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Jackson

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[54] **TAMPER RESISTANT CONTAINER**

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[52] **U.S. Cl.** **340/273**

[51] **Int. Cl.** **G08b 13/08**

[58] **Field of Search** ..... 102/8; 109/38–44; 340/253 B, 256, 273, 278, 280; 116/75, 77, 83, 85

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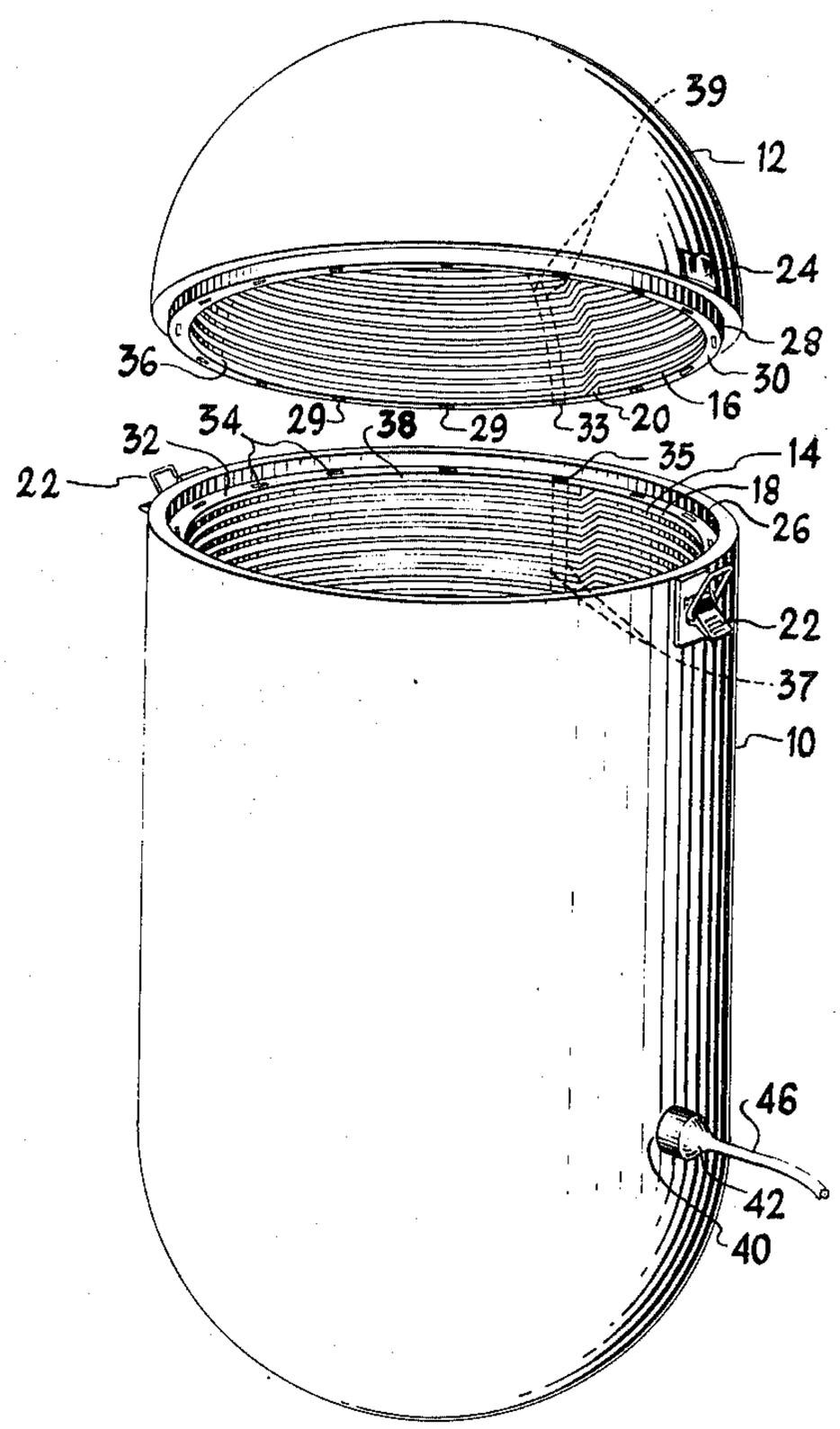
Primary Examiner—Verlin R. Pendegrass

Attorney—Robert L. Berger, James B. Eisel and Gay Chin

EXEMPLARY CLAIM

1. A tamper resistant container including a main container body and a separable cover each having mating surfaces and defining a complete enclosure when said mating surfaces are placed in abutting relationship, at least one wall carried electrical circuit formed within respective cover and main body walls, conductive tabs placed in spaced relationship upon the mating surfaces of said cover and main container body, means for electrically connecting said circuits to said spaced tabs, means for electrically connecting corresponding tabs of said main container body and said cover, said connecting means including a wet silver film positioned between respective tabs with said films being air curable to insure completion of an electrical circuit between said main container body and said separable cover, and means for energizing said circuit whereby attempts to penetrate said container result in changing the electrical characteristics of said circuit.

