June 30, 1925.

1,544,519

C. W. McKINLEY ET AL

SAND BLAST EQUIPMENT

Filed Sept. 26, 1919

3 Sheets-Sheet 1

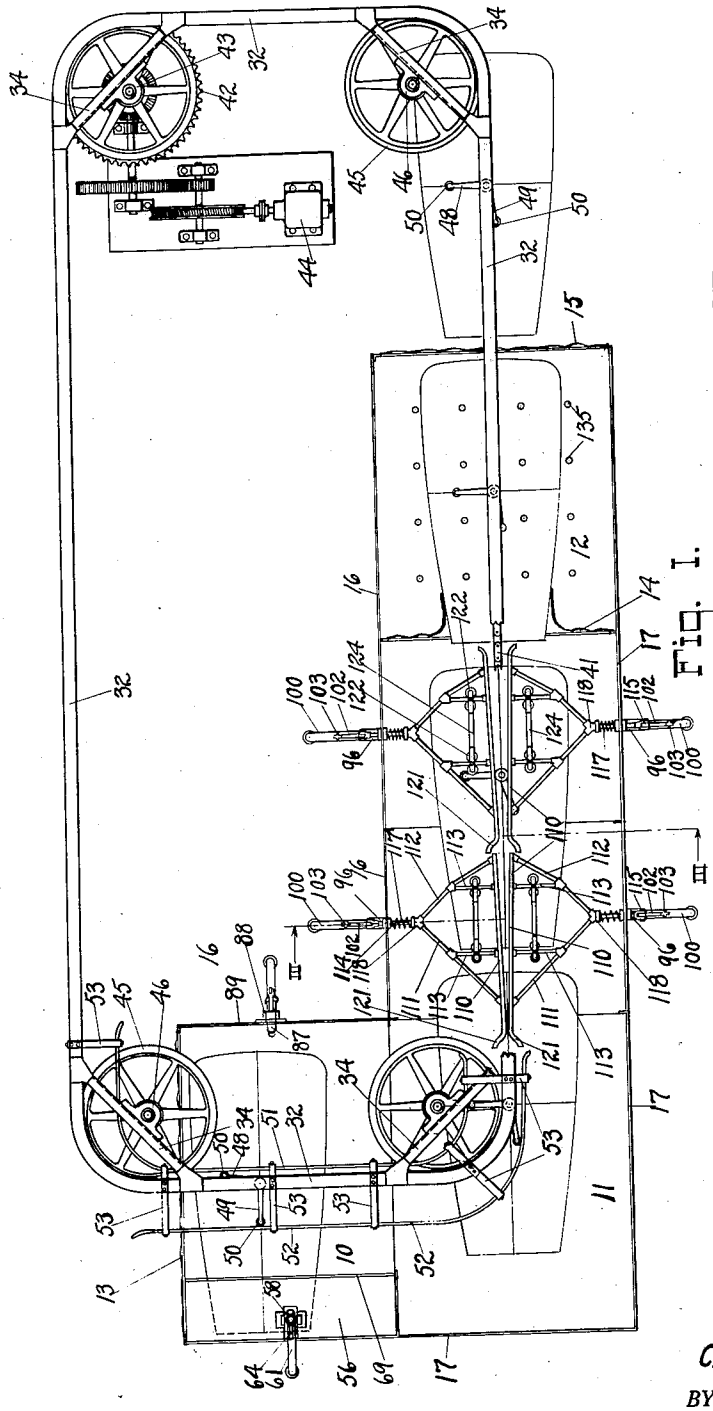


Fig. I.

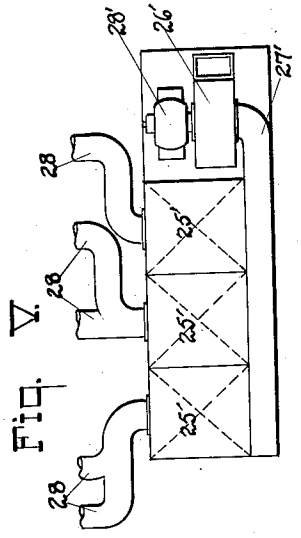


Fig. V.

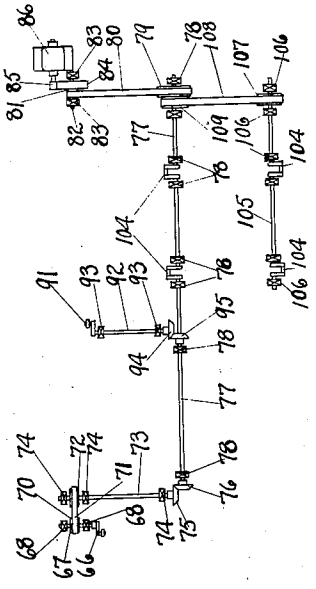


Fig. IV.

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June 30, 1925.

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SAND BLAST EQUIPMENT

Filed Sept. 26, 1919

3 Sheets-Sheet 2

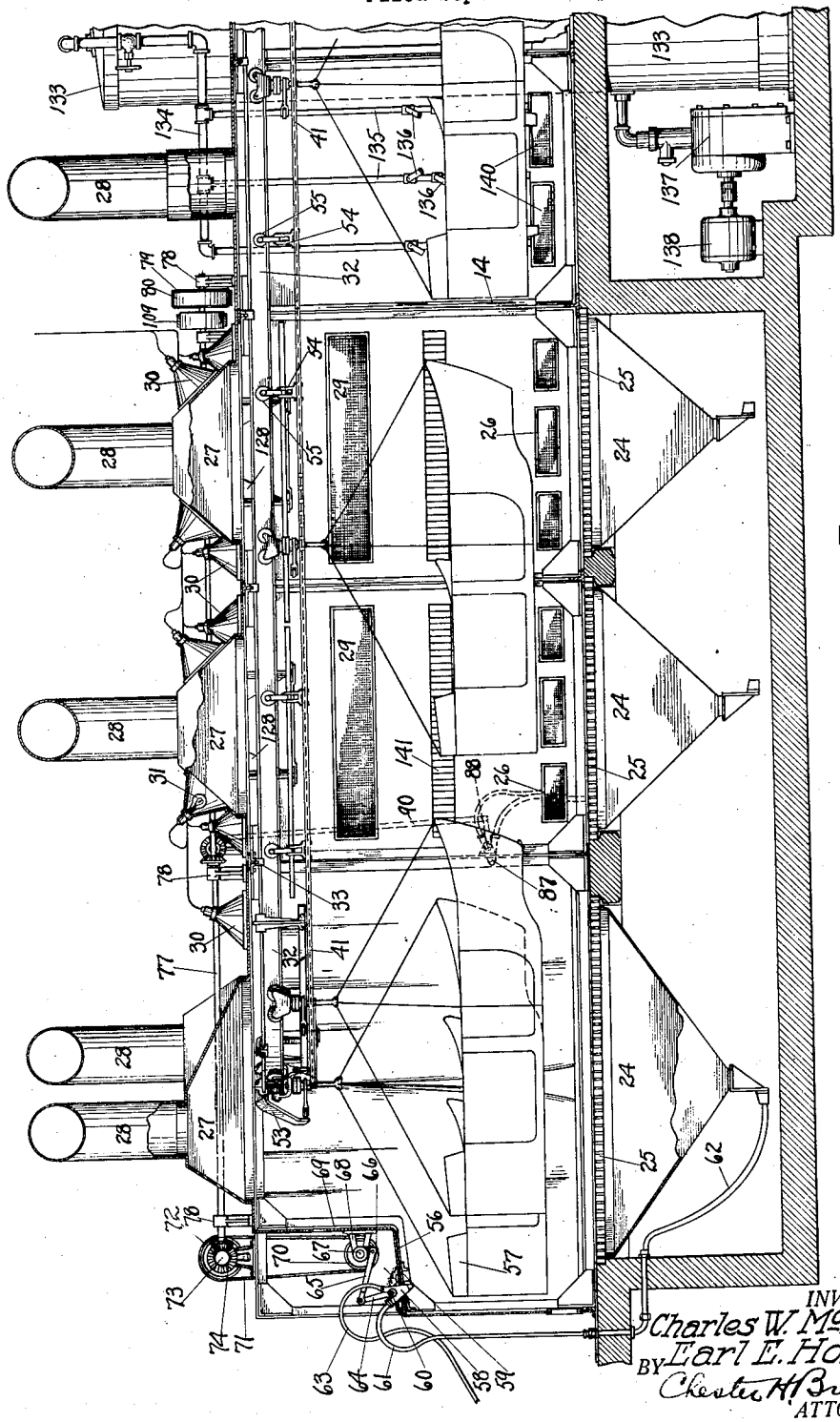


Fig. 2.

