

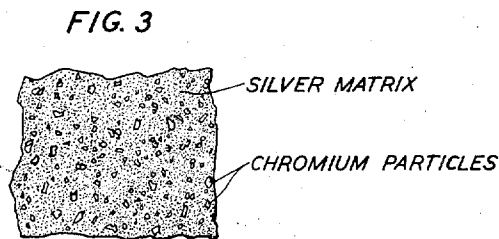
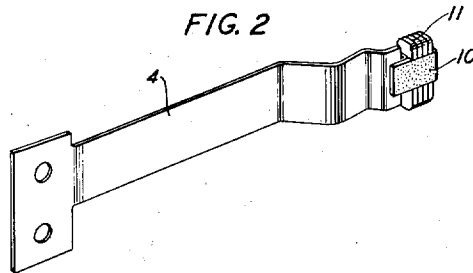
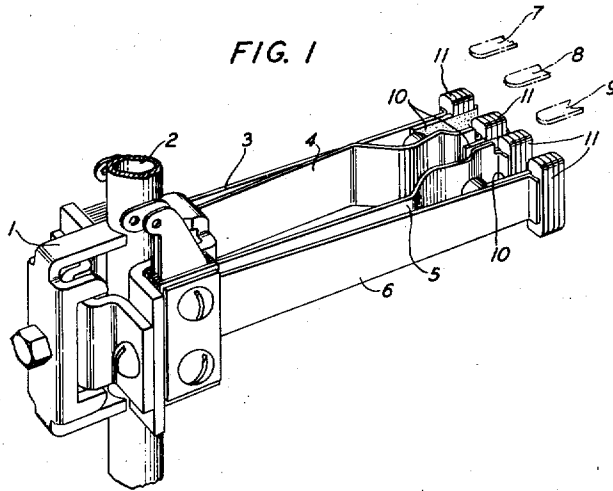
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ELECTRICAL CONTACT DEVICE

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ELECTRICAL CONTACT DEVICE

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The present invention relates to new compositions of matter useful for forming electrical contacts and to electrical switches embodying such contacts.

In telephone circuits in which machine switching devices of the panel type are employed, line noise is sometimes developed due to a defect in the contact between the selector brush and the terminals of the panel bank. In this type of switching device a series of terminals are arranged in vertical alignment and a selector brush rides up and down on a vertical rod making a sliding contact with each terminal successively, finally coming to rest in contact with the proper terminal. The terminals are usually made of brass whereas the contact element of the selector brush is usually made of phosphor bronze. The noise in the line is caused by the development of a high contact resistance between the terminals and the contact element of the selector brush. This high contact resistance appears to be the result of the formation of tarnish films on the surfaces of the brass terminals. It has, therefore, been the practice to clean these terminals periodically with an abrasive in order to remove these tarnish films.

According to the present invention, the tendency to noise is reduced by the use of a contact material in the selector brush which not only makes a good contact with the terminals but also exerts an abrasive action on the terminals as the brush slides past them. In this manner, the continual sliding of the selector brush over the terminals is utilized to remove tarnish films and thus eliminate the cause of line noise.

This result is accomplished by the use of a contact metal composed of a ductile metal of good contact properties, such as silver, which has its surface dotted with small hard abrasive particles. Several problems are involved in securing a satisfactory contact material of this type. First, the presence of the abrasive particles must not interfere with the formation of a good electrical contact with the terminals. Second, the abrasive particles must be securely bonded to the body of contact metal so that they are not pulled from the surface by the continual rubbing action of the terminals with the resulting loss of abrasive action.

In order to satisfy these requirements, it has been found desirable that the abrasive particles be formed of a metal, since a metal interferes less with electrical contact than does a non-metallic substance. In addition, the metal particles are capable of forming a metallic bond with

the contact metal body which will prevent the loss of these particles from the surface. Chromium, a metal which is not substantially soluble in silver and which possesses the requisite hardness, has been found to be a very suitable metal for use as an abrasive according to the present invention. Particles of tungsten and molybdenum or of other metals which are sufficiently hard are also suitable.

In addition, the amount of abrasive substance present and the size of the abrasive particles must be carefully chosen. If the particles are too large, they tend to hold the surface of the contact body away from the terminals with which contact is to be made and thus prevent the formation of a good electrical contact over a substantial surface area. If the particles are too small, they tend to flow with the surface of the ductile contact metal as it rubs against the terminals so that the abrasive action is lost. The same difficulties are encountered when the amount of abrasive material present is not correctly proportioned. If there are too many abrasive particles on the surface, good contact is interfered with in the same manner as when the particles are too large. If the number of particles is too small, there will be insufficient abrasive action exerted.

