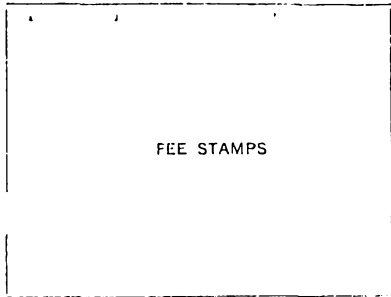


(CONVENTION—One or More Persons)

FORM 8—REGULATION 12 (2)

COMMONWEALTH OF AUSTRALIA
PATENTS ACT, 1952-1969
DECLARATION IN SUPPORT OF A CONVENTION
APPLICATION FOR A PATENT



In support of the Convention Application for a patent for an invention entitled:

(a) Here insert Title of Invention.

(a) GEL COMPOSITION

(b) Here insert (in full) name(s) of Applicant(s).

I/We (b) Clarence S. Freeman

(c) Here insert (in full) Address(es) of Applicant(s).

of (c) 16242 Katherin Lane, Houston, Texas 77430 USA

do solemnly and sincerely declare as follows:

1. I am/We are the Applicant(s) for the Patent.

2. The basic Application(s) as defined by section 141 of the Act was/were made in (d) USA on the 1st day of May 19 87
USA on the 15th day of April 19 88
by (e) Clarence Sexton Freeman

(d) Here insert Basic Country or Countries followed by date or dates of Basic Application(s)

(e) Here insert Full Name(s) of Applicant(s) in Basic Country.

3. I am/We are the actual Inventor(s) of the invention referred to in the basic Application (or, where a person other than the Inventor is the Applicant).

3. (f) _____
of _____

(f) Here insert Full Name(s) and Address(es) of actual Inventor(s) if other than Applicant(s).

_____ is/are the actual Inventor(s) of the invention and the facts upon which I am/we are entitled to make the Application are as follows:

~~I am/We are the Assignee(s) of the said Inventor(s).~~

4. The basic Application(s) referred to in paragraph 2 of this Declaration was/were the first Application(s) made in a Convention country in respect of the invention, the subject of the Application.

DECLARED at Houston Texas U.S.A.

this OCT, 2 day of _____ 19 89

(g) Signature(s) of Applicant(s).

(g) Clarence Sexton Freeman
Clarence Sexton Freeman

To THE COMMISSIONER OF PATENTS.

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(54) Title
GEL COMPOSITION

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(57) Claim

1. A composition for protecting the wires of telecommunications and other cables carrying direct current from damage caused by moisture contact of faults or breaks in the insulation thereof comprising a dielectric gel matrix and a polymer dispersed in said gel matrix, said polymer comprising a hydrocarbon backbone having anionic groups attached thereto, the anionic groups of said polymer, when exposed to direct current from a wire that is in short caused by the presence of water, causing said polymer to be attracted to the wire, the accumulated polymer re-insulating the wire thereby excluding water from the wire and eliminating the short to restore current flow through the wire.

10. A composition for protecting electrical components in an enclosed space from damage caused by invasive water comprising 67-90% of a gel matrix which is relatively non-conductive to DC current and 10-33% of a water adsorbent polymer, said polymer being dispersed in said gel matrix.

GEL COMPOSITIONBACKGROUND OF THE INVENTIONField of the Invention

This invention is for a gel chemical composition. The gel composition is activated by moisture to absorb water and can be used to protect components from water damage. The composition can be a gel or a gel with a tackifier added to make the gel sticky to coat and adhere to surfaces.

The gel composition can be introduced into confined areas such as housings for cable lines and splices to protect the communications cables for extended periods of time. The gel can be introduced into the housing prior or during service of the splices. The tacky gel can be used to coat wires and fill interstitial spaces inside cables during cable manufacturing. In addition to the gel protecting the wires, the composition also heals shorts in lines such as telephone splices which carry a small dc current.

Description of the Prior Art

Communications cables such as telephone lines are made up of a multitude of wires, typically copper wire, which are insulated with a sheath of plastic, paper wrapping or other materials. The cable of the many wires is enclosed in a flexible cable cover. Typically the wires are coated with a thin layer of thermoplastic resin such as polyethylene. The wires are drawn through a vessel of heated thermoplastic and as the wire goes through the heated resin a thin coating is deposited and adheres while cooling onto the wire. This process takes place before wrapping the wire. When the wrapped wires are brought together to make the cable a filler such as a petroleum gel is added inside the cable cover to fill the interstitial spaces.

