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PARTS TREATING AND COATING APPARATUS

Filed Dec. 19, 1957

4 Sheets-Sheet 1

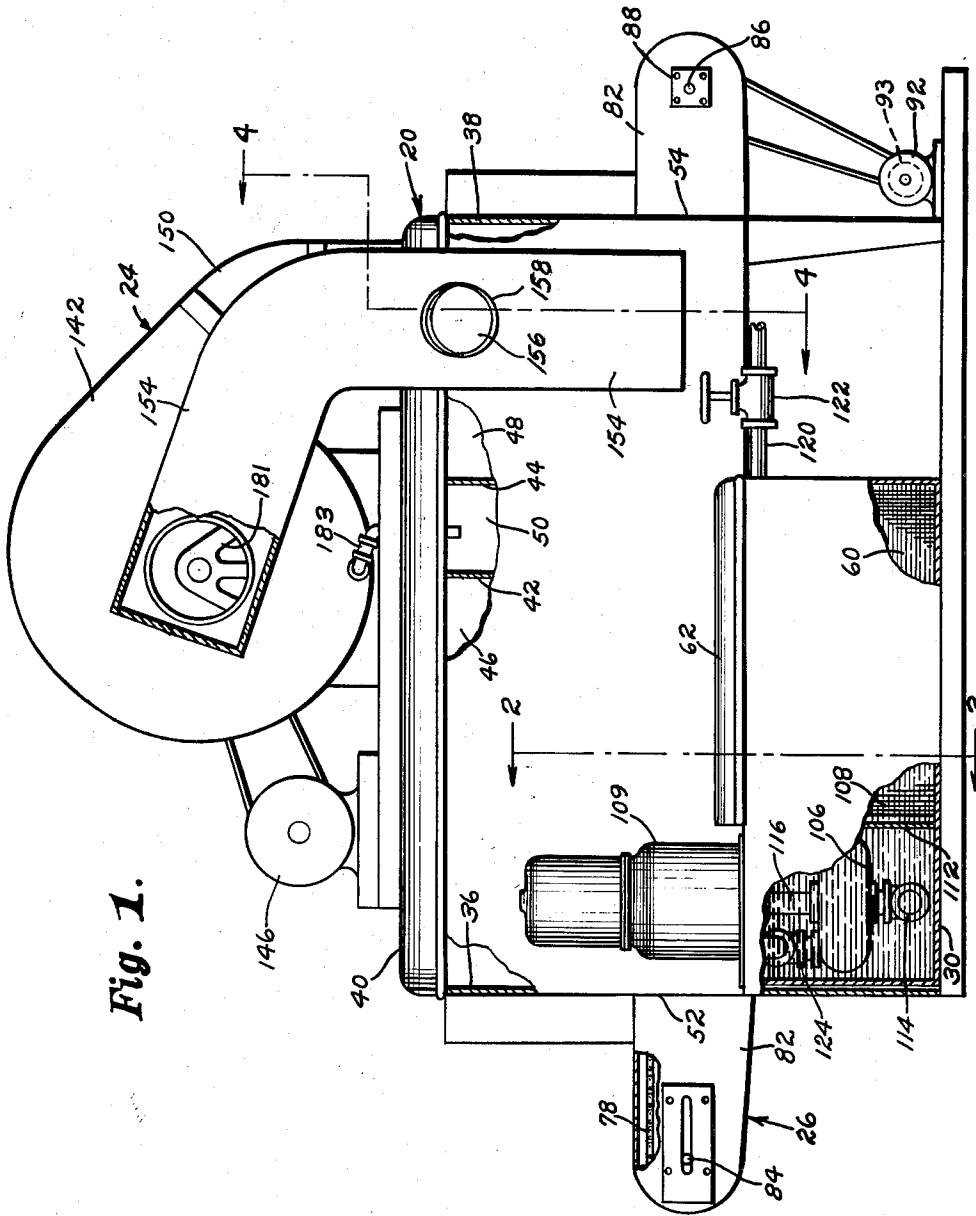


Fig. 1.

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4 Sheets-Sheet 2

Fig. 2.

