(No Model.) 4 Sheets—Sheet 1.

E. NORTON & J. G. HODGSON.

APPARATUS FOR MANUFACTURING RAILROAD RAILS.

No. 406,944. Patented July 16, 1889.

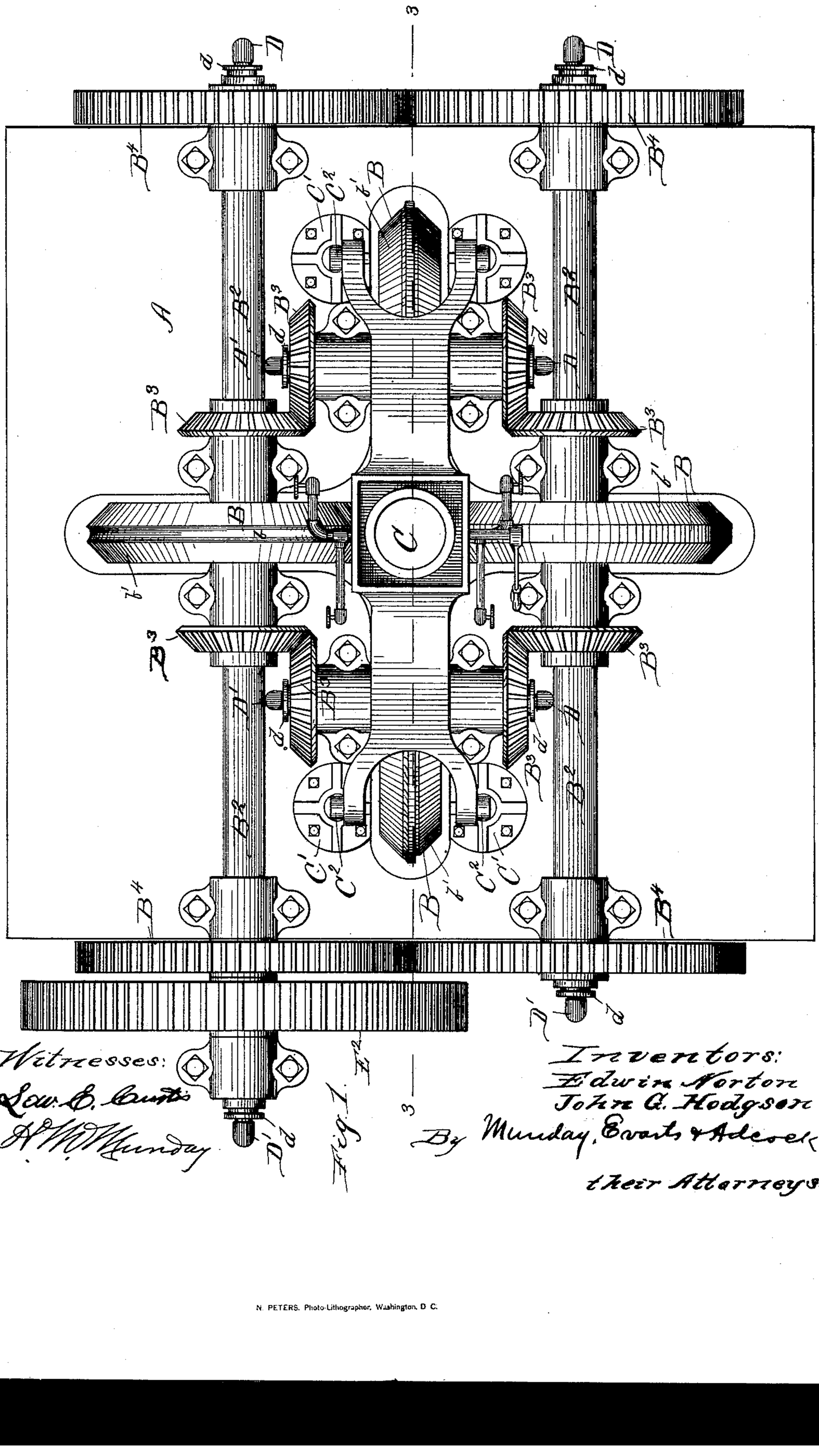

Fig. 1.

