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(54) Benævnelse: **SERVERRACK-BLÆNDPANEL OG SYSTEM**

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DESCRIPTION

STATEMENT REGARDING RELATED APPLICATIONS AND CLAIM TO PRIORITY

[0001] This application claims priority to U.S. Provisional Application 60/965,705, filed on August 21, 2007, and U.S. Provisional Application 60/998,718, filed on October 12, 2007. The aforementioned applications are both hereby incorporated by reference in their entirety.

STATEMENT REGARDING FEDERALLY SPONSORED RESEARCH OR DEVELOPMENT

[0002] Not applicable.

SEQUENCE LISTING, TABLE OR COMPUTER PROGRAM ON COMPACT DISC

[0003] Not applicable.

FIELD OF INVENTION

[0004] This invention relates generally to a panel and system that restricts airflow relative to computer server racks. More specifically, it relates to an assembly of at least one panel on at least one computer server rack, where the panel is scalable, meaning that it may be adjusted to conform to the open and unoccupied facial space on the server rack, so as to aid in preventing the circular flow and re-entry of high temperature air into the air intake of a server, thereby aiding in preventing the overheating of the server.

BACKGROUND OF THE INVENTION

[0005] Computer equipment and data centers have thermal cooling requirements in order to function properly. A high amount of electricity is required for one server to operate, which generates a great deal of heat within the casing of the server. This heat can cause numerous problems for the equipment, including operational failures and physical damage. In order to prevent the server from overheating, internal fans are typically integrated into the server to provide both an intake of cooler air, which may be ambient or conditioned, and an output of hot air. Most commonly, the intake of cooler air occurs at the front of the server, and the output of hot air occurs at the rear of the server. Servers are housed in server racks. When stored in server racks, the servers are all typically aligned such that the cooler air intake for all of the servers is on one side of the server rack, preferably the front of the rack, and the hot air output

for all of the servers is on the other side of the server rack, preferably the rear of the rack. This arrangement of one or more servers creates an air flow from the front of the server rack to the rear of the server rack, where the flow can intensify with an increase in the number of servers, due to the BTU output or certain types of high amperage Blade servers producing high amounts of heat.

[0006] Controlling high temperatures within data centers is very difficult and complex. Yet, keeping computers and data center equipment at the right temperature is critical for the life of the equipment. Such electronic equipment must be maintained in appropriate temperature environments subject to regulated rates of temperature change in order to maintain equipment reliability, abide by electronic equipment warranty provisions and ascertain optimum energy usage. Achieving these requirements is an ever constant and evolving concern for the data center facility manager due to the fact that computer and data processing equipment trend toward increasing the amount of power usage, and thus thermal output and cooling demand.

[0007] A problem may arise, however, when a server rack is not completely filled with servers. This empty space may permit the air intake of a server to draw the air output from the rear of the server, creating a cycle of air around and to the front of the server. Such a cycling of air does not permit cooler air to be drawn in, but instead draws in warm air that does not aid in the cooling of the server equipment, and instead can cause the server to overheat. To solve this problem, some data centers have installed panels to cover the space that would normally be covered by a face of a server. This covering blocks the circulation of warm air output into the air intake and allows whatever systems are in place within the data center to provide cooler air, such as a Computer Room Air Conditioner (CRAC), to effectively cool the servers.

[0008] Server rack-mounted equipment are typically measured against an international standard known as the Electronic Industries Alliance (EIA) standard unit, also known as a Rack Unit, or a Rack U (U). Each U is equal to 4.4 centimeters (1.75 inches) in height, and the height of server racks is commonly described in the art as being a certain number of U's high. Server racks may be of any height, however they are typically of a height of between 42 U to 46 U, or greater.

[0009] However, the current apparatuses for covering openings in server racks to prevent the aforementioned air circulation are inefficient and problematic. Existing panels to cover server rack spaces might have to be installed individually, with one piece to cover each 1U empty server space. Existing panels to cover server rack spaces do not necessarily permit the use of a single panel to cover the entire unoccupied space on the rack, in that existing panels are manufactured and sold in fixed heights, which can cause the need to affix more than one panel. Panels to cover server rack spaces should be made of fire-rated material, and be able to withstand continuous duty heat associated with this use, as well substantially block air circulation. Existing means for covering server racks spaces may include the use of tools, such as drills, that can damage the material to cover the spaces, as well as be inaccurate and create additional waste or messes. Existing means for affixing the material to the server racks 'to cover the spaces may include tape, Velcro, magnets and other inefficient means. There is

thus a need in the art for a system that can restrict airflow in the front of a server rack which is fire-rated and can be easily installed, modified and removed, and complies with standard industry server rack measurements. A blank panel for use with rack units is described in US 6 758 353. The blank panel comprises at least one face plate having a rectangular front plate surface, a back plate surface, top plate surface, bottom plate surface and two side plate surfaces. The face plate has a height corresponding to multiples of 4.45 centimetres (1.75 inches). The face plate incorporates a means for slidably receiving fasteners. The blank panel further comprises fasteners with mating portions for being slidably engaged with the face plate, and fastening portions for being further attachable to a rack unit. The fasteners have varied geometry to accommodate rack units with alternate configurations. The blank panel further comprises a plurality of face plates attached along the top and bottom plate surfaces. Each of the face plates is capable of individually receiving fasteners. The individual face plates of the blank panel are also modular and can be separated to configure the blank panel to varied height requirements.

SUMMARY OF THE INVENTION

[0010] The present invention meets the need in the art by providing a scalable system that allows for a single panel of the invention to be easily modified, preferably without the use of tools, to fit on a server rack, preferably a server rack that meets EIA Mounting Rail Specification EIA 310, where the single panel is so modified as to cover the desired amount of open space on a server rack, where the panel is fire-rated, and where the modified panel may be easily installed onto the server rack to as to cover the open space thereon, and prevents the circular flow of warm air output from entering the cooler air input of the servers housed on the server rack. It is within the spirit and scope of this invention for multiple panels of the invention to be used on a single server rack, which will depend on the configuration, and hence the open space of a server rack. It is an object of the present invention to provide a system that conforms to and is compatible with EIA standards.

[0011] The EIA 310 standards, which are well-known by those of ordinary skill in the art, are detailed in part in FIG. 6, which is a close up view of a portion of a server rack, showing EIA 310 standard spacing between the holes in the rack, as well as the relative location of the rack unit to the holes on a server rack. Additionally, EIA 310 standards dictate that the height of a single Rack Unit (U or RU) is 4.4 centimetres (1.75 inches). EIA standards further dictate that the horizontal spacing between the two rails in a server rack are 45.1 centimetres (17.75 inches), and that the horizontal spacing between two holes on opposing rails in a rack are 46.514 centimetres (18.3125 inches) from the center of one hole to the center of the other hole.