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SAND BLAST EQUIPMENT

Filed Sept. 26, 1919

3 Sheets-Sheet 3

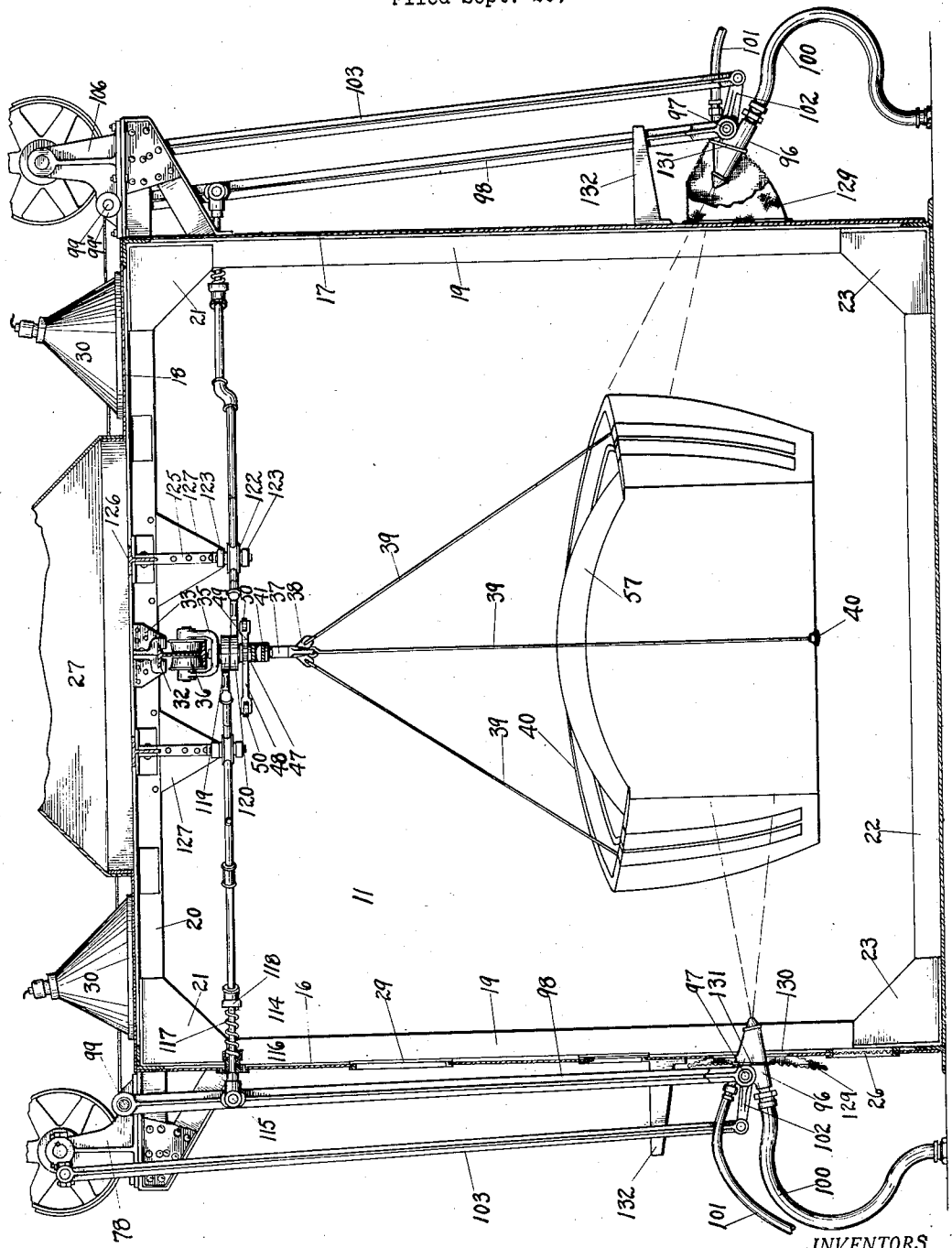


Fig. III.

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Patented June 30, 1925. 1,544,519

UNITED STATES PATENT OFFICE.

CHARLES W. McKINLEY AND EARL E. HOFFMAN, OF TOLEDO, OHIO, ASSIGNORS TO WILLYS-OVERLAND COMPANY, OF TOLEDO, OHIO, A CORPORATION OF OHIO.

SAND-BLAST EQUIPMENT.

Application filed September 26, 1919. Serial No. 326,627.

To all whom it may concern:

Be it known that we, CHARLES W. McKINLEY and EARL E. HOFFMAN, residing at Toledo, county of Lucas, State of Ohio, have invented certain new and useful Improvements in Sand-Blast Equipment, of which we declare the following to be a full, clear, and exact description.

Our invention relates to improvements in sand blast equipment and has for its object to provide a sand blast house or enclosure through which articles of various kinds may be conveyed and automatically sand blasted without requiring the attendant to enter the enclosure as is the practice at the present time in cases where objects of relatively large proportions are cleaned by this process.

A further object of the invention is to provide a sand blast house or enclosure through which the articles to be sand blasted are conveyed, with automatic means for both sand blasting and removing the dust from the articles while passing through the enclosure.

Still another object of the invention is to provide a sand blast house having angularly disposed compartments with suitable means for conveying articles of manufacture such as automobile bodies through the several compartments and with improved means for sand blasting various surfaces of the bodies while passing through the several compartments and providing also means for preventing the turning of the bodies while moving from one of the angularly disposed compartments to the other.

Another object of the invention is to provide a series of sand blast and dust removing or cleaning compartments through which articles of manufacture are adapted to be conveyed, with flexible curtains between certain of the compartments arranged to be pushed aside by the articles when passing into the compartments, the curtains being adapted to drop back to substantially closed position when released and further providing means for automatically sand blasting and cleaning the surfaces of the articles while moving in the compartments.

A further object of the invention is to provide a sand blast enclosure with means for conveying articles of manufacture through the enclosure and a plurality of sand blast guns adapted to play upon the articles through openings in the side walls of the enclosure with improved means for automatically operating the guns.

Another object of the invention is to provide a sand blast enclosure and a carrier for conveying articles of manufacture through the enclosure with improved means for automatically sand blasting the articles within the enclosure, said means being constructed in such a manner as to obviate the necessity of the attendants having to enter the enclosure during the sand blasting operation.

A still further object of the invention is to provide a sand blast enclosure or compartment with means for conveying articles to be sand blasted therethrough and further providing a plurality of sand blast guns suspended exteriorly of and adjacent openings in the side walls of the compartment and adapted to play upon the article through the openings with automatic means for oscillating the guns while the articles are passing in front of the nozzles thereof.

Another object of the invention is to provide a frame or support upon which is movably mounted a sand blast gun with means for automatically shifting the position of the gun to maintain it at substantially a predetermined distance from a surface moved obliquely thereto.

