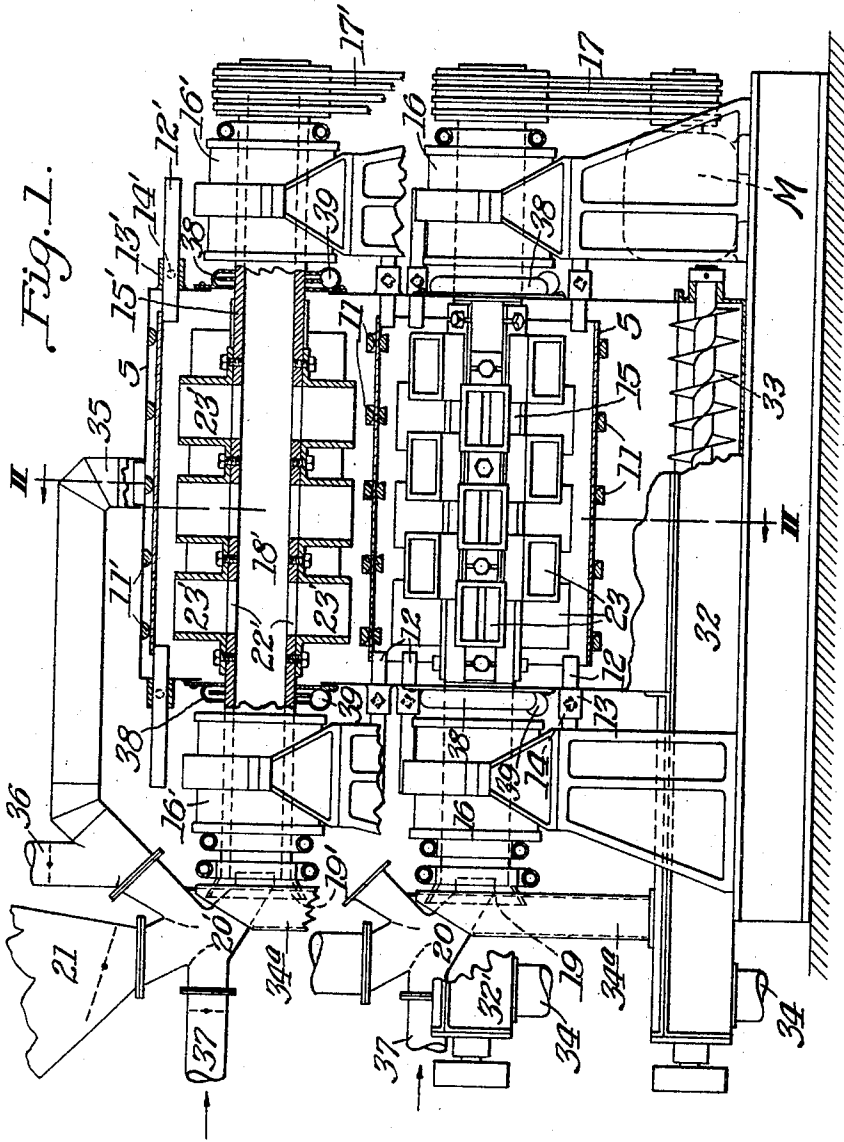


Sept. 19, 1939.

