(No Model.) 2 Sheets—Sheet 1.

R. F. PRATT & C. D. WAINWRIGHT.

MACHINE FOR CORRUGATING WROUGHT METAL TUBES.

No. 390,899. Patented Oct. 9, 1888.

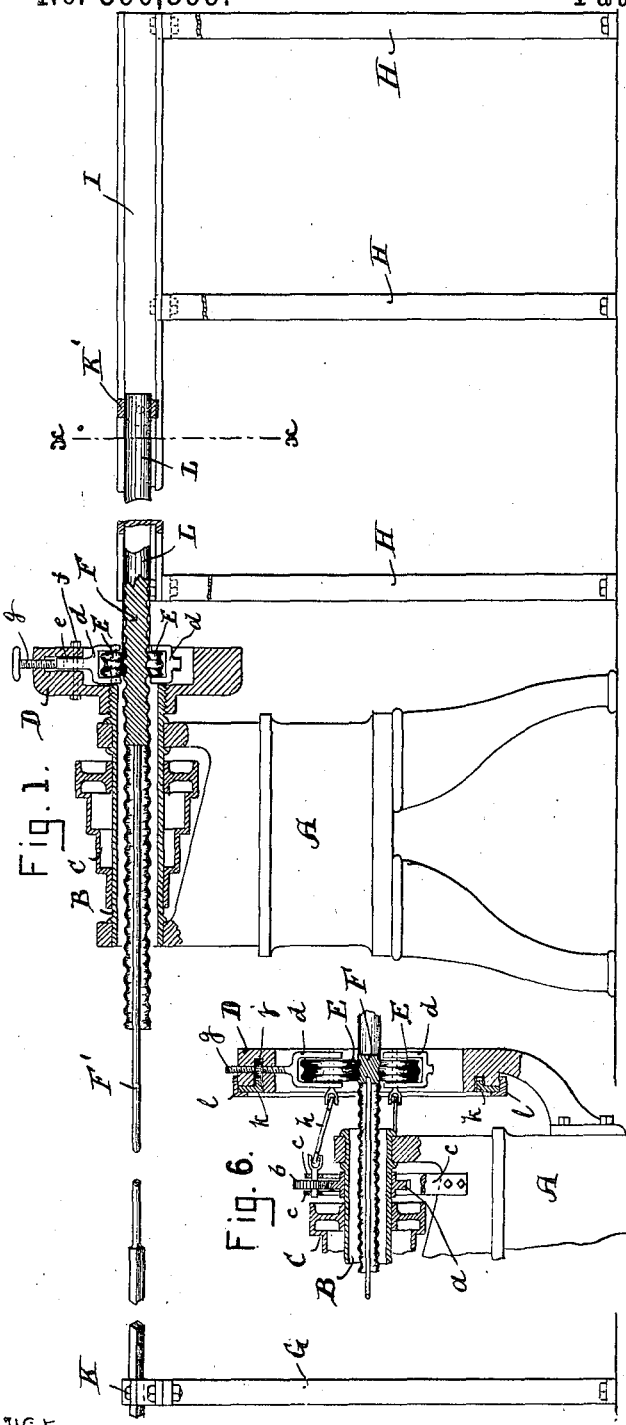

Fig. 1.

Fig. 6.

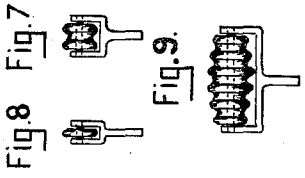

Fig. 7 Fig. 8 Fig. 9.

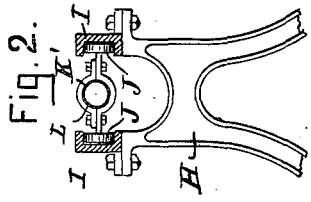

Fig. 2.

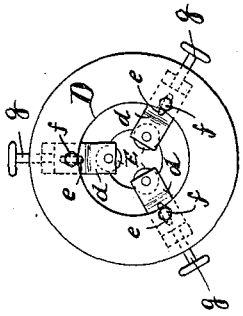

Fig. 3.

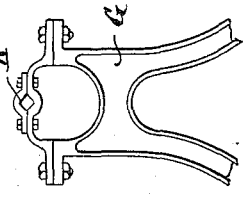

Fig. 5.

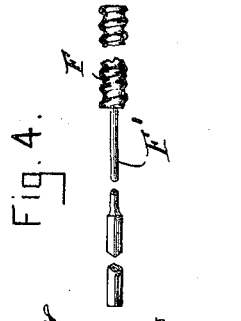

Fig. 4.

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(No Model.) 2 Sheets—Sheet 2.

R. F. PRATT & C. D. WAINWRIGHT.

MACHINE FOR CORRUGATING WROUGHT METAL TUBES.

