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 Continuation-in-part of application Ser. No. 612,253, Jan. 27, 1967, now abandoned, and a continuation-in-part of 612,254, Jan. 27, 1967, now abandoned.

[50] Field of Search..... 252/511;
 200/166 C

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[54] **CONTACT MATERIAL FOR ELECTRONIC MUSICAL INSTRUMENTS AND THE METHOD FOR MANUFACTURING THE SAME**
 8 Claims, 4 Drawing Figs.

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 252/511
 [51] Int. Cl..... H01h 3/00,
 H01b 1/06

ABSTRACT: By mixing and dispersing a carbon black, a curing agent, and other compounding ingredients in an uncured rubber in the form of a solution of relatively low viscosity by agitating means which imparts substantially no shear-force to these materials and by evaporating off the solvent of the rubber solution, an electroconductive uncured rubber material of very uniform and reproducibly constant product quality can be produced.

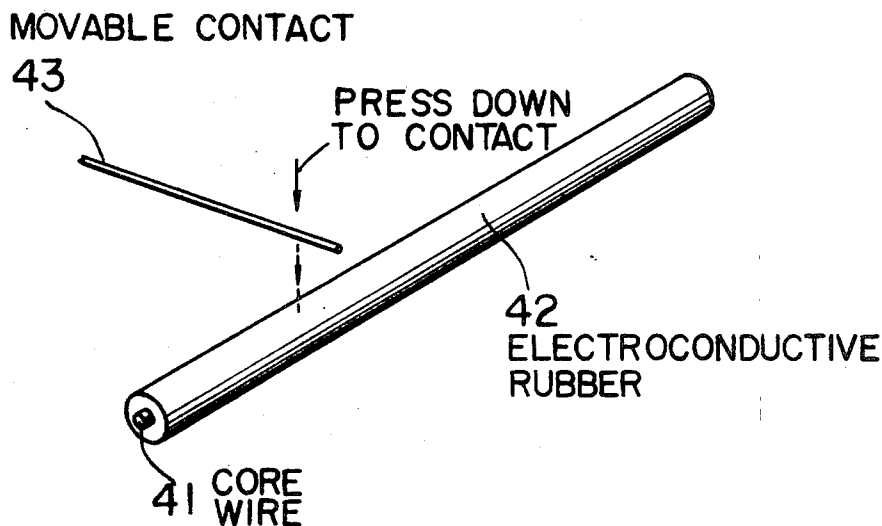


FIG. 1

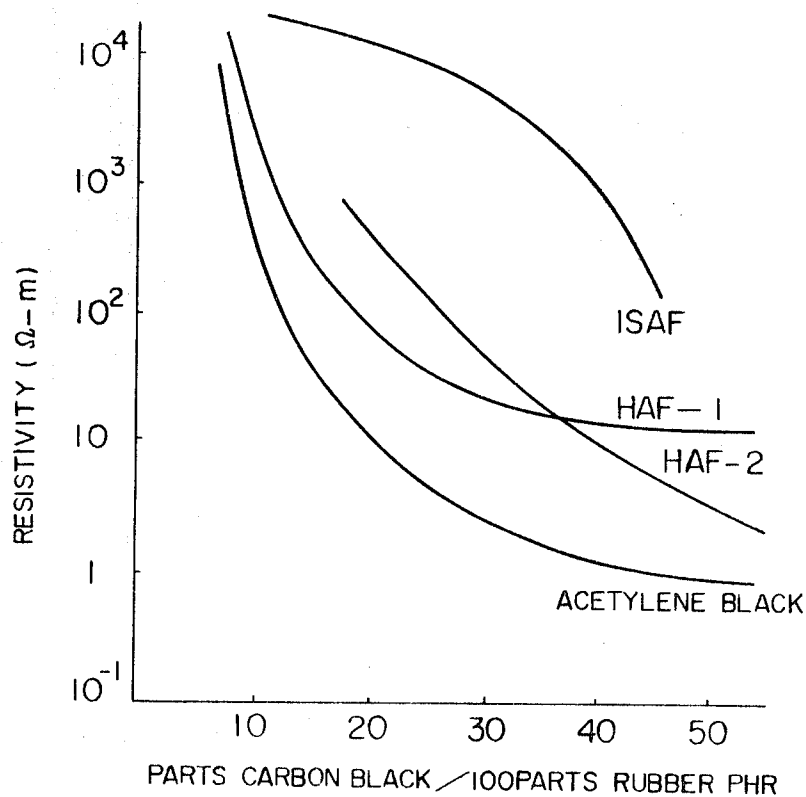
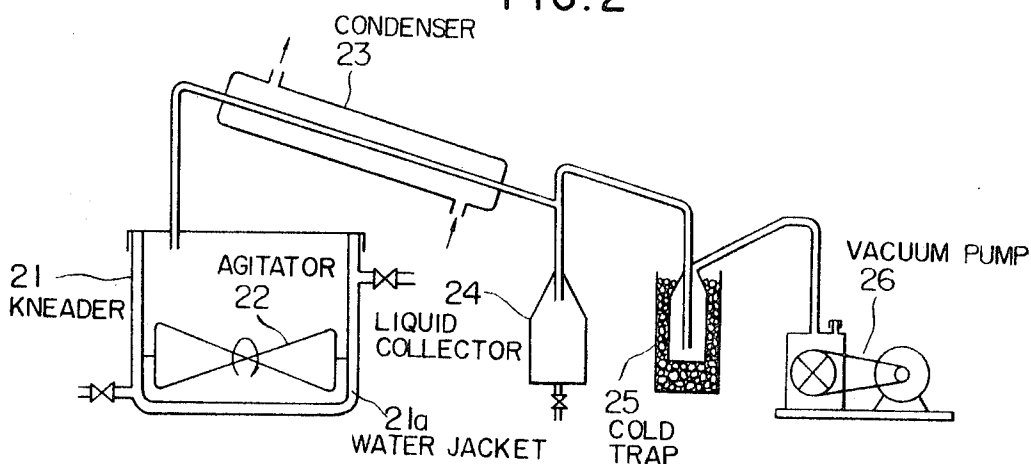


