May 15, 1934. A. E. PAIGE 1,959,302

CABLE

Filed Oct. 19, 1926

FIG. I.

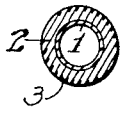


FIG. II.

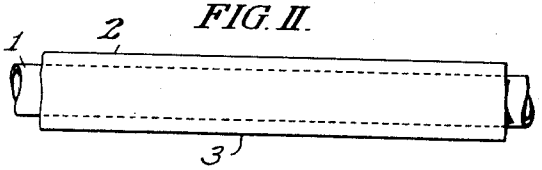


FIG. III.

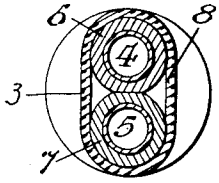


FIG. IV.

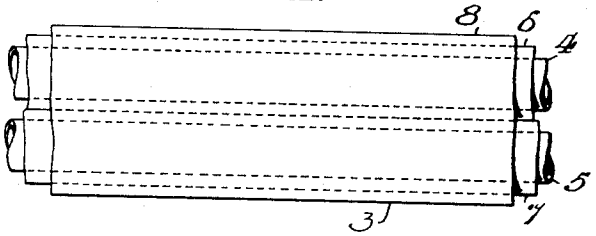


FIG. V

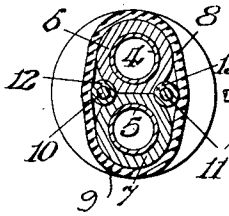


FIG. VI.

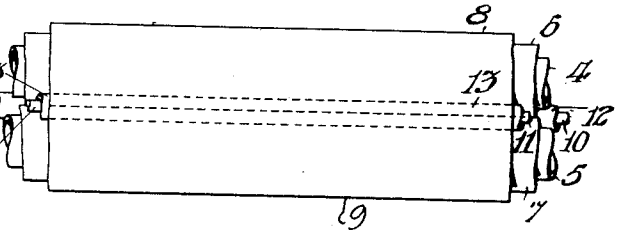


FIG. VII.



FIG. VIII.

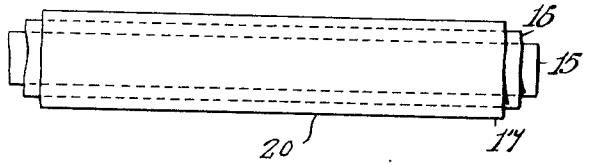
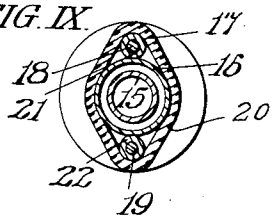


FIG. IX.



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UNITED STATES PATENT OFFICE

1,959,302

CABLE

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Application October 19, 1926, Serial No. 142,576

3 Claims. (Cl. 137—75)

It is the object and effect of my invention to provide a flexible cable including one or more conduits enclosed in a heat insulating covering comprising a fabric coated or impregnated with a primarily liquid composition which, when desiccated, leaves a residual deposit upon such fabric of material which is flame resistant and renders said covering substantially fire proof. Said composition may be more or less flexible in accordance with the nature and proportions of its ingredients; but, in any case, offers such resistance to the passage of electric curent as to be classed as a dielectric.

As hereinafter described, my invention includes a cable designed for supplying a heating fluid to a radiator and returning the cooled fluid from the radiator to the source of heat; both of said conduits being heat insulated in a single covering and, preferably, with one of the conduits extending inside of the other. Moreover, as hereinafter described, my invention includes a cable comprising such conduits and, also, inclosing in the same heat insulating covering, a pair of electrical conductors. Such conductors being adapted to supply energy to electric fan motors local to the radiators. However, the construction and arrangement of such heating, radiating, and ventilating means are the subject matter of U. S. Patent 1,667,430 of April 24, 1928, to V. Mauck, and I do not claim such organized apparatus.

My invention includes the various novel features of construction and arrangement hereinafter more definitely specified.

In said drawing: Fig. I is a cross sectional view of a cable comprising a single metallic conduit with a tubular covering of fabric, coated or impregnated with the heat insulating material aforesaid.

Fig. II is a fragmentary side elevation of the cable shown in Fig. I.

Fig. III is a cross sectional view of a cable including two metallic conduits with respective tubular fabric coverings and inclosed by a single tubular fabric covering for its outer surface, coated or impregnated with said heat insulating material.

Fig. IV is a fragmentary side elevation of the cable shown in Fig. III.

Fig. V is a cross sectional view of a cable, similar to that shown in Figs. III and IV, except that it also includes, within the same heat insulating covering, a pair of electrical conductors.

Fig. VI is a fragmentary side elevation of the cable shown in Fig. V.

Fig. VII is a cross sectional view of a cable including two metallic conduits, one inside of the other, and having a single tubular fabric covering, coated or impregnated with said heat insulating material.

Fig. VIII is a fragmentary side elevation of the cable shown in Fig. VII.

Fig. IX is a cross sectional view of a cable similar to that shown in Figs. VII and VIII, except that it also includes, within the same heat insulating covering, a pair of electrical conductors.

Referring to the form of my invention shown in Figs. I and II; the tubular conduit 1 is conveniently formed of ductile metal, preferably seamless, drawn or extruded copper. Said conduit is provided with the tubular textile covering 2 which may be formed apart from said conduit and thereafter fitted upon the conduit, but is, preferably, formed directly upon the conduit; conveniently by a circular weaving, braiding, or knitting mechanism. As above described, such covering 2 is coated with heat insulating material, which impregnates the fabric of said covering, as indicated at 3, rendering said covering flame resistant and substantially fireproof. Such outer covering 3 is like varnish and occludes air in the interstices of said fabric.

