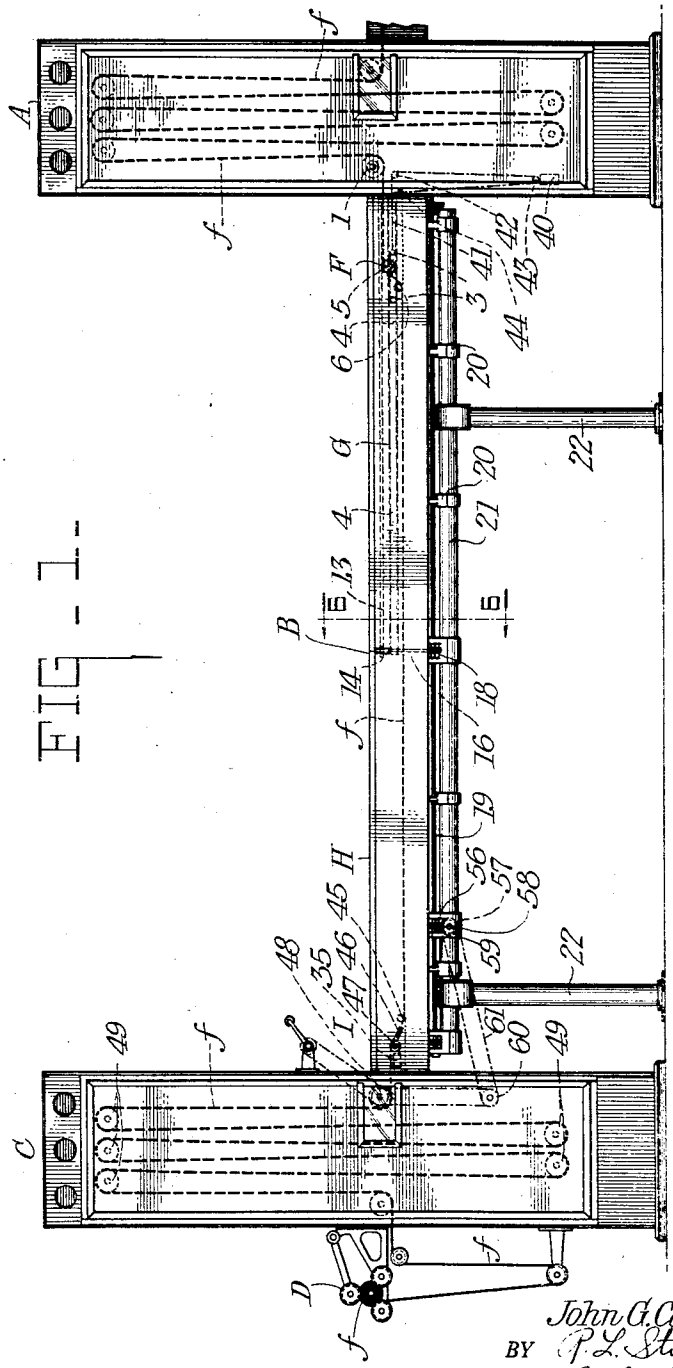
Nov. 10, 1925. 1,560,541

J. G. CAPSTAFF

FILM DYEING APPARATUS

Filed March 5, 1924 3 Sheets-Sheet 1

FIG. 1.



INVENTOR,
John G. Capstaff,
BY P. L. Stinchfield
N. M. Perrins
ATTORNEYS.

Nov. 10, 1925. 1,560,541

J. G. CAPSTAFF

FILM DYEING APPARATUS

Filed March 5, 1924 3 Sheets-Sheet 2

FIG. 2.

