J. S. WORTH.

TUBE MILL.

APPLICATION FILED DEC. 21, 1905.

946,303.

Patented Jan. 11, 1910.

3 SHEETS—SHEET 1.

Fig. 1.

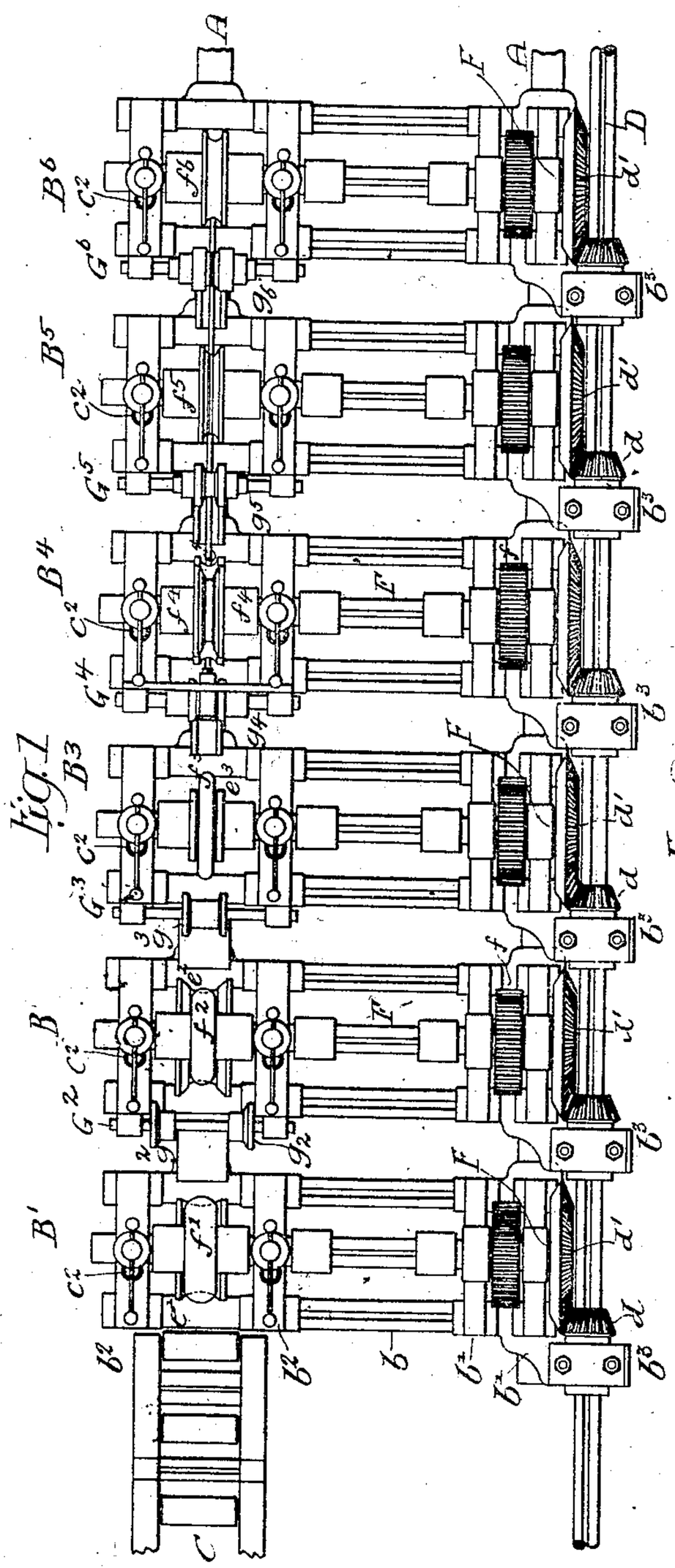
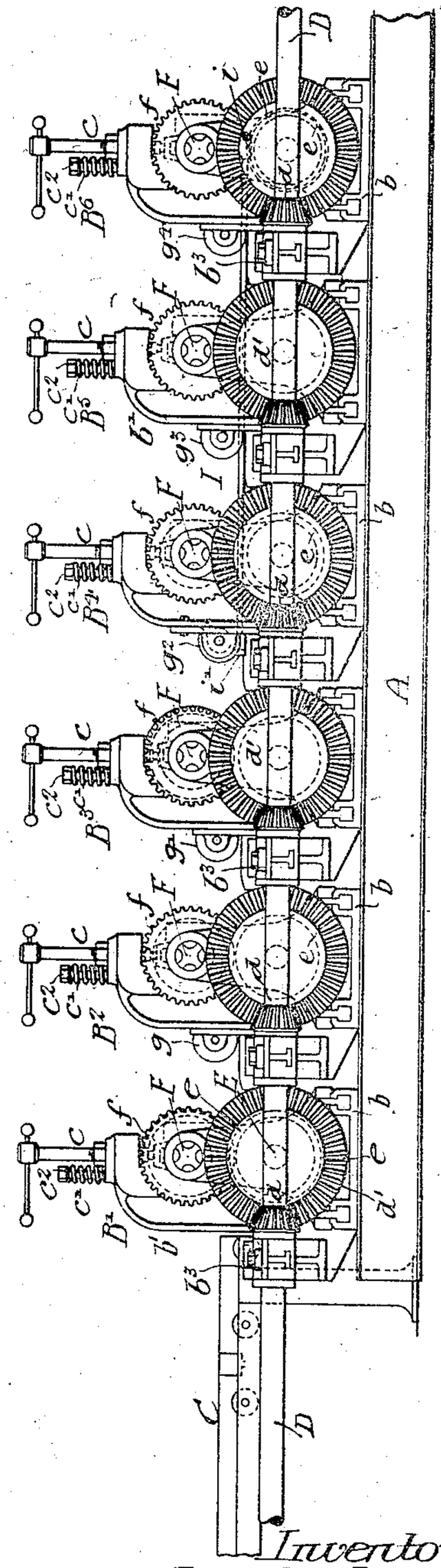