Referring to the form of my invention in Figs. III and IV; the cable includes two conduits 4 and 5 respectively provided with fabric coverings 6 and 7, similar to the covering above described. However, both of said conduits are also incased in the outer heat insulating covering 8, which is a tubular fabric formed separately from said conduits or directly upon the same, as above contemplated. As above described, said covering 8 is coated with heat insulating material, which impregnates the fabric of said covering, as indicated at 9, rendering said covering flame resistant and substantially fireproof. Such outer coating 9 occludes the air in the interstices of said fabric. Although in Fig. IV the conduits 4 and 5 extend in parallel relation; it is to be understood that they may be twisted around the axis of the cable, as indicated by the outer circle in Fig. III.

In the form of my invention shown in Figs. V and VI; a cable including the several elements above described with reference to Figs. III and IV also includes, within its outer heat insulating covering 8, (coated with heat insulating material 9 as aforesaid) the pair of electrical conductors 10 and 11, which may be strands of copper wire each provided with individual insulating coverings 12 and 13.

In the form of my invention shown in Figs. VII and VIII; the cable includes the conduit 15

extending within the conduit 16 and incased by the single heat insulating covering 17, which is a tubular fabric impregnated with heat insulating material, as above contemplated, and as indicated at 20. Although said conduits 15 and 16 are shown in coaxial relation; of course, the inner conduit 15 is deflected against the inner surface of the conduit 16 when the cable is bent. Such freedom for lateral movement of the conduit 15 within the conduit 16 is advantageous in affording greater flexibility of the entire structure than if means were provided to maintain said conduits in coaxial relation. However, it may be observed that such displacement of the conduit 15 does not vary the area of the space between the outer surface of the conduit 15 and the inner surface of the conduit 16 which affords a passage way for the return of the fluid which is primarily conveyed through the conduit 15 to the radiator above contemplated. Of course, the heated fluid may be supplied through the space aforesaid, between said conduits 15 and 16, and the cooled fluid returned through the conduit 15. However, the arrangement first described is preferable, as far as heat losses to the outer atmosphere are concerned.

In the form of my invention shown in Fig. IX; the cable includes the elements above described with reference to Figs. VII and VIII, and also includes within the outer covering 17 a pair of electrical conductors 18 and 19 having respective insulating coverings 21 and 22.

I find it convenient to manufacture primarily liquid heat insulating material aforesaid by mixing equal parts of water and the ordinary commercial aqueous solution of sodium silicate. Allowing said mixture to stand, or preferably, agitating it, until it becomes a substantially uniform colloid solution. Thereupon, adding to said solution 5% or more of a liquid diluent, binding material, the principal function of which is to render the residue of the desiccated liquid so far flexible that it does not crack when the fabric upon which it is deposited is bent. Such flexible binding material for the sodium silicate residue may be formed by mixing with the aqueous solution aforesaid 5%, more or less, of any suitable cellulose sulphocarbonate or thiocarbonate of the series known commercially as "viscose" and which coagulate from their liquid state to form impure cellulose hydrate complexes, which are not soluble in water and hold the silicate in colloid solution adherent to the fabric, when applied thereto as above described. However, any suitable paraform formaldehyde may be used in lieu of the viscose in said mixtures. For instance, hexamethylene-amin $(CH_2)_6N_4$ forms an infusible, involatile, adherent coating which is insoluble in water and resists abrasion to a greater degree than the sodium silicate per se. Such mixtures are of a consistency of ordinary varnish and may be applied by any means which may be used for applying varnish and with the effect of coating and impregnating the textile fabric insulating coverings above contemplated and occluding air in the pores and interstices of such fabric.

Moreover, glycerin may be used in the primary liquid aforesaid, say 5%, more or less, thereof, to impart flexibility to the residue of desiccated silicate; if it is desired to render such residue soluble in water.

Therefore, I do not desire to limit myself to the specific proportions or method of procedure herein set forth as it is obvious that various modifications may be made therein without departing from the essential features of my invention as defined in the appended claims.

I claim:

1. In a flexible pipe, the combination with a flexible imperforate metallic tubular conduit; of a second flexible imperforate metallic tubular conduit extending in said first conduit in laterally spaced relation therewith, forming a passageway between said conduits, said inner conduit being free for lateral movement within the outer conduit to afford maximum flexibility of the structure; a heat insulating covering for said outer conduit including a seamless tube of fibrous material, capable of occluding air; and an outer coating of flexible, plastic, heat insulating material, rendering said covering flame resistant and substantially fireproof.

2. In a flexible pipe, the combination with a flexible imperforate metallic tubular conduit; of a heat insulating covering for said conduit including a seamless tube of fibrous material capable of occluding air; and an outer coating of flexible, plastic, heat insulating material, rendering said covering flame resistant and substantially fireproof; including a metallic wire extending longitudinally between said metallic tubular conduit and the heat insulating covering for said conduit; and di-electric means separating said wire from said conduit.

3. A structure as in claim 1, including a plurality of wires extending longitudinally between said outer metallic tubular conduit and the heat insulating covering for said conduit upon opposite sides of said conduit, said structure being of different diameters in transverse relation and less resistant to flexure thereof in the plane of its minimum diameter than in the plane of its maximum diameter.

ARTHUR E. PAIGE.