A. E. JESSER
METHOD OF AND APPARATUS FOR ABRASIVE TREATMENT
OF METAL SHEETS AND THE LIKE
Filed Jan. 6, 1934

2,173,364

3 Sheets-Sheet 1



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3 Sheets-Sheet 2

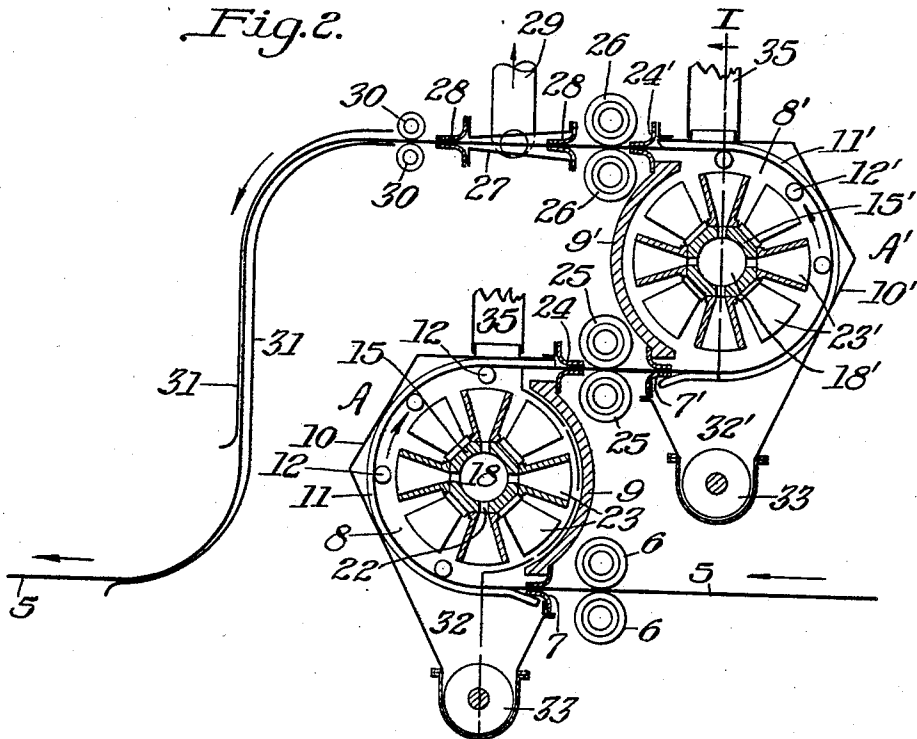


Fig. 3.

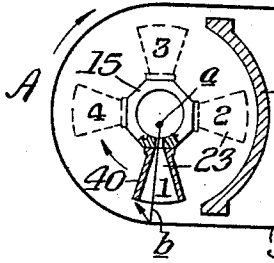
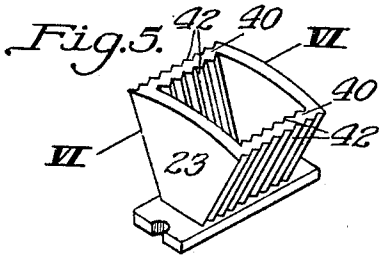
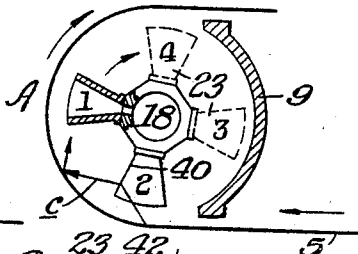


Fig. 4.



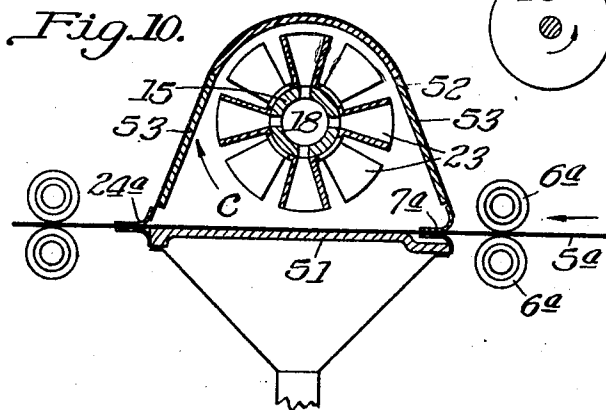
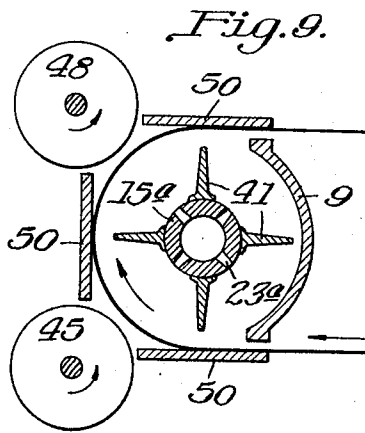
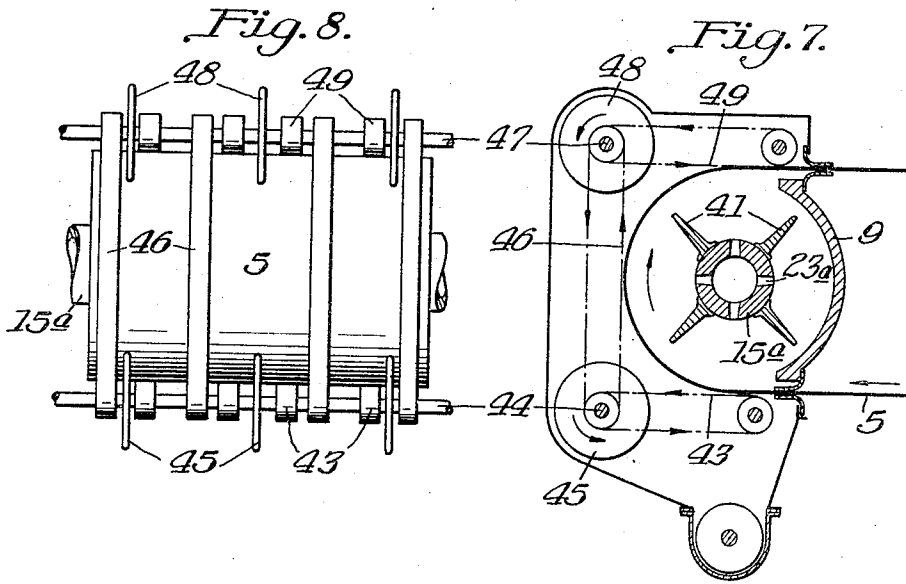
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3 Sheets-Sheet 3



