July 29, 1941. W. A. ROSENBERGER 2,251,233

ABRADING APPARATUS

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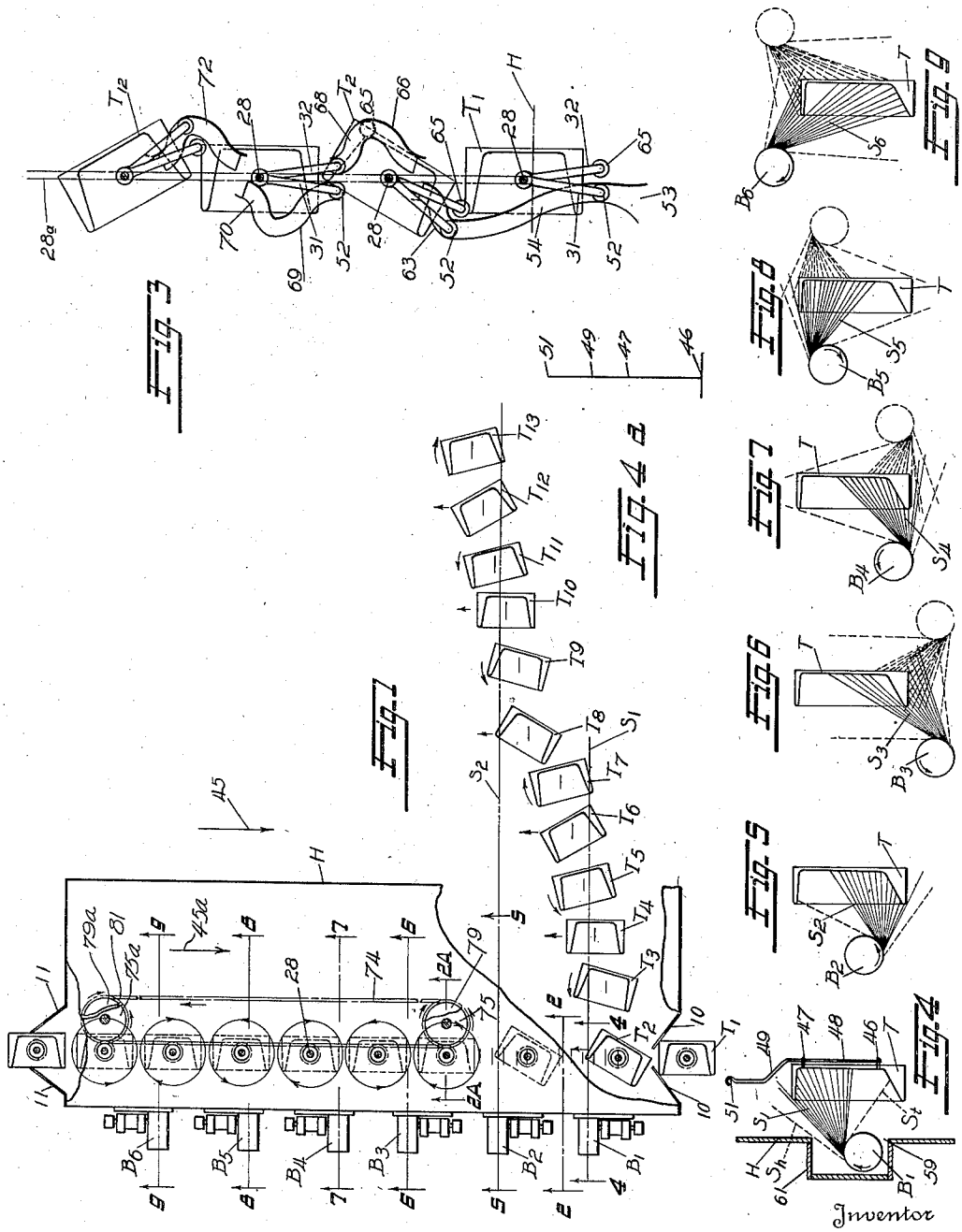


