[Third Edition.]

PATENT SPECIFICATION.

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PROVISIONAL SPECIFICATION.

Improvements in the Manufacture of Plastic or Thermo-plastic Materials.

We, COLUMBIA GRAPHOPHONE COMPANY, LIMITED, of 102 to 108, Clerkenwell Road, London, E.C. 1, a company registered under the laws of Great Britain, WILLIAM THOMAS FORSE, FREDERICK WILLIAM JONES, Junior, and GEORGE WALTERS, all of Bendon Valley, Garratt Lane, London, S.W. 18, all subjects of the King of Great Britain and Ireland, do hereby declare the nature of this invention to be as follows :—

This invention relates to the manufacture of thermoplastic materials, that is, materials which are capable of being made to flow or of being moulded under the application of heat and/or pressure.

The object of the present invention is to provide materials of the above character which may be mouldable at a temperature of about or below 140° C and with the aid of pressure for the manufacture or production of gramophone records or other articles for the preparation of which such materials may be used.

The invention consists in a thermoplastic material having as its base a nitric ester such as nitrocellulose.

The invention also consists in a thermoplastic material having as its base a nitric ester such as nitrocellulose and a non-volatile gelatiniser of the nitric ester employed.

The invention also consists in articles formed from thermoplastic material of the above character and other details hereinafter described or indicated.

In carrying our invention into effect in one convenient manner we form our improved thermoplastic material with a base of nitrocellulose and a non-volatile gelatiniser of nitrocellulose of which the following may be given as examples :—

Nitro hydrocarbons	*e.g.*	Di - nitrotoluene.
Urethanes	*e.g.*	Phenyl urethane.
Substituted ureas	*e.g.*	Di - ethyl - di - phenyl urea.
Anilides or their homologues.	*e.g.*	Form - *o* - toluidide.

The base so formed is preferably mixed with a more or less plastic or viscous material such, for example, as resinous substances which fuse with the base when moulded at the moulding temperature and there may also be added one or more filling materials such, for example, as barium sulphate, carbon black, rotten stone, or kieselguhr, the object of these latter substances being to cheapen the process of production and impart a certain degree of hardness to the finished material.

In practice we prefer to use the nitrocellulose of low nitrogen content known as "collodion cotton" but we do not restrict our invention to any particular nitric ester or form of nitrocellulose and the non-volatile gelatiniser or mixture of gelatinisers is selected to give the best results according to the particular base employed The resinous substance may be any natural resin such as copal, shellac, gum resin or synthetic resins such as phenolic condensation products and the filler adopted may be of a character depending upon whether it is desired merely to cheapen the cost of manufacture or on any particular properties which it may be desired to impart to the finished product or material.

As an example of the application of our invention we may instance the production of a gramophone record for which purpose we preferably employ a thermoplastic material of the following composition :—

Nitrocellulose (11 *per cent.* nitrogen) – – –	18.5 *per cent.*
Form-*o*-toluidide (gelatiniser) – – –	14.0 *per cent.*
Acaroid resin – – –	14.0 *per cent.*
Barium sulphate – –	49.0 *per cent.*
Lamp black – – –	4.5 *per cent.*

These ingredients may be incorporated in a mixing machine or by the aid of heated rolls and with small quantities of a volatile substance such as acetone or ethyl alcohol, the mass being then worked at a temperature of, say, 100° C.

for the purpose of removing any excess of the volatile solvent. The mass is then allowed to cool and is subsequently ground into a powder which may be heated on to paper, of which a number of layers may be employed for the production of the gramophone record or the plastic mass while still hot may be formed into circular blocks of correct size which may subsequently be reheated and pressed in the record mould.

It will be obvious that there are many ways in which the material may be prepared and treated depending upon the character of the article which is to be formed therefrom and the following methods are given merely by way of example :—

(1). The ground ingredients from which the thermoplastic material is to be formed are incorporated between heated rolls until the plastic mass is uniform, the formation of the plastic mass being facilitated by the addition of a small percentage of volatile solvents such as amyl acetate or ethyl alcohol. The incorporated mass may be formed into suitable shapes by moulding or it may be ground into powder or otherwise treated or stored for future use ;

(2). The nitrocellulose is gelatinised in any known manner by the aid of heat and with or without a volatile medium such as amyl acetate, acetone or alcohol and to the gelatinised mass the other ingredients may be added and with which they may be incorporated in any suitable manner, the finally mixed materials being subsequently used as described in Example 1.

(3). The materials may be formed into a paste by the aid of volatile solvents so that they may be spread on the surface of objects or of some other thermoplastic material which may be pressed or moulded to give an article composed of the composite materials or, alternatively, the materials of the thermoplastic substance may be spread on to paper and dried and the coated papers then pressed on to some other thermoplastic material or core.

(4). The ground material prepared as in Example 1 or 2 may be placed on paper or like material in a thin layer and heated in order to cause it to cohere, the coated papers then being used as suggested in Example 3.

(5). The material prepared as in Example 1 or 2 may be pressed or rolled into sheets which may then be pressed on to an object or mould or used in a similar manner with any suitable core.

It is to be understood that the foregoing details are given by way of illustration and not of limitation as it will be obvious that we may vary the materials employed in connection with the nitric ester, the proportions in which the various ingredients are used and the manner of preparing and employing the thermoplastic material so produced depending upon the purpose for which the material is to be employed or any particular practical requirements that may have to be fulfilled.

Dated this 24th day of August, 1921.

MARKS & CLERK.

COMPLETE SPECIFICATION.

Improvements in the Manufacture of Plastic or Thermo-plastic Materials.

