Aug. 17, 1926. 1,596,641

E. A. WEAVER ET AL

CINEMATOGRAPHIC APPARATUS

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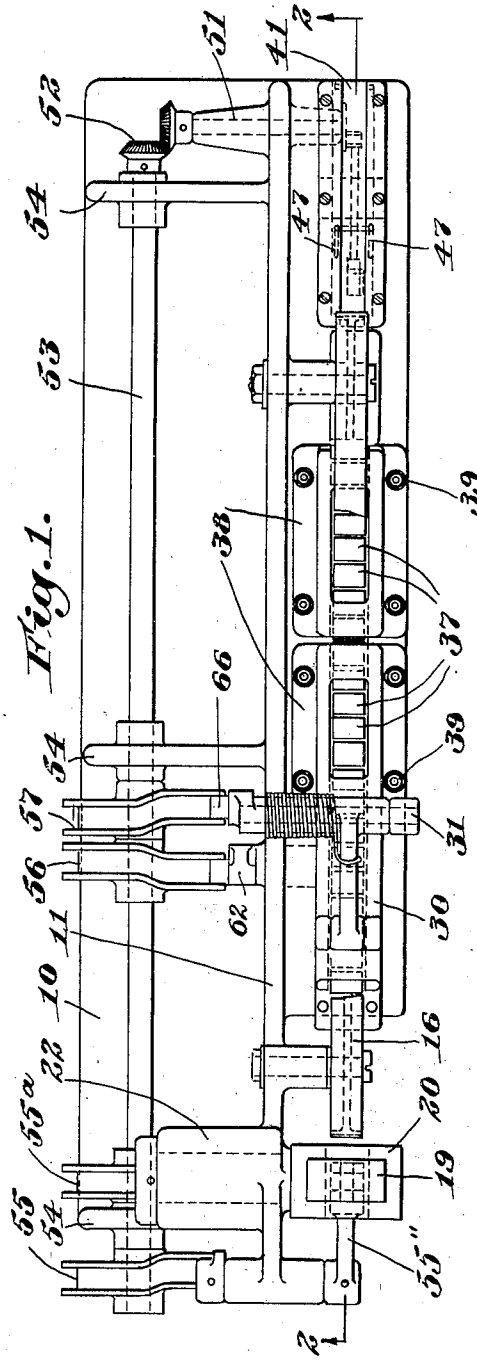


Fig. 1.

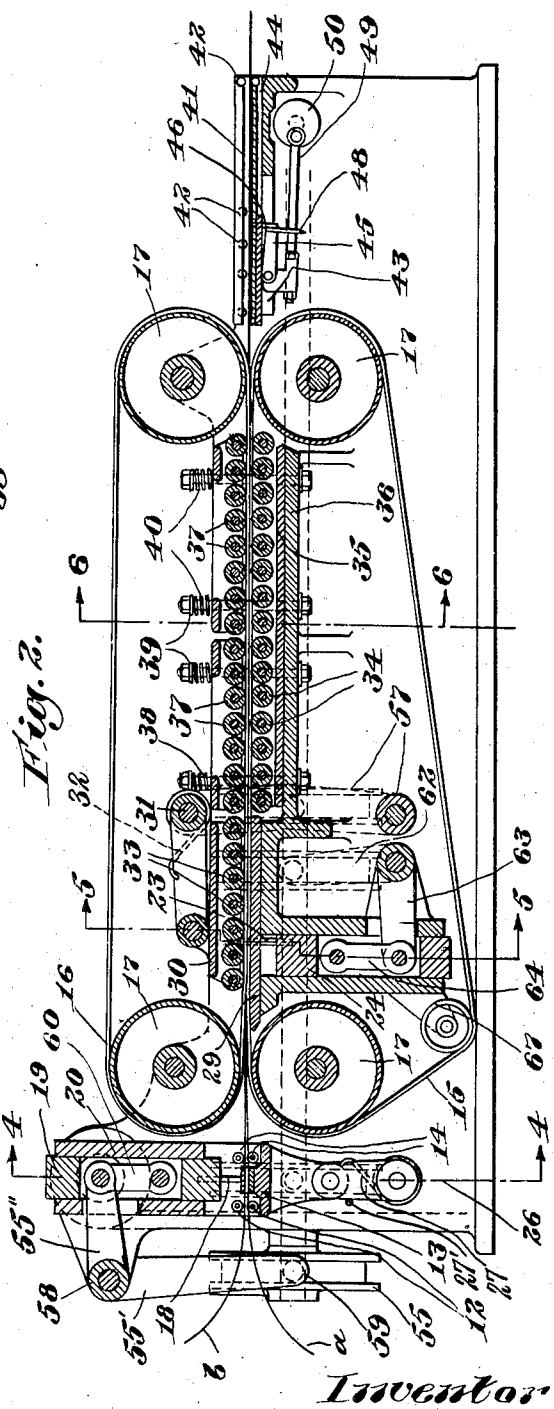


Fig. 2.

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Fig. 5.

