

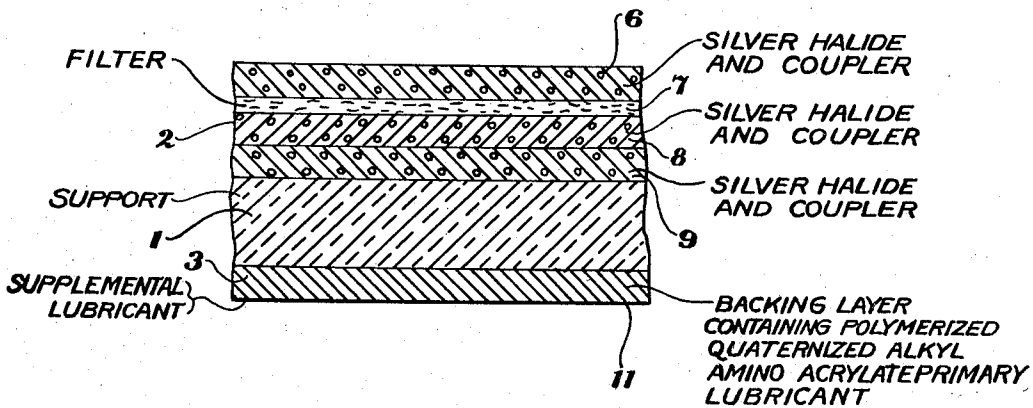
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TREATMENT OF PHOTOGRAPHIC FILM FOR STATIC RESISTANCE

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TREATMENT OF PHOTOGRAPHIC FILM FOR STATIC RESISTANCE

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This invention relates to the treatment of photographic film. More particularly this invention concerns a treating composition, a method for treating photographic film, particularly color film, as well as the improved film products resulting from the aforesaid treatment.

It has been known in general for a long time that the motivating, handling, winding, unwinding and the like operations applied to webbed materials may encounter problems of friction, static and the like. This is particularly true in handling photographic film. Hence, it has been the practice to apply various materials such as lubricating coatings, antistatic coatings, or to use other expedients such as interleaving, for facilitating handling and other operations as applied to such product.

Photographic film presents particular problems for several reasons. For example, photographic film being comprised of a relatively nonporous base or support, presents problems of finding treating agents which will suitably adhere thereto. There is the particular problem of employing treating agents which not only accomplish the result of reducing friction and static, but which do not adversely affect the sensitivity of the light sensitive layers on the photographic film. With color film there are still further problems. While some types of film may be interleaved with paper layers or the like which separate the backing from the sensitized layer, in many instances certain film and particularly color film is tightly wound for insertion into cassettes, magazines or the like, so that the sensitive layer is in direct and intimate contact with the film backing. Color film contains in the color section not only the light sensitive compounds, but may contain in addition or in lieu thereof, numerous other components such as couplers, dyes and the like. Although certain treating agents heretofore known do not adversely affect silver salts, there may be situations arise where with the more complex make-up of color film, hazing or other adverse influence on color constituents can occur. In addition, as is known, color film in its manufacturing and processing may be subjected to several and different types of steps and liquid applications. Hence, many treating materials heretofore used on certain moving webs are not particularly suitable for color film because they cannot withstand the overall combination of conditions under which the color film may be manufactured or used.

It is apparent therefore that the development of treating materials which may be applied to photographic film and particularly color film for facilitating the winding and unwinding thereof, as well as facilitating other operations that may be applied to the film, represents a highly desirable result. After extended investigation we have found that certain polymeric chemical compounds which will be described in detail hereinafter, when employed in proper proportions and otherwise in accordance with the method of the present invention, materially improve the film in many ways particularly as respects friction reduction.

This invention has for one object to provide a new method of treating photographic film, and particularly photographic color film. A primary object is to provide

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a new method of lubricating all types of photographic film. Another object is to provide a method of applying certain polymeric treating agents to film. Still another object is to produce photographic film, particularly color film, having a backing which contains a polymeric quaternized compound in the backing. A particular object is to apply a backing to color film which does not adversely affect the color layer even when the backing and color layer are wound in tight contact. Still another object is to provide a backed color film as aforesaid which exhibits the advantages of being relatively static-free and possesses a very low friction coefficient, whereby such film may be produced and used with greater facility. Still a further object is to provide formulations of polymer and solvents therefor which are particularly adapted to coat onto color films as backings. Another object is to provide a new lubricated film product. Other objects will appear hereinafter.

