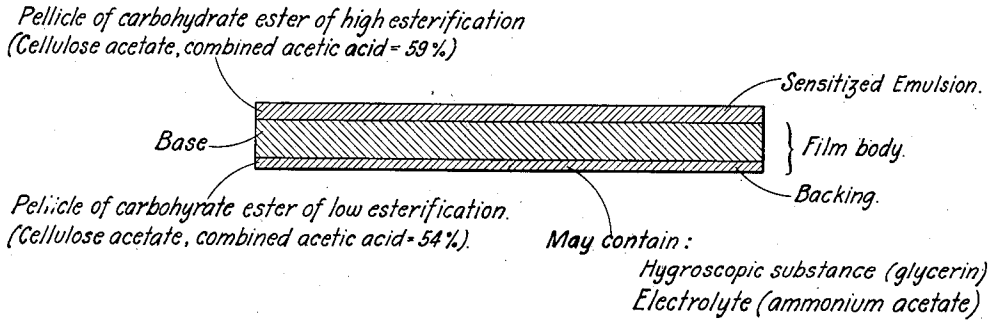
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E. C. PITMAN

NONSTATIC PHOTOGRAPHIC FILM

Original Filed Sept. 16, 1920



E. C. Pitman, Inventor

By his attorney F. R. Squair.

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UNITED STATES PATENT OFFICE.

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NONSTATIC PHOTOGRAPHIC FILM.

Application filed September 16, 1920, Serial No. 410,747. Renewed June 22, 1925.

To all whom it may concern:

Be it known that I, EARLE C. PITMAN, a citizen of the United States, and a resident of Parlin, in the county of Middlesex and State of New Jersey, have invented a certain new and useful Nonstatic Photographic Film, of which the following is a specification.

This invention relates to photographic films having provisions for the elimination of discharges of static electricity. With the ordinary film these discharges occur when the film is stripped from the casting surface, when it is run rapidly through a cinematographic camera and under various other circumstances. Such discharges cause markings on the sensitized emulsion by premature exposure thereof. It is an object of the invention to provide a film which, for practical purposes of manufacture and use, will be free from static electricity, and it is also an object to improve generally upon films of the character indicated.

For convenience and brevity of description I use the term "film" to denote the entire article, whether or not the article includes a sensitized emulsion; the term "film body" to denote the entire emulsion support whether or not that support is composed of a plurality of layers, sub-films or pellicles; the term "backing" to denote a layer of a composite film body, which lies adjacent the other side of the film body from the side intended to directly carry the emulsion; and I use the term "base" to denote the portion of a composite film body which is intended to carry the backing at one side and the emulsion at the other and to form or include the principal strength-giving portion of the film. On occasion, as will appear from the context, I use the term "base" (or pellicle base) to also indicate the substance, as cellulose acetate, which is the primary substance used to form a pellicle.

In the accompanying drawing I have, without restricting my invention thereto, shown a film embodying my invention, the view being a conventional, exaggerated, cross-sectional showing.

According to my invention, I use in the film body a substance, or substances, which will make the body, either as a whole, or at its backing where one is used, more electrically conductive than is the ordinary film. In this way, I provide that such static charges as tend to be generated shall leak away, be neutralized, or be evenly distributed, before they can accumulate in such a way, or to such amount, as to be liable to harmful discharge.

Thus, I may incorporate in the body a hygroscopic substance such as glycerine, either alone or in combination with an electrolyte such as ammonium acetate, or magnesium nitrate, the substances selected for any specified case to be soluble in the particular solvent mixture used for making the pellicle in which the substances are to be incorporated, and to be such as not to cause precipitation of the pellicle base, as cellulose acetate, used for the pellicle. The hygroscopic substance increases the conductivity by increasing the moisture content; the electrolyte increases the conductivity of any moisture present. The electrolyte is, of course, valuable, whether or not a hygroscopic substance is used also, as some moisture is present in any case.