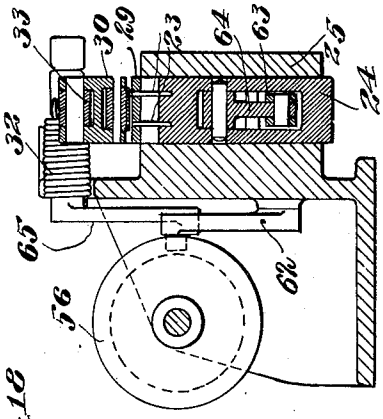


Fig. 4.

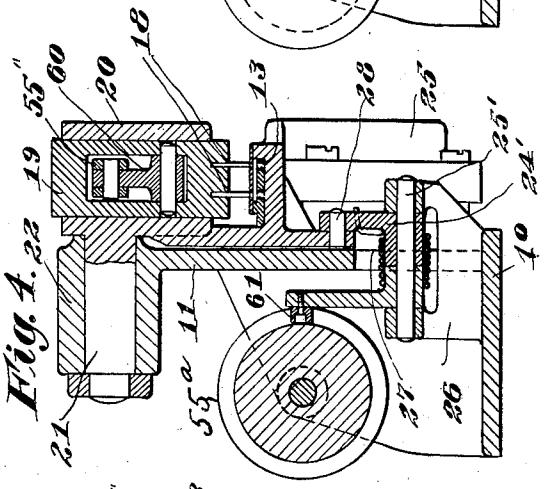


Fig. 3.

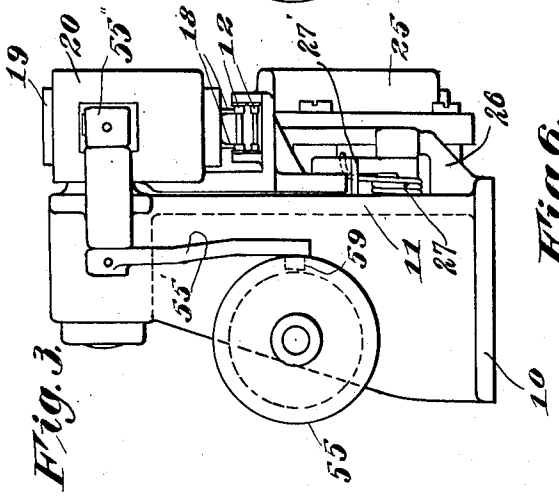


Fig. 7.

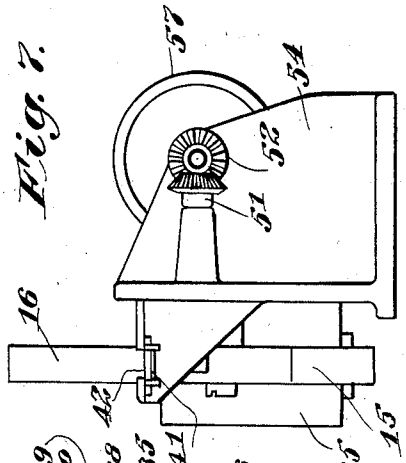
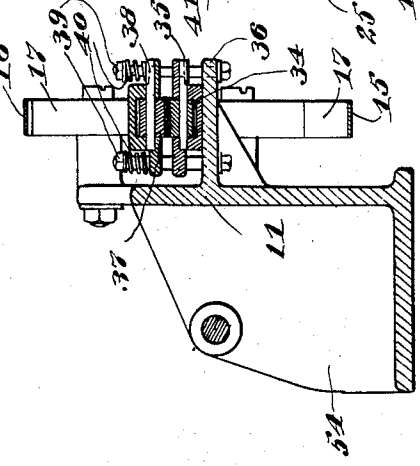


Fig. 6.



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Fig. 9.

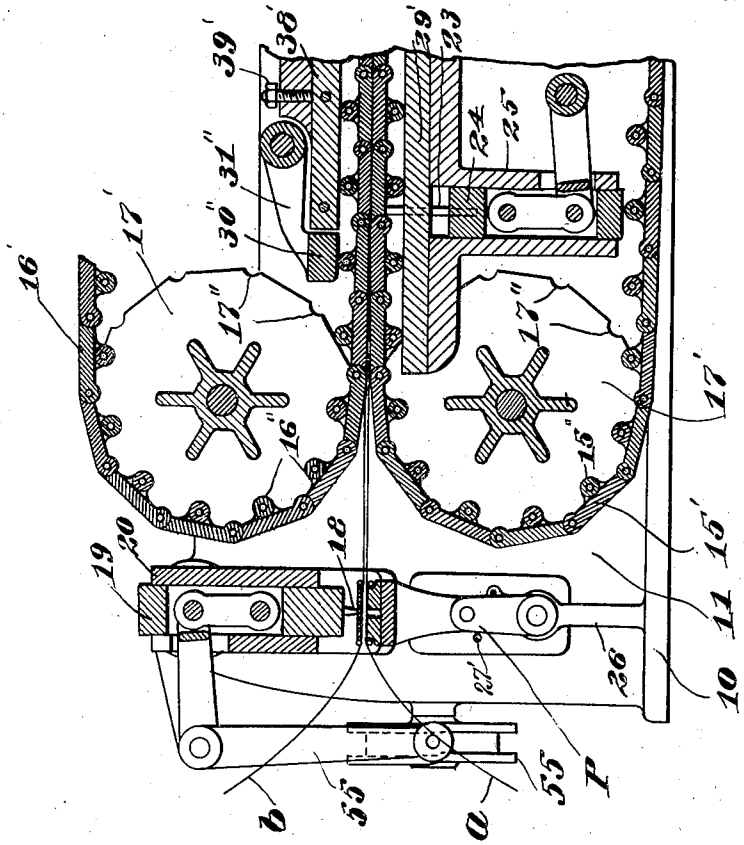
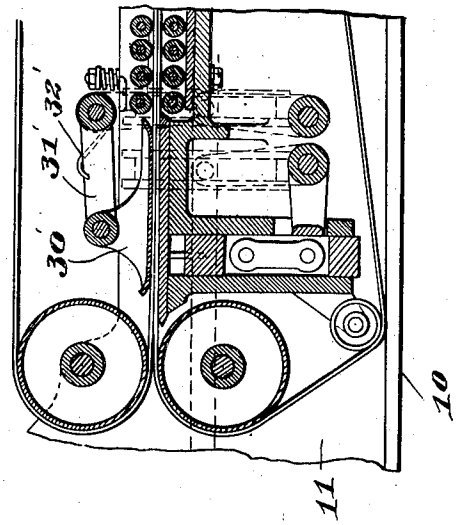