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UNITED STATES PATENT OFFICE

2,173,364

METHOD OF AND APPARATUS FOR ABRASIVE TREATMENT OF METAL SHEETS AND THE LIKE

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Application January 6, 1934, Serial No. 705,553

18 Claims. (Cl. 51—9)

This invention relates to improvements in the art of cleaning metal by abrasive treatment, and has particular adaptation to the cleaning of steel sheets, strips, skelp, and the like.

5 It is common practice to clean such products by means of what is known as sand blasting, which practice consists in impinging sand or other abrasive upon the surfaces of the metal at high velocity, whereby to remove scale and
10 other incrustations.

Insofar as I am aware, the practice has heretofore generally embodied the planar or flat straight line travel of the sheet or other product into contact with a series of abrasive jets or streams. For example, a sheet is passed flatwise
15 beneath a fixed transverse row of jets, and is then reversed and returned in order to clean both sides thereof. Or, the sheet may be passed between separate series of jets in order to clean
20 both sides of the sheet in one operation.

These present methods are inefficient and undesirable in many respects. Although an attempt is made to provide uniform cleaning by overlapping of the jets, an uneven surface and streaking frequently result, probably due to the
25 fact that each individual jet varies in force from each other jet, and also within its own dispersion, for it is a known fact that such a jet has its maximum intensity and force at the center and varies outwardly therefrom.

Further, owing to the flatwise disposition of the sheet or other product and the passage thereof into contact with the fixed jets, a limited cleaning results. Since the said jets have a relatively small effective dispersion, any given area
35 of the sheet has but a limited treatment before passing out of contact with the abrasive.

To obviate these and other undesirable features, I have provided a method and apparatus
40 for the abrasive treatment of metal, such as steel sheets and the like, whereby the sheet is passed into prolonged contact with an impinging abrasive applied in such a manner as to effect a more thorough and extensive abrasive treatment than
45 has heretofore been possible under the old practice.

It is a prime object of this invention to provide the process and means for complete distribution and dispersion of an abrasive, such as steel
50 grit, shot, sand, or the like, in impinging application to the sheet or other product being cleaned, whereby complete uniformity of treatment is effected.

The preferred practice of my invention contemplates a centrifugally applied abrasive which

is impinged directly upon and dispersed throughout a substantial area of the sheet or other product being treated, with sufficient force to remove scale and other incrustations, the said abrasive being projected throughout the width of the sheet
5 and repeatedly contacting the surface thereof for a considerable distance in a direction longitudinally of the sheet.