Fig. 3

Fig. 9

Fig. 8

Fig. 7

Fig. 6

Fig. 5

Fig. 4

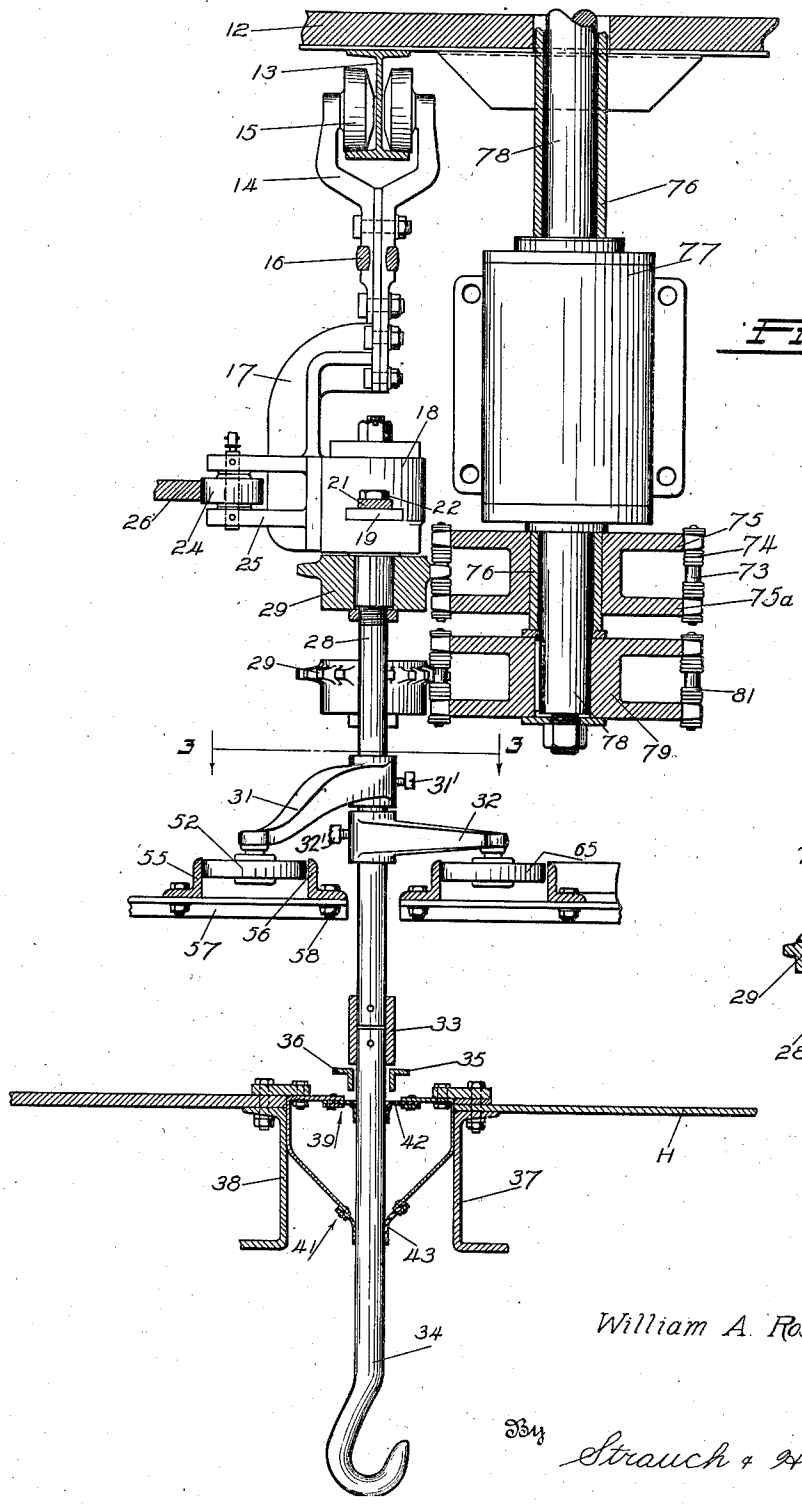
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ABRADING APPARATUS

Filed April 22, 1939 2 Sheets-Sheet 2



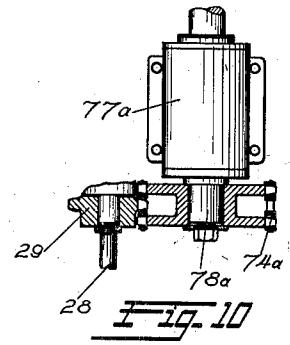


Fig. 10

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UNITED STATES PATENT OFFICE

2,251,233

ABRADING APPARATUS

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Application April 22, 1939, Serial No. 269,482

17 Claims. (Cl. 51—9)

This invention relates to abrading apparatus and more particularly to apparatus for subjecting comparatively large castings and the like to the action of abrasive streams, of the general type disclosed and claimed in my copending applications Serial Nos. 34,990 and 164,924, filed August 6, 1935, and September 1, 1937, respectively.

The blast cleaning of comparatively small parts does not involve any serious problems because they may be placed in barrels and like devices and tumbled under an abrasive stream. With the wide adoption of abrasive throwing wheels, the blast nozzles of such tumbling barrels were merely replaced by one or more wheels. However, relatively massive articles do not readily adapt themselves to cleaning by means of abrasive throwing wheels, because the latter are comparatively large and heavy and cannot be brought up to, and moved over the surface of the article in the manner of a blast nozzle.

In my co-pending application Serial No. 34,990, filed August 6, 1935, I have disclosed an apparatus for conveying large castings and the like past centrifugally thrown blast streams, and simultaneously rotating them, so as to subject all of their sides to a cleaning action. That machine made it possible, for the first time, to efficiently clean this class of work with centrifugal wheels, and represents a great advance in the art as it efficiently cleans large castings of regular or irregular shape. The major object of this invention is to improve that machine, so as to widen its field of use, make it more flexible, and adapt it for the efficient cleaning of both the internal and external surfaces of large articles having one or more recesses therein, such as bath tubs and the like.

I have discovered that when a bath tub or the like is conveyed through a blasting zone and simultaneously rotated, the exterior is abraded much more than the interior, and that when the operation is prolonged sufficiently to obtain the desired abrading on the interior of the tub, the exterior is severely abraded or "overblasted." This is very undesirable, because it is wasteful of the abrasive and produces a smooth finish on unimportant surfaces. In a bath tub it is important to produce a smooth finish on the interior which is subsequently enameled.

