

(No Model.)

L. SILVERMAN.

4 Sheets—Sheet 1.

CORRUGATED TUBE FOR BOILERS, &c.

No. 494,033.

Patented Mar. 21, 1893.

FIG. 1.

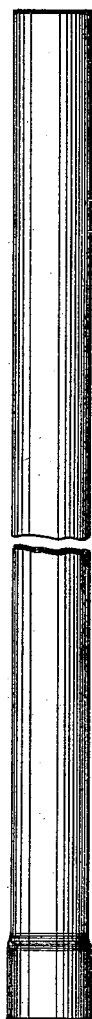


FIG. 2.

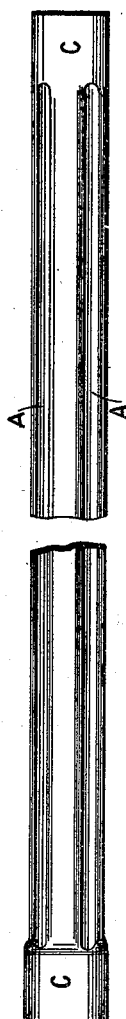


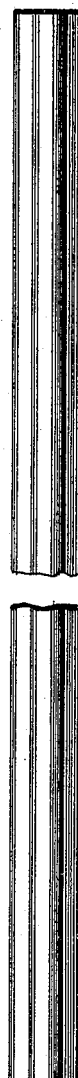
FIG. 3.



FIG. 5.



FIG. 4.



Witnesses:
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Robert Everett. By James B. Norris.
Attorney.

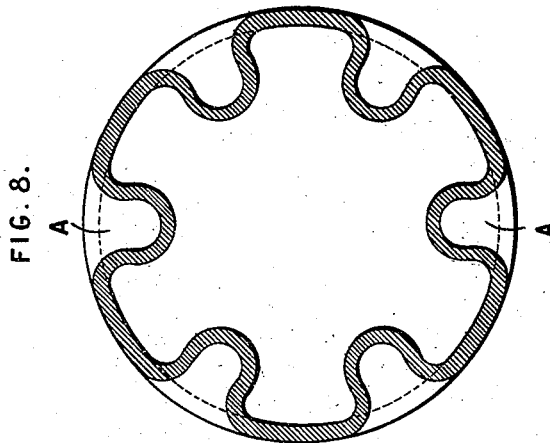
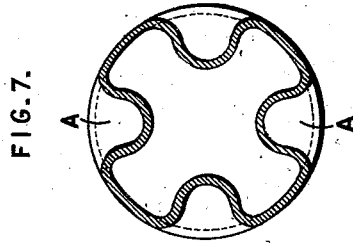
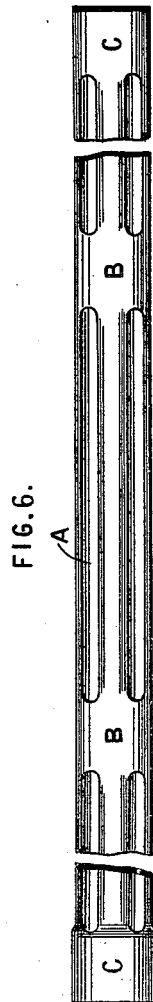
(No Model.)

4 Sheets—Sheet 2.

L. SILVERMAN.
CORRUGATED TUBE FOR BOILERS, &c.

No. 494,033.

Patented Mar. 21, 1893.