FIG. 2



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FIG. 3

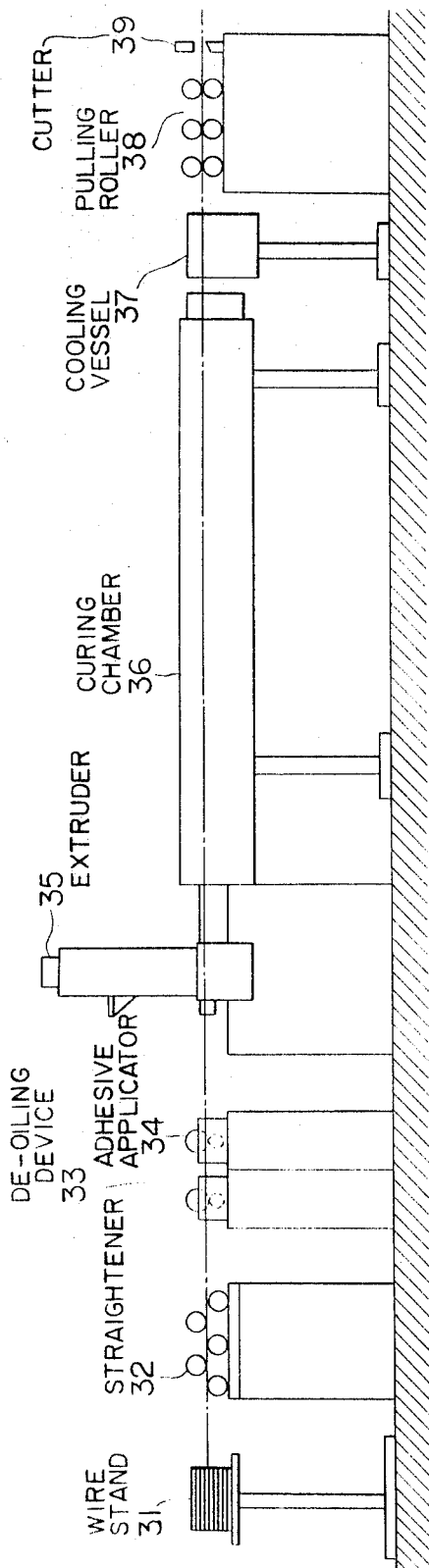
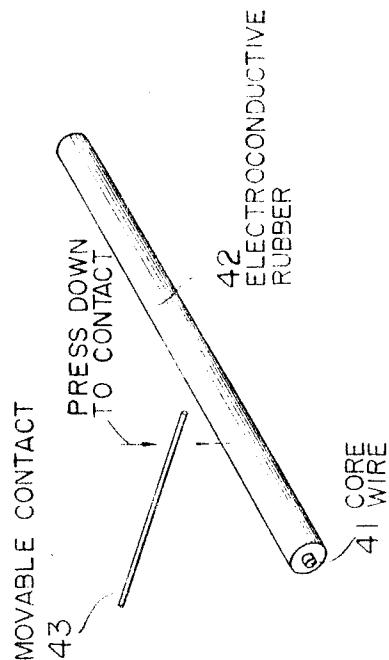


FIG. 4



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CONTACT MATERIAL FOR ELECTRONIC MUSICAL INSTRUMENTS AND THE METHOD FOR MANUFACTURING THE SAME

CROSS-REFERENCE TO RELATED APPLICATION

This application is a continuation-in-part of my copending application Ser. No. 612,253 filed on Jan. 27, 1967, entitled "PRODUCTION OF CURABLE, ELECTROCONDUCTIVE UNCURED RUBBER MATERIALS" and No. 612,254 filed on Jan. 27, 1967, entitled "CONTACT MATERIAL FOR ELECTRONIC MUSICAL INSTRUMENTS" both now abandoned.

