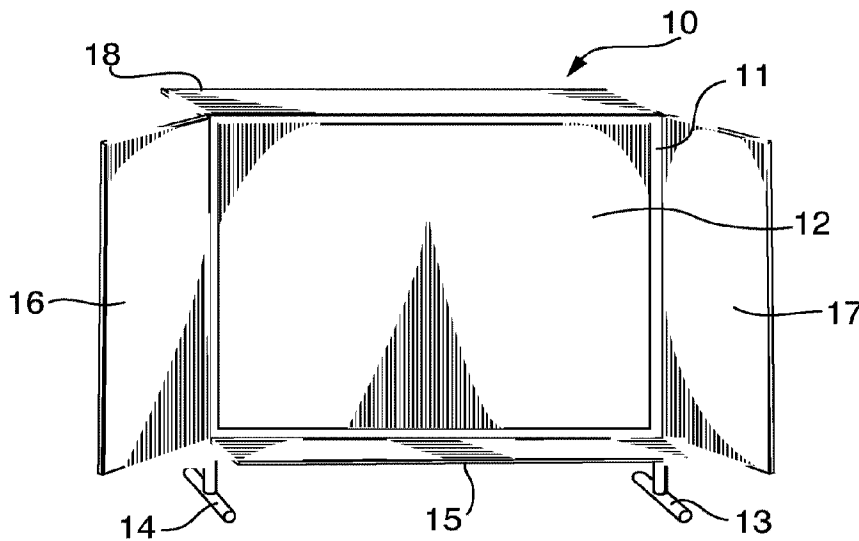




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A welding spatter protection screen formed primarily of magnetic sheeting or being a magnet is provided to further safety by halting or restricting the motion of magnetic and paramagnetic by-products, thereby preventing flame, light, magnetic material, sparks and dust from being scattered during welding or post-weld grinding. This improvement can be applied to various type of welding screens (welding curtain, welding windshield), by using a flexible magnetic sheet material as the primary barrier material.

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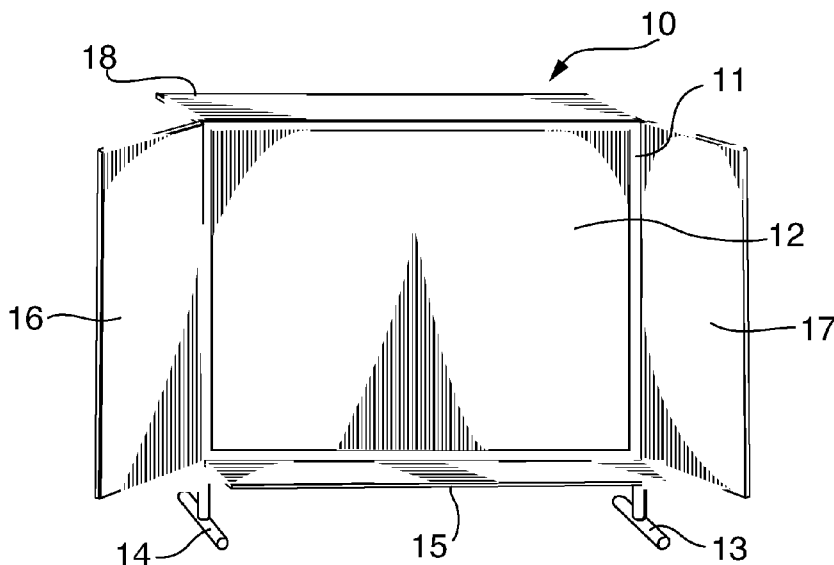
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**FIG. 1**

(57) **Abstract:** A welding spatter protection screen formed primarily of magnetic sheeting or being a magnet is provided to further safety by halting or restricting the motion of magnetic and paramagnetic by-products, thereby preventing flame, light, magnetic material, sparks and dust from being scattered during welding or post-weld grinding. This improvement can be applied to various type of welding screens (welding curtain, welding windshield), by using a flexible magnetic sheet material as the primary barrier material.

MAGNETIC SCREENS AND CURTAINS FOR WELDING AND GRINDING SPECIFICATION

FIELD

[001] The present disclosure relates to devices used to protect persons and
5 property in the vicinity of welding and grinding operations, and the use of screens,
curtains or shields for this purposes.