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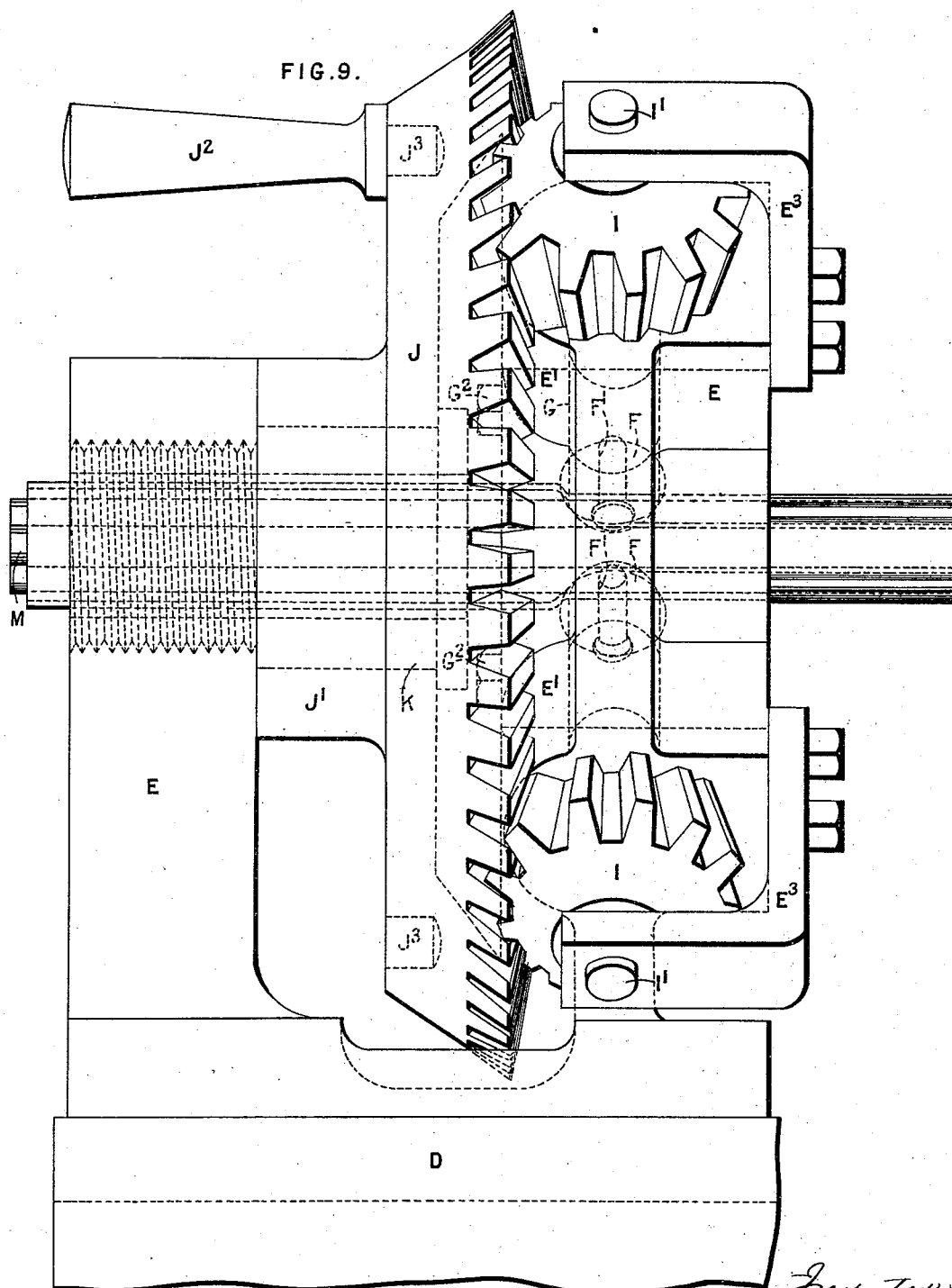
4 Sheets—Sheet 3.

L. SILVERMAN.

CORRUGATED TUBE FOR BOILERS, &c.

No. 494,033.

Patented Mar. 21, 1893.



Witnesses:
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(No Model.)