Fig. 6.



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UNITED STATES PATENT OFFICE.

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CINEMATOGRAPHIC APPARATUS.

Application filed July 21, 1923. Serial No. 652,892.

This invention relates to the registration of cinematographic films and more particularly to the production of cinematographic films by imbibition.

It is a relatively simple matter to print or stamp a picture in a single color. When such a picture is to be printed in a plurality of colors however, great care must be exercised in exactly registering the picture as each color impression is made. When the attempt is made to print a series of pictures upon a continuous strip as in cinematographic films, serious difficulties are encountered due to the character of the material employed which shrinks under liquid treatment and varies in dimensions with temperature and humidity, due also to the small size of the pictures which when magnified two hundred times under projection makes even a minute discrepancy in registration glaringly evident, and to the fact that the pictures are arranged in sequence upon a strip of the material having the above characteristics and are to be transferred to a similar strip. The strips must be brought into registration before they can be permitted to contact each other, otherwise there is a blurred transfer of color and consequently an imperfect picture. After the strips are in registration pressure must be applied in a manner to prevent relative movement or slipping of the films and the films must be maintained in contact until the transfer of the pictures or images is complete.

Objects of the invention are to bring the films into potential registration before they contact each other by stretching the films, to apply the stretching force selectively and automatically until the shorter film is stretched to equal the longer and the residual force (if any) equally to both films, to prevent injury to the films by employing a yielding force to stretch the films, to apply pressure to the films to force them into intimate contact while they are still held in registration, to maintain the films in contact under relatively light pressure, to perform the advancing, stretching and initial pressing steps intermittently and in timed relation, and in general to provide a method and apparatus by which the transfer of images from a matrix film to a blank film may be effected with speed, accuracy and satisfactory results.

In one aspect the invention comprises the method of registering cinematographic films characterized by advancing the films in juxtaposition and by inserting registering or pilot pins through the sprocket holes of the films to stretch the latter, the stretching effect being produced by moving the pins apart, preferably with a yielding force. The invention further comprises registering two films by stretching successive overlapping portions of the films to cause the shorter film to conform to the longer. The invention further comprises alternately advancing and stretching the films.

In another aspect the invention includes the method of printing films by imbibition which comprises intermittently advancing a blank film and a matrix film in juxtaposed relationship, applying tension to corresponding sections of the films during the periods of rest to stretch them into exact registration applying pressure to the registered films to force them into intimate contact and continuing the pressure until the films adhere, pressure being unnecesary for the completion of the imbibition process.

For the purpose of clearly illustrating the method and its practical application, one embodiment of apparatus therefor is illustrated in the accompanying drawings to which reference will now be had for a detailed description.

In the drawings—

Fig. 1 is a plan view of a mechanical printing device embodying the features of the invention;

Fig. 2 a vertical section substantially on the line 2—2 of Fig. 1;

Fig. 3 a left end elevation of Fig. 1;

Fig. 4 is a vertical section on the line 4—4 of Fig. 2;

Fig. 5 is a section on the line 5—5 of Fig. 2;

Fig. 6 is a section on the line 6—6 of Fig. 2;

Fig. 7 is a right end elevation;

Fig. 8 is a detail sectional view similar to Fig. 2 showing a modification; and

Fig. 9 is a detail sectional view similar to Fig. 2 showing a further modification.