BACKGROUND

[002] Welding is a dangerous industrial activity which requires specialized
devices to protect both the persons engaged in the activity, as well as other workers
10 on a project site in the vicinity of welding activity. Welding sparks, slag materials,
metallic dust, and metallic shards, are often expelled from a weld site during a weld
or during post weld grinding. Wind near the site may also debris to blow back
against the welding or affect the quality of the weld. The light produced by welding
itself is a hazard. To protect themselves against the dangerous byproducts of
15 welding, welders wear protective clothing. However, bystanders near the welder's
workspace may be exposed to the same byproducts of welding as welders, often
without the advantage of protective clothing. Moreover, welding byproducts pose a
general threat to property. For example, superheated particulate matter could
damage nearby property or cause fire, and when cooled, the particulate and dust
20 needs to be cleared.

[003] Various different sizes and shapes of screens have been used to fulfil
this purpose, and are typically configured as a frame bearing a protective translucent
or opaque screen or curtain material, which meets standards to ensure it is
sufficiently flame resistant, UV resistant & abrasion resistant and durable. The
25 welding screen can be set or even detachably attached to a work area. Under

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various embodiments, these devices are referred to as, among other names, welding shields, welding windshields, welding curtains, welding screens, and the like. As discussed herein, the term welding screen is meant to include curtains, screens, windshields and similar devices adapted to protect the welding workspace from disturbance and to restrict (to the extent practical) the welding materials from escaping the workspace.

[004] However, in many instances, the sheet plastic that tends to be used is easily melted and frequent replacement is required.

[005] There is a need for a safer welding screen.

10 [006] There is a need for a welding screen that assists in maintaining the cleanliness of the welding work space and lessens the concern that melting slag will ricochet .

[007] There is a need for a welding screen of more resilient materials not normally used for this purpose, which resists melting.

15 [008] There is a need for a replacement welding screen material of improved safety performance.

SUMMARY

[009] Welding screens in which the barrier portion includes magnetic sheeting material as a primary component, attract and restrict the motion of magnetic and paramagnetic materials, including iron, cobalt and nickel dust, metal shards, slag and other waste materials extruded during a welding operation susceptible to magnet fields. Once adhered to the magnetic surface of the portion of the screen formed using the magnetic sheeting material; dust, metal shards and ferromagnetic debris ("magnetic waste") are restricted from rebounding or being blown around. The screen can be advantageously used to clean the work environment as it attracts and

retains the magnetic waste. In an optional embodiment, a smooth exterior to the magnetic sheeting material allows the ferromagnetic waste to be wiped along its surface for cleaning, or removed using a stronger magnet.

[010] Instead of magnetic sheeting materials using permanent magnets
5 embedded within a resin, in another embodiment, the welding screen may comprise one or more electromagnets to create an electro-magnetic field attracting magnetic waste into a barrier within the magnetic field. In such an embodiment, the barrier may comprise magnetic materials to assist in strengthening the field wherein a current is passed through the windings of the electromagnet.

10 BRIEF DESCRIPTION OF THE DRAWINGS

[011] Figure 1 shows a perspective view of one embodiment of a magnetic welding screen.

[012] Figure 2 shows a perspective view of a second embodiment of a flexible magnetic sheet configured as a free standing magnetic welding screen.

15 [013] Figure 3 shows a perspective view of a configuration of four joined welding screens of magnetic material about a workspace.

[014] Figure 4 shows views of 4 configurations of joined welding screens of magnetic material.

[015] Figure 5 shows a prototype welding screen used in testing in which
20 the magnetic sheet material used was 0.76 mm (0.03 inches) thick, using strontium ferrite powder ($\text{SrFe}_{12}\text{O}_{19}$) as the permanent magnetic powder bonded within the flexible polymer sheet and having approximate maximum energy BH_{max} of between 5000 J/m^3 and 6000 J/m^3 .

DETAILED DESCRIPTION

[016] One or more preferred embodiments of the magnetic welding screen of the present disclosure will now be described in greater detail with reference to the accompanying drawings.

