G. G. CRAWFORD.

METHOD OF TREATING INGOTS.

APPLICATION FILED MAR. 31, 1913.

1,108,862

Patented Aug. 25, 1914.

3 SHEETS—SHEET 1.

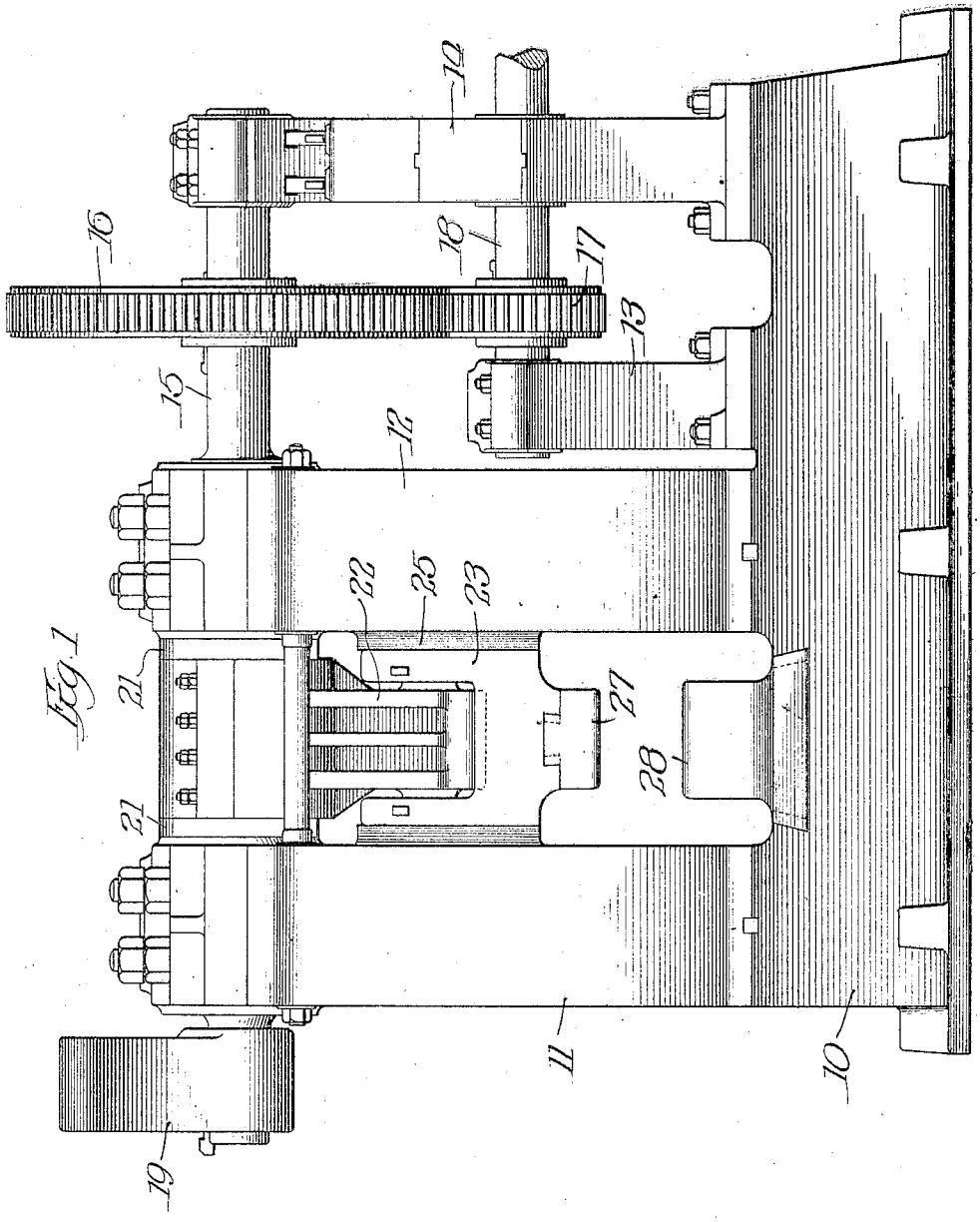


Fig. 1

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