March 16, 1971 F. D. SOLOMON 3,570,042

DRYING APPARATUS FOR A CAR WASH

Filed May 6, 1968 5 Sheets-Sheet 1

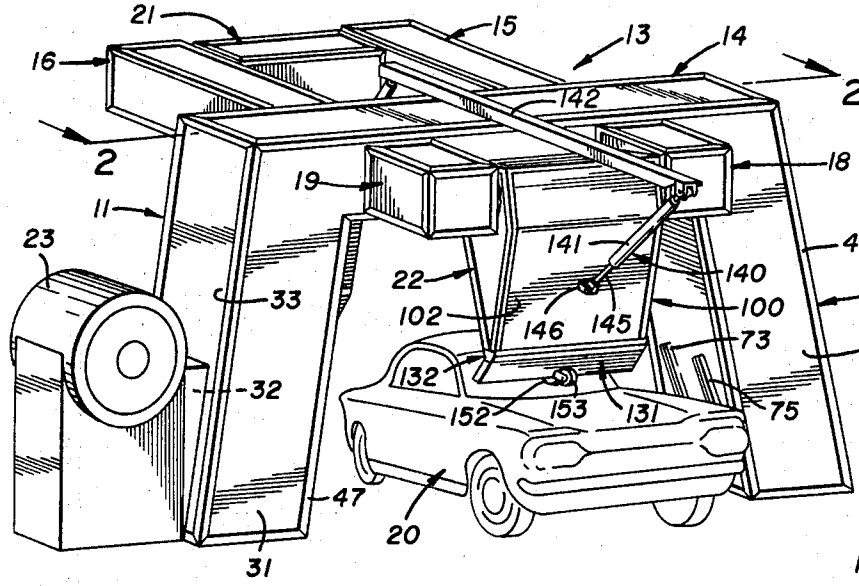

FIG. 1

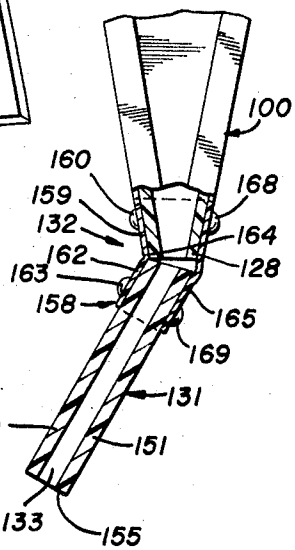

FIG. 11

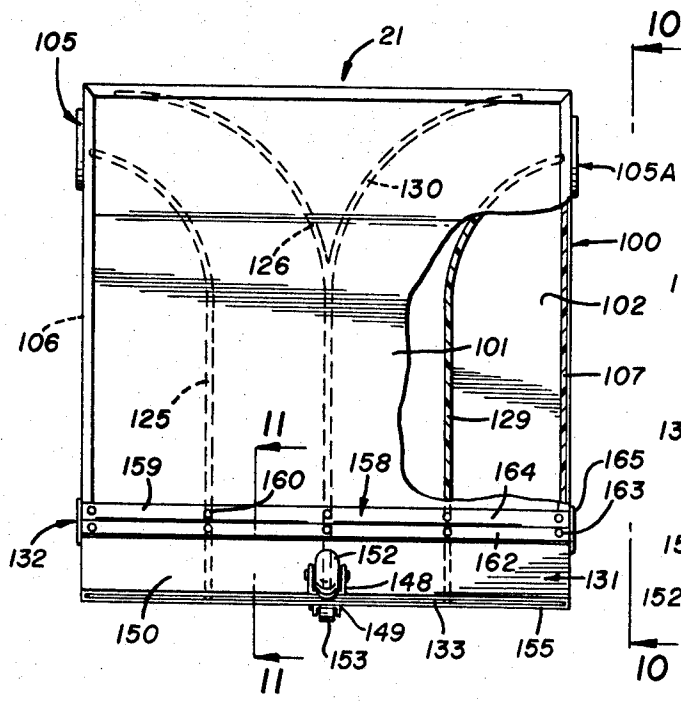

FIG. 9

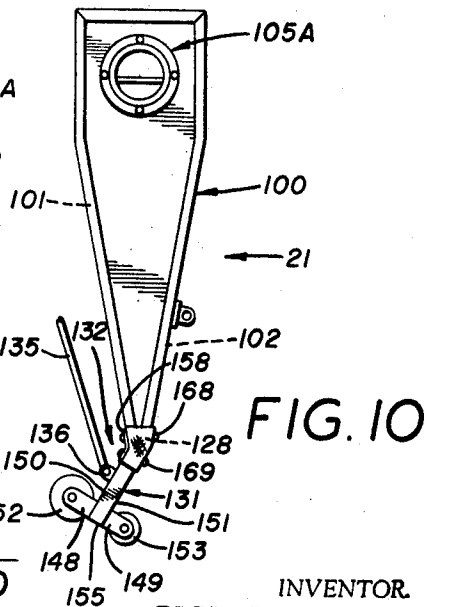

FIG. 10

INVENTOR.
FRED D. SOLOMON
BY Hamilton, Cook, Renner & Renner
ATTORNEYS

March 16, 1971 F. D. SOLOMON 3,570,042

DRYING APPARATUS FOR A CAR WASH

Filed May 6, 1968 5 Sheets-Sheet 2

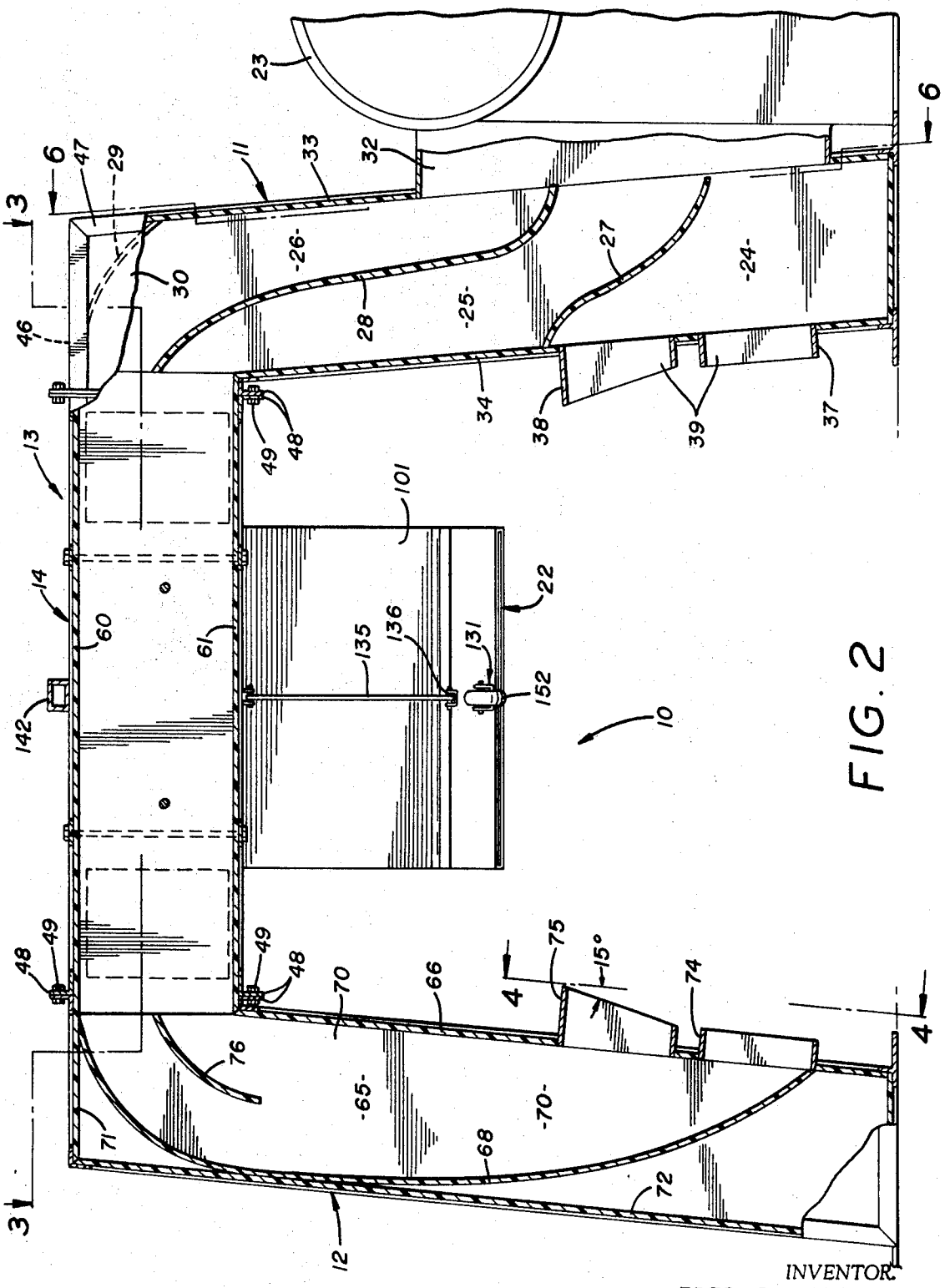

FIG. 2

INVENTOR.
FRED D. SOLOMON
