

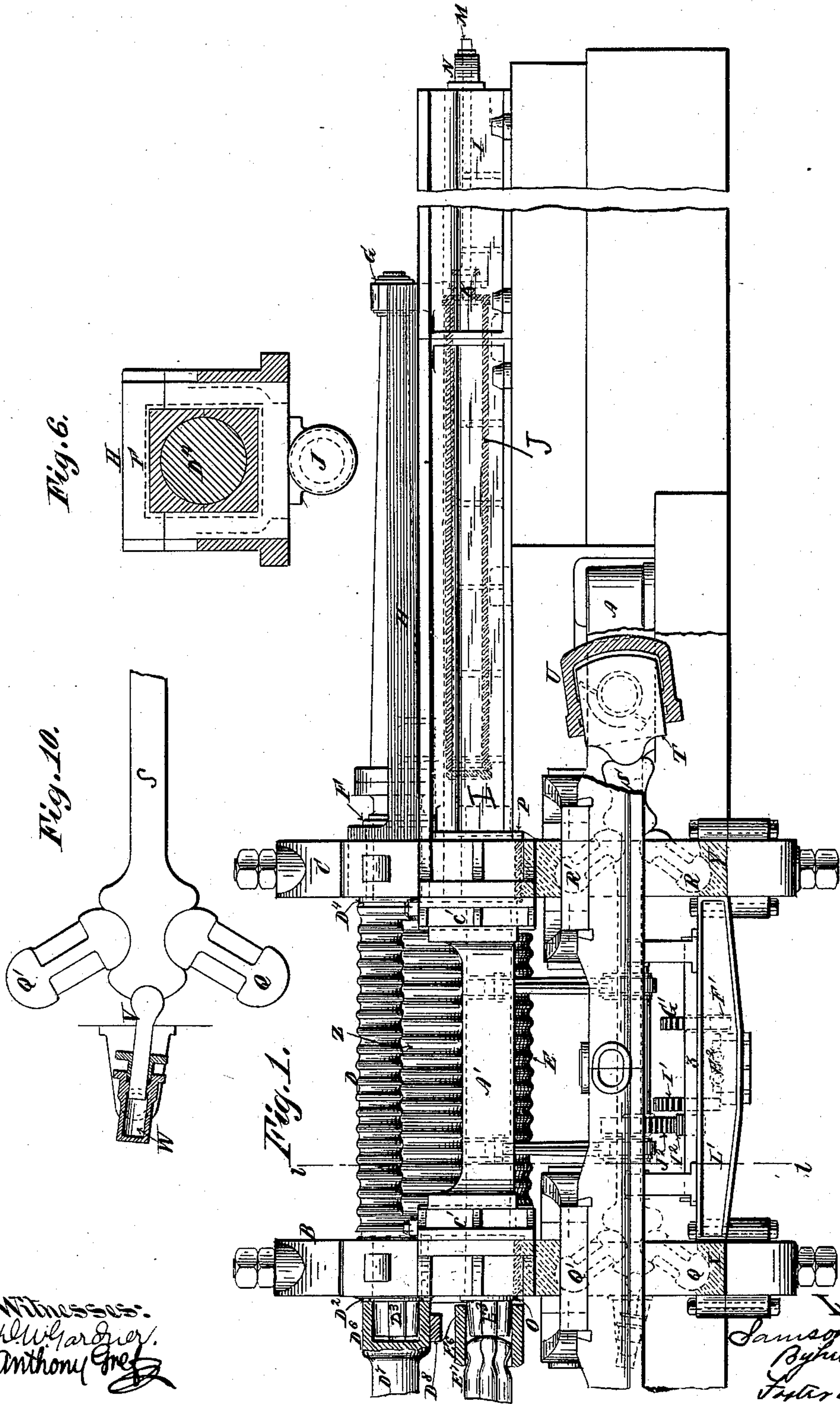
(No Model.)

5 Sheets—Sheet 1.

S. FOX.  
CORRUGATING MACHINE.

No. 384,031.

Patented June 5, 1888.



Witnesses:  
H. Wilgardier.  
Anthony Greff

Inventor:  
Samson Fox.  
By his Attorneys  
Trotter & Freeman.

(No Model.)

5 Sheets—Sheet 2.

S. FOX.  
CORRUGATING MACHINE.

No. 384,031.

Patented June 5, 1888.

Fig. 2.

