

June 30, 1964

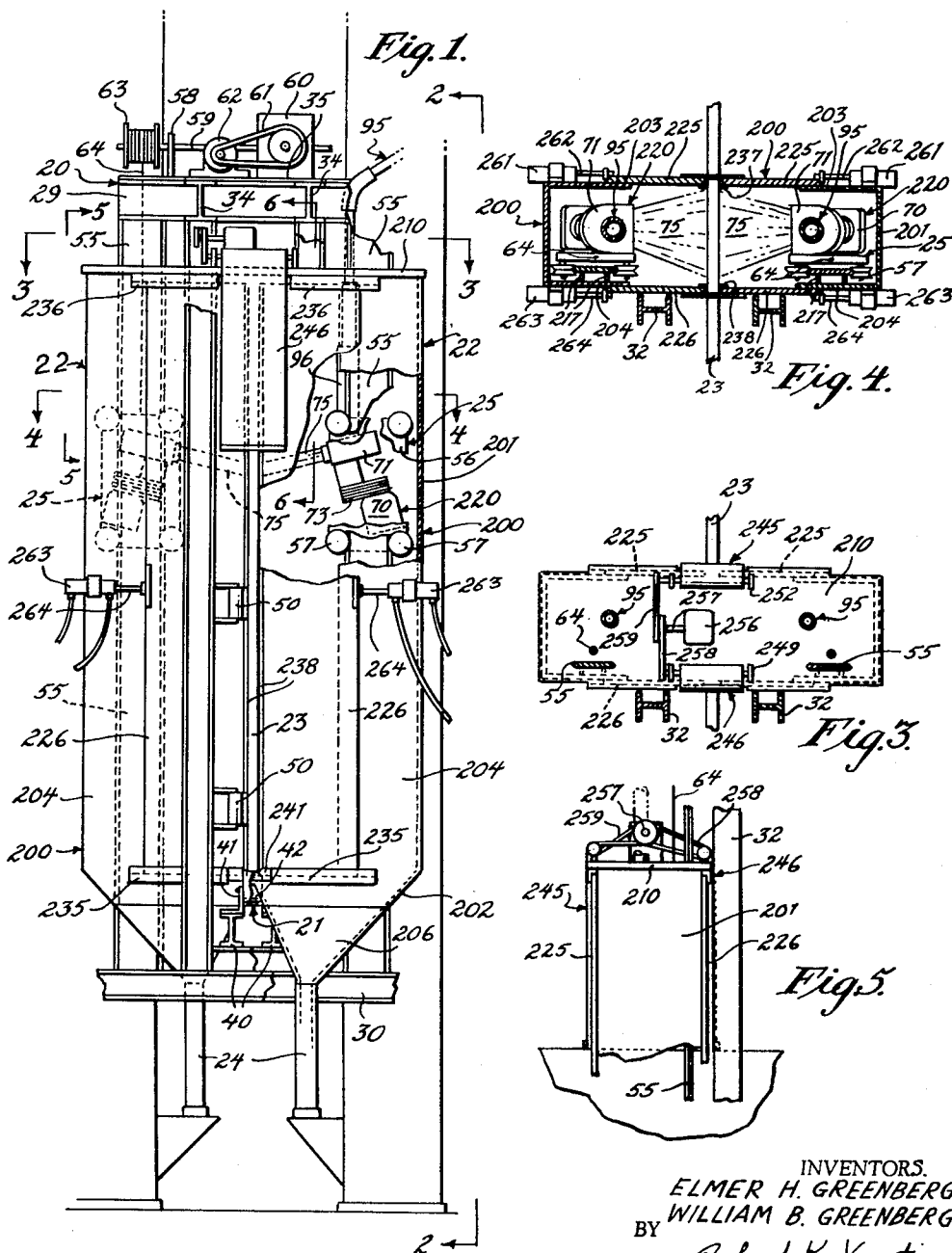
E. H. GREENBERG ETAL

3,138,900

METAL-PLATE-TREATING APPARATUS

Filed Feb. 19, 1962

4 Sheets-Sheet 1



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4 Sheets-Sheet 2

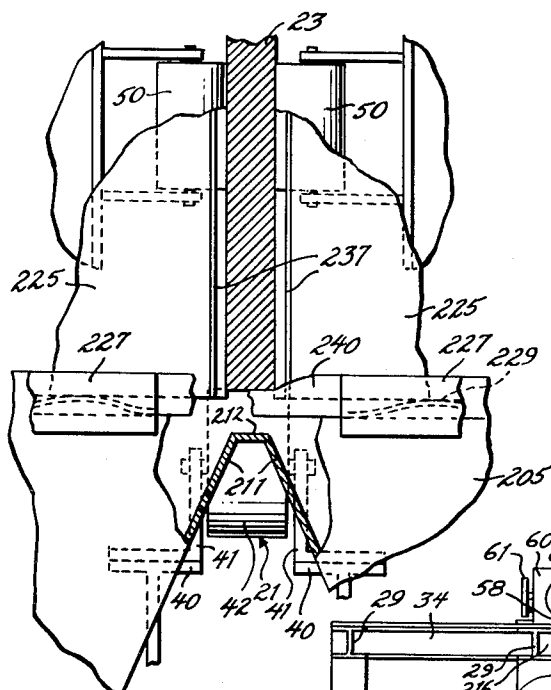


Fig. 9.