The spliced connections of the communication cables are housed in a casing type closure which can contain thousands of individually spliced wires. The cable splices are protected by housings which enclose the wire splices. The housings are typically maintained under pressure. The housings are laid underground or above ground. The closures are exposed to damaging conditions which can cause leaks in the housings thereby providing an access to water.

In use the wires in the cable are connected to one or more small dc power sources to provide the transmission current that is required and eventually to the telephone terminal equipment, one or more telephone transmitters at one end or location and one or more telephone receivers at the other end. The housings are pressure type closure systems and it is crucial to prevent the entry of invasive water and protect the splices from moisture. The entry of moisture into the cable splices or into a cable which is not surrounded by a closure causes a conductive path through the moisture from wire to wire if the insulation of the wires is not maintained. When this happens, the wires either short out all together or cross-talk is established, thereby disrupting the telephone communications.

One method of providing additional protection to the spliced connections inside the housing includes wrapping the bundle with a flexible material, and injecting a liquid epoxy or urethane into the housing which solidifies within the housing. The composition must be mixed on the site and is typically injected with a gravity flow into the housing. The material typically does not fill the entire interior of the casing and leaves voids. These voids or channels can create an avenue for the entrance of water, particularly at either end of the bundle that exits in the housing and forms the wire bundle in the cable. The wrapping around the splices as in the housing also can cause a funnel effect such that the water enters through a fissure at either end

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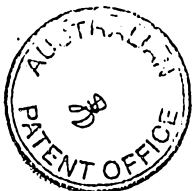
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of the closure around the cable and into the wrapping around the bundle.

Other attempts to provide some measure of protection from invasive water are illustrated in the disclosures of various patents. For instance, U. S. Patent No. 3,347,974 describes a cable having plugs or barriers located axially along the length of the cable stated to be composed of a hydrophobic jelly and a swelling medium. Moisture entering the cable causes the medium to swell to fill the cross-sectional area of the cable to prevent passage of moisture. German Patent Application No. 2,007,163 describes the introduction, between the cable core and jacket, of a layer of a strip-like carrier which is coated with a material that expands when exposed to water. Various materials are listed as being suitable expanding materials, including starch derivatives, alginates, cellulose derivatives, polyvinyl alcohol, polyvinylpyrrolidone, and polyacrylamide. French Patent No. 2,456,375 describes cable having a "refill" material therein which is said to consist of mixtures of higher molecular weight organic compounds such as silicone greases, plastisols and polyethylene waxes, or polypropylene with aromatic hydrocarbons.

British Patent Application No. 1,598,807 describes two materials for filling the space between bundles of conductors, the first being a mixture of polyacrylamide and calcium carbonate, and the second being a mixture of two materials, one of which is said to swell rapidly into a viscous mass upon contact with water and a second which swells more slowly upon contact with water into a material having a higher viscosity than the viscous material into which the first component swells. Examples of materials which are stated as being appropriate for use as the latter are bentonite, bentone, starch, cross-linked dextrine, polyvinyl alcohol, methylcellulose, cellulose acetate, and other cellulose derivatives. British Patent Application No. 2,080,998 purports to describe a telecommunications cable comprising a bundle of insulated conductors coated with a hydrophobic filler, a sleeve, a metal screen and an external sheath wherein a powder which swells in water which is



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dispersed in a viscous agent such as polybutene, glycerol or a water-soluble wax is interposed between sleeve and metal screen. Various cellulose derivatives are listed as preferred water swellable powders.

5 Summary of the Invention

The present invention is a gel composition with or without a tackifier which can be a cable filling, wire coating, or gel injected into a housing or closure surrounding wires or splices which serve as protection from invasive water. The
10 gel can be introduced into the housing during the manufacturing process or after the housing is placed in service.