The embodiment of the invention shown in Figs. 1 to 7 comprises apparatus for printing blank cinematographic film from a matrix film, the two films being together fed intermittently through the apparatus. The apparatus comprises a base 10 and an upright plate 11 extending therefrom supporting upon brackets the operative parts of the device. As indicated in Fig. 2 the matrix film *a* and the blank film *b* enter the device in spaced relation from the left and pass between guide rollers 12, between guide plates 13, and between additional guide rollers 14, thence while still out of contact progressively approach each other and extend between flexible bands 15 and 16 mounted upon suitable pulleys 17, the parallel portions of the bands being pressed together as hereinafter described to bring the films into intimate contact. As the films pass in juxtaposition but still out of contact between guide plates 13 they pass beneath spaced tapered pilot pins 18 adapted to be advanced through aligned holes in the plates and through the sprocket openings in the films. Pins 18 are mounted on a vertically slidable block 19 movable in a swinging arm 20, the pivot 21 of which has a bearing in a boss 22 integral with or otherwise fast to upright 11 of the frame. In spaced relation to pins 18 are similar pins 23 mounted on a slide 24 reciprocable in an extension or bracket 25 fast to or integral with upright 11 of the frame.

When the films come to rest after each intermittent advance pins 18 and 23 are advanced through the corresponding sprocket holes of the two films, whereupon arm 20 is swung to the left (Fig. 2) on its pivot, thereby applying tension to the two films. If there is any variation in the films due to shrinkage or other condition, this tension is first operative upon the shorter film to stretch the same until it conforms to the longer film and to bring the sprocket openings of the two films into exact registration.

The means for swinging arm 20 to the left comprises a generally U-shaped member 24′ mounted for swinging movement on a pivot 25′ supported in a bracket 26 fast to base 10. A torsional spring 27 is disposed about the hub portion of member 24′ to rotate the member to the left, there being a loose connection provided by a pin 28 between member 24′ and arm 20 by which the latter may be rocked by the former to provide a yielding tension upon the films. A stop pin 27′ (Figs. 2 and 3) mounted on the frame 11 limits the action of spring 27. Mounted above support 29, across which flexible belts 15 and 16 extend and through openings in which pins 23 are forced upwardly to engage the films and anchor them against the pulling movement of arm 20, is an arm 30 pivoted to the frame at 31 and adapted to be forced downwardly by a spring 32. Arm 30 supports a plurality of rollers 33 which are adapted to be pressed upon upper belt 16 to force the two belts together and compress the films *a* and *b* into intimate contact therebetween.

Arm 30 is timed to apply pressure upon the films as soon as the latter have been brought into exact registration in the manner above described.

Beyond pivot arm 30 and intermediate said arm and the farther pulleys 17 supporting belts 15 and 16 are a plurality of rollers 34 supported for rotation in members 35 which are in turn supported on a shelf 36 extending from upright 11, and a similar series of rollers 37 is disposed above the belts and mounted in members 38. Members 35 and 38 are retained in operative relation by bolts 39 extending through shelf 36. Springs 40 may be interposed between members 38 and the nuts on the tops of bolts 39 for yieldingly forcing members 38 toward members 35 to maintain pressure upon the films *a* and *b* between belts 15 and 16. Beyond farther pulleys 17 the films *a* and *b*, still in contact, pass out of the device through a guideway 41 provided at intervals with guide rollers 42.

The means for advancing films *a* and *b* through the apparatus may comprise a slide 43 having marginal flanges extending into guide grooves 44 in the frame of the apparatus. The slide supports a pivot arm 45 provided with pins 46 adapted to be extended through suitable slots 47 in the supporting plate for the films into the sprocket openings of the latter. Arm 45 is maintained normally in its upper position by a spring (not shown) during the movement of the slide 43 toward the right and is arranged to be pulled downwardly out of contact with the films on the reverse movement of the slide by a yoke member 48 extending around the link or pitman 49 which connects slide 43 with a crank disc 50 mounted on a transverse shaft 51 supported in suitable bearings in the frame and connected by gearing 52 to a longitudinally disposed power driven shaft 53 by which the apparatus is driven.

As indicated in Fig. 1, shaft 53 is supported in suitable bearings in webs 54 extending between base 10 and upright plate 11 and has fast thereon a plurality of cam members 55, 56, and 57. Cam member 55 con-

trols the reciprocation of slide 19 through the provision of angularly disposed levers 55′ and 55″ fast upon a shaft 58 mounted on the frame, lever 55′ having a roller 59 extending into the cam groove of cam 55 and lever 55″ being connected to slide 19 by a link 60. Cam 55ª is operative to control the position of U-member 24′ against the force applied thereto by spring 27 by the provision of a roller 61 on arm 61ª (Fig. 4) integral with or otherwise connected to member 24′ and cams 56 and 57 control the operation of slide 24 and pivot arm 30 respectively. Cam 56 operates slide 24 by means of angular arms 62 and 63 fast on a transverse shaft, the former arm having a roller extending into cam groove of cam 56 and the latter being connected to slide 24 by a link 64. The connection between cam 57 and arm 30 comprises an arm 65 provided with a roller 66. If found necessary or desirable tensioning means of well-known form may be provided for belts 15 and 16 such as tensioning arm 67 (Fig. 2).

In the modification disclosed in Fig. 8 a pressure shoe 30′ is substituted for the arm 30 of the first disclosed embodiment, the operation of the shoe being controlled in a manner similar to arm 30 by the provision of lever 31′ actuated by torsion spring 32′ and controlled by cam 57.

