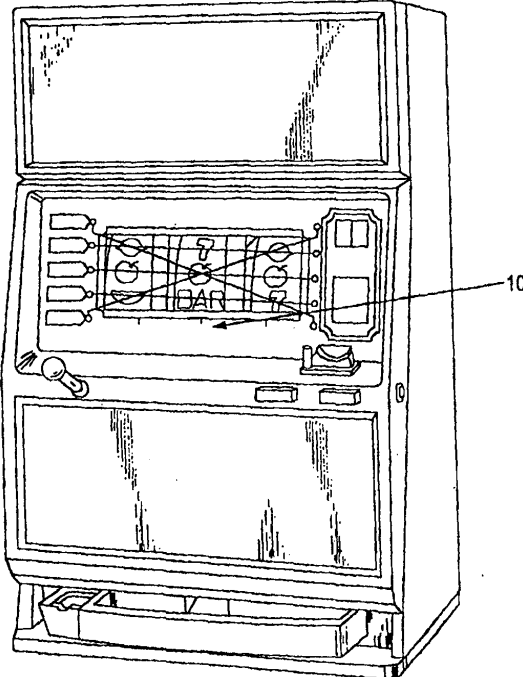




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(21) International Application Number: PCT/US99/15155 (22) International Filing Date: 2 July 1999 (02.07.99) (30) Priority Data: 60/091,580 2 July 1998 (02.07.98) US (71) Applicant (for all designated States except US): ADD-VISION, INC. [US/US]; 1305D Palmetto Avenue, Pacifica, CA 94044 (US). (72) Inventor; and (75) Inventor/Applicant (for US only): KLINE, Richard [US/US]; 235 Meadowbrook Drive, Reno, NV 89509 (US). (74) Agents: BENGTTSSON, W., Patrick et al.; Pillsbury Madison & Sutro, LLP, 1100 New York Avenue N.W., Washington, DC 20005 (US).		(81) Designated States: AE, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZA, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG). Published <i>Without international search report and to be republished upon receipt of that report.</i>
(54) Title: SHIELD TO PREVENT ELECTROSTATIC DISCHARGE AND ELECTROMAGNETIC AND RADIO FREQUENCY INTERFERENCE		
(57) Abstract Shields providing protection from electrostatic discharge, electromagnetic interference and radio frequency interference provide effective shielding of susceptible portions of slot machines, video games, pinball machines and other electronic amusement devices. The shields are cost-effective and permit high visible light transmissivity for high-quality backlit graphical images. They are easily installed using semi-permanent adhesive that allows the shields to be removed if necessary for servicing, or to remain in place permanently. ITO-coated polyester provides a clear conductor and, with proper grounding, is used to create an effective ESD shield. Shields preferably include a silver conductive trace at the perimeter to create a Faraday cage that effectively traps RFI. 		

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SHIELD TO PREVENT ELECTROSTATIC DISCHARGE AND ELECTROMAGNETIC AND RADIO FREQUENCY INTERFERENCE

BACKGROUND OF THE INVENTION

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1. Field of the Invention

The present invention is related to shields for preventing electrostatic discharge, electromagnetic interference and radio frequency interference. More particularly, the invention is related to such shields when used in amusement devices such as slot machines, video games, pinball machines and
10 other electronic gaming devices.

2. Background of the Related Art

Recent electronic game designs include high speed microprocessors and other sophisticated electronic components which are sensitive to electrostatic discharge (ESD), electromagnetic
15 interference (EMI) and radio frequency interference (RFI). ESD, EMI and RFI transmitted through the top glass of electronic gaming devices disrupt operation of the internal electronic components in the gaming devices and can cause spurious operation or generate incorrect results. Further, gaming devices have been required to comply with requirements of part 15 of FCC rules concerning such emissions since their inception. Moreover, RFI from cellular phones, hand-held radios and other
20 electronic devices now common in casino environments and other areas in which such gaming devices are used can also be problematic in connection with such gaming devices. Some kind of shielding is needed.

Grounded conductive copper tape applied to the back of the glass has been investigated as a solution to these problems. While sufficient for testing purposes, this tape does not inhibit EMI or
25 RFI interference. In addition, the copper tape is cosmetically unsatisfactory because it creates a shadow behind the artwork on the machine's display. Also, the copper tape and attached grounding strap are easily dislodged during machine servicing and thereby rendered ineffective and useless. Other metallic shields incorporated into the mechanical components of the gaming machines tend to be deficient in function and manufacturability.