We have found that there are certain chemical compounds, namely certain polymerized quaternized alkyl amino unsaturated esters which may be applied by means of certain solvent solutions to the back of film, and particularly color film, in order to provide a thin layer of backing thereon. The application of this backing may take place at most any time in the manufacture of sensitized film product. However, we usually prefer to apply the backing at the early stages of manufacture inasmuch as we have found that our new backing of the present invention is sufficiently permanent to stay on the film during subsequent manufacturing steps, thereby facilitating the carrying out of these further steps as well as staying on the support during use in magazines or other equipment.

For a further understanding of our invention, reference will be made to the attached drawing which shows on an enlarged scale and in a diagrammatic manner, a sectional view of a color film carrying the backing of the present invention.

Referring to the drawing, 1 represents the film base or film support section. The color section or component is represented overall by 2. The backing layer of the present invention is represented overall at 3.

Referring to the base or support 1, such support usually may be comprised of any of the film base materials used industrially. In particular, we prefer that the support be comprised of cellulose acetate having a 42–44% acetyl. However, as will be described hereinafter, certain other support material may be used.

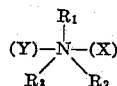
Referring to the color section 2, this is made up of a plurality of elements 6, 7, 8 and 9. For example, element 6 might be a layer comprising silver halide and coupler. Element 7 might be a gelatinous filter layer. Layers 8 and 9 would likewise be separate layers containing sensitive silver salt together with couplers or dyes. The exact make-up of the color section diagrammatically represented in the drawing, is not a limitation upon the present invention. It is sufficient to point out that the color section in general will comprise a plurality of separate layers. These separate layers in addition to containing sensitive silver salts may, and frequently will, contain various other components such as sensitizers, couplers, dyes and the like. For further details concerning the color section, reference may be made to U.S. Jelley et al. Patent 2,322,027, patented June 15, 1943. Since this patent describes in detail the composition of various color layers, the composition of various couplers, as well as procedures for making and applying such color layers, extended description herein is not required.

Referring now to the backing 3, the particular composition thereof and its method of application to color film, constitutes the more important aspects of the present invention. In the broader phases of the present invention, we have found that certain polymerized, quaternized

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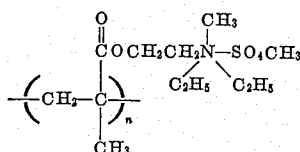
alkyl amino unsaturated ester compounds may be applied from certain solvents in controlled proportions to color film support, thereby forming a backing layer on color film, and onto various other types of photographic film as will be described hereinafter.

The type of chemical compound which we utilize in our backing 3 may be generically depicted by the following formula:



In this formula R_1 , R_2 and R_3 may be the same or different alkyl or alicyclic groups. Generally R_1 , R_2 and R_3 will be lower alkyl groups. Y represents the unsaturated ester portion of the molecule, and X represents the quaternizing constituent.

A specific illustration of a chemical compound which may be used in accordance with the present invention is as follows:



In the above formula n represents a recurring unit in which n is a large number, greater than 200.

These chemical compounds in the monomeric condition are known compounds which may be produced by known methods. However, for completeness of disclosure, set forth below is a description of a method which has been used for preparing the treating agents used in the present invention.

PREPARATION OF POLY- β -METHACRYLOXY-ETHYL-DIETHYLMETHYLAMMONIUM METHOSULFATE

A solution of 31.5 g. of redistilled dimethyl sulfate in 50 ml. of dry ether was added slowly over a period of one hour to a stirred solution of 46.5 g. of β -diethyl-aminoethyl methacrylate in 350 ml. of dry ether which was kept cold in an ice water bath. After the addition was complete, the reaction mixture was stirred and cooled for another hour. Finally the mixture was allowed to stir for one hour at room temperature. To this was added about 120 ml. of ice water and the oily quaternary salt thereby extracted. The aqueous layer was separated and the ether layer was extracted with another 30 ml. of ice water and this aqueous extract was added to the previous aqueous solution.

The combined aqueous solution was extracted with two 30-ml. portions of fresh ether to remove unreacted components. To the residual aqueous solution was added 2.0 ml. of 30% hydrogen peroxide solution and this was placed in a 60° C. constant temperature bath. In a few hours a viscous colorless solution was formed but the polymerization was allowed to proceed overnight.

The clear viscous solution was poured slowly into a large volume of a 1:1 mixture of agitated acetone-ether. The polymer was then leached in a mixture of 1:3 acetone-ether and finally in ether. The soft rubbery polymer was dried in a vacuum desiccator to give a white, crisp foam.