BY Hamilton, Cook, Renner & Kenner
ATTORNEYS

March 16, 1971 F. D. SOLOMON 3,570,042

DRYING APPARATUS FOR A CAR WASH

Filed May 6, 1968 5 Sheets-Sheet 3

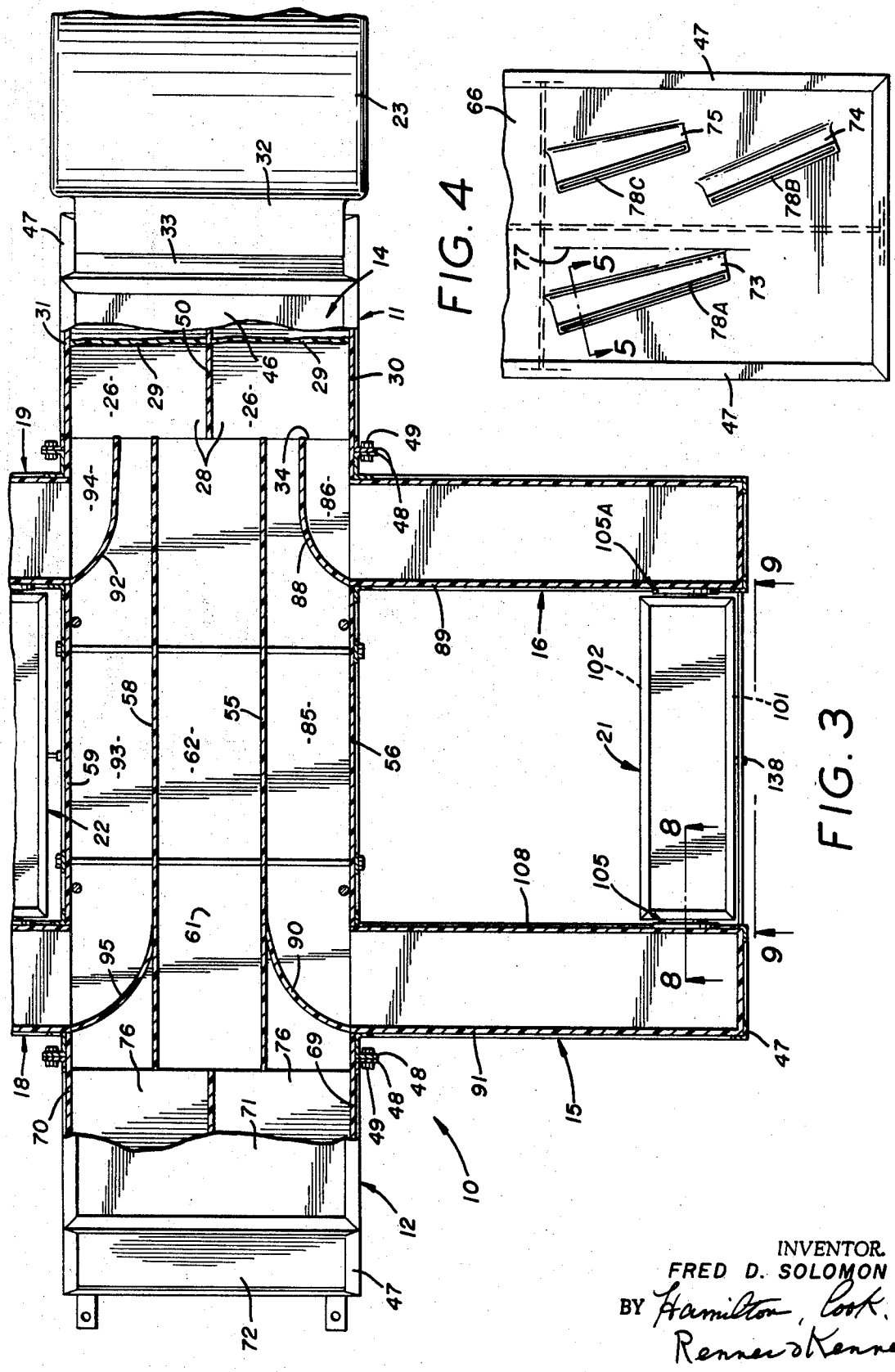

FIG. 3

FIG. 4

INVENTOR.
FRED D. SOLOMON
BY Hamilton, Cook, Rennes & Kenner
ATTORNEYS

March 16, 1971 F. D. SOLOMON 3,570,042

DRYING APPARATUS FOR A CAR WASH

Filed May 6, 1968 5 Sheets-Sheet 4

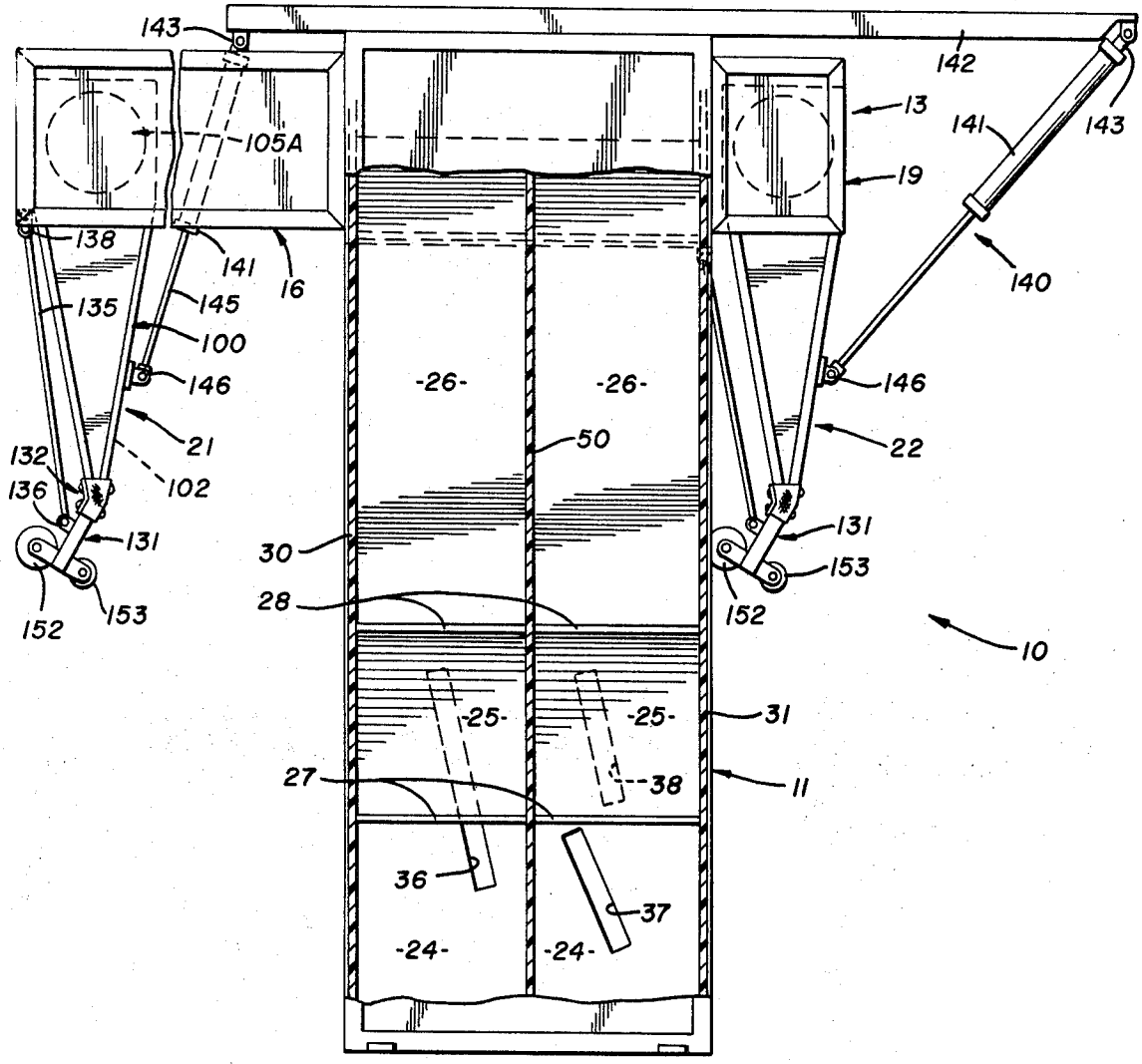

FIG. 6

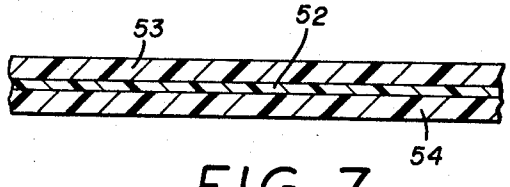

FIG. 7

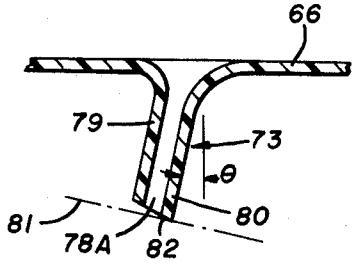

FIG. 5

INVENTOR.
