United States Patent

Dunn et al.

[15] **3,696,373**

[45] **Oct. 3, 1972**

[54] ELECTRIC ALARM SCREEN

[72] Inventors: **John Malcolm Dunn,** 305 Via Montego, San Clemente, Calif. 92672; **George Kenneth Hornbrook,** 633 Norumbega, Monrovia, Calif. 91016

[22] Filed: **Aug. 12, 1970**

[21] Appl. No.: **63,127**

[52] **U.S. Cl.**.....**340/273,** 200/52 D, 160/10

[51] **Int. Cl.**.....**G08b 13/00**

[58] **Field of Search**.....340/273, 274, 276; 200/52 D

[56] **References Cited**

UNITED STATES PATENTS

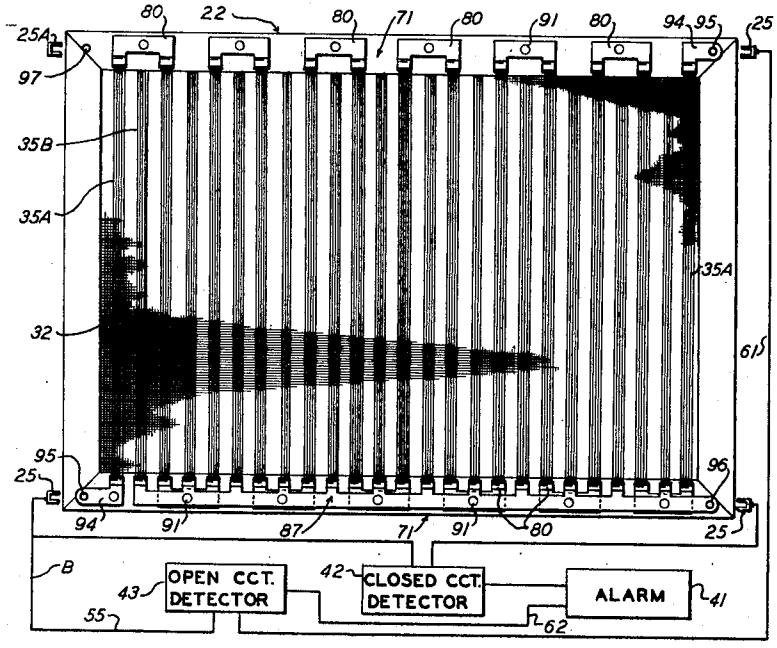
181,078	8/1876	Larned	200/52 D
3,051,935	8/1962	Willson	340/276 X
2,230,170	1/1941	Traweek, Jr.	340/273 X
1,630,808	5/1927	Siegerdt	340/273
1,712,771	5/1929	Kohler	340/273 X
3,249,686	5/1966	Paar	340/276 X

Primary Examiner—Thomas B. Habecker
Assistant Examiner—Scott F. Partridge
Attorney—Wm. Jacquet Gribble

[57] **ABSTRACT**

A screen with mesh wires of one extension of conductive material electrically separates from screen wires of the opposite extension which may be conductive or nonconductive, is held in a frame having side members each having troughs to receive and hold the wires or strands. Two sets of wire connectors in one trough and one set of wire connectors in an opposite trough establish runs spaced transversely to the conductive strands across the screen mesh. A connector from each set in a trough is next adjacent a connector from the other set. One continuous electrical path back and forth across the screen mesh is established, as are parallel discontinuous paths intermediate the spaced runs of the continuous path. Leads from the screen frame conventional join the connector sets into an alarm circuit including conventional open circuit and closed circuit detectors. The detectors are adapted to actuate an alarm—which may be audible, visual, or recording—when the screen is cut or shorted.

11 Claims, 13 Drawing Figures



PATENTED OCT 3 1972

3,696,373

SHEET 1 OF 3

FIG. 1.