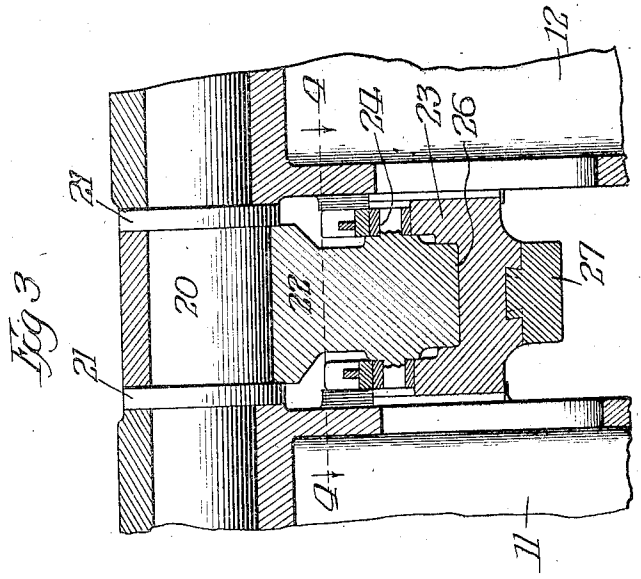


Fig. 3

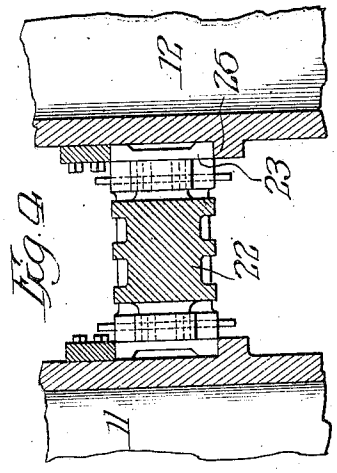


Fig. 4

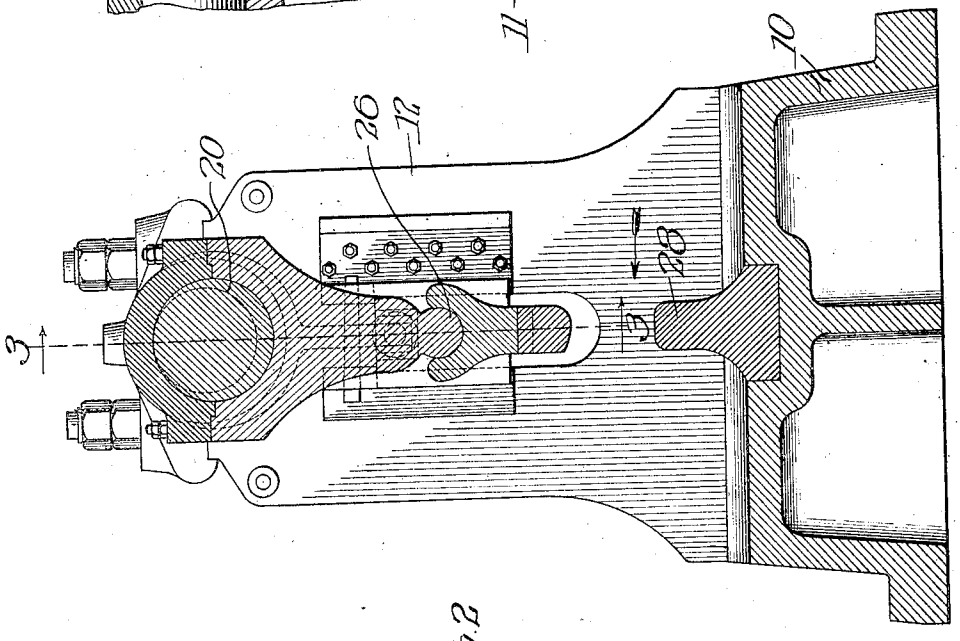


Fig. 2

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3 SHEETS—SHEET 3.

