No. 897,931. PATENTED SEPT. 8, 1908.

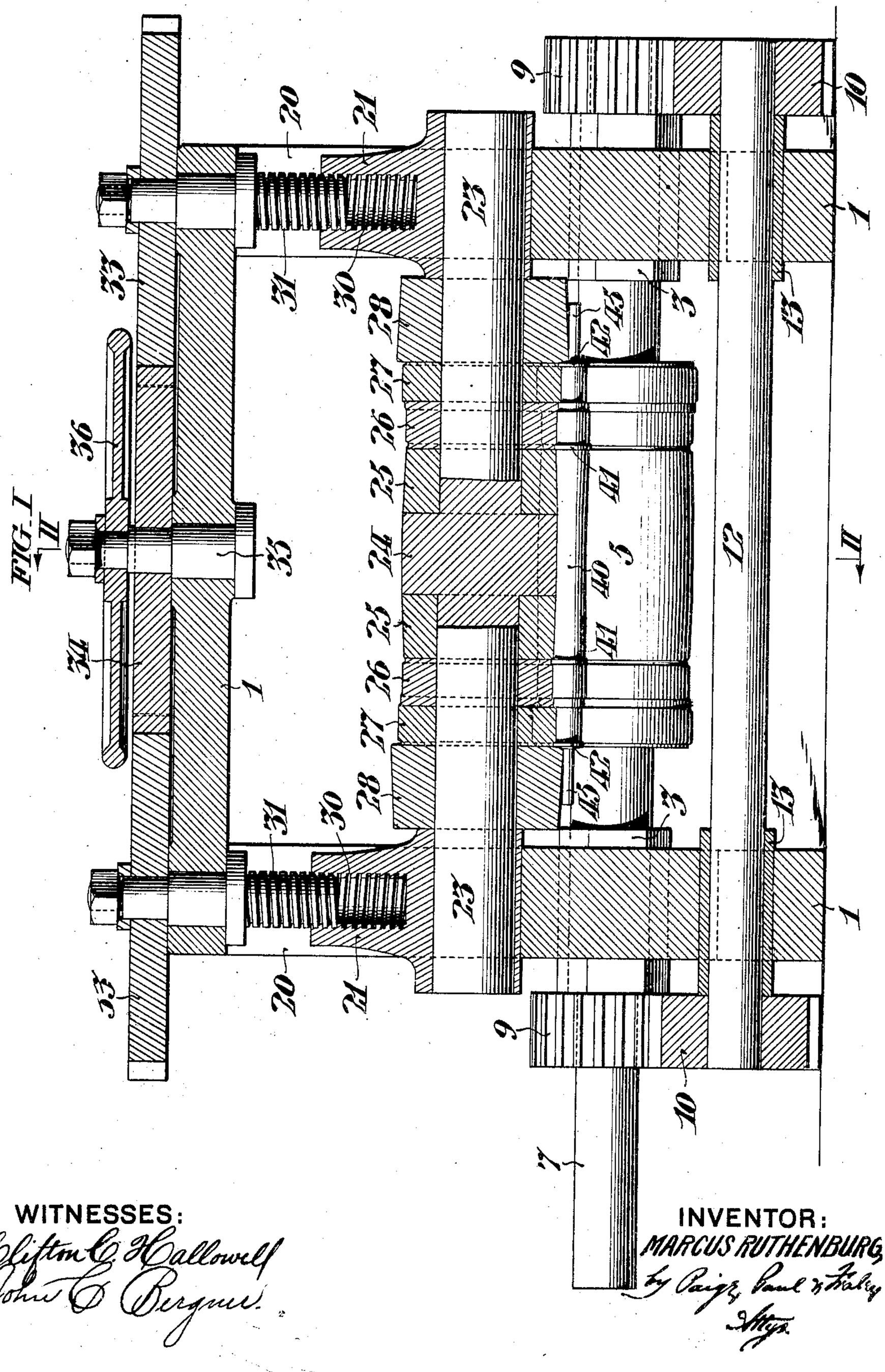
M. RUTHENBURG.

METAL ROLLING PROCESS AND MILL.

APPLICATION FILED AUG. 14, 1905.