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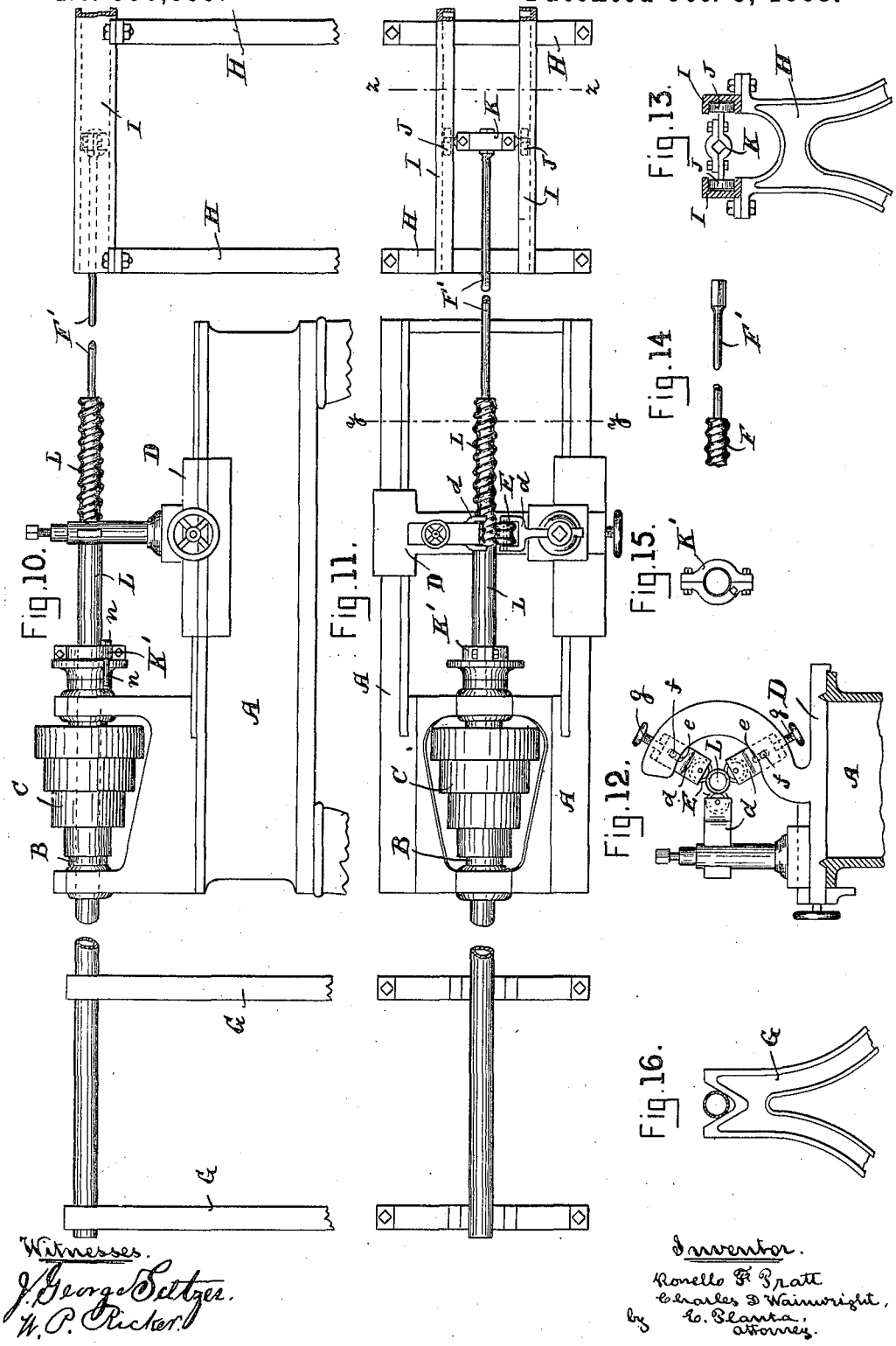

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UNITED STATES PATENT OFFICE.

RONELLO F. PRATT, OF REVERE, AND CHARLES D. WAINWRIGHT, OF MEDFORD, MASSACHUSETTS, ASSIGNORS TO THE WAINWRIGHT MANUFACTURING COMPANY, OF PORTLAND, MAINE.

MACHINE FOR CORRUGATING WROUGHT-METAL TUBES.

SPECIFICATION forming part of Letters Patent No. 390,899, dated October 9, 1888.

Application filed June 20, 1887. Serial No. 241,920. (No model.)