During the treatment by means of the invention, said sheet is preferably moved or passed
10 in a fixed path relative to the abrasive propelling means. This path of travel may be planar or straight and spaced from the said means to provide adequate and extended contact by the abrasive.
15

The invention has further object in providing means for passing the sheet or other product in an arcuate or curved path relative to the abrasive propelling means whereby to further
20 prolong the abrasive action and effect a more uniform treatment.

I also provide suitable baffles or enclosures, which, together with the sheet or product, are disposed relative to the abrasive projecting means
25 in such a manner as to receive and re-bound the propelling abrasive particles, whereby they are repeatedly re-propelled into impinging contact with the sheet.

Additional objects and advantages of the invention may be readily understood from the following description, taken in connection with the
30 accompanying drawings, wherein:

Fig. 1 is a part elevational and a part sectional view of a preferred form of device for the abrasive treatment of metal sheets and the like by
35 the method of my invention, the section being taken along the broken line I—I of Fig. 2;

Fig. 2, a cross sectional view taken along the line II—II of Fig. 1;

Figs. 3 and 4, diagrammatic views illustrating
40 the preferred manner of application of the abrasive by means of my invention;

Fig. 5, a perspective view of an abrasive nozzle;
45 Fig. 6, an enlarged detail section taken along the line VI—VI of Fig. 5, illustrating a dispersion surface of a nozzle;

Fig. 7, a detail section showing a modified construction;

Fig. 8, an elevational view of Fig. 7, showing
50 the modified sheet guiding means;

Fig. 9, a cross sectional view of a further form of sheet guiding means; and

Fig. 10, a cross sectional view of a modified form of abrasive treatment device wherein the
55

sheet or other product is passed flatwise with respect to the abrasive propelling means.

Referring to the drawings, and particularly to Figs. 1 and 2 thereof, A designates generally an abrasive treatment unit, designed to receive a metal sheet or similar product 5 from a pair of pinch rolls 6, driven by any suitable means, not shown. It is to be understood that the present invention is not to be limited to the abrasive treatment of metal sheets, the term being used merely for the purposes of illustration, as any product or article is meant which it is desired to clean by abrasive and which may be subjected to the hereinafter described process.

The rolls 6 are preferably provided with rubber coverings for engaging the sheet and conveying the latter into the unit A through a wiping and sealing device 7, consisting of a pair of angular resilient members, extending transversely of the sheet and engaging opposite surfaces thereof.

The said device 7 is mounted in any suitable manner at one side of the lower portion of a working chamber 8 formed by an arcuate baffle 9 and an enclosing casing 10. Within the chamber 8, I prefer to provide an arcuate or semi-circular path defined by means of a series of guides 11, for receiving the sheet 5 immediately upon its introduction into the chamber through the device 7, and guiding the said sheet in such path upwardly, and thence out of the chamber in a direction substantially parallel to and reversed with respect to that of its entrance. In order to minimize friction, the guides 11 are preferably semi-circular in cross-section for guiding and embracing line contact with the sheet.

A series of arcuately disposed supports 12 may be provided extending inwardly from the sides of the chamber 8, spaced from the guides 11 a sufficient distance to permit the passage of the edge portions of the sheet therebetween for assisting the curved travel of the sheet by supporting said edges. The supports 12 are slidably mounted in suitable bosses or bearings 13, and are adjustable inwardly and outwardly to accommodate various widths of sheet by means of set screws 14.

Operably mounted within the chamber 8 and preferably concentric with the arcuate guides 11, I provide means for the application of an abrasive such as steel grit, shot, sand, and the like, against the inner surface of the sheet 5 during its entire travel through the chamber. The said means preferably comprises a centrifugal device for effecting distribution and impact of the abrasive against the said sheet.

In the drawings, I have illustrated one form of such centrifugal device including a hollow rotor 15 extending through the chamber 8 transversely of the path of the sheet, and rotatably supported in suitable outboard pedestal bearings 16. One end of such rotor is provided with driving means, such as the belt drive 17, connected with a suitable motor M.

The interior chamber 18 of the rotor is open at one or both ends, one end only being shown open at 19 for the admission of air and the introduction of the abrasive through a conduit 20 leading downwardly from a storage hopper 21.

