No. 608,287. Patented Aug. 2, 1898.

J. G. HODGSON.

AUTOMATIC SHEET METAL ROLLING MILL.

(Application filed Aug. 2, 1897.)

(No Model.) 5 Sheets—Sheet 1.

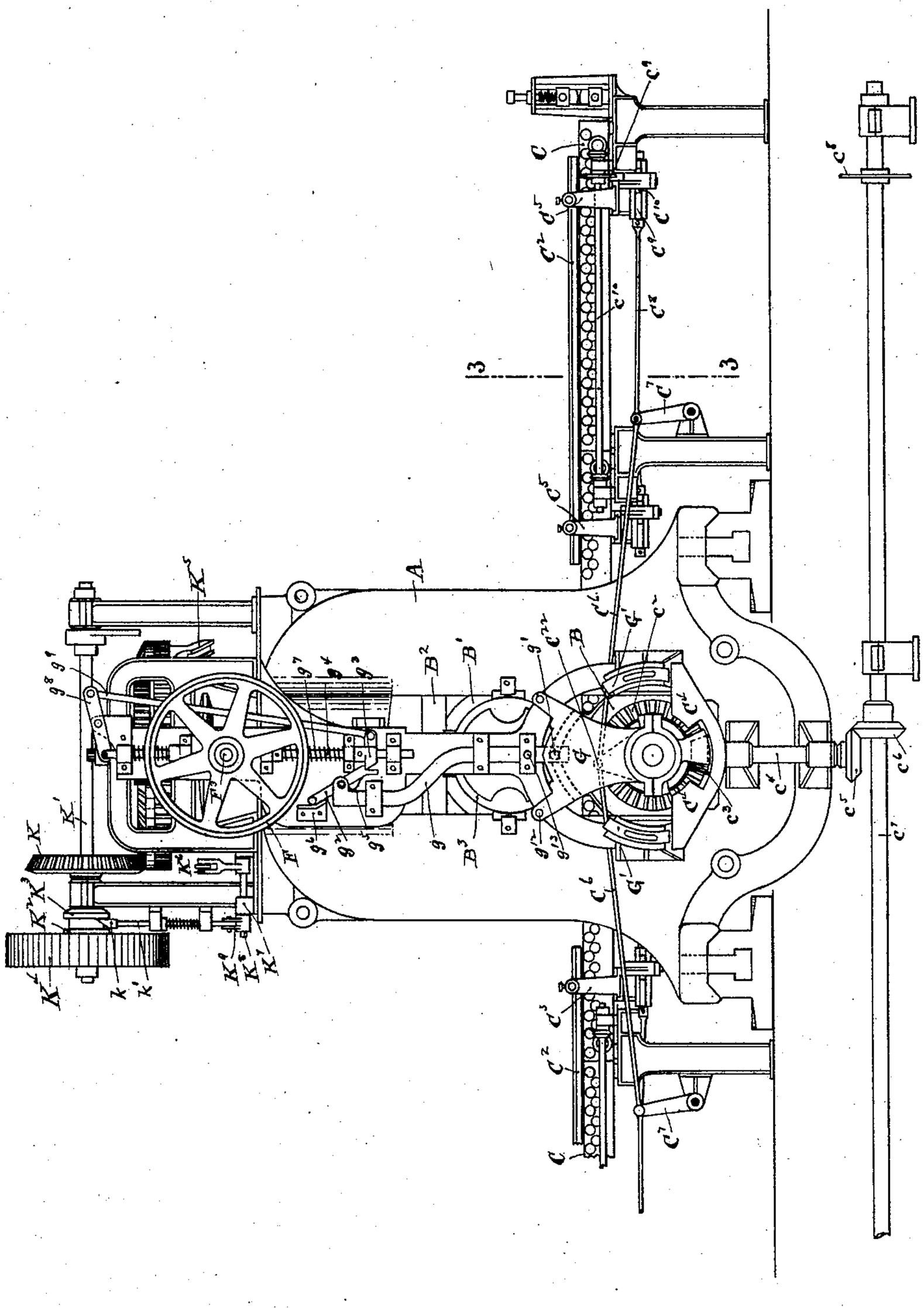

Fig 1

Witnesses:
W. S. Weston
A. W. Munday.

Inventor:
John G. Hodgson.
By Munday, Evarts & Adcock
his Attys.

No. 608,287. Patented Aug. 2, 1898.

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(No Model.) 5 Sheets—Sheet 2.

