Dec. 20, 1966 C. R. WEIDMAN ETAL 3,292,823

DISPENSER WITH HEAT EXCHANGER AT ITS DISCHARGE OUTLET

Filed Sept. 1, 1964

FIG. 1

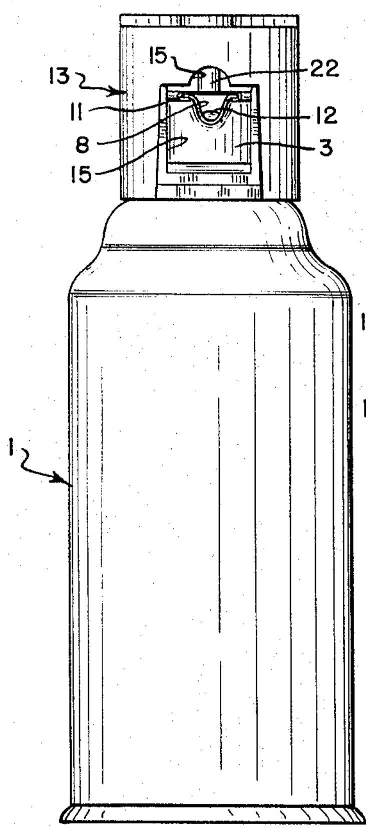


FIG. 2

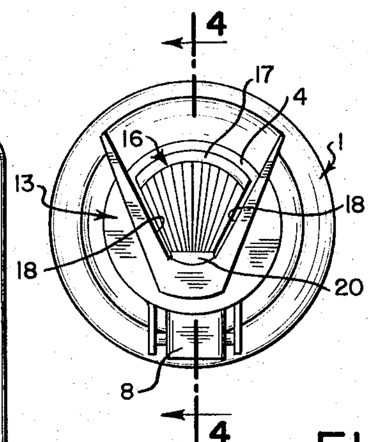


FIG. 3

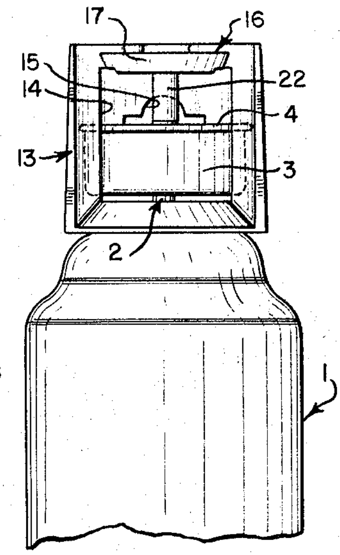


FIG. 4

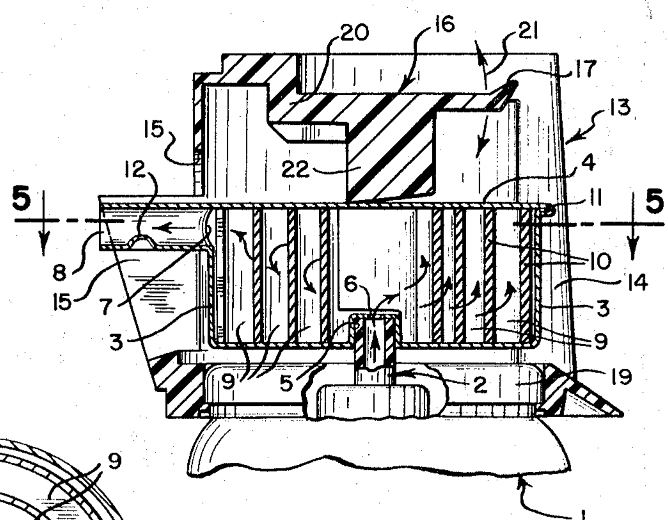
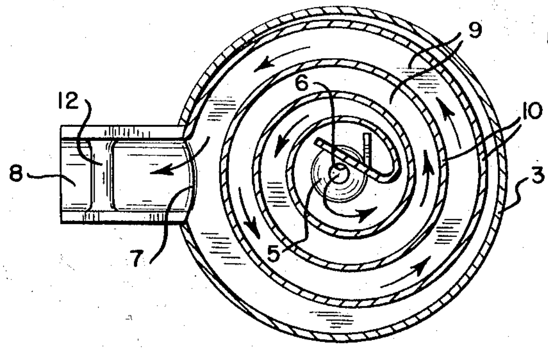