The following analyses indicated that this was essentially a homopolymer of β -methacryloxyethyl-diethyl-methylammonium methosulfate.

Calculated for $C_{12}H_{25}O_6NS$: C, 46.3; H, 8.0; N, 4.5; S, 10.3. Found: C, 45.7; H, 8.3; N, 4.3; S, 9.9.

Further details on quaternizing may be found in U.S. Patent 2,484,420, patented October 11, 1949.

In addition to using the principal compound described above, namely the content of the polymerized quater-

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nized compound aforementioned, we have found that small amounts of other ingredients such as long chain alcohols, illustrated by n-octanol and certain hydrocarbons, such as dipentene, limonene and the like, may be incorporated. That is, the principal compound would be used to give a concentration of .1 to 10%. Each of these other ingredients might be incorporated in amounts up to 50% of the principal compound.

The principal compound is dissolved in a ketone-alcohol, water-alcohol and/or certain chlorinated hydrocarbon solvents to give a concentration of .1 to 10% by weight. For example, a very satisfactory combination comprises a solvent of approximately 50-80% acetone, 20-50% methanol and 1-10% water containing 1-2% by weight of the above described polymerized quaternized compound.

Other examples of specific solvent combinations are as follows:

- (1) 0.20 to 0.50% of the compound in a solvent of 50-80% methanol, 1-10% butanol and 20-50% water.
- (2) 1-3% of the compound in 50-80% methylene chloride and 20-50% methanol.

To these solutions may be added various amounts, up to 50% of certain other ingredients, as mentioned above and as will be described in further detail in the examples which follow.

The solutions as just described may be applied to the photographic film in a number of ways, of which the following are illustrative:

- A. Wringer roller: The film is passed between two rollers with adjustable pressure between them. A bead of solution is maintained between two pieces of film. The coating is applied to one side of the film only.
- B. Dip (immersion): The film is dipped into the solution and then hung vertically to dry at room or at higher temperatures.
- C. Pouring: The film support is held while the solution is poured over one side of the support. The coated support is then hung vertically to dry at room or at higher temperatures.
- D. Machine: The film passes between two rollers. The bottom roller dips into a tank of the solution and carries the solution to the film. A bead of the solution is maintained between the film and the roller. A method such as this would preferably be used on larger scale operations.

The film support thus coated by some suitable coating method has a sufficiently satisfactory backing thereon that it may be wound or unwound, passed over rollers or otherwise motivated with improved facility. That is, as will be shown in detail hereinafter the coefficient of friction of the film is reduced more than 50%.

Also, when the several coatings comparable to 6, 7, 8 and 9 shown in the attached drawing are applied to the side of the film away from the backing, the backing will withstand the various processing operations and coating compositions. As a final step in producing a finished film of the general make-up shown in the attached drawing, if desired, but usually is not required, supplemental lubricants may be applied as shown at 11 in the attached drawing.

Tests on the resultant treated color film of the present invention show that the film exhibits a number of improved properties. For example, product such as shown in the attached drawing rolls and unrolls very readily in cine apparatus not only cine cameras but within magazines. This improvement is readily observable in cine apparatus with spring motors, in that considerably more film footage is motivated on a single rewinding. Also, the surface resistivity is excellent, being well below 1.0×10^{10} ohms, a value which is sufficient to alleviate difficulties from static generated in the normal handling of film. In addition, as already mentioned above, the

backing did not adversely affect the photographic layers even when the film was tightly wound on spools.

For a further understanding of our invention, reference is made to the following examples which are set forth for illustrating certain of the preferred embodiments thereof.

Example I

In accordance with this example, the film support employed was of cellulose acetate having an acetyl content between 42-44% and of a thickness of approximately .0052". One side of this support was coated with a coating solution comprised of about 30% ethanol, 5% H₂O and 65% acetone containing approximately 3.5% of a lubricating agent concentrate in accordance with the present invention which is prepared as follows:

18.4 parts of sodium hexadecenyl sulfate (25% to 30% aqueous paste); 6.15 parts of mixed monocyclic terpene hydrocarbons; 4.9 parts of 95% ethyl or isopropyl alcohol; and 3.05 parts of C₈ alcohol (primarily n-octanol) are mixed to yield a clear, light yellow fluid. This solution is added slowly with agitation to a mixture of 50 parts of the 30% aqueous solution of poly-beta-methacryloyloxyethyl-diethylmethyl ammonium methylsulfate of the present invention and 17.5 parts of water. A viscous, pourable white dispersion is formed which is stable which was used to coat (back) the film base, in accordance with the present invention.