BACKGROUND OF THE INVENTION

This invention relates to materials for electrical contacts in electronic musical instruments, and more particularly to a new and improved contact material consisting of electroconductive rubber produced by uniformly dispersing furnace carbon black in silicon rubber and having highly desirable characteristics particularly for key switches of electronic musical instruments, and a method of manufacturing the same.

Cured rubbers having electroconductivity produced by blending carbon black with the basic rubber are known. To the best of knowledge of the inventor, however, there has never been a rubber of this character which can be advantageously used as a contact material for electronic musical instruments. The reasons for this appears to be that, for this special use, under various restrictions as enumerated hereinafter, appropriate combinations of various factors and variables for producing a suitable electroconductive rubber have heretofore been unknown, examples of these various factors and variables being the kind of gum (the term "gum" is hereinafter used to mean uncured rubber), the kind and quantity of the carbon black, the kind and quantity of the curing or vulcanizing agent, the process of blending these compounding ingredients, and the curing or vulcanizing process.

In the design of contacts for electronic musical instruments, it is considered desirable that roundness (gradual transient) be imparted to the rising and falling of signal amplitude at the time of closing and opening of the contacts thereby to prevent so-called "click noise". For this purpose a contact material of a character such that its electrical resistance is high at the initial instant of contact and decreases as the contact pressure increases is desirable.

As a contact material of this character, any electroconductive rubber would, at first, appear to be naturally suitable. However, for the special use as a contact material for electronic musical instruments, particularly for key switches, which use involves various restrictions, a material conceived as merely rubber containing an electroconductive substance blended therewith is inadequate for solving this problem.

More specifically, an electroconductive rubber lacking in properties such as, for example, weather-resistance, heat-resistance, and cold-resistance and having functional characteristics which vary with the lapse of time is unsuitable. The electric resistivity of the contact material should not vary with the lapse of years.

Furthermore, in view of the fact that the resulting electroconductive rubber is a material having as its basic component a rubber, which is fundamentally a nonconductive material, it is natural to desire that the resistivity of the resulting electroconductive rubber be as low as possible. However, when the material is considered as that for key switch contacts for preventing occurrence of "click noise", it cannot always be said that the lower the resistivity is, the better.

SUMMARY OF THE INVENTION

It is therefore an object of the present invention to provide a specific electroconductive rubber contact material for electronic musical instruments which has the aforementioned desired variable-resistance characteristic, and in which the above-mentioned problems have been solved.

Another object of the invention is to provide a specific electroconductive rubber contact material of the above stated character said rubber contact material consisting of silicone rubber containing carbon black blended therewith and suppressing scattering of the resistivity of the product and preventing variation of the resistivity of the product with lapse of years.

A further object of the invention is to provide a simple and low-cost process for producing electroconductive uncured rubber contact materials having excellent properties as stated above without loss or error due to spattering of the process material.

The present invention has been proposed and succeeded in obtaining best material adapted for contact material of electronic musical instruments and process for producing said best material, as a result of various experiments relating to various kinds of gum and carbon black and process for blending them.

According to the inventor's laboratory research, the inventor has found that only the silicone gum and furnace carbon black among various gums and carbon blacks are respectively utilizable in practical use and only the nonshear type method, that is, only the dispersing-in-solution method is effectively utilizable as the blending-dispersion method for producing the best material.

According to the present invention, there is provided an electrical contact material for electronic musical instruments, characterized in that it consists of cured rubber material and a quantity of carbon black uniformly dispersed in said base rubber material for imparting electroconductivity thereto.

According to another aspect of the invention, there is provided a method for producing an electrical contact rubber material, characterized in that 30 to 50 parts by weight of carbon black and 0.5 to 2 parts by weight of a curing agent are blended in 100 parts by weight of silicone gum dissolved in 150 parts by weight of a solvent and the whole mixture is agitated for uniform dispersion of the carbon black and the curing agent in the silicone gum solution, then the solvent is caused to be evaporated off from the mixture below the temperature at which the curing of the rubber due to a coexisting curing agent occurs, and the whole batch is subjected to curing treatment by the known technique.