Another object of the invention is to provide a carrier for an article with means controlled thereby for automatically shifting sand blast guns to maintain them at substantially an equal distance from surfaces moving obliquely with respect thereto.

Still another object of the invention is to provide a swingingly mounted sand blast gun with improved means for maintaining the nozzle of the gun at substantially a predetermined distance from a surface moved in front of the nozzle and obliquely with respect thereto.

Another object of the invention is to provide a plurality of spaced movably mounted sand blast guns with means for conveying an object or article of manufacture having curved, tapering or converging sides moving between the guns obliquely to the nozzles thereof and further providing automatic means for simultaneously adjusting the guns to maintain the nozzles at substantially a predetermined distance from said obliquely moving surfaces.

Another object of the invention is to provide a sand blast gun arranged to be carried upon a swingingly mounted holder with means for automatically moving the gun to maintain the nozzle thereof at substantially a predetermined distance from a surface moved obliquely to the nozzle and further providing means for oscillating the gun when the nozzle is playing upon said obliquely moving surface.

Another object of the invention is to provide a frame or support having a carrier mounted thereon for moving an article of manufacture, with means controlled by the carrier for automatically moving a plurality of sand blast guns to maintain the nozzles at substantially a predetermined distance from surfaces of the articles moving obliquely to the nozzles and with independent means for automatically oscillating the guns while playing upon said surfaces.

Another object of the invention is to provide an enclosure having angularly disposed compartments and a track curved at the adjoining ends of the compartments upon which is adapted to travel a carrier for supporting an automobile body with means for preventing the turning of the body when the carrier is travelling upon the curved portion of the track, and further providing means for automatically sand blasting the sides of the body as well as means for cleaning or removing the dust from the same.

A further object of the invention is to provide a framework having a carrier mounted to travel thereon and adapted to support and convey an article of manufacture through an enclosure, the carrier being adapted to co-operate with a swinging holder for supporting a sand blast gun to cause the gun to move relatively to the article so that the nozzle will be maintained at substantially a predetermined distance from a surface of the article moved obliquely to the nozzle and furthermore to provide means for oscillating the gun while moving to increase the effective range of the nozzle and to provide also a supply of abrasive material with which the gun is connected, as well as to provide means for collecting the heavier particles of abrasive material discharged upon the article for subsequent use, means being provided also for collecting the finer or dust particles of the material accumulating within the compartment.

A further object of the invention is to provide a sand blasting compartment or enclosure with a motor driven carrier or conveyor adapted to move through or adjacent to the compartment and also to provide automatic sand blasting mechanism for sand blasting articles of manufacture within the compartment carried by said conveyor and further to provide suction producing apparatus for drawing off the particles of dust accumulating within the compartment with provision also of a sandholding receptacle adapted to receive the heavier particles of sand that fall from the surfaces of the sand blasted articles and with which the sand blasting mechanism is connected.

To these and other ends the invention comprises certain novel features of construction and arrangements of parts as will be hereinafter more fully pointed out and claimed, it being understood that the construction shown in the drawings is to a certain extent merely diagrammatic in form and that the invention in its broadest sense and as expressed in the claims is not limited to the precise construction or arrangement of parts shown. In other words, it is intended that these drawings merely embody the broad principles of the invention set forth in the claims forming a part of this specification.

A structure constituting one embodiment of our invention is illustrated in the accompanying drawings in which:

Figure I is a plan view in diagrammatic form.

Figure II is a fragmentary longitudinal sectional elevation taken centrally of Figure I.

Figure III is a transverse sectional elevation taken on line III—III of Figure I.

Figure IV is a diagrammatic view illustrating the operating mechanism for the sand blast guns; and

Figure V is a plan view of the dust collecting apparatus for drawing off the dust from the several sand blasting and cleaning compartments.

Similar reference characters refer to similar parts throughout the several views of the drawing.

Heretofore, so far as we are aware, in the construction of sand blast equipment for sand blasting relatively large bodies or articles of manufacture it has been customary for these bodies to be placed in a sand blast house or compartment in which it has been necessary for the attendant or operator to remain for the purpose of manipulating the sand blast equipment to effect the cleaning of the bodies. This method of sand blasting requires the operator to employ a more or less expensive protecting apparatus for preventing the dust from entering the lungs and other parts of the body and has proven unsatisfactory for obvious reasons. The present invention is designed to overcome these objections and to provide automatic mechanism for sand blasting relatively large bodies or articles of manufacture and in particular is especially designed for sand blasting the bodies of automobiles.

A brief description of the general ar-

rangement of the sand blast equipment in this case will serve to set forth the general principles involved and will aid in more readily comprehending the details of the mechanism to be specifically described hereinafter. In the sand blasting of automobile bodies or other substantially rectangular bodies for removing grease and other foreign matter adhering thereto, previous to the painting or enameling of the body, it is necessary that either the bodies themselves be held stationary and the sand blast gun moved relatively thereto to effect the cleaning of all the exterior and certain of the interior portions of the body or else that the sand blast gun be relatively fixed and the body moved in a certain predetermined direction or directions in order that the nozzles may play upon the several angularly disposed surfaces to be sand blasted. In designing mechanism for carrying out the last mentioned idea, we have provided means by which a body is conveyed through a sand blasting compartment or enclosure and have preferably positioned all of the sand blast guns at relatively fixed points in the path of the travel of the bodies and have mounted them in such a manner as to obviate the necessity of the attendant entering the compartment during the sand blasting operation. The enclosure which we have provided is preferably L-shaped in form as shown in Figure I and the body is preferably arranged to be brought into the outer end of the short leg of the enclosure and while passing through the first compartment, as constituted by this leg, the rear end of the body is sand blasted by an automatically operated sand blast gun which is preferably mounted exteriorly of the compartment and adapted to play upon the body through an opening in the wall thereof. The front end or cowl of the body is at the same time, or substantially the same time, sand blasted from a sand blast gun having its nozzle extending through a lowered portion of the ceiling of the compartment and directed at an angle slightly to the vertical as shown in Figure II. The body is then passed from the first to the second compartment without turning and while moving therein, the sides of the body are automatically sand blasted. The sand blast guns for playing upon the sides of the body are likewise relatively fixed and move only within certain limits to accommodate the curved or converging sides of the article which move obliquely to the nozzles of the guns as the body is passed in front of them. The body then passes into a third or dust removing compartment at the rear end of the enclosure which is separated from the second compartment preferably by a flexible curtain. The fine particles of dust accumulating upon the surfaces of the body are blown therefrom by air discharged through more or less flexible tubing members connected with a tank in which air under high pressure is maintained by a suitable compressor driven preferably by a motor, said flexible tubing members being adapted to be set in motion by the rapidly moving currents of air discharged therefrom whereby a more complete removal of the particles of dust and sand from the article is effected than if these members were non-flexible. The body or other article is then passed out of the third or cleaning compartment and is removed from the depending cables held by the carrier or conveyor which is preferably continuously driven. Any suitable abrasive material may be used for cleaning the bodies but sand is preferably employed and is stored in suitable hoppers positioned preferably beneath the enclosure from which it is forced through the sand blast gun in any preferred manner, the heavier particles of the sand being returned to the hopper for subsequent use through a screen in the bottom of the compartment and the lighter particles or dust produced by the breaking up of the sand being drawn off, in the present instance, through openings in the upper wall of the sand blasting compartment with which communicate a plurality of suction tubes connected with any suitable suction producing apparatus for forcing the dust into a suitable collector.

