June 20, 1933. G. A. WISE 1,914,587

METHOD OF FINISHING ROUNDS

Original Filed Oct. 7, 1930 2 Sheets-Sheet 1

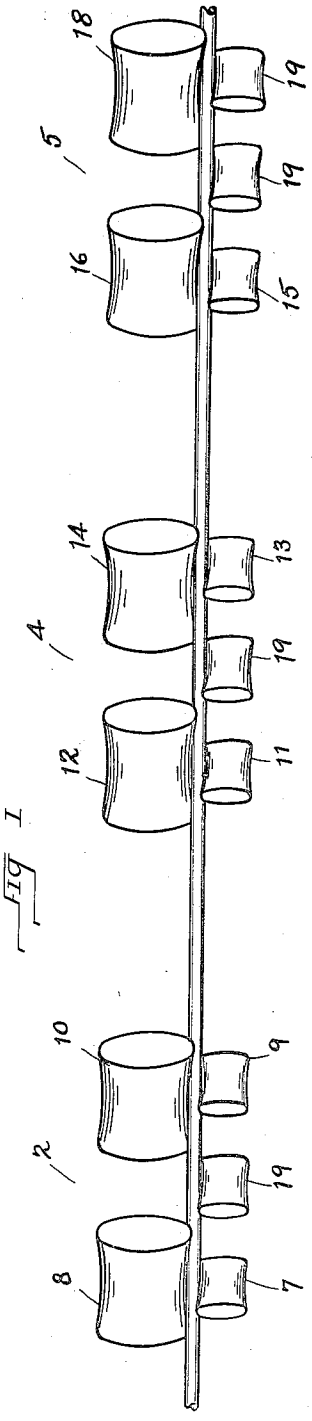


Fig I

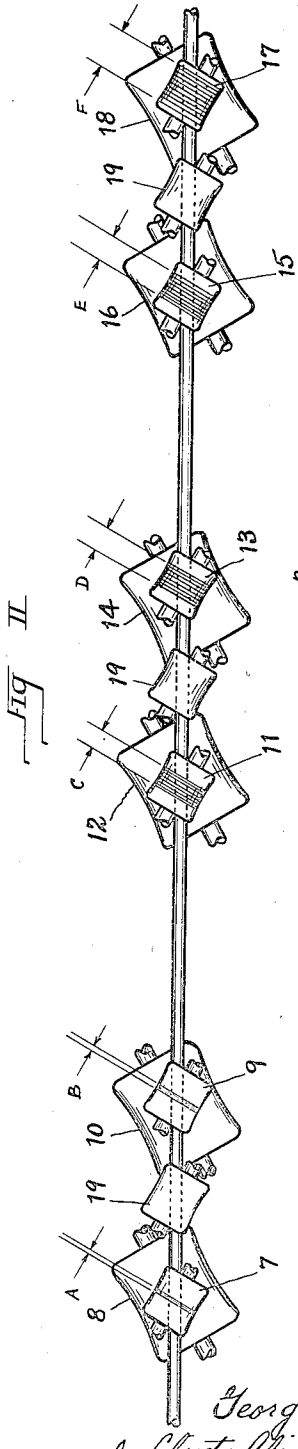


Fig II

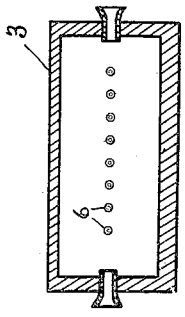


Fig III

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METHOD OF FINISHING ROUNDS

Original Filed Oct. 7, 1930 2 Sheets-Sheet 2

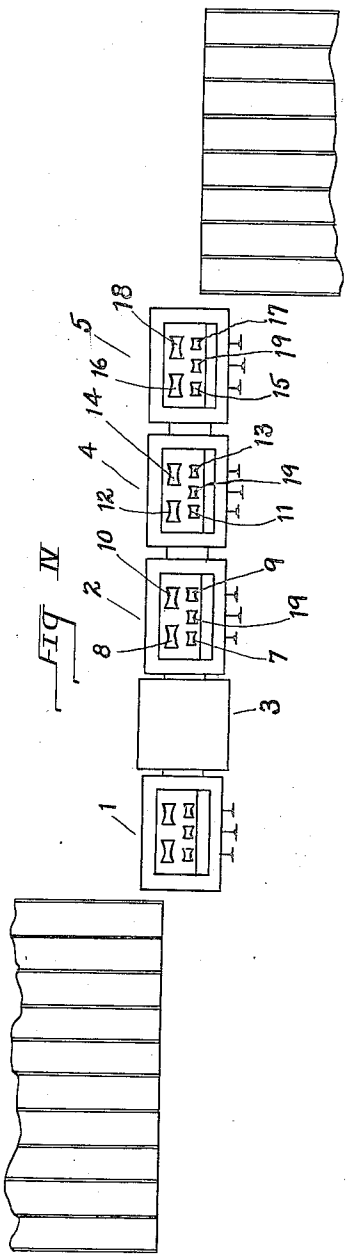


FIG IV

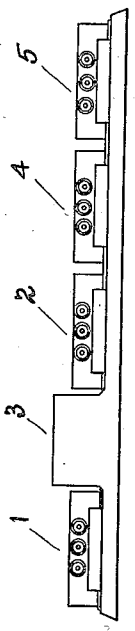


FIG V

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UNITED STATES PATENT OFFICE

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METHOD OF FINISHING ROUNDS

Application filed October 7, 1930, Serial No. 487,021. Renewed December 1, 1932.

This invention relates to a method of descaling, sizing, rounding up, straightening, and polishing solid or hollow metallic rounds by a continuous progressive and automatic operation.

As round bars and tubes come from a hot mill, or other devices producing similar material, they are not true to size, are not round, carry scale, and are not straight. The best "rounds" (which term throughout the specification and claims will be used to designate both solid bars and tubes) are therefore, as initially produced, not suitable for certain purposes which require material that is clean, straight, polished, and approximates true roundness and accurate size.

It has, therefore, been previous practice to manufacture round sections for these purposes by such methods as drawing, cold rolling, or turning and polishing. These methods are all slow and expensive.

My invention provides a rapid and economical method of producing round sections which are straight, clean and polished and which are within a narrow tolerance both as to accuracy of section and size. The method is a continuous one so that rounds are straightened, descaled, are brought closer to true section and diameter, and are polished by a continuous, progressive, and automatic operation. Rounds finished according to my method thus approximate in their qualities those produced by the slow and expensive drawing and cold rolling methods, and are more accurately straight than any drawn round sections which are straightened according to general practice.

I approximate the accuracy in section and diameter which may be obtained by drawing, and the highest degree of straightness and polish, by a method which produces finished bars at a rate many times that at which they may be produced by drawing or turning methods.

More specifically I enter the rounds initially into one or more sets of straightening cross rolls, which initially break the scale on the stock, which initially straighten it to facilitate treatment during the later stages of the process, and which serve as feeding rolls for the instrumentalities acting upon it in the later stages of the process.