Fig. 2.



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3 SHEETS—SHEET 2.

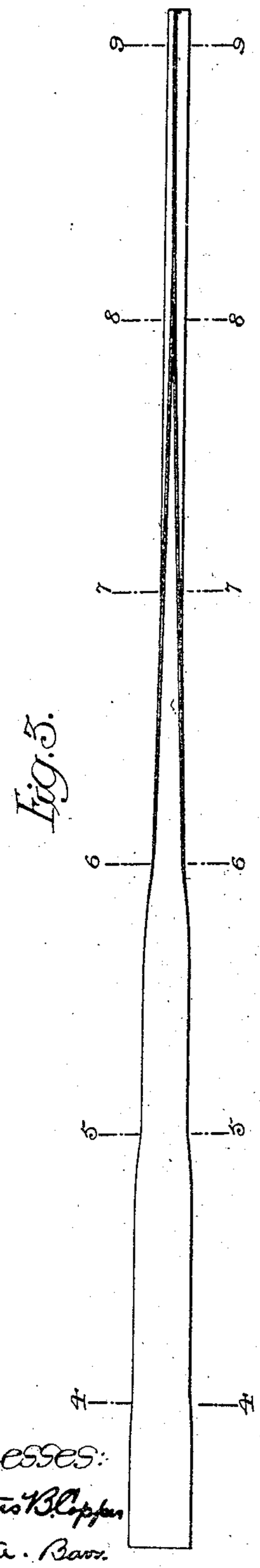
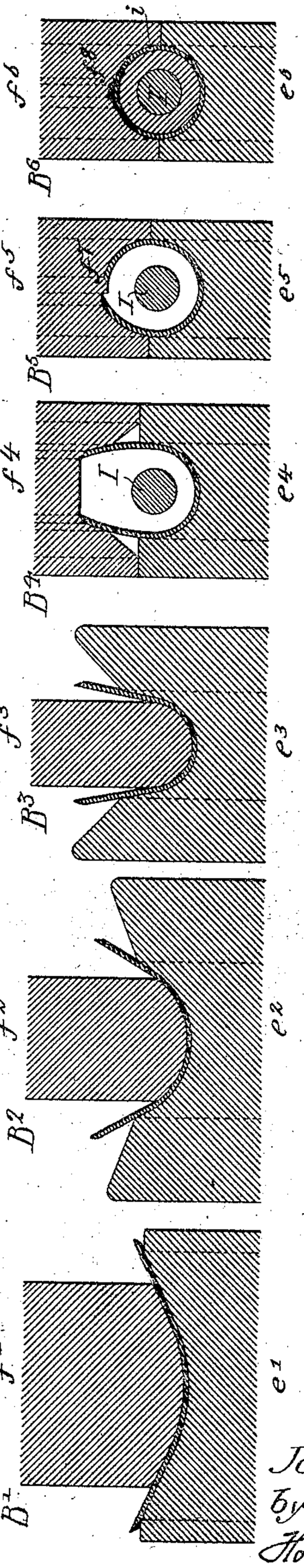


Fig. 5.