5 [017] Figure 1 shows a magnetic welding screen **10** having a frame **11** to support a primary barrier **12** comprised of ferromagnetic sheeting material and is provided with support elements **13** and **14**. Optional flexible edge barriers **15**, **16** and **17** are secondary barriers which may be used to improve the fit of the magnetic welding screen **10** to the work space, floor or walls. An optional adjustable roof barrier **18** may also be provided as a secondary barrier. Where the optional flexible edge barriers **15**, **16** and **17** and optional adjustable roof barrier **18** are also be formed of flexible ferromagnetic sheeting material, they may be used to connect the welding screen to other welding screens **10** or to other different welding screens having polls of a suitable material. This option has the dual function of allowing the device to be affixed to a ferromagnetic workspace (e.g. girders in a tower, or ship hull in marine manufacture, etc.) to both keep the magnetic welding screen **10** in position and to create an improved seal against ferromagnetic waste and other waste, or air currents, escaping or entering the work space.

[018] The ferromagnetic sheeting material can be of various commercially available types, usually formed using of magnetic particles/powders embedded within a resin, rubber and/or plastic layer (referred generally as a polymer bonded magnets). New magnetic sheeting material is created, but the use of any magnetic sheeting material for the purpose of the primary barrier in a welding screen should be considered within the scope of the present disclosure. Flexible magnetic sheeting is typically used as signage or labelling which can be adhered to ferrous metal

surfaces; but is not known to be used to as primary material in a welding screen to protect against welding byproducts.

[019] While flexible magnets tend to have much less magnetic pull than neodymium & ceramic magnets, they are also much less expensive, and provide
5 sufficient attraction forces to slow ferrous metals and prevent rebound of particles. In the prototype discussed below, the magnets are based on strontium ferrite powder ($\text{SrFe}_{12}\text{O}_{19}$) and having approximate maximum energy BH_{max} of between 5000 J/m^3 and 6000 J/m^3 , isotropic, as deposited in rubber substrate normally used for refrigerator magnets or automotive decoration applications. Other ferromagnetic
10 powders, including anisotropic ones, can be used, including barium ferrite powder, magnesium zinc powder and nickel zinc powder, embedded and oriented within a flexible rubber or plastic matrix; and these may achieve higher maximum energies. A person of skill in the art will appreciate that various magnetic powders could be used, including, without limitation, those in the group consisting of any rare earth ferrous
15 oxide permanent magnet powders, rare earth iron boron permanent magnet powders, Samarium Iron Nitride permanent magnet powders, Magnesium Zinc permanent magnet powders, Nickel Zinc permanent magnet powders and strontium ferrite powders. This can be bonded into a suitable polymer sheet.

[020] Figure 2 shows a second embodiment of a self standing magnetic
20 welding screen **20** formed in a doom configuration, having a shell **21** of flexible magnetic sheeting, affixed to a base **22**, to define a safe workspace within a cavity **23**. The welding screen **20** may be viewed as a portable free standing welding splatter protection device comprising a partial doom of flexible magnetic sheeting **21** affixed to a rigid base **22**, the flexible magnetic sheeting to magnetically attract and
25 collect welding and grinding byproducts from passing beyond a cavity **23** in which a welding job is performed.

[021] Figure 3 shows a configuration of four joined welding screens about a workspace. By replacing existing curtain/barrier material on existing welding screens, they can be refurbished. This is often required as existing materials burn and degrade easily. An existing curtain or barrier of appropriate size may be used as a template to permit the creation of a flexible magnetic sheet of similar size, dimensions and attachment locations (holes, buttons etc, if required) so that a flexible magnetic sheet may be cut and used as a replacement barrier on existing welding screen frames.

[022] Figure 4 shows views of 4 configurations of joined welding screens of magnetic material, which can be joined using flaps of flexible magnetic sheeting material where the screen abut.

[023] Figure 5 shows a prototype magnetic welding screen **50** comprised of a rubber magnetic sheet, in which strontium ferrite powder ($\text{SrFe}_{12}\text{O}_{19}$) is the bonded magnetic material. The specifications of the magnet provided a thickness of 0.7 mm (0.03 inches) and the magnet provided approximate maximum energy BH_{max} of between 5000 J/m^3 and 6000 J/m^3 , and such materials are readily available in the market place for use in other contexts, but not as welding shields. As the material is opaque, magnetic welding screen **50** may also have a transparent window **51** to permit viewing into the welding area. In the prototype, the frame **52** was also provided with support struts **53**. These would not be required in all instances where the magnetic welding screen **50** of the present invention is used; but provide a convenient way to connect the screen **50** to the frame **52**, and where the struts **53** are themselves magnetic, may provide a useful improvement to frames with which this type of screen are used.

