METHOD FOR IMPROVING THE SURFACE FINISH OF FERROUS MATERIALS

Filed March 25, 1955

INVENTORS
Arthur D. Larson
Raymond C. Spencer

By
Shall Brewer
Attorney
METHOD FOR IMPROVING THE SURFACE FINISH OF FERROUS MATERIALS

Filed March 25, 1955

INVENTORS

Arthur D. Larson
Raymond C. Spencer

By

Attorney
METHOD FOR IMPROVING THE SURFACE FINISH OF FERROUS MATERIALS

Arthur D. Larson, Dolton, and Raymond C. Spencer, Homewood, Ill., assignors to Bliss & Laughlin, Incorporated, Harvey, Ill., a corporation of Delaware

Application March 25, 1955, Serial No. 496,707

6 Claims. (Cl. 29—81)

This invention relates to a method for improving the surface finish of ferrous materials, and more particularly to such a method which is applicable to cold drawn ferrous metals.

One of the general objects of our invention, as herein disclosed, is to provide a method for accomplishing the cleaning and improvement of the surface finish of cold drawn ferrous materials during the progress of a normal production operation and without decreasing the usual rate of the production operation, thereby avoiding additional or separate handling, time and labor for the accomplishment of the purpose.

Another general object of this invention is to provide a method for effecting removal of surface smut and foreign matter from cold drawn ferrous material, so as to afford a normally smooth, clean and lustrous surface on the material.

Somewhat more specifically considered, our invention has within its purview the surface cleaning of ferrous material during the customary operation of straightening the material and also comprehends the flushing of the straightening rolls which engage the material so as to prevent particles or foreign material thereon from marring the surface of the ferrous material being straightened.

Our invention further provides a method which, in addition to affording a smooth and clean surface on cold drawn ferrous material, also leaves the surface coated with a protective layer of a rust inhibiting material.

The method of this invention also comprehends the use of a liquid cleaning material and the reclamation for use of such cleaning material which does not adhere to the metal being cleaned.

For the promotion of economy and effectiveness, our method, as herein disclosed, provides for the stripping of excess cleaning and/or rust inhibiting material from the surface of a treated metal piece in a manner such that cleaning and/or rust inhibiting material is not polluted and so that a film of the rust inhibiting material is left on the metal piece for protective purposes.

Other objects and advantages of the invention will be apparent from the following description and the accompanying drawings in which similar characters of reference indicate similar parts throughout the several views.

In the four sheets of drawings:

Fig. 1 is a fragmentary side elevational view having a portion in section and depicting salient features of the adaptation of one form of our invention;

Fig. 2 is an end sectional view taken substantially at the position of a line 2—2 in Fig. 1 and in the direction of the arrows;

Fig. 3 is a fragmentary side sectional view of the portion of the structure illustrated in Fig. 2;

Fig. 4 is a fragmentary side sectional view taken substantially on a line 4—4 of Fig. 2 and in the direction of the arrows;

Fig. 5 is a fragmentary end sectional view wherein the section is taken substantially on a line 5—5 of Fig. 1 and in the direction of the arrows;

Fig. 6 is a fragmentary side sectional view wherein the section is taken substantially as indicated by a line 6—6 and accompanying arrows in Fig. 5;

Fig. 7 is a fragmentary side elevational view illustrating another adaptation of our invention;

Fig. 8 is a side sectional view of a portion of the structure shown in Fig. 7, and is drawn to a larger scale than Fig. 7;

Fig. 9 is a fragmentary end sectional view taken substantially as indicated by a line 9—9 and accompanying arrows in Fig. 8;

Fig. 10 is a fragmentary and somewhat diagrammatic view illustrating a third adaptation of our invention;

Fig. 11 is a diagrammatic view illustrating equipment and piping adapted to use with one or more of the machines illustrated in Fig. 10;

Fig. 12 is a side elevational view of the machine shown in Fig. 10;

Fig. 13 is a fragmentary end sectional view taken substantially at a position indicated by a line 13—13 and accompanying arrows in Fig. 12;

Fig. 14 is a fragmentary front elevational view of a portion of the structure depicted in Fig. 13 and is taken substantially as indicated by a line 14—14 and accompanying arrows in Fig. 13;

Fig. 15 is an end elevational view taken substantially as indicated by a line 15—15 and accompanying arrows in Fig. 13; and

Figs. 16 and 17 are respectively fragmentary front and side elevational views of a modified structure adapted to use in place of that depicted in Figs. 13, 14 and 15.