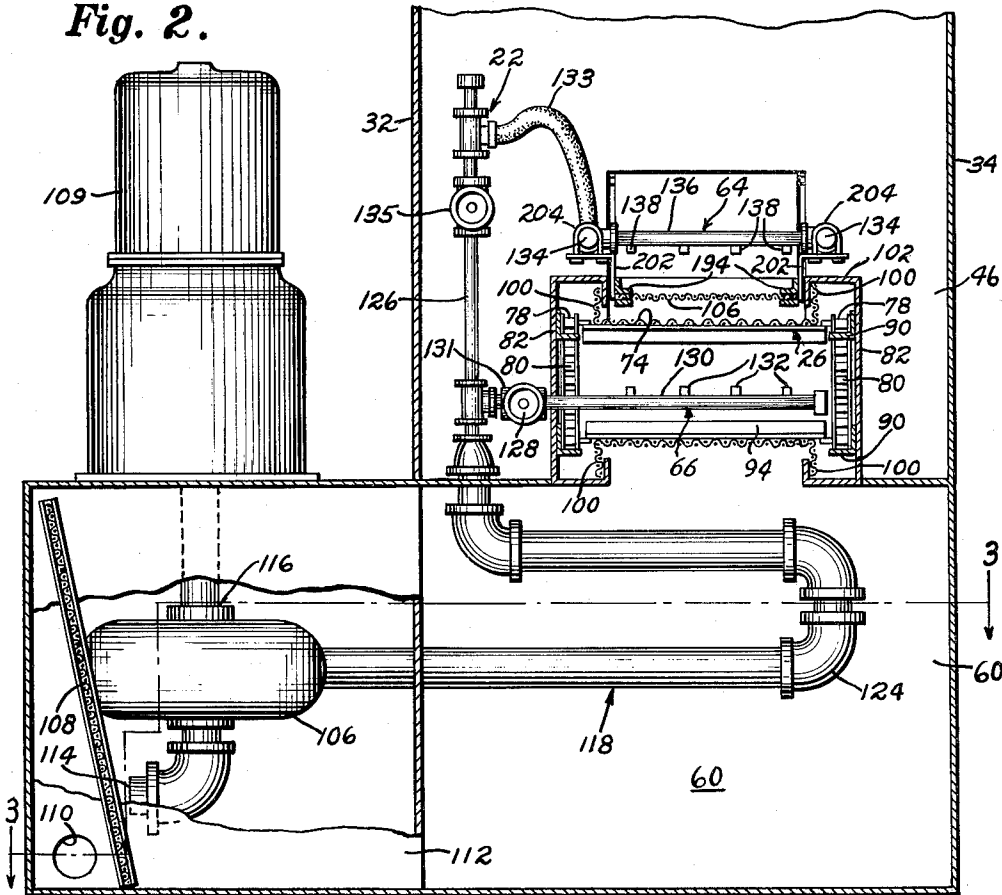
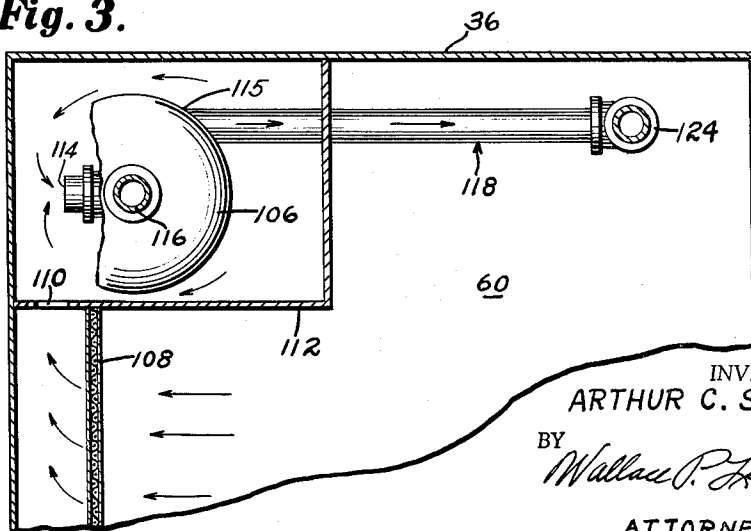


Fig. 3.