[024] In the pilot using the prototypes, six screens were deployed for use in an industrial environment for a 10 month period. During this time, none of the screens exhibited any damages due to melting – unlike the other standard plastic screens, virtually all of which showed significant melting damage.

5 [025] The welding curtain is positioned to protect the vicinity from welding byproducts, including light from the welding and metallic projectiles and sparks from the grinding step. The curtains are not affixed to the materials being welded themselves,.

[026] The foregoing examples and advantages are merely exemplary and
10 are not to be construed as limiting the present disclosure. The present teaching can be readily applied to other types of devices. Also, the description of the examples of the welding shield/screen/curtain/windshield is intended to be illustrative, and not to limit the scope of the claims, and many alternatives, modifications, and variations will be apparent to those skilled in the art.

1. A welding screen comprising:

a primary barrier, the primary barrier made of magnetic sheet, wherein the magnetic sheet is flexible;

a frame on a stand to maintain the primary barrier in place, wherein the primary barrier is affixed within the frame; and

at least one secondary barrier made of magnetic sheet, wherein the secondary barrier is affixed to the outside of the frame for detachable attachment to magnetic materials in a workspace or adjacent welding screens.

2. The welding screen of claim 1 wherein the magnetic sheet is a polymer bonded sheet having embedded permanent magnet powders.

3. The welding screen of claim 2 wherein the permanent magnet powders are selected from a group of permanent magnet powders consisting of: rare earth ferrous oxide permanent magnet powders, rare earth iron boron permanent magnet powders, Samarium Iron Nitride permanent magnet powders, Magnesium Zinc permanent magnet powders, Nickel Zinc permanent magnet powders and strontium ferrite powder.

4. A welding screen comprising:

a primary barrier, the primary barrier made of magnetic sheet, wherein the magnetic sheet is flexible;

a frame on a stand to maintain the primary barrier in place, wherein the primary barrier is affixed within the frame; and

at least one window region within the primary barrier, the at least one window region made of heat resistant, transparent polymer sheet.

5. The welding screen of claim 4 wherein the primary barrier is a replaceable curtain of size adapted to fit within the frame.

6. A portable free standing welding splatter protection device comprising a partial dome of flexible magnetic sheeting affixed to a rigid base, the flexible magnetic sheeting to magnetically attract and collect welding and grinding byproducts.

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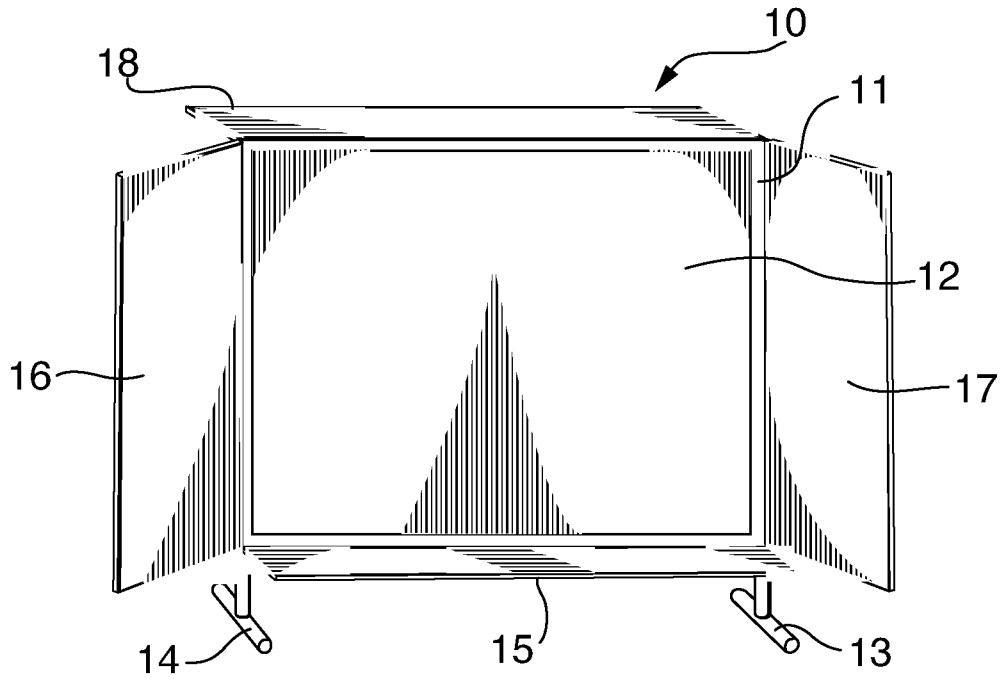