In the exemplary embodiments of our invention which are shown herein for illustrative purposes, our method is depicted in its adaptations to three somewhat different types of machines. While the more general aspects of the method are the same in each instance, there are specific differences which conform the method to the differences of the machines, the differences of the types of stock and the differences in the kinds of stock which are supplied to the machine. Furthermore, it may be readily understood as the description progresses that the methods herein disclosed could very well be applied and utilized in a machine suited to the improvement of the surface finish of stock as a separate and independent operation. However, economies in time, labor and material dictate the desirability of having the operation of improving the surface finish of the stock combined with another operation which is customarily required in the production of the finished stock. In the disclosed structures, in each instance, our method for the improvement of the surface finish of cold drawn stock of various sectional shapes is associated with a machine of a known type which is utilized for straightening the stock.

Having reference to the drawings, and particularly to the adaptation of our invention which is illustrated in Figs. 1 to 6 inclusive, a coil 20 of cold drawn ferrous bar stock is hung on a cylindrical mid-portion 22 of a spool 23 having a retaining flange 24 at one end thereof, and coiled bar stock 25 from the coil 20 is fed from the spool support into a straightening machine 26. The spool 23 is supported for rotation on a horizontal shaft 27, so that it is free to rotate as the bar stock is drawn from the coil.

The straightening machine 26 is of a known type having two sets of rolls, one of which sets includes rolls 28 which are power driven and enclosed in a housing 29, while the other set includes rolls 30 and 32 which are also power driven and mounted in a housing 31. The rolls 28 of the first mentioned set are mounted for rotation in a horizontal plane, while the rolls 30 and 32 of
the second set are supported for rotation in a vertical plane. Each set of rolls includes rolls in opposed rela-
tionship to the straightening machine and each set burnsishes the bar stock as it passes therebetween and effects flexure of the stock, thereby to provide a straightening action as the stock is moved along as a result of the gripping action of the rolls against the stock and the movement of the power driven rolls. These rolls, in effect, provide the force for drawing stock from the coil 20 and forcing it through the straightening machine. At the output end of the machine, the bar stock passes through a guide tube 33 and away from the machine, so that at a position beyond the guide tube 33, the straightened stock may be cut to prescribed lengths, if desired.

For effecting the desired improvement of the surface finish of the bar stock while it is being straightened in a straightening machine of the type disclosed, certain auxili-
ary apparatus is utilized in association with the straighten-
ing machine for carrying out the steps of our method, as herein disclosed. Below the spool 23, a basin or reservoir 34 is provided, which reservoir carries a supply of a petroleum base hydrocarbon solvent cleaner 55, which supply of liquid cleaner has a level such that the turn of the coil 20 pass therethrough as the coil 20 and spool 23 rotate during the movement of bar stock from the coil to the straightening machine. As illustrated in Fig. 1, the spool 23 is above the level of the liquid and the coil dips into the cleaning liquid.

The petroleum base hydrocarbon solvent cleaner utilized in the disclosed application is similar to kerosene. Specifically it is known as "Acipol 467" solvent cleaner, and is obtained under that name and designation from Commerce Petroleum Co. of 2980 S. Archer Avenue, Chicago, Illinois.