[0012] The system is adjustable in height, which is achieved by the separation of panel pieces along scored perforations between the pieces.

[0013] By virtue of its non-destructive mounting feature and the ease with which the panel

pieces and aperture scorings are removed and separated, the system can be easily reconfigured as spatial needs change.

[0014] When installed, the system restricts airflow around servers within the racks. By restricting airflow, the system allows data centers to save electricity and costs associated with electricity usage, as well as additional costs associated with maintaining and replacing servers or server equipment due to overheating, elongating the equipment life. In many circumstances, installation of the system may lower costs associated with the purchase of one or more computer room air conditioning units. By increasing efficiency of such an air conditioning unit, the invention may lower electricity costs. The system may reduce the number of such air conditioning units required to cool a data center, when used in concert with additional air restriction or control means, such as sub-plenum or baffling. The system is removable and repositionable thereby allowing data center managers increased flexibility in arranging equipment within a data center. The system according to the present invention is constructed of material that is more flexible and easier to work with than sheet metal, fiberglass, or other materials currently known in the art. The cost of labor for installation of the system may also be less expensive than the professional installation of substitute materials, due to the ease of installation. These and other advantages and features of the present invention will become apparent from the following detailed description in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0015]

FIG. 1 is an embodiment of a full panel of the present invention.

FIG. 2 is a close up view of an embodiment of three joined panel pieces, with a center break down the middle of the sections to show both ends of the sections on a single drawing.

FIG. 3 is another embodiment of a full panel of the present invention.

FIG. 4 is a close up view of another embodiment of three joined panel pieces, with a center break down the middle of the sections to show both ends of the sections on a single drawing.

FIG. 5 is a close up view of yet another embodiment of three joined panel pieces, with a center break down the middle of the sections to show both ends of the sections on a single drawing.

FIG. 6 is a close up view of a portion of a server rack, showing EIA 310 standard spacing between the holes in the rack, as well as the relative location of the rack unit to the holes on a server rack.

DETAILED DESCRIPTION OF THE INVENTION

[0016] The invention is an EIA rack enclosure blanking panel system comprised of lightweight and flexible material that may be easily modified and easily installed upon computer server racks without destructive attachment to the racks, or any additional equipment. After installation, blanking panel pieces of the system may be easily removed from the server rack. Upon removal from the server rack, the pieces may be further separated from each other and re-installed upon the server racks. In the preferred embodiment the blanking panel pieces are scored to allow for break-apart sizing and shaping. Due to their break-apart or tear-away construct the desired configuration of blanking panel pieces may be achieved with or without tools.

[0017] In an embodiment, the panel is between about 47.6 centimetres to about 49.5 centimetres (18.75 inches to about 19.50 inches) wide. In a preferred embodiment, the panel is between about 48.3 centimetres to about 48.9 centimetres (19.00 inches to about 19.25 inches) wide. In a particularly preferred embodiment, the panel is about 48.3 centimetres (19.00 inches) wide, more preferably exactly 48.3 centimetres (19.00 inches) wide. In another particularly preferred embodiment, the panel is about 48.8 centimetres (19.25 inches) wide, more preferably exactly 48.8 centimetres (19.25 inches) wide.

[0018] In a preferred embodiment, the panel is several U's in height, more preferably 27 U's in height or greater. In a particularly preferred embodiment, the panel is scored horizontally such that the panel is divided into equal, substantially identical separable pieces, each piece being about one U in height. In a preferred embodiment, each piece is exactly one U in height. In another embodiment of the present invention, each piece on a panel is exactly two U in height.

[0019] In another embodiment of the present invention, each piece on a panel is uniform in height throughout the panel, and the height of each piece is *n* U in height, where *n* is an integer. As an example of this embodiment, in a 27 U panel, there may be nine pieces, each piece being 3 U high. As another example of this embodiment, in a 27 U panel, there may be 27 pieces, each being 1 U high.

[0020] In another embodiment of the present invention, the pieces on a single panel are not uniform in height throughout the panel, but rather are of a of variety heights, where the height of any individual piece may be represented as y U high, where y is an integer. As an example of this embodiment, in a 27 U panel, there may be three pieces that are each 4 U high, three pieces that are each 3 U high, and three pieces that are each 2 U high. As another example of this embodiment, in a 27 U panel, there may be nine pieces that are each 2 U high, and nine pieces that are each 1 U high.

[0021] In another embodiment of the present invention, the panel comprises a single piece that is z U high, where z is an integer. As an example of this embodiment, in a 27 U panel, there is one piece that is 27 U high.

[0022] In an embodiment, the panel is further scored, in addition to the scoring between the pieces, such that, on both of the opposite horizontal ends of each piece of the panel, an aperture scoring is present. In another embodiment, the panel is further scored, in addition to the scoring between the pieces, such that, on the opposite horizontal ends of each piece of the panel, three aperture scorings are present. In a particularly preferred embodiment, the aperture scorings are present such that the panel of the present invention substantially corresponds with at least some of the rail holes of a server rack that substantially complies with EIA mounting hole locations.

[0023] In an embodiment, the panel is further scored, in addition to the scoring between the pieces, such that, on the opposite horizontal ends of each piece of the panel, at least one aperture scoring, in the shape of a circle, is present.

[0024] In an embodiment, the panel is further scored, in addition to the scoring between the pieces, such that, on the opposite horizontal ends of each piece of the panel, at least one aperture scoring, in the shape of an ellipse, is present.

[0025] In an embodiment, the panel is further scored, in addition to the scoring between the pieces, such that, on the opposite horizontal ends of each piece of the panel, at least one aperture scoring, in the shape of a rectangle, is present.

[0026] In an embodiment, the panel is further scored, in addition to the scoring between the pieces, such that, on the opposite horizontal ends of each piece of the panel, at least one aperture scoring, in the shape of a 'T' shape, is present, where a 'T shape' refers to a shape that comprises two substantially perpendicular line segments of some width greater than zero, where one line segment terminates at the midpoint of the other line segment.

[0027] In an embodiment, the panel is further scored, in addition to the scoring between the pieces, such that, on the opposite horizontal ends of each piece of the panel, at least one aperture scoring, in the shape of a half-racetrack, or a 'U' shape, is present.

