

April 27, 1943.

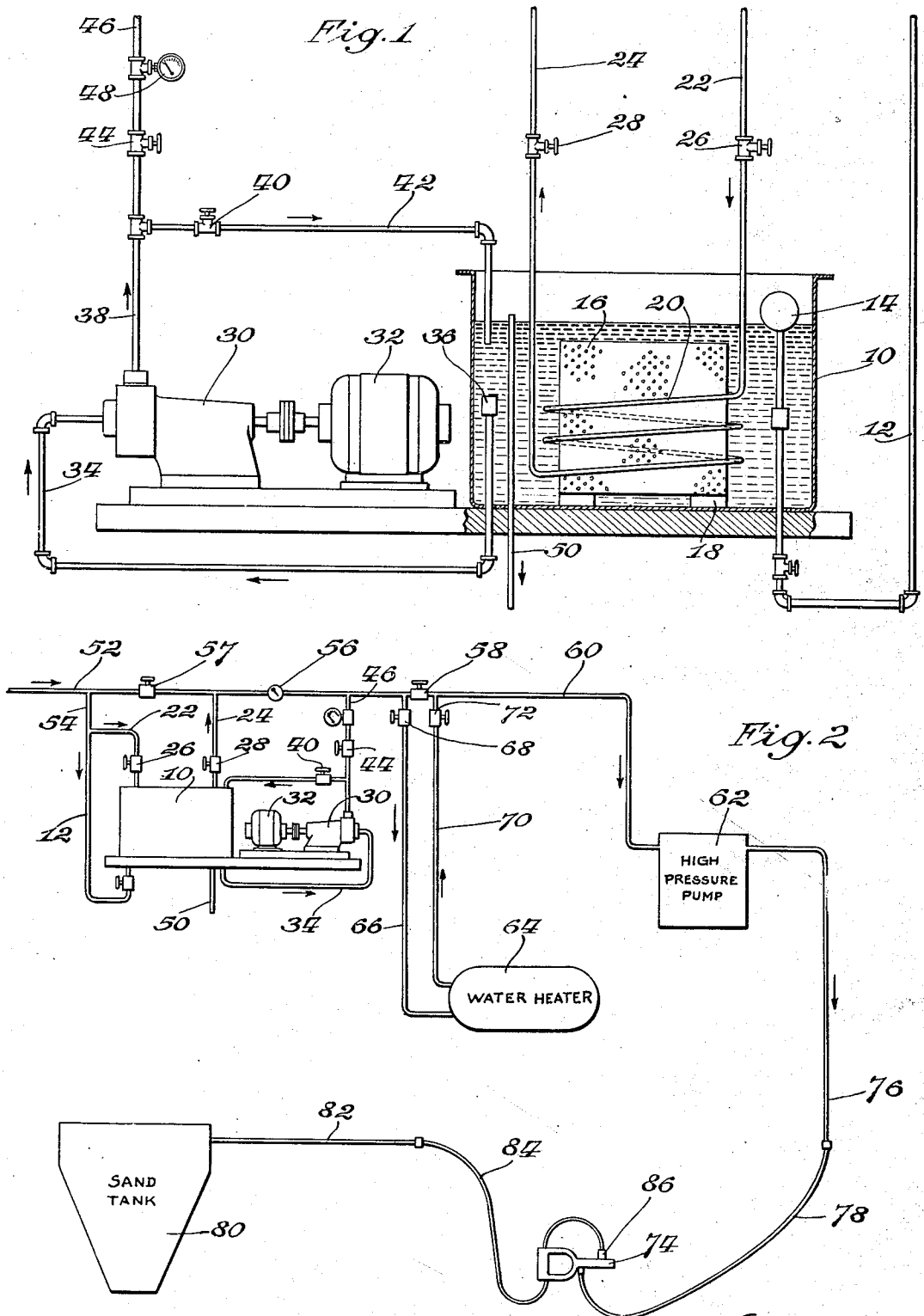
R. WEBSTER

2,317,837

METHOD AND MEANS FOR TREATING FERROUS OBJECTS

Filed July 25, 1941

2 Sheets-Sheet 1



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