2 SHEETS—SHEET 1.

FIG. 1



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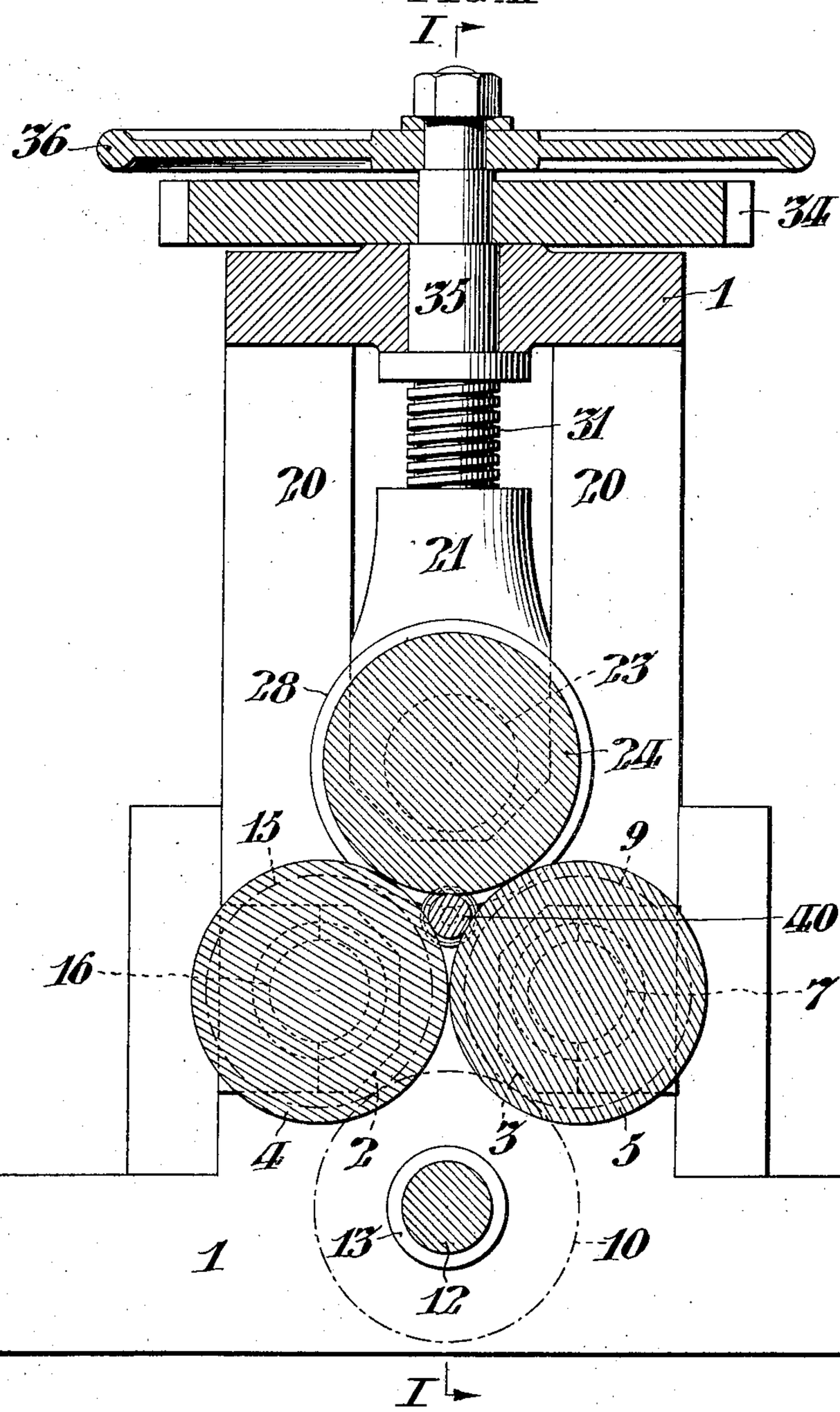
2 SHEETS—SHEET 2.

FIG. II



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UNITED STATES PATENT OFFICE.

MARCUS RUTHENBURG, OF LOCKPORT, NEW YORK.

METAL-ROLLING PROCESS AND MILL.