[0028] In a preferred embodiment, the panel is further scored, in addition to the scoring between the pieces, such that, on the opposite horizontal ends of each piece of the panel, at least one aperture scoring, in a rounded 'T' shape, is present.

[0029] In a preferred embodiment, the panel is further scored, in addition to the scoring between the pieces, such that, on the opposite horizontal ends of each piece of the panel, at least one aperture scoring, in a rounded rectangle shape, is present.

[0030] In a more preferred embodiment, where only one aperture scoring is present on each opposite horizontal end of each piece, the aperture scoring is uniform throughout the panel, and occurs halfway up each piece vertically.

[0031] In a preferred embodiment, where a piece *n* U high, that piece has 2*n* aperture

scorings, where *n* is an integer, and the piece has an even amount of aperture scorings on each opposite end of the piece, and the aperture scorings are evenly spaced through the opposite horizontal ends of the piece.

[0032] In an embodiment, where a piece is *n* U high, that piece has four aperture scorings, located substantially near the four corners of the piece.

[0033] The terms "scored" or "scoring" as used in this patent application are defined to include marks or lines created upon a surface by way of scoring, press-cutting, perforating, etching, laser cutting, knife cutting, or any other technique that results in the incomplete cutting or removal of material.

[0034] It is an embodiment of this invention, and it is understood by those of ordinary skill in the art that where the terms "scored" or "scoring" as used in this patent application in reference to the apertures, those terms also embrace as equivalents any scoring, press-cutting, perforating, etching, laser cutting, knife cutting, or any other technique that results in the complete cutting or removal of material.

[0035] In the preferred embodiment, the aperture scoring areas of the panel pieces constitute "pop-out sections." These pop-out sections may be removed by hand from the panel pieces by application of pressure applied upon the area of the panel pieces within the aperture scoring outline. In the preferred embodiment, the pressure necessary to remove the pop-out section is finger pressure. Alternatively, the pop-out section can be pressed out with a tool or can be cut out by drawing a knife-edge or sharp tool along the scored outline. Once the pop-out section is removed, a fastener-accepting aperture results in the location of the former pop-out section.

[0036] In a preferred embodiment, the panel should be of a relatively thin material. In a preferred embodiment, the panel should be of a relatively thin, fire-retardant material. In a preferred embodiment, the panel should be thin enough that it may be readily attached to a server panel through the use of mounting equipment known by those of ordinary skill in the art, such as brackets, screws, pins, pegs, bolts, hooks and other similar equipment. In a preferred embodiment, the panel may be substantially comprised of thermoplastic material, such as Acrylonitrile butadiene styrene (ABS). In another preferred embodiment, the panel may be substantially comprised of Chlorinated Polyvinyl Chloride or Chlorinated Polyvinylidine Chloride. In another preferred embodiment, the panel may be substantially comprised of Polyphenylene oxide-styrene (POS). In another preferred embodiment, the panel may be substantially comprised of plexiglass. In another preferred embodiment, the panel may be substantially comprised of high-density polyethylene (HDPE). In another preferred embodiment, the panel may be substantially comprised of any polypropylene compound.

[0037] Referring to **FIG. 1,** there is shown generally an embodiment of a full panel **10** of the present invention, this particular panel being about 27 U in height **14.** Each piece **16** is uniform in height and width **12,** and each piece has two half-racetrack shaped scoring apertures **18** on the opposite ends of the piece **16.**

[0038] Referring to **FIG. 2,** there is shown a close up view of an embodiment of three joined panel pieces **16,** where a pair of jagged lines **20** represents a continuation of the pieces, which has been done to fit the figure onto one page for close inspection. Each piece is uniform in height **22** and width **12,** and each piece **16** has two half-racetrack shaped scoring apertures **18** on the opposite ends of the piece **16.** Each aperture **18** is located within the center of the edge of the piece on which the aperture resides, such that the measurements **30** from the each of the edges of the apertures **18** to the scored edges of the piece on which it resides are equidistant. Similarly, the center of the aperture **18** is aligned such that it is halfway down the edge of the piece **24.** Each aperture is of a uniform length **28** and height **32,** and in a uniform location throughout all of the pieces **16** of the panel. The apertures **18** on each piece **16** are equidistant **26** from each other throughout the panel. Each piece **16** has been scored **34** so as to permit ready separation from adjacent pieces **16.** Each aperture **18** has been scored **36** so as to permit ready separation from the piece **16** on which it resides.

[0039] Referring to **FIG. 3,** there is shown generally another embodiment of a full panel **10** of the present invention, this particular panel being about 27 U in height **14.** Each piece **16** is uniform in height and width **12,** and each piece has two rounded T shaped scoring apertures **38** on the opposite ends of the piece **16.**

[0040] Referring to **FIG. 4,** there is shown a close up view of an embodiment of three joined panel pieces **16,** where a pair of jagged lines **20** represents a continuation of the pieces, which has been done to fit the figure onto one page for close inspection. Each piece is uniform in height **22** and width **12,** and each piece **16** has two rounded T shaped scoring apertures **38** on the opposite ends of the piece **16.** Each aperture **38** is located within the center of the edge of the piece on which the aperture resides, such that the measurements **30** from the each of the edges of the apertures **38** to the scored edges of the piece on which it resides are equidistant. Similarly, the center of the aperture **38** is aligned such that it is halfway down the edge of the piece **24.** Each aperture is of a uniform length **28.** Each aperture is of a uniform height, both in the narrowest height **40** and in the widest height **42.** Each aperture is in a uniform location throughout all of the pieces **16** of the panel. Each aperture is of a uniform depth **44** from the edge of the piece to the widest region of the aperture. Each aperture is of a uniform depth **46** throughout the widest region of the aperture. The apertures **38** on each piece **16** are equidistant **26** from each other throughout the panel. Each piece **16** has been scored **34** so as to permit ready separation from adjacent pieces **16.** Each aperture **38** has been scored **36** so as to permit ready separation from the piece **16** on which it resides. In this particular embodiment, the scoring **34** between the pieces results in nicks **48** that serve to hold the pieces **16** together until perforation. The spacing **50** between the nicks **48** is uniform in length throughout the perforations between the pieces.

