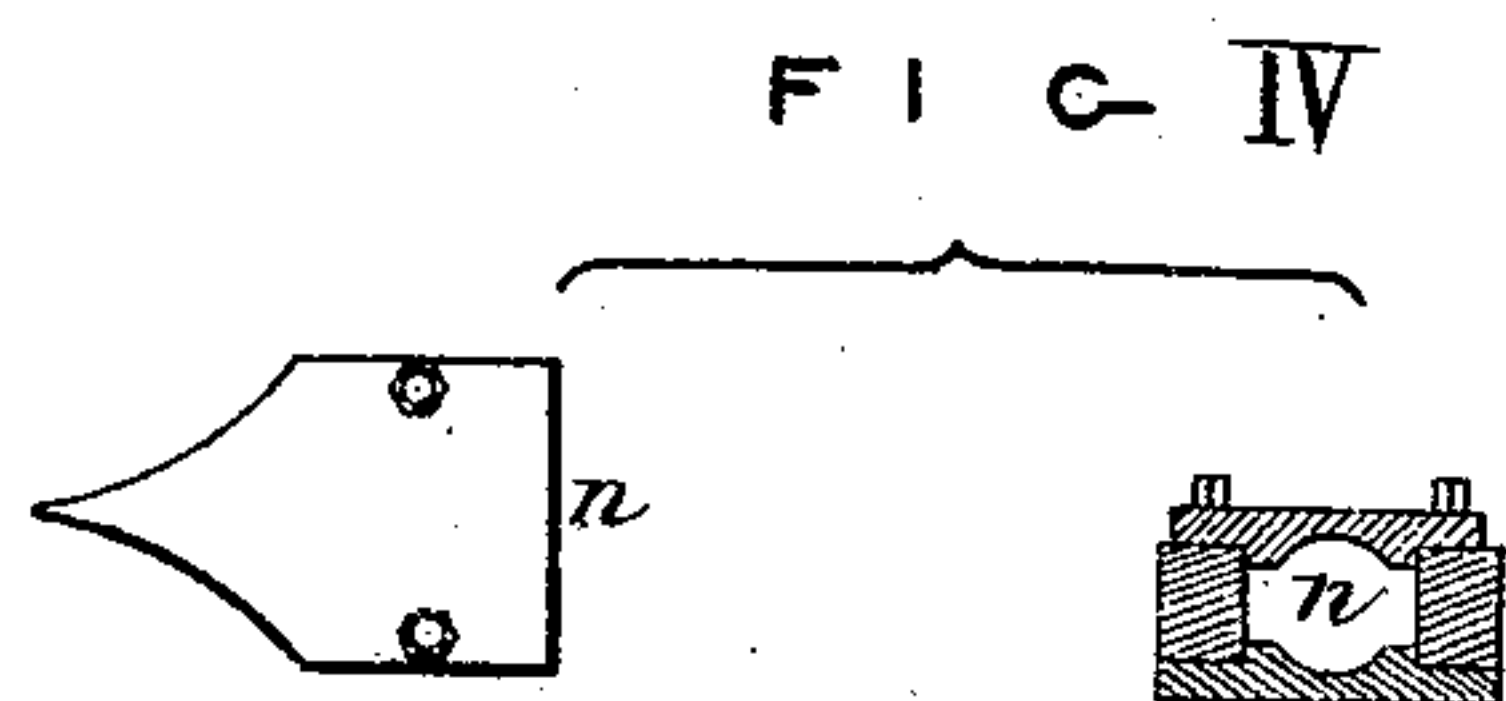