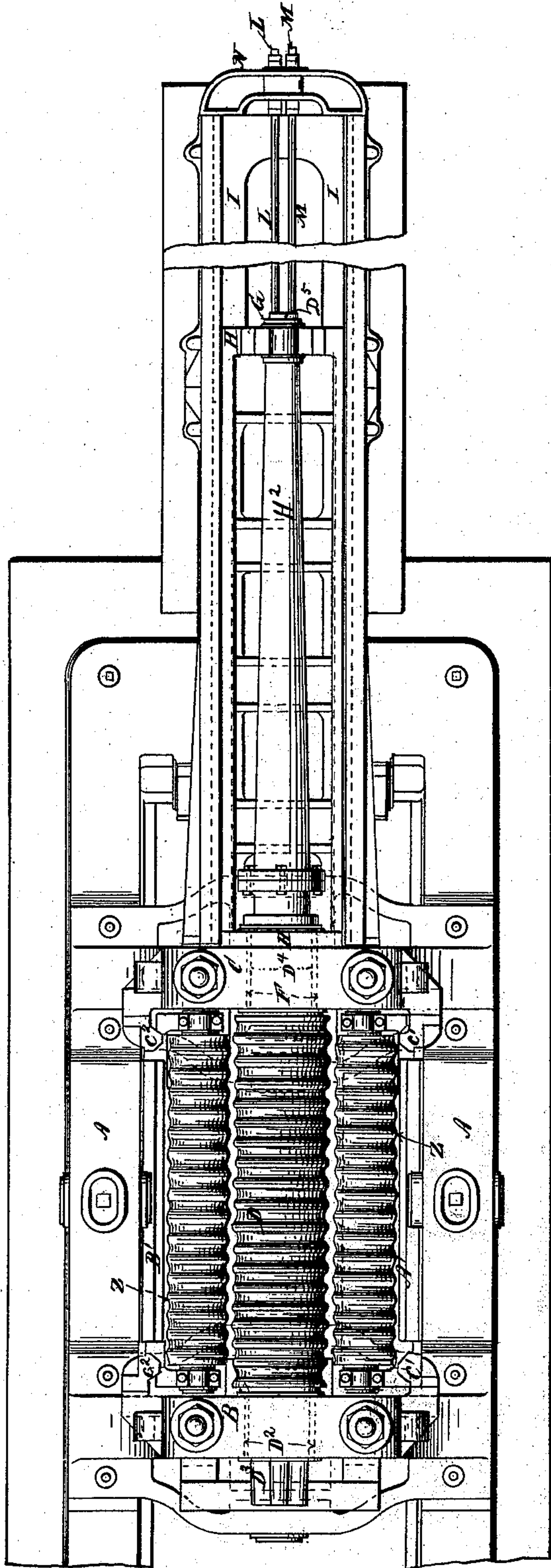
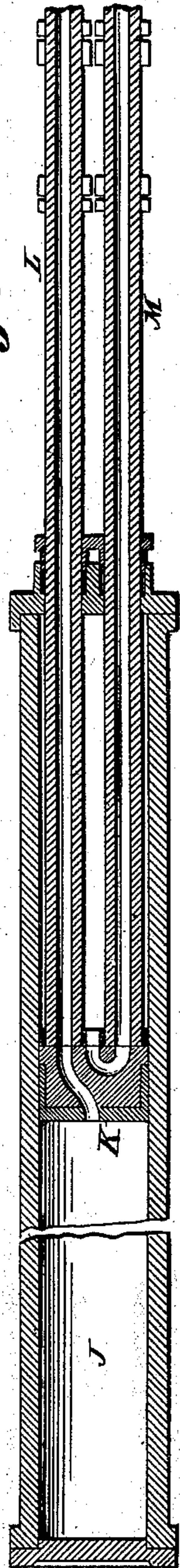


Fig. 3.



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(No Model.)

