June 13, 1967 G. W. WEST 3,324,499

CLEANING DEVICE

Filed Oct. 6, 1964 2 Sheets-Sheet 1

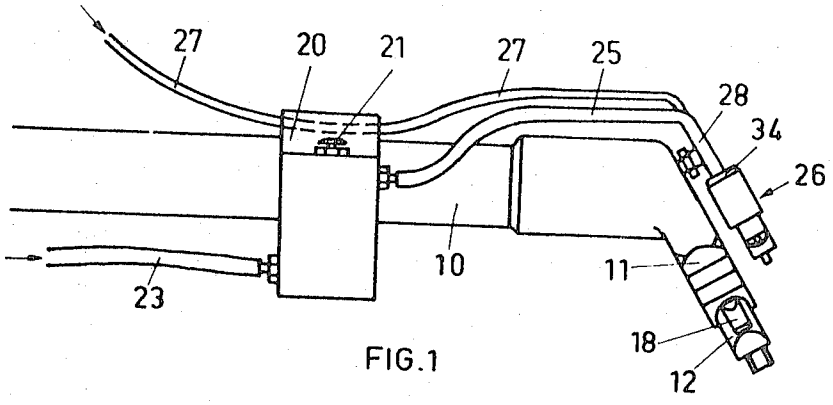

FIG.1

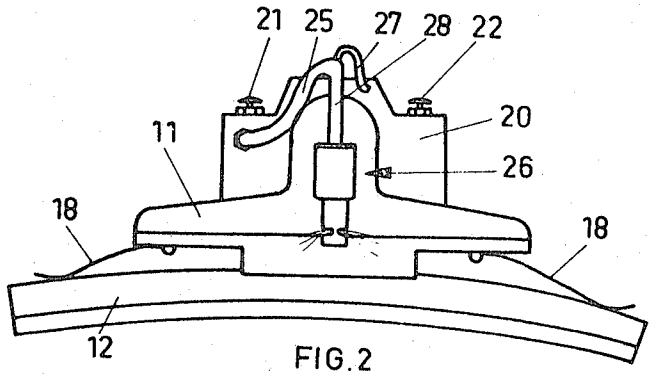

FIG.2

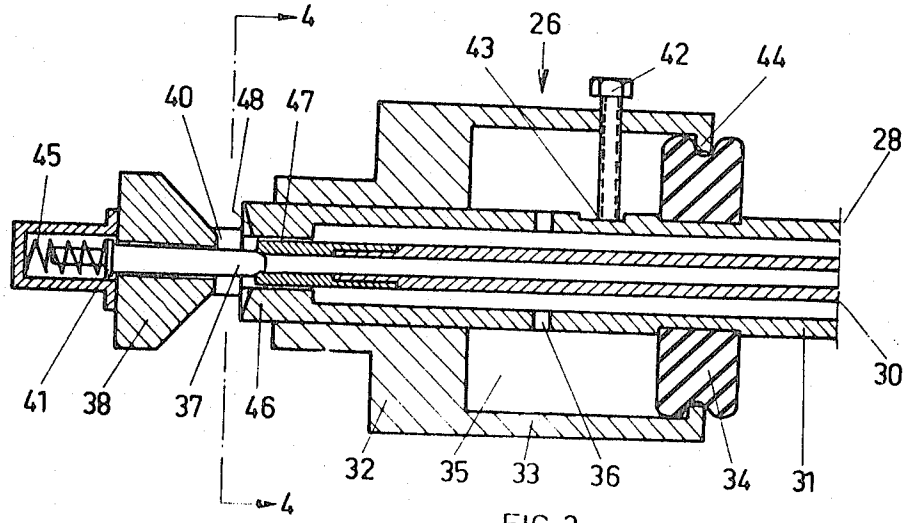

FIG.3

INVENTOR.
GEOFFREY W. WEST
BY Beale and Jones

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CLEANING DEVICE

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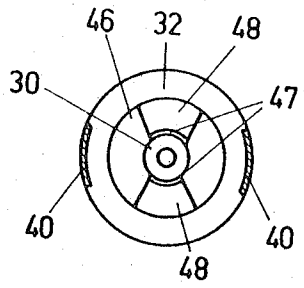

