

United States Patent

Kliewer

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[54] **TEMPERATURE INDICATOR**

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[73] Assignee: **Commodity Marketers, Inc.**, Fresno, Calif.

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[21] Appl. No.: **410,603**

1,916,989	7/1933	Rader.....	285/305
3,090,235	5/1963	Houser.....	73/358
3,140,611	7/1964	Kliewer.....	73/358

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[52] **U.S. Cl.**.....**116/114.5**, 73/358

[51] **Int. Cl.**.....**G01k 11/06**

[58] **Field of Search**.....99/192; 116/114.5; 73/358;
151/14.5; 85/66, 287, 297, 321, 305

[56] **References Cited**

UNITED STATES PATENTS

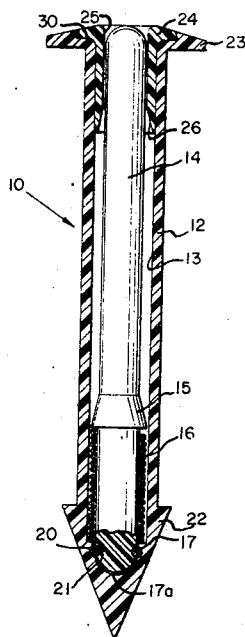
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[57]

ABSTRACT

A temperature responsive device having an extensible indicator rod or staff which is held in place within a bored shell by a ring of fusible material disposed within a generally torroidal chamber formed between confronting annular grooves on the staff and the shell adjacent complementally nestable end portions thereof.