These initial cross rolls pass the rounds to a steel blast for descaling and removing some of the surface metal of the stock, and through the steel blast to rounding, straightening, and polishing passes. The blast may obviously be of a suitable abrasive other than steel, steel being in general the preferred abrasive.

Because the stock is fed positively to the passes in which it is subjected to relatively great pressure for truing, it is unnecessary that bars be pointed or swaged for introduction into the truing passes. Because the stock is subjected to scale breaking and straightening before being subjected to the blast, the blast operates more efficiently in removing scale from the stock, and also if desired in removing some of the surface metal. Because the descaling and scouring of the stock is followed by a rounding and polishing, any surface abrasions or irregularities caused by the blast are smoothed out and eliminated in the final stages of the process.

It should be understood initially that my entire method is a straightening one, the stock being initially straightened for introduction to the blast, and the straightening action is progressively continued throughout its rounding and polishing.

In the accompanying drawings Figure I shows diagrammatically an arrangement of rounding, straightening and polishing rolls which may be utilized in conducting the method of my invention; Figure II is a generally similar view illustrating a varying contact surface of the rolls to produce the rounding effect; Figure III is a diagrammatic section through a blast constituting one of the instrumentalities employed in conducting my method; Figure IV is a diagrammatic plan view of a complete installation capable of conducting my method; and Figure V is a diagrammatic side elevation of such installation.

In conducting my method, the bars, or hollow rounds, are introduced into the feed-

ing, straightening, and scale breaking rolls, a set of which is indicated generally by the reference numeral 1 in Figures IV and V of the drawings. These rolls may be variously formed and arranged, but so cooperate as to exert a straightening effect on the stock, and to cause its rotation about its own axis. It is also desirable that they have a relatively great surface contact with the stock, in order to break efficiently the scale thereon.

With the installation shown, the stock is forced by the rolls 1 into the primary set 2 of reducing cross rolls, and is subjected to the steel blast 3 as it progresses. From the primary set 2 the stock passes by uninterrupted progression through other sets 4 and 5 of cross rolls.

