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P. D. BREWSTER

PRINTING COLOR CINEMATOGRAPHIC FILMS

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Fig. 2.

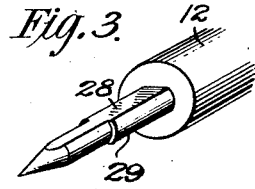
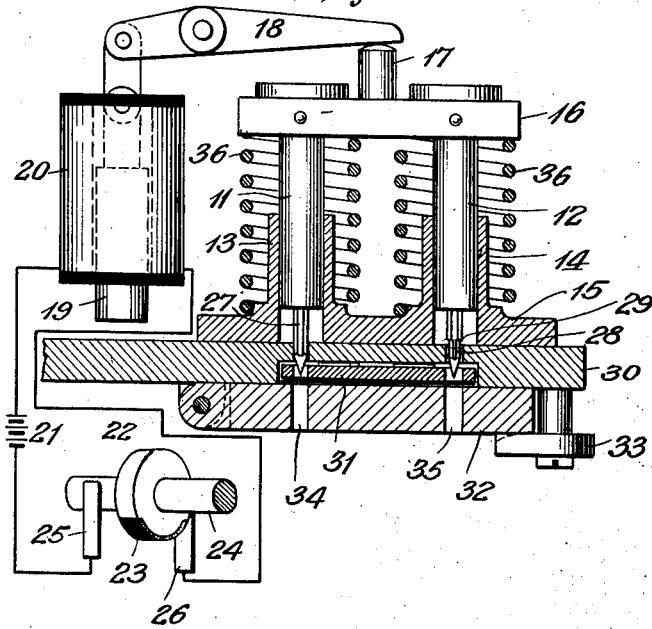


Fig. 1.

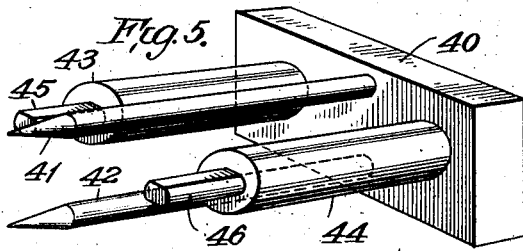
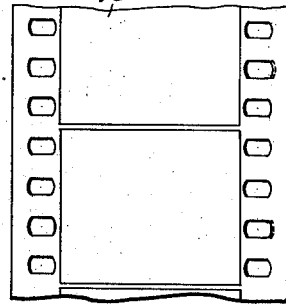


Fig. 4.

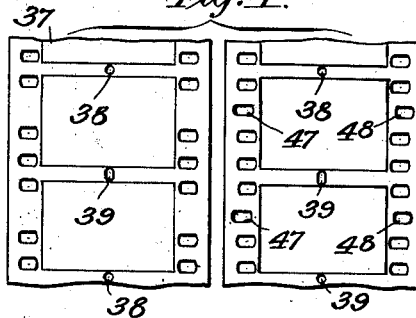


Fig. 7.

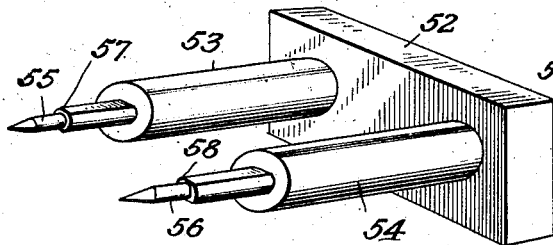
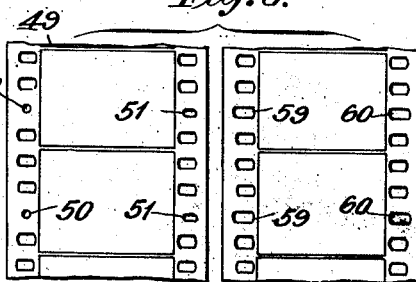


Fig. 6.



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# UNITED STATES PATENT OFFICE.

PERCY D. BREWSTER, OF EAST ORANGE, NEW JERSEY.

PRINTING COLOR CINEMATOGRAPHIC FILMS.

Application filed November 15, 1920. Serial No. 424,331.

*To all whom it may concern:*

Be it known that I, PERCY D. BREWSTER, a citizen of the United States of America, residing at East Orange, in the county of Essex and State of New Jersey, have invented certain new and useful Improvements in Printing Color Cinematographic Films, of which the following is a full, clear, and exact description.