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SUMMARY OF THE INVENTION

The present invention came from the need for effective shielding of susceptible portions of slot machines and other similar gaming devices as described above, and was made with the above problems of the prior art in mind. Shields according to a preferred aspect of the present invention are
35 cost-effective and permit high visible light transmissivity for high-quality backlit graphical images. Shields according to this aspect of the invention are easily installed using semi-permanent adhesive that allows the shield to be removed if necessary for servicing, or to remain in place permanently.

Also, ITO-coated polyester provides a clear conductor and is known as an ESD shield and a component for touch screens. However, proper grounding is needed to create an effective ESD shield. Shields according to the preferred aspect of the invention include a silver conductive trace at the perimeter to create a Faraday cage that effectively traps RFI.

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BRIEF DESCRIPTION OF THE DRAWINGS

These and other objects, features, and advantages of the present invention are better understood by reading the following detailed description of the preferred embodiment, taken in conjunction with the accompanying drawings, in which:

- 10 FIGURE 1 is an elevation view of a shield according to a preferred embodiment of the invention;
FIGURE 2 is a cross-sectional side view of the shield of FIG. 1 taken along line II-II; and
FIGURE 3 is a diagram of a shield according to the preferred embodiment installed in a slot machine.

15 DETAILED DESCRIPTION OF THE PRESENTLY PREFERRED EXEMPLARY EMBODIMENT

An exemplary shield according to a preferred embodiment of the present invention as illustrated in FIGS. 1-3 and method of construction thereof are described as follows.

- 20 First, the shield 10 is constructed of a thin transparent film 11, coated with an edge grounded, conductive transparent metal coating 12 on at least one side. This provides an optically clear conductive substrate 14 with a resistance of 70-100 ohms per square. Preferably, indium tin oxide (ITO) or a similar material is sputtered on the thin transparent film 11 to form the transparent metal coating 12 and thus the clear conductive substrate 14. Most preferably, the substrate 14 is 100Ω ITO sputter coated on 0.007" heat stabilized polyester.

- 25 This clear conductor has the additional benefit of providing an industry-standard substrate for electroluminescent lamps that can be integrated into glass graphical design to provide microprocessor-controlled illuminated graphical images and/or other illuminated graphical images for improved game function. The graphical images may be adjacent to other graphical images that are illuminated, backlit or edge lit by other sources of visible light or by non-illuminated areas. In this case,
30 grounding for the shield 10 would be accomplished via the electronic controller for the EL lamp.

- Next, a silver conductive trace 16 (preferably, a silver conductive ink such as Electrodag 477SSRFU) is applied to the entire perimeter of the conductive transparent metal coating 12 of the substrate 14 using proven screen printing techniques utilizing solvent-based inks and conventional drying. This perimeter conductor 16 is subsequently grounded to the chassis of the gaming device
35 (shown in FIG. 3) by forming a tail therefrom and connecting the tail to conductive metal contacts fixed to the cabinetry, thereby creating a Faraday cage to effectively trap RFI. The conductive

substrate 14 alone, when grounded to the chassis would provide an effective ESD shield, however the Faraday cage adds the RFI/EMI benefit.

Next, the edge (generally, the bottom edge) of the glass 20 that rests in the metal frame is grounded to the chassis. Assuming the chosen edge is the bottom edge (any edge may be used as
5 appropriate), a conductive copper tape 18 is applied to the silver conductive trace 16 print overlapping the conductive surface 12 and aligned with the bottom of the glass 20 at that edge. This provides a durable conductive surface that can withstand repeated insertions and removals from the frame during routine servicing of the machine. Preferably, the tape 18 is 3M copper tape with Z-axis conductive adhesive.

10 Then, a protective masking (not shown) is applied to the opposite side of the glass 20 to protect the shield 10 during subsequent manufacturing processes and shipping. Next, an adhesive layer 22 is applied to create a perimeter application of adhesion for the shield 10. This is not visible from the viewing side of the glass. The shield 10 is then applied to the non-viewing side of the glass 20 by removing the adhesive layer 22 on the nonconductive side and aligning the shield 10 to the glass 20.
15 The adhesive 22 creates a semi-permanent bond to the glass 20. The protective masking is removed during final inspection or in the field at installation.

