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METHOD AND APPARATUS FOR WASHING

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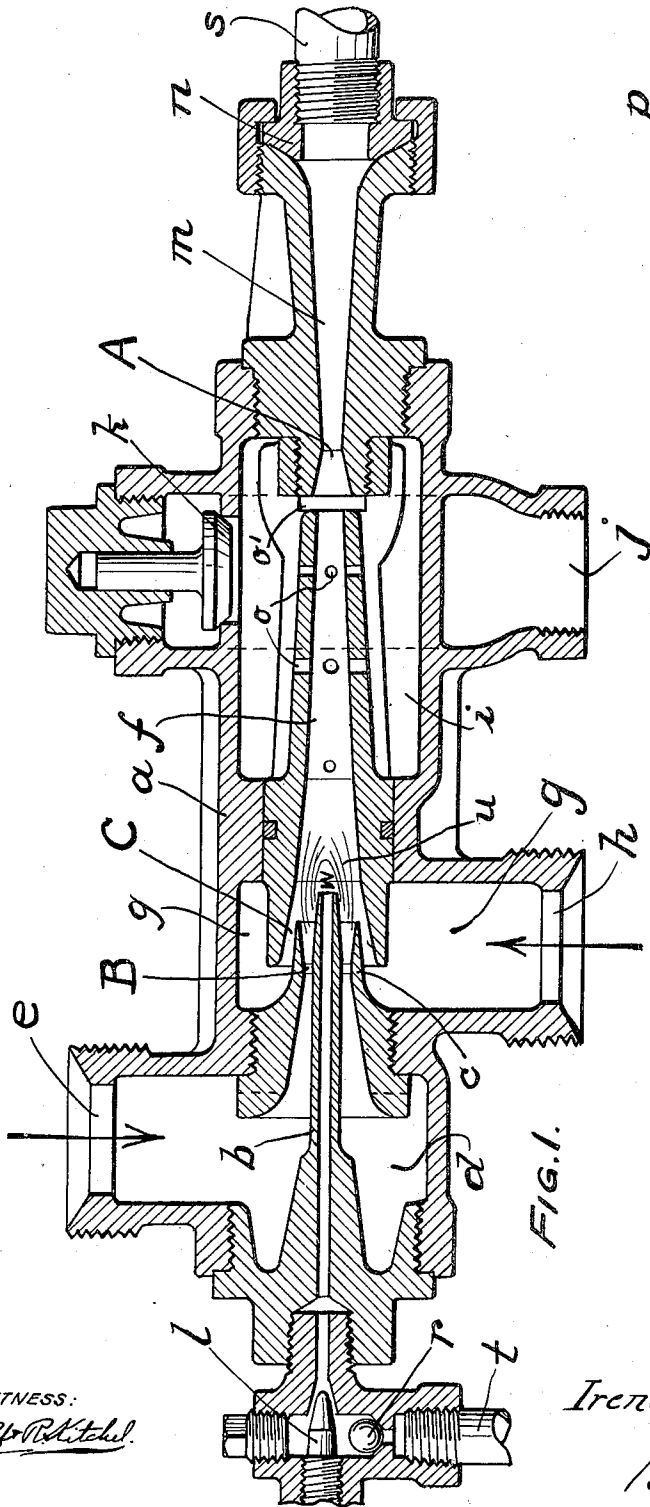


FIG. 1.

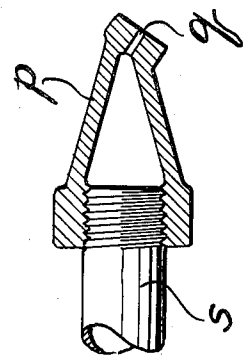


FIG. 1A

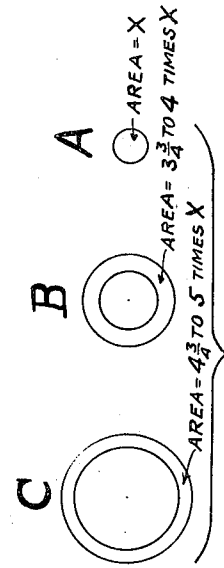


FIG. 2.

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METHOD AND APPARATUS FOR WASHING

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3 Claims. (Cl. 299—84)

This invention relates to a method and apparatus for washing surfaces.

In general, this invention contemplates an apparatus and procedure whereby a high pressure stream of hot water, with or without a solvent or detergent in admixture therewith, will be delivered against a surface for the removal therefrom of dirt, grease, encrustation, etc.

