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P. BERMAN ET AL

2,118,144

STERILIZING INDICATOR AND INK

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Fig. 1

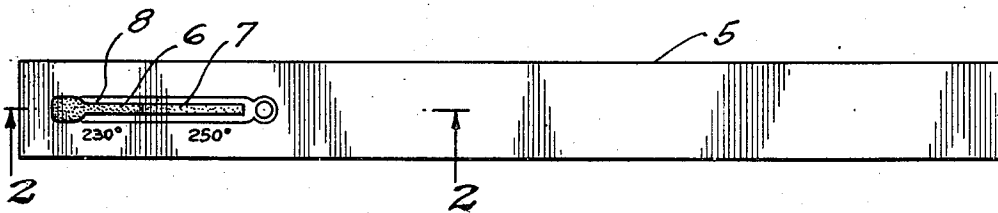
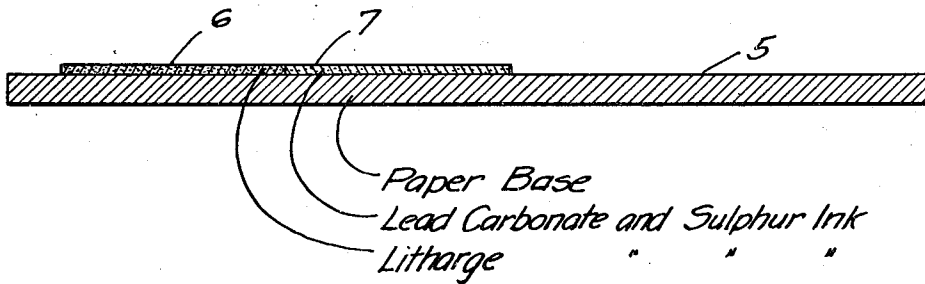


Fig. 2



Inventor
Phoebus Berman
Albert L. Chaney
By Ernest L. Mallon

Attorney

UNITED STATES PATENT OFFICE

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STERILIZING INDICATOR AND INK

Phoebus Berman and Albert L. Chaney,
Los Angeles, Calif.

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7 Claims. (Cl. 73—356)

The present invention relates to an indicator for critical temperatures adapted for insertion in bundles of garments, dressings and the like which are to be treated in sterilizers and relies upon a change of color of substances effected by heating to a critical temperature. It is common practice in hospitals and laboratories to place a temperature indicator in each package which is to be treated in a steam sterilizer in order that it may be ascertained readily and no doubt may exist that the bundle has been subjected to heat of the proper temperature corresponding to a given steam pressure. As is well known in the sterilizing art and practice, the temperature in a steam sterilizer is always constant for any given pressure and for a sufficient period to effect sterilization. The present invention comprises a supporting medium for a chemical or mixture of chemicals which shows a marked change in color after having been subjected to sterilizing temperatures and pressures. The supporting medium must be inert and form retentive such as a tab of cloth or strip or card of paper. The objects of this invention are to provide a sterilizing control having any or all of the following features: a thermo-reactive composition in the form of a sympathetic ink; a sterilizing control having an inert supporting medium bearing an imprint with the ink; and an elongated supporting medium capable of being inserted in a bundle to be treated with an end projecting so that it may be withdrawn from the bundle without the necessity of unwrapping the latter.

The present application is a continuation in part of our copending application, Serial No. 575,144, filed November 14, 1931.

A specific embodiment of the invention is illustrated in the accompanying drawing, in which:—

Fig. 1 is a plan view of an indicator unit; and Fig. 2 is a fragmentary transverse sectional view of a unit.

Referring more particularly to the drawing, the unit is shown formed of an elongated strip of paper, cardboard or like inert fabric forming a supporting material and indicated by 5. The card 5 should be relatively long so that the card may be placed in a bundle with one of its ends deeply imbedded therein while the opposite end is projecting from the bundle as a handle by which the control may be withdrawn from the bundle without the necessity of unwrapping the same. Also, as shown in Fig. 1, the card should be so shaped that its side edges are without projections which might catch or hang in the mate-

rial of the bundle to be sterilized to thus facilitate the ready removal of the card from the bundle without the same catching or becoming entangled with the contents of the bundle. The thermosympathetic inks, as hereinafter described, should be disposed near the end of the card opposite to that which constitutes the handle portion so that the inks will be located deeply within the bundle. It is preferable that the texture of the supporting medium should be loose and porous so that it may be imprinted with thermo-sympathetic inks. It is also desirable that the chemicals of which the inks are composed be initially insoluble in water and insoluble after reaction has occurred.

In the specific embodiment illustrated, the inks are initially a mixture comprising insoluble compounds of lead such as lead oxide or litharge and sulphur. An intimate mixture is made and this mixture is preferably made into an ink which may be applied to the base 5 and adhere thereto. The color is yellow. If flowers of sulphur and litharge are used, the sulphur will melt when heated at a temperature of about 230° Fahrenheit. At or above this fusion temperature, there is a chemical reaction between the litharge and sulphur whereby lead sulphide is formed. The color of lead sulphide is black, so that a change of color occurs from yellow to black. However, the reaction does not occur instantly but requires that the critical temperatures be maintained for an appreciable length of time and a full color change at the critical temperature named requires about fifteen minutes. This is advantageous, since, as is well known, the killing of bacteria is accomplished, not by an instantaneous exposure to temperature, but by exposure to killing temperatures for time periods which vary depending upon the degree of temperature. That is, higher temperatures are required to be maintained for a relatively short period of time whereas the exposure of the bacteria to lower temperatures must be maintained for a greater length of time, there being a definite time-temperature relationship required for insuring sterilization. For example, a temperature of 230° must be maintained for long periods of time while a temperature of 250° will insure satisfactory and safe sterilization if maintained for an interval of time about equal to ten or fifteen minutes.

