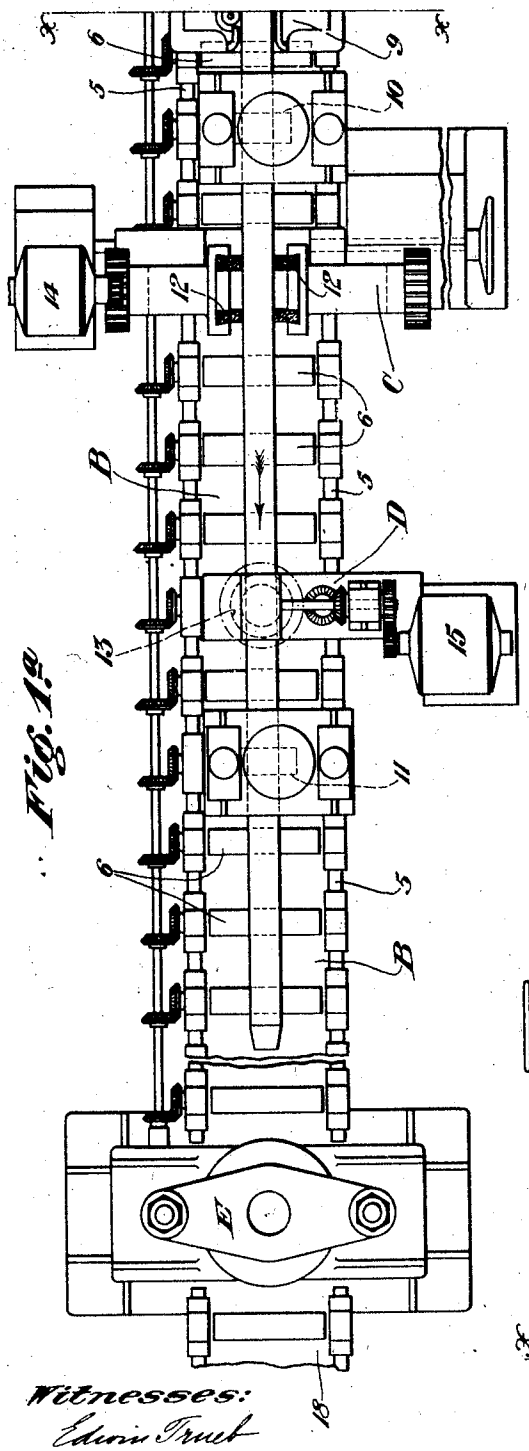
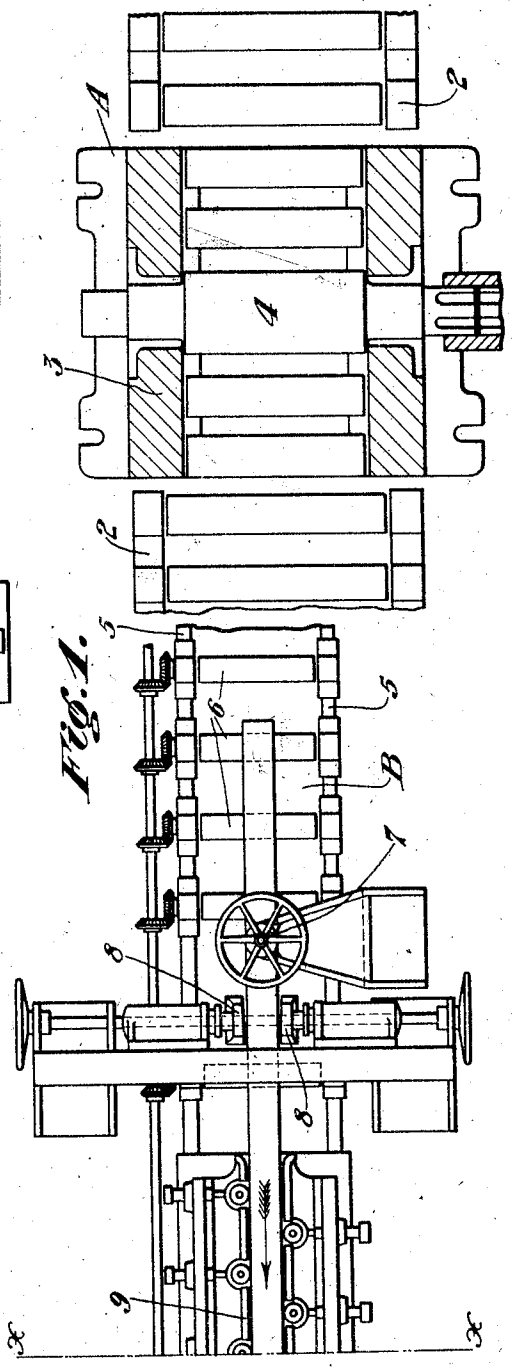
Oct. 30, 1928. 1,689,512

