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VULCANIZABLE COMPOUND

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9 Claims. (Cl. 106—13)

This invention relates to vulcanizable compounds and particularly to such a compound suitable to be applied and vulcanized on a conducting core, this application being a division of our copending application Serial No. 474,364, filed August 11, 1930, entitled Insulated conductors.

In the manufacture of electrical conductors provided with an insulated covering of vulcanizable material it is common practice to extrude the insulating material about the bare conductor which is then coiled in a pan of soapstone or similar material to keep the turns of wire from sticking together. The pans of wire thus coiled are then placed in a vulcanizing chamber and subjected to heat and pressure until vulcanization is completed, after which the coils of insulated wire are cleaned and wound on supply reels. Such a process is objectionable not only because of the labor expense involved in the panning operation and the reeling after vulcanization, but also because of the time required and the tendency for the conducting core to become decentralized in its insulating sheath prior to vulcanization and for the insulating sheath to become distorted.

It is therefore an object of the present invention to provide an insulated electrical conductor in which the conducting core is surrounded by a uniform layer of insulating material vulcanized thereon at high speed and with a minimum amount of handling.

To attain this object and in accordance with one feature of the invention an insulating compound is provided which is capable of extremely rapid vulcanization and yet one which, when mixed and applied in accordance with the process defined, does not vulcanize during the extruding operation. Furthermore, this compound is so proportioned that although it has sufficient plasticity and is soft enough to permit extruding at high speed and at comparatively low temperatures, it nevertheless possesses sufficient rigidity to prevent the conducting core from becoming decentralized or the sheath distorted during manufacture.

To attain this object there is provided an insulating compound which is adapted to be extruded about an electrical conductor and to meet the exacting requirements of a continuous vulcanization process when carried on at high speeds. This compound consists of the following ingredients in substantially the proportions named.

	Per cent
Smoked sheet rubber	22
Reclaimed rubber (boot and shoe)	10
Reclaimed rubber (whole tire)	10
Mineral rubber	5
Whiting	44.7
Zinc-oxide	2.5
Anti-oxidant	1.5
Sulphur	1.0
Softener (pine tar oil)	3.0
Ultra-accelerator	.3

The reclaimed rubber is specified primarily for the sake of economy and the percentage of such rubber to new rubber may be varied over a rather wide range so long as the total vulcanizable rubber content of the compound remains substantially 30%. The mineral rubber and pine tar oil which serve respectively as plasticizer and softener are present in such proportions as to give the compound the necessary plasticity and softness to permit it being extruded at high speeds while maintained at a relatively low temperature such that prevulcanization does not occur and, on the other hand, to have sufficient rigidity to preclude any possibility of decentralization of the core or distortion of the sheath before vulcanization. To further prevent decentralization of the core and to permit extruding and vulcanizing continuously at a high rate of speed an ultra-accelerator is employed in an amount to bring about complete vulcanization in a fraction of a minute when employed under the conditions to be described. Preferably the amount of ultra-accelerator present is 1% or more of the total rubber content and in no case should it be less than 0.9%. The term "ultra-accelerator" defines an accelerator such as tetramethylthiuram-monosulphide or tetramethylthiuramdisulphide, and the proportions of ultra-accelerator indicated above refer to these particular ultra-accelerators or ones having equivalent accelerator power. Accelerators of this type have not been used heretofore in quantities such as specified for the purpose of vulcanizing or coating conductors and could not be so used in any process requiring pan vulcanization since such compounds to resist

distortion in panning must be stiffer and extruded at higher temperatures which would result in prevulcanizing during mixing and extruding. The remaining ingredients of this compound are present for the same purpose as in common practice. The zinc-oxide activates the accelerator while the anti-oxidant resists ageing of the compound. Sulphur serves as the vulcanizing agent and whiting is used solely as a filler and consequently may be replaced by other fillers in commercial use.

In preparing this compound, all of the materials except the ultra-accelerator are masticated in a commercial type mixer and put through a strainer. The compound is then allowed to cool for a period of approximately ¾ of an hour instead of ageing for 48 hours as is the customary practice. The ultra-accelerator is then added in the warming rolls with just sufficient working to thoroughly mix it and the compound is used as soon thereafter as possible, which should always be within a period of two hours.

This vulcanizing compound is preferably used in accordance with the process described in detail in our United States Patent No. 1,927,400, dated Sept. 19, 1933, in which case it may be fed into the extruding head either by hand or by an automatic device of the intermittent type arranged to stop feeding whenever sufficient compound is in the extruding chamber. In order to prevent prevulcanization occurring in the extruding chamber, the head should be designed so that the compound is directed from the end of the extruding screw to an angular chamber around the wire eliminating all pockets in which the compound may stand and become vulcanized before application to the wire. The temperature of the extruding head must be such as to give the compound sufficient plasticity without causing too rapid an action of ultra-accelerator. These conditions are satisfactorily met if the extruding head is maintained at a temperature of approximately 160° F. which is considerably lower than used heretofore. This requirement is preferably met by means of an automatic regulator by which the circulation of steam and water, respectively, heats and cools the extruding head to maintain the desired temperature.

