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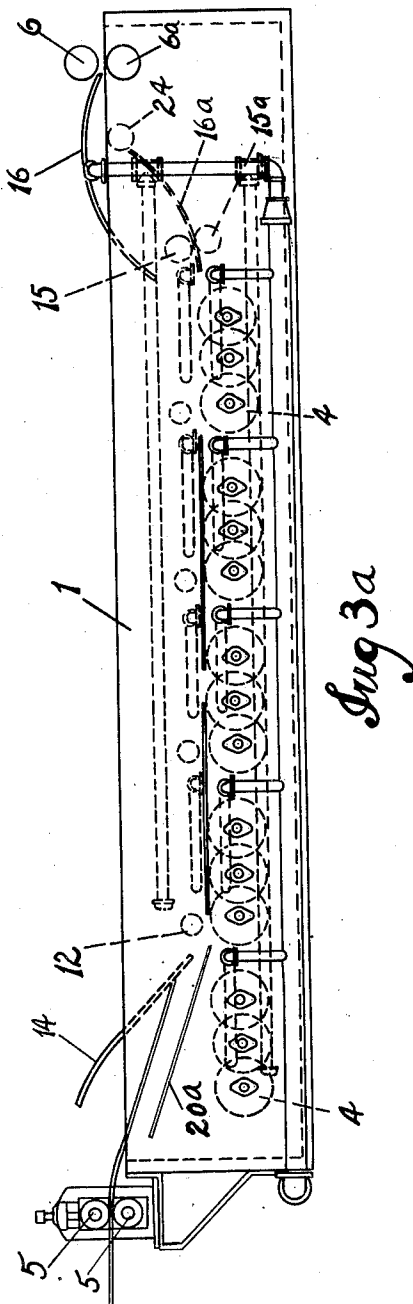
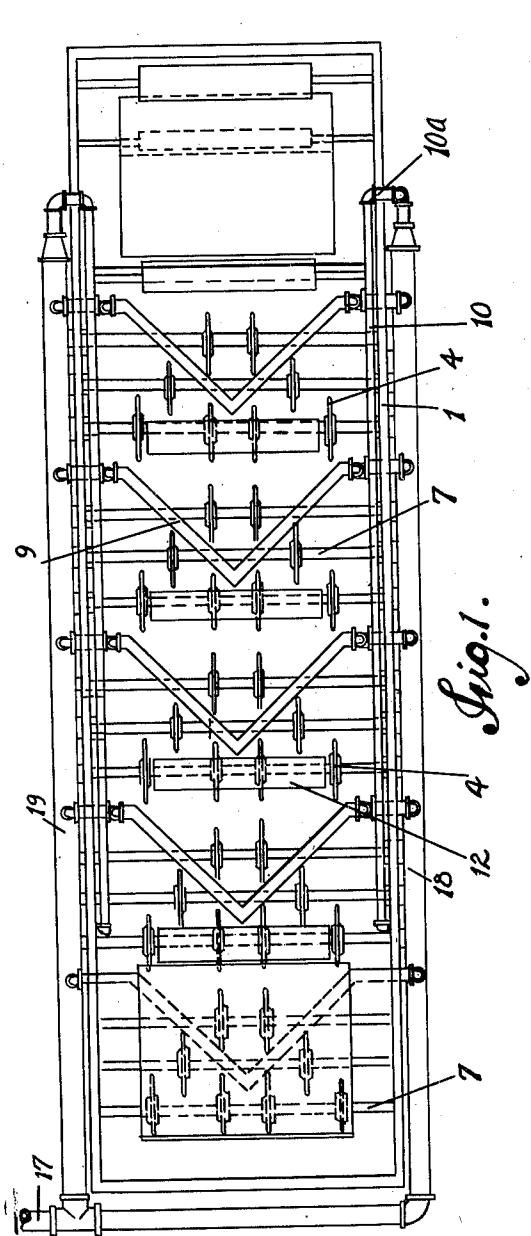
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ABRASIVE CLEANING MECHANISM AND PROCESS