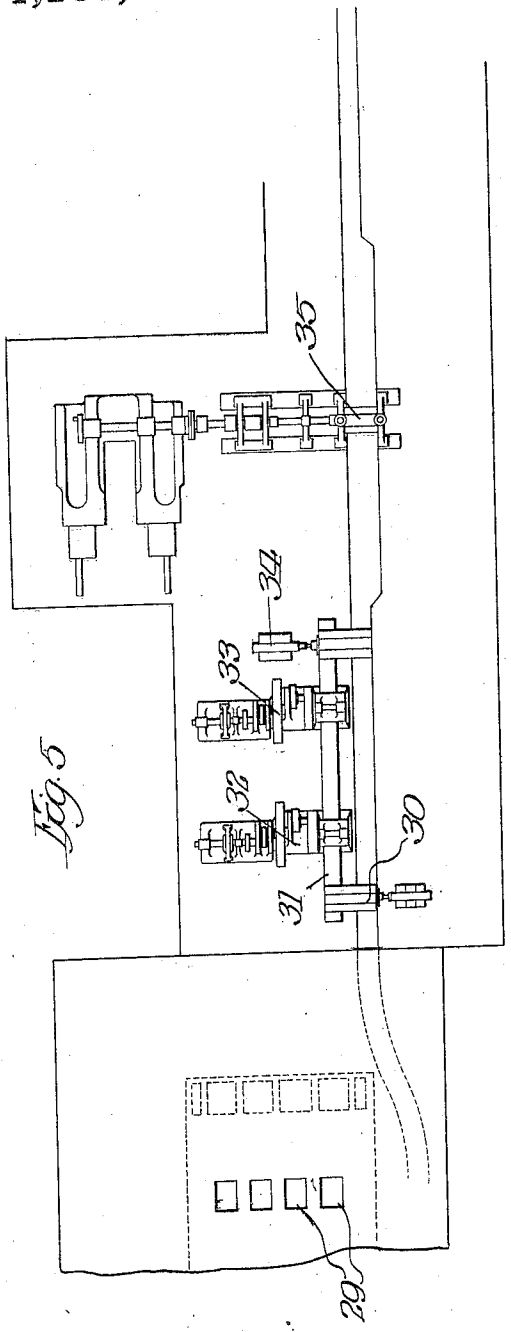


Fig. 5

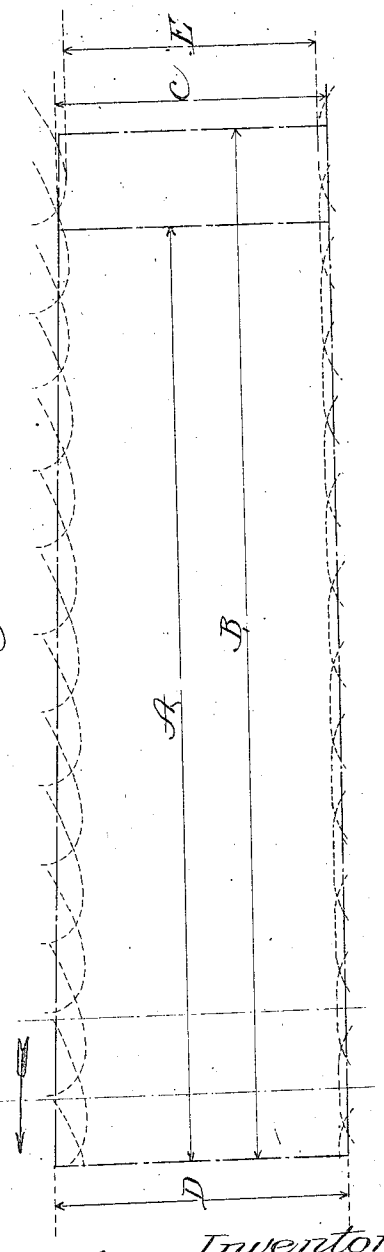


Fig 6.