In the modification disclosed in Fig. 9, link belts 15′ and 16′ are substituted for the flexible strips forming the belts 15 and 16 of the first embodiment. Each link of belts 15′ and 16′ is preferably of a size to extend across a plurality of pictures upon films *a* and *b* and the hinge joints between the links preferably are arranged to come at the division point between two adjacent pictures on each film. As disclosed in Fig. 9 the links on the two belts register exactly so that when the pressure is applied to force the links together it is operative across each picture space upon the film so as to obviate the imperfect printing which might result from the hinge joints coming within a picture space. The pulleys 17′ upon which link belts 15′ and 16′ are supported are recessed as 17″ to receive the inwardly disposed bosses produced at the hinge connections of the links. The inner faces of the link belts are provided with rollers 15″ and 16″, the former being adapted to roll on surface 29′ of the frame and the latter to roll upon adjustable plate 38′, the adjustment of which is effected by set screws 39′. In this form of the invention a movable arm 31″ is provided carrying a block 30″ adapted to be moved downwardly to form an extension of the lower surface of block 38′ to effect the initial pressing and gripping of the films after the latter have been stretched into exact registration in the manner previously described, block 30″ being adapted to bear upon the roller of the link in belt 16′ immediately therebelow as indicated in Fig. 9 and to be operated by cam 57 through suitable connections.

The sequence of operations of the apparatus is as follows: The films *a* and *b* having been threaded through the apparatus between guide rollers 12, guide plates 13, guide rollers 14 and flexible belts 15 and 16 and out through passageway 41, the mechanism for operating drive shaft 53 is set in operation. Cams 55 and 56 operate slides 19 and 24, the latter moving upwardly to extend pilot pins 23 through aligned sprocket holes of the two films and the former moving downwardly to force pilot pins 18 through other aligned sprocket holes. Cam 55ª next operates to release U-member 24′ which, actuated by torsion spring 27, swings to the left moving support 20 carrying slide 19 in the same direction. thus applying tension to the portion of the two films between pilot pins 18 and 23. which tension stretches the films until the shorter of the two is brought into exact registration with the longer. With the films maintained under tension and in stretched condition, cam 57 releases pressure arm 30 (30′ or 30″), which subjects the portions of the registered films immediately therebeneath to a relatively high pressure, such as of the order of 50 pounds to the square inch. With the films so gripped and held, cams 55 and 56 retract slides 19 and 24 withdrawing pilot pins 18 and 23 from the sprocket openings of the films. The parts of the device are now in the position disclosed in Figures 1 and 2. At this point crank disc 50 lifts link 49 permitting arm 45 to force the pilot pins 46 thereon into aligned sprocket openings in the two films. As crank disc 50 continues to turn in the direction of the arrow slide 43 is moved to the right drawing the films through the device one step to the right, this step preferably comprising a plurality of picture spaces on the films. Pins 46 are then withdrawn and cam 57 operates slightly to raise the outer end of arm 30 to relieve the pressure upon the films at this point in order not to interfere with the next stretching operation. The sequence of operations is then repeated.

As the films are intermittently drawn through the device by the reciprocations of slide 43 they pass from beneath arm 30 (shoe 30′ or block 30″), where heavy pressure is applied, to the section of the device beyond wherein a relatively light pressure is applied continuously to the film by means of the adjustable plates 38 or 38′. This section may be of sufficient extent to continue this light pressure for sufficient time to complete the printing operation. However, after such a short period of light pres-

sure the films will adhere and the printing process will continue until completed without further application of pressure thereto, the films then being ready to be separated and rolled up on suitable takeup reels (not shown). This final portion of the imbibition process may continue after the films have issued from passageway 41 if the latter is not of sufficient length to permit the completion of the process.

Flexible belts 15 and 16 or 15′ and 16′ may be of a width sufficient to cover the picture portion of the films only or may extend entirely across the films, in the latter case the flexible belts are provided with perforations or openings through which the pilot pins 23 may pass in order to extend through the sprocket openings of the films to anchor the latter in place in preparation for the stretching or registering operation. As disclosed these flexible belts are to be driven frictionally by the films as the latter are drawn through the device by the reciprocating slide 23. If the pressure applied by the various rollers and pressure devices upon the flexible belts is such that the films *a* and *b* are not strong enough frictionally to drive the belts, a suitable intermittent driving connection can be employed between drive shaft 53 and pulleys 17 or 17′.

In using the apparatus to print a blank film from a matrix film the dye or pigment is of course applied to the matrix film before it passes through the apparatus. In using the apparatus to cement two films together cement is applied to the face of one or both films before they are pressed together.

From the above it will be evident that the films are stretched into potential register before they contact each other, that the stretching force is applied selectively and automatically in that the shorter film is stretched until it equals the longer one and then whatever additional force remains is applied equally to both, that by using a spring an upper limit for the stretching force may be conveniently fixed to prevent injury to the films, and that after initial contact the films are held together for a short time with force sufficient to prevent slippage of one over the other.

We claim:

1. In the art of cinematography the method which comprises feeding two films into superposed contact, registering succeeding sections of the films before they contact between means engaging both of the same at corresponding sprocket holes therein, and pressing portions of the registered sections into contact.