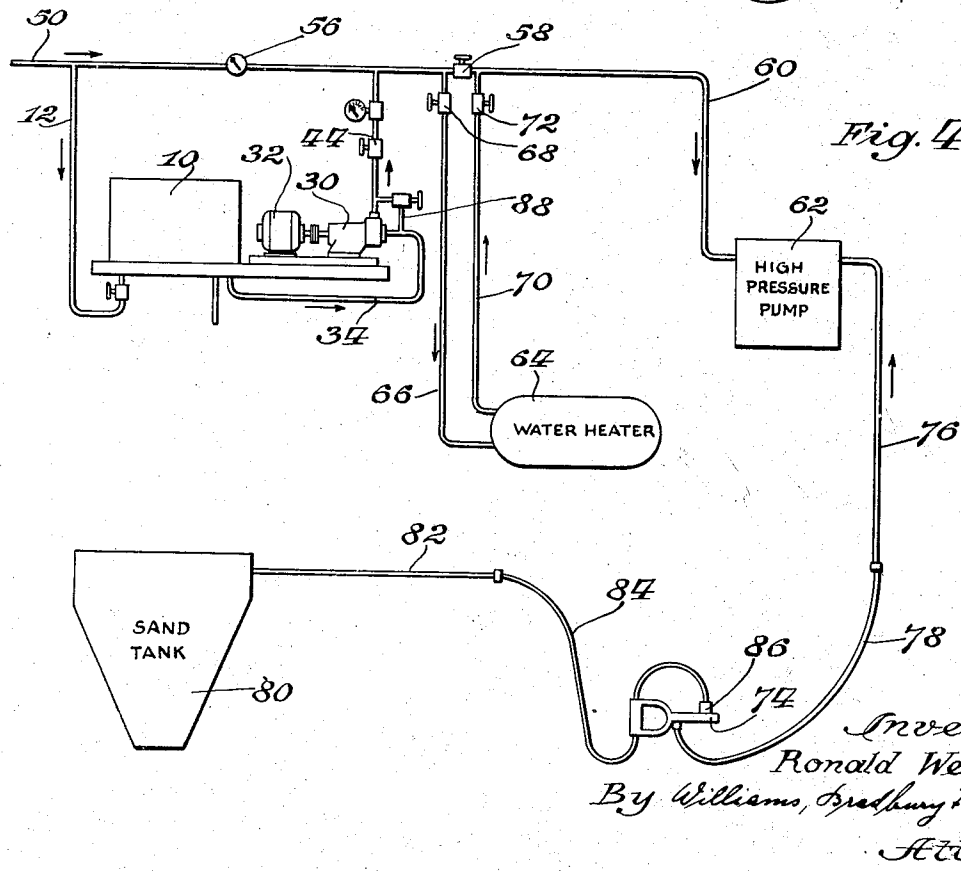
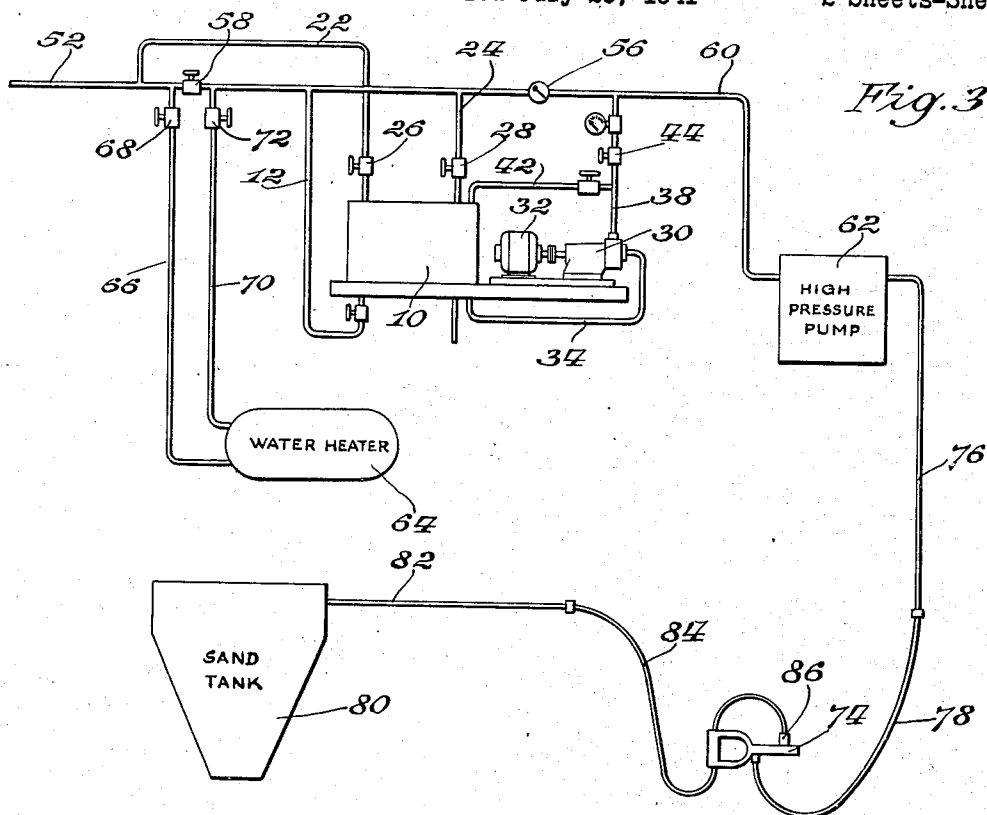
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METHOD AND MEANS FOR TREATING
FERROUS OBJECTS