10 In the art of two-color cinematography the practice now commonly in use is to print on one side of a positive film a series of images of one color value, say red, and on the other side the other series of color value images, say green, in registry with the first. The negative images from which the positive is printed may be on separate films, that is, all the "red" images may be on one film and all the "green" images may be on another film, or the red and green images may be in alternating sequence on a single film. In the former case the two negatives may be exposed in a camera of the type described and claimed in my copending application Serial No. 355,938, filed June 29th, 1918, now Patent No. 1,359,025, issued November 16th, 1920. In the second case the alternating red and green images may be taken in alternation, as in the so-called kinemacolor process, but preferably they are taken by means of any suitable camera of the type, in which the red and green images of each pair are made by simultaneous exposure, thereby avoiding the effect commonly known as color "banding" or "fringing." In order to have a sharp image on the screen when the positive film is projected, it is evident that the images on one side thereof must be in exact registry with the images on the other side. In order to secure this necessary accuracy of registry various methods have been proposed. One of the most successful of these methods involves the use of registry pins, cooperating with the usual marginal perforations in the positive and negative films, which pins serve to bring the perforations of one film into registry with the perforations in the other; it being understood of course that the images of one series of negative images have the same positions with respect to the perforations in the film as the images on the other film have to their respective perforations. Obviously, the negative film or films after exposure must be developed and fixed before they can be printed on a positive, but

in this development and fixation the films suffer more or less shrinkage, both longitudinally and transversely, with the result that the rows of perforations at the two edges of the developed and fixed film are closer together than the corresponding rows of perforations on the undeveloped and unfixed positive film. Consequently when an attempt is made to register the perforations of the negative with the perforations of the positive by means of pins fitting the perforations closely, the pins, if spaced far enough apart to fit the positive perforations, are too far apart to fit the perforations in the negative, and vice versa. It has been proposed, in order to overcome this trouble, to use in printing a full-size registry pin for the positive and negative perforations on one edge of the two films, and at the other edge to use a pin which is narrower (transversely of the films), the idea being that the latter pin will only take care of so-called vertical registry, that is, will not register the films transversely but only longitudinally. My present invention is designed to obviate the trouble due to shrinkage, and to enable the use of full-size pins at both edges of the two films in printing.

According to one method of practising my invention the negative film or films are exposed in the camera, and after exposure are developed and fixed in the usual manner. They are then passed through a re-perforating device by which selected perforations, or if desired all the perforations, at one edge of the film are widened by cutting out the celluloid at one or both side edges, preferably on the outside edge only. When the film is thus re-perforated the widened perforations can be made to register with the corresponding edges of the negative film or films by means of pins which fit the negative perforations closely.

According to another method of practising the invention the negative film or films used in the camera are not perforated completely, but have certain perforations omitted adjacent to each image area. Then, in accordance with the exposure in the camera, pilot or master perforations are made in the film or films by suitable punches operating in harmony with the feed and shutter mechanism. After development and fixation of the negative, these master perforations are used as guides for supplying the missing perforations in the edges of the film. The

pilot or master perforations referred to may be punched between successive image areas on the film, or they may be punched in the blank spaces at the edges of the film and afterwards enlarged.

Convenient and effective devices for carrying out my invention are illustrated in the accompanying drawing, in which—

Fig. 1 illustrates a piece of negative film after development and fixation, and shows by dotted lines the subsequent enlargement of perforations at one side of the film.

Fig. 2 is a side view, partly in section, illustrating mechanism for enlarging, or widening, the registry perforations in the negative film.

Fig. 3 is a detail perspective view illustrating the combined pilot pin and punch used in Fig. 2.

Fig. 4 illustrates a negative film having pilot perforations between successive image areas and having unperforated spaces at its edges; also the same film after the missing perforations in the edges have been made by punches controlled by the pilot perforations.

Fig. 5 is a detail perspective view illustrating a punching head for punching the missing perforations of Fig. 4.

Fig. 6 illustrates a negative film having the pilot perforations in its edges, and the same film after the pilot perforations have been enlarged to the full size of standard perforations. It will be understood that in this figure as well as in Figs. 1 and 4, the amount of shrinkage, indicated by the size of the enlarged or new perforations, is greatly exaggerated.

Fig. 7 is a detail perspective view illustrating a punching head for enlarging the pilot perforations shown in Fig. 6.