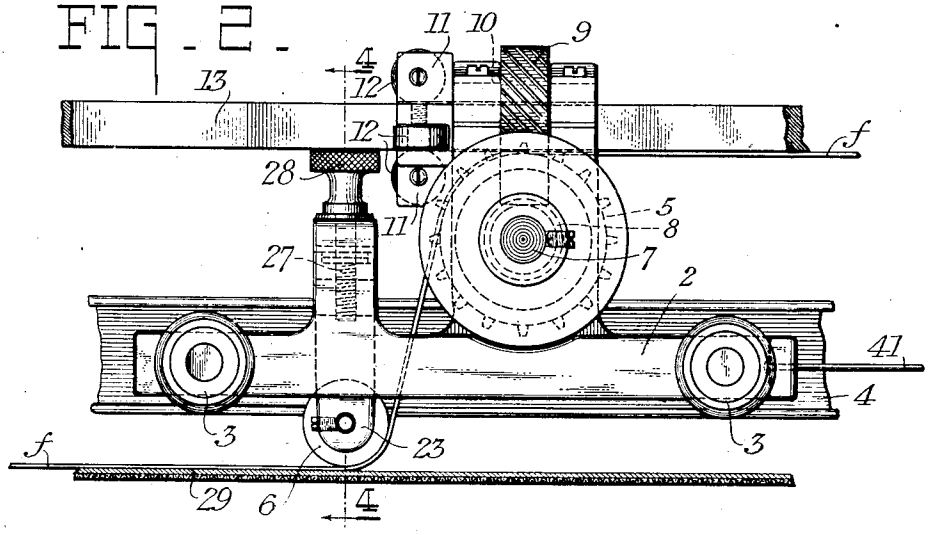


FIG. 3.

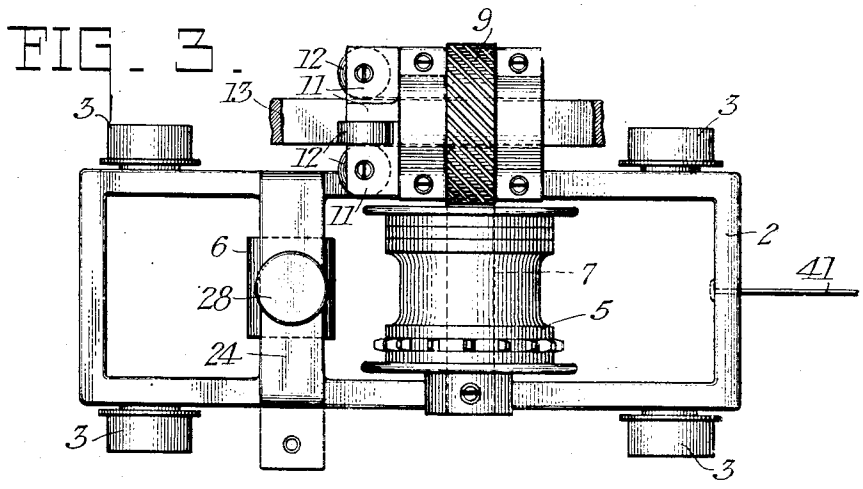


FIG. 4.

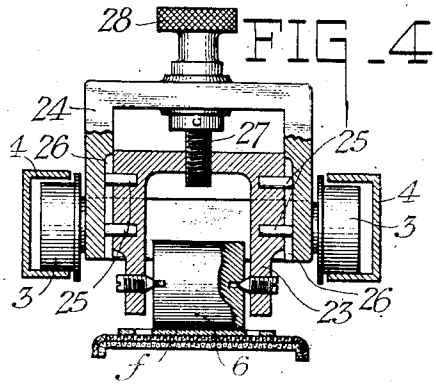
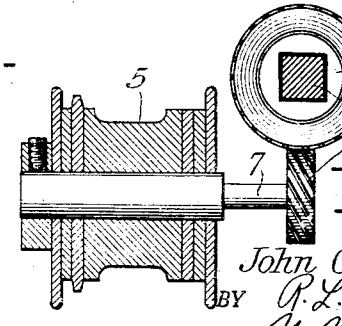


FIG. 5.



INVENTOR.
John G. Capstaff,
BY P. L. Stinchfield
M. M. Fenner
ATTORNEYS.