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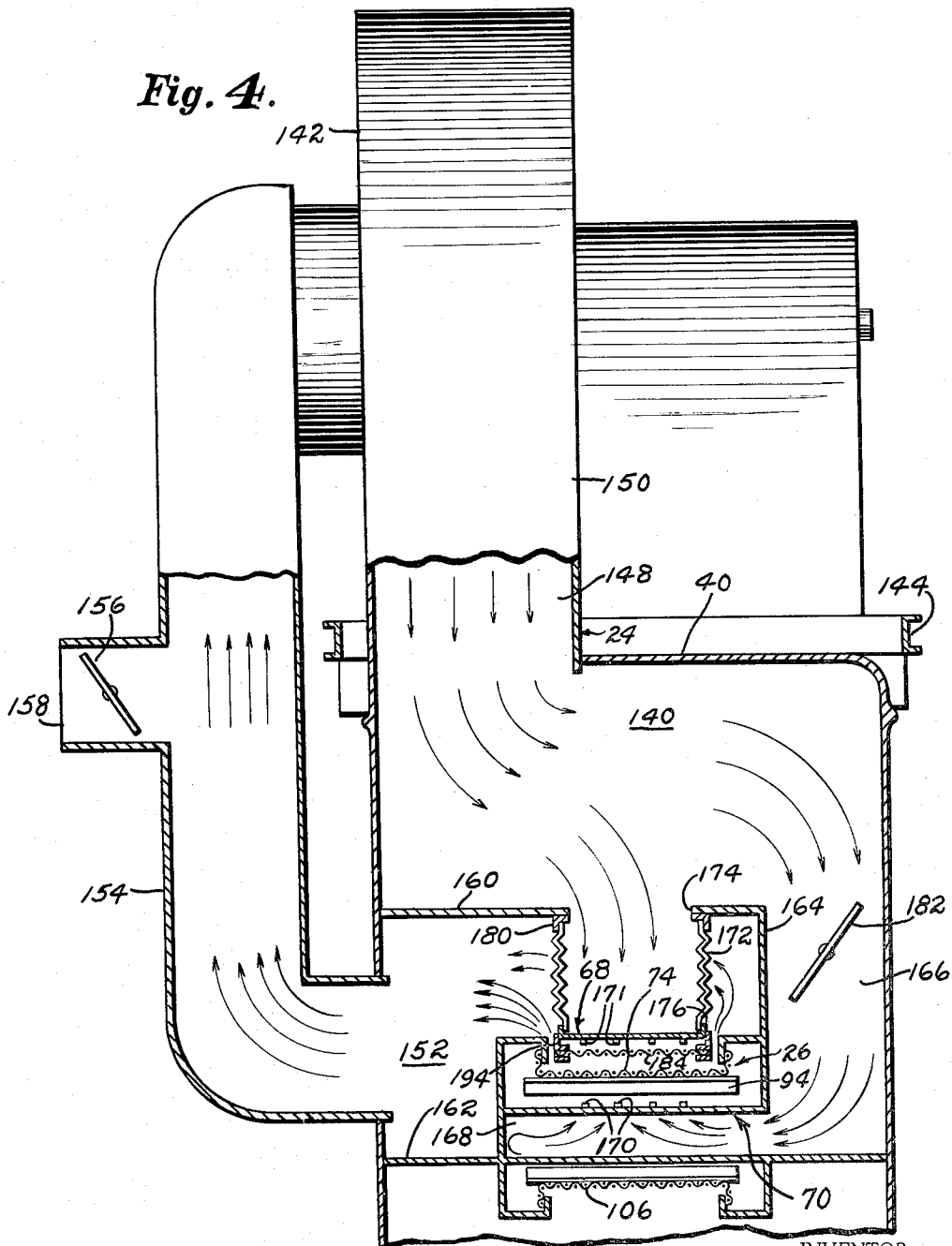
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4 Sheets-Sheet 3



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1

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**PARTS TREATING AND COATING APPARATUS**  
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 7 Claims. (Cl. 118—64)

This invention relates generally to apparatus for treating metallic parts and particularly to apparatus for washing and coating metallic parts to protect them against corrosion.

As is well known, the usual solution to the prevention of corrosion of metal product parts, particularly steel parts, is to plate them with a non-corrosive metal. While this method is essential for the parts of certain products, particularly those exposed to the elements out-of-doors, it is a very costly procedure. For products such as business machines, the cost of plating the many parts is prohibitive, yet corrosive action occurs although such machines are not subjected to the outdoor elements and such corrosion is, of course, undesirable. I have found that corrosion of metallic objects is due largely to attraction to the surfaces thereof of minute particles of soil which build-up and by bacteria chemical action initiate corrosive and rusting actions, and that this action can be inhibited for a long period by an inexpensive process that may be carried out by my improved parts washing and drying apparatus.

Accordingly, it is an object of my invention to provide an improved apparatus for treating metallic parts to protect them against corrosion, without the need and expense of plating the parts.

Another object of the invention is to provide an improved apparatus for washing metallic parts and protecting them against corrosion by baking the residue of the washing compound containing corrosion resist material onto the parts as the protective coating.