Referring now more particularly to the detailed construction of the apparatus, a sand blast house or enclosure is provided having front, intermediate and rear compartments 10, 11 and 12 respectively, the compartment 10 being that in which the rear end and cowl of the body is sand blasted and the compartment 11, that in which the sides of the body are sand blasted while the compartment 12 is that in which the cleaning or removal of the dust from the body is effected. The compartments 10 and 11 are angularly disposed as shown in Figure I and constitute an L-shaped enclosure. As previously stated a curtain 13 closes the outer end of compartment 10 and compartments 11 and 12 are separated by a flexible curtain 14 while the outer end of compartment 12 is closed by a flexible curtain 15, as shown in Figure I. The side walls 16 and 17 of the enclosure and the ceiling 18 are supported by a suitable frame work such as the uprights 19 which are connected with the cross members 20 by suitable gussets 21 while the lower cross members 22 are connected with the uprights 19 by means of gussets 23. Hoppers 24 are positioned beneath the screen 25 in the bottom of the several sand blasting compartments and the spent sand from the guns is discharged by gravity through the screen into the hoppers from whence it is drawn for subse-

quent use in sand blasting the articles to be conveyed through the enclosure.

Screens 26 may be positioned at any suitable points upon the side walls of the enclosure for the intake of fresh air for the purpose of ventilation and to assist in conveying the dust particles through the hoods 27 and exhaust pipes 28 which are preferably connected with the dust collectors 25′ into which the dust is drawn and deposited by means of the fan 26′ connected with the dust collectors by means of the air exhaust pipe 27′, the fan being driven preferably by a motor 28′.

Windows or screens 29 in the side walls of the enclosure serve to permit the attendant to view the work from time to time to determine whether or not the articles are being properly sand blasted, and openings are provided in the ceiling of the enclosure over which are placed the lamp reflectors 30 carrying the electric lights 31 for lighting up the interior of the enclosure to permit the attendant to more readily observe the sand blasting operations.

The mechanism for conveying the automobile bodies or other articles through the enclosure may comprise one of several well known conveying mechanisms but in the present instance we employ an overhead track such as the I beam 32 which extends beneath the ceiling of the enclosure and is connected with the cross frame members 20 thereof, preferably by means of the brackets 33 as shown in Figure III. The track layout is preferably rectangular in form and is curved at its four corners, the end portions of the track being preferably tied to the side portions by the diagonally extending members 34 as clearly shown in Figure 1. Any suitable means of support may be provided for supporting that portion of the track which lies exteriorly of the sand blasting enclosure. A plurality of carriers are spaced a suitable distance apart and adapted to travel upon the track 32 for conveying the automobile body or other articles through the enclosure. Each carrier comprises a yoke 35 upon the arms of which are journaled the wheels 36 which lie upon the opposite sides of the web of the I beam 32, the wheels being adapted to travel upon the lower flange of the I beam as shown in Figure III. Depending from the yoke 35 and rotatably connected therewith is a rod or stem 37 having suitably connected with the lower end thereof a head 38 for receiving the flexible cables 39, the lower ends of which are provided with hooks 40 or other suitable members adapted for quick connection with the articles to be supported by the cables such as the automobile body shown in Figure III. A sprocket chain 41 is carried by the stems 37 of the yokes, and a sprocket wheel 42 is provided for driving the chain, said sprocket wheel being preferably located at one corner of the rectangular track as shown in Figure I. The sprocket 42 is journaled upon the bearing 43 which is preferably connected with one of the ties 34 connecting the side and end portions of the track. The sprocket 43 is driven preferably by an electric motor 44 through a system of reducing gears as shown at the upper right hand corner of Figure I, whereby the sprocket chain for moving the several carriers connected therewith may be driven at a relatively low rate of speed sufficient to insure ample time for a thorough sand blasting of the surfaces of the automobile bodies or other articles while passing through the enclosure. Idlers 45 are provided for guiding the sprocket chain at the remaining corners of the rectangular track, these idlers being journaled upon bearings 46 suitably connected with the diagonally extending ties 34 for connecting the sides and ends of the track.

As it is desirable to convey the automobile bodies through the sand blasting compartment 11 with the rear end of the bodies projecting in the direction in which the conveyor is moving in order that the two portions of the flexible curtain 14 may be more readily separated or opened by the curved or rounded corners of the rear end of the body, we have provided means for preventing the turning of that portion of the carrier upon which the body is suspended when rounding the curved portion of the track lying within the sand blasting compartment 11 as shown in Figure I. It will be readily understood of course, that if the automobile body or other article to be sand blasted were not swiveled upon the carrier that it would turn with the carrier when the latter is rounding the curved portion of the track in moving from the compartment 10 to the compartment 11 and as it is preferred to not change the alignment of the body while moving through the enclosure, we have provided means for preventing the shifting of the longitudinal axis of the body while moving from one of these compartments to the other. In carrying out this idea we have fixed upon the stem 37 of the carrier a sleeve 47 from which projects the angularly disposed arms 48 and 49, each having on its end a roller 50 adapted to travel at the proper time upon the guard rails 51 and 52 on the opposite sides of that portion of the track 32 which supports the article to be sand blasted while the same is passing into and through the compartment 10 and that portion of the compartment 11 lying adjacent thereto in the manner indicated at the left of Figure I. The guard rails 51 and 52 are preferably supported and braced by the members 53 which are suitably connected with the top flange of the

track 32. It will be understood that the bodies of the automobiles or other articles will be connected with the cables depending from the carrier when the latter is moving upon that portion of the track lying exteriorly of the enclosure and parallel to the side walls thereof, or while the carrier is approaching the entrance to the compartment 10. As soon as the arm 48 of the depending stem 37 of the yoke 35 is brought to a point opposite the outer curved end of the guard rail 51, the latter will prevent the turning of the stem upon the yoke thereby preventing the turning of the car body while entering the compartment 10. As soon as the wheels of the carrier reach the straight portion of the track or substantially at that time, the roller 50 of the arm 49 will engage the guard rail 52 and both of the rollers 50 of the arms 48 and 49 will thereafter travel upon the guard rails until the wheels of the carrier have moved around the curved portion of the track within the compartment 11. In other words, the rollers of the arms during the time they are in contact with the guard rails serve to prevent any turning of the body of the automobile, thereby positively insuring its proper alignment from a point exterior of the enclosure to a predetermined point within the compartment 11, whereby the rear end of the body is moved foremost through the compartment 11 in the manner indicated in Figure I. The sprocket chain 41 is also suspended from the track 32 by means of the hangers 54 having at their upper ends the rollers 55 adapted to travel upon the track 32 to support the chain intermediate the carriers from which the automobile bodies or other articles are suspended. The compartment 10 of the sand blasting enclosure in which the rear end of the automobile body and the cowl are sand blasted has been constructed so that the sand blasting of the cowl may be effected from a point immediately above the cowl and in order to accomplish this result we have lowered the top of the enclosure at the outer edge of the compartment 10 as indicated at 56 and in so doing the ceiling of the compartment is brought to a point immediately over the cowl 57 of the automobile body as indicated in Figure II. Extending through the lowered portion 56 of the ceiling of compartment 10 and substantially at the outer edge thereof is a sand blast gun 58 projecting through an opening 59 in the ceiling, the gun being inclined slightly to the vertical so that the sand discharged from the nozzle will more effectively clean the surface of the cowl while the automobile body is passing through compartment 10. The sand blast gun 58 is pivoted at 60 upon a suitable support or bearing 60′ carried by the ceiling 56, the gun being connected with one of the sand holding hoppers 24 by means of a flexible tube 61 which connects with a pipe 62 leading to the bottom of the hopper as shown in Figure II. The sand blast gun is also provided with a flexible connection 63 which leads to a suitable source of compressed air for supplying air to the gun under a sufficient pressure to discharge the sand from the nozzle of the gun with force enough to thoroughly clean the surfaces to be sand blasted. The gun 58 is provided with a rearwardly extending arm 64 carrying at its outer end a link 65 which connects the arm with a crank 66 upon a short shaft 67 journaled in brackets 68 mounted on the vertical wall 69 of compartment 10 as shown in Figure II. The shaft 67 is provided with a pulley 70 connected by a belt 71 to a pulley 72 on a shaft 73 journaled in bearings 74 as shown in elevation in Figure II and diagrammatically in Figure IV. The shaft 73 is provided with a bevel gear 75 meshing with a similar gear 76 on a shaft 77 journaled in bearings 78. The shaft 77 is provided with a pulley 79 driven by a belt 80 which is in turn driven by a pulley 81 on a shaft 82 journaled in bearings 83. The shaft 82 is provided with a gear 84 meshing with a pinion 85 which is driven preferably by a motor 86. By the driving mechanism just described, the sand blast gun 58 may be oscillated to automatically play upon the cowl of the automobile body or other substantially horizontal surface adapted to be conveyed through the compartment 10. Likewise, and at the same time, the rear end of the body may also be automatically sand blasted by the nozzle of the gun 87 pivoted at 88 upon and adapted to operate through an opening in the side wall 89 of the compartment 10 which extends at a right angle to the side wall 16 of the compartment 11 as shown in Figure I. The sand blast gun 87 is actuated or operated by a link 90 pivotally connected at its lower end with the gun and at its upper end with a crank 91 on the outer end of the shaft 92 which is journaled in suitably supported bearings 93 and driven by a bevel pinion 94 meshing with a similar pinion 95 on the main drive shaft 77 as shown in Figure IV. The sand blast gun 87 is of course connected with one of the sand hoppers 24 as well as with the compressed air tank or other source provided for supplying air to the several sand blast guns shown in the drawing. It will be understood of course, that the sand blast guns 58 and 87 serve to simultaneously and automatically sand blast the cowl and rear end of the automobile body when the latter is passing through compartment 10, into which a second body is moved as soon as the first one is moved therefrom by the conveyor.