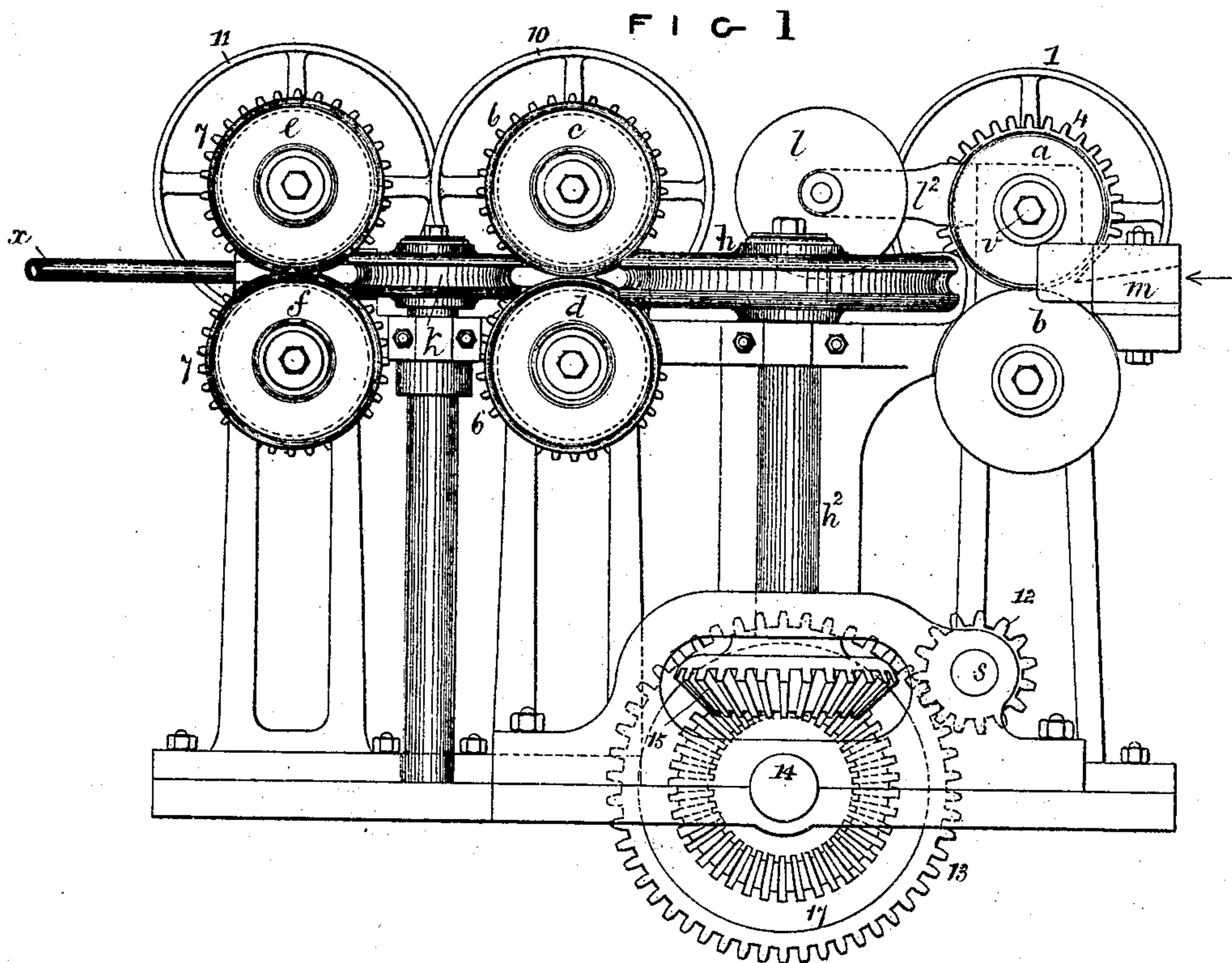