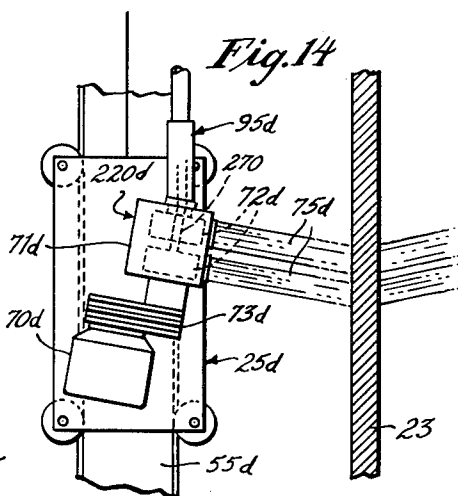


Fig. 14

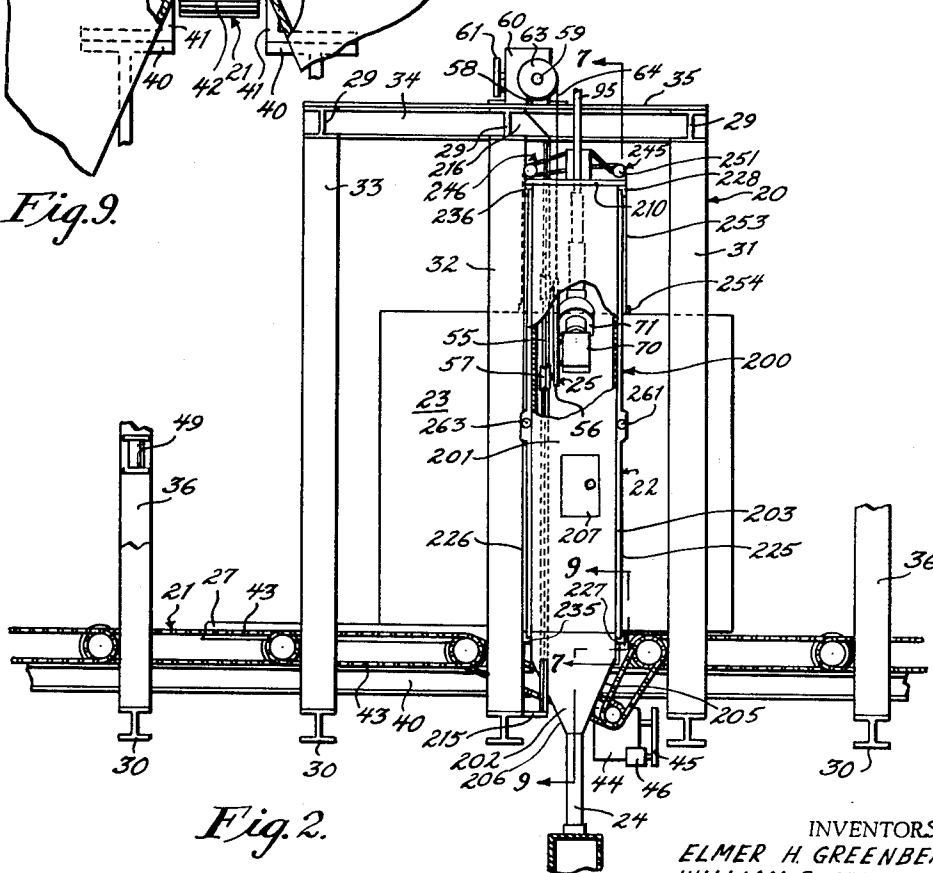


Fig. 2.

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Fig. 7.

Fig. 8.

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4 Sheets-Sheet 4

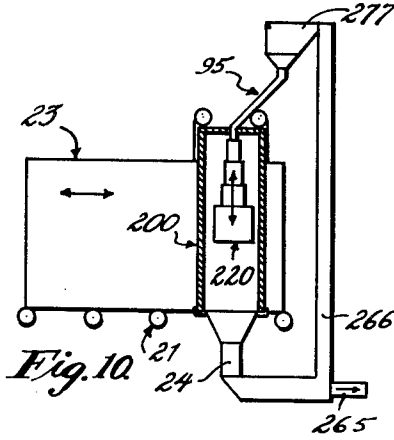


Fig. 10.

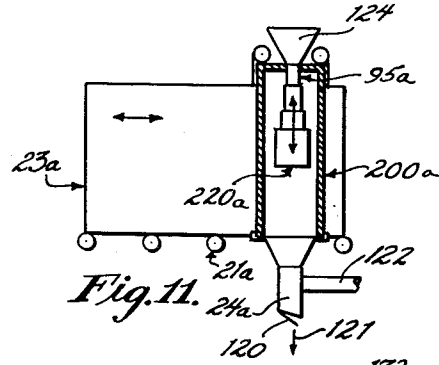


Fig. 11.

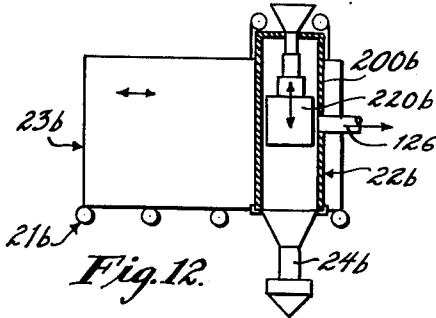


Fig. 12.

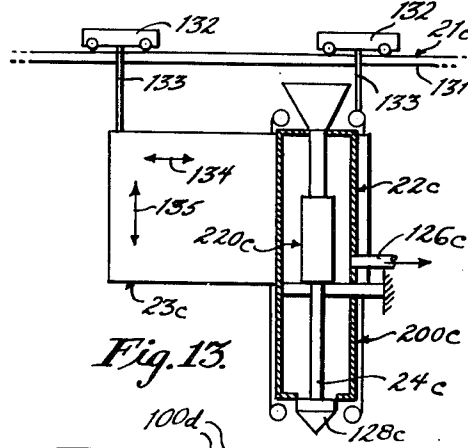


Fig. 13.

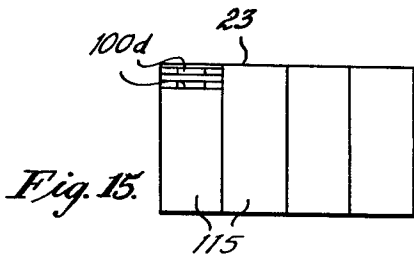


Fig. 15.