[0041] Referring to **FIG. 5,** there is shown a close up view of yet another embodiment of three joined panel pieces **16,** where a pair of jagged lines **20** represents a continuation of the pieces, which has been done to fit the figure onto one page for close inspection. Each piece is uniform in height **22** and width **12,** and each piece **16** has two rounded rectangle shaped scoring

apertures **52** on the opposite ends of the piece **16.** Each aperture **52** is located within the center of the edge of the piece on which the aperture resides, such that the measurements **30** from the each of the edges of the apertures **52** to the scored edges of the piece on which it resides are equidistant. Similarly, the center of the aperture **52** is aligned such that it is halfway down the edge of the piece **24.** Each aperture is in a uniform location throughout all of the pieces **16** of the panel. Each aperture is located at a uniform depth **54** from the edge of the piece to the outermost edge of the aperture. Each aperture is located at a uniform depth **62** from the edge of the piece to the innermost edge of the aperture. Each aperture is of a uniform height **56.** Each aperture is of a uniform width **58.** The apertures **52** on each piece **16** are equidistant **26** from each other throughout the panel. The centers of the apertures **52** on each piece **16** are equidistant **60** from each other throughout the panel. Each piece **16** has been scored **34** so as to permit ready separation from adjacent pieces **16.** Each aperture **52** has been scored **36** so as to permit ready separation from the piece **16** on which it resides. In this particular embodiment, the scoring **34** between the pieces results in nicks **48** that serve to hold the pieces 16 together until perforation. The spacing 50 between the nicks 48 is uniform in length throughout the perforations between the pieces.

[0042] In each embodiment herein, where scoring apertures are present, regardless of the width of the panel piece, the scoring apertures will substantially align with at least two opposing rack holes of an EIA compliant frame.

[0043] In a preferred embodiment, each panel piece has been scored on the ends of the panel piece, such that a half-racetrack shaped scoring aperture is present on each end, each aperture located substantially in the center of the respective vertical edges of the piece, each aperture being between about 0.64 to about 0.95 centimetres (about 0.250 to about 0.375 inches) high, and being located between about 1.59 to about 2.22 centimetres (about 0.625 to about 0.875 inches) from the vertical edge of the piece on both sides of the aperture, each aperture being about 1.746 centimetres (0.6875 inches) deep, measured horizontally from the edge of the piece to the furthest inside edge of the aperture.

[0044] In another preferred embodiment, each panel piece has been scored on the ends of the panel piece, such that a rounded T shaped scoring aperture is present on each end, each aperture located substantially in the center of the respective vertical edges of the piece, each aperture being between about 0.51 to about 0.95 centimetres (about 0.200 to about 0.375 inches) high at the narrowest region and being between about 0.76 to about 1.27 centimetres (about 0.300 to about 0.500 inches) high at the highest region. In this preferred embodiment, the apertures are located between about 0.76 to about 1.02 centimetres (about 0.300 to about 0.400 inches) from the edge of the end of the piece to the innermost scoring of the aperture.

[0045] In yet another preferred embodiment, each panel piece has been scored on the ends of the panel piece, such that a rounded rectangle shaped scoring aperture is present on each end, each aperture located substantially in the center of the respective vertical edges of the piece, each aperture being between about 0.89 to about 1.27 centimetres (about 0.350 to about 0.500 inches) high and being between about 0.51 to about 0.95 centimetres (about

0.200 to about 0.375 inches) wide. In this preferred embodiment, the apertures are located between about 1.84 to about 1.97 centimetres (about 0.725 to about 0.775 inches) from the vertical edge of the piece on both sides of the aperture. In this preferred embodiment, each aperture is about 1.746 centimetres (0.6875 inches) deep, measured horizontally from the edge of the piece to the furthest inside edge of the aperture.

[0046] In a preferred embodiment, the panel pieces have been scored such that between the scored pieces results are nicks that serve to hold the pieces together until perforation. The spacing between the nicks is uniform in length throughout the perforations between the pieces, and is preferably between about 0.51 to about 2.54 centimetres (about 0.200 to about 1.000 inches), more preferably between about 0.63 to about 1.27 centimetres (about 0.250 to about 0.500 inches). In this preferred embodiment, the nicks are of a uniform length throughout the perforations between the pieces, and are preferably between about 0.3969 to about 0.63 centimetres (about 0.15625 to about 0.250 inches) in length, and are preferably about 0.0794 centimetres (0.03125 inches) in length.

[0047] In a preferred embodiment, each panel piece has been scored three times on each of the ends of the panel piece, such that a series of three scoring apertures are present on each end, each aperture located equidistant from the two most adjacent scorings, whether those scorings are for an adjacent aperture or a scoring between two panel pieces, or the edge of the panel.

[0048] In a preferred embodiment, each panel piece has been scored three times on each of the ends of the panel piece, such that a series of three half-racetrack shaped scoring apertures are present on each end, each aperture located equidistant from the two most adjacent scorings, whether those scorings are for an adjacent aperture or a scoring between two panel pieces, or the edge of the panel. In this preferred embodiment, each aperture is between about 0.63 to about 0.95 centimetres (about 0.250 to about 0.375 inches) high, and is about 1.746 centimetres (0.6875 inches) deep, measured horizontally from the edge of the piece to the furthest inside edge of the aperture.

[0049] In a particularly preferred embodiment of the present invention, the system comprises a 27 U panel, where the panel is about 48.9 centimetres (19.25 inches) wide, and is about 120.0 centimetres (47.25 inches) high. In this particularly preferred embodiment, the panel has been scored such that each piece of the panel may be readily separated from the pieces directly adjacent to each piece, and has been scored so as to substantially prevent air flow through the scoring. In this particularly preferred embodiment, each panel piece has been additionally scored on the ends of the panel piece, such that a half-racetrack shaped scoring aperture is present on each end, each aperture located substantially in the center of the respective vertical edges of the piece, each aperture being about 0.63 centimetres (0.250 inches) high, and being located about 2.22 centimetres (0.875 inches) from the vertical edge of the piece on both sides of the aperture, each aperture being about 1.746 centimetres (0.6875 inches) deep, measured horizontally from the edge of the piece to the furthest inside edge of the aperture. In this particularly preferred embodiment, the panel has been scored such that

each half-racetrack shaped scoring aperture may be readily separated from the pieces on which it resides, and has been scored so as to substantially prevent air flow through the scoring.

[0050] As used herein, and as would be understood by those of ordinary skill in the art, the term "rounded rectangle" refers to a shape that is substantially rectangular, which includes a shape that is square, where the four corners have been rounded into equal arcical segments of ninety degrees.