The backed product was then further coated in a standard manner with several separate layers containing silver halide, sensitizers, couplers, certain filter layers and certain additional layers.

In further detail, there is first applied a red sensitive silver halide emulsion containing dispersed therein finely divided liquid particles of a cyan phenolic color former dissolved in a high boiling substantially water insoluble organic crystalloidal material. This color former is one capable of forming a quinoneimine dye with a phenylenediamine developer. This red sensitive emulsion was sensitized to the red with a sensitizing dye of the type shown in U.S. Patent 2,640,776. There was next applied a layer of a yellow-green sensitized silver halide emulsion which contained dispersed therein finely divided liquid particles of a magenta ketomethylene color former dissolved in a high boiling substantially water insoluble organic crystalloidal material. This color former was capable of forming a quinoneimine dye with a phenylenediamine developer. This layer was also sensitized with a sensitizer as discussed in the patent just mentioned. The last-mentioned layer was then coated with a yellow filter layer and finally coated with a blue sensitive silver halide emulsion containing finely divided liquid particles of a yellow color former dispersed in a substantially water insoluble organic crystalloidal material.

The resultant finished color film was tested in several different ways for several different properties. The first test comprised the measurement of friction reduction. The details of the test will be set forth hereinafter. The results of these friction tests were very favorable in that the coefficient of friction of the finished film was reduced from above 1 to less than .5 by the treatment. This reduction in friction was further evidenced from the practical standpoint when the film was tested in cine cameras, in that the film ran through the camera with much greater facility than the untreated film.

Test strips from the finished film were also tested for resistivity by a method which will be described in detail hereinafter. The test on the film of this example gave a value of 0.42×10^{10} ohms/sq. cm. This value indicates that the film had properties which would render it free from static difficulties not only under normal handling, but under even more rigorous handling.

Other test samples were rolled tightly and the roll incubated at high humidity and temperature. Upon examination no transference from the backing to the emulsion layer was indicated.

Other test samples were run through motion picture and still cameras and handled in common types of sound recording equipment. The film not only functioned satisfactorily in the equipment, but no separation or removal of the backings was observed.

Example II

In accordance with this example the film and its method of preparation were the same as in Example I. However, there was applied to one strip of the backing a further coating of castor wax deposited from a chlorinated solvent. One other strip had applied a coating of opal wax, also applied from a chlorinated solvent. The chlorinated solvents were specifically: propylene chloride or ethylene chloride. The backing thus further coated was tested for resistivity as above described. Both tests showed resistivity below 1.0×10^{10} , thereby indicating that the favorable antistatic properties of this backing had not been materially reduced by the application of the supplemental lubricating coating just described. The lubricated samples thus prepared were further tested in motion picture cameras and other types of equipment and found to readily operate therein without friction drag.

Example III

In this example the film base used was likewise a cellulose acetate having 42-44% acetyl. Also, the same backing as described in detail in Example I was used. That is the backing contained in addition to the polymerized quaternized compound certain other ingredients such as spreading agents, hydrocarbon components and the like. However, in this example the light sensitive layer which was applied to the side of the film away from the backing was of a black-and-white type. In further detail the following general type of light sensitive layer was used on the film of this example. The emulsion was a high speed gelatino-silver bromiodide type which contained .24 mole of silver halide per liter. It was optically sensitized with 3,3'-diethyl-9-methylthiacarbocyanine bromide. The emulsion contained a small amount of a saponin solution as a coating aid.

The resultant finished black-and-white photographic film product was tested in various manners. Here again it was found that the coefficient of friction was reduced more than 50% when compared to the untreated film. No adverse effects were noted on the light sensitive emulsion layer even when the film was tightly rolled so that the backing was in close contact with the sensitive layer.

Example IV

In this example the materials used and procedures were substantially identical with Example III, excepting that in this instance the black-and-white emulsion used was of a somewhat different type. That is, the gelatino-silver bromiodide emulsion containing about .24 mole of silver halide per liter, in this example was optically sensitized as in the preceding example and digested with a sulfur sensitizer. The sulfur sensitizer used was as shown in U.S. Patent 1,574,944. The digesting was carried out in the presence of potassium chloroaurate.

The testing of this film when compared to an untreated sample indicated a reduction of coefficient of friction from around 1.12 to 0.40. No adverse effects were noted on the black-and-white light sensitive layer even though the finished film was tightly wound.