In the present invention, utilization of silicone gum has an important meaning. In electronic musical instruments, as a result of various tests of the switch contacts made from various kinds of gums such as, for example, chloroprene gum, butyle gum, butadiene gum and the like it has been confirmed that only the contacts made from silicon gum can be effectively used as the contacts of electronic musical instruments. The contacts of electronic musical instruments has a strict requirement such that its resistivity should not vary with lapse of years. However, the contacts made from an electroconductive gum containing silicon gum have the following advantages.

(1) Weather-resistance is very excellent. When a rubber contact containing carbon black therein is subjected to deterioration due to ozone and oxygen in the atmosphere, the rubber material of the contact is deteriorated and structure of the carbon black dispersed in the rubber material varies, thus causing variation of the resistivity of the contact, but the contact made by using silicon gum has no disadvantage as described above.

(2) Chemicals-resistance property is superior.

(3) Use of sulfur (S) as the curing agent is not necessary. If any quantity of sulfur is contained in the rubber contact, the cooperating metal contact will be sulfurized, thereby to decrease the electroconductivity of the contact.

(4) Heat resisting property of the contact is superior.

(5) Manufacture of rubber contact becomes simple. In general, manufacturing of stable gum products requires plenty kinds of blending agents, thus causing necessity of complicated and difficult method for manufacturing the required contact. However, in the case of utilizing silicon gum, it is only necessary to use few kinds of blending agent and process for the production of the contact is relatively simple.

According to further aspect of the present invention, there is provided an apparatus for manufacturing an electrical contact material, characterized by comprising: a hermetically sealed kneader capable of withstanding reduced internal pressure and provided with a water jacket surrounding the same, an agitator inside thereof, and inlet and outlet at required portions thereof for feeding and discharging compounding ingredients for the rubber contact material; a vacuum pump mechanically connected to the interior of said kneader to evacuate the same to evaporate off a solvent in said compounding ingredients; a condenser to liquefy the evaporated solvent; a liquid collector to collect said liquefied solvent; and a cold-trap to catch noncondensed solvent vapor.

According to still further object of the present invention, there is provided an electrically conductive rubber contact for electrical musical instruments comprising a copper wire as the core for the contact and electroconductive cured rubber material surrounding the core wire, the electroconductive cured rubber material having the properties as well as being manufactured in accordance with the method as will be described hereinafter.

The nature, principle, and details of the invention will become more apparent from the following detailed description, when read in conjunction with the accompanying drawing, in which;

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a graphical representation indicating the relationships between resistivity and added quantity of carbon black respectively of electroconductive rubbers to which four different kinds of carbon black have been respectively added;

FIG. 2 is a flowsheet indicating the essential organization and principle of an example of an apparatus embodying the invention for producing electroconductive uncured rubber;

FIG. 3 is a schematic illustration of an apparatus for manufacturing the electrical contact material of the present invention; and

FIG. 4 is a perspective view showing an electrical contact using the contact material according to the present invention.

DETAILED DESCRIPTION OF THE INVENTION

The electroconductive silicon rubber according to the invention is produced by blending carbon black with the basic gum and curing the resulting gum. According to the invention, therefore, a silicon gum which is curable after dispersion of carbon black therein is used. It is to be understood that throughout this specification (including the appended claims), the term "curing" or "curing agent", being not limited to vulcanization by sulfur or sulfur compounds, refers to cross-linking or cross-linking agent of silicone gum.

The carbon black for imparting electroconductivity to the rubber is selected from those capable, in interrelated conjunction with the degree of curing and other factors, of causing the resistivity of the product to assume the aforesaid value, a specific quantity of the selected carbon black being blended with the gum.

In general, a product containing an acetylene black tends to have a low resistivity, and in a product containing a channel black, the resistivity appears to increase (even up to an insulative magnitude) as the uniformity of dispersion of the black in the rubber increases. Accordingly, furnace blacks (both gas furnace blacks and oil furnace blacks) are considered to be suitable for use in the electroconductive silicon rubber according to the invention.

Conductivity of a silicon rubber, in which carbon black has been dispersed, varies with the quantity of carbon black thus added. For example, FIG. 1 of the accompanying drawing indicates this relationship, that is, the variation of resistivity with the quantity of carbon black for cured rubbers produced by blending four different kinds of carbon black with a silicon gum ("Silastic" 410 manufactured by the Dow Corning Company, U.S.A.) and then curing it into the rubber.