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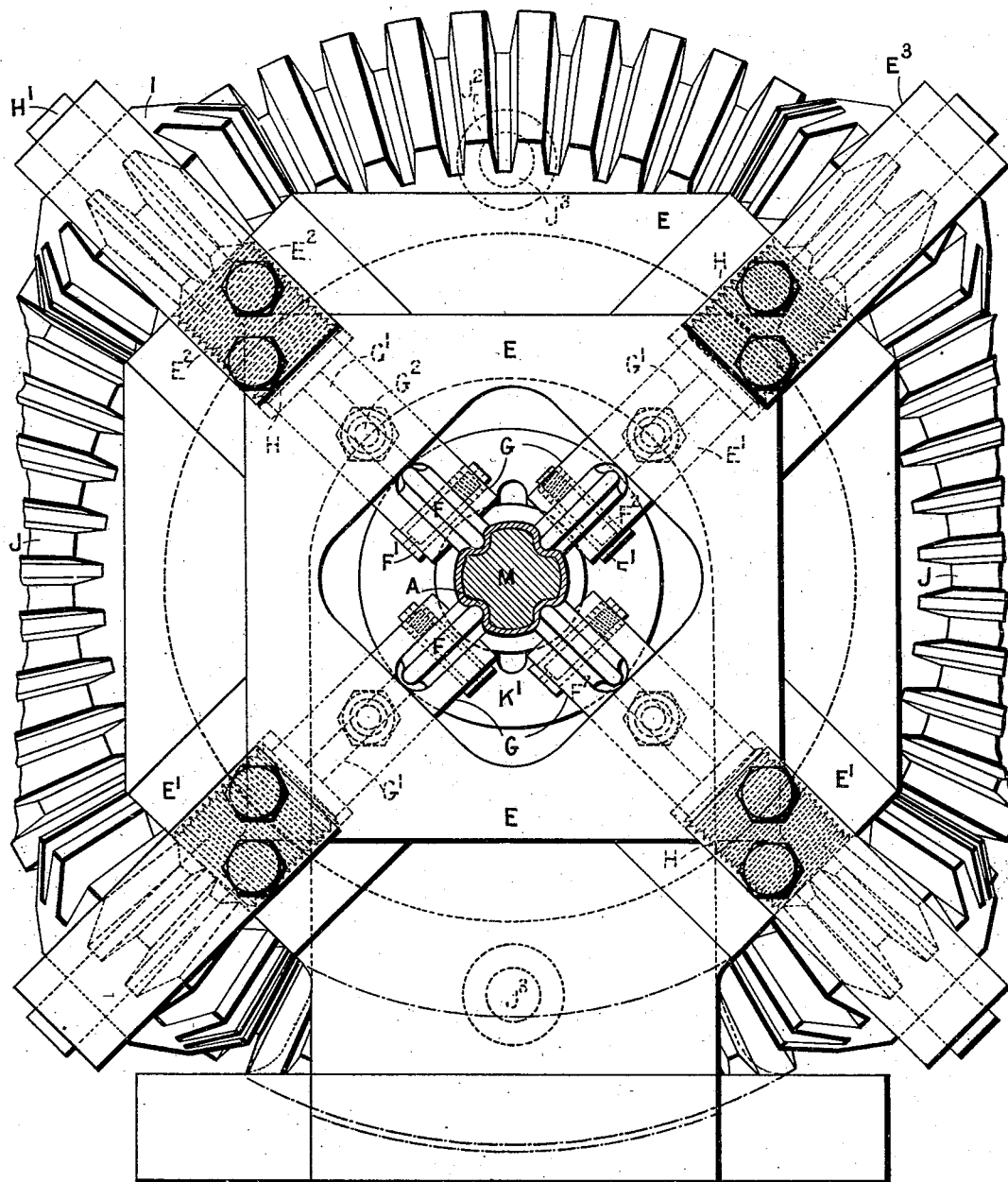
4 Sheets—Sheet 4.

CORRUGATED TUBE FOR BOILERS, &c.

No. 494,033.

Patented Mar. 21, 1893.

FIG. 10.



Witnesses: J. A. Rutherford, Robert Everett, Inventor: Louis Silverman, By James H. Norris, Attorney.

UNITED STATES PATENT OFFICE.

LOUIS SILVERMAN, OF CRAYFORD, ENGLAND.

CORRUGATED TUBE FOR BOILERS, &c.

SPECIFICATION forming part of Letters Patent No. 494,033, dated March 21, 1893.

Application filed July 21, 1892. Serial No. 440,810. (No model.)

To all whom it may concern:

Be it known that I, LOUIS SILVERMAN, engineer, a subject of the Queen of Great Britain, and a resident of Crayford, county of Kent, England, have invented certain new and useful Improvements in Corrugated Tubes for Boilers, Condensers, and Similar Apparatus, of which the following is a specification, reference being had to the accompanying drawings.

My invention relates to the manufacture of tubes for boilers, condensers and other apparatus in which it is desirable to employ tubes having a large area of heating or cooling surface in proportion to their diameter.

My invention consists in the features of construction and the combination or arrangement of devices hereinafter described and claimed, whereby the tubes are provided with longitudinal corrugations.

The invention is illustrated by the accompanying drawings, in which:

Figure 1 represents in side elevation a plain tube previous to being corrugated with longitudinal corrugations according to my invention. Fig. 2 is a side elevation of the said tube after it has been corrugated with parallel longitudinal corrugations which extend uninterruptedly for nearly the whole of its length. Fig. 3 is a transverse section of Fig. 2 through the corrugated portion of the tube. Fig. 4 shows in side elevation one form of mandrel which is employed, as hereinafter described, in the formation of such a tube as is illustrated in Fig. 2 for example. Fig. 5 is a cross section of the said mandrel. Fig. 6 is a side elevation of a tube formed according to my invention with discontinuous or interrupted longitudinal corrugations. Fig. 7 is a cross section of a tube in which the corrugations are deeper than in the figures previously referred to. Fig. 8 is a cross section of a tube such as would be employed for instance in a marine boiler the corrugations being more numerous than in the tubes shown in preceding views, which illustrate tubes of a smaller size such as may be used for example in a locomotive boiler. Fig. 9 is a side elevation of a portion of a machine by means of which plain tubes may be corrugated with the said longitudinal corrugations. Fig. 10 is an end elevation of Fig. 9.

