April 29, 1941. C. H. HAMMELL 2,240,246

APPARATUS FOR CLEANING METAL ARTICLES

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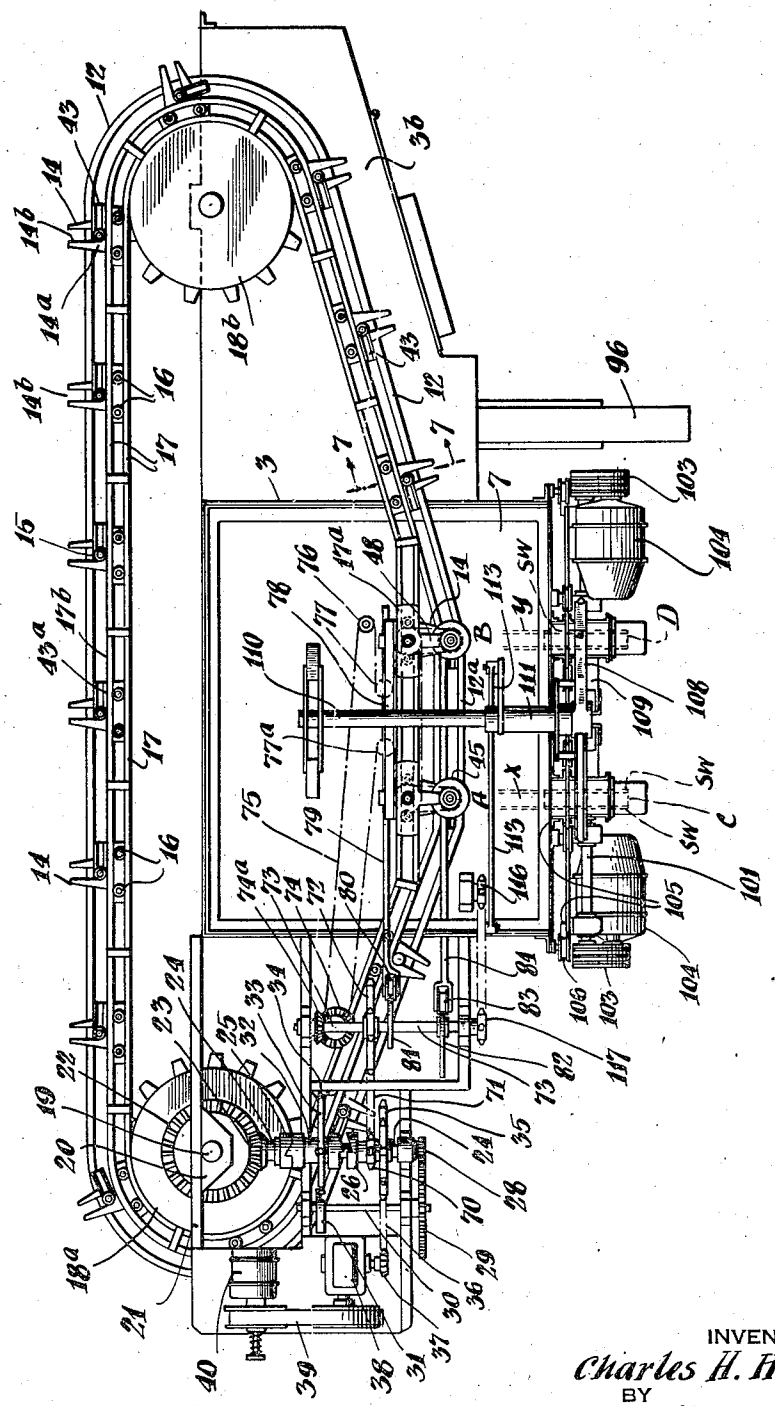


Fig. 1

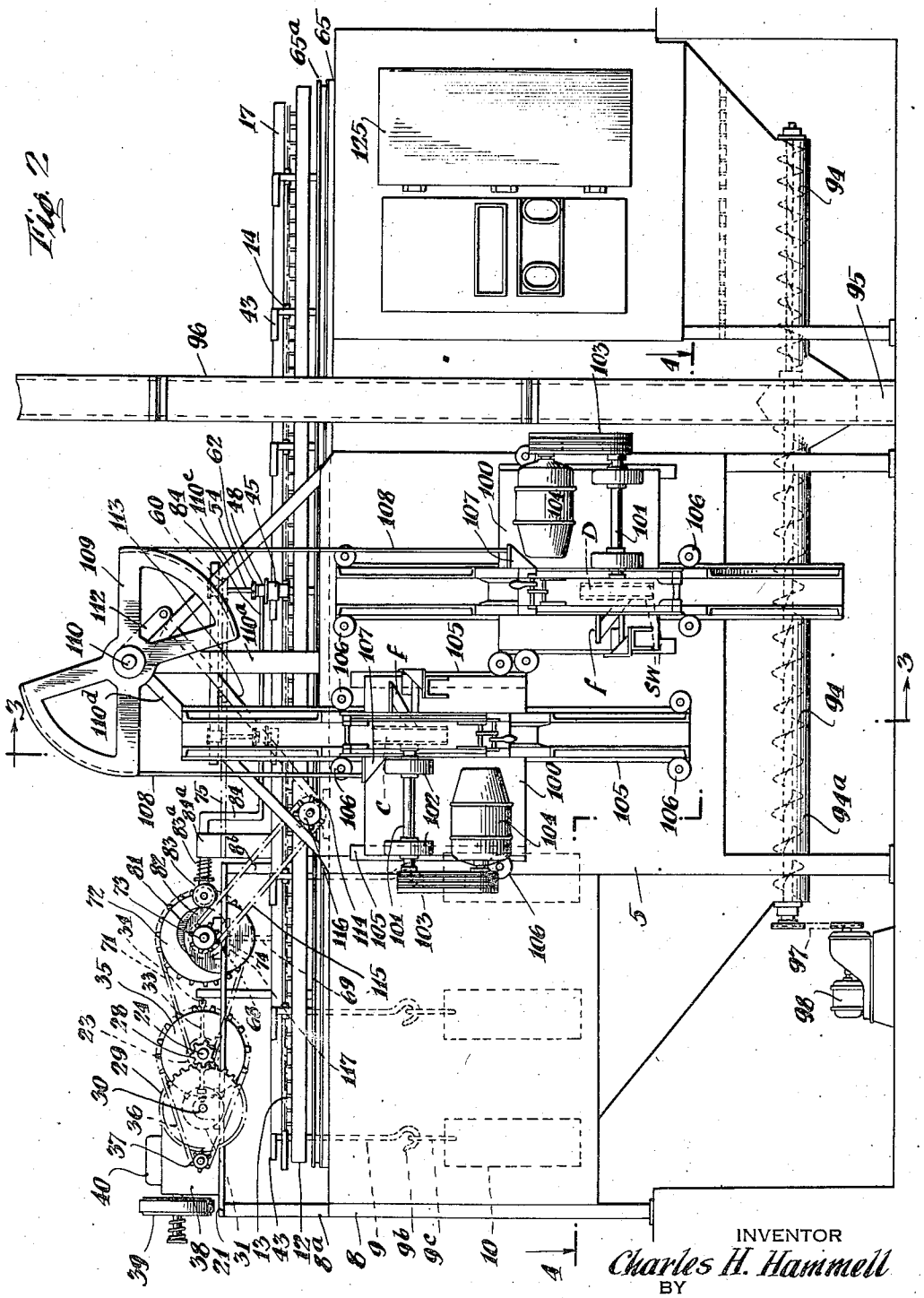
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Fig. 2