3 Claims, 6 Drawing Figures



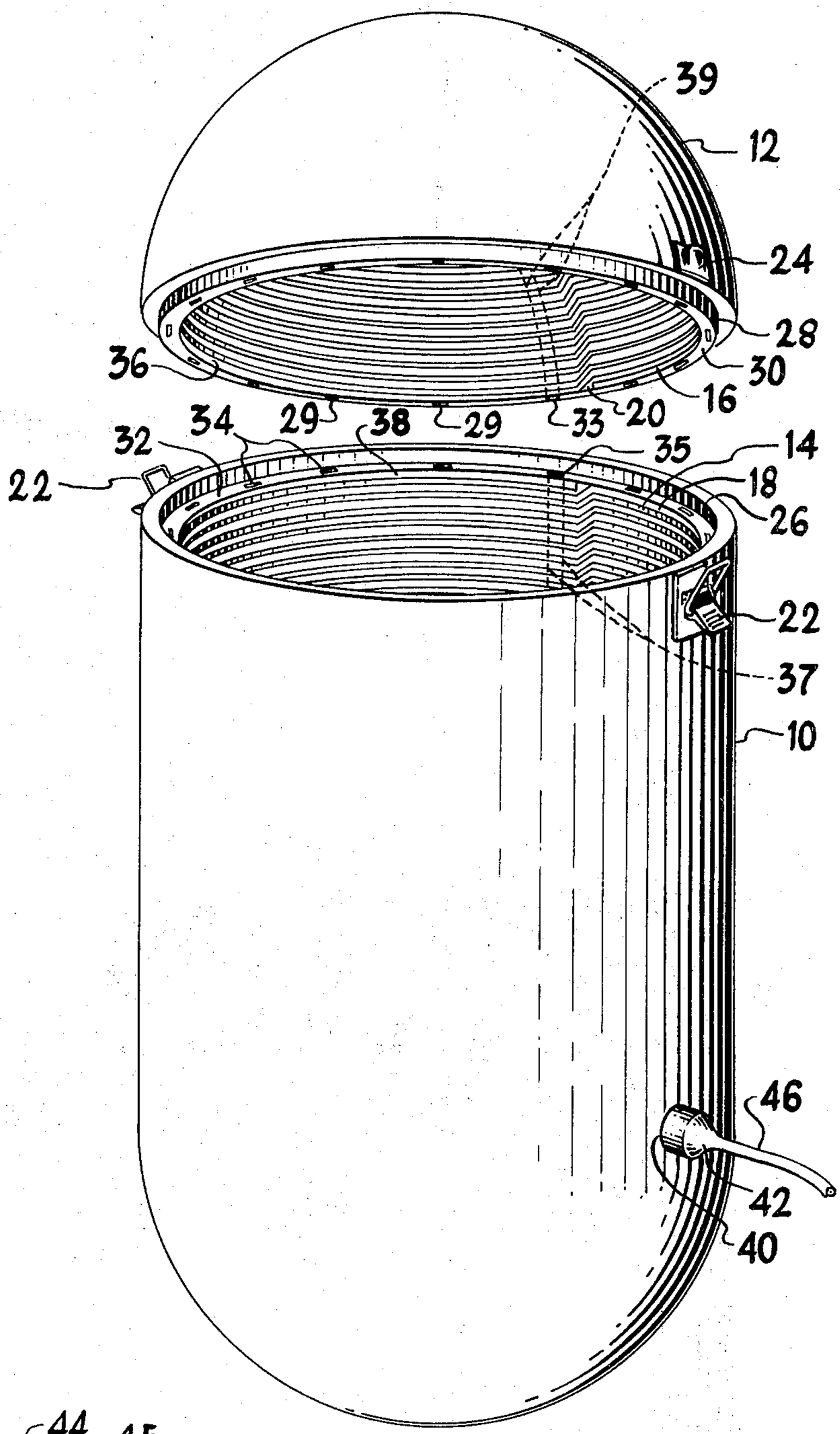


Fig 1.

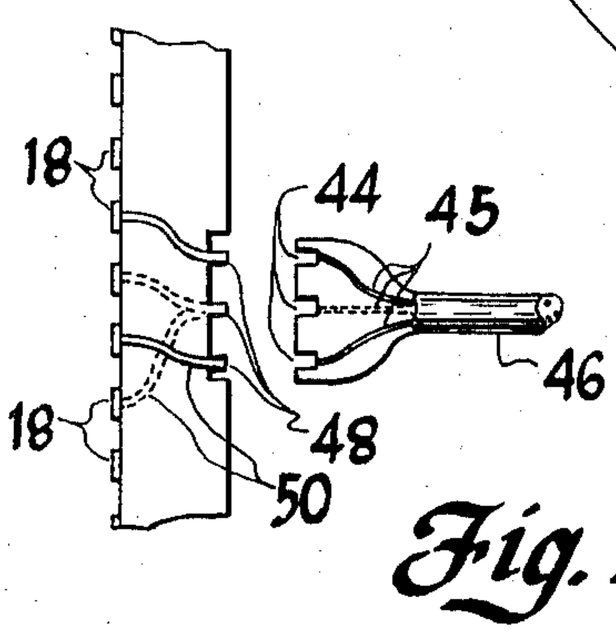


Fig. 1A.