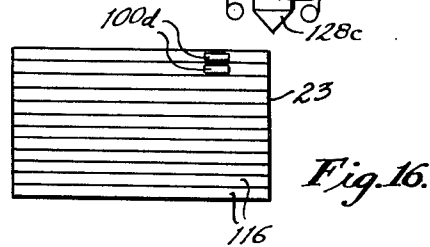


Fig. 16.

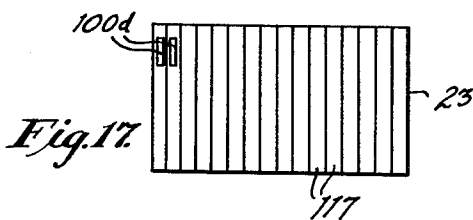


Fig. 17.

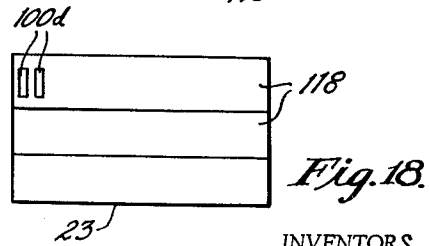


Fig. 18.

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METAL-PLATE-TREATING APPARATUS

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Filed Feb. 19, 1962, Ser. No. 174,232
14 Claims. (Cl. 51-9)

This invention relates generally to surface treatment of plates, and is a continuation-in-part of our copending patent application Serial No. 54,167, now Patent No. 3,103,767 issued September 17, 1963.

As is well known to those versed in the art, the removal of scale from heavy metal plates has previously involved considerable problems, both in handling the plates during the scale-removing procedure, and in handling the treating material, such as sand or shot in a manner which is safe and comfortable to those in the area, as well as being rapid, efficient and economical in high-quality treatment of the plate and reclaiming and recirculation of the treating material, if desired.

The instant invention relates primarily to the provision of apparatus for treating heavy metal plates with abrasive and like treating materials, wherein the plates are most conveniently handled, and the treating material is most effectively employed to achieve the desired treatment, while maintaining the adjacent area safe and comfortable for personnel, which also enhances the efficiency of reclaiming and recirculating the treating material.

While the apparatus of the instant invention has been primarily developed for use in the scale removal of heavy metal plates, and will be illustrated and described hereinafter with particular reference thereto, the novel features and advantages disclosed hereinafter are capable of many varied applications, all of which are intended to be comprehended herein.

Other objects of the present invention will become apparent upon reading the following specification and referring to the accompanying drawings, which form a material part of this disclosure.

The invention accordingly consists in the features of construction, combinations of elements, and arrangements of parts, which will be exemplified in the construction hereinafter described, and of which the scope will be indicated by the appended claims.

In the drawings:

FIGURE 1 is an end elevational view showing apparatus constructed in accordance with the teachings of the present invention, partly broken away for clarity of understanding;

FIGURE 2 is a longitudinal elevational view, taken substantially along the line 2-2 of FIGURE 1, and partly broken away to facilitate understanding;

FIGURE 3 is a horizontal sectional view taken substantially along the line 3-3 of FIGURE 1;

FIGURE 4 is a horizontal sectional view taken substantially along the line 4-4 of FIGURE 1;

FIGURE 5 is an elevational view taken substantially along the line 5-5 of FIGURE 1;

FIGURE 6 is an enlarged sectional elevational view taken substantially along the line 6-6 of FIGURE 1;

FIGURE 7 is an enlarged sectional elevational view taken substantially along the line 7-7 of FIGURE 2, and broken away to conserve drawing space;

FIGURE 8 is a horizontal sectional view taken substantially along the line 8-8 of FIGURE 7;

FIGURE 9 is an enlarged, fragmentary sectional elevational view taken substantially along the line 9-9 of FIGURE 2;

FIGURES 10-13 are schematic longitudinal eleva-

tional views showing several modifications of the instant apparatus;

FIGURE 14 is an enlarged, fragmentary elevational view showing a modified structure of material-projecting means; and

FIGURES 15-18 are diagrammatic representations showing various modes of employing apparatus in accordance with the teachings of the present invention.

Referring now more particularly to the drawings, and specifically to FIGURES 1 and 2 thereof, a frame is generally designated 20, within which is located suitable conveyor means 21 for handling an article to be treated. On opposite sides of the frame 20, see FIGURE 1, are provided treating assemblies 22 for applying treating material to a workpiece 23 carried by the handling means or conveyor 21.

It may be observed in FIGURE 1 that the frame 20 is symmetrical about the conveyor 21; and that the workpiece or plate 23 is carried in upstanding relation on the conveyor within the frame. As noted, there are provided a pair of treating assemblies 22 on opposite sides of the plate 23 for treating both faces thereof. The treating assemblies 22 may be substantially identical, and employ the same or separate means for handling the treating material (not shown). Of course, only a single treating assembly on one side of the conveyor may be employed, if desired, say where treatment of only one plate face is required.

The frame 20 includes a plurality of parallel spaced, crosswise base members 30, which may be embedded in or otherwise fixedly secured to an appropriate ground or other supporting surface. On each side of the conveyor 21, extending generally upward from a plurality of adjacent base members 30, are a plurality of uprights 31, 32 and 33. The uprights 31, 32 and 33 on each side of the conveyors 21 are in alignment with each other longitudinally of the conveyor, while each pair of identically numbered uprights 31, 32 and 33 on opposite sides of the conveyor are in alignment with each other transversely of the conveyor.

Extending across the upper ends of the uprights 31, 32 and 33 on each side of the conveyor 21 is a top frame member or lintel 34. The lintels 34 on opposite sides of the conveyor 21 may be connected together by transverse members or beams 29, and a generally horizontal mounting plate 35 may rest on the members 29 and 34, bridging the space between the latter members.