To all whom it may concern:

Be it known that we, RONELLO F. PRATT, a citizen of the United States, residing at Revere, in the county of Suffolk and State of Massachusetts, and CHARLES D. WAINWRIGHT, a citizen of the United States, residing at Medford, in the county of Middlesex and State of Massachusetts, have invented a new and useful Improvement in Machines for Corrugating Wrought-Metal Tubes, of which the following is a specification.

The object of our invention is to produce a machine upon which metal tubing may be spirally corrugated. For this purpose we have combined with the head-stock of a hollow spindle-lathe various parts, now to be described, whereby such tubes may be supported both externally and internally during the process of corrugation and while they are being subjected to the action of the corrugation-tool.

Our present invention, as embodied in the machine shown in the drawings, requires the use with such a head-stock of a non-rotating mandrel, which may be short compared with the length of the tube to be corrugated, and suitable supports for said mandrel and tube, either or both of which supports may or may not be independent of the said lathe.

Referring to the accompanying drawings, Figure 1 represents a longitudinal vertical section of a corrugation-machine embodying our invention. Fig. 2 is a vertical section taken on line *x x* of Fig. 1. Fig. 3 is a face view of the face-plate or die-carrier. Fig. 4 is a view of the mandrel and rod. Fig. 5 is a view of the standard for carrying the end of same. Fig. 6 is a vertical section through a portion of the head-stock die-holder and of a modified means of operating the dies. Figs. 7, 8, and 9 show various forms of dies. Fig. 10 shows a side elevation of a modified form of machine. Fig. 11 is a plan or top view of same. Fig. 12 is a vertical section taken on line *z z* of Fig. 11. Fig. 13 is a vertical section taken on line *z z* of Fig. 11. Fig. 14 is a view of the mandrel and rod. Fig. 15 is a face view of the clamp for holding the tube to be corrugated, and Fig. 16 is a view of the upper end of one of the standards for supporting the free end of the tube.

In the various forms of our invention shown in the drawings, A represents the frame of the machine, provided at its upper end with suitable bearings, in which is mounted a hollow shaft, B. On this shaft, between the bearings, is secured a cone-pulley, C.

D is the die carrier, which may be fastened on the end of the shaft B or mounted upon the slide-rest of the lathe, as thought best.

In the die-carrier D are mounted three forks, *d d d*, that carry at their outer ends revolving dies E E E. The shank of each fork passes into a groove in the die-carrier, and is slotted at *e*. A bolt, *f*, passes through holes in the carrier and through the slot *e*, so as to limit the play of the fork *d*. The positions of the dies E are adjusted in relation to the mandrel F by means of screws *g*, according to the size and thickness of the tube to be operated upon or the depth of the corrugation.

F is a spirally-corrugated mandrel, to which is attached a long rod, F′, the outer end of which is formed square, so as to fit into and be prevented from rotating by a suitable clamp, K. In each view the mandrel is shown broken, as it can be any desired length. This clamp K may either rest upon the top of and be bolted to a standard, G, (see Figs. 1 to 5,) or else may be provided with traveling rollers J, which shall run in ways I, mounted upon the supports H, as shown in Fig. 13. In the former case the tube is carried by a similar clamp, K′, with friction-rollers J, which move in the ways I, mounted upon the supports H, as shown in Fig. 2, and in the latter case the tube rests upon supports G, the clamp K′ holding the tube in the head.

In the embodiment of this invention shown in Figs. 1 to 5 the spirally-corrugated mandrel F and the annular corrugated rotating dies E E E are arranged in proper proximity to each other, and the tube to be corrugated is then passed over the mandrel, with its rear end secured in the clamp K′. The machine is then started, and the tube with the mandrel inside passes between the dies E E E, which revolve around it and cause it to take the form of the said mandrel, which, with the tube, is automatically fed forward by reason of the annular corrugated rolls E working in the spiral corrugations of the mandrel. After the tube has been corrugated the length of the mandrel, the man-

drel is screwed farther into the tube and the operation repeated.

Instead of employing three dies, as above described, one die only may be employed, and the place of the other dies may be occupied by flat surface-rollers, or by a crotch, so as to form a bearing for the tube; but we prefer the means first described, as there is less friction than when a plain roller or a crotch is employed.

