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F. C. DOUGHMAN

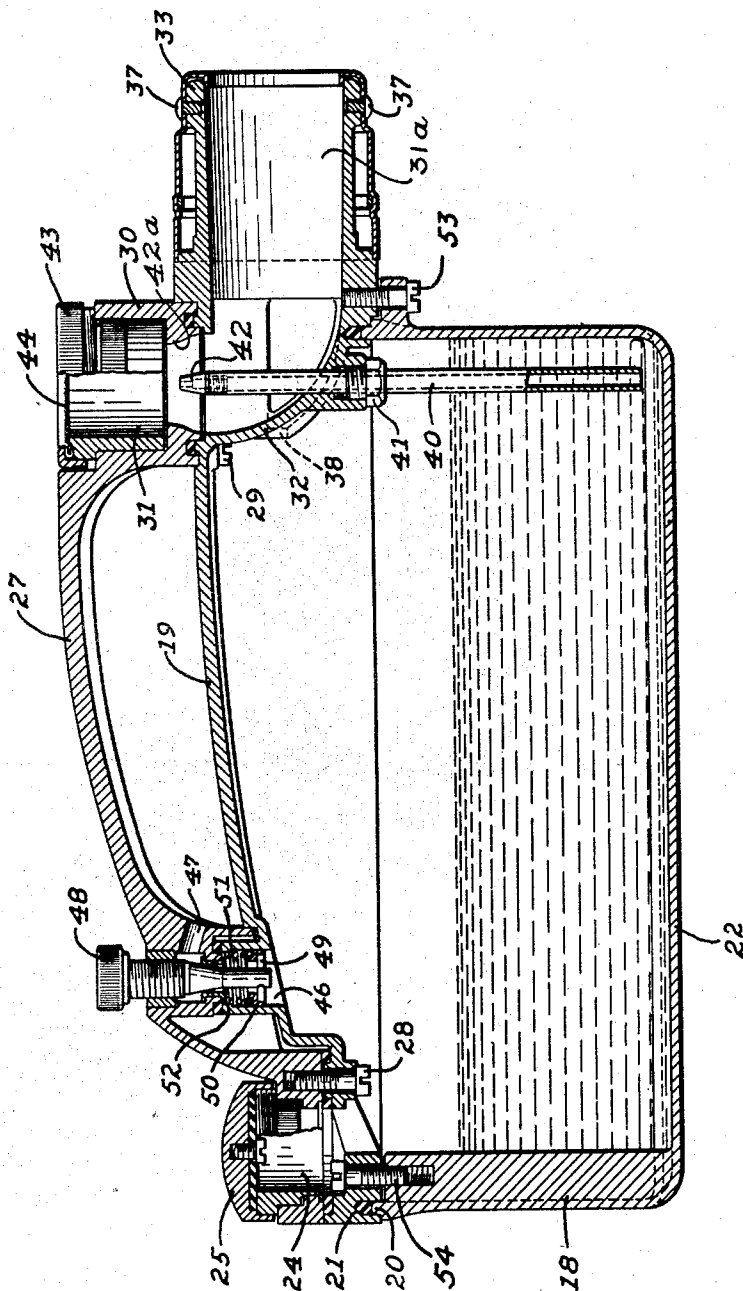
2,345,658

HUMIDIFIER

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2 Sheets-Sheet 2

Fig. 5.



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2,345,658

HUMIDIFIER

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Application August 12, 1941, Serial No. 406,505

3 Claims. (Cl. 261—72)

This invention relates to a humidifying attachment for vacuum cleaners and has for an object to provide a simple and inexpensive humidifying device which may be manufactured and sold as a unit and may be operated in connection with a vacuum cleaner without special skill or attention.

For purposes of illustration the invention will be described as applied to a humidifying unit which is adapted to be used with vacuum cleaners of the so-called inside bag type having a dust separator and a motor-fan unit located in a cleaner housing, although it will be evident that the invention may also be used with other types of vacuum cleaners.

Vacuum cleaners are commonly provided with an air discharge opening which is adapted to receive a hose for blowing purposes. The present invention provides a novel self-contained humidifying unit which may be connected to such discharge opening of a vacuum cleaner for diffusing moisture into the atmosphere of a room.

The various features and advantages of the invention may be better understood by reference to the following specification and appended claims when considered in connection with the accompanying drawings, in which:

Fig. 1 is a side elevation of a humidifying unit embodying the invention, connected to the discharge opening of a vacuum cleaner;

Fig. 2 is an end view of the humidifying unit, showing the filling opening and the valve for regulating the discharge of moisture;

Fig. 3 is a view of the opposite end of the humidifying unit, showing the discharge opening and the coupling member for connecting the unit into the vacuum cleaner;

Fig. 4 is a plan view of the humidifying unit; and

Fig. 5 is a longitudinal sectional view taken on the line 5—5 of Fig. 4.