No. 897,931. Specification of Letters Patent. Patented Sept. 8, 1908.

Application filed August 14, 1905. Serial No. 274,021.

To all whom it may concern:

Be it known that I, MARCUS RUTHENBURG, of Lockport, in the county of Niagara and State of New York, have invented certain new and useful Improvements in Metal-Rolling Processes and Mills, whereof the following is a specification, reference being had to the accompanying drawings.

My invention relates to processes and mills for rolling articles of circular cross section, and of the class wherein the article is rolled with its axis parallel with the axes of the mill rolls.—As heretofore constructed it has been impossible to roll with such mills, articles of different diameters at different portions of their length, as car axles, because the torsional strains produced by the tendency of the mill rolls to rotate the articles at different speeds at their different diameters are sufficient to fracture the articles.

Therefore, it is the object of my invention to provide a mill capable of rolling articles of the character specified, without the production of detrimental strains.

As hereinafter described, my invention comprises a mill having a group of rolls disposed on three parallel axes surrounding the article to be rolled, and one of said rolls comprises sections of different diameters, capable of independent rotation so as to permit such relative slip of the rolls and the articles rolled as to prevent any detrimental torsional strains in the latter. As described said sectional roll is adjustable with respect to the other two rolls, so as to permit of the insertion of the billet which is to form the rolled article, and the gradual reduction of the latter to the desired size and form.

My invention comprises the various novel features of procedure, construction and arrangement hereinafter more definitely specified.

In the drawings, Figure I, is a longitudinal sectional view of a mill conveniently embodying my improvements, taken on the line I, I, in Fig. II. Fig. II, is a transverse sectional view of said mill, taken on the line II, II, in Fig. I.

In said figures; the housing 1, comprises the bearings 2, and 3, for the rolls 4, and 5, and the latter is provided with the shaft 7, extending beyond said housing 1, to engage suitable driving mechanism. Said shaft 7, is provided with the gears 9, engaged with the gears 10, on the countershaft 12, which is mounted to rotate in the bearings 13, in said housing 1. Said gears 10, engage corresponding gears 15, on the shaft 16, of the roll 4, so that said rolls 4, and 5, may be positively rotated at the same speed by the driving means connected with the shaft 7, as aforesaid. Said housing 1, comprises the vertical slide bearings 20, at its opposite ends, for the bearing boxes 21, which carry the shaft 23, of the roll comprising the sections 24, 25, 26, 27, and 28. As shown in Fig. I, said section 24, is centrally fixed on said shaft 23, and the sections 25, to 28 inclusive, are loosely carried on said shaft 23, in pairs, disposed equidistantly upon opposite sides of said section 24. Said bearing boxes 21, comprise screw sockets 30, engaged with the screw shafts 31, which are mounted to rotate in the housing 1, and provided with the gears 33, connected by the gear 34, so as to be simultaneously rotated. Said gear 34, is mounted on the shaft 35, provided with the hand wheel 36, by which its rotary movement may be conveniently effected to raise and lower said boxes 21.

The mill above described is operated as follows:—The roll, provided with the shaft 23, and comprising the sections 24, to 28 inclusive, as above described, is raised in the housing 1, by rotation of the hand wheel 36, until sufficient space is afforded between said sectional roll and the rolls 4, and 5, to admit a hot billet of sufficient mass to form the axle 40. Said billet being shorter than said axle; is rotated by frictional engagement between the rolls 4, and 5, and the sectional roll, while the latter is gradually lowered in the housing, and thereby said billet has its fibers distributed helically in the axle 40, from the central section 24, of said roll outwardly, so as to produce the different diameters of said axle, (including the flanges 41, and 42,) and project the surplus metal in the form of solid trunnions 45, which are gradually forced from the centers of the opposite ends of the axle beyond said flanges 42, until the axis is formed as indicated in Fig. I.