The composition is composed of a water absorbent polymer with a hydrocarbon chain as a backbone with pendent anionic
15 groups attached to the polymer backbone. This polymer is mixed with a dielectric gel matrix. In many cases, the dielectric gel matrix is hydrophobic and the addition of a hydrophilic substance for example glycols, detergents, and surfactants, or mixtures of substituted glycols, fatty acids
20 and polyethers is necessary as explained below.

The gel composition itself will provide an initial barrier to water. If water does enter, then the water absorbent polymer is activated and the water is absorbed. In tests water was placed adjacent to the gel composition. The fine
25 powder-like material is seen travelling to the water away from the gel matrix. The composition has exhibited this travelling effect for up to six inches from the initial gel matrix boundary. This appears to be the water absorbent polymer seeking out the water. Once the water is contacted
30 it forms a gel-like material similar to a mixture of the polymer and water. The addition of a hydrophilic substance in a gel matrix composed of hydrophobic materials appears to promote this travelling to the water effect.

I have found that the water absorbent polymers with the
35 pendent anionic groups when exposed to small amount of dc current such as that present in a telephone line appears to cause an attraction of the polymer with the anionic groups to the wires which act as an anode. This apparent



attraction of the polymer to the exposed wire brings the polymer into electrochemical association with the wire, and insulation develops which excludes water from the surface of the wire. An insulation builds up and the electric path
5 through the wire is established with the short eliminated. The polymer is typically in a granular form. This invention is a mixture of the polymer with other substances to form a gel which is relatively non-conductive to dc current and can be used in telecommunications. The gel matrix mixture does
10 not inhibit or prevent the insulation of the wire.

The gel composition plays several roles in protecting contents or components in a housing from moisture damage. First, if there is invasive moisture the gel composition will repel water. Upon the presence of moisture the water
15 absorbent component of the gel is activated so that it travels out of the gel matrix to absorb the water. This is particularly useful in use with cables wherein a multitude of wires have very small interstitial spaces. The composition will travel into the small spaces if moisture is
20 present. This causes a plugging effect to further invasive water. The benefit is derived whether or not any electrical current is present.

In the case of, for instance, damaged communication splices which carry a low level dc current the polymer also
25 heals a short. The gel composition will plug the entry of water and heal the short restoring current in the lines. Upon the entrance of any water into the housing and with the exposure to a small dc current the water absorbent, insulation providing polymer in the matrix is activated to
30 insulate the exposed wire.

The gel composition can be varied as to desired viscosity, endurance of environmental conditions and introduced into housing under pressure. The viscosity range for the gel without tackifier can be from 2 centistokes at 100°C to
35 90,000 centistokes at 40°C. The viscosity is a matter of choice for the service desired and is not intended to be limited. A thin or thick gel can be used. The optimum



pentometer penetration measurement range for a gel without tackifier would be 150-425. The gel can be introduced into the housing or enclosure before or during service.

Depending on the components of the gel the healing process can take as short as several minutes to 2 to 3 hours to insulate the wire so that communication will be established. The water absorbency often starts to occur instantaneously. Typically a fast acting composition is preferred.

Re-entry into a splice housing filled with the prior art epoxy and urethane is difficult, if at all possible. The gel without tackifier of this invention can be manually cleaned off of the splices so that repairs can take place. The gel can be re-used rather than discarded as previously was necessary with the prior art epoxy or urethane encapsulants.

The gel with tackifier is sticky and designed for use during cable manufacturing. The cable filling compound of this invention provides a gel physical barrier as well as the protection of including the polymer which heals shorts which may occur during service.

Description of the Preferred Embodiments

The water absorbent polymer has a hydrocarbon chain backbone and pendent anionic groups on the hydrocarbon chain. The anionic groups can be carboxylate, sulfate, phosphate, sulfonate or any other anionic groups which will form a negative charge on exposure to water. The salt form of polymer can be used with a variety of ions including but not limited to alkali metal ions such as lithium, sodium, potassium or alkali earth metals such as magnesium, calcium, strontium, barium, zinc or aluminum. The salt used will depend on the valency of the anionic group attached to the hydrocarbon polymer. Examples of hydrocarbon polymers having the anionic groups listed above include polymers such as cellulose derivatives, polypropenoates, and salts of starch-graft copolymers of polyacrylic acid and polyacrylamide. Also, polymers of acrylates, acrylamides,



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methacrylate, methacrylamide, acrylonitrile, methacrylonitrile, tri- and/or tetraethylene glycol, diacrylate, and cellulose, having appropriate anionic groups attached to the respective hydrocarbon backbones thereof, may be used in connection with the present invention.



