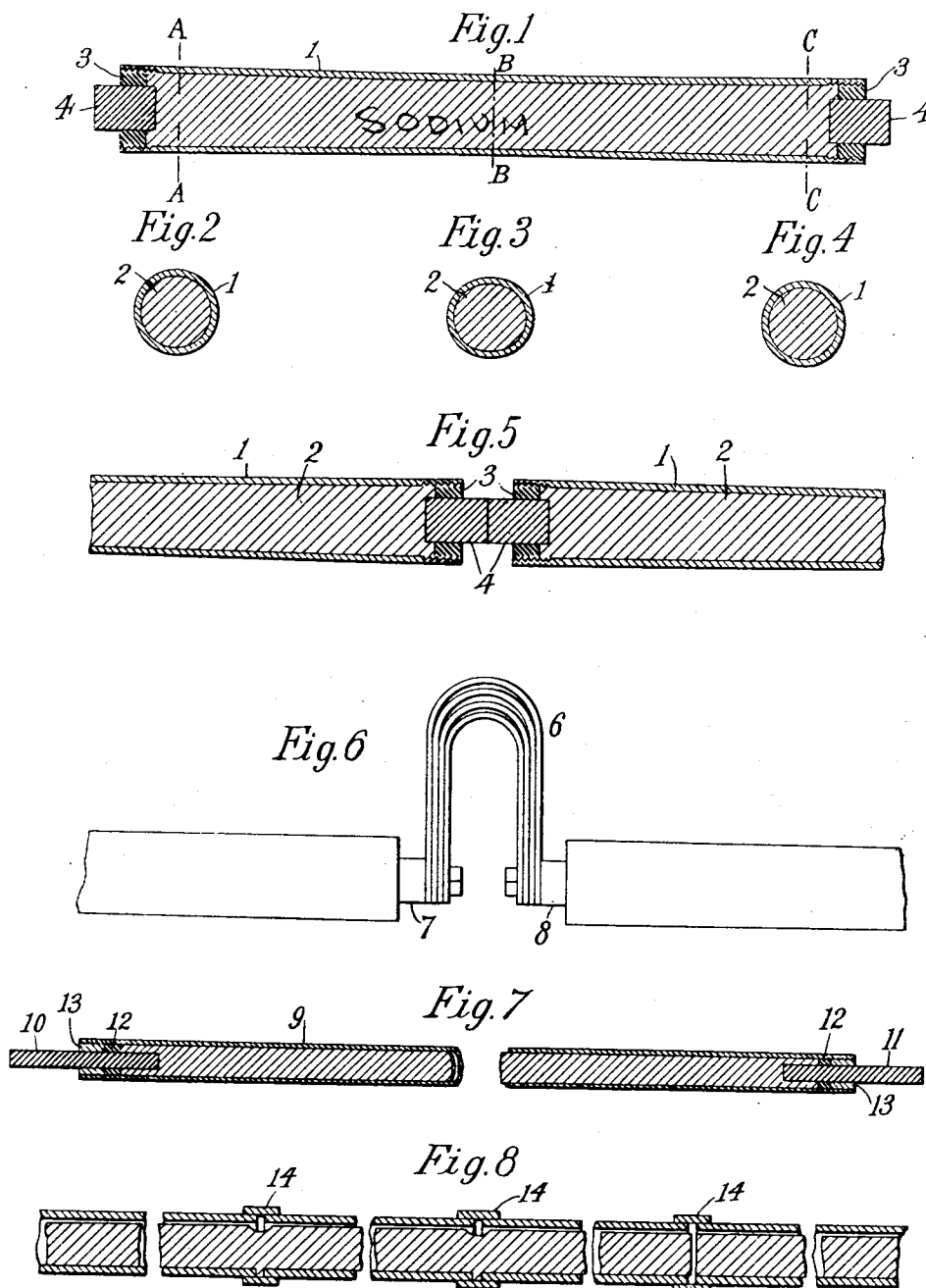


No. 833,290.

PATENTED OCT. 16, 1906.

A. G. BETTS.
ELECTRICAL CONDUCTOR.
APPLICATION FILED NOV. 30, 1904.



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UNITED STATES PATENT OFFICE.