2. In the art of cinematography the method which comprises intermittently advancing two films into superposed contact, after each intermittent advance registering the sections of the films immediately in advance of the point of contact between means engaging corresponding sprocket holes therein, and after each registration but before the next intermittent advance pressing portions of the registered sections into contact.

3. In the art of cinematography the method which comprises feeding two films into superposed contact and stretching the films into potential registry between means engaging corresponding sprocket holes therein immediately in advance of the point of contact.

4. In the art of cinematography the method which comprises feeding two films along converging paths into superposed contact, and stretching the films from the point of contact rearwardly along said paths predetermined equal distances between means engaging corresponding sprocket holes therein to bring the films into potential registry.

5. In the art of cinematography the method which comprises bringing two films, one of which has shrunken or expanded, into registered contact by first stretching the shorter film between means engaging corresponding sprocket holes in each film and then pressing stretched portions of the two films flatwise together.

6. In the art of cinematography the method which comprises engaging registering openings in each of two films, engaging registering openings spaced the same number of openings from the first openings in each film, stretching the films between the spaced openings until the linear dimensions of the two films between the spaced openings are equal, and pressing portions of the stretched films together with the openings in registry.

7. In the art of cinematography the method which comprises engaging registering openings in each of two films, engaging registering openings spaced the same number of openings from the first openings in each film, stretching the films between the spaced openings until the linear dimensions of the two films between the spaced openings are equal, and printing a portion of one stretched film from a portion of the other stretched film to form the printed images in positions relative to the registering openings in the printed film bearing a constant relationship to the positions of the printing images relative to the registering openings of the printing film.

8. In the art of cinematography the method which comprises intermittently feeding two films along juxtaposed paths, and during the periods of rest holding corresponding sprocket holes of the films in juxtaposed opposite relation to each other at spaced locations along the paths with

the intervening portions of the films under tension, thereby to register the intervening portions.

9. In the art of cinematography the method which comprises advancing two films in juxtaposed relationship and registering the films by entering registering pins into longitudinally spaced sprocket holes of the films and moving the pins apart to stretch the intervening portions of the films.

10. In the art of cinematography the method which comprises advancing two films in juxtaposed relationship and recurrently registering portions of said films by inserting registering pins into longitudinally spaced sprocket openings and moving the pins apart thereby to stretch the shorter film until it registers with the longer film.

11. In the art of cinematography the method which comprises intermittently advancing the films in closely juxtaposed relationship and registering the films during the periods of rest by stretching corresponding sections of the films until their sprocket holes register.

12. The method of bringing cinematographic films into registered juxtaposition which comprises intermittently advancing the films in juxtaposed relationship and registering the films during the periods of rest by recurrently inserting spaced pairs of registering pins in aligned sprocket openings in the films and moving one pair of pins away from the other thereby to apply tension to successively overlapping portions of the films thereby to stretch the shorter film until it conforms to and exactly registers with the longer.

13. The method of bringing cinematographic films into registered juxtaposition which comprises advancing the films in juxtaposed relation, recurrently passing pilot pins through aligned openings in the films and moving the pilot pins contrary to the direction of travel of films thereby to stretch the shorter film until it registers exactly with the longer.

14. The method of bringing cinematographic films into registered juxtaposition which comprises disposing the films in juxtaposed relation and alternately advancing and stretching succeeding sections of the films.

15. The method of printing films by imbibition which comprises advancing a blank film and a matrix film in juxtaposed relationship, applying tension to corresponding free sections of said films to stretch the shorter into exact registration with the longer, and applying pressure to the registered films to force them into intimate contact.

16. The method of printing films by imbibition which comprises advancing a blank film and a matrix film in juxtaposed relationship, applying tension to corresponding free sections of said films by means of the sprocket openings therein to stretch the shorter into exact registration with the longer, and applying pressure to the registered films to force them into intimate contact.

17. The method of printing films by imbibition which comprises intermittently advancing a blank film and a matrix film in juxtaposed relationship, recurrently applying yielding tension intermittently to successive sections of said films to stretch the shorter into exact registration with the longer, and applying pressure to the registered films to force them into intimate contact.

18. Cinematographic apparatus comprising means for advancing two films in juxtaposed relationship, common means engaging both the films at spaced points for registering the intermediate sections, and means for pressing the registered sections together.

19. Cinematographic apparatus comprising means for intermittently advancing two films in juxtaposed relationship, common means engaging the films at spaced points for registering the intermediate sections during periods of rest, and means for printing one film from the other in the registered sections.

20. Cinematographic apparatus comprising means for advancing two films in juxtaposed relationship, common stretching means engaging the films at spaced points for stretching the intermediate sections into registry, and means for pressing the registered sections together.

21. Cinematographic apparatus comprising means for intermittently advancing two films in juxtaposed relationship, common stretching means engaging the films at spaced points for stretching the intermediate sections into registry during periods of rest, and means for printing one film from the other in the registered sections.

22. Apparatus for bringing cinematographic films into exact registration comprising mechanism for advancing the films in juxtaposed relationship, spaced positioning means passing through longitudinally spaced aligned openings in the films, and means for moving said spaced means apart to stretch the films and bring them into registration.