S. G. WORTON

HOT ROLLING

Filed Dec. 19, 1921 5 Sheets-Sheet 1





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Oct. 30, 1928. 1,689,512

S. G. WORTON

HOT ROLLING

Filed Dec. 19, 1921 5 Sheets-Sheet 2

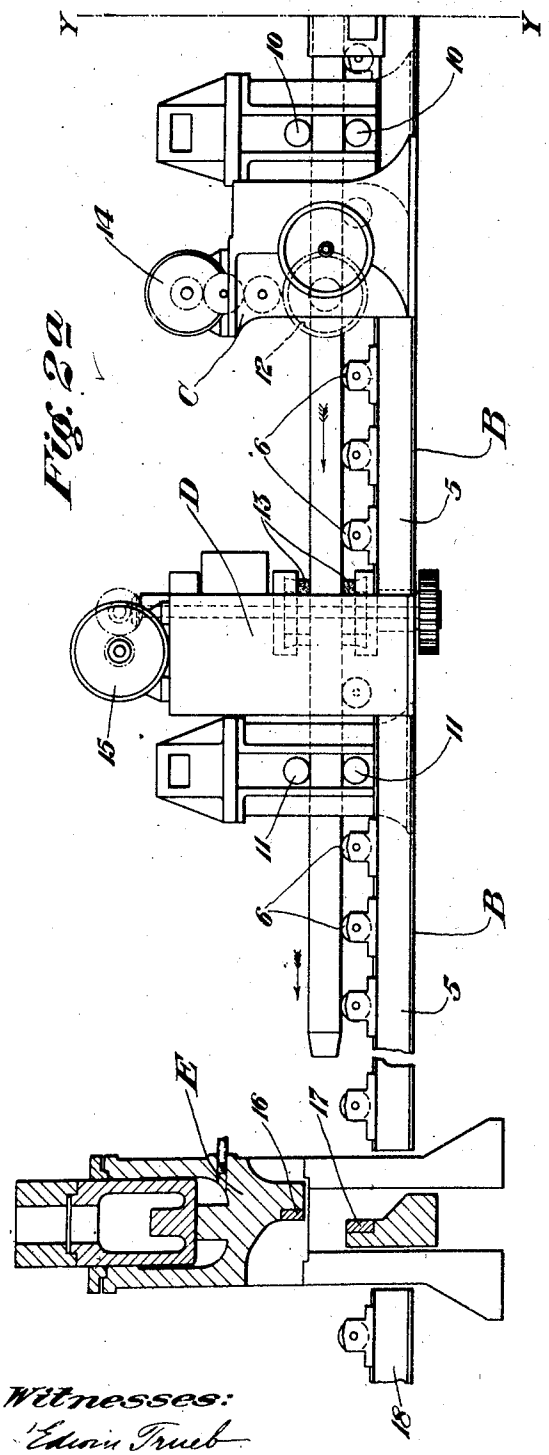


Fig. 2a.