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Typically the wires which serve as the anode are copper. However, wires made of other anodic materials such as aluminum, nickel, cobalt, chromium or iron will serve as an anode with the small voltage necessary to carry telephone transmissions.

The polymers of this nature are typically solids. The polymers have been used to sprinkle over splices or cables that needed drying. There is a need for a protective insulating agent in housings to prevent the affects of invasive water. Dry granules would not easily provide contact with the affected splices. The gel matrix provides a dispersant for the polymer to contact the splices.

The water absorbent polymer can be dispersed in a number of different types of gel matrix and the gel with the hydrocarbon injected into a housing around the splices. The gel with the dispersed polymer can be used in a confined area which allows contact to be made with the gel and the wires or splices.

A number of compositions which are gels or can be thickened to form a gel may be used. The gel matrix must be relatively nonconductive to a small dc current. The matrix should provide a fairly uniform dispersal of the anionic hydrocarbon polymer in the gel. The viscosity of the gel can be varied depending on the method used to introduce the composition into the confined system and the temperature and other conditions under which the composition will be used.

The gels that are hydrophobic have a tendency to coat the polymer and essentially shield it from the wire which needs to be protected. A small amount of a hydrophilic substance can be added to a hydrophobic gel. The gel is a carrier for the polymer. The hydrophilic materials provide a conduit between the polymer and the moisture.

The gels used in this composition include silicones, petroleum gels, high viscosity esters, glycols, polyglycols, olefins and fluorocarbons. Thickeners can be used with

certain compounds to achieve a desired viscosity. Typical thickeners for gels and greases are pyrogenic silica, organophilic clays such as bentonite and hectorite, soaps such as metal stearates, and ureas.

In addition, certain corrosive inhibitors which are typically used in greases were found to have no effect on the water absorbency or insulation characteristics of the polymer gel. The rust inhibitors must be chosen with care because an acid may neutralize the effect of the polymer. A neutral barium dinonylnaphthalene sulfonate did not affect the properties of the present invention. It did have a slight tendency to de-gel one of the gel compositions. A copper passivator which is a liquid copper triazole derivative was used without any adverse effects.

The gel matrix can also be colored with a dye when desired. The amount of dye is dependent on the deepness of color desired. A small amount of Automate green dye was satisfactory to impart a color to the gel matrix.

The following are examples of different combination of gel and compositions which thicken to produce gels which can be used with the water absorbent polymer with anionic groups. The polymer used can be any of the polymers previously described including specifically sodium 2 propenoate and salts of starch-graft copolymer of polyacrylic acid and polyacrylamide. The following examples are not intended to limit the scope of the patent application and are to be illustrative of the number of different compounds which can be used to practice the invention.

EXAMPLE 1

A fluid mixture is prepared using 20 parts by weight polyisobutylene, 4-1/2 parts by weight polyalpha olefin and one part by weight polyalkylene glycol. The polyalkylene glycol which is a random copolymer with 75% ethylene oxide and 25% propylene oxide substitution, with an average molecular weight of from 12,000 to 15,000 and a hydroxyl number between 5 to 10 mgs KOH per gram. The

polyisobutylene has a viscosity ASTM D-445 38° C of 210-227 and the viscosity index ASTM D-567 is 95 and a molecular weight of 750 to about 1200. The polyalpha olefin used was a long chain polyalpha olefin SHF-61 manufactured by Mobil which had a viscosity ASTM D-445 at 38° C of 30.5, a viscosity index ASTM D-2270 of 132. The polyalpha olefins which can be used, as exemplified by the SHF-61 Mobil product, are typically hydrocarbons with a molecular weight from 200 to 800. The SHF-61 product is an oligomer of 1-decene. The satisfactory viscosity range of the polyalpha olefins is from 2 centistokes at 100° C to 100 centistokes at 100° C.