Two sand blast guns are shown on each

side of the compartment 11 for sand blasting the sides of the automobile body or other article through openings in the wall of the compartment at each side, although one gun only may be employed if desired. The relative positions of these guns are best indicated in Figures I and III and they are generally indicated at 96 and are pivotally supported at 97 upon hangers or holders 98 mounted to swing upon journals 99 carried by suitable bearings 99′ on the frame work of the enclosure, preferably at the top of the compartment 11 as shown in Figure III. The guns 96 are provided with flexible connections 100 and 101 which lead respectively to the sources of sand and compressed air provided for effecting the necessary sand blasting operation. The guns 96 are each provided with a rearwardly extending arm 102, pivotally connected with the outer end of which is an operating rod 103 extending upwardly and exteriorly of the enclosure, the rods 103 at their upper ends being connected with the cranks 104 of the crank shafts 77 and 105, the latter shaft being journaled in suitable bearings 106 supported by the framework of the enclosure. The shaft 105 is provided with a pulley 107 driven by a belt 108 which engages a pulley 109 on the crank shaft 77 as shown in Figure IV. By the mechanism just described the four guns 96 are automatically oscillated to play upon the sides of the automobile body or other article while passing through the compartment 11.

As the sides of the automobile bodies usually taper or converge toward the front end of the body, it is necessary, of course, to provide means for maintaining the nozzles of the guns at substantially a predetermined distance from the converging surfaces which necessarily move obliquely to the nozzles if the body is moved in a straight line between the nozzles. In carrying out this idea, we preferably effect the adjustment of the guns relatively to the obliquely moving surfaces by means of the carrier upon which the article is supported. This is accomplished by interposing between the carrier and the swinging arm or holder 98 for supporting the sand blast gun, mechanism co-operating with the swinging support and carrier which will serve to effect or permit the shifting of the guns automatically to maintain the nozzles at substantially a predetermined distance from the obliquely moving surfaces. This mechanism comprises the triangular frame-like plungers indicated in Figure I, each of which is provided with a cam or inclined track 110 extending substantially parallel to the surface of the article which is moved obliquely to the nozzle of the gun. The track members form one side of the triangular frames, the other two sides of which are completed by the members 111 and 112 which are tied intermediate their ends to the track members by means of the members 113 as shown in Figure I. From the apex of the triangular frame is extended a substantially horizontally disposed rod 114 which passes through the side wall 16 of the compartment 11 and is pivotally connected at 115 to the swinging holder 98 preferably at a point just below the pivotal support 99 of the holder as shown in Figure III. The rod 114 is adapted to reciprocate in a sleeve or other suitable guide mounted upon the side wall 16 of the enclosure and a spring 117 is mounted upon the rod and interposed between said sleeve and a member 118 for connecting the rod with the frame members 111 and 112. The tracks 110 for the oppositely positioned guns converge towards each other and are inclined with respect to the center line of the compartment 11 as shown in Figure I, the track member on one side of the center line of the compartment being slightly above that on the other side so that they may be engaged by the upper and lower rollers 119 and 120 respectively which are loosely mounted upon the depending rod or stem 37 of the yoke 35 as shown in Figure III. The track members 110 at their abutting ends with which the rollers first contact are curved outwardly as indicated at 121 whereby the rollers are more readily guided into position to separate the track members when moving into engagement with the same. The triangular frame-like plungers are also guided in their movement toward and from the center of the compartment by means of the rollers 122 on the opposite sides of the frame braces 113, said rollers being suitably supported between the jaws 123 of the horizontally disposed member 124 from which extend upwardly suitable supports 125 connected with the T-bars 126 as shown in Figure III. The triangular shaped plate members 127 which are connected with the supports 125 serve as braces for the same, said plate members being connected at their upper ends with the ceiling of the enclosure in any suitable manner. The plate member 127 may also be braced if desired by the triangular brace members 128 as shown in Figure II. It will be understood, of course, that the tracks 110 on which the rollers 119 and 120 of the carrier travel will conform substantially to the contour of the curved or tapering sides of the automobile body or other object to be treated in order that the nozzles of the sand blast guns may be kept substantially at a predetermined distance from the surfaces upon which the nozzles are adapted to play.

As the sand blast guns are designed to swing outwardly from the side walls of the compartment a considerable distance, we have provided the collapsible members 129

formed preferably of flexible material which cover the openings 130 in the side walls of the compartment 11 through which the nozzles of the guns normally project, the inner ends of said collapsible members being connected with the side walls exteriorly thereof and the outer ends connected to the nozzles of the guns by the ring shaped members 131 as shown in Figure III.

In the swinging movement of the sand blast guns, the holders 98 and operating rods 103 are guided between the spaced arms 132 projecting laterally from the wall of the enclosure.

The automobile bodies or other objects when loaded upon the conveyor by the attendant are carried first into the compartment 10 after which the curtain 13 is drawn to closed position. The rear end of the body and the cowl are then automatically sand blasted and as soon as the body passes around the curved portion of the track within the compartment 11 to bring the rear end of the body to a point opposite the first pair of nozzles of the guns 96, the rollers 119 and 120 engage the tracks 110 and immediately swing the guns outwardly to the position shown at the right of Figure III. As the body begins to pass between said guns, the springs 117 will gradually return them to normal position. At the same time, these guns are being oscillated by the rods 103 in a manner previously described in order that the entire surface of the sides of the automobile bodies, from the top to the bottom thereof, may be sand blasted, it being understood that the operation is the same for the second pair of guns 96 as for the first. When the bodies of the automobiles or other objects reach the curtain 14, separating the compartment 11 from the compartment 12, they automatically push aside the two halves of the curtain as shown in Figure I, and the curtain then forms with the body a partial closure for preventing the sand or fine particles of dust from escaping to any extent from the compartment 11 into the cleaning compartment 12. When the body has moved into the compartment 12, the two portions of the curtain drop back to normal closed position. Compressed air is then released from the tank 133 and is conveyed through suitable piping to the vertically disposed pipes 135 which project into the compartment and which are provided with short pieces of flexible tubing 136 which extend downwardly around the outside of the body as well as within the same and which when the compressed air is discharged through them are set in motion and serve to play the escaping currents of air upon all parts of the body to blow the dust and other particles of dirt therefrom. Compressed air may be forced into the tank 133 under high pressure by a suitable compressor 137 driven by a motor 138 preferably positioned below the compartment 12 as shown in Figure II.