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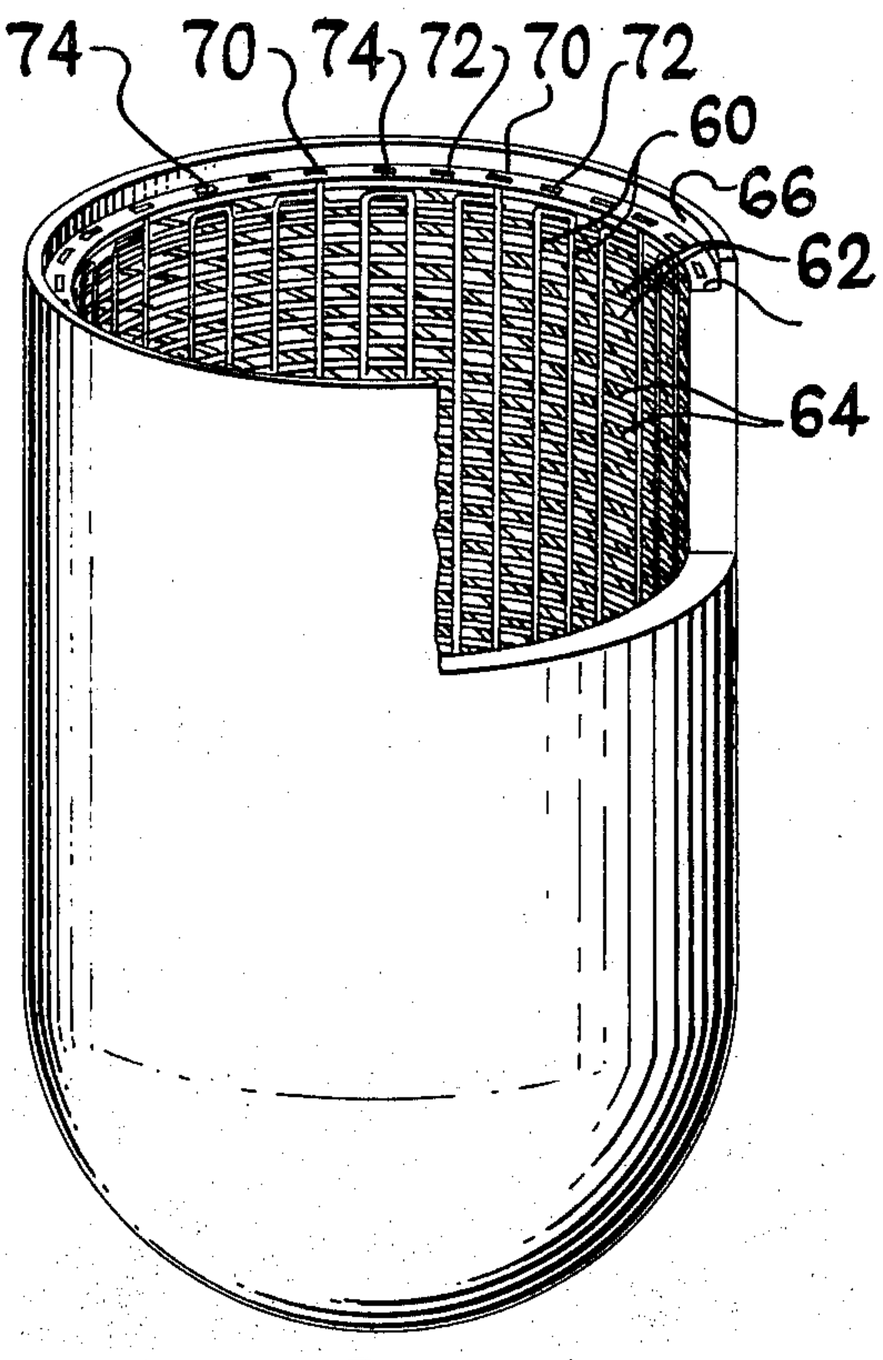


Fig 2.

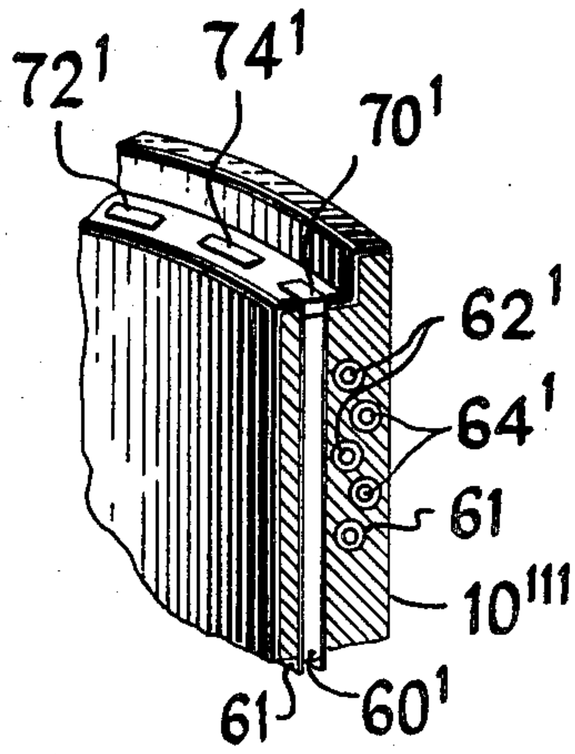


Fig. 2A.

