Dec. 8, 1931. W. A. KNOOP 1,835,788

ELECTRICAL CONTACT ELEMENT

Filed Oct. 21, 1926

Fig. 1

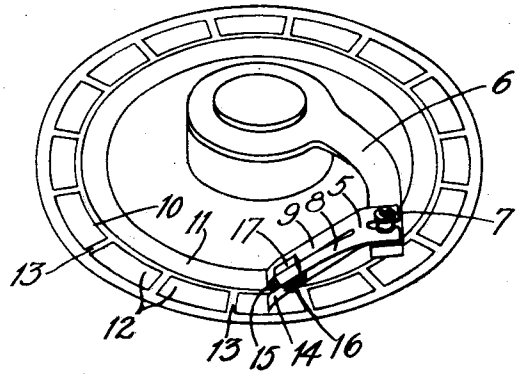


Fig. 2

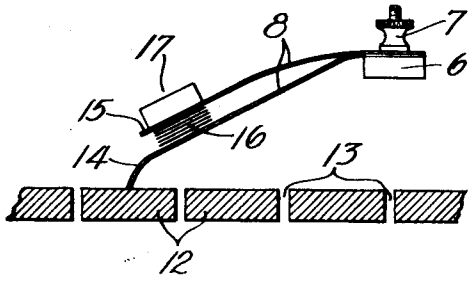
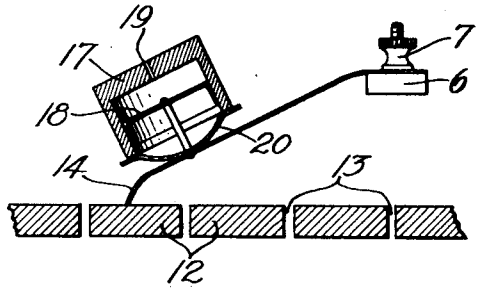


Fig. 3



Inventor:
William A. Knoop
by E. V. Briggs Atty.

Patented Dec. 8, 1931

1,835,788

UNITED STATES PATENT OFFICE

WILLIAM A. KNOOP, OF HEMPSTEAD, NEW YORK, ASSIGNOR TO BELL TELEPHONE LABORATORIES, INCORPORATED, OF NEW YORK, N. Y., A CORPORATION OF NEW YORK

ELECTRICAL CONTACT ELEMENT

Application filed October 21, 1926. Serial No. 143,148.

This invention relates to improvements in electrical contact elements such as springs and brushes and particularly to springs and brushes which are subject to vibration and chatter.

The principal object of the present invention is to insure the proper operation of electrical contact elements.

A more specific object of the invention is to reduce chatter of contacting members.

In accordance with the present invention the above objects are attained by reducing the vibration and movement of contacting members to a minimum by damping one or both of the elements so as to prevent their free vibration. This is conveniently accomplished by connecting the contacting member to an inertia member through means which do not permit free movement of the contacting members. Frictional means are suitable for this purpose and, in particular, damping means depending for their action upon the friction of fluids such as air or oil.

In the use of contact elements of the type at present generally employed considerable difficulty is encountered due to vibration and chatter. Particular difficulty is encountered with the contact brushes of multiplex telegraph distributors which pass over a series of distributor segments separated by air spaces.

If the distributor element carrying a brush is rotating slowly, the brush, in passing from one contact segment to the next, tends to fall off the back edge of one segment and make contact with the front edge of the next segment at a point which is somewhat above the tip of the brush. In multiplex telegraph distributors the difference in potential between the segments is of the order of 50 volts, and under this condition, the brush tends to pull an arc from one segment to the other, burning both the segment and the brush. In aggravated cases, where the segments are close together, the arc may be maintained after the brush has passed.

On the other hand, if the distributor element is rotating rapidly, very slight differences in the height of segments will cause the brush to jump from the back edge of one segment to a point somewhat beyond the front of the next segment, sometimes jumping as much as $\frac{1}{16}''$ from the edge of the segment. This jumping of the brush results in chatter and moreover the length of the signals transmitted does not correspond to the time of passage over the full length of the distributor segment. In either case, whether the brush is moving slowly or rapidly, if there is chatter or arcing at the contacts the signal waves transmitted do not have the proper shape. In the case of submarine signaling this may result in considerable distortion and confusion of the received impulses, particularly with the high transmitting speeds which are being employed in the operation of improved cables. This high speed operation has rendered the above mentioned difficulties much more serious.

In transmitting signals at the rate of 50 or 60 cycles per second, as is usual on one of the recently installed cables, the brush travels over the distributor segments at the rate of ten feet per second or more. At this speed the effect of chatter is very serious even though the signals are of very high frequency. The effect of chatter on the received signal is much greater when operating over a submarine cable than in other types of signaling systems, as the high frequency impulses introduced by an imperfect contact at the beginning of the signal impulse are attenuated during transmission to a much greater extent than the low frequency impulses and the wave shape of the signal is therefore badly distorted.