[0051] As used herein, and as would be understood by those of ordinary skill in the art, the term "rounded T" refers to a shape that comprises two substantially perpendicular line segments of some width greater than zero, where one line segment terminates at the midpoint of the other line segment, and where at least two corners have been rounded into equal arcical segments of ninety degrees. In an embodiment of the term "rounded T", all of the corners have been rounded into equal arcical segments of ninety degrees. In an embodiment of the term "rounded T", the two line segments are of about equal length.

[0052] The present invention additionally includes a kit, where the kit comprises at least one server rack blanking panel of the present invention and additionally mounting equipment known by those of ordinary skill in the art, such as brackets, screws, pins, pegs, bolts, hooks and other similar equipment. The mounting equipment may be readily attached to the server rack blanking panel or pre-attached thereto, and may be attached either permanently or removably.

[0053] As can be seen by the embodiments and drawings disclosed herein, the present invention permits the easy and flexible application of the invention to empty server rack space. For example, on a typical server rack that is 46 U in height, where the top ten U are empty, and where computer equipment, including potentially servers, occupy the remainder of the rack, a section of the panel may be separated such that a sub-panel of ten panel pieces is removed from the remainder of the panel along the desired scored perforations. In this example, where each panel piece has one half-racetrack shaped scoring aperture on each end, these scoring apertures on the two opposite end pieces of this sub-panel may be removed along the scored perforations of those apertures, and potentially additional apertures may be so removed as desired. In this example, the sub-panel may then be affixed to the open space of the server rack, either on the front or the back of the rack, so as to prevent air flow from the rear of the equipment on the server rack from migrating to the front of the equipment on the server rack through the server rack. In this example, the sub-panel may be so affixed in a manner known by those skilled in the art, including those disclosed herein.

[0054] While specific embodiments have been shown and described, many variations are possible. The particular shape of the segments and scored lines and markings, scoring depths and aperture outlines including all horizontal and vertical orientations, dimensions and thicknesses may be changed as desired to suit the particular server rack with which the invention is used. The material and its configuration and number of segments may vary

although preferred embodiments are shown and described. The terms, descriptions and figures used herein are set forth by way of illustration only and are not meant as limitations. Those of ordinary skill in the art will recognize that many variations are possible within the scope of the invention, which is intended to be defined by the disclosure herein and their equivalents, in which all terms are meant in their broadest reasonable sense unless otherwise indicated.

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- US96570507P [0001]
- US99871807P [0001]
- US6758353B [0009]

SERVERRACK-BLÆNDPANEL OG SYSTEM

PATENTKRAV

1. Serverrack-blændpanel, der omfatter et panel (10), hvor panelet er mellem 47,6 centimeter (18,75 tommer) til 49,5 centimeter (19,50 tommer) i bredden, og hvor panelet er x U i højden, hvor x er et positivt heltal og U er 4,4 centimeter (1,75 tomme), og hvor panelet endvidere indbefatter en horisontal rilning (34), der definerer en flerhed af paneldele (16), der hver let kan adskilles fra én eller flere af de øvrige paneldele.

2. Serverrack-blændpanel ifølge krav 1, hvor hver paneldel (16) indbefatter mindst én åbningsrilning (36) på hver af dens modsatte horisontale ender, hvor hver åbningsrilning definerer en pop-ud-sektion, der selektivt kan fjernes for at danne en fastgørelsesmiddel-accepterende åbning (18, 38, 52), og hvor åbningsrilningerne på de modsatte horisontale ender af hvert panel flugter med mindst to modsatte huller af en EIA-kompatibel ramme.

3. Serverrack-blændpanel ifølge krav 1 eller 2, hvor flerheden af paneldele (16) har en afrivningskonstruktion.

4. Serverrack-blændpanel ifølge et hvilket som helst af kravene 1-3, hvor flerheden af paneldele (16) er ens, identiske adskillelige dele.

5. Serverrack-blændpanel ifølge et hvilket som helst af kravene 1-4, hvor flerheden af paneldele (16) hver er en U i højden (22).

6. Serverrack-blændpanel ifølge et hvilket som helst af de foregående krav, hvor x er mellem 2 og 27 inklusive.

7. Serverrack-blændpanel ifølge et hvilket som helst af de foregående krav, hvor panelet (10) omfatter et brandhæmmende materiale.

8. Serverrack-blændpanel ifølge et hvilket som helst af de foregående krav, hvor panelet (10) består af et materiale, der er udvalgt fra gruppen bestående af acrylonitrilbutadienstyren, chlorineret polyvinylchlorid, chlorineret polyvinylidinchlorid, polyphenylenoxid-styren, plexiglas, højdensitetspolyethylen og en polypropylenforbindelse.

9. Serverrack-blændpanel ifølge et hvilket som helst af de foregående krav, når det afhænger af krav 2, hvor hver pop-ud-sektion er tilpasset til at blive fjernet manuelt ved anvendelse af et fingertryk mod et område af panelet inde i åbningsrilningen (36), der definerer pop-ud-sektionen.

10. Serverrack-blændpanel ifølge et hvilket som helst af de foregående krav, hvor panelet (10) er fleksibelt.

11. Serverrack-blændpanel ifølge et hvilket som helst af de foregående krav, når det afhænger af krav 2, hvor hver åbningsrilning (36) har en form, der er udvalgt fra gruppen bestående af en cirkel, en ellipse, et rektangel, en T-form, en U-form, en afrundet T-form og en afrundet rektangelform.

12. Serverrack-blændpanel ifølge et hvilket som helst af de foregående krav, når det afhænger af krav 2, hvor åbningsrilningen (36) er i form af en afrundet rektangelformet rilningsåbning (52), og hvor én åbning er til stede på hver ende af hver del, og hvor hver åbning er placeret i centrum af de tilsvarende vertikale kanter (24) af delen (16), og hvor hver åbning er mellem 0,89 til 1,27 centimeter (0,350 til 0,500

tomme) høj og mellem 0,51 til 0,95 centimeter (0,200 til 0,375 tomme) bred, og hvor hver åbning er 1,75 centimeter (0,6875 tomme) dyb, målt horisontalt fra kanten af delen til den fjernest beliggende indvendige kant af åbningen.

13. Anordning, der omfatter et serverrack og serverrack-blændpanel ifølge et hvilket som helst af de foregående krav, hvilket serverrack-blændpanel dækker et åbent facialt rum på serverracket for at hjælpe med til at forhindre cirkelformet strømning af luft ved høj temperatur.