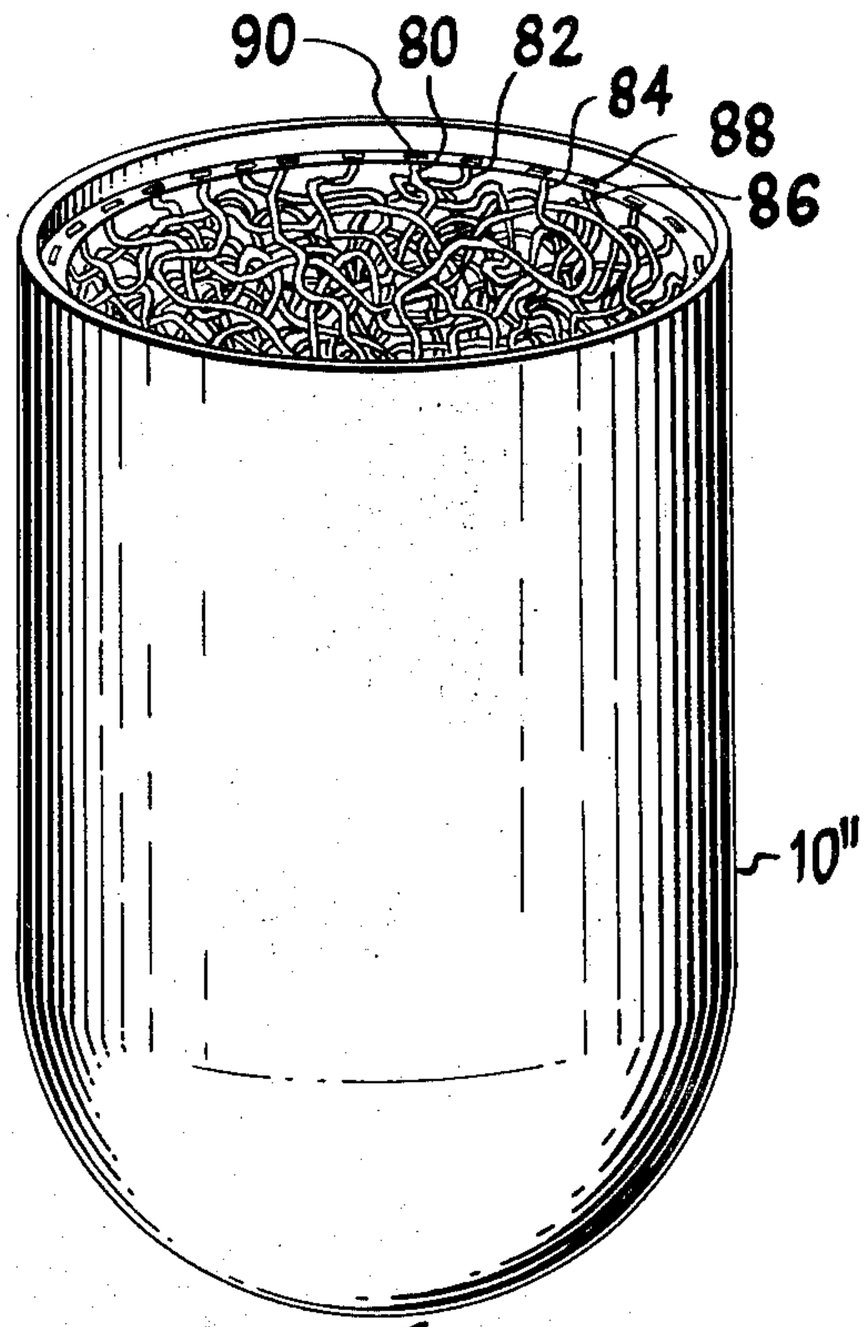


Fig. 3.