Rotor 15 is formed with radial series of longitudinally staggered or offset openings or orifices 22 in the form of longitudinal slots through the wall thereof. Communicating with said openings, and forming substantial continuations thereof, are provided a plurality of individual outwardly diverging nozzles 23, secured to the outer sur-

face of the rotor, and preferably extending radially therefrom. As clearly shown in Fig. 1, the said nozzles are staggered or offset so as to have their terminal openings disposed in overlapping relation longitudinally of the rotor, the rotative path of said nozzle terminals being spaced from the arcuate path of the sheet.

In operation, the sheet 5 is passed through the chamber in the curved path determined by the guides 11 and supports 12.

The rotor 15 is driven at a high rate of speed, preferably in the same direction of rotation as the circular travel of the sheet, as indicated by the arrows of Fig. 2. The nozzles 23 become in effect hollow fan blades and create an extremely high suction through the interior 18 of the rotor, causing the abrasive flowing through the conduit 20 to be picked up by the air rushing in through the open end 19 and distributed in temporary suspension throughout the said interior 18.

The said abrasive is immediately propelled by centrifugal force and at high velocity outwardly through the plurality of nozzles into impinging contact with the inner curved surface of the sheet 5 passing through the chamber 8. Scale and other incrustations will be removed by the abrasive during the prolonged curved passage of the sheet around the rotor or fan, the nozzles or hollow blades of which disperse the abrasive over the entire surface of said sheet.

The sheet will be subjected to the abrasive treatment continuously during its passage from the entering device 7 to a similar wiping and sealing device 24 at the upper portion of the chamber 8, where the sheet emerges from the chamber with its inner, or the then under, surface cleaned.

In the case of a single one-side treatment, sheet 5 may then be reversed and returned through the device A to clean the other side thereof in the same manner as before. However, I prefer to provide for a continuous process whereby to first clean one side and then the other, by subjecting the latter to similar abrasive treatment in a second device A'.

The sheet emerging from the device A is engaged by a second pair of driven pinch rolls 25 and is thereby passed into the second device A' through a wiping and sealing device 7'.

Said sheet is again subjected to the action of an abrasive device and travels therearound in an arcuate path in a direction reversed with respect to that of its travel in the device A. Also, the centrifugal abrasive action in the device A' takes place in a reversed direction of rotation to that of the first device, or, in other words, in the direction of travel of the sheet through said device A', as indicated by the arrow.

Since the parts of the second device A' are identical with those of device A, they have been given like reference characters throughout with the addition of a prime mark.

The completely treated sheet passes out of the second device A' through the wiping and sealing device 24', passing between a third pair of driven pinch rolls 26 and through a closed dust and abrasive removing chamber 27. Said chamber is provided with additional wiping and sealing devices 28 at its entrance and exit, and has a suction pipe 29 connected therewith for removing dust and abrasive remaining on the sheet. The pipe 29 may be connected with any suitable suction fan or the like, and preferably creates a suction acting on both sides of sheet 5 transversely of the direction of travel of said sheet through the chamber 27.

Finally, the sheet may be passed through idler rolls 30 and downwardly by guides 31 to be removed at approximately the same level or plane of its introduction into the system by the rolls 6.

During the operation of the invention, the chambers 8 and 8' will become filled with moving abrasive hurried against the baffles and casing walls, as well as directly against the sheet 5.

The spent abrasive and the removed scale will move laterally off of each edge of the sheet, and from the baffles and walls, falling downwardly into receiving hoppers 32 and 32' of the devices A and A', respectively. Wiping members 24 and 24' will cause such abrasive to be discharged over the edges of the sheet and thence into said hoppers.

Suitable means such as screw conveyors 33 may be provided in the hoppers 32 and 32' for conveying the used abrasive and removed scale particles out of the devices, whereby the mixture may be drawn off through conduits 34 to a separating device, not shown, from whence the separated abrasive may be returned to the hopper 21 for re-use, as will be readily understood. 34a designates return conduits for conveying spillage or excess abrasive from the open ends of the rotors to their respective conveyors.

In addition, the chambers 8 and 8' are each provided with a circulating return suction conduit 35 opening off the upper sides of said chambers to remove dust and abrasive, which may be returned to the conduits 20 and 20', as in Fig. 1, for re-use. A riser 36 from each of said conduits may be connected with a dust collector, if desired.