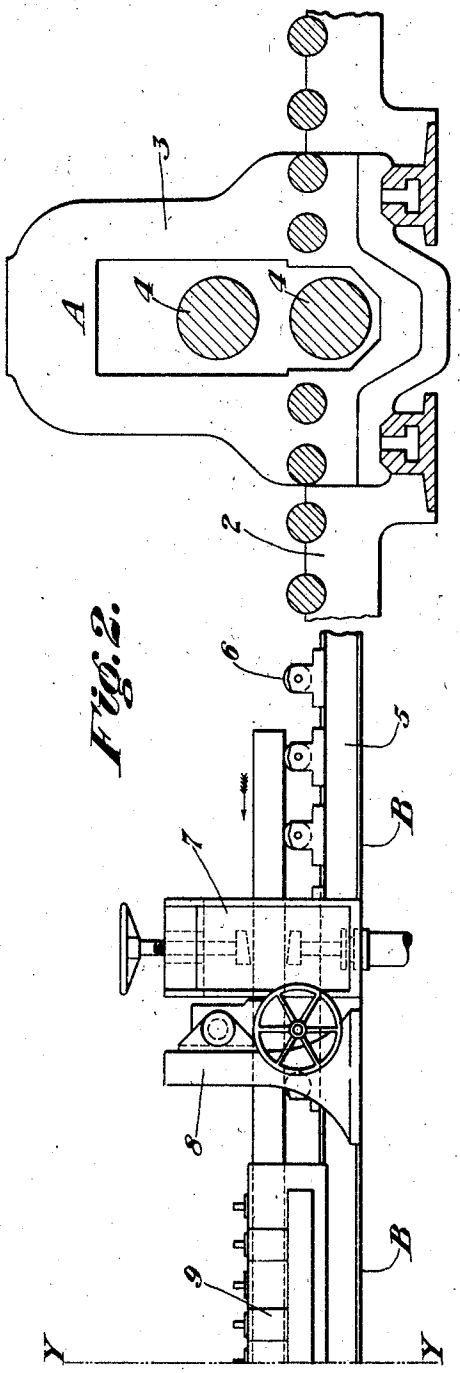


Fig. 2.

Witnesses:
Edwin Trueb

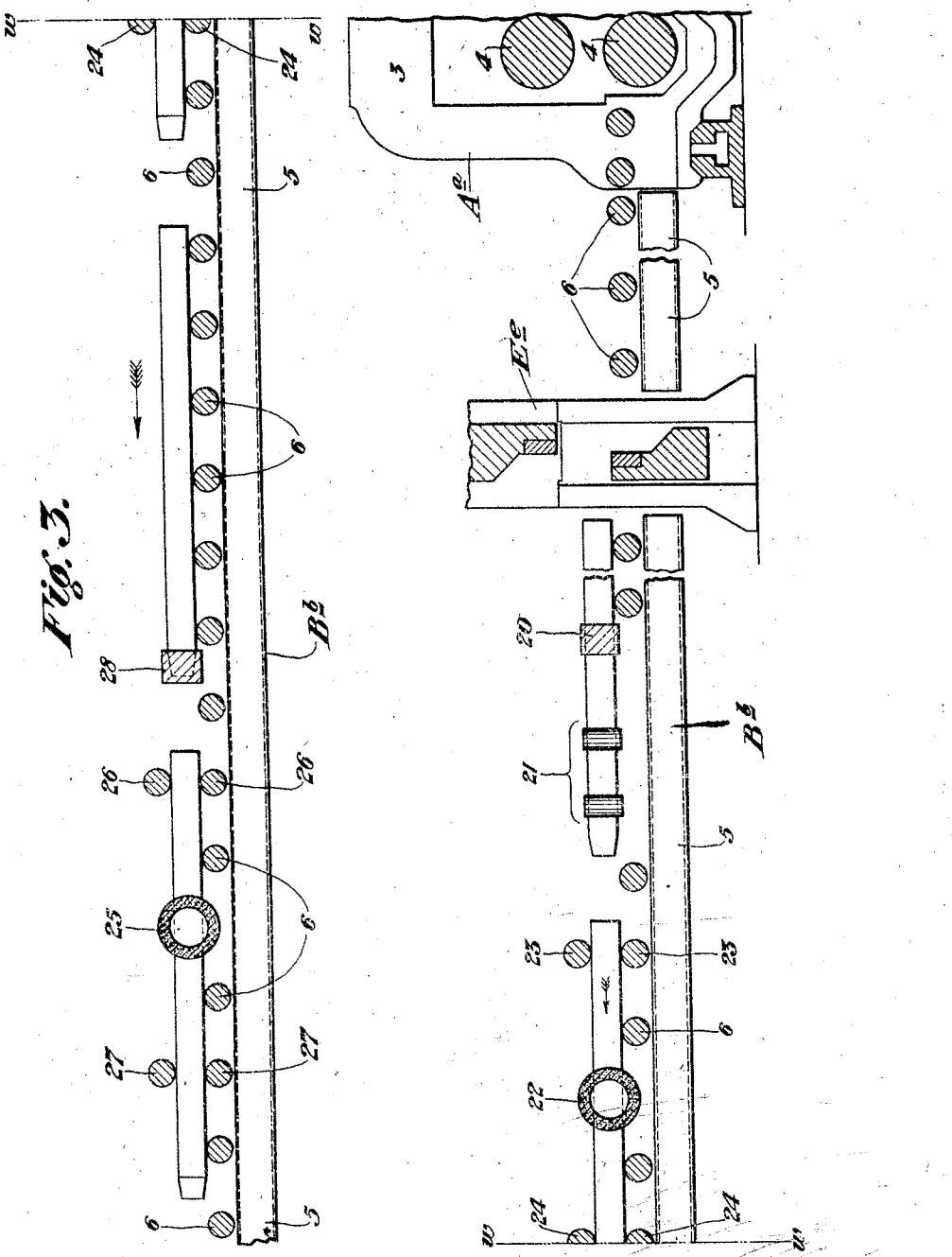
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Filed Dec. 19, 1921 5 Sheets-Sheet 3