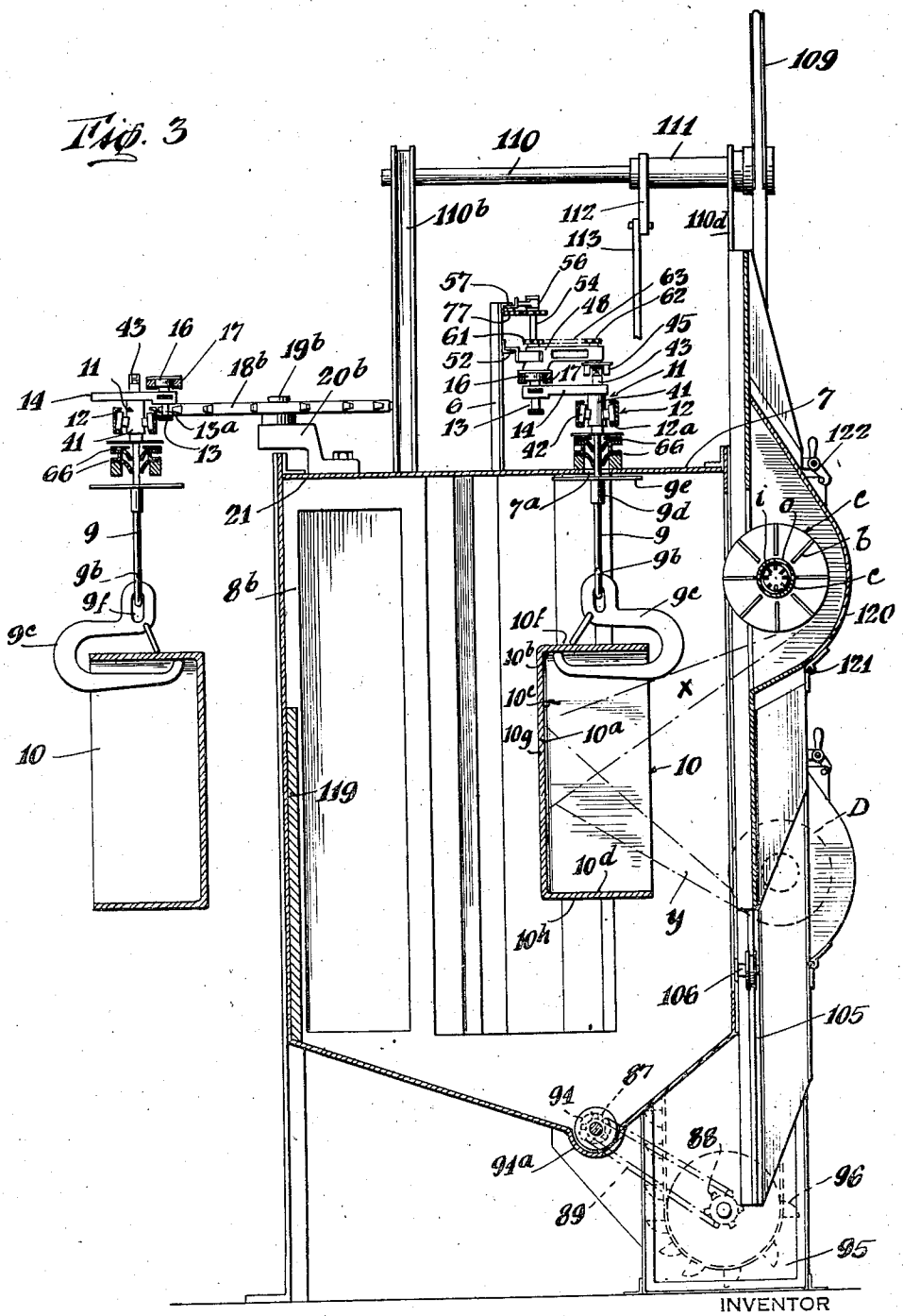
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Fig. 3