ANSON GARDNER BETTS, OF TROY, NEW YORK.

ELECTRICAL CONDUCTOR.

No. 833,290.

Specification of Letters Patent.

Patented Oct. 16, 1906.

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To all whom it may concern:

Be it known that I, ANSON GARDNER BETTS, a citizen of the United States, residing at Troy, in the county of Rensselaer and State of New York, have invented certain new and useful Improvements in Electrical Conductors, of which the following is a specification, reference being had to the drawings accompanying and forming a part of the

same. The main object of my present invention is to provide line or transmission conductors of relatively large current-carrying capacity at a less expense than that involved in the use of those heretofore employed for such purposes and which in actual practice have been, almost without exception, composed of copper. This object I have attained by the utilization of free or solid metallic sodium as a conducting medium under special conditions of application and use which I have devised and which I have discovered to be capable of rendering available for practical purposes not only the recognized conducting properties of this element, but other very valuable qualities which have never been capable of utilization heretofore.

As sodium in its free or pure metallic state has but a low degree of tensile and mechanical strength, has a high coefficient of expansion, and is extremely sensitive to the corroding action of moisture and air, I have found it necessary, in order to take advantage of its low specific gravity and comparatively good electrical conductivity for its general use as a conducting medium in a line or transmission conductor, to reinforce it to prevent fracture and protect it from atmospheric influences. To accomplish this, I construct a composite conductor in which sodium in its free or metallic state is present in proportion sufficient to constitute the entire or by far the greater proportion of the conducting-path for the electric current, but is inclosed, preferably hermetically, by a sheathing of substantially non-oxidizable reinforcing material. In order to produce such a conductor, I take advantage of the physical properties of metallic sodium which permit it to be readily fused and formed into bars of any desired length and introduce it in the form of rods into lengths of air-tight tubing of any proper material or force or run it into such tubes while in a plastic or fused state,

being careful in either case that the sodium sufficiently fills the interior of the tube or sheath to form a continuous column therein. These sectional conductors may be made up into continuous conductors of any desired length by providing for each section plugs or caps which preferably hermetically seal its ends and which are composed of or contain connectors of high specific conductivity in good electrical contact with the sodium. In lieu of using special connectors for mechanically uniting the separate sections and establishing electrical continuity between the same the tube-sections may be joined together in the usual way by sleeve-couplings or otherwise and so that the rods or bodies of sodium therein will be brought into close contact, complete electrical union being secured by heating the tube at the proper intervals to fuse the sodium at such points and cause it to run together.

The proper and successful accomplishment of the invention involves certain details of construction and precautions in the process of manufacture and assemblage of the constituent parts of the conductor which will be best understood by reference to the accompanying drawings.

Figure 1 is a longitudinal central section of a length of typical composite conductor embodying my invention. Figs. 2, 3, and 4 are cross-sectional views of the conductor of Fig. 1 on the lines A A, B B, and C C, respectively. Fig. 5 is a longitudinal central section of the conductor, showing the general manner of uniting two adjacent sections. Fig. 6 is a view in elevation of a special form of expansible joint for two contiguous sections. Fig. 7 is a longitudinal central section of a modified embodiment of the invention, and Fig. 8 is a similar view of a further modification.

Referring now to the figures in detail, 1 is a metallic tube of convenient length filled with a body of sodium 2, which has been introduced therein preferably by being fused and run in while in a molten or plastic condition in any well-known way. After the sodium has been introduced plugs 3, containing or formed with connectors 4, are screwed into the ends of the tube, so that the connectors will be forced into intimate contact with the sodium and the tube ends hermetically sealed. When two or more of these sections

are to be connected to form a line of considerable length, the connectors of adjacent sections are brought together, as shown in Fig. 5, and united or held in contact by any suitable means.

I prefer to use a sheathing or tube of wrought-iron, cast iron or steel, and as sodium has a high coefficient of expansion compared with such materials as are most available for the sheathing it is desirable to flatten somewhat the tubing along the middle portion of each section, giving it an elliptical cross-section, as shown in Fig. 3, so that when expansion occurs the pressure is relieved by the tube assuming a cross-section more nearly circular. In constructing a conductor of this kind it is desirable to run the sodium into the pipe while in a fused state.