J. HUGGINS.
Machines for Making Metallic Tubing.
 No. 145,421. Patented Dec. 9, 1873.



Witnesses,
 George Shaw
 Richard Bennett

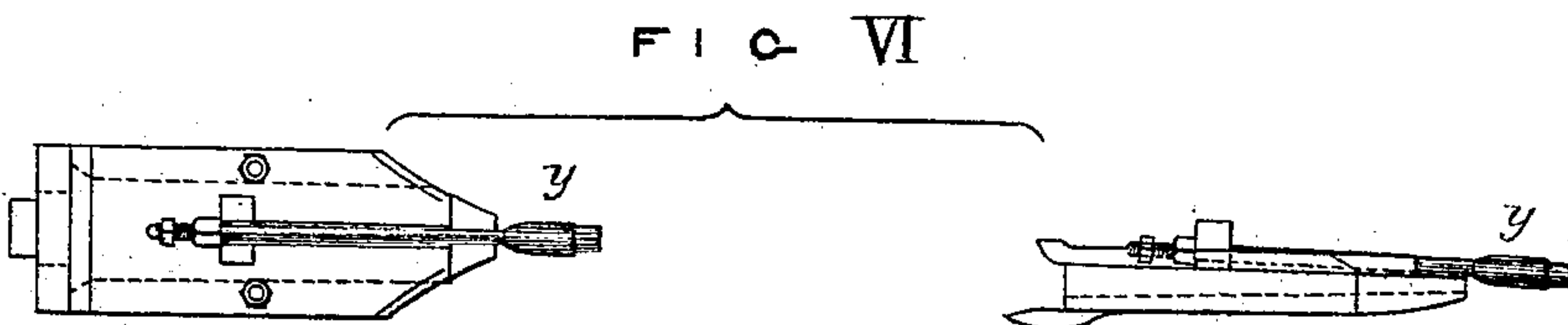
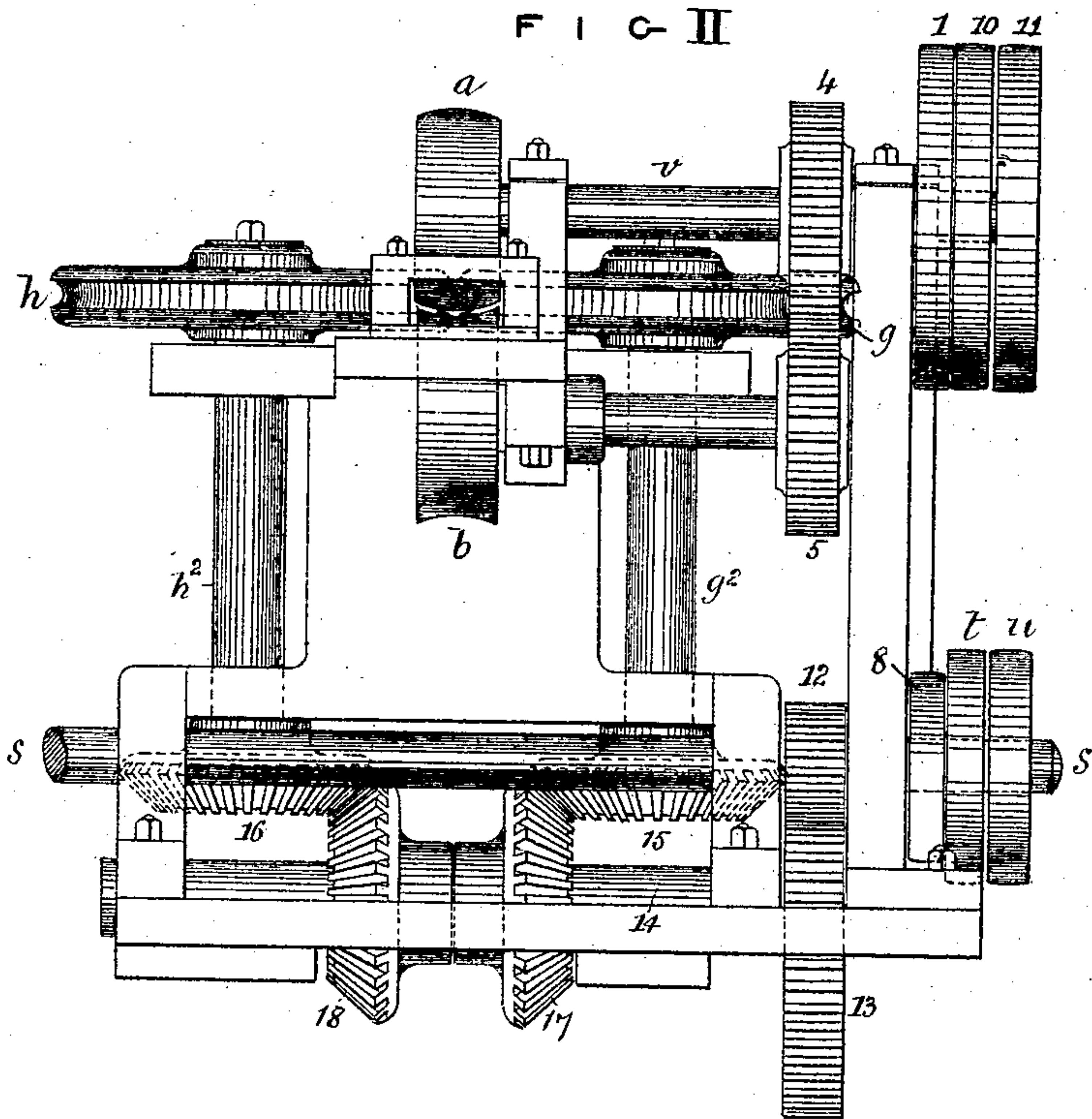
Inventor
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