April 2, 1940. D. A. WALLACE ET AL 2,195,475

SPRAYING APPARATUS

Filed Sept. 16, 1937 6 Sheets-Sheet 1

FIG. 2.

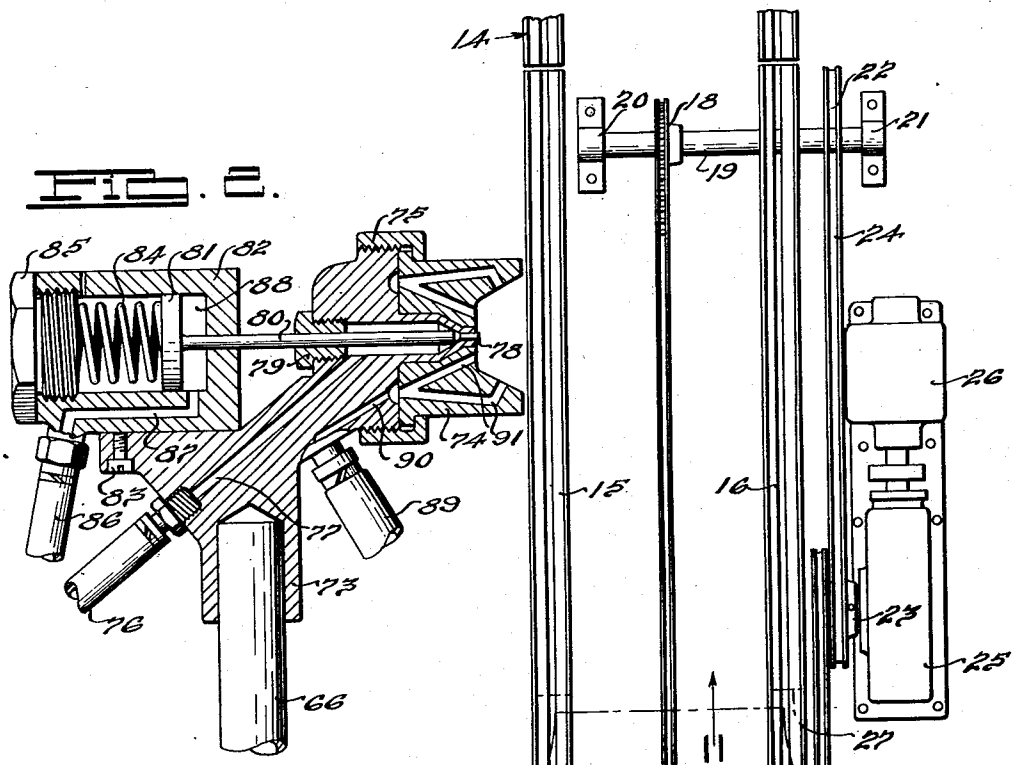
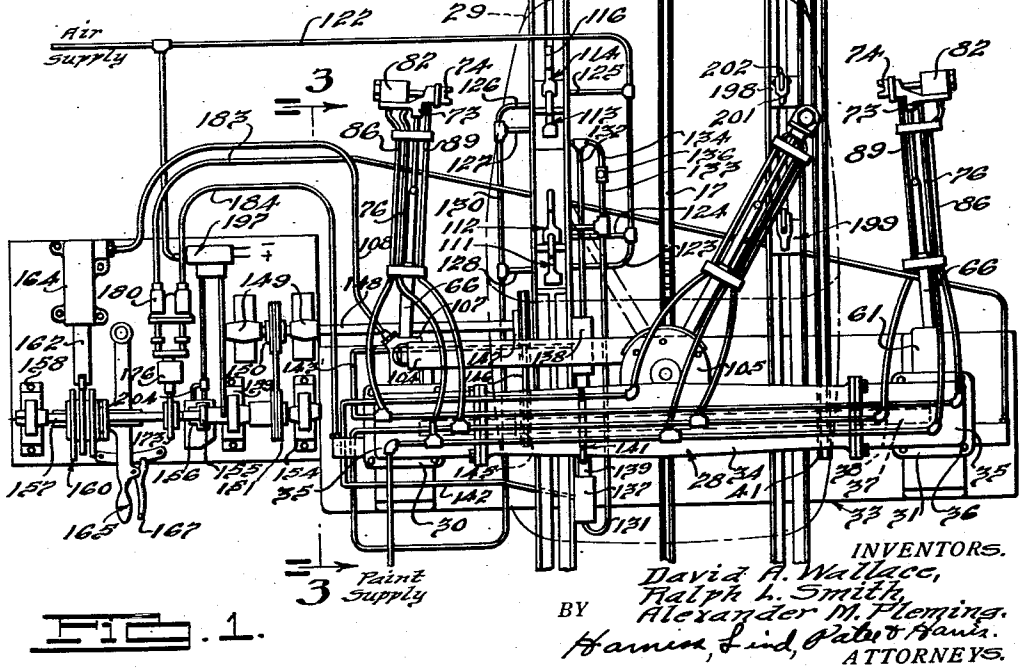


FIG. 1.



INVENTORS.
David A. Wallace,
Ralph L. Smith,
Alexander M. Fleming.
BY Harrison, Lind, Peter & Davis.
ATTORNEYS.

April 2, 1940. D. A. WALLACE ET AL 2,195,475

SPRAYING APPARATUS

Filed Sept. 16, 1937 6 Sheets-Sheet 2

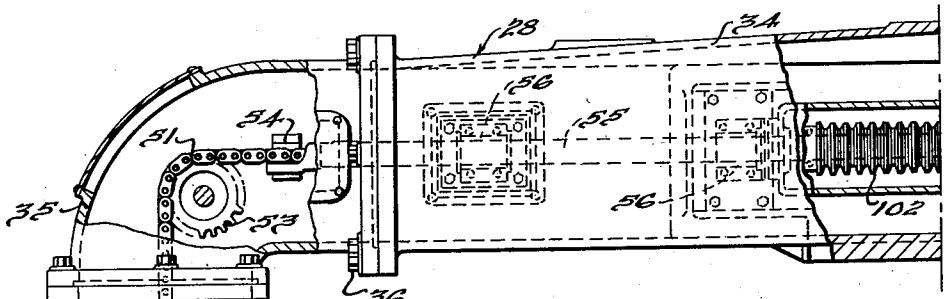


FIG. 4.