Heretofore bath tubs have generally been "hand blasted" by means of an air blast nozzle; and although special machines have been heretofore proposed for cleaning bath tubs, they are of complicated design, are limited to the use of air blast nozzles, can only be used to clean bath tubs, and are so designed that operations must be completely stopped when the tub is to be removed and replaced by another. They also possess other disadvantages which render them incapable of meeting present day production requirements.

It is accordingly the primary object of this invention to provide a novel machine for efficiently and automatically cleaning both the internal and the external surfaces of bath tubs and like articles in a continuous operation, and at low cost.

A further important object is to provide a machine for transporting bath tubs and the like past one or more blast streams and simultaneously rocking the tub so as to clean the interior, and then automatically rotating the tub through one or more full revolutions in front of one or more further blast streams, to blast clean the exterior and further blast clean the interior of the tubs.

A further object is to provide a novel method of cleaning bath tubs and similar articles by one or more blast streams, which comprises locating the tub with its opening facing the streams and then transporting it past the streams and simultaneously rocking it so as to progressively clean the side wall, the bottom and the opposite side wall of the tub, and another object is to provide an apparatus for carrying out this method.

A further object is to provide an abrading apparatus having a plurality of blast wheels spaced along the path of article travel, and having means for translating and simultaneously rocking the articles as they pass certain wheels, and means for rotating them through one or more full revolutions as they pass the other wheels, the latter being so directed as to subject all of the surfaces of the articles to an abrading action.

A still further object is to provide an apparatus having means for conveying hollow articles in a continuous path past several blast streams and so manipulating the articles during part of their travel as to subject only their interior to the blast streams, and rotating them during another part of their travel to subject both their exteriors and interiors to the blast streams.

Further objects will become apparent as the specification proceeds in connection with the annexed drawings, and from the appended claims.

In the drawings:

Figure 1 is a top plan view of an apparatus embodying the invention, and in this view the

various positions of the article to be blasted as it is advanced and rocked is developed in diagrammatic form;

Figure 2 is an end elevational view, with parts in section, of the apparatus shown in Figure 1. The lower part of the view is taken substantially on the line 2—2 of that figure, while the upper part of the figure is taken along the line 2A—2A of Figure 1, in order to also illustrate the manner in which the work carriers cooperate with the sprocket and chain;

Figure 3 is a top plan view taken substantially along the line 3—3 of Figure 2 and illustrates the manner in which the work rocking arms cooperate with their respective guide ways, the articles being shown diagrammatically in this figure to simplify the disclosure;

Figures 4 to 9, inclusive, are diagrammatic views illustrating the manner in which the cleaning streams from the various wheels cooperate with the work to be cleaned;

Figure 4 is a view taken along the line 4—4 of Figure 1 and shows an overshot wheel, cleaning the upper portion of the inside surfaces of the tubs;

Figure 4a is an elevation of the right of rod 48 as viewed in Figure 4 showing the forked construction.

Figure 5 is taken along the line 5—5 of Figure 1 and shows an undershot wheel cleaning the lower portion of the inside of the tubs;

Figure 6 is taken along the line 6—6 of Figure 1 and shows an undershot wheel cleaning the exterior of the end wall and the lower portion of the inside surfaces of the tub and the manner in which the wheel cleans the outside surfaces of the tub when the latter has been rotated through 180° is shown in dotted lines;

Figure 7 is taken along line 7—7 of Figure 1 and shows an undershot wheel cleaning the lower part of the tub, the full lines showing the cleaning of the interior and the dotted lines showing the cleaning of the exterior;

Figure 8 is taken along the line 8—8 of Figure 1 and shows an overshot wheel cleaning the upper portions of the inside surfaces of the tub, and in this figure the dotted lines show how the wheel cleans the outside surfaces of the tub when the latter is rotated through 180°;

Figure 9 is taken along the line 9—9 of Figure 1, and shows an overshot wheel cleaning the top outside surface of the tub and also the inside of the tub, and the dotted lines show how it cleans the outside of the tub when the latter is rotated through 180° from the position shown; and

Figure 10 is a fragmental sectional view similar to Figure 2, but shows a modified form of mechanism for rotating the work.

With continued reference to the drawings, wherein like reference characters have been employed to designate like parts throughout the several views thereof, and with particular reference to Figure 1, the apparatus comprises a housing H having a slot in its roof, so that articles supported on an overhead conveyor can enter a door opening at one end of the housing, be transported through the housing and leave the housing through a door opening at the other end. During travel of the articles through the housing H they are subjected to the action of a plurality of abrading wheels B_1 to B_8, and are so manipulated automatically as to be efficiently cleaned. In order to minimize abrasive leakage into the atmosphere from the cabinet, the entrance and exit door openings are provided with a pair of doors 10 and 11 respectively, which are mechanically urged toward closed position. They are automatically opened by engagement of the articles therewith, as indicated in Figure 1.

