding on said shaft, and adapted to engage either of said belt wheels, whereby the mandrel and skelp are fed between the rolls with a yielding feed, substantially as set forth.

In testimony whereof I affix my signature in presence of two witnesses.

WILLIAM J. PLECKER.

Witnesses:
H. H. BLISS,
ALEX. S. STEUART.