A. HAMBURGER.

PROCESS OF TREATING CINEMATOGRAPH FILMS.

APPLICATION FILED FEB. 4, 1919.

1,308,709.

Patented July 1, 1919

2 SHEETS—SHEET 1.

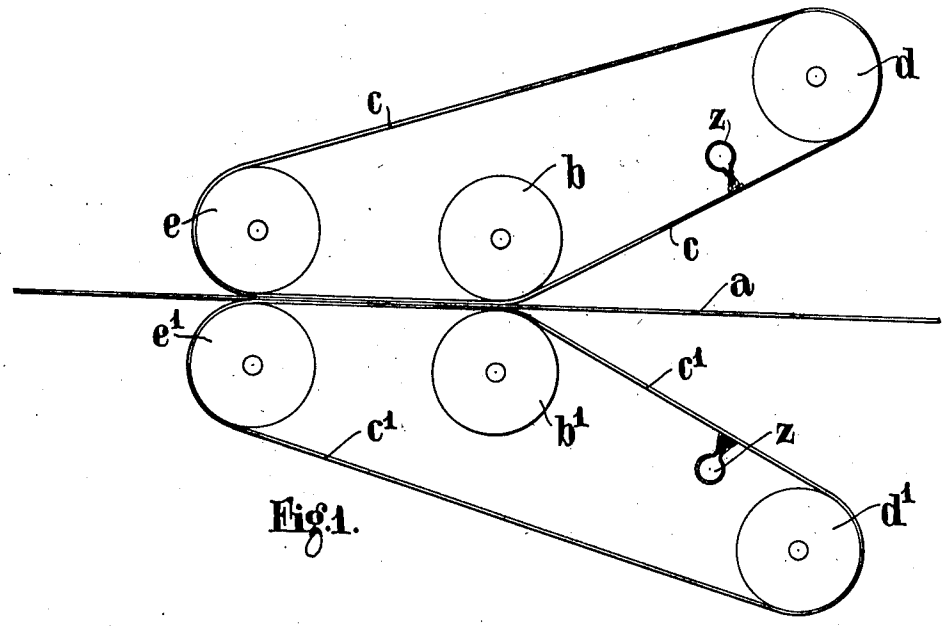

Fig.1.

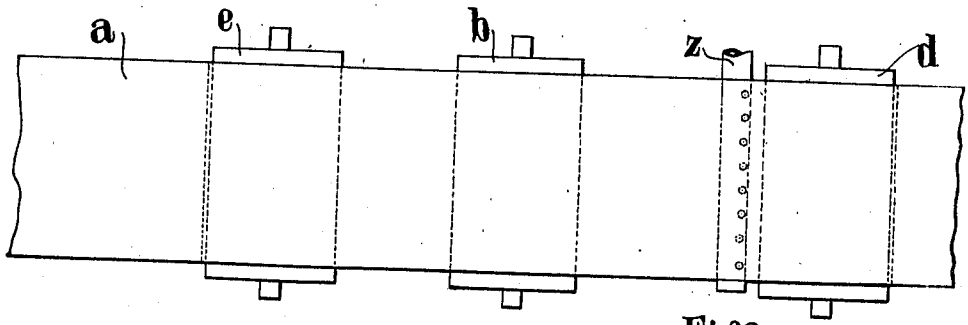

Fig.2.

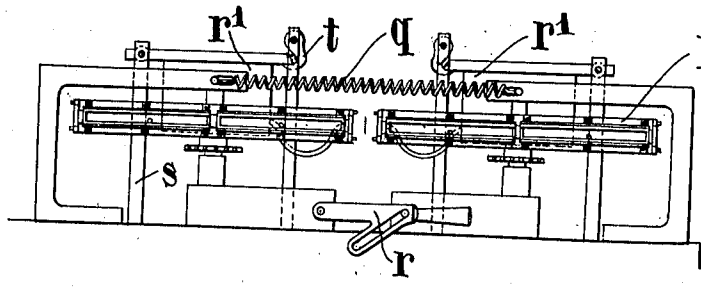

Fig.3.