Referring to Figure 2, secured to any suitable support 12 is a mono-rail 13, upon which a plurality of carrier assemblies 14 are mounted for traveling movement by rollers 15. The carriers 14 are spaced apart a predetermined distance on the mono-rail 13 and are coupled together by a sprocket chain 16. The chain 16 is driven in any suitable manner to propel the articles around the track 13. Each carrier 14 is provided with an offset portion 17 having a bearing support 18. The bearing support 18 is provided with an ear 19 and the ears 19 of adjacent carriers 14 are secured together by short links 21 which are secured to the ears 19 by means of cap screws 22. These links 21 exert a stabilizing influence upon the carriers 14 and prevent them from rocking about other than vertical axes with respect to each other.

In order to limit the swinging movement of the lower ends of the carriers 14 to the left, I have provided a roller 24, journalled in a pair of arms 25 on each carrier 14 and it rolls along a horizontally disposed track 26 which is secured to any suitable stationary support in any desired manner.

Journalled in a bearing in support 18 is a shaft 28 having a sprocket 29 and a pair of arms 31 and 32 secured thereto. Sprocket 29 is employed to effect complete rotation of the work in the secondary blast zone as will be hereinafter set forth. Secured at the lower end of shaft 28 by means of a coupler 33 is a work supporting hook 34 or the like. In order to prevent excessive lateral or side sway of the hooks 34 as they pass through the cabinet H, a pair of angle guide members 35 and 36 are mounted on each side of the hooks and disposed parallel to its path of travel, so as to form a confining track.

As seen in Figure 2, the carrier hooks 34 extend through a large longitudinal opening provided in the top of the housing H between a pair of channel members 37 and 38. Cooperating with the channel members 37 and 38 are a pair of sealing assemblies 39 and 41, each comprising a pair of flexible rubber flaps 42 and 43 which readily open up and allow the passage of hooks 34 but close and substantially seal the opening against abrasive escape between adjacent hooks 34.

The entire series of carriers 14 are accordingly mounted for traveling movement in a generally horizontal plane into the cabinet entrance opening; through the cabinet in a straight path; and out of the cabinet through doors 11. The carrier assembly 14 may be driven at any desired uniform speed by any suitable mechanism associated with chain 16. The mono-rail support 13 is preferably so shaped as to define a closed circuit and return the carrier assemblies 14 to the starting point. A loading station may be located adjacent entrance doors 10 and an unloading station adjacent doors 11, but if desired the unloading and loading stations may be combined as one adjacent doors 10, depending upon the requirements of the installation involved. Since the articles are not rotated or blasted on their return trip to the starting point the carrier assemblies 14 may be returned along a path located outside the cabinet H, as indicated at 45 in Figure 1. If desired, however, the carriers 14 may take a return path through the housing H to the loading

station, as indicated by the arrow 45a in Figure 1. In that case, and if the work is left on the carriers 14 on the return trip, they are blasted by any abrasive that fails to strike the articles undergoing treatment in the primary and secondary cleaning zones. To further this action, the spacing is preferably designed to stagger the carriers 14 of one path with respect to the carriers 14 of the other path to insure efficient cleaning of the articles as they successively pass the wheels.

As previously pointed out, the invention is primarily concerned with the efficient cleaning of hollow articles, and in the present instance the cleaning of bath tubs subsequent to their removal from the molds have been taken as illustrative of the invention. Referring to Figure 4, a bath tub is designated at T and carries a pair of ears 46 and 47 through which a rod 48 extends.

The tubs are suspended on a rod or fixture 48, having a suitably bent pin 47 entering the drain hole. Additional spacers 46 attached to or formed on rod 48 frictionally engage the bottom of the tub and space the rod from the tub proper and urge the tub into a vertical position. Preferably the lower end of rod 48 is forked, as shown in Figure 4a, so that the two spacers cooperate with pin 47 to define a stable three point support. Many other different types of supporting fixtures 48 may be provided to best suit the contour, weight and length of the various tubs or other articles to be cleaned. The upper end of rod 48 is offset at 49 and provided with a hook 51, for attachment to hook 34.

Rods 48 are hung on hooks 34 with the bath tub disposed "on end," and it is mounted for angular movement approximately about its center of gravity as an axis by reason of the rotatable mount for shaft 28.

The efficient cleaning of the tubs T is effected by the novel apparatus and methods that will now be set forth. Assuming that tub T, shown in Figure 4, has been mounted upon hook 34, and the conveyor is operating, its carrier 14 will advance it through doors 19 and into housing H. Before it enters the housing H however the loader will preferably swing it into a predetermined angular position, so that a roller 52 carried by arm 31 will enter the mouth 53 of a cam track 54. This condition is diagrammatically shown in Figure 3, and in Figure 2 the cam track is shown as being made up of a pair of angle members 55 and 56 carried by a support 57, and secured thereto by bolt and nut assemblies 58, although the cam track may assume any other suitable desired form, without departing from the spirit of the invention.

When roller 52 enters the mouth of cam track 54, as shown in Figure 3, the tub will assume the position shown in that figure and also as shown by the tub T_1 shown just entering the chamber H in Figure 1. As the tube T_1 advances into the housing H, roller 52 will ride against the curved portion of track 54 and rock the tub T_1 into the position illustrated by tub T_2 in Figure 1. When the tub attains this position, the edge of its inner side wall is impinged by the stream S_1 of wheel B_1. As seen in Figure 4, each wheel projects slightly into the housing through an opening 59, and is provided with an individual casing 61 for preventing stray abrasive from finding its way into the atmosphere.