Nov. 10, 1925. 1,560,541

J. G. CAPSTAFF

FILM DYEING APPARATUS

Filed March 5, 1924 3 Sheets-Sheet 3

FIG. 6.

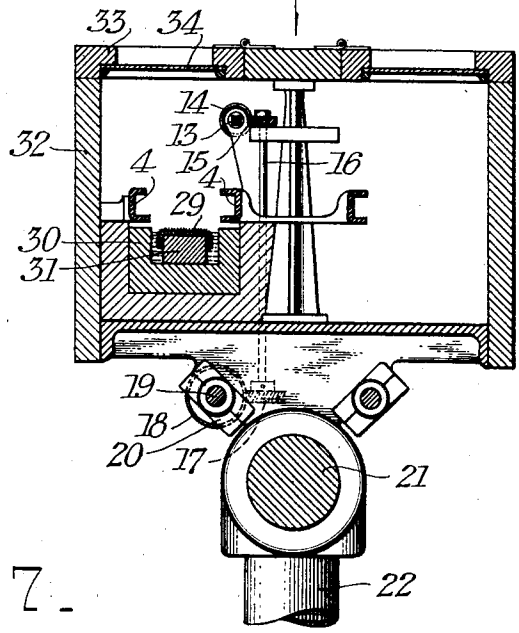
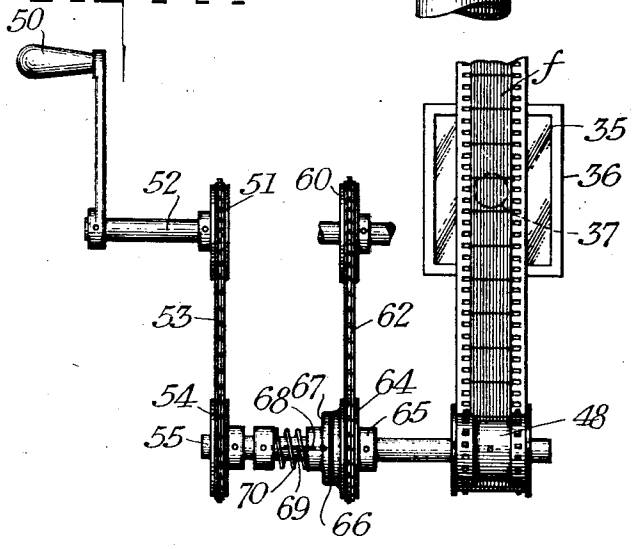


FIG. 7.



INVENTOR,
John G. Capstaff,
BY R. L. Stuckfield
N. M. Perrins
ATTORNEY

Patented Nov. 10, 1925. 1,560,541

UNITED STATES PATENT OFFICE.

JOHN G. CAPSTAFF, OF ROCHESTER, NEW YORK, ASSIGNOR TO EASTMAN KODAK COMPANY, OF ROCHESTER, NEW YORK, A CORPORATION OF NEW YORK.

FILM-DYEING APPARATUS.

Application filed March 5, 1924. Serial No. 697,142.

To all whom it may concern:

Be it known that I, JOHN G. CAPSTAFF, a subject of the King of Great Britain, residing at Rochester, in the county of Monroe and State of New York, have invented certain new and useful Improvements in Film-Dyeing Apparatus, of which the following is a full, clear, and exact specification.

This invention relates to apparatus for dyeing motion picture films.

In my prior Patent 1,469,811, granted October 9, 1923, there is described a method of color photography in which registering images are formed on opposite surfaces of a support, preferably motion picture film, and these are submitted to dye baths which are controlled to produce proper color rendering. The object of the present invention is to furnish a machine in which the extent of the dye baths, with the consequent color rendering, is under the constant supervision and control of an operator, and in which the need of change may be at once noted and remedied without waste caused by long strips of films being improperly dyed before the defects can be studied and overcome.

