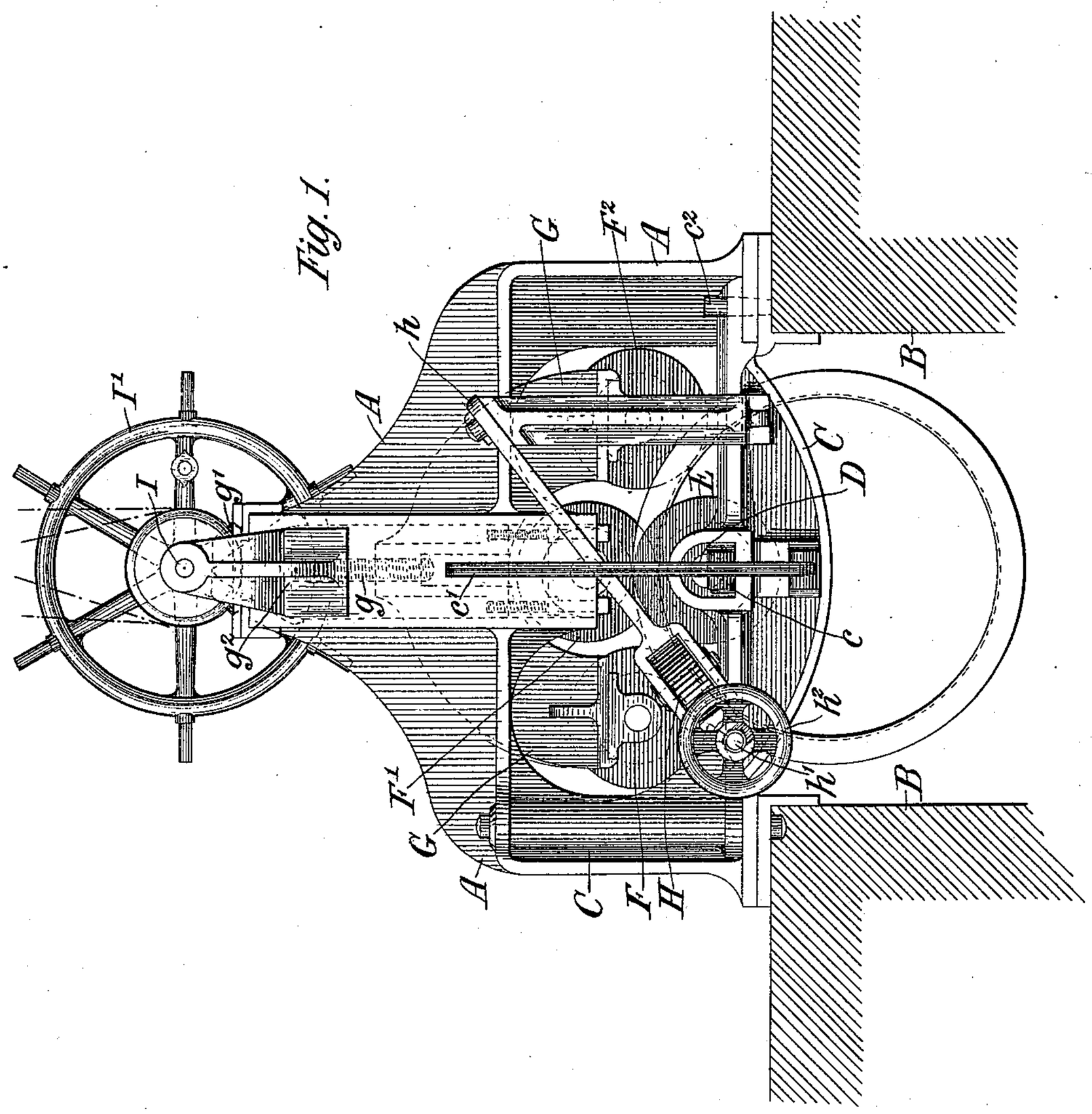
(No Model.) 4 Sheets—Sheet 1.

