No. 753,408. PATENTED MAR. 1, 1904.

D. H. LENTZ.

ROLLING MILL.

APPLICATION FILED APR. 23, 1902.

NO MODEL. 5 SHEETS—SHEET 1.

Fig. 1.

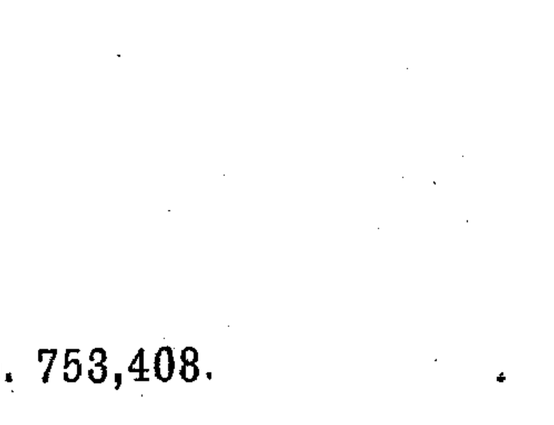
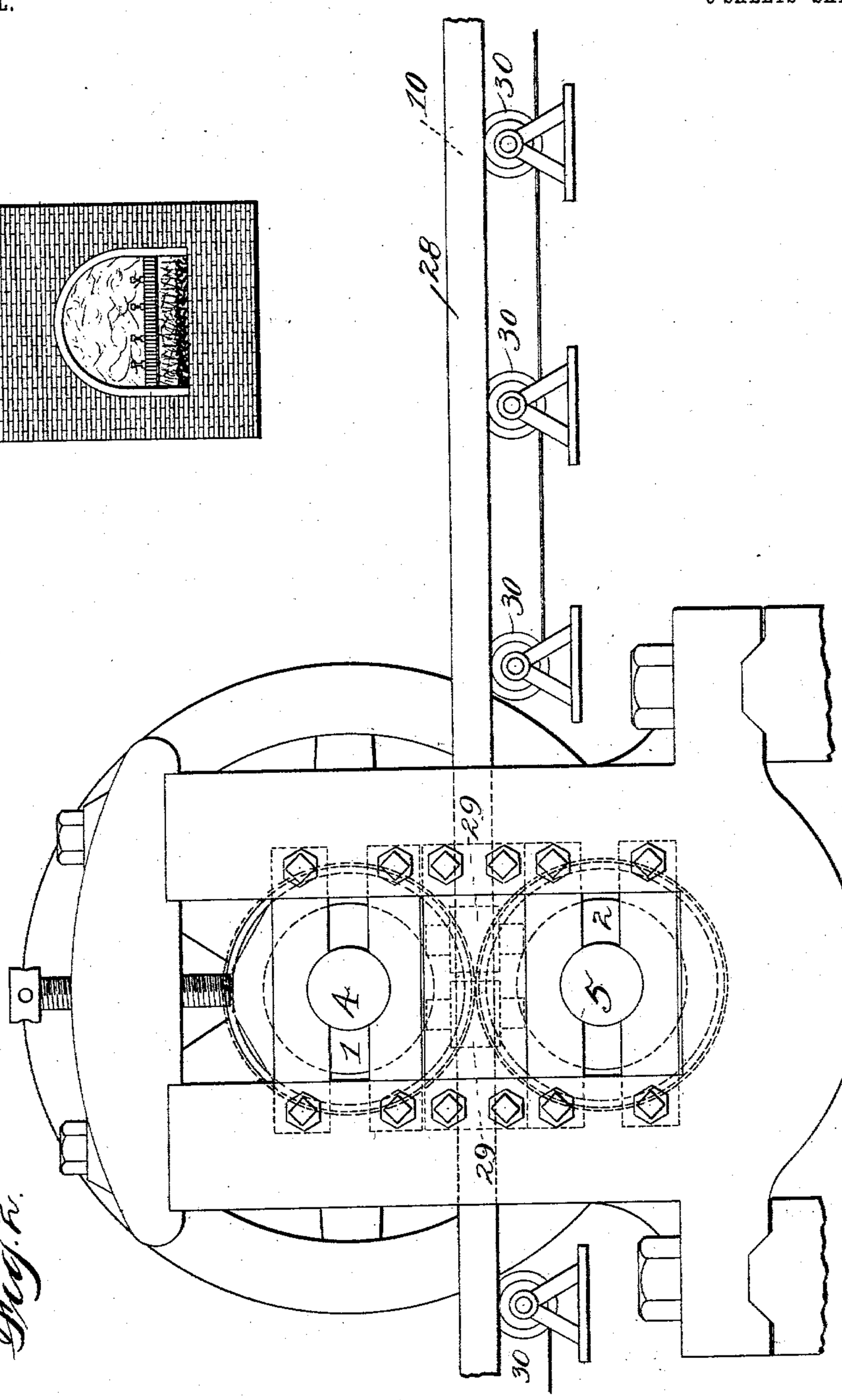


Fig. 2.