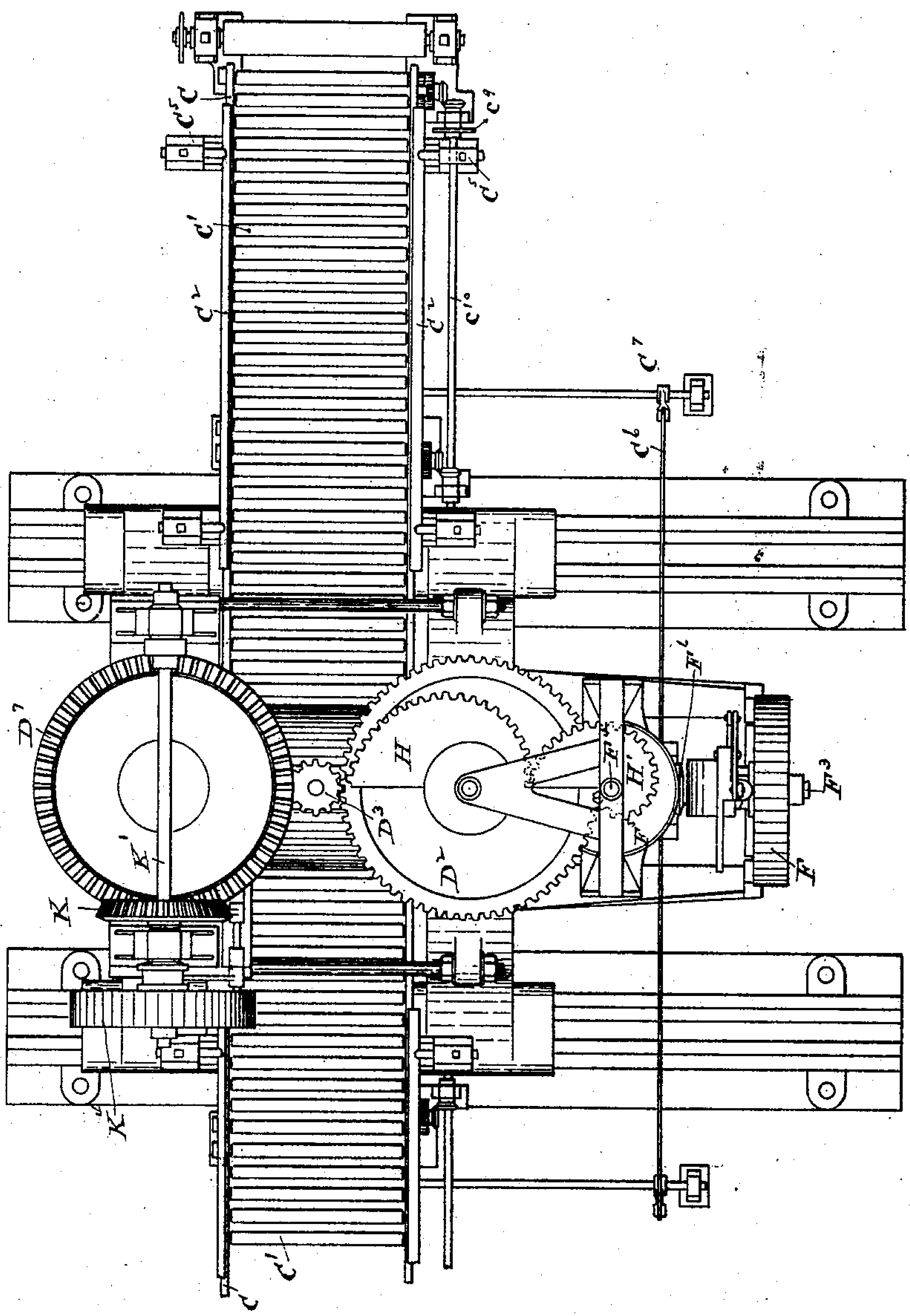

Fig. 2

Witnesses:
W. S. Weston
A. W. Munday.

Inventor:
John G. Hodgson.
By Munday, Evarts & Adcock.
his attys.

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(No Model.) 5 Sheets—Sheet 3.