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3 SHEETS—SHEET 3.

Fig. 15.

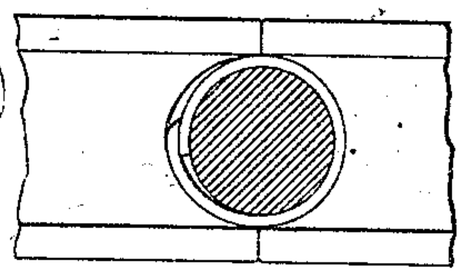


Fig. 12.

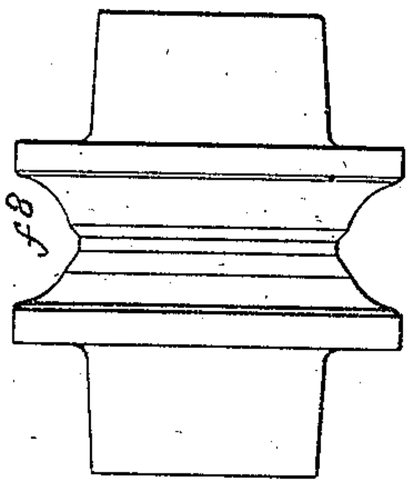


Fig. 16.

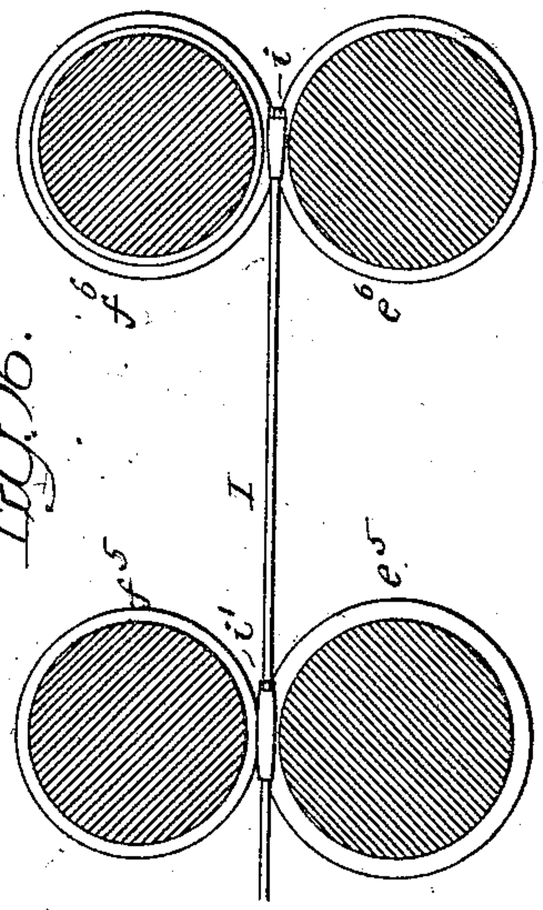


Fig. 10.