With the arrangement of parts as depicted in Fig. 1, the petroleum base hydrocarbon solvent cleaner which has been designated as a cleaning liquid washes the bar stock of the coil 20 as it passes through the reservoir 34, and such cleaning liquid adheres to the bar stock and remains thereon during the passage of the bar stock through the rolls 28 of the first set. Thus, the bar stock is burnedished by the rolls and flexed while the cleaning liquid is on the surface thereof.

As the bar stock emerges from the rolls 28 of the first set and from the housing 29, the cleaning liquid and any particles of loosened smut or other material contained therein are stripped from the surface of the bar stock. In the disclosed structure, jets of air under pressure is utilized for effecting the striping action. As illustrated in detail in Figs. 2, 3 and 4, a ringlike nozzle 36 made of tubular material is mounted exteriorly of the housing 29 and encompasses the bar stock 25 in spaced relationship thereto. A series of circumferentially spaced openings 37 in the wall of the ringlike nozzle serve as passages for directing a series of jets of air under pressure laterally against the surface or surfaces of the bar stock as it passes therethrough. As shown also in Figs. 2, 3 and 4, the openings 37 are so positioned and disposed that the jets of air projected therefrom each have a component which is opposed to the direction of movement of the bar stock through the ringlike nozzle. In the present instance, an angle 38, as designated in Fig. 4, of approximately 30 degrees, between the general plane of the ringlike nozzle and the plane of projection of the jets from the openings 38, has been found to be quite satisfactory. Relatively close spacing of the openings 37 provides for substantially complete coverage of the surface of the bar stock passing therethrough, even for polygonal sections of such stock, thereby affording striping action over the entire peripheral surface of the stock. Air under pressure is supplied to the ringlike nozzle 36 through a communicating connecting tube 39 and a suitable supply conduit 40 which extends to a reservoir of compressed air. Cleaning liquid stripped from the bar stock by the action of the air jets from the ringlike nozzle 36 may be collected in a suitable drip pan near the nozzle and it is returned from the drip pan to the reservoir 34.

After passing through the ringlike nozzle 36, the bar stock 25 passes through a guide tube 42 on the end of the housing 31 and thence to and through the rolls 30 and 32 of the second set. Further to promote the improvement of the surface finish of the bar stock during its passage through the straightening machine, a metered or controlled quantity of oil is applied to the bar stock as it enters the second set of rolls by applying the oil to the first roll 32 of the set from a reservoir 43 through a conduit 44; the reservoir 43, in the present instance, being located exteriorly and above the housing 31, so that the oil flows through the conduit 44 to regulate the oil 32 by gravitational force. The rust preventive oil utilized in this instance may be designated generally as a rust preventive petroleum base hydrocarbon oil having a viscosity in the range of 40 to 150 seconds Saybolt Universal tube, at 100°F. Specifically the oil is designated by a number "1023A" and is obtained from the products Co., Inc. of 4101-417 S. LaSalle St., Chicago, Illinois.

With the disclosed structural arrangement, the bar stock, after the initial cleaning operation is further burnedished and flexed by the action of the rolls 30 and 32 of the second set while the rust preventive oil of the designated type is on the surface thereof. As in the previous instance, it is desirable to strip the rust preventive oil and any particles of smut or loosened foreign material from the surface of the bar stock after it has passed through the rolls of the second set. In the disclosed structure, the final striping of the straightened bar stock and the insulation of a coating of clean rust preventive oil on the surface or surfaces of the finished stock are effected by opposed jets of the same rust preventive oil as that carried in the reservoir 43 which are directed under pressure against opposite surfaces of the bar stock 25.