Fig 3

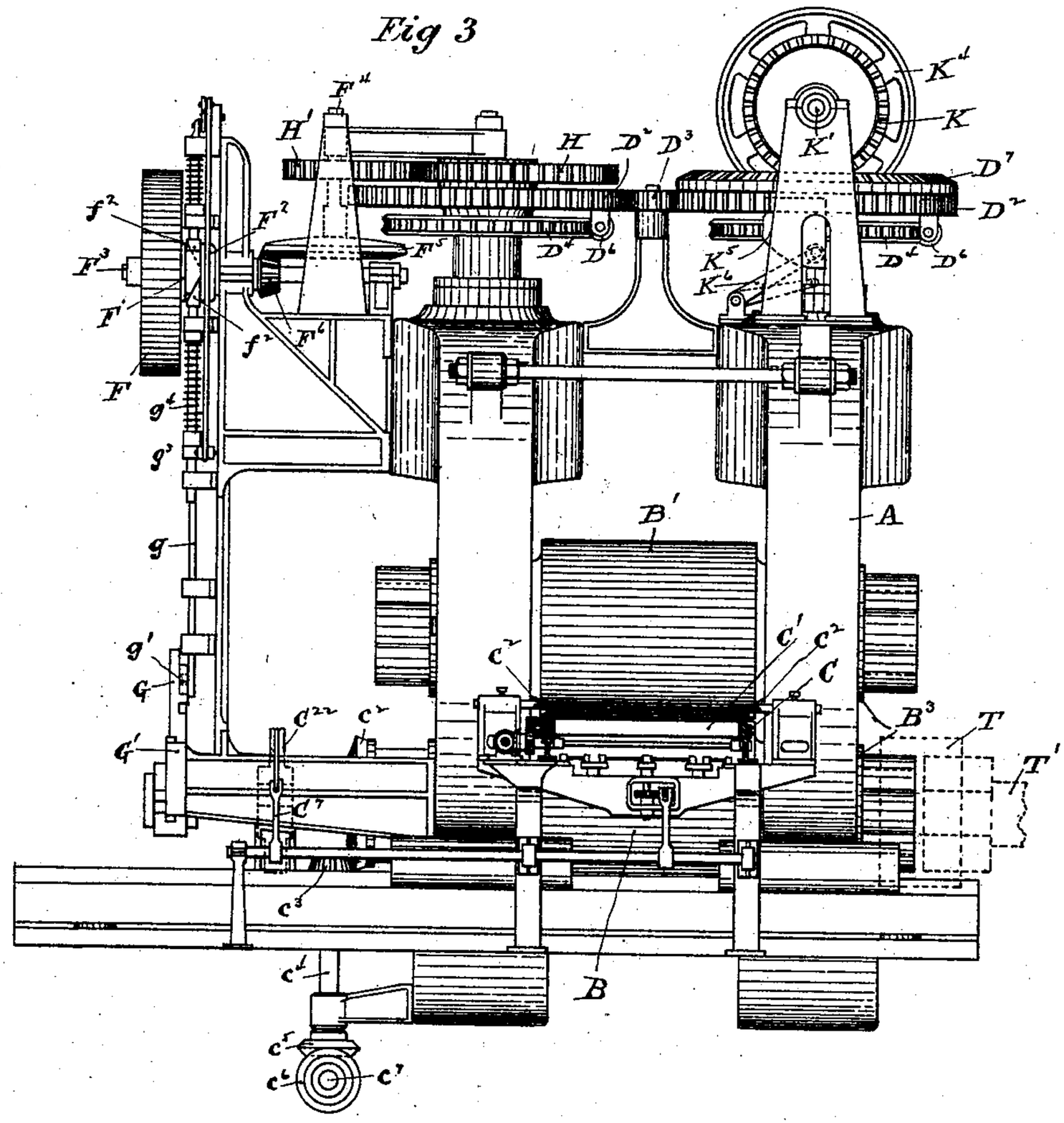


Fig. 5

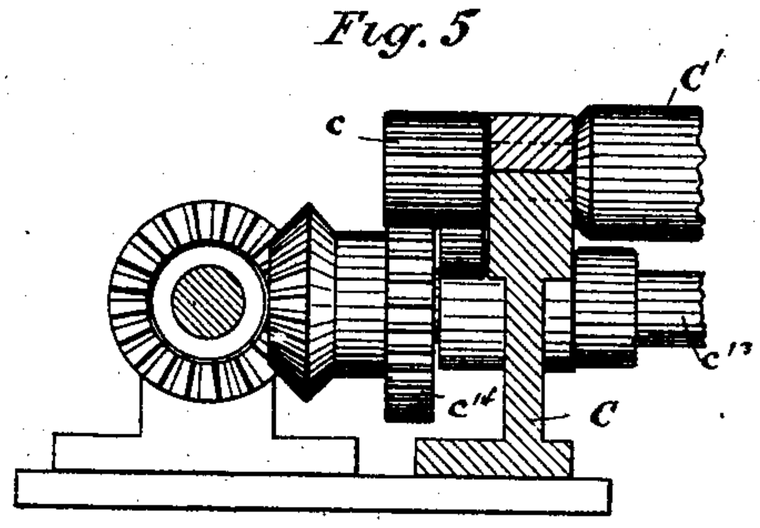
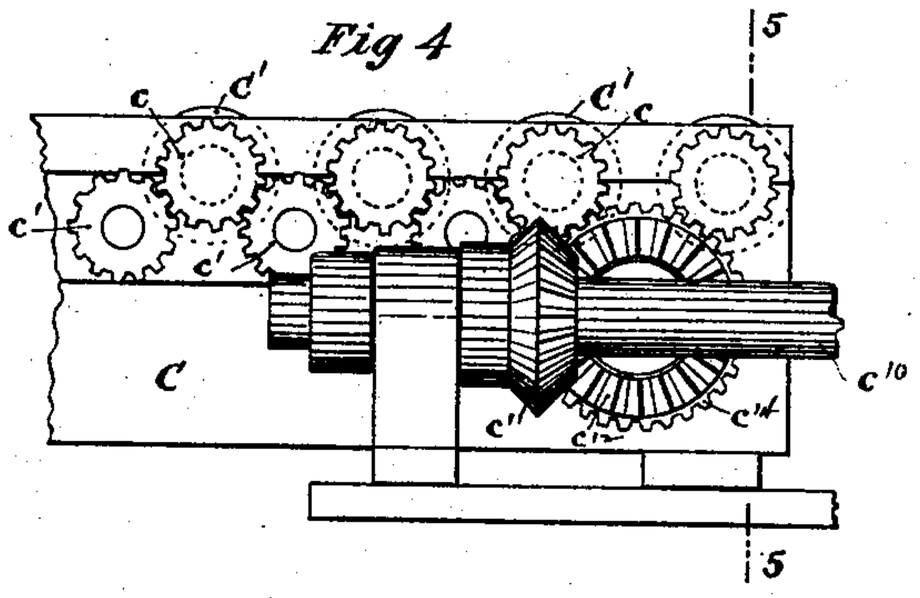


Fig 4



Witnesses:
W. S. Weston
A. W. Munday

Inventor:
John G. Hodgson.
By Munday Evarts & Adcock
his attys.

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J. G. HODGSON.

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(No Model.) 5 Sheets—Sheet 4.