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NO MODEL. 6 SHEETS—SHEET 2.

Fig. 4.

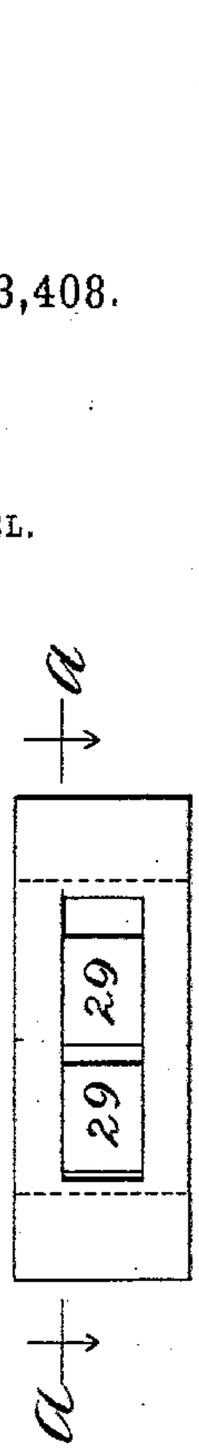


Fig. 5.

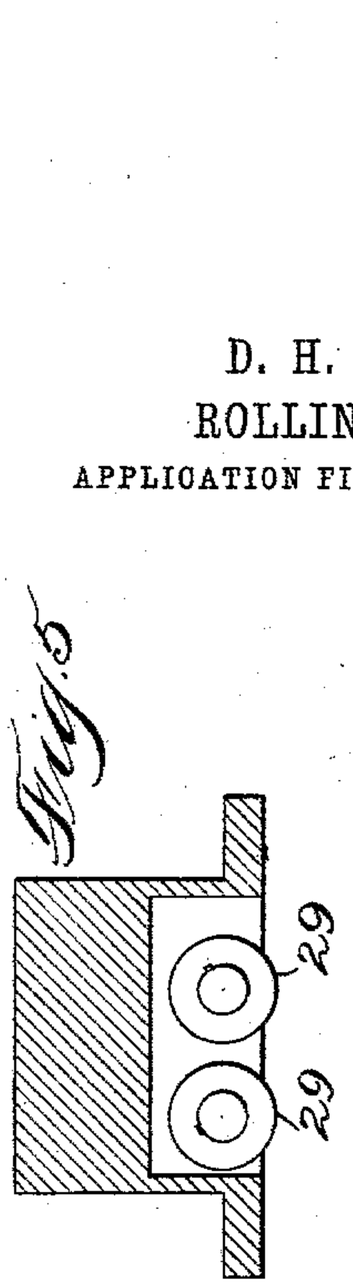
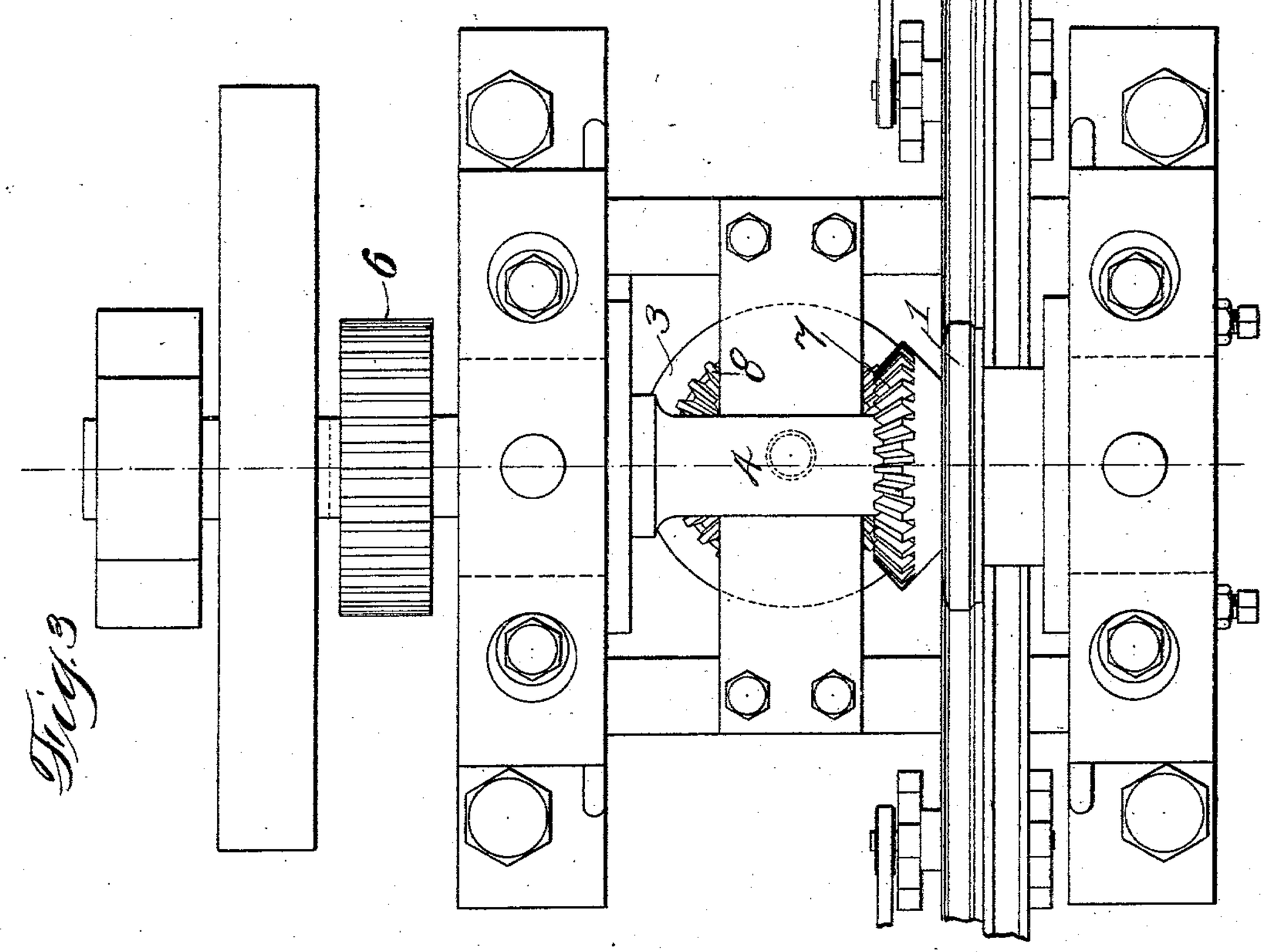