FIG. 1

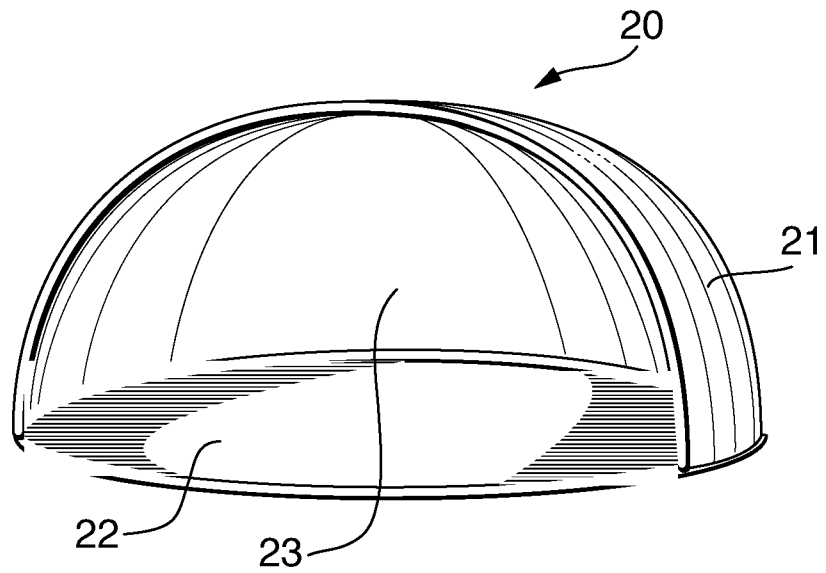


FIG. 2

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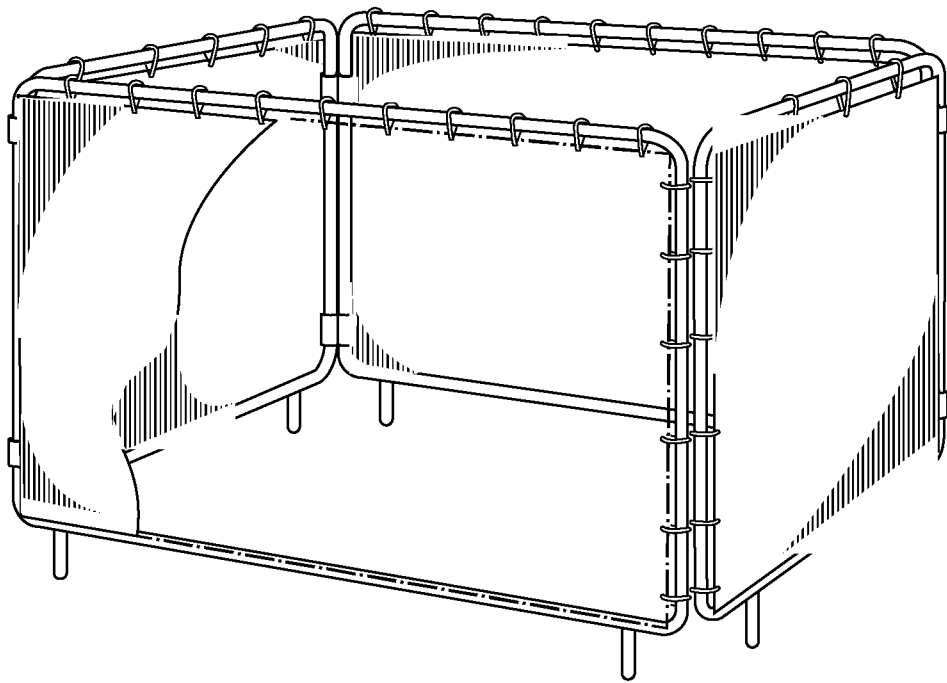


FIG. 3

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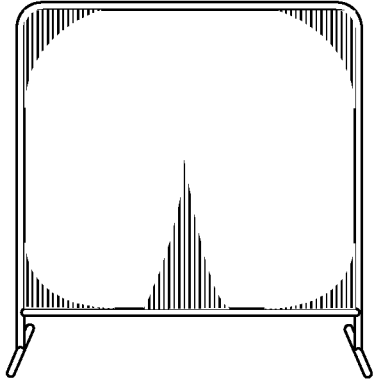