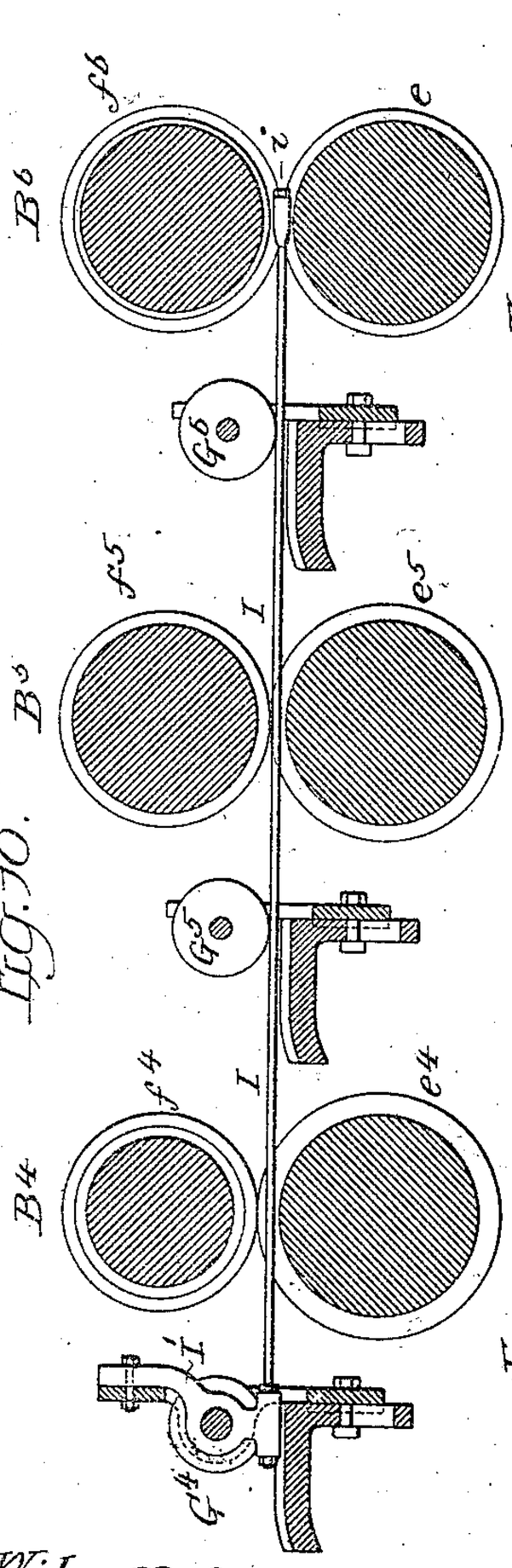


Fig. 11.

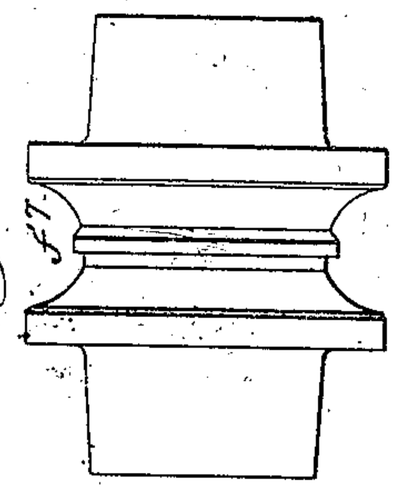


Fig. 14.

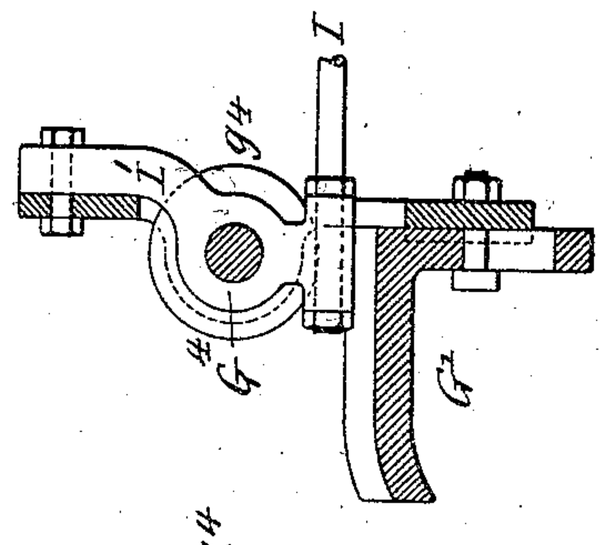
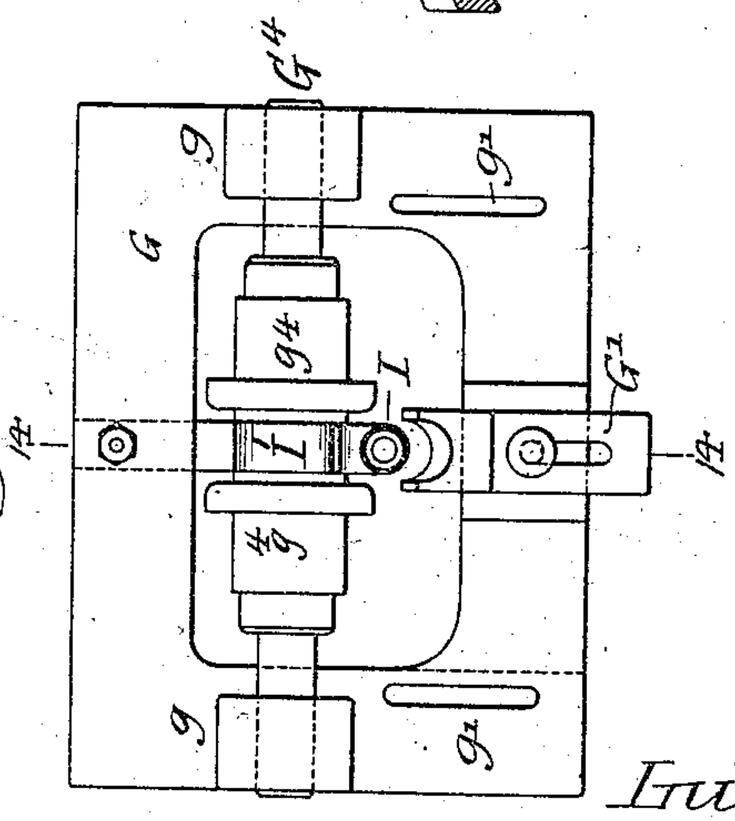