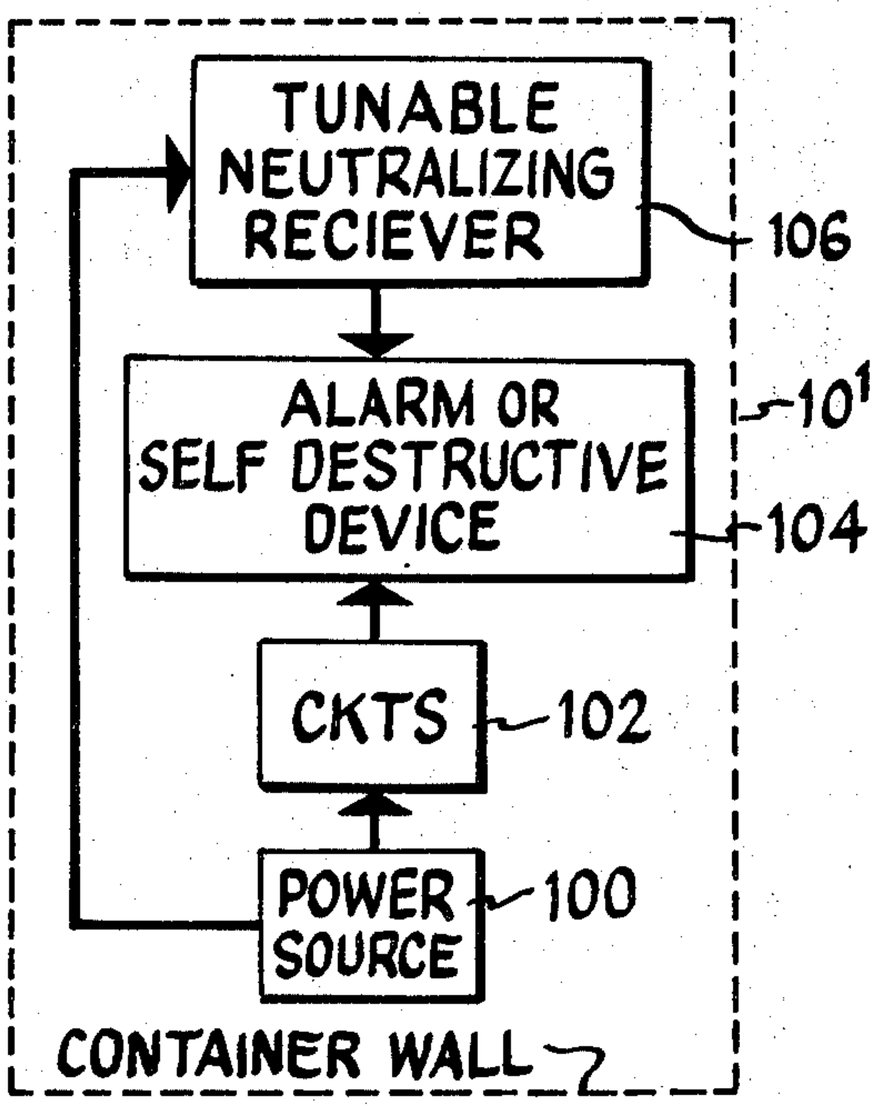


Fig. 4.

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TAMPER RESISTANT CONTAINER

This invention relates to a tamper resistant container and more particularly to a container of this type having an internal tamper detection network including alarm means for immediate penetration disclosure.

There exists today the need for variable sized containers which would act to store valuable or classified material, either permanently or temporarily, in which penetration of the container in order to disclose the contents would either result in destruction of the container and its contents or would initiate an alarm indicating penetration. Many attempts have been made to provide tamper resistant containers. Some of these devices have included electrical or electronic detection networks including alarm devices such as audible signals or the like. One of the primary difficulties in effecting a true, tamper resistant container is the relative ease in determining the nature of the electrical circuit associated with the container thereby allowing penetration of the container without adversely affecting the electrical circuit. Resultant penetration would allow nullification of the detection network and the alarm or self-destruction means after penetration.

It is therefore a primary object of this invention to provide a tamper resistant container including a novel penetration detection network which would indicate any attempt at penetration regardless of the size of the penetrating tool.

It is a further object of this invention to provide an improved tamper resistant container including a novel penetration detection network which would indicate any attempt at penetration regardless of the size of the penetrating tool.

It is a further object of this invention to provide an improved tamper resistant container including a detection network employing at least one randomly applied electrical circuit within the container in which only the individual forming the circuit within the container would know the specific configuration or pattern of the circuit thus formed.

It is a further object of this invention to provide an improved tamper resistant container including an electrical penetration detection network which has specific application to a container formed of highly stressed material.

It is a further object of this invention to provide an improved tamper resistant container including an electrical penetration detection network in which the power source and the alarm forming a portion of said network is wholly incorporated within the sealed, tamper resistant container.

It is a further object of this invention to provide an improved penetration detection network for a tamper resistant container which has applicability to a great variety of containers regardless of size or configuration.

Further objects of this invention will be pointed out in the following detailed description and claims and illustrated in the principle of this invention and the best mode which has been contemplated of applying that principle.

In the drawings:

FIG. **1** is an exploded, perspective view of the tamperproof tamper resistant container of the present invention showing the method of providing both a mechanical and electrical connection between the container proper and its cover.

FIG. **1***a* is a side elevation, partly in section, of a portion of the apparatus of FIG. **1**.

FIG. **2** is a perspective view of a partial section of an alternate embodiment of the present invention.

FIG. **2***a* is an enlarged perspective view of a section of a modified container similar to the device shown in FIG. **2**.

FIG. **3** is a perspective view of yet another embodiment of the present invention showing multiple, overlapping, randomly applied electrical circuits applied as films to the inner surface of the container.

FIG. **4** is a block diagram of the electrical network components positioned within the tamper resistant container of the present invention.