Conduits 37 are provided adjacent the outlet ends of the feeder pipes 20 and 20' for the introduction of secondary air, if it is desired to amplify the flow of abrasive from the hopper 21.

Such secondary air will also serve to assist the distribution and suspension of the abrasive in the chambers 18 and 18' of the respective rotors.

For the protection of the bearings 16 and 16', I prefer to provide abrasive seals 38 having connections 39 with a suitable suction line for the removal of particles of abrasive passing outwardly of the device.

A further important feature of my invention resides in a manner of increasing the abrasive action, both with regard to the effective cleaning action and the dispersion or distribution of said abrasive, so as to provide a perfectly treated product.

To this end, I prefer to utilize the nozzle structure described, or more particularly the radial sides 40 thereof.

During the operation of my device, the said nozzles 23 or 23' are rapidly rotated centrifugally impinge the discharged abrasive against the sheet being cleaned. For example, in Fig. 3, the dot *a* may be said to represent a particle of abrasive suspended with innumerable other such particles in the body of air within the interior chamber 18 of the rotor 15.

The centrifugal action of the rotor and nozzle projects the particle *a* outwardly at high velocity through the nozzle in some path, diagrammatically represented by the arrow *b*, against the inner curved surface of the sheet 5. The natural reaction of the particle on impinging the sheet is to re-bounce, as indicated by said arrow, in the direction of rotation of the rotor. The direction of re-bounce of said particle is away from the sheet and in the direction of movement of the rotor and nozzle, largely due to the independent

travel of the sheet 5 in the same direction as said nozzle.

The rapid rotation of the rotor brings the forward wall 40 of a succeeding nozzle, as for example, nozzle 2, into contact with the re-bouncing particle *a*, and propels said particle forwardly in the direction of rotation of the nozzle and outwardly into a second contact with the sheet 5, as indicated by the arrow *c* of Fig. 4.

This action is repeated continuously throughout the active approximately half round portion of chambers 8 and 8', the baffles 9 and 9' functioning as re-bouncing surfaces for the particles not contacting the sheet. Due to the great number of particles of abrasive distributed by the rotors to said chambers, a high degree of dispersion of abrasive is produced which repeatedly and uniformly impinges on and cleans the sheet 5.

The repeated propelling and impinging of the abrasive onto the sheet is assisted by the action of the rotors and nozzles which tend to effect a uniformity of distribution of the said abrasive. Air currents are induced outwardly into contact with the sheet, which currents are then drawn inwardly toward the rotor, thereby effecting a continuous circulation throughout the chambers.

It is to be understood that other means may be substituted for the walls 40 of the nozzles, as for example, as shown in Fig. 7, fins or abutments 41 may be interspaced with orifices or nozzles 23a formed in the wall of the rotor 15a, with efficient results. Also, my invention is not to be limited to any specific shape, size or inclination of the nozzles or abutments, as the most efficient disposition and arrangement thereof may be readily determined by experiment.

The dispersion of the abrasive by means of the walls 40 or abutments 41 may be still further increased by forming said parts with one or more uneven or ribbed contacting surfaces. For example, alternately inclined portions 42 may be incorporated as particularly shown in Figs. 5 and 6, whereby the abrasive will be laterally dispersed, as shown by the arrows of Fig. 6, outwardly into contact with the sheet being cleaned.

Figs. 7 and 8 illustrate a modified form of guiding means for defining an arcuate or curved path for the sheet, comprising a plurality of rectangularly disposed moving belts and guide rollers.

43 designates one series of belts having their sheet-engaging strands moving in the same direction as the sheet 5, said belts being driven by a rotating shaft 44, driven in any suitable manner.

Enlarged guide wheels 45 of rubber or the like are secured to said shaft between the belts 43 for engaging the forward edge of the entering sheet 5 and changing the direction of said sheet through substantially a right angle onto a second series of belts 46 also having sheet-engaging strands moving in the direction of travel of the sheet. Belts 46 extend between spaced shafts 44 and 47, the latter also having guide wheels 48 for changing direction of the sheet where it is passed outwardly of the device by means of a third series of belts 49 driven from the shaft 47.

In this manner, the sheet assumes an arcuate or semicircular path about the abrasive propelling means, the inherent resiliency of the metal 70 serving to effect a uniform curvature of the sheet. The belts are driven at substantially the same rate of speed as that of the sheet 5, whereby there will be little or no relative movement between said belts and sheet while in contact.