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2 Claims. (Cl. 51-8)

The present invention relates to a method and means for treating ferrous objects and is more particularly concerned with a method for sand blasting ferrous objects such as castings or forgings by means of a liquid stream having sand entrained therein, and for inhibiting rust formation upon such ferrous objects after they are sand blasted, and for suitable apparatus for performing the above method.

When ferrous objects are treated by a wet sand blasting process, such as that shown and described in Patent No. 2,200,587 issued to Leslie L. Tirrell on May 14, 1940, for "Method and apparatus for sand blasting," such objects are quickly cleaned of scale or other surface deposits, with the result that a very highly reactive surface is present upon the ferrous object so treated. Such a surface in the presence of water will rust extremely rapidly. In fact, a rust deposit noticeable to an unaided eye will appear in a matter of just a few minutes.

The present invention provides a method and apparatus for preventing this rusting.

I am aware that rust inhibiting chemical solutions in the broad sense are not new with me, but I have found that the use of these known solutions in the heretofore approved manner is not effective in preventing the formation of rust upon wet sand blasted surfaces. For instance, a surface treated with the sand blasting gun of the type above described and then treated with a dichromate inhibiting solution either with a spray gun or with a brush will develop rust particles in spite of such treatment. This effect may possibly be brought about by the formation of microscopic rust particles upon the surface before it is possible to complete the sand blasting operation and apply the inhibiting solution, or it may be that the sand particles moving at high velocity form relatively deep pockets into which a dichromate or other inhibiting solution cannot be forced by ordinary means. I therefore provide an arrangement which applies the inhibiting solution to the surface being sand blasted simultaneously with the sand blasting operation. Such an arrangement I have found effectively prevents the formation of rust.

It is therefore the principal object of the present invention to provide a method and means for preventing the formation of rust upon ferrous objects treated by liquid propelled sand grains.