The abrasive propelling wheel may be of any desired character. For instance, it may be a bladed centrifugal throwing wheel of the character shown in Rosenberger and Keefer Patent No. 2,108,211, dated February 15, 1938, or Keefer Patents Nos. 2,108,005 and 2,108,006, dated February 8, 1938. If desired, however, it may be a bladeless wheel of the character shown in Keefer Patents Nos. 2,116,152 and 2,116,153, dated May 3, 1938.

With the tub in the position T_2 just described, the cam track 54 and roller 52 assume the position shown in Figure 3. Upon further advancing movement of the carriers 14, roller 52 (associated with tub T_2) enters a reversely curved portion 63 of track 54 and starts to rock the tub back toward its original entering position. As this combined advancing and rocking movement is taking place, blast stream S_1 progressively sweeps over the upper part of the side wall of the tub, and when roller 52 reaches the end of track 54 the tub has passed through the position T_3 and assumes the position T_4, Figure 1. When this position is attained, stream S_1 has swept over approximately one-fourth of the bottom of the tub, as indicated by the intersection of stream S_1 with the tub bottom as shown in Figure 1. The dotted lines S_h and S_t indicate the extent of the head and tail streams of the wheel.

When position T_4 is attained, a roller 65 carried by arm 32 starts to enter the mouth of a second cam track 66, which may be constructed in the same manner as cam track 54. This condition is indicated in the lower part of Figure 2. As the advancing movement further progresses, roller 65, riding over the curved portion of track 66 rocks arm 32 in the opposite direction so as to cause stream S_1 to sweep over the bottom of the tub. When the roller attains the dotted line position in track 66 shown in Figure 3, the tub will assume the position T_6 in Figure 1 and line S_1 shows that the upper part of the bottom has been swept over once by the blast stream. As the advancing movement progresses, roller 65 engages curved portion 68 of track 66 and rocks the track in the opposite direction, and after passing through the positions T_6 and T_7, it leaves blast stream S_1. The intersection of stream S_1 with tub positions T_6 and T_7 in Figure 1 shows that the opposite side wall is completely cleaned during this phase of operation.

The ends of tracks 54, 66 and the other tracks are spaced from the path of travel of shafts 28 to freely clear them, the path of travel being indicated by the broken lines 28a in Figure 3. Also, in order to insure that the tubs will accurately follow the angular movement of arms 31 and 32, hooks 34 and 51 fit closely to avoid lost motion.

Roller 52 of arm 31 then enters the mouth of the third track 69, which rocks the tub into the position T_8 as the tub enters the stream S_2 from wheel B_2. Upon further advancing movement roller 52 engages the reversely curved portion 70 of track 69 and rocks the tub through the position T_9 into the position T_{10}. As this action is taking place stream S_2 cleans the side wall and a part of the bottom of the tub.

As roller 52 is about to leave track 69, the tub assumes the position T_{10}, and upon further advancing movement roller 65 of arm 32 enters a fourth track 72 and rocks the tub through the positions T_{11}, T_{12}, and T_{13} to complete the cleaning of the bottom and the other side wall of the tub.

The operation just described will be hereinafter termed the primary cleaning operation, and by

reason of the rocking mechanism and the arrangement of blast wheels, the entire inner surface of the tub has been completely swept over by the blast streams of wheels B_1 and B_2. The first wheel cleans the upper half of the internal tub surface as shown in Figure 4, and wheel B_2 cleans the lower half of the tub surface as shown in Figure 5. Arms 31 and 32 are preferably adjustably mounted on shafts 28 by means of set screws 31' and 32', respectively, so that their angular position may be varied to suit the work at hand. Also the cam tracks may be adjusted toward and away from the path of the carriers to vary the rocking action, or may be replaced by tracks of other configurations to insure the most efficient cleaning of the particular articles to be cleaned in the machine.

Although I have shown a particular mechanism for imparting the desired rocking movement to the tub as it is advanced through the primary cleaning zone, and it has proven entirely satisfactory, other rocking means may be employed without departing from the spirit of the invention.

The primary abrading action is complete after roller 65 leaves track 72, and the entire assembly is free to rotate about a vertical axis. If no further cleaning is desired the tubs may be removed, but I preferably subject them to a secondary cleaning operation as follows:

Upon further advancing movement, sprockets 29 of shafts 28 successively mesh with the portion 73 of a triple width sprocket chain 74 carried by two double sprockets 75, and 75a, which are spaced apart horizontally so as to dispose the chain parallel to the path of travel of the articles. One sprocket is carried by a sleeve 76 which is journalled in a bearing 77 and driven by any suitable prime mover. Journalled in the sleeve 76 is a shaft 78 carrying a second similar double sprocket 79. Passing over sprocket 79 is a triple sprocket chain 81 and it passes over an idler sprocket 79a, as in the case of chain 74.

Sprockets 29 are disposed in staggered relationship so that the sprockets of one group mesh with chain 74, and the sprockets of the other group mesh with chain 81, as seen in Figure 2. Shaft 78 is driven by any suitable prime mover but in the reverse direction to sleeve 76. If desired, they may be connected by reverse gear mechanism to the same prime mover.