The various substances may be incorporated in a body having any desired pellicle base and without a backing, or may be incorporated in a backing and such backing applied to any desired base. The backing may be one which primarily functions merely by virtue of the substances and, so, may not contain a pellicle base, e. g. cellulose acetate; or it may contain a pellicle base of any suitable character and either having substantially the same conductivity as the pellicle base used in making the base of the film, or having a conductivity somewhat greater than that of the pellicle base used in making the base of the film and enabling the pellicle base of the backing to itself serve in giving the backing a superior conductivity.

As to the use for the backing of a pellicle base which is itself of superior conductivity, I may apply a backing layer of carbohydrate ester of relatively low esterification, e. g., cellulose acetate containing 55% combined acetic acid or less, that is, of not over 55% combined acetic acid. I have found that cellulose acetate decreases in hygroscopicity and in conductivity as the combined acetic acid content increases, though it increases in strength, so that cellulose acetate containing not over 55% combined acetic acid is more hygroscopic and more conductive than cellulose acetate containing more than 55%

combined acetic acid; yet experience has shown that, if proper strength is to be secured in a cellulose acetate film, then a film primarily of cellulose acetate of more than 55% combined acetic acid is a practical necessity, despite the fact that, used alone, it is liable to static discharges due to its non-conductivity. So, in carrying out my invention, I apply a backing of cellulose acetate of 55% or less combined acetic acid, preferably about 54%, to a base of cellulose acetate of more than 55% combined acetic acid, preferably about 59%. In this way I produce a cellulose acetate film which has the strength demanded by the trade and yet is conductive and substantially non-static. As will be understood, a film of the character just indicated may, if desired, contain no added hygroscopic or electrolytic substances and yet present the advantage of conductivity to a marked degree. In such cases any suitable formulas for the base and the backing solution may be used; conveniently the below-given formulas "3," and "1" or "3," each with the glycerine omitted, may be used for the base, and the backing, respectively.

While the above mentioned cellulose acetate backing is highly advantageous of itself, either when applied to any suitable film base or, particularly, when applied to the mentioned cellulose acetate film base, I have found, as previously indicated, that the incorporation, in such a backing, of conductivity-increasing substances, as a hygroscopic substance, alone or in combination with an electrolytic substance, gives a particularly satisfactory film.

The mechanical operations of making films in accordance with my invention will be evident to those skilled in the art, the casting of films, and similar operations, as such, being, of course, well known in the art. The backing solution may be applied, and the solvents evaporated to give the backing, in any convenient manner. Below I give formulas illustrative of films embodying my invention, it being understood that I do not restrict the invention to the examples given. In the formulas, figures refer to parts by weight.

(1) For a backing containing a hygroscopic substance, glycerine, the following formula may be used:—

	Approximate range.	Preferred.
Cellulose acetate (dry)	4 to 16	6
Glycerine	0.25 to 15	1
Acetone	100 to 140	120
Wood alcohol	60 to 100	80

In making up, to the combined solvents add (*a*) the glycerine and (*b*) the cellulose acetate in order.

(2) For a backing containing a hygroscopic substance, glycerine, and an electrolyte, ammonium acetate, the formula, as to ingredients, ranges, and preferred amounts, may be the same as for "1" except that it should in addition include approximately 0.25 to 10 parts, preferably 1 part, of ammonium acetate. In making up, add (*a*) the ammonium acetate, (*b*) the glycerine, and (*c*) the cellulose acetate in order to the combined solvents.

While the various backings may be of any desired thickness serving the ends sought, I have found a relatively thin backing desirable. A film base for them may be "3", glycerine omitted.

(3) For a film body not having a backing but yet containing a hygroscopic substance, glycerine, I recommend the following formula.

	Approximate range.	Preferred.
Cellulose acetate (dry)	25 to 40	30
Glycerine	0.25 to 15	1
Acetone	100 to 140	120
Wood alcohol	60 to 100	80
Triacetin	3 to 15	6

In preparing, to the combined solvents add (*a*) the glycerine and (*b*) the cellulose acetate in order.