We, COLUMBIA GRAPHOPHONE COMPANY, LIMITED, of 102 to 108, Clerkenwell Road, London, E.C. 1, a company registered under the laws of Great Britain, WILLIAM THOMAS FORSE, FREDERICK WILLIAM JONES, Junior, and GEORGE WALTERS, all of Bendon Valley, Garratt Lane, London, S.W. 18, all subjects of the King of Great Britain and Ireland, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement :—

This invention relates to the manufacture of plastic or thermoplastic materials, that is, materials which are capable of being made to flow or of being moulded under the application of heat and/or pressure.

The invention has more particular reference to the class of plastic or thermoplastic materials having a basis of nitric ester of cellulose which is associated with a gelatinising agent and also with a suitable filling material.

In the preparation of such compositions for general purposes it has hitherto been suggested to embody therein one or more resins but we have found that for the production of a material of this character on a commercial scale which will be suitable for the making of gramophone records an acaroid resin should

be embodied in the composition, and our invention is based upon our observations in this respect.

In carrying our invention into effect in one convenient manner, we form our improved thermoplastic material with a base of nitrocellulose and a non-volatile gelatiniser of nitrocellulose of which the following may be given as examples :—

Nitro hydrocarbons	*e.g.*	Di-nitrotoluene
Urethanes	*e.g.*	Phenyl urethane
Substituted ureas	*e.g.*	Di - ethyl - di - phenyl urea
Anilides or their homologues.	*e.g.*	Form - *o* - toluidide.

The base so formed is mixed with one or more of the resins known as "acaroid resins" or "xanthorrhea resins" which fuse with the base when moulded at the moulding temperature, and there may also be added one or more filling materials, such for example as barium sulphate, carbon black, rotten stone or kieselguhr, the object of these latter substances being to cheapen the process of production and impart a certain degree of hardness to the finished material.

In practice we prefer to use the nitrocellulose of low nitrogen content known as "collodion cotton" but we do not restrict our invention to any particular nitric ester of cellulose and the non-volatile gelatiniser or mixture of gelatinisers is selected to give the best results according to the particular base employed. The filler adopted may also be of a character depending upon whether it is desired merely to cheapen the cost of manufacture or on any particular properties which it may be desired to impart to the finished product or material.

As an example of the application of our invention we may instance the production of a gramophone record for which purpose we preferably employ a thermo-plastic material in which the acaroid resin content does not exceed the gelatiniser content and of the following composition :—

Nitrocellulose (11 *per cent.* nitrogen) – – –	18.5 *per cent.*
Form-*o*-toluidide (gelatiniser) – – –	14.0 *per cent.*
Acaroid resin – – –	14.0 *per cent.*
Barium sulphate – –	49.0 *per cent.*
Lamp black – – –	4.5 *per cent.*

These ingredients may be incorporated in a mixing machine or by the aid of heated rolls and with small quantities of a volatile substance, such as acetone or ethyl alcohol, the mass being then worked at a temperature of, say, 100° C. for the purpose of removing any excess of the volatile solvent. The mass is then allowed to cool and is subsequently ground into a powder which may be heated on to paper, of which a number of layers may be employed for the production of the gramophone record or the plastic mass while still hot may be formed into circular blocks of correct size which may subsequently be reheated and pressed in the record mould.

It will be obvious that there are many ways in which the material may be prepared and treated depending upon the character of the article which is to be formed therefrom and the following methods are given merely by way of example :—

(1). The ground ingredients from which the thermo-plastic material is to be formed are incorporated between heated rolls until the plastic mass is uniform, the formation of the plastic mass being facilitated by the addition of a small percentage of volatile solvents, such as amyl acetate or ethyl alcohol. The incorporated mass may be formed into suitable shape by moulding or it may be ground into powder or otherwise treated or stored for future use ;

(2). The nitrocellulose is gelatinised in any known manner by the aid of heat and with or without a volatile medium, such as amyl acetate, acetone or alcohol, and to the gelatinised mass the other ingredients may be added and with which they may be incorporated in any suitable manner, the finally mixed materials being subsequently used as described in Example 1 ;

(3). The materials may be formed into a paste by the aid of volatile solvents so that they may be spread on the surface of objects or of some other thermo-plastic material which may be pressed or moulded to give an article composed of the composite materials or, alternatively, the materials of the thermo-plastic substance may be spread on to paper and dried and the coated papers then pressed on to some other thermo-plastic material or core ;

(4). The ground material prepared as in Example 1 or 2 may be placed on paper or like material in a thin layer and heated in order to cause it to cohere, the coated papers then being used as suggested in Example 3 ;

(5). The material prepared as in Example 1 or 2 may be pressed or rolled into sheets which may then be pressed on to an object or mould or used in a similar manner with any suitable core.

It is to be understood that the foregoing details are given by way of illustration and not of limitation as it will be

obvious that we may vary the materials employed in connection with the nitric ester and acaroid resin, the proportions in which the various ingredients are used and the manner of preparing and employing the thermo-plastic material so produced depending upon the purpose for which the material is to be employed or any particular practical requirements that may have to be fulfilled.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is :—

(1). A plastic or thermoplastic material of the class referred to having an acaroid resin incorporated therein.

(2). A plastic or thermoplastic material according to Claim 1 in which the acaroid resin content does not exceed the gelatiniser content.

(3). A plastic or thermoplastic material of the class referred to having the specific composition herein given by way of example.

(4). Improved plastic or thermoplastic materials of the class referred to, substantially as hereinbefore described.

(5). Homogeneous or laminated gramophone or like records formed of or comprising the herein described plastic or thermoplastic materials.

Dated this 24th day of May, 1922.

MARKS & CLERK.

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