Another object of the invention is to provide an improved apparatus of the above mentioned character in which heat necessary to the washing and treating of the parts against corrosion is generated internally and by operation of the apparatus.

Specifically, it is an object of my invention to wash metallic parts with a cleaning compound and simultaneously with the removal of excess water from the parts, apply heat to the parts in such a manner as to cause a film of the cleaning compound residue to contract about and envelop the part as a protective coating against corrosion.

Another object of the invention is to provide an improved parts treating apparatus in which fluid jet streams directed to impinge against opposite faces of the parts to clean and dry the parts, and which would ordinarily bounce the parts about, causing nicks therein, are instead, utilized as means of positively holding the parts down against the conveyor.

In connection with the next preceding object, it is a further object to provide an improved and convenient arrangement for changing the fluid pressure differential for accommodating parts of different size or different weight, or both.

A further object of the invention resides in the introduction into the cleaning compound of a wetting reagent to insure a complete film of the corrosive resisting compound residue over the entire surface of the part preliminary to drying the film.

Other objects of the invention will become apparent from the following detail description, taken in connection with the accompanying drawings, in which;

FIG. 1 is a side view, partly broken away and in section, of a parts treating apparatus embodying features of my invention;

2

FIG. 2 is a cross sectional view, taken along the line 2—2 of FIG. 1;

FIG. 3 is a horizontal cross sectional view, taken along line 3—3 of FIG. 2;

FIG. 4 is a vertical cross sectional view, taken along the line 4—4 of FIG. 1;

FIG. 5 is a fragmentary view of one end of the apparatus, partly broken away and in section;

FIG. 6 is a fragmentary cross sectional view, taken along the line 6—6 of FIG. 5.

Referring to the drawings by characters of reference, the parts treating apparatus shown includes a housing 20, a parts washing apparatus 22, a parts treating and drying apparatus 24 and a parts carrying conveyor 26. The parts washing apparatus 22 and the parts drying apparatus 24 are arranged within the housing 20, and the conveyor 26 extends through the housing carrying the parts to be cleaned and treated.

The housing 20 may be a box-like structure having side walls 32, 34, end walls 36, 38 and a top wall 40. Vertical partitions 42, 44 spaced longitudinally of the housing divide the interior thereof into a parts washing chamber 46 and a parts drying and heat treating chamber 48, the chambers 46 and 48 being separated by a drain chamber 50. In the housing end walls 36 and 38, are inlet and outlet openings 52 and 54, respectively, for passage through of the conveyor 26. Below the conveyor 26 within housing 20, is a tank or reservoir 60 for a predetermined quantity of water containing a cleaning compound for washing the parts passing through the housing on conveyor 26. The tank 60 preferably extends laterally from the housing side 32, and has a hinged lid 62 to provide ready access to the tank 60 for inspection and to add cleaning compound to the water.

Disposed within the parts washing chamber 46 is an upper spray head 64 and a lower spray head 66 of the parts washing apparatus, and disposed within the parts drying chamber 48 is an upper air discharge head 68 and lower air discharge head 70 of the parts drying and heat treating apparatus. The conveyor 26 is of the continuous type having an upper lead side that carries the parts to be washed and treated, the lead side passing between the upper and lower heads of the washing and drying apparatuses.

The conveyor 26 includes a continuous wire mesh belt 74 that travels with and between a pair of laterally positioned, parallel chains 78, which travel about sprockets 80 at opposite ends of housing 20. Extending through the housing 20 is a pair of laterally positioned parallel supports 82 which project beyond the opposite housing end walls and support the sprockets 80 on shafts 84 and 86, the shafts being rotatably supported in bearing plates 88, secured to the opposite sides of the supports 82 outwardly thereof. Preferably both the top or lead side of the belt 74, and the bottom or trailing side, are supported on the horizontal legs of angle members 90, on which the chains 78 slide. The angle members 90 are secured to the sides of the supports 82 inwardly thereof, such as by welding. The shaft 86 is the driving shaft of the conveyor and may be driven by means of an electric motor 92 through suitable speed reduction mechanism.

A plurality of spaced cross members 94 connect the wire mesh belt 74 to the chains 78, as is shown more clearly in FIG. 6, and provide added support for the belt throughout the length thereof. Each of the links of the chains 78 has an inwardly directed extension lug 96 to which the opposite ends of the cross members 94 may be riveted, or be otherwise suitably secured. Extending transversely of the belt 74 on the underside thereof, the cross members 94 may be secured by screws 98 or other suitable means to the belt. The belt 74 is preferably of the so-called basket type having side flanges

100 to retain the parts on the belt. These belt flanges are preferably enclosed by guards 102 on the supports 82 and provided with downturned flange portions 104 that position inwardly of the belt flanges in spaced relation thereto.