The vacuum cleaner shown in Fig. 1 is of the inside bag type, and includes a cleaner housing 10 containing a dust bag, a motor-fan unit and an air filter (not shown); a front cover 11 which controls access to the dust bag and to which a flexible hose may be connected by a suitable coupling member 12 for cleaning purposes; and a rear cover 13 containing a discharge opening 14 into which a hose may be inserted for blowing purposes.

The vacuum cleaner 10 stands on runners 15 by means of which it may be pulled over the floor or carpet. The cleaner also has a suitable

handle 16 by means of which it may be lifted and carried from place to place. This general type of cleaner and its mode of use are well known, one form being shown in the Lofgren Patent #2,174,444, dated September 26, 1939.

The humidifying unit embodying the present invention includes a casing consisting essentially of a lower shell or housing 18 and an upper shell or cover 19, which are preferably of cast metal, although they may be made from flat sheet metal stock by die forming in a punch press. The lower shell or housing 18 is relatively deep, being adapted to hold a substantial supply of liquid for humidifying purposes, while the upper shell or cover 19 is relatively shallow. The lower shell has a continuous ridge 20 formed about its upper edge, and the cover 19 has a corresponding continuous groove 21 about its lower edge, the groove 21 mating with the ridge 20 to form a water-tight seal when the cover is secured to the lower shell. The lower shell is shown as formed on the bottom with longitudinal ridges 22 by means of which it is supported on the floor.

The cover 19 has a filling opening 24 which is closed by a threaded cap 25. This opening 24 is below the top inner wall of cover 19 so that, even when the liquid admitted to the humidifying unit reaches the top of opening 24, an air space will remain between the upper level of the liquid in the humidifying unit and the top of cover 19, as will be evident from Fig. 5.

The cover 19 has a handle 27 which may be secured thereto by suitable means, shown as screws 28 and 29. The forward end of handle 27 is enlarged to form a post 30 having a circular opening 31 which extends downwardly through the cover 19 into a passage 31a formed in part by a curved interior wall 32 therein and thus communicates directly with a cylindrical coupling member 33 which projects outwardly from the forward end of the cover. The opening 31 constitutes the humidifying outlet of the unit.

The coupling member 33 of the humidifying unit is at the same height as the opening 14 in the rear cover 13 of vacuum cleaner housing 10, so that, when the humidifying unit and the vacuum cleaner are arranged end-to-end, the coupling member 33 of the humidifying unit may enter said opening 14 and be coupled thereto as shown in Fig. 1. In the embodiment illustrated, coupling member 33 is provided with spring-pressed latches 35 which engage with cooperating recesses within the opening 14 in the vacuum cleaner cover 13 to secure the unit together, the latches 35 being actuated by depressible finger

The invention claimed is:

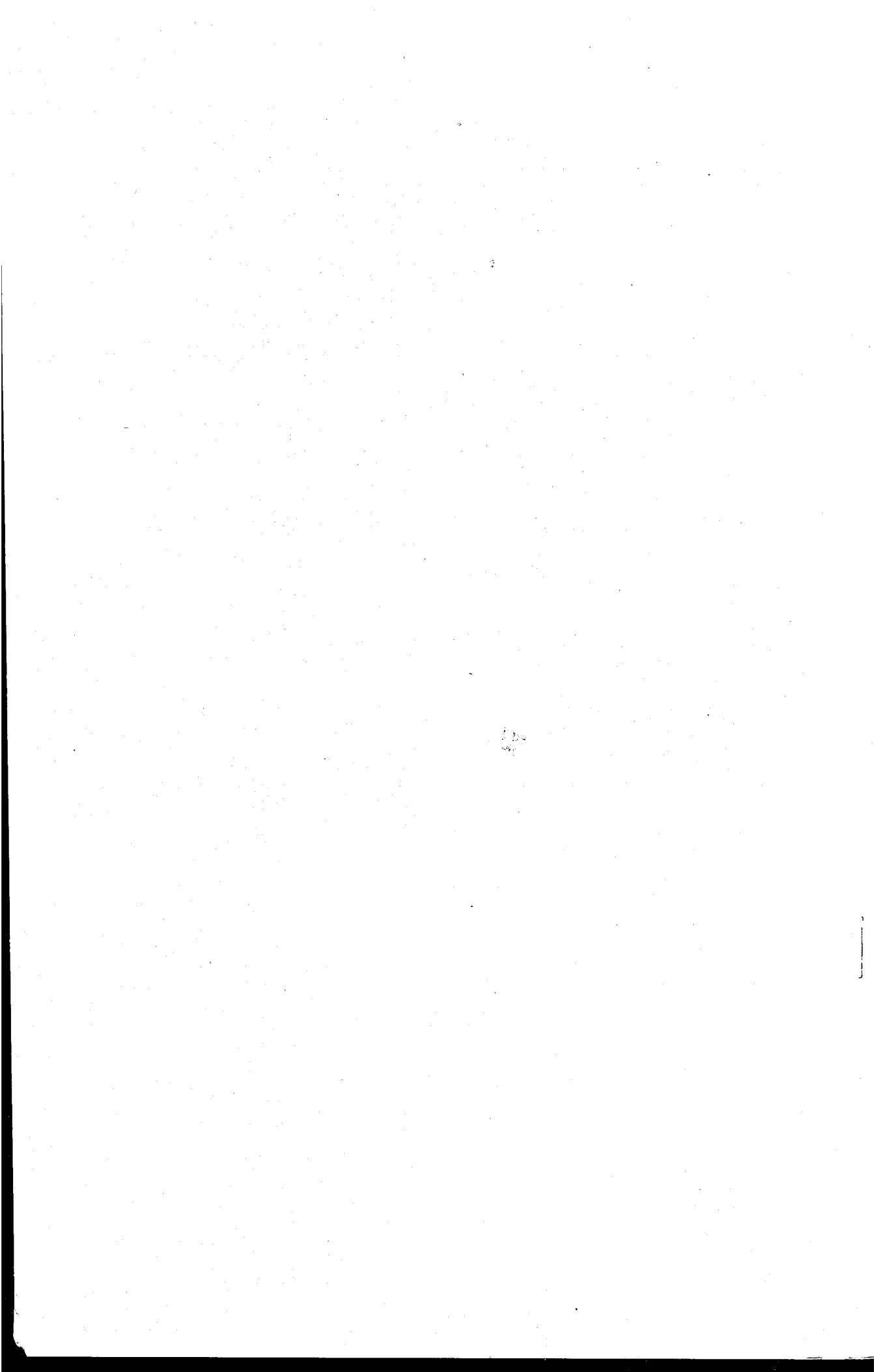
1. A humidifying attachment for vacuum cleaners for use in transforming water to water vapor and discharging the same into the atmosphere and adapted to receive a flow of air heated or otherwise from the vacuum cleaner for discharging the water into the atmosphere, said attachment comprising a container for water designed with the cleaner to be supported in a substantially horizontal position on a common substantially horizontal surface, an air tube supported by the container, the end of said air tube being constructed to be coupled with the cleaner while the container is maintained in substantially horizontal position and without rotation of either the container or the cleaner but merely by the moving toward each other and together on said surface the container and the cleaner so that when coupled the flow of air produced by the cleaner will be caused to pass through said air tube, means for introducing water from the container into the air tube so that the flow of air around the place of introduction of the water into the air tube will produce atomization of the water and cause the water vapor to be discharged into the atmosphere from the discharge end of the air tube, means for subdividing the water as it passes from the discharge end of the air tube, and means providing an air passage between the air producing means of the vacuum cleaner into the upper portion of the container for supplying air thereto and producing pressure on liquid contained therein.

2. A humidifying attachment for vacuum cleaners for use in transforming water to water vapor and discharging the same into the atmosphere and adapted to receive a flow of air heated or otherwise from the vacuum cleaner for discharging the water into the atmosphere, said attachment comprising a container for water designed with the cleaner to be supported in a substantially horizontal position on a common substantially horizontal surface, an air tube supported by the container, the end of said air tube being constructed to be coupled with the cleaner while the container is maintained in substantially horizontal position and without rotation of either the container or the cleaner but merely

by the moving toward each other and together on said surface the container and the cleaner so that when coupled the flow of air produced by the cleaner will be caused to pass through said air tube, means for introducing water from the container into the air tube so that the flow of air around the place of introduction of the water into the air tube will produce atomization of the water and cause the water vapor to be discharged into the atmosphere from the discharge end of the air tube, and means for subdividing the water as it passes from the discharge end of the air tube and a bleeder passage through the wall of the air tube into the upper portion of the container so that air may pass thereto and supply pressure on liquid in the container.

3. A humidifying attachment for vacuum cleaners for use in transforming water to water vapor and discharging the same into the atmosphere and adapted to receive a flow of air heated or otherwise from the vacuum cleaner for discharging the water into the atmosphere, said attachment comprising a container for water designed with the cleaner to be supported in a substantially horizontal position on a common substantially horizontal surface, and air tube supported by the container, the end of said air tube being constructed to be coupled with the cleaner while the container is maintained in substantially horizontal position and without rotation of either the container or the cleaner but merely by the moving toward each other and together on said surface the container and the cleaner so that when coupled the flow of air produced by the cleaner will be caused to pass through said air tube, means for introducing water from the container into the air tube so that the flow of air around the place of introduction of the water into the air tube will produce atomization of the water and cause the water vapor to be discharged into the atmosphere from the discharge end of the air tube, and means for subdividing the water as it passes from the discharge end of the air tube and means for controlling both the pressure above the liquid in the container and the ejection of liquid from the container.