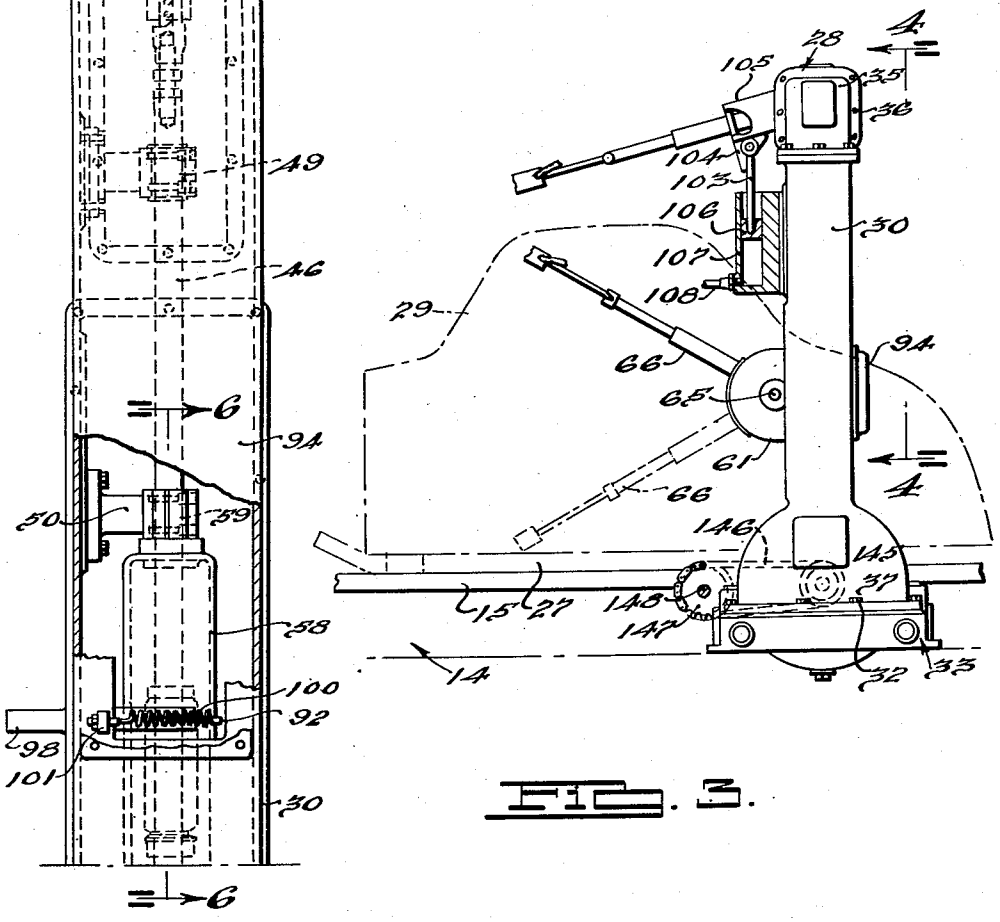


FIG. 3.

INVENTORS.
David A. Wallace,
Ralph L. Smith,
BY Alexander M. Fleming.
Harness, Dickey, Pierce & Harris.
ATTORNEYS.

April 2, 1940. D. A. WALLACE ET AL 2,195,475

SPRAYING APPARATUS

Filed Sept. 16, 1937 6 Sheets-Sheet 3

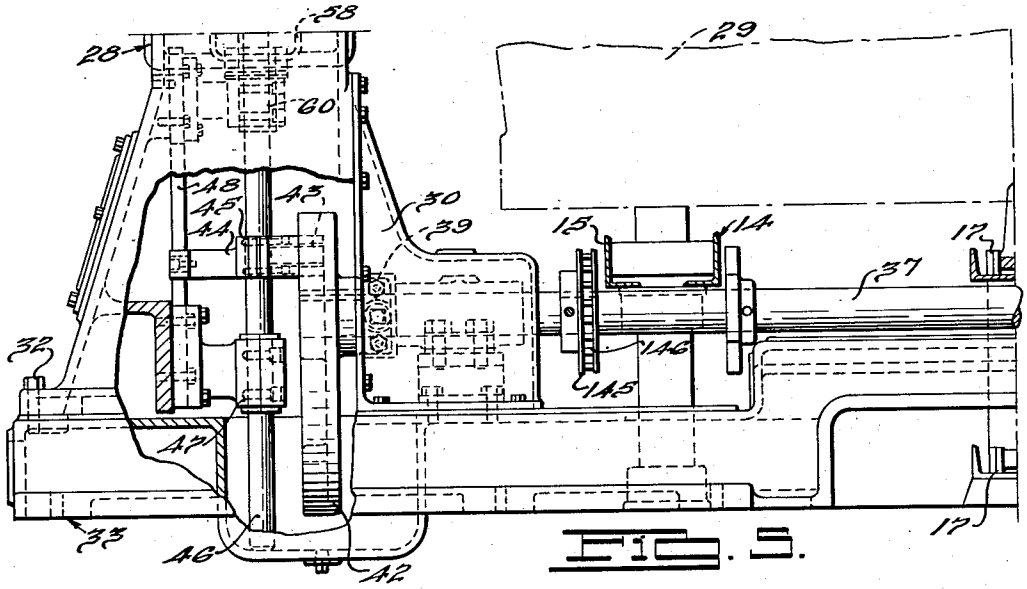


FIG. 5.

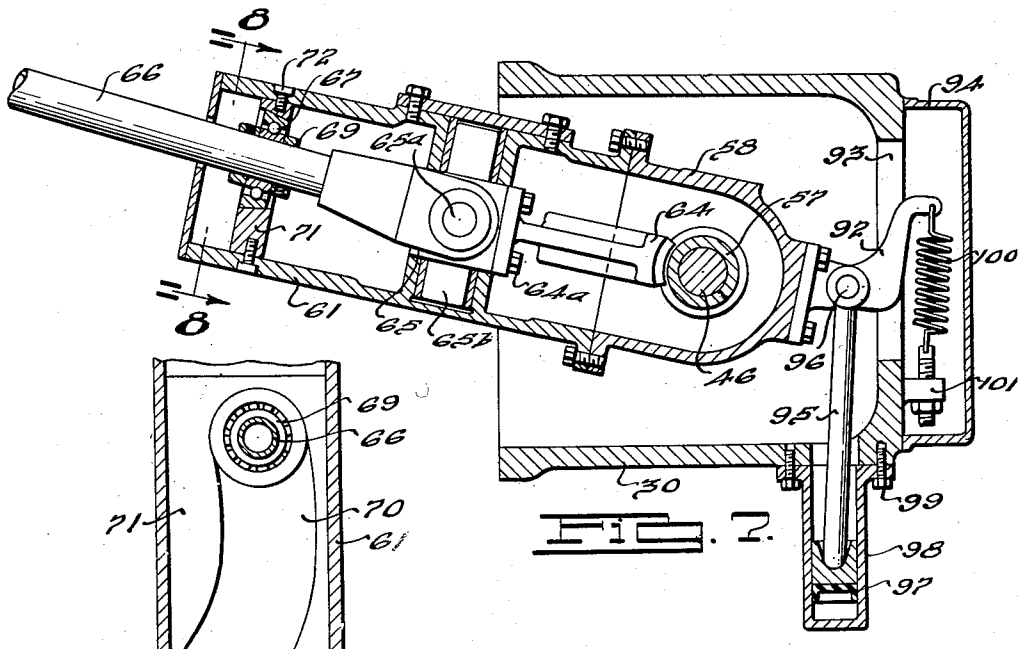


FIG. 7.

FIG. 8.

INVENTORS.
David A. Wallace,
Ralph L. Smith,
BY Alexander M. Fleming.
Harness, Lind, Potts & Hanis.
ATTORNEYS.

April 2, 1940. D. A. WALLACE ET AL 2,195,475

SPRAYING APPARATUS

Filed Sept. 16, 1937 6 Sheets-Sheet 4

FIG. 8.