FIG. 5



INVENTORS
CHARLES R. WEIDMAN
JAN DAWIDOWICZ
EDWARD A. BEDDALL

BY
Pennie, Edmonds, Morton, Taylor & Adams ATTORNEYS

United States Patent Office

3,292,823

Patented Dec. 20, 1966

1

2

3,292,823
DISPENSER WITH HEAT EXCHANGER AT ITS DISCHARGE OUTLET

Charles R. Weidman, Stratford, and Jan Dawidowicz and Edward A. Beddall, Fairfield, Conn., assignors to Eversharp, Inc., Milford, Conn., a corporation of Delaware

Filed Sept. 1, 1964, Ser. No. 393,566
3 Claims. (Cl. 222—146)

This invention relates to a method for changing the temperature of flowable substances as they are being dispensed from a container. This invention also relates to heat exchange devices which are especially adapted for use in the foregoing method and more particularly to a heat exchanger especially adapted for use on a dispenser of flowable substance whereby the temperature of the substance may be changed, as the substance is being dispensed, from that temperature at which the substance is contained during storage to either a higher or lower temperature which is more suitable to the end use of the substance.

The development of aerosol-type containers and dispensers has made it possible to bring to the consumer a considerable variety of both new and old products in new forms having greater utility and convenience. However, the contained substance is dispensed at substantially the same temperature as that at which the container has been stored even though the substance should be or may more desirably be used or applied at a substantially different temperature. This disparity cannot be eliminated in most cases simply by storing the container at the most desirable temperature—especially not a temperature substantially above ordinary room temperature—because of the unsafe effect on the pressure of the aerosol propellant.

Numerous means are known for cooling or heating packaged or contained substances dispensed from a container so that the contents of the container or some part of it, may be delivered from the container to a utilization site at a temperature which is substantially different from the normal temperature of the container. Many of these heat the container, or some part of it, and its contents. Other means heat the dispensed substance in some reservoir outside the container itself and the heated substance is then dispensed from the reservoir to the site of actual use. The heat is sometimes obtained from built-in chemical or electric sources; in other instances external sources of heat are utilized. None of these known means is entirely suitable for altering the temperature of substances dispensed from aerosol-type containers because of the charracteristics of containers and their contents and because of their inherent portability and manner of use.

We have invented a method which utilizes readily and widely available sources of heat, such as hot water drawn from an ordinary household faucet, to heat substances as they are being dispensed from aerosol or other type containers. Broadly stated, our method is for changing the temperature of a flowable substance as it is dispensed from a container having an outlet and having means at the outlet for controlling the flow of substance therethrough. The method comprises the steps of providing an elongated conduit bounded along its length by material having substantial thermal capacity and good heat transfer characteristics. The conduit is provided with an inlet in communication with the outlet of said container and is also provided with an outlet. According to the method of our invention, a thermal transfer substance is flowed in thermal contact with the material bounding the conduit to cause the temperature of the material to approach the temperature of the transfer substance. A quantity of the flowable substance is then released from the container by means of the outlet valve and flowed through the conduit to a utilization site beyond the outlet of the conduit. By this method the temperature of the flowable substance is, thus, caused to approach the temperature of the material bounding said conduit.

In accordance with another aspect of our invention, we have invented a heat exchange device which is especially adapted for use in accordance with the foregoing method. This heat exchange device comprises, in combination with a dispensing container for flowable substance and having means for propelling said substance from the container and further having a discharge valve for controlling the flow of substance from within said container to a region external thereto, comprises a body of material for substantial thermal capacity and good heat transfer properties, the body is provided with a tortuous conduit therethrough from an inlet connected to the discharge valve of the container to an outlet for delivering the substance to a utilization site. The external surfaces of the body are exposed. Thus, by utilizing the device of our invention, the temperature of a quantity of the substance may be altered during its delivery from the container to a utilization site simply by flowing over the exposed surfaces of the body a heatable fluid at a temperature different from that of the body and then opening the discharge valve of the container to discharge substance into and through the conduit.