Additional uprights 36 may be fixed at their lower ends to additional base members 30, on both sides of the conveyor 21. All of the frame members 29, 30, 31, 32, 34 and 36 may be formed of structural I beams, or other suitable construction, if desired. The frame members, as well as the mounting plate 35, may all be fixedly secured to each other in the above-described arrangement, as by welding or other suitable fastening means.

The conveyor 21 includes a pair of longitudinally extending, laterally spaced, generally horizontal support members 40 fixedly secured by any suitable means between the uprights 31, 32, 33 and 36. At longitudinally spaced locations along the support members or beams 40, there are provided pairs of upstanding journal pedestals 41, see FIGURES 1 and 9, each pair of journal pedestals carrying therebetween a rotatable roller 42. A plurality of such rollers 42 are arranged in longitudinally spaced relation between the uprights of the frame 20, each roller being journaled for rotation about a horizontally disposed axis extending transversely of the conveyor means. Suitable drive means, such as by sprocket-and-chain connections 43, may positively connect the several rollers 42 to each other and to a variable-speed transmission 44 for simultaneous rotation of the rollers. The

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variable-speed transmission 44 may be connected through any transmission means 45 to a suitable drive means or motor 46. Thus, the motor effects simultaneous motion and equal angular velocity of all the rollers 42, for conveyance thereby of the workpiece or plate 23 resting on edge on at least two of the conveyor rollers.

In order to maintain the workpiece or plate 23 in its upright condition while resting on and being conveyed by the rollers 42, the relatively tall uprights 31, 32 and 33 are preferably each provided on their inner sides with a plurality of guide rollers 50. The uprights 36 may also be provided with similar, additional guide rollers 49, if desired; and, the guide rollers 49 may be mounted on their respective uprights for lateral adjustment toward and away from each other to accommodate plates of different dimensions. If desired, the work-carrying rollers 42 may be provided with frictional peripheral surfaces, as being serrated or the like, for more positive conveying engagement with the supported article or plate. Also if desired, there may be provided longitudinally of the conveyor 21, between the uprights of frame 20 in the lower region thereof, an elongate, upwardly facing trough or guide channel 27, as seen in FIGURE 2, which more effectively guides a relatively short plate which might tend to turn laterally of the conveyor.

Thus, the conveyor 21, as in said copending patent applications, provides motive means for moving the plate 23 generally edgewise in its upstanding condition along the substantially horizontal path of the conveyor. Located on opposite sides of the conveyor 21, preferably directly opposite to each other, are a pair of generally upright or vertically elongate enclosures 200. The enclosures 200 may each be considered part of a respective treating assembly 22, and may be substantially identical to each other, but of opposite hand. Each enclosure 200 includes a generally vertical outer wall 201 in a plane generally parallel to the track 21 and spaced therefrom. Each outer enclosure wall 201 may extend vertically from the region of track 21 to the region adjacent to and spaced below the beams 29 and 34. Extending from the lower edge of each outer wall 201, declining inward therefrom, is a downwardly narrowing outer-wall extension 202, best seen in FIGURES 1 and 2. Extending from opposite sides or vertical edges of each outer enclosure wall 201, are a pair of generally vertical enclosure side walls 203 and 204. The enclosure side walls are generally vertically coextensive with the adjacent enclosure outer wall 201, and extend in facing spaced parallelism with each other inward toward the path of movement of plate 23. As best seen in FIGURE 4, the enclosure side walls 203 and 204 terminate at their inner edges spaced from the plate 23. The lower end regions of the enclosure side walls 203 and 204, respectively designated 205 and 206, may decline obliquely toward each other along opposite side edges of the outer-wall extension 202, and taper toward their lower ends. The enclosures 200, as thus far described, are suitably fixed in stationary relation, by means appearing presently; and, the enclosures are advantageously provided with access doors, as at 207 in FIGURE 2, for convenience in making adjustments and repairs, as well as for observation.

A generally horizontal upper end plate or cover member 210 extends across the upper ends of both enclosures 200, bridging the space over conveyor 21, and may be fixedly secured by any suitable means to the upper end regions of enclosure walls 201, 203 and 204, bridging the space therebetween. Beneath the path of plate 23, as best seen in FIGURE 9, there are provided a pair of downwardly and outwardly inclined lower walls 211, each tapering downwardly and extending between the inner edges of walls 205 and 206 of a respective enclosure 200. Thus, each enclosure includes walls 202, 205, 206 and 211 which combine to define a funnellike lower end region of the respective enclosure for gravitationally collecting treating material, as will appear more fully herein-

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after. In addition, a connection wall 212 extends generally horizontally between the upper regions of walls 211, whereby the lower end regions of the enclosures 200 may be connected together. It may be noted in FIGURES 2 and 9, that the enclosures 200 are arranged at a location along the conveyor 21 to permit of their lower end connection without interference of the conveyor, and their upper end connection by the cover plate 210 without interference of the frame structure 20.

Outward of the uprights 31-33, and adjacent to the upright 32, there may be fixed a generally vertically extending track or rail 55 on each side of the frame. Each track or rail 55 may have its lower and upper ends welded or otherwise fixed to a base member 30 and an upper transverse member 29. As best seen in FIGURES 1, 2, 3 and 4, each rail 55 extends vertically through a respective enclosure 200 along an adjacent enclosure wall 204. The rails or tracks 55 may lie in the same vertical plane extending transversely of the conveyor 21, and have their lower and upper ends projecting beyond the lower and upper ends of the respective enclosure 200, for securement, as by structural members 215 and 216 to the beams 30 and 29. Further, each vertical track or rail 55 may be welded or otherwise fixedly secured to the lower and upper enclosure walls 206 and 210, as well as being fixed to the enclosure side wall 204, as by braces 217. In this manner, the enclosures 200 may be fixedly secured in stationary relation with respect to the frame 20.