FIG. 4a

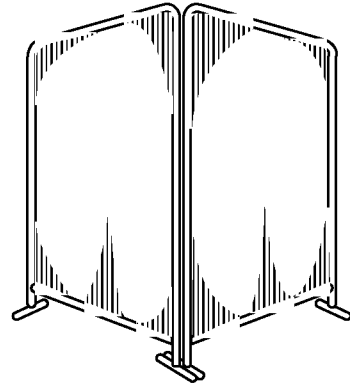


FIG. 4b

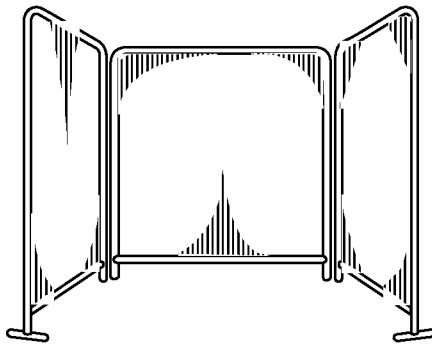


FIG. 4c

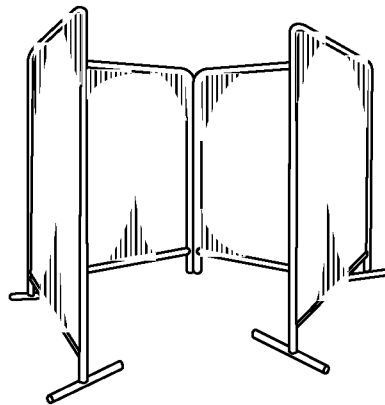


FIG. 4d

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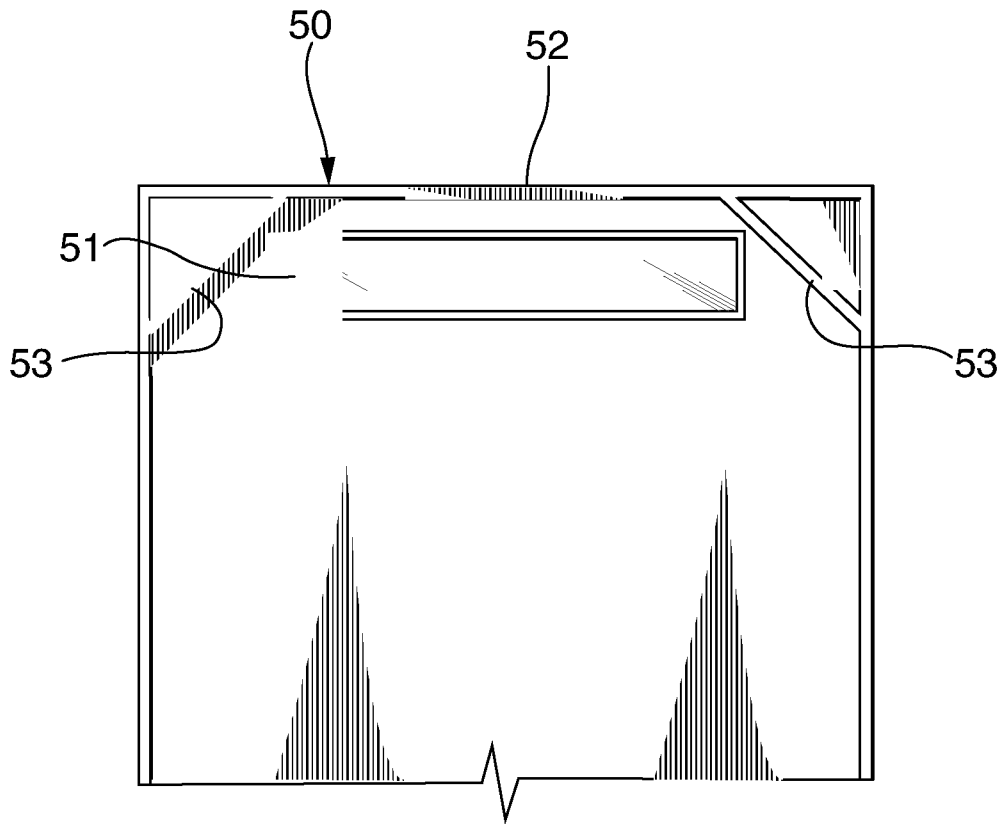


FIG. 5