Fig. 3



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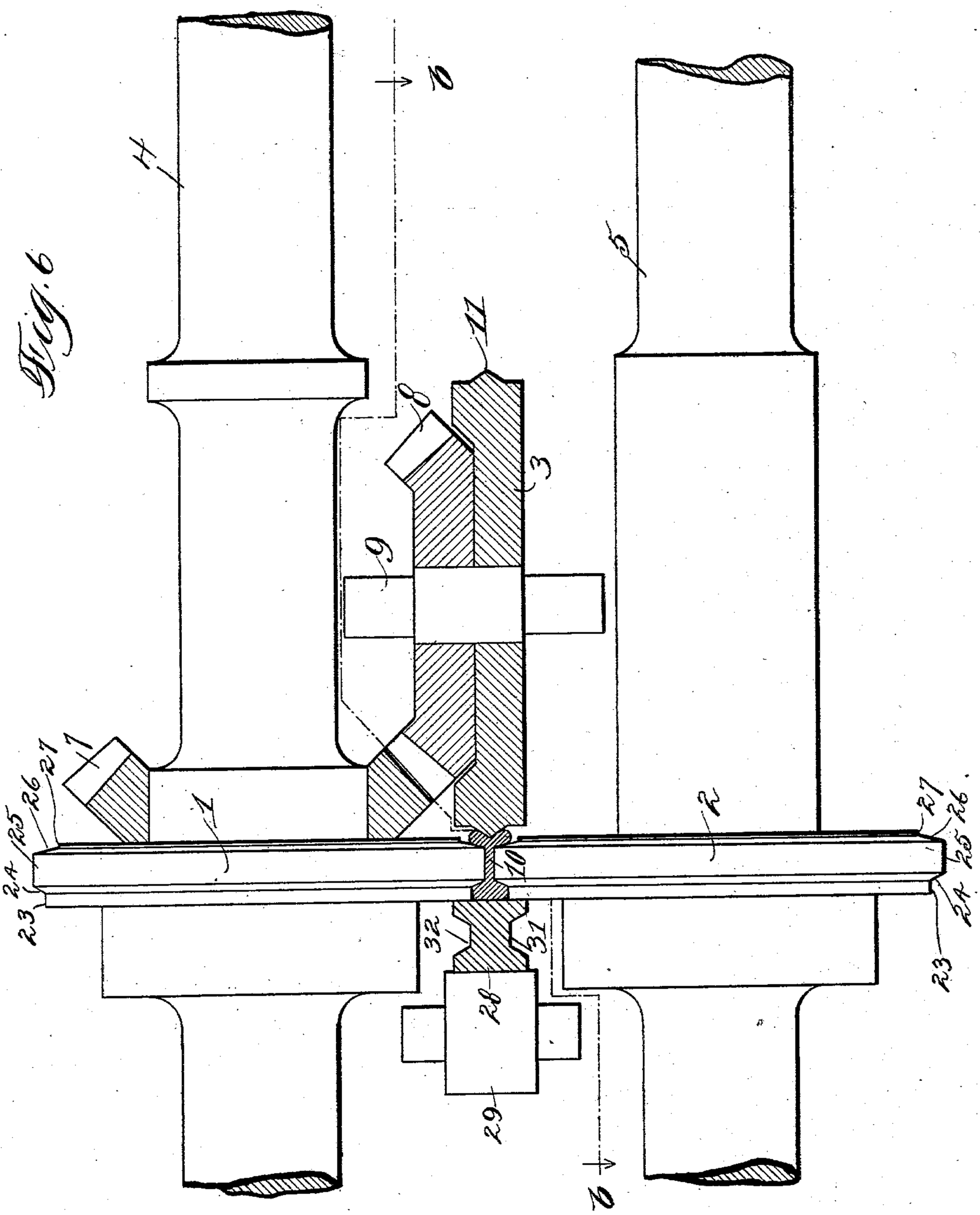
NO MODEL. 5 SHEETS—SHEET 3.

