Patents

Transmission Line Spacer Damper Device
US Patent 5,362,920
AR®Spacer Damper

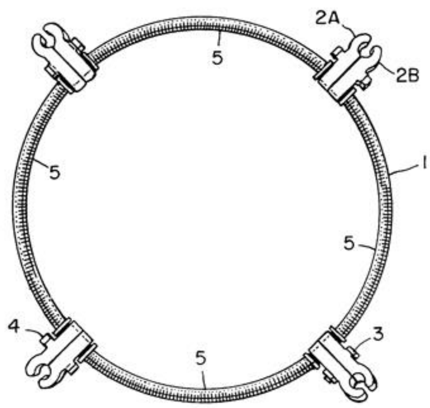

FIGURE 1

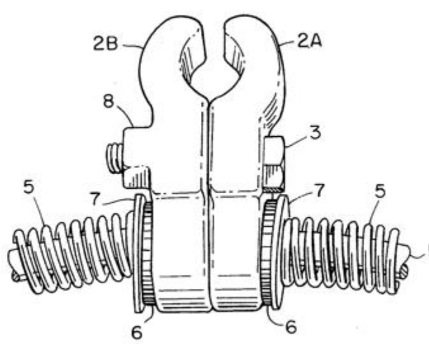

FIGURE 2

TRANSMISSION LINE SPACER DAMPER DEVICE
UNITED STATES PATENT 5,362,920
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ABSTRACT
A spacer damper for installation on twin, triple, or quad bundled lines at various distances along the line to provide proper separation and effective vibration damping of subconductors includes a structural hoop about which two or more clamps are positioned at equal intervals. The distance between the clamps is maintained by springs about the hoop and between the clamps that compress against each side of the clamp through a flat washer and a rubber washer. The clamps allow attachment of the spacer damper to the subconductors.

BACKGROUND OF THE INVENTION
Transmission lines that are used to transmit electrical energy are often characterized as, high voltage lines, extra high voltage (EHV) lines, and ultra high voltage (UHV) lines. The voltage levels in each category are approximately, under 300 kilovolts (kV), 300kV to 500kV, and over 500kV, respectively.

Transmission lines that are in the category of EHV and UHV are referred to as bulk power transmission lines, meaning that power is transferred along the lines from a generating point to a distribution point over great distances which can be as much as several hundred miles. Another feature of such power delivery is that total power is in the range of hundreds of megawatts delivered to the distribution point or load point. It is not uncommon to see several transmission lines, consisting of the three phase conductors each, passing over a common right-of-way from the generating point to the load point. These lines may be located in open farmlands, or hilly terrain, or up and down a mountainside. In any case the uninterrupted delivery of power to the load point is a primary concern. Economy of delivers is also a major concern in the design of the line.

One way of achieving economical design at the EHV and UHV voltages is to cause the conductors to be bundled. A bundled conductor differs from a single conductor because two or more conductors are tied together by devices known as spacers, or spacer-dampers. These devices are designed to keep the individual wires in a bundle separated by a fixed distance, usually 18 inches. The spacing of the spacer devices from each along the line is about 200 feet. Hence, a line having a span of 1000 feet will have four spacers, or spacer-dampers along its span length. Since there are three phases in a circuit, a single span of 1000 feet will have twelve spacers or spacer-dampers. Therefore, there are approximately fifty spacer units per mile, or five thousand spacer units per 100 miles of line.

Modern spacers are called spacer-dampers because they combine the function of spacing the bundle with the damping of the vibration of the individual wires in the bundle. The individual wires are called subconductors. A typical 500kV line will have three subconductors per phase in the shape an inverted equilateral triangle (inverted delta) with 18 inches separating each subconductor. Other lines may have only two subconductors and these are also separated by spacer-dampers at 18 inches, usually in a horizontal plane. Other higher voltage lines may have four subconductors in a square box arrangement separated at 18 inch intervals. A typical voltage in the case of two subconductors is 345kV, while typical voltage in the case of four subconductors is 765kV.

There are as many different ways to design spacer-damper devices as there are manufacturers that make them. Competitive cost is always a major concern. Long life in service over a period of twenty years or more is a major concern as well. Most especially, it is desired to provide a spacer-damper that performs effectively to dampen vibration of the subconductors without damaging the individual wires. Another factor which is very important is to provide a device that is easy and quick to install on the line. This usually means that a quick-acting, positive-locking bolt or clip is needed. This is especially needed when the spacer-damper units are to be contracted on the basis of lowest cost.

SUMMARY OF THE INVENTION

The present invention spacer damper device provides the necessary spacing of subconductors from each other while allowing the subconductors to vibrate without causing damage to the subconductors. The spacer damper device includes a series of clamps spaced along a hoop formed of rigid material by a series of springs about the hoop which are between the clamps.

In preferred embodiments, a pair of aluminum clamps are used to fix the relationship between the subconductors along the rigid hoop, and to provide attachment to the subconductors while allowing articulation in the case of bending vibration. The most dangerous case of fatigue is the bending of the subconductor against the clamp. Other spacer-dampers do not allow freedom of bending. The present invention allows freedom of bending so that zero bending stress occurs during any subconductor vibration. The articulation in the present invention is resisted by a rubber washer which is positioned along the rigid hoop and sandwiched between the clamp and the flat steel washer. Each steel washer is adjacent to the spring. This causes the rubber washer to resist bending motion by shearing in the rubber. In the event that the rubber fails over a long time, the pressure provided by the springs will continue to push the steel washer against the clamp, thus resisting bending of the subconductor by dry friction (coulomb type damping).

The above described damping action will occur in any number of subconductors and the diameter of the loop.

Individual design of the product may be achieved by varying the diameter of the hoop, the diameter of the round rods that forms the hoop, the size of the clamps that attach to the subconductor, the number of clamps, the spacing of the clamps, the composition of the material (common grade steel etc.) and the design of the clamp itself.