Submerged in the wash water in tank 60, is a centrifugal pump 106 of sufficient capacity to deliver the wash water to the spray heads 64, 66 under pressure. The pump 106 together with the spray heads 64, 66 and tank 60 form a closed circulatory system for the wash water which, after impingement against the parts to be cleaned, gravitates back to the tank 60. The soil and other foreign matter removed from the parts is filtered against entry to pump 106 by a removable screen 108 in tank 60, the screen 108 overlying an opening 110 in a separator partition 112 between the screen 108 and pump 106. The pump 106 has the usual intake 114 and outlet 115. Preferably an electric motor 109 is used for driving the pump 106 the motor and pump being connected by a shaft 116.

In order to clean the parts properly and efficiently, I have found that the wash water temperature should be above room temperature, but lower than the temperature which would destroy the effectiveness of the compound. I have found that an efficient washing job is obtained when the wash water temperature is maintained at from about 90 to 100 degrees Fahrenheit and that the heat necessary to maintain such temperatures can be generated by circulation of the wash water. Accordingly, I have provided for increasing the temperature of the wash water to a degree for efficient cleaning of the parts and in the present instance without need of extraneous heating apparatus and accompanying maintenance problems. To accomplish this, the wash water is delivered by the large capacity pump 106 from tank 60 to the spray heads 64, 66 at a greater rate than the rate of discharge of the water from the heads, whereby to effect a back pressure on the pump 106 with accompanying molecular agitation of the water and corresponding generation of heat. In addition, I connect the outlet 115 of the pump 106 to the spray heads 64, 66 by a sinuous conductor 118 which by its several turns baffles flow of the water to head 64 with accompanying generation of heat. The heat so generated is stored and conserved by using a closed circulatory wash water system. The system contains a predetermined amount of the wash water which is recirculated through the closed circulatory system to retain the heat generated, which heat is stored in the relatively large body of water in tank 60. Water is added to tank 60 only when the level thereof decreases due to drip losses, vaporization, etc., to a predetermined level, whereupon water may be added to the tank 60 from a supply pipe 120 under control of a suitable float operated valve (not shown). A shut-off valve 122 may be provided in the water supply pipe 120.

From the pump outlet 115, the sinuous conductor or pipe 118 extends across the tank 60 having a water baffling loop 124, the pipe returning to a point adjacent housing wall 32, where it is connected by reducing connections, or joint fittings to a vertical pipe 126. Connected to the vertical pipe 126 is the lower spray head 66, comprising a horizontal header or pipe 128, to which is connected a plurality of spaced parallel branch headers 130 that extend transversely of and beneath the upper side of the conveyor belt 74. Secured into each of the pipes 130 is a plurality of preferably equally spaced flow restricting nozzles 132 which are upwardly directed, as shown, to effect impingement of the wash water against the undersides of parts on the conveyor belt 74. The upper spray head 64 is similar to the above described lower head 66, but comprises a pair of laterally positioned, horizontal headers 134 communicatively connected by branch headers 136 in each of which is secured a plurality of spaced nozzles 138, directed downwardly at the conveyor 26. The upper spray head 64 differs further from the lower spray head 66 in that the upper head is

movable vertically to change the downward force of impingement of the wash water against the upper surfaces of the parts, and to adjust the head to larger or smaller parts, as the case may be. In order that the upper spray head 64 may be raised and lowered, the head is connected to the vertical pipe 126 by a flexible conduit or hose 133. In the header 130 is a manually operable valve 131 and in pipe 126 above header 130 is a similar valve 135. These valves 131 and 135 may be adjusted and set to effect a pressure differential between the upper and lower spray heads.