Fig. 6



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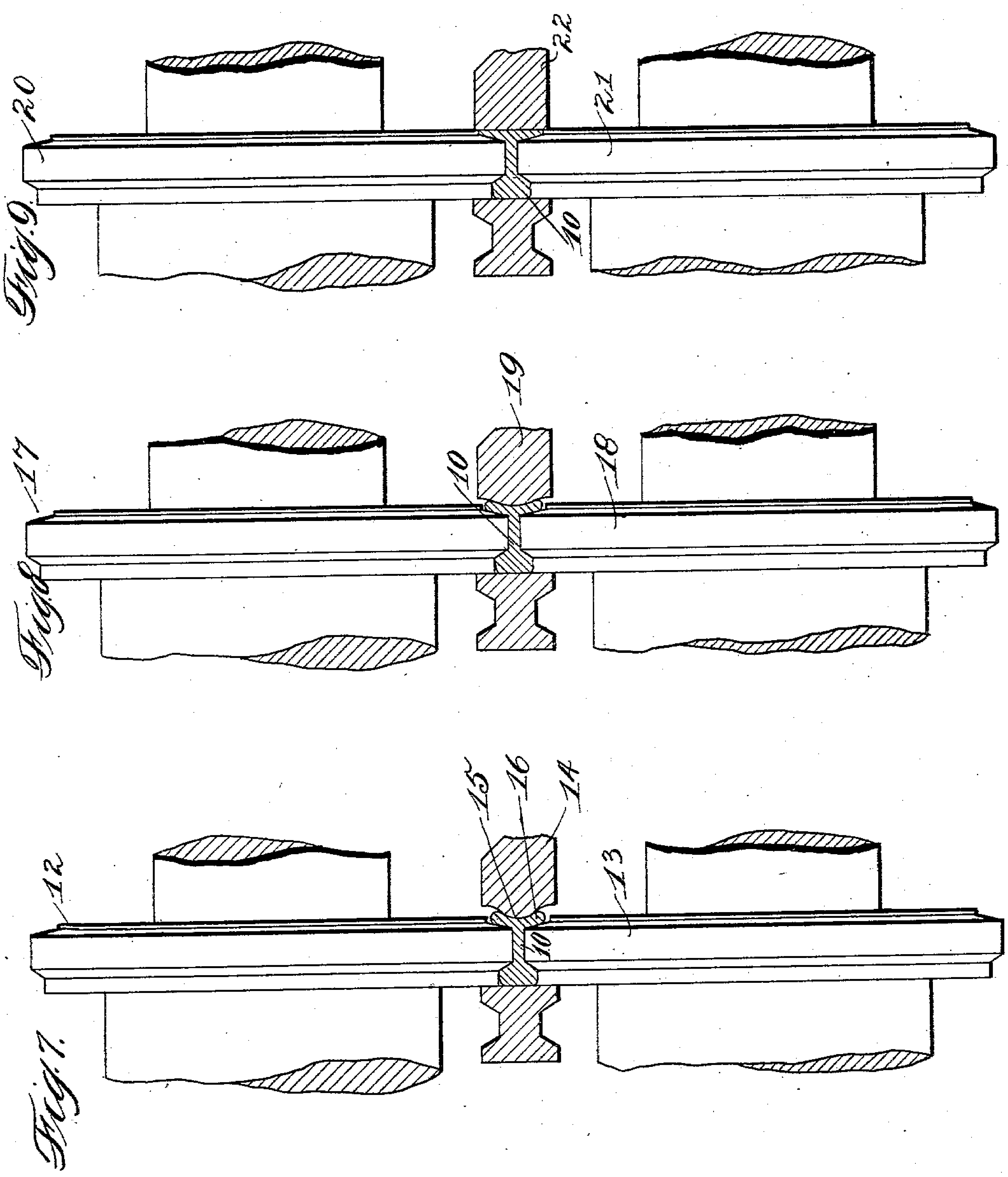
APPLICATION FILED APR. 23, 1902.