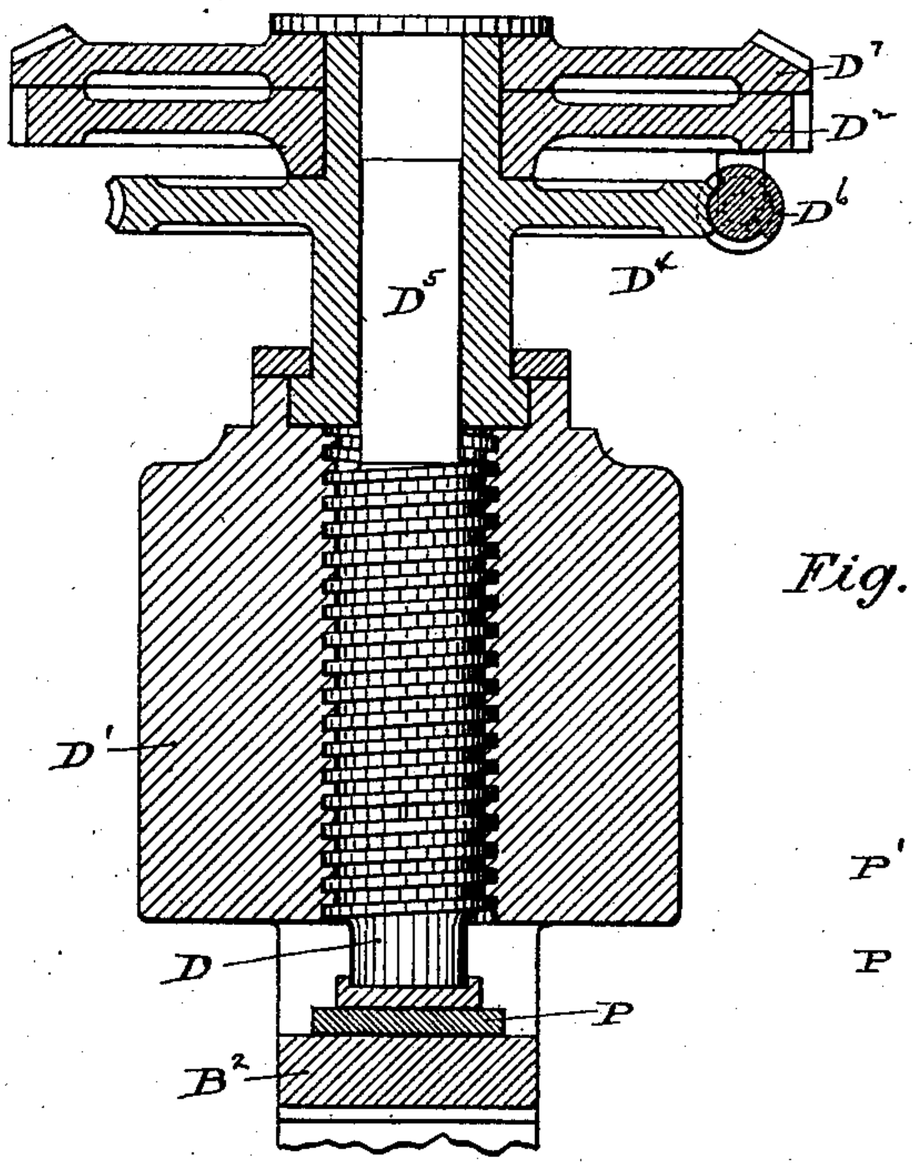

Fig. 6

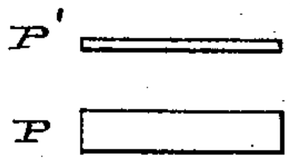

Fig. 11

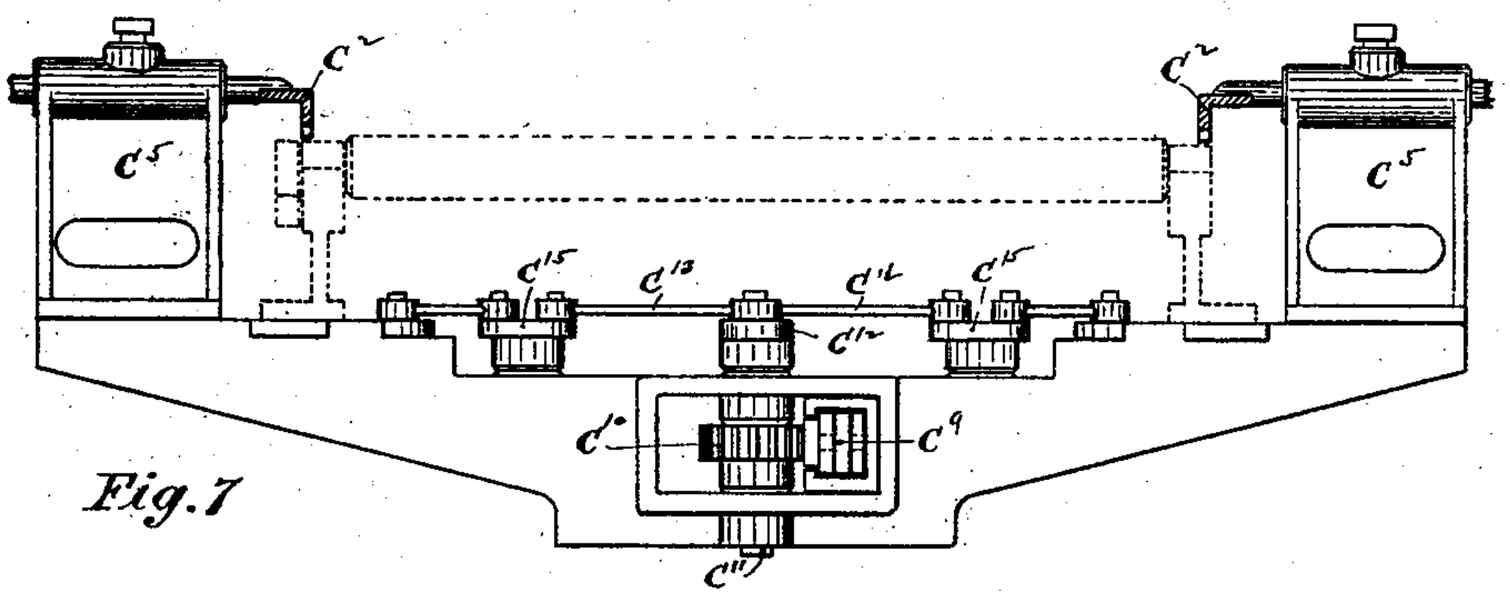

Fig. 7

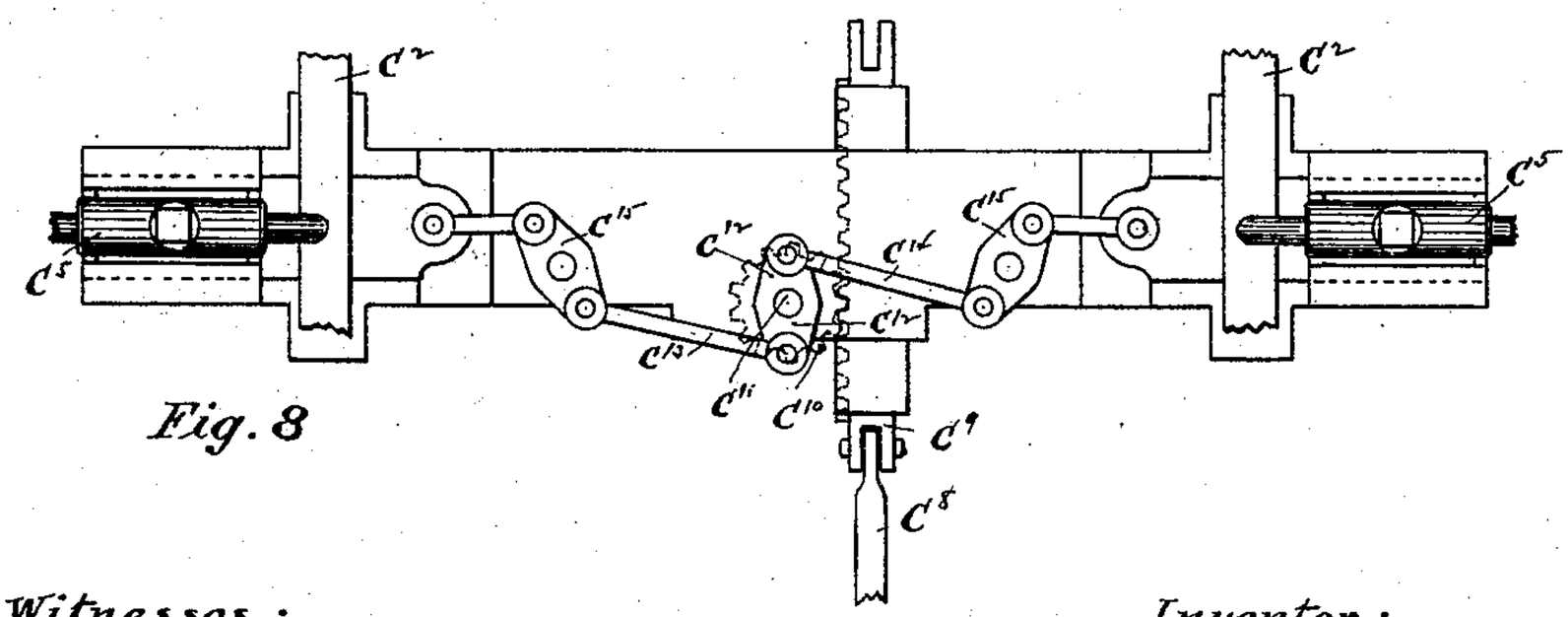

Fig. 8

Witnesses:
W. S. Weston
H. W. Munday,

Inventor:
John G. Hodgson
By Munday, Evarts & Adcock
His attys.