10 Claims, 4 Drawing Figures



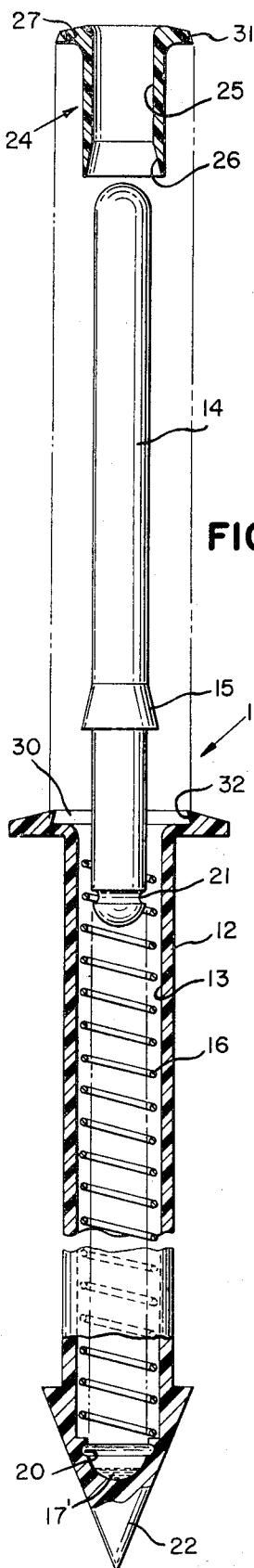


FIG. 2

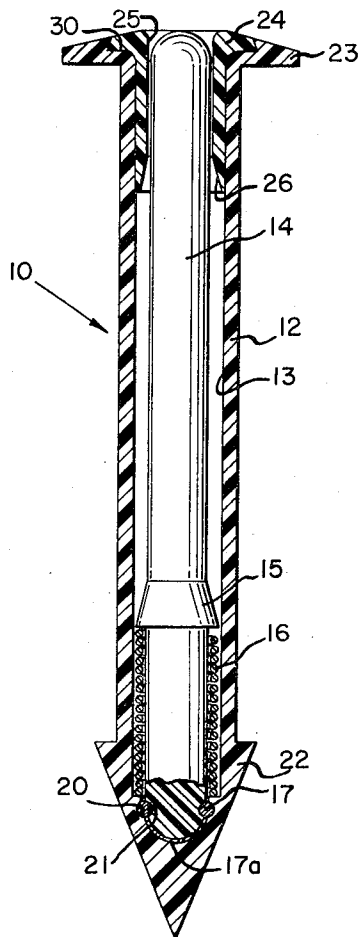


FIG. 3

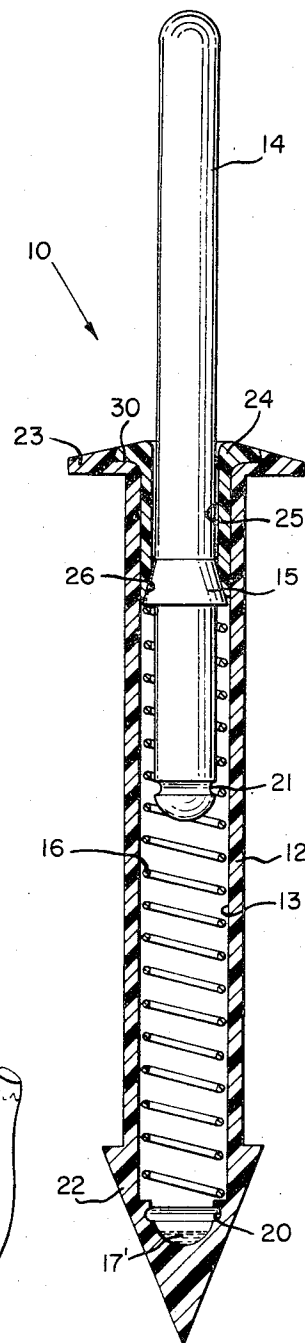


FIG. 4

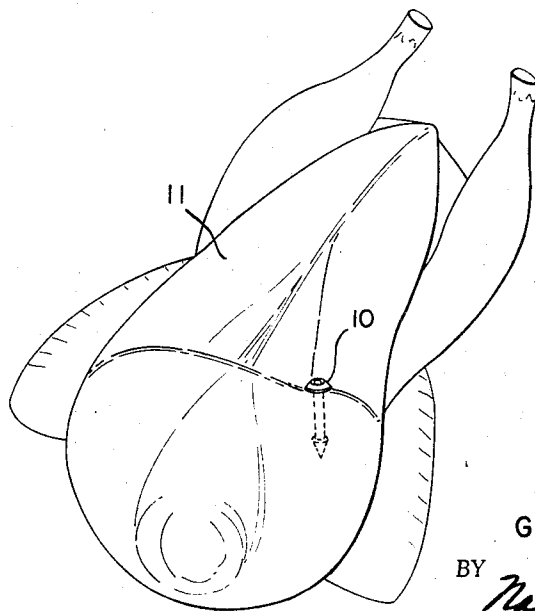


FIG. 1

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TEMPERATURE INDICATOR

The present invention relates to a signaling device adapted to be inserted into an article of food to indicate the attainment therein of a predetermined temperature. The invention is especially directed to an improved device of the type disclosed in U.S. Pat. No. 3,140,611 which is ideally suited for commercial marketing with the article of food in which it is to be used.

Thermometers of the type disclosed in the aforementioned patent have met with great commercial success largely as a result of their inexpensive character, convenience and reliability. These thermometers are typically purchased by food distributors and inserted into their products, such as poultry, for retail distribution along therewith. Due to the competitive nature of the business in which these devices are used, it is essential that they be as inexpensive as possible while at the same time durable and reliable in use.

It is, accordingly, a principle object of the present invention to provide a temperature indicating or signaling device of the type disclosed in the aforementioned patent which may be manufactured at less expense and has improved characteristics of durability and reliability.

A more specific object of the invention is to provide a device of the type described which has a minimum number of parts and may be assembled with the utmost of ease.

Yet another object of the invention is to provide a device of the type described in which the likelihood of inadvertent release of the indicator element is minimized.

Still another object of the invention is to provide a device of the type disclosed incorporating an improved construction which assures that the device will remain assembled at all times during normal use.

A further object of the invention is to provide a device of the type described incorporating a thermally responsive element which is arranged to be readily exposed to the temperature of the article in which it is being used.

The basic structure of the present invention includes a tubular housing or bored shell defining an axially extensive cavity closed at one end and open at the other end, which housing is fluid tight except for the open end of the cavity, and is formed of a thermally conductive imperforate material. An axially extensive indicator rod or staff is received in the cavity for axial slidable movement relative to the housing between extended and retracted positions and a resilient element is interposed between the rod and housing to urge the rod to the extended position. The basic structure is completed by a ring fusible at a predetermined temperature extending around the rod within the cavity, which ring is fixed in engagement on the inner and outer peripheral surfaces thereof with the rod and cavity, respectively. The ring normally retains the rod in the retracted position and restrains the resilient element, but upon fusion functions to release the rod for extension by the resilient element.