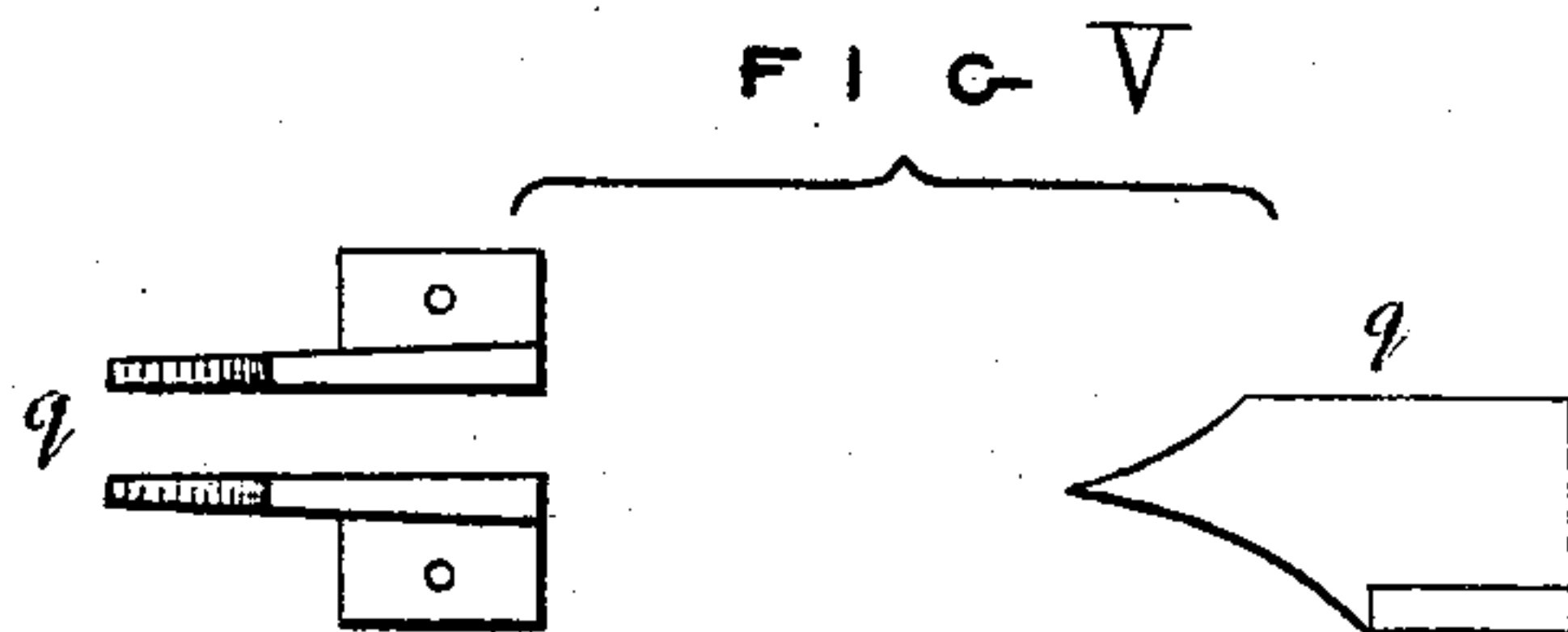
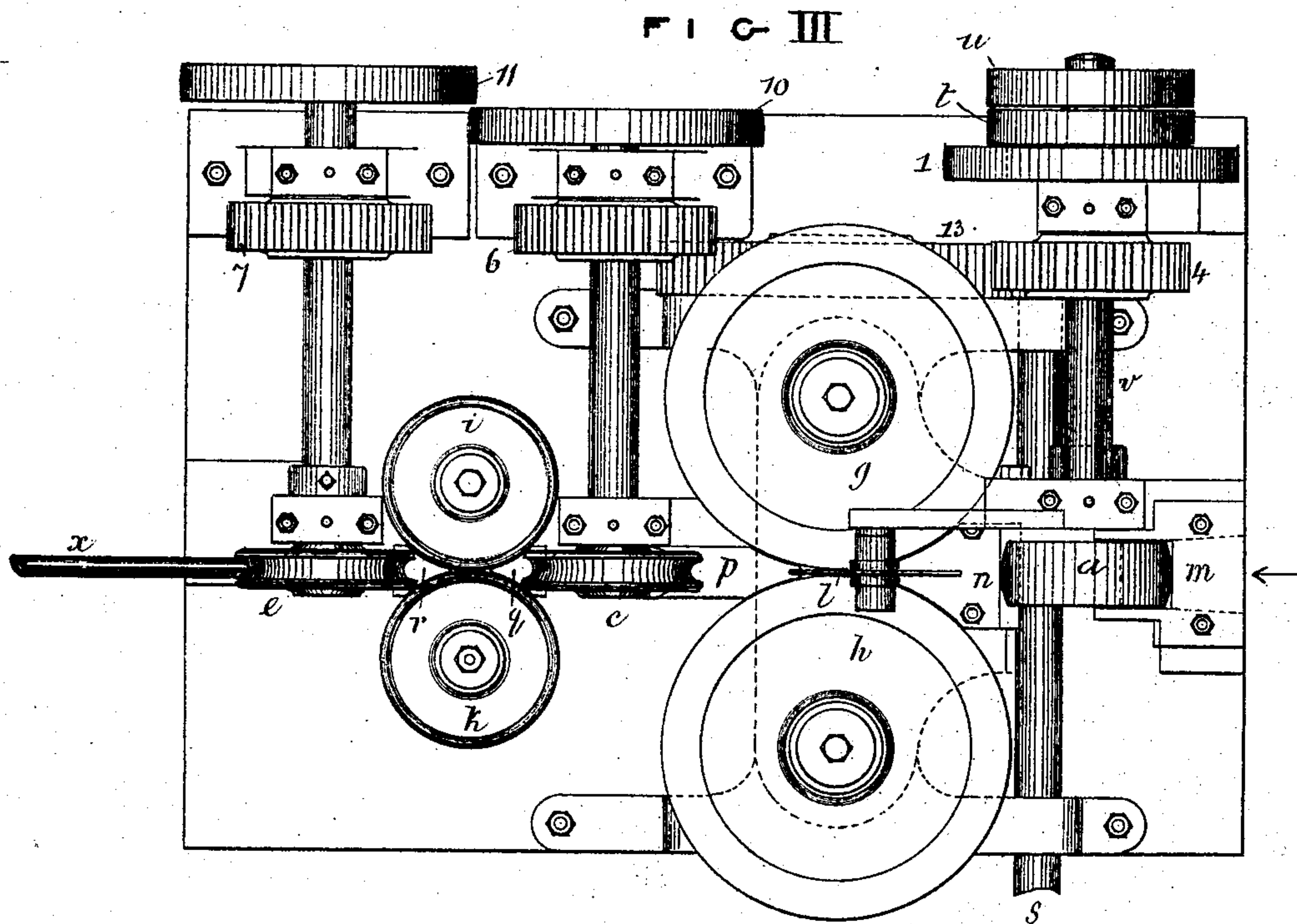
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UNITED STATES PATENT OFFICE.