Example V

In this example the film support was a high acetyl cellulose acetate similar to the support used in the preceding examples. The backing layer was of substantially the same composition and proportions as used in the preceding examples. However, here again a different light sensitive coating was applied. The light sensitive coating was made as follows:

Three solutions, A, B and C, were prepared as follows:

- A—300 g. of photographic gelatin were dissolved in 10,000 cc. of water and 50 cc. of a 1.5 N aqueous solution of ammonium hydroxide were added.
 B—800 g. of potassium bromide and 20 g. of potassium iodide were dissolved in 4500 cc. of water.
 C—1000 g. of silver nitrate were dissolved in 6000 cc. of water.

An emulsion was prepared from the above three solutions as follows:

Precipitation.—Solution A was heated to about 60° C. and solutions B and C, each advantageously heated to from 50° to 60° C., were simultaneously slowly added to solution A, with stirring. The silver halides precipitated.

First digestion.—After addition of solutions B and C, the resulting mixture was maintained at a temperature of about 60° C. for about 30 minutes. At the end of this time, 1000 g. of gelatin were added to the mixture slowly, with stirring. The resulting mixture was allowed to cool slowly, during a period of about 30 minutes, to about 40° C. during which time the gelatin was completely dispersed.

Washing.—The mixture was then chilled for several hours until it solidified. It was then shredded and thoroughly washed with water for several minutes to remove the soluble salts.

Melting out and second digestion.—The washed emulsion was heated to from 50° to 60° C. and further gelatin was added, with stirring. After addition of the gelatin, the emulsion was held at a temperature of about 60° C. for about 40 minutes and finally was allowed to cool to about 40° C., when it was ready for coating.

The emulsion thus prepared was then sensitized with auric chloride dissolved in water just before the emulsion was ready for coating onto the high acetyl support. The emulsion was then coated in a conventional manner to produce the light sensitive layer on our film.

The resultant finished film was then tested for friction, static and the like. The coefficient of friction was reduced to less than one-half of that of an untreated film. The resistivity was less than 1×10^{10} ohms per sq. cm. No adverse effects of the backing on the light sensitive layer were noted.

Example VI

In accordance with this example the color film support was made from the so-called acetone soluble type of cellulose acetate. That is, a different base was used. This different type of support then had applied thereto a backing of the present invention such as described in detail in Example I. A plurality of color emulsion layers were also applied. Several sections of the finished film were tested. The coefficient of friction was reduced to less than one-half. The resistivity test gave values substantially below 1.0×10^{10} . The film operated satisfactorily in photographic apparatus.

Example VII

In accordance with this example, the film support was comprised of oriented polystyrene. This type of film support then had applied thereto a coating from a solution comprised of about 60% methanol, 10% butanol, and 30% H₂O containing approximately 1% of the concentrate of the present invention, the preparation of which is described in Example I.

On the opposite side from the backing there was applied a light sensitive emulsion layer of the type used in the graphic arts. That is, the emulsion was a high contrast, fine grained, gelatino silver chlorobromide composition ortho sensitized and having a relatively high concentration of silver halide per sq. ft. Tests of this polystyrene type of film gave the following results: A backing resistivity of $<1.0 \times 10^{10}$ ohms/sq. cm.

Example VIII

In accordance with this sample the film was the type of material known as polyester (specifically polyethylene terephthalates) and the method of preparation of the backed film was the same as in Example VII. Color emulsion layers as in the preceding examples were applied. Tests of this polyester type of film gave a backing resistivity of $<1.0 \times 10^{10}$ ohms/sq. cm. The coefficient of friction was materially reduced.

Example IX

In accordance with this example the film support was polyester as in Example VIII. However, one side of this support was coated with a solution (using a different solvent) comprised of about 80% methylene chloride and 20% methanol containing approximately 4.0% of the concentrate, the preparation of which is described in Example I. Tests on this type of film gave a backing resistivity of $<1.0 \times 10^{10}$ ohms/sq. cm. and a substantially reduced coefficient of friction.

Example X

In accordance with this example, the film support was the type of material known as Vinylite (polyvinyl chloride). One side of this support was coated with a solution comprised of about 80% methylene chloride and 20% methanol containing approximately 4.0% of the concentrate, the preparation of which is described in Example I. Tests on this type of film gave a backing resistivity of $<1.0 \times 10^{10}$ ohms/sq. cm.