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2 SHEETS—SHEET 2.

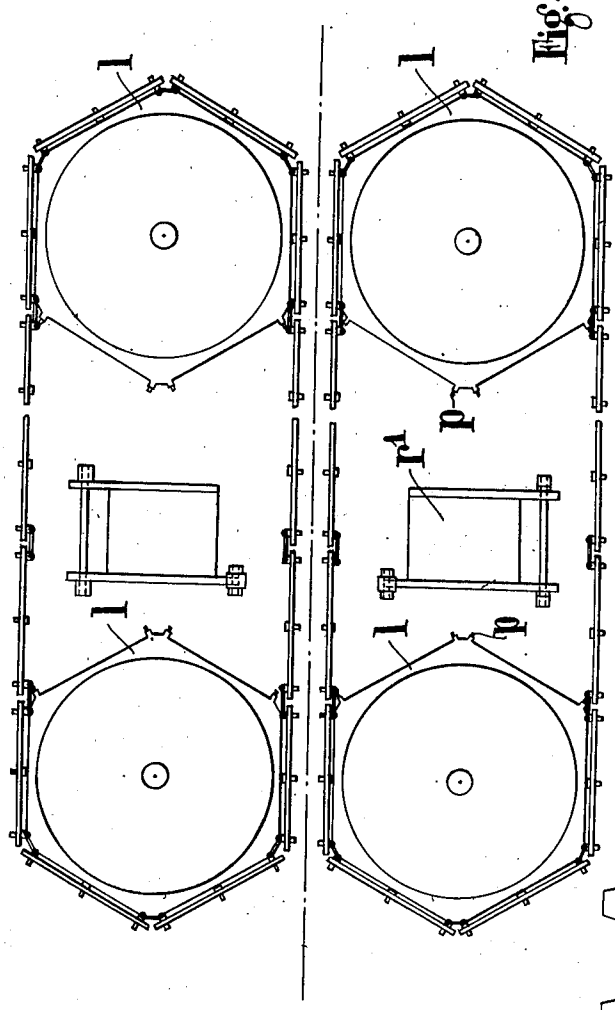

Fig. 4.

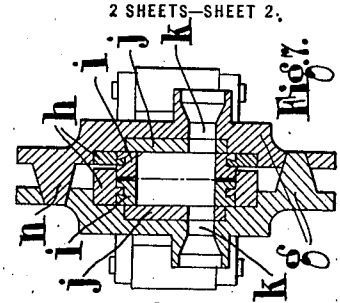

Fig. 7.

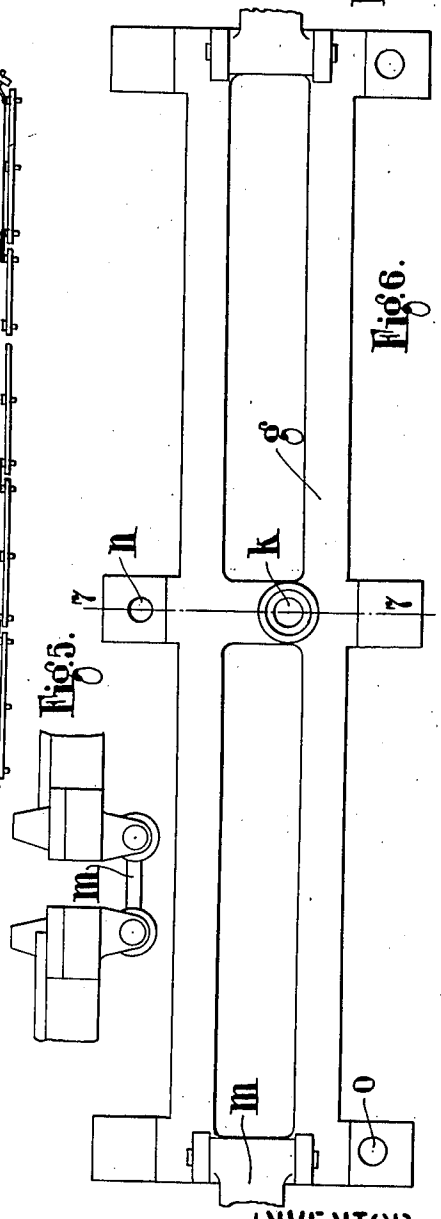

Fig. 6.