NO MODEL.

5 SHEETS—SHEET 4.



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No. 753,408. PATENTED MAR. 1, 1904.

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ROLLING MILL.

APPLICATION FILED APR. 23, 1902.

NO MODEL. 5 SHEETS—SHEET 5.

Fig. 11

Fig. 10

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No. 753,408. Patented March 1, 1904.

UNITED STATES PATENT OFFICE.

DAVID H. LENTZ, OF JOLIET, ILLINOIS.

ROLLING-MILL.

SPECIFICATION forming part of Letters Patent No. 753,408, dated March 1, 1904.

Application filed April 23, 1902. Serial No. 104,319. (No model.)

To all whom it may concern:

Be it known that I, DAVID H. LENTZ, a citizen of the United States, residing at Joliet, in the county of Will and State of Illinois, have invented a certain new and useful Improvement in Rolling-Mill Apparatus, (Case No. 11,) of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawings, forming a part of this specification.

My invention relates to machines for treating rolled products, being of special service in connection with machines for rerolling old rails.

Some features of my invention relate fundamentally to machines and apparatus for readapting double-headed rails for use as single-headed rails. In Europe the traction-rails most largely employed are those provided with double heads interchangeable as traction-heads, the object of this rail construction being to use one of the heads for a traction-head until it becomes too worn for further good service, whereafter the rail is reversed in position and the remaining head then used as a traction-head. Heretofore after this double use of such rails they have been discarded from further use as rails. Bull-headed rails (another form of double-headed rails not designed for reversal) are also contemplated in connection with my invention, as, indeed, is the ordinary type of rail, which may have its single head treated in accordance with my invention.

One of the objects of my invention is to readapt this form of rail for use where single-headed rails are employed, which is altogether the case in the United States and some other countries, and to this end I provide a machine which is adapted to reshape one of the heads into a rail-flange and which serves to make this re-formed rail of standard height and cross-section corresponding to its future use.

My invention, generally speaking, comprises in its preferred embodiment a rolling-train which is adapted to act upon one of the heads of a rail to transform the same into a flange. There are certain peculiar steps that are desirable to follow in practicing the invention to secure the desired dimensions of the web and to secure a rail free of folds, as it is not permissible to raise the rail that is to be reshaped to a welding heat, as this would result in a decarbonization of the steel and would render the rail totally unfit for further service.

I preferably first heat the rail to a temperature near to but below the point at which the carbon contained therein would be materially affected; which temperature, however, may be such as to permit a remolding or shaping of the rail. After the rail has been thus heated it is preferably first passed through rollers which cause a groove in the bottom of the rail to be formed, this operation causing that portion of the rail which was previously a head portion to spread into an embryo flange. The roller that forms the groove is preferably V-shaped, so as to secure a decided spreading action, whereafter the rail is preferably passed through a train in which is included a roll having a bead which engages the flange to be and further spreads the same. The rail is next passed through rolls which further flatten the base of the flange and finally subjected to the action of a roll which completely flattens the base of the flange. In each of these operations there are preferably employed two additional rolls which engage between them the web of the rail and which determine the shape of the upper surfaces of the flange and act in coöperation with the rolls that engage the base of the flange to shape the same. These additional rolls are requisite, as the fishing-angles between the heads and the web of a double-headed rail are not usually the same as the fishing-angles between the flange and web of a standard rail, such as is used in the United States. In any event they would be useful in so constraining the flow of the metal as to preserve or secure the proper fishing-angles and the desired shape of the flange.

There are additional features of a machine constructed in accordance with my invention which may be useful in connection with the rolling of other than double-headed rails, which will be more fully explained hereinafter.