As depicted in Figs. 1, 5 and 6, a housing 45 is secured to the exterior of the housing 31 at the output end of the rolls 30 and 32 of the second set, and has openings 46 and 47 therein through which the stock passes. Within the housing 45 and at positions spaced from opposite sides of the bar stock 25, nozzles 48 and 49 are mounted to direct opposed jets of rust preventive oil under pressure against opposite surfaces of the stock. Pipes 50 and 52 support the nozzles 48 and 49 respectively and deliver a supply of rust preventive oil under pressure thereto from a supply tank or reservoir 53 through a supply conduit 54 connected to both of the pipes 50 and 52. A pump 55 connected in series with the supply conduit 54 provides the desired pressure for projecting the jets of oil from the nozzles 48 and 49, and a valve 56 serves to regulate the flow of oil through the conduit 54. Excess oil which does not adhere to the surface or surfaces of the stock 25 collects at the lower portion of the housing 45 and returns to the reservoir 53 through a return conduit 57. A preferred structure for the nozzles 48 and 49 is illustrated in detail in Figs. 14 and 15 and is employed in connection with another adaptation of our invention.

From the foregoing description, it may be readily understood that the method utilized for improving the finish of cold drawn ferrous material while straightening the material in a machine of the type illustrated in Fig. 1 includes the steps of applying a petroleum base hydrocarbon solvent cleaner to the stock and then burnedishing and flexing the stock while the cleaning liquid is on the surface thereof. As another step, the cleaning liquid and any loosened material remaining on the surface of the stock are stripped therefrom by the action of a plurality of jets of air under pressure directed against the surface or surfaces of the stock at an angle such that the jets have a component opposed to the direction of movement of the stock. After this initial cleaning, a rust preventive petroleum base hydrocarbon oil is applied to the stock as it enters a second set of rolls in which it
is again burnished and flexed while the rust preventive oil is on the surface thereof. As a final step, jets of a rust preventive oil are directed laterally against the surface or surfaces of the stock as it emerges from the second set of rolls. This latter application of rust preventive oil has a washing action and leaves the stock completely coated with a thin layer of rust preventive oil. As indicated in Figs. 7, 8 and 9 of the drawings, our method for improving the surface finish of cold drawn ferrous stock and the like is illustrated in an adaptation to a different type of straightening machine 58. In this instance, the straightening machine, like the one illustrated in Fig. 1, has two sets of straightening rolls mounted on a frame 59 and 60 of the machine, the first set of rolls being supported for rotation in a horizontal plane, and rolls such as 62 and 63 of the second set being supported for rotation in a vertical plane. The rolls are carried in spaced relationship on a supporting frame structure 64 and are power driven by a prime mover such as an electric motor 65. The straightening machine illustrated in Fig. 1 is of the known type, and is adapted to the straightening of polygonal bar stock and the like which has been cut in preselected lengths prior to the straightening operation.

In applying our method for the improvement of the surface finish of the cut lengths of stock to the straightening machine of Fig. 1, a supporting table 66 is placed at the end of the machine at which a piece of bar stock or the like, such as 67, enters the machine. A housing 68 is mounted on the top of the table 66 and has openings 69 and 70 in opposite ends thereof, which openings are aligned with a guide tube 72 on the machine and through which the stock 67 passes to the first set of rolls in the portion 59 of the machine. The housing 68 has mounted therein a plurality of nozzles 73 which are equiangularly spaced circumferentially of the position at which the stock passes through the housing and are also separated so as to be spaced radially from the stock as it passes through the housing and the openings 69 and 70. In this instance, four nozzles are used, which nozzles are spaced in 90° relationship to one another and at approximately 45° angles to the vertical and horizontal planes. Pipes 74 support the nozzles within the housing 68, and each such pipe is provided with a valve 75, so that the nozzles may be individually shut off or controlled, as desired, and so that the material flowing through the nozzles can be regulated. Material flows through a supply conduit 76 and a main control valve 77 to branch pipes 78 to the pipes 74 and nozzles 73.