Another object of the present invention is to provide a means for incorporating a rust inhibiting substance in a wet sand blasting jet.

Still another object of the present invention is

to provide a novel device having the above objectives and which enables the proportion of inhibiting substance incorporated in the sand propelling stream to be kept substantially constant under varying conditions.

An additional object of the present invention is to provide a novel wet sand blasting system having the above objectives and which additionally insures the operator's comfort.

Still another object of the present invention is to provide a means for producing a rust inhibiting wet sand blasting stream.

In the drawings, in which similar characters of reference refer to similar parts throughout the several views:

Fig. 1 is a somewhat diagrammatic representation of a device for forming an inhibiting solution of constant proportions and for feeding this solution to a sand blasting gun;

Fig. 2 is a diagrammatic representation illustrating the device shown in Fig. 1 as used in connection with a sand blasting device of the type shown in the before-mentioned Tirrell patent;

Fig. 3 is a diagrammatic representation similar to that shown in Fig. 2 showing an alternative arrangement for using the device illustrated in Fig. 1 in connection with the sand blasting system shown in the before-mentioned Tirrell patent; and

Fig. 4 is a diagrammatic representation of a somewhat different inhibiting arrangement adapted for use with a sand blasting arrangement such as that shown in the before-mentioned Tirrell patent.

Referring to the drawings and especially to Fig. 1, the device there shown for forming the inhibiting solution is comprised of a tank 10 within which the inhibitor is dissolved in water. The water level in this tank is maintained by means of a water inlet pipe 12 equipped with a float valve 14, which may be of any well-known construction. Thus water under pressure in the pipe 12 flows into the tank 10 when the liquid level therein drops below a predetermined point, and after sufficient water has entered the tank through the pipe 12 to refill the tank to a predetermined level, the float valve closes until the water level again drops, whereupon it recycles.

A perforated metal basket 16 is positioned within the tank 10 and is supported somewhat above the bottom thereof upon blocks 18. A quantity of potassium dichromate crystals is placed in the basket 16 and dissolve in the water until a saturated solution has been reached. The purpose of the basket is to expedite the forma-

tion of the inhibitor solution by providing a greater area of contact between the water in the tank and the dichromate crystals than would be afforded if these crystals were merely placed upon the bottom of the tank where they would have a tendency to clump together and expose only their upper surfaces. Since the solubility of potassium dichromate varies considerably depending upon the temperature of the water in which it is dissolved, a coil 20 surrounds the basket 16 and is connected to cause cold water at a substantially constant temperature to flow therethrough from the pipe 22 and into pipe 24. This supply of cold water should preferably be below atmospheric temperature and for this purpose I have found that an ordinary commercial water supply line is adequate, inasmuch as under normal circumstances the temperature of this water is comparatively constant and is considerably below the temperature of the atmosphere within the room in which the inhibitor is located. The flow of water through the coil 20 is controlled by means of valves 26 and 28. The valve 26 is positioned between the water pipe 22 and the coil 20 while the valve 28 is similarly connected between the coil 20 and the outlet pipe 24.

To the left of the tank 10 I have arranged a pump 30 driven by an electric motor 32. This pump can be of any well-known type, providing it will pump a comparatively small amount of liquid at a pressure somewhat above the city water supply line pressure. The inlet side of this pump is connected by means of a pipe 34 to an inlet opening enclosed within a strainer 36 positioned within the tank 10. The exhaust side of the pump is connected by means of a pipe 38 and a valve 40 to a pipe 42. The opposite end of this pipe 42 is open, and is positioned within the tank 10. Thus, with the pump operating, the inhibiting solution flows through the screen 36 and pipe 34 to the pump 30, and is returned to the tank from the pump by way of the pipe 38, valve 40 and pipe 42. This recirculation of the inhibiting fluid and the resulting agitation insures the rapid formation of a saturated solution of dichromate and water within the tank 10. The action of the pump 30 increases the temperature of the water flowing therethrough somewhat, and would normally cause a gradual rise in temperature within the tank 10, were it not for the cooling coil 20 the flow through which is so adjusted that the temperature of the water in the tank is maintained comparatively constant and below that of the room within which the tank is housed. The reason for maintaining this low temperature will be indicated presently.