The general arrangement of these sets 2, 4, and 5 may be any suitable arrangement, although each is shown as comprising two pairs of cooperating cross rolls and an intermediate idler roll. The only general requirement is that the rolls be so arranged as to exert a straightening effect as the stock is rounded, trued in section, and polished.

As scale is broken progressively along the length of the stock, it progresses, with the scale broken, past the blast. Primarily the blast scours the stock and tears off the scale which has been already broken and loosened on it. As the round section is rotated about its own axis, all points on the periphery of the stock are subjected equally to the scale breaking and blasting actions; and as it has also been subjected to a preliminary straightening, it may be passed close to the mouths of blast nozzles 6 so that the blasting step may be most efficiently conducted. For the latter reason, the size and number of the nozzles, and the pressure at which the blasting material is delivered, will be a minimum for the desired purpose.

Where bars are over size they may be cut down so that they are within the specified tolerance, by the blasting step of the process. The cutting effect of the blast for this purpose may be increased in several ways.

Thus, the longitudinal speed of the stock may be decreased by decreasing the speed of the rolls. The regulation of speed may be made in any desired manner, but is conveniently made by regulating the speed of a variable speed motor, or motors, driving the rolls. The decreased speed at which the stock progresses through the blast obviously results in an increased cutting action by the blast.

Other modes of regulating the blast action are effected by regulation of the blast itself. Thus the number of nozzles in action and the pressure at which they deliver abrasive may either be increased, or the size of the nozzles may be increased to increase the cutting effect. The most convenient manner of regulating the cutting by the blast itself is to provide initially more nozzles than are necessary for a normal descaling and scouring step, and cutting in the requisite additional number of nozzles for the desired trimming down of the stock.

It should be understood that the blasting step does not affect the sectional contour of the stock to produce a true round from stock which is initially out of round. For example we will assume that a bar is eight thousandths of an inch over size, and seven thousandths out of round. Assuming that the tolerance for size is four thousandths, and that the stock is cut down so that it may be brought within this tolerance by the subsequent operations, the stock is still seven thousandths out of round. The "rounding up" is effected subsequent to the blasting or cutting step in the complete performance of the finishing process.

The stock is pitted by the blast, and these surface irregularities also are remedied by the subsequent steps of the process.

As the forward end of the stock progresses past the steel blast, it is entered between the initial pair of cross rolls of the set 2. In this respect the primary set 1 of rolls serves as feeding rolls for the set 2, and the stock is thus positively entered.

The idler roll 7 of the entering pair of rounding and reduction cross rolls is so contoured as to have a narrow contact A with its cooperating driven roll 8. The stock is therefore subjected to pressure on a narrow area, which facilitates rounding and reduction. The bar is subjected to further pressure by the action of the second pair of cross rolls, which comprises the idler 9 and the driven roll 10. The idler 9 of this pair is so contoured that it also has a narrow contact with its cooperating driven roll 10, although the contact B is wider than that of the entering pair.

In the second set 4 of rolls the contact C of idler 11 with its driven roll 12 is appreciably wider than that of idler 9 with its roll 10, and the bearing D of idler 13 with its driven roll 14 is wider than that of the pair immediately preceding. This set of rolls therefore performs an initial smoothing effect on the stock, although it continues to some degree the rounding and reducing effect of the first set 2.

In the final set 5 of cross rolls the final smoothing and polishing step is performed; the first pair 15 and 16 having a bearing E wider than the bearing D, and the final pair 17 and 18 having the widest bearing F.

It should be understood that the stock is subjected to high pressure throughout the entire working portion of the process, which follows the blasting step. In the initial pair of cross rolls, the bearing being least, the

effective pressure is greatest. In succeeding passes the effective pressure is progressively decreased in favor of a wider area of contact for smoothing and polishing.

In the installation shown, each of the sets comprises an intermediate idler roll 19, which cooperates in producing the straightening effect.

During the finishing operation it is important that the stock be maintained under a tension effective in the direction of its longitudinal travel. By placing the stock under tension from the point at which it is first gripped by two pairs of rolls, which exert a relatively high degree of pressure on it, there is no point or region in which the stock is subjected to severe pressure without the relief afforded by placing it under tension.

The stock may be placed under tension in several ways. One such way of producing the tension is the progressively increased area of contact surface of succeeding pairs of rolls. This in itself tends to produce increased speed of longitudinal travel of the stock as it progresses, and thereby places the stock under tension. Another way in which the tension to which the stock is subjected may be produced or increased is to make the rolls (in the installation disclosed each driven roll of a pair) of progressively increased diameter. That is, the driven rolls 8, 10, 12, 14, 16, and 18 are of progressively increased diameter. This progressive increase in roll diameter also results in a tendency toward progressively increased speed of longitudinal travel of the stock, and in the typical installation shown supplements the tendency toward increased longitudinal speed resulting from the progressively increased areas of contact with the stock.