I will describe my invention more fully by reference to the accompanying drawings, in which—

Figure 1 diagrammatically indicates a furnace within which the rails may be heated

prior to reshaping. Fig. 2 is a side elevation of a rolling-machine for reshaping the rails. Fig. 3 is a plan view of a machine shown in Fig. 2. Fig. 4 is a side elevation of a pair of rolls, including their housing, that preferably forms a part of my improved structure. Fig. 5 is a sectional view on line *a a* of Fig. 4. Fig. 6 is a detailed view in elevation, showing certain parts in section of the rolling mechanism employed in the first pass. Fig. 7 is a detailed view of the rolls employed in the second pass. Fig. 8 is a detailed view of the rolls employed in the third pass. Fig. 9 is a detailed view of the rolls employed in the fourth pass. Fig. 10 is a plan view on line *b b* of Fig. 6. Fig. 11 is a view of a double-headed rail of the kind which may be reworked into a single-headed rail.

Like parts are indicated by similar characters of reference throughout the different figures.

There are preferably employed in each roll-train for each pass three rollers, two of which engage one head and the web, while the third engages the other head to form it into a flange. The first set of rolls is shown in Fig. 6, comprising an upper roll 1, a lower roll 2, the axes of these rolls preferably lying horizontally in the same vertical plane, and an intermediate roll 3, whose axis is vertical.

The machine illustrated in Figs. 2 and 3 is the kind that is preferably employed for each set of rolls, there being, preferably, as many machines as there are sets of rolls. I have deemed it essential to illustrate but one machine, as the adaptation of other rolls to similar machines will be readily apparent.

In such a machine as that illustrated in Figs. 2 and 3 the upper roll 1 may be directly mounted upon a driving-shaft 4, while the lower roll, mounted upon a shaft 5, may be driven by gearing 6, intervening between the shafts 4 and 5, this arrangement serving to drive the rolls 1 and 2 in opposite directions, and preferably operating, in addition to forming-rolls, as feeding-rolls. The intermediate roll 3 may be driven from the shaft 4 by means of a spur-gear 7, engaging a corresponding gear 8, that is keyed upon the shaft 9, to which shaft the roll 3 is also keyed. This shaft is located within such proximity to the rolls 1 and 2 as to cause the roll 3 to engage that which is the horizontal surface of the head of the worn rail 10, as said rail is disposed in the railroad adjacent thereto. The roll 3 (indicated in Fig. 6) is shown as one of the rolls of the first train and is preferably provided with a **V**-shaped periphery 11, which forms in the tread-surface of the contiguous head of the rail 10 a corresponding groove, this head being somewhat flattened or spread in the formation of the groove, as indicated in Fig. 6.

The second set of rolls through which the rail is passed after issuing from between the rolls 1, 2, and 3 is shown in Fig. 7, wherein the upper roll 12, the lower roll 13, and the intermediate roll 14 may be driven in the same manner as rolls 1, 2, and 3. (Shown in Fig. 6.) The roll 14, in place of having a **V**-shaped rim 11, is provided with a rim 15, which is curved in cross-section and which serves further to spread what has now become an embryo flange 16.

The third set of rolls. (Illustrated in Fig. 8.) employs an upper roll 17, a lower roll 18, and an intermediate roll 19, which may be operated as the rolls 1, 2, and 3 of Fig. 6. The intermediate roll 19 has its periphery shaped in cross-section with a longer but less prominent curve than the periphery of the roll 14 to further flatten the flange.

The fourth set of rolls, that serves to complete the shape of the re-formed rail, employs an upper roll 20, a lower roll 21, and an intermediate roll 22, which may also be driven as the rolls 1, 2, and 3 of the set shown in Fig. 6. The intermediate roll in this last instance, however, is preferably provided with a cylindrical periphery to engage the bottom of the flange and flatten the same.

The rolls 1, 12, 17, and 20, and 2, 13, 18, and 21 are preferably uniformly shaped, each having five peripheries 23, 24, 25, 26, and 27, which correspond to the side walls of the head of the rail, the surfaces that unite the side walls with the web of the rail, the surfaces that unite the web of the rail with the side walls of the flange, and the surfaces which correspond to the side walls or edges of the flange.

In the steps illustrated in Figs. 6, 7, and 8 the peripheral surfaces 26 and 27 are not fully engaged by the flange of the rail; but the rolls 3, 14, and 19 press the flange portion of the rail toward these peripheral surfaces, these peripheral portions 26 and 27 thus constituting shaping means and which serve to limit the flow of the metal, so that when the final roll 22 is applied to the base of the flange the space between the roll 22 and the rolls 20 and 21 is completely filled, securing thus a proper shape.