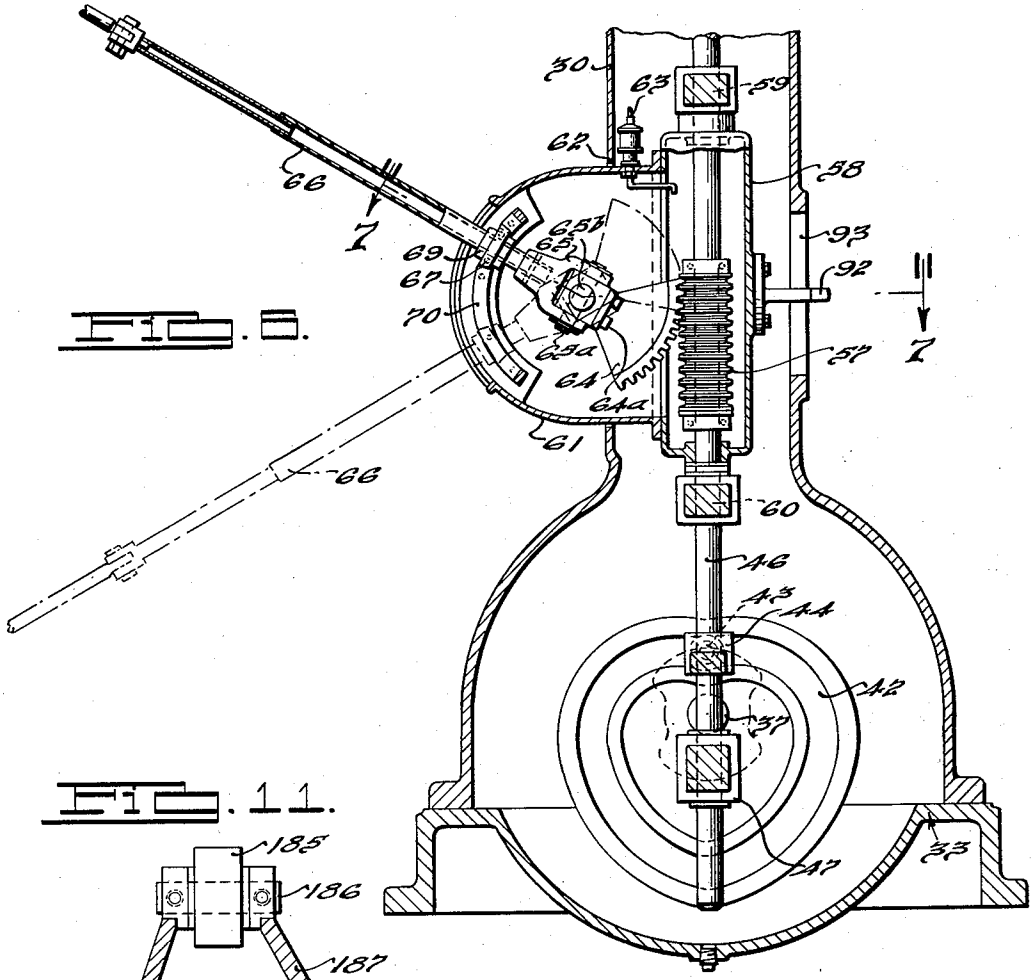
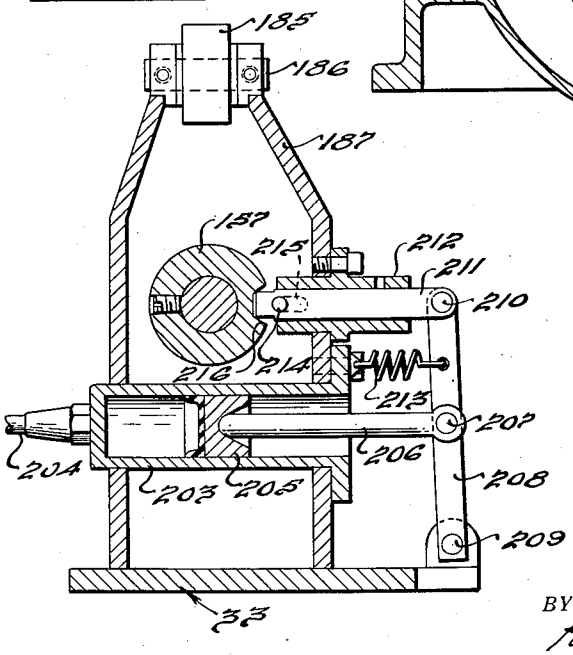


FIG. 11.



INVENTORS.
David A. Wallace,
Ralph L. Smith,
BY Alexander M. Fleming.
Harness, Lind, Peter & Harris.
ATTORNEYS.

April 2, 1940. D. A. WALLACE ET AL 2,195,475

SPRAYING APPARATUS

Filed Sept. 16, 1937 6 Sheets-Sheet 5

FIG. 9.

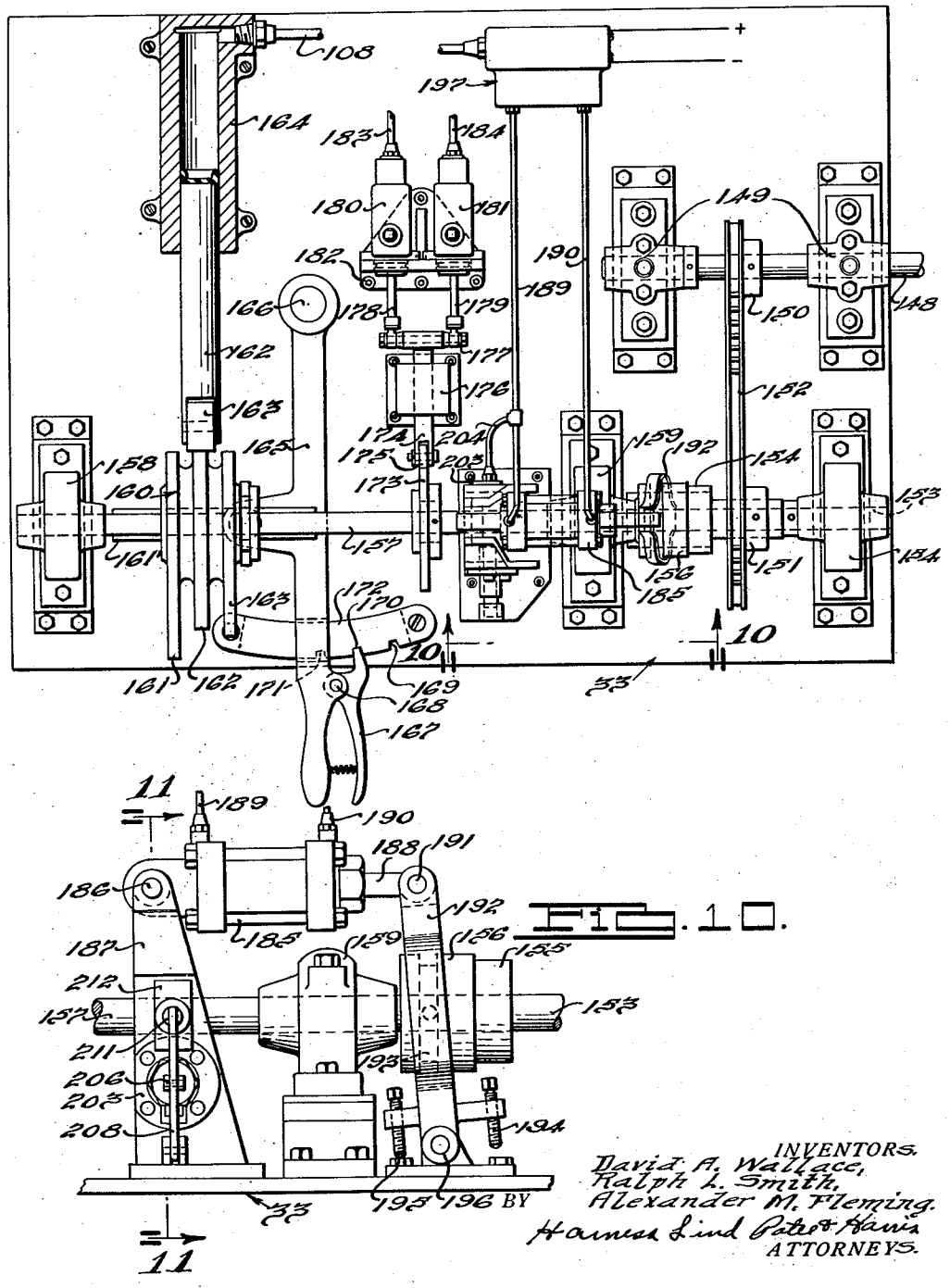


FIG. 10.