Referring now to the parts drying and heating apparatus 24, this apparatus comprises, in general, a plenum chamber 140, the upper and lower air discharge heads 68 and 70, and an air blower 142. The plenum chamber 140 is disposed within the housing 20 together with the heads 68 and 70, and the blower 142 may be mounted on a reinforcing base 144 on top of the housing. A suitable electric motor 146 may be used to drive the blower 142 by means of a belt or other drive connection. In the top wall 40 of the housing 20, the plenum chamber 140 has an inlet 148, connected to the outlet of blower 142 by a duct 150, and within the housing 20 is a plenum outlet chamber 152 from which air is returned to the blower intake by a return duct 154. This arrangement of the air circulating components provides a closed air circulatory system in which the air is pressurized in the plenum chamber 140 under high pressure with accompanying generation of heat that is largely retained by the closed system. The temperature of the recirculated air may be controlled by the provision of a damper 156 in a fresh air intake 158 that may be provided in the air return duct 154. The temperature of the air is maintained sufficiently high so that the heat will bake a film of the compound residue onto the parts, but is maintained at a lower temperature than that which would destroy the residue film. A temperature of 100 to 110 degrees Fahrenheit of the air in the closed circulatory system.

The plenum chamber 140 is separated from its outlet chamber 152 by an upper horizontal partition 160, and a lower horizontal partition 162, joined by a vertical partition 164. The horizontal partitions 160, 162 extend from housing side wall 32 partway across the housing to the vertical partition 164 which is spaced inwardly from housing side wall 34 to provide a connecting passageway 166 between the plenum chamber inlet 148 and a lower leg 168 of the plenum chamber 140. As shown, the lower leg 168 of the plenum chamber 140 positions between the upper and lower sides of belt 74, and the top wall of the plenum chamber leg 168 serves as the lower air discharge head having a plurality of nozzles 170 secured therein and directed so that the air impinges against the undersides of the parts on the conveyor.

The upper air discharge head 68 comprises a plate-like support that overlies the upper side of belt 74, and secured in and to said plate is a plurality of downwardly directed air jets or nozzles 171 arranged so that the air discharging therefrom impinges against the upper surfaces of the parts on the conveyor. The upper air discharge head 68 is made vertically adjustable so that, for example, it may be raised for clearance purposes when larger parts are to be treated. To this end, the head 68 is connected by a bellows 172 to an inlet 174 in the plenum chamber partition 160. An upwardly extending peripheral flange 176 on head 68 is provided for connection with the lower end of the bellows 172 and any suitable type of fastener, as at 178, may be used to attach the lower end of the bellows 172 to the flange 176. The upper end of the bellows 172 may be similarly connected to a metallic ring 180 which may be secured by bolts or other suitable means to the underside of partition 160. Thus, pressurized air from the plenum chamber 140 and interior of the bellows 172 is forced out of the nozzles 171 to impinge against the

upper surfaces of the parts, the air passing into outlet chamber 152 for return to the blower 142.

In order to maintain a high air pressure in the plenum chamber 140 with accompanying high molecular agitation and corresponding generation of heat, the blower 142 is preferably a high capacity rotary blower. As shown, the blower 142 has a scroll type housing provided with an inlet 181 at one side in communication with the return duct 154, and a tangential outlet in communication with the plenum chamber inlet duct 150. In operation of the blower 142, considerable moisture entrained in the air from operation of the washing apparatus tends to collect in the blower housing, and to avoid interference with the blower, and also to retrieve the wash water, a drain 183 is provided from the blower housing to the drain chamber 50.

As in the washing apparatus, it is desirable that fluid impingement against the parts does not cause the parts to bounce about, as this ordinarily tends to deface or nick the parts, and so I provide a pressure differential between the upper air discharge head 68, and the lower discharge head 70 to hold the parts down against the conveyor belt 74. To this end, a damper 182 is provided in passageway 166, and is adjusted such that the pressure in the lower leg 168 of the plenum chamber 140 is lower than the pressure above the damper 182, thus providing a pressure differential in favor of the upper nozzles 171. Although raising of the upper air discharge head 68 will decrease the pressure against the upper surfaces of the parts, the differential pressure established by the damper 182 may be made sufficiently large with respect to the adjustment range of head 68, so that the damper 182 may be used as a fixed setting.

Mounted on the opposite end walls 36 and 38 of the housing 20 is a vertically movable support 184 for both the upper wash water spray head 64 and the upper air discharge head 68. The support 184 extends entirely through the housing 20 from end to end thereof, directly above the upper or lead side of the conveyor belt 74. By raising or lowering the support 184, the upper spray head 64 and air discharge head 68 may be positioned closer to, or farther away from the parts on the conveyor belt. As shown, the support 184 is positioned within the basket-like conveyor belt 74 and, in addition to supporting the heads 64, 68, functions as a cover for the conveyor to insure that the parts are retained on the belt in the areas where the parts enter the drain compartment 50, and where the parts approach entrance into the drying chamber 48. Opposite ends of the support 184 are secured respectively to vertically movable closure plates 186 that respectively partially overlie the housing inlet 52 and outlet 54, the plates 186 being guided for vertical movement on rollers 188. A system of cables and pulleys 190 connected to the plates 186, may be used to raise and lower the support 184, and therefore heads 64 and 68 with the aid of a counterbalance or weight 192. Carried by each of the end plates 186 is a flexible closure 193, preferably a sheet of rubber which overlies the housing openings through which the conveyor extends. These closures are provided to decrease loss of heat generated by the blower 142, and a similar closure 195 may overlie the opening in partition 44. Closure 195 is provided to decrease flow of water vapor from the parts washing apparatus to the parts drying apparatus.