FIG. 4

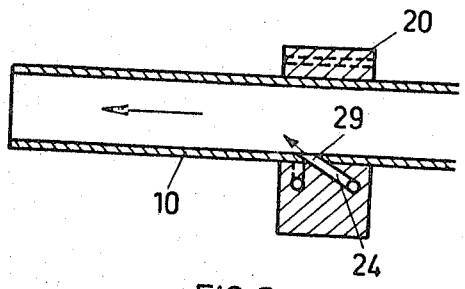

FIG. 5

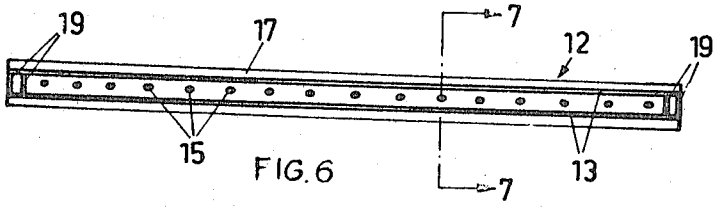

FIG. 6

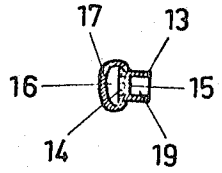

FIG. 7

GEOFFREY W. WEST
INVENTOR.
BY Beale and Jones

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CLEANING DEVICE

Geoffrey Ward West, 25 Daleham Mews, Hampstead, London, NW. 3, England

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Claims priority, application Great Britain, Oct. 8, 1963, 39,599/63; Dec. 19, 1963, 50,168/63
9 Claims. (Cl. 15—322)

This invention relates to a cleaning device, and particularly to a device for drying vehicle bodies, glazed walls, and other smooth surfaces.

In some known devices of this type the drying action is accomplished by contacting the surface to be cleaned with a mouth piece which is moved over the wet surface while simultaneously a subatmospheric pressure is created within the mouth piece to remove liquid or moisture from the wet surface. The subatmospheric pressure is created by means of a suction or vacuum pump to which the cleaning device is connected through a flexible tube or hose. The vacuum pump forms an additional requirement which is costly in relation to the cleaning device if not needed for other purposes. For instance, on a garage forecourt or a service station yard a vacuum pump is normally not available, but it is especially in such places that a cleaning device for cleaning windscreens or the body of automobiles is needed most.

Therefore, it is the object of the invention to provide a cleaning device which is simple in construction and which can be simply operated with energy sources normally already available at the cleaning site for other purposes without the need for a special vacuum pump to be installed.

Accordingly, the cleaning device of the invention comprises a body structure supporting a hollow squeegee type element for application to the surface to be dried and adapted to contact said surface in sealing relationship, and means for creating suction in the hollow space of the squeegee element, the suction creating means being adapted to be operated by compressed air.

On garage forecourts and the like places compressed air is always available, for example, for the inflation of tyres, and the cleaning device of the invention can be operated with the available source of compressed air. The cleaning device is particularly useful when additionally provided with spray means which may direct a spray of water or another cleaning liquid onto the screen or surface to be cleaned, and in that case both the spray means and the suction means can be operated by the compressed air. In fact, all that is required to operate the device will be to connect the device with a hose to the supply of compressed air and to connect the spray means with a supply of cleaning liquid. This liquid can be gravity fed from a storage container carried by the device or supported separately near the cleaning site, or the liquid can be supplied under pressure, for instance by connecting the spray means to a water tap. One specific embodiment of the invention will now be described with reference to the accompanying schematic drawing, in which:

FIGURE 1 is a side view of a cleaning device according to the invention,

FIGURE 2 is an end view of the device of FIGURE 1,

FIGURE 3 shows the spray means and the outlet valve control means of the cleaning device in detail on an enlarged scale,

FIGURE 4 is a section through the line 4—4 of FIGURE 3,

FIGURE 5 is a longitudinal section through the left portion of the device illustrated in FIGURE 1 to show the suction creating means of the device,

FIGURE 6 is a bottom view of the squeegee element of the device, and

FIGURE 7 is a cross-section of the squeegee element through line 7—7 of FIGURE 6.