FRED D. SOLOMON
BY Hamilton, Cook, Renner & Kenner
ATTORNEYS

March 16, 1971 F. D. SOLOMON 3,570,042

DRYING APPARATUS FOR A CAR WASH

Filed May 6, 1968 5 Sheets-Sheet 5

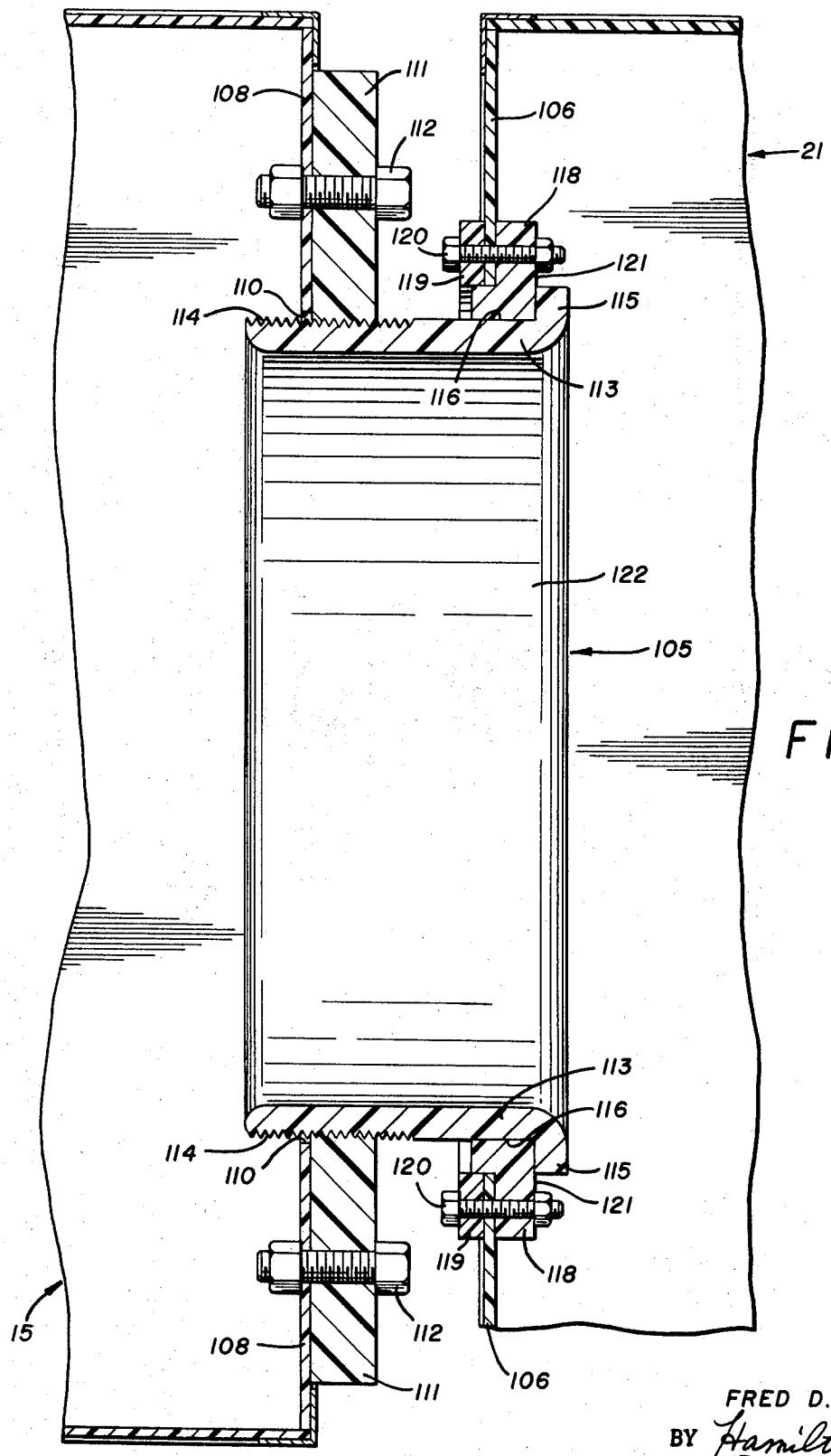

FIG. 8

INVENTOR.
FRED D. SOLOMON
BY Hamilton, Cook, Renner & Kenner
ATTORNEYS

United States Patent Office 3,570,042 Patented Mar. 16, 1971

3,570,042

DRYING APPARATUS FOR A CAR WASH

Fred D. Solomon, Akron, Ohio, assignor to Lanning Equipment Corp., Akron, Ohio

Filed May 6, 1968, Ser. No. 726,839
Int. Cl. F26b 19/00
U.S. Cl. 15—316 16 Claims