Filed June 18, 1930

3 Sheets-Sheet 1



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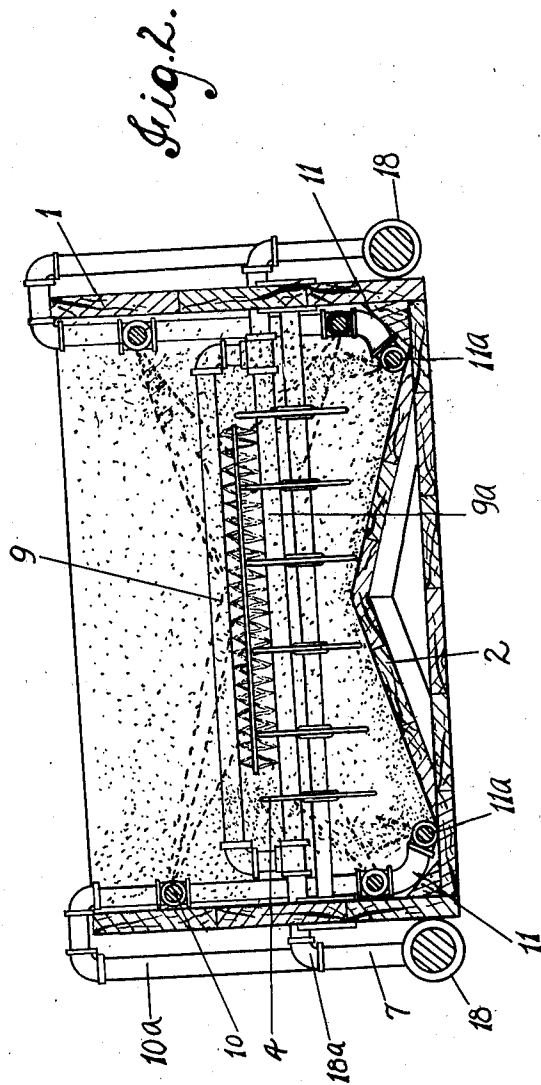
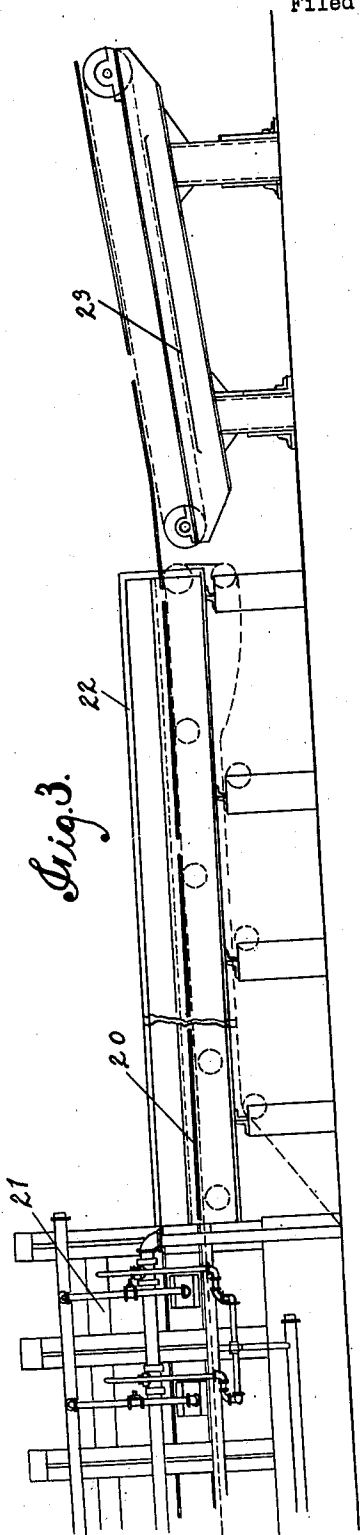
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ABRASIVE CLEANING MECHANISM AND PROCESS