No. 608,287. **Patented Aug. 2, 1898.**

J. G. HODGSON.

AUTOMATIC SHEET METAL ROLLING MILL.

(Application filed Aug. 2, 1897.)

(No Model.) 5 Sheets—Sheet 5.

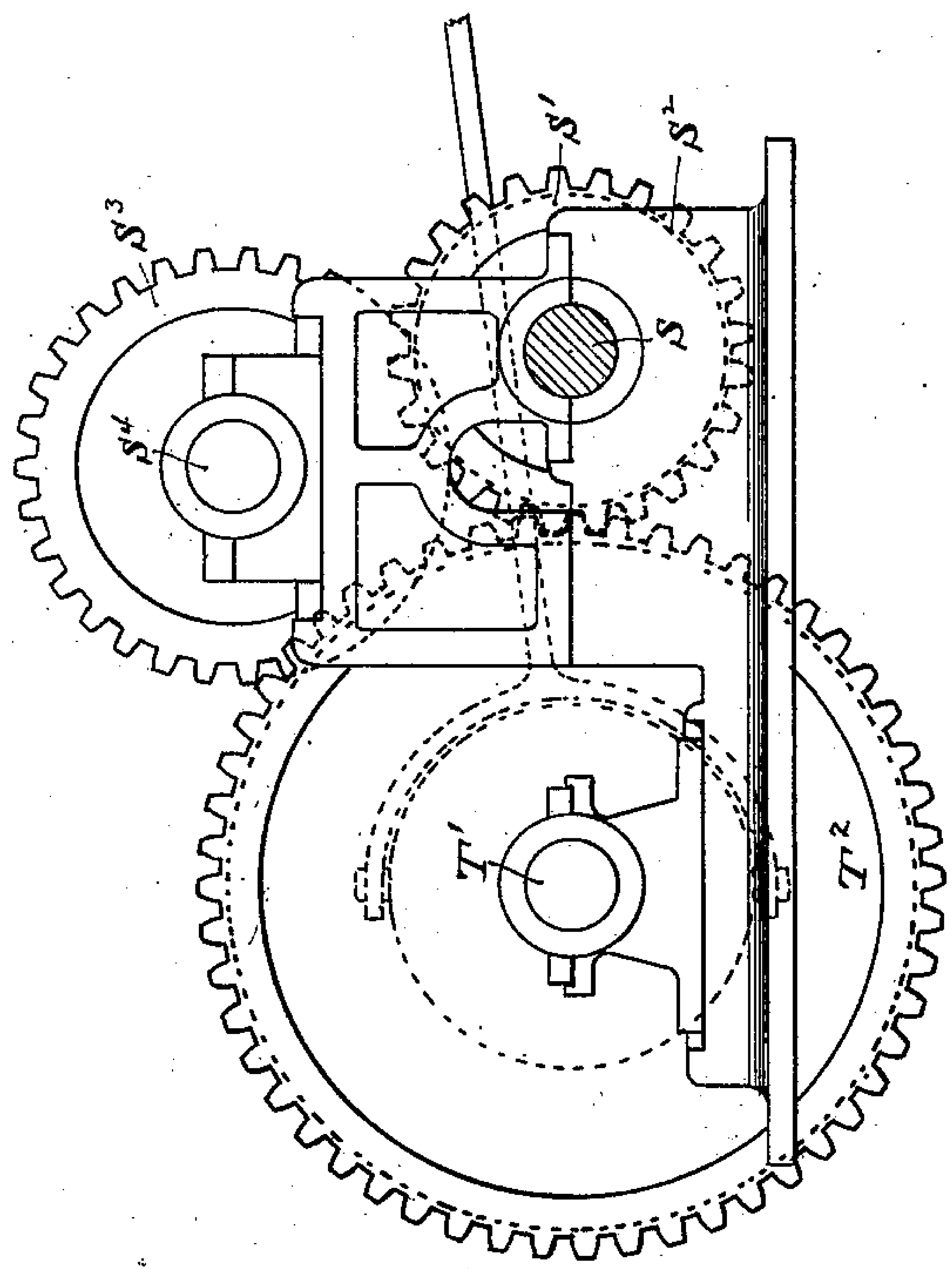

Fig. 10

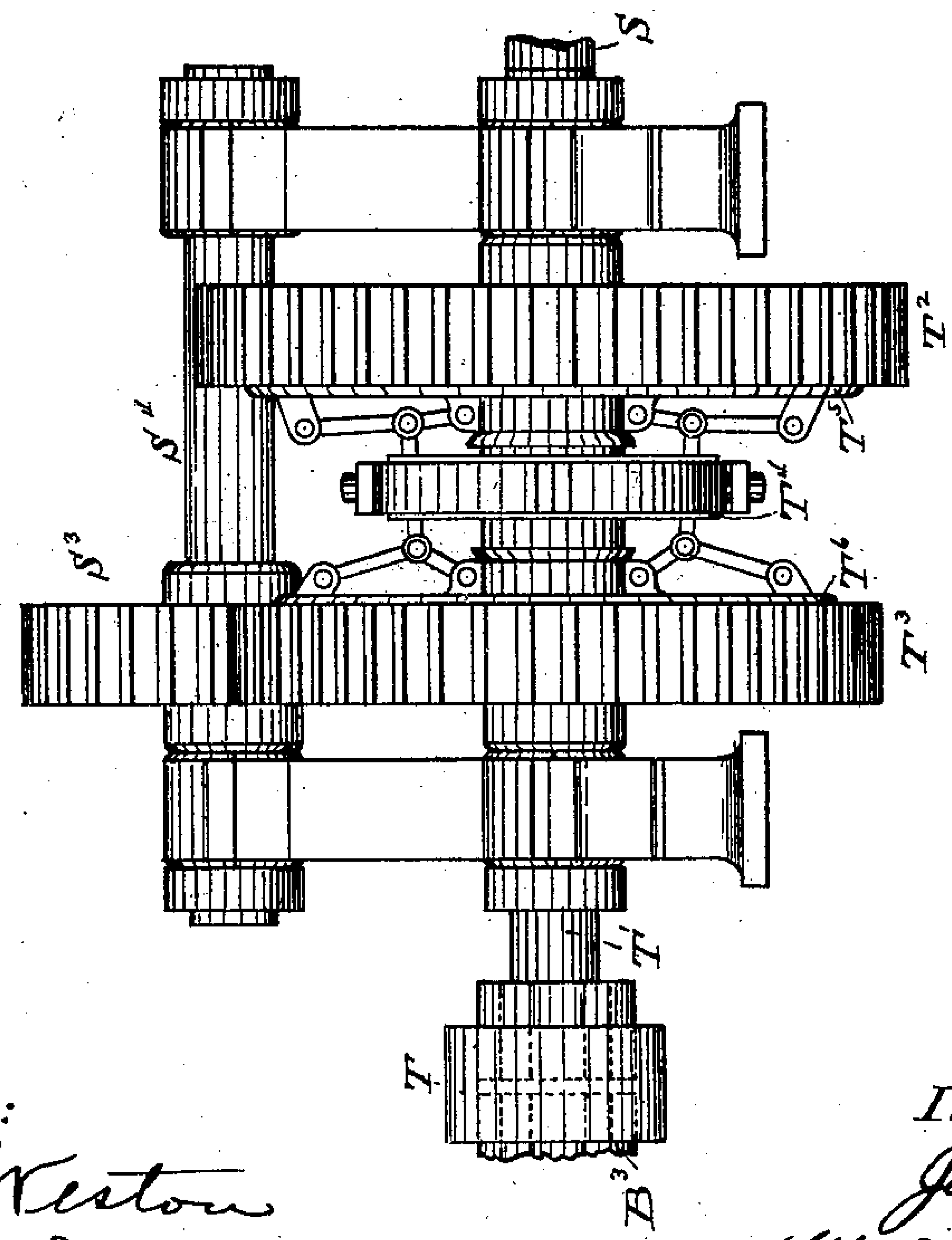

Fig. 9

Witnesses:

W. S. Weston

H. M. Munday

Inventor:

John G. Hodgson.

By Munday, Evarts & Adcock,

his attys.

UNITED STATES PATENT OFFICE.

JOHN G. HODGSON, OF MAYWOOD, ILLINOIS, ASSIGNOR TO THE NORTON BROS., OF CHICAGO, ILLINOIS.

AUTOMATIC SHEET-METAL-ROLLING MILL.

SPECIFICATION forming part of Letters Patent No. 608,287, dated August 2, 1898.

Application filed August 2, 1897. Serial No. 646,745. (No model.)

To all whom it may concern:

Be it known that I, JOHN G. HODGSON, a citizen of the United States, residing in Maywood, in the county of Cook and State of Illinois, have invented a new and useful Improvement in Automatic Sheet-Metal-Rolling Mills, of which the following is a specification.

My invention relates to sheet-metal-rolling mills.

The object of my invention is to provide an automatic sheet-metal-rolling mill of a simple, efficient, and durable construction by means of which bars, sheets, or packs of sheets may be automatically passed rapidly and successively back and forth between the rolls for a predetermined number of passes and the rolls automatically set closer and closer together by a continually-diminishing increment after each successive pass and the rolls or their feed-screws automatically returned to position for repeating the operation on another set or series of bars or sheets after the predetermined number of passes have been made upon the first set or series of bars or sheets.

With this object in view my invention consists in the novel construction of parts and devices and in the novel combinations of parts and devices herein shown and described, and specified in the claims.

In the accompanying drawings, forming a part of this specification, Figure 1 is a side elevation of a machine or rolling-mill embodying my invention. Fig. 2 is a plan view. Fig. 3 is a vertical section on line 3 3 of Fig. 1, showing the mill in end elevation. Fig. 4 is an enlarged detail side elevation of the gearing for operating the roller feed-table. Fig. 5 is a section on line 5 5 of Fig. 4. Fig. 6 is a vertical section through the housing of one of the feed-screws by which the rollers are set together. Fig. 7 is an enlarged detail cross-section of the movable guides for the roller feed-table, showing in elevation the mechanism for operating the same. Fig. 8 is a detail plan view of the parts shown in Fig. 7. Fig. 9 is a detail side elevation of the jack or mechanism for reversing the motion of the mill. Fig. 10 is an end view of the same. Fig. 11 is a detail view of the gage-plates for use in setting or adjusting the feed-screws for rolling bars or sheets to any required limit or gage.

In the drawings like letters of reference indicate like parts in all the figures.

In said drawings, A is the frame of the machine or mill.

B B′ are the rolls, the lower one, B, being the driven one.