As illustrated in Figs. 8 and 9, the main control valve 77 77 is controlled by a valve 89 having a roller 80 on the end thereof which engages one end of a bracket 84. The bellcrank is supported at its mid-portion for swinging movement by a pin 83, which pin is carried by a bracket 84. A spring 85 has one end connected to the arm of the bellcrank 82 which engages the roller 80 on the plunger 79, and has its other end anchored to a bracket 86 secured to the bottom of the machine 87. With this arrangement of parts, the spring 85 normally biases the valve 77 to a closed position, so that normally no material flows from the nozzle 73. The other arm of the bellcrank 82 carries a roller 87 at a position adjacent the opening 69 at the exterior of the housing 68, the roller being normally disposed in a position such that it is engaged by a piece of stock 67 as that stock is inserted through the openings 69 and 70 in the housing 68, as well as during the passage of the stock to and through the rolls of the straightening machine. Engagement of the stock with the roller 87 on the bellcrank 82 moves the bellcrank against the bias of the spring 85, thereby to effect opening of the valve 77, so that material is sprayed from the nozzles onto the stock whenever a piece of stock is inserted into the machine and while it is passing to and through the machine. Material supplied to the nozzles through the supply conduit 76 is normally under pressure provided by a suitable pump connected to a supply reservoir. As indicated in Fig. 9, the valve 77 in the supply conduit 88, through which the material is diverted back to the supply reservoir when the valve 77 is in its normally closed position. Excess material sprayed from the nozzle 73 which does not adhere to the surface of the stock 67 collects within the housing 68 and is returned to the supply reservoir through a drain conduit 89. The material which is sprayed through the nozzle 73 onto the surface of the stock 67, in this instance, is a rust preventive petroleum base hydrocarbon oil having a viscosity in the range of 50 to 150 seconds Saybolt Universal tube, at 100° F. Specifically, we use for this purpose a mixture of two such oils of different viscosities. The heavier and lighter bodied oils which are mixed are in the approximate proportions of 60% by weight of either to 40% by weight of the other. One of the rust preventive oils in the mixture is designated as No. "1023A" and purchased from Oil Products Co., Inc. of 4103-17 S. LaSalle Street, Chicago, and the other is designated as "B & L 100," and is purchased from the same source.

As may be readily understood from the disclosure at this point, the rust preventive petroleum base hydrocarbon oil is sprayed under pressure onto the surface or surfaces of the stock as it passes through the housing 68. The spray being emitted through a plurality of peripherally spaced nozzles, the surface or surfaces of the stock are thoroughly and completely coated with the oil prior to the passage of the stock into and through the two sets of straightening rolls. As in the instance of the machine depicted in Fig. 1, the straightening rolls burnish and flex the stock as it passes therethrough, this burnishing and flexing action being accomplished while the stock surface is coated with the cleaning liquid which, in this instance, constitutes the rust preventive oil mixture previously identified.

As shown in Fig. 7, a ringlike nozzle 36 of the same structure as that illustrated in Figs. 2, 3 and 4 and described in connection with those figures is secured to the end of the straightening machine 69 from which the stock emerges after being straightened. This ringlike nozzle 36 is aligned on the straightening machine 69, so that the stock moving outwardly from the rolls 62 and 63 of the straightening machine passes therethrough in substantially a central position. As described in connection with Figs. 2, 3 and 4, the nozzle emits a plurality of jets of air under pressure laterally of the stock surface or surfaces, thereby to strip cleaning liquid and loosened particles of material from the exterior of the stock. Also, in this instance, as in the machine depicted in Fig. 1, the openings in the bellcrank 82 are disposed so that the air jets have a component which is directed in the direction of movement of the stock. Since the cleaning liquid utilized with the machine depicted in Fig. 7 is effectively a rust preventive oil, and since that oil is not completely removed from the stock by the action of the air jets from the nozzle 36, a sufficient coating remains on the stock to serve as a rust preventive protective layer.

From the description of the structure and process as illustrated in Figs. 7, 8 and 9, it may be understood that cut pieces of stock of preselected or predetermined lengths are passed through both horizontally and vertically disposed sets of straightening rolls and are burnished and flexed by those rolls while coated with an ample quantity of a cleaning liquid which is sprayed onto the stock prior to its entry into the machine. Then, after passing through the straightening rolls of the machine with the cleaning liquid thereon, that cleaning liquid and loosened particles of smut or other surface materials are stripped from the stock by the action of a plurality of air jets directed angularly and laterally against the outer surface or surfaces of the stock. The stock emerging from the cleaning process has a thin layer of a rust preventive oil re-
main thereon which protects the surface finish of the stock in storage.