The exhaust pipe 28 leading from the compartment 12 discharges into one of the dust collectors 25′ as shown in Figure V.

Air for ventilating the compartment 12 may be drawn in through the screens 140 located at the bottom of the compartment or at any other suitable point. Relatively narrow openings may be provided in the side walls of the compartment 11 if desired to permit the use of hand operated sand blast guns for the purpose of cleaning any relatively small areas of the body not reached by the automatically operated sand blast guns such as the backs of the seats of the body and other more or less inaccessible parts thereof, said openings being preferably protected by overlapping flexible members such as soft rubber pads, as indicated at 141. During any hand controlled blasting operations, the attendant will, of course, be able to view the body through the screens or windows 29 as the interior of the compartment is properly illuminated by a suitable lighting system as shown in Figure II.

Although we have shown means for exhausting the air and dust through the top of the several compartments of the enclosure it will be understood that we may readily locate the exhaust pipes at the bottom of the enclosure, or if desired, exhaust the dust through the upper edges of the side walls of the sand hoppers, or in any other manner found most desirable.

It will be also understood that the compressed air for blowing the dust from the body in compartment 12 may be taken from any suitable source of supply and that a special tank and compressor and motor for operating the same may not necessarily be required in connection with an apparatus of this kind.

Although we have shown the carrier or conveyor suspended from the ceiling of the sand blasting enclosure, it will be understood that we may, if found desirable, locate a track at the bottom of the enclosure upon which any suitable form of carrier may be mounted for conveying the bodies or other articles through the enclosure.

Having thus described our invention, what we claim as new and desire to secure by Letters Patent, is:

1. A device of the class described comprising in combination a support, a pivoted link upon said support, a sand blast gun pivotally mounted upon the link, and means for producing independent movements of the link and the gun upon their pivots.

2. A device of the class described comprising in combination a support, a carrier, a pivoted holder upon the support, a sand blast gun movable upon the holder, means

controlled by the carrier for moving the holder, and means adapted to automatically move the gun upon the holder.

3. A device of the class described comprising in combination a support, a sand blast gun, and a plurality of members movable upon the support each pivotally connected with the gun for independently effecting different operations of the same.

4. A device of the class described comprising in combination a support, a sand blast gun, a plurality of members each mounted to swing upon the support said members being each connected with the gun for effecting different operations of the same, and means for actuating said members independently of each other.

5. A device of the class described comprising in combination a support, a sand blast gun, a plurality of independent members upon the support each connected with the gun, and independent means for actuating each of said members to simultaneously impart a swinging and oscillating movement to the gun.

6. A device of the class described comprising in combination a support, a sand blast gun, a swingingly mounted member upon the support pivotally connected with the gun, a second member pivotally connected with the gun, and means adapted to actuate said second member to effect oscillation of the gun upon said swingingly mounted member independent of any movement thereof.

7. A device of the class described comprising in combination a sand blast gun, means for moving an irregularly shaped body to be sanded past said gun, and means for simultaneously oscillating said gun and for automatically bodly moving said gun to preserve a substantially uniform spacing thereof from said irregularly shaped body.

8. A device of the class described comprising the combination of an oscillatory holder, a sand blast gun mounted for oscillation upon the holder, a member pivotally connected to the gun, means for actuating said member to oscillate the gun upon the holder, and means for oscillating the holder.

9. A device of the class described comprising in combination a support, a plurality of pivoted holders upon the support, a sand blast gun pivoted upon each of the holders, means for automatically actuating said holders, and means for automatically oscillating the guns upon the holders.

10. A device of the class described comprising in combination a frame, a carrier for an article to be sanded, a plurality of pivoted holders upon the frame, a sand blast gun pivotally connected with each of said holders, a rotatable member operatively connected with each of the guns for effecting oscillation of the same, and means operated by said carrier for moving the holders upon their pivots.

11. A device of the class described comprising in combination a frame, a plurality of sets of pivoted holders upon said frame, a sand blast gun pivotally mounted upon each of said holders, a rotatable member operatively connected with the guns of each set of holders, means for actuating said rotatable members and means for actuating the holders.

12. A sanding device of the class described comprising in combination a frame, a holder mounted on said frame to swing toward and from a body to be sanded, a sand blast gun pivoted upon said holder, an operating member connected with said gun for oscillating the same, and means for actuating said holder.

13. A device of the class described comprising in combination a frame, oppositely spaced holders mounted to swing upon said frame, a sand blast gun pivoted upon each of said holders, an operating member connected with each of the guns for oscillating the same, means for actuating said operating members, means connected with said holders by which they may be actuated, and means for conveyir g an article between the holders, said means being adapted to actuate the last mentioned means.

14. A device of the class described comprising in combination a support, a sand blast gun movably mounted upon the support, means for moving a body in front of the gun, having a surface inclined relatively to the nozzle thereof, and means controlled by said last mentioned means for automatically moving the gun to maintain the nozzle at substantially a predetermined distance from said inclined surface.

15. A device of the class described comprising in combination a support, a sand blast gun movably mounted upon the support, means for moving a body in front of the gun having a surface inclined relatively to the nozzle thereof, means controlled by said last mentioned means independent of the body for automatically moving the gun to maintain the nozzle at substantially a predetermined distance from said surface, and independent means for oscillating the gun.

16. A device of the class described comprising in combination a support, a sand blast gun movable upon the support, means for moving an object in front of the gun having a surface extending obliquely to the longitudinal axis of the nozzle of the gun, means for maintaining the gun at substantially a predetermined distance from said surface during movement thereof, and independent means for simultaneously oscillating the gun to vary the angle of the longitudinal axis thereof with respect to said surface.

17. A device of the class described comprising in combination a support, a sand blast gun movable upon the support to said blast the surface of an irregular body, and means for simultaneously moving the gun bodily toward and from said body and oscillating the same to maintain the nozzle of the gun at substantially a uniform distance from said surface.

18. A device of the class described comprising in combination a support, a sand blast gun movable upon the support, means for simultaneously moving the gun bodily in the direction of the blast and oscillating the same to maintain the gun at a substantially uniform distance from an obliquely moving surface of an object moved in front of the gun, and means for moving the object.

19. A device of the class described comprising in combination a frame, a carrier for an article of manufacture, a sand blast gun movably mounted upon the frame and means actuated by the carrier independent of said article for moving said gun relatively to the article.

20. A device of the class described comprising in combination a frame, a carrier for an article of manufacture, a sand blast gun movable upon the frame, means adapted to be actuated by the carrier for shifting the gun relatively to the article, and independent means for moving the gun relatively to the article.

21. A device of the class described comprising in combination a frame, a carrier for an article of manufacture, oppositely spaced sand blast guns swingingly mounted upon the frame, and means adapted to be actuated by the carrier independent of said article for shifting the guns relatively to the article.

22. A device of the class described comprising in combination a frame, a sand blast gun swingingly mounted upon the frame, a carrier for an article of manufacture and spring controlled means interposed between the carrier and the gun adapted to effect the swinging of the gun in a plane at an angle to the surface of an article to be sand blasted during movement of the latter by the carrier.

23. A device of the class described comprising in combination a frame, spaced sand blast guns movably mounted upon the frame, a carrier for an article of manufacture adapted to move between the guns, means controlled by the carrier adapted to effect movement of the guns relatively to the article, and independent means for moving the guns relatively to the article.