W. ARNOLD.

MACHINE FOR MANUFACTURING BOILER TUBES.

No. 352,987. Patented Nov. 23, 1886.

Fig. 1.



Witnesses:
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Henry McBride

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Fig. 2.

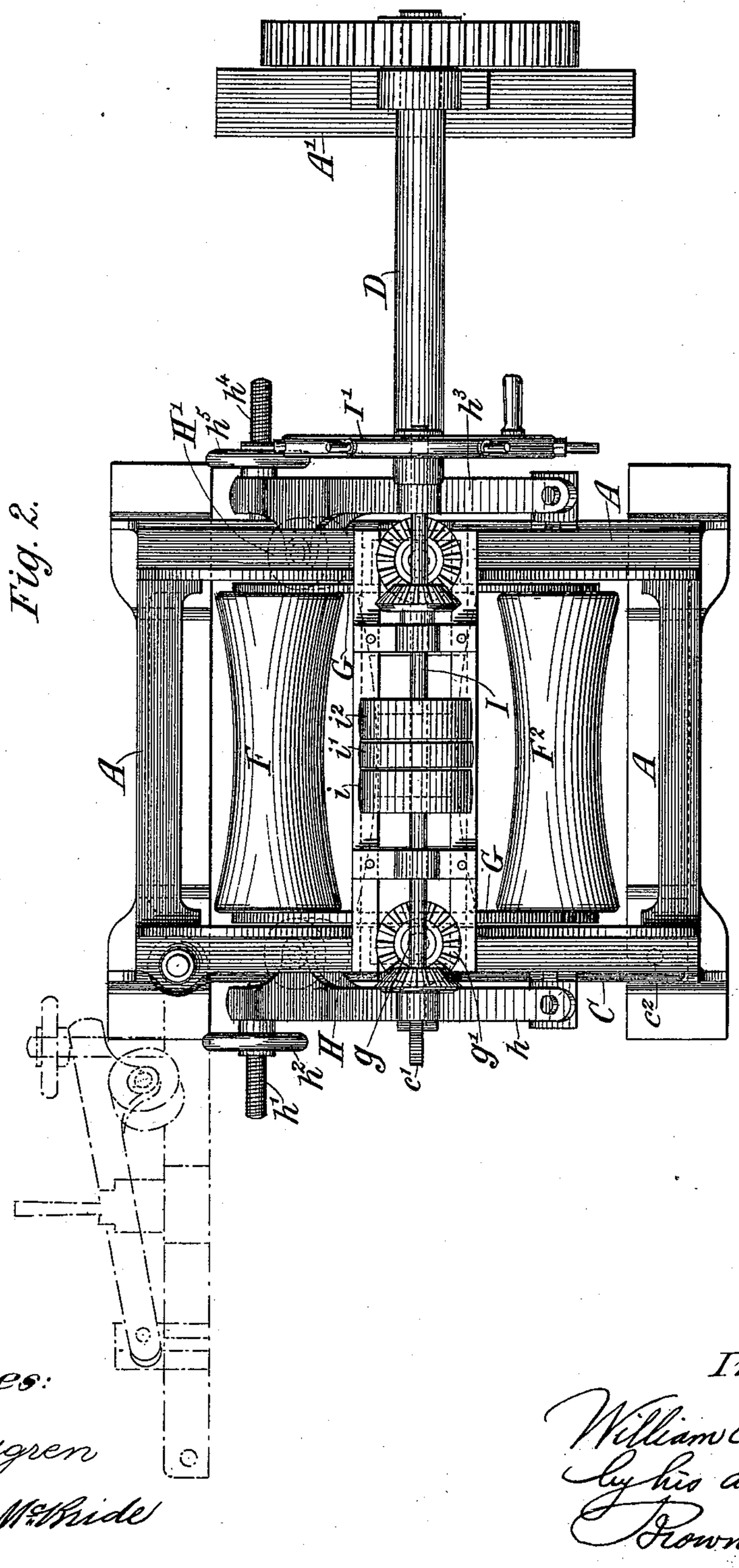

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Fig. 4.