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UNITED STATES PATENT OFFICE.

GEORGE G. CRAWFORD, OF BIRMINGHAM, ALABAMA.

METHOD OF TREATING INGOTS.

1,108,802. Specification of Letters Patent. Patented Aug. 25, 1914.

Application filed March 31, 1913. Serial No. 757,968.

To all whom it may concern:

Be it known that I, GEORGE G. CRAWFORD, a citizen of the United States, and resident of Birmingham, in the county of Jefferson and State of Alabama, have invented certain new and useful Improvements in Methods of Treating Ingots, of which the following is a specification.

My invention relates to the art of metal rolling and has particular reference to a novel method of ingot treatment whereby the finished rolled product shall be free from some defects caused by the rolling process.

Much attention has been directed to the failure of railroad rails, these failures very frequently occurring in rails rolled from the top part of an ingot. However, of late there have been many failures in rails produced from the bottom portion of the ingot where the steel is supposed to be sound. The majority of these failures are due to the fact that the rolls in the blooming mills or other rolls which make the first pass on all ingots are of relatively small diameter compared with the thickness of the ingot, and the molecules of the ingot when they have as yet had no flow motion imparted to them are less cohesive. The effect of the bite of the roll on the ingot in this tender condition is to drag the piece of steel through the rolls in much the same manner as a piece of steel is pulled through a die, and the draft and speed at which this work is done is so great that the sides of the ingots are torn, and defects are produced which are not corrected in the later rolling operation. In order to overcome the difficulties mentioned and to so manipulate the ingot that the surfaces thereof may be made more dense and less liable to be torn in the first pass of the mill, I provide at a point between the soaking pit and the blooming mill a powerful forging press or presses, whereby, by a forging action, the surface of the ingot is made tough and dense. In the forging action the complete reduction is made in two overlapping strokes; that is, one portion of the die will complete the reduction begun by another portion in the preceding stroke. Preferably the ingot will be worked on two sides simultaneously, then given a quarter turn and passed through the same or another set of dies whereby the unworked surfaces are treated. The latter form is theoretically preferable for the reason that the cracks or fissures usually appear at the corners of the ingot. However, in practice the illustrated form will be found desirable. This forging action will not materially elongate the ingot, but its sides will be made parallel, that is, the cross sectional area will be substantially uniform throughout.

The invention may be stated broadly as consisting in the method of treating ingots in which an ingot is first suitably heated, then subjected to a forging process whereby a flow of the molecules is imparted and the surface made more tough and dense, previous to rolling the ingot in the usual manner.

Mechanism by which my improved method may be carried out is shown in the accompanying drawings, wherein,

Figure 1 is a side elevation of a forging press for use in forging ingots as described; Fig. 2 is a transverse vertical section through the forging dies as shown in Fig. 1; Fig. 3 is a section on the line 3—3 of Fig. 2; Fig. 4 is a section on the line 4—4 of Fig. 3; Fig. 5 is a diagrammatic plan of a plant adapted for carrying out my improved method, and, Fig. 6 is a view of an ingot showing in dotted lines the degrees of reduction throughout its length.

Referring more particularly to the drawings it will be seen that a forging press suitable for carrying out my invention may be composed of a base 10, having upwardly projecting housings 11, 12, 13, 14. Carried in bearings in the tops of the housings 11, 12 and 14, is a transverse shaft 15, having a large gear 16, keyed thereto, which gear meshes with a pinion 17, keyed to a shaft 18, carried in bearings in the housings 13, 14. The shaft 18 is connected to a suitable source of power. The shaft 15 is over-hung at one end and is provided with a counterweight 19, which may act to augment the force of the forging stroke. At a point between the bearings in the housings 11, 12, the shaft 15 is eccentric as at 20, in Fig. 2. This eccentric portion is located between two integral annular rings or collars 21, which bear against portions of the housings 11, 12. Carried by this eccentric portion is a pitman 22, pivotally connected to a cross-head 23, by means of pins 24, which are adapted for limited sidewise movement as required, the recess within which the pins are retained permitting such movement. The cross-head

is adapted for vertical movement between ways 25, on the sides of the housings 11, 12.