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Oct. 30, 1928. 1,689,512

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HOT ROLLING

Filed Dec. 19, 1921 5 Sheets-Sheet 4

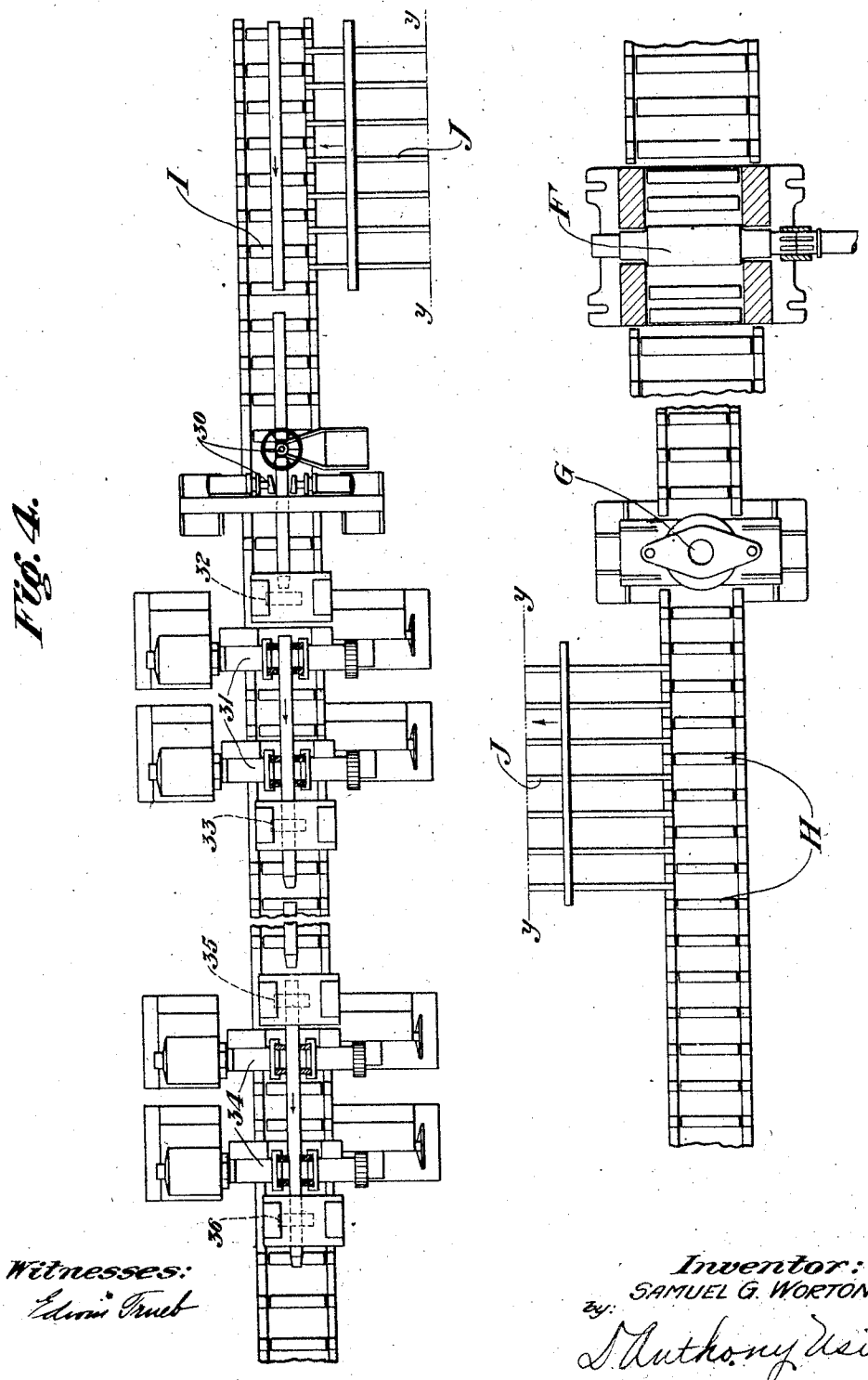


Fig. 4.