C C are roller feed-tables, one on each side of the rolls B B′. The direction of rotation of the rolls C′ C′ of the roller feed-tables is adapted to be changed or reversed with the reversal of the direction of rotation of the rolls B B′, and for this purpose the feed-table rolls C′ are preferably connected by suitable gearing directly with the lower or driven one of the rolls B B′.

The feed-screws D, one at each end of the upper roll B′, turn in suitable housings D′ on the frame and press at their lower ends against the bearing B^2 of the shaft B^3 of the upper roll B′.

The feed-screws D D are geared together, so as to both revolve in the same direction, by gears D^2 D^2 through an intermediate gear D^3. Each of the gears D^2 is connected to its feed-screw D through the medium of a worm-gear D^4, which fits on the squared end D^5 of the screw D, and which worm-gear engages a worm D^6, journaled in brackets on the gear D^2, so that by turning the worm D^6 by hand the screw D may be independently turned or adjusted in respect to the other screw, as may be required from time to time to compensate for wear or to bring the rolls B B′ truly parallel to each other or to set the mill for rolling different gages of metal.

F is a power-driven pulley or shaft from which motion is communicated to the feed-screws at intervals or after each pass for the purpose of turning the feed-screws down to set the rolls B B′ closer together after each pass by a diminishing increment through the connecting-clutch F′ F^2 and the involute gears H H′ and the mechanism for automatically operating the clutch at each reversal of the motion of the rolls B B′. The clutch F′ F^2 may be of any suitable construction adapted to cause or permit an interval of connection between the shaft F^3 and the pulley F and then automatically disconnect the

two, one part F′ of the clutch being attached to or made integral with the pulley F and the other part F^2 being connected to the shaft F^3, through which motion is communicated to one of the intergeared feed-screws D D. One of the members of the clutch F′ F^2 has a sliding bolt or pin *f*, actuated by a spring and adapted to be engaged by a wedge or trip f^2 on the clutch-rod, and thus withdraw from the notch or recess in the opposing member of the clutch after the shaft F^3 makes, say, a half-revolution. One of the two involute gears II is secured to or made integral with the gear D^2 on one of the feed-screws and the other involute gear II′ is secured to an upright shaft F^4, which has a bevel-gear F^5, that meshes with a bevel-gear F^6 on the clutch-shaft F^3, which connects through the clutch F′ F^2 with the driving-pulley F, before mentioned. The bevel-gears F^5 F^6 are preferably so proportioned to each other that the shaft F^4 will make one revolution to, say, every five revolutions of the shaft F^3. This will give ten successive passes of the bars or sheets between the rolls at each heat, as the shaft F^3 is arranged to make a half-revolution at each reversal of the mill, and owing to the involute form of the connecting-gears II II′ the feed-screws D D will be turned or set down a continuously or successively diminishing increment or extent at each successive pass, and by simply removing the involute gears II II′ from the mill and substituting other involute gears of different relations to each other the extent of each successive reduction of the metal at each successive pass may be regulated as required.