In an effort to overcome these difficulties the tension on the brush is sometimes increased, reducing the amplitude of the vibrations of the contact brush. Although this is effective to some extent it is found that a stiff contact-brush continues to vibrate for a greater length of time than a more flexible brush and therefore in a large measure fails to overcome chatter. In the ideal case the contact brush would leave the back edge of one segment and just touch with its tip the front edge of the next segment, engaging with the distributor segment over its entire length.

The invention may be readily understood by referring to the following detailed description and the accompanying drawings in which:

Fig. 1 is a perspective view of a multiplex telegraph distributor and contact brush embodying the present invention;

Fig. 2 is a side view of the brush enlarged to show the damping element employed; and

Fig. 3 is a cross section of a modified form of brush.

In the embodiment of the invention illustrated in the drawings, the brush 5 is carried by a rotatable arm 6 and is attached thereto in any suitable manner, as by a knurled thumb-nut 7. The brush 5 preferably comprises two arms 8 and 9 adapted to engage the two distributor rings 10 and 11. As ordinarily employed the distributor ring 10 comprises a series of segments 12 which are separated by air spaces 13 of the order of .02″ to .04″. The contact ring 11 is continuous and therefore it will not ordinarily be necessary to provide damping means for the brush arm 9. The contact arm 8 comprises two members 14 and 15, one above the other and separated from each other by suitable damping means 16 which is preferably in the form of a book or plurality of spaced layers of aluminum foil. The upper element or inertia member 15 is weighted as at 17 but does not contact with the surface of the distributor segments.

The operation of the book of aluminum foil as a damping element is due to the small spaces or apertures between the separate layers of the foil, these layers having a bellows-like action in forcing the air from between them and in drawing the air back into the spaces with each vibration of the contact element 14. The friction of the air against the leaves of aluminum foil prevents the element from responding readily to vibrations which ordinarily result in chatter and arcing. The use of folded or laminated material broadly for damping purposes is disclosed in the copending application of C. A. Moore, Serial No. 627,729, filed March 26, 1923. Obviously the damping element may be composed of numerous other materials besides aluminum foil and may either be folded in any suitable way or may consist merely of a pile of laminated material.

In the rotation of the distributor arm carrying the contact brush, the inertia member 15 maintains a substantially uniform distance from the surface of the distributor segments 12 and, because of its relatively great inertia, does not respond readily to the movements of the lower contact element 14. The ordinary vibration of the contact member in passing from one segment to another over the air spaces is prevented by the damping action of the aluminum foil 16. This damping prevents such vibration of the contact member as would cause chatter and insures the direct passage of the brush from the back edge of one distributor segment to the front edge of the next succeeding distributor segment and the movement of the brush over the face of the distributor segment without appreciable vibration.

As illustrated in Fig. 3 the damping means connecting the contact element 14 with the inertia element 17 may be in the form of a dashpot, the inertia member itself being the cylinder of the dashpot and the piston 18 carried by the contact member 14 operating to force air through the small aperture 19 when the contact member is vibrated. The supporting spring 20 holds the inertia member and the contact member in spaced relation and operates to restore them to their normal position after any relative movement of the parts has taken place. It may be preferable to employ a flexible diaphragm in place of the piston 18 or any other suitable damping means may be employed to connect the contact member to the inertia member.

The invention obviously is not limited in its use to contact brushes of multiplex telegraph distributors but may be employed with relays or with any type of movable contact where it is desired to reduce chatter and maintain intimate contact between contacting members. It is also apparent that the damping elements may be immersed in oil or other liquid to increase the damping action and either or both of the contacting members may be damped as desired.

What is claimed is:

1. An electrical contact element comprising two members, and fluid damping means connecting said members, whereby the movement of one of said members is damped by said fluid damping means.

2. An electrical contact element comprising an inertia member and a contact member, and frictional damping means connecting said members.

3. An electrical contact element comprising an inertia member and a contact member, and fluid damping means connecting said members.

4. A contact brush comprising two members one of which maintains a substantially uniform distance from a contact surface and the other of which contacts with said surface and fluid damping means connected with said first member.

5. A contact brush comprising two members one of which is weighted to provide inertia and the other of which is separated from said weighted member by a damping element comprising a plurality of spaced layers of flexible material.

6. A contact brush comprising an inertia member and a contact member movable relative to said inertia member and connected

thereto by a plurality of spaced layers of aluminum foil.

7. A contact brush comprising a leaf spring contact member, a second leaf spring member having an inertia member secured to the free end thereof, and damping means consisting of a plurality of spaced layers of aluminum foil connected between the free ends of said leaf spring members.

8. In combination, a plurality of conductive contact elements, a conductive contact member slidably displaceable thereupon, and means for maintaining intimate contact between said elements and member comprising fluid damping means supported by the slidable member.

9. Means for maintaining intimate electrical sliding contact between a movable contact member moving upon a plurality of spaced flat contact elements, comprising fluid damping means acting upon said movable member to cushion the effect of impacts with the contact elements.

In witness whereof, I hereunto subscribe my name this 20th day of October, A. D. 1926.

WILLIAM A. KNOOP.