It is to be noted that if the roll sections 28, were not of larger diameter than the roll sections 27 so as to project radially nearer to the axis of the axle 40, than the circumference of the axle journal flanges 42, the surplus metal from the axle 40, would not be forced to flow from the centers of the opposite ends thereof, but would be "piped", *i. e.*, caused to flow outwardly as a hollow shell having its outer surface coincident with the diameter of

the axle journal flanges 42, the hollow thereof starting from points representing the original length of the billet. Therefore, said roll sections 28, perform the double function of forming the end surfaces of the axle flanges 42, and compelling the flow of the metal in solid form throughout the length of the axle and the trunnions 45, thus preventing the formation of flaws at the ends of the axle. It is to be understood that said trunnions of surplus metal 45, may be of greater or less extent in accordance with slight variations in the quantity of metal in the billet, and, are finally severed from the axle adjoining said flanges 42; leaving the axle accurately shaped and finished to the desired dimensions, determined by the configuration of the rolls employed.

It may be here stated that the present invention is the result of practical experience, I having first attempted to roll axles with a mill comprising three rolls arranged as indicated in Fig. II, but without relatively movable sections. Being unable to roll an axle with such a mill without breaking the axle, I lubricated the billet so that it could slip, and found that this relieved the torsion upon the billet. I then fitted the upper roll with relatively movable sections where the breaks had occurred in the axles made with the solid rolls and was then able to roll axles without breaking them. However, the rolls at the ends of the mill being of such diameter as to contact with the circumference of the journal flanges of the axle, the axles made therewith were piped or hollow as aforesaid. I then provided the mill with relatively movable sections 28, which forced the metal of the billet to flow solidly to and beyond the ends of the axle. Therefore, I do not claim to be first to construct a three roll mill for the purpose described but believe that I am the first to provide such a mill capable of rolling axles without breaking them or piping the ends thereof.

I may add that I found in practice that although the two lower rolls 4 and 5 shown in Fig. II, are rigid throughout their length, their twisting effect upon the axle 40, which lies between them is practically negligible, said rolls forming in effect merely a die bed opposed to the action of the movable upper roll. It may be observed that said lower rolls 4 and 5, tend to drive the axle throughout its length, and that the upper roll presses the axle throughout its length but does not set up opposing strains because different sections are separately rotatable being free to make what speed the billet requires, and allowing the billet to slip on the lower solid rolls.

Although I have found it convenient to employ a single sectional roll and to provide means to adjust it toward and away from the other rolls, it is to be understood that more than one of the rolls may be sectional, and, that the axis of the sectional roll or rolls may be maintained stationary in the housing, and the desired adjustment effected by movement of a roll which is not sectional. Therefore, it is to be understood that I do not desire to limit myself to the particular construction and arrangement set forth, as it is obvious that various modifications may be made therein without departing from the essential features of my invention.

I claim:—

1. In a rolling mill, the combination with a roll having loose rings, of a roll having positively driven zones opposed to said loose rings.

2. In a rolling mill, the combination with a roll having loose rings; of two rolls comprising positively driven zones respectively opposed to said loose rings; said rolls comprising positively driven zones forming a bed to retain the article to be rolled.

3. In a rolling mill, the combination with a roll having zones of different diameters; of a roll having loose rings opposed to said zones, and, loose rings respectively overlapping the end zones.

4. In a rolling mill, the combination with two rolls comprising zones of different diameters forming a bed to retain the article to be rolled; of a roll having loose rings opposed to said zones, and, loose rings respectively overlapping the end zones.

5. The process which consists in confining a heated billet at its ends, except for a limited area around its axis, against longitudinal expansion, and subjecting it throughout its length to the action of a transversely operating rolling and reducing means and reducing it while the outer portions of the ends are thus confined and while the said limited area about the axis is unconfined.

6. The process of forming a car axle, which consists in reducing by rolling transversely with respect to its axis a heated metal billet, while restricting the longitudinal flow of the metal at the outer portion of the ends of said billet to the length of the prospective axle, and at the same time leaving the central portions of the said ends unconfined; whereby the surplus metal is forced toward the center of the billet and thence axially outward beyond the restricted regions thereof as the rolling progresses.

In testimony whereof, I have hereunto signed my name at Lockport, in the county of Niagara and State of New York, this 19th day of July 1905.

MARCUS RUTHENBURG.

Witnesses:
J. FRANK SMITH,
CHARLOTTE E. SPALDING.