The foregoing and other objects and the detailed structure of the invention will become more apparent when viewed in light of the following detailed description and the accompanying drawings, wherein:

FIG. 1 is a perspective view of a fowl which has been prepared for roasting and has the signaling device of the present invention inserted into the breast thereof;

FIG. 2 is an exploded elevational view of the device, partially in section, illustrating the manner in which it is assembled; and,

FIGS. 3 and 4 are sectional elevational views of the inventive device showing the indicator element thereof in the retracted and extended positions, respectively.

Referring now to the drawings, the inventive signaling device is designated in its entirety by the numeral 10 and is shown in FIG. 1 inserted into the breast of a turkey 11. In operation, as will be developed subsequently, the device acts to indicate when the breast meat of the turkey is fully roasted. The breast of the turkey 11 was chosen for insertion of the device since this is the portion of the fowl having the greatest mass and requiring the longest roasting time.

The device 10 will now be described with reference to FIG. 3 wherein it is shown in the assembled and "cocked" condition. As will become apparent subsequently, the term "cocked" refers to the condition of the device wherein the indicator rod is in the retracted position and has not been released for visual observation. The device comprises a tubular housing or bored shell 12 defining therein an axially extensive cavity 13 closed at its lower end and open at its upper end. An indicator rod or staff 14 is slidably received in the cavity 13 for axial movement relative to the housing 12 and has formed therearound a tapered collar 15. The inner end of the bore in the housing or shell is formed with a concave surface portion and the inner end of the rod or staff is formed with a convex surface portion complementally nestable with said concave surface portion to substantially fill said concave portion when nested therewith (See FIG. 3). A coil spring 16 is loosely received around the rod 14 and interposed between the collar 15 and the lower end of the housing 12 and functions as means to bias the rod outwardly of the housing. From a comparison of FIGS. 3 and 4, it can be seen that the spring 16 is in the compressed state in FIG. 3 and that upon release from this state it is adapted to force the rod to the extended position shown in FIG. 4. The rod 14 is held in the retracted position illustrated in FIG. 3 by an annular ring 17 of fusible material received in opposed confronting annular grooves 20 and 21 formed, respectively, in the housing 12 and rod 14 adjacent to and outwardly of the inner ends thereof, respectively. Together, these grooves define a generally toroidal chamber. The ring 17 is formed of a thermoplastic substance having a predetermined fusing temperature which corresponds to the desired minimum cooking temperature of the food item with which the signaling device is to be used. Where the device is designed to indicate the properly cooked condition of a turkey, the ring may be made of a metal or like substance having a fusing temperature of approximately 84° C. For example, a metal alloy which will fuse at this temperature may be formulated as follows: 12 parts of an alloy consisting of bismuth—52 percent, lead—40 percent, cadmium—8 percent, to which is added 2 parts of Wood's alloy.

The ring 17 is particularly effective in holding the rod 14 in the "cocked" condition since its entire length is held under shear between the grooves 20 and 21. It is noted that the area of the fusible element under shear per unit volume thereof is far greater with this type of arrangement than would be possible with a simple pin and aperture arrangement, such as is suggested by the

aforementioned Pat. No. 3,140,611. Thus, the possibility of inadvertent release of the rod 14 due to failure of the fusible element under shear is greatly decreased. The arrangement of the fusible element or ring 17 is also particularly advantageous since it provides for maximum contact area between the material thereof and the housing 12. As a result, the ring 17 is very responsive to changes in temperature of the housing 12. The latter characteristic is particularly important since, for the sake of economy, the housing 12 is typically fabricated of polyethylene or styrene plastics, both of which are of relatively low thermal conductivity. The responsiveness of the ring 17 to thermal changes in the housing 12 may also be enhanced by a thin sheet of material 17a which is integral with the ring and extends downwardly therefrom in intimate contact with the housing. The sheet of material 17a is formed during the assembly of the device, as will be apparent subsequently.