In Figs. 10 and 12 of the drawings, a different and known type of straightening machine 90 is illustrated, and those figures show the adaptation of our disclosed method to that type of machine. The straightening machine, in this instance, has a base structure 92 with a gear box 93 at one end from which angularly disposed power driven straightening rolls 94 and 95 are driven through shafts 96 and 97, in each instance, with universal joints 98 and 99. To effect the straightening of round stock, such as 100, it is passed between the straightening rolls 94 and 95 after those rolls have been adjusted relative to one another to accommodate the size of the stock being passed therebetween. In passing between the rolls, the stock is burnished and flexed, and the stock is rotated by the action of the rolls while it is being moved longitudinally as a result of the force applied thereto by the rolls. After passing between the rolls 94 and 95, the stock passes through a guide tube 102 and is discharged from the end of the guide tube opposite the rolls.

In the application of our method for the improvement of the surface finish of stock to the straightening machine depicted in Figs. 10 and 12, cleaning liquid is flushed onto the surface of both the stock and the rolls 94 and 95 from a supply conduit 103. In this instance, a steady stream of the cleaning liquid flows onto the stock and the straightening rolls 94 and 95 while the stock is being burnished and flexed by the action of the rolls, and the stream of cleaning liquid affords a flow which is sufficient to wash loosened particles of surface material from both the rolls and the stock as it is loosened by the combined action of the cleaning liquid and the burnishing and flexing operations, thereby to prevent the particles of material from being reground into the surface of the stock or to prevent particles from scratching or marring the stock surface.

In this application, the cleaning liquid utilized is a rust preventive base hydrocarbon oil and comprises the same mixture as that described in connection with the machine and apparatus illustrated in Figs. 7, 8 and 9. While the cleaning liquid flows under some pressure, it flows in a stream from the supply conduit 103, as distinguished from the application by jets from nozzles illustrated and described in connection with Figs. 8 and 9. For the purpose of economy in the quantity of cleaning liquid utilized in the apparatus depicted in Figs. 10 and 12, the cleaning liquid is collected in a pan 104 below the straightening rolls 94 and 95 and is then filtered and returned to the supply system for reuse.

As shown in Figs. 11, a plurality of the machines 90 may be supplied with cleaning liquid from a single filtering and supply system which, as there depicted, includes a supply pipe 105 and a return pipe 106 connected to each of the machines 90 through branch pipes 107 and 108 respectively. The return pipe 106 is connected to a supply tank 109 which holds a quantity of the cleaning liquid. The supply pipe 105 is connected to the supply tank through a filter 110 and a pump 112, the filter being provided for the removal of foreign matter from the cleaning liquid which is removed from the stock in the cleaning operation. The pump effects a continuous flow of the cleaning liquid through the system which, as indicated, is closed through a connecting pipe 113 and a pressure relief valve 114, so that when the machines in use in the flow system do not use enough of the cleaning liquid from the supply pipe 105 to reduce the pressure therein below a predetermined amount, the relief valve opens automatically to circulate the cleaning liquid through the filter and supply tank. A pipe 115 bridges the filter 110 so that the filter may be effectively removed from the flow system, when desired. It may be readily appreciated that at periods when the system is not in use, some of the contaminating material will settle from the cleaning liquid in the supply tank.