Hence, if abrasive particles are caught therebetween, any tendency to produce scratches will be eliminated.

In Fig. 9, I have shown a still further modification whereby a curved path may be defined, as by angularly arranged fixed guides or bars 50, and guide wheels 45 and 48 disposed at the intersections of the continuations of said guides or bars, for assisting in the change of direction of the sheet.

While the foregoing description particularly relates to the preferred practice of my invention, wherein the sheet or product being treated is passed in a curved path relative to the abrasive propelling device, it is possible by means of the invention to successfully treat or clean sheets and the like disposed flatwise with respect to said device.

Thus in Fig. 10, a sheet 5a is passed flatwise between a pair of pinch rolls 6a through a wiping and sealing device 7a and into a working chamber C, formed by a bottom plate 51 and an upper casing 52, enclosing a centrifugal abrasive projecting and distributing device of the character hereinbefore described, including a hollow rotor 15 and a plurality of abrasive nozzles 23.

The device is rotated at high speed and abrasive is fed through the chamber 18 of the rotor as before, which abrasive is hurled outwardly in all directions by means of the nozzles, into impinging contact with the sheet and casing 52.

The centrifugal device extends transversely the full width of the sheet as in Fig. 1, and due to its effective propulsion and dispersion, is capable of treating a substantial area of the sheet 5a. The longitudinal distance between the point of entrance 7a of the sheet and its exit through a wiping and sealing device 24a may attain considerable size with my method, producing a highly efficient cleaning treatment.

In this connection, the casing 52 may be so disposed about the centrifugal device as to assist in the abrasive treatment much in the same manner as before described. For example, the downwardly and outwardly sloping sides of the casing as well as the upper curved portion thereof, may be provided with renewable wear or baffle plates 53 which will be impinged by the propelled abrasive. Said baffles in turn will re-bound the particles of abrasive into contact with the sheet 5a and thence into the path of the nozzles 23 to produce a high degree of dispersion of abrasive which repeatedly and uniformly impinges on and cleans the sheet. Likewise, the abrasive particles are re-bounded from contact with the sheet and again hurled about by the nozzles into repeated contact with said sheet.

What I claim is:

1. An abrasive treatment device for cleaning metal sheets and the like including a hollow rotor, means on the rotor for projecting an abrasive therefrom, arcuate guides for receiving and bending a sheet in curved relation to and presenting a concavely curved surface thereof toward said means, and means for moving said sheet on the guides.

2. An abrasive treatment device for cleaning metal sheets and the like including an enclosed working chamber, a hollow member rotatable therein, abrasive-projecting means on said member, and guides about and spaced from said means for bending a sheet in a curved path about and presenting a concavely curved surface toward said abrasive projecting means, and means for moving said sheet on the guides.

3. An abrasive treatment device for cleaning metal sheets and the like including an enclosed working chamber, a hollow member rotatable therein, a plurality of abrasive nozzles on said member, and guides about and spaced from said means for bending a sheet in a curved path through the chamber with a concavely curved surface of the sheet toward said rotatable member, and means for moving said sheet on the guides.

4. An abrasive treatment device for cleaning metal sheets and the like including an enclosed working chamber, a hollow rotor therein, abrasive nozzles on the rotor, guides for receiving and bending a sheet in an arcuate path through said chamber about said rotor, sheet-engaging sealing means at the points of entrance and exit of the sheet to and from the chamber, and means for moving said sheet on the guides and through the sealing means.

5. An abrasive treatment device for cleaning metal sheets and the like including an enclosed chamber, guides for receiving and bending a sheet in a curved path through said chamber, rotary abrasive-projecting means concentrically positioned relative to the curved path of the sheet, and means for moving said sheet on the guides.

6. An abrasive treatment device for cleaning metal sheets and the like including a pair of enclosed chambers, guides in said chambers for bending a sheet in arcuate paths therethrough, the path through one of said chambers being in a reverse direction to the path through said other chamber, means for passing the sheet through said chambers in the defined paths, and abrasive-projecting means in each of the chambers.