The curve designations and their corresponding carbon blacks are as follows:

ISAF: Furnace black "Seast 6" (manufactured by Tokai DenkyokuSha, Japan) of an oil adsorption of 1.18 ml./gram and iodine adsorption of 140 mg./gram;

HAF-11: Furnace black "Seast H" (manufactured by Tokai DenkyokuSha, Japan) of an oil adsorption of 1.18 ml./gram and iodine adsorption of 97 mg./gram;

HAF-2: Furnace black "Seast 3" (manufactured by Tokai DenkyokuSha, Japan) of an oil adsorption of 1.15 ml./gram and iodine adsorption of 90 mg./gram; and

ACETYLENE BLACK: Acetylene black (manufactured by Denki KagakuSha, Japan) of an oil adsorption of 1.45 ml./gram and iodine adsorption of 100 mg./gram.

For production of electroconductive silicon rubber of uniform product quality on a commercial basis, the selection of a carbon black which exhibits a saturationlike leveling off of the resistivity due to increase in the added quantity, as in the case of HAF-1, and the addition thereof in a quantity within the saturation (level) region is indicated as being indispensable. In this way, the small difference of carbon quantity will not substantially influence on the resistivity of the product rubber.

The resistivities as set forth in the present disclosure are to be understood as being those measured in the following or other equivalent manner. Each test specimen or sample is a rubber sample of 100 mm. in length, 50 mm. in width, and 3 mm. in thickness, thereby being of sheet form with two opposite surfaces and two longitudinal ends. Each end part of the specimen is clamped between two brass sheets, each of 50 mm. in length (corresponding to the width of the specimen), 10 mm. in width, and 1 mm. in thickness, the brass sheets being placed flat against respective opposite surfaces of the specimen and functioning as an electrode. Clamping force is applied to the two brass sheets by an ordinary spring paper clamp (clasp). Variations in this clamping force produce almost no change (variations being a few percent or less) in the measured resistivity value. Measurements of resistivity are made with the specimen and secured electrodes in a chamber of constant-temperature, constant-humidity maintained at a temperature of 20° C. and a relative humidity of 65 percent.

Among these carbon blacks, furnace blacks of oil adsorption quantities of from approximately 0.8 to 1.6 ml./gram and iodine adsorption quantities of approximately 110 mg./gram or less are particularly suitable when used in a quantity of from approximately 30 to 50 parts by weight per 100 parts by weight of rubber (PHR) as, for example, 40 PHR.

In this invention, particular adoption of the furnace black oil-adsorption of which is 0.8 — 1.6 ml./gram and iodine adsorption of which is below 110 mg./gram has a significant meaning. The inventor has confirmed that although contacts containing acetylene, other furnace black except the furnace black having the above-mentioned properties, and the like have been tested, only the contact containing the furnace black having the above-mentioned properties can be used as effective rubber contact of electronic musical instruments. When this particular furnace black of 30 parts or more is added, resistivity of the electroconductive rubber varies within very narrow range depending upon quantity of the furnace black, so that a very stable product having very low scattering can be obtained, and moreover said resistivity itself is most appropriate as the contacts of electronic musical instruments. On the one hand, carbon having relatively low conductivity must be blended in plenty quantity, but excess blending of the carbon black causes decrease of strength of the rubber product. On the one hand, when a carbon having a large conductivity is used, "click-noise" protection cannot be accomplished, said protection being an essential object of using rubber contacts as the contacts of electronic musical instruments.

In the curing process, the curing conditions and various other variables are adjusted so as to produce a cured rubber of a durometer hardness number of from 45 to 70 (according to A.S.T.M. D-676, at 20° C. and relative humidity of 65 percent). Further, since the resistivity of the gum is increased by the curing, the various conditions are adjusted so as to cause

the resistivity of the cured rubber to be approximately from 1 to 30 ohm-m, preferably approximately from 7 to 20 ohm-m.

In the curing of silicon gum materials of this kind, the organic peroxides are generally used. They do not entail, differing from sulfur or sulfur compounds, the possibility of sulfiding of the other substances in the process, and, moreover, the curing process is also simple and convenient.

The curing through the use of organic peroxides of a silicone gum to which carbon black has been added appears to involve complicated phenomena, and a curing agent of suitable kind and quantity in accordance with the conditions such as the kind and quantity of the carbon black and the curing conditions is used. For example, approximately from 0.5 to 2 PHR (e.g., approximately 1 PHR) of a curing agent such as dicumyl peroxide or 2,5-dimethyl-2,5 (tetrabutyl peroxy)-dihexane is used.

Referring now to FIG. 2, mention is made about method for dispersing carbon black and curing agent uniformly in the silicon gum.

In the process of adding these two compounding ingredients (carbon black and curing agent) to the gum, it is desirable that they be blended in by agitation with the silicon gum in a solution state so as to apply substantially no shear force to the process material.