When a conductor is employed of such dimensions or under such conditions as to make it desirable to provide for longitudinal expansion and contraction, the form of joint shown in Fig. 6 may be employed. In this arrangement an expansible bowed or bent copper strip or series of laminae 6 is clamped or otherwise secured to the projecting ends of the connectors 7 8 of two pipe-sections.

In some cases the magnetic properties of iron and steel might preclude its use as a sheathing, in which event a non-magnetic metal, such as copper, may be employed, particularly in conductors of comparatively small diameter. In this event the sodium may be introduced or run into a copper tube 9, Fig. 7, and wires 10 11 embedded in its ends. Washers of iron or other material 12 are then passed over the wires and forced down into contact with the sodium, after which the spaces around the wires at the ends of the tube are filled up with solder 13.

The connections may be dispensed with, if so desired, and the tube-sections joined by suitable sleeve-couplings 14, Fig. 8. In such case the ends of the sodium rods should be in contact when the tube-sections are assembled, and this union may be perfected by heating the pipe until the sodium is fused and runs together.

Other means for joining the sections of composite conductor may obviously be adopted; but the above examples will suffice to illustrate the principle of and the most desirable ways of carrying out my invention.

My improved composite conductor may be supported or suspended in any suitable manner, and I have devised certain special means for the purpose which I do not describe herein, as they will be made the subject of another application.

By my invention while I am enabled to take full advantage of the conducting properties of sodium I am also able to produce a conductor which compares favorably with the ordinary aerial conductors in weight and

tensile strength. For example, a two-inch wrought-iron pipe has a tensile strength of about thirty-seven thousand five hundred pounds. Filled with sodium the total weight per foot is about 3.6 pounds. This would carry a current of, say, eight hundred and sixty amperes, of which the iron carried about seventy amperes. A soft pure copper conductor of equivalent conductivity is about 1.15 square inches in cross-sectional area, weighs 4.4 pounds per foot, and has a tensile strength of about thirty-two thousand pounds.

For conductors of large current-carrying capacity the cost of my composite conductor, even at the present cost of sodium, is very much less than that of a copper conductor of equal capacity.

I do not understand that my invention is limited to the use of any particular material as the protective sheathing for the sodium, nor to the shape or dimensions of the same, nor to the manner of connecting up the several sections or making contact with the sodium therein; but

What I claim as novel and of my invention is—

1. A composite conductor for electrical transmission lines or circuits consisting of a body of free or metallic sodium and a reinforcing-sheathing within which it is inclosed, the conductivity of the composite conductor being due essentially to the sodium present therein, as set forth.

2. A composite conductor for electrical transmission lines or circuits consisting of a body of free or metallic sodium with a reinforcing-sheathing which contains the sodium and is entirely filled thereby, the conductivity of said composite conductor being due essentially to the sodium present therein, as set forth.

3. A composite conductor for electrical transmission lines or circuits consisting of sections of reinforcing-tubing filled with free or metallic sodium and provided with connectors of relatively high conductivity at their ends in electrical contact with the sodium, as set forth.

4. A composite conductor for electrical transmission lines or circuits consisting essentially of free or metallic sodium contained within sections of a less readily oxidizable metal tubing, as set forth.

5. A composite conductor for electrical transmission lines or circuits consisting essentially of free or metallic sodium contained within sections of less readily oxidizable metal tubing, portions of which are flattened or of approximately elliptical cross-section to provide for the expansion of the sodium, as set forth.

6. A composite conductor for electrical transmission lines or circuits consisting es-

5 sentially of free or metallic sodium inclosed
by sections of iron tubing, the ends of said
sections being closed and provided with con-
nectors of a good conducting material ex-
tending through the ends of the sections into
the sodium filling, as set forth.

In testimony whereof I have signed my

name to this specification in the presence of
two subscribing witnesses.

ANSON GARDNER BETTS.

Witnesses:

ETHEL K. BETTS,
EDWARD F. KERN.