The pipe 38 connected to the exhaust side of the pump 30 also connects by way of a needle valve 44 with a pipe 46 leading to the point at which the inhibiting solution is to be introduced into the water supply line. In order to facilitate control of the system, the pipe 46 is equipped with a suitable pressure gauge 48.

Because of the possibility that the float valve 14 may at some time fail in operation, an overflow pipe 50 leading to a drain is provided to prevent the inhibiting solution from overflowing the tank and spilling upon the floor upon which the tank rests.

Referring to Fig. 2 of the drawings, a main water line is indicated by the numeral 52. Branch pipes connected to this line extend downwardly and are connected with the pipes 12 and

22 previously mentioned. Water from the main line, therefore, can be used to fill the tank 10 and also can pass through the cooling coil 20. The pipe 24 connected to the exhaust side of the cooling coil is connected at its opposite end to the water supply pipe 52 at the point somewhat beyond the connection between the supply line 52 and the before-mentioned branch pipe 54, while a valve 57 is positioned in the main line 52 between the connections to the branch pipes 54 and 24. Thus, by regulating the valves 57, 26 and 28, the quantity of water flowing through the cooling coil 20 can be determined.

At a point beyond the connection between the pipe 24 and the line 52, the main water line 52 is connected to the inhibitor outlet pipe 46, while a check valve 56 in the main line 52 between the branch pipes 24 and 46 prevents the return flow of the inhibiting solution from the pipe 46 into the main line.

Beyond its connection with the pipe 46, the supply line 52 is connected by way of a valve 58 with a pipe 60 leading to a high pressure pump 62. A water heater 64 which may be of any well-known type, has its inlet side connected by means of a pipe 66 and a valve 68 with the inlet side of the valve 58, while the exhaust side of the water heater is similarly connected by means of a pipe 70 and a valve 72 with the outlet side of the valve 58.

The outlet side of the high pressure pump 62 is connected to the sand blasting gun 74 by means of a pipe 76 and hose 78 and furnishes water under high pressure to this sand blasting gun. A tank 80 containing wet sand is connected to a pipe 82 which is in turn connected by a hose 84 with the sand inlet fitting 86 of the gun 74. For a detailed description of the gun 74 and the sand tank 80, reference is made to the before-mentioned Tirrell patent. The high pressure pump 62 can be of any desirable design that will properly operate the gun 74. Preferably it should pump water at a rate of approximately thirty gallons a minute at a pressure of approximately twelve hundred pounds per square inch.

With the arrangement thus described, the pump 30 recirculates the inhibiting solution through the tank 10 and rapidly forms a saturated solution of potassium dichromate and water at a temperature controlled by the coil 20. As required, a portion of this fluid is diverted through the needle valve 44 into the main line 52, where the mixture of water and inhibiting solution properly proportioned passes onwardly to the water heater 64, from which it returns to the main line and continues to the high pressure pump 62. By regulating the valves 68, 72 and 58, the temperature of the water reaching the high pressure pump 62 can be determined. From the pump 62, water under high pressure mixed with the inhibiting solution, passes to the gun 74, where it picks up abrasive particles and projects them against the work to be treated.

The needle valve 44 should be so regulated that the water forced to the gun 74 has mixed therein approximately one pound of potassium dichromate to four thousand gallons of water. Under different conditions, this proportion may vary, but I have found that the figures given above will serve in most instances.

The reason for the provision of the water heater 64 is that without this heater, the water flowing through the gun 74 causes the gun to become very cold. The gun as thus cooled is uncomfortable to hold and soon numbs the hands of

the operator. By the use of the water heater 64, however, the temperature of the water can be increased to whatever is desirable to insure the operator's comfort.