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Fig. 8

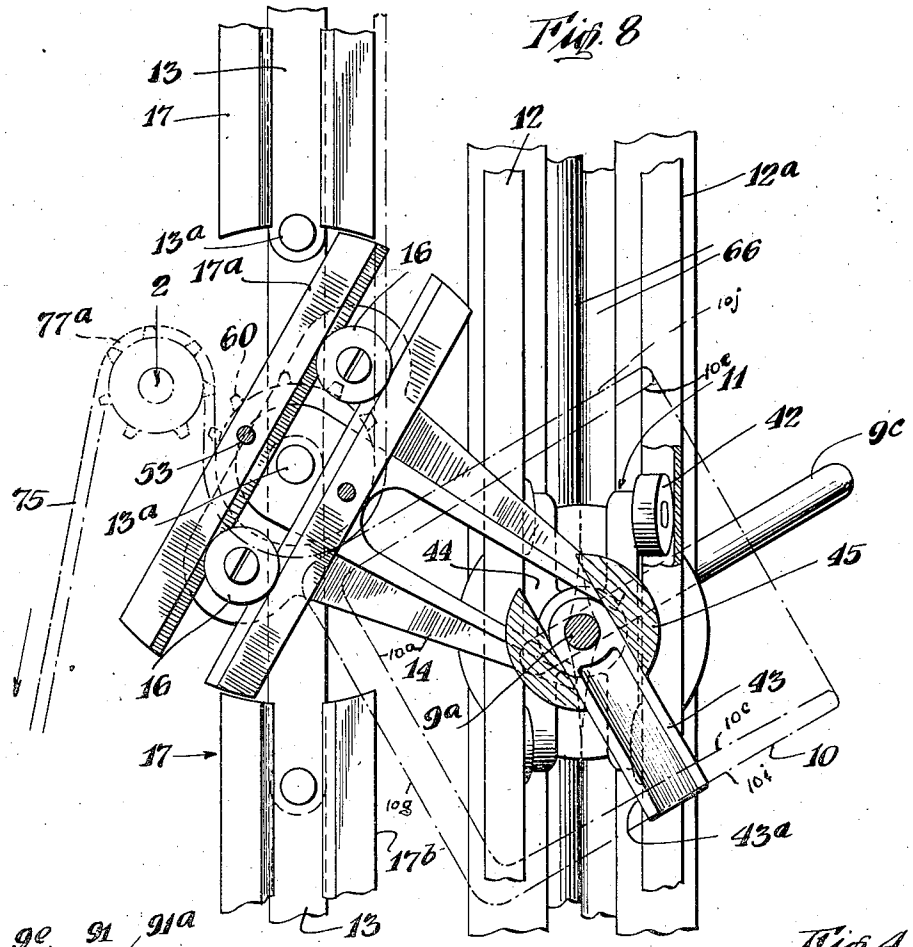
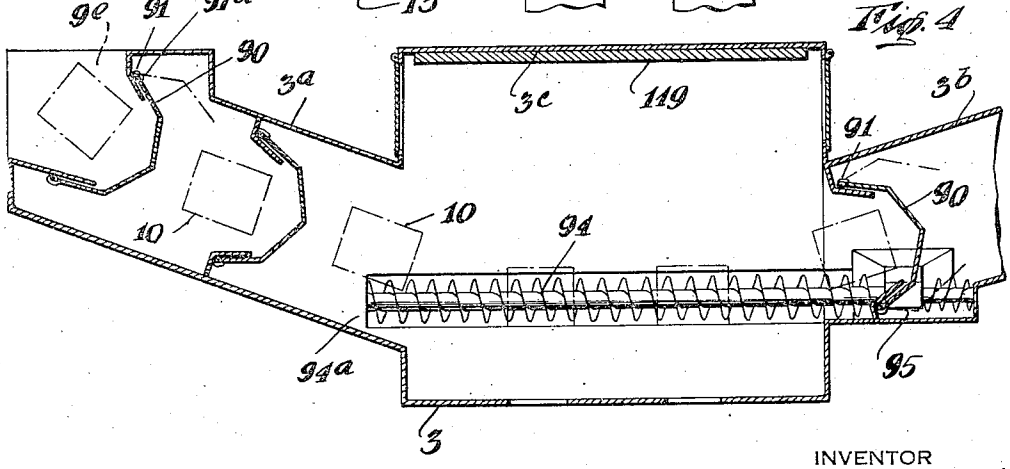


Fig. 4



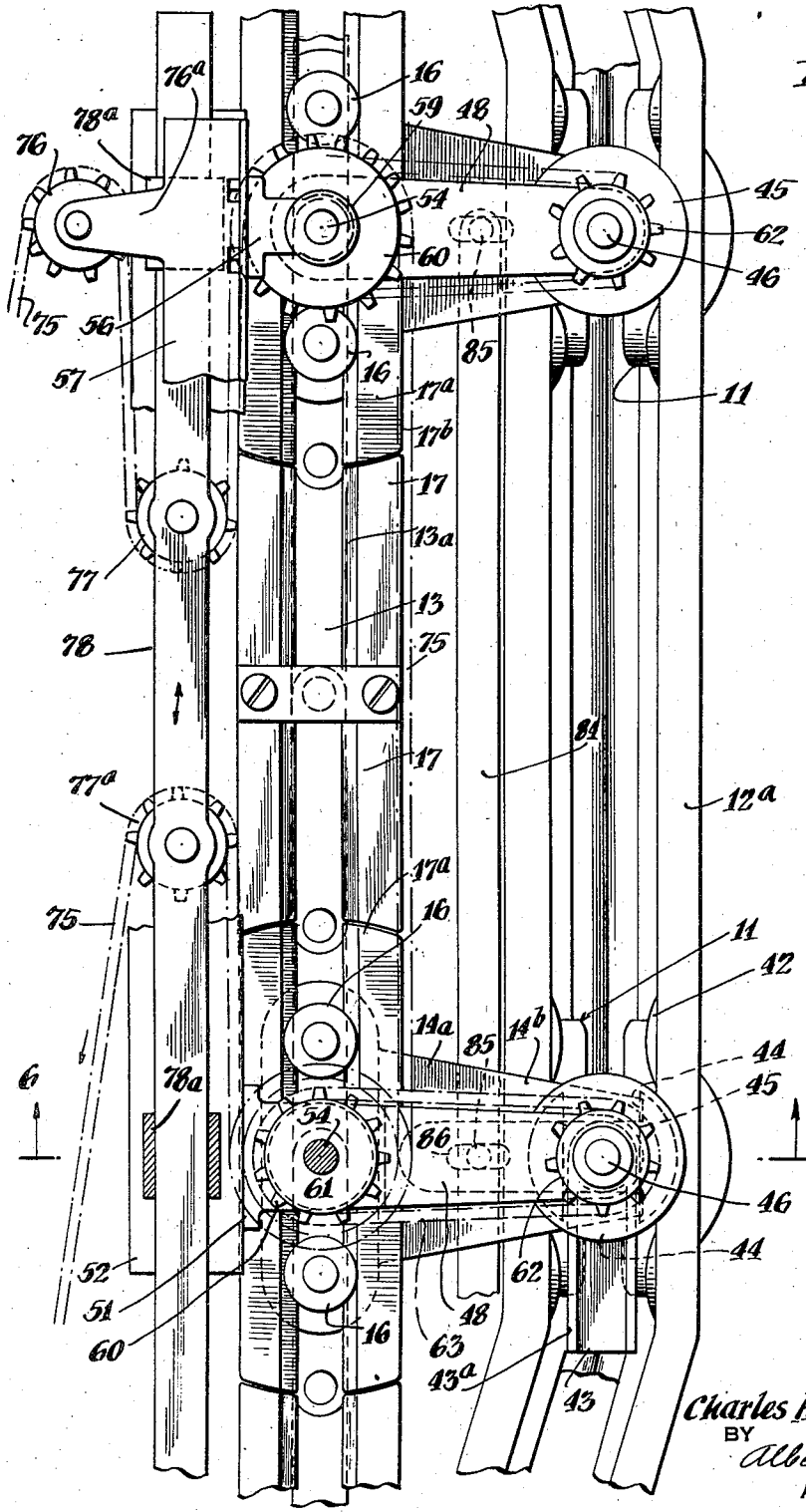
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Fig. 5