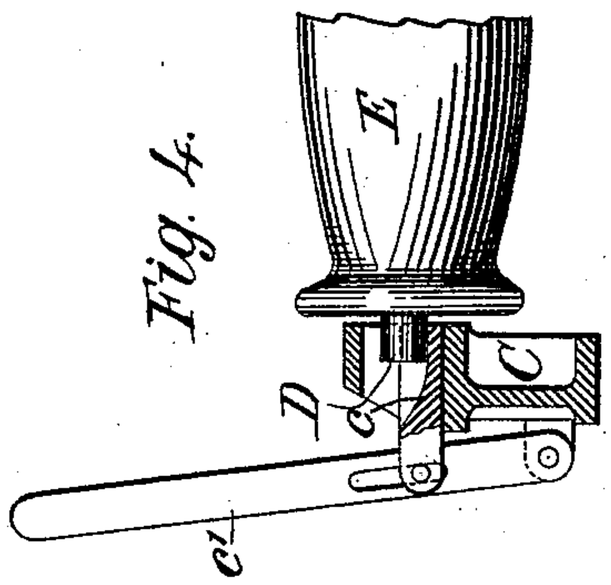

Fig. 3.

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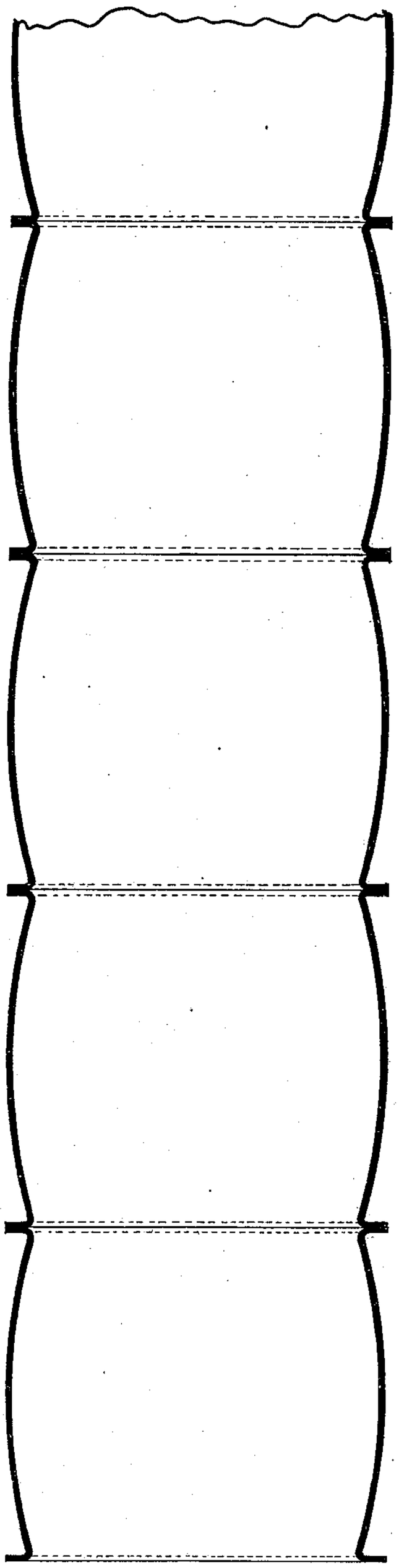

Fig. 5.

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UNITED STATES PATENT OFFICE.

WILLIAM ARNOLD, OF BARNSLEY, COUNTY OF YORK, ENGLAND.

MACHINE FOR MANUFACTURING BOILER-TUBES.

SPECIFICATION forming part of Letters Patent No. 352,987, dated November 23, 1886.