Twelve parts of fluid mixture was mixed with one part of pyrogenic silica to give a gel matrix. The gel matrix has a dielectric constant of less than 3. The resulting gel matrix is blended two parts by weight gel to one part by weight of an absorbent hydrocarbon polymer.

A 12v battery was hooked up to a pair of spliced wires and water was introduced into the spliced area causing a short. A spliced area was then filled with a composition of Example 1 and water began to be absorbed in 15 seconds. The short healed and the cable pair became conductive.

EXAMPLE 2

The same composition of Example 1 can be used increasing the percentage by weight of polyalkylene glycol from the 1% to 10% range. Example 1 was duplicated with the polyalkylene glycol at 4% by weight of the gel matrix composition. The composition with 4% polyalkylene glycol performed in a substantially similar manner as described in Example 1 above.

EXAMPLE 3

The gel matrix components of Example 1 are mixed in the same proportions. The water absorbent polymer sodium 2-polypropenoate is mixed with the gel matrix in a 10% by weight ratio of the final mixture. This example was tested and performed in substantially the same manner as described in Example 1 above.

EXAMPLE 4

The gel matrix components of Example 1 were mixed in the same proportions. The polymer specifically sodium 2 polypropenoate is added to the gel matrix in the amount of 20% by weight of the final mixture.

It has been found that sodium 2-polypropenoate can be used in a range from at least 10% to at least up to 33% with the gel matrix and perform satisfactorily.

EXAMPLE 5

A gel matrix of Example 1 was made substituting for the polyalkylene glycol with isopropyl alcohol. This substitution was of another hydrophilic substance of polyalkylene glycol.

The isopropyl alcohol was 5% of the weight of the gel matrix. The gel matrix was mixed in a 2:1 ratio with the polymer 2-polypropenoate. The response time to water absorption was very fast with water absorption occurring within 10 seconds.

EXAMPLE 6

The gel matrix preparation in Example 1 was duplicated substituting 2-ethyl hexanol for the polyalkylene glycol component. The 2-ethyl hexanol was 5% by weight of the gel matrix. The gel matrix was mixed in the polymer in a 2:1 ratio. The water absorption was slower, however the short did heal after 20 minutes.

EXAMPLE 7

The gel matrix described in Example 1 was prepared in a similar manner with a substitution of ethylene glycol for the polyalkylene glycol described. The ethylene glycol was 5% by weight of the gel matrix. The gel was mixed with 33% by weight with polymer. There was a slower response time with water absorption starting after one minute.

EXAMPLE 8

The gel matrix is prepared as disclosed in Example 1 with the substitution of 5% by weight of hexylene glycol for the polyalkylene glycol described therein. The gel was mixed with 33% by weight of polymer. The response time for water absorption was instantaneous with restoration of conductivity in approximately 20 minutes.

EXAMPLE 9

The gel matrix is prepared as disclosed in Example 1 with the substitution of 5% by weight of a polypropylene with terminating hydroxyl groups with a molecular weight of about 900. The gel was mixed with 33% by weight of polymer. The response time for water absorption was instantaneous.

EXAMPLE 10

The gel matrix of Example 1 was duplicated using a polyglycol composed of a 50-50 mixture of ethylene oxide and propylene oxide substituted polyglycol at 5% by weight of the gel matrix instead of the polyalkylene glycol. The composition of this example had instantaneous response to water absorption when the gel matrix was mixed with a 33% by weight water absorbent polymer.

EXAMPLE 11

This example duplicates the gel formulation of Example 1 with a substitution of oleic acid for the polyalkylene glycol. The oleic acid is in a 5% by weight of the gel composition. The gel is then mixed with 33% by weight of a

water absorbent polymer described herein. The oleic acid composition takes a longer time to initiate water absorbency. In a test as described in Example 1 current was restored after 40 minutes.

EXAMPLE 12

This example duplicates the gel formulation of Example 1 with a substitution of tall oil fatty acid with the polyalkylene glycol. The tall oil fatty acid is in a 5% by weight of the gel matrix. The gel is then mixed with 33% by weight of a water absorbent polymer described herein.