It has been found that sulphur may be mixed with lead hydroxide or lead carbonate, or basic lead carbonate and the results obtained. However, there is a slight difference in critical temperatures for each of these specific lead com-

pounds. It is thought that reaction starts at a critical temperature dependent on the lead compound used. However, we do not wish to limit ourselves to any particular theory but only to the facts as we have found them. The use of dextrose, or glycerine as an ingredient of the mixture lowers the critical temperature. The theory has been advanced that dextrose or glycerine reduces the fusion temperature of the sulphur. It has also been found that other metallic compounds having metals substituted for lead may be used. As illustrations of such substitutions, iron oxide, bismuth carbonate and bismuth hydroxide have been used. An ink may then be made by mixing the chemicals with library paste, printer's varnish or the like so that the chemicals in powdered form are suspended in a vehicle. As shown in the drawing, an ink of one composition having a critical temperature of 230 degree Fahrenheit comprising sulphur and litharge and an ink of another composition comprising flowers of sulphur and lead carbonate and having a critical temperature of 250 degrees Fahrenheit are printed on the strip to simulate a thermometer column, the lengths of inks in the column being denoted by 6 and 7. The sulphur and litharge ink is initially yellow and the sulphur and lead carbonate ink is initially white. There is imprinted by any suitable printer's ink an outline 8 to simulate a clinical thermometer and suitable numbers or legends, as shown in Fig. 1, may be printed on the card adjacent each of the different ink strips to denote the temperature to which the adjacent ink is sensitive, that is, the critical temperature to which the ink must be subjected to start the color change. The simulation of the thermometer is at one end of strip 5.

In the use of the indicator it is inserted in a bundle to be sterilized with the end opposite to the thermometer projecting so that it may be withdrawn. Two such indicators may be placed in the bundle. The bundle is then placed in the sterilizer and treated. After the sterilizing temperature has been attained and maintained for what is thought to be the proper time, the bundle is removed and one of the indicators withdrawn. If the sterilizing temperature has been reached and maintained for a sufficient length of time, the column or a portion thereof will appear black. If only 230 degrees has been attained and has been maintained for, say, 15 minutes, only the portion 6 will be black. If 250 degrees have been reached and maintained for an appreciable period of time, both the portions 6 and 7 will be black. The other indicator may be left in the bundle as a check to show sterility when unwrapped. If a sterile condition has not been attained the bundle may be returned to the sterilizer for further treatment, the other indicator remaining in the bundle. Thus, unwrapping of the bundle may be avoided before assurance of sterilization has been obtained. Unwrapping the bundle before use may result in the contents becoming contaminated and losing their sterility. By the use of the present control, the bundle may remain wrapped with assurance of its sterility until ready for use.

What we claim is:—

1. In a device of the class described, a card, a plurality of heat sensitive means on said card, each adapted to permanently change color when subjected to a predetermined temperature different from the others of said heat sensitive means, to indicate by the changed color of one or more of said heat sensitive means the maximum tem-

perature to which said device has been subjected.

2. In a device of the class described, a card, a plurality of heat sensitive means on said card, each adapted to permanently change color when subjected for a predetermined length of time to a temperature above a predetermined critical temperature different from the others of said heat sensitive means, to indicate by the changed color of one or more of said heat sensitive means the maximum time-temperature exposure to which said device has been subjected.

3. In a device of the class described, a card, a plurality of heat sensitive means on said card, each adapted to permanently change color when subjected to a predetermined critical temperature different from the others of said heat sensitive means, and indicating means associated with said heat sensitive means and cooperating with the changed color thereof to indicate the maximum temperature to which said device has been subjected.

4. In a device of the class described, a card having a plurality of heat sensitive elements on said card arranged in a line, a portion of the length of said line being formed by one heat sensitive means, another portion of said line being formed by another of said heat sensitive means, each of said heat sensitive means being adapted to permanently change color when subjected to predetermined time-temperature exposure different from that of the other of said heat sensitive means to indicate, by the length of the changed color portion of the line, the time-temperature exposure to which said device has been subjected.

5. In a device of the class described, a card, a plurality of heat sensitive elements on said card, each arranged as a short line and all of said lines being arranged in longitudinal alignment with each other, each of said heat sensitive elements being adapted to permanently change color when subjected to a predetermined critical temperature different from that of the others of said heat sensitive means.

6. In a device of the class described, a card, a simulation of a clinical thermometer on said card having an indicating column comprised of a plurality of heat sensitive elements, each adapted to permanently change color when subjected to a predetermined time-temperature exposure different from that of the others of said heat sensitive elements, said heat sensitive elements being arranged in said column in the consecutive order of their temperature sensitivity whereby the length of the column which has changed color will indicate the time-temperature exposure to which said device has been subjected.

7. In a device of the class described, a card, a simulation of a clinical thermometer on said card having an indicating column comprised of a plurality of heat sensitive elements, each adapted to permanently change color when subjected to a predetermined temperature different from that of the others of said heat sensitive elements, said heat sensitive elements being arranged in said column in the consecutive order of their temperature sensitivity whereby the length of the column which has changed color will indicate the maximum temperature to which said device has been subjected, and indicating means associated with said heat sensitive elements for denoting the temperature to which each of said elements is sensitive.

PHOEBUS BERMAN.
ALBERT L. CHANEY.