More particularly the apparatus in accordance with this invention comprises means for combining steam and water, and more specifically also a solvent or detergent if desired, for heating the water and developing and delivering a high pressure stream against a surface to be cleaned.

More particularly, from the method standpoint, procedure in accordance with this invention comprises development, through the medium of steam, of a high velocity stream of heated water and effecting delivery thereof through the medium of steam under pressure against a surface to be cleaned. More specifically a solvent or detergent is dispersed in finely divided form or dissolved in the water in the development of the high velocity stream.

The apparatus and procedure in accordance with this invention, which will be hereinafter described in detail, will find wide usages in the cleaning of surfaces soiled by grease, oil, etc., or otherwise soiled. The apparatus is readily and economically constructed and maintained and the method is highly efficient and economical.

Having now indicated in a general way the nature and purpose of this invention, I will proceed to a detailed description of a preferred embodiment thereof with reference to the accompanying drawing, in which

Figure 1 is a cross sectional view of a form of apparatus in accordance with this invention.

Figure 1a is a view, partly in section, of a nozzle adapted for connection with the apparatus shown in Figure 1.

Figure 2 is a diagrammatic view illustrative of relative areas of parts of the apparatus shown in Figure 1.

With reference to the drawing, *a* indicates a casing which may be made of any suitable material, as iron or other metal or alloy, and may, for example, be a casting.

Into one end of the casing *a* extends a nozzle *b*, controlled by a needle valve *l*, about the end portion of which is a steam nozzle *c*, which communicates with a steam chamber *d* in communication with a steam inlet *e* in the casing. Extending from the steam nozzle *c* is a combining tube *f*. The rear end of the combining tube

embraces the forward ends of the steam nozzle *c* and of the nozzle *b* and communicates with a water chamber *g* in communication with a water inlet *h* in the casing. A delivery tube *m*, spaced from the combining tube and receiving delivery therefrom, extends through the end of the casing and is threaded at its forward end for the reception of a hose coupling *n*, to which a suitable length of hose *s*, carrying a nozzle *p* having a restricted outlet *q* will be attached. The tubes *f* and *m* form a venturi for the development of a high velocity stream of water for discharge under pressure through the restricted opening *q* in nozzle *p*.

Surrounding the combining tube is an overflow chamber *i* adapted for communication with an overflow discharge *j* through a port controlled by a valve *k*, and in communication with the combining tube through ports *o*, *o* therein and through the slot *o'* formed by the space between the combining tube and the delivery tube.

The nozzle *b*, controlled by needle valve *l* is arranged for connection with a source of solvent or detergent solution, as, for example, kerosene, oil, light car oil, trisodium phosphate, or other desired solvent or detergent, which may be contained in a suitable tank, through a pipe *t*, back flow through which will be prevented by a ball check valve *r*.

The discharge end of nozzle *b* is positioned within the combining tube *f* and beyond the discharge end of steam nozzle *c* a distance such that it is within the vacuum area formed by the discharge of steam from the nozzle *c* around the nozzle *b* and by the condensation of steam issuing from nozzle *c* on contacting with water from chamber *g*. For clarity, the discharge of steam from nozzle *c* is indicated by lines *u*, Figure 1, and the vacuum area referred to is indicated at *w*. As a result of the positioning of the discharge end of the nozzle *b* in the vacuum space *w*, solvent from the source is drawn by the check valve *r*, through the needle valve *l* and through and discharged from the tube *b* in liquid form, under the influence of vacuum.

In apparatus in accordance with this invention, such as that described above, the minimum cross sectional areas of the steam nozzle *c*, the entrance for water into the combining tube, and the combined area of the overflow openings *o* and slot *o'* will, desirably, bear a certain proportional relationship to the cross sectional area of the delivery tube *m* on its minimum diameter, as a result of which, using a source of cold water and of relatively low pressure steam, a stream of

hot water at relatively high pressure, and with a solvent or detergent therein if desired, is delivered from the restricted opening q of nozzle p .

Thus, by way of example, assuming that the cross sectional area of the delivery tube on its minimum diameter, at A, is equal to x , the cross sectional area of the steam entrance on the minimum diameter of the steam nozzle, at B, will be $3.75x-4x$ while the minimum cross sectional area of the water entrance, at C, will be $4.75x-5x$, and the combined area of the overflow openings o and slot o' will be $8x-9x$.