To automatically operate the trip-clutch F′ F^2 or its releasing-wedge f^2 at each reversal of the motion of the mill, the shaft of the driven roll B is provided with an oscillating or friction arm or cam G, the same being frictionally secured to the shaft of the roll, so that the roll may continue to revolve after the cam or arm G has been oscillated to one side and its further motion arrested by striking against one or the other of the stops G′ G′, attached to the frame. The clutch-operating friction-arm G will thus be oscillated at the very beginning of each reversal of the motion of the mill, so that the feed-screws D D will be automatically turned and the rolls set for the next pass before the feed-table enters the sheets or bars into the bite of the rolls B B′. The mechanisms employed for communicating motion from the friction cam or arm G to the clutch-operating wedge f^2 consist, preferably, of a reciprocating slide *g*, having a pin or roller *g′* engaging the friction-cam G, and which is provided at its upper end with a pawl or dog g^2, that is adapted to engage a collar or projection g^3 on the clutch-operating rod g^4. A spring g^5 holds the pawl normally in position to engage said collar. A stationary cam g^6, engaging the free end of the pawl or dog g^2, causes it to disengage said collar on the clutch-operating rod after having first operated the clutch-rod, so that the spring g^7 on the clutch-rod may return it to position to again disengage the clutch after the shaft F^3 has made one revolution. To cause the shaft F^3 to be disconnected from its driving-pulley F after a half-revolution, I duplicate the clutch-operating wedge f^2 at the diametrically opposite point of the clutch and connect this second wedge f^2 with the clutch-operating rod g^4 by a connecting-lever g^8 and link g^9.

After the mill has made its predetermined number or series of passes upon the bars or sheets to be reduced the feed-screws D D are automatically run back or returned to position for repeating the operation upon another set of bars or sheets by means of a bevel-gear D^7, which is attached to or made integral with the gear D^2 on one of the feed-screws, and which bevel-gear D^7 meshes with the bevel-gear K on the shaft K′, which is connected by a clutch K^2 K^3 with the driving-pulley K^4, from which motion is derived for the purpose of turning the feed-screws back. The clutch K^2 K^3 is similar to the clutch F′ F^2, and its operating-wedge *k* and clutch-rod *k′* are automatically operated after the rolling is thus completed by a cam K^5 on the gear D^2 engaging a lever K^6, from which, through suitable connections K^7 K^8 K^9, motion is communicated to said clutch-rod *k′*.

The movable gages or guides C^2 C^2 at the opposite edges of each of the roller feed-tables are automatically operated to approach either after each pass of the bars or sheets between the rolls, and thus by grasping the bars or sheets at their side edges to automatically true or square up and center all the bars or sheets on the feed-table preparatory to their being again passed between the rolls, so that they will all enter the rolls smoothly and centrally with the rolls. After the bars and sheets are thus automatically adjusted properly in position on the feed-table the gages or guides again open or separate, and thus permit the bars or sheets to be fed forward by the roller feed-table into the rolls without friction-contact with the gages. The gages or guides C C are thus automatically operated after each pass by an arm C^{22}, frictionally secured to the shaft B^3 of the driven rolls B, similarly to the friction-cam G, and which is adapted to vibrate from one of the stops C^4 C^4 to the other at each reversal of the rolls, and which is connected to the slides C^5 C^5, carrying the opening and closing gages C^2 C^2, preferably by means of a link C^6 C^6, pivoted to the friction cam or arm C^{22} and to a lever or arm C^7, which is connected by a link C^8 with a rack C^9, that meshes with a gear C^{10} on a rock-shaft C^{11}, that is provided with a pair of lever-arms C^{12} C^{12}, connected by links C^{13} C^{14} and intermediate levers C^{15} with the gage-carrying slides C^5 C^5, so that at each movement of the friction cam or arm C^{22} the two gages C^2 C^2 are first made to momentarily close or approach each other to center and

square the bars or sheets on the feed-table and then at once to open or separate to permit the bars or sheets to be fed forward into the bite of the rolls without again touching the gages, which might otherwise tend to disarrange the bars or sheets on the table before entering the rolls.

The rollers C′, comprising each of the roller feed-tables, are provided each with a gear *c*, and all the gears *c* of each section of the feed-table are geared together, so as to rotate all in the same direction, by means of the intermediate gears *c′*. Motion is communicated to one or more of the gears *c* in each section of the feed-table from the driven roll B by means of a bevel-gear c^2 on the shaft of said roll, which meshes with a gear c^3 on a shaft c^4, having a gear c^5, meshing with a gear c^6 on the counter-shaft c^7, which communicates motion through the sprockets c^8 and chain c^9 to the shaft c^{10}, which has gears c^{11}, meshing with gears c^{12} on the shafts c^{13}, which are provided with gears c^{14}, that mesh with gears *c*. By this means the feed-rollers C′ are geared directly to the roll B, so that the motion of the feed-tables is reversed at each reversal of the rolls B B′.

To enable the mill to be run any desired number of passes without turning the feed-screws D D or setting the rolls B B′ closer together, the cam or arm G may be fixed in its side position by inserting a pin through the cam G in the holes g^{12} g^{13}.

To provide the mill with means for readily setting or adjusting the feed-screws to any required thickness of metal or to any required distance of the rolls B B′ apart when the feed-screw involute driving-gears are turned completely to the end of their stroke, two gage plates or disks P P′ are provided to fit between the end of the feed-screw and the bearing of the upper roll, one of which is less in thickness than the other by the thickness of metal to which the bars, sheets, or packs are designed to be finished, so that in setting or adjusting the mill the thicker gage-plate P may be inserted and the rolls then set down directly together, the screws being at this time turned down ready for returning, after which the thicker gage-plate is removed and the thinner one, P′, inserted in its place. This makes an easy and expeditious means for setting or adjusting the mill to any required thickness designed to be rolled. These gage-plates, in connection with the feed-screws, also serve as a ready means for readjusting or resetting the mill to compensate for wear.