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Fig. 6

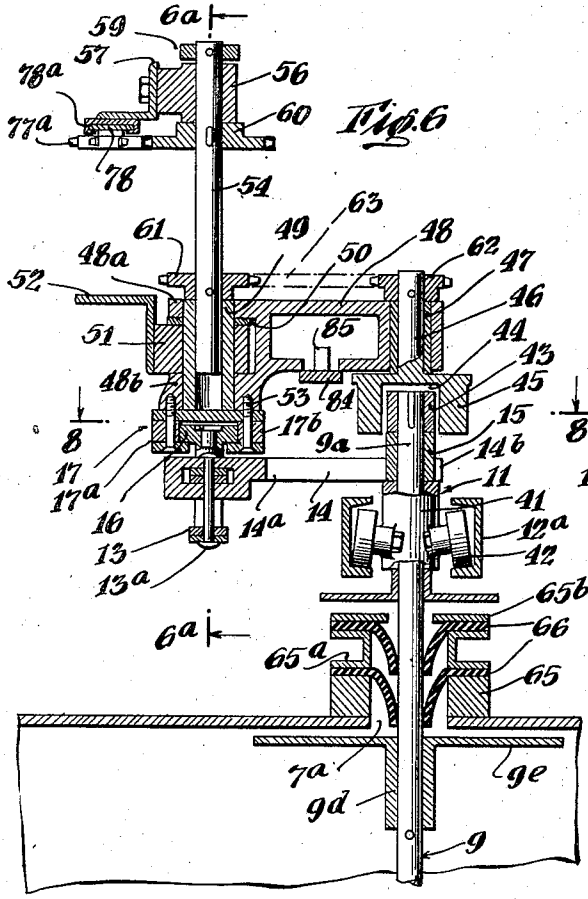


Fig. 7

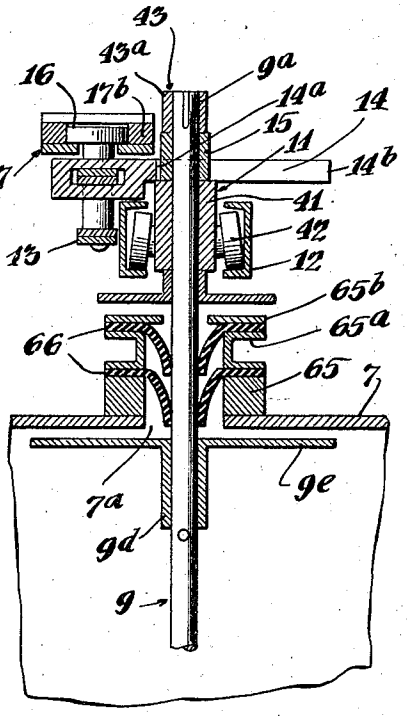
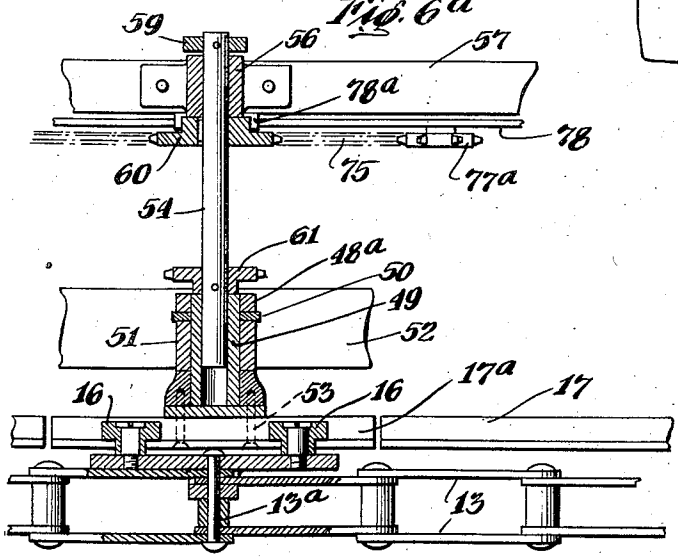


Fig. 6a



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Patented Apr. 29, 1941 2,240,246

UNITED STATES PATENT OFFICE

2,240,246

APPARATUS FOR CLEANING METAL ARTICLES

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Application June 12, 1939, Serial No. 278,643

7 Claims. (Cl. 51—9)

This invention relates to the art of cleaning, polishing, hardening or otherwise modifying the surface characteristics of metal articles such as castings, forgings or the like, by the use of one or more streams of abrasive or polishing materials. It is particularly concerned with cleaning or otherwise treating heavy metal castings such as bath tubs, sinks, cylinder blocks, engine bases, furnace parts and the like which have certain surfaces requiring treatment different from that required by certain other surfaces.