The structure of the housing 12 is completed by a barbed section 22 formed at its lower end thereof and a stop collar 23 formed at its upper extremity. The pointed lower end of the barbed section facilitates insertion of the housing 12 into articles in which it is used, while the diverging upper portion of the barbed section impedes inadvertent removal of the housing from such articles. The collar 23 limits the degree to which the housing 12 may be inserted into an article.

Movement of the rod 14 outwardly with respect to the housing 12 is limited by a bushing 24 received in the upper end of the cavity 13. The bushing 24 has a passage 25 therethrough which slidably receives the upper portion of the rod 14. The lower end of the passage 25 is formed with a divergent inclined section 26 which is adapted to mate in sealed engagement with the inclined portion of the collar 15 when the rod 14 is in the extended position illustrated in FIG. 4. Thus, the bushing 24 functions to both limit movement of the rod 14 and seal the escape of material, such as the fused material of the ring 17, from the cavity 13. This sealing function is particularly important since the escape of the fused material could have adverse effects on the food article in which the indicator is being used.

The bushing 24 is held in place by an annular collar 27 formed therearound, which collar is adapted to be received in locked engagement with an annular recess 30 formed in the housing 12. The collar 27 and recess 30 have inclined outer boundary surfaces 31 and 32, respectively, which surfaces are adapted to mate in overlapped engagement as illustrated in FIGS. 3 and 4. It is noted that the surfaces 31 and 32 are inclined towards the upper end of the cavity 13 and that passage of the surface 31 beneath the surface 32 is facilitated by the resiliency of the collar 27.

The manner in which the signaling device 10 is assembled will now be described with reference to FIGS. 2 and 3. Assembly is commenced by first inserting a slug of fusible material into the cavity 13 and then melting this material to a fused state. The volume of this material must be sufficient to form both the sheet of material 17a and the ring 17 when the rod 14 is forced into the cavity 13. After the material 17' is in the fused state, the spring 16 is dropped into the cavity and the lower end of the rod 14 is inserted into the spring. At this point, the bushing 24 is slid over the upper end of

the rod 14 and forced into locked engagement with the housing 12 by snapping the surface 31 beneath the surface 32. As was noted previously, the latter action is facilitated by the resiliency of the collar 27. Assembly is completed by forcing the rod 14 to the position illustrated in FIG. 3 wherein the complementally nestable end portions on the rod and staff function to displace or extrude the fused material into the torroidal chamber formed by the confronting grooves 20 and 21 and then cooling the housing 12 to a degree sufficient to solidify the fused material 17'. Once cooled, the material 17' sets up into the ring 17 and sheet of material 17a, thus locking the rod 14 in the condition shown in FIG. 3. The sheet of material 17a is formed because the ends of the rod and cavity do not mate perfectly when the rod is in the retracted position.

Once the aforescribed signaling device has been assembled, and inserted into an article, such as the turkey 11, its operation is very simple. Specifically, after the portion of the article containing the barbed section 22 has reached the fusion temperature of the ring 17, the ring 17 functions to release the rod 14 to the action of the spring 16. The actual temperature at which release occurs may be referred to as the yield temperature. The spring in turn forces the rod 14 to the extended position illustrated in FIG. 4 wherein it may be visually observed. Upon observation of the extended rod 14, the user knows that the interior of the article has reached a temperature at which it is fully cooked.

To conclude, from the foregoing description it is believed apparent that the present invention enables the accomplishment of the objects initially set forth herein. In particular, a temperature indicator of simplified structure and improved reliability has been provided. It is to be understood, however, that the invention is not intended to be limited to the details of the specific embodiment illustrated and described, but rather is defined by the following claims.

What is claimed is:

1. A signaling device adapted to be inserted into an article to indicate the attainment of a predetermined internal temperature, comprising:

- a. a tubular housing defining an axially extensive cavity closed at one end and open at the other end, said cavity having a groove formed therein in spaced relationship to said one end and said housing being fluid tight except for the open end of said cavity and formed of a thermally conductive imperforate material;
- b. an axially extensive indicator rod received in said cavity for axial slidable movement relative to said housing between retracted and extended positions, said rod having:
 1. opposed ends, one of which is in opposition to the one end of said cavity;
 2. a groove formed therein in spaced relationship to the one end thereof by a distance substantially equal to the distance between the groove of said cavity and the one end thereof whereby, when said rod is in the retracted position, the groove therein is in opposition to the groove in said cavity; and,
 3. a portion disposed between the one end thereof and the groove therein of a volume sufficient to displace fluid contained in said cavity between

the groove therein and the one end thereof to a position filling the grooves in said rod and cavity when said rod is depressed within said cavity to the retracted position wherein said grooves are in opposition;