24. A device of the class described comprising in combination a frame, a sand blast gun movably mounted upon the frame, a carrier for an article of manufacture having a curved surface, means controlled by the carrier for automatically maintaining the nozzle of the gun at substantially a predetermined distance from said curved surface during movement of the latter with respect to the nozzle of the gun, and means for oscillating the gun in the plane in which it is moved.

25. A device of the class described comprising in combination a frame, spaced sand blast guns movably mounted upon the frame, a carrier for an article of manufacture, the article having converging sides, the carrier being adapted to move the article between the guns, means adapted to automatically maintain the nozzles of the guns at substantially a predetermined distance from said surfaces when the article is moved between the nozzles, and means independent of said carrier adapted to automatically oscillate the guns.

26. A device of the class described comprising in combination a frame, a sand blast gun, a holder for the gun mounted upon the frame, a carrier for an article of manufacture having a surface adapted to move obliquely to the nozzle of the gun, an operating member for the holder, means upon the carrier co-operating with said operating member to maintain the nozzle of the gun at substantially an equal distance from said obliquely moving surface, and means for simultaneously oscillating the gun.

27. A device of the class described comprising in combination a frame, a sand blast gun, a swinging holder upon the frame for supporting the gun, a carrier for an article of manufacture having a surface adapted to move obliquely to the nozzle of the gun, and means extending between said holder and said carrier and adapted to be actuated by the latter for maintaining the gun at substantially a predetermined distance from the obliquely moving surface.

28. A device of the class described comprising in combination an enclosure, a carrier adapted to move an article of manufacture through the enclosure, automatic means for sand blasting the article while moving through the enclosure, and means within the enclosure for cleaning the article when the sand blasting operation is completed.

29. A device of the class described comprising in combination an enclosure, a sand blast gun mounted to swing relatively to the enclosure, a carrier adapted to move an article within the enclosure, the article having a surface adapted to move obliquely to the nozzle of the gun, and means controlled by the carrier for automatically maintaining the nozzle of the gun at substantially a predetermined distance from said obliquely moving surface.

30. A device of the class described comprising in combination an enclosure, sand blast guns mounted to swing upon the oppo-

site sides of the enclosure, a carrier adapted to move an article of manufacture within the enclosure between the nozzles of the guns, the article having converging surfaces extending obliquely to the nozzles, and means controlled by the carrier for maintaining the nozzles substantially at a predetermined distance from said surfaces when the article is moving between the nozzles.

31. A device of the class described, comprising in combination an enclosure having an opening in the wall thereof, a carrier adapted to move an article within said enclosure, a holder mounted to swing toward and from said article, a sand blast gun pivoted to said holder and adapted to play upon said article through said opening in the wall of the enclosure, and means for oscillating the gun and swinging the holder.

32. A device of the class described comprising in combination an enclosure, a carrier for moving an article of manufacture within the enclosure, a holder mounted to swing upon the enclosure, a sand blast gun carried by the holder and adapted to play upon a surface of the article moving obliquely to the nozzle of the gun, and cooperating means extending between the carrier and said holder for maintaining the nozzle of the gun at substantially a predetermined distance from said obliquely moving surface.

33. A device of the class described comprising in combination an enclosure, a carrier for moving an article of manufacture within the enclosure, a sand holding receptacle, a sand blast gun connected therewith and adapted to play upon a surface of the article moving obliquely to the nozzle of the gun, means controlled by the carrier for maintaining the nozzle substantially at a predetermined distance from said obliquely moving surface, and a suction producing apparatus connected with the enclosure for drawing off the dust accumulating therein.

34. A device of the class described comprising in combination an enclosure, a carrier for moving an article of manufacture within the enclosure, a sand holding receptacle beneath the enclosure, a sand blast gun connected with the receptacle and adapted to play upon the article through an opening in the wall of the enclosure, automatic means for maintaining the nozzle of the gun at substantially a predetermined distance from the article, means for moving said carrier, a dust collector, and means for drawing off the dust from the enclosure and forcing it into the dust collector.

35. A device of the class described comprising in combination an enclosure, a carrier adapted for moving an article of manufacture within the enclosure, a sand holding receptacle, a sand blast gun connected with the receptacle, a pivoted holder for the gun adjacent the enclosure, the gun being adapted to play upon the article through an opening in the wall of the enclosure, means controlled by the carrier for automatically maintaining the gun at substantially a predetermined distance from a surface of the article moving obliquely to the nozzle of the gun, suction producing apparatus for drawing off the dust accumulating within the enclosure, and means for lighting the interior of the enclosure.

36. A device of the class described comprising in combination an enclosure, a carrier for moving an article of manufacture through the enclosure, a sand blast gun mounted to swing at each side of the enclosure, a sand holding receptacle with which said guns are connected, the guns being adapted to play upon converging sides of the article through openings formed in the wall of the enclosure, means controlled by the carrier for maintaining the nozzles of the guns at substantially a predetermined distance from said converging sides, and a suction producing apparatus connected with the enclosure for drawing off the dust accumulating therein.

37. A device of the class described comprising in combination an enclosure, a carrier for moving an article of manufacture within the enclosure, a swinging holder upon the enclosure, a sand blast gun connected with said holder and adapted to play upon the article through an opening in the wall of the enclosure, a roller connected with the carrier, a spring pressed member connected with said holder and extending in the path of the roller and adapted to be controlled by the roller to maintain the nozzle of the gun at substantially a predetermined distance from a surface of the article moved by the carrier obliquely to the nozzle of the gun, and means for moving the carrier.

38. A device of the class described comprising in combination a frame, a track mounted upon said frame, a carrier movable upon said track and adapted to support an article of manufacture having converging sides, sand blast guns pivotally mounted upon the frame on opposite sides of the track, spring pressed members normally maintaining the nozzles of the guns at a predetermined distance apart, and rollers upon said carrier adapted to engage said spring pressed members at a predetermined point in the travel of the carrier whereby the nozzles of the guns are moved apart substantially at the time when the article begins to move between the nozzles and thereafter automatically returning to normal position at a rate of speed which insures the maintenance of the nozzles at substantially a predetermined distance from the converging sides of the article.

39. A device of the class described comprising in combination a frame, a carrier mounted to travel upon the frame and adapted to support an article of manufacture, a holder movably mounted upon the frame, a sand blast gun carried by the holder and adapted to play upon a surface of the article moving obliquely to the nozzle of the gun, a roller upon the carrier, and a spring pressed member upon which the roller is adapted to travel extending obliquely to the line of travel of the carrier, said spring pressed member being connected with said holder and co-operating with the roller to maintain the nozzle of the gun at substantially a predetermined distance from the obliquely moving surface of the article.

40. A device of the class described comprising in combination a frame, a carrier mounted to travel upon the frame adapted to support an article of manufacture having a surface extending obliquely to the direction of movement of the carrier, a holder pivotally mounted upon the frame, a sand blast gun mounted upon the holder, a member inclined with respect to the line of movement of the carrier, means connecting said inclined member with said holder, a roller connected with the carrier and adapted to travel upon said inclined member to first move the gun in an outward direction from the article and thereafter permitting the gun to gradually return to normal position during which time it is kept substantially at a predetermined distance from the obliquely moving surface of the article.

41. A device of the class described comprising in combination a track, a carrier mounted for movement upon the track and adapted to support an article of manufacture having convergently arranged sides, holders movably mounted at the opposite sides of the track, a sand blast gun mounted upon each of said holders, convergent members connected with said holders, rollers connected with the carrier and adapted to engage said convergent members to actuate the same for the purpose of moving the nozzles of the guns in a direction away from the converging sides of the article substantially at the time that the article is brought to a point opposite the nozzles, and springs for returning said holders to normal position as the rollers travel upon said convergent members whereby the nozzles of the guns are maintained at substantially a predetermined distance from the obliquely moving surfaces of said article.