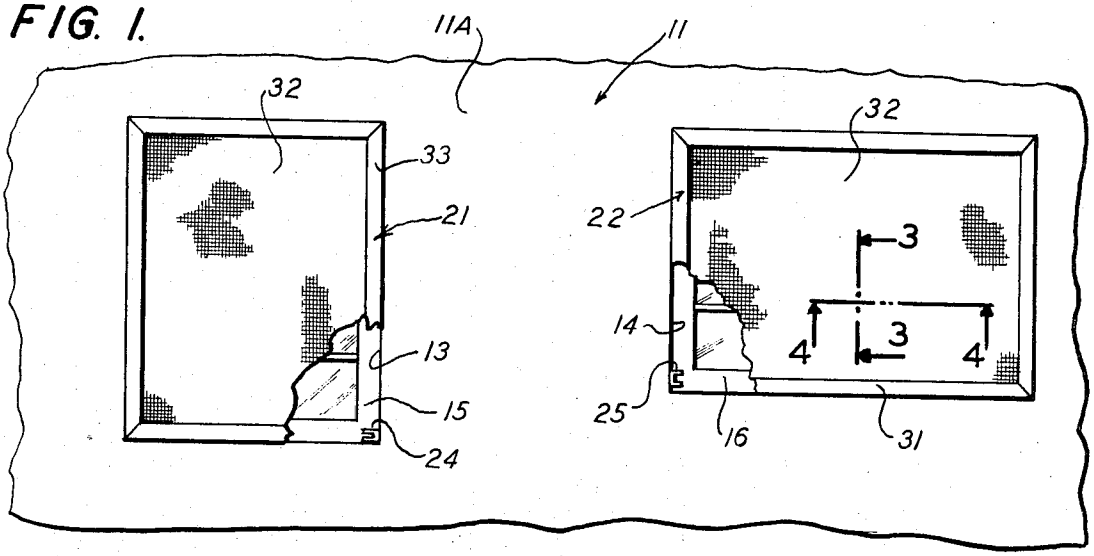
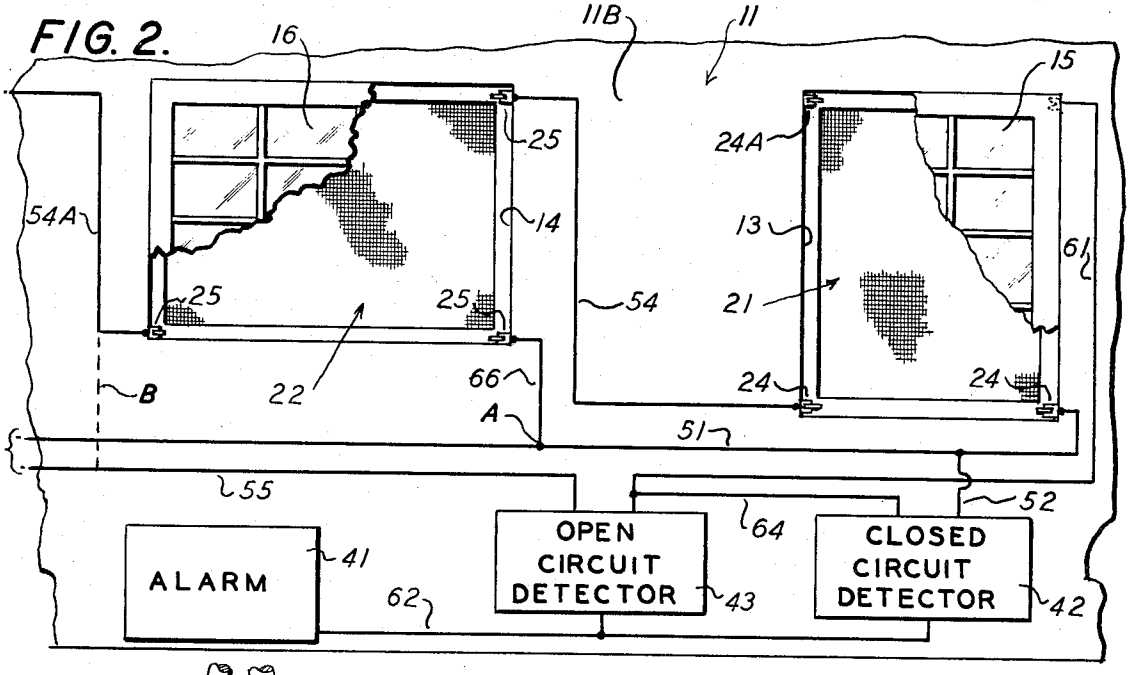


FIG. 2.



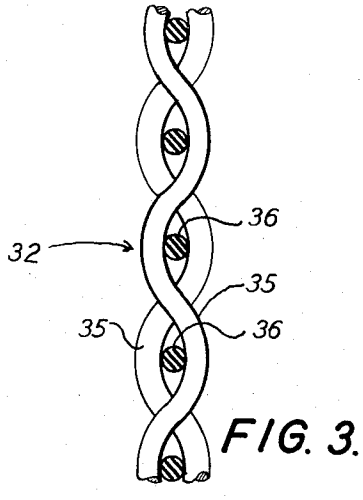


FIG. 3.

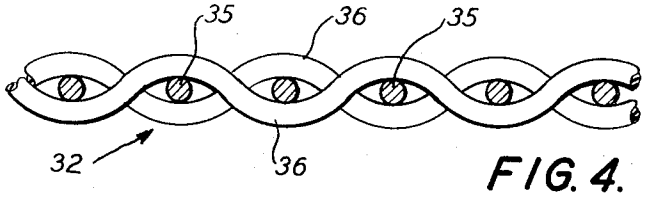


FIG. 4.

INVENTORS:
JOHN MALCOLM DUNN
GEORGE KENNETH HORNBROOK
BY
W. J. Gribble
ATTORNEY

FIG. 5.