After the cleaning action which is effected by the application of cleaning liquid to the stock and the burnishing and flexing of the stock while the cleaning liquid is on the surface thereof, the cleaning liquid and loosened particles of material therein are stripped from the surface of the stock by jets of air under pressure directed laterally against the stock surface by a nozzle 116 which is supported on the machine in spaced relationship to the output ends of the straightening rolls 94 and 95. The material removed from the stock surface at this position by the action of the air jets is returned to the pan 104. Air under pressure, which pressure may be in the range of 60 to 80 pounds per square inch, is supplied to the nozzle 116 from a supply conduit 117 through a connecting conduit 118. The stripping action of the air jets projected from the nozzle 116 cleans the surface of the stock sufficient to prevent any accumulation of cleaning liquid or particles of loosened material within the guide tube 102. Also, since the stock is rotated as it is moved longitudinally by the action of the straightening rolls 94 and 95, a second nozzle 119 is mounted on the machine adjacent the output end of the straightening rolls 94 and 95, and the stock to a second stripping action as it is finally emitted from the machine. This nozzle 119 is substantially like the nozzle 116 and is supplied with air from the supply conduit 117. The structure of our preferred type of nozzle for use as the nozzles 116 and 119 of Figs. 10 and 12 is shown in detail in Figs. 13, 14 and 15, and Fig. 13 illustrates the positions of the nozzles 116 and 119 with reference to the stock in the adaptation of Figs. 10 and 12. In the form depicted in Figs. 13, 14 and 15, the nozzle 116 has a spread and flattened end portion 120 and an adjoining connecting portion 122; the connecting portion 122 having an internally threaded opening 123 therein for connection to an air supply pipe 124. A plurality of relatively small openings 125 communicative with the opening 123 and extend through the spread and flattened end portion 120 in substantially aligned and angular relationship to one another so that air passing therethrough from the supply pipe 124 is projected from the openings 125 in a series of jets which are spread in fan type fashion.

As utilized, the fan type spread of the projected air jets extends longitudinally of the stock 100, as shown in Fig. 13, so as to cover a substantial length of the stock. Also, the position of the nozzle with respect to the stock 100, as illustrated in the disclosed application, is above the horizontal and directed downwardly in a radial direction toward the stock at an angle of 126 degrees, which, in the present instance, is approximately 45 degrees. It may also be observed that in the disclosed application, the nozzle is so related to the direction of rotation of the stock that it is on the side at which the surface of the stock is moving upwardly.

In Figs. 16 and 17, we have illustrated a modified form of nozzle 127 which may be utilized in place of the nozzle depicted in Figs. 13, 14 and 15. This modified nozzle is made from tubular stock having an end portion 128 which is flattened to provide an elongated and relatively thin internal opening 129 from which a thin and relatively wide jet of air is emitted. The end opposite the flattened portion 128, the nozzle has a substantially round end portion 130 which is provided for connection to a suitable supply conduit.

From the foregoing description of the application of our method to the straightening machine of the type illustrated in Figs. 10 and 12, it will be understood that the method comprehends the flushing of both the stock and the rolls which burnish and flex the stock simultaneously with a continuous stream or rust preventive petroleum base hydrocarbon oil, and then stripping the oil and loosened particles of material from the stock surface at separated positions after it has been subjected to the action of the cleaning liquid and the rolls 94 and 95. Since
the quantity of cleaning liquid which is utilized to effect the simultaneous flushing of the stock and the rolls is considerably in excess of that which adheres to the surface of the stock, and since the cleaning liquid is contaminated by the material which is flushed from the surface of the stock at the rolls and by the stripping action of the first air jets, the cleaning liquid is supplied from a system which includes a filter for removing as much as possible of the contaminating material from the cleaning liquid, so that it may be reused.

Although our invention has been described in connection with specific details of the embodiments thereof, it must be understood that it is not intended to be limited thereto except insofar as set forth in the accompanying claims.

Having thus described our invention, what we claim as new and desire to secure by Letters Patent of the United States is:

1. The method of improving the surface finish of cold drawn ferrous materials and the like by the removal therefrom of surface smut which is characteristic of such materials and which method comprises the steps of applying petroleum base cleaning liquid to the surface of said cold drawn material having the smut thereon, burnishing and flexing the material in at least one of two laterally disposed planes while the cleaning liquid is on the surface thereof, and removing the cleaning liquid and smut from the surface of the material.