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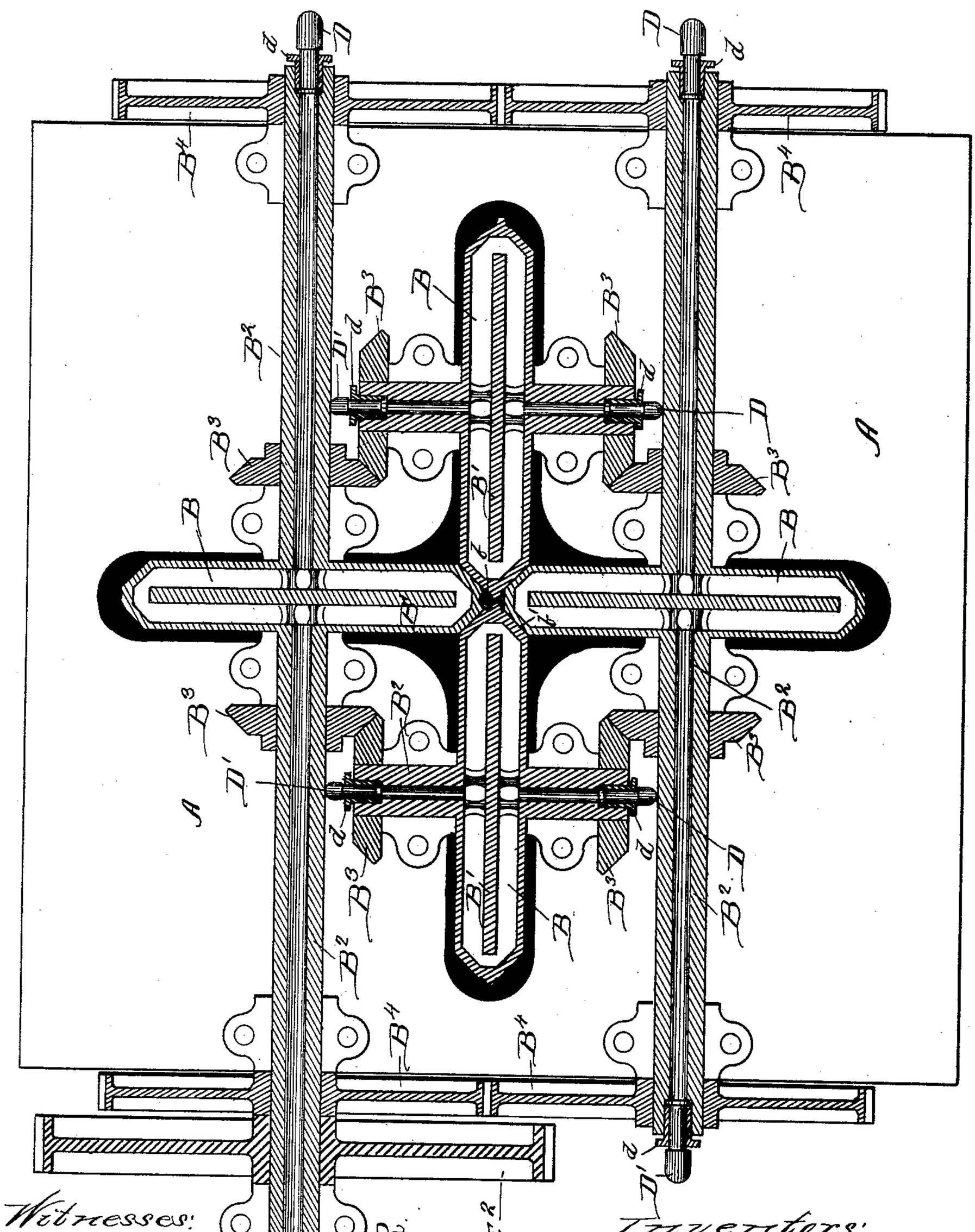

Fig. 2.

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4 Sheets—Sheet 3.

E. NORTON & J. G. HODGSON.

APPARATUS FOR MANUFACTURING RAILROAD RAILS.