ABSTRACT OF THE DISCLOSURE

A drying apparatus for an automatic car wash. This apparatus is supplied with forced air from a single source and comprises two, upright, side enclosures to which an overhead assembly is connected to present an inverted U-shaped configuration. The side enclosures and the major portion of the overhead assembly are preferably made of a plastic material and include a system of internal baffle arrangements to provide ducting for the distribution of forced air therethrough from a single source. A plurality of uniquely constructed and arranged linear slot nozzles direct air from the upright side enclosures to dry the sides of a car by peeling the water therefrom, and two nozzles depend from the overhead assembly to dry the top of the car. While the slot nozzles in the side enclosures are preferably fixed, the two overhead slot nozzles are swingingly mounted on the overhead assembly so as to provide an unimpeded air flow from one of the upright enclosures, through an enclosure in the overhead assembly and into the overhead nozzles. The overhead nozzles each have a head portion that articulates with respect to a body portion to assure that air emitted therefrom will sweep the water across and off the top of the car. The nozzles are also constructed so that air emitted therefrom tends to swing the nozzle away from the vehicle being dried so that it will not strike thereagainst. Retarding means counterbalance the rotative forces induced by the emitted air so that contact means on the nozzle ride lightly along the top of the vehicle to maintain the nozzle the desired spacing from the surfaces being dried thereby.

BACKGROUND OF THE INVENTION

Automatic car washing systems are generally of two types. In one type the automobile is parked in a stationary position and the washing mechanism traverses the extent of the auto, often making several passes to complete the job. In the second type system, the washing mechanism is stationary and the automobile is propelled therethrough at a predetermined speed, the speed and spacing of successive autos being controlled by the utilization of a conveyor system. The present invention relates to an apparatus employed to dry the vehicle after it has been thoroughly washed. Although this apparatus will only be described in conjunction with the second type of system described above, adaptations of the present concept can also be employed by those skilled in the art of the first type of system.

Most prior known drying systems consist of an inverted U-shaped plenum chamber through which the cars pass and from which air, usually somewhat heated, is impinged against the vehicle in an attempt to remove residual rinse water.

These chambers have usually been made of steel or some other metallic material. As such, they are expensive

to manufacture, heavy and difficult to install. Moreover, being excellent thermal conductors they effect a cooling of the air and thus decrease the efficiency of those systems in which heated air is employed. Further, as air is forced into, and through, these plenum type chambers, they tend to vibrate. This not only creates a great deal of noise but also tends to shorten the useful life of the dryer.

The use of a plenum chamber itself compounds the drawbacks of the prior known systems. The pressure differential between the plenum and the surrounding atmosphere must be maintained quite high if the emitted air is to dry the car. In order to achieve a sufficient pressure diffierential in the large, inverted U-shaped plenum, experience has taught that multiple blowers are more economical than a single blower of the capacity that would be required. But even the use of multiple blowers engenders prohibitive operational costs when traffic through the car wash is light. Thus, during periods of light traffic many car wash operators attempt to hedge on the operational costs by operating less than the required number of blowers, but this results in incomplete drying and dissatisfied customers.

Economical operation of a dryer embodying the concept of the plenum chamber also severely limits the number of vents from which the air can exit against the vehicle being dried.

Accordingly, each side, or leg, of the inverted U-shaped plenum has, heretofore, generally been provided with a single vent that merely impinges air onto the sides of the vehicle to remove water therefrom. However, a single vent has been found to be deficient in that it is inherently not adapted to accommodate the wide variety of side contours that exist between various makes and models of automobiles. Further, while a single vent may be oriented to remove a large portion of the residual rinse water, a single vent is impractical for adequately drying even the particularly contoured side for which it might be best adapted.

The plenum concept also requires venting to dry the top of the car. Most prior known constructions suspend a vent means from the top, or overhead portion of the inverted, U-shaped plenum. The basic problem encountered in providing an overhead vent is that the vent must be close enough to the hood portion of the car to dry it, yet be far enough away to clear the windshield and dry the roof of the car, and then again be close enough to the car to dry the trunk, or rear deck, portion. If the vent is merely allowed to be suspended close to the hood portion, it would strike the windshield and could cause damage thereto. In an attempt to alleviate this problem many prior known systems employ a trip switch assembly which, when contacted by the windshield of the vehicle being dried, activates suitable power means to swing the vent upwardly in order to clear the windshield. As such, these vents are often swung prematurely away from the vehicle, further decreasing their effective drying capability.

This swinging motion of the vent presents still further problems in that most overhead nozzles currently employ a flexible conduit to duct the air from the plenum to the swingable vent, and when the vent swings upwardly to clear the windshield, the flexible conduit tends to kink and cut off the air supply.

Furthermore, most overhead vents of this nature are constructed merely to impinge the air flow against the

top of the vehicle. Although such impingement of air may remove a considerable portion of the residual rinse water, it tends merely to scatter the water rather than systematically remove it.

SUMMARY OF THE INVENTION

It is therefore a primary object of the present invention to provide a more effective drying apparatus for vehicles.

It is another object of the present invention to provide a drying apparatus, as above, having a novel system of internal ducting, fixed nozzles of novel configuration and orientation for drying the sides of a vehicle and swinging nozzles of novel configuration for drying the top of a vehicle.

It is still another object of the present invention to provide a drying apparatus, as above, which requires only one blower to provide enough air economically and effectively to dry vehicles of all makes and models irrespective of whether the traffic through the car wash is heavy or light.

It is a further object of the present invention to provide a drying apparatus, as above, in which the swinging nozzles are so connected to the overhead assembly that the air flow to and through the nozzles will not be hampered by swinging of the nozzles.

It is an even further object of the present invention to provide a drying apparatus, as above, in which the overhead nozzles are adapted to follow the top profile of the vehicle with only light pressure thereagainst and sweep the water across and off the top of the vehicle by directing the forced air thereagainst at a moderate angle.

It is a still further object of the present invention to provide a drying apparatus, as above, that is lighter in weight, of low thermal conductivity, easier to install, less expensive, and constructed so as to decrease vibration.

These and other objects of the invention, as well as the advantages thereof over existing and prior art forms, will become apparent from the following detailed description of the attached drawings and are accomplished by means hereinafter described and claimed.

In general, a drying apparatus constructed according to the concept of the present invention comprises an inverted U-shaped archway formed by two, upright, side enclosures connected across the top by an overhead assembly that includes a third, overhead, enclosure. The enclosures contain a system of internal ducting which receives air from a single source and directs it to various nozzle members that emit the air, under pressure, across the vehicle being dried.

Each upright enclosure utilizes a plurality of fixed nozzle members possessing unique configuration and orientation from which air is directed to dry that side of the car passing in proximity thereto.

The overhead assembly supports two nozzle members that are swingingly carried by conduit-journal means attached to supporting compartments extending forwardly and rearwardly from the enclosure in the overhead assembly. The overhead nozzles are also constructed to ride lightly over the upwardly directed contour of the vehicle, while sweeping the residual rinse water thereacross and off.

The nozzles, enclosures and the baffles delineating the ducting therethrough are preferably made of a plastic material.

One preferred embodiment of the present invention is shown by way of example in the accompanying drawings and described in detail without attempting to show all of the various forms and modifications in which the invention might be embodied; the invention being measured by the appended claims and not by the details of the specification.