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3 Sheets-Sheet 2



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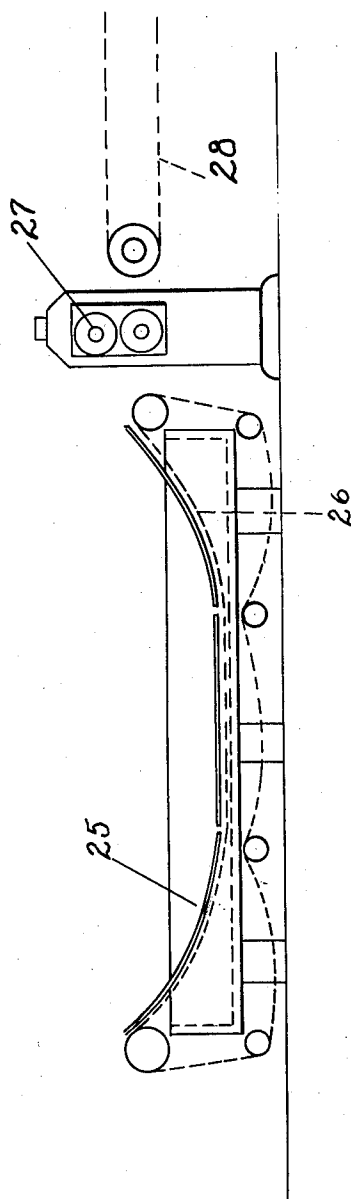
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ABRASIVE CLEANING MECHANISM AND PROCESS

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3 Sheets-Sheet 3

Fig. 3b



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ABRASIVE CLEANING MECHANISM AND PROCESS

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Application June 18, 1930, Serial No. 461,991

11 Claims. (Cl. 51—8)

The primary object of my invention is the provision of an improved process and apparatus for the cleaning of objects with a powdered or granular abrasive. Hitherto such abrasives have been applied to articles to be cleaned or polished, by the positive mechanical action of some rubbing or polishing device, such as a belt, a brush, a wheel or a roll; or the abrasive substance has been entrained in a blast of air and blown against the article, as in the familiar sand blasting procedure. The particular articles for the cleaning of which my process and apparatus were directly devised are metal sheets or shapes, and especially iron and steel sheets or strips from which it is desired to clean the oxide after a hot rolling, annealing, or normalizing, treatment. My process and the specific exemplary embodiment of my apparatus, which I shall hereinafter specifically describe, will be suitable for the cleaning of such sheets; but it will be obvious that various modifications may be made in them by way of adaptation to other articles, that my process may be used with appropriate apparatus for the cleaning of articles of any shape, and that my mechanism may be varied for the treatment of different articles, all without departing from the spirit of my invention.

The primary object of my invention is the provision of a new process and apparatus for abrasive cleaning. Ancillary objects of my invention are the provision of an abrasive cleaning procedure in which the abrasive is entrained in and held by a liquid medium, together with means for directing the abrasive against an article to be cleaned; the provision of means for controlling the abrasive more perfectly, as well as means for effecting a cleaner operation free of dust and conditions detrimental to the health of workmen; more confined as to space, and more intense as to aggregate action, thus permitting a greater speed of travel of the articles through the cleaning mechanism.

These and other objects of my invention which will be apparent to one skilled in the art upon reading these specifications or will be pointed out hereinafter, I accomplish by that certain construction and arrangement of parts, and in that certain process, of which I shall now describe the aforesaid exemplary embodiment, reference being made to the drawings which form a part hereof.

In these drawings:

Figure 1 is a plan view of my abrasive cleaning mechanism.

Figure 2 is a cross section therethrough.

Figures 3, 3a and 3b are to be taken together as showing the parts of an assembly of mechanisms for cleaning iron or steel sheets as they leave an annealing or normalizing furnace.

