United States Patent

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[54] **SAMPLE HOLDER FOR MAINTAINING BLOOD SAMPLES AT A PRESELECTED TEMPERATURE**
9 Claims, 3 Drawing Figs.

[52] **U.S. Cl.** ..... **23/292,** 23/253 R, 206/46 FC, 220/9 F, 249/119, 249/134
[51] **Int. Cl.** **B01l 3/00**
[50] **Field of Search** ..... 23/253, 259, 292, 230 B; 206/82, 46 FC; 220/9 F

[56] **References Cited**

UNITED STATES PATENTS

3,072,362	1/1963	Allen	23/259 UX
3,219,421	11/1965	Schwarz, Jr. et al.	23/253 X
3,233,975	2/1966	McCormick	23/259
3,271,112	9/1966	Williams et al.	23/253

OTHER REFERENCES

Modern Plastics, September 1958 pages 289 and 293

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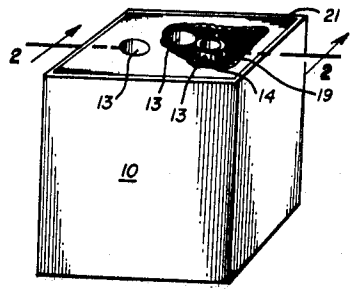
ABSTRACT: A portable thermal holder for maintaining articles at preselected temperatures is particularly suitable for maintaining blood samples near body temperatures for blood coagulation tests. The holder includes a thermally insulated heat-absorbent body portion having article support means into which articles are placed. In forming the holder a curable material is mixed with a quantity of low heat-conductive granules and poured into a low heat-conductive container. In the container, the lighter granules rise to the top and form a layer of insulation, the curable material hardening to form the heat-absorbent body portion. An external heat source or a self-contained heating unit establishes the desired temperature of the heat-absorbent body portion.