As will be apparent to those skilled in the art, the efficacy of a heat exchanger of this type depends upon the mass and specific heat of the material constituting the body as well as the surface area of the conduit walls with which the flowable substance comes into contact. For a conduit of given cross section the effect may be increased by increasing the length of the conduit. A conduit having a tortuous course in accordance with our invention permits a heating conduit of extended length to be contained in a body having a mass which is relatively large compared to the volume of the device. This enhances its convenience and efficiency. In a preferred embodiment of our invention the tortuous course which the conduit describes is a spiral path in a substantially cylindrical body.

An additional feature of our invention is a means for improving the transfer of heat from the thermal transfer substance to the heat exchanger and it comprises a shroud element fabricated of plastic or metal. This shroud substantially surrounds the body of the heat exchanger and is generally spaced from it. Preferably, there are at least two openings in the shroud through which may pass some suitable thermal transfer substance such as water. These openings are at spaced locations so that transfer substance directed into one of them is directed by the walls of the shroud around and in good thermal contact with the external surfaces of the exchanger itself before it reaches another of the openings from whence the transfer substance may leave the shroud. For example, at least one such opening may be located in a wall of the shroud at a position diametrically opposed to the outlet of the heat exchanger conduit. At least one other such opening may be conveniently located in a wall of the shroud adjacent to the outlet of the conduit.

In operating such a shrouded heat exchanger in accordance with the method of the invention, thermal transfer substance, either hot or cold as may be desired, is flowed through the shroud opening located diametrically opposite the outlet of the conduit and into the space between the walls of the shroud and the body of the heat exchanger while within the space the shroud directs the transfer substance over the external surfaces of the body of the heat exchanger to add or subtract heat and thereby raise or lower the temperature of the body. The transfer substance then flows out of the space through the shroud opening adjacent the outlet of the conduit. As the flow of transfer substance continues, the temperature of the body approaches that of the transfer substance. The flow of transfer substance is then discontinued, whereupon the discharge valve of the container may be actuated so that a quantity of the substance in the container is released to flow through the conduit in the heat exchanger in contact with the peripheral walls of the conduit so that heat is transferred between the body of the heat exchanger and the substance being dispensed from the container. The substance emerging from the outlet of the conduit will thus be at a temperature which approaches the temperature of the transfer substance flowed over the exposed surfaces of the heat exchanger body and is then ready for use.

The foregoing and other features of the method and apparatus according to the invention are described in greater detail in the following specification. In the course of the specification reference is made to the accompanying drawing.

FIG. 1 is a front elevation of a shrouded heat exchanger in accordance with the invention and mounted directly on an aerosol-type container-dispenser.

FIG. 2 is a plan view of the shrouded heat exchanger shown in FIG. 1.

FIG. 3 is a rear elevation of the shroud heat exchanger shown in FIG. 1.

FIG. 4 is an enlarged sectional view, taken along the line **4—4** of FIG. 2, of the shrouded heat exchanger shown in FIGS. 1–3.

FIG. 5 is an enlarged sectional view taken along the line **5—5** of FIG. 4.

In FIGS. 1, 2 and 3 we illustrate a conventional aerosol-type container-dispenser of, for example, shaving lather. Shaving lather which is packaged in this form has achieved great popularity in recent years. It has achieved this popularity even though, contrary to the dictates of long standing tradition and maximum comfort, it has had to be applied to the users face at room temperature, which is the temperature usually assumed by the container. As is well known, aerosol-type container-dispensers should not be stored at or subjected to even moderately elevated temperatures for a time that would be long enough to raise the temperature of the shaving lather in the container substantially above room temperature.

The heat exchanger device we have invented makes it possible for the first time to quickly and easily dispense from an aerosol container-dispenser a quantity of heated shaving lather sufficient for one shave. When an external heat exchanger adapted to an aerosol container-dispenser of shaving lather is operated in accordance with our new method, it is a simple matter to dispense heated shaving lather without subjecting the container itself to any increase in temperature at all.

The preferred embodiment of a heat exchanger device according to our invention is directly adapted to a conventional aerosol-type container **1**. Such a container is provided with a dispensing valve built into the top of the container and the valve is normally spring-biased to the closed position so that any suitable quantity of the lather may be dispensed from the container merely by exerting pressure on a control member, usually an exposed part of the valve outlet. Such valves are well known and in the drawing the valve outlet and control member is generally illustrated at **2**.