Referring to first Fig. 1, 10 represents a small section of negative film on which are shown, in whole or in part, three picture image areas, with the usual perforation at the edges of the film. If after the negative is developed and fixed an unexposed positive film be laid on it, with the perforations at one edge of the positive in exact registry with the perforations on the adjacent edge of the negative, it will be found that the positive perforations at the other edge of the positive will overlap the negative perforations by a substantial amount, as indicated (with considerable exaggeration) by the dotted lines at the right of the figure. Evidently a registry pin of the right size to fit the positive perforations closely at the right edge of the film will not fit the negative perforations without shifting one or the other film sidewise. Hence if the two films are held firmly together by full-size pins fitting the perforations in both at the other edge, the entry of a similar pin at the right will result in

buckling the film or in seriously injuring the perforations. In order to obviate this difficulty, I propose to enlarge the perforations at one side of the negative, or at least certain selected perforations suitably located with respect to the negative images. For this purpose mechanism such as is shown in Fig. 2 may be conveniently employed. As there illustrated the device comprises a pair of stems 11, 12, mounted to reciprocate in fixed guides 13, 14, a suitable distance apart on a base 15. The stems themselves are fixed to a cross-head 16 which has a stud 17 cooperating with a lever 18 actuated by the core 19 of a solenoid 20. The latter is in circuit with a source of current indicated diagrammatically at 21, through a rotating commutator 22, comprising a disk of insulating material having on its periphery, a conducting contact 23 connected electrically to the shaft 24, with which the brush 25 cooperates. The brush mentioned is connected to one side of the source 21, as shown. Bearing on the periphery of the disk is a brush 26 connected to the other terminal of the solenoid. Evidently as the commutator rotates, the circuit of the solenoid will be alternately closed and opened, thereby causing the core 19 to be reciprocated, and the stems 11, 12, also to be reciprocated in their guides. In the apparatus illustrated one of the stems, say 11, carries a registry pin 27 of such cross-sectional size and contour as to fit accurately the perforations on one edge of the negative film. The other stem, 12, carries a registry pin 28 of such cross sectional size and contour as to fit a negative perforation also (at the other edge of the film), but at a suitable distance in rear of its point the pin has a shoulder, preferably at the outer side of the pin, as indicated at 29, constituting a punch for cutting additional celluloid out of the side of the perforation to enlarge the same. It will of course be understood that the two pins are spaced apart a distance corresponding to the average amount of shrinkage in negative films. The two pins work in openings in the guide plate 30, below which is a spring-actuated presser plate 31, overlying a hinged die plate 32 held in place by a button 33. The die plate is provided with an opening 34 which the pin 27 enters idly, and with an opening 35 constituting a die member to cooperate with the shoulder 29 for the purpose of cutting out the additional celluloid at the outer edge of the film perforations. Suitable mechanism for passing the film between the presser plate 31 and the die plate 32 in a step-by-step manner is provided, but inasmuch as such mechanisms are well understood, I have deemed it unnecessary to illustrate the same herein. Suffice it to say that it may be of the Geneva-movement type, for example such as is illustrated in

my said Patent No. 1,359,025, referred to above, which mechanism is designed to advance the film one image space at each step.

The commutator 22 should be connected with the feed mechanism in such a way that the contact 23 will engage the brush 26 after the film has come to rest, thereby causing energization of the solenoid and consequent actuation of the stems 11, 12, and will pass out of engagement with the brush before the film starts to move in the next feeding step. The movement of the contact 23 out of engagement with the brush 26 of course breaks the circuit of the solenoid and so allows the springs 36 to raise the punching head and thereby disengage the pins from the film.

After the negative film has been re-perforated, as described above, it may be used in a printing machine having full-size pins spaced the standard distance apart.

In Fig. 4, 37 represents a negative film in which one perforation at each side of each image area is omitted, but having between successive picture areas, pilot perforations 38, 39. In order to take care of longitudinal shrinkage of the film, alternate pilot perforations may be elongated lengthwise of the film, as shown. Preferably these pilot perforations are made by punching devices in the camera in which the negative film is exposed, for example by mechanism of the type illustrated in my copending application Serial No. 268,673, filed December 28, 1918. In such cases every fourth tooth on the feed sprocket or sprockets of the film-feeding mechanism is omitted, to avoid damage to the film at the points where the perforations are omitted. After the negative film is developed and fixed it is passed through a perforating device of the type illustrated in Fig. 2, but provided with pilot pins to enter the perforations 38 and 39 and align the film so that the new perforations, punched in the blank spaces at the edges of the film, will be accurately and uniformly positioned with respect to the images on the film. For this purpose a punching head, such as is shown in Fig. 5, may be employed. This comprises a head 40 provided with pilot pins 41, 42, to cooperate with the pilot perforations 38, 39. At the ends of the head, in a plane between the pilot pins, are two stems 43, 44, carrying on their ends punches 45, 46. As will be readily understood, the pilot pins 41, 42, first enter the pilot perforations and thereby shift the film to a standard position, after which the punches come down upon the edges of the film and punch therein the missing perforations. These punches are spaced the standard distance apart so that the resulting perforations, as 47, 48, are correspondingly spaced, thereby making it possible to use these perforations in a standard

printing machine having full-size pins spaced the standard distance apart.