Since the support 184 is disposed between the upper fluid discharge headers 64, 68 and the parts carrying belt 74, the support is fluid pervious, preferably a heavy gauge screen. Along its opposite side edges, the support 184 has margins thereof clamped between the horizontal leg of an angle member 194 and a lower clamp strip 196 by bolts 198. To the vertical legs of the angle members 194 is secured the air nozzle head 68 (see FIG. 6), such as by bolts 200. Similarly, the upper head 64 of the washing apparatus is mounted on the support

184, as is shown more clearly in FIG. 2. In this construction, a pair of angle brackets 202 are secured respectively to the upright legs of the angle members 194 having horizontal legs on which the spray head 64 is mounted. Any suitable fasteners may be used to secure the spray head 64 to the brackets 202, such as U-bolts 204.

Any suitable well known parts washing compound may be used that includes a corrosion inhibitor, such as sodium chromate, a bactericide, a solvent to prevent caking of the compound and a wetting agent to cause the residue of the compound to spread over the entire surfaces of the parts.

#### Operation

In operation of the apparatus, parts to be treated may be fed manually or otherwise onto the feed end of the conveyor 26 and are carried thereby first into the washing chamber 46. As the parts pass between the upper and lower spray heads 64 and 66, both the upper and lower surfaces of the parts are impinged by the wash water discharging from the nozzles 132, 138. The impingement force of the wash water against the surfaces of the parts, aided by the cleaning compound, removes all soil from the parts as they pass through the wash chamber. During this washing operation, the parts instead of being tossed about by the high velocity sprays, are held down against the conveyor by reason of the pressure differential of the spray heads 64 and 66. From the washing chamber 46, the parts are carried by the conveyor into the drain chamber 50, wherein excess wash water drips from the parts into the reservoir tank 60 below. The parts now enter the drying and heating chamber 48, wherein the air blows most of the remaining moisture from the parts, there being a film of the wash water and cleaning compound residue remaining on the parts. This film containing the corrosion inhibiting elements of the compound and bactericide flows or is caused to spread over the entire surfaces of the parts by the air pressure and by reason of the presence of the wetting reagent in the compound. This means that the wash water residue enters and covers the surfaces of the minute peaks and valleys of the parts thereof, and thus, completely envelops the parts with a film that provides a barrier to atmosphere. At the same time that the air blows excess moisture from the parts, the heat contained by the air is applied thereby to bake the film of washing compound residue onto the part, the film contracting and hardening by the application of the heat. This results in a coating of corrosive resisting material on the parts which will protect the parts for a considerable period.

From the foregoing description, it will now be appreciated that I have provided an improved apparatus for inexpensively providing metal objects with a skin of corrosive resist material from the residue of the wash operation. By having the corrosion inhibitor in the wash water and spreading the wash water as a film residue including the inhibitor over the entire surface of the object or machine part, and then baking the film onto the parts, a very effective corrosion inhibiting envelope is contracted about the part without materially changing the size tolerances thereof. Furthermore, I have provided a parts treating (wash and coating), apparatus of a structural character such that heat both for parts washing purposes and parts coating purposes is inherently generated by operation of the apparatus, making it unnecessary to employ extraneous heat devices. In addition, I have provided a combination parts washing and corrosion inhibitor applying apparatus that recirculates the solution containing the washing chemicals and corrosion inhibiting chemicals, both in the interests of economical operation and to generate and store heat to aid the washing action.

What is claimed is:

1. In a parts treating apparatus, a housing having a parts drying compartment, a parts carrying pervious belt

passing through said compartment, a blower, a plenum chamber having a plurality of nozzles discharging air downwardly onto said belt, and a second plurality of nozzles discharging air upwardly against the underside of said belt, the force of air from said first plurality of nozzles impinging the upper surfaces of the parts on said belt being greater than the force of air from said second plurality of nozzles impinging against the undersides of said parts to hold the parts to said conveyor by the force differential, means operable to move said first plurality of nozzles vertically to change the force differential for different parts, a vertically movable support for said first plurality of nozzles, and a bellows connecting said first plurality of nozzles to said plenum chamber.