By this arrangement, the shafts 28 of adjacent carriers 14 will rotate in opposite directions as they are translated past wheels B_3, B_4, B_5 and B_6, and I have found that this arrangement causes adjacent sides of two successive tubs to move in the same direction, thus avoiding harmful collision should they inadvertently contact one another.

The cleaning actions to which the tubs are subjected as they pass through the secondary blasting zone is illustrated in Figures 6, 7, 8 and 9.

As the tubs pass the respective blast wheels, they rotate about their axes, and although the rotative speed may be varied as desired, it is preferably adjusted to rotate each tub one complete revolution for each six inches of conveyor travel. In Figures 6 to 9, inclusive, however, the tubs are illustrated as assuming one position in order to simplify the disclosure.

In Figure 6, the tub is shown in front of wheel B_3 which is located considerably below the path of travel of the lower part of the tub, and is an undershot wheel. Stream S_3 of this wheel cleans the bottom or end wall of the article (which in this instance is the skirt of the tub) and also the lower portion of the inside of the tub. As indicated in dotted lines, when the article has been rotated through 180° from the position shown, the skirt of the tub is subjected to a further cleaning operation, and the stream also cleans the lower portion of the tub exterior.

In Figure 7 the cleaning action of wheel B_4 is illustrated. This wheel is located adjacent the lower part of the path of travel of the tub and is an undershot wheel, so as to throw a stream S_4 over the lower part of the inside of the tub. When the tub is reversed, as indicated by the dotted lines, the stream cleans the outside of the skirt and the lower portion of the bottom of the tub.

Referring to Figure 8, wheel B_5 is located with its axis adjacent the upper part of the path of travel of the tub and is an overshot wheel for cleaning the upper portions of the tub. Stream S_5 cleans the upper part of the inside and the upper part of the outside of the tub as the latter is rotated and translated past it.

Figure 9 illustrates wheel B_6, which is located above the path of travel of the upper part of the tub, and is an overshot wheel, throwing a stream S_6 down upon the upper end wall of the tub and also cleaning inclined end portion of the tub. When the tub is rotated through 180° the stream cleans the tub as illustrated in dotted lines, the stream still striking the top end wall of the tub and in addition cleaning the outside of the tub bottom.

The present invention therefore provides a novel method and apparatus for cleaning hollow articles, such as bath tubs and the like, and subjects them to an efficient, continuous automatic cleaning action, which subjects every bit of surface thereof to the abrasive throwing wheels, manual manipulation is avoided, and the cost per unit of work is low.

The advantages of rocking the articles while advancing and subjecting them to the cleaning action may be summarized as follows:

As the articles pass through the blast chamber and are subjected to the aforementioned primary and secondary cleaning operations, their internal and external surfaces are exposed to wheels B_1 to B_6, inclusive, as follows:

Wheel	Internal surfaces	External surfaces
	Percent	*Percent*
B_1	100	0
B_2	100	0
B_3	35	65
B_4	35	65
B_5	35	65
B_6	35	65
	340	260

The internal surfaces are therefore subjected to the major cleaning action. In the case of bath tubs and the like this is highly important because the internal surface must be carefully prepared to receive the subsequently applied coat of vitreous enamel. If desired the degree of internal cleaning may be further increased by including a further wheel in the rocking stage, and the external cleaning may be augmented by adding another wheel in the rotating stage.

On the other hand if the articles were merely rotated as they passed through the blast chamber they would be subjected to the same abrading action by each wheel. The external surfaces would receive 65 per cent and the internal sur-

faces 35 per cent of the blast. Totalling, the article would be blasted 390 per cent on its external surfaces and only 210 per cent on its internal surfaces, which is a highly undesirable ratio. If the article were again put through the machine to obtain a better finish on the interior, the exterior would be subjected to a blast of 780 per cent or severely "overblasted."

The invention completely obviates these difficulties in a simple and thoroughly efficient manner and makes it possible to clean hollow articles such as bath tubs and the like more efficiently, at less cost, and at a greater rate than heretofore believed possible.

Adjacent articles are preferably rotated in opposite directions in the secondary cleaning stage so that should they inadvertently contact each other, damage through chipping will not occur because the peripheries are travelling in the same direction and the impact is negligible. However, if smaller articles are treated, or they are spaced further apart to avoid any possibility of interference, the apparatus may be simplified by rotating them in the same direction.

If desired, the tubs may be all rotated in the same direction in the secondary abrading zone, and in Figure 10, I have illustrated a construction of this character. Referring to this figure, all of the sprockets **29** are disposed in the same horizontal plane and cooperate with sprocket chain **74***a* carried by a sprocket **75***a* mounted on a shaft **78***a*. Shaft **78***a* is journalled in a bearing **77***a* and it may be rotated by any suitable prime mover.

Assuming that the apparatus is to be operated with two workers, the loader is stationed adjacent doors **10** and places articles upon hooks **34** and rocks them into a convenient position so that roller **52** will readily enter mouth **53** of cam track **54**. The articles are then carried through the blast chamber and subjected to a primary and secondary cleaning operation, as previously described. Upon emerging through doors **11** the cleaned articles are removed by a worker and the hooks then travel back to the loading station. If desired, however, the articles may be applied to, and removed from the hooks adjacent doors **10**, in a combined loading and unloading station.