Briefly in my invention, instead of directing sand or other abrasive against the articles to be cleaned by a blast of air or gas, I provide a bath of liquid with the abrasive suspended therein, together with means for causing the abrasive-bearing liquid to be directed against all parts of the articles to be cleaned. I provide means for doing this which do not involve the recirculation of the liquid medium outside of the bath itself, and inasmuch as the abrasive is entrained in the liquid, I do not have any problem of separating it therefrom or of protecting workmen from injurious atmospheres of abrasive dust and the like. There is no way in which the abrasive can get out of my apparatus, and in this way I economize the abrasive itself and am able to use it to much better effect.

I shall first describe the actual apparatus used by me in cleaning. I have shown in the figures a tank 1 which may be of wood or the like, and which has a false bottom 2 tapering from each side wall upward to a ridge in the center forming a roof-like construction. This tank I fill with water or other suitable liquid, in which I place a quantity or sand or other desired abrasive. I provide means within the tank for directing the abrasive bearing liquid against the sheets to be cleaned, which means comprise air jets providing, as will hereinafter be described; not only for the continuous agitation of the liquid so as to keep the abrasive suspended therein, but also for directing jets of the liquid containing the abrasive forcibly against the articles to be cleaned whereby scale or dirt is removed from their surfaces. To this end I provide means for carrying sheets through the tank and the water bath therein in a predetermined path. These means comprise transverse shafts 7 bearing discs 4 upon which the sheets ride, and I may provide above the upper edges of the discs, rollers 12 tending to keep the sheets down on to the table formed by the disc edges and to guide the ends of the sheets positively beneath the upper jet directing devices which I shall presently describe. In order that the sheets may be moved through the tank I drive the shafts 7 and the discs thereon. This is preferably accomplished by extending the shafts 7 through the sides of the tank, the bearings of the shafts being provided with suitable glands to prevent the leakage of the liquid and the entrance of the abrasive into the bearings, and I provide

outside the tank a drive of any suitable type. This drive causes all the shafts to rotate in the same direction and is preferably controllable as to speed. I have not illustrated any particular drive since the character of the drive is not controlled in my invention. The rollers 12 may be driven or not as desired. It will be understood that sheets directed into my tank, by mechanism later to be described, will be caused to move therethrough over a table formed by the peripheries of the discs 7, and it will be further understood that these discs will be interspaced and staggered, as shown or otherwise, so as to provide a suitable table for the movement of sheets and so as not to interfere with the other mechanism in my tank.

Above and below the path of travel of the sheets through my tank I provide pipes 9 and 9a which have a series of holes in alignment forming jets directed upwardly in the case of the pipes 9a and downwardly in the case of the pipes 9, against the sheet. I prefer to make the pipes as shown clearly in Figure 1 in a V shape, since this enables me to provide a greater number of jets in each pipe per unit length across the width of the sheet, so as to cover the sheet entirely with blasts from the nozzles of each pipe. The length of my tank will of course be proportioned to the amount of abrasive cleaning to be done and the desired speed of travel of sheets therethrough, and within the limits of the length of the tank as many of the jet directing pipes 9 and 9a may be provided as is deemed desirable.

From a main air line 17 from a tank or compressor, I provide manifolds or headers 18 and 19 on each side of my tank, and to these headers I attach the pipes 9 and 9a, as shown, by suitable connections at either end thereof, so that air enters the V-shaped pipes from both ends, maintaining substantially a constant pressure thereacross and an even velocity at all jets. The headers are conveniently located along the floor line and are connected to the pipes by connections 18a as shown in Figure 3, which have portions passing through the walls of the tank. The ends of the pipes 9 and of the pipes 9a may be connected together, and to the delivery pipes 18a by connections within the tank. I also provide within the tank and near the surface of the liquid therein longitudinal pipes 10 located near the side walls of the tank and provided with jets directed diagonally against the sheets as shown clearly in Figure 2. These pipes I connect to the headers by means of pipes 10a, which may go up from the headers on the outside of the tank down on the inside, where they connect first with pipes 10 and then with pipes 11 parallel to pipes 10 but located near the bottom of the tank. The pipes 11 are provided with jets directed diagonally upward against the sheets, as shown in Figure 2.

