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REED-TYPE SWITCHING DEVICE

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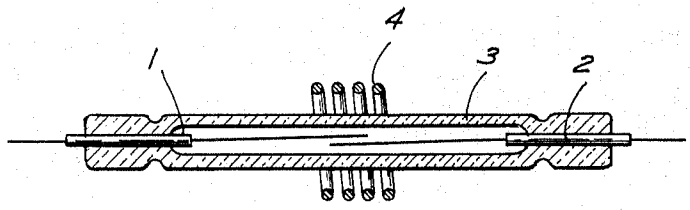

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REED-TYPE SWITCHING DEVICE

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The present invention refers to a dry reed switch, such as a reed switch in a sealed protective tube.

A reed switch of a known type is shown in the enclosed drawing. Two reeds 1 and 2 of magnetic material extend hermetically sealed through the ends of a protective tube 3. The inner ends of the reeds overlap each other, spaced apart. When energizing a magnetic coil 4 the magnetic field will bring the ends of the reeds in electrical contact with each other. When the magnetic field ceases, the contact will be opened.

With the known sealed protective tube contacts, the protective tube is normally filled with an inert gas, for instance nitrogen, often with an addition of hydrogen. The object of the gas is to avoid corrosion of the contact surfaces, so that the contact resistance remains low, the hydrogen neutralizing possible rests of oxygen. These contact devices ordinarily have a sufficiently long life at normal use in telephone equipment. When the contacts are used for heavy work, for instance for digit impulsing, the contacts do serve satisfactorily only for a limited time. The defects appearing on the contacts principally consist in sticking of the two contact parts. Such a sticking appears because of material propagation between the contact parts, whereby roughness appears on the surfaces of the contact parts so that they may stick together. This sticking appears the earlier, the heavier the current is that is closed and interrupted by the contact, and with certain uses entailing a great number of makes and breaks the life duration of these contacts is highly unsatisfactory.

This disadvantage is avoided by the invention, wherein the sticking tendency is reduced to such an extent that the life duration of the contact device is doubled many times over. This is obtained in such a manner that contrary to the known devices which have the purpose of eliminating rests of oxygen, the tube contains, besides the inert gas, an amount of oxygen per volume unit that is smaller or at the most equal to that present in ambient air. In tubes with a small volume a higher concentration of oxygen may be used, and conversely, in tubes having a large volume the concentration of oxygen must be lower. The oxygen present in the tube is to a certain extent consumed by oxidization of iron and nickel from the contacts, the quantity of oxygen chemically bound thereby being proportionally bigger the smaller the tube volume is, so that in a smaller tube the concentration of free oxygen is reduced more quickly than in a bigger tube, where the concentration is already lower from the beginning.

When the contact surfaces of used reed contacts of the conventional design are determined by means of a microscope and compared with reed contacts used in presence of oxygen, considerable differences are found between them. The former show a substantial surface roughness while the latter are comparatively smooth. This depends upon the influence of the oxygen and may be explained in the following way. The reed contacts are made of an alloy of iron and nickel and have at the contact surfaces a thin layer of some precious metal. When the current is interrupted, a material propagation occurs between the contact parts, said material propagation forming projections on the one surface and cavities

on the other surface. In the known devices these projections and cavities are slowly increasing and finally become so pronounced as to cause sticking by the roughness of the contact parts hooking together. In contradistinction thereto, when oxygen is present, iron and nickel particles uncovered by the material propagation and wear at the contact surfaces, are oxidized. The oxide to great extension forms an insulating protection at the surface points at which the current was interrupted. The next time the current is closed this generally occurs at other points which means that the contact points are constantly moved over the contact surfaces. Because of the presence of oxygen the projections on one of the contact parts respectively the cavities on the other contact part are many more and therefore much smaller.

It is of importance that the oxygen concentration is not too high. With a weak concentration of oxygen FeO and NiO are formed, and with higher concentration Fe_2O_3 and Ni_2O_3 are formed which latter oxides produce a higher contact consistence. Provided the air had free access a complete contact interruption would soon occur. Tests carried out show that the appropriate oxygen concentration is different for different contact materials. Thus it has been found convenient to use a higher oxygen concentration with gold contacts than, for instance, with rhodium contacts. A content of 1% oxygen and 99% inert gas seems to give a good increase of the life duration and so does also a concentration of oxygen of 20% (the concentration of oxygen in air) with 80% inert gas, which however as already mentioned gives a relatively high contact resistance. An oxygen content of up to 5% seems to give the best result.

I claim:

1. In a switching device of the kind including a closed tubular envelope, a pair of resilient contact reeds of magnetizable material extending into said envelope gas-tight sealed thereto and having parts within the envelope overlapping each other in spaced-apart relationship, and a coil disposed outside said envelope to flex said contact reeds into contact-making engagement upon excitation of the coil, the improvement comprising a gas mixture of an inert gas and oxygen contained in said envelope, the oxygen component in said mixture being less per volume unit than the oxygen content of atmospheric air.

2. A switching device according to claim 1, wherein the oxygen component in said mixture is between 1% to 20% per volume unit.

3. A switching device according to claim 1, wherein the oxygen component in said mixture is between 1% to 5% per volume unit.

4. A switching device according to claim 1, wherein the inert gas component in said mixture is nitrogen.

5. A switching device according to claim 1, wherein the engageable parts of said reeds are coated with a precious metal.

6. A switching device according to claim 1, wherein said contact reeds extend into said envelope from opposite ends thereof in mutually parallel relationship, the inner ends of said reeds overlapping each other.

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