Although I have illustrated an apparatus and methods wherein the articles are rocked and subjected to a cleaning action in the primary blasting zone, and are rotated and cleaned in the secondary zone, it is to be understood that the operations may be reversed without departing from the spirit of the invention. For instance, the articles may be rotated by the drive sprockets in the primary abrading zone, and may then be rocked by the cam and track mechanism in the secondary cleaning zone, and the appended claims are intended to embrace my invention when it assumes this form.

The invention may be embodied in other specific forms without departing from the spirit or essential characteristics thereof. The present embodiments are therefore to be considered in all respects as illustrative and not restrictive, the scope of the invention being indicated by the appended claims rather than the foregoing description, and all changes which come within the meaning and range of equivalency of the claims are therefore intended to be embraced therein.

What is claimed and desired to be secured by United States Letters Patent is:

1. In an abrading apparatus for an irregularly shaped article, such as a bathtub or the like, a housing having a primary blasting zone and a secondary blasting zone; blasting means in said zones; a support mounted for travelling movement with respect to said housing, an article carrier mounted on said support for rotation about a substantially vertical axis; means for advancing said support so as to translate said article carrier through said housing; means for rocking said article carrier through a predetermined angle of less than 360 degrees about said vertical axis as it passes through said primary blasting zone for subjecting an article carried thereby to a primary abrading action; and means for continuously rotating said carrier as it travels through said secondary blasting zone, for subjecting the article to a secondary abrading action.

2. In an abrading apparatus for an irregularly shaped article, such as a bathtub or the like, a housing having a primary blasting zone and a secondary blasting zone; blasting means in said zones; a support mounted for travelling movement with respect to said housing, an article carrier mounted on said support for rotation about a substantially vertical axis; means for advancing said support so as to translate said article carrier through said housing; means for rocking said article carrier first in one direction and then in the opposite direction through an angle of less than 360 degrees about said vertical axis as it passes through said primary blasting zone for subjecting an article carried thereby to a primary abrading action; and means for continuously rotating said carrier as it travels through said secondary blasting zone, for subjecting the article to a secondary abrading action.

3. In an abrading apparatus for an irregularly shaped article, such as a bathtub or the like, a housing having a primary blasting zone and a secondary blasting zone; blasting means in said zones; a support mounted for travelling movement with respect to said housing, an article carrier mounted on said support for rotation about a substantially vertical axis; means for advancing said support so as to translate said article carrier through said housing; means for rocking said article carrier first in one direction and then in the opposite direction about said vertical axis as it passes through said primary blasting zone for subjecting an article carried thereby to a primary abrading action; and means for continuously rotating said carrier as it travels through said secondary blasting zone, for subjecting the article to a secondary abrading action.

4. In an abrading apparatus for an irregularly shaped article, such as a bathtub or the like, a housing having a primary blasting zone and a secondary blasting zone, blasting means in said zones, a support mounted for travelling movement with respect to said housing; an article carrier mounted on said support for rotation about a substantially vertical axis; means for advancing said support so as to translate said article carrier through said housing; means for rocking said article carrier into a predetermined angular position as it approaches said primary blasting zone, and being operable to rock said article carrier through a predetermined angle less than 360 degrees about said vertical axis as it passes through said primary blasting zone for subjecting an article carried

thereby to a primary abrading action; and means for continuously rotating said carrier as it travels through said secondary blasting zone, for subjecting the article to a secondary abrading action.

5. In an abrading apparatus for an irregularly shaped article, such as a bathtub or the like, a housing having a primary blasting zone and a secondary blasting zone, blasting means in said zones, a support mounted for travelling movement with respect to said housing; an article carrier mounted on said support for rotation about a substantially vertical axis; means for advancing said support so as to translate said article carrier through said housing; means for rocking said article carrier into a predetermined angular position as it enters said primary blasting zone, for causing the blasting operation to be initiated upon a predetermined area of the article carried thereby, and being operable to rock said article carrier first in one direction and then in the opposite direction about said vertical axis as it passes through said primary blasting zone for subjecting said article to a primary abrading action; and means for continuously rotating said carrier as it travels through said secondary blasting zone, for subjecting the article to a secondary abrading action.

6. In an abrading apparatus, a housing; a support mounted for translatory movement with respect to said housing; an article carrier mounted on said support for rotation about a substantially vertical axis; means for advancing said support so as to translate said article carrier through said housing; a plurality of blasting wheels arranged to project streams of abrasive into said housing; said blasting wheels being spaced apart along the path of translatory movement of said carrier to define a plurality of blasting zones; means for rocking said carrier through a predetermined angle of less than 360 degrees as it passes through one of said blasting zones, to subject only a portion of the surface of the article carried thereby to an abrading action; and means for rotating said carrier through one or more complete revolutions as it travels through another of said blasting zones, to subject all of the surfaces of said article to an abrading action.