DESCRIPTION OF THE DRAWINGS

FIG. 1 is a prespective view of the rear side of an improved drying apparatus showing an automobile emerging therefrom;

FIG. 2 is an enlarged vertical cross section of the drying apparatus taken substantially along line **2—2** of FIG. 1 so as to face the same direction as the automobile depicted in FIG. 1 would be moving;

FIG. 3 is a horizontal cross section taken substantially along line **3—3** of FIG. 2 depicting the overhead enclosure, the supporting compartments and associated components;

FIG. 4 is a partial elevation of the nozzles secured to one of the upright enclosures, taken substantially along line **4—4** of FIG. 2;

FIG. 5 is a further enlarged partial cross section taken substantially on line **5—5** of FIG. 4;

FIG. 6 is a further vertical cross section taken substantially along line **6—6** of FIG. 2;

FIG. 7 is an enlarged cross section of a typical baffle used internally of the upright and overhead enclosures;

FIG. 8 is a further enlarged cross section taken substantially along line **8—8** of FIG. 3 and depicting a conduit-journal means, as used to swingingly mount the overhead nozzles on the supporting compartments;

FIG. 9 is a frontal elevation, partly in section, of an overhead nozzle, taken substantially on line **9—9** of FIG. 3;

FIG. 10 is a side elevation of an overhead nozzle, taken substantially on line **10—10** of FIG. 9; and

FIG. 11 is an enlarged cross section taken substantially along line **11—11** of FIG. 9.

DESCRIPTION OF THE PREFERRED EMBODIMENT

A preferred embodiment of the improved drying apparatus, indicated generally by the numeral **10**, is depicted in FIG. 1. The drying apparatus **10** has the appearance of an archway formed from upright, side enclosures **11** and **12** connected across the top by an overhead assembly **13**. The assembly **13** has a laterally oriented overhead enclosure **14** joining the upright enclosures **11** and **12** and from which two, laterally spaced, relatively long, supporting compartments **15** and **16** and two, laterally spaced, relatively short, supporting compartments **18** and **19** extend. The supporting compartments **15**, **16**, **18** and **19** are all longitudinally aligned and are thus parallel to the path along which a vehicle **20** will travel when passing through the drying apparatus **10**. The supporting compartments in turn carry the swinging overhead nozzles **21** and **22** adapted to dry the top of the vehicle **20**. The sides of the vehicle are dried by nozzles affixed to the upright enclosures **11** and **12**, as will be more fully hereinafter explained.

A blower **23** supplies air, under pressure, to the interior of the apparatus **10**. While the blower may force the air into the apparatus **10** through the overhead enclosure **14**, convenience often dictates that the blower **23** be positioned adjacent one of the upright enclosures, and it is therefore depicted as blowing air into the upright side enclosure **11** in the preferred embodiment.

The upright enclosure **11** is internally divided into three primary ducts **24**, **25** and **26** by vertically curved baffles **27**, **28** and **29** (FIG. 2). The baffles **27**, **28** and **29** extend between the front and rear walls **30** and **31** of enclosure **11** (FIGS. 3 and 6) and are inclined laterally with respect to the drying apparatus **10** to direct the air from a supply chamber **32** adjacent blower **23** through the enclosure **11**. Specifically, baffle **27** curves upwardly from a plane defined by the laterally outer wall **33** of enclosure **11** to the laterally inner wall **34** thereof so that duct **24** will direct air from approximately the lower third of the supply chamber **32** to the three nozzles **36**, **37** and **38** affixed to the laterally inner wall **34** of the upright enclosure **11**. Each nozzle **36**, **37** and **38** has a linearly slotted aperture **39** through which the forced air is emitted to dry that side of the vehicle passing in proximity thereto. It has been found that if the nozzles **36–38** are con-

structed with a particular configuration and if they are placed in a particular orientation, the air emitting therefrom will literally peel the water off the side of the vehicle and leave substantially no residual droplets. The configuration and orientation of the nozzles will be hereinafter discussed in detail.

The baffle **28** also curves upwardly from a plane defined by the outer wall **33** to a plane defined by the laterally inner wall **34** of enclosure **11** so that the duct **25** will direct air from approximately the middle third of the supply chamber **32** to the lower half of the overhead enclosure **14**.

Baffle **29** curves upwardly from the latterly outer wall **33** of enclosure **11** to a location along the upper wall **46** thereof adjacent the overhead enclosure **14** so that duct **26** will direct air from approximately the upper third of the supply chamber **32** to the upper half of the overhead enclosure **14**.

It has been found that the exterior walls **30**, **31**, **33** and **34** of the enclosure **11** and, in fact, the exterior walls of the entire apparatus **10**, may be economically made from a synthetic resinous sheet material; the preferred material being an acrylic such as is marketed under the name "Kydex." Acrylic sheet material has exceptional dimensional stability, displays excellent wetherability, possesses remarkable strength and rigidity and is nonflammable, light in weight and economical. By way of example, acrylic sheets weigh 44% less than aluminum, are 20% more efficient than glass as a thermal insulator and yet have as much as seventeen times the impact resistance of glass in thicknesses of approximately ¼ inch, as would be preferably utilized for fabricating the subject apparatus **10**.

Additionally, the surface of acrylic sheet material may be formed to a wide variety of finishes. For the subject application the acrylic sheet material may be finished with a glass smooth surface on one side to minimize skin friction offered against the flow of air through apparatus **10** and yet the other side may be provided with a textured surface to enhance external appearance of apparatus **10**.

Fabrication is simplified in that acrylic sheet material may be joined together under the influence of heat and pressure to achieve substantially the same strength as enjoyed by the parent material. Accordingly, this sheet material can be joined by such commercial welding methods as hot gas welding and heated tool welding. Acrylic sheet material may also be joined by bolts, or, corner pieces **47** may be welded to the sheets in order further to strengthen the apparatus **10**. These corner pieces may simply be of L-shaped cross section, termed angles, or the corner pieces may be provided with tabs **48** for joining by bolts **49**. The latter construction is particularly suitable for joining the overhead assembly **13** to the upright enclosures **11** and **12** during field installation (FIG. 2).

With the exterior walls **30**, **31**, **33** and **34** made of ¼ inch acrylic sheet material it may be desirable to include a vertical partition **50** (FIG. 3) within the enclosure **11**, the partition being oriented laterally between the inner and outer walls **34** and **33** and in spaced relation between the front and rear walls **30** and **31**, respectively, further to rigidify the enclosure. While such a partition **50** divides the ducts **24**, **25** and **26**, the partition **50** may be formed from an acrylic sheet material that is smooth on both sides to obviate any substantial resistance to the air flow through those ducts.

Although acrylic sheet material would be excellent for all the internal baffles as well, it has been found more advantageous to utilize a material that can be bent to the desired curvature for the various baffles rather than molding rigid acrylic material to the proper shape.

One satisfactory construction for the internal baffling is represented in FIG. 7. A very thin core sheet **52** of acrylonitrile-butydiene-styrene (ABS) is laminated between two outer sheets **53** and **54** of polyvinyl chloride (PVC). Only very thin sections of ABS may be flexed, and even thin sections possess the strength for which ABS is noted. Thus, the core sheet **52** imparts the required rigidity to the baffles, and the outer sheets **53** and **54** of PVC provide relatively friction free surfaces for the baffles while, at the same time, increasing thickness of the baffles to a more workable dimension than could be obtained if ABS, with polished surfaces, were used alone.

Returning now to the structural details of the preferred embodiment, a vertically oriented partition **55** is spaced inwardly of the front wall **56** and extends laterally of the enclosure **14** (FIG. 3). A second partition **58** is spaced between the first partition **55** and the rear wall **59** of the enclosure **14**. The partitions **55** and **58**, together with the upper and lower walls **60** and **61**, respectively, of the enclosure **14** define a duct **62** that extends the length of the overhead enclosure **14** to convey a portion of the air flowing from the ducts **25** and **26** in enclosure **11** through the enclosure **14** and into the opposed, upright enclosure **12**.