According to our invention we provide a heat transfer device which is preferably mounted directly on the valve outlet and control member **2**. The heat exchanger comprises a body **3** of material having substantial thermal capacity and good heat transfer characteristics. Suitable materials for the body of the heat exchanger are copper and aluminum, although other materials will also serve these purposes. In this particular embodiment, the heat exchanger body consists of a cup-shaped member **3** and a cover member **4**. The bottom of the cup-shaped member **3** is provided with a central recess **5** which is proportioned to fit snugly over the valve outlet member **2**. This recess has an inlet aperture **6** through which

shaving lather flows from the valve outlet into the body of the heat exchanger. The heat exchanger body is also provided with an outlet aperture **7** in the peripheral wall of the cup **3**. A spout **8** which may be formed integrally with the cup leads away from the outlet aperture **7** so that shaving lather dispensed through the heat exchanger may be conveniently and neatly delivered to the hand or face of the user.

In accordance with our invention the body of the heat exchanger has an elongated tortuous conduit **9** extending through the body from the inlet aperture **6** to the outlet aperture **7** and spout **8**. In this particular embodiment the tortuous path is a spiral and the conduit is formed by a spirally wound strip **10** of a material having the same good thermal characteristics as the material from which the cup **3** is formed, for the strip **10** combines with the cup **3** and the cover **4** to form the body of the heat exchanger.

In this embodiment the strip **10** has several characteristics each one of which contributes to the efficiency of operation of the heat exchanger as a whole. As is illustrated in FIGS. 4 and 5, the strip is wound with several turns so that the innermost turn terminates adjacent the inlet aperture **6** and is braced against the recess **5**. From there each turn of the strip is generally spaced from the next innermost turn by a progressively greater distance so that the cross sectional area of the conduit formed by the combination of the spirally wound strip **10**, the bottom wall of the cup **3** and the cover member **4** increases from the inlet **6** to the outlet **7**. This permits the lather, which comprises innumerable small gas-filled bubbles, to continuously expand as it progresses through the heat exchanger and absorbs heat. This feature is desirable where the substance being dispensed has a significant coefficient of thermal expansion and heat is being transferred to it by the heat exchanger.

It is advantageous to make the width of the spiral strip equal to the depth of the cup **3** between the bottom wall and the cover member **4** so that there is good thermal contact between the top and bottom of the body of the heat exchanger and the several turns of the spiral strip itself. In the interest of simple and economical construction, the strip is not bonded to the cup or cover in any way; therefore, a close mechanical fit between the parts is desirable to insure that heat is conducted to all parts of the strip so that it, too, absorbs heat from the transfer substance and passes the heat on the lather. For the same reason it is desirable to form the outer end of the strip so that a substantial area near the end bears directly against the peripheral wall of the cup **3**.

This embodiment of the heat exchanger is simple and intxpensive to form and assemble. As previously stated, the cup member may be drawn from a relatively thin aluminum sheet. The cover member **4** is simply stamped from a sheet of the same material and the spiral strip is wound from a strip of the same material. The spiral strip need only be positioned within the cup as shown in FIG. 5 and it is generally not necessary to fasten it in place for the natural tendency of the spiral to expand will usually result in a frictional fit between the outer turn of the spiral and the peripheral walls of the cup which is sufficient to hold the spiral in place. The cover member **4** may be crimped to the top edges of the peripheral walls of the cup as illustrated at **11** in FIG. 4.

The heat exchanger described above, together with a conventional aerosol container-dispenser, is sufficient in and of itself to perform in accordance with the invention. With the heat exchanger in position on outlet member **2** of the discharge valve, a quantity of shaving lather may be dispensed from the container and heated by the following simple method. First, the heat exchanger is held for a short while in any convenient heated substance, in for example, a stream of hot water from a household faucet, until the temperature of the cup **3**, the cover member **4** and the spiral strip **10** have been raised to approximately the temperature of the water or other substance. The heat exchanger is then removed from the hot water whereupon it is only necessary to actuate the discharge valve of the container so that shaving lather is propelled from the container into the inlet **6** and through the spiral conduit of the heat exchanger to the outlet aperture **7** and then through the spout **8**. As the lather emerges from the outlet member of the discharge valve, it immediately expands to fill the cross section of the spiral conduit and it begins to absorb heat from the surfaces bounding the conduit, namely, the bottom of the cup **3**, the cover member **4** and the spiral strip **10**. As more and more lather is discharged from the container into the heat exchanger, that part of the lather which first entered the heat exchanger is propelled along the spiral conduit and it continues to absorb heat. The heat exchanger having approximately the portions shown in the drawing can, in about 10 seconds, readily absorb enough heat from water at 160° F. to raise by about 25° F. the temperature of a quantity of shaving lather sufficient for one shave. This increase in temperature of the shaving lather gives that very pleasant sensation which users of aerosol shaving lather will recall from their last shave by a barber. The heated lather also has a markedly improved action during the course of the shave.