In carrying out the method in accordance with this invention, using, for example, the apparatus described, the water inlet h and steam inlet e are connected to suitable sources of water and live steam and the overflow j is connected to a suitable drain. If solvent or detergent is to be used the pipe t is connected with a suitable supply of solvent. A hose s carrying a nozzle p , having a restricted outlet q , is secured to the discharge end of the delivery tube m . The apparatus as a whole may be supported in any desired manner on or from any suitable support and, if desired, may be supported from the water and drain pipes connected to the water inlet h and drain f .

For operation, in carrying out the method in accordance with this invention, water is turned on under sufficient head to flow into the combining tube and steam is turned on. The steam issuing from nozzle c at high velocity will pick up and be combined with the water in the combining tube, heating it and developing a stream through the tube which is discharged through the delivery tube m at high velocity. In the event that a stream of water is not immediately developed in the combining tube, overflow will occur through openings o and slot o' , which will cease on the formation of the stream, the passage of which through the tube draws a vacuum on the overflow chamber and holds the overflow valve k in closed position.

If solvent or detergent is to be used, after the stream has been started, the needle valve l is opened sufficiently to admit solvent to the nozzle b in required quantity, under the influence of vacuum. The vacuum in the space w , heretofore described, will raise solvent from the supply, through the check valve r , and cause it to be discharged in liquid form into the space w . The liquid solvent is picked up by the steam flowing past the end of nozzle b and is intimately mixed in a finely divided state with the water in the combining tube.

The high velocity stream of water discharged from the delivery tube m not only has a high velocity but has been highly heated by the steam, which, in the combining and delivery tubes, has largely condensed in the water. From the delivery tube, the highly heated water, carrying a solvent or detergent, passes through the hose s and issues through the nozzle p under high pressure due to the restricted opening q therein and the high velocity of the stream in the delivery tube. The stream issuing from the nozzle p may, as will be obvious, be directed upon any surface to be cleaned.

The stream from nozzle p is highly heated and under high pressure and operates both from the

standpoint of its temperature and physically to remove the heaviest coatings of grease, dirt, etc. from a surface upon which it is directed. Where a solvent or detergent is included in the stream, it will be a highly effective aid in cleaning, and where the solvent or detergent is immiscible, or relatively so, it will be present in the stream in minute subdivision, or practically emulsified therein, so that it will have a maximum cutting action on, for example, grease.

The method and apparatus in accordance with this invention is especially advantageous more particularly in that efficient cleaning can be effected with use of steam at relatively low pressure and in that combination of a solvent or detergent with the water is effected with minimum effort and maximum efficiency.

It will be appreciated that various modifications may be made in the apparatus described herein and in procedure comprising the method described herein without departing from the scope of this invention.

This application constitutes a continuation in part of an application for United States patent filed by me December 3, 1932, Serial No. 645,497.

What I claim and desire to protect by Letters Patent is:

1. A washer including in combination a casing, a combining tube within said casing, a delivery tube in line with said combining tube arranged to discharge without the casing, a steam nozzle adapted to be connected with a source of live steam and arranged for the discharge of steam into said combining tube, an inlet for the water to the combining tube, the steam nozzle being characterized by the fact that its minimum cross-sectional area is related to the minimum cross-sectional area of the delivery tube on the ratio of 3.75-4:1.

2. A washer including in combination a casing, a combining tube within said casing, a delivery tube in line with said combining tube arranged to discharge without the casing, a steam nozzle adapted to be connected with a source of live steam and arranged for the discharge of steam into said combining tube, an inlet for the water to the combining tube, the steam nozzle being characterized by the fact that its minimum cross-sectional area is related to the minimum cross-sectional area of the delivery tube on the ratio of 3.75-4:1 and by the fact that the minimum cross-sectional area of the water inlet is related to the minimum cross-sectional area of the delivery tube on the ratio of 4.75-5:1.

3. The method of cleaning a surface which includes directing an annular jet of steam at relatively low pressure into a tube, introducing an annular stream of cold water into the tube exteriorly of the jet and subsequently introducing a solvent interiorly of the jet, permitting the water and solvent to intermix under the influence of the steam, discharging the admixed water and solvent through a second tube under the influence of the steam, the tubes together forming a venturi in which the water and solvent are heated and whereby the admixed water and solvent is discharged from the second tube at high velocity, and directing the discharge against a surface to be cleaned through a restricted opening.

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