A solvent for making a gum solution according to the invention must, of course, be capable of dissolving the gum but must also be a solvent which can be evaporated off at a temperature below the temperature at which curing of the rubber due to a coexisting curing agent occurs. In the case of silicon gum, solvents such as benzene, carbon tetrachloride, toluene, and xylene have been found to be suitable. Furthermore, in the case of silicon gum, a gum from which volatile components such as low molecular weight substances have been removed beforehand should be used.

While a carbon black and a curing agent are essential and indispensable compounding ingredients in the process of this invention, other compounding ingredients such as a curing accelerator and a stabilizer may also be added as necessary.

The selection and proportioning of the quantities of the above-described compounding ingredients are determined in accordance with the art of so-called "compounding" and in consideration of the viscosity of the solution, difficulty or ease of recovering the solvent, conductivity of the electroconductive rubber to be produced, rubber properties, and other factors. One example of a solution composition is 100 parts of a silicon gum, from 30 to 50 parts of a carbon black (electroconductive), from 0.5 to 2 parts of a curing agent, and 150 parts of a solvent.

The mixing of these ingredients is carried out by means of a mixing apparatus which will impart substantially no shear force to the mixture. Since the gum is in the form of a solution of low viscosity, it is possible to use a mixing apparatus having relatively narrow clearances or gaps through which the solution is forced. A large variety of known mixing apparatuses of this character are available and can be selected in accordance with the production requirements. It is also possible to carry out simultaneously the dissolving of the gum and the adding of the compounding ingredients.

After the carbon black and other compounding ingredients have been dispersed uniformly throughout the gum solution, the solvent which has formed the gum solution is evaporated off. As mentioned hereinbefore, the evaporation (boiling) temperature of the solvent must be lower than the temperature of curing due to the coexisting curing agent. Since a solvent of a somewhat high boiling point (at the normal pressure) is ordinarily used, it is preferable to carry out the evaporation of the solvent under reduced pressure in order to lower temperature of the boiling point.

The above-mentioned resultant gum containing well dispersed carbon black and curing agent of the type with which this invention is concerned has resistivities of approximately from 0.1 to 1 ohm-m, those having resistivities of approximately from 0.4 to 0.8 ohm-m being especially suitable

for later producing the cured rubber material of the invention. Furthermore, gum having values of Mooney index of, for example, 20 ± 2 at 17°C . ML (1 + 4) and 10 ± 1 at 100°C ., ML(1 + 4) is particularly suitable.

In this invention, it has a significant meaning to adopt, as a method of blending a filler into the rubber material, a system of dissolving the gum material with a solvent thereby to prepare a solution and blending the powdery carbon black into said solution to carry out blending-dispersion without applying shear force thereto.

It is conventional to carry out addition of various components into a gum material by means of two-roll mill or Banbury mixer. However, on the one hand, when the rubber contact material has been produced according to the above-mentioned conventional methods, electric resistivities of the product has scattered and on the other hand when the production working was carried out for a long period of time in order to decrease said scattering, said resistivity has become too large to be used as the contact material. The reason for this seemed to reside in destruction of the structure of the carbon black by the action of the shearing force during the working. Accordingly, in this invention, adoption of blending-dispersion system of nonshear type in order to produce the contact material is an indispensable feature.

The gum produced in the above-described manner is fabricated into the desired form by itself or in combination with a conductor metal. The gum produced as described above by thorough mixing and kneading, as the gum is in the state of a solution, does not require further mastication and can be immediately fabricated into rubber products as contacts of key switches. While the fabrication is carried out in a manner such that excessive shear force is not applied to the gum, formed articles can be readily produced without difficulty from the silicon gum according to the invention since it is of relatively low viscosity.

By subjecting a formed article thus produced to curing conditions, a cured electroconductive silicon rubber according to the invention is obtained. A curing process suitable for the objects of the invention is selected from among known techniques relating to silicon rubber or rubbers in general. For example, the curing may be carried out by a batch process or a continuous process in a suitable vulcanizer (curing vessel) or a metal mold at a suitable curing temperature.

Although the facility with which the gum material after the solvent has been evaporated off can be handled depends on the kind of rubber, a silicon gum is relatively soft and, therefore, can be taken out of the solvent evaporation device and otherwise handled with relative ease. The electroconductive gum material obtained by evaporating off the solvent is fabricated into the desired form and then cured by impressing the activation conditions for the coexisting curing agent, whereby an electroconductive material having the characteristics of rubber is obtained.

For the aforesaid compounding operation, a single-set apparatus in which the functions of devices for accomplishing mixing and dispersion without substantially imparting any shear force, evaporating off of the solvent, and recovering the solvent are combined in coupled arrangement is convenient. The present invention therefore contemplates provision of such an apparatus combined in a series for accomplishing the above described process.