INVENTORS.
David A. Wallace,
Ralph L. Smith,
Alexander M. Fleming.
BY
Haines Lind Gates & Davis
ATTORNEYS.

April 2, 1940. D. A. WALLACE ET AL 2,195,475

SPRAYING APPARATUS

Filed Sept. 16, 1937 6 Sheets-Sheet 6

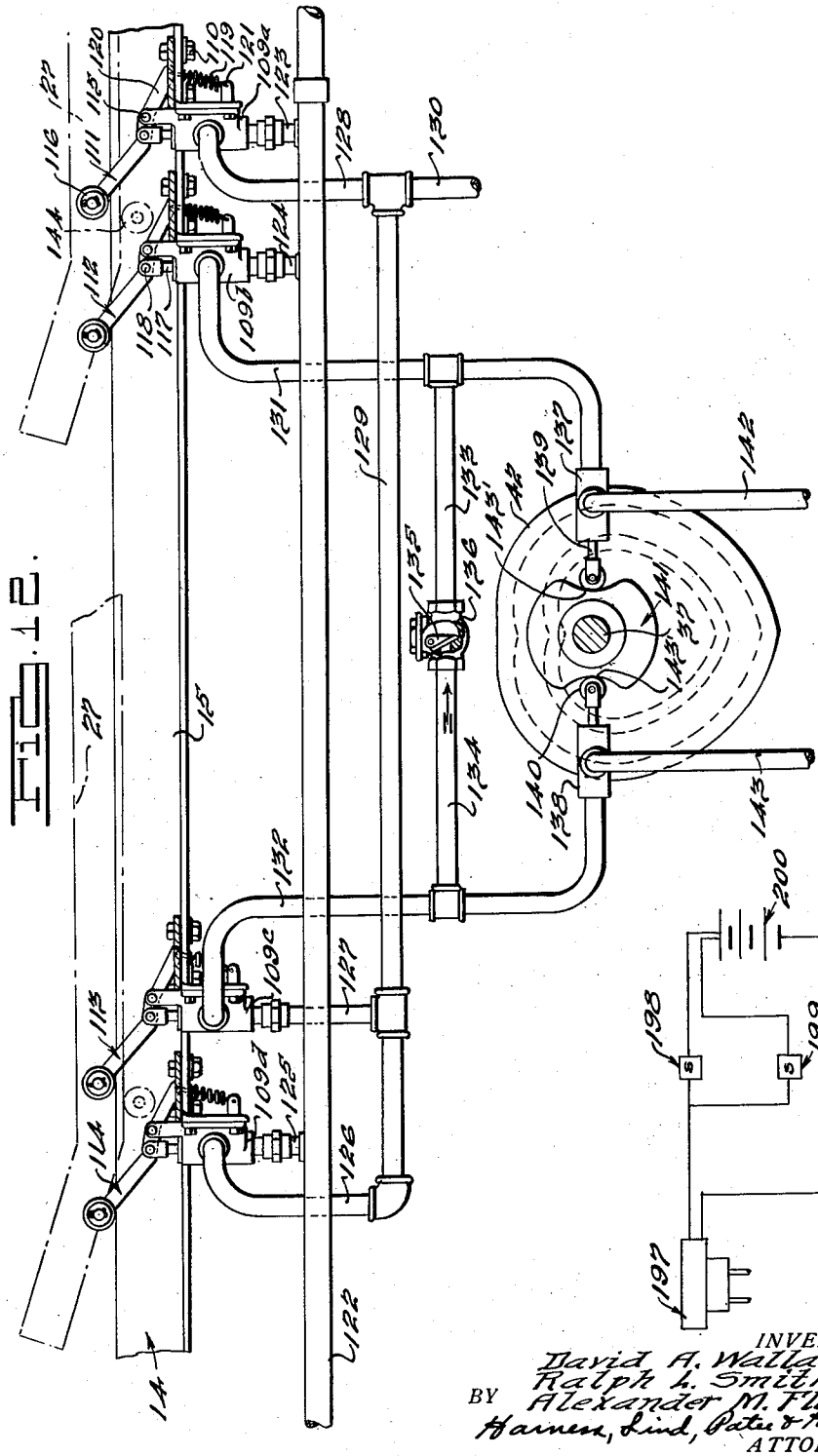


Fig. 12.

Fig. 17.

INVENTORS.
David A. Wallace,
Ralph L. Smith,
Alexander M. Fleming.
BY Harness, Dickey, Pierce & Harris.
ATTORNEYS.

Patented Apr. 2, 1940 2,195,475

UNITED STATES PATENT OFFICE

2,195,475

SPRAYING APPARATUS

David A. Wallace, Detroit, Ralph L. Smith, St. Clair Shores, and Alexander M. Fleming, Detroit, Mich., assignors to Chrysler Corporation, Highland Park, Mich., a corporation of Delaware

Application September 16, 1937, Serial No. 164,130

12 Claims. (Cl. 91—45)

This invention relates to improved surface coating material spraying apparatus, and refers more particularly to apparatus of this kind which is automatic in operation.

It is an object of our invention to provide a spraying apparatus of the character which effects relative movement between a spray discharge device and the article to be sprayed.

Another object of our invention resides in the provision of such a spraying apparatus which includes means for variably maintaining the ends of the spraying device at a desired distance from all portions of irregular surfaces of articles which are unlike in contour.

A further object of our invention is to provide in an apparatus of this kind a spraying device which moves throughout a substantial distance during operation so that a single or relatively small number of spraying devices may be employed to spray extended surfaces.

An additional object of the invention is to provide means for oscillating a spray device at uniform speed throughout substantially all portions of its oscillatory path in order that a film of coating material of uniform thickness will be built up upon all portions of the surface sprayed upon.

Heretofore, in spraying apparatus of this nature, the spraying device did not automatically or uniformly follow the contour of the articles being treated, and as a result inferior coatings, uneven in thickness, were produced and a comparatively large portion of the coating material was wasted. With our spraying apparatus, however, the spraying device automatically follows the surface contour by remaining at a fixed distance therefrom even when such surfaces are extremely irregular and curvilinear and thereby produces a coating of uniform thickness and appearance on the article with a resulting economy in the spraying cost.

Other objects of our invention are to provide in a spraying apparatus of this kind a movable spraying device which moves in a plurality of directions; and to provide a spraying apparatus that may be easily converted to the spraying of unlike articles, particularly automobile bodies of different types.

Further objects and advantages of our invention will be apparent from the following detailed description of one illustrative embodiment of the principles of our invention, reference being had to the accompanying drawings in which:

Fig. 1 is a plan view illustrating one embodiment of our surface coating material spraying apparatus.

Fig. 2 is an enlarged detail elevational view, partly in section, of one of the spraying devices of the apparatus.

Fig. 3 is a fragmentary elevational view, partly in section, showing the apparatus as viewed from the line 3—3 of Fig. 1.

Fig. 4 is an enlarged partial elevational view showing the apparatus as viewed from the line 4—4 of Fig. 3, and illustrating portions broken away to disclose the underlying structure.

Fig. 5 is a fragmentary partial elevational showing a continued portion of the structure illustrated in Fig. 4 and continuing from the lowered portion thereof.

Fig. 6 is detail sectional view taken approximately as indicated by the line 6—6 of Fig. 4.

Fig. 7 is an enlarged detail sectional taken along the line 7—7 of Fig. 6.

Fig. 8 is a sectional view taken as indicated by the line 8—8 of Fig. 7.

Fig. 9 is a plan view of the hydraulic control system for the spraying devices.

Fig. 10 is an enlarged elevational view as viewed from the line 10—10 of Fig. 9.