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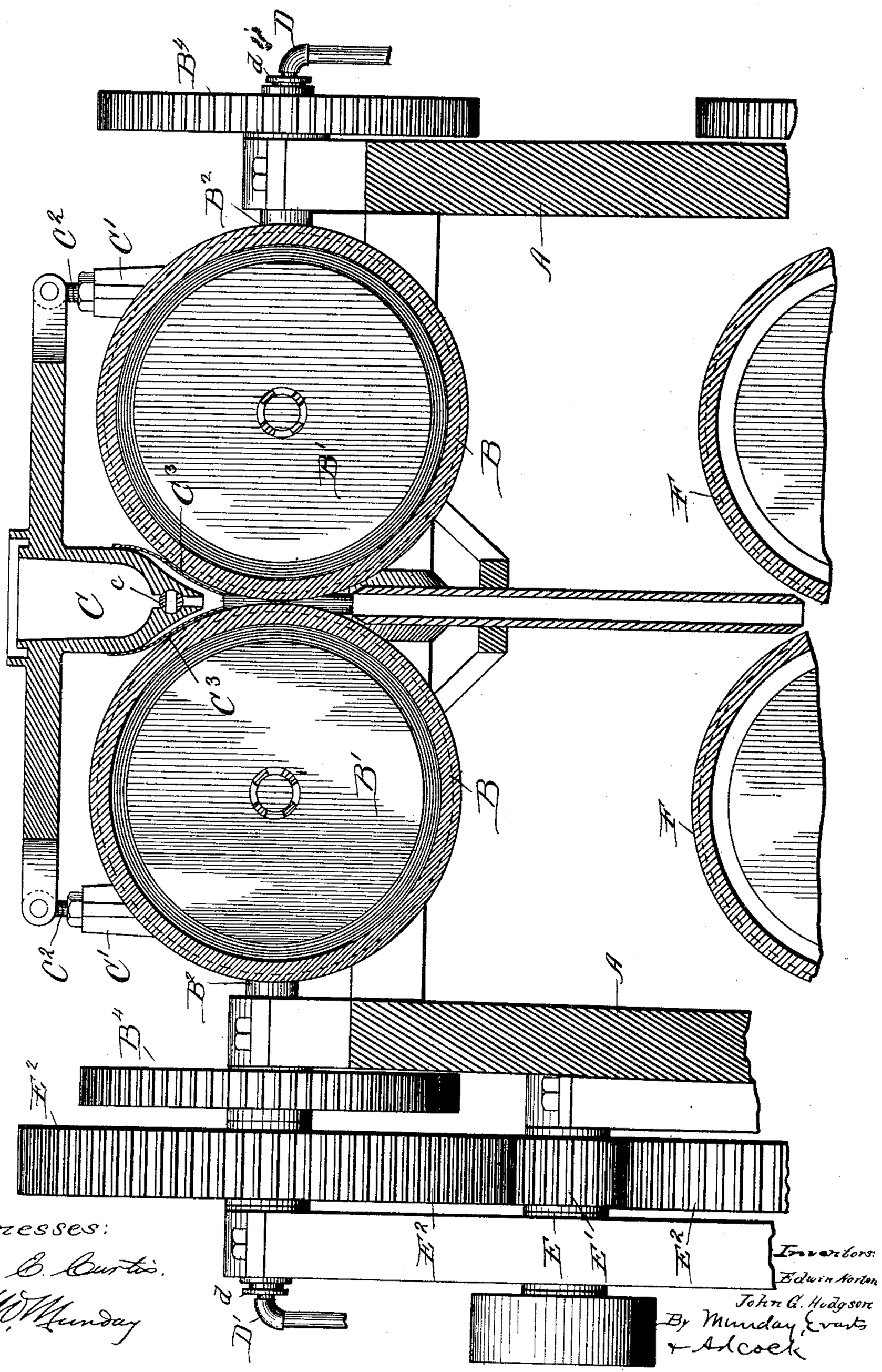
Fig. 3.



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(No Model.) 4 Sheets—Sheet 4.

E. NORTON & J. G. HODGSON.

APPARATUS FOR MANUFACTURING RAILROAD RAILS.