The coil 20 is advisable because, as has been previously mentioned, the recirculation of the inhibiting fluid by the pump 30 raises the temperature of the fluid and thus increases the concentration of potassium dichromate in the solution. If the solution is permitted to become warmed appreciably above room temperature and then the pump 30 is stopped, the pump and the several connecting pipe lengths containing the concentrated inhibiting solution will cool to room temperature. As the fluid cools, it becomes supersaturated and a portion of the potassium dichromate will precipitate from the solution in the form of crystals. These crystals may clog the pump and the needle valve 44, thus rendering the device inoperative until they have been removed. With the arrangement shown, however, the temperature of the water in the tank 10 is maintained below atmospheric temperature. Therefore, when the pump 30 is stopped, the fluid within the pump and the various connecting fittings and the valve 44 will not precipitate dichromate crystals, since the fluid in the system is below atmospheric temperature. That is, the tendency is for the fluid to become warmer rather than colder when the apparatus stands idle. The system, therefore, is always maintained in condition for immediate use.

In Fig. 3 I have shown an arrangement which differs somewhat from that shown in Fig. 2, principally in that the temperature of the water is raised by the water heater 64 prior to the entrance of the water into the inhibiting solution forming apparatus. In this arrangement the heater branch pipes 66 and 70 are connected across the valve 58 which is located in the supply line 52 in a position ahead of the inhibitor. After passing through the heater, a portion of the water is diverted through the branch pipe 12 to the tank 10. Inasmuch as the water in a position adjacent the inhibitor is heated and may be above atmospheric temperature, water is diverted from the main line through the branch pipe 22 from a position ahead of the valve 58. Thus the water flowing through the coil 20 is at the same temperature as the incoming water, rather than at the temperature of the heated water. The return pipe 24 from the coil 20 connects with the main water line at a position beyond the valve 58. Beyond the point of connection between the pipe 52 and the branch 24, the water in the pipe 52 passes through the check valve 56 to the high pressure pump 62.

As in the previous embodiment, inhibiting fluid is drawn from the tank 10 through the pipe 34 to the inlet side of the pump 30, from where it passes through the pipe 38 back to the tank 10 by way of the return pipe 42. Similarly also, a portion of this liquid is diverted through a needle valve 44 to the main line 52 at a point beyond the check valve 56.

With this alternative arrangement, the system can be started somewhat more quickly than with the one previously shown. This is because hot water passing to the tank 10 will more quickly dissolve the crystals in the basket 16 than will cold water. The solution, therefore, can be brought up to saturation more quickly with the apparatus shown in Fig. 3 than is possible with that shown in Fig. 2. During the interval of

time while a saturated solution is being formed, one or both of the valves 26 and 28 may be closed to prevent cold water from flowing through the coil 20. The limitation of the system shown in Fig. 3 over that shown in Fig. 2 is that the heat brought into the tank 10 with the incoming water must be absorbed by the cold water coil 20 in order to keep the concentration of the solution from becoming excessively high. This limitation is not great in practice, however, because the heat reabsorbed by the coil 20 is not lost, but is taken back into the system, since this coil on its outlet side connects to the main water line leading to the high pressure pump 62.