Fig. 11 is a vertical sectional view taken approximately as indicated by the line 11—11 of Fig. 10.

Fig. 12 is a diagrammatic view of the valve mechanism for controlling the atomizing air and surface coating material.

Fig. 13 is a diagrammatic view illustrating the electrical system of the apparatus.

With reference to the drawings, a conveyor 14 is illustrated (best shown in Figs. 1 and 12) as comprising two parallel channelled tracks 15 and 16. A conveyor chain 17 is centrally disposed between the tracks 15 and 16 and passes around a sprocket wheel 18 by which it is driven.

The wheel 18 is fixed to a shaft 19 which is journalled in bearing supports 20 and 21 located below the level of the tracks 15 and 16. The shaft 19 is driven by a sprocket wheel 22 fixed to the shaft 19 adjacent to the support 21. Extending around the wheel 22 and around one sprocket a double sprocket drive wheel 23 is a chain 24 which transmits the drive therebetween from a reduction unit 25 coupled with a prime mover 26.

The chain 17 is adapted to move article carrying skids 27 toward an arch-like structure 28 of our spraying apparatus. In the illustrated embodiment of our invention we prefer to show our surface coating material spraying apparatus

operating upon automobile bodies to be painted, but attention is directed to the fact that other articles may be so treated with paint or any other surface coating material that can be sprayed.

An automobile body of the coupé style is indicated at 29 on one of the skids 27 in the proximity of the arch-like structure 28 and in position to be automatically sprayed, as will hereinafter be more apparent.

The structure 28 preferably comprises two vertical hollow stanchions 30 and 31 provided with inspection plates and secured by bolts 32 to a base 33, a horizontal hollow member 34, and two hollow elbow joints 35, fixed together by assembly bolts 36.

The reduction unit 25 simultaneously transmits the drive through the drive wheel 23 to the chain 17 and to a driving shaft 37 extending under and transversely of the tracks 15 and 16. Suitable supports are provided at 38 and 39 on the arch-like structure 28 for rotatively supporting the shaft 37 which is driven in timed relation to the conveyor chain 17 by a drive belt 40 extending around the double sprocket wheel 23 and around a sprocket wheel 41 fixed to the shaft 37.

Drivingly connected to the left end of the shaft 37, as viewed in Fig. 1, is a face cam 42 within which is located a roller follower member 43 which is adapted to follow the cam surface. The roller member 43 is carried by a link member 44 fixed at 45 to a reciprocating vertical rod 46 reciprocably mounted on an extension 47 of the stanchion 30. The heart-shaped cam groove of the cam 42 is so constructed and arranged as to subject the rod 46 and the spray gun carrying arms (hereinafter described) to movement of substantially uniform velocity during all portions of their respective strokes. The movement of the link member 44 is further confined to a vertical course by a vertical guide member 48 fixed to the stanchion 30. Additional supports for the reciprocating rod 46 are provided by the stanchion 30 at 49.

Fixed to the upper end of the rod 46 is a block chain 51 which extends over a sprocket wheel 53 and transmits movement of the rod 46 to a horizontal rod 55 which is slidably mounted within the hollow member 34 at 56. Inasmuch as the right side of the structure 28 is symmetrical with the other side it has not been shown or described.

The rod for the right side which serves as the equivalent of the rod 46, however, is adapted to be reciprocated by a face cam fixed to the shaft 37 that is swung around 180 degrees with respect to the position of the face cam 42. During the rotation of this shaft 37 the cam faces are simultaneously rotated and they impart reciprocatory movement to the rods 46 and 55, and chains 51 as a unitary structure.

Inasmuch as both sides of the structure of Figs. 4 and 5 are symmetrical, we shall treat the left half as the representative one. A toothed rack sleeve 57 is fixed to rod 46 and housed within a casing 58. The casing 58 is journalled on the rod 46 and the rod is slidably mounted in bearings 59 and 60 carried by the stationary structure 30. A fixed extension member 61 of the casing 58 is adapted to move with the casing 58 within an opening 62 (best shown in Fig. 6) in the stanchion 30. An oiling device 63 is carried by the extension member 61 to lubricate the moving parts within the casing 58. In engagement with the rack sleeve 57, is a toothed sector 64 secured by bolts 64^a to a member 65 having pairs of arms 65^a and 65^b.

A spray gun arm 66 is pivotally supported by the arms 65^a of the member 65 which accommodate pivotal movement of the arm about an axis extending normal to the axis of the sector 64. Mounted on an intermediate part of the arm 66 is a ball bearing member 67 which is held in place by lock rings 69. The bearing 68 is adapted to move within an arcuate slot 70 (best shown in Fig. 8) provided in web structure 71 detachably secured in position by set screws 72. The curvature of this slot 70 is such that a spray gun mounted on the end of the arm 66 will oscillate mainly in a vertical course and at uniform speed throughout all portions of its stroke adjacent the side of the vehicle body to the extent of the movement produced by the cam 42, as will presently be more apparent. During the oscillatory movement, the arm and spray device are moved inwardly and outwardly with respect to a vertical plane to the extent established by the action of the roller 69 in the slot 70 in order to assist in maintaining the discharge end of the spray device at a fixed distance from a laterally curved side wall of the body.

Fixed to the outside of the casing 58 is a bracket 92 extending through a slot 93 and into a recessed cover 94 on the stanchion 28. A piston rod 95 is so pivotally connected at 96 with the member 92 that movement of the rod 95 will swing the spray gun transversely of the reciprocatory travel of the gun induced by the cam face 42 by bodily turning the gun supporting arm, and casing about the rotative axis of the latter, this movement of the spray gun being provided for in order to compensate for variations in the width of the body at diverse longitudinal locations and to keep the gun at a fixed distance from all portions of longitudinally curved side surfaces of the body. The rod 95 carries a piston 97 which is adapted to reciprocate with a cylinder 98 fixed by bolts 99 to the stanchion 30 when fluid medium is forced into the cylinder 98 under conditions which will presently be more apparent. To yieldingly return the member 92 in opposition to the action of the piston 97, a return spring 100 is fixed to the member 92 and to an extension 101 of the stanchion 30.

Another spray gun is mounted to spray the upper surface of the vehicle body 29. The upper gun is quite similar to the illustrated side guns, the former receiving its reciprocatory movement from a toothed rack sleeve 102 fixed to the rod 55 intermediate its ends. A piston rod 103 (best shown in Fig. 3) is also pivotally connected to a laterally extending bar 104 fixed to the casing 105 of the arm supporting structure. The piston rod 103 is adapted to move the spray gun vertically in response to fluid pressure on a piston 106 carried by the rod 103 in order to permit the gun to be maintained in fixed spaced relationship to all portions of laterally curved body tops. The piston 106 moves within a cylinder 107 carried by the stanchion 30 and is actuated by fluid pressure introduced into the cylinder 107 through a conduit 108. Supply of fluid medium to the cylinders 98 and 107 of the side and top gun controlling means is automatically controlled as hereinafter more fully set forth.

The spray gun comprises a body member 73 fixed to the end of the arm 66. A discharge nozzle 74 is detachably secured to the member 73 by a threaded ring 75. Paint is admitted from a hose 76 into a passage 77 communicating with a

tapering discharge conduit 78 within the member 73. The larger end of the conduit 78 is closed by a hollow threaded plug 79 that receives a valve stem 80 which is normally adapted to close the smaller end of the conduit 78 to stop the spraying of paint. The valve stem is fixed to a piston 81 of valve actuating mechanism disposed within a cylinder 82 secured to the body portion 73 by a set screw 83. A resilient means such as a spring 84 is interposed between the piston 81 and a threaded plug 85 which seals the open end of the cylinder 82 for normally urging the valve toward its closed position. Air is admitted from a hose 86 through a passage 87 in the cylinder 82 to one side 88 of the piston therein and thereby moves the piston against the pressure of the spring 84 to open the spray discharge outlet of the conduit 78. A hose 89 admits air through registering passages 90 and 91 within the body portion 73 and the nozzle 74 to atomize the paint emerging from the conduit 78 and to predetermine the shape of the spray pattern.