The rails or tracks 55 may have their vertical edges generally V-shaped in cross section to rollably mount a carriage 25 for vertical movement along each rail. The carriages 25 may each include a body 56, and a plurality of vertically disposed V-grooved wheels 57 in rolling engagement with the track edges.

The mounting plate 35 on top members 29 and 34 is substantially directly above the vertical tracks 55 and carriages 25. On the upper surface of the plate 35 are mounted a pair of upstanding, laterally spaced journal bearings 58 which journal a transversely extending shaft 59. The shaft is connected through a transmission 60, also mounted on the plate 35, and a belt 61, or other suitable power-transmission means, to a motor or variable-speed drive element 62, also mounted on the plate 35. Thus, the motor 62, through the transmission means 60 and 61, effects axial rotation of the shaft 59, and the motor may be adapted for rotation in opposite directions for effecting opposite rotation of the shaft 59.

A pair of drums or winches 63 are carried on opposite ends of the shaft 59, each winch having coiled thereabout a cable 64 which depends toward and has its lower end connected to the carriage 25 on the adjacent side of the frame structure. That is, the cables 64 depend through the cover member 210 into respective enclosures 200, there being connected to the adjacent carriage 25, whereby the motor 62 serves to raise and lower the carriages.

Mounted on each of the carriages 25, for vertical movement therewith, is an assembly 220 for projecting treating material against the adjacent surface of plate 23. Each material-projecting assembly 220 includes a motor 70 fixedly secured to the respective carriage body 56, and a housing 71 also fixed to the adjacent carriage body. The housing may contain a centrifugal impeller, bladed wheel or other suitable means for projecting treating material, such as abrasive. Suitable power-transmission means 73 may be connected between the motor 70 and material-projecting means, as for operating an impeller thereof. In practice it may be advantageous to protectively enclose the entire assembly 220, as by a rubber-covered steel housing or the like, to resist wear and damage from ricocheting abrasive. Also, protective deflector plates, such as rubber-covered steel or the like, may be employed to further protect the enclosure.

In one embodiment of the present invention, impellers are located conformably within the housings 71 so as to rotate about generally vertical axes inclined slightly to-

ward each other, as indicated by the inclination of the housings. Thus, while the material-projecting means 220 are located directly opposite from each other, on opposite sides of the plate, they are arranged out of horizontal alignment, as best seen in the elevation of FIGURE 1, so that the projected stream of each does not move directly toward the housing of the other. This arrangement avoids excessive wear of the housings, as when a plate is not interposed therebetween, which will be discussed hereinafter more fully. Further, this out-of-line relationship is important to insure that spent and ricocheting abrasive be out of the way of the projective abrasive, so that the full force of the projective abrasive impinges upon the plate. However, the treating-material projecting means 220 are preferably arranged symmetrically about the plate 23, as by respective opposite angular rotation of impellers, to produce substantially congruent and registering abrasion patterns simultaneously on opposite sides of the plate 23.

Projected streams of treating material, emitted from the projecting means 220 and impinging upon the plate 23, are designated 75. Their oblique, or out-of-line relationship is best seen in FIGURE 1, where it may be observed that the projected streams will impinge upon and nullify the force of each other in the absence of a plate, to thereby prevent unnecessary abrasion and wear of the apparatus. In this regard, deflection shields or plates, preferably rubber-covered may also be provided. Such deflection plates, and those mentioned above, as well as the above-mentioned protective, rubber-covered housing for assembly 220 are omitted from the drawings in the interest of clarity and understanding.

As noted hereinbefore, the lower region of each enclosure 200 is generally funnel-shaped, for gravitational collection and discharge of spent treating material. A collection conduit 24 depends from the lowermost region of each enclosure 200 for conducting used abrasive away and to a material-handling system (not shown) such as that disclosed in said copending patent applications. After processing of the treating material by a suitable such system, the treating material is returned to the projecting means 220 by respective inlet or feed conduits 95, each associated with one material-projecting assembly. The feed conduits 95 may each depend through the cover member 210 into a respective enclosure 200, and there include a telescopically extensible and retractile portion 96 depending into communication with the respective impeller housing 71. Of course, any extensible and retractile conduit construction may be employed in the conduit region 96, such as telescoping sections, rubber hose, or the like, to permit up-and-down movement of the material-projecting assemblies 220 while receiving a constant supply of treating material to be projected.

It will now be appreciated that the enclosures 200 are open on their facing sides. That is, the enclosures 200 open toward the plate 23 moving along its path. To effectively prevent the escape of treating material from the enclosures 200, each is provided on opposite sides with a pair of generally vertically extending, facing spaced closure plates or shutters 225 and 226. That is, extending vertically along each enclosure wall 203, and inward therefrom toward the path of plate 23 is a closure or shutter 225, while a closure or shutter 226 extends vertically along each enclosure wall 204 and inward therefrom toward the plate being treated. The closures or shutters 225 are preferably substantially coplanar, in a vertical plane transverse of the conveyor 21. Similarly, the closures or shutters 226 are preferably coplanar in a vertical plane transverse of the conveyor 21. The shutters 225 may be located closely outward of respective walls 203, and the shutters 226 closely outward of walls 204. In particular, each shutter 225 is mounted at its lower and upper ends by channellike guideways 227 and 228 fixedly secured to the adjacent wall 203. The guideways 227 and 228 respectively slidably receive the lower and upper ends of the shutters 225; and, there are preferably provided in the

guideways suitable yieldable means, such as leaf springs 229 and 230. The springs 229 and 230 may respectively resiliently and yieldably engage with the lower and upper ends of the shutters 225 to mount the latter for limited tilting action. This permits accommodation by the shutters to the tilt of a plate being treated, as will appear presently. The shutters or closures 226 are similarly provided with channellike, lower and upper guideways 235 and 236 carried by the enclosure walls 204 and slidably tiltable receiving the lower and upper ends of the shutters 226.

It will be noted that the closures or shutters 225 and 226 extend vertically substantially between the upper ends of the enclosures 200 and to just slightly below the upper sides of conveyor rollers 42, see FIGURE 9.