In cleaning such articles it is ordinarily desirable to relate the stream of abrasive to the article in such fashion as uniformly to subject the exposed surfaces of the article to a uniform abrasive action from the abrasive particles. When the articles are small and sufficiently rugged to withstand such treatment they may be tumbled in various kinds of apparatus designed for this purpose. When they are large and heavy or when they are insufficiently rugged to withstand a tumbling treatment it is necessary to mount them independently in such fashion that they may be conveyed to and from the abrasive stream without undue stress and with minimum loss of time, power and labor and with maximum efficiency. Preferably the treatment of such large articles should be accomplished in such a way that the articles are treated successively as they are brought within effective range of the abrasive projecting stream and are conveyed thereto and therefrom in a substantially continuous column.

Where such heavy articles have certain surfaces which require little or no cleaning, and certain other surfaces that require a high degree of cleaning, it is not commercially economical to subject all their surfaces to the same degree of treatment. Such is the case in the manufacture of bath tubs, sinks and the like to which a hard, smooth, lustrous coating of porcelain enamel must be applied to the surfaces that are to be exposed, yet which have certain other surfaces which will be concealed in the constructional elements of the building or other structure in which they are to be installed and which do not require such a finish. These latter surfaces require little or no cleaning, and the cleaning thereof in an abrasive projecting apparatus in the ordinary manner results in increased manufacturing costs with no resultant benefit.

It has been proposed to mount certain kinds of articles on supports and to carry the same into the path of an abrasive stream while imparting a rotative movement to the supports. It has also been proposed to reciprocate a casting in a vertical direction and simultaneously to subject it to the abrasive action of a sand blast. With such devices it has not been possible to regulate the degree of abrasive action on predetermined parts of the exposed surfaces of the work piece and they have been otherwise unsuitable for the efficient and economical treatment of the large articles alluded to above.

It is an object of the present invention to provide apparatus for cleaning articles of the nature described by abrasive streams, in which the movement of the articles and the movement of the streams, are controlled and regulated so that certain predetermined portions of their surfaces are subjected to a more intense treatment than certain other predetermined portions.

It is a further object of the invention to provide apparatus of the nature described in which the cleaning operation is concentrated upon certain predetermined surfaces, for instance upon those which will ultimately require a finish, and thus to avoid the loss of time, labor and power which would be entailed if the whole of said surface of the article were subjected to identical treatment.

It is a further object of the invention to provide a cleaning system for heavy metallic castings which is simple in construction and economical and efficient in operation and which yields beneficial and commercially desirable results.

A further object of the invention is to provide an apparatus for efficiently cleaning castings, in which the latter are suspended from movable supporting mechanisms which are intermittently moved into such positions that one or more castings can be subjected to the action of a controlled abrasive stream from one or more abrasive projecting wheels, during which time the said castings are subjected to a predetermined movement or a series of movements within the abrasive stream in order that certain surfaces thereof may receive a less intense blasting treatment than certain others or in order that certain surfaces may pass through said stream substantially unaffected by the blasting action thereof.

A still further object is to provide a conveying means which moves the articles to be cleaned rapidly to and from one or more cleaning stations.

According to the present invention the article to be treated is suspended by means of a conveyor mechanism which interposes the minimum of obstruction to the rapidly moving abrasive or

other treating materials that are directed against the article. The article is transported along a predetermined path, preferably closed, and into one or more abrasive streams. During the movement of the article along its path it is stopped at predetermined times and moved and rotated in the abrasive stream to expose certain areas of its surface to the maximum abrasive effect of the stream and to expose certain other areas to the minimum abrasive effect thereof. Each treating stream is projected in a generally fan-like formation whereby the several portions of the stream strike the article at varying angles thereby effectively treating both the raised and the depressed surfaces thereof.

Preferably a plurality of abrasive projecting stations are provided at which abrasive projecting mechanisms are provided and arranged to move in a direction generally transverse of the direction of movement of the article in order more thoroughly to clean the same and to distribute the abrasive stream thereover. A housing provided with suitable ingress and egress openings is provided to enclose the articles as they are subjected to treatment. The driving and controlling mechanisms for the various operating parts are disposed outside of this housing and thus protected from wear and damage which might result from contact with the abrasive.

Various other features and advantages of the invention will more clearly appear from the following specification taken in conjunction with the accompanying drawings.

Although the novel features which characterize the invention are particularly pointed out in the claims appended hereto, the invention, its object and advantages, and the manner in which it may be carried out will be better understood by referring to the following description taken in connection with the accompanying drawings in which:

Fig. 1 is a plan view of an apparatus by means of which the principles of the invention may be utilized;

Fig. 2 is a front elevation thereof;

Fig. 3 is a section taken along lines 3—3 of Fig. 2 in the direction of the arrows;

Fig. 4 is a horizontal section showing the lower portion of the treating chamber and the means of ingress thereto and egress therefrom;

Fig. 5 is an enlarged plan view with parts broken away showing the position taken by certain trolley units and their associated mechanisms during the time they carry objects through the abrasive stream;

Fig. 6 is a section taken along lines 6—6 of Fig. 5;

Fig. 6*a* is a section taken along lines 6*a*—6*a* of Fig. 6;

Fig. 7 is a section taken along lines 7—7 of Fig. 1; and

Fig. 8 is an enlarged section taken from the same point of observation as in Fig. 5, along line 8—8 of Fig. 6.

In the following description and in the claims various members will be identified by specific names for convenience, but they are intended to be as generic in their application as the art will permit.

Like reference characters denote like parts in the several figures of the drawings.

In the drawings accompanying and forming part of this specification, certain specific disclosures of the invention are made for purposes of illustration and explanation, but it will be understood that the details may be modified in various respects without departing from the principles of the invention.

It will be observed from an examination of Figs. 1 to 3 that the invention comprises separately suspending a plurality of articles 10 by means of spindles 9 from separate trolley units 11 and conveying the same, preferably in a closed path, about track 12. The units 11 are conveyed by means of a driven chain 13 carrying a plurality of bifurcated driving yokes 14, each of which engages a bushing 15 on the upper end of spindle 9 so that the trolley unit with which it is associated may be advanced along the track 12. The chain 13 supports the yokes 14 by means of extended pins 13*a* and the said yokes are supported and guided by horizontal rollers 16 operating in a secondary closed track 17 located inside and slightly above the trolley tracks 12.

