(No Model.) 3 Sheets—Sheet 1.

H. H. JACK.

MANUFACTURE OF SEAMLESS TUBING.

No. 562,728. Patented June 23, 1896.

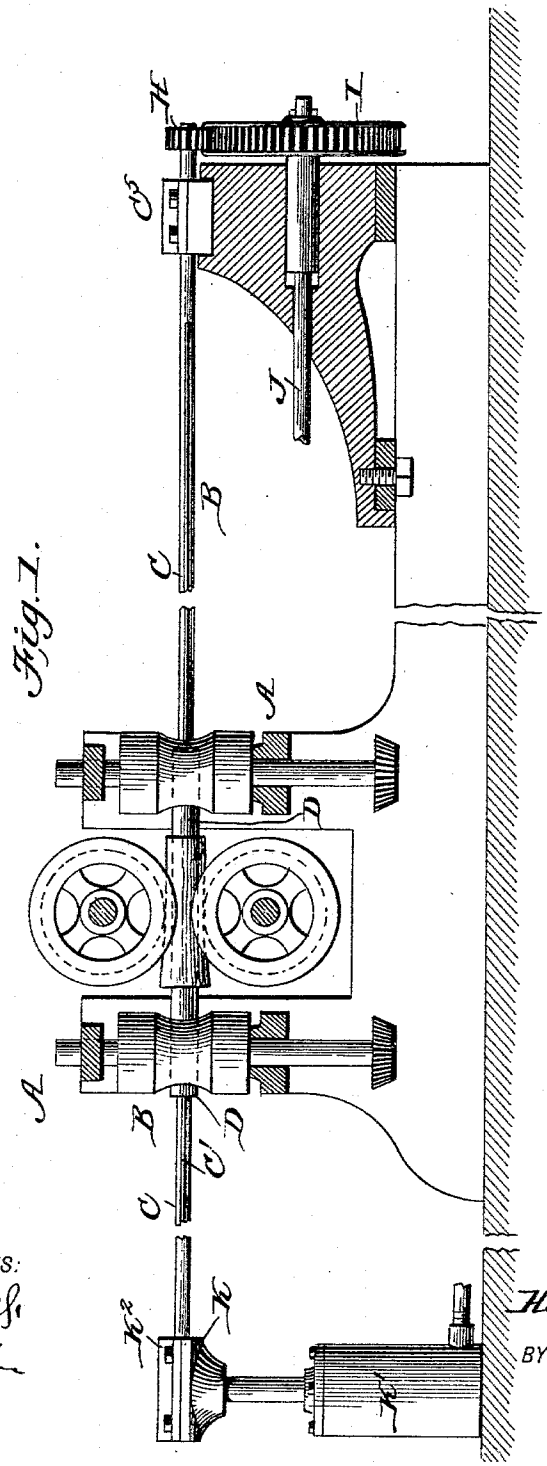

Fig. 1.

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(No Model.) 3 Sheets—Sheet 2.

H. H. JACK.

MANUFACTURE OF SEAMLESS TUBING.

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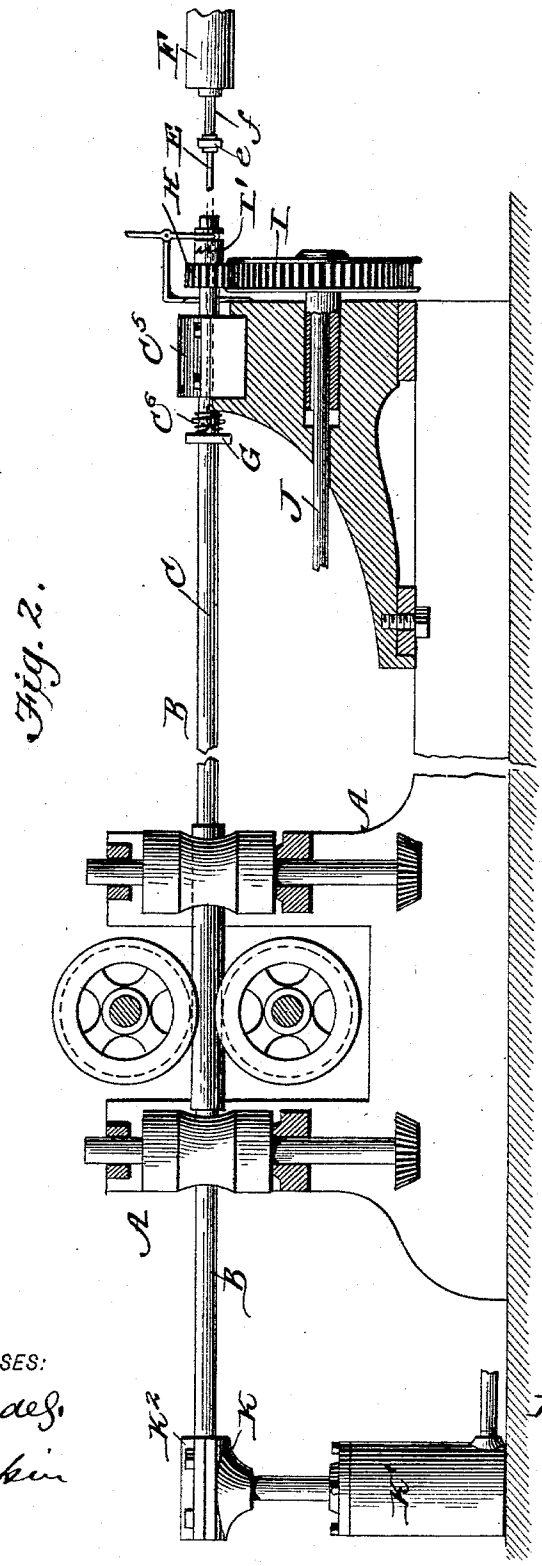