In Fig. 4, I have shown an alternative arrangement which is satisfactory for some installations, although it does not provide the nicety of control present in the previously described embodiments. It is, however, more economical to construct. In this system, no cooling coil is provided within the tank 10. The tank is otherwise arranged as shown in Fig. 1. In this embodiment, water from the main line 52 passes through a check valve 56 and through a water heater 64 to the high pressure pump 62, all in a manner similar to that provided in the scheme shown in Fig. 2. In a position ahead of the check valve 56, a portion of the water is diverted to the branch conduit 12 and thence into the tank to maintain the water level therein. The inhibiting solution removed from the tank passes in the manner previously described through the pipe 34 to the inlet side of the inhibitor pump 30. Instead of the inhibiting solution being recirculated by the pump 30 back to the tank 10, this solution, by means of a by-pass 88, is recirculated to the inlet side of the pump. Thus the inhibiting solution is continuously being recirculated from the exhaust to the inlet side of the pump, while, as needed, a portion of this fluid is withdrawn from the pump circuit through a branch pipe and needle valve 44, to the main line at a position beyond the check valve 56. As the fluid slowly passes through the needle valve 44 to the main line, this fluid is replaced in the pump 30 by additional fluid being drawn through the pipe 34 from the tank 10.

Since in this arrangement no cooling coil is provided to maintain the temperature within the tank 10, and since additionally the water is not recirculated through this tank, the result is that the solution will not come up to a saturated condition as rapidly as it will in the previously described embodiments. Additionally, as water is periodically supplied to the tank 10 to replace the fluid withdrawn, the concentration of the solution within the tank 10 will be periodically lowered. In fact, with this arrangement, a saturated solution will seldom be reached excepting when the apparatus is permitted to stand idle for a period of time since the entering water has a tendency to maintain the solution somewhat below the saturation point. It will be appreciated also that atmospheric temperature will affect the tank temperature and therefore the concentration of the solution passed to the main line 50. This system, therefore, needs more attention in order to insure a proper concentration of potassium dichromate in the water reaching the pump 62.

Under some conditions, the concentration of solution used in a sand blasting operation is not particularly critical. Under these conditions, therefore, the inhibitor can be operated with little

attention providing it is adjusted to insure a sufficient concentration of potassium dichromate in the water reaching the gun inasmuch as ordinarily an excess of potassium dichromate will do no harm. It will be appreciated that when an apparatus of the type last described is used, some potassium dichromate will be wasted, since the system does not lend itself to the nicety of adjustment necessary in order to insure just the minimum desirable amount of inhibitor chemical in the final sand blasting jet.

Although the present invention has been described as being adapted for the purpose of mixing potassium dichromate with the water supplied to a sand blasting gun, it will be appreciated that other inhibiting chemicals may readily be used in the place of potassium dichromate. The reason for the choice of potassium dichromate is that this chemical in its commercial state is comparatively inexpensive and can be allowed to remain upon the surface of the castings or forgings even though they are subsequently painted, whereas certain other inhibitors which leave an oily film must be removed in order to secure adequate adhesion of a paint film.

From the above description of my invention as illustrated in three separate alternative embodiments, it will be appreciated that the method and apparatus described adequately fulfill the objectives set out for this invention at an earlier portion of this specification.

What I claim is new and useful and desire to secure by Letters Patent of the United States is:

1. A sand blasting system comprising a water

supply line, a high pressure pump connected to said line, a sand blasting gun connected to said high pressure pump, said sand blasting gun having means therein to incorporate abrasive particles in the high pressure water stream passing therethrough, means to dissolve a corrosion inhibiting chemical in water to form a substantially saturated solution, heat exchange means to control the temperature of said solution and to maintain the temperature of said solution below atmospheric temperature, pump means for withdrawing said saturated inhibiting solution and for forcing said inhibiting solution into said supply line, and heat exchange means adapted for elevating the temperature of the mixed water and inhibiting fluid to approximately the body surface temperature of the operator.

2. A sand blasting device comprising, a water supply line, a tank, means for dissolving a rust inhibiting chemical in said tank, means to circulate water away from and back into said tank, means to by-pass a portion of the water so circulated to the water supply line, means to maintain the temperature within said tank substantially constant and at a temperature below atmospheric temperature, means to heat the water in said supply line to substantially the body surface temperature of the operator, a high pressure pump, means connecting said high pressure pump to said supply line, a sand blasting gun, and means connecting said sand blasting gun to said high pressure pump and means to supply abrasive material to said gun.

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