- c. resilient means interposed between said rod and housing adapted to urge said rod to the extended position; and,
 - d. a slug of material, fusible at said predetermined temperature, disposed in the one end of said cavity so as to be, upon fusion thereof, displaceable by said portion into the volume defined by said grooves when in opposition, said slug of material:
 1. upon freezing in said volume, being of sufficient shear strength to maintain said rod in the retracted position against the force of said resilient means; and,
 2. upon fusion in said volume, being adapted to release said rod for movement relative to said housing to the extended position.
 2. A device according to claim 1, including:
 - a. a stop element carried by said housing and extending laterally therefrom to limit penetration thereof into an article; and,
 - b. a barb element carried by said housing and extending laterally therefrom to impede removal thereof from an article.
 3. A device according to claim 1 including means to limit slidable movement of said rod relative to said housing and sealingly close said cavity when said rod is in the extended position, said means comprising:
 - a. a collar fixed to and extending around said rod intermediate the ends thereof, said collar being slidable within said cavity upon movement of said rod between extended and retracted positions; and,
 - b. a bushing fixedly received in the open end of said cavity, said bushing being adapted to slidably receive said rod upon movement thereof between the retracted and extended positions and to sealingly abut against said collar when the rod is in the extended position.
 4. In a signaling device adapted to be inserted into an article to indicate the attainment of a predetermined internal temperature, comprising:
 - a. a housing defining an axially extensive cavity closed at one end and open at the other end;
 - b. an axially extensive indicator rod received in said cavity for axial slidable movement relative to said housing between retracted and extended positions;
 - c. resilient means interposed between said rod and housing and adapted to urge said rod to the extended position; and,
 - d. thermally responsive means within said cavity cooperating between said housing and rod to maintain said rod in the retracted position against the action of said resilient means, said means being adapted to release said rod for extension by said resilient means upon attainment of said predetermined temperature;
- an improved means to limit slidable movement of said rod relative to said housing and sealingly close said cavity when said rod is in the extended position, said means comprising:

1. a collar fixed to and extending around said rod intermediate the ends thereof, said collar being slidable within said cavity upon movement of said rod between the extended and retracted positions;
2. a head portion fixed to said housing at the open end of said cavity, said portion having an annular recess extending around and communicating with the open end of said cavity, which recess has an inclined outer boundary surface converging towards the end of said housing through which said cavity opens;
3. a bushing received in the open end of said cavity, said bushing being adapted to slidably receive said rod upon movement thereof between the retracted and extended positions and to sealingly abut against said collar when the rod is in the extended position;
4. a collar fixed to said bushing and extending therearound, said collar having an outer boundary surface locked in mating engagement with said recess under the boundary surface thereof; and wherein,
5. said collar is adapted to be resiliently deflected to pass under the boundary surface of said recess.
5. A device according to claim 4, wherein:
 - a. said collar and bushing have opposed inclined annular surfaces extending therearound; and,
 - b. said surfaces are adapted to assume juxtaposed mating relationship upon abutment of said collar and bushing.
6. In a temperature-responsive device of the type having a bored shell, a staff slidable in said shell, and means for biasing the staff outwardly of the shell, the improvement comprising a convex surface portion formed on the inner end of said staff, a concave inner end formed in said staff bore, said concave inner end being complementally nestable with said convex staff portion so that said convex portion when nested in said concave end substantially fills the concave end, an annular groove formed in said bore and said staff adjacent to and outwardly of said concave and convex portions, respectively, said grooves being in mutually confronting alignment when said convex portion is in nesting contact with said concave portion so as to define a generally torroidal chamber, and a ring of fusible material in said chamber and substantially totally filling said chamber for securing said staff in said bore against said biasing means until the fusible material is raised to the yield temperature thereof.
7. In a temperature-responsive device of the type having a bored shell, a staff slidable in said shell, and means for biasing the staff outwardly of the shell, the improvement comprising a convex surface portion formed on the inner end of said staff, a concave inner end formed in said staff bore, said concave inner end being complementally nestable with said convex staff portion, a first annular groove formed in said bore adjacent to and outwardly of said concave portion, a second annular groove formed in said staff adjacent to and outwardly of said convex portion, said grooves being in mutually confronting alignment when said convex portion is nested with said concave portion, so as to define a generally torroidal chamber, and a quantity of fusible material in said bore which when in a molten state can be extruded into said chamber in

response to movement of said convex portion into nesting relation with said concave portion to fill said chamber with fusible material that when solidified is adapted for securing said staff in said bore against said biasing means until the fusible material is raised to the yield temperature thereof. 5