Fig. 5.

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UNITED STATES PATENT OFFICE.

ARON HAMBURGER, OF MAYFAIR, LONDON, ENGLAND.

PROCESS OF TREATING CINEMATOGRAPH-FILMS.

1,308,709. Specification of Letters Patent. Patented July 1, 1919.

Application filed February 4, 1919. Serial No. 274,966.

To all whom it may concern:

Be it known that I, ARON HAMBURGER, an American citizen, and residing at 38 Dover street, Mayfair, London, W. 1, England, have invented a certain new and useful Process of Treating Cinematograph-Films, of which the following is a specification.

This invention relates to the production of cinematograph films in color.

It has been proposed to prepare cinematograph films by printing a doubly sensitized film from complementary color negatives, one of which is reversed, and then coloring the developed images each with its appropriate color. This has, however, hitherto involved either the incorporation of chemicals for the coloring operation in the emulsion on each side or the successive treatment in separate operations of each side of the film while the other is protected.

The object of the present invention is to avoid the difficulties introduced by the incorporation of color toning or dyeing chemicals in the emulsion on the one hand, and on the other to avoid the hitherto necessary protective coating of one side of the film prior to the other side being treated.

This invention consists broadly in causing a doubly sensitized cinematograph film printed, preferably simultaneously, and developed on both sides to be colored on both sides simultaneously or practically simultaneously.

The invention further consists in causing dye impregnated bands or bands of pigmented paper to be passed between pressing rollers, the double printed film to be dyed, which may or may not have been previously bleached, being introduced between the bands as they pass between the pressing rollers, which are preferably disposed on practically vertical axes.

The invention further consists in employing dye fixing rollers preferably immediately behind the first pressing rollers.

The invention also consists in feeding a double printed bleached film between a pair of clamping frames, adapted to clamp the the film between them, and making fluid tight joints around the edges, and arranging for dyeing fluids to be brought into contact with the film within the frames on each side, to effect the dyeing, the fluid circulation arrangements being such that the fluids are kept separate.

In carrying this invention into effect one form of apparatus is shown, by way of example, in the accompanying diagrammatic drawings, in which:—

Figures 1 and 2 show in plan and elevation, views of the general arrangement of the operative parts of a machine for dyeing a continuous sensitized film on each side with a suitable dyeing fluid.

Figs. 3 to 7 show a modification in which a series of frames in chain form are arranged around suitable spring-pressed polygonal rollers for carrying the dyes instead of employing absorbent bands.

Fig. 3 is an end elevation of the complete machine.

Fig. 4 is a plan.

Fig. 5 is a detail plan of a joint between the ends of two elements or frames.

Fig. 6 is an elevation of one element or frame, and

Fig. 7 is a section on the line 7—7 of Fig. 6 showing two elements pressed together.

The machine shown in Figs. 1 and 2 is provided with means for carrying a double printed bleached film *a* and passing it between a pair of suitably operated pressing rollers *b b'* by which the continuous bands *c c'* of porous absorbent material charged with the dyeing fluid and the film is fed.

The machine is also provided with guide or tension rollers *d d'*, and at a point beyond the pressing rollers *b b'* there are conveniently a pair of dye fixing perforated rollers *e e'* emitting dry steam on the dye bands to fix the dye on such portion of same as is required to be dyed, around which sets of rollers the continuous bands are in engagement. At points intermediate of the tension rollers and the pressing rollers suitable means indicated by *z* are provided for keeping the absorbent bands *c c'* suitably saturated with the dyeing fluid.