One example of embodiment of the invention in this aspect is illustrated in the accompanying drawing. In the apparatus shown in FIG. 2, there is provided a kneader 21 of perfectly sealable construction which is capable of withstanding reduced internal pressure and includes a water jacket 21a whereby heating (or cooling) of the work material contained therein can be accomplished. Furthermore, this kneader is provided with agitator blades 22 and with means (not shown) whereby the starting materials can be supplied thereto and the resulting materials can be taken out therefrom in accordance with common practice.

In carrying out the process of the invention, gum from which volatile matter has been removed is metered and supplied into the kneader 21. A specific quantity of a solvent is supplied into the kneader, and the blades 22 are operated to cause the gum to dissolve in the solvent. When the gum has dissolved completely, a specific quantity of a carbon black which has been sufficiently demoistured is added to the gum solution, and the blades 22 of the kneader are operated until the carbon black particles have dispersed uniformly throughout the solution.

When the dispersion of the carbon black has been completed, a curing agent (together with other necessary compounding ingredients) is added to the resulting process material, and the agitator blades are further operated to accomplish uniform mixing and dispersion of the ingredients. Upon completion of this dispersion step, hot water (70°C. or higher) is passed through the kneader water jacket 21a, and the kneader interior is evacuated (to a degree of vacuum of the order of from 20 to 30 mm. Hg) by means of a vacuum pump 26 connected mechanically to the interior of the kneader 21 thereby to evaporate off the solvent in the gum solution. During this process step, the rotation of the kneader blades 22 may be continued to promote the evaporation of the solvent.

This heating under reduced pressure is continued until the solvent used has completely evaporated off, whereupon an electroconductive gum material in which the carbon black, curing agent, and other compounding ingredients are uniformly dispersed is obtained.

The solvent which has been evaporated by the heating under reduced pressure is condensed by a condenser 23 and collected in a liquid collector 24. Solvent vapor which has not been condensed in the condenser 23 is trapped in a cold trap 25.

By the use of the apparatus of the above-described composition and arrangement, there is no possibility of loss or error due to spattering of the work material since agitation and mixing is carried out within a sealed vessel, and the entire apparatus is of compact structure and simple operation since the series of process steps of mixing and dispersion, solvent-evaporation, and solvent-recovery can be carried out with a serially combined apparatus.

Another advantageous feature of the above described apparatus is that it requires very little labor, the required operational manipulations being principally for merely supplying the material and taking out the product, and this work requires very little technical skill and experience. A further advantage of this apparatus is that the process conditions for the steps of mixing and dispersion can be controlled by controlling only the operational times and temperatures. Accordingly, the reproducibility of dispersion states in the product is excellent, whereby it is readily possible to produce an electroconductive rubber of constant product quality.

Next, referring to FIG. 3, explanations will be made as to a method for producing the contact material for electronic musical instrument from the silicon gum in which carbon black is uniformly dispersed.

Copper wire of 1.4 mm. dia. manufactured by wire-drawing method is fed from a wire-stand 31 to a straightener 32 where the wire is made straight from its wound state on the reel. Then this straightened copper wire is sent into a de-oiling apparatus 33 where shower of trichloroethylene removes machine oil applied to the surface of the copper wire at the time of wire-drawing, thereby to secure sufficient electrical conductivity between the metal wire and an electroconductive gum as well as good adhesion of an adhesive agent. After the de-oiling treatment, the wire is sent into an adhesive applicator 34, where an adhesive agent strong enough to cause the electroconductive gum to fastly adhere to the surface of the copper wire. Then, by means of an extruder 35 containing therein uncured electroconductive gum which has been prepared in the kneader 21 shown in FIG. 2, the surface of the copper wire applied with an adhesive agent is covered with

this uncured electroconductive gum while it is passing through the extruder. This treatment is carried out just in the same manner as covering the surface of electric wire with an insulating material such as a synthetic resin tube. In the next stage, the wire with the electroconductive gum on its surface is caused to pass through a curing chamber where it is heated to cure the gum. The wire with the cured rubber covering is cooled down in the cooling vessel 37, which is then fed to a pulling roller 38. The copper wire thus processed is automatically cut by a cutter at a required length for the contact. The ordinary length of the contact for manual key switches of an electronic organ will be 620 mm. for a bus bar over 44 keys, 160 mm. for a bus bar over 12 keys of an octave, and 80 mm. for a bus bar over 6 keys of a half octave.