Fig. 13.



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Inventor:

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UNITED STATES PATENT OFFICE.

JOHN S. WORTH, OF COATESVILLE, PENNSYLVANIA, ASSIGNOR OF ONE-HALF TO WILLIAM P. WORTH, OF COATESVILLE, PENNSYLVANIA.

TUBE-MILL.

946,303. Specification of Letters Patent. Patented Jan. 11, 1910.

Application filed December 21, 1905. Serial No. 292,358.

To all whom it may concern:

Be it known that I, JOHN S. WORTH, a citizen of the United States, residing at Coatesville, Pennsylvania, have invented certain Improvements in Tube-Mills, of which the following is a specification.

My invention relates to certain improvements in mills for cold rolling a strip of metal into the form of a tube with lapped edges so that the blank thus produced can be passed through the welding machine and completed.

The main object of my invention is to so construct a mill that the tube blank after being formed into an open tube is completed and lapped over a mandrel or ball so as to produce a cylindrical tube with the edges properly lapped.

A further object of the invention is to provide means whereby the several mill housings can be adjusted independently on a base so that they can be spaced the proper distance apart according to the blank being formed.

A still further object of the invention is to provide means by which the plate can be properly guided through the mill.

It will be understood that my invention is particularly adapted for cold rolling a blank into the form of a tube and that the blank after being bent to the proper form is heated and passed through the welding machine to be completed and the longitudinal rib formed by the overlapping portion of the blank is reduced in this last step.

Heretofore lap tube blanks were heated and drawn through a bell, but by my invention the metal is bent cold by passing the blank through a series of rolling mills and over a mandrel.

In the accompanying drawings:—Figure 1, is a plan view of my improved tube rolling mill; Fig. 2, is a side view; Fig. 3, is a view of a blank showing the different stages in the formation of the tube; Figs. 4, 5, 6, 7, 8 and 9, are sectional views through the different rolls of the mill, the blank being taken on the different lines indicated in Fig. 3 of the drawings; Fig. 10, is a sectional view through the last three rolls; Figs. 11 and 12, are views of the rolls shown in Figs. 8 and 9; Fig. 13, is a view of the roller guide and support for the rod of the mandrel; Fig. 14, is a sectional view on the line 14—14, Fig. 13; Fig. 15, is a view of a modification of the last pair of rolls; Fig. 16, is a view showing a mandrel between two sets of rolls.

In the present instance A, A are two longitudinal foundation beams which support the entire structure.

B′, B², B³, B⁴, B⁵, B⁶ are independent mill structures, the housings b' and b^2 of each structure being connected by base portions b. Each mill structure is suitably clamped to the beams A and can be adjusted one independently of the other on said beams when desired.

Mounted in the housings are the two roll shafts E and F and the rolls are mounted between the housings b^2, b^2 and the gears f and e by which the two shafts are geared together are mounted between the housings b', b'. The shafts E and F are preferably made in sections coupled together in the ordinary manner so that the rolls can be adjusted toward and from each other. c, c are adjusting screws for adjusting the upper roll in respect to the lower one and c' is a spring mounted on a hooked stud c^2, this stud engages the upper bearing and the spring tends to keep the bearing up against the screw.