The film and the dyeing bands are caused to pass slowly through the rolls, the rate being such as will permit of the dyeing being properly effected. The film is then washed off and fixed in the usual way.

In carrying the invention into effect in another form, instead of employing absorbent bands to carry the dyes I mount a series of frames in chain form around suitable spring-pressed polygonal rollers. These frames act in a similar manner to those described in the specification of my copending application No. 272201, filed Jan. 20, 1919, and are preferably closed shallow tanks, the

closure of which is effected on the outside by glass plates, and on the inside by jointing material which seals them in a liquid-tight manner against the film, which one element of each pair of chains clamps between them.

In Figs. 3 to 7, cast brass frames *g* carry brass frames *h* securing rubber sealing strips *i* and glass plates *j* perforated to connect with inlet and outlet passages *k* for the dyeing fluids. The two halves of the cells are carried respectively around polygonal drums *l*, adjacent cells being connected by a plain link joint *m*, shown especially in Fig. 5. The two halves forming a complete cell, one half being carried on one series of drums and the other on a second series, are registered by means of tapered guiding pins *n* which enter tapered holes, and the frames as a whole are positioned with respect to the drums by projections *p* on the latter entering holes *o* on the former. The two halves of the frames (and the drums *e*) are normally caused to approach by means of a spring indicated by *q*, and a simple linkage *r* can be provided for moving them to and fro. The dye may conveniently be fed from tanks *r* disposed centrally within the chains of frames around the rollers and means may conveniently be provided for raising or lowering these tanks; for instance, they can be mounted on standards *s* and held in the top position by a swinging link *t* which can be moved by hand so that the tanks can be lowered into the bottom position. They are raised to cause the flow of the fluid into the tank chambers, and lowered to withdraw the fluid therefrom; or again, in another arrangement the fluids may be caused to circulate through jets, which play upon the film while it is clamped between the frames. When dyeing has been effected, the chains are moved on one link and the operations repeated on the next section of film. The film is also arranged to be fed on through washing, fixing and drying appliances, as usual.

In another method of carrying this invention into effect, I effect the bleaching and pigmenting in one operation, by providing a bath the composition of which is given below in which the strips of carbon paper or dye gelatin paper are caused to be soaked for a suitable time, say five minutes, on their passage to the two pairs of pressing rolls above described. They are allowed to remain in contact with the film to be dyed a sufficient time and are then fed forward into a position where the carbon paper is brought into contact with hot water for development or, in the case of the dye paper, with cold water for washing. Simultaneous bleaching and pigmenting is thus effected.

The required combined bleaching and pigmenting solution for use either with dye bands or carbon pigment paper is prepared from the following ingredients:—

Copper sulfate	4 oz.
Potassium bromid	1400 grs.
Potassium bichromate	180 grs.
H. Cl	80 minims.

The copper sulfate is dissolved with the potassium bromid in 20 oz. of water, and the potassium bichromate in another equal quantity of water, with the indicated H. Cl. added. The two solutions are then mixed slowly while stirring well and the resulting solution is ready for use. The dyes required are for greenish blue, basic methylene blue, which should be as nearly as possible devoid of red, and for magenta red basic fuchsin red which should be as nearly as possible devoid of green.

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

1. A method for producing cinematograph films in color on a film sensitized on both sides which consists in printing and developing the film and then coloring both sides practically simultaneously.

2. A method for producing cinematograph films in color on a film sensitized on both sides which consists in printing and developing the film and then dyeing both sides practically simultaneously.

3. A method of dyeing the two sides of a continuous film bearing images on both sides consisting in forcing dye containing material against each side of the film substantially simultaneously.

4. In coloring cinematographic film, the herein described process which comprises positioning successive portions of the length of the said film between successive pairs of boxes to form containers on both sides of such cinematographic film, such containers being separated by said film, and subjecting the two sides of any given one of said portions of film, substantially simultaneously to the action of coloring solutions, and repeating such last-mentioned operation with successive portions of the length of said film.

In testimony whereof I have signed my name to this specification.

ARON HAMBURGER.