We have found that the bare heat exchange device we have described above performs extremely well. However, it is inevitable that a stream of running water from a household faucet, for example, will tend to splash off the upstream surfaces of the exchanger and contact the downstream surfaces only intermittently, thus requiring that the heat exchange device be held in the stream for a longer time before the entire body of the device approaches the temperature of the water. Therefore, in the preferred embodiment of the invention we provide a shroud **13** for the heat exchange device. As shown in FIGS. 1–4, the shroud surrounds the device and is generally spaced from it. There is an inlet aperture **14** in the wall of the shroud and a diametrically opposite outlet aperture **15** through which the outlet spout **8** protrudes. The bottom of the shroud is open and is provided with a suitable mounting collar **16** which is adapted to fit over the top of the container-dispenser. When the shroud is in place over the heat exchange device and mounted on the container the external surfaces of the heat exchanger and the internal surfaces of the shroud form relatively narrow channels around the heat exchanger between the inlet aperture **14** and the outlet aperture **15**. Now, a stream of water directed into the inlet aperture will not splash away from the surfaces of the heat exchange device, but will be closely confined to them as the water flows through the channels to the outlet aperture **15**; thus, we considerably improve the efficiency of the device.

The shroud may be formed of any suitable material such as molded synthetic resin. The heat transfer properties of the shroud itself are immaterial to the functioning of the heat exchanger, although a material having a relatively low specific heat will remove less heat from the water which is intended, after all, to heat the device within the shroud. The use of a shroud material having low specific heat also acts as a thermal insulator to protect the user against direct contact with the heat exchange device which may become uncomfortably warm.

We have also found that a trigger member for indirectly actuating the discharge valve of the container may be molded as an integral part of a plastic shroud provided only that the cured resin has some slight elasticity. As shown in FIGS. 2–4 a portion **16** of the top of the shroud is separated from the main body of the shroud along the rear and side edges **17** and **18** and is only attached along the front edge **20**. This line of attachment acts as an elastic hinge so that the trigger member **16**, although an integral part of the shroud, may move up and down through at least a small angle as indicated by the arrows at **21**.

A stud **22**, which may also be molded as an integral part of the trigger member **16**, depends from the underside of the trigger member far enough to bear upon the cover **4** of the heat exchange device. Thus, digital pressure exerted on the trigger member will actuate the discharge valve of the container, for the pressure on the trigger is transmitted through the stud **22** to the body of the heat exchanger and then to the control member **2** of the discharge valve.

One may find that small quantities of shaving lather tend to drip from the spout after the discharge valve is permitted to close. This is sometimes due to residual heat in the exchanger which may heat and expand the lather remaining in the conduit after the discharge valve is closed. If the after-drip is objectionable, it may usually be stopped by crimping the bottom wall of the spout as indicated at **12** in FIGS. 4 and 5. A slight crimp placed there will not significantly impede discharge of shaving lather through the spout while it is being expelled from the container by the pressure of the gaseous propellant; however, the slight dam created by the crimp is usually sufficient to prevent the shaving lather which remains in the heat exchanger from expanding through the spout.

The preferred embodiment of our invention is quite efficient from the thermodynamic point of view. It is also compact and readily adaptable to the valves and contours of conventional aerosol-type container-dispensers. It will, however, be apparent to those skilled in the art that a heat exchanger according to our invention may be embodied in many different forms. For example, a channel having a tortuous path may be embossed or drawn into a metal plate and a second metal plate, either flat or having a reciprocally shaped channel therein, may be used to close the channel to form a conduit in accordance with the invention.

The foregoing description of the preferred embodiment is given only for purposes of illustration. The scope of the invention is defined in the following claims.