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Oct. 30, 1928

1,689,512

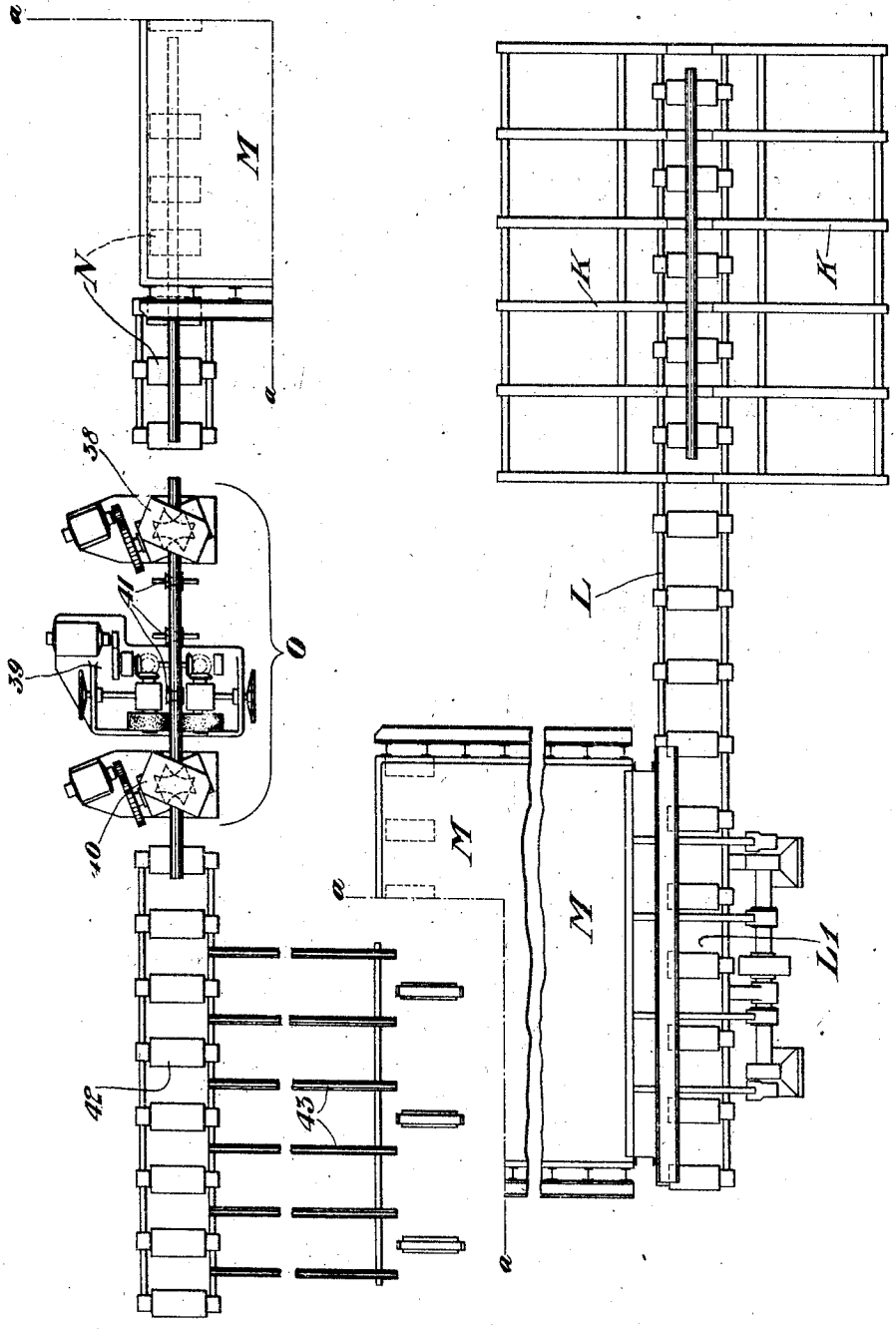
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HOT ROLLING

Filed Dec. 19, 1921

5 Sheets-Sheet 5

Fig. 5.



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Patented Oct. 30, 1928. 1,689,512

UNITED STATES PATENT OFFICE.

SAMUEL G. WORTON, OF DUQUESNE, PENNSYLVANIA.

HOT ROLLING.

Application filed December 19, 1921. Serial No. 523,362.

This invention relates to methods of removing surface defects from steel before final rolling and more particularly to a method of removing surface defects from hot blooms after they have been rolled in the blooming mill.