The conveyor structure above described is illustrated in greater detail in Figures 5 and 7.

During their travel around track 12, the trolley units 11 are stopped at one or more stations where the suspended articles are subjected to the action of an abrasive stream. Preferably, the articles are treated in pairs, one at station A and the other at station B (see Fig. 1), at which they are subjected to the action of the abrasive streams *x* and *y* from abrasive projecting wheels C and D, respectively. These wheels are preferably mounted for vertical movement, as will hereinafter be described, and comprise (see particularly Fig. 3) blades *b* radially disposed between side walls *sw* (Figs. 1 and 2), at least one of which is secured in known manner to a shaft 101 for rotation by motor 104 through drive 103.

The blades *b* terminate short of the axis of rotation of the wheel in order to define a central aperture in which is disposed a control cage *c* having an opening *o* therein. Within the cage *c* is an impeller *i* for impelling abrasive fed centrally of the device through a feed pipe *f*.

The construction of the abrasive projecting devices as thus briefly described is now well known in the art and need not be further described. Abrasive fed into the feed pipes or spouts *f* is acted upon by the rotating blades *b* after it is flowed thereon through opening *o* in cage *c* and is thrown from the blades *b* at high velocity in the form of a generally fan-shaped spray as shown at *x* or at *y* in Figure 3, the direction, volume and extent of the abrasive stream being controlled by the regulation of factors well known in the art.

The particular structure of the individual trolley units 11 and their associated mechanism will more clearly appear from an examination of Figures 5 and 7. Referring particularly to Figure 7, the spindle 9 is rotatably mounted in the body member 41 of the trolley unit 11 and carries at its upper end 9*a* a hardened bushing 15, free to turn about the spindle 9 and adapted to make a rolling contact with the inner edges of the bifurcated driving yoke 14 (see Fig. 1). Above the bushing 15 a guide follower 43 is keyed to the upper end 9*a* of shaft 9. Throughout the greater portion of the travel of the trolley unit 11 around track 12 the side wall 43*a* of guide follower 43 contacts the side walls 17*b* of track 17 thereby preventing rotation of the spindle 9 until the trolley unit is moved onto the outwardly extended portion 12*a* of track 12 so as to bring the trolley units 11 in such position as to suspend the articles 10 within the blast zone. Guide

follower 43 also serves to engage the spindle 9 with the spinner head 45 when the trolley unit 11 is in blasting position as will hereinafter be described.

Two pairs of wheels 42 extend from the body portion 41 of the trolley unit 11 and engage the lower rail of the track 12 so that the trolley units 11 may be conveyed around the track 12 as the chain 13 moves driving yokes 14 along their prescribed path. Each spindle 9 extends downwardly through a slot 7a in the top wall 7 of the blasting cabinet and carries a sleeve 9d provided with a circular abrasive baffle 9e on its intermediate portion immediately below the slot 7a and a hook member 9b at its lower end portion, the latter being adapted to engage an eye 9f in the hook member 9c which carries the article 10 to be cleaned, which in the instance shown is a hollow casting of generally rectangular configuration.

Adjacent the slot 7a in the top of the cleaning cabinet 7 may be provided sealing members 66 preferably of rubber or similar flexible material held in place by holding members 65, 65a and 65b.

The chain 13 which drives the trolley units is carried by sprockets 18a and 18b located at opposite ends of the cleaning cabinet 7. Referring to Figs. 1 and 2 the driving sprocket 18a is mounted on shaft 19 journaled in a bearing disposed in bracket 20 affixed to the upper longitudinal frame member 21 disposed on uprights 8a, 8b. Shaft 19 carries gear 22 arranged in operative engagement with a gear 23 secured to clutch member 25 which is rotatably mounted on the end of shaft 24 which is journaled in suitable bearings in the framework of the machine. A clutch member 26 fixed to drive sprocket 70 is also rotatably mounted on the shaft 24. A clutch sleeve 32 positioned between the clutch members 25 and 26 is mounted for reciprocating moving on the shaft 24 but rotates therewith. Shaft 24 is driven from a motor 40 through sprocket 35, drive 36, sprocket 37, reduction gears 38 and drive 39 which latter may advantageously be of the variable speed type.

Also operating from shaft 24 is a countershaft 30 driven by gear 29 meshing with pinion 28 on shaft 24 and being provided with a cam 31 cooperating with a cam follower disposed upon a lever 33 pivoted intermediate its ends on the clutch sleeve 32 and at its opposite end on a bracket 34 affixed to the framework of the machine. The gears and cams are selected and arranged so that the cam 31 moves clutch sleeve 32 into alternate engagement with clutch members 25 and 26 for predetermined intervals of time. When the clutch sleeve 32 is in engagement with clutch member 25 power from the motor 40 is applied to the shaft 19 so that the conveyor 13 is activated to move the trolley units 11 around the track 12.

When the clutch sleeve 32 is engaged in clutch 26, power is transmitted to the mechanisms which impart the desired movement to the article to be cleaned while they are suspended at stations A and B. These mechanisms will now be described:

As the trolley units 11 move into stations A and B, the track 12 is separated from track 17 as at 12a so that the bushing 15 rides from the inner ends 14a of the driving yokes 14 to the outer ends 14b as the track 12a causes the trolley units 11 to move outwardly. During this movement the guide followers 43, which have been hugging the side of the conveyor track 17 as previously described are free to engage the spinner head 45. Thus the relationship of parts changes from that indicated at 7—7 of Figure 1 and in Figure 7 to that shown in Figures 5 and 6.

The initial position of the spinner head 45 and its associated mechanism will be seen from an inspection of the upper part of Figure 6 when related to Figure 5. This mechanism imparts controlled rotative movements to the spindle 9 and at the same time oscillates it slowly in a direction transverse to the abrasive stream. By the combined movements thus imparted to spindle 9 predetermined surfaces of the article 10 may be subjected to varying degrees of abrasive action as the article is simultaneously oscillated and rotated in the abrasive stream.