The effects of oleic acid and tall oil fatty acid were compared to the composition without a hydrophilic component in the gel. The gel matrix of Example 1 was made without the polyalkylene component. The oleic acid and tall oil fatty acid slightly speed up the response time for absorption by about one-half. Without the hydrophilic additive it takes at least 2 minutes for the compound to initiate water absorbency.

EXAMPLE 13

The gel matrix was prepared substituting surfactants for the polyalkylene glycol. The surfactants used were SPAN® 80 and TWEEN® 80 which are sorbitan mono-9-octadecenoate poly oxy-1, 2-ethanediyl derivatives. The surfactants were substituted as 5% by weight of the gel matrix. The surfactants did change the consistency of the gel to some degree. The SPAN® 80 inhibited water absorbency initially. The TWEEN® 80 did not and exhibited instantaneous water absorbency in the gel matrix with polymer added.

EXAMPLE 14

Another surfactant was substituted for the polyalkylene glycol in Example 1. This surfactant was 2, 4, 7, 9-tetramethyl -5-decyn-4, 7-diol. This surfactant was 5% by weight of the gel matrix. The gel matrix was then mixed

with 33% by weight of a hydrocarbon polymer to achieve the final composition. The final mixture exhibited good water absorbency qualities. The same surfactant was used in a 1% by weight substitution of a polyalkylene glycol in the gel matrix. The decrease in the amount of surfactant slowed the response time to water absorbency from instantaneous to 10 to 20 seconds.

EXAMPLE 15

The polyalkylene glycol constituent of the gel matrix of Example 1 was substituted with 2 polypropylene oxide polyethers with different molecular weights. The two polyethers used had average molecular weights of 1,000 and 2,000 respectively. They were substituted for the polyalkylene glycol in a 5% by weight to the gel matrix. The water absorbency was almost instantaneous with the lower molecular weight compound and slightly slower with the higher molecular weight compound.

EXAMPLE 16

In addition to the gel components of the gel matrix described in Example 1 other gellant types were used. Polydimethyl siloxanes of the silicone group with a molecular weight from 2,000 to 10,000 are mixed with 33% by weight of hydrocarbon polymer. The silicones slow the water absorbency and insulation effects. When testing the silicone mixed with the polymer, the healing of a shorted wire pair would take a matter of hours rather than minutes. The silicones would be used in cases where an instantaneous healing was not necessary.

EXAMPLE 17

The water absorbent hydrocarbon polymer can be mixed with polyalkylene glycols with a thickener such as pyrogenic silica. The molecular weight range can be from 100 to 90,000 with various alkyl substitutions. The hydrocarbon polymer can be added in a 10% to at least 33% ratio. The preferred viscosities after thickening should be from 100 centistokes at 40° C to 90,000 centistokes at 40° C.

EXAMPLE 18

The hydrocarbon polymer can be mixed with a gel from a petroleum hydrocarbon base of paraffinic-aliphatic, naphthenic or a mixed base. The average molecular weight ranges from 200 to 1,000 with viscosities from 5 to 500 centistokes at 40° C. The petroleum hydrocarbons must be free of impurities which would corrode the wires of the splices.

EXAMPLE 19

Fluorocarbon gels have also been used as a gel matrix mixed with the polymer. NYE fluoroether grease 3834, a completely fluorinated grease was used as the gel matrix. The fluoroether grease had viscosities of 26 centistokes at 210° F and of 270 centistokes at 100° F. Seven grams of the NYE fluoroether was mixed with 3 gms of sodium 2 polypropenoate and 0.5 gms pyrogenic silica thickener. The water absorption and healing of the short was slow but effective.

EXAMPLE 20

The 9.5 gms the fluorocarbon matrix and polymer described in Example 19 was mixed with 0.5 gms of the polyalkylene glycol described in Example 1. The addition of the polyalkylene glycol to the fluorocarbon gel matrix caused instantaneous water absorption and correspondingly faster healing of the short.

EXAMPLE 21

Polyesters can be used as a gel matrix. The polyesters range in molecular weight from 300 to 800 and have viscosities from 25 to 100 centistokes at 40° C. The polyesters can be mixed with 10 to 30% of the polymer. The polyesters which have been utilized are trimethylol propane esters, pentaerithritol and triallyl mellitate.