Along the inner edges of the shutters 225 and 226 there may be provided resilient seals or gaskets 237 and 238, respectively, for sealing engagement with a plate 23. Also, a lower edge seal 240 may extend along the lower edges of shutters 225 and therebetween, beneath a plate 20 in sealing engagement with the lower edge thereof, see FIGURES 7 and 9. The lower edge seal 240 may be secured to and extend between the opposite aligned pair of lower-end guideways 227. The lower edge seal 240 may be any suitably resilient material, such as rubber or the like. Extending between the lower-end guideways 235 may be a similar lower edge seal 241, see FIGURE 1.

Also, the closures or shutters 225 may be provided with outer edge seals or gaskets 243 in sealing engagement with the adjacent enclosure walls 203, while the closures or shutters 226 may be similarly provided with outer edges seals in sealing engagement with the enclosure walls 204.

Thus, it will be seen that the shutters 225 and 226, by their outer edge seals 243 with the enclosure walls, and their inner edge seals 237 and 238 engaging the plate 23, together with the lower edge seals 240 and 241 along the lower margins of the shutters and nether edge of the plate, serve to effectively close the enclosures 200 below the upper plate edge.

In order to close the space between the upper plate edge and the enclosures 200, additional closure means is provided at opposite sides of the enclosures, designated 245 and 246. The closure means 245 and 246 may be substantially identical, the latter being seen in greater detail in FIGURE 6. It will there be observed that the closure means 246 includes a flexible strip or screen 247 having its upper end region coiled about a roller 248 mounted on the upper side of cover 210 for rotation about a generally horizontal axis by a journal pedestal 249. The free end of strip 247 may be weighted, as at 250, and depends vertically exteriorly and in covering relation with the space between the shutters 226. That is, the free lower end 250 of strip or screen 247 depends to the upper edge of plate 23 and is vertically extensible and retractile for engagement with the upper edges of plates of different height. Of course, the vertically extensible and retractile closure means 245 operates in the same manner to extend across and close the space between shutters 225 above the upper plate edge. The closure means 245 similarly includes a roll or roller 251 mounted for rotation about a horizontal axis by journal pedestals 252 and having coiled thereabout a strip 253 which has its free end 254 depending to engagement with the upper edge of plate 23.

The closure means 245 and 246 may be operated to effect vertical extension and retraction thereof by a motor or drive means 256 having its shaft 257 in driving relation with the rollers 248 and 251 through belts or transmission means 258 and 259.

Also, the shutters 225 and 226 may be operated to effect inward and outward movement thereof toward and away from the plate 23, as may be required to accommodate plates of differing thickness. Such shutter-operating means may take the form of a pair of fluid-actuated cylinders 261 mounted on respective enclosure walls 203 and including piston rods 262 suitably connected to adjacent

shutters 225. Similarly, fluid-actuated cylinder assemblies 263 may be mounted on enclosure walls 204 and connected to adjacent shutters 226 by rods 264. Thus, by fluid actuation of the cylinders 261 and 263, the shutters 225 and 226 may be moved inward toward each other for sealing engagement with thinner plates, and outward away from each other for sealing engagement with thicker plates. The piston rods 262 and 264 are preferably connected to the shutters 225 and 226 in a manner enabling the shutters to tilt in their guideways 227, 228, 235 and 236 in conformance with the tilt of a plate on the conveyor.

In operation, the plate 23 is placed in upright or vertical condition on the rollers 42 of the conveyor 21, and intermittently moved by the conveyor longitudinally therealong. The plate is supported in its upright condition by the guide rollers 50. With the plate 23 in position between the treating assemblies 22 on opposite sides of the plate, the carriages 25 are simultaneously moved vertically, say downward, while the plate remains stationary, to treat a vertical strip or area on each side of the plate. At the lowermost position of movement of the carriages 25, the conveyor 21 effects movement of the plate horizontally therealong an increment slightly less than the horizontal width of the treated strip or area while the carriages 25 remain stationary. The carriages 25 then move simultaneously vertically upward to treat an additional contiguous, and preferably slightly overlapping strip or area of the plate while the latter remains stationary, the vertical speed of the carriages being adjustable by the drive 62. When the carriages 25 reach the upper edge of the plate 23, their vertical movement ceases and the plate is again shifted horizontally by the conveyor a distance slightly less than the horizontal width of a treated strip. This procedure continues until the plate is completely treated, and may be entirely automatic in operation by the provision of suitable controls.

In practice, the treating material may be any suitable form of particulate material, such as sand or shot adapted to remove scale from a plate or sheet. The particulate treating material is directed against the faces of the plate 23 by the streams 75, and after impingement upon the plate falls gravitationally to the lower regions of enclosures 200. By the present invention, the material-projecting means 220 need not have a stream guide or nozzle; and, the treating material is effectively retained in the housing so that the surrounding atmosphere remains uncontaminated.

In the diagrammatic illustration of FIGURE 10 is shown the plate 23 movable edgewise in its upstanding condition, generally horizontally along the conveyor 21. A stationary enclosure is designated 200, and the material-projecting means is shown at 220. These elements are diagrammatically illustrative of the above-described embodiment of FIGURES 1-9. In addition, the diagrammatic illustration of FIGURE 10 shows the conduit 24 connected through a recirculating conduit 266 to apparatus 277 for processing the treating material and conducting the same to the feed conduit 95. Suitable suction or vacuum removal of fines is indicated by the conduit 265 in the recirculating system. The diagrammatic illustration of FIGURE 10 therefore shows that the treating material may be recirculated and processed for reuse, either in part or in whole. Also, the apparatus 277 may include a hopper for receiving make-up or replacement material for that discarded as un reusable.