As indicated in the figures the spinner head 45 is provided with a slot 44 adapted to engage the guide follower 43. The spinner head 45 is mounted on a shaft 46 journaled in a sleeve bearing 47 disposed at the end of an arm 48 which is free to turn in a predetermined angle about a bushing 49 and thrust washer 50 located at the other end 48a of the arm 48. Bushing 49 is disposed in a stationary supporting member 51 secured to a bracket 52 in turn secured to stanchion 6 (see Fig. 3) fixed to the framework of the machine.

A short section 17a of track 17 is secured to the lower portion 48b of arm 48 below bushing 49 by suitable means, as by screws 53. When the spinner head 45 is in engagement with guide follower 43, the rollers 16 supporting yokes 14 and chain 13 are within the short section 17a of track 17, and when the arm 48 is rotated about bushing 49 the yoke 14 is simultaneously rotated throughout the same angle. Thus the spinner head 45 and yoke 14 are given an oscillatory movement which is accomplished by means of a connecting rod 84 secured to the lower web of the arm 48 by pin 85 in a manner presently to be described.

The inside bore of bushing 49 acts as a lower journal for the spinner unit drive shaft 54 the upper end of which is journaled in a bearing 56 attached to a bracket 57 carried by the stanchion 6 affixed to the framework of the machine. The shaft 54 is held from endwise movement by collar 59 and sprocket 60, and the lower portion of shaft 54 carries sprocket 61 connected to sprocket 62 on shaft 46 by chain 63.

A controlled rotative movement is imparted to the spinner mechanism by chain 75 trained around sprocket 60 on each spinning device, idlers 77 and 77a, idler 76 and sprocket 68 on vertical shaft 69 (see Figs. 1 and 5). Idlers 77 and 77a are disposed on a movable cross head 78 reciprocable in the direction of the arrow (see Fig. 5) in bearings 78a. The idler 76 is supported in a bearing which is fixedly secured to a bracket 76a in the framework of the machine.

Shaft 69 is rotated through bevel gears 74 and 74a from shaft 73, which carries sprocket 72 driven by chain 71 from sprocket 70 on shaft 24 when clutch sleeve 32 is in engagement with clutch member 26.

The cross head 78 which carries sprockets 77, 77a is reciprocated by a connecting rod 79, the end of which carries a cam follower 80 running on cam 81 disposed on shaft 73. Shaft 73 also carries a second cam 82 coacting with cam follower 83 on rod 84. The arms 48 are pivotally connected to the rod 84 by pins 85, each pin 85 extending through a slot 86 in one of the arms 48, in the manner previously described. The cam 82 imparts an oscillatory motion to arms 48 so that they oscillate throughout a predetermined

angle about the bushings 49. This moves track section 17a and associated mechanism so that the yokes 14 are moved throughout the same angle as is illustrated in Fig. 8.

When the trolley units 11 arrive at station A, the guides 43 engage spinner heads 45 through slots 44 and the parts take the position shown in Figs. 5 and 6. At the same time, the clutch member 32 disengages from clutch member 25 and engages in clutch member 26. This stops the forward movement of the trolley units and puts the spinning and oscillating mechanism into operation. Through the driving connections previously described, the chain 75 is thus started on its travel around the sprockets 68, 76, 77, 60, 60 and 77a and imparts rotary motion to spindles 9 through sprockets 60, 61 and 62 and chain 63. Let us say that during this time, the chain 75 is traveling in the direction of the arrow in Fig. 5 at a predetermined speed.

When the action of the cam 81 is such as to move the cross head 78 to the left in the direction of the arrow in Fig. 5, part of the movement of chain 75 is absorbed, thereby reducing the rate of speed of rotation of sprockets 60 and shafts 54, which reduction of speed is communicated by the means previously described to the spindles 9. During this time the spindles rotate more slowly and by properly positioning the objects 10 on their carriers predetermined surfaces thereof may during this time be subjected to the full effect of the abrasive streams. When the cam 81 is further rotated to such position as to push connecting rod 79 toward the right, the cross head 78 is likewise moved to the right and will cause an increase in the speed of rotation of the spinner-unit driving shafts 46. During the time this is going on, the cam 82 operating through cam follower 83 and rod 84 causes the arms 48 and yokes 14 to oscillate about an axis coincident with the center of the shaft 54, as shown in Fig. 8, and thus causes the articles 10 suspended at the ends of spindle 9 to oscillate slowly through and across the respective abrasive streams *x* and *y*. The oscillation of the trolley units 11 through the angle determined by cam 82, and the slow and rapid turning of the spindle hook carrier 9 may be timed to expose the work most advantageously to the action of the abrasive stream from devices C and D. In the case of bath tubs it is preferable to turn the articles slowly while their interior surfaces 10a, 10b, 10c, 10d and 10e are within the range of the abrasive streams, after which they are turned rapidly in order only momentarily to expose the surfaces 10f, 10g, 10h, 10i and 10j to the said stream, see Figs. 3 and 8. In any case the relationship of movements can be adjusted so that the hard-to-clean portions of the wrok piece are brought within the direct blast of the abrasive for a longer time than the easy-to-clean portions.

In order still more effectively to control the abrasive action, the abrasive projecting wheels C and D may be mounted for vertical reciprocation. It is preferable, as indicated more clearly in Fig. 2, to reciprocate the device C over a more elevated path or range than device D. By so relating the two devices, the angle at which abrasive thrown therefrom impinges the surfaces of the workpiece may be more effectively varied and the cleaning of the desired surfaces of articles 10 controlled.

Each abrasive projector is mounted on a movable support 100 which carries abrasive projecting wheel shaft 101 journaled in bearings 102 and provided with drives 103 from motors 104. Along each vertical edge of the supports 100 and adjacent the wheels proper are provided side rails 105 adapted to travel vertically on guide rollers 106 mounted on the front face 5 of the apparatus. Firmly attached to brackets 107 on each base or support 100 are cables 108, each secured to one arm of a double segment member 109, which is provided with a sleeve 111 mounted on a shaft 110 which is rotatably supported in framework 110a, 110b, 110c and 110d.