Example XI

In accordance with this example, the film support was the type of material known as Vinylite. One side of this support was coated with a solution comprised of about 60% methanol, 10% butanol and 30% H₂O containing approximately 1% of the concentrate the preparation of which is described in Example I. Tests on this type of film gave a backing resistivity of $<1.0 \times 10^{10}$ ohms/sq. cm.

Example XII

In accordance with this example the film support was the type of material known as cellulose acetate butyrate. One side of this support was coated with a solution comprised of about 60% methanol, 10% butanol and 30% H₂O containing approximately 1.50% of the concentrate the preparation of which is described in Example I. Tests on this type of film gave a backing resistivity of $<1.0 \times 10^{10}$ ohms/sq. cm.

In the above examples we have referred to a resistivity test. A value below 1.0×10^{10} ohms/sq. cm. in such test indicates that for film the antistatic properties would be quite satisfactory. This value is measured by a surface electrical resistance measuring apparatus. This apparatus is built around a megohmmeter type 1020, manufactured by the Freed Transformer Company, New York, and it is designed to operate within a resistance range of 10^6 to 10^{12} , which is indicated by the position of the sensitivity selector switch on the megohmmeter. The electrodes used for this test consist of two steel plates 10 cm. in length and 0.5 cm. apart. Surface resistivity is defined as follows:

$$R = \rho \frac{W}{L}$$

R —true resistance measured on the megohmmeter

ρ —surface resistivity measured in ohms

W —distance between electrodes (0.5 cm.)

L —length of electrodes in contact with the sample (10 cm.)

Hence, for the apparatus described, the surface resistivity of any sample can be determined by multiplying the true resistivity, measured on the instrument, by a factor of 20.

In use the sample whose surface resistivity is to be determined is held in contact with the aforementioned

electrodes by a spring loaded metal bar. A 500 volt direct current charge is fed into the apparatus and the reading on the megohmmeter together with the sensitivity factor are noted. This figure is then multiplied by 20 to give the surface resistivity of the sample.

In the foregoing description we have referred to testing which indicates that friction drag has been materially reduced, camera action improved and the like. The following will give information on the tests used and the like aspects.

The resistance of film to sliding over a given surface varies because of differences in emulsion and backing composition of the film. The coefficient of friction test is made to determine this sliding resistance by pulling a standard block, with a metal or other surface, along a strip of film and measuring the force required to overcome friction between the two surfaces. The standard block is pulled along the film surface by a motor drive, and the friction may be measured and recorded by a strain gauge and electronic recorder, respectively. In many instances, the test is run with metal to the emulsion surface, metal to the back surface and back surface to emulsion surface.

Example A

COEFFICIENT OF FRICTION OF CINE NEGATIVE SUPPORT

	Back to Back ¹	Velvet to Back ²
Check Film (not lubricated).....	At 70° F.— 50% RH 1.12	At 70° F.— 50% RH 0.82
Film Backed in Accordance Present Invention.....	0.40	0.43
Check Film.....	At 70° F.— 70% RH 0.86	At 70° F.— 70% RH 0.86
Backed Film.....	0.47	0.68

¹This value may be important in certain gun cameras. These cameras are threaded in such a way that the films rub back to back at certain positions in the camera. If a film has a high, back to back, coefficient of friction, it may seize causing the film to break.

²This value may be important on films sold in cassettes. This value is indicative of the relative forces which will be required to strip the films from the cassettes. A high coefficient of friction means a large force or pull will be needed to strip the film through the velvet lined lips of the cassettes.

Example B

COEFFICIENT OF FRICTION OF CINE NEGATIVE FILMS COATED ON SUPPORTS AS DESCRIBED ABOVE

	Back to Back	Velvet to Back
Check.....	At 70° F.— 50% RH 0.73	At 70° F.— 50% RH 0.80
Backed Film.....	0.32	0.29
Check.....	At 70° F.— 70% RH .74	At 70° F.— 70% RH 0.89
Backed Film.....	.45	0.57

COEFFICIENT OF FRICTION OF COLOR FILM

	Back to Metal	Back to Velvet
Backed Film.....	At 70° F.— 50% RH 0.27	At 70° F.— 50% RH 0.23
Backed Plus Supplemental Lubricant.....	0.29	0.27
Check Film (Unlubricated).....	0.73	1.0

Example D

PULLOUT FORCE REQUIRED TO STRIP COLOR FILM FROM 35 MM. CASSETTE

[Avg. pullout force (10 cassettes) at 70° F.—50% RH.]