The water absorption occurs less than one minute and conductivity is restored after 20 minutes.

EXAMPLE 22

A fluid mixture is prepared using 20 parts by weight polyisobutylene, 4-1/2 parts by weight polyalpha olefin and one part by weight polyalkylene glycol. The polyalkylene glycol which is a random copolymer with 75% ethylene oxide and 25% propylene oxide substitution, with an average molecular weight of from 12,000 to 15,000 and a hydroxyl number between 5 to 10 mgs KOH per gram. The polyisobutylene has a viscosity ASTM D-445 38° C of 210-227 and the viscosity index ASTM D-567 is 95 with a molecular weight of 750 to about 1200. The polyalpha olefin used was a long chain polyalpha olefin SHF-61 manufactured by Mobil which had a viscosity ASTM D-445 at 38° C of 30.5, a viscosity index ASTM D-2270 of 132. The polyalpha olefins which can be used, as exemplified by the SHF-61 Mobil product, are typically hydrocarbons with a molecular weight from 200 to 800. The SHF-61 product is an oligomer of 1-decene. The satisfactory viscosity range of the polyalpha olefins is from 2 centistokes at 100° C to 100 centistokes at 100° C.

Twelve parts of the fluid mixture were mixed with one part of pyrogenic silica thickener to make a gel matrix. The gel matrix has a dielectric constant of less than 3. The resulting gel matrix is blended two parts by weight gel to one part by weight of a water absorbent polymer. To this mixture a high viscosity polyisobutylene was added in the range of about 0.125% to about 1% by weight of the gel matrix. The high viscosity polyisobutylene has a molecular

weight range of from about 1200 to 2300 and ASTM D-445 97.8° C° of 3,000 - 5,000.

A 12v battery was hooked up to a pair of spliced wires and water was introduced into the spliced area causing a short. A spliced area was then filled with a composition of Example 1 and water began to be absorbed in 60 seconds. The short healed and the cable pair became conductive.

EXAMPLE 23

The same composition of Example 22 can be used substituting the tackifier poly methyl methacrylate (PMM) for high viscosity polyisobutylene. The poly methyl methacrylate can be used as one of the water absorbent polymers. However, when mixed with a diluent such as a petroleum oil, PMM serves as a tackifier. A typical preparation is a PMM with a molecular weight of 2000-5000 mixed in a 6% solution with polyalpha olefin oligomers of 1-decene (such as Rohm and Haas Acriloid). This solution is added to the gel matrix and polymer mixture of Example 22 in the range of 0.125% - 1% by weight to give a tacky composition.

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:-

1. A composition for protecting the wires of telecommunications and other cables carrying direct current from damage caused by moisture contact of faults or breaks in the insulation thereof comprising a dielectric gel matrix and a polymer dispersed in said gel matrix, said polymer comprising a hydrocarbon backbone having anionic groups attached thereto, the anionic groups of said polymer, when exposed to direct current from a wire that is in short caused by the presence of water, causing said polymer to be attracted to the wire, the accumulated polymer re-insulating the wire thereby excluding water from the wire and eliminating the short to restore current flow through the wire.
2. The composition of claim 1 wherein the anionic groups of said polymer are carboxylate groups.
3. The composition of claim 1 wherein said polymer is selected from the group consisting of polypropenoates, polyacrylic acids, and salts of starch graft copolymers of polyacrylic acid and polyacrylamide.
4. The composition of claim 1 wherein said gel matrix additionally comprises a tackifier.
5. The composition of claim 1 wherein said gel matrix is selected from the group consisting of olefins, petroleum hydrocarbons, or mixtures of olefins and petroleum hydrocarbons.
6. The composition of claim 5 wherein said gel matrix additionally comprises a thickener.