The furnace illustrated in Fig. 1 is simply a diagrammatic illustration of one that may be employed for heating the rails to a temperature near to but below the point at which the carbon contained therein would be materially affected, which temperature, however, may be such as to permit a remolding or shaping of the rail. If desirable, the rails in process of reconstruction may be heated between passes, so as to be readily worked.

It is desirable not to reroll the portion of the rail that is to constitute the tread while the flange is being formed. This rerolling of the tread may be done by processes that have hitherto been devised for just this purpose.

I will now describe those features of the in-

vention which while particularly useful in connection with the main object of my present invention are also highly advantageous in connection with the general rolling-mill art.

Where the rail is to be subject to transverse pressure in a direction coincident with the plane of the web, there is a tendency to upset parts thereof which are not at the particular stage of the process to be upset. I have provided improved means for opposing this tendency. The head of the rail is engaged underneath and on the sides by the peripheral surfaces 24 and 23, respectively. To prevent the tread-surface of the rail from being thrust beyond the rolls, thus engaging the head thereof, there is preferably provided in association with each pair of rolls thus engaging the head an abutment 28, which engages the tread of the rail and preferably extends on both sides of the same into engagement with the rolls, so that this abutment in combination with the peripheral surfaces 23 and 24 forms a space that corresponds approximately to the cross-section of the rail-head. This abutment is preferably in the form of a flat bar, and it is preferably moved at the same rate of speed as the rail passing through the rolls, so that there will be no relative motion between the rail and bar, which might result in friction and an improper displacement of the metal. In order that the bar may be pressed firmly against the rail where the same is acted upon by the part of the machine where the roll 3 is in engagement with the rail, I preferably employ two idlers 29 29, in line with the space between which is located the web of the rail. In order that this bar, which is preferably coextensive in length with the rail, may accompany the rail in its travel, I preferably drive the same by means of belt-driven friction-pinions 30, which are shaped at their peripheries to correspond to the channel 31 in the abutment-bar 28. To effect a return of the abutment-bar after the rail which it accompanies has been passed through a machine, the direction of rotation of the rolls 30 may be reversed or the bar otherwise reciprocated. As the heat of the rail is likely to be communicated to the bar 28 to an undesirable extent, a groove 32 is formed in the upper side of the bar, within which water may be passed to cool the bar.

The diameter of the reshaping-rolls is made slightly larger than that of the feed-rolls, and the axes thereof are placed slightly in advance of the plane containing the axes of the feeding-rolls. The rates of revolution of the reshaping-rolls and the feed-rolls remaining equal, the peripheral speed of the reshaping-rolls is consequently greater than the speed of the rail passing through the feeding-rolls, and on account of the friction created thereby between a reshaping-roll and the rail the material of the rail tangent to the reshaping-roll is pushed and worked forward into the rail and compressed between the points of tangency of the rail with the reshaping-roll and the points of tangency of the rail with the feeding-rolls, the rail being thus subjected simultaneously to transverse compression between the reshaping-roll and the abutment-bar and to longitudinal compression between the reshaping-rolls and the feeding-rolls.

The rolling-mill apparatus that I have herein specifically illustrated may obviously be modified in many respects without departing from the spirit of my invention. I do not, therefore, wish to be limited to the precise disclosure herein set forth; but,

Having thus described my invention, I claim as new and desire to secure by Letters Patent—

1. In a rolling-mill, the combination with a pair of rolls between which a rail may be grasped and fed, the said rolls being placed in substantial alinement, of a third roll acting upon the rail at right angles to the aforesaid rolls and engaging one side of the rail, an abutment engaging the other side of the rail, the said abutment being in the form of a bar, and means whereby the said bar may be caused to travel as the rail is passed through the rolls, substantially as described.

2. In a rolling-mill, the combination with a pair of rolls between which a rail may be grasped and fed, the said rolls being placed in substantial alinement, of a third roll acting upon the rail at right angles to the aforesaid rolls and engaging one side of the rail, an abutment engaging the other side of the rail, the said abutment being in the form of a bar, means whereby the said bar may be caused to travel as the rail is passed through the rolls, and means whereby the said bar may be reciprocated after the passage of a rail through the rolls, substantially as described.

3. In a rolling-mill, the combination with a pair of rolls between which a rail may be grasped and fed, the said rolls being placed in substantial alinement, of a third roll acting upon the rail at right angles to the aforesaid rolls to engage one side of the rail, said third roll having a peripheral speed greater than that of the aforesaid rolls, and an abutment engaging the other side of the rail, the said abutment being in the form of a slidable bar adapted to move with said rail in contact therewith throughout its length, substantially as described.