The purpose of the roof shaped supplementary floor of my tank is to direct toward the side walls thereof the abrasive material which settles in the liquid and falls thereon. This abrasive material slides down the slanting portions of my supplementary floor 2, and I have provided, connected with an extension of the pipes 10a, additional parallel pipes 11a, one on either side of the floor of the tank. These pipes have holes forming jets directed upwardly, and these jets have the purpose primarily of catching the abrasive as it rolls down the slanting sides of the supplementary base 2 and bringing it into suspension again by blowing it and the liquid containing it upwardly.

I have illustrated in Figure 2 the combined ac-

tion of these several jets. The liquid is maintained in constant agitation, and it is directed evenly but from a plurality of directions forcibly against the surfaces of the sheets from above and below so as to clean them. The air, of course, bubbles up through the liquid and passes out from the tank, but the abrasive material stays in the liquid and does not form a dust in the atmosphere. The action of my abrasive cleaning mechanism is quite intense and has all the advantages of a sand blast without the enumerated disadvantages. Such abrasive material as tends to settle out from the liquid falls down upon the supplementary bottom, slides down the sides thereof, and is blown upwardly and brought into suspension again by the jets from pipes 11a. It will be clear that other arrangements of jets may be provided for the same or for different uses, and that the form and structure of my abrasive cleaning mechanism may be modified for the cleaning of different articles without departing from the spirit of my invention.

In Figures 3, 3a, etc., I have shown sheets 20 emerging from a gas heated continuous annealing or normalizing furnace 21 and being conveyed through a water sealed cooling device 22. Emerging from this device I have shown the sheets being carried by a conveyor table 23 to a pair of pinch rolls 5 which may be mounted upon my tank and which direct the sheets against a guide 14, which directs them downwardly within the tank as shown. The sheet 20a having passed the pinch rolls 5 falls downwardly through the liquid until it rests upon the table formed by the discs 4, upon which it is caused to move as shown between the pipes 9 and 9a so as to be cleaned as hereinabove described.

At the end of the table formed by the discs 4 I have shown positively driven pinch rolls 15 and 15a which engage the sheet and feed it against a deflector or guide 16a which carries it upwardly so as to bring it above the surface of the liquid. The guide 16a may terminate adjacent to an idler roller 24 which deflects it still further upwardly and into engagement with another deflector 16 carrying it into pinch rolls 6 and 6a. Adjacent my abrasive cleaning tank 1, I have provided a hot water washing tank 25 having a continuous belt conveyor 26 for the purpose of carrying the sheets therethrough. Adjacent to the washing tank I may provide flannel drying rolls 27 through which the sheets pass to a conveyor 28 carrying them to a sheet piler.

The operation of my cleaning device has heretofore been explained. The oxide and scale which is removed from the sheets becomes entrained in the liquid, and since it is of abrasive character serves to increase the amount of abrasive in the tank and to compensate somewhat for the deterioration of the original abrasive through comminution thereof. No abrasive is lost in my mechanism and process, and while it will be necessary from time to time to change the abrasive or to add new abrasive of better cutting qualities, yet such changes are comparatively very infrequent, and the abrasive itself is thus greatly economized. The entire operation is also very much cleaner. I need not use in my tank water as the liquid medium, but may use other liquids such, for example, as heavier liquids approaching more nearly a specific gravity equivalent to that of the abrasive, whereby the abrasive may be more readily retained in suspension. Again I may combine pickling with my abrasive cleaning process by making the liquid medium slightly acid, so

that a chemical effect is combined with a mechanical cleaning effect. By reason of the mechanical cleaning effect, if a pickling is desired, the pickle liquor used may of course be much weaker than that which has to be relied upon alone to loosen and remove scale. Where the liquid medium used is appreciably acid, I prefer to construct my tank of acid resisting materials and to construct the pipes, conduits, shafts and rollers of some metal, material or alloy which will be resistant to the acid employed.