In rolling steel articles such as blooms and billets, longitudinal surface seams and other defects are formed in the metal. Heretofore it has been the practice to remove these surface defects after the metal has cooled, by chipping or cutting away the metal, and such operations are costly, due to the amount of labor required. Also since it was necessary to allow the metal to cool before such defects could be removed, the heat remaining in the metal after the blooming mill operations, was lost and the metal had to be entirely reheated from a cold state before finish rolling.

With the present method the surface defects are removed by grinding while the metal is hot, and preferably immediately after it has been rolled in the blooming mill. The metal, which is still at approximately a rolling temperature and therefore is more or less plastic, is readily cut away by the grinding wheels in removing the defects, and furthermore the blooms are still heated after the defects are removed, and may be transferred direct to the finishing mill in such heated state, so that materially less reheating is necessary to again bring the blooms up to a rolling temperature for finish rolling than is necessary when the blooms are cold.

In the accompanying drawings, forming a part of this specification, Figure 1 is a plan showing a blooming mill having one arrangement of apparatus adapted for use in carrying out my invention and Figure 1ª is a continuation of the plan of Figure 1, a complete plan being had by joining Figures 1 and 2 on the lines X—X of these figures.

Figure 2 is a side elevation of the apparatus of Figure 1 and Figure 2ª is a side elevation of the apparatus of Figure 2, a complete side elevation being had by joining F gures 2 and 2ª on the lines Y—Y of these figures.

Figure 3 is a diagrammatic elevation of a mill showing a modified arrangement of apparatus adapted for use in carrying out my invention.

res 4 and 5 are diagrammatic plans showing further modifications in apparatus usable in carrying out my invention.

It will be understood that the apparatus shown in the several figures described above, and which will be described in detail hereinafter, are only illustrative of the various means that may be used to carry out my invention and are not construed as a limitation thereof.

Broadly my invention consists in receiving blooms or other articles, having surface defects to be removed, at a red or approximately rolling heat, pointing the forward end of such blooms or articles, straightening the blooms or articles, and grinding one or more of the side faces of said blooms or articles to cut away the surface or surfaces a sufficient depth to remove the defects.

Referring particularly to Figures 1, 1ª, 2 and 2ª of the drawings, the blooming mill, which is of ordinary design, is designated as a whole by the letter A, and comprises the usual roller tables 2, housings 3, and reducing rolls 4.

A grinding table B is located forward of the blooming mill A and comprises a table member 5 having a plurality of power driven transfer or conveying rollers 6 journaled therein. Vertical and horizontal bulldozers 7 and 8 are mounted on the grinding table B which are adapted to taper the forward end of the bloom as it passes to the grinding table B from the blooming mill A. A suitable straightening mechanism 9 is mounted on the table B forward of the bulldozers 7 and 8 to straighten the blooms before they are ground. Suitable horizontal and vertical grinding machines C and D are mounted on the grinding table B successively forward of the straightening machine or mechanism 9. A pair of pinch rollers 10 is mounted between the straightening machine 9 and the grinding machine C, and a second pair of pinch rollers 11 is mounted just forward of the grinding machine D. The pinch rollers 10 and 11 are adapted to feed the blooms being operated upon through or between the grinding machines C and D.

The grinding machines C and D are provided with horizontal and vertical cup-shaped or ring-like grinding wheels 12 and 13, respectively, mounted on suitable shafts and driven through suitable gearing by motors 14 and 15, respectively. The horizontal grinding wheels 12 of the machine C are

adapted to grind away the defects on the side faces of the blooms or other articles being operated upon as they are passed therebetween, and the vertical grinding wheels 13 are adapted to grind or cut away the defects on the upper and lower faces of blooms passed therebetween.

The grinding table B extends an appreciable distance beyond the grinding machine D and terminates at a shear E of usual design having cutting jaws 16 and 17, these jaws being adapted to cut the rolled bloom into the desired short lengths. A suitable conveying table 18, located forward of the shear E, is provided to convey the sheared blooms to any desired point.

It will be understood that the grinding machines C and D may be of any desired construction and the grinding wheels may be of any desired or necessary design, in order to cut away the side surfaces of blooms of different cross section in the most expeditious manner.

