

(No Model.)

G. EASTMAN.
PHOTOGRAPHIC FILM.

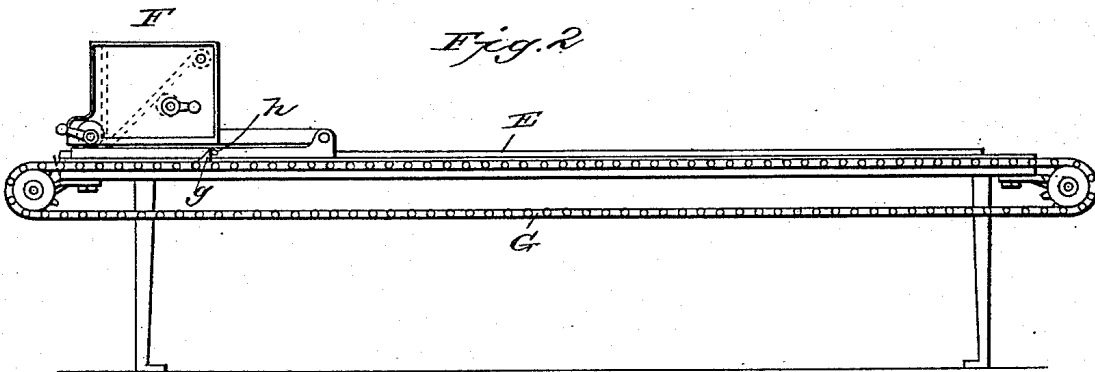
No. 441,831.

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Fig. 1.



Fig. 2.



WITNESSES:

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UNITED STATES PATENT OFFICE.

GEORGE EASTMAN, OF ROCHESTER, NEW YORK.

PHOTOGRAPHIC FILM.

SPECIFICATION forming part of Letters Patent No. 441,831, dated December 2, 1890.

Application filed November 6, 1890. Serial No. 370,435. (No model.)

To all whom it may concern:

Be it known that I, GEORGE EASTMAN, of Rochester, in the county of Monroe and State of New York, have invented certain Improvements in Photographic Films; and I do hereby declare the following to be a full, clear, and exact description of the same, reference being had to the accompanying drawings, forming a part of this specification, and to the letters of reference marked thereon.

Difficulty has heretofore been found in using photographic film—such, for instance, as is described in United States Letters Patent No. 417,202, dated December 10, 1889, granted to the Eastman Dry Plate and Film Company as the assignee of Henry M. Reichenbach—composed of a film-support made from a compound of nitro-cellulose, camphor, and other substances, and having applied thereto, after being dried, a film or layer of gelatino-argentic emulsion, especially if the photographic film be wide, owing to the tendency of such film to contract at the edges more than the central parts, so that it will not lie flat on the table or support of the roll-holder—such, for instance, as that of the Eastman & Walker roll-holder—but when strained tight the edges alone will be brought in contact with the table, while the central parts will bulge and buckle, thereby rendering it objectionable or unsuitable for photographic purposes. This unequal contraction and buckling I believe to be due to the drying out or evaporation of the volatile substance or substances used with the nitro-cellulose to make the compound from which the film-support is produced and which remain in it after it is dried. One reason for this belief is that I have observed that such photographic film that has been kept on spools for some time becomes permanently set and the buckling is more marked. I have discovered that by coating and thus protecting or sealing the film-support on both of its surfaces with some material—such as gelatine (which I believe prevents, retards, or modifies the evaporation of said substance or substances in the film-support when dried)—the film is prevented from unequally contracting or buckling to an objectionable extent and is caused to remain in good condition, so that it may be kept in rolls or on spools for a considerable

period of time without materially changing, thus enabling it to be employed in all cases where paper films are used. I shall call these coatings herein “sealing-coatings.”

In the accompanying drawings, Figure 1 is an enlarged sectional view of a photographic film containing my invention, and Fig. 2 a side view of one form of apparatus that may be employed in making the same.

Referring to Fig. 1, the letter A indicates a translucent or transparent film-support, preferably made from a compound of nitro-cellulose, camphor, and other substances, as described in the said Letters Patent No. 417,202.