Application filed May 12, 1886. Serial No. 201,905. (No model.) Patented in England February 9, 1882, No. 635.

To all whom it may concern:

Be it known that I, WILLIAM ARNOLD, of Barnsley, in the county of York, England, engineer, have invented certain Improved Machinery for the Manufacture of Boiler-Flue Tubes, of which the following is a specification.

This invention relates to a novel arrangement of machinery for shaping up cylindrical tubes into a barrel or double-cone section with flanged ends, for the purpose of constructing therewith steam-boiler flues, which, besides presenting a large heat-absorbing surface to the flame and heated gases of the furnace-fires, will possess an increased power of resisting the external pressure of the water in the boiler as compared with cylindrical tubes of like weight.

In preparing tubes of this character it is essential that the operation of shaping and flanging them should be carried out with great expedition, because the metal under treatment must be worked while at a high heat to prevent the fiber of the metal being distressed or weakened during the manufacture. To effect this compound operation of shaping and flanging at one heating of the metal, I employ the arrangement of machinery illustrated in the drawings, where—

Figure 1 is a front view of my improved machine. Fig. 2 is a plan view, and Fig. 3 is a side elevation, of the same. Fig. 4 is a sectional view of a removable bearing for the axle of the main shaping-roll, the same being shown in section with its supporting-bracket; and Fig. 5 is a longitudinal section of a boiler-flue made up of tubes manufactured by my improved machine.

This machine consists, mainly, of a set of shaping-rolls, between which the tube is subjected to a rolling-pressure.

A A is the main framing, set upon a hollow foundation, B B, the front part of which is open to provide space for the pendent work under treatment. Hinged to the front part of the framing A is a bracket, C, fitted with a bearing, *c*, for supporting the front end of a driven horizontal axle, D, which extends rearward of the framing A, and has its rearmost bearing in a casting, A′. Keyed to this axle is a roll, E, having a profile corresponding to the line of section which the tube is designed to receive, and above this roll are three rolls, F″ F′ F², the counterpart of the lower roll mounted in a pair of vertically-sliding frames fitted to the inner sides of the end frames, A A. These sliding frames G G depend from adjusting-screws *g g*, which work in tapped holes in the frames G, and are free to turn in sockets made for them in the main framing. Each screw *g* is fitted with a bevel-pinion, *g′*, which pinions rest upon the top of the framing A and serve to carry the whole weight of the three top rolls and their axles. The screws are also fitted with collars g^2 g^2, which will prevent the screws from being forced upward by the back-pressure of the top rolls.

H H′ is a pair of small rollers set to work in a vertical plane, for the purpose of bearing upon the ends of the tube and bending them up into flanges.

The hinged bracket C, which carries the bearing for the front end of the axle D, is employed to allow of the tube being slid endwise onto the shaping-roll while the upper pressing-rolls are in their raised position.

By reference to Fig. 4 it will be seen that the bearing *c* is wedge-shaped in longitudinal section, and is pivoted to a hand-lever, *c′*, which has its fulcrum on the hinged bracket C. This bracket is held fast in its closed position by a pin, c^2, which passes through the free end of the bracket and enters a pin-hole in the foot of the framing A.

The flanging-roller H is mounted in bearings carried by an adjustable arm, *h*, which is pivoted to a short standard carried by the hinged bracket C. Fitted to this hinged bracket is a screwed pin, *h′*, which passes through the free end of the pivoted arm *h* and carries a wheel-nut, h^2, by turning which the roller H is forced into contact with the end of the tube to complete the formation of a flange thereon.

To provide for the ready admission of the heated tube to the rolls, it is only necessary to withdraw the pin c^2 and to pull back the hand-lever *c′*, which withdraws the bearing *c* from under the axle D, and at the same time throws back the bracket C, together with the flanging-roller H, which it carries, to the dotted position of Fig. 2.

At the back of the machine the flanging-roller H′ is carried by an adjustable arm, h^3, pivoted to a fixed portion of the framing A.

