The present invention relates to cables for transmitting high tension electric current wherein bare or uninsulated conductors are located within a pipe and the latter filled with high pressure insulating gas. In such a cable, it is necessary to provide mechanical and insulating support for the conductors so as to hold them in proper spaced relation to each other and to the inner wall of the pipe. The dielectric strength of highly compressed gas per unit of thickness is much greater than that of solid insulations of the same thickness now available. To keep the cost of the pipe within reasonable limits, its diameter must necessarily be restricted. This means that if insulators of any ordinary or usual design are interposed directly between the conductors and the pipe in a plane transverse to the axis of the pipe, they will be ineffective to properly insulate the conductors, although as mechanical supports such insulators would be quite satisfactory. One of the problems is to provide suitable means for properly insulating the conductors one from the other and from the pipe, and a further problem is to provide means whereby by the properly insulated conductors can be inserted into the pipe or removed therefrom when necessary or desirable.

The object of my invention is the provision in a high tension gas filled cable of improved means for supporting bare or uninsulated conductors within a pipe containing insulating fluid, such as gas, under a determined pressure whereby such conductors may be readily inserted or withdrawn from the pipe.

For a consideration of what I believe to be novel and my invention, attention is directed to the accompanying description and the claims appended thereto.

In the drawing, which is illustrative of my invention, Fig. 1 is a view partly in section of a length of high tension gas filled cable; Fig. 2 is a cross-sectional view of said cable; Fig. 3 is a diagrammatic view showing the relation of the conductors and their insulating supports; Fig. 4 is a perspective view of the parts associated with one of the conductors; and Fig. 5 is a sectional view of a modification.

Referring especially to Figs. 1 and 2, 5 indicates a pipe which may be made of any suitable material either insulating or non-insulating. Desirably, it is made of steel. Inside of the pipe are three conductors 6, 7 and 8 spaced 120° apart for carrying current under high potential which are bare or have such a thin covering of insulating material as not to effectively insulate them. The conductors are supported on relatively long solid rods 9 of insulation which form chords that are inclined to the axis of the pipe. Instead of dividing the rod into relatively short lengths, it may be made in a single piece and bent to conform to the desired shape. The rods may be made of any suitable material which has a relatively high dielectric strength and is capable of supporting the weight of the conductors without undue bending. The rods are arranged in end to end relation and held in place by means to be described later. The conductors are fastened to the rods by suitable means such as clamps 10. Inclining the rods in the manner shown permits of relatively wide spacing between the clamps and the ends of the rods, and in this manner an amount of solid insulation is interposed between conducting parts which is comparable in its insulating effect to that of the high pressure insulating gas which fills the pipe.

As will be seen from the drawing and particularly from Fig. 4, each conductor has its own insulating support. In order to facilitate the introduction of the conductors and their supports into the pipe 5, special means are provided in the form of segmental members which when assembled define a cylinder. These members extend longitudinally of the pipe and desirably are made of preformed thin metal but which may be of insulation if desired. When assembled, they make a reasonably good fit with the inner wall of the pipe but should not fit too tightly because of the fact that they have to be moved endwise into the pipe and some allowance has to be made for irregularities in the inner surface of the pipe as each member covers an arc of 120 degrees.

Each member has curved or turned longitudinally extending edges 12, and also turned projections 13 to form clamps. The rods 9 extend diagonally between the said curved edges and are anchored at their ends thereby, each projection 13 serving to hold the adjacent ends of two rods. The members may be formed of a number of such members be provided and arranged end to end. The members may, if desired, be lightened by removing material as indicated at 14. From Fig. 4, it will readily be seen that each conductor with its insulating supports and member 11 form an element which is mechanically independent of the others. By reference to Fig. 2, it will be seen that when the three elements are assembled to form a cylinder with the curved edges 12 of the members in engagement, they may be slipped endwise into the pipe, either by pushing or pulling, after which the
ends of the conductors of one pipe length may be united with those of the adjacent length or lengths.

As shown in Fig. 5 each of the rods may under certain conditions support more than a single conductor, provided adequate spacing is provided between the conductors 18 and between said conductors and its supporting member 11.

After the conductors and their supports are assembled within the pipe and the lengths of the pipe and conductors properly united, the pipe is filled with dry insulating gas under high pressure by any suitable means and maintained in such condition. Prior to filling the pipe with such gas, it is desirable to remove air and any moisture contained therein, as for example by blowing a heated neutral gas, such as CO₂, through it. There are various insulating gases which are suitable for the insulating purpose of which nitrogen and carbon tetrachloride may be taken as examples. The pressure of said insulating gas will depend in large part upon the voltage of the current in the conductors, as an example, it may be of the order of 600 pounds per square inch.

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

1. A cable comprising uninsulated conductors, an enclosing pipe therefor, rods of insulation for supporting the conductors which are inclined to the axis of the pipe, a means which supports the rods at points remote from the conductors and itself is supported by the inner wall of the pipe, and a filling of insulating fluid under positive pressure for the pipe.

2. A cable comprising uninsulated conductors, an enclosing pipe therefor, diagonally extending rods of solid insulation for supporting the conductors at points midway of their length, members for independently supporting the rods of said conductors located between said rods and the pipe and forming a cylinder, and a filling of insulating fluid under positive pressure for the pipe.

3. A cable comprising a plurality of uninsulated conductors, an enclosing pipe therefor, insulating rods of solid insulation for supporting the conductors, a supporting means for the rods comprising segmental members corresponding in number to those of the conductors, said members when assembled with abutting edges forming a cylinder located within and supported by the pipe, and a filling of insulating fluid for the pipe under superatmospheric pressure.

4. A cable comprising a plurality of uninsulated conductors, an enclosing pipe therefor, a support located within the pipe and supported thereby which comprises as many individual members as there are conductors, each member having inturned edges engaging the corresponding edges of other members when assembled to form a cylinder, a solid rod of insulation for supporting each conductor which is supported at points remote from the conductor by the inturned edges of a member, and a filling of insulating fluid for the pipe under superatmospheric pressure.

5. A pipe cable having a support for a high tension electric conductor located inside of the pipe comprising a segmental member having inturned longitudinal edges and rod means of insulation extending diagonally of the member to form chords which are supported by the said inturned edges.

6. A pipe cable having a support for a high tension electric conductor located within a pipe, comprising a relatively long segmental member having inturned longitudinal edges, clamping means located at said edges, and straight rods of insulation defining chords arranged in end to end relation and secured in place by the clamping means.

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