23. Apparatus for bringing films into exact registration comprising means for positioning the films in superposition, means passing through longitudinally spaced aligned openings in the films, and yielding means for moving said second means apart to stretch the films and bring them into registration.

24. Apparatus for bringing cinemato-

graphic films into exact registration comprising means for intermittently advancing the films in superposition but in spaced relation, and spaced means engaging said films and adapted to be moved apart to stretch the films and bring them into registration.

25. Apparatus for bringing films into exact registration comprising means for positioning the films in superposition, a pair of members passing through aligned openings in said films, a second pair of members passing through aligned openings in spaced relation to said first pair, and means for moving one pair away from the other to stretch the films and bring them into registration.

26. Apparatus for bringing films into exact registration comprising means for intermittently advancing the films in superposition, spaced pairs of members recurrently entering aligned openings in the films while the latter are at rest, and yielding means for moving one pair of members away from the other to stretch the films and bring them into registration.

27. Apparatus for bringing films into exact registration comprising means for intermittently advancing films in superposition, spaced pairs of members recurrently entering aligned openings in the films while the latter are at rest, one of said pairs being mounted for swinging movement, and means for swinging said last named pair away from the other pair to stretch the films and bring them into registration.

28. Apparatus for bringing films into exact registration comprising means for intermittently advancing films in superposition, spaced members movable toward and from said films, means on said members adapted to pass through aligned sprocket openings in said films, and means for moving one of said members away from the other to stretch the films and bring them into registration.

29. Apparatus for bringing films into exact registration comprising means for intermittently advancing films in superposition, spaced members reciprocable transversely of the path of movement of said films to extend pins thereon through aligned openings in the films, and yielding means for moving one of said members away from the other longitudinally of the films to stretch the latter and bring them into registration.

30. Apparatus for bringing films into exact registration comprising means for intermittently advancing films in superposition but not in contact, spaced slides movable transversely of the direction of movement of the films, pilot pins on said slides adapted to extend through aligned openings in said films, and means for automatically moving one slide from the other thereby to stretch the films and bring them into registration.

31. Apparatus for bringing films into exact registration comprising means for intermittently advancing films in superposition, spaced slides movable transversely of the direction of movement of the films, pilot pins on said slides adapted to extend through aligned openings in said films, one of said slides being mounted for swinging movement, and means for swinging the latter away from the other slide to stretch the films and bring them into registration.

32. Apparatus for bringing films into exact registration comprising means for intermittently advancing films in superposition but not in contact, spaced slides movable transversely of the direction of movement of the films, pilot pins on said slides adapted to extend through aligned openings in said films, one of said slides being mounted for swinging movement, yielding means for swinging the latter away from the other slide, and positive means for returning the arm to its original position.

33. Apparatus for bringing films into exact registration comprising means for intermittently advancing films in superposition, spaced slides movable transversely of the direction of movement of the films, pilot pins on said slides adapted to extend through aligned openings in said films, one of said slides being carried by a pivoted arm, and means for swinging said arm away from the other slide to stretch the films and bring them into registration.

34. Apparatus for bringing films into exact registration comprising means for intermittently advancing films in superposition, spaced slides movable transversely of the direction of movement of the films, pilot pins on said slides adapted to extend through aligned openings in said films, one of said slides being carried by a pivoted arm, and yielding means for swinging said arm away from the other slide to stretch the films and bring them into registration.

35. Apparatus for printing films by imbibition comprising means for intermittently advancing a blank film and a matrix film in substantially parallel superposition but not in contact, means for successively stretching sections of the films to bring the films into registration, and means for applying pressure to the films while in registration to force them into intimate contact to produce a transfer of images from the matrix film to the blank film.

36. Apparatus for printing films by imbibition comprising means for intermittently advancing a blank film and a matrix film in substantially parallel superposition, means for successively stretching sections of the films to bring the films into registration, and means including a pivoted member for applying pressure to the films while in registration to force them into intimate contact to produce a transfer of images from the matrix film to the blank film.

37. Apparatus for printing cinematographic films by imbibition which comprises a pair of elongate strips disposed in facing relationship and traveling in the direction in which their surfaces extend, means for advancing a blank film and a matrix film in juxtaposition between said strips, and means for forcing said strips together to press the films into intimate contact to produce a transfer of images from the matrix film to the blank film.

38. Apparatus for printing films by imbibition which comprises a pair of elongate strips disposed in facing relationship, means for advancing a blank film and a matrix film in juxtaposition between said strips, means for forcing said strips together to apply a heavy initial pressure to said films, and means for thereafter maintaining a lighter pressure on said strips whereby a transfer of images is produced from the matrix film to the blank film.

39. Apparatus for printing films by imbibition which comprises a pair of endless flexible belts arranged with portions thereof in facing relationship, means for advancing a blank film and a matrix film in juxtaposition between said belts, means for stretching said films into registration as they enter between said belts, and means for applying pressure to said belts to force said films into intimate contact while still in registration to produce a transfer of images from the matrix film to the blank film.