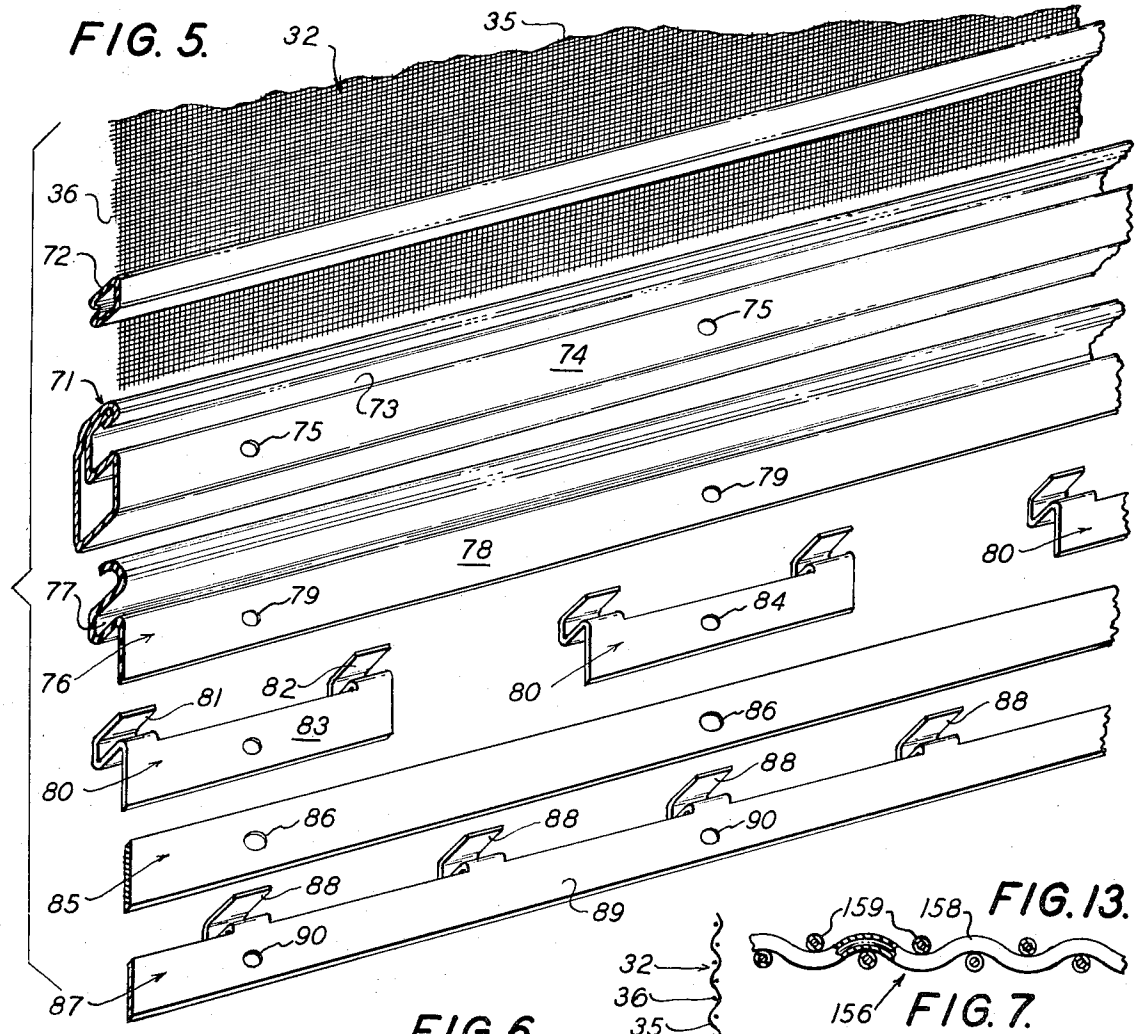


FIG. 13.

FIG. 7.

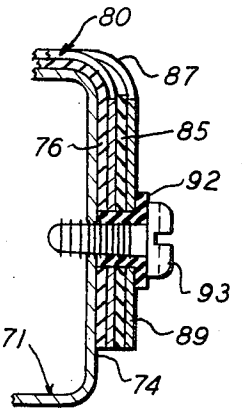


FIG. 6.

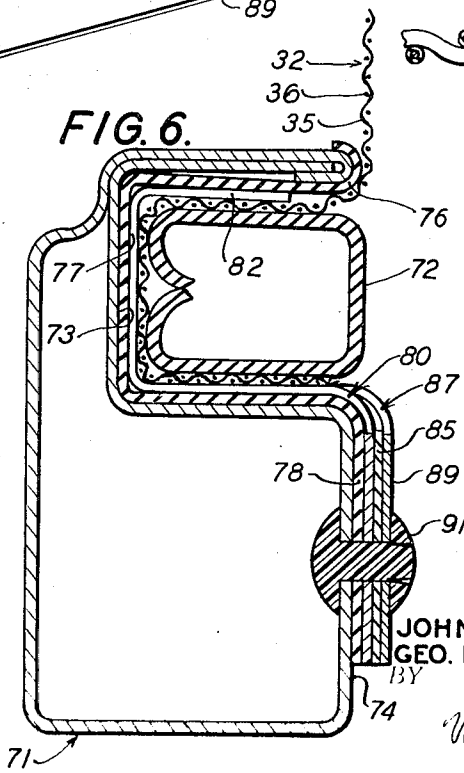
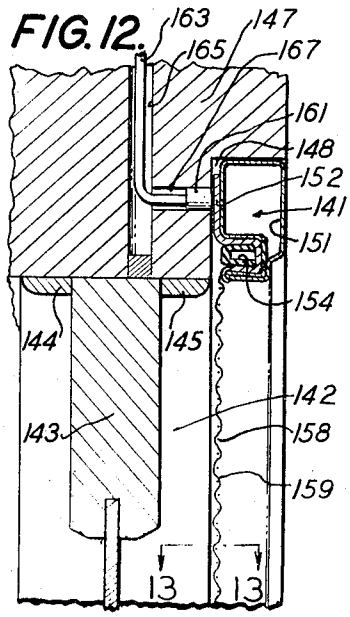


FIG. 12.



INVENTORS:
JOHN MALCOLM DUNN
GEO. KENNETH HORNBROOK
BY
W. J. Gribble
ATTORNEY

FIG. 8.