In general, the apparatus of this invention comprises a tamper resistant container including joined side and end walls forming a complete enclosure which may include a separable cover. There is provided within the container at least one electrical circuit having closely spaced wall-carried conductors with external or internal means provided for energizing the cirucit whereby any attempt to penetrate the container wall results in changing the electrical characteristics of the circuit. In a preferred form, multiple, randomly applied conductors are sprayed on the inner surface of the container wall, each circuit being separated by a thin film of insulating material. The conductors form a part of an electrical network which may include a source of power, alarm means and/or self-destructive means as well as a circuit neutralizing device allowing neutralization of the detecting means through the application of a remote, correlated, radio signal.

Referring to FIG. **1** of the drawing, a typical tamper resistant container is shown to include a main container body **10** and a cover **12** which may be both mechanically and electrically connected. The container body **10** and the cover **12** may be formed of any material, preferably an insulator which may, for instance, be glass or other vitrified material. The type of glass may be a heat resistant glass, suitably hardened to resist entry; or alternately, the container including its cover may be formed of a highly stressed glass which would disintegrate upon attempted entry. Preferably, the material is opaque to increase the difficulty of entry and specifically to prevent viewing of the electrical circuit or circuits involving conductors randomly applied to the inner surface of the container wall in the form of thin films or the like or formed integrally within the wall itself.

As indicated in FIG. **1**, the interior or inner wall of the container is covered with one or more circuits formed by thin film conductors. The conductors **16** and **18** which may be silver or other metal of high conductivity, are shown in the FIG. **1** embodiment applied, respectively, to the inner surface **14** of the container body **10** and inner surface **20** of cover **12** in a somewhat regular pattern consisting of concentric circles in a spiral form, the individual conductors **16** and **18** being spaced slightly in the form of loops to prevent short-circuiting. The circuits formed thereby may be spray painted, etched, silk screened, or decaled in place by conventional coating processes. The spiral formed by the conductors may be protected by glazing or spraying with a plastic to provide an insulator over each circuit thus preventing inadvertent shorting of the circuitry by equipment or other apparatus installed within the container.

As mentioned previously, the container may be of various sizes and shapes. For instance, the container shown in FIG. **1** may have an approximate volume of two cubic feet, being fourteen inches in diameter and 24 inches in length. For a container of this size, the individual conductor width will be approximately 1/64 inch wide and 1/000 to 2/1000 inches thick. To prevent penetration of the container without disrupting the electrical characteristics of the circuit including the conductors **16** and **18,** the conductors should be spaced 1/64 inch apart in the spiral pattern shown for a container of this size.

As mentioned previously, the container when in use forms a sealed enclosure having a single, continuous detection circuit with the cover **12** being mechanically and electrically secured to the main container body **10.** To effect mechanical attachment and locking, clamps are used. The clamps include latch members **22** fixed to the outer surface of main container **10** and catch members **24** fixed to the outer surface of cover **12.** The main container body **10** is formed with an annular recess **26** at the open top to provide a rim **32** within the main container body **10.** By undercutting the open end of cover **12,** a projecting lip **28** is formed integrally therewith, thus forming a mechanical locating means between the main container body **10** and cover **12.**

The spiral conductor **16** formed within the cover **12** includes a number of conductive portions or tabs **29** which extend downwardly through lip **28** to the exposed under-surface **30.** The conductive tabs **29** actually pass through the lip **28** and are connected to the conductor forming the outermost spiral **36** of the conductor network within cover **12.** In like manner, the rim portion **32** formed by recess **26** within the container body **10** also has a number of conductive tab portions **34** which act as electrical connecting means to the outermost spiral **38** of conductor **18** of the electrical network within the container body **10.**

Thus, the respective spirals **36** and **38** of the cover and body portions of the container are electrically linked through conductive tabs **29** and **34** spaced circumferentially of the lip **28** and rim **32,** respectively. To assure the desired electrical continuity between the portion of the circuit within cover **12** and the portion of the circuit within main container body **10,** a wet silver coating is applied to the conductor segments or tabs **29** and **34** only at the tab locations about the surface of rim **32** and protruding lip **28.** When the cover **12** is brought into contact with main container section **10** in proper circumferential orientation, the respective tab surfaces **29** and **34** will be in alignment and the wet silvered conductors touch and aircure, thus completing the circuit between conductors **16** and **18.** The cover is physically secured in place by operating the latch means **22** to prevent inadvertent interruption of the circuitry. To complete the electrical circuit or circuits, a tab **33** is connected to an embedded vertical conductor (indicated by dotted lines **39**) which runs to the center of cover **12** and is connected to the inner end of spiral conductor **16.** Likewise, a vertical embedded conductor **37** connects mating tab **34** to the inner end of spiral conductor **18.** It is apparent that any attempt to penetrate the container will either break the spiral conductor within cover **12** or main container body **10** or affect the electrical characteristics of the circuit in some related way to trigger detecting devices located within or exterior of the container itself.

