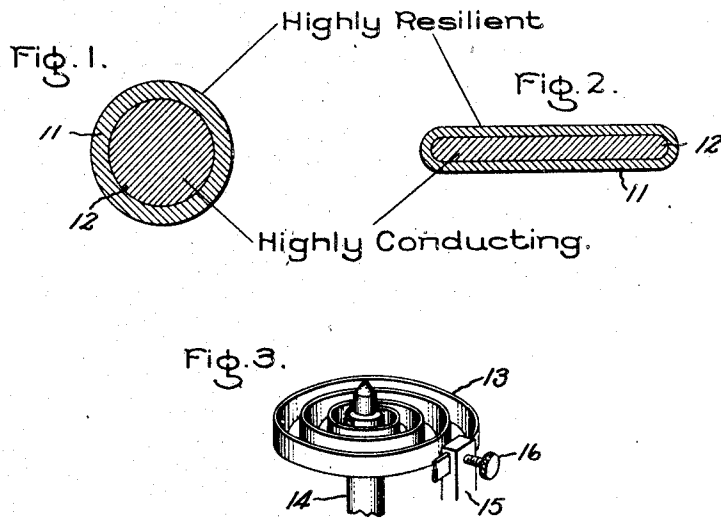


A. R. BECKERT.
TORSION SPRING.
APPLICATION FILED OCT. 21, 1919.

1,386,834.

Patented Aug. 9, 1921.



Inventor:
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UNITED STATES PATENT OFFICE.

ALBERT R. BECKERT, OF LYNN, MASSACHUSETTS, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

TORSION-SPRING.

1,386,834.

Specification of Letters Patent.

Patented Aug. 9, 1921.

Application filed October 21, 1919. Serial No. 332,171.

To all whom it may concern:

Be it known that I, ALBERT R. BECKERT, a citizen of the United States, residing at Lynn, county of Essex, State of Massachusetts, have invented certain new and useful Improvements in Torsion-Springs, of which the following is a specification.

My invention relates to torque producing members which are also utilized for carrying a current. Such members, for example, are utilized in the ordinary electric measuring instruments for the element necessary to produce a torque opposed to the torque of the operating elements of the motor, and usually designated as a torsion spring. These torque producing elements are in some classes of instruments used for carrying in the current to the member adapted to be moved by the action of the instrument. The use of my device in this connection is merely illustrative, since it may eventually be utilized in any other relation where an electric conductor is adapted to be flexed or strained during its normal operation at frequent intervals.

A serious problem which confronts the designer of a conductor embodying the functions which are stated above, is that involved in making the conductor sufficiently resilient so as to enable the instrument to be operated repeatedly without any deterioration of the material due to vibrations, etc., and also in having the conductivity of the member sufficiently low so that there be no undue loss due to the flow of current in it. I have succeeded in producing an element fulfilling all of the above requirements in a simple and efficient manner. In my device I employ a conductor made of two different metals; one of them of high resilience disposed in such a relation as to receive the maximum stress, while the other is a metal of high conductivity so located as to receive a minimum stress and carrying most of the current.

By way of example I have illustrated in the accompanying drawings one embodiment of my device in a torsion spring used for an electrical measuring instrument. Fig. 1 of the drawing is an enlarged sectional view of a composite conductor during one stage of its manufacture; Fig. 2 is an enlarged cross section of the same conductor at a later stage of manufacture, and Fig. 3 shows, on an en-

larged scale, the conductor bent in the form of a spiral spring and used in the manner that I have indicated above.

Referring now more particularly to the drawing, the hollow metallic casing 11 is made of highly resilient material. For this purpose, I have found, for example, that phosphor bronze is well adapted, but other metals possessing the necessary qualities may also be used. This hollow metal casing is disposed around an inner core or wire 12 composed of a metal having high conductivity. This metal may be of copper, for example, which, although not resilient, possesses the necessary conducting properties. The relative ratio of the cross sections of the outer member 11 and the inner core 12 is so chosen as to give the right degree of resilience with the right amount of conductivity. When this compound conductor is to be used as a spiral torsion spring for an instrument it is preferably flattened out by passing it between rollers. This treatment causes the compound conductor to assume the shape shown in Fig. 2. When this has been done it is an easy matter to wind a given length of this material into a flat spiral spring 13 of the sort shown in Fig. 3. In this latter figure the spiral spring is shown as securely attached at its inner end to a spindle 14. The stationary post 15 is shown with a fastening screw 16 to illustrate by way of example how the outer end of the spiral spring may be appropriately anchored.

My compound conductor is of a peculiar utility in connection with electric measuring instruments, since in this class of work the torsion spring must be of great uniformity and have sufficient resilience so that it may be flexed a very large number of times without receiving a permanent set. At the same time it is extremely important that the resistance be maintained as low as possible, since a dead loss in energy results from the I²R loss in the leading-in conductor. Copper itself would make a good spiral spring as far as its conductivity is concerned, but it does not possess sufficient resilience to operate efficiently as a retarding torque producing member. In the same way a spring made wholly of phosphor bronze would fulfill the requirements as regards resilience but its conductivity would be entirely too low.

In the past alloys have been used which have a comparatively low resistance but which have not the requisite resilience needed for this class of work. By making use of my
5 compound conductor for these retarding torque producing springs, I combine the advantages of a resilient material and a conducting material. As shown in the drawings, resilient material is disposed exteriorly
10 so that it takes the maximum stress when the spring is flexed, while the inner core is only slightly stressed. It has been found, by a comparison of spiral springs made respectively of solid phosphor bronze and of a
15 compound material, when the retarding torques of both springs are the same for the same deflection, that the resistance of the phosphor bronze spring is more than three times as great as that of the compound
20 spring described in this application.

The advantages I secure by this mode of construction are not limited to instrument springs but are present when the same sort of service is required of an electric con-
25 ductor; namely, to serve also as a torque producing means, or when such conductor is

adapted to be flexed for long intervals and a large number of times.

While I have shown in the accompanying drawings the preferred embodiment of my
30 device, my invention is not limited thereto, and I aim in the appended claims to embrace all modifications falling fairly within the scope of my invention.

What I claim as new and desire to secure
35 by Letters Patent of the United States, is,—

1. A torsion spring adapted to serve both as a torque producing means and as an electrical conductor, comprising a comparatively
40 thin casing of highly resilient material, and an inner core of highly conducting material.

2. A torsion spring for an electrical measuring instrument adapted to serve both as a torque producing means and as an electrical
45 conductor, comprising a casing of highly resilient material, the cross section of which is a hollow oval, and a core completely filling said hollow casing, of highly conducting material.

In witness whereof, I have hereunto set
50 my hand this 17th day of October, 1919.

ALBERT R. BECKERT.