(No Model.)

2 Sheets—Sheet 1.

A. PILKINGTON.

METAL TUBE ROLLING MACHINE.

No. 576,822.

Patented Feb. 9, 1897.

FIG 1

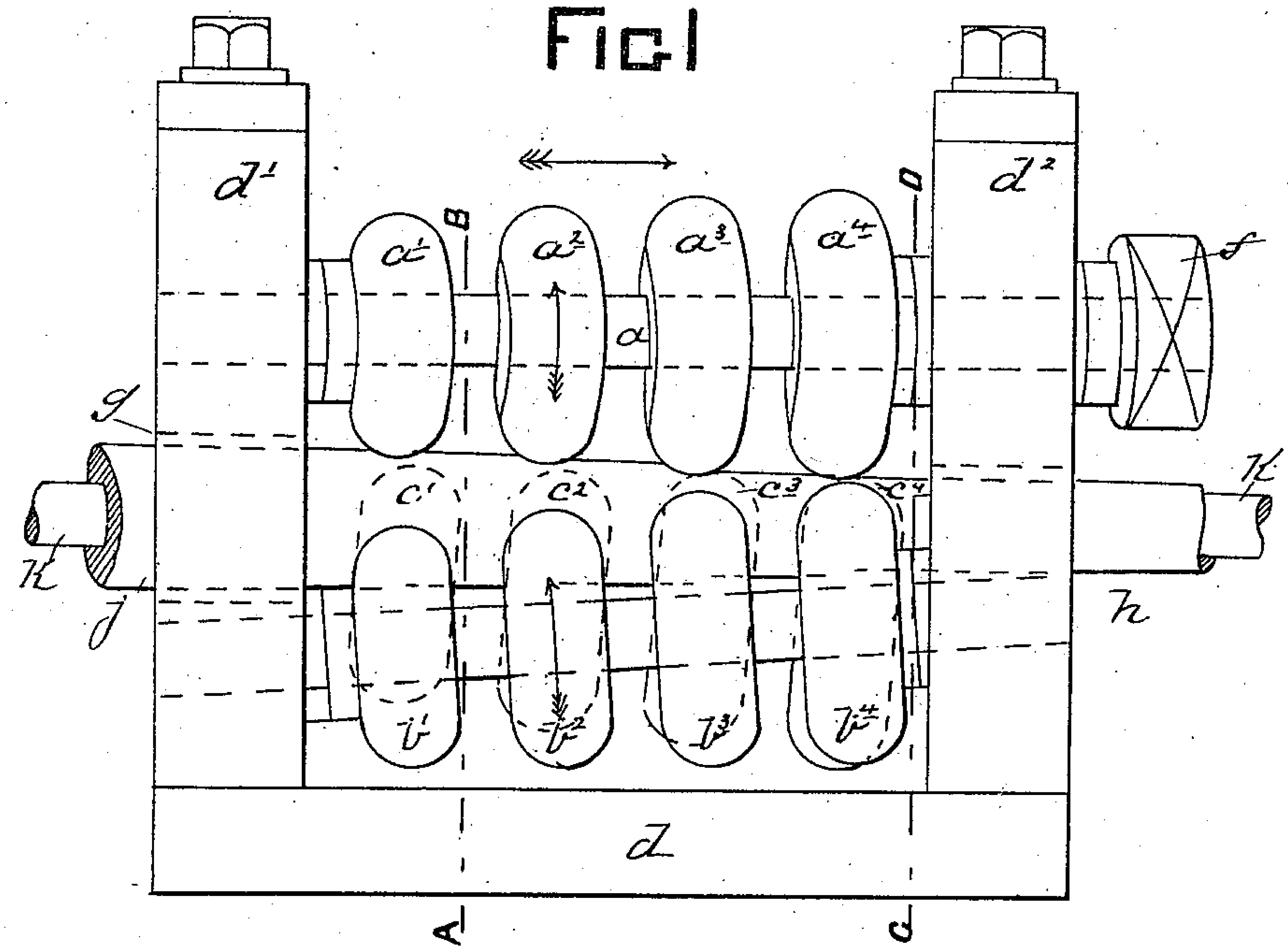
