

UNITED STATES PATENT OFFICE

2,374,214

CONDUCTIVE PAPERS

Bernard L. Kline, Manhasset, and Curt E. Mobius,
Brooklyn, N. Y., assignors to The Western
Union Telegraph Company, New York, N. Y., a
corporation of New York

No Drawing. Application July 27, 1939,
Serial No. 286,804

4 Claims. (Cl. 92—21)

The present invention relates generally to a novel conducting paper, and more particularly to a light colored conducting paper and the method of rendering the fibrous structure of the paper electrically conductive.

It has been proposed heretofore to produce conductive sheets by incorporating powdered metals in the fibrous structure of a paper but apparently a film of oxide or other material forms between the particles which impairs its conductivity.

In the process of electric recording it is advantageous to utilize a light colored paper which is electrically conductive, but the prior art fails to teach a method of producing conductive metallic papers, the known conducting papers being either dark colored and composed of various compositions of carbon or depending upon ionic conduction. It is also advantageous that a paper should not require preparatory treatment such as humidification or dehumidification as such operations are expensive.

Accordingly, the principal object of this invention is to produce a novel light colored recording paper suitable for use without preparation or treatment supplementary to the recording process.

Another object of this invention is to produce a metal bearing recording paper which is electrically conductive.

A still further object of this invention is to provide a paper containing aluminum powder and suitable for electrical recording.

Still another object of this invention is to provide a novel method of rendering light colored metal bearing papers electrically conductive.

A still further object of this invention is to provide a method of rendering a light colored paper containing aluminum powder electrically conductive.

As stated above, when aluminum or other metallic powder is mixed with fibrous paper pulp it is found that the electrical conductivity of the resulting product is impaired for the reason that a film of oxide or other material forms between the particles of metal and acts as an insulator. However we have found that certain materials, which are reducing or neutral to the metallic powders, have the property of promoting conductive intimacy of the particles of powdered metal and preventing formation of highly insulating films on the surface thereof and when the metallic powder is mixed with such material or vehicle a metallic appearing mass is obtained in which the metallic particles make sufficient elec-

tric contact to produce a conductive mixture. Such material may for example be solid aliphatic and aromatic alcohols, both monohydric and polyhydric, or aldehyde or ketone type materials with or without a dissolved electrolyte. One solid which gives excellent results is mannitol, also known as mannite. This is a hexahydric alcohol and is obtainable in white powder form. A second important material is diglycol stearate, that is, a stearic acid ester of diethylene glycol, which gives results comparable with those of mannitol. Another material which will serve as a protecting medium is erythritol, which is a tetrahydric alcohol. Each of the polyhydric alcohols mentioned is a simple polyhydric alcohol. Other materials may be resorcinol, a dihydroxybenzene, which may be considered a phenolic alcohol, monohydric alcohols where there are ten or more atoms of carbon in the molecule, certain sugars such as dextrose, maltose and sucrose and certain hydroxy and dibasic acids such as succinic or malic acid. Higher aldehydes such as paralbol and lactic aldehyde and ketones such as benzophenone are solids and may also be utilized in the same manner. Preferred protective materials are solid polyhydric alcohols and their derivatives; however, related materials and their derivatives, such as aldehydes, ketones, sugars and certain hydroxy acids exhibit the same tendencies. Esters of alcohols such as carnauba wax are also suitable.

These materials, of which mannitol and diglycol stearate are preferred, may be melted and mixed with from 30 to 150% of metal powder, such as aluminum, and allowed to cool. This mixture is found to be electrically conductive and may therefore be incorporated in fibrous sheets such as paper. Aluminum is cited by way of example only, since it is obvious that other powdered metals may be substituted, such as copper, brass, bronze, iron, zinc, etc. These metallic powders which are obtained in flaky form, such as aluminum, copper, brass, bronze, etc. are preferred due to the greater light reflecting properties thereof and hence lighter color.

Any of the mixtures of one of the materials named above and a metal powder may be incorporated into a sheet of paper by first introducing the aluminum or other metal powder into a beater with the paper pulp in the usual manner, and after the web is at least partially dried the mixture may be impregnated with an aqueous or alcoholic solution of one of the materials named above, preferably diglycol stearate or mannite. The web may be impregnated by running the

same through a bath of molten vehicle or transferring the vehicle from a roll to the web. The web may then be dried and subjected to hot calendering which will melt the mannitol or diglycol stearate and form a conducting mixture with the metal powder in the paper.

Conductive papers of this nature are usually provided with a color-changing material whereby the passage of marking current through the paper produces a color change in accordance with the desired pattern to be reproduced thereon. Materials such as lead thiosulphate, lead thiocyanate or mercuric sulphide may be put in the beaters with the metallic powder whereby the material becomes an integral part of the fibrous structure of the paper. The coloring material may also be incorporated as a layer external to the web of the paper. In any case passage of electrical current through the sheet, which has been made conductive in the manner described above, results in reproduction of the desired character or pattern on the surface of the paper. From the above description it is evident that the objects of this invention have been accomplished in that the process results in a novel light colored metal bearing paper which is electrically conductive.

Further advantages and modifications of this invention will be obvious to those skilled in the art, and therefore I desire that this invention shall be limited only to the extent required by the prior art and appended claims.

We claim:

1. The process of producing an electrically conducting paper comprising the steps of mixing and beating aluminum powder and pulp, forming the beaten mixture into a web, at least partially drying said web, impregnating said web with a solution of mannitol, drying said web and hot calendering said web to melt the mannitol and form a conducting mixture with the aluminum powder.

2. A conducting paper comprising a fibrous body containing a mixture of finely divided metal particles and a solid, fusible compound of the class consisting of monohydric alcohols, simple polyhydric alcohols, and sugars, dispersed throughout said fibrous body, said compound promoting conductive intimacy of said metal particles.

3. A conducting paper comprising a fibrous body containing a mixture of finely divided metal particles and mannitol dispersed throughout said fibrous body, said mannitol promoting conductive intimacy of said metal particles.

4. A conducting paper comprising a fibrous body containing a mixture of finely divided metal particles and erythritol dispersed throughout said fibrous body, said erythritol promoting conductive intimacy of said metal particles.

BERNARD L. KLINE,
CURT E. MOBIUS.