C is what I shall term the “back sealing-coating” on the back of the film-support A, composed, preferably, of translucent or transparent gelatine, preferably rendered insoluble in water by any suitable material, such as chrome-alum.

B is what I shall term the “front sealing-coating,” preferably made of sensitive gelatino-argentic emulsion, such as is commonly employed in the photographic art.

I will now describe one method which I have successfully employed to make the photographic film containing my discovery or invention. I first prepare a solution of hard white gelatine in the proportion of about ten grains of the gelatine to an ounce of water, which I heat to about 100° Fahrenheit, and then add thereto sufficient of an aqueous solution of ten grains to the ounce of chrome-alum to render the gelatine insoluble when dried, the amount of chrome-alum solution required varying with the quality of the gelatine, which can be readily ascertained by a few trials, as is well understood, it varying from about two ounces to three ounces per gallon of the gelatine solution. I then flow or spread this gelatine solution upon a rigid supporting-surface—such as plate-glass—in a thin layer or film, care being taken to secure contact with said surface and to prevent the formation of bubbles between it and the gelatine solution, after which the gelatine while on this support is dried and forms the back sealing-coating. I have found a thickness of one-half to one one-thousandth of an inch for this coating when dry satisfactory; but this may vary. If this gelatine solution be applied

directly to the perfectly clean surface of a glass plate and then dried while on said surface and the subsequent operations herein-after described to make the complete photographic film are performed, it will be found to adhere so firmly to said surface that it can be removed only by application of considerable force, sometimes resulting in the tearing of the photographic film or stretching it unequally, so that it will buckle and be unfitted for use in roll-holders or for photographic purposes.

To facilitate the removal or stripping of the photographic film, I rub or coat the surface of the glass plate or other rigid supporting-surface with a very weak solution of mineral wax in benzine or other suitable solvent, or a weak solution of beeswax, or with any other equivalent agent to produce the same result before spreading the gelatine solution upon said surface. This preliminary coating should be of a character to weaken without preventing the adhesion of the back sealing-coating to the rigid supporting-surface, as it is very desirable that it should adhere throughout its whole under surface to such supporting-surface during the application thereto and the drying of the other coatings, herein-after described, and until the photographic film is ready for removal and use. I then flow upon this back sealing-coating, after it is dried and while still adhering to the rigid supporting-surface, a thin layer or film of a fluid compound of nitro-cellulose, camphor, and other substances, made substantially in the manner set forth in the said Patent No. 417,202, which is then dried, forming what I term the "film-support," which adheres firmly to the back sealing-coating and forming what I shall term the "film-support." I have found a thickness of two one-thousandths of an inch for this film-support when dry satisfactory; but this may vary. I then coat or spread upon this film-support a thin layer or film of sensitive gelatino-argentic emulsion, which is dried. I have found a thickness of one one-thousandth of an inch for this film when dry satisfactory; but this may vary. Before this latter layer or film is applied I prefer to wash the surface of the film-support with clear water to which has been added a binding agent, as described in said Letters Patent No. 417,202. After the photographic film has thus been completed and dried it is stripped from the rigid supporting-surface, preferably by detaching one end and applying it to a suitable winding device.

In another application filed by me, Serial No. 319,666, I have described in detail an apparatus capable of being used to perform the various flowing or spreading operations that I have described, including the stripping of the completed photographic film from the rigid supporting-surface upon which it is made.

In Fig. 2 of the accompanying drawings I have illustrated an apparatus capable of be-

ing used for flowing or spreading the various layers or films composing the photographic film. In said figure, E indicates a rigid support formed, preferably, of glass; F, a hopper or receptacle for containing the various solutions and spreading them successively upon one another, as described, having a suitable adjustable gate and spreader and being propelled longitudinally of the rigid support by suitable means—such, for instance, as a traveling sprocket-chain G, having a projection *g*, adapted to engage a corresponding projection *h* on the receptacle; but as this apparatus forms no part of my present invention further description of it is unnecessary. It is described more at length in said Letters Patent No. 417,202.

The photographic film containing my invention will lie practically flat on the table or support of the roll holder or frame in which it may be employed, and the edges will not contract and its surface will not buckle to an objectionable extent even after being kept for a considerable period of time in a roll or on a spool.