	Grams
Backed film	85
Lubricated and backed film	90
Check film (unlubricated)	195

Example E

CAMERA ACTION WITH AND WITHOUT BACKING OF PRESENT INVENTION

Camera	Av. No. of Winds	Film Used
Cine Kodak Model K, #S-48374.....	33.30 33.25 27.60	Backed. Backed plus lub. Check.
Bell & Howell Model 70E, #31107.....	8.00 8.00 7.20	Backed. Backed plus lub. Check.

The values given above in Example E refer to the number of winds required to rewind the spring on said camera after it has been "run down." The point where the camera spring is "run down" is reached not when the spring has reached its absolute unwound point, but when the amount of drive exerted by the spring is equal to the force required to move the film through the camera. Hence, the higher the number of winds required to rewind the camera spring the closer the spring has approached its absolute unwound point before the two forces mentioned previously have balanced each other. This means that the film which gives the higher number of rewinds offers the least resistance to movement through a camera, assuming of course that the same camera is used for all the films tested.

The camera action test for Cine film is made to determine the action of Cine roll and magazine film in cameras. In this test, modifications in films are evaluated both by observation during camera operations and during projection of the exposed and processed film. During the operation of the film in the camera, length of wind, jams, noise and other indications of variable camera action are observed and recorded. During projection of the exposed and processed film, the rolls are evaluated for lateral and vertical steadiness of the projected image, double image and loss of loop. Comparative evaluation with a check film is then made from the above observations.

The apparatus used for the measurement of 135 and 70 mm. magazine pullout tension consists of a jig for holding the loaded magazine, a constant-speed pulling device including a strain gauge, and a continuous recorder which amplifies and records the strain gauge impulses as force in grams required to pull film from the magazine. The jig is designed to support the magazine in a position similar to its orientation in a camera so that the tensed film assumes the same angle with respect to the magazine lips. The pulling device is driven at constant speed by an electric motor. This winds the film on a 6-in. diameter drum. The apparatus is operated at a pulling rate of one inch per second and is kinetically calibrated with weights.

The instantaneous pullout values sometimes show a high initial tension due to inertia, starting friction, and deformation of the film in the lips. This value is important because it is the peak which must be overcome for the film advance to function. Subsequent values are read as maximum, minimum and average pullout force. The film may be pulled for any length, although about 12 inches is usually sufficient.

It can be seen from the foregoing examples that we have shown our new polymeric backing applied to various types of film support carrying various types of light sensitive layers. The finished backed film product was motivated in various manners, rolled tightly upon itself and otherwise subjected to different tests and usage. In all instances the coefficient of friction of the finished film was materially reduced as compared with untreated film. For example, in some instances the coefficient of friction was reduced to nearly one-third of its original value, i.e. from 1.12 to .40. This reduction in coefficient of friction evidenced itself from the practical standpoint in that the film operates materially better in photographic equip-

ment. For example, in motion picture cameras operated by spring motors, considerably more film footage is motivated on a single rewinding. In addition, there are other advantages from this better film lubricating such as there being less possibility of perforations being torn.

As already established above, there are other advantages accomplished by our new backing, such as reduction of static and non-injury to the light sensitive layers even when the film is tightly rolled upon itself.

While the preferred embodiment of our invention comprises applying the complete combination of materials set forth in Example I of the present application, namely a composition containing not only the polymeric component but also containing coating aids, hydrocarbon components and the like, in the broader concepts our invention is not thus limited. That is, we have found that good results can be obtained by applying from 1 to 6% of the polymeric material in solvent preferably also in the presence of a coating aid. The solvent proportions are regarded as critical for obtaining best results in that material variation from the solvent proportions may in instances of some film combinations, introduce problems of haze.

While the foregoing polymeric material is preferred, the polymeric material can also be poly-beta-methacryloxyethyl-di-n-propylmethyl ammonium methylsulfate or poly-beta-methacryloxyethyl-diisopropylmethyl ammonium methylsulfate or poly-beta-methacryloxyethyl-dipropylethyl ammonium ethylsulfate or poly-beta-methacryloxyethyltriethyl ammonium ethylsulfate.

Although we prefer sodium hexadecenyl sulfate, other spreading agents which may be used are:

- (1) Sodium or ammonium or N substituted ammonium salts of any long chain alcohol (such as octyl and dodecyl sulfate)
- (2) The alkyl aryl sulfonates or their salts
- (3) Long chain esters of sodium sulfosuccinate

The terpene hydrocarbon and higher alcohol are not absolutely essential for this backing but since they aid in the coating, they are included in our preferred embodiment.

Therefore, it is apparent from the above that our invention is susceptible to certain modifications, and that considerable advantages are obtained by treating film in accordance with the present invention.