7. The composition of claim 6 wherein said thickener is silica or an organophilic clay.
8. The composition of claim 1 wherein said gel matrix additionally comprises a hydrophilic substance.
9. The composition of claim 8 wherein said hydrophilic substance is selected from the group consisting of glycols, detergents, and surfactants, or mixtures of substituted glycols, fatty acids, polyethers and alcohols or mixtures of said substances.
10. A composition for protecting electrical components in an enclosed space from damage caused by invasive water comprising 67-90% of a gel matrix which is relatively non-conductive to DC current and 10-33% of a water adsorbent polymer, said polymer being dispersed in said gel matrix.
11. The composition of claim 10 wherein said gel matrix has a viscosity of 100 to 90,000 centistokes.
12. The composition of claim 10 wherein said gel matrix has a viscosity of 5 to 500 centistokes.
13. The composition of claim 10 wherein said gel matrix has a viscosity of 5 to 270 centistokes.
14. The composition of claim 10 wherein said gel matrix has a viscosity of 2 to 100 centistokes.
15. The composition of claim 10 wherein said water adsorbent polymer represents 10 to 20% of the gel matrix.
16. The composition of claim 10 wherein said water adsorbent polymer represents 10% of the gel matrix.
17. The composition of claim 10 wherein said gel matrix



has a dielectric constant of less than 3.

18. The composition of claim 10 wherein said gel matrix is selected from the group consisting of olefins, petroleum hydrocarbons, or mixtures of olefins and petroleum hydrocarbons.

19. The composition of claim 18 wherein said gel matrix additionally comprises a thickener.

20. The composition of claim 19 wherein said thickener is silica or an organophilic clay.

21. The composition of claim 10 wherein said gel matrix additionally comprises a hydrophilic substance.

22. The composition of claim 21 wherein said hydrophilic substance is selected from the group consisting of glycols, detergents, and surfactants, or mixtures of substituted glycols, fatty acids, polyethers and alcohols or mixtures of said substances.

23. The composition of claim 10 wherein the anionic groups of said polymer are carboxylate groups.

24. The composition of claim 10 wherein said polymer is selected from the group consisting of polypropenoates, polyacrylic acids, and salts of starch graft copolymers of polyacrylic acid and polyacrylamide.


25. The composition of claim 10 wherein said gel matrix additionally comprises a tackifier.

26. A composition substantially as herein described with reference to any one of the accompanying examples.



INTERNATIONAL SEARCH REPORT

International Application No PCT/US 88/01406

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) ⁶		
According to International Patent Classification (IPC) or to both National Classification and IPC		
IPC ⁴ : C 09 K 3/18		
II. FIELDS SEARCHED		
Minimum Documentation Searched ⁷		
Classification System	Classification Symbols	
IPC ⁴	C 09 K; H 01 B	
Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched ⁸		
III. DOCUMENTS CONSIDERED TO BE RELEVANT ⁹		
Category ⁹	Citation of Document, ¹¹ with indication, where appropriate, of the relevant passages ¹²	Relevant to Claim No ¹³
Y	GB, A, 1598807 (BICC) 23 September 1981 see claims 1,9,10 --	1-4
Y	US, A, 3347974 (PUELL) 17 October 1967 see claims 1,4,5 and column 2, line 48 --	1-4
Y	GB, A, 2080998 (PIRELLI) 10 February 1982 see claims 1,3 --	1-4
A	FR, A, 2456375 (CABLES DE LYON) 5 December 1980 see claims 1,6,8 --	1
A	DE, A, 2007163 (SICHEL-WERKE) 2 September 1971 see claims 1,6 -----	1
<p>⁹ Special categories of cited documents: ¹⁰</p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> <p>"T" later document published at the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step</p> <p>"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.</p> <p>"A" document member of the same patent family</p>		
IV. CERTIFICATION		
Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report	
27th July 1988	26 AUG 1988	
International Searching Authority	Signature of Authorized Officer	
EUROPEAN PATENT OFFICE	 P.C.G. VAN DER PUTTEN	

ANNEX TO THE INTERNATIONAL SEARCH REPORT
ON INTERNATIONAL PATENT APPLICATION NO.

US 8801406

SA 22115

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report. The members are as contained in the European Patent Office EDP file on 17/08/88. The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
GB-A- 1598807	23-09-81	None	
US-A- 3347974		None	
GB-A- 2080998	10-02-82	FR-A- 2487107	22-01-82
		SE-A- 8104460	22-01-82
		DE-A- 3128779	29-04-82
		AU-A- 7273581	16-09-82
FR-A- 2456375	05-12-80	None	
DE-A- 2007163	02-09-71	None	