My improved method when carried out with the above described mechanism is as follows: The ingot from which the bloom is formed is first rolled in the blooming mill A to work the metal and to reduce the cross sectional area and elongate the ingot so as to form a bloom, this being done in the usual manner. The multiple length bloom after being formed is then delivered by the table 2 to the grinding table B which continues to move the bloom forward until its forward end enters the bulldozers 7 and 8. The bulldozers are then operated to point or taper the forward end of the bloom so as to facilitate its movement into and through the straightening machine 9 and grinding machines C and D and between the pinch rollers 10 and 11. The longitudinal surface seams and other surface defects that are formed in rolling the ingot to form a bloom are removed by the grinding machines C and D. The bloom after being pointed and straightened is engaged by the pinch rollers 10 and is fed thereby between the horizontal grinding wheels 12 of the grinding machine C, and the grinding wheels engage the side surfaces of the bloom and cut or grind away the metal to a depth sufficient to remove the surface defects. The bloom as it is fed through the grinding machine C is passed into the grinding machine D and between the pinch rolls 11, so that for a part of its travel all four sides are being worked upon. The grinding wheels 13 of the grinding machine D are arranged to engage the top and bottom surfaces of the bloom and to cut or grind away the metal to a depth sufficient to remove the surface defects from said faces.

The bloom passes from the grinding machine D with smooth even side surfaces, free of defects, and is ready to be cut into the desired short lengths for rolling into shapes. The time consumed in passing the blooms through the bulldozers, straightening machine, and grinding machines is so short that the metal is still at a red heat or temperature high enough for it to be readily sheared. Therefore the blooms are passed directly from the grinding machines to the shears E and are there cut into pieces of the desired length. After being cut to length by the shear E, the blooms are delivered to the conveying table 18 which carries them to the finishing mill or other desired location.

In Figure 3 is shown apparatus for removing the surface defects from the blooms after they have been sheared to length. In this figure the letters A^a designate the blooming mill as a whole, and E^e designate the shears which are adapted to deliver the sheared blooms to a grinding table B^b. The grinding table B^b is of slightly different construction since it is adapted to operate on blooms of a length materially shorter than those operated upon by the apparatus of Figures 1, 1^a, 2 and 2^a. The table B^b is provided with a horizontal bulldozer 20 immediately forward of the shears E^e and with a straightening machine 21 forward of the bulldozer 20. A pair of horizontal grinding wheels 22 are arranged forward of the straightening machine 21 which are adapted to engage with and cut away or grind the side surfaces of the blooms. Pinch rollers 23 and 24 arranged respectively at the rear and in front of the grinding wheels 22, are adapted to move the blooms between the grinding wheels 22.

A second pair of horizontal grinding wheels 25 is arranged and spaced an appreciable distance forward of the grinding wheels 22. The table space between the grinding wheels 22 and 25 is utilized as a turning space, and the blooms are turned either manually or mechanically, so that the top and bottom or horizontal sides of the bloom when passing between the grinding wheels 22 become the vertical sides and are in position to be engaged by the grinding wheels 25. Pinch rollers 26 and 27 are arranged, respectively, to the rear and forward of the grinding wheels 25 and are adapted to move blooms from between the grinding wheels 25. The blooms after passing between the grinding wheels are conveyed to the finishing mill in any desired manner.

A second horizontal bulldozer 28 is located on the table B^b to the rear of the pinch rollers 26, and is adapted to taper the forward portion of the side faces of the blooms to be ground by the grinding wheels 25.

In carrying out my improved method with the apparatus of Figure 3, the order of the successive steps is slightly changed. That

is, the multiple length blooms are first sheared to short lengths before removing the surface defects. The short length blooms are straightened, the vertical side surfaces are tapered at their forward ends by the bulldozer 20, and said faces are then cut away by the grinding wheels 22 to remove the surface defects. After passing between the grinding wheels 22 the blooms are turned so that the top and bottom or horizontal sides when passing between the grinding wheels 22, become the vertical sides for passing through the grinding wheels 25. The bulldozer 28 then operates to taper the forward portion of the vertical sides of the blooms before they pass between the grinding wheels 25 where the surface defects are cut from said sides.

It will be understood that the grinding machines may be of any desired construction, the essential feature being that they have grinding surfaces for cutting away the defects in the surfaces of heated articles of any cross section. It is also to be understood that disk wheels having peripheral grinding surfaces may be employed in place of the cup-shaped or ring-like wheels shown.

In Figure 4 a further modified mechanism is shown for carrying out my invention. In this figure the letter F designates the blooming mill and G designates the shears, both of which may be of any standard design.

An extended shear table H extends forward beyond the shears for an appreciable distance, and a grinding table I is arranged alongside and parallel with the shear table, being connected therewith by a series of transfer skids or other suitable transfer mechanism J.