The rubber contact produced by the above-described method is as shown in FIG. 4. That is, electroconductive cured rubber 42 surrounds a core wire 41 of 1.4 mm. dia. The total diameter of this contact material may be 3.0 mm. dia. at the most. The configuration of the rubber covering is not only circular but also any other appropriate shape such as triangular or polygonal. To this contact as a bus bar for a key switch, a plurality of movable contacts made of nickel-silver wire of 0.4 mm. plated with gold of 6 microns thick are disposed opposite to the rubber contact, thereby forming a switch for closing and opening the tone signal. The movable contacts are actuated by respective keys of the electronic organ. The pressure at contact of the movable contact 43 against the rubber contact 42 is about 12 grams weight and the contact resistance between the movable contact 43 and the core wire 41 will be 1—3 kilo-ohms.

Referring to the contacts shown in FIG. 4, resistance between the movable contact 43 and core wire 41 is the case of pressing said movable contact 43, with a pressure of 12 grams, onto the electroconductive rubber contact 42 was measured in connection with a plurality of sample products. As a result of the above measurement, the following data relating to scattering range of the resistance were obtained.

	This invention	Prior Art
Samples from various lots	3.02—3.32 kΩ	1—10 kΩ
Samples from one lots	3.13—3.24 kΩ	1—10 kΩ
One sample measured at various points thereon	3.21—3.22 kΩ	2—6 kΩ

As will be well understood, it can be confirmed that the rubber contacts manufactured according to this invention has very stable quality having little of scattering.

The reason why the rubber contacts having very stable quality can be manufactured according to the present invention resides in that a carbon black presenting the characteristic curve of resistivity to carbon black percentage having saturation portion as indicated by HAF-1 in FIG. 1 is used as the carbon black to be dispersed in the base rubber material.

EXAMPLE OF THE CONTACT MATERIAL ACCORDING TO THE PRESENT INVENTION

Ingredients	Favorable value	Available range
Silicon gum	100 PHR	30—50 PHR
Furnace black 40 Ig		
0.5—2		
Dicumyl peroxide	1	0.5—2
Solvent (C ₁₄)	75	10—150 tz
Blending		
Blending time	6.5 hours	3—10 hours
Evaporating temp.	70° C.	less than 100° C.
Evaporating time	1 hour	1—5 hours
Vacuum pressure	20 mm. Hg.	less than 30 mm. Hg

Curing

Pressure	4.5 kg./cm. ²	4—6 kg./cm. ²
Time	5 min.	3—15 min.
Atmosphere	Steam	

As described in the above, the rubber contact according to the present invention can be manufactured in an ordinary method of manufacturing insulated electric wire, hence its productivity is high. Furthermore, as the electroconductive rubber surrounds the core wire, close contact between the core wire and the electroconductive rubber can be secured, which causes no problem even if adhesion between them is deficient more or less. Moreover, due to resiliency of the rubber material, the contact can be readily set in the switch board and secured therein without failure.

I claim:

1. In an electric contact for electronic musical instruments the improvement comprising cured rubber material made from methyl-vinyl-polysiloxane gum, and from approximately 30 to 50 parts by weight per hundred parts by weight of rubber, of carbon black of a furnace black quality uniformly dispersed in said base rubber material for imparting electroconductivity thereto, said furnace carbon black having oil adsorption quantities of from approximately 0.8 to 1.6 ml./gram and iodine adsorption quantities of approximately 110 mg/gram or less.

2. The improvement of claim 1, in which the cured rubber has a resistivity of from approximately 1 to 30 ohm-m, and a durometer hardness number of from 45 to 70 in accordance

with ASTM Designation D-676 at a temperature of 20° C. and a relative humidity of 65 percent.

3. The improvement of claim 1, in which carbon black having saturation portion in its characteristic curve relating to resistivity to carbon black percentage is used as said carbon black.

4. A method for producing an producing an electrical contact rubber material, comprising steps of blending 30 to 50 parts by weight of carbon black and 0.5 to 2 parts by weight of a curing agent with 100 parts by weight of silicon gum dissolved in 150 parts by weight of a solvent, agitating the whole mixture for uniform dispersion of the carbon black and the curing agent in the silicon gum solution, then causing the solvent to be evaporated off from the mixture at a temperature below the curing temperature of the rubber to take place due to a coexisting curing agent, and subjecting the whole batch to the curing treatment.

5. A method as claimed in claim 4, in which the curing agent is organic peroxides for the silicon gum selected from group consisting of dicumyl peroxide and 2,5-dimethyl-2,5 (tetrabutyl peroxy)-dihexane.

6. The improvement of claim 1 wherein said contact comprises a copper wire as a core for the contact and electroconductive cured rubber material as defined in claim 1 surrounding said core.

7. The improvement of claim 6, in which the transverse configuration of said contact is circular.

8. The improvement of claim 6, in which the transverse configuration of said contact is polygonal.

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