In the embodiment shown in FIG. **1,** the power supply to the electrical circuit as well as the alarm device is remotely positioned from the container and the electrical connection is made through the use of socket **40** and plug **42** shown in FIG. **1***a*. The plug **42** may be formed of molded phenolic material and may include a series of prong receiving conductive apertures **44** located within the insulative body **42** and connected by conventional means to electrical leads **45** by means of insulated lead wire **46.** The socket **40** is in the form of a plug receiving aperture and includes a like number of protruding prongs **48** which are received within apertures **44** to make the appropriate electrical connection. In order to resist tampering in the area of the electrical connection, the male prong members **48** do not pass directly through the container wall but are electrically connected through the wall of the container **10** to embedded sinuous conductors **50** which pass through the wall. The inner ends of the conductors **50** are attached directly to spiral conductor **18** to form one or more circuits of the detecting network. While the embodiment shown in FIG. **1** includes but a single circuit formed by an elongated conductor in a spiral-like form about the inner surface of both the container body and its cover, it is preferable to form a number of individual circuits either in symmetrical or random fashion in which the individual conductors of the separate circuits actually overlap other conductors but are insulated therefrom. FIGS. **2, 2***a* and **3** show alternate embodiments of this particular type. For instance, in FIG. **2** the main container body **10′**, which is formed of opaque glass, includes three different circuits formed in a somewhat symmetrical fashion with each circuit having parallel conductor sections. A first circuit is formed of conductors indicated at **60** being vertically oriented with respect to and in line with the axis of the cylindrical container. A second elongated circuit is formed by parallel conductors **62** which are formed in somewhat the same spiral manner as conductors **16** and **18** of the first embodiment and are horizontally oriented with respect to container **10′**. A third circuit is formed by diagonal, spaced conductors **64.** The conductors **60, 62** and **64** overlap but, as mentioned previously, are separated by a transparent thin film insulation which may be sprayed on as the conductors are applied to the inner surface of container **10′** in a sequential manner.

The container **10′** includes a recessed portion **66** forming a rim **68** upon which is formed a series of spaced electrical tabs or conductive portions. Tabs **70** are electrically connected to the ends of vertical conductors **60,** tabs **72** to the diagonal conductors **64** and tabs **74** to the spiral horizontally oriented conductors **62.** Again, specific connecting leads between the respective tab elements and the thin film circuit portion are not visible since the glass container **10′** is preferably opaque. It is important to note that a similar pattern is formed within a cover (not shown) but the same type of electrical and mechanical connection occurs between the container **10′** and its cover through the use of suitable mechanical latches (not shown). The wet silver electrical connecting technique is employed as in the previously described embodiment of FIG. **1.**

While the superimposed, insulated, multiple circuits are applied by film application techniques in the specific uniform patterns already described, the same patterns may be employed in an alternate structure in which the conductors are actually molded into the glass

wall of the container. FIG. 2*a* shows the individual conductors insulated with "Vycor" glass tubing to facilitate fabrication with insulation allowing the different sheathed conductors to touch without shorting between circuits.

Instead of forming conductors of thin films in a spiral-like configuration on the inner wall surface of both the container body and its cover, an alternate approach is to mold the conductors in the glass walls. These conductors are insulated with "Vycor" glass tubing to facilitate fabrication with the insulation and allow conductors to touch without shorting. For a container of the dimensions noted previously, the wall thickness in the case of this design would be from ¼ inch to ½ inch in thickness. This particular container design would not only be economical to manufacturer initially due to the prefabricated conductors but would allow salvage of the container body when authorized entry was necessary for maintenance. With the exception that the conductors are embedded, the arrangement is identical with FIG. 2. Thus, tabs **70′** connect embedded vertical conductors **60′** with the container body **10‴** to like vertical conductors of the cover (not shown). Likewise, tabs **72′** are connected to embedded horizontal conductors **62′**, while tabs **74′** are connected to diagonal conductors **64′** for completion of respective circuits between the container body **10‴** and the cover.

FIG. 3 shows a third embodiment of the present invention in which a container **10‴** formed of opaque glass is provided with multiple, randomly applied circuits which overlap in the same manner as the FIG. 2 embodiment and in which the circuits are applied by spraying the conductor on the container wall in the form of thin film and by placing an insulating film between the respective multiple circuits. For instance, starting at the rear center of the container **10′** and moving to the right, a first circuit would start at **80,** while a second, completely different circuit would start at **82** and a third at **84.** The first circuit may pass freely in random fashion about the circumference of the inner wall from top to bottom of the container, exit as indicated at **86** and be connected to an appropriate electrical connector tab **88.** Thus, a circuit would be initiated at tab **90** as a result of conductors **80** and **86** to tab **88** for completion through a container cover (not shown). In the embodiments of FIG. **2, 2***a* and **3,** penetration of the container by a metal tool or the like would not only affect the electrical characteristics of any individual circuit, but would probably result in providing a shortened electrical path between one or more of the circuits since the circuits are applied in overlapping, insulated fashion. Again in both the FIG. **2***a* and FIG. **3** embodiments, electrical connection between the cover and the container body is facilitated by the application of wet silver at the tab points which form electrical connections between circuits within the container body and its cover.