JOHN HUGGINS, OF BIRMINGHAM, ENGLAND.

IMPROVEMENT IN MACHINES FOR MAKING METALLIC TUBING.

Specification forming part of Letters Patent No. **145,421**, dated December 9, 1873; application filed July 5, 1873.

To all whom it may concern:

Be it known that I, JOHN HUGGINS, of Birmingham, in the county of Warwick, England, tube-manufacturer and machinist, have invented Improvements in Machinery for the Manufacture of Metallic Tubes, of which the following is a specification:

My invention consists of machinery for the manufacture of open-jointed tubes of various metals and alloys, and of welded tubes of iron or steel, the parts of the said machinery being constructed, combined, and used substantially as hereinafter described, and illustrated in the accompanying drawings. The said machinery consists, essentially, of two series of pairs of vertical and horizontal shaping or bending and welding rolls, through which the strip is passed in succession, and gradually bent into an open-jointed tube, or bent or shaped into a tube and its edges welded, the strip and partially-made tube being guided by suitable guides to the rolls.

Figure 1 represents a side elevation, Fig. 2 an end elevation, and Fig. 3 a plan, of machinery constructed according to my invention, for the manufacture of tubes. Figs. 4, 5, and 6 represent details of the machine, as hereinafter explained.

The same letters of reference indicate the same parts.

The said machinery consists of a series of pairs of vertical rolls, marked, respectively, *a b*, *c d*, and *e f*, and a series of pairs of horizontal rolls, marked, respectively, *g h* and *i k*, the pairs of horizontal rolls alternating with the pairs of vertical rolls, in the manner represented. The first pair of vertical bending-rolls, *a b*, consists of an upper roll having a convex periphery, and of a lower roll having a corresponding concave periphery, as best seen in the end elevation, Fig. 2, the distance between the peripheries of the said rolls being a little greater than the thickness of the strip to be bent. The second and third pairs of vertical bending or shaping rolls *c d* and *e f* are grooved rolls, the grooves in the said rolls having a semicircular figure. The two pairs of horizontal bending or shaping rolls *g h* and *i k* have grooves in their peripheries of a semicircular figure; but the rolls of the first pair of horizontal rolls *g h*, are so adjusted

that their peripheries nearly meet, (see Fig. 2,) while the peripheries of the second pair of horizontal rolls *i k* meet, and form between them a nearly cylindrical groove. The first pair of horizontal rolls *g h* are of larger diameter than the second pair *i k*. The rolls *g h* are driven by gearing, in the manner hereinafter described; but the other rolls, *i k*, have motion communicated to them by the friction of the partially-made tube passing between them. Situated in the axis of the machine is a vertical disk or guide, *l*, by means of which the edges of the tube (when open-jointed tubes are being made) are prevented from being closed by the action of the rolls, and the open joint is preserved straight. This disk or guide *l* is carried by the bracket *l'*, fixed to the framing of the machine. In front of the first pair of bending-rolls *a b* is a guide, *m*, through which the flat strip is passed to the rolls *a b*; and in front of the first pair of horizontal rolls *g h* is a guide, *n*, by which the bent strip issuing from the rolls *a b* is conducted between the grooves of the said rolls *g h*. This guide *n* is shown separately in plan and cross-section in Fig. 4. In front of the pair of vertical rolls *c d* is a guide, *p*, similar to the guide *n*, and in front of the pairs of rolls *i k* and *e f* are vertical guides *q r*, by means of which the lateral spreading of the partially-made tube is prevented as it issues from the said rolls *i k* and *e f*. One pair of the guides, marked *q*, is represented detached, in Fig. 5.