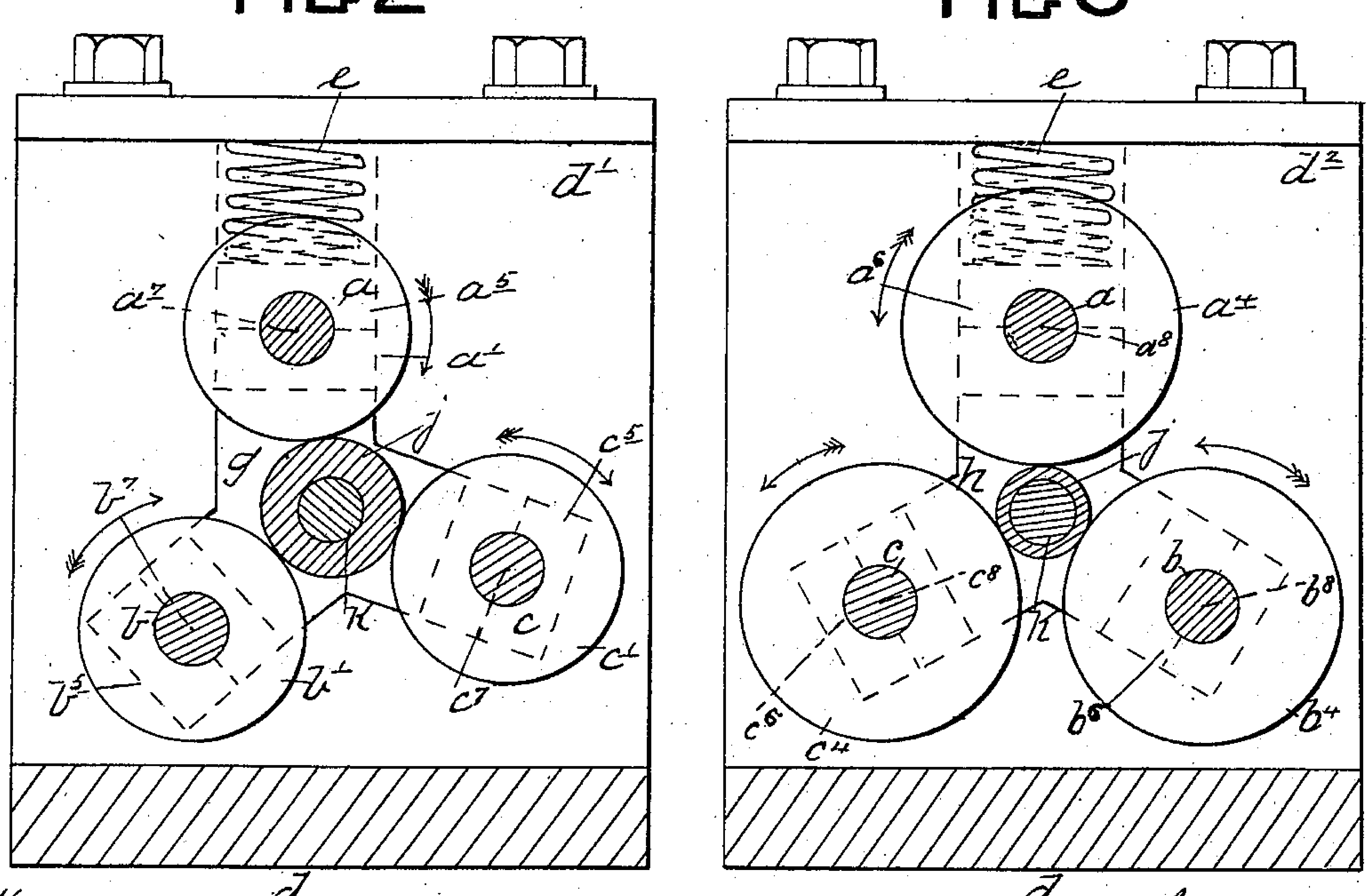


FIG 2

FIG 3



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(No Model.) 2 Sheets—Sheet 2.