A significant advantage lies in the utilization of a container of the type shown in FIG. **3** since the multiple separate electrical conductors formed within the container proper or along the inner surface of the opaque container are formed in a completely random fashion. Once the cover has been attached and an electrical connection completed between the cover portion and the main container body **10″**, there is no way in which the conductor configuration or path may be determined without the aid of expensive x-ray equipment. A prime advantage lies in this specific embodiment since only the operator forming the random pattern would know the specific pattern of the multiple conductor, and since each container would have a different pattern when manufactured in this form, the likelihood of penetration without affecting the electrical circuity is greatly diminished and as a matter of fact, practically impossible under these circumstances. It is intended that these circuits would be completely random at the sole discretion of the operator applying the circuits. That is, he would apply each conductor path randomly, with no prearranged pattern. This would have the effect that no one including the operator himself, would be able to describe just how the circuits are arranged in any given container. Also, there would of course be no drawings of the circuit configurations which might compromise the security of the device.

Unlike the arrangement illustrated in FIG. **1,** the tamper resistant containers of FIG. **2** and FIG. **3** carry their own source of electrical power for energizing the circuits or associated apparatus. Referring to FIG. **4,** it is noted that the container wall for a container such as **10′** which includes a cover for forming a completely enclosed container surrounds appropriate electrical or electronic apparatus indicated in block form diagram. The electrical apparatus includes an electrical power source **100,** such as a battery with or without inverter means, which is connected to the electrical circuits carried by the container walls as shown in FIGS. **2, 2***a* and **3.** The power source is further coupled to an alarm or self-destructive device **104** through said circuits. With just these three elements forming the detection network, penetration will result in changing the electrical characteristics of the circuits which would activate either the alarm or the self-destructive device for destroying both the container and the material positioned therein.

Normally, once the container is mechanically and electrically sealed by latching the cover, no entry into the interior of the container is desired. However, in the case of the package unit, such as that shown in FIG. **4,** an additional device in the form of a tunable neutralizing receiver **106** is provided. It is also coupled directly to power source **100** and to the alarm or self-destructive device by circuit paths which by-pass circuits **102.** An appropriate signal is generated by a transmitting device (not shown) exterior of the container to operate the neutralizing receiver and thus neutralizes the alarm or self-destructive circuit. At this point, penetration of the container may be made without effecting the alarm or self-destructive device **104.** The tunable neutralizing receiver **106** may take the form of an electronic, radio receiver having a variable frequency setting such that the radio signal frequency to which the neutralizing device responds may be changed from day to day or from container to container with the frequency so set being noted for later correlation between a remote transmitting device and the particular container **10′**. This, in addition to the random application of circuits such as in the FIG. **3** embodiment would further increase resistance to successful tampering.

From the above, it is obvious that each tamper resistant container is novel in its circuitry and may employ either single or multiple circuits wherein only the individual forming the circuit would know the specific pattern or configuration of the deposited conductor portion. It is further apparent that penetration of the con-

tainer wall, since the inner wall is completely covered by slightly spaced, very thin conductors, would result in a change in the electrical characteristics of the individual circuits by varying circuit resistance, capacitance or inductance with the change operating any suitable, conventional alarm or self-destructive device. The conductors are "wall carried"; they may be embedded in or applied to the inner surface of the container wall. In forming the conductors on the container walls by thin film techniques, it may be necessary to air-cure a part of the conductors, at least the wet silver coatings applied to the tabs forming the connection between the container proper and its cover. To effect accelerated curing of either the deposited conductors or the wet silver tab connectors, conventional baking or heat curing processes may be utilized. The embodiments employing self-container power sources may use nickel cadmium batteries as the power source. In one alternative form, the container and its coupler may be formed of highly stressed glass such that attempted penetration by drilling, etc. would break the cover and/or the container in a great many pieces thus destroying the circuitry.

While there have been shown and described and pointed out the fundamental novel features of the invention as applied to a preferred embodiment, it will be understood that various omissions and substitutions and changes in the form and detail of the device illustrated and in its operation may be made by those skilled in the art without departing from the spirit of the invention. It is the intention, therefore, to be limited only as indicated by the scope of the following claims.

What is claimed is:

1. A tamper resistant container including a main container body and a separable cover each having mating surfaces and defining a complete enclosure when said mating surfaces are placed in abutting relationship, at least one wall carried electrical circuit formed within respective cover and main body walls, conductive tabs placed in spaced relationship upon the mating surfaces of said cover and main container body, means for electrically connecting said circuits to said spaced tabs, means for electrically connecting corresponding tabs of said main container body and said cover, said connecting means including a wet silver film positioned between respective tabs with said films being air curable to insure completion of an electrical circuit between said main container body and said separable cover, and means for energizing said circuit whereby attempts to penetrate said container result in changing the electrical characteristics of said circuit.

2. The apparatus as claimed in claim **1** further including latch means acting to mechanically couple said separable cover to said main container body wherein latching of said latch means enhances completion of the electrical circuit through said tabs and the sandwiched wet silver film.

3. The apparatus as claimed in claim **1** wherein said container wall includes electrical connecting means in the form of transverse conductive members passing through said wall with a portion of said transverse conductors within said wall proper being suitably curved to effect misalignment between the terminal portions of said conductive members exteriorly and interiorly of said wall member.

* * * * *