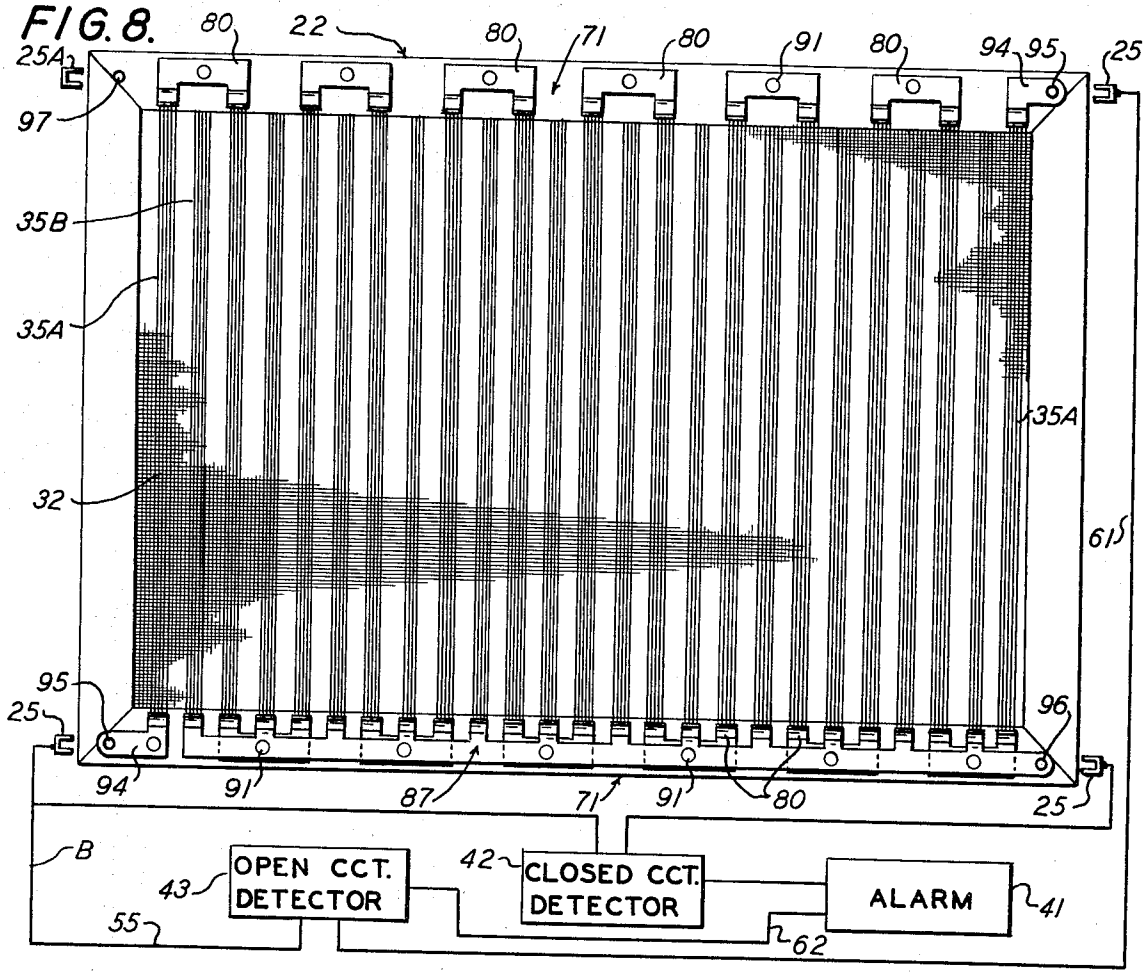
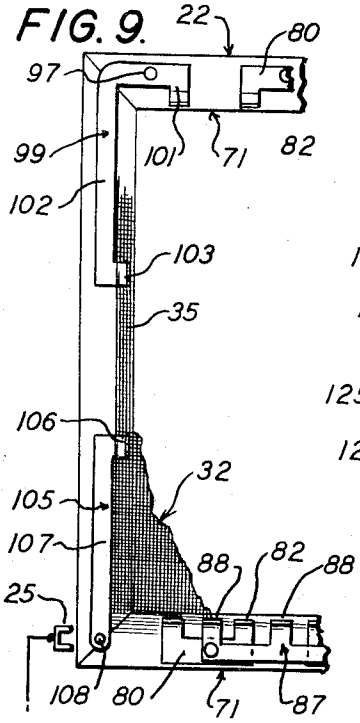


FIG. 9.



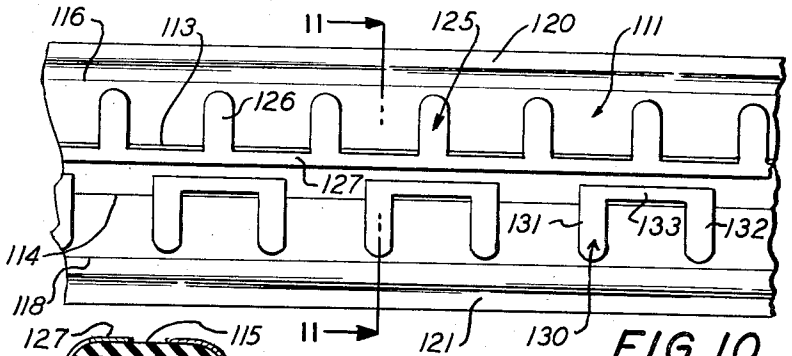


FIG. 10.