The rolls are driven in the following manner: *s* is the driving-shaft, having on its end the three driving-pulleys *8 t u*. Above the shaft *s* is a parallel shaft, *v*, having on one end the driving-pulley 1, and on its other end the upper roll *a* of the first pair of rolls *a b*. The shafts of the rolls *a b* are geared together by the toothed wheels 4 5, and the shafts of the other pairs of vertical rolls are similarly geared together by toothed wheels 6 6 and 7 7. Motion is transmitted from the driving-shaft *s* to the shaft *v* of the upper roll *a* by a band passing over the pulleys 1 and 8 on the said shafts. The shaft of the upper roll *c* of the pair of rolls *c d* is driven by a band passing over the pulleys *t* and 10, and the shaft of the upper roll *e* of the pair of rolls *e f* is driven by a band passing over the pulleys

u and 11. The first pair of horizontal rolls *g h* is driven from the driving-shaft *s* by the pinion 12, gearing with the toothed wheel 13 on the shaft 14. This shaft 14 carries bevel-toothed wheels 17 and 18, which respectively gear with bevel-toothed wheels 15 and 16 on the bottoms of the shafts $g^2 h^2$ of the said rolls *g h*, as will be understood by an examination of Figs. 1 and 2.

Although I have only represented an arrangement of three pairs of vertical rolls and two pairs of horizontal rolls, yet a greater number of rolls than those represented may be employed.

In making an open-jointed tube of iron by the use of the machinery described and represented, the process is conducted as follows: In front of the machine a horizontal table is supported, (not shown in the drawings,) and in proximity to the said table the muffle used for heating the strips is situated. The strip of iron, properly heated, is passed through the guide *m*, and its end presented to the peripheries of the first shaping or bending rolls, *a b*. By the action of the said rolls *a b* the heated strip is seized and carried through them, and a trough form given to the strip. As the trough-shaped strip leaves the rolls *a b* it passes through the tubular guide *n*, by which its proper position is preserved. The strip issuing from the guide *n* is presented to the first pair of horizontal rolls, *g h*, by which it is seized and carried through them, and the partially-made tube further bent, the disk or vertical guide *l* being situated between the edges of the partially-made tube. It next passes through the guide *p* and rolls *c d*, and is thereby further shaped. It is then carried in succession through the guide *q*, rolls *i k*, guide *r*, and finishing-rolls *e f*, by the action of which the form of the partially-made tube is perfected, the finished tube *x*, on leaving the rolls *e f*, being received on a table (not represented) behind the said rolls *e f*. By the operation of the rolls *g h*, the bent strip has a nearly elliptical figure in cross-section given to it, the longer diameter of the ellipse being vertical. In passing between the rolls *c d*, the roughly-made tube is compressed vertically, and passes from the rolls, having an elliptical figure in cross-section, the longer diameter of the ellipse being horizontal. By the action of the rolls *i k*, the tube is further compressed, and re-

ceives an elliptical figure, the longer diameter being vertical. By the action of the last pair of rolls, *e f*, a truly cylindrical figure is given to the tube. In this way the heated strip of iron introduced into the machine is converted into an open-jointed tube, the straightness of the open joint being preserved by the disk or guide *l*.

When welded tubes of iron or steel are to be manufactured by the machine, I remove the disk or guide *l*, and fix between the grooves of the horizontal rolls *g h* a plug, *y*. (Represented separately in plan and side elevation in Fig. 6.) By means of the said plug *y*, internal support is given to the partially-made tube as it passes through the rolls *g h*. In making welded tubes, the strip is heated to a welding-heat, and passed through the machine in the manner described with respect to the manufacture of an open-jointed tube, excepting that the edges of the tube are brought together, and welded by the action of the rolls *g h*, the figure of the tube being perfected and the welding consolidated by the succeeding pairs of rolls.

Besides open-jointed tubes made of iron or steel, my invention is applicable to the making of open-jointed tubes of copper, brass, and zinc.

Having now described the nature of my invention, and the manner in which the same is to be performed, I wish it to be understood that I do not limit myself to the precise details herein described and illustrated, as the same may be varied without departing from the nature of my invention; but

I claim as my invention—

The combination of alternate pairs of vertical and horizontal forming or shaping and welding rolls and guides, for conducting the strip and partially-made tube to the successive pairs of rolls, said parts being constructed and arranged to operate as herein shown and described, so that the partially-formed tube shall be compressed into an elliptical form in cross-section, the longer axis of the ellipse being alternately vertical and horizontal, until said tube is made cylindrical in the last or finishing rolls.

JOHN HUGGINS. [L. S.]

Witnesses:

GEORGE SHAW,

RICHARD SKERRETT,

Of 37 Temple street, Birmingham.