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ELECTRIC POWER CABLE

Filed March 11, 1968

PRIOR ART

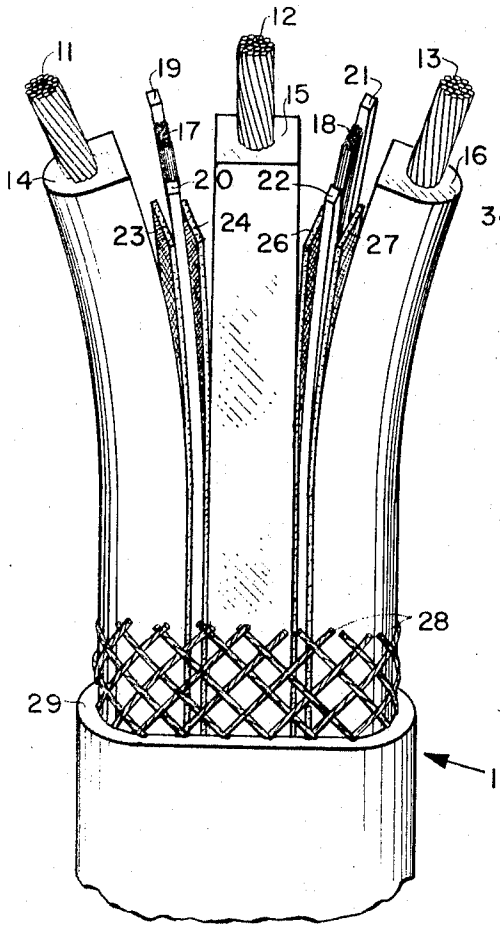

Fig. 1

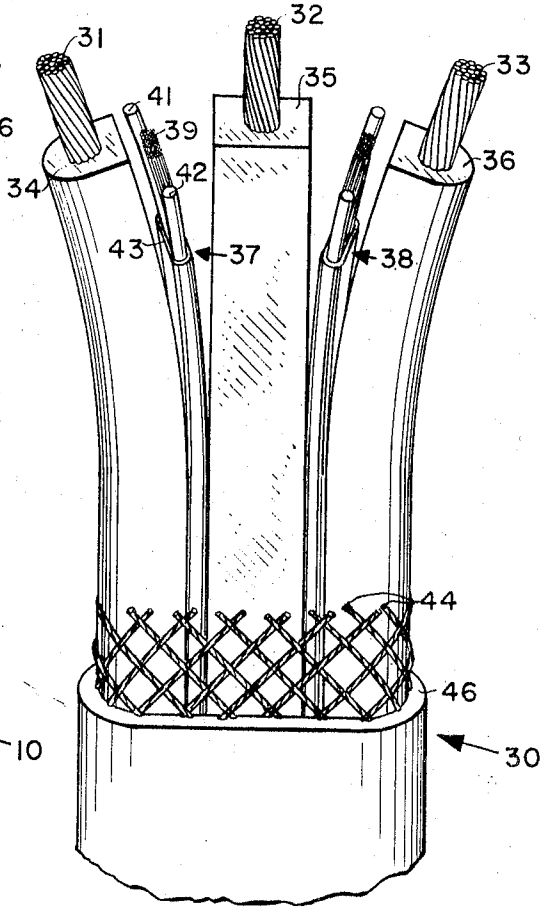

Fig. 2

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THEIR AGENT

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ELECTRIC POWER CABLE

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ABSTRACT OF THE DISCLOSURE

Flat power cables, used in hard service, such as powering mining machines, have flat, grounding-conductor, spacer assemblies, with extruded coverings, between the insulated conductors.

BACKGROUND OF THE INVENTION

Our invention relates to insulated cables with dissimilar or auxiliary conducting elements and particularly to flat tough, flexible portable cables of the type that can be repeatedly taken up on reels and dragged over the ground. Such cables are typically used to carry power to mining machines and, for such use, are known as mining machine cables.

It has been known to make such cables with the insulated conductors parallel, as in Patent 2,455,773, and with flat grounding wires, reinforced by fabric breaker strips between the conductors as in Patent 2,689,268. A commercially successful 3-conductor mining machine cable that has proven very satisfactory in hard service is constructed flat with the two end conductors having D-shaped insulation and the center conductor with a square insulation. In the two divisions between the insulated conductors there are disposed bare (in the sense of being uninsulated), stranded grounding conductors that have been rolled flat. When the flat cable is considered in a horizontal position the flat grounding conductors are vertical. These grounding conductors are not as wide as the power conductor insulation and at both edges of each of the grounding conductors there are square or rectangular rubber or plastic positioning spacers. The spacers keep the stranded grounding conductors centered, and it has been found that they must be square or rectangular to be retained in position during assembly. In this known cable nylon fabric breaker strips are laid flat on both sides of each grounding conductor, making four breaker strips in all. The assembly so far described is covered with a nylon open web braid and then paid into an extrusion machine where a tough synthetic rubber jacket is applied over it.

While cables constructed in the manner described have performed well they have been difficult to make because of the need for fabric nylon breaker strips, the care required in handling of the square spacers to keep them from twisting and, particularly, because of the difficulty of paying the complex assembly of thirteen elements into the braider. It has been found that round spacers cannot be retained in their proper positions in this assembly.

SUMMARY

The difficulty of producing mining machine cables has been reduced with no sacrifice, and even an improvement, in performance and the simplicity of manufacture has been greatly increased by the cable of our present invention. Our new flexible electric cable comprises a plurality, usually two or three, insulated power-carrying conductors laid in flat, parallel arrangement, with a thick, tough jacket surrounding them. It also comprises at least one uninsulated flat grounding conductor positioned, within

the jacket, between two of the insulated conductors and parallel to them, and dielectric positioning spacers laid against the edge of each grounding conductor. A positioning spacer is laid against each edge of each grounding conductor. A thin continuous extrusion of synthetic polymer, preferably nylon 1–10 mils thick, surrounds each grounding conductor and the positioning spacer or spacers, forming a grounding-conductor-spacer assembly directly adjacent to the insulated conductors.