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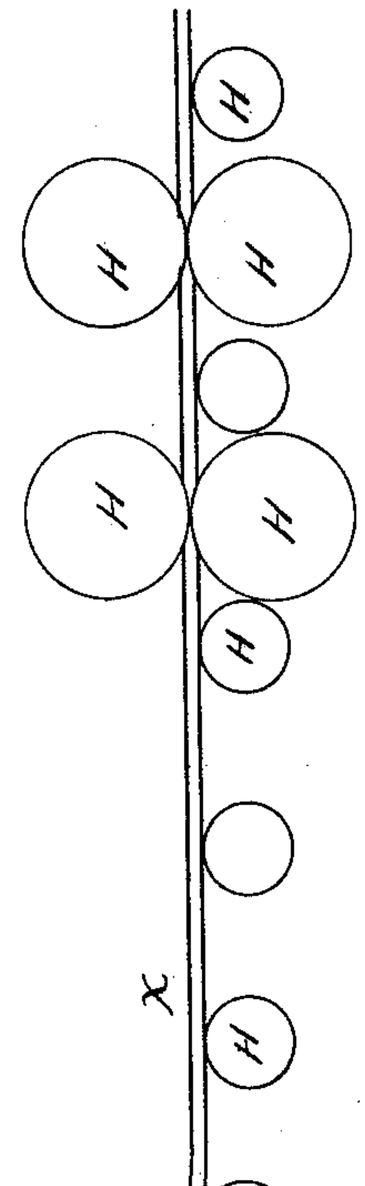

Fig. 4.

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UNITED STATES PATENT OFFICE.

EDWIN NORTON AND JOHN G. HODGSON, OF MAYWOOD, ASSIGNORS TO SAID NORTON, AND OLIVER W. NORTON, OF CHICAGO, ILLINOIS.

APPARATUS FOR MANUFACTURING RAILROAD-RAILS.

SPECIFICATION forming part of Letters Patent No. 406,944, dated July 16, 1889.

Application filed April 6, 1889. Serial No. 306,205. (No model.)

To all whom it may concern:

Be it known that we, EDWIN NORTON and JOHN G. HODGSON, citizens of the United States, residing in Maywood, in the county of Cook and State of Illinois, have invented a new and useful Improvement in Apparatus for Manufacturing Railroad-Rails and other Metal Bars, of which the following is a specification.

In manufacturing railroad-rails and other metal bars it has heretofore been customary to first cast the metal into an ingot, then reheat it, and finally reduce it by rolling to the required size and cross-sectional shape. The manufacture when thus carried on is slow, laborious, and expensive, and requires an extensive and costly plant of machinery.

The object of our invention is to provide a more simple and expeditious means of manufacturing railroad-rails or other metal bars, and one whereby the molten metal will be compressed or subjected to pressure while it is still in the fluid state, or while it is just in the act of setting, so as to thus improve the character and quality of the metal and render it free from air-holes and imperfections and of a very dense and homogeneous structure, whereby the strength, durability, and wearing qualities of the rails or bars produced may be materially increased.

By our invention the rails or bars are produced directly from the molten metal without first casting the metal into an ingot and then reheating and rolling and rerolling it. The molten metal is poured in a continuous solid stream, from a suitable bowl or pouring-vessel, between a series of rolls, preferably four in number, having their axes arranged in the same horizontal plane, and having a pocket or space between their peripheries at their common meeting-point for the reception of the stream of molten metal, so that the stream of molten metal, as it passes between the rolls, will be compressed by the wedging action of the rolls, and the molten metal at the same time chilled or set by contact with the rolls. The rolls are made hollow and filled with water, which is made to constantly flow through them, so as to keep them cool or at the proper temperature for chilling or setting the stream of molten metal as it flows between the rolls. The pouring bowl or nozzle is arranged directly over the common meeting-point of the series of rolls, so that the stream of molten metal will flow in a direction tangential to all the rolls. Each roll thus comes in contact with the stream of molten metal, or with the metal bar produced, only at a single point, so to speak, of its periphery at a time, thus making it practicable to easily keep the rolls cool or at a proper temperature for chilling or setting the stream of molten metal as it passes between the rolls. The rolls are revolved at a sufficiently great surface speed, in respect to the velocity of the stream of molten metal and in respect to the space between the rolls or the size of the bar being produced, as to prevent the molten metal collecting or damming up in the space between the rolls. We thus prevent a large surface-contact between the molten metal and the chilling-rolls, which would tend to heat the rolls rapidly and render it difficult to keep them cool or at the proper temperature, on the one hand, and which, on the other hand, would tend to chill or set the molten metal before it reaches the meeting line or plane joining the axes of the rolls, and where the passage between them is most contracted, thus subjecting the apparatus to greater strain, and requiring greater force to revolve the rolls, and interfering to a greater or less extent with the proper compression of the metal while yet in the molten or setting state.