The interior of the upright enclosure **12** (FIG. 2) incorporates a single duct **65** between the laterally inner wall **66** of the enclosure **12** and a vertically curved deflector **68**. The deflector **68** extends between the front and rear walls **69** and **70**, respectively, of the enclosure **12** and curves rather sharply from a location on the upper wall **71** thereof adjacent the overhead enclosure **14** downwardly and laterally outwardly to the laterally outer wall **72** of the enclosure **12** and then laterally inwardly along a more gentle curve to the laterally inner wall **66** at a point beneath the three nozzles **73**, **74** and **75** affixed thereto for drying the sides of the vehicle. The use of a splitter vane **76** has been found to be greatly beneficial to flow characteristics of the air being blown from the overhead enclosure **14** into the upright enclosure **12**. The splitter vane **76** also extends between the front and read walls **69** and **70** of the enclosure **12** and curves laterally outwardly and downwardly to deflect that portion of the air flowing through the lower half of the duct **62** toward the nozzles **73–75**.

The configuration and orientation of nozzles **73**, **74** and **75** is identical, though reversed, with the configuration and orientation of nozzles **36–38**.

Referring in details to FIGS. 2, 4 and 5, the nozzles **73**, **74** and **75** are also each provided with a linear aperture **78A**, **78B** and **78C**, respectively, and are inclined both vertically and horizontally in order to peel the water rearwardly and downwardly across the side of the auto.

The air emitting from nozzle **73** is the first to contact the side of the vehicle being dried, and the linear aperture **78A** in nozzle **73** is therefore preferably longer than the other two so that it will initially remove the majority of the water. For this purpose the aperture **78A** should be approximately two and one-half feet in length with the upper extent thereof positioned substantially on a level with the top of a typical automobile. With respect to a vertical reference, or plumb line **77** (FIG 4), nozzle **73** is inclined forwardly at between 10° to 15°, it having been found that approximately 13½° provides the optimum performance with the majority of today's automobiles. This vertical inclination of the nozzle, designated by the letter θ, provides a directional component that tends to sweep the water downwardly, and a horizontal inclination of nozzle **73** (FIG. 5) is also utilized to provide a directional component that tends to sweep the water rearwardly. The optimum horizontal, or rearward, inclination is substantially the same as the vertical inclination and is, therefore, also represented by the letter θ. In addition to this compound inclination of the nozzle **73**, the aperture **78A** is also vertically inclined. As represented in FIG. 2, the aperture **78A** is inclined at approximately 15° so that the upper portion is positioned laterally inwardly of the lower portion.

Removal of the water is also enhanced by including

a horizontal bias to the aperture **78A**. As best shown in FIG. 5, the forward wall **79** of nozzle **73** is somewhat shorter than the rearward wall **80** so that the air will tend to spill off the forward wall **79** inducing a mild vortical turbulence in the air as it strikes the side of the car. This vortical turbulence assists in peeling the water therefrom and is readily accomplished by biasing the aperture at approximately 15° with respect to a reference plane **81** normal from the rearward wall **80** and including the outer edge **82** thereof.

Nozzle **74** is generally lower than nozzle **73** and is disposed to remove any accumulation of water on the lower side portion of the auto. As such, the aperture **78B** in nozzle **74** need not be as long as the aperture **78A** in nozzle **73**, but the nozzle **74** is preferably inclined at a greater angle with respect to a vertical reference than is nozzle **73**. As such, the aperture **78B** need only be approximately three-quarters the length of aperture **78A**, whereas the nozzle **74** is inclined forwardly at between 20° to 25° with respect to a vertical reference, it having been found that approximately 23½° provides the optimum performance.

The horizontal inclination of nozzle **74** may be quite satisfactorily the same as that used for nozzle **73**. However, inasmuch as the lower side portions of most vehicles are oriented in a generally vertical fashion, even though they may have some designed contours, the aperture **78B** need have no vertical inclination as viewed in FIG. 2, although aperture **78B** is also preferably biased at 15° to induce a vortical turbulenec in the air emitting therefrom.

Nozzle **75** provides the final blast of air across the side of the car. This nozzle is, therefore, located upwardly of nozzle **74** and preferably directs the flow of air according to the same general pattern as nozzle **73**. However, for the final drying blast a lesser volume of air is required than from nozzle **73** so that nozzle **75** too need only be on the order of three-quarters the length of nozzle **73**, although the compound inclination of nozzle **75** as well as the inclination and bias of the aperture **78C** are preferably identical with that of nozzle **73**.

Turning now to that portion of the apparatus **10** which dries the top of the car, the overhead assembly **13**, as shown in FIGS. 1, 2 and 3, includes a plurality of supporting compartments **15**, **16**, **18** and **19** that extend horizontally outwardly from the overhead enclosure **14**. The relatively long compartments **15** and **16** communicate with the interior of the enclosure **14** through the front wall **56**, and the relatively short compartments **18** and **19** communicate with the interior of the enclosure **14** through the rear wall **59**.

The relatively long supporting compartments **15** and **16** are supplied by air from upright enclosure **11** through individual ducts **85** and **86**, respectively, in the overhead enclosure **14**. Duct **85** is separated from duct **86** by a baffle **88** that extend vertically between the upper and lower walls **60** and **61** of the overhead enclosure **14**. Baffle **88** is anchored at the juncture of the laterally inner wall **89** of compartment **16** with the front wall **56** of enclosure **14** and curves from that point rearwardly and laterally toward the upright enclosure **11**, terminating medially of the partition **55** and the front wall **56** of the enclosure **14**. The air flow through duct **86** is thus directed into compartment **16**.

Duct **85** opens between the partition **55** and baffle **88**, and the air flow therethrough is directed into the supporting compartment **15** by a baffle **90** that also extends vertically between the upper and lower walls **60** and **61** of the overhead enclosure **14**. Baffle **90** is anchored at the juncture of the laterally outer wall **91** of supporting compartment **15** with the front wall **56** of enclosure **14** and curves from that point rearwardly and laterally toward the compartment **11** to intersect the partition **55**.

A baffle **92**, similar to baffle **88**, is positioned between the partition **58** and the rear wall **59** of enclosure **14** to separate a duct **93** through which air is supplied from the upright enclosure **11** to the relatively short supporting compartment **18** and a duct **94** through which air is supplied from the upright enclosure **11** through the relatively short supporting compartment **19**. Duct **93** is also provided with a baffle **95** similar to baffle **90**.

Suspended between the relatively long supporting compartments **15** and **16** and the relatively short supporting compartments **18** and **19** are the two, overhead, swinging nozzles **21** and **22**. The construction of nozzles **21** and **22** may be identical so that only one need be described in detail.

The body portion **100** of nozzle **21** has front and rear walls **101** and **102**, respectively, that converge such that the body portion **100** is of substantially wedge-shaped, or triangular, cross section (FIG. 10). A conduit-journal means, indicated generally by the numeral **105**, is secured to each end wall **106** and **107** of the body portion **100** and are also secured to the laterally inner walls **108** and **89** of the supporting compartments **15** and **16**, respectively. These conduit-journals **105** permit the nozzle **21** to swing with respect to the supporting compartments **15** and **16** and also permit the forced air in compartments **15** and **16** to enter the body portion **100** of the nozzle **21**.

A conduit-journal **105** is best depicted in FIG. 8. As shown therein, a circular bore **110** is provided through the laterally inner wall **108** of supporting compartment **15**. An internally threaded mounting ring **111** is secured, as by bolts **112**, to the wall **108** in registry with the bore **110**.