As illustrated, a progressive increase in contact area in successive pairs of cross rolls is obtained by graduated roll contour to secure this result. It may, however, be obtained by a progressive adjustment of the angle at which succeeding pairs of cooperating rolls are crossed. When the rolls are contoured to give progressively increased contact surfaces, the angular adjustment may still be utilized to effect a final regulation of the areas of contact, and to accommodate for various runs of stock which differ in size.

It may be stated generally, that I take rough, unfinished rounds of steel or other material, and operating on the stock while it is cold, so treat the stock that its surface is freed from scale, and it is sized, rounded, straightened, and polished. In the case of solid rounds, or bars, the stock is then ready for immediate shipment. In the case of hollow rounds, or tubes, the finishing is complete except for possible interior scale; which, if present, has been broken and is in condition for ready removal. These results are obtained by an automatic, continuous, and rapid process, and without detriment to the qualities of the material in the rounds so treated.

It should be observed that the process eliminates the slow and laborious operations, and repeated handling of stock, encountered in producing polished, straight, round sections by the methods now in use. For example, in the cold drawing process, it is the practice that the stock be subjected to pickling baths for the removal of scale and neutralization of acid, to pointing in a pointing machine or in the drawing die, to "slushing", that is coating with a lubricant for drawing, and to drawing. After drawing, the stock must be cropped, this cropping being a machine operation which involves the discarding of a substantial amount of material. The stock is also straightened, either before or after cropping, and coated for protection against rust. In my method the equivalent of all these operations is effected during a single passage of the stock.

It is further a fact that the cold drawing step is injurious to the metal, because of the excessive severity of the working in the drawing die. My method thus in practical effect produces finished stock, physically superior to cold drawn stock.

The process may be conducted by various instrumentalities, variously arranged. For example, application of the pressure in a spiral path may be obtained by rotating the pairs of cooperating rolls about the axis of the stock, instead of rotating the stock about its own axis.

Further, when the bar is rotated about its own axis, it is possible to obtain the desired result by the application of the principles of the present process to roll installations of various types. For example I may employ a cross roll installation in which all the rolls are driven, and an installation in which all rolls are driven and are also angularly adjustable.

As concerns the intermediate pressure roll illustrated in each set of rolls herein, this may be replaced by a pair of cooperating rolls. This pair may be both driven, both idle, or one driven and one idle. They desirably, but not necessarily are so mounted that they may be angularly adjusted. They are, necessarily, so mounted that they cooperate with each other, and with the other pairs of rolls in producing a straightening effect.

It is a further important advantage of the process that the surface compression produced by the cold working of the stock results in a marked increase in the fatigue strength of the metal. This is true not only

for steel, but also in the case of non-ferrous metals such as copper and bronze. The improvement in this physical quality of the metal is obtained without impairing any other physical quality of the original material.

I claim as my invention:

1. The herein described method of finishing rounds which comprises causing simultaneous rotation and longitudinal progress of the stock, feeding the stock while exerting a straightening effect thereon past blasting instrumentalities, continuing the progress of the stock while continuing its rotation under tension effective in the direction of its longitudinal travel, and as the stock progresses exerting uninterruptedly thereon pressure applied upon areas of progressively increased width.

2. The herein described method of finishing rounds which comprises causing simultaneous rotation and longitudinal progress of the stock while exerting a straightening effect thereon past blasting instrumentalities, continuing the progress of the stock while continuing its rotation under tension effective in the direction of its longitudinal travel, as the stock progresses exerting uninterruptedly thereon pressure applied upon areas of progressively increased width, and so directing the pressure thereon that a straightening tendency is present throughout the progress of the stock.

3. The herein described method of finishing rounds which comprises causing simultaneous rotation and longitudinal progress of the stock while exerting a straightening effect thereon past blasting instrumentalities, continuing the progress of the stock while continuing its rotation under tension effective in the direction of its longitudinal travel, and as the stock progresses exerting uninterruptedly thereon pressure so directed that a straightening effect is present throughout the progress of the stock.

4. The herein described method of finishing rounds which comprises subjecting the stock to scale cracking pressure, feeding the stock uninterruptedly as the scale is progressively broken thereon past blasting instrumentalities, continuing the longitudinal progress of the stock while rotating it upon its longitudinal axis under tension effective in the direction of its longitudinal travel, and as the stock progresses exerting uninterruptedly thereon pressure so directed that a straightening effect is present throughout the progress of the stock.

