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M. J. GRUBELICH

3,074,520

CONTINUITY DEVICE

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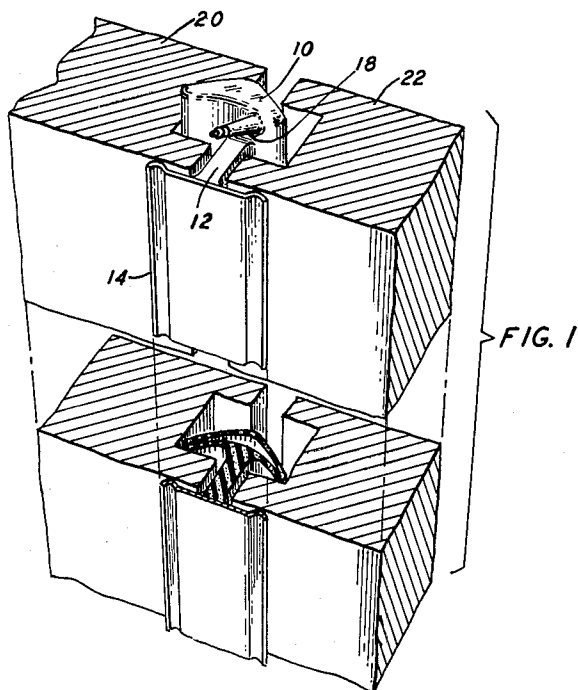


FIG. 2

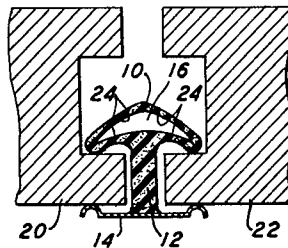


FIG. 3

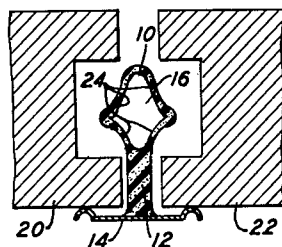


FIG. 4

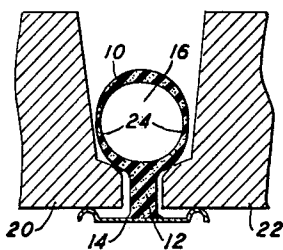


FIG. 6

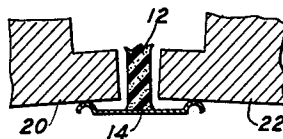


FIG. 7

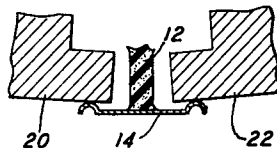
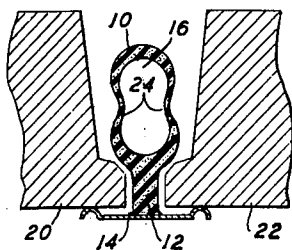


FIG. 5



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3,074,520

CONTINUITY DEVICE

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4 Claims. (Cl. 189-36)

This invention relates to continuity devices and particularly to means for providing electrical and/or surface continuity between spaced relatively movable bodies.

One particular application for which the present invention is intended is the bridging of sections of a high frequency radar antenna. It is desirable that the reflecting surface of such a radar antenna be a continuous surface without physical or electrical voids. Nevertheless, for the sake of portability and ease of repair and replacement, the antenna is usually formed in sections which are assembled together at the point of installation. To require that the sections when assembled form a continuous surface would place stringent limits on their manufacturing tolerances and thereby greatly increase their cost. A better approach appears to be to deliberately space the sections one from the other and then provide some means for bridging the spaces. However, with the sections spaced, relative movement between sections will occur when the antenna is in motion.

Accordingly, an object of this invention is to provide a device that bridges spaced relatively movable bodies, conducting current and/or covering the opening therebetween.

Another object of this invention is to provide a device of this type that develops uniform contact pressure against the bodies being bridged but does not hamper their relative movement.

A further object of this invention is to provide a device of this type that is inexpensive to manufacture and easy to use.

These and other objects of the invention are achieved in an illustrative embodiment thereof wherein the device comprises a bridging member secured to a closed hollow pneumatically deformable member, a pneumatically deformable member being herein defined as a component that is deformed by the pressure of air or any other fluid. The deformable member is resilient, and it is designed to assume one particular shape when it is deformed by inflation or evacuation and another particular shape when it is relaxed or undeformed by inflation or evacuation. The deformed shape allows the device to be easily positioned between the adjacent edges of two spaced relatively movable bodies, the deformable member being placed in grooves formed in the adjacent edges and the bridging member being placed adjacent to the surfaces on which the continuity is desired. Once the device is properly positioned, the pressure or vacuum in the deformable member is relieved, and its relaxed shape is such that it engages the grooves in the adjacent edges and biases the bridging member against the surfaces of the bodies.

Thus, a feature of this invention resides in a continuity device having a pneumatically deformable member that in an inflated or evacuated condition is easily positioned between spaced relatively movable bodies and in a relaxed condition biases a bridging member against the surfaces of the bodies.