2. The method defined in claim 1, and wherein the burnishing and flexing of the material is that normally used for straightening the material.

3. The method defined in claim 1, and wherein the cleaning liquid is applied to material by flushing the material surface therewith while the material is being burnished.

4. The method defined in claim 1, and further characterized by burnishing the material in two successive steps, and applying a rust inhibiting oil to the surface of the material at the beginning of the second burnishing step.

5. The method defined in claim 1 and further characterized in that said petroleum base cleaning liquid has a viscosity of from about 40 to about 150 seconds Saybolt Universal tube at 100° F.

6. The method of removing surface smut characteristic of cold drawn ferrous material from cold drawn ferrous material, which method comprises the steps of applying petroleum base cleaning liquid to the surface of said cold drawn ferrous material, burnishing and flexing said cold drawn ferrous material while said cleaning liquid is on the surface thereof, and removing the cleaning liquid containing said surface smut from the surface of the material.

References Cited in the file of this patent

UNITED STATES PATENTS

<table>
<thead>
<tr>
<th>Patent Number</th>
<th>Inventor</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>781,078</td>
<td>Legard</td>
<td>Jan. 31, 1905</td>
</tr>
<tr>
<td>1,285,057</td>
<td>Cutter</td>
<td>Nov. 19, 1918</td>
</tr>
<tr>
<td>1,290,561</td>
<td>Jackson</td>
<td>Jan. 7, 1919</td>
</tr>
<tr>
<td>1,422,979</td>
<td>Sundh</td>
<td>Apr. 18, 1922</td>
</tr>
<tr>
<td>1,918,207</td>
<td>Grobstein</td>
<td>July 11, 1933</td>
</tr>
<tr>
<td>1,982,518</td>
<td>Howard</td>
<td>Nov. 27, 1934</td>
</tr>
<tr>
<td>2,038,204</td>
<td>Bidle</td>
<td>Apr. 21, 1936</td>
</tr>
<tr>
<td>2,133,231</td>
<td>Schermer</td>
<td>Oct. 11, 1938</td>
</tr>
<tr>
<td>2,153,811</td>
<td>Montgomery</td>
<td>Nov. 11, 1939</td>
</tr>
<tr>
<td>2,194,565</td>
<td>Moss</td>
<td>Mar. 26, 1940</td>
</tr>
<tr>
<td>2,197,022</td>
<td>Petterson</td>
<td>Apr. 16, 1940</td>
</tr>
<tr>
<td>2,234,153</td>
<td>Herbert</td>
<td>Mar. 4, 1941</td>
</tr>
<tr>
<td>2,241,547</td>
<td>Flint</td>
<td>May 13, 1941</td>
</tr>
<tr>
<td>2,242,024</td>
<td>Dillon</td>
<td>May 13, 1941</td>
</tr>
<tr>
<td>2,310,356</td>
<td>Eberhardt</td>
<td>Feb. 9, 1943</td>
</tr>
<tr>
<td>2,337,186</td>
<td>Caugherty</td>
<td>Dec. 21, 1943</td>
</tr>
<tr>
<td>2,394,514</td>
<td>Evans et al.</td>
<td>Feb. 5, 1946</td>
</tr>
<tr>
<td>2,477,411</td>
<td>King</td>
<td>July 26, 1949</td>
</tr>
<tr>
<td>2,614,316</td>
<td>Daily et al.</td>
<td>Oct. 21, 1952</td>
</tr>
<tr>
<td>2,711,660</td>
<td>Friedman</td>
<td>June 28, 1955</td>
</tr>
<tr>
<td>2,713,011</td>
<td>Hurst</td>
<td>July 12, 1955</td>
</tr>
<tr>
<td>2,776,230</td>
<td>Scott</td>
<td>Jan. 1, 1957</td>
</tr>
</tbody>
</table>