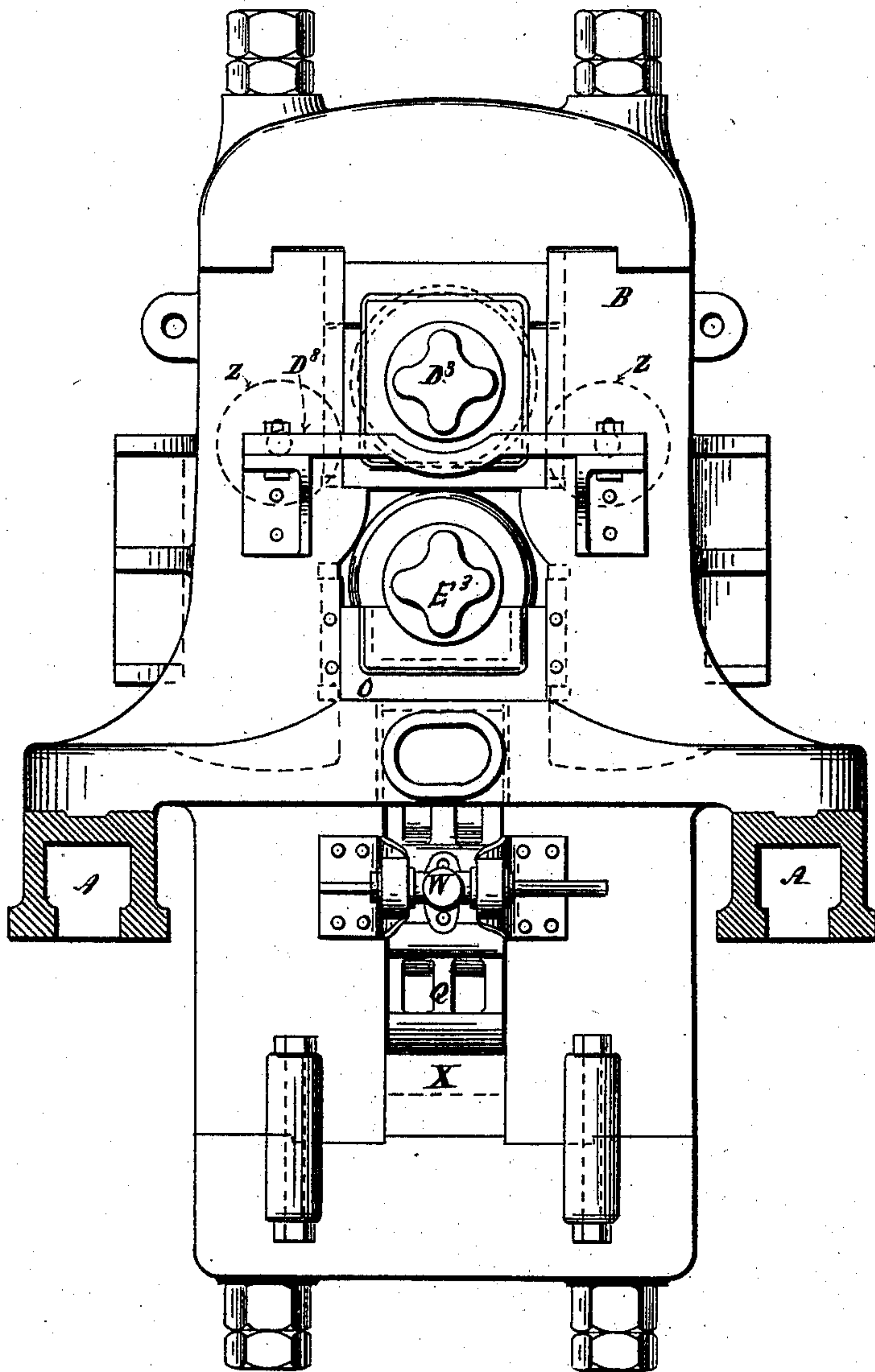
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S. FOX.  
CORRUGATING MACHINE.

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*Fig. 4.*



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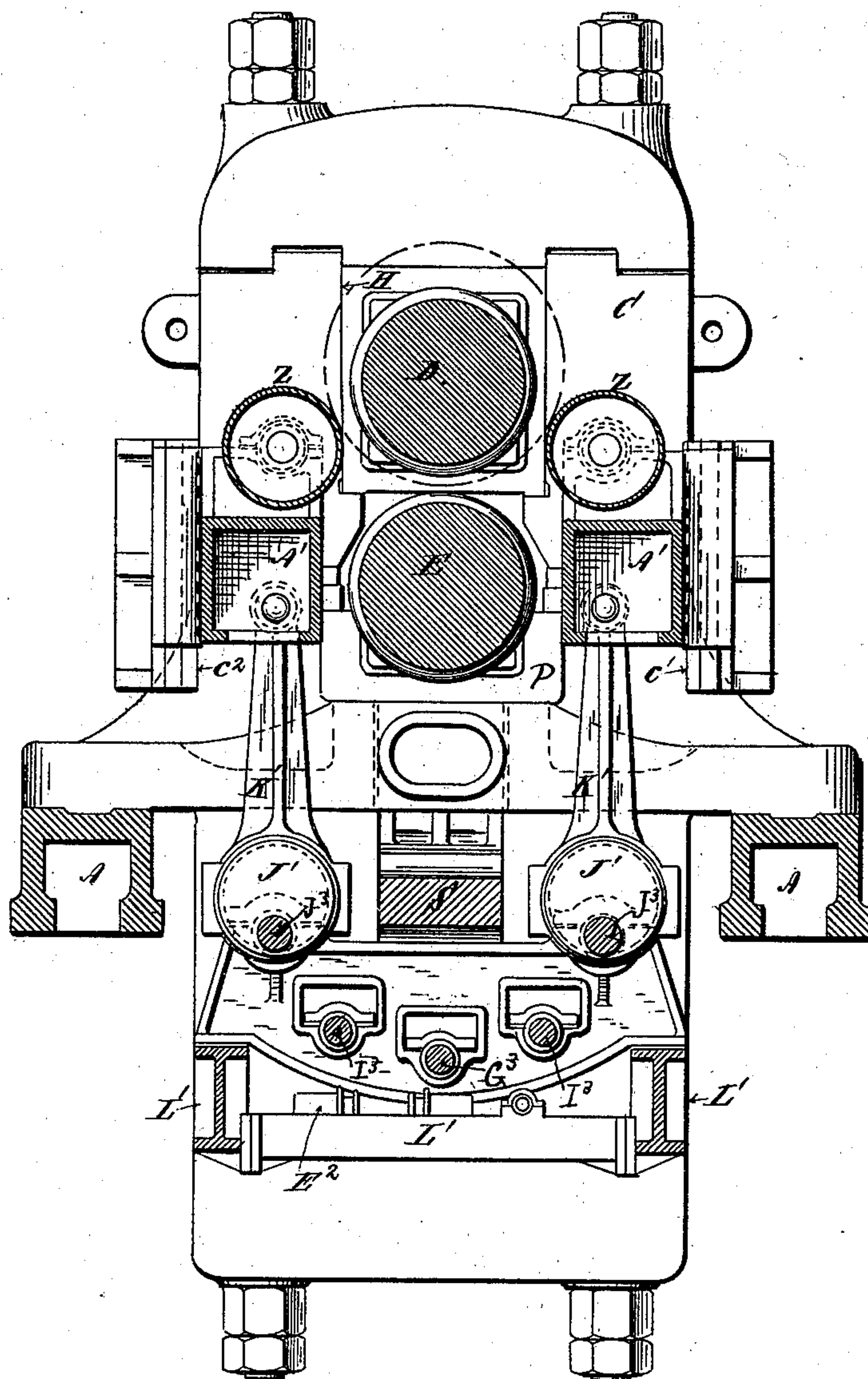
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S. FOX.  
CORRUGATING MACHINE.