2. In a parts treating apparatus, a housing having an inlet and an outlet, a blower having an intake connected to the outlet of said housing, a fluid pervious parts conveying belt passing through said housing, a plenum chamber within said housing having a plurality of lower air outlets directed against the underside of said belt, a plurality of nozzles externally of and spaced from said plenum chamber, said nozzles directed toward and disposed adjacent the upper side of said belt, a vertically adjustable support carrying said nozzles, and a bellows connecting said nozzles communicatively to said plenum chamber.

3. In a parts treating apparatus, a housing having a parts drying compartment, a parts carrying pervious belt extending through said housing having opposite side retaining flanges, a blower having an air intake in communication with said housing, a plenum chamber within said housing having an inlet in communication with the outlet of said blower and having a plurality of air outlets directed toward and adjacent the underside of said belt, a pervious guard overlying said conveyor within the confines of said flanges and vertically movable, a plurality of nozzles carried by said guard directed to discharge downwardly onto said conveyor, and a bellows connecting said nozzles communicatively to said plenum chamber.

4. In a parts drying apparatus, a housing, wall means within said housing separating a plenum chamber from an outlet chamber, a pervious parts conveyor extending through said outlet chamber, a lower plurality of air flow restricting apertures in said wall means arranged to direct air upwardly at parts on said conveyor, an upper and vertically movable wall of said wall means having a plurality of flow restricting apertures diverted downwardly at the parts on said conveyor, vertically movable supporting means extending through said outlet chamber supporting said vertically movable wall, said wall movable to change the effective pressure differential of the air impinging opposite sides of the parts, and a damper in said plenum chamber controlling flow only to the lower apertures.

5. In a parts treating apparatus, a housing, a pair of spaced parallel supporting members mounted on and extending horizontally through said housing, a pervious parts carrying conveyor mounted on and extending horizontally between said supporting members through said housing, said conveyor having flexible sides, outwardly disposed slideways on said supporting members and slidably supporting and guiding said conveyor, inwardly disposed guard members on said supporting members and extending downwardly into overlapping relationship with the sides of said conveyor, a vertically movable support overlying said conveyor and slidably received and guided by said inwardly disposed side members, a plurality of

nozzles carried by said vertically movable support and arranged to direct fluid at parts on said conveyor, and means operable to move said support vertically to adjust the position of said nozzles relative to said conveyor.

6. In a parts treating apparatus, a housing including side and bottom walls, a partition within said housing dividing the interior thereof into a plenum chamber having an air inlet and an outlet chamber, a blower in communication with said air inlet to maintain air pressure within said plenum chamber in excess of atmosphere pressure, a pair of spaced parallel supporting members extending through said outlet chamber, an air pervious conveyor extending through said outlet chamber and slidably guided by and between said supporting members, said partition including a horizontal portion spanning said supporting members beneath said conveyor and having a plurality of outlet ports in communication with said plenum chamber to direct air upwardly at the conveyor, a horizontal upper plate overlying said conveyor between said supporting members and having a plurality of air ports in communication with said plenum chamber to direct air downwardly at said conveyor, said plate spaced from said supporting members forming air outlets therebetween in communication with said outlet chamber.

7. In a parts treating apparatus, a housing, having an air inlet and an air outlet, a pair of spaced apart parallel supporting members extending through said housing, partition means within said housing cooperating with said supporting members between the inlet and outlet to divide the interior of said housing into a plenum chamber and an outlet chamber and a parts treating chamber intermediate said plenum and outlet chambers, an air pervious parts conveyor extending through said parts treating chamber and slidably supported on said supporting members, said supporting members forming the side walls of said parts treating chamber and said partition means spanning said supporting members to form the bottom wall of said parts treating compartment, said bottom wall having a plurality of apertures establishing communication between said plenum chamber and said parts treating chamber, a vertically movable plate positioned between said supporting members and cooperating therewith to form the top wall of said parts treating chamber, said plate having a plurality of apertures for inlet of air into said parts treating chamber and spaced from said supporting members to provide slotted air outlets connecting said parts treating chamber to said outlet chamber, and a bellows seal between said wall and said partition means connecting the apertures in said plate to said plenum chamber.

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