The above description of the preferred embodiment of the present invention has been given for purposes of illustration only, and the invention is not so limited. Modification and variations thereof will become readily apparent to those skilled in the art, and these too are within the scope of the
20 invention. Thus, the present invention is limited only by the scope of the appended claims.

WHAT IS CLAIMED IS:

1. A shield for preventing electrostatic discharge, electromagnetic interference and radio frequency interference, the shield comprising:
 - an optically transparent substrate which is conductive on at least one side;
 - grounding means for enabling the generation of an ESD shield using the at least one conductive side of the substrate; and
 - affixing means for using the substrate to complete a Faraday cage.
2. A shield for preventing electrostatic discharge, electromagnetic interference and radio frequency interference, the shield comprising:
 - an optically transparent substrate which is conductive on at least one side;
 - a conductive trace covering a perimeter of the at least one conductive side of the substrate; and
 - grounding means for grounding the conductive trace to conductive contacts,whereby a Faraday cage and EDS shield are simultaneously created by connection of the perimeter conductor to conductive contacts.
3. A shield as described in claim 2, wherein the optically clear substrate comprises:
 - a thin, transparent film and
 - an edge-grounded, conductive transparent metal coating which covers at least one side of the film.
4. A shield as described in claim 2, wherein the transparent film comprises polyester.
5. A shield as described in claim 2 wherein the conductive trace comprises silver.
6. A shield as described in claim 2, further comprising a conductive tape applied to the at least one conductive surface and overlapping the conductive trace.
7. A shield as described in claim 2, further comprising a protective masking covering at least a portion of a side opposite the at least one conductive side of the substrate.
8. A shield as described in claim 2, further comprising an adhesive layer attached to a perimeter of a side opposite the at least one conductive side of the substrate.
9. A method of manufacturing a shield for preventing electrostatic discharge, electromagnetic interference and radio frequency interference, the method comprising:

providing an optically transparent substrate which is conductive on at least one side;
applying a conductive trace to a perimeter of the at least one conductive side of the substrate; and
grounding the conductive trace to conductive contacts to simultaneously create a Faraday cage and ESD shield.

10. The method of claim 9, further comprising applying a conductive tape to the at least one conductive side of the substrate in a region which overlaps the conductive trace.

11. The method of claim 10, wherein the conductive tape is copper tape.

12. The method of claim 9, further comprising applying a protective masking onto at least a portion of the at least one conductive side of the substrate.

13. The method of claim 9, further comprising applying an adhesive layer to a perimeter of a side of the substrate opposite the at least one conductive side.

14. The method of claim 9, wherein providing the substrate comprises:
providing a thin, transparent film; and
coating the film on at least one side with an edge-grounded, conductive, transparent metal coating.

15. The method of claim 9, wherein applying a conductive trace comprises applying the conductive trace onto the at least one conductive side of the substrate using screen printing techniques utilizing solvent based inks and conventional drying.

16. The method of claim 9, wherein the transparent film comprises polyester.

17. The method of claim 9, wherein the conductive trace comprises silver.

18. The method of claim 9, wherein grounding the conductive trace comprises grounding the trace to a chassis of a device using metal contacts affixed to the device cabinetry.