(4) For a similar film body containing a hygroscopic substance, glycerine, and an electrolyte, ammonium acetate, the formula, as to ingredients, ranges, and preferred amounts, may be the same as "3" except that it should include, in addition, approximately 0.25 to 10 parts, preferably 1 part, of ammonium acetate. When making up, to the combined solvents add (*a*) the ammonium acetate, (*b*) the glycerine, and (*c*) the cellulose acetate, in order.

I would call attention to the fact that the above compositions are substantially neutral, as is evident from consideration of the ingredients thereof, they having neither a pronounced alkaline or acid reaction. In consequence, the composition will have substantially no harmful effect upon metallic casting surfaces, a feature of particular importance in connection with the making of the film body; and in further consequence, the film body itself, and the backing itself, although containing, of course, "residual solvent" to assist in flexibility, will have no desensitizing effect on the emulsion. This is of importance not only with respect to a film body, the emulsion being spread upon that, but also with respect to a backing since when a film is rolled upon itself (no shielding paper being used) as in motion picture films, the backing of one coil comes into direct contact with the emulsion of the next coil.

In all the above formulas the cellulose acetate may have 55% or less combined acetic acid, or may have more than 55% combined acetic acid, but, as explained above, it is desirable that cellulose acetate having 55% or less combined acetic acid, that is not over 55% combined acetic acid, be used for the backings, and that such backings be applied to a base of cellulose acetate having more than 55% combined acetic acid. In the cases of unbacked films it is desirable to use cellulose acetate having more than 55% combined acetic acid.

To provide backings which are soluble in water and can be totally removed, say in development, (after which there is no longer any danger from "static marks"), glycerine and ammonium acetate in the preferred amounts and ranges given in formulas "1" and "2" may be dissolved in 100 to 400, preferably 200, parts of denatured alcohol.

Although, for purposes of specific illustration, I have made more particular reference to cellulose acetate as the pellicle base to be used for the various layers, it is to be understood that I do not restrict my invention to the use of cellulose acetate, as various other materials, particularly, other carbohydrate esters, may be used for the pellicle containing the hygroscopic substance alone or with an electrolyte.

While, in describing my invention, I have referred to it as embodied in a "body without a backing" and as embodied in a "backing" it is to be understood that by neither of these terms do I exclude films wherein the pellicle which more particularly exemplifies the invention may have applied to its (normally) exposed surface a coating of such character as not to destroy the efficacy of the pellicle, the pellicle, from the standpoint of the present invention, yet being "without a backing" or being a "backing" as the case may be.

Of course, should it be desired for any reason, both the film base and the backing of a backed film may contain the conductivity-increasing substances.

I claim:

1. A transparent flexible, thin, substantially neutral photographic film having a body of carbohydrate ester containing glycerine.

2. A substantially neutral, flexible photographic film containing a hygroscopic substance and an electrolyte.

3. A substantially neutral, flexible photographic film containing glycerine and an electrolyte.

4. A photographic film containing a hygroscopic substance and ammonium acetate.

5. A photographic film containing glycerine and ammonium acetate.

6. A photographic film having a base and a backing, said backing comprising 4 to 16 parts of a pellicle base and 0.25 to 15 parts of glycerine.

7. A photographic film having a base and a backing, said backing comprising 6 parts of a pellicle base and 1 part of glycerine.

8. A photographic film having a base and a backing, said backing comprising 4 to 16 parts of a pellicle base, a hygroscopic substance, and 0.25 to 10 parts of ammonium acetate.

9. A photographic film having a base and a backing, said backing comprising 6 parts of a pellicle base, a hygroscopic substance, and 1 part of ammonium acetate.

10. A photographic film having a base and a backing, said backing comprising 4 to 16 parts of a pellicle base, 0.25 to 15 parts of glycerine, and an electrolyte.

11. A photographic film having a base and a backing, said backing comprising 6 parts of a pellicle base, 1 part of glycerine, and an electrolyte.

12. A photographic film having a base and a backing, said backing comprising 4 to 16 parts of a pellicle base, 0.25 to 15 parts of glycerine, and 0.25 to 10 parts of ammonium acetate.

13. A photographic film having a base and a backing, said backing comprising 6 parts of a pellicle base, 1 part of glycerine, and 1 part of ammonium acetate.