I have above described a preferred manner of carrying out or embodying in a photographic film my discovery; but I do not wish it to be understood that I restrict myself thereto, as there are many other ways of embodying or carrying out my invention, some of which I will now describe. Thus, instead of the film-support being made of a fluid compound of nitro-cellulose, camphor, and other substances, such as are set forth in said Letters Patent No. 417,202, it may be made from a compound containing nitro-cellulose or a substitute therefor and other substances that have a tendency to evaporate when the film-support is dried. So, also, instead of making the front sealing-coating of sensitive gelatino-argentic emulsion, it may be made from the same gelatine solution that I have described the back sealing-coating to be made of, and then the sensitive emulsion described or a collodion or other sensitive emulsion may be applied thereto after it is dried and while the back sealing-coating and film-support are upon the rigid supporting-surface. So, again, instead of using a solution of gelatine for the sealing-coatings, they may be made from substitutes therefor—such as albumen solutions made insoluble in water when dried—that will produce substantially the same effect in preventing the unequal contracting or buckling of the film-support or of that and the sensitive coating. Again, although I prefer to employ a translucent or transparent back sealing-coating, it may be opaque and arranged so that it may be stripped off or removed therefrom.

All the operations of flowing or coating of the different layers or films and stripping of the completed photographic film from the supporting-surface on which it is formed may be effected by different means from those described.

I do not claim herein the process of making flexible photographic films, which consists in flowing or spreading a fluid compound of nitro-cellulose upon a supporting-surface, drying
 5 the same, then coating with a photographic sensitive material, and, after drying said coating, removing the photographic film from said supporting-surface, as this forms the subject-matter of another application filed by
 10 me, Serial No. 306,284; nor do I claim herein the preparation of the rigid supporting-surface by waxing or other treatment preliminary to the application of the coating of the gelatine solution nor the employment of a
 15 binding solution, as these are not of my invention.

What I claim is—

1. As a new article of manufacture, a flexible film-support containing when dried a volatile substance, combined with a sealing-coating on each of its sides.

2. As a new article of manufacture, a photographic film consisting of a flexible film-support containing a volatile substance, combined with a sealing-coating on one side and
 25 with a sealing-coating which is photographically sensitive on the other side, substantially as described.

3. As a new article of manufacture, a photographic film consisting of a flexible film-support containing a volatile substance, combined with a sealing-coating on one side and
 30 with a sealing-coating of sensitive gelatino-argentic emulsion on the other side, substantially as described.

4. As a new article of manufacture, a photographic film consisting of a flexible film-support containing a volatile substance, combined with a sealing-coating of insoluble gelatine on one side and with a sealing-coating
 40 of sensitive gelatino-argentic emulsion on the other side, substantially as described.

5. As a new article of manufacture, a photographic film consisting of a flexible film-

support containing a volatile substance, combined with a sealing-coating on each side, one of said coatings carrying photographically-sensitive material, substantially as described.

6. As a new article of manufacture, a flexible film-support composed of a nitro-cellulose compound containing a volatile substance, as camphor, combined with a sealing-coating on each of its sides, substantially as described.

7. As a new article of manufacture, a photographic film consisting of a flexible film-support composed of a nitro-cellulose compound containing a volatile substance, as camphor, combined with a sealing-coating on one side and with a sealing-coating which is photographically sensitive on the other side, substantially as described.

8. As a new article of manufacture, a photographic film consisting of a flexible film-support composed of a nitro-cellulose compound containing a volatile substance, as camphor, with a sealing-coating on one side and with a sealing-coating of sensitive gelatino-argentic emulsion on the other side, substantially as described.

9. As a new article of manufacture, a photographic film consisting of a flexible film support composed of a nitro-cellulose compound containing a volatile substance, as camphor, combined with a sealing-coating of insoluble gelatine on one side and with a sealing-coating of sensitive gelatino-argentic emulsion on the other side, substantially as described.

10. As a new article of manufacture, a photographic film consisting of a flexible film-support composed of a nitro-cellulose compound containing a volatile substance, as camphor, combined with a sealing-coating on each side, one of which coatings carries photographically-sensitive material.

GEO. EASTMAN.

Witnesses:

M. B. PHILIPP,
 FRED F. CHURCH.