Fig. 2.

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(No Model.) 3 Sheets—Sheet 3.

H. H. JACK.

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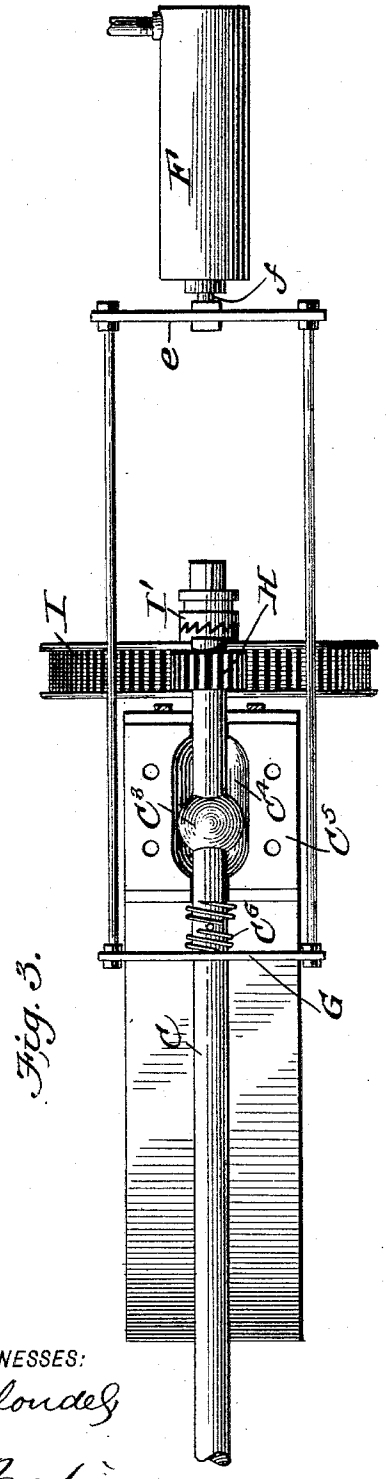

Fig. 3.

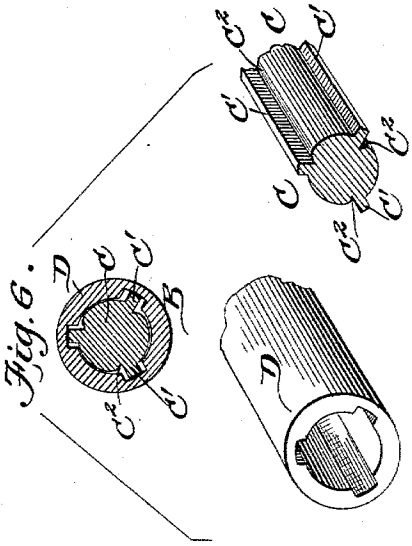

Fig. 6.

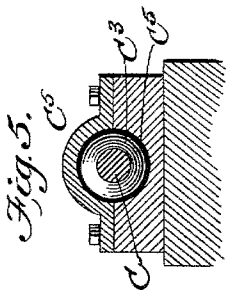

Fig. 5.