When abrasive chromium particles are uniformly distributed throughout a silver matrix, it has been found that the particle size of the chromium should lie between about 100 and 500 mesh and advantageously between 200 and 300 mesh. The amount of chromium present in the mass should lie between about .1 and .5 per cent by weight of the silver and is advantageously about .3 per cent by weight of the silver. Substantially the same proportions are applicable when other abrasive metals and other ductile contact metals are employed.

In addition to the abrasive action possessed by these novel contact materials, it has been found that their resistance to frictional wear is markedly greater than that of pure silver contacts. Thus, by employing silver contacts containing correctly proportioned and sized particles of an abrasive metal, the exceptional contact properties of silver may be utilized without the more or less rapid wear to which this soft and expensive metal is normally subject.

In the accompanying drawing:

Fig. 1 is an isometric view of a selector brush employing contact elements formed in accordance with the present invention;

Fig. 2 is an isometric view of one of the con-

tact arms of the brush assembly shown in Fig. 1; and

Fig. 3 is an enlarged view of a portion of the surface of the material of which the contact elements are made, showing the abrasive particles dispersed in a matrix of contact metal.

In Fig. 1 the brush assembly 1 rides up and down on the vertical rod 2. In so doing, the contact arms 3, 4, 5 and 6 are caused to brush against and to make contact with the terminals 7, 8, 9 which project from a panel bank, not shown. Only a single horizontal line of terminals 7, 8, 9 is illustrated for purposes of clarity. Actually, however, a plurality of such rows of terminals are arranged vertically one above the other and are spaced a small distance apart. Thus, the contact arm, in moving up and down vertically, comes successively in contact with each horizontal row of terminals. The actual contact between each terminal and each contact arm is made by means of a contact element 10 which is mounted at the end of each arm. Thus, the contact element 10 on the arm 3 makes contact with the vertical row of terminals corresponding to terminal 7. The contact elements 10 at the end of arms 4 and 5 both make contact with the vertical row of terminals corresponding to terminal 8. The contact element 10 at the end of contact arm 6 makes contact with the vertical row of terminals corresponding to terminal 9.

When the selector brush is operated so as to establish contact between the contact arms and one particular horizontal row of terminals, the brush assembly 1 slides upward on the rod 2, making contact with each successive horizontal row of terminals as it passes until the proper row is reached. The brush assembly then stops and remains in contact with this particular row. The manner in which the abrasive surfaces of the contact elements 10 rub against the contact surfaces of the terminals and keep them free of tarnish films can thus be seen.

Fig. 2 is a detail view of the contact arm 4 of the brush assembly shown in Fig. 1. At the end of the contact arm, a contact element 10 is fastened in such a position as to enable it to make contact with the proper terminals of the panel bank. The contact element may be fastened to the arm in any suitable manner as by welding, soldering or brazing. A guide 11 of hard insulating material is provided in order to enable the contact arm to slide freely past the successive terminals in spite of the fact that a moderate amount of pressure is exerted against the terminals by the spring action of the arm.

Fig. 3 represents an enlarged view of a portion of the surface of the contact element 10. The enlargement is about fifty times. This figure illustrates how the particles of chromium are embedded in the surface of the silver contact metal, thus imparting to it an abrasive action.

The contact material shown in Fig. 3 may be prepared in any suitable manner which causes the formation of a strong bond between the surfaces of the abrasive particles and the adjacent contact metal. Thus, this material may be prepared by intimately mixing finely divided contact metal with finely divided abrasive metal, compressing the mixture and sintering the compressed mixture. The particle size of the finely divided contact metal does not appear to be important, but it is advantageous to have the powder sufficiently fine to cause the formation of a substantially uniform and solid matrix upon compression and sintering. The particle size of the

abrasive metal and the amount of abrasive present are quite critical factors, as discussed above. The mixture is compressed under a very high pressure, preferably of the order of about sixty tons per square inch, in order to compact the mass thoroughly. The compacted mass is then sintered, preferably in an inert atmosphere or under a vacuum, at a temperature below the melting point of the contact metal. The abrasive metal should be of a higher melting point than the contact metal and is preferably insoluble therein. However, this latter condition is not essential if the sintering conditions are carefully controlled.

As a specific example of this procedure, silver having a particle size of about 150 mesh is intimately admixed with about .3 per cent by weight of finely divided chromium having a particle size of about 200 to 300 mesh. The mixture is compressed into a block under a hydraulic pressure of about sixty tons per square inch. The compressed block is then placed in an oven and heated under a vacuum to a temperature of about 700° to 900° C. for a sufficient time to permit a thorough sintering of the silver. The sintered block is then rolled to the desired thickness by successive rollings. During each rolling operation the thickness of the block is reduced fifty per cent. After each successive rolling the block is annealed at 900° C. under a high vacuum. The resulting contact material is capable of establishing a good electrical contact and is capable of keeping the terminals with which it operates reasonably free from tarnish films. The chromium particles are securely retained by the silver in spite of the continual rubbing caused by the operation of the contact device.