I have found in my device that all of the beneficial effects of sand blasting on sheets or shapes are attained, and my process is as readily controllable, and indeed, more readily controllable, than a sand blasting operation. I can, in particular, more carefully control the nature of the surface left by the abrasive cleaning process than in a sand blasting operation.

Having thus described my invention, what I claim is new and desire to secure by Letters Patent is:

1. In an abrasive cleaning apparatus a container, a body of liquid held therein, abrasive cleaning substance suspended in said liquid, means for maintaining said liquid in constant agitation, means in said container for directing abrasive material settling from said liquid, and jet means for receiving and returning said abrasive to suspension therein, all of said means being located in said body of liquid.

2. In an abrasive cleaning mechanism a tank, a body of liquid held therein, means for carrying articles to be cleaned through said liquid, an abrasive material suspended in said liquid, and jet means for directing said liquid against said articles, said jet means being located in said body of liquid.

3. In an abrasive cleaning mechanism a tank, a body of liquid held therein, means for carrying articles to be cleaned through said liquid, abrasive material suspended in said liquid, jet means for directing said liquid against said article, said jet means located in said liquid and comprising means for directing blasts of a gas through said liquid.

4. In an abrasive cleaning mechanism a tank, a body of liquid in said tank, means for carrying articles to be cleaned through said liquid, abrasive material suspended in said liquid, jet means for directing said liquid against said articles, said jet means being in said body of liquid and comprising means for directing blasts of a gas through said liquid, means on the floor of said tank to direct abrasive material settling from said liquid and supplementary jet means located in said liquid to return said abrasive material to suspension.

5. In an abrasive cleaning mechanism a tank, a body of liquid in said tank, means for carrying articles through said liquid, said means comprising a plurality of shafts with conveying means

thereon, abrasive material suspended in said liquid, pipes in said liquid located above and below the path of travel of articles through said tank, connections between said pipes and a source of gas under pressure, jet means on said pipes for directing jets of said gas against said articles.

6. In an abrasive cleaning mechanism a tank, a body of liquid in said tank, means for carrying articles through said liquid, said means comprising a plurality of shafts with conveying means thereon, abrasive material suspended in said liquid, pipes in said liquid located above and below the path of travel of articles through said liquid, connections between said pipes and a source of gas under pressure, jet means on said pipes for directing jets of said gas against said articles, means on the floor of said tank to direct abrasive material settling from said liquid and supplementary jet means to receive and to return said abrasive material to suspension.

7. In an abrasive cleaning mechanism a tank, a body of liquid held in said tank, abrasive material suspended in said liquid, means for conveying articles to be cleaned through said liquid, means for forming in said liquid a plurality of jets of gas directed from a plurality of directions toward said articles to be cleaned, and means for maintaining said abrasive in continuous suspension.

8. In an abrasive cleaning mechanism a tank, a body of liquid in said tank, abrasive material suspended in said liquid, means for conveying articles to be cleaned through said liquid, means for forming in said liquid a plurality of currents directed from a plurality of directions toward said articles to be cleaned, and means for maintaining said abrasive in continuous suspension.

9. A process of abrasive cleaning which comprises suspending an abrasive cleaning substance in a contained body of liquid and directing the liquid from a plurality of directions by blasts of gas against an article to be cleaned suspended within said body of liquid.

10. A process of abrasive cleaning which comprises suspending an abrasive cleaning substance in a contained body of liquid and directing the liquid from a plurality of directions by blasts of gas against an article to be cleaned suspended within said body of liquid and maintaining said abrasive cleaning substance in suspension by means of a supplementary blast of gas.

11. A process of abrasive cleaning which comprises suspending an article to be cleaned within a body of contained liquid, said liquid containing an abrasive cleaning substance, maintaining said abrasive in suspension in said body of liquid by means of a jet of gas within said liquid, providing a plurality of jets of gas above and below said article in said liquid and directed toward said article, said jets being wholly within said liquid, and thereby forcing the abrasive cleaning substance against the article.

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