A complete understanding of the invention and of this and other features and advantages thereof may be gained from consideration of the following detailed description taken in conjunction with the accompanying drawing wherein two embodiments of the invention are illustrated. It is to be expressly understood, however, that the drawing is for the purposes of illustration and de-

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scription and is not to be construed as defining the limits of the invention.

In the drawing:

FIG. 1 is a perspective view partly in section of a first embodiment of the device of this invention showing the pneumatically deformable member of the device in a relaxed condition whereby it biases the bridging member of the device into contact with the surfaces of two spaced relatively movable bodies;

FIG. 2 is a cross sectional view of the device in FIG. 1; FIG. 3 is a view similar to FIG. 2 but showing the deformable member in an inflated condition;

FIG. 4 is a cross sectional view of a second embodiment of the continuity device showing the deformable member in a relaxed condition;

FIG. 5 is a view similar to FIG. 4 showing the deformable member in an evacuated condition; and

FIGS. 6 and 7 are fragmentary cross sectional views showing how, when the deformable member is in a relaxed condition, the bridging member maintains continuity between the spaced bodies even though there is relative motion between the bodies.

Referring to the drawing, the continuity device comprises a pneumatically deformable member 10, hereinafter referred to as a tube, having a stem portion 12 affixed to a bridging member 14, hereinafter referred to as a cap. The tube is formed from a flexible material, such as rubber, and it is formed with a hermetically sealed cavity 16 extending therethrough. The cavity is in communication with a valve 18 that is advantageously integral with the tube and is located at a convenient point on the tube.

As illustrated in FIGS. 2 and 4, the tube 10 is designed to assume one particular shape when it is in a relaxed condition, that is, when there is no pressure differential between the inside and the outside thereof, and as illustrated in FIGS. 3 and 5, it is designed to assume another particular shape when it is in a deformed condition, that is, when there is a pressure differential between the inside and the outside thereof caused either by the introduction of air or some other fluid into the cavity 16 by the evacuation of air from the cavity.

Both shapes are determined by the configuration of the opening between the spaced relatively movable bodies to be joined, the bodies being indicated on the drawing by the reference numerals 20 and 22. Advantageously the juxtaposed surfaces of the bodies are notched or grooved as shown in FIG. 2, or relieved as shown in FIG. 4. The opening defined by the juxtaposed surfaces of the bodies then takes on the configuration of a constricted entryway leading into a cavity, the surfaces at the juncture of the entryway and the cavity providing ledges or shoulders. A relaxed shape is selected that includes lateral extremities that are spaced a greater distance apart than the width of the entry way and bearing portions that tend to assume positions that are spaced closer to the cap 14 than the length of the entryway. The lateral extremities prevent movement of the tube through the entryway and the bearing portions bear against the ledges or shoulders provided and bias the cap 14 against the external surfaces of the bodies. Then a deformed version of the relaxed shape is selected having a peripheral length (herein defined as the length of the line bounding the cavity of the tube when viewed in transverse cross section) that is substantially the same as the peripheral length of the relaxed shape but having this peripheral length rearranged to provide a second shape in which the lateral extremities are moved toward one another and the bearing portions are spaced a greater distance from the cap than the length of the entryway. This deformed shape permits the tube to be easily placed through the entryway and into the cavity.

To achieve the desired transition from the selected relaxed shape to the selected deformed shape, the tube 10 is designed with particular portions of the wall around the cavity thinner than the other portions, the thinner portions being indicated on the drawing by the reference numeral 24. When a pressure differential is created between the inside and the outside of the cavity, the pressure exerted on the wall is everywhere equal, but the portions of the wall that are thinner are more flexible and therefore flex to a greater degree than the thicker portions, thereby giving the tube the selected deformed shape.

In the embodiment in FIGS. 1, 2, and 3, the tube 10 is formed in the shape of a mouth with the midportions of the lower and upper lips thinner than the extremities. When the tube is in a relaxed position, the corners of the mouth, which are both the lateral extremities and the bearing portions of the tube, tend to move downward, thereby biasing the cap 14 against the spaced bodies. When the tube is in an inflated condition, both lips flex, thereby moving the corners of the mouth in toward each other and away from the cap.

In the embodiment in FIGS. 4 and 5, the tube 10 is formed in the shape of a cylinder with the walls at the side thinner than the walls at the top and the bottom. When the tube is in a relaxed condition, the bottom wall of the cylinder, which is the bearing portion of the tube, tends to assume a position that is closer to the cap than the length of the entryway, and thus the cylinder biases the cap 14 against the spaced bodies. When the tube is in an evacuated condition, the side walls, which are the lateral extremities of the tube, move in toward each other, thereby moving the bottom wall of the cylinder away from the cap.