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FIG 4

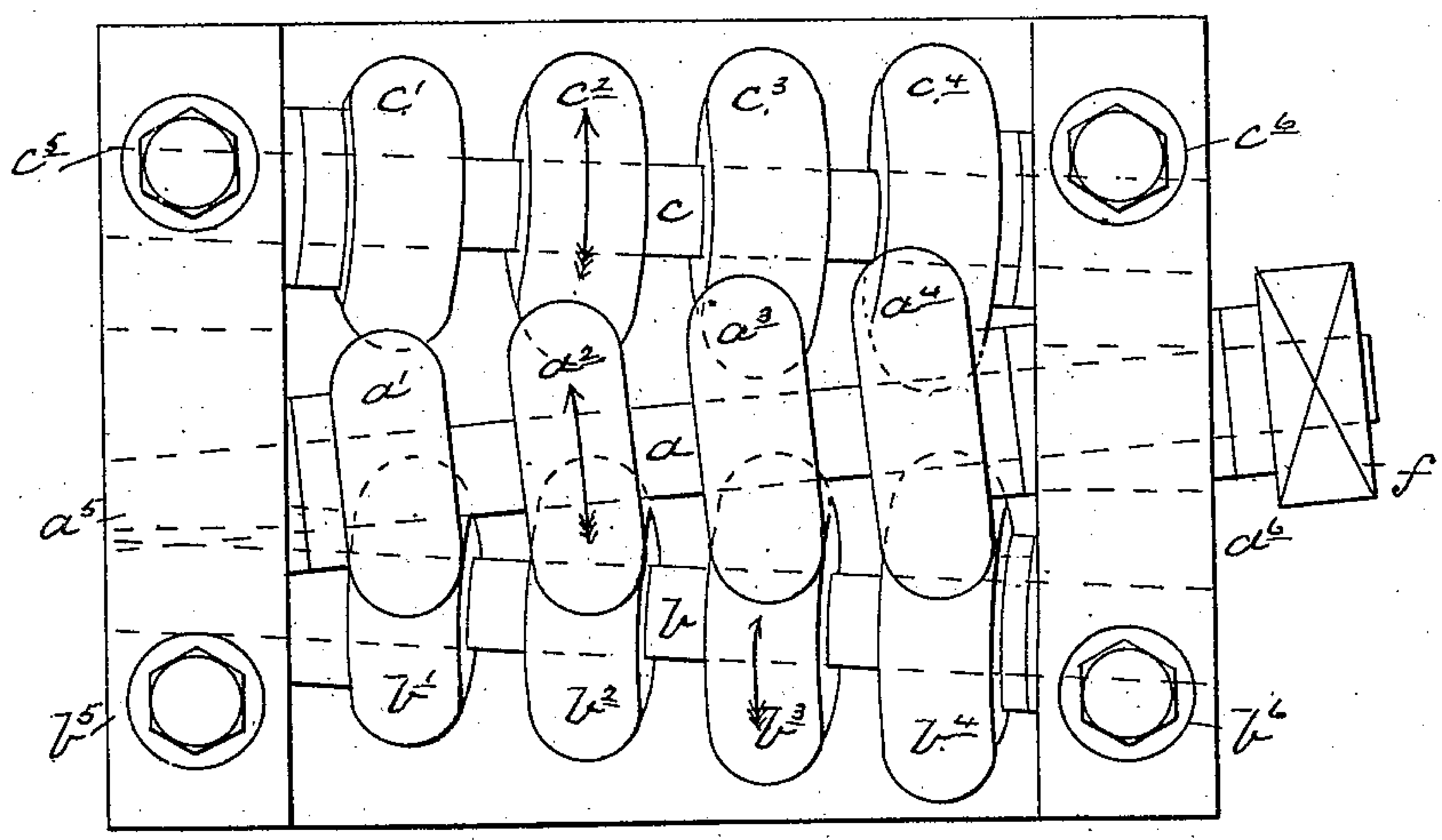


FIG 5