14. Fremgangsmåde til forhindring af cirkelformet strømning af luft ved høj temperatur i et serverrack ved anvendelse af et serverrack-blændpanel (10), hvor panelet er mellem 47,6 centimeter til 49,5 centimeter (18,75 tommer til 19,50 tommer) i bredden, og hvor panelet er x U i højden, hvor x er et positivt heltal og U er 4,4 centimeter (1,75 tomme), hvor panelet indbefatter horisontal rilning (34), der definerer en flerhed af paneldele (16), der hver let kan adskilles fra én eller flere af de øvrige paneldele, hvilken fremgangsmåde omfatter:

fjernelse én eller flere af paneldelene fra panelet for at justere en størrelse af panelet og

fastgørelse af panelet til serverracket.

15. Fremgangsmåde ifølge krav 14, hvor panelet har modsatte horisontale ender og mindst én åbningsrilning (36) på hver af de modsatte horisontale ender, hvor hver åbningsrilning definerer en pop-ud-sektion, der selektivt kan fjernes for at danne en fastgørelsesmiddel-accepterende åbning (18, 38, 52), hvilken fremgangsmåde omfatter:

fjernelse af mindst to af pop-ud-sektionerne for at danne mindst to fastgørelsesmiddel-accepterende åbninger; og

anvendelse af de to fastgørelsesmiddel-accepterende åbninger til at fastgøre panelet (10) til serverracket.

16. Fremgangsmåde ifølge krav 15, hvor fjernelse indbefatter fjernelse af hver pop-ud-sektion manuelt ved at påføre fingertryk på et område af panelet (10) inden for åbningsrilningen (36), der definerer pop-ud-sektionen.

17. Fremgangsmåde ifølge krav 15 eller 16, hvor fastgørelse indbefatter fastgørelse af panelet (10) til serverracket ved anvendelse af de to fastgørelsesmiddel-accepterende åbninger (18, 38, 52) og to fastgørelsesmidler.

18. Fremgangsmåde ifølge krav 14, hvor fjernelsen af én eller flere af paneldelene (16) udføres, før panelet (10) fastgøres til serverracket.