To automatically control the atomizing air and the paint admitted to the spray guns there is provided a series of valve mechanisms which are adapted to be progressively actuated by the movement of the skids 27 along the tracks of the conveyor 14.

A number of similar valve bodies 109a, 109b, 109c, and 109d (best shown in Fig. 12) are disposed below the track 16 and fixed thereto by fasteners 110. Yoked arms 111, 112, 113, and 114 are progressively arranged and pivotally supported by pins 115 on each of the bodies 109a, 109b, 109c, and 109d. The upper end of each of the arms 111 to 114 carries a roller 116 which normally protrudes through and above the track 16. A valve 117 is pivotally connected at 118 to each of the arms 111 to 114 and is adapted to reciprocate within the bodies 109 to control the air passing through these valve bodies. To yieldingly urge the arms 111 to 114 to their normal condition, a spring 119 is interposed between an extension 120 of these arms and a projection 121 of the bodies 109a, 109b, 109c and 109d.

A main air supply line 122 is in constant communication through connector line 123, 124 and 125 with the bodies 109a, 109b, and 109d. The bodies 109a, 109c, and 109d are in continuous communication through the lines 126, 127, 128, and 129, and a line 130 is adapted to convey air to the hoses 89 for the top and the side spray guns.

Leading from the valve bodies 109b and 109c are lines 131 and 132 respectively. Interposed between the lines 131 and 132 are lines 133 and 134 having a one-way clapper valve 135 housed in a casing 136 joining the line 133 and 134 but permitting air to pass only from line 134 into line 133. The ends of the lines 131 and 132 lead to valve casings 137 and 138 which are so disposed with respect to each other that reciprocating valves 139 therein having rollers 140 will ride on a cam 141 fixed to the shaft 37.

When the valve 139 of the casing 137 is closed, as shown, no air will pass into a line 142 communicating with the hose 86 of the top spray gun cylinder, thereby allowing the stem 80 to stop the passage of paint. With the valve 140 of the casing 138 in its closed condition, as shown, no air passes into a line 143 communicating with the hoses 86 of the side spray guns and as a result the paint discharge valve 80 thereof is held in its closed position. The cam 141 has oppositely spaced low sides 143' which are so arranged thereon that the flow of paint from the top and the side guns will be automatically cut off when the path of the top gun and each of the side guns overlaps in their travel during the spraying operation. This prevention of overlapping eliminates double spraying of the same surface of the body 29, resulting in an improved and less costly paint job.

When a body moving on the tracks 15 and 16 is in position to be sprayed, air under pressure is admitted to the mechanism, shown in Fig. 12, except under certain conditions as will hereinafter be more apparent, the conveyor chain 17 and the shaft 37 automatically move the body and cause the spray guns to oscillate while spraying the body. The arms 111 to 114 are normally in their illustrated positions. As the conveyor chain 17 moves the skid 27 the skid forces the arm 111 down to the position indicated at 144, which opens the valve to pass the air from the line 123 into the line 128 where it communicates with the line 130. The admittance of air to the line 130 furnishes atomizing air to all the spray guns.

As the skid moves further it also depresses the arm 112 which connects the line 124 to the line 131. With the arms 111 and 112 down, the pressure in the lines 131 and 133 does not pass into the line 134 because of the closed one-way valve 135, but passes through the line 142 if the valve 139 is opened by the cam 141. The pressure in the line 142 passes to the cylinder 82 of the top spray gun to cause the gun to spray paint as it oscillates. This is particularly advantageous when the top wall of a car body or other article extends beyond the side walls thereof for spraying of paint on the side walls can be delayed until the side wall portions to be painted have moved into paint spray receiving position. Naturally all guns may be conditioned to start to spray paint at the same time if desired by suitable arrangement of the valves.

Additional movement of the skid 27 allows the arms 111 and 112 to progressively return to their illustrated positions as the skid depresses the lever 113. The movement of the arm 113 connects the lines 127 and 132 from whence the air passes to the line 143, if the valve 138 is opened by the cam 141, into the cylinder 82 of the side spray guns to cause the guns to spray paint as they oscillate. Air within the line 132 also passes through line 134, valve 135, line 133, and line 131 to the cylinder 82 of the top gun as aforesaid so as to maintain operation of the top guns after the skid has passed out of contact with the levers 111 and 112 and while the skid is in contact with lever 113 and 114.

Continued movement of the skid 27 depresses both the arms 113 and 114. The arm 114 thereby opens the line 125 to the line 126 from whence the air passes into lines 129 and 130 to provide atomizing air to all the spray guns even though the arm 111 is in its illustrated position.

As the skid moves off the arm 113 the passage of air through the line 142 and 143 is discontinued and the valves 80 of all the spray guns move in response to the springs 84 to stop the passage of paint.

When the skid allows the arm 114 to swing up to its illustrated position the passage of air through the line 126 is stopped and the line 130 no longer supplies any of the guns with atomizing air.

The mechanism for causing the spray guns to automatically follow the contour of the body 29,

includes a sprocket wheel 145 which is fixed to the shaft 37 and which drives through a block chain 146, a sprocket wheel 147 fixed to a shaft 148.

The shaft 148 (best shown in Figs. 1 and 9) is rotatably mounted on bearings 149 carried by the base 33 and has drivingly connected thereto a sprocket wheel 150. This wheel 150 transmits the drive from the shaft 148 to a sprocket wheel 151 by means of a block chain 152.

A shaft 153, which is parallel to the shaft 148, has fixed thereto the wheel 151. The shaft 153 is journalled in a bearing 154 and has a clutching element 155 adjacent a shiftable clutching element 156 fixed to a shaft 157 in axial alignment with the shaft 153. The shaft 157 is journalled in bearings 158 and 159 carried by the base 33.

A cam member 160 having three faces 161, 162, and 163 is drivingly connected to the shaft 157 by the elongated keys 161'. These cam faces 161, 162, and 163 correspond to the contour to be followed in spraying top surfaces of sedans, coupes, and trunk sedans respectively and they are so shaped that they act through a closed hydraulic system to cause the piston 106 to move the top gun so as to follow the contour of the tops of these particular bodies respectively.

To transmit the contour following movement of the top gun, a piston rod 162 having a roller 163 to ride the cam faces, reciprocates within a cylinder 164 fixed to the base 33. The conduit 108 is filled with fluid and any movement of the rod 162 is transmitted to the piston 106.

A manual control is shown whereby the operator may make a selection of the proper cam face 161 to 163 as the various vehicle bodies are conveyed along the tracks 15 and 16 for painting. A shift lever 165 has an articulated connection 166 on the base 33 and has a slip ring connection with the cam member 160. A spring positioned ratchet member 167 is pivotally connected at 168 to the lever 165 and adapted to engage arcuate notches 169, 170, and 171 carried by an arcuate member 172 fixed to the base 33. When the member 167 engages the notches 169, 170, and 171 the roller 163 is positioned to ride the cam faces 161, 162, and 163 respectively. This shifting of the cam faces can only be effected when the low sides of the cam faces are aligned immediately adjacent the roller 163.

To automatically control the contour following movement of the side guns, a cam member 173 is drivingly connected to the shaft 157 and is so shaped that it acts through two closed hydraulic systems to cause the pistons 97 of the side guns to move the side guns so as to follow the contour of the sides of the body, which side contours for the sedan, coupe, and trunk sedan aforesaid are quite similar.