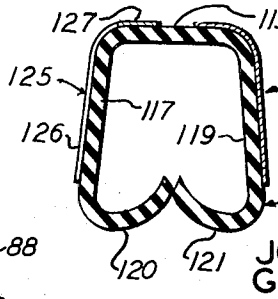


FIG. 11.

INVENTORS:
JOHN MALCOLM DUNN
GEORGE KENNETH HORNBROOK

BY

W. J. Gribble

ATTORNEY

ELECTRIC ALARM SCREEN

BACKGROUND OF THE INVENTION

The invention relates to electric alarm screens and more particularly to screens for windows and sliding doors wherein the screen is conventionally insect mesh which, when cut or electrically shorted, registers an alarm signal.

Prior attempts to utilize the insect screening at windows and doors as part of an alarm system have resulted in devices which are either expensive to install and initially obvious as to purpose, or devices which are particularly expensive to fabricate and which have mechanical flaws which enable intruders to defeat the alarm. Many such devices have required special alarm circuits or supplementary devices which complicate fabrication, installation and maintenance. The general type of electric screen alarm related to the present invention is shown and described in U.S. Pat. No. 3,051,935 issued to C. P. Willson on Aug. 28, 1962, titled "Protective Screen."

Some of the prior devices have been effective bars to penetration if the screen mesh is cut in one direction, but prove inadequate against penetration made by cutting screen strands in the other direction parallel to the visible alarm path in the screen mesh. Other devices have required special motion sensitivity instruments to generate a signal when the screen frame is displaced from its normal position.

We have invented an electric alarm screen which accomplishes the objective of normal screen appearance, achieved by utilizing conventional screen frame and screen mesh strands combined in unique fashion in a screen alarm which signals when the screen is cut or when the screen is short-circuited or displaced from normal position within an opening.

The electric screen alarm of the invention may be combined with conventional open circuit or closed circuit detectors coupled to audible, visual, or recording signalling devices. The instant alarm apparatus, by using conventional screen frame material, including the screen bead to hold the mesh to the frame, and conventional screen strands such as metallic copper or galvanized wire and fiber glass strands (which may be compatible in color with the metallic strands), has an overall cost considerably lower than other alarm apparatuses which do not achieve the same results.

SUMMARY OF THE INVENTION

The invention contemplates an alarm screen for use with electrical open circuit and closed circuit detectors linked to a perceivable alarm. Side and end members define a screen frame. Means for securing the frame at an opening preferably includes electrical connectors to the detectors. Each side and end member may have a screen mesh receptor or trough by which the margin of the screen mesh is secured. The mesh has conductive strands of one extension electrically separate from strands of opposite extension. A plurality of electrical connectors in each of two opposed screen frame members establishes a continuous electrical path back and forth across the screen mesh. A continuous connector conductor on one of the two opposed frame members has connector elements spaced along the conductor in electrical contact with transversely spaced conductive strands to establish a plurality of discontinuous electrical paths across the mesh. Conductive means insulated from the frame connect the connectors and the continuous conductor to the detectors, preferably through the means for securing the frame to the opening.

In a preferred embodiment the conductive strands are of conventional screen wire, either galvanized steel or copper. The strands of opposite extension are nonconductive conventional fiber glass strands. Alternatively, the strands of both extensions may be metallic wire covered by an insulating sheath. The screen alarm of the invention cannot be distinguished from conventional screens, may use conventional screen mesh materials and framing members, and can actuate conventional alarm systems when the screen is cut, shorted or moved from its opening. The invention is applicable to windows, doors and other screened openings.

These and other advantages of the invention are apparent from the following detailed description and drawing, wherein like numbers are used for like parts.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a fragmentary exterior elevation of a wall having openings covered by screen alarms in accordance with the invention;

FIG. 2 is an interior elevation of the wall of FIG. 1;

FIG. 3 is a fragmentary sectional elevation taken along line 3—3 of FIG. 1;

FIG. 4 is a fragmentary sectional view taken along line 4—4 of FIG. 1;

FIG. 5 is a fragmentary exploded view of an alarm screen of preferred form;

FIG. 6 is a fragmentary sectional elevation taken transversely of a frame member of the screen of FIG. 5;

FIG. 7 is a fragmentary sectional elevation of the frame member of an alternate embodiment of the invention;

FIG. 8 is a schematic elevation of a screen including the electrical linkage to the detectors and alarm;

FIG. 9 is a fragmentary schematic elevation of another alternate embodiment of the invention;

FIG. 10 is a further alternate embodiment of the invention employing a screen locking bead with a printed circuit, shown prior to final shaping;

FIG. 11 is a sectional view of the shaped locking bead taken along a line similar to line 11—11 of FIG. 10;

FIG. 12 is a fragmentary sectional elevation of a still further embodiment of the invention shown in place in a window frame; and

FIG. 13 is a fragmentary sectional view taken along line 13—13 of FIG. 12, to an enlarged scale.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

FIG. 1 and FIG. 2 illustrate opposite sides of a building wall 11 in which there are two window openings 13 and 14. FIG. 1 shows exterior face 11A, whereas FIG. 2 shows interior face 11B. A glazed sash 15 occupies window opening 13. The sash may be divided into several panes. A glazed sash 16 occupies window opening 14. Sash 16, too, may have several panes or lights. In conventional fashion the sash rests within the window opening.