Referring to FIGURES 1 and 2, the cleaning device includes a body structure comprising a tubular moulding or pipe 10, flattened and flared at its forward end to form a mouth portion 11 upon which is mounted a squeegee element 12. The latter is shown in detail in FIGURES 6 and 7, and consists of a channel section rubber strip 13 reinforced at the base of the channel by a flexible metal strip 14, the channel base wall and metal strip being provided with perforations 15 at intervals to place the interior of the channel 13 in communication with an elongated cavity 16 on the rear side of the element. A U-section plastic or other cover strip 17 embraces the element at its rear side, the complete squeegee unit being fixed to the mouth portion 11 of the body structure with the elongated cavity 16 opening into said mouth portion 11. A pair or rubber flaps 19 are mounted at each end of the squeegee unit 12 to seal together with the legs of the channel strip 13 the squeegee unit against a surface. Preferably, the squeegee unit 12 is curved so that it adapts itself more readily to curved windscreens and blade springs 18 may be pivotally mounted on the body structure to engage the squeegee unit 12 near its ends and press these portions into firm engagement with the windscreen when the device is in use.

As shown in FIGURES 1 and 2, the body structure further comprises a manifold 20 with air control valves 21 and 22. An air hose 23 for the supply of compressed air is connected to an inlet of the manifold 20. In the manifold 20 the compressed air conduit which is in communication with the air hose 23 is divided into two separate outlet conduits, one conduit 24 discharging into the pipe 10 (FIG. 5), while the other conduit is in communication with an air tube 25 leading to a spray device 26 mounted on the mouth portion 11. The supply of air to the air tube 25 is controlled by valve 21, whereas the supply of air to the pipe 10 is controlled by valve 22. Water or another cleaning liquid is supplied through a tube 27 from a source (not shown) which is outside, i.e., independent of the manifold 20. Near the spray device 26 the air tube 25 and the water tube 27 are combined in a coaxial pipe 28. To create the necessary suction within the body structure the compressed air conduit 24 (FIG. 5) is discharged through one or more inclined ports 29 in the wall of the pipe 10. The arrangement is such that the rapid flow of the compressed air from the ports 29 induces an air flow through the body structure in a direction away from the mouth portion 11, which air flow in turn creates the necessary suction within the channel strip 13 of the squeegee unit 12. The air, which entrains a mist of liquid from the surface to be cleaned, is discharged through the open end portion of the pipe 10 at the left in FIG. 1.

A suction creating means of the above type will be found satisfactory for most applications, and has the advantage of simplicity. However, if desired, a more powerful underpressure could be created by installing a venturi-tube in the pipe 10, the compressed air being supplied through the throat of the venturi, and the channel strip 13 of the squeegee unit 12 being in communication with a lateral port in the venturi-tube.

Supported on the body structure immediately above its mouth portion 11 is the spray device 26 (FIGURE 3) to which compressed air and cleaning liquid are delivered through the coaxial pipe 28, the liquid through the inner tube 30 of the pipe 28 and compressed air through the outer tube 31 thereof. The tubes 30, 31 terminate in a tubular fitting 32 comprising a hollow sleeve member 33

longitudinally slidable on the tubes and closed at one end by a rubber or like elastic grummet **34**, said grummet **34** defining with the other end of the hollow member **33** and the pipe **28** an air chamber **35**. The air chamber **35** is in communication with the supply of compressed air through the outer tube **31** by means of perforations **36** in the wall of the tube **31**. The inner and outer tubes **30**, **31** extend through the air chamber **35**, and the inner tube **30** terminates in an outlet which serves as a seating for a spring-loaded poppet or similar type outlet valve **37**, the latter being disposed within a valve housing **38** on the end of the tubular fitting **32**.