Vertical reciprocation is imparted to the supports 100 and their associated structure, including the abrasive projecting wheels C and D, by means of an arm 112 secured to sleeve 111 and having its outer end connected by connecting rod 113 to a pin 114 on a chain 115 carried by sprockets 116 and 117. As shown in Figs. 1 and 2, the sprocket 117 is secured to shaft 73. It will be apparent that rotation of the cam shaft 73 not only imparts the desired rotative and oscillatory motion to the carrying spindles 9, but also through the instrumentalities just described imparts an up and down reciprocating movement to the abrasive projecting wheels C and D whereby the angle of impingement may be still further controlled.

It is desirable to confine the operation of projecting the abrasive within a substantially closed cabinet and for this purpose a treating chamber is provided, having an ingress wing 3a and an egress wing 3b, as indicated in Figs. 1 and 4. As shown in Fig. 3, a deflecting plate or baffle 119 may be provided at the rear wall 3c of chamber 3.

As the workpieces 10 are carried by their respective trolley units 11 along the path prescribed by the track 12, the deflecting baffle 9e of the spindles 9 contact movable doors 90 held on pivots 91, so that the forward travel of the workpieces opens the doors 90 for the entry thereof, after which springs 91a associated with the pivots or hinges 91 move the doors 90 back to their normally closed position.

At the bottom of the treating chamber 3, it is desirable to provide means for collecting spent abrasive. For this purpose, screw conveyors 94 are provided in order to force abrasive accumulated in the bottom portion 94a of the cabinet 3 into the boot 95 of an elevator 96, adapted to elevate the abrasive to a suitable hopper (not shown) from which it can be run through suitable conduits into the feeding spouts *f*, indicated in Fig. 2. The screw conveyor and the elevating conveyor may be provided with sprockets 87 and 88 connected by chain 89, so that the two conveyors may be operated from the same drive. The conveyors 94 and 96 may be driven by motor 98 operating through drive 97.

It will be understood that the speed of the driving mechanism and the size, shape and position of the sprockets and cams are to be adjusted in such fashion as most effectively to carry out the principles outlined above. The cam 31 and the gearing to and from shaft 24 will of course be so constructed and related that the conveyor 13 will move the units 11 rapidly as they are carried to and from stations A and B, and so that such movement is accomplished without interfering with the desired rotative and oscillatory movements of the spindles 9 or the reciprocative movements of projectors C and D.

While certain novel features of the invention have been disclosed and are pointed out in the annexed claims, it will be understood that various omissions, substitutions and changes may be

made by those skilled in the art without departing from the spirit of the invention.

What is claimed is:

1. An apparatus for cleaning metallic articles including in combination, a track, an abrasive projector disposed adjacent thereto, a plurality of trolley units disposed on said track each carrying a spindle on which the articles to be cleaned are adapted to be mounted, a conveyor having yokes disposed thereon engaging said spindles for moving the trolley units along said track on actuation of said conveyor, a spinner head disposed above said track at a point adjacent said projector, said head having means for engaging said spindles when they arrive separately at said point, means for rotating said spindle engaging head, and cam means for automatically modifying the movement of said spindle-rotating means to impart variable speeds of rotation to said spindles.

2. An apparatus for cleaning metallic articles including in combination, a track, an abrasive projector disposed adjacent thereto, a plurality of trolley units disposed on said track each carrying a spindle on which the articles to be cleaned are adapted to be mounted, a conveyor having yokes disposed thereon engaging said spindles for moving the trolley units along said track on actuation of said conveyor, a spinner head disposed above said track at a point adjacent said projector, said head having means for engaging said spindles when they arrive separately at said point, means for rotating said spindles, cam means for automatically modifying said rotative movement, and a second cam means for automatically simultaneously oscillating said spindles.

3. In an apparatus for cleaning heavy metallic articles by projecting abrasive thereagainst including in combination an abrasive projecting wheel and a conveyor assembly for suspending the articles and moving them through the abrasive stream thrown by said wheel, means for automatically oscillating the articles and simultaneously rotating the same at varying speeds of rotation while they are within said stream.

4. Apparatus for blast cleaning metallic articles including in combination, means for separately suspending the articles to be cleaned, means for moving each article to a cleaning station, an abrasive projector operative to direct a stream of abrasive against the surface of the article at said station, means for rotating said article in said stream alternately rapidly and slowly, and automatic means for simultaneously oscillating the article in said stream whereby to expose predetermined portions of its surface to more intense abrasive action than the remaining portions.

5. Apparatus for blast cleaning metallic articles such as metallic bath tubs, sinks, basins, cylinder blocks, engine bases, furnace parts and the like, which articles have predetermined surfaces which require more thorough cleaning than other surfaces thereof, including in combination, means for automatically advancing said articles intermittently to a cleaning station, a centrifugal projector operable to project a stream of abrasive particles against the articles positioned at said station, means for automatically turning said articles about a vertical axis at different speeds while in said stream and simultaneously reciprocating the articles in the stream along a horizontal plane whereby said predetermined surfaces are subjected to an intensive cleaning action and the other surfaces are subjected to a less intensive cleaning action.

6. Apparatus for blast cleaning metallic articles including in combination, a generally horizontally extending track, an abrasive projector positioned at a station adjacent said track, a plurality of article carrying devices supported on said track and adapted to be advanced therealong, an article supporting spindle rotatably connected to each of said carrying devices, a conveyor chain disposed alongside of said track having a plurality of yokes attached thereto, each of said yokes being arranged to engage one of said carrying devices, driving means for imparting movement to said chain to move each of said article supporting spindles into, through and out of said blasting station, a spinner head disposed above said track adjacent said station operative to engage a portion of the spindle advanced to said station, and automatic means for turning said head alternately slowly and rapidly whereby the article supporting spindle engaged by said head is given an alternately slow and rapid turning movement during its residence at said blasting station.

7. Apparatus for blast cleaning metallic articles including in combination, a generally horizontally extending article supporting conveyor, means for driving said conveyor to advance said articles along a generally horizontally extending path, a pair of abrasive throwing wheels positioned adjacent the path of advance of said articles, driving means for each of said wheels, a vertically reciprocal support for each of said wheels and its associated driving means, a walking beam operably connected to each of said supports, and means for driving said walking beam to automatically reciprocate said wheels to shift the abrasive streams projected thereby.

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