In Fig. 6 we have shown another means for operating the dies to be used with one tube-carrying mechanism above described—that is to say, the dies E are caused to rotate positively, while the holder D remains stationary. This is accomplished in the following manner: To the hollow shaft B is secured a cog-wheel, *a*, that is in gear with three pinions, *b*, mounted in bearings *c*, secured to the frame A. The outer ends of the spindles of these pinions *b* are connected to the spindles of the rollers E by means of rods *h* and universal joints, so that as the pinions *b* revolve the dies revolve with them and feed the tube through the machine. The ends of the forks *d*, carrying the dies E, are in this case provided with screw-threads *g*, that pass through threaded pinions *j*, which are all operated simultaneously by a circular rack, *k*, which is held in position on the die-holder D by a ring, *l*; or the forks may be operated the same as the jaws of any ordinary chuck, either independent or universal. The tube being placed upon the mandrel, which is non-rotating and kept from moving longitudinally, and the dies E being adjusted so as to bear upon it, the dies are caused to rotate each on its own axis and the tube is both corrugated and fed over the mandrel, the dies pressing the tube into the spiral corrugation on the mandrel and screwing the tube along it, thus performing the double function of feed-rolls and corrugating-rolls. The same result would of course be attained by rotating the mandrel instead of each die.

In the embodiment shown in Figs. 10 to 16 the tube to be corrugated is clamped in the clamp K′, which sets into the face-plate and revolves with it, and the mandrel and dies travel along as the tube is corrugated. In this case we prefer to make the clamp K′ of wood, of the form shown in Fig. 15, and provide its inner face with a layer of sand-paper or other rough material to insure a firm grip upon the tube. The clamp is, by reason of the long bolt *n*, free to travel outward from the front of the face-plate to allow for the extra length of tube taken up by the corrugations. The free end of the tube is supported in standards G G.

The wheels J in guides I on standards H, instead of supporting the end of the tube, carry the end of the rod F′, connected to the mandrel F, and travel along as the mandrel is drawn in by the corrugation formed on the tube. The die-carrier D in this case is carried by an ordinary slide-rest, of which it is a part, and is free to travel on the top of the frame.

In operating this form of our invention a portion of the tube L is passed through the head of the machine and the short mandrel F inserted therein. The dies E are then brought into contact with the tube and the machine started, which causes the tube L to rotate, and as it rotates it is caused to take the form of the mandrel, thus forming a spiral corrugation, which, screwing upon the spirally-grooved mandrel, causes the mandrel F and die E to be fed toward the head of the machine. When that section has been corrugated, the tube is loosened from the clamp K′ and another section pushed through the head, the mandrel being carried with it. The dies E are then adjusted and the machine set in motion, when the operation before described is repeated until the entire length of tube has been corrugated.

If short spirally-corrugated tubes are required, we place a long tube in the machine, and when the required length has been corrugated we cut it off with an ordinary cutting-off tool, which leaves a smooth and finished end, and then corrugate another length and cut it off, and so on.

Although we have shown and described a specially-constructed machine, an ordinary hollow spindle-lathe with the other attachments might be employed.

We have described above what we believe to be the simplest method of using our invention; but it is obvious that by reversing the direction of rotation of the pulley or spindle in each case the direction of the feed may be altered, and consequently the tube-holder and the tool-holder will move away from each other and not toward each other, as above described.

What we claim as our invention is—

1. In a machine for spirally corrugating wrought-metal tubes, provided with a hollow spindle, a spirally-corrugated non-rotating mandrel arranged in line with said hollow spindle, in combination with dies E and mechanism, substantially as above described, whereby one or more of said dies are rotated, all as set forth.

2. In a machine for spirally corrugating metal tubes, a hollow main shaft through which the tube to be corrugated may be passed, in combination with a spirally-corrugated mandrel adapted to lie within the tube to be corrugated and arranged in line with the hollow of the shaft, supported and prevented from rotation at its farther end, as described, and one or more corrugating-tools mounted as described, all arranged as and adapted for the purposes set forth.

3. In a machine for spirally corrugating wrought-metal tubes, a hollow shaft through which the wrought-metal tube is passed, said hollow shaft being provided with a cone-pulley for rotating the same, in combination with a spirally-corrugated mandrel and rotating dies, substantially as shown and described.

4. In combination with a machine for spirally corrugating wrought-metal tubes, the

supporting-clamp mounted on wheels J, the tracks or ways I, and standards H, substantially as and for the purposes described.

5. In a machine for spirally corrugating wrought-metal tubes, the hollow head-stock C, a tool-holder carrying one or more dies, E, the standard G, the track-carrying supports H, provided with a track, I, and a non-rotating corrugated mandrel, in combination with a clamp mounted upon rollers J, all as set forth.

6. In a machine for spirally corrugating metallic tubes, provided with a hollow head-stock, C, a non-rotating spirally-corrugated mandrel, a tube-holder, and a tool-holder provided with one or more rotating corrugating-dies, in combination with mechanism, substantially as above described, whereby either said tool-holder or said tube-holder is moved toward or from the other, as and for the purposes set forth.

In testimony whereof we have signed our names to this specification in the presence of two subscribing witnesses.

RONELLO F. PRATT.
CHARLES D. WAINWRIGHT.

Witnesses:
HENRY W. FOLSOM,
E. PLANTA.