Other objects of my invention will be apparent from the following description of a preferred embodiment of my invention, reference being made to the accompanying drawings, wherein like reference numerals designate like parts throughout:

Fig. 1 is a side elevation of a machine built in accordance with, and illustrating, one embodiment of my invention;

Fig. 2 is a side elevation (with parts in section) of a film sprocket carriage;

Fig. 3 is a top plan view of the carriage;

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

Fig. 5 is a diagrammatic view of the carriage sprocket drive;

Fig. 6 is a section on line 6—6 of Fig. 1, with the drying chamber omitted; and

Fig. 7 is a plan view of portions of the film dyeing control mechanism.

This machine is particularly adapted for coloring a film by dyeing, and is especially designed for two color work, although obviously it may be used for any cases where strip material is to be colored.

It comprises broadly a supply chamber A, here shown as a drying chamber, a dyeing compartment B, a drying chamber C, and a winding station D. My invention is particularly directed to the dyeing compartment B and I contemplate a number of similar compartments separated by drying chambers so that a series of dyes may be successively used.

Within each compartment B is an adjustable member F which can be moved along a portion G to vary the time of dyeing, and is controlled from station I in the end H of chamber B.

More specifically the film *f* is guided into the chamber B over an idle sprocket or roller 1 and is drawn to the adjustable member F. Referring to Figs. 2 to 5, this member consists of a carriage 2, mounted on wheels 3 which travel in the U-shaped tracks 4. These tracks extend through a portion G of tank B as shown in Fig. 1. Carriage 2 carries a sprocket 5 and a roller 6. The former is supported on a shaft 7 driven through worm 8 and sleeve 10 having a series of bearings 11 at one end, these bearings carrying four rollers 12 contacting with the four sides of the square shaft 13. When this shaft is revolved, sprocket 5 is driven through the mechanism above described.

Shaft 13 is driven (Fig. 6) through gears 14 and 15, shaft 16, gears 17 and 18, and shaft 19 which is power driven and is supported in a series of bearings 20 which are carried by a main supporting bar 21, extending horizontally over the legs 22.

Roller 6 is of non-corrodible material and is carried by a yoke 23 slidably mounted in frame 24 upon the pins 25 which may move in slots 26 when screw 27 is turned through the adjusting nut 28. The height of the roller 6 can be thus adjusted.

The film is carried over the constantly driven sprocket 5 and is then passed under roller 6 which presses film band *f* into contact with the dye saturated fabric 29. Fig. 6 shows this fabric supported in a dye trough 30 upon a leveling strip 31. This trough is preferably enclosed by a casing 32 having a door 33 with a glass pane 34 in the top so the progress of dyeing may be watched. There is a viewing station at 35 where a diffused light chamber 36 is provided, the light coming from a lamp 37, so that as the film *f* passes over this chamber the depth of the dyeing can be readily observed. The degree of dyeing is controlled by the length of the film band in the dye-

ing chamber in contact with the dye, that is between rollers 6 and 45.

Carriage 2 is connected to a weight 40 by cord 41 passing over guide pulleys 42 and 43 and attached at 44 to the wall of chamber A. Pulley 43 supports weight 40.

As shown in Fig. 1 the film *f* passes under a roller 45, over a suitable wiper 46 for removing the superflous fluid, over a roller 47 and then over the inspection chamber 35 over sprocket 48, being then looped by rollers 49 through the drying chamber C and finally wound up at station D by any well known device.

At the inspection station I, I provide a handle 50 which controls a sprocket 51, as both are mounted on a shaft 52. A chain 53 connects sprocket 51 to sprocket 54 pinned to shaft 55 carrying sprocket 48 which draws the film from the drying chamber B. Shaft 55 is normally driven by power from power shaft 19, gears 56 and 57, shaft 58, sprockets 59 and 60 through chain 61. Chain 62 passing over sprocket 60 and 64 may drive shaft 55 through a slip clutch to be hereinafter described. The number and location of these driving elements are not material and for simplification in Fig. 7 64 may be considered as being constantly driven by power.