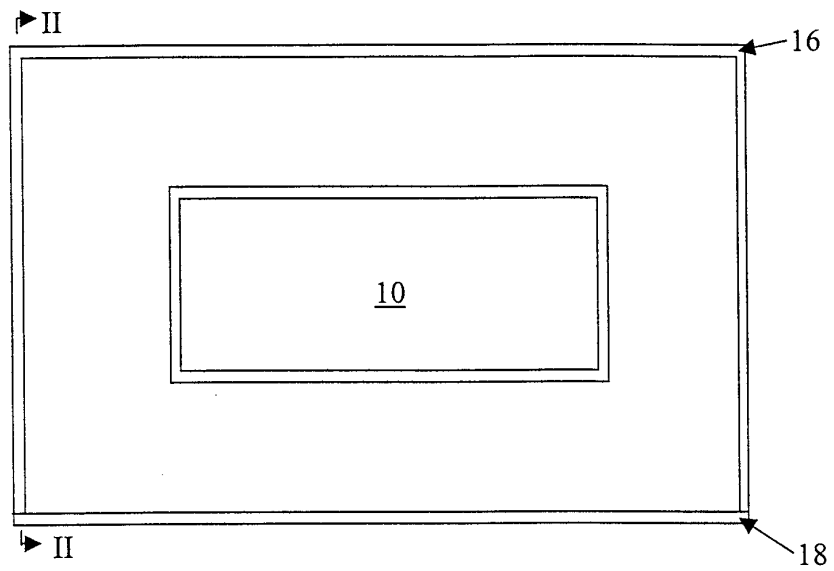


FIGURE 1

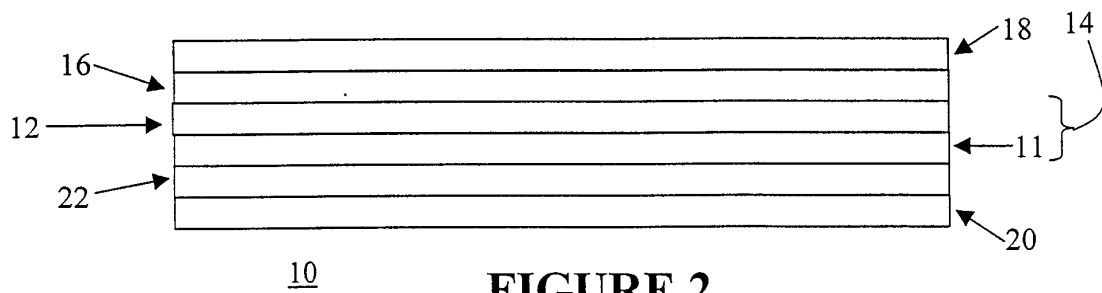


FIGURE 2

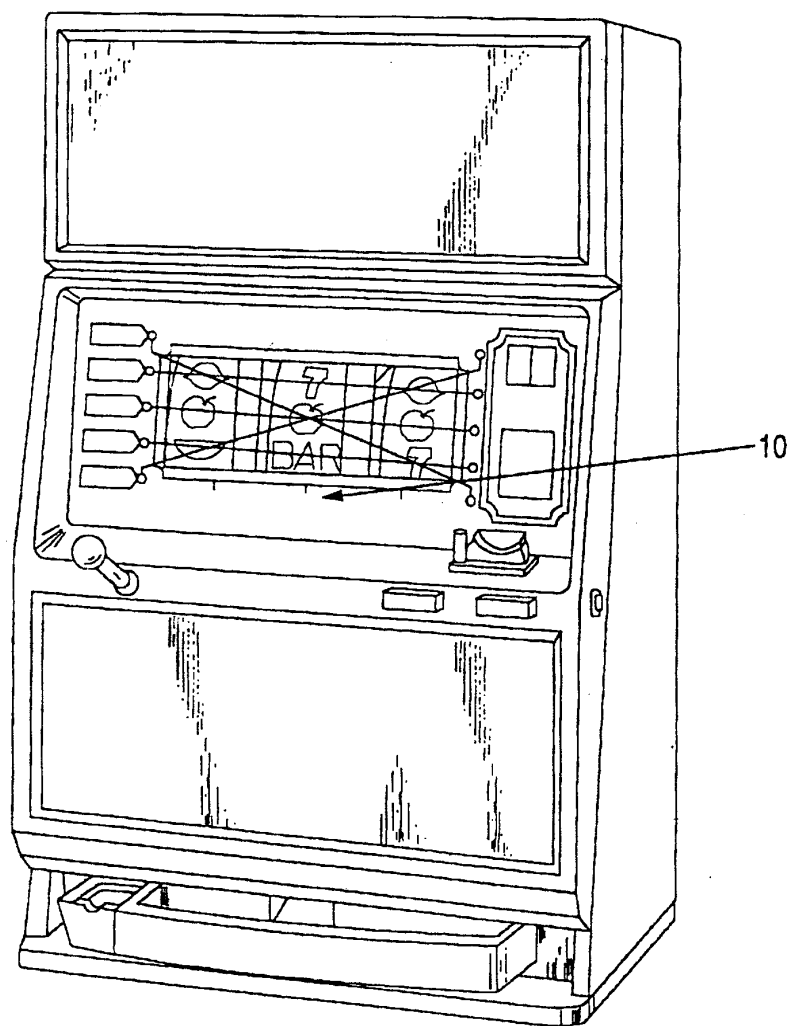


FIGURE 3