40. Apparatus for printing films by imbibition which comprises a pair of endless flexible belts arranged with portions thereof in facing relationship, means for advancing a blank film and a matrix film in juxtaposition between said belts, means for stretching said films into registration as they enter between said belts, and anti-friction means for applying pressure to said belts to force said films into intimate contact whereby said belts are frictionally driven by said films.

41. Apparatus for printing films by imbibition which comprises a pair of endless flexible belts arranged with portions thereof in facing relationship, means for intermittently advancing a blank film and a matrix film in juxtaposition between said belts, means operated in timed relation with said advancing means for stretching corresponding sections of said films to bring them into exact registration, and means actuated in timed relation with both said means for forcing said belts together to produce intimate contact between said films.

42. Apparatus for printing films by imbibition which comprises a pair of endless flexible belts arranged with portions thereof in facing relationship, means for advancing a blank film and a matrix film in superposition between said belts, means for stretching said films into registration as they enter between said belts, anti-friction rollers engaging the inner faces of said belts to force the latter together and thereby the films into intimate contact, and means for urging said rollers toward each other with an adjustable yielding pressure.

43. Apparatus for printing films by imbibition which comprises means for intermittently advancing a blank film and a matrix film in superposition, means for successively stretching overlapping portions of said films to bring them into registration, means for applying first a heavy momentary pressure to the films while held in registration and thereafter a lighter pressure thereon and means for operating said means in timed relation.

44. Apparatus for printing films by imbibition which comprises means recurrently entering corresponding sprocket openings in a blank film and a matrix film disposed in superposed relation for intermittently advancing said films, means for successively stretching corresponding portions of said films during the periods of rest to bring them into registration, means for applying first a heavy momentary pressure to the films while held in registration and thereafter a lighter pressure thereon, and means for operating said means in timed relation.

45. Apparatus for printing films by imbibition which comprises means recurrently entering corresponding sprocket openings in a blank film and a matrix film disposed in superposed relation for intermittently advancing said films, means including spaced pilot pins recurrently entering sprocket openings in said films for successively stretching corresponding portions of said films to bring them into exact registration, means for applying first a heavy momentary pressure to the films while held in registration and thereafter a lighter pressure thereon, and means for operating said means in timed relation.

46. Apparatus for printing films by imbibition which comprises means recurrently entering corresponding sprocket openings in a blank film and a matrix film disposed in superposed relation for intermittently advancing said films, means including spaced pilot pins recurrently entering sprocket openings in said films to bring them into exact registration, a pair of endless flexible belts between which said films are advanced while in registration, means for applying first a heavy pressure to said belts and thereafter a lighter pressure whereby the films are forced into and held in intimate contact, and means for actuating all said means in timed relation.

47. Cinematographic apparatus comprising two endless belts having parallel juxtaposed portions traveling in the same direc-

tion, and means for feeding two cinematographic films between the belts with their sprocket holes in registry including means for registering the films with each other as they pass between said belts.

48. Cinematographic apparatus comprising two endless belts having parallel juxtaposed portions traveling in the same direction, means for feeding two cinematographic films between the belts with their sprocket holes in registry, and means operative upon said portions of the belt for pressing the films together.

49. Cinematographic apparatus comprising two endless belts having parallel juxtaposed portions traveling in the same direction between which two films are adapted to be fed in flatwise contact, and means for registering the films with each other immediately in advance of said portions.

50. Cinematographic apparatus comprising two endless belts having parallel juxtaposed portions traveling in the same direction between which two films are adapted to be fed in flatwise contact, and mechanism including film stretching means for registering the films with each other immediately in advance of said portions.

51. The method of printing films by imbibition which comprises the steps of forcing a blank film and a matrix film into intimate surface contact under a relatively high pressure, and thereafter causing them to traverse an approximately straight path a substantial number of picture spaces in length while still in contact.

52. The method of printing films by imbibition which comprises the steps of forcing a blank film and a matrix film into intimate surface contact under a relatively high pressure, and thereafter causing them to traverse a path of material length while still in contact and under reduced pressure.

53. The method of printing films by imbibition which comprises the steps of forcing a blank film and a matrix film into intimate surface contact under relatively high pressure, and causing them thereafter to traverse a path of material length while still in contact between a pair of moving belts.

54. Apparatus for printing films by imbibition which comprises means for feeding a blank film and a matrix film in juxtaposition, means for pressing the films forcibly into intimate contact, and means including an endless belt for holding the films in contact while traversing a predetermined path.

55. Apparatus for printing films by imbibition which comprises means for feeding a blank film and a matrix film in juxtaposition, means for initially forcing them into intimate contact, and means for thereafter maintaining them in contact during travel over an extended path including a belt adapted to be superposed upon the upper one of said films.

56. Apparatus for printing films by imbibition which comprises means for feeding a blank film and a matrix film in juxtaposition, and means for holding the films in intimate contact with each other while traversing a predetermined path, said last means including an endless belt above the films.

57. Apparatus for printing films by imbibition which comprises means for feeding a blank film and a matrix film in juxtaposition along a predetermined path, and means for maintaining the films in contact including a belt superposed upon the upper one of said films during their travel along said path.

Signed by us at Boston, Massachusetts, this 11th day of July, 1923.

EASTMAN A. WEAVER.
ERNEST A. GALLISON.