We claim:

1. A heat exchange device in combination with a dispensing container for flowable substance, said container having control means having an outlet for controlling the flow of substance from within said container to a region external thereto, which heat exchange device comprises
   - (a) a cup-shaped member having a bottom wall and peripheral side walls defining a cavity therein and being formed of material having substantial thermal capacity and good heat transfer properties, the external surfaces of said cup-shaped member being exposed,
   - (b) a closure member forming the top wall of said cavity,
   - (c) a channel member consisting of a spirally formed plate, with its upper and lower edges in good thermal contact, respectively, with said closure and bottom wall, and its terminal portion in good thermal contact with said peripheral side walls, said channel member, together with said cup-shaped member and said closure member forming a single elongated conduit,
   - (d) an inlet to said conduit and an outlet from said conduit spaced from said inlet and located at the terminal end of said conduit and in juxtaposition with a portion of said peripheral side walls,
   - (e) means communicating between the outlet of the control means and the conduit inlet,
   - (f) whereby the temperature of a quantity of the substance dispensed from the container may be altered during delivery from the container to a utilization site by flowing over the external surfaces of the cup-shaped member a heatable fluid having a temperature different from that of the body and then opening the control means of the container to discharge substance into and through the conduit to a utilization site.

2. A heat exchange device in combination with a dispensing container for flowable substance, said container having control means having an outlet for controlling the flow of substance from within said container to a region external thereto, which heat exchange device comprises

(a) a cup-shaped member having a bottom wall and peripheral side walls defining a cavity therein and being formed of material having substantial thermal capacity and good heat transfer properties, the external surfaces of said cup-shaped member being exposed,

(b) a closure member for said cavity,

(c) a channel member in said cavity and in good thermal contact with said cup-shaped member and said closure member, said channel member together with said cup-shaped member and said closure member forming an elongated conduit,

(d) an inlet to said conduit and an outlet from said conduit, said outlet being spaced along said conduit from said inlet,

(e) means communicating between the outlet of the control means and the conduit inlet,

(f) a shroud member spaced from and at least partially enveloping the external surfaces of said cup-shaped member, said shroud member having at least one inlet aperture therein for admitting a heatable fluid to the interior of said shroud member and having at least one outlet aperture spaced from said inlet aperture, and the space between said shroud member and the external surfaces of said cup-shaped member forming means for channelling through-flowing heatable fluid from said inlet aperture around and in contact with said external surfaces to said outlet aperture,

(g) whereby the temperature of a quantity of the substance dispensed from the container may be altered during delivery from the container to a utilization site by flowing over the exposed surfaces of the cup-shaped member a heatable fluid having a temperature different from that of the cup-shaped member and then opening the control means of the container to discharge substance into and through the conduit to a utilization site.

3. A heat exchange device in combination with a dispensing container for flowable substance said container having control means having an outlet for controlling the

flow of substance from within said container to a region external thereto, which heat exchange device comprises

(a) a body of material having substantial thermal capacity and good heat transfer properties,

(b) the external surfaces of said body being exposed,

(c) said body having a tortuous conduit therethrough and said conduit having an inlet connected to the outlet of the control means and also having an outlet for delivering the substance to a utilization site,

(d) a shroud member spaced from and at least partially enveloping the external surfaces of said body, said shroud member having at least one inlet aperture therein for admitting a heatable fluid to the interior of said shroud member and having at least one outlet aperture spaced from said inlet aperture, and the space between said shroud member and the external surfaces of said body forming means for channeling through-flowing heatable fluid from said inlet aperture around and in contact with said external surfaces to said outlet aperture,

(e) whereby the temperature of a quantity of the substance may be altered during delivery from the container to a utilization site by first flowing over the exposed surfaces of the body a heatable fluid at a temperature different from that of the body and then actuating the control means of the container to discharge substance into and through the conduit so that heat is transferred between the conduit walls and the flowable substance as the latter traverses the conduit to the utilization site.

References Cited by the Examiner

UNITED STATES PATENTS

2,060,440	11/1936	Rosenblad	165—163 X
2,148,986	2/1939	Hoyt	239—135
2,460,861	2/1949	Walters	239—132.1
2,499,448	3/1950	Axelson et al.	165—165
2,736,533	2/1956	Allen	165—163 X
2,767,960	10/1956	Fast	222—146
2,970,812	2/1961	Kritzer	165—165 X
3,111,967	11/1963	Bullard.	
3,171,572	3/1965	Reich et al.	222—394 X
3,175,733	3/1965	Lerner.	
3,184,114	5/1965	Minear	239—135 X

RAPHAEL M. LUPO, *Primary Examiner.*