DRAWINGS

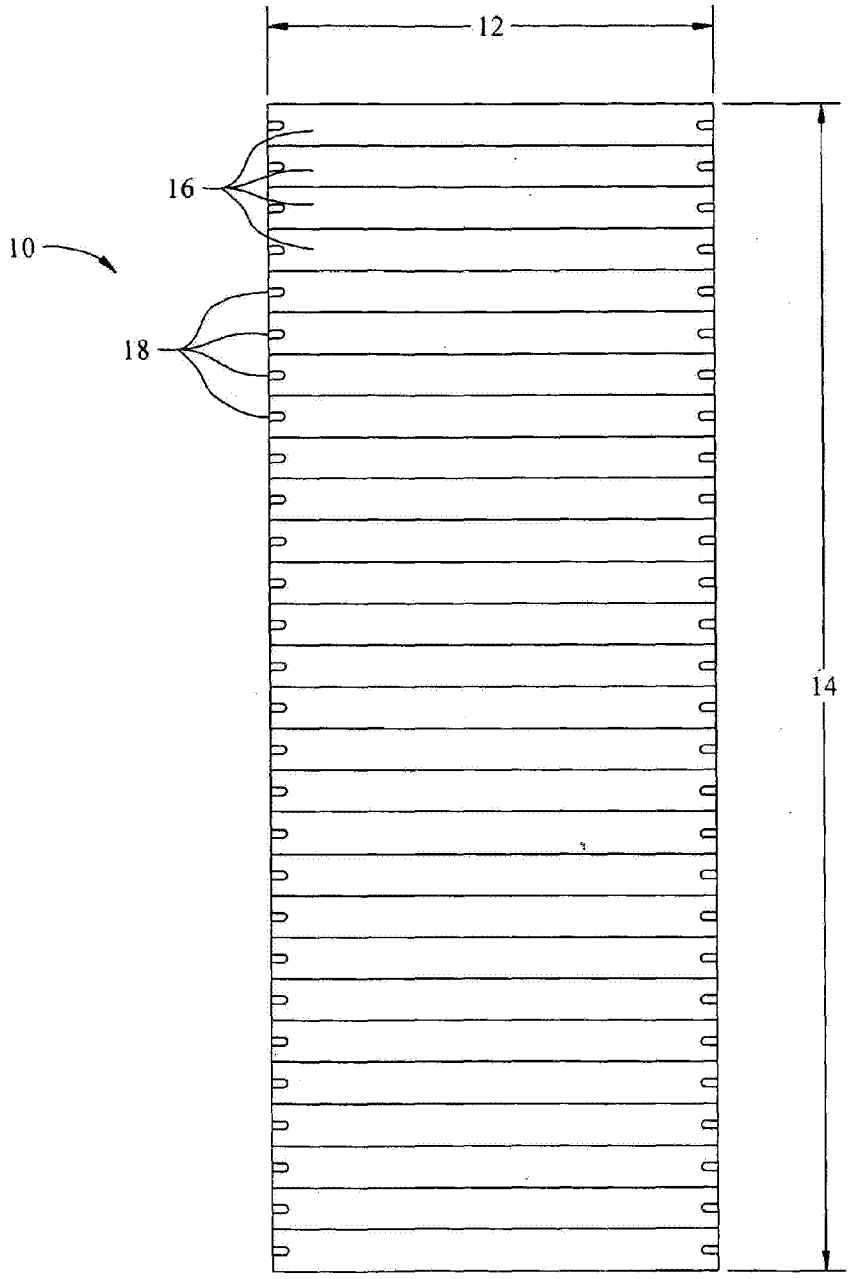

Fig. 1

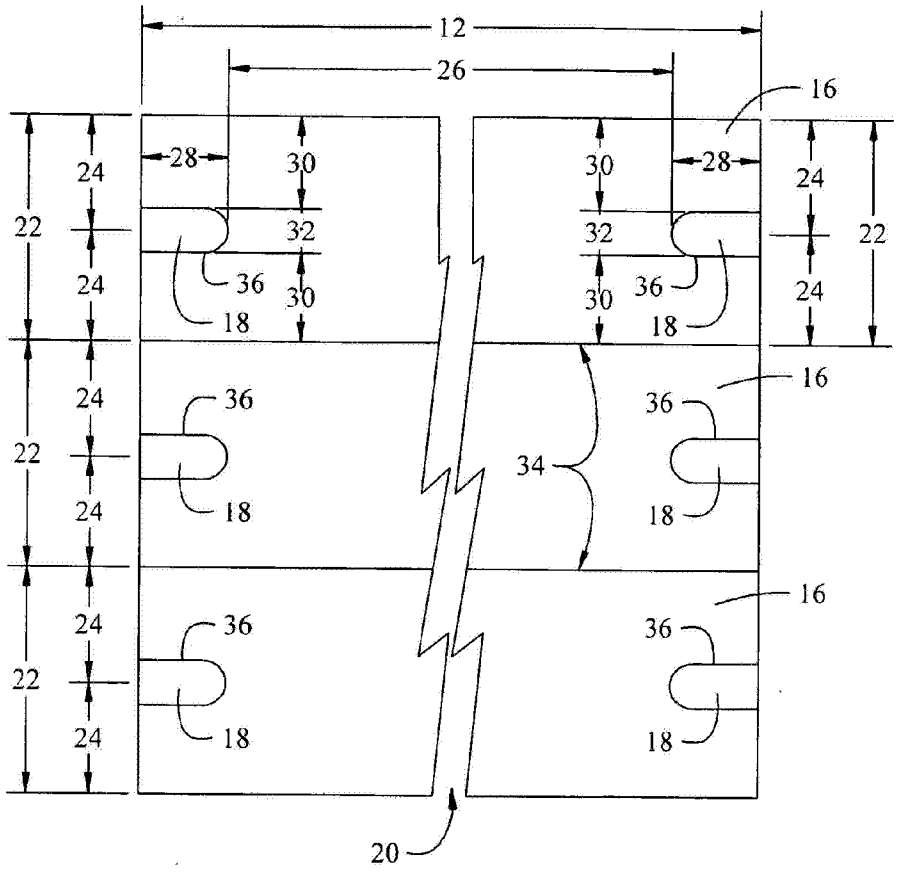

Fig. 2

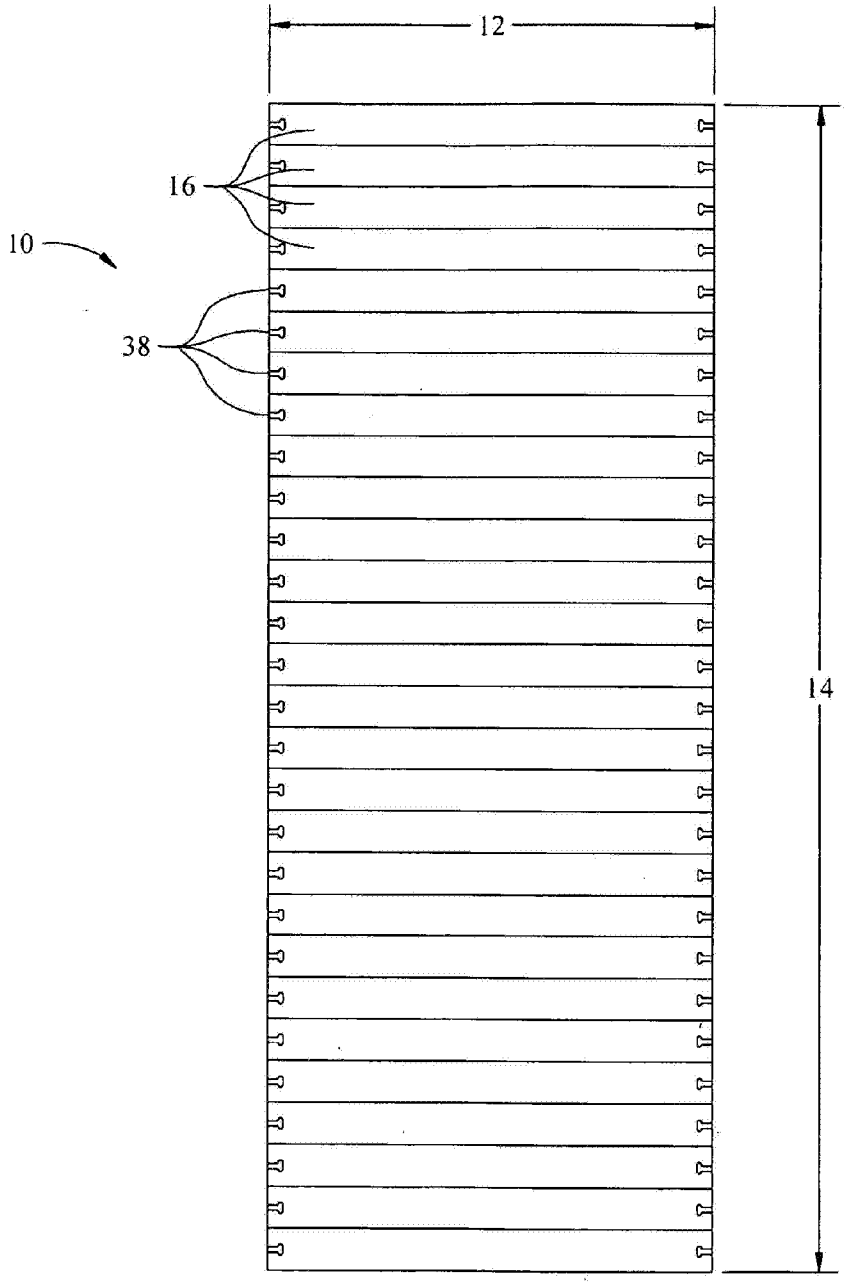

Fig. 3

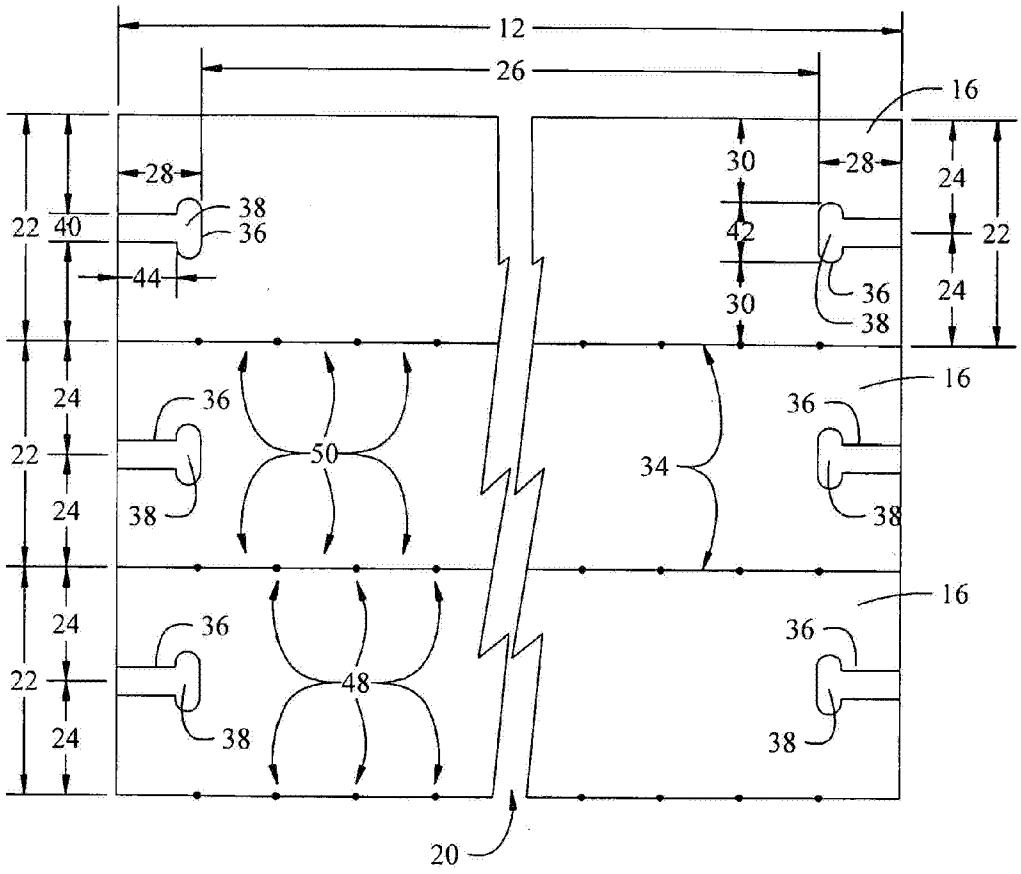
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Fig. 4