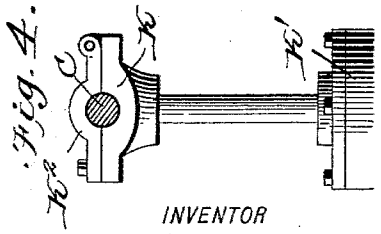

Fig. 4.

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UNITED STATES PATENT OFFICE.

HARTLEY HOWARD JACK, OF HOLLIDAYSBURG, PENNSYLVANIA.

MANUFACTURE OF SEAMLESS TUBING.

SPECIFICATION forming part of Letters Patent No. 562,728, dated June 23, 1896.

Application filed November 9, 1895. Serial No. 568,437. (No model.)

To all whom it may concern:

Be it known that I, HARTLEY HOWARD JACK, of Hollidaysburg, in the county of Blair and State of Pennsylvania, have invented a new and useful Improvement in the Manufacture of Seamless Tubing, of which the following is a specification.

The invention is an improvement in the manufacture of seamless tubing; and it consists in the improved process and in the apparatus, as will be hereinafter described, and pointed out in the claims.

In the drawings, Figures 1 and 2 are side views, part in section, respectively, of the hot and cold mills. Fig. 3 is a detail plan view, parts being removed; and Figs. 4, 5, and 6 are detail views.

The process includes rolling or compressing the ingots while the same are upon a revolving longitudinally-movable mandrel-section, whereby there is imparted to the interior of the ingot, while the exterior thereof is being compressed, broadly, a rotary motion, and, specifically, a rotary spiral motion, all of which will be better understood when the apparatus has been fully described.

In my invention I employ a mill having vertical and horizontal rolls of any suitable number of pairs, and this mill A is preferably a universal or reversing mill, as shown, this being a mill in which the tube can be worked back and forth until finished. The mandrel B works through this mill and is in the construction shown in Fig. 1 composed of an inner solid section C and an outer hollow section D. The section C is provided with longitudinal feathers C′ and adjacent thereto with water-grooves C^2, the latter being for the purpose of receiving water by which to keep both the inner and outer sections cool. This water may be supplied in any suitable manner. These waterways C^2 are used to hold enough water along the mandrel to keep both inner and outer sliding sections cool. The water is received on same from rolls and is distributed along the inner mandrel by the outer mandrel sliding over the same, and also by the rotary movement of the inner mandrel-section. The outer hollow section D fits upon the section C and is provided in its interior with keyways to receive the feathers of the inner section. By this construction the outer section is held from turning upon and may be moved longitudinally independently of the inner section, so that when the ingot is upon the outer section, the latter will revolve with the inner section and yet may move independently thereof giving a rotary and spiral motion to the interior of the ingot as the exterior thereof is being compressed by the rolls. This rotating movement of the outer section also keeps the tube or ingot loose thereon and the thickness of the shell of tube perfect, while the sliding movement of such outer section relieves the mill of unequal strain as experienced with stationary mandrels, and also avoids the nicety of regulation or adjustments of mills heretofore required.

The inner mandrel-section should be of sufficient length to allow the outer section to slide over it on both sides of the mill, making the inner section at least twice the length of the outer section, plus the width of the mill, as will be understood from the drawings. At one end the inner section is supported in a bearing K, connected with a small steam-cylinder K′, and having a hinged or removable cap K^2, so that such end of the inner section, it being the feed end thereof, may be cleared by lowering the bearing when it is desired to place an ingot on or take a tube or outer mandrel-section off the inner section.

An important feature of my invention is the provision of a mandrel movable longitudinally in both directions, in connection with mechanism by which to impart a rotary movement to said mandrel. In the construction shown in Fig. 1 the outer section is practically the mandrel, it being movable longitudinally on and turning with the inner section while the latter is forcibly turned by the drive mechanism. This is the construction preferred for hot mills and for use in cold mills in making large sizes of tubes; but ordinarily in cold mills I may employ the construction shown in Fig. 2, in which the outer section is omitted and the mandrel-section C alone is used, such section being supported at its feed end as before. At its other end the inner section C is provided with a head or ball C^3, which operates in a slot or elongated socket C^4, which is elongated in the direction of the mill in order to permit the section C to move backward and forward. The purpose of this sliding bear-