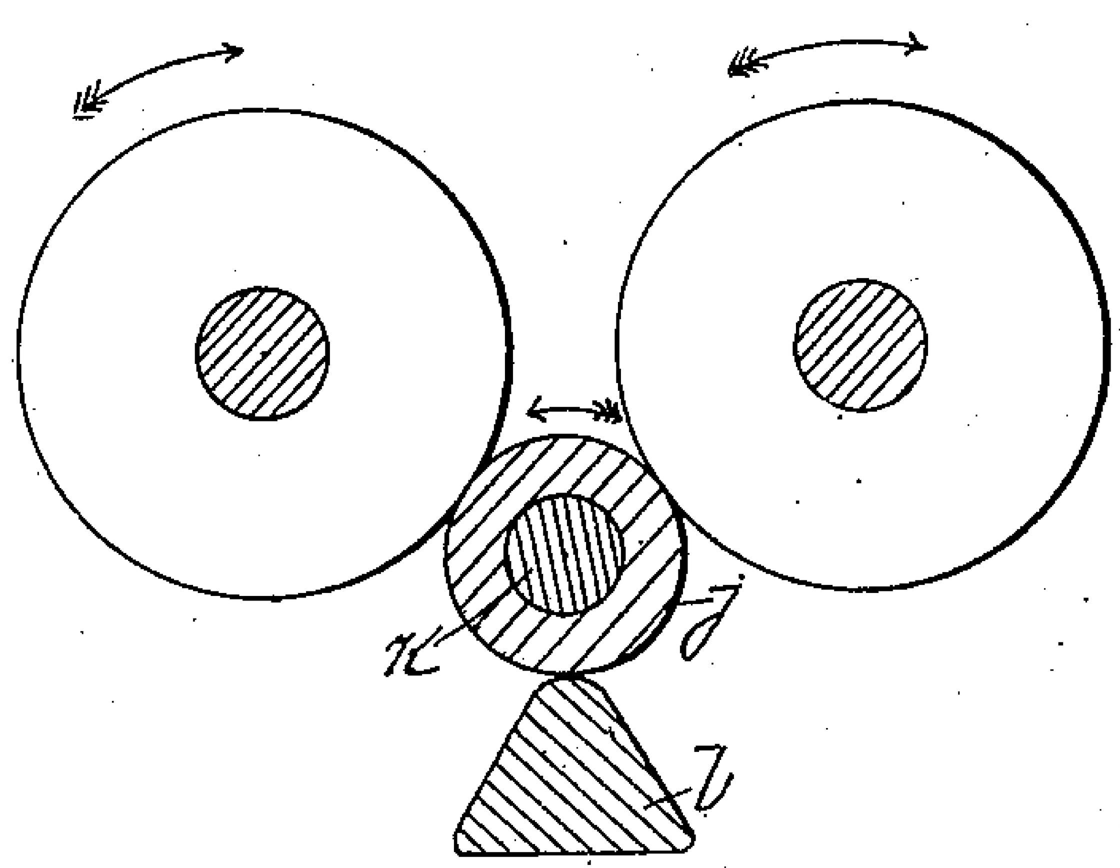
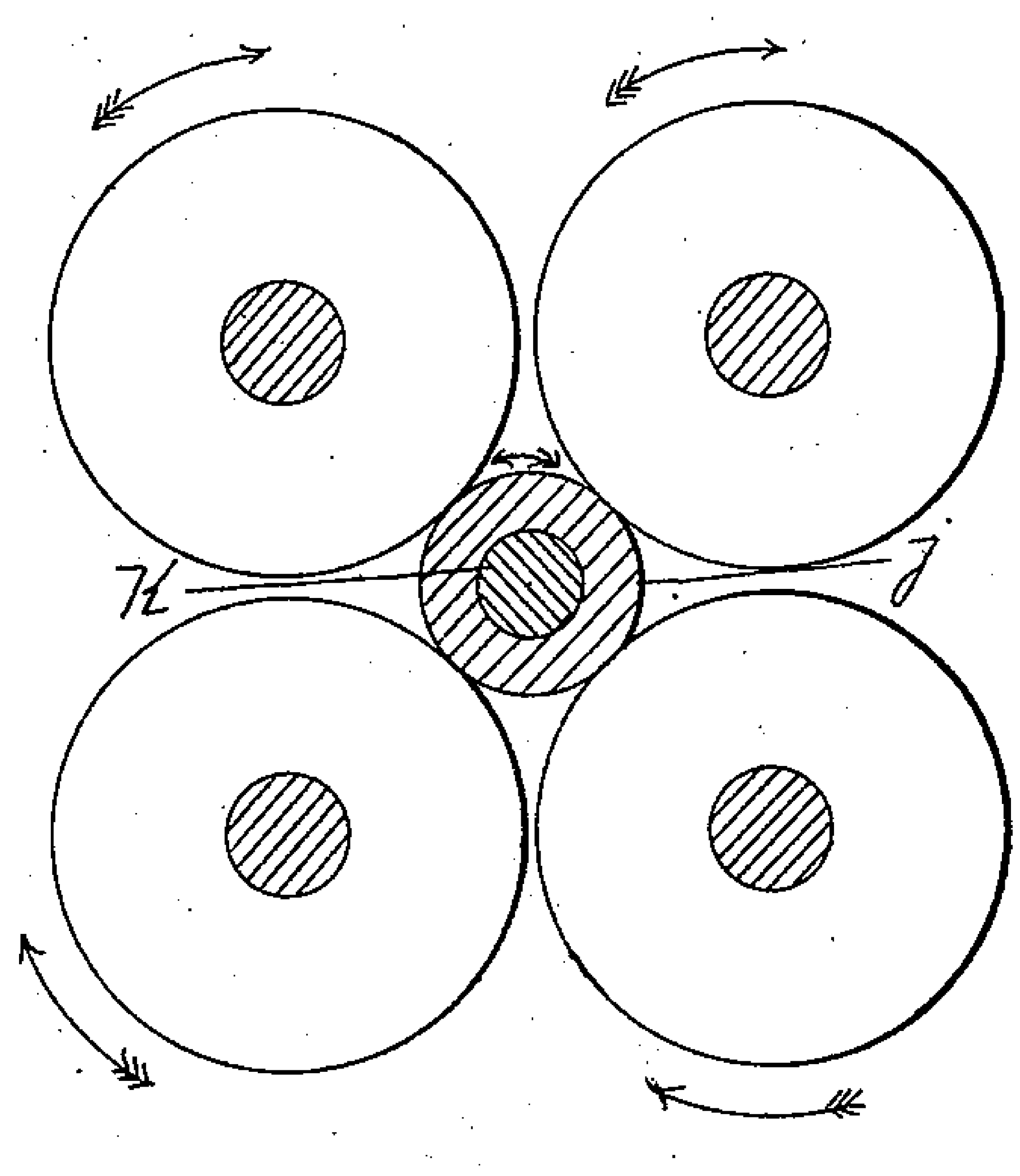