Projecting from this framing and through the free end of the arm h^3 is a screwed pin, h^4, carrying a wheel-nut, h^5, for pressing the flanging-roller H′ into contact with the tube and completing the formation of a flange thereon.

I have stated that the tube to be shaped and flanged is introduced into the machine when the pressing-rolls are in their raised position. In order to bring them down rapidly to their work, the bevel-pinions g', which support the sliding frames G, are caused to rotate simultaneously by means of bevel-wheels keyed to a longitudinal shaft, I, which has its bearings at the top of the framing A. This shaft is provided with fast and loose band-pulleys $i\ i'\ i^2$, which receive driving-bands from overhead shafting. One of these bands is open and the other crossed for the purpose of imparting rotary motion in reverse directions to the shaft I. A belt-shifter is provided for throwing one or other, or both, of these bands out of action. By this arrangement a rapid rotation is imparted to the screws g, from which the frames G and their rolls depend, and thus the pressing-rolls F F′ F² are brought rapidly into action. To impart increased energy to the rolls, I apply a hand-wheel, I′, to the shaft I, by turning which the middle roll, F′, will be forced into closer contact with its work than could be effected through the driving-band. This roll F′, I prefer to make in tubular sections—say five in number—to compensate for the unequal friction due to the varying diameters of the rolling-surface.

The outer rolls, F and F², serve to steady the work and keep it in position while the rolls E and F′ are molding it to the required shape. The roll E, it will be seen, has a barrel-shaped contour, which corresponds to the form of section desired to be imparted to the tube. This roll is also shaped at its ends so as to turn up the edges of the tube and prepare them for conversion into flanges.

The compound roll F′ corresponds in profile with the roll E, it being a counterpart thereof. The action of the two rolls is to contract the diameter of the tube near its ends, and to force the greater part of the displaced metal toward the enlarged center.

The axle D, which carries the shaping-roll E, receives motion from any prime mover, and when the pressing-rolls are brought down into action they will, by contact with the heated tube, which is rotated by the shaping-roll E, receive also an axial motion. Thus every portion of the tube will be brought in succession into the bite of the rolls E F′, the bite being increased as desired by the turning of the hand-wheel I′. While the tube is thus being molded to shape the attendant will, by means of the wheel-nuts h^2 and h^5, gradually force inward the flanging-rolls H H′, which, bearing on the inclined ends of the tube, will bend them up at right angles without putting any undue strain on the metal.

From the foregoing it will be understood that I am enabled greatly to expedite the shaping operation, and so effectually to impart an endwise and downward pressure upon the yielding metal as to insure the crowding up of metal toward the middle of the tube, and the maintenance of the normal thickness at that part, notwithstanding the increased diameter imparted thereto. At the same time I effect an increased thickening of the root of the flanges, thus making them strong enough to render unnecessary the insertion of a welded stiffening-ring between the flanges, such rings being a hinderance to free contraction and expansion.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is—

1. The combination, in a machine for manufacturing flanged boiler-flue tubes having varying diameters, of the shaping-roll E, pressing-rolls F F′ F², and flanging-rollers H H′, arranged to act simultaneously upon the heated tube presented to the machine.

2. The pressing-rolls carried in a pair of vertically-sliding frames, which, by means of gearing setting in action a pair of suspending-screws, are simultaneously forced rapidly down to or raised from their work.

3. In combination with the driving-axle carrying the shaping-roll, the hinged bracket at the front of the machine, with its adjustable bearing pivoted to a hand-lever for supporting the front end of the axle, and providing for the insertion into the machine of the heated tube to be molded and flanged.

4. In combination with the hinged bracket carrying the bearing of the shaping-roll axle, the flanging-roller H, mounted in an adjustable arm, h, pivoted to the bracket and serving to press the roller to its work.

WILLIAM ARNOLD.

Witnesses:
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Notary Public, Sheffield, England.
CHARLES RENSHAW,
His Clerk.