In the embodiment of FIGURE 11, a plate 23a is movable by the conveyor means 21a, and an enclosure 200a contains a vertically movable material-projecting means 220a. In this embodiment, the treating-material handling apparatus has been omitted, and a downwardly opening one-way valve or flap 120 may be provided on the lower end of the collection conduit 24a for discharging relatively heavy and reusable treating material in the direction of arrow 121. A branch conduit 122 may extend laterally

from the collection conduit for pneumatically conducting away relatively fine particulate material. A hopper 124 may be arranged above and communicating with the upper end of the feed conduit 95a for directing treating material into the latter.

In the embodiment of FIGURE 12 are shown conveyor means 21b for moving an upstanding plate 23b. The treating assembly 22b may include an enclosure 200b having contained therein treating-material projecting means 220b. Associated with the enclosure 200b is a separate outlet 126 for removing fines, while the collection conduit 24b serves to remove the heavier, reusable particulate material.

In each of the embodiments of FIGURES 10, 11 and 12, it will be observed that the plate is movable in opposite horizontal directions, as indicated by the arrow thereon and that the material-projecting means is movable vertically in opposite directions as indicated by its arrow. Thus, by the desired combination of intermittent plate movement and projecting-means movement, the plate can be treated in either horizontal or vertical stripes, or in any pattern susceptible of rectangular coordinates.

A further embodiment is diagrammatically shown in FIGURE 13, wherein a conveyor means 21c includes a track or rail 131 of the overhead type, and one or more crane carriages or hoists 132 for movement along the track. The plate 23c is arranged vertically and suspended from the cranes 132, as by cables 133 and clamps or other suitable securing means (not shown). Of course, the plate 23c may be suspended by other appropriate means, such as a frame or the like carrying the plate. A fixed treating assembly 22c includes a fixed enclosure 200c, and a fixed material-projecting means 220c. The enclosure may be provided with a lateral discharge conduit 126c, say for removing fines, and a lower-end receiver 128c at the discharge end of the collection conduit 24c for receiving heavier particulate treating material. As indicated by the arrows 134 and 135, respectively, the plate is reciprocable both horizontally and vertically with respect to the treating assembly for achieving any desired treating pattern susceptible of rectangular coordinates.

In FIGURE 14 is shown a further embodiment of the instant invention, wherein a carriage 25d is rollably mounted on a vertical track 55d for reciprocating movement therealong, in the manner of the first-described embodiment. The material-projecting means 220d of FIGURE 14 include a drive motor 70d, transmission means 73d, and housing 71d, all similar to the first-described embodiment. However, within the housing 71d are mounted a pair of generally parallel impellers or wheels 72d serving to project generally parallel streams 75d of treating material against a plate 23. A feed conduit 95d feeds treating material to the housing 71d, the feed conduit being shown as connected to the upper impeller wheel; and, a divider conduit 270 is spaced concentrically within the lower region of feed conduit 95d for diverting part of the treating material to the lower impeller wheel. By this arrangement, a greater rate of treating material may be projected against the plate 23, whereby treating action thereof is accelerated, and movement of the projecting means 220d relative to the plate may be more rapid. Of course, plural impeller wheels may be arranged otherwise than as shown, say on separate shafts and bearings, if desired; and, a protective housing and deflector plates may be employed in this embodiment, if desired, as described hereinbefore.

In the preferred embodiment of FIGURE 1, a plurality of relatively wide, generally vertical stripes of treated regions are provided on the plate. Such configuration is diagrammatically illustrated in FIGURE 15, wherein the plate 23 is shown as having a plurality of generally vertical, relatively wide stripes or strips 115 produced by vertical movement of the projecting means 220, as with a generally horizontal impeller. Also illustrated is the

configuration of surface treated by the plural-impeller embodiment of FIGURE 14, as indicated at 100d.

By the instant invention, the apparatus may be operated to effect horizontal back-and-forth movement of the plate 23 during operation of the material-projecting means 220 and with the latter remaining stationary, except for intermittent vertical movement. A pattern produced by such operation is shown in FIGURE 16, wherein a plate 23 is provided with a plurality of generally horizontal treated regions, strips or stripes 116 of relatively narrow vertical dimension or width. The pattern shown in FIGURE 16 may be formed with a generally horizontal impeller rotating about a generally vertical axis to produce a horizontally elongate stream, and by intermittent vertical movement of the impeller in alternate relation with back-and-forth movement of the plate. Such pattern may also be formed by the modification of FIGURE 14, two such strips being formed simultaneously, as indicated by the plural treating areas 100d.

Each of the treatment patterns of FIGURES 15 and 16 may also be produced by each of the embodiments of FIGURES 11, 12 and 13, it being only necessary to arrange the impeller as required, and employ the necessary sequential movements of plate and impeller assembly.

In FIGURE 17 is shown a plate 23 having a treatment pattern produced by intermittent horizontal plate movement in alternate relation with vertical movement of the material-projecting means, but with the impeller disposed generally vertically for rotation about a generally horizontal axis. In this manner of practicing the instant invention, a plurality of generally vertical strips or stripes 117 will be formed on the plate, which stripes are relatively narrow, corresponding to the lesser dimension of the impeller stream. Here also, it is shown that the plural-impeller arrangement of FIGURE 14 may simultaneously produce plural treated stripes, as by the plural treating areas 100d.

By the mode of operation described in connection with FIGURE 16, the pattern of FIGURE 18 may be produced with an impeller generally vertical and rotating about a generally horizontal axis, thereby providing relatively wide horizontal stripes 118 on the plate 23. The rapidity of plate treatment to the desired quality may be enhanced by employing plural impellers, as in the embodiment of FIGURE 14, but with the impellers arranged for rotation about horizontal axes to provide the plural treating areas 100d.

From the foregoing, it is seen that the present invention provides a unique apparatus for treating metal plates, which fully accomplishes its intended objects and is well adapted to meet practical conditions of operation and use.

Although the present invention has been described in some detail by way of illustration and example for purposes of clarity of understanding, it is understood that certain changes and modifications may be made within the spirit of the invention and scope of the appended claims.