We claim:

1. A photographic film comprising a transparent base at least one light-sensitive silver halide emulsion layer on one surface of the base and a backing layer on the opposite surface of the base, said backing layer containing poly-beta-methacryloxyethyl-diethylmethyl ammonium methylsulfate, sodium hexadecenyl sulfate and a monocyclic terpene hydrocarbon and a C₈ alcohol.

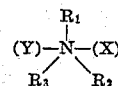
2. A photographic film comprising a base consisting essentially of cellulose acetate, at least one light-sensitive silver halide emulsion layer on one surface of this cellulose acetate base and a backing layer on the opposite surface of said base, said backing layer containing poly-beta-methacryloxyethyl-diethylmethyl ammonium methylsulfate, sodium hexadecenyl sulfate and a monocyclic terpene hydrocarbon and a C₈ alcohol.

3. A photographic film comprising a base consisting essentially of cellulose acetate having an acetyl content between 42-44%, at least one light-sensitive silver halide emulsion layer on one surface of this cellulose acetate base and a backing layer on the opposite surface of said base, said backing layer containing poly-beta-methacryloxyethyl-diethylmethyl ammonium methylsulfate, sodium hexadecenyl sulfate and a monocyclic terpene hydrocarbon and a C₈ alcohol.

4. A photographic film comprising a base consisting essentially of a polyester, at least one light sensitive silver halide emulsion layer on one surface of the polyester base and a backing layer on the opposite surface of said base,

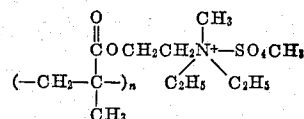
said backing layer containing poly-beta-methacryloxyethyl-diethylmethyl ammonium methylsulfate, sodium hexadecenyl sulfate and a monocyclic terpene hydrocarbon and a C₈ alcohol.

5. A photographic film comprising a base, at least one light-sensitive silver halide emulsion layer on one surface of the base and a backing layer on the opposite surface of the base, said backing layer containing a polymerized quaternized alkyl amino acrylate compound having the recurring units:



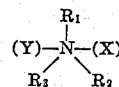
wherein R₁, R₂ and R₃ represent substituents from the group consisting of lower alkyl and alicyclic groups, Y represents the unsaturated ester portion of the molecule, and X represents the quaternizing constituent.

6. A photographic film comprising a base, at least one light-sensitive silver halide emulsion layer on one surface of the base and a backing layer on the opposite surface of the base, said backing layer containing a compound having the formula:



wherein n represents a recurring unit in which n is a large number greater than 200.

7. The process of manufacturing a photographic film comprising a base, at least one light-sensitive silver halide emulsion layer on one surface of the base and a backing layer on the opposite surface of the base, said backing layer containing a polymerized quaternized alkyl amino acrylate compound having the recurring units:



- wherein R₁, R₂ and R₃ represent substituents from the group consisting of lower alkyl and alicyclic groups, Y represents the unsaturated ester portion of the molecule, and X represents the quaternizing constituent, and which film exhibits low friction drag, high static resistance and may be tightly wound on itself without said backing chemically adversely affecting the light sensitive layer on the film, which process comprises incorporating said compound in a liquid environment containing a substantial amount of at least one solvent from the group consisting of ketones, alcohols and chlorinated hydrocarbons to obtain a concentration from .1 to 10% by weight of said compound in the solvent and then applying this liquid to the side of the film opposite the side carrying the light sensitive layer in order to obtain said backing on the film.

8. A process of manufacturing a backed film which comprises a film base which has on one surface of the base at least one light sensitive silver halide emulsion layer and on the opposite surface a backing which comprises incorporating a polymeric quaternized compound from the group consisting of poly-beta-methacryloxyethyl-diethylmethyl ammonium methylsulfate, poly-beta-methacryloxyethyl-di-n-propylmethyl ammonium methylsulfate, poly-beta-methacryloxyethyl-diisopropylmethyl ammonium methylsulfate, poly-beta-methacryloxyethyl-dipropylethyl ammonium ethylsulfate and poly-beta-methacryloxyethyltriethyl ammonium ethylsulfate, in a liquid environment containing a substantial amount of at least one solvent from the group consisting of ke-

tones, alcohols and chlorinated hydrocarbons to obtain a concentration from .1 to 10% by weight of said polymeric quaternized compound in the solvent and then applying this liquid to one side of a film carrying on its opposite side at least one light sensitive silver halide emulsion layer. 5

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