By employing a series of three or more rolls the fluid or setting stream of metal passing between the rolls is compressed on all sides, thus densifying the metal by the wedging action of the rolls, and this densifying or compressing action of the rolls upon the metal aids in solidifying or setting the molten metal as well as to greatly improve the quality of the steel or metal bar produced. The compressing and rolling action of the rolls upon the fluid or setting stream of metal passing between the rolls also tends to give the metal bar a superior texture, grain, or fiber, and thereby to increase the strength of the bar produced.

Another feature of our invention consists in employing another series of rolls, preferably arranged directly below the first series,

which serve to further chill, compress, shape, and roll the rail or bar as it issues from the first or upper series of rolls. The continuous-roll or bar produced is delivered from this second series of rolls to a horizontal carrier or series of rolls by an intermediate curved passage or conveyer, consisting, preferably, of a series of rolls arranged in a curve. As the rail or bar is conveyed out horizontally, it may, while still hot, be passed through finishing and straightening rolls and further rolled to a greater or less extent, as may be desired.

In the accompanying drawings we have shown at Figure 1 a plan view of an apparatus embodying our invention. Fig. 2 is a central horizontal section taken through the axes of the rolls. Fig. 3 is a vertical section taken on the line 3 3 of Fig. 1, the section being also indicated by the line 3 3 on Fig. 2. The section of Fig. 2 is indicated on Fig. 3 by the line 2 2. Fig. 4 is a side elevation, partly in section, showing the horizontal conveyer and intermediate curved conveyer for receiving the rail or bar as it issues from the series of rolls.

Similar letters of reference indicate like parts in all the figures.

In the drawings, A represents the frame of the machine, on which is journaled a series of rolls B, preferably four in number, revolving together and having their peripheries shaped or grooved to form a passage or way *b* between them to receive the stream of molten metal as it flows down from the pouring bowl or nozzle C.

As indicated in Figs. 1, 2, 3, and 4 of the drawings, the working or meeting faces or peripheries of the rolls B are given the shape or configuration to form an ordinary railroad-rail. They may, however, be shaped to give the space or passage *b* any desired cross-section, and thus produce a bar of any form required.

The rolls B have beveled faces *b'*, which meet or roll against each other and serve as stops for the several rolls against each other, so that the space or passage *b* for the metal will always be maintained of a uniform size, and thus produce the rail or bar of a uniform cross-section throughout. The rolls B are each made hollow, and preferably with a central web B', and the shafts B^2 are also made hollow, so that water or other cooling fluid or liquid may be made to circulate through each of the rolls for the purpose of keeping them cool or of the desired temperature. The hollow shafts B^2 are each furnished with a packing or stuffing box *d* at each end, by which they are connected with the inlet and outlet water-pipes D D'.

The pouring bowl or vessel C is supported by any suitable means above the rolls B during the pouring operation, preferably by standards C', furnished with adjusting-screws C^2. The pouring-nozzle C is preferably furnished with a valve or device *c* for opening and closing the discharge-passage. The hollow shafts B^2 of the rolls are all geared together, so that they revolve or roll together at the same surface speed. The gearing employed may preferably be bevel-gears, such as indicated at B^3. Two of the shafts B^2 are also geared together by spur-gears B^4. E is the driving-shaft, having a gear E', which meshes with a gear E^2 on one of the shafts B^2. The pouring bowl or nozzle C is furnished with a guide or shield C^3, extending down to near the meeting-point of the rolls. This is designed to prevent the metal from splattering at the beginning of the pouring operation. A greater or less number of rolls than four may be employed.