The radially outer surface on the laterally outer portion of sleeve **113** is provided with threads **114** for engaging the mounting ring **111**. A radial stop flange **115** defines the laterally inner extent of the sleeve **113**, and an annular journal surface **116** extends between the threads **114** and the stop flange **115**. The journal surface **116** is rotatably received within a bearing ring **118** that is secured to, and through, the end wall **106** of nozzle **21** by a clamp ring **119** and a plurality of bolts **120**.

In the operative position the sleeve **113** is turned into the mounting ring **111** until the stop flange **115** snugly engages the radially directed, laterally inner surface **121** of the bearing ring **118**.

By periodically adjusting the sleeve **113** with respect to the mounting ring **111** so as to maintain the stop flange **115** snugly against the surface **121** contacted thereby, air loss past the relatively rotatable members **113** and **118** will be minimized without the necessity of complex, and expensive, sealed and packing arrangements.

The forced air within the supporting compartment **15** flows through the hollow interior **122** of sleeve **113** and into the body portion **100** of the nozzle **21**. Curved baffles **125** and **146** interiorly of the nozzle **21** direct the air entering, through the conduit-journal **105**, from compartment **15** downwardly toward the apex **128** of the triangularly shaped body portion **100**. Similar baffles **129** and **130** direct the air entering, through a similar conduit-journal **105A** aligned with conduit-journal **105**, from compartment **16** toward the apex **128**.

A head portion **131** is secured to the apex **128** of the body portion **100** by a resilient hinge means **132**. The head portion **131** has a linear aperture **133** that communicates, through the hinge means **132** and the apex **128**, with the interior of the body portion **100**. Thus, the air directed, by baffles **125**, **126**, **129** and **130**, through the body portion **100** will exit via the linear aperture **133** to dry the top of the vehicle.

An articulation control means in the form of a link **135** is pivotally connected between a mounting tab **136** on the head portion **131** and a mounting tab **138** (FIG. 6) fixedly positioned with respect to the overhead assembly **13** to articulate the head portion **131** about the hinge means **132** in response to swinging movement of

the body portion **100** about conduit-journal means **105** and **105A**.

It has been found that the water will be swept rearwardly and off the top of the auto by directing the blast of air at a moderate angle across the top of the car. At the same time, however, one must remmber that the top of an automobile is comprised of several general surface areas of varying disposition. The hood, top and rear deck, while being vertically separated, are, for the most part, generally horizontal, whereas, at least the windshield and the rear window are considerably inclined with respect to the hood, roof and rear deck.

By utilizing a control link **135** the head portion **131** will be articulated to compensate for these varying orientations of an auto's component top surfaces. For example, it has been found most advantageous to incline the head portion **131** so that the air is directed against the hood of the car being dried approximately 30°. This can be controlled by the length of the link **135**.

At this point it would be well to note that as the forced air leaves the linear aperture **133** and head portion **131** a reaction force tends to rotate the nozzle **21** rearwardly and away from the auto. Accordingly, a swing retarding means **140** is connected to the nozzle **21**. As best seen in FIG. 6, a cylinder **141** is dependingly mounted from a longitudinal beam **142** in overhead assembly **13**, as by the pivotal clevis connection **143**. A piston, not shown, is reciprocally slidable in cylinder **141** and is attached to a rod **145** that extends outwardly of the cylinder **141** and is pivotally attached to the rear wall **102** of nozzle **21**, as by the clevis attachment **146**. The cylinder **141** utilizes a standard, controlled air release, not shown, to apply a constant pressure against the piston and thus oppose that rotation of nozzle **21** incidental to the reaction force of the air passing outwardly through aperture **133**. The standard, controlled air releases are adjustable so that one can balance the force applied by the retarding means **140** against the reaction force.

It is preferred that the nozzle **21** be balanced to ride lightly across the top of the vehicle. To assure that the nozzle **21** will not scratch, or otherwise mar, the car, contact means are also provided on each nozzle. As best seen in FIG. 10, brackets **148** and **149** on the front and rear walls **150** and **151** of the head portion **131** mount rotatable wheels **152** and **153**, respectively, to comprise the contact means. Because the head portion **131** terminates in a mouth **155** that extends generally transversely the axis of the slotted aperture **133**, the wheel **152** must extend axially beyond the mouth **155** so as to prevent engagement of the head portion **131** against the windshield of the car being dried. Although the wheel **152** could as well be of the same size as wheel **153**, if the bracket **148** were modified so as to position the outer periphery of the wheel **152** beyond the outermost edge, or mouth, **155** of the head portion **131**, in the preferred embodiment the wheel **152** is of greater diameter than wheel **153** to accomplish the desired purpose.

The outer periphery of wheel **153** is positioned to space the aperture **133** the desired distance above the hood of the car being dried as the wheel **153** makes contact therewith. With the desired balance of the nozzle **21** being achieved by adjustment of the retarding means **140**, the wheel **153** will lightly traverse the longitudinal extent of the hood as the car passes into the apparatus **10**. When the windshield of the car comes into proximity to the head portion **131** of the nozzle **21**, the wheel **152** makes contact therewith so that continued forward motion of the car will cause the body portion **100** to rotate counterclockwise, as viewed in FIG. 6. Counterclockwise rotation of the body portion results in a concomitant clockwise rotation of the head portiton **131** about hinge means **132** by the pantographic action of the control link **135**. This rotation adjusts the disposition of the head portion **131** with respect to the windshield of the car to minimize the downward direction of the air flow with respect thereto. Thus, the water will tend to be swept upwardly along the windshield and onto the top.

As the head portion **131** arrives at a position near the juncture of the windshield and the roof of the car, the clockwise rotation of the head portion **131** has brought the wheel **153** into a position for re-engagement by the car—the disposition of the wheel **152** having prevented the mouth **155** of the head portion **131** from coming into direct contact with the car.

Even though the body portion **100** has by now rotated sufficiently to raise the head portion **131** from a level where it dried the hood to a level where it will dry the roof, the head portion **131**, by its simultaneous counterrotation, maintains its desired moderately angled orientation with respect to the roof.

When the auto has progressed sufficiently to bring the head portion to the rear window, the wheel **153** will traverse downwardly therealong and onto the rear deck, of trunk. This movement allows the body portion **100** to rotate in a clockwise direction, as viewed in FIG. 5, so that the control link **135** forces the head protion **131** to rotate in a counterclockwise direction. This retrorotation of the nozzle components thus achieves the desired drying of the rear window and deck. It will similarly caused the nozzle to dry a roof and rear deck that are commonly inclined in that configuration popularly referred to as a "fastback."

Nozzle **22** operates identically with nozzle **21** and provides a second drying pass across the top surface of the car. The sole difference between nozzles **21** and **22** is in the length of the supporting compartments on which the two nozzles are mounted. In view of the foregoing discussion concerning the rotation of the nozzle components during the drying operation it should be apparent that the two compartments **15** and **16** supporting nozzle **21** must be longer than the two compartments **18** and **19** in order to assure clearance between nozzle **21** and the overhead compartment **14**.

It should now be appreciated that each hinge means **132** will articulate its associated head portion **131** in two directions for each car washed. Thus, the hinge means **132** should be sturdy and must be of a construction that will not adversely effect the flow of air from the body portion **100** into the head portion **131**. A preferred construction employs a flexible strap **158** having one arm **159** secured, as by rivets **160**, to the forward wall **101** of the body portion **100** and a second arm **162** secured, as by rivets **163**, to the forward wall **150** of the head portion **131**. The arms **159** and **162** are joined by a thin neck section **164**. The strap **158** so described is preferably made of material such as polypropylene which possesses the property of provided a so-called "living hinge" in thin sections in which the molecules are oriented by stretching while the material is heated. In strap **158** this molecular orientation may be accomplished by pinching the material while heated to stretch, and thin, the neck section **164**.