The valve housing **38** is fixedly secured to the tubular fitting **32** by a pair of supporting elements **40**, which leave most of the circumference of the end portion of the fitting **32** free for undisturbed spraying of liquid laterally from the inner tube **30** to the outside of the spray device. The front portion of the tubular fitting **32** is of reduced internal diameter slightly greater than the external diameter of the outer tube **31** of the coaxial pipe **28**, so that this front portion of the tubular fitting **32** may slidingly move over the front portion of the outer tube **31** of the coaxial pipe **28**. The tubular fitting **32** is held in position by an inwardly extending flange **44** on the lower portion of the fitting **32**, which flange **44** is located in a circumferential groove of the grummet **34**. The grummet **34** is firmly locked in a recessed portion of the outer tube **31**. By this arrangement the fitting **32** with valve housing **38** may move slightly with respect to the coaxial pipe **28**, since the rubber grummet **34** provides sufficient elasticity to permit the air chamber **35** to expand in volume and allow such movement. The extent to which such movement is possible is limited by a control screw **42** which threadedly passes through the fitting **32** and with its front end portion fits slidingly into a slot **43** in the outer tube **31**. The travel of the valve member **37** with respect to the valve housing **38** under the influence of the spring **45** is limited by a lost motion connection due to the presence of flange **41** on the valve **37**, which may abut against the wall of the valve housing **38**. Thus, when no compressed air is supplied to the air chamber **35** the spring **45** urges the outlet valve **37** on its seat in the inner tube **30** to close the outlet end of inner tube **30**.

The front portion of the outer tube **31** has a portion **46** of reduced internal diameter, so that the front of the outer tube **31** encloses a large portion of the circumference of the inner tube **30**, leaving only two narrow and elongated orifices **47** for the discharge of air from the outer tube **31**. The front portion **46** of the outer tube **31** is also provided with reflector recesses **48** opposite the orifices **47** to direct the spray of liquid from the inner tube **30** laterally and forwardly of the spray device.

The operation of the cleaning device is as follows:

Cleaning liquid is supplied through tube **27** to the inner tube **30** of the spray device **26**, and compressed air is supplied through air hose **23** to the manifold **20**. By pressing valve **22** on the manifold the compressed air is admitted to conduit **24** in the manifold for discharge through port **29** into the pipe **10**, to create a subatmospheric pressure in the upstream portion of the pipe **10** which is in communication with the squeegee element **12**. Pressing valve **21** on the manifold **20** admits air via the air tube **25** to the outer tube **31** of the spray device **26**.

When the spray device **26** is inoperative, the valve member **37** is spring urged onto its seating in the inner tube **30**. Admission of compressed air through the outer tube **31** and the perforations **36** to the air chamber **35** causes the elements **31**, **32**, **33** and **34** to act as an expansible chamber device which displaces the tubular fitting **32** by a small amount sufficient to cause the flange **41** of the valve member **37** to abut the valve housing **38**. Due to the operative connection between the fitting **32** and the valve member **37**, further displacement of the fitting **32** causes the valve member **37** to lift from its seating in tube **30**, the flexible grummet **34** accommodating such movement of the fitting **32**. Air delivered to the outer tube **31** is discharged from the forward end **46** thereof through the orifices **47** and in so doing flows past the end of the liquid supply tube **30** whereby liquid is entrained in the air streams and is evenly spread in finely atomised form over the surface to be cleaned immediately ahead of the squeegee unit **12**. When the air supply ceases, the elasticity of the grummet **34** is sufficient to return the fitting **32** to its initial position and so permit the valve member **37** to return to its seating in the outermost end of the inner tube **30**.

As will be understood, a short moment before the tubular fitting **32** has been returned to its inoperative position by closing off the supply of compressed air the valve member **37** has already returned to its seating in the inner tube **30** and is urged onto the seating positively by the action of the spring **45**. In this way no dripping of cleaning liquid can occur when the air valve **21** is closed, so that no cleaning liquid, which may be costly, will be spilled and the cleaned surface will not be contaminated.