7. The abrading apparatus defined in claim 6, wherein one of said blasting wheels is located adjacent the upper part of the path of travel of said article and is an overshot wheel for cleaning the tops and the upper part of the sides thereof, and wherein another of said blasting wheels is located adjacent the lower part of the path of movement of said article and is an undershot wheel for cleaning the bottom and the lower part of the sides thereof.

8. The abrading apparatus defined in claim 6, wherein said means for rocking said carrier comprises an arm supported on said carrier and having a free end riding in a stationary track.

9. In an abrading apparatus, a housing having a slot in its roof; a conveyor track located adjacent said housing and disposed parallel to said slot; a plurality of carriers mounted on said track and extending through said slot into said housing; said carriers being rotatable about vertical axes and operable to have articles suspended therefrom within said housing; a plurality of abrasive propelling devices for propelling streams of abrasive into said housing and providing a plurality of blasting zones therein; means for advancing said carriers through said housing, to successively carry articles suspended on said carriers through said blasting zones; cam means for rocking said carriers through a predetermined angle of less than 360 degrees as they pass through one of said blasting zones, and drive means for rotating said carriers through a full revolution as they pass through another of said blasting zones.

10. In an abrading apparatus, a housing having a slot in its roof; a conveyor track located adjacent said housing and disposed parallel to said slot; a plurality of carriers mounted on said track and extending through said slot into said housing; said carriers being rotatable about vertical axes and operable to have articles suspended therefrom within said housing; a plurality of abrasive propelling devices for propelling streams of abrasive into said housing and providing a primary and a secondary blasting zone therein; means for advancing said carriers through said housing, to carry articles suspended on said carriers through said blasting zones; cam means for rocking said carriers through a predetermined angle of less than 360 degrees as they successively pass through said primary blasting zone, and drive means for rotating said carriers through a full revolution as they pass through said secondary blasting zone.

11. In an abrading apparatus, a housing having a slot in its roof; a conveyor track located adjacent said housing and disposed parallel to said slot; a plurality of carriers mounted on said track and extending through said slot into said housing; said carriers being rotatable about vertical axes and operable to have articles suspended therefrom within said housing; a plurality of abrasive propelling devices for propelling streams of abrasive into said housing and providing a primary and a secondary blasting zone therein; means for advancing said carriers through said housing, to carry articles suspended on said carriers through said blasting zones; cam means for rocking said carriers through a predetermined angle of less than 360 degrees as they pass through said primary blasting zone, drive means for rotating said carriers through a full revolution as they pass through said secondary blasting zone, said cam means being operable to automatically rock said carriers into a predetermined angular starting position before they enter said primary blasting zone.

12. In an abrading apparatus, a housing having a slot in its roof; a conveyor track located adjacent said housing and disposed parallel to said slot; a plurality of carriers mounted on said track and extending through said slot into said housing; said carriers being rotatable about vertical axes and operable to have articles suspended therefrom within said housing; a plurality of abrasive propelling devices for propelling streams of abrasive into said housing and providing a plurality of blasting zones therein; means for advancing said carriers through said housing, to successively carry articles suspended on said carriers through said blasting zones; cam means for rocking said carriers through a predetermined angle of less than 360 degrees as they pass through one of said blasting zones, and drive means for rotating said carriers through a full revolution as they pass through another of said blasting zones, said means for advancing said carriers, said cam means and

said drive means all being located above said roof exterior to said housing.

13. In an abrading apparatus for an irregularly shaped article, such as a bathtub or the like, means for projecting a stream of abrasive, a support mounted for travelling movement, a carrier journalled on said support, and adapted to carry articles through said stream of abrasive, means for advancing said support, and cam means cooperating with said carrier for causing the latter to rotate through a predetermined angle less than 360 degrees, first in one direction and then in the opposite direction as said carrier is advanced.

14. The apparatus defined in claim 13, wherein said cam means comprises a cam track stationarily supported adjacent the path of travel of said carrier and cooperates with a lever rigidly supported on said carrier.

15. The apparatus defined in claim 13, wherein said cam means comprises a cam track assembly cooperating with a dual-armed lever assembly supported on said carrier, said lever-arms being individually adjustable to provide for variations in the rotating movement of said carrier.

16. An abrading apparatus comprising a blast chamber; blasting means in said blast chamber; a plurality of carriers for supporting articles to be blasted relatively close to one another for travel in single file through said blast chamber to present a substantially continuous surface to said blasting means; means mounting said carriers for rotation during their travel; and means for simultaneously rotating one group of carriers in one direction and another group in the opposite direction during at least a portion of their travel through said blast chamber, each carrier of one group being located between two carriers of the other group whereby the adjacent surfaces of adjacent articles move in the same direction relative to one another to minimize damage through contact with one another.

17. In an abrading apparatus for irregularly shaped articles such as bathtubs or the like having relatively deep cavities therein, a plurality of article carriers arranged to support said articles with said cavities in predetermined positions; substantially fixed blasting means defining a blasting zone, said blasting means being positioned at one side of said zone; means for continuously advancing said plurality of carriers to transport said articles successively past said blasting means with said cavities exposed thereto; and means for rocking each carrier through a predetermined angle of less than 360 degrees simultaneously with its advance, so as to limit the blasting of the article carried thereby to the cavity side.

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