The use of the contact material of the present invention has been described in connection with selector brushes for machine switching devices in telephone circuits. However, it is to be understood that this contact material may be used in other electrical contact devices in which there is a sliding action between the contact element and the terminal with which it makes contact. The abrasive particles have been described as uniformly dispersed throughout the body of contact metal. In some instances it may be desirable to embed these particles only in the surface of the contact element.

Although the invention has been described in terms of its specific embodiments, it is to be understood that it is of broad application and is to be limited only by the scope of the appended claims.

What is claimed is:

1. An electrical contact material comprising a body of contact metal having dispersed therethrough between about .1 and about .5 per cent of particles of a harder material with a particle size between about 100 and 500 mesh, said particles being bonded to the adjacent contact metal.

2. An electrical contact material comprising a body of a silver containing contact metal having dispersed therethrough and bonded thereto by a metallic bond between about .1 and about .5 per cent of particles of harder metal of a size between about 100 and about 500 mesh.

3. A material for use in an electrical contact comprising a body of silver having dispersed therethrough and bonded thereto by a metallic bond about .3 per cent of finely divided chromium of a particle size between about 200 and about 300 mesh.

4. In a sliding electrical contact device, a con-

tact element adapted to cooperate in sliding relationship with at least one terminal, said contact element comprising a body of silver having dispersed therethrough and bonded thereto by a metallic bond between about .1 and about .5 per cent of particles of chromium having a particle size between about 100 and about 500 mesh.

5. In a switching device for electrical circuits carrying sound modulated currents, at least one terminal and a contact element adapted to cooperate in sliding relationship with said terminal in such manner as to establish and break electrical contact between said contact element and said terminal, said contact element being made up of a body of silver having dispersed therethrough and bonded thereto by a metallic bond about .3 per cent of finely divided chromium of a particle size between about 200 and 300 mesh.

6. A material for use in an electrical contact comprising ductile contact metal of good conductivity having dispersed therein and firmly bonded thereto a small proportion of discrete particles of a harder substance, the number and size of which particles are small enough so that when the surface of said material is in contact with a smooth surfaced cooperating contact said particles do not interfere appreciably with conduction of electrical current by the ductile contact metal, but the number and size of which particles are large enough to provide abrasive action on the cooperating contact and to prevent said particles from flowing with said ductile contact metal.

7. A material for use in an electrical contact comprising ductile contact metal of good conductivity having dispersed therein and firmly bonded thereto with a metallic bond a small proportion of finely divided particles of a harder metal, the number and size of which particles are small enough so that when the surface of said material is in contact with a smooth surfaced cooperating contact said particles do not interfere appreciably with conduction of electrical current by said ductile contact metal, but the number and size of which particles are large enough to provide abrasive action on the cooperating contact and to prevent said particles from flowing with said ductile contact metal.

8. A material for use in an electrical contact comprising silver having dispersed therein and firmly bonded thereto a small proportion of finely divided particles of chromium, the number

and size of which particles are small enough so that when the surface of said material is in contact with a smooth surfaced cooperating contact said particles do not interfere appreciably with conduction of electrical current by the silver, but the number and size of which particles are large enough to provide abrasive action on the cooperating contact and to prevent said particles from flowing with the silver.

9. A sliding electrical contact device comprising two smooth surfaced contact elements adapted to move in sliding relation to each other, one of said contact elements comprising ductile metal of good electrical conductivity having dispersed therein and firmly bonded thereto a small proportion of discrete particles of a harder substance, the number and size of which particles are small enough so that when the surfaces of said contact elements are in contact said particles do not interfere appreciably with conduction of electrical current by said ductile metal, but the number and size of which particles are large enough to provide abrasive action on the surface of the cooperating contact element and to prevent said particles from flowing with the ductile metal.

10. A sliding electrical contact device comprising two smooth surfaced contact elements adapted to move in sliding relation to each other, one of said contact elements comprising silver having dispersed therein and firmly bonded thereto a small proportion of finely divided particles of chromium, the number and size of which particles are small enough so that when said contact elements are in contact said particles do not interfere appreciably with conduction of electrical current by the silver, but the number and size of which particles are large enough to provide abrasive action on the surface of the cooperating contact element and to prevent said particles from flowing with the silver.

11. A sliding electrical contact device comprising two smooth surfaced contact elements adapted to move in sliding relation to each other, one of said contact elements comprising a body of ductile metal of good electrical conductivity having dispersed therein and firmly bonded thereto between about .1 and about .5 per cent of particles of a harder metal having a particle size between about 100 and about 500 mesh.

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