Exteriorly of each window opening is fixed a framed screen. Opening 13 is covered by an alarm screen 21

and opening 14 is covered by an alarm screen 22. Each window screen is secured in place by conductive mounting clips such as a mounting clip 24 of opening 13 and a mounting clip 25 of opening 14. Such mounting clips are fixed in each corner of the window opening.

Alarm screen 22 has a surround or frame 31. A unique mesh 32 is stretched and held within the frame. Screen 21 comprises a similar panel of mesh 32 similarly held within a frame 33.

FIGS. 3 and 4 show the unique nature of the mesh within the frame. The insect mesh is conventionally woven but of an unconventional combination of materials. In FIG. 3 mesh 32 has vertical strands 35 interwoven with horizontal strands 36 shown in cross-section. Strands 36 are nonconductive and shown in FIG. 3 as being of an insulating material. "Fiberglas" or other like fibrous plastics may be utilized for the horizontal strands 36. In FIG. 4 strands 36 are shown interwoven with strands 35 which appear in cross-section in that Figure. Strands 35 are cross-hatched to show that they are metallic, and thus conductive. Thus the mesh 32 of FIGS. 1 and 2 is capable of carrying electrical current across the frame in one direction.

This capability is used in the apparatus of the invention in the fashion disclosed schematically in FIG. 2 wherein an alarm 41 is connected with a closed circuit detector 42 and an open circuit detector 43. The alarm may be silent or audible. FIG. 2 represents the wiring scheme between windows, while the wiring schematic for each screen frame and insect mesh is shown in later Figures.

The alarm may be a conventional battery-operated type, batteries being preferred so that the potential intruder cannot defeat the alarm system by disturbing the normal AC supply to the structure. Electrical contact between the detectors and the alarm screen is achieved by connecting the detectors to the mounting clips 24 and 25 of the respective windows.

As can be seen from FIG. 2, only three of the corner clips are used in the circuitry. For instance, mounting clip 24 of window opening 13 is not electrically connected with the alarm circuit.

A lead 51 is common to all alarm screens within the system. It is connected to the closed circuit detector by a connecting wire 52. The screens 21 and 22 are interconnected by a lead 54. A similar lead 54A connects to the next adjoining alarm screen (not shown) in the system. If there are only the two openings to be secured, a return lead, indicated by the dotted line B, connects with the line 55 and extends to the open circuit detector.

The open circuit detector is connected in series with the screens 22 and 21 through a lead 61 from the first alarm screen and return lead 55 and the interconnecting leads 54, 54A, etc. between adjacent window openings. The series path is completed through each alarm screen by means of the conductive strands 35 in a manner to be explained later. A connective line 62 links each detector 42 and 43 to the alarm 41. The closed circuit detector is connected to the open circuit detector by a lead 64, in addition to being connected to line lead 51 and in parallel to each of the alarm screens through connecting lead 66 which is joined to lead 51 at each succeeding alarm screen at a point similar to point A.

FIGS. 5 and 6 illustrate in exploded view and section the physical arrangement of the unique screen of the invention. A mesh 32 has vertical strands 35 and horizontal strands 36, of which strands 36 are nonconductive and strands 35 are conductive. A conventional retaining bead 72 of horseshoe configuration is usually of a linear plastic material and nonconductive. Likewise, conventional side frame 71 is conventionally of aluminum, therefore conductive, and contains a screen bead trough 73 and a flat inner face 74 with spaced mounting holes 75.

An insulating channel 76, having a trough 77, is adapted to fit into the trough 73 of the side frame and has a flat flange 78 adapted to fit over the face 74 of the framing member. The channel 76 may be made of any suitable electrically insulating material, like plastic. The flange 78 has holes 79 spaced to coincide with holes 75 of face 74. A plurality of conductive connectors 80, each with U-shaped contacts 81, 82 spaced at opposite ends of the spanner and connected by a flange 83 with a hole 84, are adapted to seat on flat flange 78 of the insulating channel with the U-shaped contacts 81, 82 fitting into the trough 77 of the channel 76.

An insulator strip 85 with spaced holes 86 is commensurate in width with the flanges 74, 78 of the framing member and the insulating channel.

A closed circuit detector connector strip 87 of conductive material has spaced contacts 88 of U-shaped configuration adapted to fit into the trough 77 of the insulating channel 76. The contacts 88 are lodged in trough 77 intermediate the contacts 81, 82. Strip flange 89 has holes 90 spaced to insure proper contacts location.

As can be seen from FIG. 6, the side frame 71 receives the insulating channel 76 and the contacts 81, 82 and 88 after which screen mesh 32 is locked in the channel in contact with the conductive connectors 80, 87 by screen bead 72. The strands 35 are thus intermittently and alternately contacted by the contact members 81, 82 and 88 along the width of the screen mesh, as shown if FIG. 8.

In order to maintain electrical discontinuity between the flanges 83, 89 and 74, an insulating rivet 91, which may be of a pull, or blind type, rivet, is lodged through each of the various aligned holes 75, 79, 94, 86, and 90 of the flanges to secure the component parts to the frame.

An alternative to the blind rivet is illustrated in FIG. 7 wherein the connecting holes are slightly larger and receive a flanged insulating grommet 92 through which a self-fastening metal screw 93 penetrates to threadably engage with the flat frame flange 74 without contacting the conductive connectors 80 and 87.