BRIEF DESCRIPTION OF THE DRAWING

FIGURE 1 shows a perspective, with elements exposed, of a prior art cable.

FIGURE 2 shows a perspective, with elements exposed, of an embodiment of the cable of our invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Prior list

Since it is difficult to understand the nature of our invention without a detailed consideration of the prior art, a very brief description of present practice is herein given.

In FIGURE 1 a known type of mining machine cable is indicated generally by the numeral **10**. It has **3** conductors **11**, of flexibly stranded copper encased, respectively, in thick walls of insulation **14**, **15**, **16**. Between each pair of insulated conductors there is positioned an uninsulated flat grounding conductor, a conductor **17** being positioned between the conductors **11** and **12**, and a conductor **18** between the conductors **12** and **13**. The conductor **17** is protected by 2 square rubber positioning spacer strips **19**, **20** and the conductor **18** by two strips **21**, **22**. These spacer strips must be square or rectangular in section since it has been established that round strands will work out of position during assembly or use of the cable. Woven nylon breaker strips **23**, **24** separate the conductor **17** from the insulated conductors **11** and **12**, respectively, and identical breaker strips **26**, **27** separate the conductors **18** from the respective insulated conductors **12** and **13**. These strips **23**, **24**, **26**, **27** are essential to prevent destruction, under flexing, of the grounding conductors **17**, **18**. The whole 5-conductor assembly (3 insulated and 2 grounding) is covered by an open nylon braid **28** over which is extruded a jacket **29** of neoprene or other tough material. Considering the five conductors **11**, **12**, **13**, **17**, **18**; four positioning spacers **19**, **20**, **21**, **22**; and four breaker strips **23**, **24**, **26**, **27** it will be seen that a complex assembly of thirteen unconnected units must be paid into a braiding machine to apply the braid **28**.

In our improved cable, indicated generally by the numeral **30** of FIGURE 2, three flexibly stranded copper conductors **31**, **32**, **33** are insulated respectively with heavy walls of insulation **34**, **35**, **36**. The insulated conductors are separated by grounding-conductor assemblies **37**, **38** constructed as follows. A flat grounding conductor **39** of very flexible construction has assembled with it, against it edges, continuous elongated extruded positioning spacers **41**, **42** of a material such as polyvinyl chloride, neoprene, nylon or the like. The strand **39** is made in a known manner by rolling a bunched strand of copper wires, or it may be braided, within the scope of our invention. The positioning spacers **41**, **42** are round in section as opposed to the strips **19**, **20** since, as shall be seen, they are firmly held in position. It will be understood that an important saving is effected by the use of round, rather than square positioning spacers since no special precautions are necessary to keep them from twisting. In production there is less scrap and the operation can proceed much faster with less operator attention with the use of our round spacers,

but these are only possible because of an extrusion **43** of nylon that we have applied over the grounding-strand spacer assembly. This extrusion is very thin, preferably 3 to 5 mils, or at the extremes 1–10 mils in thickness. Prior to our invention it had not been found possible to substitute films of nylon for the woven strips **23**, **24**, because in the strenuous service for which mining machine cables are intended, the film would buckle and fold, eventually causing a failure in the grounding conductor. A nylon braid **44** is applied over the assembly of the conductors **31**, **32**, **33** similar to the braid **28** but instead of having to pay thirteen separate elements into the braider we have to pay only five, the three conductors **31**, **32**, **33** and the two grounding wire assemblies **37** and **38**. In addition we have eliminated the slow operation of weaving the strips **23**, **24**, **26** and **27** in favor of a high-speed extrusion of the coverage **43** on the assembly **37** and its equivalent on the assembly **38**.

The cable of FIGURE 2 having walls **34**, **35**, **36** formed of neoprene, extrusion **43** of nylon, and a jacket of neoprene was found to perform well as a mining machine cable. Other known conductor insulations and jacketing materials may, however, be used within the scope of our invention, as may extrusions **43** of materials other than nylon such as polypropylene, polyvinyl chloride, polyvinylidene fluoride, and polyethylene. Although the cable **30** that has been described has three power conductors and two grounding-conductor assemblies it will be understood that other embodiments of our invention may have two power conductors with one grounding conductor assembly or four power conductors with three grounding-conductor assemblies, etc.

We have invented a new and useful cable of which the foregoing description has been exemplary rather than

definitive and for which we desire an award of Letters Patent as defined in the following claims.

We claim:

1. A flexible electric power cable comprising

(A) a plurality of insulated power-carrying conductors laid in flat, parallel arrangement,

(B) a thick, tough jacket surrounding said insulated conductors,

(C) at least one uninsulated flat grounding conductor positioned within said jacket between two of said insulated conductors and parallel thereto,

(D) two dielectric positioning spacers laid against the edges of said grounding conductor,

(E) a thin continuous extrusion of synthetic polymer surrounding said grounding conductor and said spacer strand, forming a grounding-conductor, spacer assembly directly adjacent to said insulated conductors.

2. The cable of claim **1** comprising three insulated power-carrying conductors and two grounding-conductor, spacer assemblies.

3. The cable of claim **1** comprising dielectric positioning spacers against both edges of said grounding conductor, said extrusion surrounding said grounding conductor and said positioning spacer.

4. The cable of claim **1** wherein said extrusion comprises nylon.

5. The cable of claim **1** wherein said extrusion is between one and ten mils thick.

References Cited

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