What is claimed is:

1. Metal-plate-treating apparatus comprising powered support rollers rotatable about generally horizontal axes for supporting an upstanding plate substantially by its lower edge and moving said plate generally edgewise horizontally, a relatively stationary enclosure located along one side of the path of plate movement and having an opening facing toward said path, said opening being effectively closed by a plate moving along said path, material-projecting means associated with said enclosure facing toward said opening for laterally projecting treating material against said plate, inlet means connected to said projecting means for feeding treating material to said projecting means, and outlet means at the lower region of said enclosure for gravitationally receiving and discharging treating material after projection against and rebound from a plate.

2. Metal-plate-treating apparatus according to claim 1,

in combination with laterally movable closure means mounted on said enclosure at opposite sides of said opening and engageable with a plate moving along said path to prevent escape of treating material.

3. Metal-plate-treating apparatus according to claim 1, said projecting means being mounted in said enclosure for vertical movement therein.

4. Metal-plate-treating apparatus according to claim 1, in combination with a second enclosure along the other side of said path, said second enclosure having an opening facing toward said path and being effectively closed by a plate moving along said path, second material-projecting means associated with said second enclosure facing toward the opening of said second enclosure for laterally projecting treating material against said plate, and second inlet means connected to said second projecting means for feeding treating material to said second projecting means.

5. Metal-plate-treating apparatus according to claim 4, said first and second named enclosures being directly opposite to each other, a cover extending over and bridging the space between said enclosures, a connecting portion connecting the lower regions of said enclosures below said path, extensible and retractile generally vertical closure means depending from said cover on opposite sides of said enclosures for engagement with the upper edge of a plate moving along said path, said cover and vertical closure means combining to close the region over a plate and between said enclosures.

6. Metal-plate-treating apparatus according to claim 5, in combination with lower-edge sealing means upstanding from said connecting portion on opposite sides of said enclosure for sealing engagement with the lower edge of a plate moving along said path.

7. Metal-plate-treating apparatus according to claim 5, in combination with lateral closure means mounted on said enclosures at opposite sides of said opening and engageable with a plate moving along said path to prevent escape of treating material.

8. Plate-treating apparatus comprising support means for supporting a plate in upstanding condition, motive means for moving said plate generally edgewise horizontally along a predetermined path, a relatively stationary enclosure located along one side of the path of plate movement and having an opening facing toward said path, said opening being substantially closed by a plate moving along said path, material-projecting means associated with said enclosure facing toward said opening for projecting treating material against said plate, inlet means connected to said projecting means for feeding treating material to said projecting means, outlet means at the lower region of said enclosure for gravitationally receiving and discharging treating material after projection against and rebound from a plate, and a pair of laterally movable closure structures mounted on said enclosure at opposite sides of said opening for horizontal movement transversely of said path into and out of engagement with a plate moving along said path, to prevent escape of treating material.

9. Plate-treating apparatus according to claim 8, in combination with a second enclosure along the other side of said path, said second enclosure having an opening facing toward said path and being substantially closed by a plate moving along said path, second material-projecting means associated with said second enclosure facing toward said second opening for projecting treating material against said plate, second inlet means connected to said second projecting means for feeding treating material to said second projecting means, a second laterally movable closure structure mounted on said second enclosure at opposite sides of said second opening and engageable with a plate moving along said path to prevent escape of treating material, said first and second named enclosures being directly opposite to each other, a cover extending over and bridging the space between said enclosures, a connecting portion connecting the lower regions of said

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enclosures below said path, and vertically extensible and retractile closure means depending from said cover on opposite sides of said enclosures for engagement with the upper edge of a plate moving along said path, said cover and vertically extensible and retractile closure means combining to close the region over a plate and between said enclosures.

10. Plate-treating apparatus according to claim 9, in combination with lower-edge sealing means upstanding from said connecting portion on opposite sides of said enclosures for sealing engagement with the lower edge of a plate moving along said path.

11. Plate-treating apparatus comprising support means for supporting a plate in upstanding condition, motive means for moving said plate generally edgewise horizontally, a pair of relatively stationary enclosures located on opposite sides of the path of plate movement and each having an opening facing toward said path, said openings being substantially closed by a plate moving along said path, material-projecting means associated with each of said enclosures facing toward the respective opening for projecting treating material against said plate, inlet means connected to said projecting means for feeding treating material to said projecting means, outlet means connected to the lower regions of said enclosures for gravitationally receiving and discharging treating material after projection against and rebound from a plate, a cover extending over and bridging the space between said enclosures, and vertically extensible and retractile closure means depending from said cover on opposite sides of said enclosure for engagement with the upper edge of a plate moving along said path, said cover and vertical closure means combining to close the region over a plate and between said enclosures.

12. Plate-treating apparatus according to claim 11, in combination with laterally movable closure structures mounted on each of said enclosures at opposite sides there-

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of and engageable with a plate moving along said path to prevent escape of treating material between said enclosures and the faces of a plate.

13. Plate-treating apparatus according to claim 12, in combination with a connecting portion connecting the lower regions of said enclosures below said path, and lower-edge sealing means upstanding from said connecting portion on opposite sides of said enclosures for sealing engagement with the lower edge of a plate moving along said path.

14. Plate-treating apparatus comprising support means for moving a plate in upstanding condition, motive means for moving said plate generally edgewise horizontally, a pair of relatively stationary enclosures located on opposite sides of the path of plate movement, and each opening toward said path, centrifugal-impeller means associated with each enclosure for projecting treating material laterally against said plate, inlet means connected to said projecting means for feeding treating material to said projecting means, outlet means connected to the lower regions of said enclosures for gravitationally receiving and discharging treating material after projection against and rebound from a plate, covering means extending over the space between said enclosures, and closure means on each of said enclosures at opposite sides thereof for sealing engagement with a plate movable along said path.

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