On one end of each mill structure is a bracket b^3 in which is mounted the hub of a bevel pinion d, and passing through the several bevel pinions is a longitudinal driving shaft D which extends the full length of the machine and can be driven in any suitable manner. The shaft has a spline throughout its entire length and the bevel pinions have keys which enter the spline so that while the pinions can be moved longitudinally on the shaft when the mill structures are adjusted they must turn with the shaft. On the lower shaft E of each mill structure is a bevel wheel d' which meshes with its respective bevel pinion d and on the shaft E is a gear wheel e which meshes with a gear wheel f on the upper shaft F of the mill, as clearly shown in Fig. 2 of the drawing.

C is a roller table mounted in front of the first of the series of rolls so that the blank or skelp to be converted into a tube can be fed correctly to the rolls. The blank is gradually bent from a flat to a U-shape in the first series of rolls and in the last series of rolls from the U-shape to the round. The lower roll c' of the first mill B′ is slightly

grooved and the upper roll f' is shaped so as to force the metal against the grooved lower roll, bending the blank as shown in Fig. 4. The lower roll e^2 of the mill B^2 is grooved, as shown in Fig. 5, and the upper roll f^2 is narrower than the roll f', tending to force the central portion of the blank more into a U-shape, as shown in Fig. 5. The lower roll e^3 of the mill B^3 has a deep groove and the upper roll f^3 is narrow so as to enter this groove and force the blank into the shape shown in Fig. 6. The upper roll f^4 and the lower roll e^4 are booth grooved as shown in Fig. 7, so as to give the initial bend to form the tube, the edges of the blank being bent in as shown. The lower roll e^5 of the mill B^5 is grooved and the upper roll f^5 is also grooved and has a rib f^7, one edge of the rib is beveled so as to fit the scarfed edge of the blank while the other edge of the rib forms a positive shoulder against which the other edge of the blank rests, the groove on this side of the blank being deeper than the one on the opposite side, insuring the proper lapping of the edges of the tube when presented to the final pair of rolls. The rolls e^6 and f^6 of the mill B^6 are shaped so that the tube will assume a perfectly round shape. The tube blank as it passes through this mill is shaped over a mandrel i carried by a rod I which is supported in the present instance from the housing of the mill B^4. The roll f^6 has a groove f^8 which allows for the reception of the overlapped portion of the tube which is rolled down when the two edges of the tube are welded together in another machine.

Secured to the front of each of the housings, with the exception of the first, is a plate G having bearings g, g for a roller shaft upon which guide rollers are mounted. This plate is slotted at g' and the confining bolts are passed through the slots in the plate, by providing the plate with these slots it can be raised and lowered to adjust the rollers in respect to the passes between the rolls. Carried by each plate is a bracket guide G', shown clearly in Figs. 13 and 14, which is adjustably secured to the plate so that it can be raised and lowered in respect to the rollers. The guide brackets G' are preferably shaped to conform to the shape of the blank at the different passes in the rolls.

The shaft G^2 of the mill B^2 carries two flanged rollers g^2 spaced a sufficient distance apart so that the flanges will engage the edges of the skelp or blank. The shaft G^3 of the mill B^3 has two flanged rollers g^3 placed closer together than the rollers g^2 and the shaft G^4 of the mill B^4 has two flanged rollers g^4, as indicated in Figs. 13 and 14, spaced apart, and carried by the shaft G is a bracket I' having an extension bolted to the plate G and attached to this bracket is a rod I carrying the mandrel or ball i, as clearly shown in Fig. 10. The shaft G^5 of the mill B^5 has a double flanged roller, as illustrated in Fig. 1, and the shaft G^6 of the mill B^6 has a grooved roll corresponding somewhat in shape to the roll f^5 of the mill B^5, retaining the two edges of the blank in proper position so as to insure the lap being properly made when the blank is passed between the final pair of rolls.

While I have shown the bracket I' to which the rod I is attached secured to the third from the last mill, the rod passing through three sets of rolls, the bracket may be secured to any mill desired and instead of the mandrel being mounted only between the last pair of rolls e^6 and f^6 another mandrel i' may be mounted between the next to the last pair of rolls, as shown in Fig. 16, so that the blank will be formed around a mandrel in this pass as well as the last. Instead of making the rolls of the last pass as shown in Figs. 9 and 12, the rolls may be made as shown in Fig. 15, the upper roll being grooved to a sufficient depth to allow the two edges of the blank to properly overlap, as shown in said figure.