The lower face of the pitman 22 is circular in cross-section and fits within a corresponding recess in the upper face of the cross-head 23, as shown at 26, in Fig. 2. This provides for the necessary strength and at the same time permits the oscillation of the pitman. The lower face of the cross-head 23 is provided with a dove-tailed recess within which is fitted the forging die 27, the face of which may be given the desired contour, that shown in Fig. 2, being preferable. By such contour of the die the reduction of the ingot will be substantially as shown on the upper face of the ingot in Fig. 6; that is, the complete reduction is not secured in any one stroke, the strokes overlapping.

The bottom die 28 is fitted within the base 10, and its working face may be shaped as desired. That shown in Fig. 2 is believed to be preferable. The reducing strokes will overlap but the reduction will not be as great as that on the upper surface of the ingot. However, the ingot will be finished with parallel sides and all the surfaces will have been worked.

As shown in Fig. 6, the original length of the ingot may be as shown by the dimension line A, the final length being represented by the dimension line B. The original diameter of the ingot at the top is represented by C, at the bottom by D, and the finished diameter by E, which diameter is uniform throughout the length of the ingot. It will thus be seen that the elongation is not material, neither is there material reduction in the cross-sectional area at the top of the ingot.

The method will preferably be carried out with an arrangement such as shown in Fig. 5. It is assumed that the ingots have been suitably cast and stripped and thereafter placed in soaking pits 29. From the soaking pits they are removed and placed on the ingot chariot and thereafter delivered in front of a hydraulic pusher 30, by means of which they are transferred to a roller table 31. From the roller table they are passed through the first forging press 32, wherein two sides of the ingot are reduced as shown in dotted lines in Fig. 6. From the press 32, the ingots are delivered to a second press 33, where the other two sides are treated. From the press 33 the ingot is delivered in front of a second hydraulic pusher 34, and returned to an ingot chariot or delivered directly onto the blooming mill roller table. The ingots are then passed through the blooming mill 35, the steps from there on being as usual in rolling operations.

By following the method herein described it will be found that ingots are produced which possess a dense and tough surface not easily torn by the passage of the ingot through the first pass of the blooming mill with the usual consequent great reduction in area.

The heating of the ingot referred to in the claims may consist in utilizing the heat contained in the ingot after it has been poured and becomes solidified or the ingot may be heated in any other suitable manner.

It will be obvious also that modifications may be made and such modifications as are within the scope of my claims I consider within the spirit of my invention.

I claim:

1. The method of treating ingots which consists in first suitably heating the same, then forging the ingots between dies in order to toughen and improve their structure, then rolling the ingots, substantially as described.

2. The method of treating ingots which consists in first suitably heating the same, then forging two opposing surfaces of the ingots in order to change the molecular structure thereof, then rolling the ingots, substantially as described.

3. The method of treating ingots which consists in suitably heating the same, then forging two opposing surfaces, then forging two additional opposing surfaces whereby the cross section of the ingots is made substantially uniform and their outer surfaces are densified and toughened, then rolling the ingots, substantially as described.

4. The method of treating ingots, whereby the tearing of the surfaces thereof in the first rolling pass is avoided, which consists in first suitably heating the ingots, then forging their surfaces and making the ingots of substantially uniform cross section, then rolling the ingots, substantially as described.

5. The method of forging ingots which consists in placing an ingot between opposing dies, partially reducing a transverse dimension of said ingot in one stroke of the die and in another and later stroke of the die completing the reduction and partially reducing an advanced portion of the ingot, substantially as described.

GEORGE G. CRAWFORD.

Witnesses:
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H. C. RYDING.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."