7. An abrasive treatment device for cleaning metal sheets and the like including an enclosed chamber, a hollow rotor therein, abrasive nozzles on the rotor communicating with the interior thereof, guides for receiving and bending a sheet in a curved path through the chamber about the rotor, an abrasive feeder conduit communicating with the interior of the rotor, and a suction conduit for the enclosed chamber, said suction conduit also communicating with the feeder conduit for continuous circulation of abrasive through the device.

8. An abrasive treatment device for cleaning metal sheets and the like including an enclosed chamber, means for passing a sheet in a curved path within the chamber, a hollow rotor disposed concentrically and transversely of the curved sheet and having a longitudinal series of outwardly diverging abrasive nozzles communicating with the interior thereof, and means for driving said rotor, whereby abrasive is propelled into impinging contact with the sheet.

9. An abrasive treatment device for cleaning metal sheets and the like including a hollow rotor, means for introducing abrasive to the interior of the rotor, abrasive propelling nozzles on the rotor arranged in staggered longitudinal series, means for driving the rotor, and means for receiving and passing a sheet in a fixed path relative to the rotor whereby the abrasive is applied and distributed over the surface of said sheet.

10. An abrasive treatment device for cleaning metal sheets and the like including an enclosed chamber, a centrifugal abrasive propelling rotor in the chamber having circumferential abrasive discharge orifices, means for passing a sheet in a fixed path relative to said rotor, driving means for the rotor, whereby abrasive is propelled and

impinged upon the surface of the sheet, and means on the rotor outwardly of said orifices whereby abrasive re-bounding from contact with the sheet is repeatedly repropelled into impinging contact with said sheet.

5 11. An abrasive treatment device for cleaning metal sheets and the like including a centrifugal abrasive propelling rotor having circumferential abrasive discharge orifices, means enclosing said rotor including baffle walls, means for passing a sheet in a fixed path relative to said rotor and wells, driving means for the rotor whereby abrasive is propelled and impinged upon the surface of the sheet and walls, and means on the rotor outwardly of said orifices whereby abrasive re-bounding from contact with the sheet and walls is repeatedly repropelled into impinging contact with said sheet.

10 12. The herein described method of abrasive treatment of metal sheets and the like, which consists in bending a flat sheet and at the same time causing it to travel through a curved path about an abrasive throwing means, and simultaneously applying abrasive from said throwing means to the concave surface of said sheet.

15 13. The herein described method of abrasive treatment of metal sheets and the like, which consists in bending a flat sheet and at the same time causing it to travel through a curved path about an abrasive throwing means, and continuously applying abrasive from said throwing means to the concave surface of said sheet during the curved travel thereof.

20 14. An abrasive treatment device for cleaning metal sheets and the like including an enclosed chamber, a hollow rotor therein, abrasive nozzles on the rotor communicating with the interior thereof, means for passing a sheet in a fixed path relative to said rotor, an abrasive feeder
25 40 conduit communicating with the interior of the

rotor, and a suction conduit connecting the upper portion of the enclosed chamber and communicating with the feeder conduit for continuous circulation of abrasive through the device, the fixed path of the sheet intervening between the abrasive nozzles and the suction outlet.

5 15. In a device of the character described, a hollow abrasive propelling rotor having longitudinally staggered circumferential discharge orifices, and means extending outwardly of said orifices for effecting dispersion of the discharged abrasive laterally with respect to the rotation of the rotor.

10 16. In a device of the character described, a hollow abrasive propelling rotor having longitudinally staggered circumferential discharge orifices, and members extending outwardly of said orifices, said members having irregular contact surfaces for contacting and dispersing the discharged abrasive laterally with respect to the rotation of the rotor.

15 17. The herein described method of abrasive treatment of metal sheets and the like, which consists in bending a flat sheet in a curved manner and at the same time causing it to travel in a fixed path relative to an abrasive throwing means with the concave surface of the sheet substantially concentric with and disposed toward said means, and simultaneously applying abrasive from said throwing means to the concave surface of said sheet.

20 18. An abrasive treatment device for cleaning metal sheets and the like including a rotary abrasive throwing means, means for receiving and bending a sheet in curved relation to and presenting a concavely curved surface thereof toward said abrasive throwing means, and means for moving said sheet on said receiving means.

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