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UNITED STATES PATENT OFFICE

2,345,659

PROCESS FOR POLYMERIZING VINYL CHLORIDE

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6 Claims. (Cl. 260—88)

This invention relates to a process for polymerizing vinyl chloride whereby the relatively insoluble modification of the polymer may be obtained at a rapid rate of polymerization.

It is well known that vinyl chloride will polymerize to a vinyl resin under the influence of heat and many catalysts have been suggested to accelerate the rate of reaction. These catalysts include oxygenated compounds, such as ozone, hydrogen peroxide, dibenzoyl peroxide, diacetyl peroxide and barium peroxide; metal compounds which act as oxidizing agents in the presence of oxygen, such as uranium nitrate or lead salts; as well as non-oxygenated agents, such as lead tetraethyl. Actinic light is also effective to bring about polymerization. For the production of the insoluble modification of polyvinyl chloride, which has been classified in the chemical literature as "beta," "delta" or "gamma" polyvinyl chloride in accordance with its increasing insolubility and molecular weight, it is necessary to employ low temperatures of polymerization. This is because the molecular weight of a vinyl polymer has been found, in general, to be inversely proportional to the temperature of polymerization. At low temperatures, however, the rate of reaction is extremely slow; even on a small scale, two or three days being usually required to convert even half of the monomeric vinyl chloride charged to the insoluble grade of resin.

In accordance with this invention, it has been found that a high yield of polyvinyl chloride resin of the "beta," "delta" or "gamma" variety can be obtained in a few hours. The essence of this invention involves the discovery that hydrogen peroxide, which despite many suggestions for its use, has previously been found to be an indifferent catalyst for this reaction when employed in the amounts customary for other oxygenated catalysts, i. e. from 0.3 to 1.6% of the monomeric vinyl chloride charged, is an excellent catalyst for the polymerization of vinyl chloride when present in minute amounts. By this is meant that the concentration of hydrogen peroxide (H₂O₂) must be kept below 0.1% by weight of the vinyl chloride charged, preferably at a concentration below about 0.07% by weight of the vinyl chloride. Under these conditions, as much as 10 to 12% of the monomeric vinyl chloride in a batch can be polymerized per hour to insoluble polymers whereas previously, using other oxygenated catalysts, or hydrogen peroxide in the customary amounts, insoluble polyvinyl chloride was produced at rates of about 1% monomeric vinyl chloride polymerized per hour. The effect of traces of hydrogen

peroxide in markedly accelerating the rate of polymerization is singular in that experience with other oxygenated catalysts has shown, in general, that the rate of polymerization decreases with decreasing amounts of catalyst.

The extreme sensitiveness of the rate of polymerization to the concentration of the hydrogen peroxide catalyst, within the critical ranges of this invention, has been demonstrated experimentally. The experiments were conducted by polymerizing at 40° C. vinyl chloride in a mixture containing, by weight, 96% vinyl chloride, 4.0% acetone, and varying amounts of hydrogen peroxide as a catalyst. The results of these experiments are tabulated below:

Concentration of hydrogen peroxide, per cent	Time of polymerization (hours)	Conversion (per cent monomer polymerized)	Rate of polymerization (per cent monomer polymerized per hour)
0.10	40.0	20.0	0.5
0.072	23.7	37.6	1.6
0.050	2.95	26.3	8.9
0.025	3.05	42.1	13.8

The rate of polymerization is that percentage of the vinyl chloride charged to the polymerization vessel which is polymerized per hour. In a batch process, this is an average rate determined by dividing the total percentage conversion of monomer to resin by the time of polymerization in hours. In a continuous process, the rate is the percentage of vinyl chloride monomer in the reaction vessel which is polymerized per hour.

In working with the minute amounts of hydrogen peroxide which are effective as a catalyst for the polymerization of vinyl chloride, certain precautions must be observed to prevent the decomposition of the peroxide. It is obvious that, if the catalyst is destroyed in this manner, the polymerization will be retarded because of the absence of any catalyst, and it may even be inhibited completely since the oxygen which is released by the decomposition of hydrogen peroxide is a polymerization inhibitor. It has been found that materials which are commonly used in the construction of polymerization autoclaves, such as iron, steel, stainless steel alloys, lead and aluminum, catalyze or promote the decomposition of hydrogen peroxide. Accordingly, if the polymerization is to be conducted with the reactants in contact with materials such as these, it is necessary that the hydrogen peroxide catalyst be