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Patented June 5, 1888.

*Fig. 5.*



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(No Model.)

5 Sheets—Sheet 5.

S. FOX.  
CORRUGATING MACHINE.

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Fig. 7.

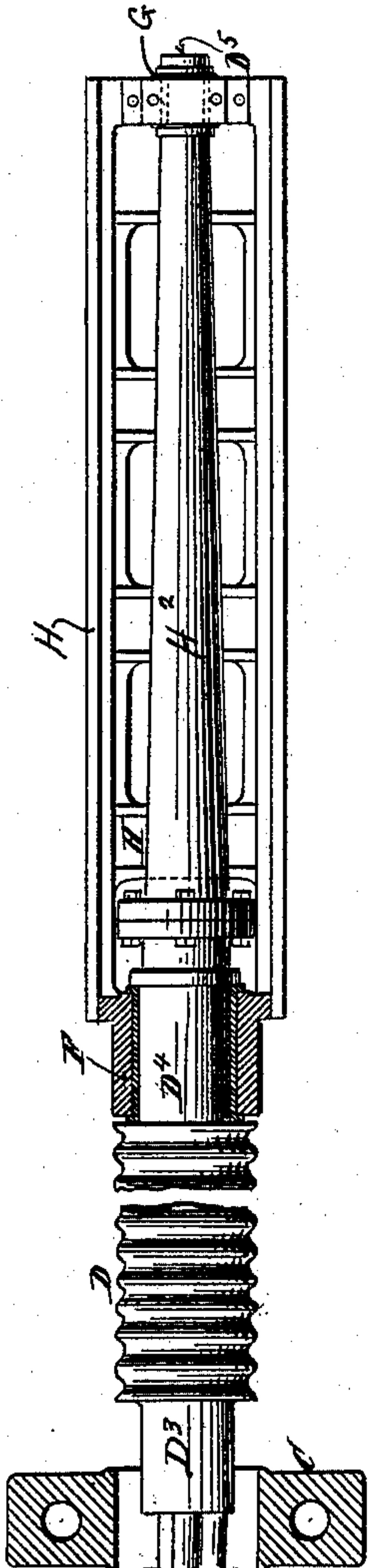


Fig. 8.