Sprocket 64 is not directly attached to shaft 55, but rests against a sleeve 65 pinned to the shaft and has frictional contact at 66 with clutch element 67 which turns with, but is slidable along, shaft 55 through pin 68 and slot 69 in the shaft. A spring 70 presses the clutch against sprocket 64, so that this member normally drives shaft 55.

It is evident that the film is continuously advanced by the action of the two sprockets 5 and 48, which are driven at the same peripheral speed from the same source of power. If the operator grasps the handle 50 and holds it stationary, shaft 55, clutch element 67 and sprocket 68 will also stop and clutch element 64 will slip on 67. The sprocket 5 will continue to turn however. The film *f* being drawn around rollers 1 and 6 is held in engagement with sprocket 5 which continues to exert a driving stress on it. This sprocket alone is unable to push the film under the roller 6 and through the compartment, and the result of the stress between it and the film is to cause the sprocket to roll, in engagement with the film, toward the right, moving the carriage 2 which is mounted to move easily. While the film alone has sufficient stiffness to cause this action, the weight 40 also tends to draw the slide in the same direction and takes the strain from the film rendering the action certain. The weight alone cannot move the carrier which cannot slide with respect to the film. The sprocket can be moved only when its periphery is moving at a different rate from the film.

If the operator turns the handle 50 at a rate to move the sprocket 48 faster than it would be moved by the driving means, the sprocket will pull the film forcibly under the rollers, and as it cannot slip with respect to sprocket 5, it will exert a driving stress thereon, moving the sprocket, and with it the carriage 2, toward the left.

In any event the rate and direction of movement of the carriage 2 depends on and corresponds to the difference in the peripheral speeds of the sprockets 5 and 48, and the extent of its movement depends on the duration of the difference. Both factors are under the complete control of the operator, who views the film as it passes the observation window. If the tint is too deep he will turn the handle ahead, moving carriage 2 to the left and shortening the extent to which the film is submitted to the dye. If the tint is too faint, he will stop the handle, or he could either let it turn more slowly than usual or even turn it backward, whereupon the carriage 2 will move toward the right and the film will be submitted to longer contact with the dye pad.

The film may have had a color applied to it on the reverse side in a previous operation, in which case the operator judges the combined color rendering.

The machine can be made in duplicate, and since it would be confusing to show it so completely, I have merely shown in Fig. 6 the dye compartment arranged for the installation of a second dyeing apparatus symmetrically to the first.

It is obvious that the operator can immediately detect and correct incorrect color renderings and consequently minimize the wastage in film due to this cause.

It is to be understood that the above described apparatus is an example of my invention and I contemplate as within the scope thereof all such modifications, and equivalents as fall within the appended claims.

What I claim as new and desire to secure by Letters Patent is:

1. Apparatus for the purpose described comprising two separated driving means for engaging and feeding strip material, and means for actuating said driving means to feed the material at the same speed, one of said driving means being mounted on a movable carrier, and one of said driving means being disconnectible from said actuating means without disconnection of the other, whereby stress is exerted between the strip material and the driving means on the carrier to move the carrier.

2. Apparatus for the purpose described comprising two separated rollers for engaging and feeding strip material, means for driving said rollers at the same peripheral speed, one of said rollers being mounted on

a slidable carrier, and one of said rollers being disconnectible from said driving means without disconnection of the other, whereby the latter continues to exert a stress on the engaged strip material.

3. Apparatus for the purpose described comprising two separated sprocket wheels for engaging and feeding perforated strip material, means for driving said sprockets at the same uniform peripheral speed, one of said sprockets being mounted on a slidable carrier, and one of said sprockets being disconnectible from said driving means without disconnection of the other, whereby the latter continues to exert a stress on the engaged strip material.

4. Apparatus for the purpose specified comprising two separated driving means for engaging and feeding strip material, and means for actuating said driving means to feed the material at the same speed, a dyeing surface between said driving means, means for holding the strip material in contact with said surface, one of said driving means being mounted on a carrier movable toward and from the other driving means to vary the amount of strip material submitted to the dyeing surface, and one of said driving means being disconnectible from said actuating means without disconnection of the other, whereby driving stress is exerted between the strip material and the driving means on the carrier to move the carrier.