5. The herein described method of finishing rounds which comprises subjecting the stock to scale cracking pressure, feeding the stock uninterruptedly as the scale is progressively broken thereon past blasting instrumentalities, continuing the longitudinal progress of the stock while rotating it upon its longitudinal axis under tension effective in the direction of its longitudinal travel, as the stock progresses exerting uninterruptedly thereon pressure applied upon areas of progressively increased width, and so directing the pressure thereon that a straightening tendency is present throughout the progress of the stock.

6. The herein described method of finishing rounds which comprises subjecting the stock to scale cracking pressure so directed as to also exert a straightening effect while simultaneously rotating it upon its longitudinal axis and feeding it longitudinally past blasting instrumentalities as the scale is progressively broken on it, continuing the longitudinal progress and rotation of the stock under tension effective in the direction of its longitudinal travel, and as the stock progresses exerting uninterruptedly thereon pressure so directed that a straightening effect is present throughout the progress of the stock.

7. The herein described method of finishing rounds which comprises subjecting the stock to scale cracking pressure so directed as to exert a straightening effect on the stock while simultaneously rotating it upon its longitudinal axis and feeding it longitudinally past blasting instrumentalities as the scale is progressively broken on it, continuing the longitudinal progress and rotation of the stock under tension effective in the direction of its longitudinal travel, as the stock progresses exerting uninterruptedly thereon pressure applied upon areas of progressively increased width, and so directing the pressure on the stock that a straightening tendency is present throughout the progress of the stock.

8. The herein described method of finishing rounds which comprises subjecting the stock to scale cracking pressure, feeding the stock uninterruptedly as the scale is progressively broken thereon past blasting instrumentalities, continuing the longitudinal progress of the stock while rotating it upon its longitudinal axis, as the stock progresses exerting thereon pressure applied upon areas of progressively increased width, and so directing the pressure on the stock that a straightening tendency is present throughout the progress of the stock.

9. The herein described method of finishing rounds which comprises subjecting the stock to scale cracking pressure so directed as to exert a straightening effect on the stock while simultaneously rotating the stock upon its longitudinal axis and longitudinally feeding the stock past blasting instrumentalities as the scale is progressively broken on it, continuing the longitudinal progress and rotation of the stock, as the stock progresses exerting uninterruptedly thereon pressure applied upon areas of pro-

gressively increased width, and so directing the pressure on the stock that a straightening tendency is present throughout the progress of the stock.

10. The herein described method of finishing rounds which comprises causing simultaneous rotation and longitudinal progress of the stock with the stock under tension effective in the direction of its longitudinal travel, as the stock uninterruptedly progresses exerting thereon pressure applied upon areas of progressively increased width, and simultaneously throughout the progress of the stock subjecting it to a succession of cross roll straightening steps in which the stock is acted upon by flexing forces producing a straightening bend or wave.

11. The herein described method of finishing rounds which comprises causing simultaneous rotation and longitudinal progress of the stock, feeding the stock while exerting a straightening effect thereon past blasting instrumentalities, thereafter causing simultaneous rotation and longitudinal progress of the stock under tension effective in the direction of its longitudinal travel, as the stock progresses exerting uninterruptedly thereon pressure applied upon areas of progressively increasing width, and simultaneously throughout the progress of the stock subjecting it to a succession of cross roll straightening steps in which the stock is acted upon by flexing forces producing a straightening bend or wave.

12. The herein described method of finishing rounds which comprises subjecting the stock to scale cracking pressure, passing the stock with the scale broken thereon past blasting instrumentalities while rotating the stock about its longitudinal axis, thereafter causing simultaneous rotation and progress of the stock under tension effective in the direction of its longitudinal travel, as the stock progresses exerting uninterruptedly thereon pressure applied upon areas of progressively increasing width, and simultaneously throughout the progress of the stock subjecting it to a succession of straightening steps in which the stock is acted upon by flexing forces producing a straightening bend or wave.

13. The herein described method of finishing rounds which comprises subjecting the stock to scale cracking pressure so directed as to exert a straightening effect on the stock, passing the stock with the scale broken thereon past blasting instrumentalities while rotating the stock about its longitudinal axis, thereafter causing simultaneous rotation and longitudinal progress of the stock under tension effective in the direction of its longitudinal travel, as the stock progresses exerting uninterruptedly thereon pressure applied upon areas of progressively increased width, and simultaneously throughout the progress of the stock subjecting it to a succession of cross roll straightening steps in which the stock is acted upon by flexing forces producing a straightening bend or wave.

In testimony whereof I have hereunto set my hand.

GEORGE A. WISE.