ing is to relieve the cold mill from the sudden shocks it would receive if the bearing were rigid, the spring being used to receive the impingement and the bearing and spring lessening the shock, as will be understood. In the cold mill this bearing or socket C^4 will be as long as desired to allow the mandrel to move back and forth to relieve the shock and to carry tube to mill if it should stick to mandrel *c*. When the tube delivers, if it should happen the tube should stick in the hot mill to the mandrel-section D before it can be returned to mill, the mandrel carries it to the mill. When the tubes are removed from the mandrel after the hot process, they go to an annealing-furnace and thence to the cold mill for finishing purposes; but should the tube stick to the outer mandrel-section it should be taken therewith to an expanding-mill, which may be made of three, five, six, or eight rolls. When it finally arrives at the cold mill, the mandrel is polished and oil dripped thereon and it revolved or not, as desired, and rolled back and forth to a polished surface. The longitudinal slipping of the mandrel-section C in the cold mill tends to return tube to mill, if necessary, and to relieve shock, and a spring C^6 is arranged, as shown, to assist in such relief of the shock and normally retain the mandrel-section at a point midway between the opposite extremes of its motion.

The socket C^4 is formed in a suitable frame C^5, and over such frame is fitted a sliding clearing-frame E, whose outer end is connected at *e* with the piston-rod *f* of its steam hydraulic or other cylinder F, so such frame E can be forcibly moved back and forth. At its other end the frame E has a bearing G, fitting upon the inner mandrel-section C and adapted to operate in clearing the mandrel when the single sliding mandrel is used.

On the rear end of the inner mandrel-section C, I fix a pinion H, meshing and held in mesh with a gear I on a counter-shaft J, so such gear can be moved longitudinally along its shaft J, to which it is keyed, as the pinion moves back and forth with its mandrel, before described. A clutch-section I′ is connected with the gear I and may be operated to fix or release the gear upon its shaft.

An important feature of my invention is the provision of the sectional mandrel, the outer section being keyed to revolve with, but free to slide along, the inner mandrel-section, such construction and operation not only tending to keep the ingot loose upon the mandrel, but also imparting to the interior of such ingot the circular spiral motion tending to give it a twist, whereby a stronger seamless tube is secured than by methods now practiced.

Having thus described my invention, what I claim, and desire to secure by Letters Patent, is—

1. In an apparatus substantially as described the combination of the mill, a mandrel movable longitudinally in both directions, an inner mandrel, and mechanism by which to impart a rotary movement to the inner mandrel said inner mandrel directly imparting a rotary movement to the outer longitudinally-moving mandrel, substantially as set forth.

2. In an apparatus substantially as described a mandrel composed of an inner section an outer section movable longitudinally upon the inner section and held from turning independently of said section substantially as shown and described.

3. In an apparatus substantially as described, a mandrel-section adapted to receive the ingot and a support for said section by which the same may be turned, the mandrel-section being movable longitudinally independently of its support substantially as shown and described.

4. A mandrel for use in a tube-manufacturing mill comprising an inner section and an outer section keyed thereon and adapted to receive the ingot and to move longitudinally in both directions over the inner section, substantially as described.

5. In an apparatus for the manufacture of tubes the combination of the mill, and the mandrel composed of inner and outer sections, the outer section being adapted to receive the ingot and movable freely in a longitudinal direction along the inner section and being keyed to and adapted to turn with the inner section substantially as set forth.

6. An apparatus for use in manufacturing tubes, comprising a mill and a mandrel composed of an inner section and an outer section held from turning independently of said inner section and adapted to rotate with and slide upon said inner section, substantially as set forth.

7. An apparatus substantially as described, comprising a mill, a mandrel extending through the same and an adjustable support for one end of said mandrel having its bearing provided with a removable cap and a piston-rod and cylinder supporting and operating the same whereby such end of the mandrel may be cleared substantially as set forth.

8. In an apparatus substantially as described, the combination of the mandrel having a head or ball and the frame having an elongated socket receiving said head or ball whereby the mandrel may move back and forth substantially as set forth.

9. In an apparatus substantially as described, the combination of the longitudinally-movable mandrel and a spring in engagement therewith whereby to aid in relieving the shock substantially as set forth.

10. The combination in an apparatus substantially as described of the mandrel movable longitudinally as described, and provided with a pinion, the drive-gear meshing said pinion and the counter-shaft supporting said drive-gear and along which the latter is movable whereby it may adjust itself back and forth with the movement of the mandrel substantially as set forth.

11. In an apparatus substantially as described, the combination of the mill, the mandrel having inner and outer sections, the adjustable support at one side of the mill for one end of the mandrel and the drive-gearing at the other end of the mandrel, substantially as set forth.

12. The combination of the mill the mandrel having an inner section and an outer section revolving with and sliding along the inner section, a support for such inner section and operating means substantially as set forth.

HARTLEY HOWARD JACK.

Witnesses:
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O. W. GARDNER.