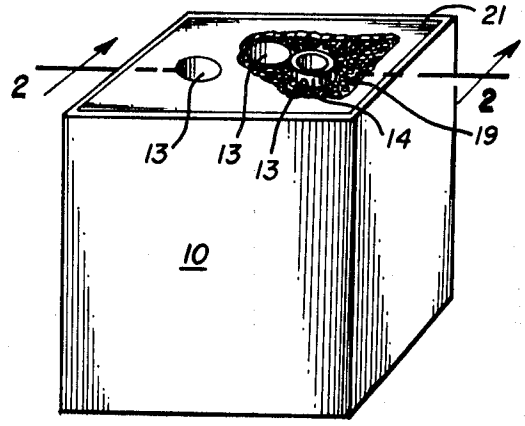


FIG. 1

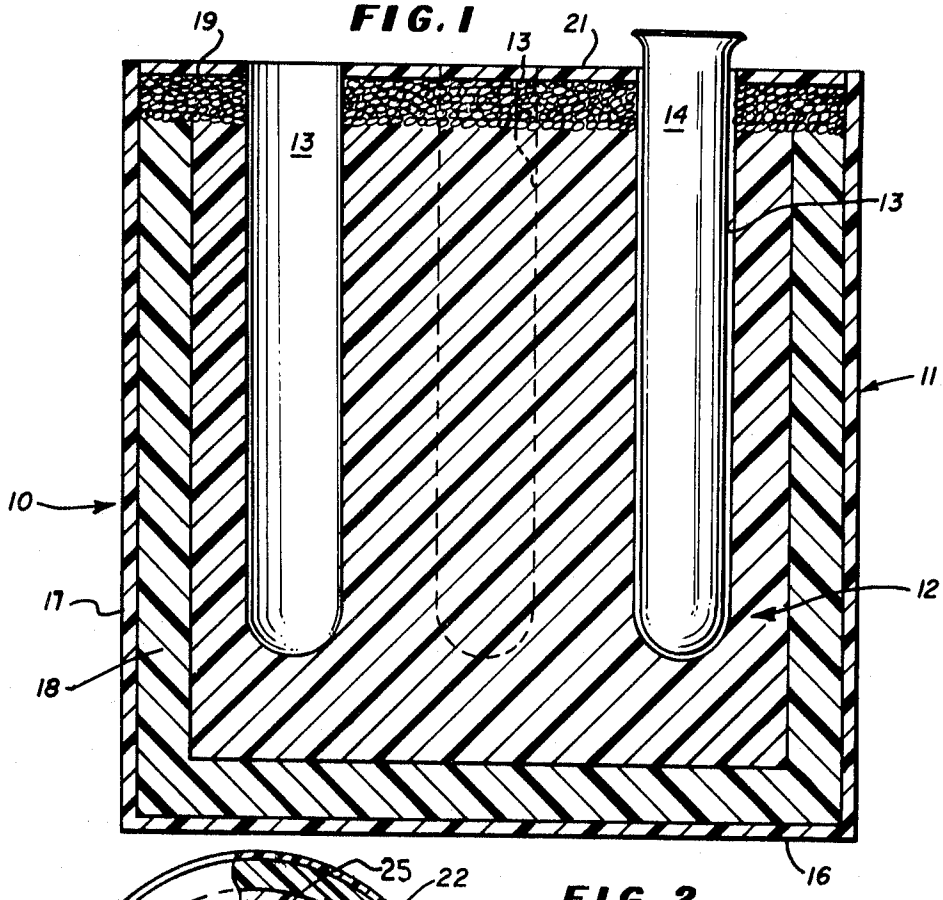


FIG. 2

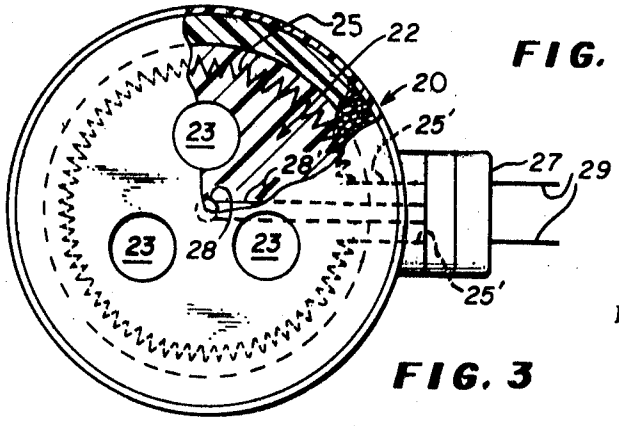


FIG. 3

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SAMPLE HOLDER FOR MAINTAINING BLOOD SAMPLES AT A PRESELECTED TEMPERATURE

This invention relates to thermal holders and more particularly to a new and useful method of making a portable thermal article support holder and a holder which will maintain articles, such as, blood samples at substantially body temperatures during coagulation tests and the like. There are a variety of applications wherein articles are required to be maintained at other than surrounding ambient air temperatures for relatively short periods of time. For example in conducting a coagulation test on blood, blood samples must be maintained at substantially body temperatures to obtain accurate results. Accordingly it is an object of this invention to provide a simple, durable and lightweight thermal article support holder having good heat absorbing and insulating properties and characteristics.

Another object of this invention is to provide a method of making a portable thermal article support holder which is constructed as an essentially integral body from lightweight plastic materials.

It is a further object of this invention to provide a compact, integral test tube holder for supporting blood samples in test tubes during coagulation tests and the like.

In accordance with the present invention there is provided a portable thermal article support holder including a thermally insulated heat-absorbent body or heat sink. The preferred construction and method is to use a rigid or semirigid casing, open at the top, having its inner walls lined with a low heat-conductive material. A curable material in an initially fluid state, and a quantity of low heat-conductive material of less density than the curable material, are poured to essentially fill the lined container. As the curable material sets, the less dense material rises to the top of the curable material to form a layer of insulation above the heat-absorbent body. Article support stations are formed in the absorbent body by mold inserts or drilled holes which form bores into which the article, for instance, a test tube containing a blood sample may be inserted and supported in an upright position. In conducting blood coagulation tests, the holder may be heated in an oven and then removed with the articles inserted into the bores or it may have a self-containing heating unit which elevates it to body temperature, or slightly above, prior to insertion of the test tubes.

Other objects, advantages and capabilities of the present invention will become more apparent as the description proceeds taken in conjunction with the accompanying drawings, in which:

FIG. 1 is a perspective view of a thermal article-support holder embodying features of the present invention shown as a generally square or block configuration having three centrally arranged bores opening through the top to receive test tubes or the like with one test tube being illustrated in position and a top portion broken away to show the top layer of heat insulation.