FIG 6



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UNITED STATES PATENT OFFICE.

ARTHUR PILKINGTON, OF BIRMINGHAM, ENGLAND.

METAL-TUBE-ROLLING MACHINE.

SPECIFICATION forming part of Letters Patent No. 576,822, dated February 9, 1897.

Application filed August 25, 1896. Serial No. 603,832. (No model.) Patented in England July 6, 1895, No. 13,092.

To all whom it may concern:

Be it known that I, ARTHUR PILKINGTON, a citizen of England and a subject of Her Britannic Majesty, of Birmingham, England, have invented a new and useful Improvement in or Relating to Machinery Employed in the Manufacture of Metallic Tubes, (for which I have obtained a patent in England, No. 13,092, bearing date July 6, 1895,) of which the following is a full, clear, and exact description, which will enable others skilled in the art to which it appertains to use the same.

My invention has reference to machines used for the purpose of elongating tubes in the process of manufacture, such elongation being accompanied by a reduction or diminution of the gage or thickness of the metal forming the tube.

The manufacture of tubes of the lengths and thickness of metal usually employed is often effected, as is well known, by first making a short thick tube, which is then drawn through a set of suitable dies in a draw-bench and is thus gradually formed into a longer tube having the metal reduced in gage or thickness.

The object of my invention is to effect this increase of length and reduction of gage or thickness of metal in a new and advantageous manner.

In order that this my said invention may be the more readily understood, I will now proceed to describe it with the aid of the accompanying sheet of drawings.

Similar letters of reference denote similar parts in each figure in which they occur.

Figure 1 is a side elevation of a tube-rolling machine constructed according to my invention and in the manner most usual, that is to say, with three roll-spindles. Fig. 2 is a cross-section of the same, taken on the line A B, Fig. 1, looking toward d'. Fig. 3 is a cross-section of the same, taken on line C D, Fig. 1, looking toward d^2. Fig. 4 is a plan of the machine as above. Fig. 5 is a cross-section of a modification of my invention wherein two sets of rolls are employed with one fixed bar. Fig. 6 is a cross-section of another modification of my invention in which four sets of rolls are employed.

a b c, Figs. 1, 2, 3, and 4, are three spindles. Each of these spindles has secured to it or formed in one piece with it a set of rolls, as a' a^2 a^3 a^4, b' b^2 b^3 b^4, c' c^2 c^3 c^4. These rolls are side by side and each roll is preferably of the shape of a thick disk with rounded edge or periphery.

The roll a' is the smallest in diameter of the rolls on the spindle a, and the rolls on this spindle increase in diameter according to their position on the spindle, a^2 being larger than a', a^3 larger than a^2, and a^4 larger than a^3. Similarly b' is the roll smallest in diameter on the spindle b, and b^4 the largest, the diameters of the rolls increasing in the same order as those on the spindle a, and c' is the smallest roll on spindle c, and c^4 the largest on that spindle, the diameters of these rolls also increasing in the same order as those on the spindle a.

The spindles are so placed that their ends carrying the smallest rolls are all at one side of the machine and the ends carrying the largest rolls are all at the other side.

The spindles a b c are mounted in bearings a^5 a^6, b^5 b^6, c^5 c^6. These bearings are carried in openings formed in the framing d of the machine. In the drawings only the bearings of the spindle a are shown adjustable, and the adjustments are elastic and are effected by springs e e, Figs. 2 and 3; but I may vary and make all the bearings adjustable, or so many of them as I wish.

A revolving motion is given to the spindle a by an appropriate wheel (not shown) gearing into the pinion f or in any other well-known manner.

When the machine is in use, the other roll-spindles will be caused to revolve by the friction between the tube being manipulated and the peripheries of the rolls which they carry. I may, however, if desired, drive each spindle in a positive manner.

The bearings of the spindles are placed in the manner shown in the cross-sections, Figs. 2 and 3, where a^7 b^7 c^7 are the centers of the spindles in the bearings carried in the side d' of the machine, Figs. 1 and 4, and a^8 b^8 c^8 are the centers of the spindles in the bearings carried in the side d^2 of the machine. The bearings being placed in this manner, the spindles will be caused to be nearly but not quite (in the same general direction) parallel to each other, as shown in Figs. 1 and 4. The effect of this position of the roll-spindles is that when the spindles are all caused to revolve in the same direction the inner and opposing parts of the peripheries of the rolls form a kind of revolving female screw.

In Fig. 3 it will be seen that the inner and opposing parts of the peripheries of the rolls form a space somewhat triangular or, more properly, trilateral, the sides of this figure being curved. The closer the rolls approach each other the nearer does this space become triangular in shape.

The framing *d* of the machine has a central aperture *g* at the entering side *d'* of the machine and a similar opening *h* at the exit side d^2. The openings to receive the bearings for the rolls are preferably connected with the openings *g* and *h* and are arranged substantially radial to the center line of the work.