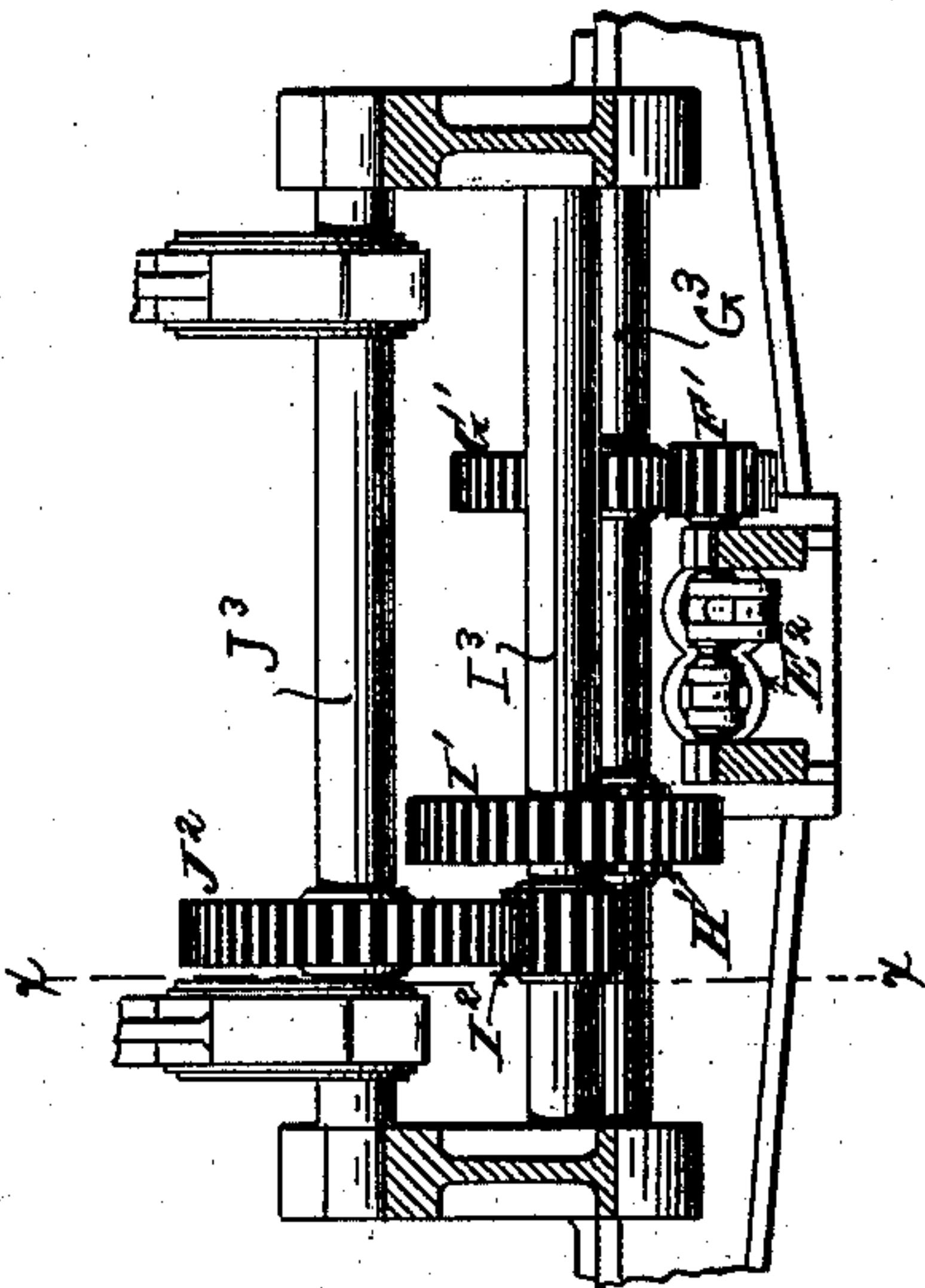
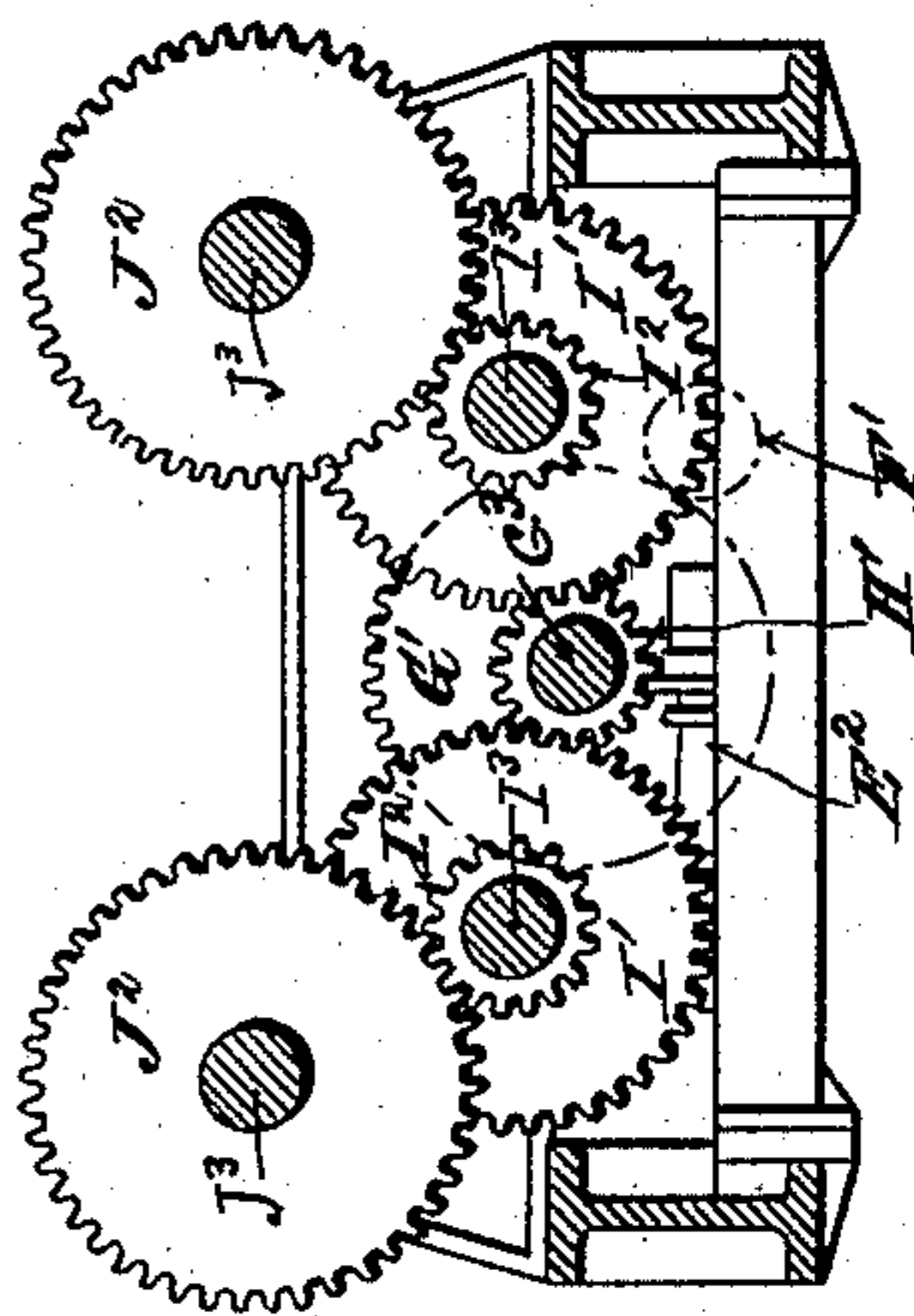