The grinding table I is provided with a vertical and horizontal bulldozing mechanism 30, a grinding mechanism 31, pinch rollers 32—33 at the rear and front of the grinding mechanism 31, a second grinding mechanism 34, which is spaced a considerable distance in front of the grinding mechanism 31, and pinch rollers 35—36 at the rear and in front of the grinding mechanism 34.

In carrying out my improved method with the mechanism of Figure 4, the sheared blooms are transferred across the skids J onto the table I, and the forward ends thereof are tapered by the bulldozing mechanism 30. The blooms are then passed through the grinding mechanism 31 which grinds the vertical sides thereof to remove surface defects therefrom. The blooms, after passing beyond the grinding mechanism 31, are turned either manually or mechanically, before entering the grinding mechanism 34 so as to present the unground surfaces thereof to the grinding wheels of the grinding mechanism 34. After passing through the grinding mechanism 34, all four sides of the blooms will have been ground or cut away sufficiently to remove all surface defects.

In Figure 5 a mechanism is shown which is particularly adapted for use in removing the surface defects from round blooms, billets, bars or other steel articles, either finished or unfinished.

The mechanism of Figure 5 comprises receiving skids K, a furnace transfer table L, a furnace charging machine L′, a continuous heating furnace M, and a delivery table N, all of which may be of any known construction, and a grinding mechanism O.

The grinding mechanism O comprises a pair of rear cross rolls 38 having concave surfaces, a grinding machine 39, a pair of forward cross rolls 40, and a series of idler rollers 41 adapted to support the articles being operated upon. A suitable run-out table 42 is provided on the delivery end of the grinding mechanism O, which is adapted to receive and convey the ground articles to a suitable cooling bed 43.

In carrying out my invention with the mechanism of Figure 5, the articles being rolled, which may be either blooms, billets, finished or unfinished steel bars, etc., are transferred to the receiving skids K from which they are moved to the furnace transfer table in any desired manner. This transfer table conveys the blooms to the furnace charging machine L′, which in turn charges them into the continuous heating furnace M. The articles in passing through the furnace M are heated, to approximately a rolling temperature, and are then delivered to the delivery table N, which feeds them forward into the grip of the cross rolls 38. These cross rolls rotate and feed the articles forwardly between the peripheral faces of the horizontal grinding wheels of the grinding machine 39, which cut away the surfaces of the articles to remove any surface defects. The articles as fed forwardly through the machine 39 are engaged by the second set of cross rolls 40, which continue to rotate the articles and pull them through the machine 39 after they have passed from between the cross rolls 38. The articles after passing beyond the grinding machine 39 are delivered to the run-out table 42 which in turn delivers them to the cooling bed 43 where they are allowed to cool.

The advantages of my invention will be appreciated by those skilled in the art. By grinding the metal while heated, the surface defects are readily removed in a rapid, cheap and economical manner.

In the appended claims the expression "side surfaces" is used in its broadest sense, and will be understood to include the top, bottom and side surfaces of a square article,

the periphery of a round bar or billet, and the irregular surfaces or contour of a shaped article.

Many modifications in the apparatus and in the steps of grinding the rolled articles will suggest themselves to those familiar with the art. A plurality of sets of grinding wheels may be employed so as to successively operate on the surface or surfaces of a bloom or other article and cause each successive set of grinding wheels to remove a part of the defective surface instead of making one deep cut in removing the defects, and other changes may be made within the scope of my invention as defined in the appended claims.

I claim:—

1. The method of removing surface defects from rolled steel articles before final rolling, which consists in grinding all of the side surfaces of said articles having said defects therein while said articles are heated to approximately a rolling temperature.

2. The method of removing surface defects from rolled steel articles before final rolling, which consists in grinding all of the side surfaces of said articles while said articles are heated to approximately a rolling temperature and removing an approximately equal thickness of metal from all of said surfaces.

3. The method of removing surface defects from rolled steel blooms, which consists in pointing the forward ends of said blooms, and passing said blooms between suitable grinding elements while said blooms are at approximately a rolling temperature to remove an equal depth of metal from all of the side surfaces thereof.

4. The method of removing surface defects from rolled steel blooms, which consists in transferring said blooms onto a grinding table while at approximately a rolling temperature, straightening said blooms, and passing said blooms between successive grinding elements to cut away all of the side surfaces of said blooms a sufficient depth to remove the defects.

In testimony whereof I have hereunto set my hand.

SAMUEL G. WORTON.