S is the shaft of the engine, from which the shaft B^3 of the roll B is driven through a loose or wabble coupling or shaft T and a connecting-shaft T′. To enable the motion of the mill to readily be reversed, the engine-shaft S is provided with two gears S′ and S^2, both fast to the shaft, the latter meshing with a gear S^3 on a counter-shaft S^4, and the connecting-shaft T′ is provided with two gears T^2 T^3, both loose thereon, but either adapted to be clutched thereto by the friction-clutch T^4 T^5 T^6. The gear S′ on the engine-shaft meshes with the gear T^2 and drives the mill in one direction when said gear T^2 is clutched to the shaft T′, and the gear S^3 meshes with the gear T^3 and drives the mill in the opposite direction when said gear T^3 is clutched to said shaft S′, as the gear S^3 on the counter-shaft S^4 of course revolves in opposite direction from the gear S^2 on the engine-shaft. The clutch member T^4 slides on and is splined to the shaft T′, so that it may be brought into engagement with either of the clutch members T^5 T^6, which are secured to or made integral with the gears T^2 T^3, respectively. This makes a convenient and ready means of reversing the mill. The clutch T^4 T^5 T^6 is preferably a friction-clutch, but it may be of any suitable construction.

By simply increasing or diminishing the number of the clutch trips or wedges f^2 the number of passes required to turn the involute feed-screw-turning gears H H′ to the end of their stroke may be diminished or increased, according to the number of passes or reductions desired to be made at each heat.

I claim—

1. In an automatic sheet-metal-rolling mill, the combination with the rolls, feed-tables and feed-screws for setting the rolls closer together, of a pair of involute gears for turning the feed-screws by diminishing increments after each reduction or pass of the metal between the rolls to set them for the next pass, substantially as specified.

2. In an automatic sheet-metal-rolling mill, the combination with the rolls, feed-tables and feed-screws for setting the rolls closer together, of a pair of involute gears for turning the feed-screws by diminishing increments after each reduction or pass of the metal between the rolls to set them for the next pass, and means for automatically turning the shaft of one of said intermeshing involute gears after each successive pass, substantially as specified.

3. In an automatic sheet-metal-rolling mill, the combination with the rolls of a pair of feed-screws, one at each end of the rolls, geared together for setting the rolls together, and involute gears for turning the feed-screws by diminishing increments after successive passes, substantially as specified.

4. The combination with the rolls, feed-screws and feed-tables, of a driving pulley or shaft for the feed-screws, a clutch and connecting-gearing for communicating motion to said feed-screws, mechanism for automatically operating said clutch at each reversal of the mill, said connecting-gearing having a pair of involute gears to cause the feed-screws to be turned a less and less extent at each successive turn, substantially as specified.

5. The combination with the rolls, feed-screws and feed-tables, of a driving pulley or shaft for the feed-screws, a clutch and con-

necting-gearing for communicating motion to said feed-screws, mechanism for automatically operating said clutch at each reversal of the mill, said connecting-gearing having a pair of involute gears to cause the feed-screws to be turned a less and less extent at each successive turn, and mechanism for automatically running back the feed-screws after a predetermined number of passes have been made, substantially as specified.

6. The combination with the rolls and feed-screws for setting the rolls closer together, a driving pulley or shaft for the feed-screws, gearing connecting said driving pulley or shaft with the feed-screws, a clutch for connecting and disconnecting said gearing with said driving-pulley, a friction cam or arm on the shaft of one of the rolls, and connecting mechanism between said cam or arm and the clutch for operating the clutch at each reversal of the motion of the rolls, said connecting-gearing between the feed-screws and their driving pulley or shaft having a pair of involute gears to cause the feed-screws to be turned a diminishing amount, substantially as specified.

7. The combination with the rolls and feed-screws for setting the rolls closer together, a driving pulley or shaft for the feed-screws, gearing connecting said driving pulley or shaft with the feed-screws, a clutch for connecting and disconnecting said gearing with said driving-pulley, a friction cam or arm on the shaft of one of the rolls, and connecting mechanism between said cam or arm and the clutch for operating the clutch at each reversal of the motion of the rolls, said connecting-gearing between the feed-screws and their driving pulley or shaft having a pair of involute gears to cause the feed-screws to be turned a diminishing amount, and mechanism for automatically running back or returning the feed-screws to position after a predetermined number of passes have been made, substantially as specified.

8. In a sheet-metal-rolling mill, the combination with the feed-table and rolls, of movable gages at the opposite edges of the feed-table for automatically truing and centering the bars or sheets on the feed-table, and mechanism for automatically opening and closing the gages at each reversal of the motion of the mill comprising a rack and gear, connecting links and levers, and a friction-arm on the shaft of one of the rolls, substantially as specified.

9. In a sheet-metal-rolling mill, the combination with the feed-table and rolls, of movable gages at the opposite edges of the feed-table for automatically truing and centering the bars or sheets on the feed-table, and mechanism for automatically opening and closing the gages at each reversal of the motion of the mill, said mechanism consisting in a friction cam or arm and connections connecting said friction cam or arm with said movable gages, substantially as specified.

10. The combination with the rolls, feed-table and centering-gages and the engine-shaft of a jack or mechanism for reversing the direction of rotation of the rolls comprising two gears fixed to the engine-shaft one of which meshes directly with a loose gear on the roll-shaft, the other meshing with a gear on a counter-shaft which meshes with a second loose gear on the roll-shaft and a clutch upon the roll-shaft to engage either of the loose gears on that shaft at the will of the workman in charge, the feed-screws, and mechanism for automatically turning the feed-screws at each reversal of the direction of rotation of the rolls to set or adjust the rolls for the next succeeding pass, substantially as specified.

11. The combination with the rolls and feed-screws, each having a squared end, of a worm-gear fitting on the squared end of the feed-screw, a gear loose on the hub of the worm for communicating motion to the feed-screw, and a worm journaled on said gear and engaging said worm-gear, substantially as specified.

JOHN G. HODGSON.

Witnesses:
H. M. MUNDAY,
EDMUND ADCOCK.