Fig. 9.



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# UNITED STATES PATENT OFFICE.

SAMSON FOX, OF LEEDS, COUNTY OF YORK, ENGLAND.

## CORRUGATING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 384,031, dated June 5, 1888.

Application filed March 5, 1888. Serial No. 266,128. (No model.) Patented in England January 16, 1882, No. 219, and in France July 13, 1882, No. 150,104.

*To all whom it may concern:*

Be it known that I, SAMSON FOX, of Leeds, county of York, England, have invented a new and useful Improvement in Corrugating-Machines, (for which I have obtained Letters Patent in Great Britain January 16, 1882, No. 219, and in France July 13, 1882, No. 150,104,) of which the following is a full, true, and exact description, reference being had to the accompanying drawings.

In the specification of my former Letters Patent, granted to me the 16th day of March, 1880, No. 225,586, is described a machine or apparatus for the manufacture of corrugated tubes and plates (to be used for the internal fire-boxes, flues, and shelves of steam-boilers) wherein corrugating is effected by the use, in combination, of two corrugating-rolls and two guide-rolls; and my present improvements have reference to this kind of machine. The rolls employed in my improved machine have corrugated annular grooves and projections such as those described in the former specification above referred to, both corrugating-rolls being suitably driven. These features have been patented in the following countries—viz., England, dated January 16, 1882, No. 219; France, dated July 13, 1882, No. 150,104.

One improvement has reference to the mode of mounting the upper roll. I still mount and carry this roll as described in my former specification; but in my present improved arrangement I dispense with the opening bearing for the journal at the end of said top roll, and in lieu thereof employ, to carry or support the said journal, one of a pair of specially-arranged housings, and the middle and the other end journals of the roll are according to my present invention carried in a sliding carriage or head-stock capable of being moved endwise in either direction upon a fixed foundation plate or bed suitably prepared for that purpose, the said endwise movement being effected by hydraulic or other motor. When the roll is in its working position, that end of the aforesaid carriage which contains and supports the middle journal-bearing is, with the middle bearing itself, embraced by one of the aforesaid housings, which thus forms an additional support for the said middle bearings in

all directions. Beyond the end journal just referred to, is a projecting part by which the upper roll is driven by a suitable arrangement of coupling-box or connection with the motive power. This driving of the upper roll takes place at the contrary end to that described and shown in my former specification. The bottom roll is carried in movable bearings in the before-named housings in a similar manner to that described in my former specification, before referred to.

Another part of my present invention relates to the use, in combination, of hydraulic and compound toggle mechanism, by which I cause the bottom roll to approach the first-named or upper roll during the operation of corrugating a tube and to recede therefrom (after such corrugating has been completed) such a distance as to permit that part of the tube in contact with the periphery of the top roll to leave the same and to allow of the free withdrawal of the said top roll endwise, as above described, when the corrugated tube may either be lifted or rolled away from between the two housings.

Furthermore, my invention relates to the means of mounting on each side of the said main rolls a guide-roll, which may be either plain or have corrugations corresponding with those of the main rolls. I cause the said guide-rolls to move up and down vertically (or they may deviate from the vertical, if desired) on suitable guides provided for the purpose, and by an arrangement of hydraulic motor or motors and suitably-arranged gearing, eccentrics, and links, or by other suitable and equivalent means. When it is required to place a plain tube in the machine for the purpose of being corrugated, the carriage or head-stock, before mentioned, together with the top roll which it carries, is by the mechanism above described moved longitudinally and out of the end bearing in the first-named housing, and also out of the driving coupling-box, such a distance as to leave the space between the two housings perfectly clear for the admission of a tube. This tube is now placed between the said housings, with its axis in the same direction as that of the rolls, and rests upon the bottom main roll, which is in its lowest position.