FIG. 2 is a vertical sectional view taken along lines 2—2 of FIG. 1 and drawn to an enlarged scale; and

FIG. 3 is an alternate form of test tube holder shown as of a generally cylindrical configuration having an electric heating element associated therewith for heat input.

Referring now to the drawings, the holder shown in FIGS. 1 and 2 is generally designated by numeral 10 and is of a square or block configuration and may be generally considered as comprising an outer, low heat-conductive housing or shell portion 11 and an inner curable heat-absorbent body portion or heat sink 12 essentially enclosed within and heat insulated by the outer housing portion 11. Article support stations are provided in the heat-absorbent body portion 11 in the form of a plurality of centrally arranged, spaced upright bores or vertical passages 13 which open through the top of the housing and terminate at their lower extremities above the bottom of the body portion 11. Each of the bores 13 which are shown is shaped to permit the slidable insertion and removal of a test tube 14, which for a typical application of the invention contains blood samples. While the holder shown herein is suitable for conducting coagulation tests on blood samples and is hereinafter described with reference thereto, it is understood that the present invention is not limited to this particular application but is further useful as a thermal holder for maintaining other articles at other than ambient temperatures.

As shown, the outer housing or enclosure portion 12 comprises a casing or hollow boxlike container inclusive of a bottom 16 and upright sidewalls 17 preferably composed of a lightweight rigid or semirigid plastic material. This casing is lined with an inner layer 18 of a good heat-insulating material which preferably is styrofoam or the like. This styrofoam layer 18 adheres to the inner surfaces of the casing and is coated thereon prior to forming of the curable heat-absorbent body portion 12 as hereafter described.

The heat-absorbent body portion 11 is preferably a curable material, such as, a catalyst-cured epoxy or polyester resin having good heat-absorbent properties. A top layer of insulation 19 covers the casing and overlays the lining 18 and the heat-absorbent body 11 to complete the outer housing portion. A preferred material for forming layer 19 is a vitreous granular material such as perlite. In addition, cover 21 may be positioned over the top layer of insulation 19 although this is optional.

In a preferred practice, the granular perlite material is intermixed with the epoxy or polyester resin when the latter is in its fluid state, and the resultant mixture is poured into the lined casing. The lined container thereby functions as a mold; and to this end round mold inserts are positioned in the lined casing to form the centrally arranged test tube stations or bores 13. The granular material, being relatively light or less dense as compared to the fluid resin, rises to the top and when the resin solidifies forms a rigid hard layer of granular material intimately bonded to the resin. In curing the resin becomes cohesive with the lined container and when solidified forms an essentially integral block or body defining an inner heat-absorbent body portion which is insulated from the surrounding atmospheric air by the container to maintain the body portion at a selected temperature for an extended period of time. The mold inserts are then removed leaving the bores 13. An alternative to using mold inserts is to drill the holes after the body 12 has been formed.

The procedure in conducting a coagulation test includes the placing of a holder shown in FIGS. 1 and 2 in an oven where it is brought up to slightly above body temperature and then it is removed from the oven. The test tubes are placed in the bores 13 and the heat-absorbing medium forming body 12 is effectively heat insulated by the outer housing or enclosure portion 11 so that the blood samples are maintained at or near body temperature during coagulation test.

As an alternative embodiment there is shown in FIG. 3 a generally cylindrical shaped thermal holder including a low heat-conductive enclosure or housing portion 20 having an inner heat-absorbent body portion 22 constructed in a manner corresponding to that of the square configuration of FIGS. 1 and 2. The article support stations or bores 23 are formed in equally spaced circumferential relation about the central axes of the cylinder and centrally of the body portion 22. This embodiment has a self-contained heating unit to avoid the necessity of an oven and is herein illustrated schematically as including a heating element or coil 25 embedded in the formed heat-absorbent body 22, preferably at a location midway between the top and bottom and outwardly of and in a generally surrounding relation to bores 23. While only a single heating coil 25 has been shown in the top plan view of FIG. 3, it is understood that there may be provided a selected number of similar coils disposed in spaced relation between the top and bottom of the formed heat-absorbent body 22. As is conventional in the electric heating art the coil 25 has electric leads 25' at each end which terminate in a control box 27 mounted on the side of the outer casing. In addition there is provided a thermal element or thermostat 28 preferably disposed centrally of the heat-absorbent body and having leads 28' which interconnect in series with the leads 25' to

disconnect the electric power when the heat-absorbent body reaches a preselected temperature. The control box **27** is arranged with any of a variety of conventional sockets to detachably connect power lines **29** of an electric power source to the heater elements through the thermostat.