It will be understood that the embodiment of the invention above described is capable of various modifications. For example, the hollow member **33** of the spray device **12** may be conveniently made up of two members which are screw-threaded together so that rotation of one member relative to the other member provides a ready means of adjusting the axial position of the fitting **32** with respect to the grummet **34**, but, if desired the grummet **34** may be substituted by a spring-loaded resilient diaphragm.

Instead of the spray device being gravity fed with cleaning liquid, a pressurized source of cleaning liquid may be used, such an arrangement being particularly applicable, for example, to window cleaning apparatus which needs to be completely and readily portable.

It has been found that with a cleaning device constructed as above described it is possible to clean windscreens and similar surfaces using only a relatively small amount of liquid and leaving the screen so free of moisture that no further drying or other treatment is necessary.

In carrying the invention into effect according to its simplest form, the cleaning device follows closely the construction described with respect to the above specific embodiment with the exception that the liquid delivery **27**, the spray device **12** and the control valve **21** therefor are omitted. It will be understood, however, that the provision of the spray device **26** increases considerably the utility of the device so that, even where drying only is the main purpose of the cleaning device, the addition of a clean water supply will in many instances be an additional asset in obtaining a clean dry surface.

I claim:

1. A cleaning device comprising

(a) a hollow squeegee head for contacting a surface to be cleaned;

(b) suction means operable by compressed air and joined to and communicating with the squeegee head;

(c) spray means for distributing cleaning fluid mounted near the squeegee head, the spray means comprising an outlet for cleaning fluid positioned to direct cleaning fluid in use onto a surface to be cleaned;

(d) outlet valve means for opening and closing the outlet of the spray means;

(e) outlet-valve control means operable to open the outlet when compressed air is supplied to the outlet-valve control means and to close the outlet when compressed air is not supplied, the control means comprising an expansible chamber device operatively connected to the outlet valve;

(f) a manifold comprising an inlet for compressed air and outlets to the control means and the suction means;

(g) a supply source for cleaning fluid independent of the manifold.

2. A cleaning device as described in claim 1 in which a tube supplies air to the spray means to carry atomized cleaning fluid from the spray means, the tube being in direct communication with said outlet valve control means; whereby air is supplied to said spray means only when said outlet valve is open.

3. A cleaning device as described in claim 1 having means for controlling independently of each other the flow from the manifold outlets to the outlet-valve control means and to the suction means.

4. A cleaning device as described in claim 1 wherein the spray means is mounted outside and in fixed relation to the squeegee head.

5. A cleaning device as described in claim 1 having lost motion means interconnecting the outlet valve and the outlet-valve control means to cause the outlet valve to remain seated upon initial movement of said outlet valve control means.

6. A cleaning device as described in claim 1 in which the outlet valve control means includes resilient means maintaining the outlet valve in its closed position and air operated means for opposing the resilient means to urge the outlet valve toward its open position.

7. A cleaning device as described in claim 1 in which said spray means comprises an inner tube for cleaning fluid, an outer tube for air in concentric relationship with said inner tube, and in which the outlet-valve control means comprises a sleeve slidable longitudinally with respect to said tubes, the sleeve having the outlet valve

means connected thereto being located to open and close the outermost end of said inner tube, and air operated means for moving the sleeve longitudinally with respect to said tubes to open and close said valve.

8. A cleaning device as described in claim 7 in which said sleeve and said outer tube are spaced apart to define an enclosed air chamber therebetween, annular resilient grummet means interconnecting and fixed to said sleeve and said outer tube at only one end of said air chamber and biasing the sleeve to maintain the outlet valve means in its closed position; whereby the introduction of compressed air to the air chamber will move the sleeve longitudinally with respect to the tubes to open the outlet valve.

9. A cleaning device as described in claim 8 having means to limit the movement of the sleeve toward its valve-opening position.

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ROBERT W. MICHELL, *Primary Examiner.*