Referring again to FIG. 8, the alarm screen 22 is shown with parallel spaced side frames 71, each of which has a plurality of conductive connectors 80 attached thereto in the manner described with respect to FIGS. 5 and 6. Additionally, the lower side frame in FIG. 8 has the connector strip 87 in contact with certain of the conductive strands 35 which extend between the side frames 71 of the screen alarm. Each side frame has a terminal spanner 94. The spanners are diagonally opposite each other in the screen alarm. Each spanner has a post terminal 95 adapted to electrically connect to a mounting clip 25 as described with respect to FIG. 2. Conductive connector strip 87 terminates

rightwardly in the Figure in a post **96** similar in function to the post terminals **95**, both post and terminal being electrical extensions of the connector or connector strip. A nonconducting post **97** is diagonally opposite post **96**. It is electrically null.

End frames **98** of conventional screen design are fixed to side frames **71** and mesh **32** is secured in the end frames in conventional manner by a screen bead (not shown).

The contacts **81, 82** of the opposite conductive connectors are aligned parallel to the conductive strands **35** in staggered array so that the electrical path is from the second contact of a connector through the strands to the first contact of a connector, across the connector to the second contact thereof, and then back across the mesh by way of another set of strands **35** to another connector contact. The conductive strands are schematically illustrated in FIG. **8** such that only those strands contacted by connector contacts **80, 81** and **88** continue across the screen alarm. The intermediate strands **35** are shown only fragmentarily. Thus each conductive strand **35** extends from one connector **80** to another connector **80** on an opposite side frame. The electrical path of the signal is from a post terminal **95** through the terminal spanner and thence through a strand group **35A** to a connector contact opposite the spanner, then through a second strand group to a connector contact of a connector **80** on the opposite side frame, and then repetitively from connector to connector via strand groups to terminate in opposite post terminal **95**.

It can thus be seen that a continuous electrical path is established through the mesh **32** at spaced intervals across the mesh from end frame **98** to opposite end frame **98**. The mounting clips **25** which make contact with terminal posts **95** are connected to leads **55** and **61** to the open circuit detector, which in turn is connected to the alarm **41** through lead **62**. If any group of strands is severed in an attempt to gain entry through the mesh, electrical continuity is broken and the alarm is actuated.

One technique for defeating such detection is to short across the conductive strands by soldering a conductive wire across the face of the screen mesh before cutting the strands. In the inventive apparatus such a technique is foiled by the closed circuit detector **42**, which is electrically connected to one of the posts **95** and to post **96** on the continuous connector strip **87**. Each contact **88** of the continuing strip **87** makes contact with spaced pluralities of conductive strands **35B** which terminate in the side frame opposite the strip in insulated relationship to the frame, as described with respect to FIGS. **5** and **6**. Any attempt to solder a conductive wire across the face of the mesh results in the establishment of a closed circuit between the shorted strands and the strip such that the closed circuit detector responds by actuating the alarm **41**.

In FIG. **9** the apparatus of the invention is further combined with a corner conductive strip **99** which has a contact **101** adapted to fit into the trough **77** of side frame **71** and a conductive connector **102** connecting between contact **101** and a second contact **103** adapted to make electrical contact with the strands immediately adjacent end frame **98**. A null post **97** extends from the corner conductive strip **99**. A second corner conductive strip **102** has a contact **106** in electrical contact with the conductive strands adjacent frame **98** and a terminal post **108**, connected by connective strip **107** to contact **106**. The strip **99** and **105** are a part of the circuit established by conductive connectors **80**. Should an intruder attempt to defeat the screen alarm by removing the mesh **32** from the end frames **98**, the continuity established by the corner conductive strips would be broken and the open circuit detector would actuate alarm **41**.

As can be seen fragmentarily in FIG. **9**, the contacts **81, 82** and **88** of the connector strips **80** and **87** make their normal contact with the mesh **32** except that each contact is displaced one increment leftwardly in the Figure as compared with FIG. **8**.

FIGS. **10** and **11** illustrate a further alternate embodiment of the invention wherein the contacts for both open circuit detector and closed circuit detector are printed upon those portions of the screen bead which locks the mesh in the frame side members (like side members **71** of the previously described embodiment). In the FIGS. **10** and **11** the bead **111** has parallel fold lines **113, 114** which define an exterior flat wall **115**. The folds **113, 114** may be made subsequent to the printing of the conductive pattern.

A third fold line **116** defines a side wall **117** between the exterior wall and the fold line. A similar fold line **118** defines a side wall **119** opposite wall **117**. Each side wall terminates in a curved end **120, 121**, respectively, said curved ends having been formed prior to the printing of the conductive pattern.

As can be seen from FIG. **10**, a continuous connector strip **125** has a plurality of protruding contacts **126** which extend from a central connecting bar **127** which is continuous along the length of the bead paralleling the side frame. A plurality of conductive connectors **130** have spaced contacts **131, 132** extending toward fold line **118** from short connecting bars **133**. Both the connecting bars **133** and the continuous connecting bar **127** are located on the exterior wall **115** such that they extend from trough **73** of the side frame to be electrically connected to detector circuitry in the manner previously described with respect to the embodiment of FIG. **8**.

Conventionally, the printed circuitry is plated copper and the screen bead **111** may be of any of those plastics, such as mylar or vinyls which successfully accept metallic deposits or can be surface treated to accept such plating.