When using the compound in accordance with this invention for the insulation of electrical conductors, a decidedly superior product results. Not only is the core centralized with respect to the covering but the covering, per se, possesses superior mechanical and electrical properties. As a result of the exceedingly rapid vulcanization the rubber compound does not deteriorate to the extent that a similar compound does when subjected to a slow vulcanizing process. Furthermore, in producing this improved conductor the expense of handling, reeling, etc., inherent in pan vulcanizing methods, is eliminated; the process is continuous; and may be carried on at a high rate of speed limited practically only by the rate at which satisfactory extrusion is possible. For example, in coating No. 17 B & S gauge drop wire with a coating 3/64 of an inch thick, satisfactory results are obtained when the speed of travel of the wire is from 400 to 500 feet per minute. Since these results were obtained when using a vulcanizing chamber 100 feet in length, the corresponding vulcanizing periods for these speeds would be 12 to 15 seconds. Such a period of vulcanization is exceedingly small when compared with the vulcanizing periods used heretofore for the vulcanization of insulating compounds on electrical conductors and prevents to a considerable degree the deterioration which occurs in the rubber when a corresponding compound is vulcanized at the rate commonly employed in practice.

The specific compound described is one which is particularly suitable as the covering for "drop wire." Obviously, in order to provide an insulating sheath having different physical or electrical properties, or for other reasons, certain of the constituents of this compound may be replaced by equivalents or employed in varying amounts without departing from the spirit of the invention as defined in the appended claims.

What is claimed is:

1. A vulcanizable insulating compound for coating electrical conductors containing rubber, plasticizer, softener and an ultra accelerator so compounded that the resulting compound is sufficiently plastic and soft at a temperature of 160° F. to permit extrusion upon a conductor at the rate of 400 feet per minute without being sufficiently soft to permit decentralization of the conductor when vulcanized at a temperature corresponding to 170 to 175 pounds steam pressure.

2. A vulcanizable insulating compound for coating electrical conductors, the physical properties of said compound being such as to permit its being extruded without vulcanization upon a conductor at the rate of 400 feet per minute while maintained at a temperature of approximately 160° F. and substantially completely vulcanized in 15 seconds while subjected to a temperature corresponding to 170 to 175 pounds steam pressure.

3. A vulcanizable insulating compound for coating electrical conductors comprising the following ingredients in substantially the proportions named: crude rubber 22.0%, reclaimed rubber 20.0%, mineral rubber 5.0%, whiting 44.7%, zinc oxide 2.5%, anti-oxidant 1.5%, sulphur 1.0%, pine tar oil 3.0%, ultra-accelerator .3%.

4. A vulcanizable insulating compound for coating electrical conductors containing rubber, plasticizer, softener and an ultra-accelerator of the group consisting of tetramethyl-thiuram-monosulphide and tetramethylthiuram-disulphide so compounded that the resulting compound is sufficiently plastic and soft at a temperature of 160° F. to permit extrusion upon a conductor at the rate of 400 feet per minute without being sufficiently soft to permit decentralization of the conductor when vulcanized at a temperature corresponding to 170 to 175 pounds steam pressure.

5. A vulcanizable insulating compound for coating electrical conductors containing rubber, plasticizer, softener and tetramethylthiurammonosulphide so compounded that the resulting compound is sufficiently plastic and soft at a temperature of 160° F. to permit extrusion upon a conductor at the rate of 400 feet per minute without being sufficiently soft to permit decentralization of the conductor when vulcanized at a temperature corresponding to 170 to 175 pounds steam pressure.

6. A vulcanizable insulating compound for coating electrical conductors containing rubber, plasticizer, softener and tetramethylthiuramdisulphide so compounded that the resulting compound is sufficiently plastic and soft at a temperature of 160° F. to permit extrusion upon a conductor at the rate of 400 feet per minute without being sufficiently soft to permit decentralization of the conductor when vulcanized at

a temperature corresponding to 170 to 175 pounds steam pressure.

7. A vulcanizable insulating compound for coating electrical conductors comprising the following ingredients in substantially the proportions named: crude rubber 22.0%, reclaimed rubber 20.0%, mineral rubber 5.0%, whiting 44.7%, zinc oxide 2.5%, anti-oxidant 1.5%, sulphur 1.0%, pine tar oil 3.0%, an ultra-accelerator of the group consisting of tetramethylthiurammonosulphide and tetramethylthiuramdisulphide .3%.

8. A vulcanizable insulating compound for coating electrical conductors comprising the following ingredients in substantially the proportions named: crude rubber 22.0%, reclaimed rubber 20.0%, mineral rubber 5.0%, whiting 44.7%, zinc oxide 2.5%, anti-oxidant 1.5%, sulphur 1.0%, pine tar oil 3.0%, tetramethylthiurammonosulphide .3%.

9. A vulcanizable insulating compound for coating electrical conductors comprising the following ingredients in substantially the proportions named: crude rubber 22.0%, reclaimed rubber 20.0%, mineral rubber 5.0%, whiting 44.7% zinc oxide 2.5%, anti-oxidant 1.5%, sulphur 1.0%, pine tar oil 3.0%, tetramethylthiuramdisulphide .3%.

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