By the use of a strap **158** having the quality of a living hinge the axis about which the head portion **131** rotates with respect to the body portion **100** is defined by the neck section **164**. As such, a flexible retaining means must be provided to assure that the flow of air leaving the apex **128** enters the head portion **131**. A piece of canvas **165**, which may be impregnated with vinyl to reduce its porosity, may be secured between the body and head portions **100** and **131** to constitute a suitable retaining means. As shown, the canvas retaining means **165** spans between the rear wall **102** of body portion **100** and the rear wall **151** of head portion **131** to which it is secured by rivets **168** and **169**, respectively, and around the edges to at least the ends of strap **158**.

The above-described drying apparatus **10** is capable of delivering forced air from a single blower to remote side and top nozzles that have been uniquely constructed

to effect adequate, and rapid, drying for an automatic car wash. The drying apparatus embodying the aforedescribed concept has been found capable of delivering a much larger volume of air than prior known constructions employing identical blowers. For example, a 48 inch fan turning at only 1800 r.p.m. will deliver 32,000 cubic feet of air per minute from a dryer constructed according to the present invention whereas the same size fan operating at the same speed can deliver only about one-sixth that volume of air from prior known constructions. Not only this increased volume of air but also the manner in which it strikes the vehicle assures adequate drying.

It should therefore be apparent that the subject drying apparatus fully accomplishes the objects of the invention.

I claim:

1. An apparatus for drying vehicles moving with respect thereto comprising, a pair of upright, side enclosures presenting spaced, laterally inner walls and an overhead enclosure connected to the upper portions of said side enclosures, blower means for delivering air, under pressure, into said enclosures, a plurality of nozzles attached to the laterally inner walls of each side enclosure to direct forced air from interiorly of the side enclosures to which they are attached against the adjacent side of a vehicle moving with respect thereto, at least one overhead nozzle swingingly mounted to receive air from said overhead enclosure, said overhead nozzle having a body portion and a head portion, resilient hinge means between said head portion and said body portion so that forced air received from said overhead enclosure passes through said body portion and hinge means to said head portion, articulation control means to rotate said head portion about said hinge means in response to swinging movement of said body portion, rotation of said head portion directing forced air against the top of the vehicle at desired angular inclinations.

2. An apparatus for drying vehicles, as set forth in claim 1, having baffle means within said enclosures for directing the air received from said blower to said fixed nozzles and said swinging nozzle.

3. An apparatus for drying vehicles moving with respect thereto comprising, a pair of upright, side enclosures presenting spaced, laterally inner walls, an overhead enclosure connected to the upper portions of said side enclosures, blower means for delivering air, under pressure, into said enclosures, a plurality of nozzles attached to the laterally inner walls of each side enclosure to direct forced air from interiorly of the side enclosures to which they are attached against the adjacent side of a vehicle moving with respect thereto, laterally spaced, supporting compartments communicating with said overhead enclosure, at least one overhead nozzle swingingly mounted between said supporting compartments by conduit-journal means, the overhead nozzle communicating with said supporting compartments through said conduit-journal means, said overhead nozzle having a body portion and a head portion, hinge means joining said head portion to said body portion, articulation control means to rotate said head portion about said hinge means in response to swinging movement of said body portion, rotation of said head portion directing forced air against the top of the vehicle at desired angular inclinations.

4. An apparatus for drying vehicles, as set forth in claim 3, in which the conduit-journal means connected between said relatively rotatable overhead nozzle and supporting compartments comprise a hollow sleeve, a bearing ring secured to one of said relatively rotatable members, a mounting ring secured to the other of said relatively rotatable members, said sleeve threadably engaging said mounting ring, said sleeve being journaled in said bearing ring.

5. An apparatus for drying vehicles, as set forth in claim 4, in which a stop flange extends radially of said sleeve, said threaded engagement of the sleeve and mounting ring permitting said sleeve to be moved axially of itself selectively to position said stop flange against said bearing ring.

6. An apparatus for drying vehicles, as set forth in claim 1, in which a retarding means oppose swinging of the overhead nozzle induced by the reaction force of the air emitting from the head portion of said nozzle.

7. An apparatus for drying vehicles, as set forth in claim 6, in which the head portion has a front wall facing in the direction from which a vehicle moves with respect to the drying apparatus and an oppositely facing rear wall and in which contact means are carried on the head portion of said overhead nozzle, said contact means comprising a first element mounted from said front wall and a second element mounted from said rear wall.

8. An apparatus for drying vehicles, as set forth in claim 7, in which the head portion terminates in a mouth extending generally transversely the axis of a slotted aperture therethrough and in which at least one of said contact elements extends axially beyond said mouth portion.

9. An apparatus for drying vehicles, as set forth in claim 8, in which the contact elements are rotatably mounted wheels and in which the periphery of that wheel mounted from the front wall of said head portion extends axially beyond the mouth of said head portion.

10. An apparatus for drying vehicles, as set forth in claim 1, in which the fixed nozzles on each side enclosure are inclined vertically and horizontally to sweep the water rearwardly and downwardly off the side of a vehicle.

11. An apparatus for drying vehicles, as set forth in claim 10, in which each nozzle has a forward wall and a rearward wall to define a slotted aperture and in which the forward wall is shorter than said rearward wall to bias said aperture with respect to a reference plane normal to said rearward wall and including the outer edge thereof.

12. An apparatus for drying vehicles, as set forth in claim 11, in which the aperture of said fixed nozzles is biased at approximately 15°.

13. An apparatus for drying vehicles, as set forth in claim 1, in which three fixed nozzles emit air from the laterally inner wall of each side enclosure, two of said three nozzles being inclined at approximately 10° to 15° with respect to a plumb line and inclined horizontally at approximately the same angle with respect to said inner wall, the third nozzle being inclined at approximately 20° to 25° with respect to a plumb line and being inclined horizontally at approximately the same angle as the other of said nozzles.

14. An apparatus for drying vehicles, as set forth in claim 13, in which each said side nozzle has a forward wall and a rearward wall to define a slotted aperture and in which the forward wall is shorter than said rearward wall to bias said aperture at approximately 15° with respect to a reference plane normal to said rearward wall and including the outer edge thereof.

15. An apparatus for drying vehicles, as set forth in claim 1, in which the blower means delivers air under pressure into the first of said two side enclosures, baffle means within said first enclosure to duct a portion of the air being blown into said first enclosure to the plurality of nozzles fixed thereto, and the remainder of said air into said overhead enclosure, baffle means within said overhead enclosure to duct a portion of the air being blown therein to said overhead nozzle and the remainder of said air to said second, side enclosure, baffle means within said second side enclosure to direct the air being blown therein to the plurality of nozzles fixed thereto.

16. An apparatus for drying vehicles, as set forth in claim 15, in which said enclosures are acrylic sheet material and the baffle means comprise a thin core sheet

of acrylonitrile-butydiene-styrene sandwiched between two sheets of polyvinyl chloride.

References Cited

UNITED STATES PATENTS

2,440,157	4/1948	Rousseau	34—229
3,279,093	10/1966	Dutton	34—229
3,323,228	6/1967	Maxwell	15—CCP Dig
3,409,995	11/1968	Greenwood et al.	34—229X
3,442,027	5/1969	Hurwitz	15—405X

FOREIGN PATENTS

1,023,105	3/1966	Great Britain	34—229

EDWARD L. ROBERTS, Primary Examiner

U.S. Cl. X.R.

34—229