Like letters indicate the same parts throughout the drawings.

With reference to Figs. 1 to 8, A A are the said longitudinal corrugations. The said corrugations as hereinbefore stated may be continuous as in Fig. 2 or may be interrupted by plain surfaces B as in Fig. 6.

C C are the plain surfaces left at the tube ends so that they may be conveniently fitted into tube plates.

With reference to Figs. 9 and 10 D is a table or bed, E is a head-stock which may be secured upon the bed D at any convenient point. The said headstock has a central orifice through which the tube to be corrugated may pass.

F F are rollers which are free to rotate on pins F' carried in the ends of spindles G. The said pins F are preferably made hollow as at F² and a cooling liquid is circulated by any suitable means through the hollow interiors thereof to keep the pins cool when the apparatus is employed upon hot material. The said spindles are grooved at G' and are movable endwise in guides E' in the headstock E. Set screws G² are provided in the walls of the guides E' and enter the said grooves G' to exert sufficient pressure therein to retain the spindles G in any position to which they may be moved. The said set screws and grooves act also to prevent the spindles from rotating upon their axes.

H H are screws which are inserted into the guides E' and bear upon the ends of the spindles G.

I I are bevel pinions in which are formed square axial holes so that the said pinions may be placed upon the square extensions of the screws H. The said bevel pinions are prevented from moving endwise upon the square extensions by wings E³ formed upon the headstock E and bearing upon the outer end faces of the said pinions, the inner end faces of which bear upon the headstock E. The said squared holes and squared extensions of the screws H are provided in order that the said screws may be able to move endwise relatively to the pinions I. The said pinions I gear with a bevel wheel J. The said bevel wheel J is provided with a boss J' of large diameter is carried upon the bearing K,

the said bearing being provided with a large axial opening, in line with the hereinbefore mentioned central orifice of the head stock. J² is a handle which may be inserted in one
5 or other of the sockets J³ upon the bevel wheel J to rotate the said wheel.

The said apparatus operates as follows:—
The tube which is to be corrugated has a mandrel such for example as is shown in Fig. 4 inserted within it the said mandrel being somewhat smaller than the diameter of the tube in its plain or uncorrugated condition but the same in cross section as that of the interior of the corrugated part or parts of the finished corrugated tube. The end of the tube is passed
15 through the orifices of the bevel wheel bearing and the head stock and is gripped by a chuck or by other suitable means such as are commonly employed in the operation of drawing seamless tubes. The bevel wheel J is then rotated by means of the handle J² and rotates the pinions I, and they in turn rotate the screws H by means of the squared extensions so that the said screws move the spindles C
20 inward and the rollers F are forced against the outer surface of the tube and force it into the grooves of the mandrel as shown in Fig. 10. The tube is then drawn by any suitable means through the reduced space between
30 the rollers E which rollers act as a die and form corrugations in the tube as it is drawn between them. By rotating the bevel wheel J the screws H may be moved outward away from the tube at any moment to allow the
35 rollers F to rise out of the depressions in the tube and leave any portion of it plain as at B or C Figs. 2 and 6.

The full depth of the corrugations need not be formed in one operation but the tube may
40 be worked backward and forward in the die

formed by the rollers F, and the corrugations formed by such a series of operations.

Instead of moving the tube relatively to a headstock provided with corrugating-rollers, the tube may be held stationary by any suitable means and the said head-stock moved
45 along it.

The mandrel within the tube need not extend in the tube any considerable portion of the length of the tube but may be of short
50 length and be retained within the tube by means of a rod in such a manner that it shall always be situated at a point in the tube between the corrugating rollers, whether the said rollers move relatively to the tube, or
55 vice versa.

The mandrels employed may be collapsible if desired so that they may be readily withdrawn from the finished tubes.

What I claim is—

A machine for longitudinally corrugating
60 tubes, comprising the head-stock E, spindles G provided with rollers F and adjustable endwise in guides in the head stock toward or away from the central orifice of the head-
65 stock, and screws H, screwed into the ends of the guides, to bear upon the ends of the spindles G, and provided with squared ends, a bevel wheel J placed upon a large hollow bearing K and geared with bevel pinions I which
70 are placed upon the square portions of the spindles G and are retained in place by wings E³ formed on the head-stock, substantially as set forth.

In witness whereof I have hereunto set my
75 hand this 8th day of July, 1892.

LOUIS SILVERMAN.

Witnesses:

WM. JNO. TENNANS,
T. DEVIN.