The film shown at 49, Fig. 6, also has certain perforations omitted from its edges, but their place is supplied by pilot perforations 50, 51. The former, like the perforations 38 in Fig. 4, are preferably circular, but perforations 51 are preferably elongated transversely, so as to take account of transverse shrinkage. To enable film of this type to be used in a printing machine with full-size registry pins spaced the standard distance apart, the missing perforations must be supplied. For this purpose a device such as is shown in Fig. 2, but with a punching head of the type shown in Fig. 7, can be used. The device illustrated in the figure just referred to comprises a head 52 carrying stems 53, 54, provided at their ends with pilot pins 55, 56, which in rear of their points are provided with shoulders 57, 58, constituting punches for making the desired perforations. In using the device illustrated the pilot pins enter the pilot perforations and thereby bring the film accurately to the standard position. The punches then engage the film and cut out perforations 59, 60, which are spaced the standard distance apart and which are uniformly located with respect to the adjacent images. Hence the negative film with the missing perforations supplied in this manner can be used in a printing machine employing full-size registry pins spaced the standard distance apart.

In printing from the re-perforated negatives any suitable printing apparatus may be used, as for example any of those described in my copending application Serial No. 355,958, before referred to, preferably one of the type illustrated diagrammatically in Fig. 17. This type of printer is designed for use in a method of two-color cinematography in which the two series of color value images are on separate films. If both series are on one film, but in "alternating sequence", as in a negative of the so-called kinemacolor type, a printing apparatus of the type illustrated in my copending application Serial No. 224,110 may be used.

The positive film may be of the kind having a sensitive emulsion on each side, in which case one series of negative images is printed on one side of the positive and the other series is printed on the other side of the positive. After both sides of the positive have been printed it is developed and fixed, and afterwards dyed or stained, in different colors on the two sides, so that when projected on the screen the unitary image, substantially in the colors of the object photographed, will be produced. Usually one series of the color-valve negative images is made by light predominantly green in color, and the other series by light

predominantly red, in which case the parts of the images printed from the "red" series are stained green and those printed from the "green" series are stained red. It will  
 5 be understood that the dyeing or staining can be effected by any suitable method, as for example described in the prior patent to Hoyt Miller, No. 1,214,940, of February 6, 1917. Another printing method which may  
 10 be employed instead of the one described involves printing on only one side of the positive film. In this method a "single-coated" film is used, on which one series of negative  
 15 images is printed. The positive film is then developed, fixed and dyed, after which the series of stained or dyed images thereon is protected by an insoluble varnish or other coating. On top of this coating another  
 20 emulsion is laid, upon which the second series of negative images is printed, followed by development, fixation and dyeing.

It is to be understood that the invention is not limited to the specific features herein described and illustrated, but can be practised  
 25 in other ways without departure from its spirit.

What I claim is—

1. In the art of color cinematography, the improvement comprising exposing a negative  
 30 film in a suitable camera for the production of a series of color value images, developing and fixing the film so exposed, and thereafter re-perforating the film to provide registry perforations a suitable distance  
 35 apart in uniform relation to the images, for subsequent use in printing the images on a positive film.

2. In the art of color cinematography, the improvement comprising re-perforating a developed and fixed negative film to provide at  
 40 the edges thereof registry perforations a suitable distance apart across the film in uniform relation to the images, printing the images on the negative film upon a positive film in contact therewith; and in printing,  
 45 registering selected perforations in the positive film with the registry perforations in the negative film by means of registry pins fitting the perforations in the positive film.

3. In the art of color cinematography, the improvement comprising developing and fixing a negative film having a series of perforations at each edge, and thereafter enlarging laterally at least one perforation adjacent to each image on the film, to enable  
 55 a pair of perforations for each image, one at each side thereof, to be matched with a pair of perforations in the unexposed positive film in printing.

4. In the art of color cinematography, the improvement comprising exposing a negative  
 60 film in a suitable camera for the production of a series of color value negative images, and at each exposure punching pilot perforations in the film adjacent to the image on the film; developing and fixing the  
 65 film; thereafter cutting registry perforations in the film; and in cutting the registry perforations, positioning the film by means of pilot pins inserted in the pilot perforations.  
 70

In testimony whereof I hereto affix my signature.

PERCY D. BREWSTER.