The two guide-rolls are now moved upward so far as to steady the tube in its position. The top roll is next moved into the tube, with its end journal into the bearing in the first-named housing and its driving end into the coupling-box, before mentioned. The machine being now set in motion and the process of corrugating commenced by the bottom roll being caused to gradually approach the top and corresponding main roll, in the mean time the two guide-rolls are moving upward, so as to bear against and support the tube while under the corrugating operation, and to cause it to assume a comparatively true circular form.

As in the machinery described in my former specification, plates may be corrugated in this machine, and, further, by the aid of one or both of the said guide-rolls they may be made to assume a curvilinear form in the direction of the corrugations.

In the accompanying sheets of drawings the same letters refer to the same or like parts wherever they occur.

Figure 1 is a front elevation of an improved corrugating-mill according to my invention, the driving mechanism on the left-hand side being cut away. Fig. 2 is a plan. Fig. 3 is an enlarged sectional plan of a part of Fig. 2. Fig. 4 is a sectional elevation at the driving end. Fig. 5 is a sectional elevation on the line 1 1 of Fig. 1. Fig. 6 is a sectional view of the end bearing of the removable roll through which it is withdrawn. Fig. 7 is a view of the roll as withdrawn through this bearing. Fig. 8 is a detail of the mechanism for operating the guiding-rolls. Fig. 9 is an end view of the same on the line *x x*, and Fig. 10 a view of the toggle-joint mechanism by which the lower roll is raised against the upper roll.

A is the bed of the machine. B and C are the housings mounted thereon. D is the top corrugated or grooved roll; E, the bottom corrugated or grooved roll, the projections and grooves of the two rolls being so relatively arranged that they mesh with each other. The end journal of the top roll, D, takes its bearing at D<sup>2</sup> in the housing B. On the outside of this journal is the projecting end D<sup>3</sup>, by which it is driven, and which takes into a driving coupling-box provided for the purpose. The middle journal, D<sup>4</sup>, and the other end journal, D<sup>5</sup>, take, respectively, into the bearings F and G in the carriage or head-stock H. This carriage is mounted on the bed I in such wise that it is capable of sliding endwise thereon, (carrying the said top roll, D, therewith,) backward and forward by hydraulic power operating in the hydraulic cylinder J, attached to the under side of said head-stock H, and shown to an enlarged scale in Fig. 3.

H<sup>2</sup> is an extension, by means of which, when the machine is to be used horizontally, the roll D is supported when withdrawn. It is capable of revolution on the journals D<sup>4</sup> D<sup>5</sup>, supported upon the sliding head-stock operated by the cylinder below the head-stock.

K is the piston or ram within the said cylinder and fixed in position by the hollow piston rods or pipes L and M, attached to the cross-head N at the end of the bed I. The rod or pipe L supplies water under pressure to one end of the cylinder J and the rod or pipe M to the contrary end thereof, such supply of water being regulated as required by distribution-valves provided for the purpose. The cylinder J is properly secured to the under side of the head-stock H and moves forward and backward therewith, and an opening or slot in the bed-plate allows for the moving action of the cylinder J with the head-stock H.

The rolls D and E are, except as to distance apart, shown in their working position, and with that end of the carriage or head-stock H in which is the middle bearing, F, of the top roll, D, within and firmly embraced and supported in all directions by the housing C. The bottom roll, E, is carried by the vertically-movable bearings O and P, which bearings are moved upward and cause the said roll E to approach the top roll, D, during the process of corrugating a tube. These bearings are actuated by a compound toggle arrangement consisting of the toggles Q Q' R R' (two to each of the said bearings) and the horizontal toggle-bar S. This bar S (while corrugating) is moved forward by means of the hydraulic ram T within the cylinder U, and after the corrugating of a tube has been completed the said bar S is moved backward by a similar but smaller ram, V, in the cylinder W, placed at the contrary end of the bar S, water or other fluid under pressure being supplied to the said cylinders as required.

The lower toggles, Q and R, are carried in bearings X and Y, respectively, in the lower part of the aforesaid housings. Z Z are guide-rolls, one on each side of the main rolls D and E. These guide-rolls I prefer to form either wholly or partially with corrugations around their peripheries corresponding with those of the main rolls, so as to bear against the corrugated projections which are being formed on the tube under operation, and in such a manner as not to injure or distort such corrugations. These guide-rolls are each mounted in bearings in a kind of head-stock, A', and are capable of being moved up and down in the guides C' C' and C<sup>2</sup> C<sup>2</sup>. They are for the purpose of steadying a tube and for insuring its taking a comparatively true circular form while under operation. The guide-rolls are actuated by hydraulic motors E<sup>2</sup>, Figs. 1, 5, and 8.