A yoked rod 174 carries a roller 175 adapted to ride the cam member 173. The rod 174 reciprocates within a support block 176 and engages a link member 177 tying together two piston rods 178 and 179. The rods 178 and 179 are adapted for reciprocatory movement within parallel cylinders 180 and 181 respectively carried by a bracket 182 fixed to the base 33. A conduit 183 communicates between the cylinder 180 and the cylinder 98 of the right hand gun as viewed in Fig. 1; another conduit 184 communicates between the cylinder 181 and the cylinder 98 of the left hand gun.

It is deemed desirable to automatically control the contour following movement of all the spray guns. This mechanism includes cylinder member 185 which has an articulated connection 186 on a vertical support bracket 187 carried by the base 33. A piston rod 188 is adapted to reciprocate within the member 185 in response to air admitted to this member through lines 189 and 190. The rod 188 is pivotally connected at 191 to a yoke shifter member 192 engaging a collar 193 of the clutching element 156. The lower portion of the shifter member 192 has movement limiting stops 194 and 195, and is pivotally supported at 196 on the base 33.

The line 189 is in communication with a valve casing 197 (best shown in Figs. 1 and 9) fixed to the base 33, and when air is admitted therethrough the clutching element 156 moves into engagement with the element 155 to drivingly connect the shafts 153 and 157. The line 190 communicates with the valve casing 197 and when air is admitted the clutching element 156 is moved out of engagement with the element 155 and thereby interrupts the drive between the shafts 153 and 157.

To control the air admitted to the casing 197 electrical switches 198 and 199 (best shown in Figs. 1 and 13) are positioned below the track 16, the switches being arranged in parallel and receive current from a battery 200. Each of the switches 198 and 199 has a yoked arm 201 having a roller 202 adapted to be depressed by the skid 27. The switch 198 is so positioned in alignment with the arm 114 that a two-way valve (not shown) within the casing 197 will admit air from a line 202 to the line 189 simultaneously with the admittance of atomizing air to all the guns as was described earlier.

As the skid travels off of the switch 198 the circuit is not broken inasmuch as the switch 199 is in parallel and closed. The switch 199 is so positioned with respect to the arm 113 that when the skid moves away from this switch the valve of the casing 197 will admit the air from the line 202 to the line 181 to uncouple the shafts 153 and 157 simultaneously with the shutting off of the paint to all the guns in the manner already described.

It is considered desirable to properly locate the shaft 157 to align the low portions of the cam faces 161 to 163 to permit movement of the lever 165 when this shaft and the shaft 153 are uncoupled. To accomplish this end, a cylinder 203 is carried by the bracket 187 and receives air pressure through a line 204 communicating with the line 197. A piston 205 is adapted to reciprocate within the cylinder 203, and has a rod 206 which is pivotally connected at 207 to a link member 208.

The member 208 has an articulated connection at 209 and 210 on the base 33 and a reciprocating key member 211 respectively. A sleeve 212 is fixed to the bracket 187 and receives the member 211. The member 211 is yieldingly urged by a spring 213 toward the shaft 157 until a nib 214 engages the inner end of a slot 215 carried by the sleeve 212 as shown at which time the member 211 engages a notch 216 on the shaft 157. The notch 216 is so located on the shaft 157 that when the member 211 engages the notch 216 the low portions of the cam faces 161 to 163 will be aligned. When air is admitted to the cylinder 203 the piston 205 will move the member 211 out of engagement wth the notch 216, at which time the nib 214 is adjacent the outer end of the slot 215.

In operation of this embodiment of our invention, the power source 26 simultaneously moves

the conveyor chain 17 and rotates the shaft 37 which causes the skid with the body to approach as all the spray guns are oscillated by the face cam 42.

The operator adjusts the lever 165, to accommodate the particular body style to be sprayed. As the skid strikes the arm 111 and the switch 199, the shafts 153 and 157 are coupled and the atomizing air to all the guns is admitted into the system. The roller 163 of the piston rod 162 follows the selected cam face 161 to 163 causing the top gun to move upwardly and downwardly as required to maintain it at a substantially uniform distance from successively longitudinally adjacent portions of the top of the body which vary in elevation. During this movement of the gun, which occurs while it oscillates, the gun is also moved by the action of the roller 69 in the slot 70 to compensate for transverse curvature of the body top in order to also maintain the gun in substantially uniform spaced relation from successive laterally adjacent portions of the top of the body. Simultaneously the roller 175 follows the cam 173 to cause the side guns to move inwardly and outwardly in conformity with change in contour of the sides of the body at successively longitudinally adjacent portions thereof. The side guns are also moved inwardly and outwardly by the action of the roller 69 in the slot 70 to conform to transverse curvature of the sides of the body. Thus both the top and side guns are held at uniform distance from the surface portion upon which they discharge paint. While the lever 111 is depressed, atomized air but no paint is supplied to the guns.

As the skid strikes the arm 112 the air pressure is admitted to the cylinder 82 of the top gun and the paint is admitted into the air spray thereof.

Continued movement of the skid until the arm 113 is depressed and the arms 111 and 112 uncovered admits air to the cylinders 82 of the side guns and thereby allows the paint to enter the air spray.

As the skid depresses both of the arms 113 and 114, atomizing air is still supplied to all the guns even though the arm 111 is in its undepressed illustrated position of Fig. 12.

When the skid finally allows the arm 113 to return to its normal position the air to the cylinders 82 of all the guns is stopped and no paint is delivered by the guns.

As the skid allows the arm 114 to return to its upper position all the atomizing air to the guns is stopped. Simultaneously the skid opens the switch 198 which causes the shafts 153 and 157 to uncouple, and the member 211 engages the notch 216 to properly hold the shaft to permit the operator to again select with the lever 165 to accommodate a different body style if the next body presented for spraying by the conveyor differs from the previous one.

The spraying of the vehicle body is automatic and the guns follow the contour of each particular body style without overlapping in their spraying.

It is evident that if additional guns are used the guns need not necessarily oscillate but need only follow the contour of the body. However, to secure a saving in cost and weight we find it desirable to have the guns both oscillate and follow the contour of the body.

Various modifications and changes will be readily apparent from the teachings of our invention, as set forth in the appended claims, and it is not our intention to limit our invention to the particular details of construction and operation shown and described for illustrative purposes.

What we claim is:

1. Apparatus for spraying coating material on a surface of an article having misaligned successively adjacent surface portions comprising a frame structure, a spray device including an arm having a spray gun at one end portion thereof, means at the opposite end portion of said arm pivotally mounting the latter on said frame structure for oscillatory movement over said surface portions about an axis generally normal thereto and for pivotal movement about another axis toward and away from said surface, a support for said article to be sprayed, said frame structure and support being relatively movable for bringing successive adjacent portions of said article into spray receiving relationship to said device, means for oscillating said arm to move said spray gun in an arcuate course across said surface portions about said first mentioned axis during relative movement between said article and said frame structure, and means for automatically oscillating said arm about said second mentioned axis toward and away from said misaligned successively adjacent surface portions for maintaining said spray gun at a substantially uniform distance from all portions of said surface as said surface portions are successively brought into spray receiving relationship with respect to said device.