5. Apparatus for the purpose described comprising two separated driving means for engaging and feeding strip material, and means for actuating said driving means to feed the material at the same speed, one of said driving means being mounted on a movable carrier, and the other of said driving means being disconnectible from said actuating means without disconnection of the first driving means, whereby stress is exerted between the strip material and said first driving means to move the latter and its carrier.

6. Apparatus for the purpose described comprising two separated driving means for engaging and feeding strip material, one of said driving means being a rotatable sprocket wheel mounted on a movable carrier, means for actuating both said driving means to feed the material at the same speed, means for disconnecting the other of said driving means from said actuating means without disconnection of said sprocket, whereupon the actuating means will continue to engage the film with a driving stress and will cause the movement of the sprocket and its carrier.

7. Apparatus for the purpose described comprising two separated sprocket wheels for engaging and feeding perforated strip material, means for actuating said sprocket wheels at the same peripheral speed, one of said sprocket wheels being mounted on a carrier movable toward and from the other, means for disconnecting the other sprocket wheel from the actuating means without disconnection of the first sprocket wheel, whereupon the other sprocket wheel will continue to engage the strip material with a driving stress and will cause a bodily movement of itself and its carrier.

8. Apparatus for the purpose described comprising two separated driving means for engaging and feeding strip material, means for actuating said driving means to feed the material at the same speed, a dyeing surface between said driving means, means for holding the strip material in contact with said surface, one of said driving means being mounted on a carrier movable toward and from the other to vary the amount of strip material submitted to the dyeing surface, means for disconnecting the other of said driving means from said actuating means without disconnection of the first, whereupon driving stress continues to be exerted on said strip material by the driving means on the carrier resulting in the movement of the carrier.

9. Apparatus for the purpose described comprising two separated sprocket wheels for engaging and feeding perforated strip material, means for actuating said sprocket wheels at the same peripheral speed, a dyeing surface between said sprockets, means for holding the strip material in contact with said surface, one of said sprocket wheels being mounted on a carrier movable toward and from the other to vary the amount of material submitted to the surface, means for disconnecting the other sprocket wheel from said actuating means without disconnection of the first, whereupon driving stress continues to be exerted between the film and the first sprocket wheel causing the bodily movement of the first sprocket wheel and its carrier.

10. Apparatus for the purpose described comprising an elongated compartment for the treatment of strip material, means for guiding strip material into one end of such compartment, a carriage slidable in said compartment and having a roller for positively engaging such strip material, and means for feeding strip material from the other end of said compartment, means for driving said roller and said feeding means in synchronism to advance the strip material through the compartment, means for disconnecting the driving means from the feeding means only, and means for independently operating the driving means whereby driving stress will be exerted between the film and the roller, corresponding to the difference in speed of the roller and the feeding means, and causing the bodily movement of the roller and its carrier.

11. Apparatus for the purpose described comprising an elongated compartment for the treatment of perforated strip material, means for guiding a long strip of such material into said compartment at one end, a carriage in said compartment slidable longitudinally thereof and carrying a sprocket adapted to engage the perforations in the strip material, a second sprocket at the other end of the compartment adapted to engage the perforations in the strip material a dyeing surface between said sprockets, means for holding the strip material in contact with said dyeing surface, operating means for driving said sprockets at the same peripheral speed whereby film will be advanced through the compartment and across said dyeing surface, means for disconnecting said second sprocket from said operating means without disconnecting said first sprocket, and independent means for turning said second sprocket at the will of the operator, whereby stress will be exerted between the film and the roller corresponding to the difference in speed of the two sprockets and causing the movement of the carrier and the sprocket carried thereby.

Signed at Rochester, New York this 29th day of February, 1924.

JOHN G. CAPSTAFF.