The motors, gearing, eccentrics, and links to be described are, as will be seen, carried by the frame-work L', attached to the lower parts of the housings B and C. This gearing is for the purpose of raising and lowering the head-stocks or carriages A', Figs. 1 and 2, and is shown in cross-section in Fig. 5, and is actuated by a pair of hydraulic motors, E<sup>2</sup>. These give a rotary motion to the first-motion shaft, which



is a crank-shaft. On this shaft is the pinion F', which imparts motion to the wheel G' on the second-motion shaft, G<sup>3</sup>. (Represented in Fig. 8 and in end view, Fig. 5.) On the said shaft is also the pinion H', which imparts motion to the wheels I', each of which is on one of the third-motion shafts I<sup>3</sup>. Each of these shafts carries a pinion, I<sup>2</sup>, which takes into and drives the wheels J<sup>2</sup> J<sup>2</sup>, respectively, on the last or fourth-motion shafts, J<sup>3</sup>. On each of these shafts are two eccentrics, J' J', provided with links K' K', the upper ends of which are suitably connected to the head-stocks A', in which are mounted the guide-rolls Z Z. The said motors E<sup>2</sup>, on imparting rotary motion to the above train of gearing and eccentrics, and by means of the links and their connections, thus effect the rising and falling of the said rolls Z Z, as required during the corrugating process.

In Fig. 1 are shown the coupling-boxes D<sup>6</sup> E<sup>6</sup> engaging the ends D<sup>3</sup> E<sup>3</sup>, and a portion of the usual driving-spindles, D<sup>7</sup> E<sup>7</sup>, by which the motion-rolls D and E are driven from a motive power. On the introduction of a heated tube to be corrugated the carriage H, with the roll D, is moved backward, thus removing the said roll from the housings B and C, as shown in Fig. 7. The end D<sup>3</sup> of the roll thus leaves its coupling-box D<sup>6</sup>, which in the meantime is supported by a bearing, D<sup>8</sup>, in order that it may be retained in a direct line for the re-entry of the end D<sup>3</sup> of the roll D, when it is returned to its working position. If desired, the direct driving of the top roll, D, may be dispensed with, and one only of the rolls may be driven, the other being driven by friction. The sliding carriage H is provided with a bearing at F, supporting the middle journal of the roll, which bearing is supported, as shown, in a part which fits in C when the roll is in position. The bearing G is unnecessary when the rolls are arranged vertically.

It is obvious that parts of my invention may be employed in differently constructed machines without the employment of all of the parts. It is obvious, likewise, that by the method of withdrawing the movable roll from the fixed roll through a solid bearing I am enabled to give the same a very firm support and maintain a fixed relation with reference to the other parts of the machine. The bearing, of course, must be large enough to allow the withdrawal of the roll through it, and therefore larger than the roll. The method of withdrawing the same by a hydraulic cylinder is likewise important as enabling it to be quickly and certainly withdrawn. It is obvious, likewise, that the part of my improvement relat-

ing to the withdrawal of this roll is applicable to a vertical as well as a horizontal corrugating-machine. It is obvious, likewise, that the guide-rolls can be adjusted either in or out during the process of corrugation, as it may be necessary.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. The combination, in a corrugating-machine, of a corrugating-roll, two fixed bearings for supporting the same, one of said bearings being greater in diameter than the roll, and mechanism for withdrawing the roll longitudinally through said bearings, substantially as described.

2. The combination, in a corrugating-machine, of a corrugating-roll, two fixed bearings for supporting the same, one of said bearings being greater in diameter than the roll, and a hydraulic motor for withdrawing said roll through said bearing, substantially as described.

3. The combination, in a corrugating-machine, of a roll supported in two fixed bearings, one of said bearings being greater in diameter than the roll, so as to allow of the withdrawal of the roll therethrough, with a second roll and mechanism for causing the approach of the second roll to the first roll, substantially as described.

4. In a corrugating-machine, the combination of the adjustable corrugating-roll E, the fixed roll D, the movable bearings O and P, the double-toggle mechanism operated by bar S, and mechanism for moving said bar in both directions, substantially as described.

5. In a corrugating-machine, the combination of the guide-rolls Z Z, hydraulic motors E<sup>2</sup>, gearing F' G' H' I' I<sup>2</sup> J<sup>2</sup>, eccentrics J', and links K', substantially as described.

6. The combination, in a corrugating-machine, of a roll supported in two fixed bearings, one of said bearings being greater in diameter than the roll, so as to allow of the withdrawal of the roll therethrough, with a second roll and mechanism for causing the approach of the rolls to each other during corrugation, and adjustable guide-rolls for guiding the corrugating-cylinder during the process of corrugation, substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

SAMSON FOX.

Witnesses:

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