F represents a second series of rolls arranged, preferably, directly below the chilling-rolls B, and between which the bar *x* passes as it issues from the chilling-rolls B. The series of rolls F are preferably of the same form and construction as the rolls B, being hollow and having the same connections for passing water through them, so that they may operate as chilling-rolls, as well as to further roll, compress, and finish the rail or bar produced. The roll F may, however, be of any ordinary or known construction. The series of rolls F is preferably, like the series B, composed of four rolls revolving together.

G is a curved guide or conveyer, consisting, preferably, of a series of rolls, or idle-pulley wheels arranged in a curved path to curve and guide the bar as it issues from the rolls F to the horizontal conveyer or series of rolls H. Some of the rolls H are preferably driven and operate to further roll and straighten the rail or bar, as well to convey it along or away. The curved guide G also affords some slack in the rail or bar between the chilling-rolls and the rolls H H to compensate for difference in speed or slipping.

We claim—

1. The combination, with a series of chilling-rolls revolving together with a space or passage between them, of a pouring vessel or nozzle for directing a stream of molten metal between said rolls, substantially as specified.

2. The combination, with a pouring-vessel, of a series of chilling-rolls having working-faces and bevel rolling or stop faces to limit the extent to which said rolls may approach each other, substantially as specified.

3. The combination, with a pouring-vessel, of a series of hollow chilling-rolls revolving together and having a space or passage for the stream of molten metal between them, and means for causing water to circulate through said hollow rolls, substantially as specified.

4. The combination, with a pouring-vessel, of a series of chilling-rolls revolving together, and a second series of rolls, between which the rail or bar passes as it issues from said chilling-rolls, substantially as specified.

5. The apparatus for producing metal bars directly from molten metal, consisting in a series of rolls revolving together, with a space

or passage between them and having their axes in a common horizontal plane, so that a vertical stream of metal may be passed between them tangentially and be compressed and set thereby, substantially as specified.

6. The combination, with a series of chilling-rolls arranged to revolve together, with their axes in a horizontal plane, of means for directing a continuous stream of molten metal tangentially between said rolls, so that the stream of metal will be compressed from all sides while in a fluid or setting state, substantially as specified.

7. The combination, with a series of chilling-rolls revolving together, with a space or passage between them, of a pouring vessel or nozzle for directing a stream of molten metal between said rolls, said rolls revolving at an equal or greater surface speed than the velocity of the flowing metal, substantially as specified.

8. The combination, with a pouring-vessel, of a series of chilling-rolls having working-faces and bevel rolling or stop faces to limit the extent to which said rolls may approach each other, said rolls revolving at an equal or greater surface speed than the velocity of the flowing metal, substantially as specified.

9. The combination, with a pouring-vessel, of a series of hollow chilling-rolls revolving together and having a space or passage for the stream of molten metal between them, and means for causing water to circulate through said hollow rolls, said rolls revolving at an equal or greater surface speed than the velocity of the flowing metal, substantially as specified.

10. The combination, with a pouring-vessel, of a series of chilling-rolls revolving together, and a second series of rolls between which the rail or bar passes as it issues from said chilling-rolls, said rolls revolving at an equal or greater surface speed than the velocity of the flowing metal, substantially as specified.

11. The combination, with a series of chilling-rolls arranged to revolve together, with their axes in a horizontal plane, of means for directing a continuous stream of molten metal tangentially between said rolls, so that the stream of metal will be compressed from all sides while in a fluid or setting state, said rolls revolving at an equal or greater surface speed than the flowing metal, substantially as specified.

12. The combination, with a pouring-vessel, of a series of rolls revolving together, a second series of rolls between which the rail or bar passes as it issues from said first series of rolls, a curved guide, and a horizontal series of rolls, substantially as specified.

13. The combination, with a series of rolls having their axes arranged in a horizontal plane, a pouring-vessel arranged above and between them in a direction tangential to the peripheries of all of said rolls, and a second series of rolls arranged directly beneath the first series, of a curved guide consisting of a series of rolls arranged in a curve, and a horizontal conveyer consisting of a horizontal series of rolls, substantially as specified.

14. In an apparatus for rolling fluid metal, the combination, with chilling-rolls, of a pouring nozzle or vessel above and between them, and a guide or shield C^3, surrounding said pouring-vessel and extending down to near the meeting-point of the rolls, substantially as specified.

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