14. A photographic film having a base and a backing, said backing being of cellulose actate and more conductive than said base.

15. A photographic film having a backing of cellulose acetate containing not over 55% combined acetic acid.

16. A photographic film having a base and a backing each of cellulose acetate, the cellulose acetate of said backing being of greater conductivity than is the cellulose acetate of said base.

17. A photographic film having a base and a backing each of cellulose acetate, the cellulose acetate of said backing being of greater hygroscopicity than is the cellulose acetate of said base.

18. A photographic film having a base and a backing each of cellulose acetate, the cellulose acetate of said backing having a lower combined acetic acid content than the cellulose acetate of said base.

19. A photographic film having a base and a backing each of cellulose acetate, the cellulose acetate of said base having more than 55% combined acetic acid, and the cellulose acetate of said backing having a lower percentage of combined acetic acid than has said base.

20. A photographic film having a base and a backing each of cellulose acetate, the cellulose acetate of said base having more than

55% combined acetic acid, and the cellulose acetate of said backing having not over 55% combined acetic acid.

21. A flexible, thin, substantially neutral photographic film including a layer of cellulose acetate containing a conductivity-increasing substance.

22. A photographic film having a backing of cellulose acetate having not over 55% combined acetic acid and containing a conductivity-increasing substance.

23. A photographic film having a base and a backing each of cellulose acetate, the cellulose acetate of said base having more than 55% combined acetic acid, and the cellulose acetate of said backing having not over 55% combined acetic acid, said backing containing a conductivity-increasing substance.

24. A photographic film having a base and a backing each of cellulose acetate, the cellulose acetate of said base having more than 55% combined acetic acid, and the cellulose acetate of said backing having not over 55% combined acetic acid, said backing containing 4 to 16 parts of cellulose acetate, and 0.25 to 15 parts of glycerine.

25. A photographic film having a base and a backing each of cellulose acetate, the cellulose acetate of said base having more than 55% combined acetic acid, and the cellulose acetate of said backing having not over 55% combined acetic acid, said backing containing 6 parts of cellulose acetate, and 1 part of glycerine.

26. A photographic film having a base and a backing each of cellulose acetate, the cellulose acetate of said base having more than 55% combined acetic acid, and the cellulose acetate of said backing having not over 55% combined acetic acid, said backing containing 4 to 16 parts of cellulose acetate, a hygroscopic substance, and 0.25 to 10 parts of ammonium acetate.

27. A photographic film having a base and a backing each of cellulose acetate, the cellulose acetate of said base having more than 55% combined acetic acid, and the cellulose acetate of said backing having not over 55% combined acetic acid, said backing containing 6 parts of cellulose acetate, a hygroscopic substance, and 1 part of ammonium acetate.

28. A photographic film having a base and a backing each of cellulose acetate, the cellulose acetate of said base having more than 55% combined acetic acid, and the cellulose acetate of said backing having not over 55% combined acetic acid, said backing containing 4 to 16 parts of cellulose acetate, 0.25 to 15 parts of glycerine, and an electrolyte.

29. A photographic film having a base and a backing each of cellulose acetate, the cellulose acetate of said base having more than 55% combined acetic acid, and the cellulose acetate of said backing having not over 55% combined acetic acid, said backing containing 6 parts of cellulose acetate, 1 part of glycerine, and an electrolyte.

30. A photographic film having a base and a backing each of cellulose acetate, the cellulose acetate of said base having more than 55% combined acetic acid, and the cellulose acetate of said backing having not over 55% combined acetic acid, said backing containing 4 to 16 parts of cellulose acetate, 0.25 to 15 parts of glycerine, 0.25 to 10 parts of ammonium acetate.

31. A photographic film having a base and a backing each of cellulose acetate, the cellulose acetate of said base having more than 55% combined acetic acid, and the cellulose acetate of said backing having not over 55% combined acetic acid, said backing containing 6 parts of cellulose acetate, 1 part of glycerine, and 1 part of ammonium acetate.

In testimony whereof I affix my signature.

EARLE C. PITMAN.