The continuous connector strip **125** is parallel in function to the connector strip **87** of the previously described embodiment and the conductive connectors **130** are parallel in function to the connectors **80** previously described with respect to FIGS. **5** and **8**. The embodiment of FIG. **10**, while possibly more expensive to fabricate than are the separate metallic components of FIG. **8**, saves time and labor at assembly with the screen frames.

FIGS. **12** and **13** show a further alternate embodiment of the invention wherein a screen alarm **141** covers an opening **142** in a structure. A sliding sash **143** moves in the opening between guide stops **144, 145**. An opening framing member **147** has a recess **18** which may be cut into the framing members on all four sides of the opening or defined by the offset of the exterior

trim fastened to the framing members of the opening. The recess **148** is therefore extended on all four sides of the opening.

A framing member **151** similar to the member **71** of the previously described embodiments contains the connector strips and insulating strips schematically represented at **152**. The strips are of the type shown at **80, 87** and **76, 85** in FIG. **5**, along with the fasteners of FIG. **6**. The screen bead **154** also contains in electrical contact with the components **152**, a screen mesh **156** made up of horizontal and vertical strands **158, 159**, respectively.

The screen alarm **141** may be secured to the opening in conventional fashion and electrical continuity with the alarm circuitry is achieved by a contact sleeve **161** lodged in the opening framing member near the corner of the screen to contact the chosen connector strip or conductive connector. An electrical lead **163** extends from the sleeve upwardly through the framing member by means of a duct **165** preferably bored upwardly through the framing member to give access to an attic or crawl space through which the alarm wiring may extend to the detector and alarm components (not shown). Contact sleeve **161** resides in a bore **167** cross-bored to intersect vertical duct **165**.

By lodging the screen wire in an opening recess like recess **148**, the electrical components of the screen alarm may be concealed. Would-be intruders can be further inhibited by varying the positions of the mounting clips **25** from window to window of a structure.

In addition, as indicated in FIG. **13**, the horizontal and vertical strands may both be of a metallic core with an outer cover of insulation such that the conductive paths of the mesh may be horizontal or vertical, depending upon the desire of the installer. The concealment and optional electric paths give further opportunity to defeat the efforts of intruders to circumvent the alarm system.

The apparatus of the invention has been illustrated by several embodiments. These embodiments in no way exhaust the scope of the invention, and many other embodiments within the scope of the invention will occur to those skilled in this particular art. It is therefore desired that the invention be measured by the appended claims rather than by the purely illustrative apparatus disclosed herein.

We claim:

1. An alarm screen for use with electrical open circuit and closed circuit detectors linked to a perceivable alarm, the combination comprising side and end members defining a screen frame, means for securing the frame at an opening, a screen mesh receptor in the members of the screen frame, a screen mesh having conductive strands of one extension electrically separate from strands of opposite extension, a plurality of electrical connectors in each of two opposed screen frame members establishing a continuous electrical path back and forth across the screen mesh through the conductive strands, a continuous connector conductor on one of the two opposed screen members, connector elements spaced along the conductor and making electrical contact with transversely spaced conductive strands, and means electrically connecting the connectors and the continuous conductor to the detectors.

2. Apparatus in accordance with claim **1** wherein each strand of the screen mesh of one extension comprises a conductive wire, and wherein each strand of opposite extension comprises a nonconductive wire.

3. Apparatus in accordance with claim **1** wherein each strand of the screen mesh comprises a conductive wire, and an insulating sheath on the wire.

4. Apparatus in accordance with claim **3** wherein a second pair of opposed screen frame members carries on each frame member second plurality of electrical connectors establishing a continuous electrical path back and forth across the screen mesh through the conductive strands of opposite extension, a second continuous conductor on one of the two opposed screen frame members of the second pair, connector elements spaced along the conductor and making contact with transversely spaced conductive strands of the opposite extension, and means connecting the second connectors and the second conductor to the detectors.

5. An alarm screen for use with electrical open circuit and closed circuit detectors linked to a perceivable alarm, the combination comprising side and end members defining a screen frame, means for securing the screen frame to on opening, a screen mesh retaining trough in the members of the screen frame, screen mesh having conductive strands and nonconductive strands, a screen bead securing the screen mesh margins in the troughs of the screen frame members, a continuous conductor on one screen frame member electrically contacting a plurality of transversely spaced conductive strands; a plurality of contactors on each of two opposed frame members each in contact with at least one conductive strand so as to establish a continuous electrical path back and forth across the screen mesh through the conductive strands, and means electrically connecting the conductor and the connectors to the detectors.

6. Apparatus in accordance with claim **5** wherein the screen bead carries the continuous conductor and the plurality of connectors.

7. Apparatus in accordance with claim **5** wherein the conductor strands of the screen mesh extend transversely to the nonconductor strands.

8. Apparatus in accordance with claim **5** wherein the screen bead, the continuous conductor and a plurality of spaced connectors bind the screen mesh margins to the frame members.

9. Apparatus in accordance with claim **5** wherein the means for securing the frame to the opening includes connector means linking the conductor to the closed circuit detector.

10. Apparatus in accordance with claim **5** wherein the means for securing the screen frame to the opening includes connector means linking the contactors to the open circuit detector.

11. Apparatus in accordance with claim **5** wherein the continuous conductor comprises conductive strip, contact fingers extending from the edge of the strip, and curved portions on said fingers conforming to the retaining trough and adapted to contact electrically the conductive strands of the screen mesh at the mesh margin.

* * * * *