4. A rolling-mill for converting a head of a rail into a flange, comprising two gripping-rolls, an abutment-bar adapted to travel with the rail and to form with said gripping-rolls a suitable caliber for said rail, and a shaping-roll acting in conjunction with said gripping-rolls and said abutment-bar to alter the form of the rail-head, substantially as described.

5. In a rolling-mill apparatus for transforming the head of a traction-rail into a flange, the combination with a set of rolls having peripheral surfaces in correspondence with sur-

faces of the flange, of additional rolls for successively spreading the head varying degrees until the flange is finally shaped, the said additional rolls including those having grooving and cylindrical peripheries for engagement with the bottom of the flange portion to be, to groove this head portion to transform the same into a flange, said additional rolls having a peripheral speed greater than that of the aforesaid set of rolls, substantially as described.

6. In a rolling-mill apparatus for transforming the head of a traction-rail into a flange, the combination with a set of rolls having peripheral surfaces in correspondence with surfaces of the flange, of additional rolls for successively spreading the head varying degrees until the flange is finally shaped, the said additional rolls including those having grooving and cylindrical peripheries for engagement with the bottom of the flange portion to be, to groove this head portion to transform the same into a flange, the peripheral speed of said additional rolls being greater than that of the aforesaid set of rolls, and the axes thereof being placed in advance of the plane containing the axes of the aforesaid set of rolls, substantially as described.

7. A machine for transforming a double-headed traction-rail into a single-headed flanged rail including rolls engaging the web of the rail and the bottom of that which is to be the flanged portion of the rail, the rolls being so disposed that this portion of the rail is substantially inclosed by the rolls, the space intervening between the rolls substantially corresponding in cross-section to the flange of the rail whereby as the rail is passed between the rolls that which was a head portion is transformed into a flange, an abutment for said rolls in the shape of a bar, and means whereby the said bar may be caused to travel as the rail is passed through the rolls, substantially as described.

8. A machine for transforming a double-headed traction-rail into a single-headed flanged rail including rolls engaging the web of the rail and the bottom of that which is to be the flanged portion of the rail, the rolls being so disposed that this portion of the rail is substantially inclosed by the rolls, the space intervening between the rolls substantially corresponding in cross-section to the flange of the rail whereby as the rail is passed between the rolls, that which was a head portion is transformed into a flange, an abutment for said roll in the shape of a bar, means whereby the said bar may be caused to travel as the rail is passed through the rolls, and means whereby the said bar may be reciprocated after the passage of the rail through the rolls, substanstantially as described.

9. In a rolling-mill, the combination with a pair of rolls between which a rail may be grasped and fed, the said rolls being placed in substantial alinement, of a third roll acting upon the rail at right angles to the aforesaid rolls to engage one side of the rail, the peripheral speed of said third roll being greater than that of the aforesaid rolls, and the axis thereof being placed in advance of the plane containing the axes of the aforesaid pair of rolls, substantially as described.

10. In a rolling-mill, the combination with a pair of rolls between which a rail may be grasped and fed, the said rolls being placed in substantial alinement, of a third roll acting upon the rail at right angles to the aforesaid rolls to engage one side of the rail, the peripheral speed of said third roll being greater than that of the aforesaid rolls, and the axis thereof being placed in advance of the plane containing the axes of the aforesaid pair of rolls, and an abutment engaging the other side of the rail, said abutment being in the shape of a slidable bar adapted to move with said rail in contact therewith throughout its length, substantially as described.

11. A rolling-mill for converting a head of a rail into a flange comprising two gripping-rolls, an abutment adapted to travel with the rail and to form with said gripping-rolls a suitable caliber for said rail, and a shaping-roll acting in conjunction with said gripping-rolls and said abutment-bar, to alter the form of said rail-head, the peripheral speed of the shaping-roll being greater than that of the gripping-rolls, and the axis thereof being placed in advance of the plane containing the axes of the gripping-rails, substantially as described.

12. In a rolling-mill, the combination with a pair of coacting rolls between which a rail may be grasped and fed, of a third roll acting upon the rail at right angles to the aforesaid rolls to engage the head of the rail to press the metal thereof into the shape of a flange, and an abutment for said rail in the shape of a slidable bar adapted to move with said rail in contact therewith throughout its length, substantially as described.

13. In a rolling-mill, the combination with a pair of coacting rolls between which a rail may be grasped and fed, of a third roll acting upon the rail at right angles to the aforesaid rolls to engage the head of the rail to press the material thereof into the shape of a flange, said third roll having a diameter greater than that of the aforesaid rolls, and the rates of revolution of all said rolls being equal, whereby the peripheral speed of said third roll is greater than that of the aforesaid rolls, substantially as described.

In witness whereof I hereunto subscribe my name this 5th day of April, A. D. 1902.

DAVID H. LENTZ.

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