The design of the cap 14 is determined by the function that the continuity device is to perform. If it is to provide only surface continuity between the spaced relatively movable bodies, it is designed to engage the surfaces along the entire length of the adjacent edges, and advantageously it can be formed from a highly flexible material, such as rubber, which will provide a good closure over the space between the bodies. If it is designed to provide only electrical continuity, it need only engage the electrically conductive portions of the surfaces of the bodies. It is designed to make a good electrical contact with these surfaces, and it is formed from an electrically conductive material, such as aluminum. If it is to provide both surface and electrical continuity between the bodies, it is designed to engage the surfaces along the entire length of the adjacent edges, making a good electrical contact with the conductive portions of the surface and a good closure against the entire length of the surfaces. In this case, it may be formed entirely from an electrically conductive material, or it may be a composite of conductive material and a highly flexible material.

In the utilization of the continuity device, the tube 10 is, depending upon how it is designed, either inflated or evacuated by the introduction or removal of fluid through the valve 18. In its deformed state, the tube is easily positioned between the spaced bodies, and the cap 14 is easily positioned adjacent to the surfaces of the bodies. The pressure or vacuum in the tube is then relieved through the valve, and the tube assumes its relaxed shape, whereby the cap is biased against the surfaces of the bodies. As shown in FIGS. 6 and 7, the contact between the cap and the surfaces of the bodies is maintained even though relative motion occurs between the bodies. To remove the continuity device from between the spaced bodies, it is again deformed by inflation or evacuation.

Although two embodiments of the invention have been illustrated and described in detail, it is to be expressly understood that the invention is not limited thereto. Various changes can be made in the design and arrangement of the parts without departing from the spirit and the scope of the accompanying claims.

What is claimed is:

1. In a structure including two spaced elements, each element having a first surface facing the first surface of the other element, a second surface extending from the first surface and diverging from the second surface of the other element, and a third surface extending from the first surface a spaced distance from the second surface and diverging from the third surface of the other element, the combination therewith of a device for providing continuity between the spaced elements, the continuity device comprising a bridging portion joined to a hollow pneumatically deformable portion, the bridging portion being positioned in juxtaposition with the second surfaces of the spaced elements at the same time that the deformable portion is positioned in juxtaposition with the third surfaces of the spaced elements, the deformable portion when in a relaxed condition having a first shape that includes portions that bear against the third surfaces and bias the bridging portion against the second surfaces, and the deformable portion when deformed by a pressure differential between the inside and outside thereof having a second shape in which the bearing portions are spaced a greater distance from the bridging portion than the distance between the second and third surfaces and thereby allow the continuity device to be removed from or positioned between the spaced elements.

2. In a structure including two spaced elements, each element having a first surface facing the first surface of the other element, a second surface extending from the first surface and diverging from the second surface of the other element, and a third surface extending from the first surface a spaced distance from the second surface and diverging from the third surface of the other element, the combination therewith of a device for providing continuity between the spaced elements, the continuity device comprising a bridging portion joined to a hollow pneumatically deformable portion, the bridging portion being positioned in juxtaposition with the second surfaces of the spaced elements at the same time that the deformable portion is positioned in juxtaposition with the third surfaces of the spaced elements, the deformable portion when in a relaxed condition having a first shape that includes lateral extremities that are spaced a greater distance apart than the distance between the first surfaces and thereby prevent the removal of the deformable portion through the space between the first surfaces, the deformable portion when deformed by a pressure differential between the inside and outside thereof having a second shape in which the lateral extremities are moved toward one another and thereby facilitate the removal or insertion of the deformable portion through the space between the first surfaces.

3. In a structure including two spaced elements, each element having a first surface facing the first surface of the other element, a second surface extending from the first surface and diverging from the second surface of the other element, and a third surface extending from the first surface a spaced distance from the second surface and diverging from the third surface of the other element, the combination therewith of a device for providing continuity between the spaced elements, the continuity device comprising a bridging portion joined to a pneumatically deformable portion, the bridging portion being positioned in juxtaposition with the second surfaces of the spaced elements at the same time that the deformable portion is positioned in juxtaposition with the third surfaces of the spaced elements, the deformable portion being hollow and the wall of the deformable portion selectively varying in flexibility, the deformable portions when in a relaxed condition having a first shape that has a particular peripheral length and includes portions that bear against the third surfaces and bias the bridging portion against the second surfaces, and the deformable portion when deformed by a pressure differential between the inside and outside thereof having a second shape in

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which the peripheral length thereof is substantially the same as the peripheral length of the first shape but the bearing portions are spaced a greater distance from the bridging portion than the distance between the second and third surfaces and thereby permits the continuity device to be removed from or positioned between the spaced members.

4. A continuity device comprising a pneumatically deformable portion joined to a bridging portion, the pneumatically deformable portion being hollow and the wall thereof selectively varying in flexibility, the deformable portion when relaxed having a first shape that has a particular peripheral length and includes bearing portions that are spaced a first distance from the bridging portion and lateral extremities that are spaced a second distance apart, and the deformable portion when deformed by a pressure differential between the inside and outside thereof having a second shape in which the pe-

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ripheral length thereof is substantially the same as the peripheral length of the first shape but the bearing portions are spaced a third distance from the bridging portion, which distance is greater than the first distance, and the lateral extremities are spaced a fourth distance apart, which distance is less than the second distance.

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