The blank is preferably scarfed before being bent into shape and it will be noticed that, in the present instance, the first three sets of rolls bend the blank from a flat to a U-shape and the last three sets of rolls bend the blank from the U-shape to the round.

By my invention I am enabled to make an accurate cylindrical tube of the lapped type, keep the blank absolutely under control while it is being converted from the flat to a cylinder, adjust each individual mill without interfering with the other mills, and, in the event of a breakdown on one mill, it can be displaced by a duplicate without dismantling the entire train.

I claim:—

1. In a machine for rolling a blank having scarfed edges into the form of a tube with overlapping edges, of a series of upper and lower rolls, the lower rolls of the series being grooved and the upper rolls being shaped to enter the grooves of the lower rolls and to bend the tube blank into the form of a trough, a roll grooved and shaped to receive the scarfed edges of the blank and to hold the said blank central, a series of rolls shaped so as to close the tube and allow one edge of the blank to overlap the other, and a mandrel mounted between one of said last series of rolls over which the tube is formed.

2. The combination in a tube mill of two longitudinal under cut foundation beams, housings independently mounted on said beams and spaced a given distance apart, means for clamping the said housings to the beams so that they can be longitudinally adjusted, a longitudinal driving shaft, rolls carried by each set of housings and gearing

between the rolls and the driving shaft, substantially as described.

3. The combination in a tube mill, of a foundation, mill housings independently mounted on said foundation, upper and lower rolls mounted in each housing, a driving shaft longitudinally arranged in respect to the mill, a bevel gear wheel mounted on one of the roll shafts of each mill housing, a series of bevel pinions splined to the said driving shaft so that it can slide longitudinally on the shaft but must turn with the shaft, and bearings projecting from each housing carrying the said bevel pinions, the bevel pinions being geared to their respective bevel wheels, substantially as described.

4. In a machine for bending lapped tubes from scarfed blanks, of a train of rolls, the first series of the train forming a blank from the flat to the trough shape, the last series forming the blank from the trough to the lapped tube, the upper roll of the second from the last mill having a rib shaped to seat the scarfed edges of the tube, one out of line with the other, substantially as described.

5. The combination in a machine for bending lapped tubes from scarfed blanks, of a series of rolls arranged to shape a blank from a flat strip with scarfed edges to a tube with one edge overlapping the other, the upper roll of the last mill having a groove for the reception of the overlapping edge of the tube, with a cylindrical mandrel mounted between the upper and lower rolls of the said last mill so that the rib formed by the lapping will be only on the exterior of the tube, substantially as described.

6. The combination in a tube bending mill, of a series of mill housings, upper and lower rolls mounted in each housing, a plate secured to each housing, a shaft carried by each plate, guide rollers mounted on the said shafts, a bracket guide also mounted on the plate below the rollers so that the blank as it passes from one mill to the other will be guided by the rollers and the bracket, substantially as described.

7. The combination in a tube bending mill, of a series of mill housings, upper and lower rolls mounted in each housing, said rolls being shaped so that the blank will be converted from a flat strip to a round tube with lapped edges, a series of roller guides between the several mills, and a series of brackets under said rollers, both the rollers and brackets being adjustable, substantially as described.

8. The combination in a tube bending mill, of a series of mill housings, upper and lower rolls carried by each housing, guide rolls secured to the housings, shafts having bearings carried by the said housings, a bracket mounted on one of the said shafts, a rod secured to the bracket, and a mandrel secured to the rod and mounted between a pair of the above mentioned rolls, substantially as described.

9. The combination in a tube bending mill, of a series of mill housings, upper and lower rolls mounted in each housing, a plate secured to each of said housings with the exception of the first, shafts carried by the said plate, guide rollers mounted on the said shafts, one set of guide rollers being spaced apart, a bracket mounted on the shaft between the said rollers and having an extension secured to the plate, a rod carried by the said bracket and extending rearwardly between the rolls, and a mandrel on the rod, substantially as described.

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

JOHN S. WORTH.

Witnesses:

WILLIAM S. G. COOK,

HENRY HOWSON.