42. A device of the class described comprising in combination a frame, a track upon said frame, a carrier adapted to travel upon said track and arranged to support the body of an automobile, automatic means for sand blasting the ends of the body while the carrier is traveling upon one portion of the track, and automatic means for sand blasting the sides of said body while traveling upon another portion of said track.

43. A device of the class described comprising in combination a frame, a track mounted upon said frame having a curved portion, a carrier arranged to travel upon said track including a depending portion adapted to support the body of an automobile, means for moving the carrier, means for preventing the turning of said depending portion when the carrier moves upon the curved portion of the track, automatic means for sand blasting the ends of the body while the carrier is traveling upon one portion of the track, and automatic means for sand blasting the sides of the body when the carrier is moving upon another portion of the track.

44. A device of the class described comprising in combination a frame, a continuous track mounted upon said frame, a carrier for supporting an automobile body having converging sides and adapted to travel upon said track, a plurality of sand blast guns suspended to swing upon said frame, and means controlled by the carrier for maintaining the nozzles of the guns substantially at an equal distance from the sides of the body when the latter is moved by the carrier, and means for moving the carrier upon the track.

45. A device of the class described comprising means for moving an automobile body in two directions, means for sand blasting the ends of the body when moving in one direction, and means for automatically sand blasting the sides of the body when moving in the other direction.

46. A device of the class described comprising means for moving an automobile body in two planes at substantially right angles to each other without changing the direction in which the longitudinal axis of the body is normally aligned, means for sand blasting the ends of the body when said body is moved in one of the planes, and automatic means for sand blasting the sides of the body while moving in the other of said planes.

47. A device of the class described comprising in combination an L-shaped enclosure, means for moving an automobile body through the enclosure without changing the direction in which the body is aligned, means for sand blasting the ends of the body while moving through one leg of the L-shaped enclosure, and means for sand blasting the sides of the body while moving through the other leg of the enclosure.

48. A device of the class described comprising in combination an L-shaped enclosure, means for conveying the body of an automobile through the enclosure, sand

blast guns mounted to play upon the ends of the body through openings in the wall of the enclosure while moving through one leg thereof, and a plurality of sand blast guns adapted to play upon the sides of the body through openings in the wall of the other leg of the enclosure while the body is moving therethrough.

49. A device of the class described comprising in combination an L-shaped enclosure, a track comprising two portions extending at substantially a right angle to each other and having a curved connecting portion at the connecting ends of the legs of the enclosure, a carrier adapted to travel upon said track, means for suspending an automobile body from said carrier, means for sand blasting the ends of the body while passing through one leg of the enclosure, means for sand blasting the sides of the body while passing through the other leg of the enclosure, and means for preventing the turning of said body suspending means when the carrier travels around the curved portion of the track to prevent the shifting of the longitudinal axis of the body while moving through said L-shaped enclosure.

50. A device of the class described comprising in combination a frame, a track supported by said frame comprising two portions extending at substantially a right angle to each other and having a curved connecting portion therebetween, a carrier adapted to travel upon said track, means for suspending an automobile body from the carrier, arms connected with the carrier, guides spaced upon the opposite sides of the track between which said arms are adapted to move to prevent the turning of the body suspending means while the carrier is rounding the curved portion of the track, means for sand blasting the ends of the body while on one portion of the track, and means for sand blasting the sides of the body while upon the other portion of the track.

51. A device of the class described comprising in combination a frame, a track upon the frame having two portions extending at substantially a right angle to each other and connected by an intermediate curved portion, a carrier adapted to travel upon said track, means for suspending an automobile body from said carrier, means for moving the carrier upon the track, means adapted to prevent the turning of the body when the carrier is traveling upon the curved portion of the track, sand blast guns adapted to play upon the rear end and cowl of the body while the carrier is moving upon one portion of the track, and additional sand blasts guns adapted to automatically play upon the sides of the body while the carrier is moving upon the other portion of the track.

52. A device of the class described comprising in combination a frame, a track upon the frame having two straight portions extending substantially at a right angle to each other connected by an intermediate curved portion, a carrier mounted to travel upon the track a swiveled member upon the carrier adapted to support an automobile body, arms upon the swiveled member, guides for said arms serving to prevent the turning of the swiveled member when the carrier is rounding the curved portion of the track, a sand blast gun adapted to automatically play upon the rear end of the body while the carrier is moving upon one straight portion of the track, a plurality of sand blast guns adapted to automatically play upon the sides of the body when the carrier is moving upon the other straight portion of the track, and means for moving the carrier.

53. A device of the class described comprising in combination an enclosure, means for conveying an automobile body through said enclosure, means for sand blasting the surfaces of the body while passing through the enclosure, a second enclosure into which the body is carried by said conveying means, and means for cleaning the body within said second enclosure.

54. A device of the class described comprising in combination an enclosure, having separate compartments, a flexible curtain between said compartments, a carrier for conveying an automobile body through said enclosure, means for sand blasting the surfaces of the body while passing through one of the compartments, and means for cleaning the body while passing through the other compartment.

55. A device of the class described comprising in combination an enclosure having two portions extending at substantially a right angle to each other, means for conveying an automobile body through said enclosure, means adapted to prevent the turning of the body while passing through the enclosure, means for sand blasting the ends of the body in one portion of the enclosure, means for sand blasting the sides of the body in the other portion of the enclosure, a cleaning compartment in line with the last mentioned enclosure adapted to receive the body when moving out of said last mentioned enclosure, and means for cleaning the body in said compartment.

56. A device of the class described comprising in combination an L-shaped enclosure, flexible curtains at the ends of said enclosure, a flexible curtain intermediate the ends of the enclosure dividing the same into separate compartments, a carrier for conveying an automobile body through said enclosure, the intermediate curtain being temporarily pushed aside by the body while passing through the enclosure and there-

after automatically dropping back to substantially closed position, means for automatically sand blasting the surfaces of the body while passing through that portion of the enclosure between the first and intermediate curtains, means for cleaning the body while within the compartment between the last and intermediate curtains, and means for preventing the body from turning while passing through said L-shaped enclosure.

57. A device of the class described comprising in combination an L-shaped enclosure including two separate compartments, a carrier for conveying an automobile body through said enclosure, means for preventing the turning of the body while passing through the enclosure, means for sand blasting the surface of the body while in one of the compartments, and means for cleaning the body while in the other compartment.

58. A device of the class described comprising in combination a frame, a track thereon having straight and curved portions, a carrier mounted to travel upon the track, a swiveled member upon the carrier adapted to support a work member, an arm upon the swiveled member, a guide for said arm serving to prevent the turning of the swiveled member when the carrier moves upon the curved portion of said track, and means adapted to sand blast said work member when supported by said carrier.

59. A device of the class described comprising in combination a frame, a track thereon having straight and curved portions, a carrier mounted to travel upon the track, a swiveled member upon the carrier adapted to support a work member, an arm upon the swiveled member, a guide for said arm serving to prevent the turning of the swiveled member when the carrier moves upon the curved portion of said track, a sand blast gun for sand blasting said work member, and means controlled by the carrier adapted to move the gun relatively to the work member.

60. A device of the class described comprising in combination a frame, a track thereon having straight and curved portions, a carrier mounted to travel upon the track, a swiveled member upon the carrier adapted to support a work member, arms upon the swiveled member, guides between which said arms are adapted to move to prevent turning of the swiveled member when the carrier moves from the straight to the curved portion of the track, a sand blast gun mounted to swing opposite said work member, and means controlled by the carrier for moving the gun relatively to the work member.

61. In a device of the class described, a sand blast compartment having a sand blast equipment, a dust removing compartment having means for directing blasts of air, flexible means separating said compartments, a carrier extending continuously through said two compartments for transporting an article first through said sand blast compartment and then through said dust removing compartment, and means for driving said carrier.

In testimony whereof, we affix our signatures.

CHARLES W. McKINLEY.
EARL E. HOFFMAN.