By way of example and not by limitation one epoxy resin suitable for forming the heat-absorbent body portions in the holders shown is a low viscosity epichlorohydrin/bisphenol A-type epoxy resin containing a reactive dilutent. This resin will have a viscosity of 5 to 7 poises at about 25° C. In a preferred practice the epoxy resin will be used with a catalyst-type curing agent of a polyamide resin derived from a dimerized fatty acid and an aliphatic polyamine. An epoxy resin and curing agent which has been found suitable as a heat-absorbent body is manufactured and sold under the trademark "Epon" by the Shell Chemical Company. The epoxy resin is Epon Resin No. 815 and the curing agent is Epon Curing Agent *V*–15. As a suitable alternative, thermosetting plastics with the requisite heat absorbent properties may be utilized in place of the epoxy resins described, although it has been found in practice that the epoxy resins are particularly effective and easy to handle.

Although the present invention has been described with a certain degree of particularity, it is understood that the present disclosure has been made only by way of example and that changes in details of structure and materials may be made without departing from the spirit thereof.

What is claimed is:

1. A test sample holder for maintaining blood samples and the like at a preselected temperature, said holder comprising a casing, an outer low heat-conductive housing portion lining the casing and an inner heat-absorbent body portion adapted to be heated to a preselected temperature, said housing portion enclosing all sides and the top and bottom of said body portion, said body portion having at least one test sample support passage extending through the top of said housing portion into said body portion and into which a test sample is supported and retained.

2. A holder as set forth in claim **1** wherein a plurality of said test sample support passages are formed in uniformly spaced relation in the heat-absorbing body portion and which extend through the top of the insulator housing portion and terminate above the bottom of the body portion to support the test samples in an upright position.

3. A test sample holder for maintaining test samples at a preselected temperature comprising an outer low heat-conductive housing portion inclusive of a container lined with a low conductive thermal insulation and having an open top and a heat-absorbent body portion formed of a plastic material molded in said container, said outer portion including an upper low heat-conductive layer composed at least in part of granular glass material intermixed with a portion of the plastic material forming said heat-absorbent body portion and adhering to the inner walls at the top of said container, said body portion having a plurality of centrally arranged bores opening through said top layer to provide test tube support passages into which test tube samples are inserted into direct contact with the heat-absorbent body portion.

4. A thermal holder as set forth in claim **3** wherein said outer housing portion includes an outer rigid plastic casing having its inner surfaces lined with styrofoam material.

5. A thermal holder as set forth in claim **3** wherein said heat-absorbent body portion is an epoxy resin.

6. A thermal holder as set forth in claim **3** wherein said heat absorbent body portion is a polyester resin.

7. A thermal holder as set forth in claim **3** wherein said inner heat-absorbent body portion includes a heater element adapted to be energized from an external source to raise the temperature of the heat-absorbent body portion to a preselected temperature.

8. A blood sample test tube holder for maintaining blood samples at essentially body temperatures during coagulation tests comprising an outer low heat-conductive housing portion and an inner heat-absorbent body portion formed of a molded material disposed within and enclosed on all sides by said housing portion and adapted to be heated to a temperature near body temperature, said housing portion including a plastic rigid container open at the top inclusive of a bottom and upright sidewalls and being lined with a styrofoam material, said outer housing portion including a top layer of perlite intermixed with a molded material covering the top of said container and integral therewith and overlying said heat-absorbent body portion, said heat-absorbent body portion being of an initially fluid resin cured to an essentially rigid body integral with said outer housing portion, said body portion being shaped with a plurality of centrally disposed passages opening through said top layer for insertion of test tubes containing blood samples into direct contact with the heat absorbent body portion.

9. A blood sample test tube holder according to claim **8**, wherein said heat-absorbent body portion is composed of epoxy resin and includes a heater element energizable from an external source to raise the temperature of the body portion to a preselected temperature.