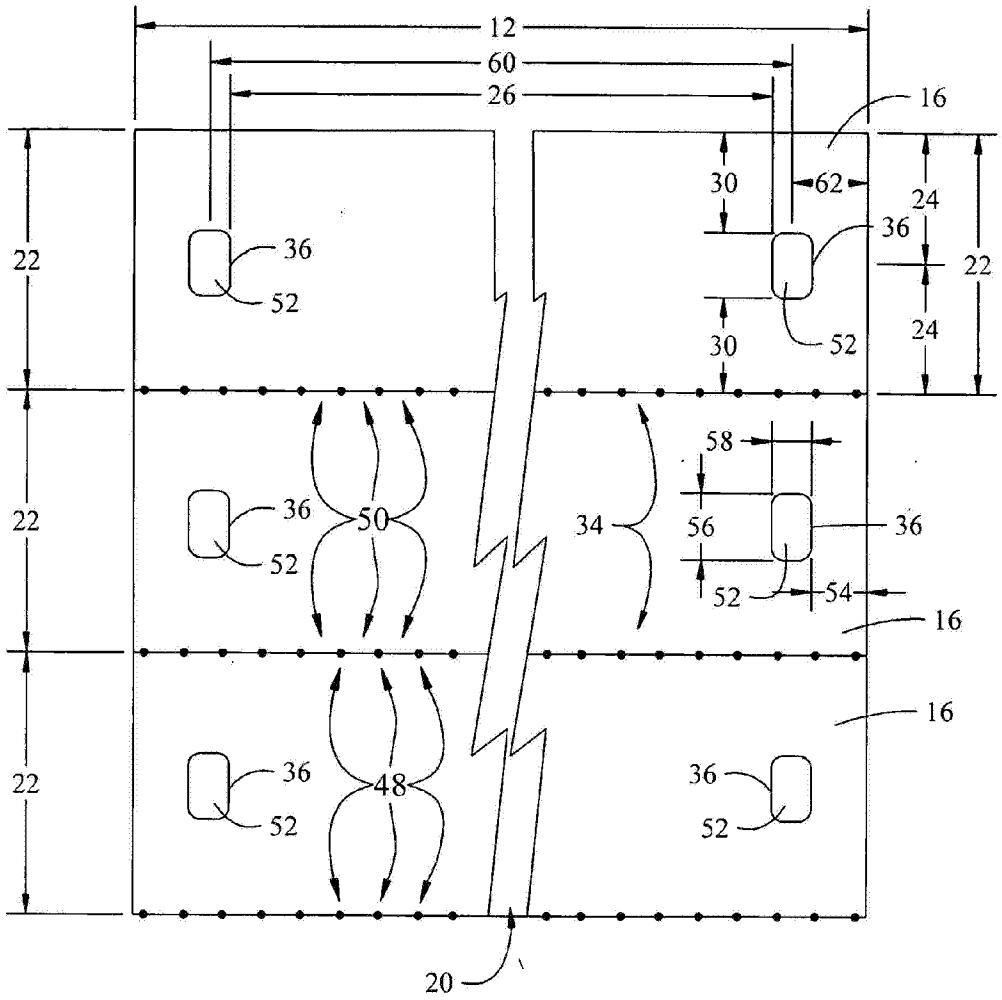

Fig. 5

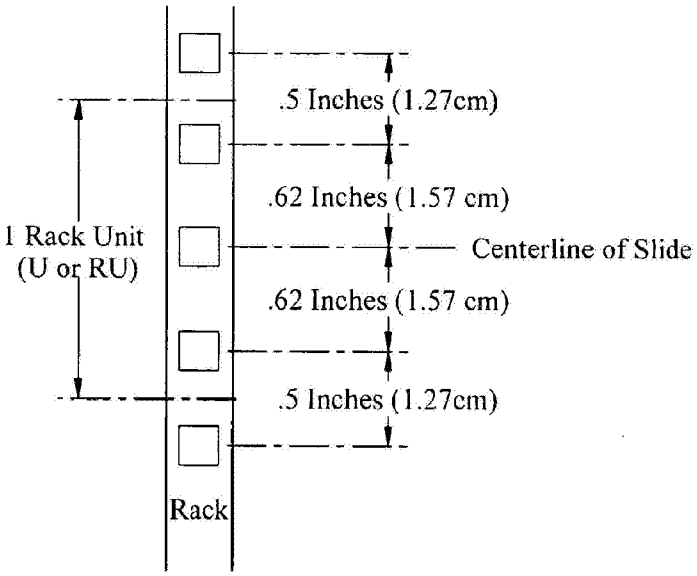
.5 Inches (1.27cm)
.62 Inches (1.57 cm)
1 Rack Unit
(U or RU)
Centerline of Slide
.62 Inches (1.57 cm)
.5 Inches (1.27cm)
Rack

Fig. 6