The action of a machine constructed according to my invention and as hereinbefore described is as follows: A short thick tube *j* is prepared and placed on a rigid mandrel *k*. The tube must be in a sufficiently plastic condition to be acted on by the machine. It may be cold or hot, according to the nature of the metal of which it is made. The roll-spindle *a* is caused to revolve, and, if necessary, the other spindles are also caused to revolve in the same direction, as shown by the arrows. The tube *j* on its mandrel *k* is then pushed through the opening *g* at the entering side of the machine. It is immediately seized by the revolving rollers *a' b' c'* and receives from them a double motion, one a motion of rotation about its own axis and the other a motion of translation in the direction of the arrow in Fig. 1. Presently the tube meets the second set of rolls a^2 b^2 c^2, which, being larger in diameter than the first set, have less space between them and therefore compel the plastic tube to decrease in outside diameter and to increase in length. The tube being still urged on in the direction of the arrow, Fig. 1, meets, successively, the rolls a^3 b^3 c^3 and a^4 b^4 c^4, and by each of these successively the action of reducing the outside diameter of the tube and increasing its length is repeated. The inner diameter of the tube being invariable, (the tube being supported on a rigid mandrel *k*,) the effect of the reduction of the outer diameter of the tube will be to reduce the thickness or gage of the metal of which the tube is formed. When the tube emerges from the last set of rolls a^4 b^4 c^4, it passes out of the machine through the opening *h*.

The number of rolls on the spindles is immaterial. Four are shown on the drawings for convenience.

In the modification of my invention shown in cross-section in Fig. 5 I employ only two spindles, set in the manner hereinbefore described. Rolls are mounted on these spindles, but the place of the third set of rolls is taken by the fixed bar *l*, along which the tube slides during the process of manufacture. The mounting and driving of the spindles is similar to that hereinbefore described as for three spindles.

In the modification of my invention shown in cross-section, Fig. 6, I employ four sets of rolls. The space between their opposing peripheries is in this case quadrangular, or, more properly, quadrilateral, the sides being curved. The mounting and driving of the spindles is similar to that hereinbefore described.

Whether in the primary form of my invention or in any of its modifications the inner and opposing peripheries of sets of rolls, mounted on spindles nearly but not quite parallel, as hereinbefore described, will when caused to revolve in the same direction as each other form a species of revolving female screw, through which the tube is drawn in a direction which is the mean direction of the axes of the spindles. The rolls being of gradually-increasing size, the space between their peripheries will become smaller, and thereby the outer diameter of the tube will be diminished and the length of the tube increased.

The place of one or more sets of rolls may be taken under certain conditions by a fixed bar or guide.

I do not limit myself to the number or exact position of spindles or to the number and shape of the rolls shown in Figs. 1, 2, 3, 4, and 6 nor to the number or section of the bar shown in Fig. 5; nor do I limit myself to the configuration of the bearings or to the manner of their adjustment or to the configuration of the framing of the machine.

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. In a tube-rolling mill, the combination, with three roll-shafts *a*, *b* and *c* arranged in spiral form about and inclined with respect to the axis of the work, each said shaft being provided with a similar series of disks increasing step by step in diameter; of a frame provided with rigid bearings for the two lower roll-shafts *b* and *c* and openings arranged between the shafts for the entrance and exit of the work, slidable bearings for the upper roll-shaft *a*, springs pressing said slidable bearings toward the work, and a driving device secured on the end of the shaft *a* outside the frame, substantially as set forth.

2. In a tube-rolling mill, the combination, with three roll-shafts *a*, *b* and *c* arranged in spiral form about and inclined with respect to the axis of the work; of bearings for the ends of the roll-shafts to run in, a frame provided with openings for the entrance and exit of the work, and substantially radial openings, for receiving the said bearings, connected with the aforesaid openings; and springs pressing the bearings of the driving-roll toward the work, substantially as set forth.

ARTHUR PILKINGTON.

Witnesses:

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