8. A temperature-responsive device comprising a shell defining a bore having an outer end communicating exterior of said shell and an interior end within the shell terminating in a concave portion, a staff slidably disposed in said bore and having an inner convex end complementally nestable in said concave bore portion, a first annular depression formed in said bore adjacent to and outwardly of said concave portion, a second annular depression formed in said staff outwardly of said convex portion and disposed in confronting relation to said first depression when said convex portion is received in said concave portion so that a generally toroidal chamber is defined by said depressions, a ring of fusible material entirely filling said toroidal chamber for retaining said staff in said shell, and means for biasing said staff outwardly of said shell bore so that on attainment of the yield temperature of said fusible material said staff is moved outwardly of said shell bore by said biasing means. 10 15 20 25

9. The method of retaining a staff in a bore against force biasing the staff outwardly of the bore which comprises the steps of forming a concave portion at the bottom of said bore, forming a convex portion on the inner end of said staff complementary with and receivable in said concave portion, forming annular grooves in said bore and said staff so that when the convex staff portion is received in the concave bore portion the annular grooves confront one another to define a generally toroidal chamber proximate said concave portion, introducing a quantity of fusible material at least equal to the volume of the toroidal chamber, urging said staff into said bore, raising ambient temperature to at least the fusion temperature of the fusible material, maintaining said temperature until said convex staff portion enters said concave bore portion and forces the fusible material into said toroidal chamber, lowering the ambient temperature below the fusion temperature of the fusible material while urging the staff into the bore, and terminating the urging step after the fusible material has cooled and solidified. 30 35 40 45

10. A signaling device adapted to be inserted into an article to indicate the attainment of a predetermined 50

internal temperature, comprising:

- a. tubular housing defining an axially extensive cavity closed at one end and open at the other end, said cavity having a groove formed therein and extending therearound and said housing:
 1. being fluid tight except for the open end of said cavity and formed of a thermally conductive imperforate material;
 2. having therein an annular recess extending around and communicating with the open end of said cavity, which recess has an inclined outer boundary surface converging toward the end of said housing through which said cavity opens;
- b. an axially extensive indicator rod received in said cavity for axial slidable movement relative to said housing between retracted and extended positions, said rod having a groove formed therein and extending therearound, said groove being located so as to be directly opposite the groove in said cavity when said rod is in the retracted position;
- c. resilient means interposed between said rod and housing adapted to urge said rod to the extended position;
- d. a ring fusible at said predetermined temperature disposed in said grooves to normally maintain said rod in the retracted position and restrain said resilient means, said ring upon fusion being adapted to release said rod for extension by said resilient means;
- e. a bushing fixedly received in the open end of said cavity, said bushing being adapted to slidably receive said rod upon movement thereof between the retracted and extended positions and having a collar fixed thereto and extending therearound, said collar:
 1. being resiliently deflectable to pass under the boundary surface of the annular recess extending around and communicating with the open end of said cavity; and,
 2. having an inclined outer boundary surface locked in mating engagement with said recess under the boundary surface thereof;
- f. a collar fixed to and extending around said rod intermediate the ends thereof, said last mentioned collar being slidable within said cavity upon movement of said rod between extended and retracted positions and adapted to sealingly abut against said bushing when the rod is in the extended position.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,693,579

Dated September 26, 1972

George G. Kliever

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

In the identification sheet: item [73] should identify the assignee as DUN-RITE MANUFACTURING CORPORATION, Fresno, California.

Signed and sealed this 10th day of April 1973.

(SEAL)
Attest:

EDWARD M. FLETCHER, JR.
Attesting Officer

ROBERT GOTTSCHALK
Commissioner of Patents