

UNITED STATES PATENT OFFICE.

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CELLULOSE ACETATE.

SPECIFICATION forming part of Letters Patent No. 774,713, dated November 8, 1904.

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To all whom it may concern:

Be it known that I, WILLIAM H. WALKER, of Newton, county of Middlesex, State of Massachusetts, have invented an Improvement in Cellulose Acetate, of which the following description is a specification.

My invention relates to improvements in cellulose acetate and other stable derivatives of cellulose, whereby the same is adapted for use as a substitute for celluloid and other pyroxylin compounds; and my invention consists in modifying the intrinsic physical properties of cellulose acetate and other stable and non-explosive cellulose esters or derivatives thereof.

The very general employment of celluloid and other pyroxylin compounds for constructive purposes, either by themselves or as elements in structures composed in part of other materials, is widely known. Their introduction, manufacture, and present extended use has been accompanied by much danger and has resulted in many serious disasters, caused by the unstable explosive character of the nitrocellulose which forms the basis of these compounds or by the volatility and highly-inflammable nature of the solvents necessary to the manufacture.

Other derivatives of cellulose or, more particularly, esters of cellulose with organic acids—as, for example, cellulose acetate—have been known for many years, and their appearance and properties in excessively-thin films or structures heretofore produced therefrom have from time to time raised the expectation that these stable derivatives or esters of cellulose might replace for many purposes the highly-inflammable, dangerous, and explosive compounds of pyroxylin. These expectations have heretofore met only with disappointment, and the inherent properties of these stable derivatives and organic esters as now understood are such as to preclude their use as substitutes for celluloid. They are brittle in the mass or in sheets of any thickness, and even the excessively-thin films above referred to commonly become brittle upon complete expulsion of the solvent. A further and practically complete bar to their manipulation is

found in the fact that none of the stable cellulose derivatives now known are plastic under heat.

I have discovered that despite the great dissimilarity which exists in many important particulars between the inflammable and explosive nitrates of cellulose and stable derivatives of cellulose, as the organic esters of cellulose, these stable compounds—as, for example, cellulose acetate—may nevertheless be readily manipulated by methods familiar to those working in plastic materials and become generally available as substitutes for celluloid when said stable compounds are combined or associated with a solvent of low volatility, such as a phenol—as, for instance, thymol, phenol, cresol, or certain essential oils containing phenolic compounds, or other organic bodies or substances having equivalent effects. The solvent should preferably be one like thymol, which melts at a temperature at which the cellulose compound is unaffected, and the action of the solvent may be promoted by the conjoint use of a volatile solvent, as chloroform, in the case just named. I have also discovered that the thymol or other solid solvent may be replaced wholly or in part by certain liquid solvents of low volatility.

The necessary point and the essence of my invention is that the acetate or other organic ester or stable derivative of cellulose must be associated with a solvent of low volatility, as a phenol such as thymol, phenol, cresol, or certain essential oils containing phenolic compounds, or organic bodies or substances having equivalent effects. When these conditions are fulfilled, these stable cellulose derivatives as cellulose acetate become general substitutes for celluloid and other pyroxylin compounds for constructive purposes. They possess, moreover, under these conditions the advantage of entire safety in their manufacture and general use.

The importance of an invention as offering a general substitute for celluloid and pyroxylin compounds appears from a consideration of its application—such as, for example, in

modified as above described, in place of celluloid or other pyroxylin compounds in a photographic film or plate.

Among the many advantages possessed by the above-described compound may be mentioned its entire safety, stability, non-explosive character, flexibility, and strength and relatively non-inflammability. This great advantage of non-inflammability may be enhanced by the use of a non-inflammable volatile solvent—for example, chloroform—in connection with the solvent of low volatility. For example, in preparing a solution of my compound suitable for spreading on glass or other surface which may be employed for the production of a photographic film I may take chloroform, one hundred parts; cellulose acetate, ten parts; thymol, five parts; or in the manufacture of my new compound I may take a quantity of cellulose acetate and add, say, twenty-five to fifty per cent. of the solvent of low volatility, varying more or less according to the solvent used, then manipulate the plastic mass, and then dry it.

The usual pigments and weighting materials, as zinc oxid, may be incorporated with my composition as with celluloid.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. A stable derivative of cellulose, as cellulose acetate, modified by the addition or presence of a solvent of low volatility.

2. A new composition of matter containing a stable derivative of cellulose, as cellulose acetate, and a solvent of low volatility.

3. The herein-described substitute for horn, celluloid and the like consisting of acetyl cellulose, in combination with a phenol, substantially as described.

4. The herein-described substitute for horn, celluloid and the like consisting of acetyl cellulose, in combination with thymol, substantially as described.

5. A stable derivative of cellulose, as cellulose acetate, modified by the addition or pres-

ence of a solvent of low volatility, and a highly-volatile solvent.

6. A new composition of matter containing a stable derivative of cellulose, as cellulose acetate, and a solvent of low volatility, and a highly-volatile solvent.

7. A new composition of matter consisting of acetyl cellulose, in combination with a phenol, and a volatile solvent, substantially as described.

8. A new composition of matter consisting of acetyl cellulose, in combination with thymol and a volatile solvent, substantially as described.

9. A new composition of matter consisting of acetyl cellulose, in combination with thymol and chloroform, substantially as described.

10. The herein-described substitute for horn, celluloid and the like, consisting of acetyl cellulose, in combination with an organic body of the character described.

11. The herein-described process of producing horn-like substances, consisting in reacting upon acetyl cellulose with an organic body of the character described.

12. The herein-described process of producing horn-like substances, consisting in reacting, under heat, upon acetyl cellulose with an organic body of the character described.

13. The herein-described process of producing horn-like substances, consisting in reacting, under heat and pressure, upon acetyl cellulose with an organic body of the character described.

14. The herein-described process of producing horn-like substances, consisting in reacting upon acetyl cellulose with a phenol, substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

WILLIAM H. WALKER.

Witnesses:

B. J. NOYES,

LOUIS H. HARRIMAN.