2. Apparatus for spraying coating material on a surface of an article having laterally and longitudinally misaligned successively adjacent surface portions comprising a frame structure, a spray device including a bracket pivotally mounted on said frame structure and having an arm provided at one end with a spray gun and pivotally mounted at its opposite end on said bracket about an axis generally normal to said surface portions for arcuate oscillatory spray distributing movement, said arm being pivotally adjustable relative to said bracket about another axis for predetermining the effective distance of said spray gun from said surface portions, a support for said article to be sprayed, said frame structure and support being relatively movable for bringing successive adjacent portions of said article into spray receiving relationship to said gun, means for pivotally adjusting said arm and bracket as a unit about the pivotal axis of said bracket during such relative movement for automatically moving said gun toward and away from said longitudinally misaligned surface portion of said article, and means coacting between said bracket and said arm for pivotally adjusting the latter relative to said bracket during such relative movement of said supports for automatically moving said gun toward and away from said laterally misaligned surface portions of said article.

3. Apparatus for spraying coating material on a surface of an article having laterally misaligned successively adjacent surface portions comprising a frame structure, a spray device including an arm provided at one end with a spray gun and pivotally supported at its opposite end on said frame structure about an axis extending transversely of said surface portions for arcuate oscillatory spray distributing movement in a course generally parallel with said surface portions, said arm being pivotally adjustable about another axis for predetermining the distance of the discharge part of said spray device from said surface portions, a support for said article to be sprayed, said frame structure and support being relatively

movable for bringing successive adjacent portions of said article into spray receiving relationship to said device, means for oscillating said arm about said first mentioned axis throughout its spray distributing movements during relative movement between said article and said frame structure, and means responsive to said oscillatory movement of said arm for automatically adjusting said arm about said second mentioned pivotal axis to bring the discharge part of said spray device into uniform spaced relationship with respect to successive laterally adjacent portions of said surface.

4. A surface coating material spraying apparatus for a plurality of articles having unlike surface contours comprising a spray device support, a spraying device including an arm provided at one end with a spray gun for discharging a surface coating material and pivotally mounted on said support at its opposite end for oscillatory arcuate movement about one axis across a surface of an article and about a second axis for adjustment toward and away from said surface, and means for automatically adjusting said device about said second axis, said means including members for selectively causing said spraying device to follow the contour of the surface of each of said plurality of articles of unlike contour to which said surface coating is to be applied.

5. Apparatus for spraying coating material on a surface of an article having misaligned surface portions comprising a frame structure, a spray device carried by said structure including a casing having an arcuate opening and a spray discharge member extending therethrough, means in said casing for supporting said spray member for pivotal spray distributing movement about one axis and pivotal movement about another axis, a support for said article to be sprayed, said frame structure and support being relatively movable for bringing successive adjacent portions of said article into spray receiving relationship to said member during relative movement thereof with respect to said article, and means for oscillating said member about said first axis during relative movement of said article and frame supports, pivotal movement of said member about said second axis being produced and predetermined by said arcuate opening for maintaining the discharge end of said member in predetermined spaced relationship with respect to misaligned portions of said surface of said article during spray distributing movement of said device about said first mentioned axis.

6. Apparatus for spraying coating material on a surface of an article having misaligned surface portions comprising a spray device support, a support for said article to be sprayed, said supports being relatively movable for bringing said successive adjacent portions of said article into spray receiving relationship, a spray device including a bracket pivotally mounted on said spray device support for adjustment about one axis and an arm pivotally mounted on said bracket for arcuate spray distributing oscillatory movement about another axis in a plane generally parallel to said surface portions, means for oscillating said arm and moving said article in timed relationship, and means operable in timed relationship to the movement of said article for automatically pivotally adjusting said arm about said first mentioned axis to maintain the discharge part of said spray device at a substantially uniform distance from said misaligned surface portions of said article during movement of the latter.

7. Apparatus for spraying coating material on an article having laterally and longitudinally misaligned successive surface portions comprising a frame structure located in close proximity to the path of the article, a plurality of spray devices including top and side spray devices oscillatively and adjustably mounted on said structure, a support for said article to be sprayed, said frame structure and support being relatively movable for bringing successive adjacent portions of said article into spray receiving relationship to said devices, and means for controlling said devices including valve members responsive to relative movement of said frame structure and support and successively operable by such relative movement, said members being so constructed and arranged as to energize said devices in sequence to discharge coating material on the top of said article and then simultaneously on the sides thereof during movement of said article relative to said frame support and in timed relationship to such movement.

8. Apparatus for spraying coating material on an article having angularly disposed surface portions of unequal lengths comprising a frame structure located in close proximity to the path of the article, a plurality of spray devices including top and side spray devices oscillatively and adjustably mounted on said frame structure, a support for said article to be sprayed, said frame structure and support being relatively movable for bringing successive adjacent portions of said article into spray receiving relationship to said devices, means for controlling the discharge of coating material from said devices including valve members responsive to relative movement of said frame structure and support and successively operable by such relative movement, said means being so constructed and arranged as to condition said devices in sequence to discharge coating material on one of said surface portions of said article and then simultaneously on all of said surface portions during movement of said article relative to said frame support and in timed relationship to such movement, mechanism for drivingly oscillating said spray devices, and control apparatus for said mechanism adapted to discontinue the oscillation of both said top and side devices when said article has passed out of spray receiving relationship to said devices.

9. In a spraying machine having a support, means adjacent said support for positioning a surface of an article to receive a spray discharge, a spray unit comprising a housing, an arm having one end pivotally mounted on said housing for oscillatory arcuate travel about an axis extending transversely of said surface of said article and for pivotal movement about a second axis disposed in a plane generally parallel to said surface, guide means on said housing coacting with said member for producing pivotal movement thereof about said second mentioned axis during oscillation of said member about said first mentioned axis, a spray discharge device mounted on said arm at a location spaced from said pivoted end thereof and means for imparting said oscillatory travel to said arm and said device.

10. In a spraying machine having a support, a spray unit comprising a movable housing, a gun discharge member pivotally mounted on said housing for oscillatory arcuate travel about one axis, guide means on said housing coacting with said member for producing movement thereof in paths departing from a plane normal to said axis during said arcuate travel, mechanism carried by said housing for swinging the latter and

said nozzle member substantially transversely to said plane, and means for imparting said oscillatory travel to said nozzle member and for actuating said mechanism to move said nozzle transversely of said plane in timed relationship.

11. Apparatus for spraying a plurality of types of vehicle bodies having laterally and longitudinally misaligned successive surface portions comprising a support for said bodies to be sprayed, a frame structure located in close proximity to said support for said bodies, a plurality of spray devices including top and side spray devices each including an arm oscillatively and adjustably mounted at one end of said frame structure, said frame structure and support being relatively movable for bringing successive adjacent portions of each of said bodies into spray receiving relationship to said devices, a discharge gun nozzle carried by the other end of each of said arms, a cam member corresponding to the contour of each unlike surface of the bodies to be coated, a closed hydraulic system including pistons for adjusting each of said arms respectively and a piston operable by said cam members, means for simultaneously rotating said cam members and producing relative movement of said frame structure and support in timed relationship, and a selector member for selectively adjusting said cam members for operative connection with said hydraulic system, said cams being adapted during rotation thereof to cause said first-mentioned pistons to automatically adjust each of said arms and nozzles toward and away from said laterally and longitudinally misaligned successive surface portions for maintaining each of said spray nozzles at a substantially uniform distance from all portions of said surface as said surface portions are brought into spray receiving relationship with respect to said devices.

12. Apparatus for spraying coating material upon articles including an article support and a spray device support, a spray device pivotally mounted on said spray device support for arcuate oscillatory spray distributing movement in a plane extending in the same general direction as and about an axis extending transversely of the path of said article, driving means for producing relative movement between said supports, and apparatus operable in timed relationship with respect to said driving means for drivingly oscillating said spray device, said apparatus comprising driving mechanism including a cam member so constructed and arranged as to maintain the velocity of oscillatory movement of said spray device substantially constant throughout substantially all portions of its stroke.

DAVID A. WALLACE.
RALPH L. SMITH.
ALEXANDER M. FLEMING.